STONEFIELD

STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

PROPOSED MULTI-TENANT DEVELOPMENT

PARCEL ID: 208-02528-212, 208-02528-216,208-02528-226
212,216, & 226 CHARLTON ROAD
TOWN OF STURBRIDGE
WORCESTER COUNTY, MASSACHUSETTS

PREPARED FOR:
STURBRIDGE RETAIL MANAGEMENT, LLC

PREPARED BY:
STONEFIELD ENGINEERING & DESIGN, LLC
120 WASHINGTON STREET, SUITE 201
SALEM, MASSACHUSETTS

REPORT DATE:
JANUARY 31, 2023
REVISED: MAY 16, 2023

JAKE MODESTOW, PE
MA PE LICENSE #55253

I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED IN THIS DOCUMENT AND ALL ATTACHMENTS AND THAT, BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING AND PREPARING THE INFORMATION, I BELIEVE THAT THE INFORMATION IS TRUE, ACCURATE, AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR KNOWINGLY SUBMITTING FALSE INFORMATION, INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT.

REPORT CONTENTS

APPENDICES

1.0 PROJECT DESCRIPTION

Sturbridge Retail Management, LLC is proposing to develop Map 208 Lots: 226, 216, & 212 commonly known as 212, 216, & 226 Charlton Road, to accommodate the construction of a 2,402 SF restaurant with drive-thru facilities and a 5,079 SF medical building. Additional improvements for the development include parking facilities, landscaping, utility services, site lighting, stormwater management infrastructure and other associated site improvements.

The property is located within the Commercial (C) District in the Town of Sturbridge. The proposed development is bounded by commercially zoned properties to the east, Charlton Road to the south, and commercial and industrial properties to the north and west, which also include wetland features and Hobbs Brook. The site will be accessed via two driveways off Charlton Road, one (1) ingress-only driveway, and one (1) right-egress only driveway. Refer to **APPENDIX A** for project maps of the project site.

The project site is 128,728 SF (2.95 acres), the extent of land disturbance is 102,374 SF (2.35 acres), and an increase of impervious area of 33,435 SF (0.77 acres) shall result from the project.

This Report has been prepared to analyze the potential stormwater runoff impacts of the proposed project site and outline proposed measures to conform to the stormwater management regulations set forth by the Town of Sturbridge and the Massachusetts Department of Environmental Protection.

2.0 EXISTING CONDITIONS

EXISTING SITE DEVELOPMENT

The project site is currently developed with three (3) residential homes and associated features to each. The site is currently accessed by three (3) driveways onto Charlton Road and is bounded by commercially zoned properties to the east, Charlton Road to the south, and commercial and industrial properties to the north and west, which also include wetland features and Hobbs Brook. The existing development is presently comprised of 15,661 SF of impervious coverage. There are no known stormwater management measures onsite. Portions of the property are captured within the municipal storm drain conveyance system. An Aerial Map depicting the existing site conditions can be found in **APPENDIX A**.

EXISTING TOPOGRAPHY

The existing site has high points in the vicinity of the fronts of the existing residences, directing portions of runoff towards the northern property line and associated stream to the rear of the property, as well as to the south of the site toward Charlton Road and the associated municipal storm drain conveyance system. The flow towards the northern property line ultimately discharges into the wetlands to the rear of the property, while the flow towards Charlton Road ultimately discharges into the existing conveyance system within Charlton Road.

PROJECT SITE SOILS

Soil mapping was obtained from the National Resource Conservation Service (NRCS) for the project site and immediate area. Generally, the project site is underlain with two (2) major soil groups: Canton Fine Sandy Loam extremely stony on the northern portion of the property, and Canton Fine Sandy Loam on the remainder of the site.

TABLE 1: NRCS SOIL MAPPING RESULTS

Soil Unit Code	Soil Description	Approximate Project Coverage	Hydrologic Soil Group
420B	Canton Fine Sandy Loam, 3% to 8% Slopes	26.6%	B
422B	Canton Fine Sandy Loam, 0% to 8% Slopes, extremely stony	73.4%	B

The hydrologic soil group classifications above have been utilized in the landcover data for the stormwater analysis performed on the project. Additional information regarding the NRCS soil mapping can be found in **APPENDIX B**.

A Geotechnical Investigation Report was conducted by John Turner Consulting, dated August 8, 2022, which consisted of nine (9) geotechnical test borings. Topsoil onsite primarily consisted of dark brown, silty sand (SM) with rootlets and organics. Bedrock was encountered on site at depths from 7 foot to 11.75 feet below the existing grade and groundwater was encountered at 6 feet below existing grade. Please refer to **APPENDIX B** for the complete geotechnical report.

WATERSHED / RECEIVING WATERS – TMDL DESIGNATION

Under existing conditions, a majority of the site runs off to Hobbs Brook, ultimately discharging to Pistol Pond (State Waterbody ID: MA141057). The watershed for the development is part of the McKinstry Brook-Quinebaug River Watershed (HUC 011000010103) as defined by the United States Environmental Protection Agency for Community Waterway Mapping. Per the Final Massachusetts Integrated List of Waters For the Clean Water Act 2018/2020 Reporting Cycle prepared by the Massachusetts Department of Environmental Protection, Pistol Pond is identified as an impaired water for aquatic plants and dissolved oxygen.

EXISTING ENVIRONMENTAL INVENTORY

Based on the effective FEMA flood insurance rate mapping (FEMA Map #25027C0927E issued July 4, 2011), portions of the site are located within Zone A with no bas flood elevations determined. The remainder of the site is located in Zone X. The FEMA Map can be found in **APPENDIX A** of this Report.

There are federal and state MassDEP regulated freshwater wetlands within 100 feet of the project site that are subject to the Wetlands Protection Act Regulations (310 CMR). As there are regulated wetlands within the project site, the limits of the areas and associated Buffer Zones are shown on the Site Plans prepared by Stonefield Engineering in conjunction with this Report.

3.0 PROPOSED CONDITIONS

PROPOSED SITE DEVELOPMENT

The proposed development will consist of the construction of a 2,402 SF single story restaurant with drive-thru facilities and a 5,079 SF single story medical building. Additional improvements for the development include parking facilities, landscaping, utility services, site lighting, stormwater management infrastructure, and other associated site improvements. The site will be accessed via one (1) ingress only driveway and one (1) right only egress driveway off of Charlton Road. Refer to **APPENDIX A** for project maps of the property.

PROPOSED TOPOGRAPHY

Project site topography and drainage patterns will generally remain similar to existing conditions. Steep slopes to the north and east of the property shall remain undisturbed to the maximum extent practicable. The driveway has a grading design consistent with local regulations. Additionally, ADA compliant areas including parking spaces and access to the right-of-way have been provided.

ANTICIPATED ENVIRONMENTAL INVENTORY IMPACTS

The proposed development will disturb the area within the buffer associated with the wetlands at the rear of the property. The proposed development will require an NOI from the Sturbridge Conservation Commission, which will ultimately be further approved by MassDEP. The Township will remain apprised of the MassDEP permitting status as applicable as the project moves forward.

4.0 STORMWATER MANAGEMENT METHODOLOGY & PARAMETERS

HYDROLOGIC METHODOLOGY

The analysis program "HydroCAD" Version 10.0 by HydroCAD Software Solutions was utilized to calculate and plot the runoff hydrographs. The program incorporates the time of concentration, C values, rainfall data, and project drainage areas to calculate the runoff characteristics. The existing and proposed drainage areas have been analyzed utilizing Intensity-Duration-Frequency data obtained from NOAA for the project area; specifics of the rainfall distribution can be found in **APPENDIX C.** Additional key variables utilized in the analysis include:

TABLE 2: HYDROCAD DESIGN VARIABLES

Variable	Input	Variable	Input
Runoff Calculation Method	SCS TR-20	NRCS Rainfall Frequency Data Set	Worcester
Pervious/Impervious CN Calculations	Separate	Storm Intervals (Year Events)	2, 10, 100
Stage-Storage Relationship	Dynamic	Storm Duration	24 Hours
Minimum time of concentration	6 minutes	Storm Curve	NOAA D

Additional information regarding the hydrologic calculations can be found in **APPENDIX C**.

HYDRAULIC METHODOLOGY

The analysis program "HydraFlow Storm Sewers" Version 2020 by Autodesk was utilized to generate hydraulic grade lines through the proposed conveyance system model based on various pipe / junction losses and the runoff tributary to each inlet or discharge structure. Additional key variables utilized in the analysis include:

TABLE 3: HYDRAFLOW DESIGN VARIABLES

Variable	Input	Variable	Input
Runoff Calculation Method	Rational	Pipe Conveyance Method	Std. Step
C-value for impervious surfaces	0.95	Initial Hydraulic Grade Line	Normalized
C-value for pervious surfaces	0.35	Inlet Drainage Area Delineation	Surveyed
Minimum time of concentration	6 minutes	Inlet Geometry & Capacity	MassDOT Std.

5.0 STORMWATER ANALYSIS

EXISTING DRAINAGE AREAS

Under existing conditions, the site is comprised of two (2) drainage areas discharging to two (2) points of interest (POI). Drainage area EX-1 consists of the existing pavement, the existing buildings, and a large area of green space on the northern portion of the property, ultimately discharging to the wetlands at the rear of the site (POI-1). Drainage area EX-2 consists of the green space located between the existing buildings and Charlton Road and the existing driveways, ultimately discharging to the existing conveyance system in Charlton Road (POI-2). As it stands today, there are no known existing stormwater management facilities located within the site limits. See table below for breakdown of existing drainage areas:

TABLE 4: SUMMARY OF EXISTING DRAINAGE AREAS

Drainage Area	Description	Area Extents	Impervious Area	Time of Concentration
EX-1 (POI-1)	Existing Drainage to Wetlands	63,388 SF	8,046 SF	15.2 Minutes
EX-2 (POI-2)	Existing Drainage to Charlton Road	33,862 SF	7,615 SF	6.1 Minutes

All existing drainage areas were delineated based on field surveying data. Hydrologic calculations and parameters for each drainage area can be found in **APPENDIX C**; specific drainage area delineations and land cover can be found in **APPENDIX D.**

PROPOSED DRAINAGE AREAS

Under proposed conditions, the general drainage patterns and ultimate points of interest will be maintained. There shall be three (3) drainage areas in proposed conditions, discharging to two (2) points of interest. Drainage area P-1A consists of the two (2) proposed buildings, the proposed parking lot, drive-thru lane, and greenspace, and shall be conveyed via subsurface piping to the proposed above ground infiltration basin, ultimately discharging via sheet flow to the wetlands at the rear of the property (POI-1). Area P-1B consists of a vegetated portion of the rear of the property, discharging undetained to the wetlands (POI-1). Drainage area P-2 is comprised of the remainder of the driveway, and portions of vegetated area which discharged undetained via sheet flow to the existing stormwater conveyance system within Charlton Road. An aboveground infiltration basin is proposed to meet the Massachusetts Department of Environmental Protection Stormwater Management Standards as outlined in the next Report section of this Report. The table below outlines the proposed drainage areas:

TABLE 5: SUMMARY OF PROPOSED DRAINAGE AREAS

Drainage Area	Description	Area Extents	Impervious Area	Time of Concentration
P-1A	Parking and Buildings to Infiltration Basin	71,505 SF	47,324 SF	6.0 Minutes
P-1B	Undetained Flow to Wetland	5,917 SF	0.0 SF	6.0 Minutes
POI-1	Discharge to Wetlands	77,422 SF	48,043 SF	N/A
P-2 (POI-2)	Undetained flow to Charlton Road	19,828 SF	1,772 SF	6.0 Minutes

All proposed drainage areas were delineated based on the proposed grading design overlain on field survey data. Hydrologic calculations and parameters for each drainage area can be found in **APPENDIX C**; specific drainage area delineations and land cover can be found in **APPENDIX D.**

STORMWATER MANAGEMENT DESIGN PARAMETERS

The extent of development proposes to disturb 102,374 SF (2.35 AC) of the existing site; as such, it is subject to all Stormwater Standards as defined in the Town of Sturbridge Ordinances and the Massachusetts Stormwater Handbook Volume 1. See below for a summary of each design parameter and compliance requirements:

TABLE 6: STORMWATER DESIGN STANDARDS SUMMARY

Design Parameter	Design Target for Compliance
Standard 1: *Stormwater Discharge*	Demonstrate that no new stormwater conveyances will discharge untreated stormwater directly to or cause erosion in wetlands or waters.
Standard 2: *Stormwater Quantity*	Demonstrate through hydrologic and hydraulic analysis that for stormwater leaving the site, post-construction runoff hydrographs for the 2-, 10-, and 100-year storm events do not exceed the pre-construction runoff hydrographs for the same storm events.
Standard 3: *Groundwater Recharge*	Demonstrate through hydrologic and hydraulic analysis that the site and its stormwater management measure shall approximate average annual pre-construction groundwater recharge volume for the site.
Standard 4: *Stormwater Quality*	Stormwater management measures shall be designed to reduce the post-construction load of total suspended solids (TSS) in stormwater runoff generated from the water quality design storm by 80 percent of the anticipated load from existing and proposed impervious coverage onsite.
Standard 5: *High Pollutant Loads*	Demonstrate that the discharge of stormwater runoff from land uses with higher potential pollutant loads will be eliminated or reduced through complete protection from potential runoff or use of a specific structural BMP.
Standard 6: *Critical Areas*	Discharges to Outstanding Resource Waters and/or Special Resource Waters will be removed and relocated away from the receiving water and/or wetland and receive highest and best practical method of treatment.

STANDARD 1 – STORMWATER DISCHARGE

No new stormwater conveyance discharges of untreated water are proposed directly to wetlands or waters of the Commonwealth. Under existing conditions, portions of the site discharge directly into wetlands toward the rear of the site. The post development conditions do not increase discharge to the existing wetlands and provide a reduction of runoff rate to the wetland. Additionally, all discharge shall be adequately treated prior to outfall into the wetlands through the use of catch basins equipped with hoods and sumps, a sediment forebay, and an infiltration basin, improving upon existing conditions within the waterway. All discharge is stabilized prior to the outflow via the implementation of rip-rap pads sized to reduce flow velocity and minimize the potential for erosion. Existing discharge points are maintained, and no new discharge points are created within the wetland area. As such, the proposed development complies with Standard 1.

STANDARD 2 – STORMWATER QUANTITY

One (1) above ground infiltration basin is proposed with the development to attenuate peak stormwater runoff rates to the mandated regulatory levels. The tables below summarize the various drainage areas in relation to flow rates and runoff volume during regulatory storm events:

TABLE 7: SUMMARY OF EXISTING POI FLOW RATES

Drainage Area	2-Year Flow Rate	10-Year Flow Rate	100-Year Flow Rate
EX-1	0.58 CFS	1.57 CFS	4.64 CFS
EX-2	0.67 CFS	1.47 CFS	3.80 CFS

TABLE 8: SUMMARY OF PROPOSED POI FLOW RATES

Drainage Area	2-Year Flow Rate	10-Year Flow Rate	100-Year Flow Rate
POI-1	0.04 CFS	0.65 CFS	4.12 CFS
POI-2	0.24 CFS	0.68 CFS	2.02 CFS

Under post-development conditions the runoff flow rates are reduced the required amount for each point of interest. The diverted runoff from these areas is collected in the on-site stormwater management systems for runoff attenuation, groundwater recharge, and water quality treatment. The table below outlines the regulatory compliance parameters for runoff quantity on the project site:

TABLE 9: STORMWATER RUNOFF QUANTITY COMPLIANCE SUMMARY (POI-1)

Rainfall Event	Existing Flow Rate	Proposed Flow Rate	Proposed % Reduction
2-Year Storm	0.58 CFS	0.04 CFS	93.10%
10-Year Storm	1.58 CFS	0.65 CFS	58.86%
100-Year Storm	4.67 CFS	4.12 CFS	11.78%

TABLE 10: STORMWATER RUNOFF QUANTITY COMPLIANCE SUMMARY (POI-2)

Rainfall Event	Existing Flow Rate	Proposed Flow Rate	Proposed % Reduction
2-Year Storm	0.67 CFS	0.24 CFS	64.17%
10-Year Storm	1.47 CFS	0.68 CFS	53.74%
100-Year Storm	3.80 CFS	2.02 CFS	46.84%

The one (1) aboveground infiltration basin provides sufficient flow rate attenuation to ensure that no adverse impacts are anticipated downstream of the project site. Detailed hydrologic calculations for each point of interest can be found in **APPENDIX C**.

STANDARD 3 – GROUNDWATER RECHARGE

Groundwater recharge is required as the infiltration rates of the soils were assumed to be greater than 0.17 in/hour and there are no contaminated soils on or within the vicinity of the site. Groundwater recharge is met through the implementation of an aboveground infiltration area.

The required recharge volume was calculated by multiplying the total impervious area, by the target depth factor for soils with HSG B as outlined within the MassDEP manual.

Required Groundwater Recharge:

$R_v = (F/12 \text{ inches/foot}) * (A_{IMP})$

$R_v = (0.35 \text{ inches}/12 \text{ inches/foot}) * (49{,}096 \text{ sf})$

$R_v = 1{,}431.97 \text{ CF Required}$

$R_v = 4{,}168 \text{ CF Provided}$

STANDARD 4 – STORMWATER QUALITY CONTROL

The proposed subsurface detention basin has been designed to comply with the Massachusetts Stormwater Handbook regulations for water quality. The above ground infiltration basin is certified for 80% TSS removal. Additionally, the proposed catch basins shall be equipped with hoods & sumps discharging into a sediment forebay in order to further treat runoff prior to entering the aboveground infiltration system. The Total Suspended Solid (TSS) removal calculations are included in **APPENDIX E.** A total TSS removal of 89% is provided with the proposed stormwater management measures. The water quality treatment calculations are outlined below. The site is not located within an interim wellhead protection area, Zone 1, & Zone 2, however discharges near a wetland. As such, a water quality depth of 1.0 inch is used per MassDEP regulations for discharge near environmentally sensitive features.

Required Water Quality:

$V_{WQ} = (D_{WQ}/12 \text{ inches/foot}) * (A_{IMP})$

$V_{WQ} = (1.0 \text{ inches}/12 \text{ inches/foot}) * (49{,}096 \text{ sf})$

$V_{WQ} = 4{,}091.33 \text{ CF Required}$

$V_{WQ} = 4{,}168 \text{ CF Provided}$

Additional detail regarding the water quality design can be found within **APPENDIX C**.

STANDARD 5 – HIGH POLLUTANT LOADS

The proposed use for the development is a coffee shop with drive-thru facilities and a medical building, neither of which are considered a land us with high potential pollutant loads (LUHPPL) by the MassDEP, however, as the development will introduce greater than 1,000 ADT as reflected within the traffic analysis prepared by by Stonefield Engineering & Design, the LUHPPL standard shall apply. As the site has the potential to generate higher potential pollutant loads of oil and grease as the proposed use generates greater than 1,000 ADT, pretreatment and water quality requirements are enhanced. Deep sump catch basins have been proposed to provide 25% TSS pre-treatment, which then convey runoff into a sediment forebay, ultimately discharging into the aboveground infiltration basin, which is certified for 80% TSS removal.

STANDARD 6 – CRITICAL AREAS

The site discharges near an Outstanding Resource Water (OWR) and therefore, a Deep Sump Catch Basin proposed to provide 25% TSS pre-treatment while the proposed Exfiltrating infiltration area is proposed to provide 80% TSS removal for the required 4,168 CF water quality volume. The stormwater BMPs proposed are setback from the receiving water/wetland. As the proposed development disturbs more than 1 acre of land, a notice of intent will be filed with the Town of Sturbridge Conservation Commission and MassDEP prior to approval.

STANDARD 7 – REDEVELOPMENT PROJECT

Since the site has a net increase of impervious cover by 33,435 SF (0.77 AC), the site is not determined to be a redevelopment project and must comply with all Standards as defined in the Massachusetts Department of Environmental Protection Stormwater Management Standards.

STANDARD 8 – EROSION, SEDIMENTATION, AND POLLUTION PREVENTION PLAN

A Soil Erosion & Sediment Control Plan has been prepared in accordance with the latest edition of Volume 2 of the Massachusetts Stormwater Handbook and the Erosion and Sedimentation Control Guidelines. This plan can be found within the Site Plan Set prepared by Stonefield Engineering in conjunction with this Report. Proposed temporary measures during construction include silt fencing, stabilized construction entrances, inlet filters, street sweeping, temporary seeding for soil stabilization. No land disturbance will occur until certification and permits have been obtained. Details for all proposed control measures have also been provided.

STANDARD 9 – STORMWATER FACILITY OPERATIONS AND MAINTENANCE

A Stormwater Operations & Maintenance Manual has been prepared and included as a supplemental document with this report. Any necessary easements or covenants associated with the stormwater improvements will be recorded prior to the start of construction.

STANDARD 10 – ILLICIT DISCHARGES

The proposed stormwater management system discharges are entirely comprised of stormwater. Firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, and water for street washing are prohibited to discharge onsite and will therefore not result in an illicit discharge. The development is not located within any environmentally sensitive area and there shall be no risks to critical areas through the discharge from the stormwater management facilities. Pollution prevention measures shall be implemented to prevent any illicit materials to the private or municipal systems, including but not limited to: wastewater discharge, raw materials, toxic pollutants, hazardous substances, oil or grease. Please refer to **APPENDIX A** for project maps of the development, showing no sensitive areas within the vicinity of the project, and **APPENDIX C** for hydraulic calculations showing water quality treatment and prevention of contaminants.

6.0 EROSION, SEDIMENTATION, AND POLLUTION PREVENTION

TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES

Under proposed conditions, erosion and sediment controls will be utilized to limit the potential effects due to construction of the proposed development. Refer to the Soil Erosion and Sediment Control Plans in **APPENDIX A** of this report. The following includes the temporary sediment controls proposed for this project:

Construction Entrance – To provide a stable entrance and exit from a construction site and keep mud and sediment off public roads, a temporary stone-stabilized pad located at points of vehicular ingress and egress on a construction site. If the action of the vehicle traveling over the gravel pad is not sufficient to remove the majority of the mud, then the tires must be washed before the vehicle enters a public road. If washing is used, provisions must be made to intercept the wash water and trap sediment before it is carried off-site.

Dust Control – To reduce surface and air movement of dust from exposed soil surfaces during land disturbing, demolition, and construction activities, preventative measures must be taken. Sprinkling or other approved methods must be used to reduce dust generated on the site. Dust control shall be provided by the general contractor to a degree acceptable to the owner/operator, and in compliance with the applicable local and state dust control requirements.

Inlet Protection – A sediment filter or an excavated impounding area around a storm drain, drop inlet, or curb inlet must be used to prevent sediment from entering storm drainage systems prior to permanent stabilization of

the disturbed area. During construction, the inlet protection measures shall be replaced as needed to ensure proper function of the structure.

Preserving Natural Vegetation – Natural vegetation should be preserved whenever possible, but especially on steep slopes, near perennial and intermittent watercourses or swales, and on building sites in wooded areas. Clearly flag or mark areas around trees that are to be saved. It is preferable to keep ground disturbance away from the trees at least as far out as the dripline. If possible, place a barrier/fencing around the trees. Inspect flagged areas regularly to make sure flagging has not been removed. If tree roots have been exposed or injured, re-cover and/or seal them.

Sediment Fence – A temporary sediment barrier consisting of a filter fabric stretched across and attached to supporting posts and entrenched must be established along the perimeter of areas to be disturbed before initiation of and during construction. The sediment fence is constructed of stakes and synthetic filter fabric with a rigid wire fence backing where necessary for support. Sediment fence can be purchased with pockets presewn to accept use of steel fence posts. Silt fences should be inspected immediately after each rainfall and at least daily during prolonged rainfall. Repair as necessary. If the fabric tears, decomposes, or in any way becomes ineffective, replace it immediately. Replace burlap used in sediment fences after no more than 60 days.

Temporary Seeding – Disturbed areas that will not be brought to final grade for a period of more than 30 working days or in a season not suitable for permanent seeding shall be temporarily seeded to minimize erosion and sediment loss. Other stabilization methods may be used and shall be in conformance with the *Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas*, latest edition.

Temporary Soil Stockpile – Locate the topsoil stockpile so that it does not interfere with work on the site. Side slopes of the stockpile should not exceed 2:1. Surround all topsoil stockpiles with an interceptor dike with gravel outlet and silt fence. Either seed or cover stockpiles with clear plastic or other mulching materials within 7 days of the formation of the stockpile. Topsoil should not be placed while in a frozen or muddy condition, when the subgrade is excessively wet, or when conditions exist that may otherwise be detrimental to proper grading or proposed sodding or seeding. Do not place topsoil on slopes steeper than 2:1. Maintain protective cover on stockpiles until needed.

Construction Waste Disposal – All disposal of onsite construction materials shall be managed in accordance with current MassDEP policies and regulations. All materials outlined within the MassDEP Construction & Demolition materials guidance manuals shall be disposed of in accordance with applicable regulations. No materials prohibited from disposal shall be deposited into any Massachusetts landfill.

PERMANENT EROSION AND SEDIMENT CONTROL MEASURES

Permanent Seeding – Permanent seeding of grass and planting trees and shrubs shall be established on any graded or cleared area where long-lived plant cover is needed to stabilize the soil in accordance with the accompanying plans. Areas which will not be brought to final grade for a year or more shall also be seeded permanently. Inspect seeded areas for failure and make necessary repairs and reseed immediately. Conduct or follow-up survey after one year and replace failed plants where necessary.

Riprap – A permanent, erosion-resistant ground cover of large, loose, angular stone must be installed in accordance with the accompanying plans to protect slopes, streambanks, channels, or areas subject to erosion by wave action. Riprap should be checked at least annually and after every major storm for displaced stones, slumping, and erosion at edges, especially downstream or downslope. If the riprap has been damaged, it should be repaired immediately before further damage can take place.

CONSTRUCTION PHASING PLAN AND SEQUENCE OF OPERATIONS

The Soil Erosion & Sediment Control Plans have been phased in order to effectively control erosion and sedimentation and minimize impacts due to seasonal changes. Please refer to **APPENDIX A** for half size Soil Erosion & Sediment Control Plans for detailed construction sequencing.

FINAL SITE STABILIZATION

Recommended practices for final surface stabilization include surface roughening, terrace, topsoiling, permanent seeding, sodding, trees and shrub planting, mulching, and riprap. The stabilization measures shall be in conformance with the *Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas*, latest edition.

7.0 CONCLUSIONS

As demonstrated in this Report, the increase in runoff flow rate generated by the proposed development will be satisfactorily mitigated by the introduction of the proposed above ground infiltration basin. Deep sump catch basins and a sediment forebay alongside the aboveground infiltration basin and associated sediment forebay will provide treatment to remove total suspended solids to a satisfactory regulatory level.

The proposed project complies with all applicable stormwater management regulations and standards. As such, the project is not anticipated to have any adverse drainage impacts on neighboring properties, downstream watercourses, or adjoining conveyance systems.

8.0 REFERENCES

1. Massachusetts Stormwater Handbook and Stormwater Standards, last amended January 2, 2008

   https://www.mass.gov/guides/massachusetts-stormwater-handbook-and-stormwater-standards

2. Massachusetts Complete Erosion and Sedimentation Control Guidelines for Urban and Suburban Areas: A Guide for Planners, Designers, and Municipal Officials, last amended May 2003

   https://www.mass.gov/doc/complete-erosion-and-sedimentation-control-guidelines-a-guide-for-planners-designers-and/download

3. Town of Sturbridge, Massachusetts Zoning Regulations

   https://ecode360.com/35316561

4. Town of Sturbridge, Massachusetts Stormwater Management Regulations

   https://ecode360.com/35320946#35320946

APPENDIX A
PROJECT FIGURES

INVENTORY

FIGURE 1: USGS LOCATION MAP

FIGURE 2: AERIAL MAP

FIGURE 3: TAX & ZONING MAP

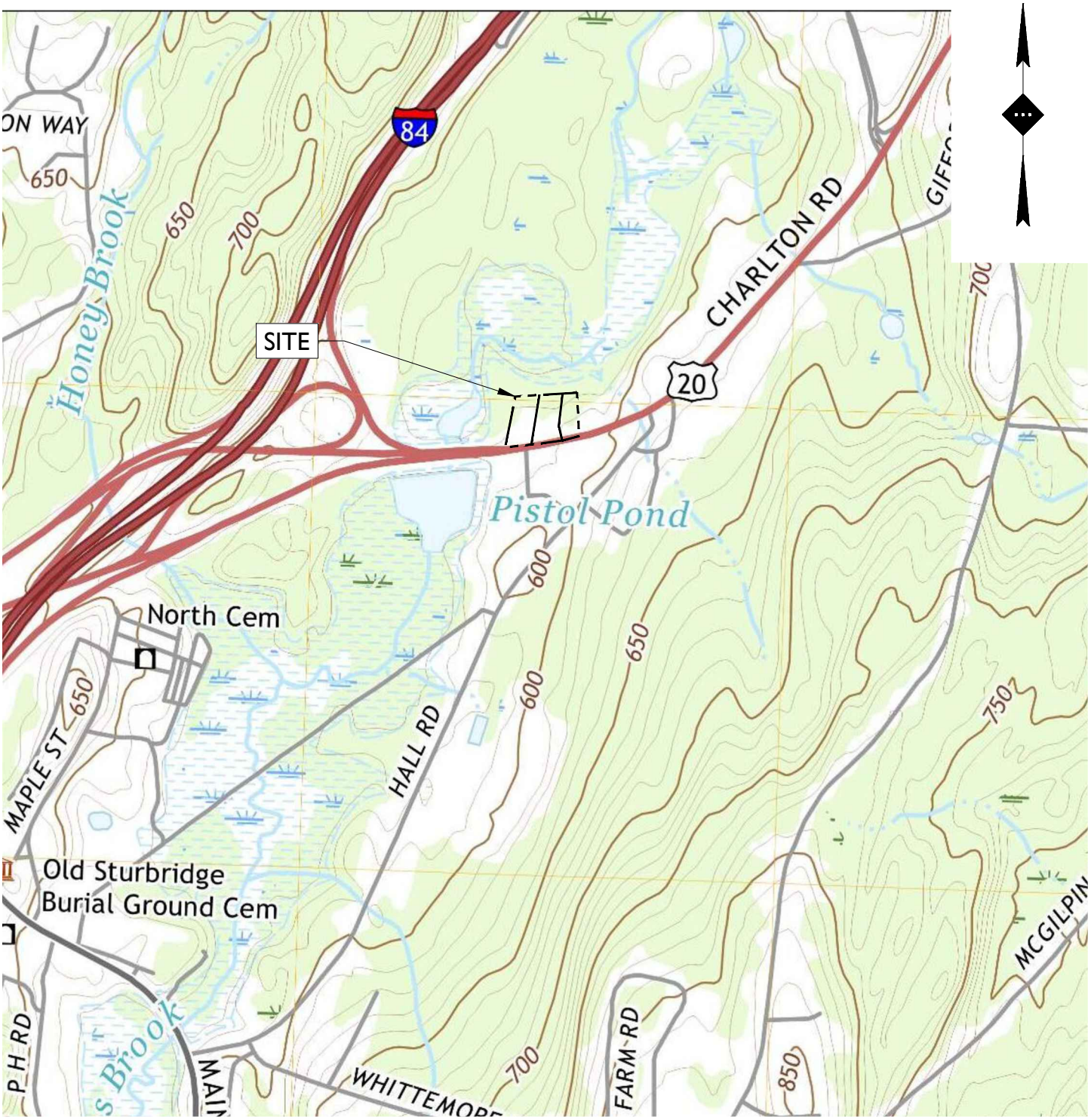
FIGURE 4: FEMA MAP

FIGURE 5: NATIONAL HERITAGE MAP

FIGURE 6: SITE PLAN (NOT TO SCALE)

FIGURE 7: STORMWATER MANAGEMENT PLAN (NOT TO SCALE)

FIGURE 8: SOIL EROSION AND SEDIMENT CONTROL PLAN (NOT TO SCALE)



USGS MAP

2000' 0' 2000' 4000'

GRAPHIC SCALE IN FEET

1"= 2000'

STORMWATER MANAGEMENT REPORT

STURBRIDGE RETAIL MANAGMENT, LLC

PROPOSED MULTI-TENANT DEVELOPMENT

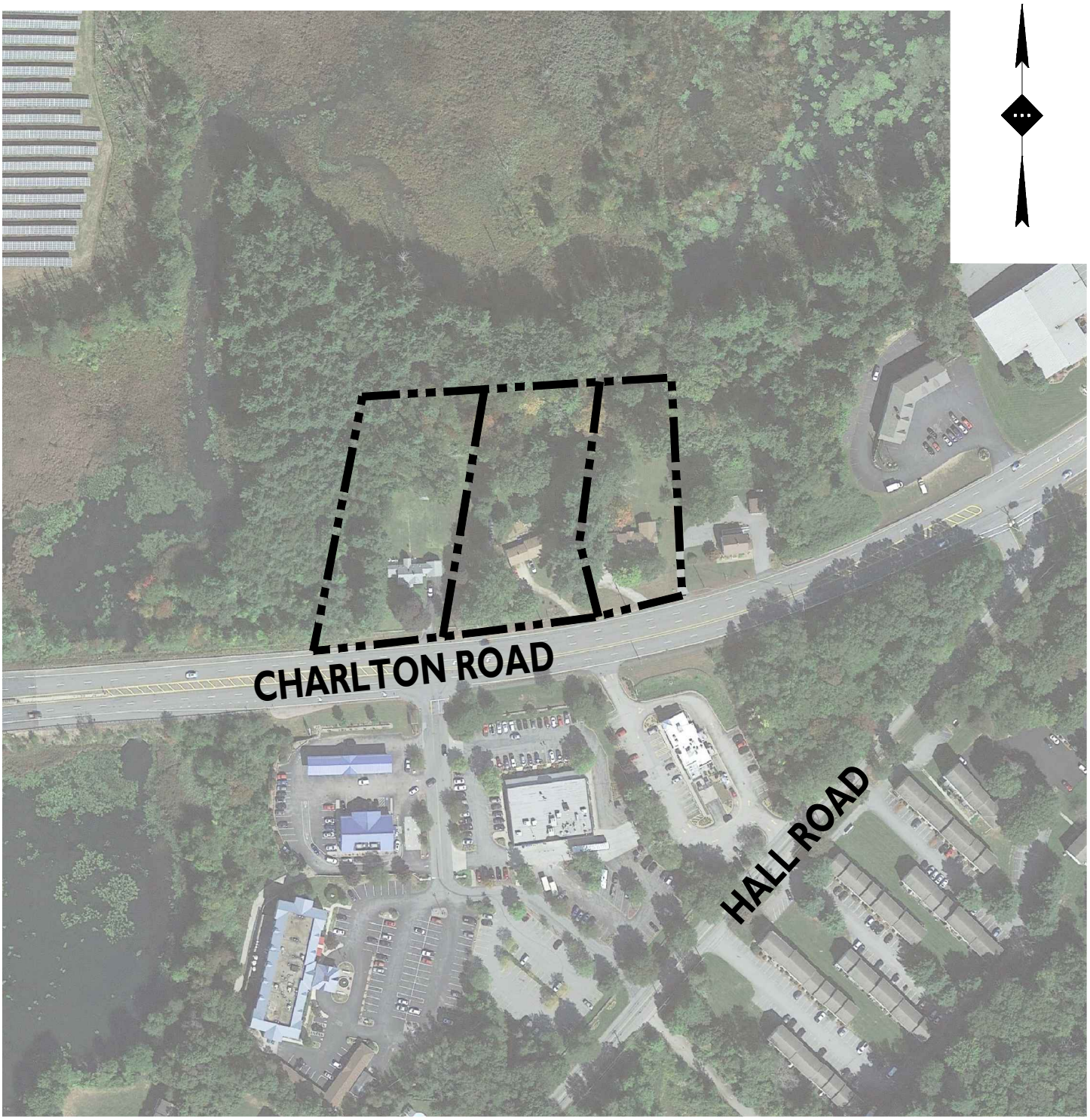
MAP 208 LOTS: 212, 216, & 226
216,212, 226 CHARLTON ROAD
TOWN OF STURBRDIGE
WORCESTER COUNTY, MASSACHUSETTS

DRAWN BY:	JR
CHECKED BY:	JAM
DATE:	01/31/2023
SCALE:	1" = 2000'
PROJECT ID:	BOS-210035

STONEFIELD engineering & design

Rutherford, NJ · New York, NY · Boston, MA
Princeton, NJ · Tampa, FL · Detroit, MI
www.stonefieldeng.com

1 Beacon Street, 15 Floor, Boston, MA 02108
Phone 617.203.2076



AERIAL MAP

200' 0' 200' 400'

GRAPHIC SCALE IN FEET

1" = 200'

STORMWATER MANAGEMENT REPORT

STURBRIDGE RETAIL MANAGMENT, LLC

PROPOSED MULTI-TENANT DEVELOPMENT

MAP 208 LOTS: 212, 216, & 226
216,212, 226 CHARLTON ROAD
TOWN OF STURBRDIGE
WORCESTER COUNTY, MASSACHUSETTS

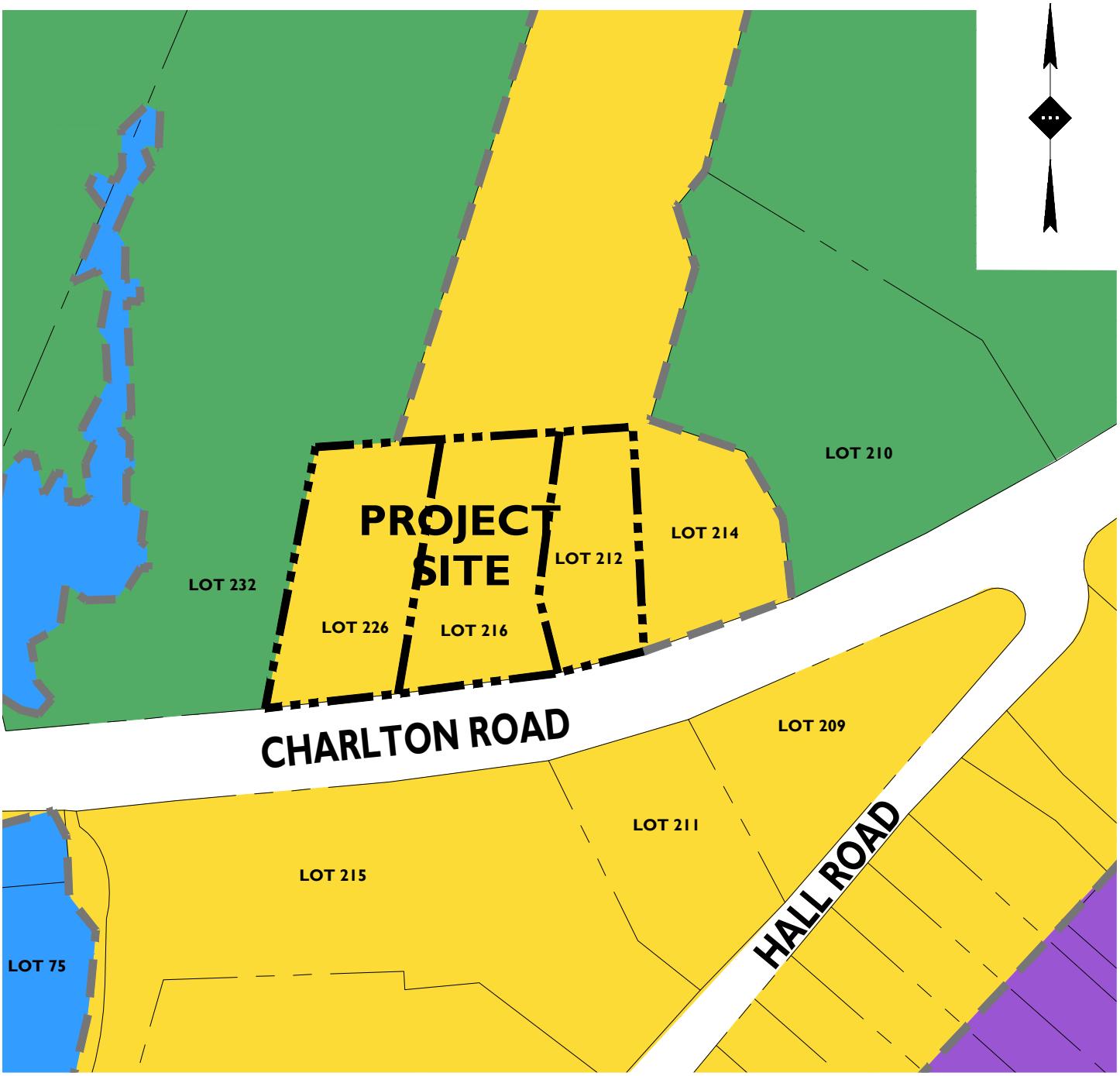
DRAWN BY:	JR
CHECKED BY:	JAM
DATE:	01/31/2023
SCALE:	1" = 300'
PROJECT ID:	BOS-210035

STONEFIELD engineering & design

Rutherford, NJ · New York, NY · Boston, MA
Princeton, NJ · Tampa, FL · Detroit, MI
www.stonefieldeng.com

1 Beacon Street, 15 Floor, Boston, MA 02108
Phone 617.203.2076

Z:\Boston\BOS\2021\BOS-210035 Alrig - 212, 216 & 266 Charlton Road, Sturbridge, MA\CADD\Exhibits\2023-01-31_Project Maps.dwg



ZONING LEGEND

INDUSTRIAL PARK | COMMERCIAL DISTRICT | COMMERCIAL II DISTRICT | RURAL RESIDENTIAL | WATERBODY

TAX & ZONING MAP

200' 0' 200' 400'

GRAPHIC SCALE IN FEET

1" = 200'

STORMWATER MANAGEMENT REPORT

STURBRIDGE RETAIL MANAGMENT, LLC

PROPOSED MULTI-TENANT DEVELOPMENT

MAP 208 LOTS: 212, 216, & 226
216,212, 226 CHARLTON ROAD
TOWN OF STURBRDIGE
WORCESTER COUNTY, MASSACHUSETTS

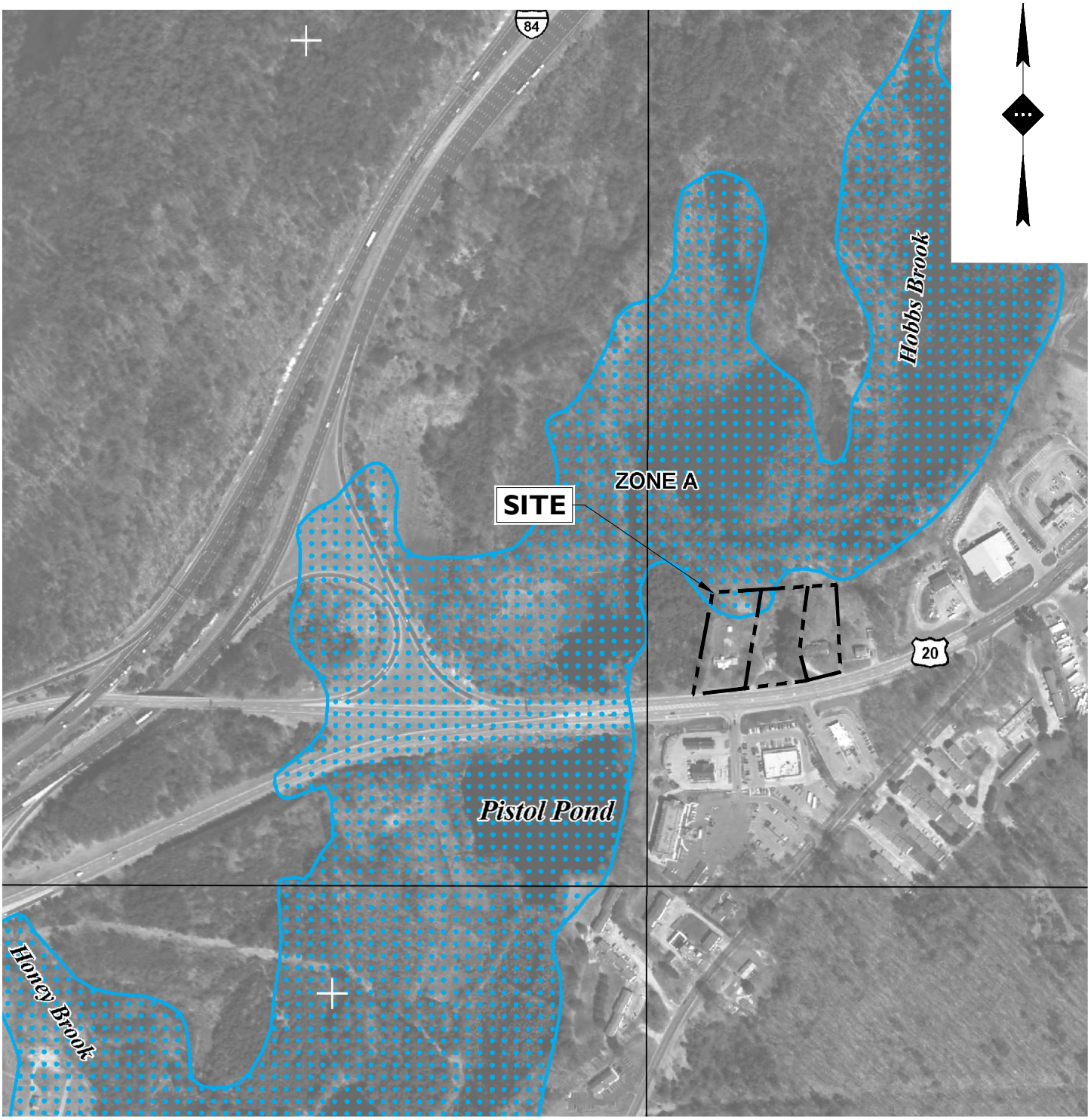
DRAWN BY:	JR
CHECKED BY:	JAM
DATE:	01/31/2023
SCALE:	1" = 200'
PROJECT ID:	BOS-210035

STONEFIELD engineering & design

Rutherford, NJ · New York, NY · Boston, MA
Princeton, NJ · Tampa, FL · Detroit, MI
www.stonefieldeng.com

1 Beacon Street, 15 Floor, Boston, MA 02108
Phone 617.203.2076

Z:\Boston\BOS\2021\BOS-210035 Alrig - 212, 216 & 266 Charlton Road, Sturbridge, MA\CADD\Exhibits\2023-01-31_Project Maps.dwg



FEMA FLOOD PLANE MAP

500' 0' 500' 1000'

GRAPHIC SCALE IN FEET

1"= 500'

STORMWATER MANAGEMENT REPORT

STURBRIDGE RETAIL MANAGMENT, LLC

PROPOSED MULTI-TENANT DEVELOPMENT

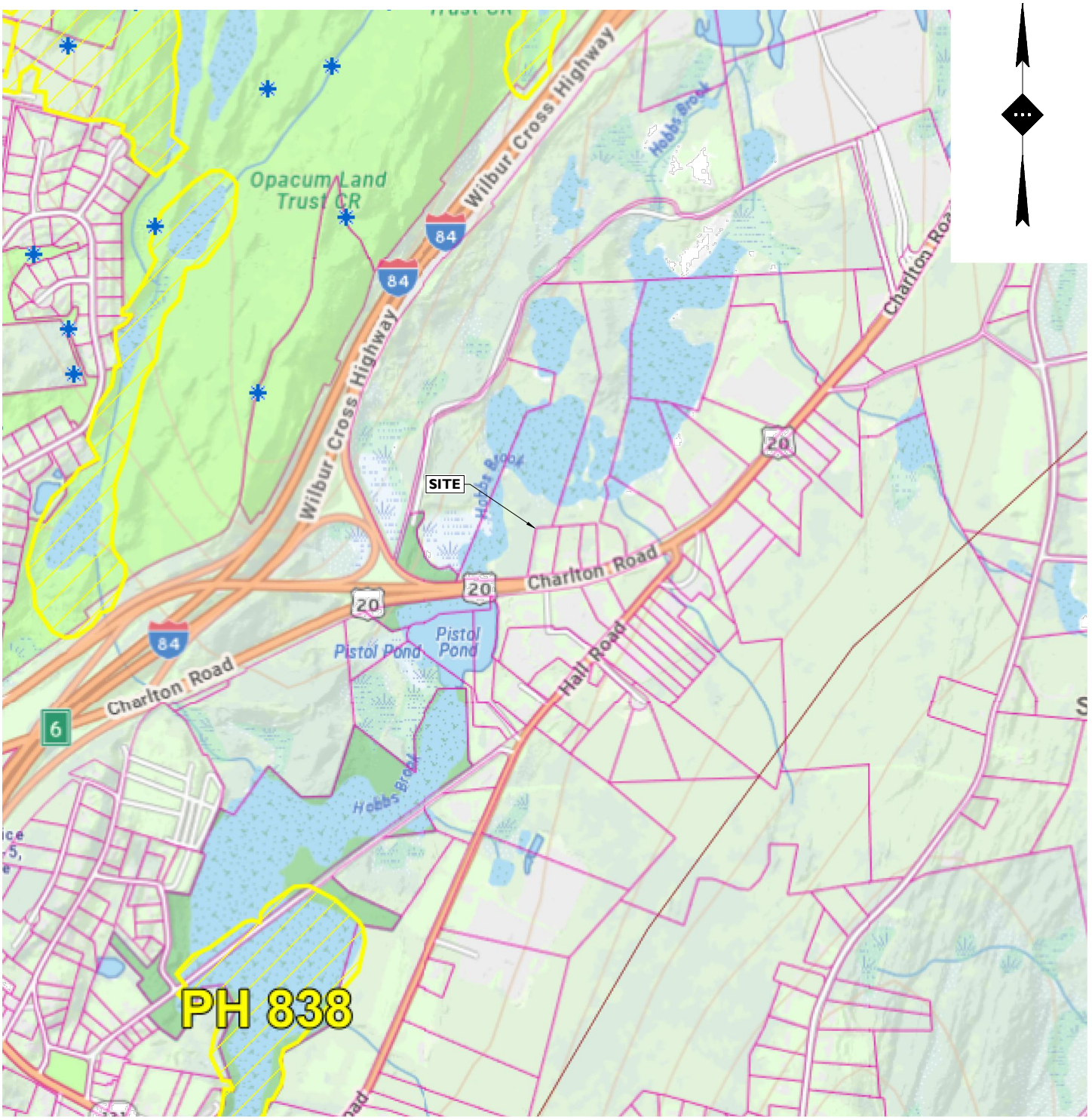
MAP 208 LOTS: 212, 216, & 226
216,212, 226 CHARLTON ROAD
TOWN OF STURBRDIGE
WORCESTER COUNTY, MASSACHUSETTS

DRAWN BY:	JR
CHECKED BY:	JAM
DATE:	01/31/2023
SCALE:	1" = 500'
PROJECT ID:	BOS-210035

STONEFIELD engineering & design

Rutherford, NJ · New York, NY · Boston, MA
Princeton, NJ · Tampa, FL · Detroit, MI
www.stonefieldeng.com

1 Beacon Street, 15 Floor, Boston, MA 02108
Phone 617.203.2076



NATIONAL HERITAGE MAP

1000' 0' 1000' 2000'

GRAPHIC SCALE IN FEET

1"= 1000'

STORMWATER MANAGEMENT REPORT

STURBRIDGE RETAIL MANAGMENT, LLC

PROPOSED MULTI-TENANT DEVELOPMENT

MAP 208 LOTS: 212, 216, & 226
216,212, 226 CHARLTON ROAD
TOWN OF STURBRDIGE
WORCESTER COUNTY, MASSACHUSETTS

DRAWN BY:	JR
CHECKED BY:	JAM
DATE:	01/31/2023
SCALE:	1" = 500'
PROJECT ID:	BOS-210035

STONEFIELD engineering & design

Rutherford, NJ · New York, NY · Boston, MA
Princeton, NJ · Tampa, FL · Detroit, MI
www.stonefieldeng.com

1 Beacon Street, 15 Floor, Boston, MA 02108
Phone 617.203.2076

OFF-STREET PARKING REQUIREMENTS

CODE SECTION	REQUIRED	PROPOSED
§ 300-16.11 B.	MINIMUM PARKING REQUIRED: MEDICAL FACILITY 1 PER 300 SF OF FLOOR AREA. (5,079 SF) / (300 SF) =17 SPACES RESTAURANT 1 SPACE FOR EVERY 3 SEATS AND 1 SPACE FOR EVERY EMPLOYEE ON LARGEST SHIFT (54 SEATS) / 3 = (18 SPACES) + (8 EMPLOYEES) = 26 SPACES TOTAL: 17 + 26 = 43 SPACES	68 SPACES
§ 300-16.14 C.(1)	DRIVE-THRU AISLES SHALL HAVE A MINIMUM 10 FT INTERIOR RADIUS AT CURVES AND A MINIMUM 12 FT WIDTH.	20' R 12 FT WIDTH
§ 300-16.4 A.(1)	MINIMUM DRIVE AISLE WIDTH: TWO WAY: 24 FT	24 FT
§ 300-16.4 A.(2)	MINIMUM ANGLED DRIVE AISLE WIDTH: ONE WAY: 18 FT	24 FT
§ 300-16.9 A.(1)	PARKING SPACES, DRIVEWAYS, BUILDINGS, STRUCTURES AND STORAGE MATERIALS SHALL NOT BE ALLOWED WITHIN THE FRONT SETBACK, AND THE AREA OF THE FRONT SETBACK SHALL BE A BUFFER AND LANDSCAPED AS SUCH. BUFFER SHALL ALLOW FOR NECESSARY ACCESS TO SITE, BUT DRIVEWAYS SHALL OTHERWISE NOT BE ALLOWED IN THE BUFFER.	COMPLIES
§ 300-26.3 A.(1)	MINIMUM PARKING SPACE WIDTH: 10 FT MINIMUM PARKING SPACE DEPTH: 20 FT	10 FT 20 FT

SIGNAGE REQUIREMENTS

CODE SECTION	REQUIRED	PROPOSED
§ 300-17.3 E	SIGNS INDICATING "ENTRANCE", "EXIT", AND "PARKING" NOT TO EXCEED 5 SF	5 SF COMPLIES
§ 300-17.5 A(3)	LIGHTING OF A SIGN MAY ONLY BE BY WHITE LIGHT OF REASONABLE INTENSITY SOLELY DIRECTED AT THE SIGN	COMPLIES
§ 300-17.5 A(4)	SIGNS WILL NOT OBSTRUCT THE VIEW OF TRAFFIC ENTERING OR LEAVING THE PREMISES, THE SIGN WILL NOT EXTEND MORE THAN 3.5 FT ABOVE ESTABLISHED STREET GRADE, AND WILL BE PLACED 25 FT AWAY FROM POINT OF INTERSECTION OF THE MEASURED INTERSECTING STREET LINE	28.3 FT SIGN IS LOCATED OUTSIDE OF SIGHT TRIANGLES
§ 300-17.5 A(6)	NO FREESTANDING SIGN SHALL EXCEED 18 FT IN HEIGHT ABOVE THE NATURAL GRADE, OR PROJECT ABOVE THE RIDGE LINE OF THE PRIMARY BUILDING	18 FT COMPLIES
§ 300-17.5 A(7)A	SIGNS PARALLEL TO OR AGAINST THE FACE OF A BUILDING SHALL NOT EXTEND MORE THAN 15" FROM SAID FACE.	1.25 FT COMPLIES
§ 300-17.5 A(7)B	SIGNS PERPENDICULAR TO THE FACE OR WALL OF A BUILDING SHALL EXTEND NO MORE THAN 54" FROM SUCH BUILDING LINE	4.5 FT COMPLIES
§ 300-17.5 C	SIGN WILL BE SET BACK 10 FT FROM THE PROPERTY LINE	10 FT COMPLIES
§ 300-17.7 A(1)	NO MORE THAN 4 SIGNS SHALL BE MAINTAINED BY EACH COMMERCIAL OR INDUSTRIAL USE, OF WHICH NO MORE THAN 2 SIGNS MAY BE LOCATED ON THE PROPERTY ITSELF; ONLY ONE OF THE TWO SIGNS ON THE PROPERTY MAY BE FREESTANDING	1 FREESTANDING SIGN
§ 300-17.7 A(2)	FREESTANDING SIGNS SHALL NOT EXCEED THE HEIGHT OF THE PRINCIPAL BUILDING OR 18 FT IN HEIGHT, WHICHEVER IS LESS 21.0 FT > 18 FT	18 FT
§ 300-17.7 B	MAXIMUM BUSINESS, BUILDING MOUNTED AND/OR FREESTANDING SIGN - 50 SF MAXIMUM MULTI-TENANT SIGN FOR BUSINESS SIGN - 50 SF	50 SF

LAND USE AND ZONING

PARCEL ID: 208-02528-212, 208-02528-216, 208-02528-226

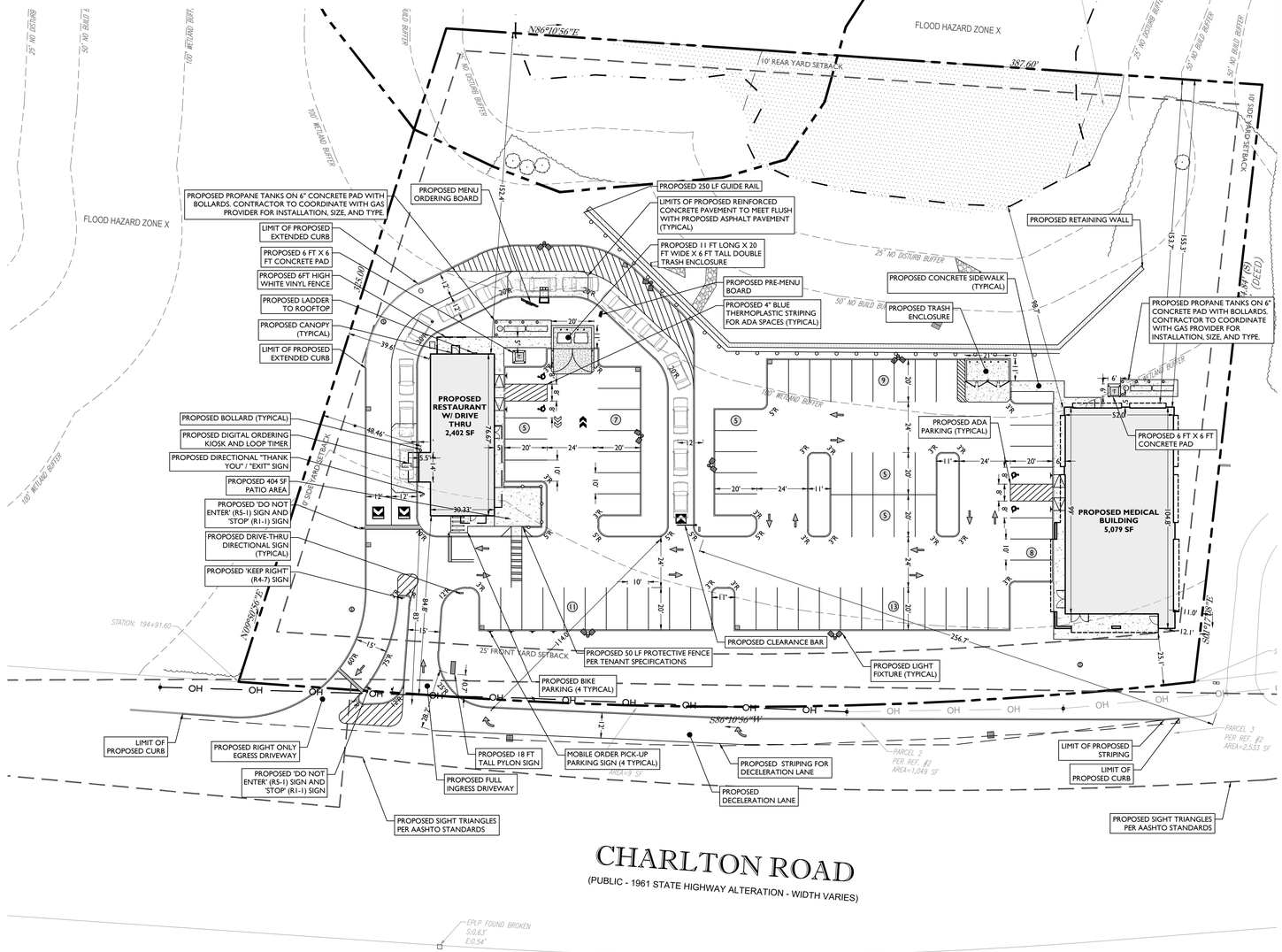
COMMERCIAL DISTRICT (C)

PROPOSED USE			
FAST FOOD ESTABLISHMENT WITH DRIVE-THRU	PERMITTED USE		
MEDICAL FACILITY	PERMITTED USE		
ZONING REQUIREMENT	**REQUIRED**	**EXISTING**	**PROPOSED**
MINIMUM LOT AREA	1 AC	2.95 AC (128,728 SF)	2.95 AC (128,728 SF)
MINIMUM LOT WIDTH*	150 FT	387.6 FT	387.6 FT
MINIMUM LOT FRONTAGE	150 FT	452.9 FT	452.9 FT
MAXIMUM IMPERVIOUS COVERAGE	70%	12.1% (15,661 SF)	38.1% (49,096 SF)
MAXIMUM LOT COVERAGE	30%	4.8% (6,233 SF)	5.8% (7,481 SF)
MAXIMUM HEIGHT	35 FT	< 35 FT (2 STORIES)	RESTAURANT: 21.0 FT URGENT CARE: 35 FT
MINIMUM FRONT YARD SETBACK	25 FT	65.3 FT	25.1 FT
MINIMUM SIDE YARD SETBACK	10 FT	20.3 FT	11.0 FT
MINIMUM REAR YARD SETBACK	10 FT	181.8 FT	152.4 FT

* NO LOT SHALL HAVE A WIDTH LESS THAN THE FRONTAGE SPECIFIED

DRIVE-THRU REQUIREMENTS

CODE SECTION	REQUIRED	PROPOSED
§ 300-16.14 C (1)	DRIVE-THRU AISLES SHALL HAVE A MINIMUM 10 FT INTERIOR RADIUS AT CURVES AND A MINIMUM 12 FT WIDTH	20' R 12 FT COMPLIES
§ 300-16.14 C (2)	DRIVE-THRU ENTRANCES/EXIT SHALL BE AT LEAST 50 FT FROM AN INTERSECTION OF PUBLIC RIGHTS-OF-WAY AND AT LEAST 25 FT FROM THE CURB-CUT OF AN ADJACENT PROPERTY	106.5 FT 251.4 FT COMPLIES
§ 300-16.14 C (3)	ENTRANCE TO A DRIVE-THRU SHALL BE CLEARLY DESIGNATED BY SIGNS AND PAVEMENT MARKINGS	COMPLIES
§ 300-16.14 D (2)	DRIVE-THRU WINDOWS SHALL PROVIDE 180 FEET OF STACKING SPACE	274 FT
§ 300-16.14 E (1)	A 5 FT WIDE PLANTER OR OTHER SUITABLE LANDSCAPE AREA BETWEEN THE DRIVE-THRU AISLE AND THE PARKING AREA THAT INCLUDES SHADE TREES CONSISTENT WITH THOSE USED IN THE PARKING AREA	COMPLIES



SYMBOL / DESCRIPTION

- PROPERTY LINE
- SETBACK LINE
- SAWCUT LINE
- PROPOSED CURB
- PROPOSED DEPRESSED CURB
- PROPOSED FLUSH CURB
- PROPOSED MOUNTABLE CURB
- PROPOSED EXTENDED CURB
- PROPOSED SIGNS / BOLLARDS
- PROPOSED BUILDING
- PROPOSED CONCRETE
- PROPOSED AREA LIGHT
- PROPOSED RETAINING WALL
- PROPOSED HANDRAIL
- PROPOSED CHAINLINK FENCE
- PROPOSED BOARD-ON-BOARD FENCE
- PROPOSED GUIDERAIL
- PROPOSED BUILDING DOORS

GENERAL NOTES

1. THE CONTRACTOR SHALL VERIFY AND FAMILIARIZE THEMSELVES WITH THE EXISTING SITE CONDITIONS AND THE PROPOSED SCOPE OF WORK (INCLUDING DIMENSIONS, LAYOUT, ETC.) PRIOR TO INITIATING THE IMPROVEMENTS IDENTIFIED WITHIN THESE DOCUMENTS. SHOULD ANY DISCREPANCY BE FOUND BETWEEN THE EXISTING SITE CONDITIONS AND THE PROPOSED WORK THE CONTRACTOR SHALL NOTIFY STONEFIELD ENGINEERING & DESIGN, LLC. PRIOR TO THE START OF CONSTRUCTION.
2. THE CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS AND ENSURE THAT ALL REQUIRED APPROVALS HAVE BEEN OBTAINED PRIOR TO THE START OF CONSTRUCTION. COPIES OF ALL REQUIRED PERMITS AND APPROVALS SHALL BE KEPT ON SITE AT ALL TIMES DURING CONSTRUCTION.
3. ALL CONTRACTORS WILL, TO THE FULLEST EXTENT PERMITTED BY LAW, INDEMNIFY AND HOLD HARMLESS STONEFIELD ENGINEERING & DESIGN, LLC. AND IT'S SUB-CONSULTANTS FROM AND AGAINST ANY DAMAGES AND LIABILITIES INCLUDING ATTORNEY'S FEES ARISING OUT OF CLAIMS BY EMPLOYEES OF THE CONTRACTOR IN ADDITION TO CLAIMS CONNECTED TO THE PROJECT AS A RESULT OF NOT CARRYING THE PROPER INSURANCE FOR WORKERS COMPENSATION, LIABILITY INSURANCE, AND LIMITS OF COMMERCIAL GENERAL LIABILITY INSURANCE.
4. THE CONTRACTOR SHALL NOT DEVIATE FROM THE PROPOSED IMPROVEMENTS IDENTIFIED WITHIN THIS PLAN SET UNLESS APPROVAL IS PROVIDED IN WRITING BY STONEFIELD ENGINEERING & DESIGN, LLC.
5. THE CONTRACTOR IS RESPONSIBLE TO DETERMINE THE MEANS AND METHODS OF CONSTRUCTION.
6. THE CONTRACTOR SHALL NOT PERFORM ANY WORK OR CAUSE DISTURBANCE ON A PRIVATE PROPERTY NOT CONTROLLED BY THE PERSON OR ENTITY WHO HAS AUTHORIZED THE WORK WITHOUT PRIOR WRITTEN CONSENT FROM THE OWNER OF THE PRIVATE PROPERTY.
7. THE CONTRACTOR IS RESPONSIBLE TO RESTORE ANY DAMAGED OR UNDERMINED STRUCTURE OR SITE FEATURE THAT IS IDENTIFIED TO REMAIN ON THE PLAN SET. ALL REPAIRS SHALL USE NEW MATERIALS TO RESTORE THE FEATURE TO ITS EXISTING CONDITION AT THE CONTRACTORS EXPENSE.
8. CONTRACTOR IS RESPONSIBLE TO PROVIDE THE APPROPRIATE SHOP DRAWINGS, PRODUCT DATA, AND OTHER REQUIRED SUBMITTALS FOR REVIEW. STONEFIELD ENGINEERING & DESIGN, LLC. WILL REVIEW THE SUBMITTALS IN ACCORDANCE WITH THE DESIGN INTENT AS REFLECTED WITHIN THE PLAN SET.
9. THE CONTRACTOR IS RESPONSIBLE FOR TRAFFIC CONTROL IN ACCORDANCE WITH MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, LATEST EDITION.
10. THE CONTRACTOR IS REQUIRED TO PERFORM ALL WORK IN THE PUBLIC RIGHT-OF-WAY IN ACCORDANCE WITH THE APPROPRIATE GOVERNING AUTHORITY AND SHALL BE RESPONSIBLE FOR THE PROCUREMENT OF STREET OPENING PERMITS.
11. THE CONTRACTOR IS REQUIRED TO RETAIN AN OSHA CERTIFIED SAFETY INSPECTOR TO BE PRESENT ON SITE AT ALL TIMES DURING CONSTRUCTION & DEMOLITION ACTIVITIES.
12. SHOULD AN EMPLOYEE OF STONEFIELD ENGINEERING & DESIGN, LLC. BE PRESENT ON SITE AT ANY TIME DURING CONSTRUCTION, IT DOES NOT RELIEVE THE CONTRACTOR OF ANY OF THE RESPONSIBILITIES AND REQUIREMENTS LISTED IN THE NOTES WITHIN THIS PLAN SET.

30' 0' 30' 60'

GRAPHIC SCALE IN FEET

1" = 30'

ISSUE	DATE	BY	DESCRIPTION
5	05/16/2023	KO	FOR MUNICIPAL SUBMISSION
4	04/06/2023	JR	REVISED PER NEW BUILDING ELEVATIONS
3	01/31/2023	JR	FOR CONSERVATION COMMISSION SUBMISSION
2	01/06/2023	JR	FOR DOT SUBMISSION
1	11/02/2022	JR	FOR DOT SUBMISSION

NOT APPROVED FOR CONSTRUCTION

STONEFIELD engineering & design
Rutherford, NJ · New York, NY · Boston, MA
Princeton, NJ · Tampa, FL · Detroit, MI
www.stonefieldeng.com
120 Washington Street, Suite 210, Salem, MA 01970
Phone 617.203.2076

SITE PLANS

ALRIG USA DEVELOPMENTS

PROPOSED MULTI-TENANT DEVELOPMENT

MAP: 208 LOTS: 216, 216 & 212
212, 216 & 226 CHARLTON ROAD
TOWN OF STURBRIDGE
WORCESTER COUNTY, MASSACHUSETTS

JAKE MODESTOW, P.E.
MASSACHUSETTS LICENSE No. 55253
LICENSED PROFESSIONAL ENGINEER

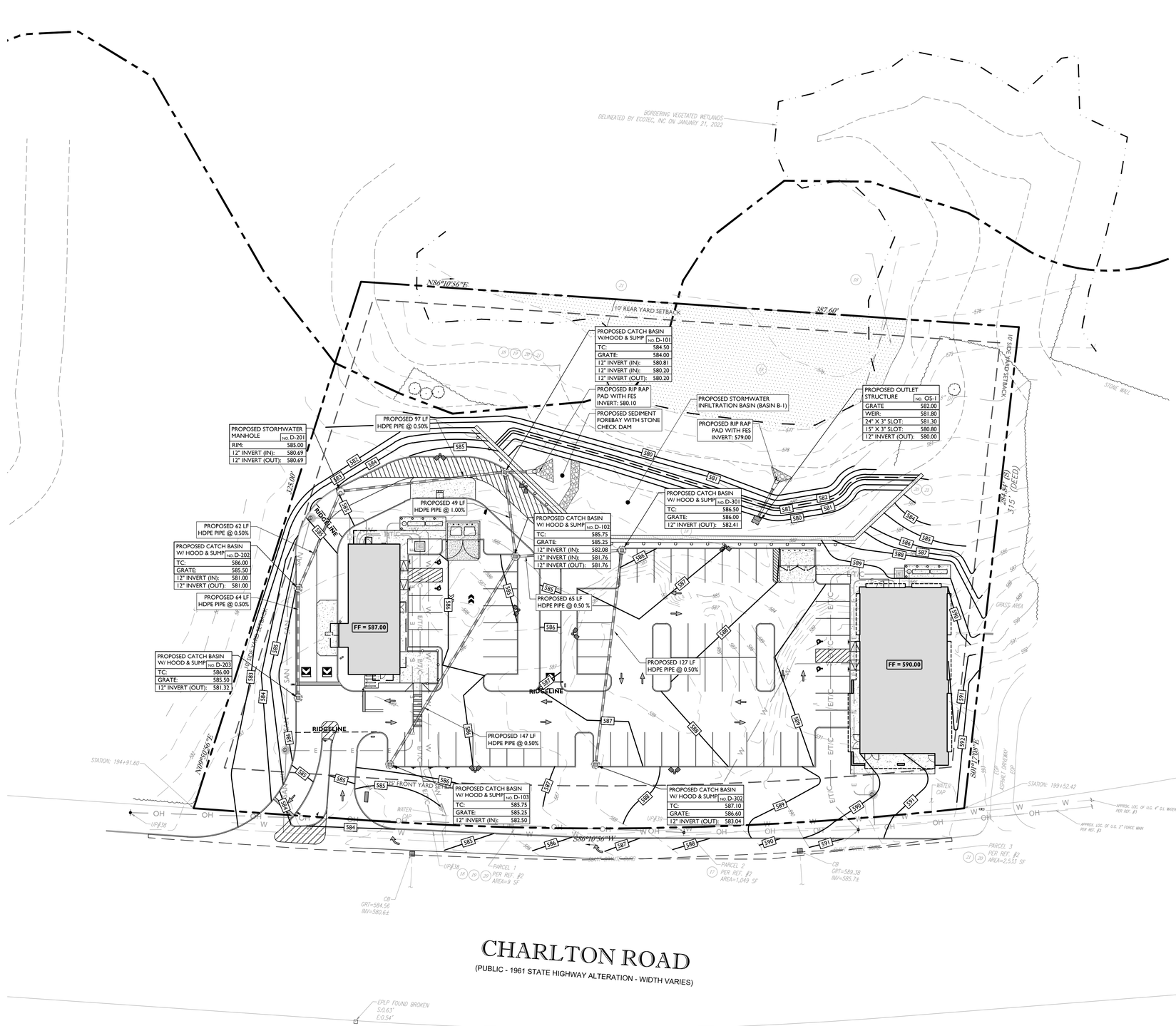
STONEFIELD engineering & design

SCALE: 1" = 30' | PROJECT ID: BOS-210035

TITLE: SITE PLAN

DRAWING: C-4

Z:\BOSTON\BOS\2021\BOS-210035.A\ENG - 212, 216 & 226 CHARLTON ROAD, STURBRIDGE, MA\CAD\PLOT\XXX-24-SITE.DWG



SYMBOL / DESCRIPTION

- PROPERTY LINE
- 100 — PROPOSED GRADING CONTOUR
- RIDGELINE — PROPOSED GRADING RIDGELINE
- PROPOSED STORMWATER STRUCTURES
- PROPOSED STORMWATER PIPING
- PROPOSED UNDERGROUND OUTLET STRUCTURE

DRAINAGE AND UTILITY NOTES

1. THE CONTRACTOR TO PERFORM A TEST PIT PRIOR TO CONSTRUCTION (RECOMMEND 30 DAYS PRIOR) AT LOCATIONS OF EXISTING UTILITY CROSSINGS FOR STORMWATER IMPROVEMENTS. SHOULD A CONFLICT EXIST, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY STONEFIELD ENGINEERING & DESIGN, LLC. IN WRITING.
2. CONTRACTOR SHALL START CONSTRUCTION OF STORM LINES AT THE LOWEST INVERT AND WORK UP-GRADIENT.
3. THE CONTRACTOR IS REQUIRED TO CALL THE APPROPRIATE AUTHORITY FOR NOTICE OF CONSTRUCTION/EXCAVATION AND UTILITY MARK OUT PRIOR TO THE START OF CONSTRUCTION IN ACCORDANCE WITH STATE LAW. CONTRACTOR IS REQUIRED TO CONFIRM THE HORIZONTAL AND VERTICAL LOCATION OF UTILITIES IN THE FIELD. SHOULD A DISCREPANCY EXIST BETWEEN THE FIELD LOCATION OF A UTILITY AND THE LOCATION SHOWN ON THE PLAN SET OR SURVEY, THE CONTRACTOR SHALL NOTIFY STONEFIELD ENGINEERING & DESIGN, LLC. IMMEDIATELY IN WRITING.
4. THE CONTRACTOR IS RESPONSIBLE TO MAINTAIN A RECORD OF THE AS-BUILT LOCATIONS OF ALL PROPOSED UNDERGROUND INFRASTRUCTURE. THE CONTRACTOR SHALL NOTE ANY DISCREPANCIES BETWEEN THE AS-BUILT LOCATIONS AND THE LOCATIONS DEPICTED WITHIN THE PLAN SET. THIS RECORD SHALL BE PROVIDED TO THE OWNER FOLLOWING COMPLETION OF WORK.

EXCAVATION, SOIL PREPARATION, AND DEWATERING NOTES

1. THE CONTRACTOR IS REQUIRED TO REVIEW THE REFERENCED GEOTECHNICAL DOCUMENTS PRIOR TO CONSTRUCTION. THESE DOCUMENTS SHALL BE CONSIDERED A PART OF THE PLAN SET.
2. THE CONTRACTOR IS REQUIRED TO PREPARE SUBGRADE SOILS BENEATH ALL PROPOSED IMPROVEMENTS AND BACKFILL ALL EXCAVATIONS IN ACCORDANCE WITH RECOMMENDATIONS BY THE GEOTECHNICAL ENGINEER OF RECORD.
3. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING SHORING FOR ALL EXCAVATIONS AS REQUIRED. CONTRACTOR SHALL HAVE THE SHORING DESIGN PREPARED BY A QUALIFIED PROFESSIONAL. SHORING DESIGNS SHALL BE SUBMITTED TO STONEFIELD ENGINEERING & DESIGN, LLC. AND THE OWNER PRIOR TO THE START OF CONSTRUCTION.
4. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING THAT ALL OPEN EXCAVATIONS ARE PERFORMED AND PROTECTED IN ACCORDANCE WITH THE LATEST OSHA REGULATIONS.
5. THE CONTRACTOR IS RESPONSIBLE FOR ANY DEWATERING DESIGN AND OPERATIONS, AS REQUIRED. TO CONSTRUCT THE PROPOSED IMPROVEMENTS. THE CONTRACTOR SHALL OBTAIN ANY REQUIRED PERMITS FOR DEWATERING OPERATIONS AND GROUNDWATER DISPOSAL.

STORMWATER INFILTRATION BMP CONSTRUCTION NOTES

1. PRIOR TO THE START OF CONSTRUCTION, ANY AREA DESIGNATED TO BE USED FOR AN INFILTRATION BMP (E.G. BASIN, BIORETENTION AREA, ETC.) SHALL BE FENCED OFF AND SHALL NOT BE UTILIZED AS STORAGE FOR CONSTRUCTION EQUIPMENT OR AS A STOCKPILE AREA FOR CONSTRUCTION MATERIALS. NO ACTIVITY SHALL BE PERMITTED WITHIN THE INFILTRATION BASIN AREA UNLESS RELATED TO THE CONSTRUCTION OF THE INFILTRATION BASIN. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO NOTIFY ALL SUBCONTRACTORS OF BASIN AREA RESTRICTIONS.
2. THE CONTRACTOR SHALL MAKE EVERY EFFORT, WHERE PRACTICAL, TO AVOID SUBGRADE SOIL COMPACTION IN THE AREAS DESIGNATED TO BE USED FOR AN INFILTRATION BMP.
3. ALL EXCAVATION WITHIN THE LIMITS OF ANY INFILTRATION BMP SHALL BE PERFORMED WITH THE LIGHTEST PRACTICAL EXCAVATION EQUIPMENT. ALL EXCAVATION EQUIPMENT SHALL BE PLACED OUTSIDE THE LIMITS OF THE BASIN WHERE FEASIBLE. THE USE OF LIGHT-WEIGHT, RUBBER-TIRED EQUIPMENT (LESS THAN 8 PSI APPLIED TO THE GROUND SURFACE) IS RECOMMENDED WITHIN THE BASIN LIMITS.
4. THE SEQUENCE OF SITE CONSTRUCTION SHALL BE COORDINATED WITH BASIN CONSTRUCTION TO ADHERE TO SEQUENCING LIMITATIONS.
5. DURING THE FINAL GRADING OF AN INFILTRATION BASIN, THE BOTTOM OF THE BASIN SHALL BE DEEPLY TILLED WITH A ROTARY TILLER OR DISC HARROW AND THEN SMOOTHED OUT WITH A LEVELING DRAW OR EQUIVALENT GRADING EQUIPMENT. ALL GRADING EQUIPMENT SHALL BE LOCATED OUTSIDE OF THE BASIN BOTTOM WHERE FEASIBLE.
6. FOLLOWING CONSTRUCTION OF AN INFILTRATION BASIN, SOIL INFILTRATION TESTING BY A LICENSED GEOTECHNICAL ENGINEER IS REQUIRED TO CERTIFY COMPLIANCE WITH THE DESIGN INFILTRATION RATES IN ACCORDANCE WITH APPENDIX E OF THE NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION'S BEST MANAGEMENT PRACTICES MANUAL, LATEST EDITION. IF THE FIELD INFILTRATION RATES ARE LOWER THAN THE RATE USED DURING DESIGN, THE CONTRACTOR SHALL NOTIFY STONEFIELD ENGINEERING & DESIGN, LLC. IN WRITING IMMEDIATELY TO DETERMINE THE APPROPRIATE COURSE OF ACTION.
7. THE CONTRACTOR SHALL NOTIFY THE MUNICIPALITY TO DETERMINE IF WITNESS TESTING IS REQUIRED DURING INFILTRATION BASIN EXCAVATION AND/OR SOIL INFILTRATION TESTING.

STORMWATER UNDERGROUND BMP CONSTRUCTION NOTES

1. THE CONTRACTOR SHALL INSTALL AND BACKFILL THE UNDERGROUND BMP IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS.
2. UNDERGROUND BASINS SHALL UTILIZE A STONE BACKFILL WITH A MINIMUM VOID RATIO OF 40%.
3. NO CONSTRUCTION LOADING OVER UNDERGROUND BASINS IS PERMITTED UNTIL BACKFILL IS COMPLETE PER THE MANUFACTURER'S SPECIFICATIONS. NO VEHICLES SHALL BE STAGED OR OPERATE FROM A FIXED POSITION OVER THE BASIN.

30' 0' 30' 60'
GRAPHIC SCALE IN FEET
1" = 30'

ISSUE	DATE	BY	DESCRIPTION
5	05/16/2023	KO	FOR MUNICIPAL SUBMISSION
4	04/06/2023	JR	REVISED PER NEW BUILDING ELEVATIONS
3	01/31/2023	JR	FOR CONSERVATION COMMISSION SUBMISSION
2	01/06/2023	JR	FOR DOT SUBMISSION
1	11/02/2022	JR	FOR DOT SUBMISSION

NOT APPROVED FOR CONSTRUCTION

STONEFIELD engineering & design
Rutherford, NJ · New York, NY · Boston, MA
Princeton, NJ · Tampa, FL · Detroit, MI
www.stonefieldeng.com
120 Washington Street, Suite 210, Salem, MA 01970
Phone 617.203.2076

SITE PLANS

ALRIG USA DEVELOPMENTS
PROPOSED MULTI-TENANT DEVELOPMENT

MAP: 208 LOTS: 216 & 212,
212, 210 & 224 CHARLTON ROAD
TOWN OF STURBRIDGE
WORCESTER COUNTY, MASSACHUSETTS

ALRIG USA

JAKE MODESTOW, P.E.
MASSACHUSETTS LICENSE No. 55253
LICENSED PROFESSIONAL ENGINEER

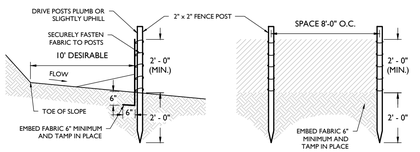
STONEFIELD engineering & design

SCALE: 1" =30' | PROJECT ID: BOS-210035

TITLE: STORMWATER MANAGEMENT PLAN

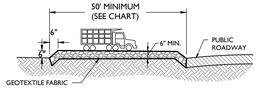
DRAWING: C-6

Z:\BOSTON\BOS\2021\BOS-210035-ALRIG - 212 216 & 224 CHARLTON ROAD, STURBRIDGE, MA\CAD\PLOT\XXX-BASTRM.DWG

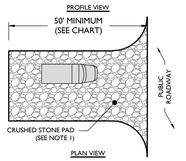


NOTES:
1. SECURELY FASTEN GEOTEXTILE TO FENCE POST BY USE OF WIRE TIES, HOG RINGS, STAPLES OR POCKETS. FOUR TO SIX FASTENERS PER POST.
2. GEOTEXTILE FABRIC TO BE EMBEDDED 6" (MIN.) AND TAMP IN PLACE.
3. SECURELY FASTEN ENDS OF INDIVIDUAL ROLLS OF GEOTEXTILE TO A POST BY WRAPPING EACH END OF THE GEOTEXTILE AROUND THE POST TWICE AND ATTACHING AS SPECIFIED IN NOTE 1 ABOVE. SPLICING OF INDIVIDUAL ROLLS SHALL NOT OCCUR AT LOW POINTS.
4. SET SILT FENCE WITHIN PROJECT LIMITS. 10'-0" IS DESIRABLE.

SILT FENCE DETAIL

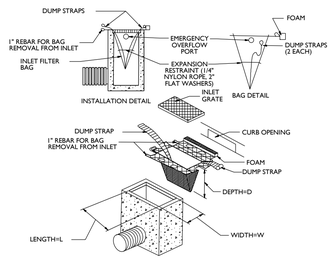


SLOPE OF PUBLIC ROADWAY	LENGTH OF STONE REQ'D	
	COARSE GRAINED SOILS	FINE GRAINED SOILS
0% TO 2%	50 FEET	100 FEET
2% TO 5%	100 FEET	200 FEET
> 5%	SEE NOTE 4	



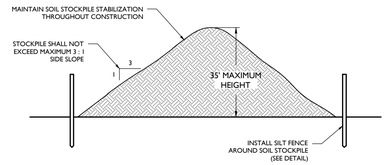
NOTES:
1. STONE SHALL BE ASTM C-33, SIZE No. 2 (2.5" TO 1.5") OR No. 3 (2" TO 1") CLEAN CRUSHED ANGULAR STONE.
2. WIDTH SHALL BE 15' MINIMUM OR THE FULL WIDTH OF THE ACCESS POINT, WHICHEVER IS GREATER.
3. STORMWATER FROM UP-SLOPE AREAS SHALL BE DIVERTED AWAY FROM THE STABILIZED PAD, WHERE POSSIBLE. AT POORLY DRAINED LOCATIONS, SUBSURFACE DRAINAGE GRAVEL FILTER OR GEOTEXTILE SHALL BE INSTALLED BEFORE THE STABILIZED CONSTRUCTION ENTRANCE.
4. WHERE THE SLOPE OF THE ROADWAY EXCEEDS 5%, A STABILIZED BASE OF HOT MIX ASPHALT BASE COURSE SHALL BE INSTALLED. THE TYPE AND THICKNESS OF THE BASE COURSE AND USE OF DENSE GRADED AGGREGATE SUB-BASE SHALL BE AS PRESCRIBED BY LOCAL MUNICIPAL ORDINANCE OR GOVERNING AUTHORITY.
5. CONTRACTOR SHALL PROVIDE A SMOOTH TRANSITION BETWEEN THE STABILIZED CONSTRUCTION ACCESS AND THE PUBLIC ROADWAY.

STABILIZED CONSTRUCTION ACCESS DETAIL



INLET FILTER BAG DETAIL

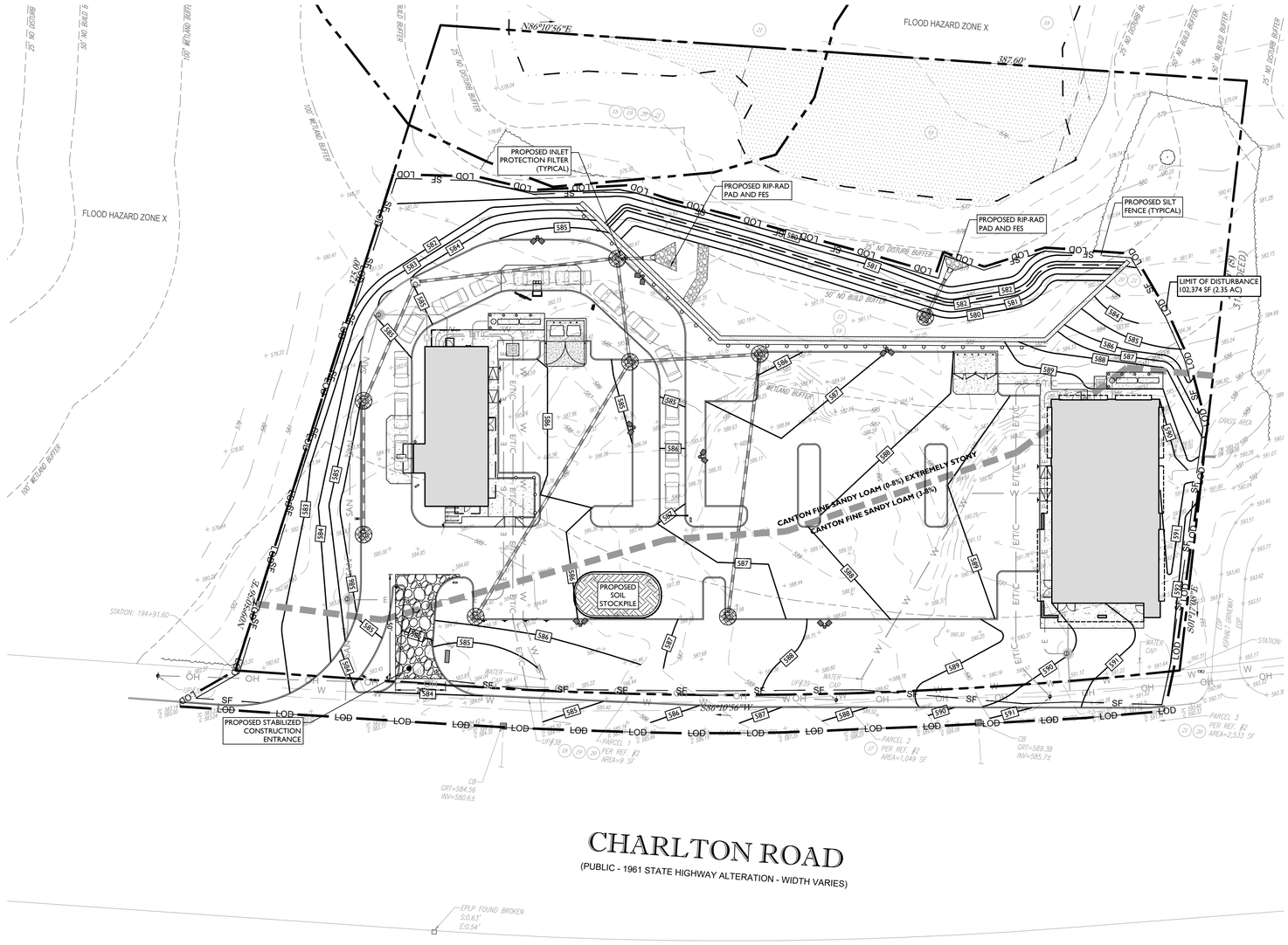
NOT TO SCALE



NOTES:
1. STOCKPILES SHALL BE SITUATED SO AS NOT TO OBSTRUCT NATURAL DRAINAGE OR CAUSE OFF-SITE ENVIRONMENTAL DAMAGE.
2. STOCKPILES SHALL BE STABILIZED IN ACCORDANCE WITH THE STANDARDS FOR PERMANENT OR TEMPORARY VEGETATIVE COVER FOR SOIL STABILIZATION, AS APPROPRIATE (SEE SOIL EROSION NOTES).

SOIL STOCKPILE DETAIL

NOT TO SCALE



DUST CONTROL NOTES

1. MULCHES - SEE STANDARD OF STABILIZATION WITH MULCHES ONLY, PG. 5-1
2. VEGETATIVE COVER - SEE STANDARD FOR: TEMPORARY VEGETATIVE COVER, PG. 7-1, PERMANENT VEGETATIVE COVER FOR SOIL STABILIZATION PG. 4-1 AND PERMANENT STABILIZATION WITH SOD, PG. 6-1
3. SPRAY-ON ADHESIVES - ON MINERAL SOILS (NOT EFFECTIVE ON MUCK SOILS). KEEP TRAFFIC OFF THESE AREAS.
4. TILLAGE - TO ROUGHEN SURFACE AND BRING CLODS TO THE SURFACE. THIS IS A TEMPORARY EMERGENCY MEASURE WHICH SHOULD BE USED BEFORE SOIL BLOWING STARTS. BEGIN PLOWING ON WINDWARD SIDE OF SITE. CHISEL-TYPE PLOWS SPACED ABOUT 12 INCHES APART AND SPRING-TOOTHED HARROWS ARE EXAMPLES OF EQUIPMENT WHICH MAY PRODUCE THE DESIRED EFFECT.
5. SPRINKLING - SITE IS SPRINKLED UNTIL THE SURFACE IS WET.
6. BARRIERS - SOLID BOARD FENCES, SNOW FENCES, BURLAP FENCES, CRATE WALLS, BALES OF HAY AND SIMILAR MATERIAL CAN BE USED TO CONTROL AIR CURRENTS AND SOIL BLOWING.
7. CALCIUM CHLORIDE - SHALL BE IN THE FORM OF LOOSE, DRY GRANULES OR FLAKES FINE ENOUGH TO FEED THROUGH COMMONLY USED SPREADERS AT A RATE THAT WILL KEEP SURFACE MOIST BUT NOT CAUSE POLLUTION OR PLANT DAMAGE. IF USED ON STEEPER SLOPES, THEN USE OTHER PRACTICES TO PREVENT WASHING INTO STREAMS OR ACCUMULATION AROUND PLANTS.
8. STONE - COVER SURFACE WITH CRUSHED STONE OR COARSE GRAVEL.

SEQUENCE OF CONSTRUCTION

1. INSTALL CONSTRUCTION ENTRANCE AND SILT FENCE (2 DAYS).
2. DEMOLISH EXISTING STRUCTURES, PAVEMENT, AND GRAVEL (7 DAYS).
3. ROUGH GRADING AND TEMPORARY SEEDING (21 DAYS).
4. BUILDING CONSTRUCTION AND SITE IMPROVEMENTS (120 DAYS).
5. LANDSCAPING IMPROVEMENTS AND FINAL SEEDING (7 DAYS).
6. REMOVE SOIL EROSION MEASURES (1 DAY).

TOTAL ESTIMATED TIME = 8 MONTHS

NOTE: TIME DURATIONS ARE APPROXIMATE AND ARE INTENDED TO ACT AS A GENERAL GUILE TO THE CONSTRUCTION TIMELINE. ALL DURATIONS ARE SUBJECT TO CHANGE BY CONTRACTOR. CONTRACTOR SHALL SUBMIT CONSTRUCTION SCHEDULE TO TOWNSHIP AND ENGINEER. CONTRACTOR SHALL PHASE CONSTRUCTION ACCORDINGLY

STABILIZATION SPECIFICATIONS:

1.A. TEMPORARY SEEDING AND MULCHING:
GROUND LIMESTONE - APPLIED UNIFORMLY ACCORDING TO SOIL TEST RECOMMENDATIONS.
FERTILIZER - APPLY 11LBS/1,000 SF OF 10-20-10 OR EQUIVALENT WITH 50% WATER INSOLUBLE NITROGEN (UNLESS A SOIL TEST INDICATES OTHERWISE) WORKED INTO THE SOIL A MINIMUM OF 4".
SEED - PERENNIAL RYEGRASS 100 LBS./ACRE (2.3 LBS./1,000 SF) OR OTHER APPROVED SEEDS; PLANT BETWEEN MARCH 1 AND MAY 15 OR BETWEEN AUGUST 15 AND OCTOBER 1.
MULCH - UNROTTED STRAW OR HAY AT A RATE OF 70 TO 90 LBS./1,000 SF APPLIED TO ACHIEVE 95% SOIL SURFACE COVERAGE. MULCH SHALL BE ANCHORED BY APPROVED METHODS (I.E. PEG AND TWINE, MULCH NETTING, OR LIQUID MULCH BINDER).

1.B. PERMANENT SEEDING AND MULCHING:
TOPSOIL - UNIFORM APPLICATION TO A DEPTH OF 5" (UNSETTLED).
GROUND LIMESTONE - APPLIED UNIFORMLY ACCORDING TO SOIL TEST RECOMMENDATIONS.
FERTILIZER - APPLY 11 LBS./1,000 SF OF 10-10-10 OR EQUIVALENT WITH 50% WATER INSOLUBLE NITROGEN (UNLESS A SOIL TEST INDICATES OTHERWISE) WORKED INTO THE SOIL A MINIMUM OF 4".
SEED - TURF TYPE TALL FESCUE (BLEND OF 3 CULTIVARS) 350 LBS./ACRE (8 LBS./1,000 SF) OR OTHER APPROVED SEEDS; PLANT BETWEEN MARCH 1 AND OCTOBER 1 (SUMMER SEEDINGS REQUIRE IRRIGATION)
MULCH - UNROTTED STRAW OR HAY AT A RATE OF 70 TO 90 LBS./1,000 SF APPLIED TO ACHIEVE 95% SOIL SURFACE COVERAGE. MULCH SHALL BE ANCHORED BY APPROVED METHODS (I.E. PEG AND TWINE, MULCH NETTING, OR LIQUID MULCH BINDER).

SOIL CHARACTERISTICS CHART

TYPE OF SOIL	CANTON FINE SANDY LOAM (0-8%) EXTREMELY STONY	CANTON FINE SANDY LOAM (3-8%)
PERCENT OF SITE COVERAGE	73.40%	26.60%
HYDROLOGIC SOIL GROUP	B	B
DEPTH TO RESTRICTIVE LAYER	19 - 39 INCHES	19 - 39 INCHES
SOIL PERMEABILITY	0.14 - 14.17 INCH/HOUR	0.14 - 14.17 INCH/HOUR
DEPTH TO WATER TABLE	>80 INCHES	>80 INCHES

30' 0' 30' 60'
GRAPHIC SCALE IN FEET
1" = 30'

SYMBOL / DESCRIPTION

- PROPERTY BOUNDARY
- ADJACENT PROPERTY BOUNDARY
- LOD — PROPOSED LIMIT OF DISTURBANCE
- SF — PROPOSED SILT FENCE
- TPF — PROPOSED TREE PROTECTION FENCE
- PROPOSED STOCKPILE & EQUIPMENT STORAGE
- PROPOSED STABILIZED CONSTRUCTION ENTRANCE
- PROPOSED INLET PROTECTION FILTER

SOIL EROSION AND SEDIMENT CONTROL NOTES

1. THE CONTRACTOR IS RESPONSIBLE FOR SOIL EROSION AND SEDIMENT CONTROL IN ACCORDANCE WITH LOCAL, STATE, AND FEDERAL REQUIREMENTS.
2. THE CONTRACTOR IS RESPONSIBLE FOR DUST CONTROL IN COMPLIANCE WITH LOCAL, STATE, AND FEDERAL AIR QUALITY STANDARDS.
3. THE CONTRACTOR IS RESPONSIBLE TO INSPECT ALL SOIL EROSION AND SEDIMENT CONTROL MEASURES WEEKLY AND AFTER A PRECIPITATION EVENT GREATER THAN 1 INCH. THE CONTRACTOR SHALL MAINTAIN AN INSPECTION LOG ON SITE AND DOCUMENT CORRECTIVE ACTION TAKEN THROUGHOUT THE COURSE OF CONSTRUCTION AS REQUIRED.

ISSUE	DATE	BY	DESCRIPTION
5	05/16/2023	KO	FOR MUNICIPAL SUBMISSION
4	04/06/2023	JR	REVISED PER NEW BUILDING ELEVATIONS
3	01/31/2023	JR	FOR CONSERVATION COMMISSION SUBMISSION
2	01/06/2023	JR	FOR DOT SUBMISSION
1	11/02/2022	JR	FOR DOT SUBMISSION

NOT APPROVED FOR CONSTRUCTION

STONEFIELD engineering & design
Rutherford, NJ · New York, NY · Boston, MA
Princeton, NJ · Tampa, FL · Detroit, MI
www.stonefieldeng.com
120 Washington Street, Suite 210, Salem, MA 01970
Phone 617.203.2076

SITE PLANS

ALRIG USA DEVELOPMENTS

PROPOSED MULTI-TENANT DEVELOPMENT

MAP: 208 LOTS: 216 & 212,
216, 214 & 224 CHARLTON ROAD
TOWN OF STURBRIDGE
WORCESTER COUNTY, MASSACHUSETTS

ALRIG USA

JAKE MODESTOW, P.E.
MASSACHUSETTS LICENSE No. 55253
LICENSED PROFESSIONAL ENGINEER

STONEFIELD engineering & design

SCALE: 1" = 30' | PROJECT ID: BOS-210035

TITLE: SOIL EROSION & SEDIMENT CONTROL PLAN

DRAWING: C-9

Z:\BOS\PROJECTS\BOS\210035 (ALRIG - 212,216 & 224 CHARLTON ROAD, STURBRIDGE, MA)\CAD\PLOTS\XX-DR-SESC.DWG

APPENDIX B
PROJECT SOILS

INVENTORY

B-1: NRCS SOILS REPORT

B-2: JOHN TURNER CONSULTING, INC.

GEOTECHNICAL REPORT

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Worcester County, Massachusetts, Southern Part

June 8, 2022

Custom Soil Resource Report
Soil Map

Map Scale: 1:931 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 10 20 40 60

Feet
0 45 90 180 270

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Worcester County, Massachusetts, Southern Part
Survey Area Data: Version 14, Sep 3, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 15, 2020—Oct 31, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
420B	Canton fine sandy loam, 3 to 8 percent slopes	0.9	26.6%
422B	Canton fine sandy loam, 0 to 8 percent slopes, extremely stony	2.5	73.4%
Totals for Area of Interest		**3.4**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the

Worcester County, Massachusetts, Southern Part

420B—Canton fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2w81b
Elevation: 0 to 1,180 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Canton and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canton

Setting

Landform: Hills, moraines, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, crest, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: gravelly fine sandy loam
2C - 26 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Scituate

Percent of map unit: 10 percent
Landform: Hills, drumlins, ground moraines
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Montauk

Percent of map unit: 5 percent
Landform: Moraines, ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Charlton

Percent of map unit: 4 percent
Landform: Ridges, ground moraines, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Swansea

Percent of map unit: 1 percent
Landform: Marshes, depressions, bogs, swamps, kettles
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

422B—Canton fine sandy loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w818
Elevation: 0 to 1,180 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Canton, extremely stony, and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canton, Extremely Stony

Setting

Landform: Moraines, hills, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 5 inches: fine sandy loam
Bw1 - 5 to 16 inches: fine sandy loam
Bw2 - 16 to 22 inches: gravelly fine sandy loam
2C - 22 to 67 inches: gravelly loamy sand

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Charlton, extremely stony

Percent of map unit: 6 percent
Landform: Ridges, ground moraines, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Scituate, extremely stony

Percent of map unit: 6 percent
Landform: Hills, ground moraines, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest

Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

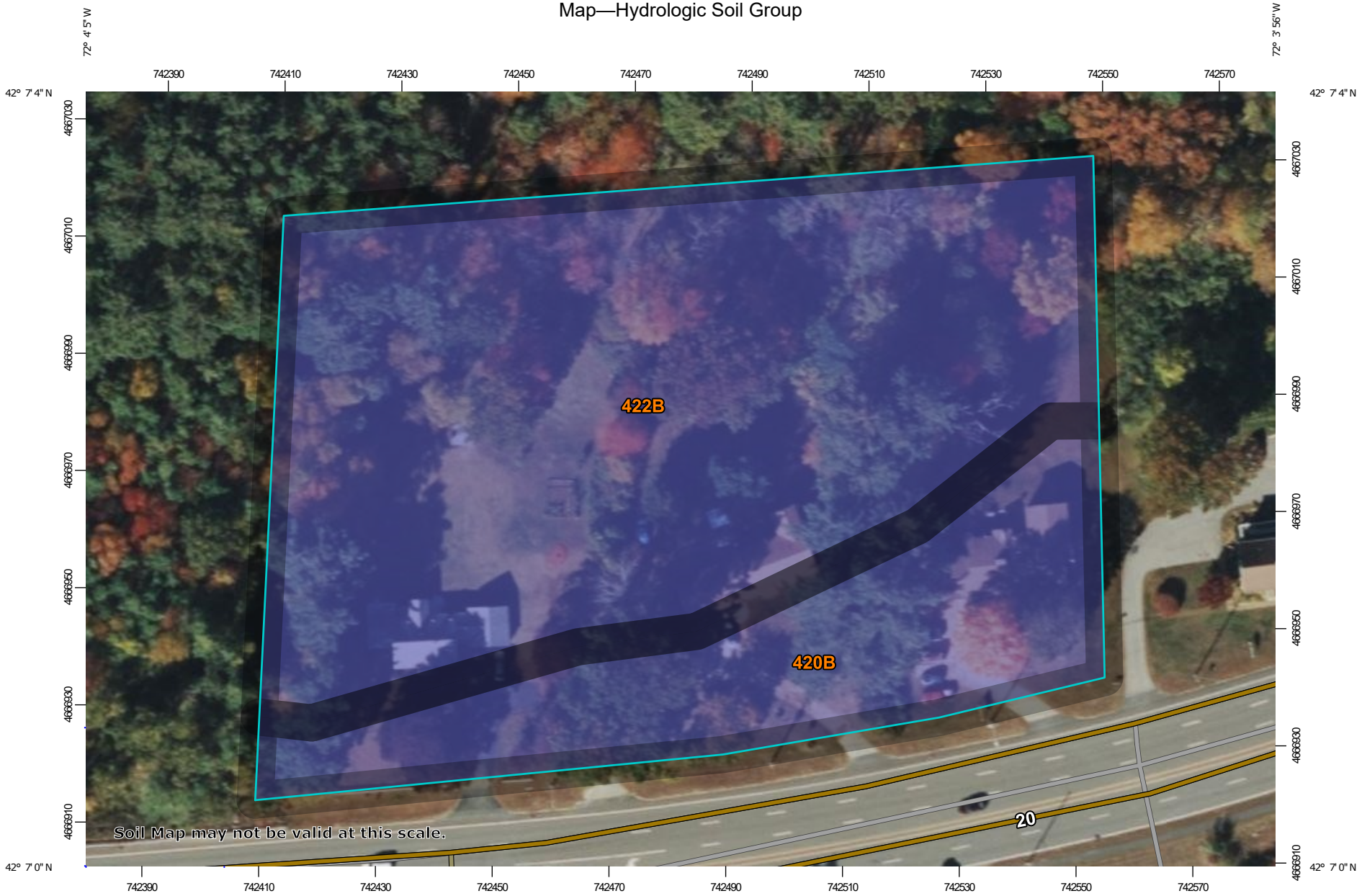
Swansea

Percent of map unit: 4 percent
Landform: Marshes, depressions, bogs, swamps, kettles
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Montauk, extremely stony

Percent of map unit: 4 percent
Landform: Recessionial moraines, ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Custom Soil Resource Report
Map—Hydrologic Soil Group



Map Scale: 1:931 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 10 20 40 60

Feet
0 45 90 180 270

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Worcester County, Massachusetts, Southern Part
Survey Area Data: Version 14, Sep 3, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 15, 2020—Oct 31, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
420B	Canton fine sandy loam, 3 to 8 percent slopes	B	0.9	26.6%
422B	Canton fine sandy loam, 0 to 8 percent slopes, extremely stony	B	2.5	73.4%
Totals for Area of Interest			**3.4**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

GEOTECHNICAL INVESTIGATION REPORT

PROPOSED MIXED-USE DEVELOPMENT
212-226 Charlton Road
Sturbridge, Massachusetts

Prepared for:

Alrig USA
30200 Telegraph Rd, Suite 205
Bingham Farms, MI 48025

Prepared by:

John Turner Consulting, Inc.
356 Manchaug Road
Sutton, MA 01590

JTC Project No. 22-04-059

August 8, 2022

Alex Pryor
Geotechnical Staff Engineer
356 Manchaug Road
Sutton, MA 01590
apryor@consultjtc.com
Ph: (401) 330-8382

Stephen C. Lanne, P.E.
Vice President of Engineering
356 Manchaug Road
Sutton, MA 01590
slanne@consultjtc.com
Ph: (413) 222-1675

August 8, 2022

Ms. Jordyn Maxwell
Alrig USA
30200 Telegraph Rd, Suite 205
Bingham Farms, Michigan 48025
E: jordyn@alrigusa.com
PH: 248-303-6083

RE: Geotechnical Investigation Report
Proposed Mixed-Use Development
212-226 Charlton Road
Sturbridge, Massachusetts

Dear Ms. Maxwell:

In accordance with our proposal and authorization to proceed, John Turner Consulting, Inc. (JTC) has completed a geotechnical investigation for the above captioned project. Presented herein and attached are the results of the site subsurface investigation, and our recommendations regarding the design and construction of the foundation, and other geotechnical related concerns or issues.

This report completes our scope of services under the approved contract. We appreciate the opportunity to assist you on this project and we look forward to working with you on this project through its completion. Please do not hesitate to contact us if you have any questions or require additional information.

Sincerely,
JOHN TURNER CONSULTING, INC.

Stephen C Lanne, PE
Vice President of Engineering
356 Sutton Road
Sutton, Massachusetts 01590
slanne@consultjtc.com
Ph: (413) 222-1675

Table of Contents

1.0 INTRODUCTION

John Turner Consulting, Inc. (JTC) is pleased to present this Geotechnical Investigation Report for the proposed mixed-use development in Sturbridge, Massachusetts. Geotechnical explorations, laboratory testing, and engineering evaluations were conducted in general accordance with our proposed scope of services submitted to Alrig USA on April 28, 2022.

The purpose of the geotechnical investigation was to obtain information on the subsurface conditions at the site and to provide geotechnical engineering recommendations to support the planning, design, and construction of the project. This investigation did not include an environmental assessment relative to oil, gasoline, solid waste, and/or other hazardous materials. Similarly, this investigation/evaluation did not include review of site design or construction issues such as infiltration systems, dry wells, underground utilities, protection of existing structures, retaining walls, temporary excavation support, and/or other site/temporary design issues unless specifically addressed herein.

Geotechnical explorations and laboratory testing services were performed in June and July of 2022. The contents of this report are subject to the attached *Limitations*.

2.0 PROJECT INFORMATION

The following subsections provide general descriptions of the site, the regional geologic setting, and the proposed development.

2.1 Site Description

The subject property is located at 212-226 Charlton Road in Sturbridge, Massachusetts. The site consists of three developed properties, each with a single-story structure located near the southern end of the properties. Each has an associated driveway extending south. The site is bounded by Charlton Road to the south, a commercial property to the east, and woods to the north and west.

JTC understands that the proposed development involves razing the existing buildings and construction of two new structures, an approximately 2,300 square-foot (sf) structure on the west end of the property and an approximately 5,100 square-foot (sf) structure on the east end of the property with associated parking and driveways in between. JTC understands the intent is to support the buildings on conventional shallow spread footing foundations and with a concrete slab on grade finished floor. Paved parking and drive lanes will be constructed in between the new buildings.

2.2 Regional Geologic Setting

JTC's review of the *Surficial Materials Map of the Southbridge Quadrangle, Massachusetts (2018)* indicates that site soils are most likely to consist of Glacial Stratified Deposits including sand and gravel. Swamp deposits, potentially consisting of silt and clay are also mapped in proximity to the site.

3.0 GEOTECHNICAL EXPLORATIONS

JTC subcontracted Soil Exploration Corp (Soil-X) to drill eight (8) geotechnical test borings (designated as B-1 through B-8) using a Geoprobe 6712DT. JTC directed the drilling, testing, and sampling activities and logged the subsurface conditions encountered at each boring location.

The exploration locations were selected in relation to the existing site features and proposed development, and under the constraints of drill rig access and utility conflicts. Subsequently, the relative location of each exploration was established via measurements from existing site features and scaling the dimensions onto the provide

The test borings were advanced to depths ranging from 7 to 24 feet below the ground surface (bgs) utilizing 3¼-inch inside-diameter flush-wall casing. As the borings were advanced, standard penetration tests (SPTs) were conducted at regular intervals and soil samples were obtained via 2-inch outside-diameter split-spoon samplers driven by a 140-pound (Safe-T) hammer. SPTs were performed in general accordance with ASTM D1586, Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils.

Soil samples were sealed in moisture-tight containers and returned to JTC's office for further review, classification, and/or geotechnical laboratory testing. The test borings were backfilled with soil cuttings upon completion of drilling. Detailed records of the soil, drilling, testing, sampling performed, and groundwater conditions observed at each test boring location are provided on the attached *Test Boring Logs*.

4.0 GEOTECHNICAL LABORATORY TESTING

JTC selected representative soil samples for geotechnical laboratory testing. The following tests were performed, moisture content determinations, particle-size analyses, Atterberg limits, vane shear testing, density of soil, unconfined compression, and one-dimensional consolidation.

Geotechnical laboratory testing was performed in general accordance with ASTM procedures. Test results are provided on the attached *Geotechnical Laboratory Testing Reports*.

- 2 Moisture Content determinations
- 2 Washed Sieve Analyses

5.0 SUBSURFACE CONDITIONS

The following subsections describe the site soil, bedrock, and groundwater conditions encountered, based on results of the geotechnical explorations and laboratory testing. Detailed descriptions of the conditions observed at each test boring are provided on the attached *Test Boring Logs*.

5.1 Soil Profile

The overburden soils encountered at the test boring locations appear to be consistent with those described by the published geologic data. The primary soil strata are briefly described in the paragraphs below.

5.1.1 Topsoil

Topsoil was encountered at the ground surface of all borings. The Topsoil consisted mostly of dark brown, silty sand (SM) containing frequent rootlets. Where encountered, the thickness of the Topsoil was approximately 3 to 6 inches. The Topsoil is generally considered as very loose to medium dense, based on SPT N-Values.

5.1.2 Subsoil

Subsoil was encountered beneath the Topsoil at B-1, B-2, and B-5. Where encountered, the Subsoil was approximately 0.3 to 1.5 ft thick. The Subsoil consisted of brown silty Sand (SM) with gravel. The Subsoil was typically described as loose to medium dense, based on SPT N-Values.

5.1.3 Glacial Stratified Deposits

Native soils described as Glacial Stratified Deposits were encountered beneath the Topsoil and Subsoil (where encountered) at all test boring locations. The native material consisted primarily of brown to orange-brown silty Sand (SM) and silty Sand (SM) with gravel. These soils were encountered to the depth of termination of the borings and are generally considered loose to dense based on SPT N-Values.

5.2 Bedrock

Refusal to further penetration of the casing was encountered in B-1, B-7, B-7A, and B-8 at depths of about 24, 9.5, 11 and 10 feet bgs respectively. Refusals may be indicative of encountering the bedrock surface.

5.3 Groundwater

Groundwater and/or wet soils was encountered at depths of approximately 6 feet bgs to 13 feet bgs at the time of drilling. Short-term (i.e., during drilling, upon completion of drilling, and/or a few hours after drilling) water levels observed in test borings should be considered approximate.

JTC estimates that this investigation occurred during a period of seasonally normal ground water. Site groundwater levels should be expected to fluctuate seasonally and in response to precipitation events, construction activity, site use, and adjacent site use.

6.0 GEOTECHNICAL ANALYSIS & RECOMMENDATIONS

The evaluation of the site and the proposed development was based on the subsurface conditions encountered at the geotechnical test borings, results of geotechnical laboratory testing, conceptual site plans, and preliminary/assumed structural loading conditions, as described herein.

JTC believes that the proposed buildings can be supported upon shallow foundations bearing on native Stratified Glacial Deposits, and/or *Structural Fill* or Crushed Stone built-up from properly prepared Stratified Glacial Deposits subgrades, provided that the geotechnical design and construction recommendations presented herein are satisfied.

6.1 Site Preparation and Grading

Site preparation and grading should be performed in accordance with the following procedures:

- A geotechnical engineer should directly observe site preparation and grading activities;
- The site soils contain substantial proportions of fine sand and may degrade and/or become unworkable when subjected to construction traffic or other disturbance during wet conditions. As such, site preparations, grading, and earthworks should be performed during a dry season if possible. The Contractor shall be aware of these conditions and must take precautions to minimize subgrade disturbance. Such precautions may include diverting storm run-off away from construction areas, reducing traffic in sensitive areas, minimizing the extent of exposed subgrade if inclement weather is forecast, backfilling excavations and footings as soon as practicable, grading (and compacting) exposed subgrades to promote surface water run-off, and maintaining an effective dewatering program, as necessary. Over-excavation to remove degraded or unworkable subgrade soils should be anticipated and budgeted (cost and schedule);
- Any existing buildings, structures, associated foundations (including footings, foundation walls, slabs-on-grade, and/or basements), utilities, or other underground structures, should be completely removed from proposed building areas and replaced/backfilled with properly placed and compacted *Structural Fill;*
- Any existing structures or subsurface utilities located in areas outside of the proposed building footprint may be removed or appropriately abandoned in place. Utilities abandoned in place should be plugged or capped to prevent migration of water. Structural elements to remain in place should be at least 3 feet below finished grade. Slabs left in place should be drilled or periodically broken to prevent ponding of water;
- The site should be cleared and stripped of any existing asphalt-concrete pavement not designated to remain; existing trees/vegetation not designated to remain; Topsoil, rootmat, forest mat; loamy/organic-laden Subsoil; and any otherwise unsuitable materials; The explorations encountered approximately 3 to 6 inches of Topsoil. Topsoil thickness may vary at other locations. In addition, organic soils may extend deeper in and around the root structure of trees and shrubs. The required stripping depth should be expected to vary across the site.
- In cut areas, the final foot of excavation should be performed using a smooth-edged cutting bucket (no teeth) to minimize subgrade disturbance;
- Following clearing, stripping, cutting, and/or over-excavation, the exposed subgrade soils should

be proof-rolled. The exposed parking area and slab-on-grade subgrades should be proof-rolled and subject to vibratory densification with at least 8 passes using a large (10-ton) smooth-drum roller in a crisscross pattern. Proof-rolling of foundation subgrades should be completed with a heavy plate or trench compactor. Proof-rolling/densification should not be performed if/when the exposed subgrade soils are wet (i.e., due to presence of groundwater, stormwater, perched water, etc.) because this may result in soil pumping and instability. Therefore, the proof-rolling efforts, including the number of passes and whether to emply static or vibratory methods, should be directed by the on-site geotechnical engineer;

  - Any loose, soft, wet, and/or otherwise unsuitable soils (typically evidenced by rutting, pumping, and/or deflection of the subgrade) should be over-excavated to expose suitable soils, or other remedial measures should be taken, as approved by the on-site geotechnical engineer; and
  - Any over-excavations should be backfilled with properly placed and compacted *Structural Fill;*

- *Structural Fill* should be used for subgrade fill within the building pad. The placement of *Structural Fill* materials to achieve design subgrades in the building pad should not begin until the exposed subgrade soils have been directly observed and approved by the on-site geotechnical engineer;
- *Common Fill* is acceptable for subgrade fill in parking and driveway areas. The placement of *Common Fill* materials to achieve design subgrades in pavement areas should not begin until the exposed subgrade soils have been directly observed and approved by the on-site geotechnical engineer; and
- *Structural Fill* and *Common Fill* materials and placement and compaction requirements are provided in the attached *Tables*.

6.2 Shallow Foundations and Foundation Walls

Based on the subsurface conditions encountered at the exploration locations and our current understanding and assumptions relative to the proposed development, the following foundation design recommendations are provided:

- The building can be supported on a continuous and/or isolated spread foundations bearing on properly prepared native soil subgrades;
- Shallow foundations may be designed using an allowable bearing pressure of 2,250 psf. Design bearing pressures may be increased by one-third (⅓) when considering seismic and or transient wind loading conditions;
- Continuous wall footings should have a minimum width of 2 feet. Isolated column footings should have a minimum width of 3 feet;
- Exterior footings should be founded at a minimum of 4 feet below finished grade. Interior footings in heated portions of the building should be founded at least 2 feet below FFE; and
- Total post-construction settlements due to applied foundation loads are estimated to be on the order of 1 inch or less. Differential settlements along continuous wall footings and/or between isolated column footings are estimated to be on the order of 1.0 inches or less. The estimated

settlements and resulting angular distortion are anticipated to be within the allowable limits for this type of structure.

Recommendations for shallow foundation subgrade preparation and construction are provided as follows:

- A geotechnical engineer or his/her representative should directly observe foundation subgrade preparation activities;
- If shallow and/or perched groundwater is encountered, it must be continuously maintained at least 2 feet below the bottom of excavation and subsequent construction grade until the backfilling is complete;
- The native foundation subgrade soils may be sensitive to moisture content due to elevated fines content and will readily disturb or soften if exposed to wet conditions during construction activities. Consideration should be given to protecting the subgrades with a 6-inch (minimum) thick layer of ¾-inch minus crushed stone encased in a geotextile fabric (e.g., Mirafi 140N or equal). The fabric and crushed stone should be placed immediately following proof-rolling of the native subgrade soils and seated with multiple passes with a plate compactor until exhibiting stable conditions. The purpose of the crushed stone is to protect the subgrade soils from disturbance, facilitate construction dewatering (if necessary), and provide a dry/stable subgrade upon which to progress construction;
- Prior to placing crushed stone, setting forms, and/or placing reinforcing steel, a geotechnical engineer should directly observe footing subgrades;
    - Footing subgrades should be level or suitably benched and free of standing water and/or debris;
    - Loose, soft, wet, frozen, or otherwise unsuitable soils should either be re-compacted or over-excavated to a suitable subgrade, as approved by the on-site geotechnical engineer; and
    - Over-excavations should be backfilled with properly placed and compacted Structural Fill or crushed stone as approved by the on-site geotechnical engineer.
- Foundation subgrade soils should be protected against physical disturbance, precipitation, and/or frost throughout construction. Surface water run-on/run-off should be diverted away from open foundation excavations. The Contractor shall ultimately be responsible for the means and methods to protect the foundation subgrade during construction;
- Interior footings, piers, and/or walls and the interior side of balanced perimeter foundation walls should be backfilled with *Structural Fill,* as described in the attached *Tables*;
- Exterior footings, piers, and the exterior side of balanced foundation walls should be backfilled with non-frost-susceptible fill in order to mitigate potential adverse effects of frost. Backfill for exterior footings, piers, and foundation walls should consist of well-graded, free-draining, granular soil conforming to the requirements of *Clean Granular Fill*, as described in the attached *Specifications*. Alternatively, a suitable bond break (such as rigid polystyrene insulation) may be provided as approved by the on-site geotechnical engineer. In this case, footings and walls (excluding unbalanced/basement walls) may be backfilled with *Common Fill* (see attached *Specifications*) having a maximum particle-size of 3 inches, as approved by the on-site geotechnical engineer;

- Backfill for footings and foundation walls should be placed in uniform horizontal lifts having a maximum loose lift thickness of 8 inches and compacted to 95 percent of its modified proctor maximum dry density (MPMDD; per ASTM D1557). Thinner lifts may be required in order to achieve the required compaction criteria;
- To minimize the potential for foundation wall damage during the backfill and compaction activities, it is recommended that foundation wall backfill be placed in a manner that maintains a balanced fill height on both sides of the wall (up to the final exterior grade); and
- A geotechnical engineer or his/her representative should directly observe foundation subgrade preparation activities.

6.3 Floor Slab-On-Grade

Design recommendations for the floor slab-on-grade are provided as follows:

- A modulus of vertical subgrade reaction, k_{vi}, of 150 pounds per cubic inch (pci) should be available for structural design of the floor slabs-on-grade, provided that the subgrade, *Structural Fill*, and the *Clean Granular Fill* are prepared as recommended in Subsections 6.1, 6.2, and 6.3;
- Floor slabs-on-grade should be underlain by a minimum 9-inch thick layer of *Clean Granular Fill* to provide a capillary break and a stable working surface;
- The floor slab should be isolated structurally from foundation walls and columns/piers to allow for differential movement; and
- The need/desire to provide a moisture/vapor barrier beneath floor slab-on-grade should be evaluated by the architect and/or the structural engineer, based on the building's specific interior usage requirements.

During construction, we expect that much of the building footprint will be excavated or disturbed during site preparation and grading (Subsection 6.1), excavations for shallow foundations (Subsection 6.2), and/or excavations for new underground utilities. It is imperative that the subgrade beneath the floor slab-on-grade be reinstated with properly placed and compacted *Structural Fill* and/or prepared as recommended herein. Additionally:

- A geotechnical engineer should directly observe the subgrade soils prior to the placement of the recommended *Clean Granular Fill* base course;
  - The subgrade should be level and free of standing water and/or debris;
  - Loose, soft, wet, frozen, or otherwise unsuitable soils should either be re-compacted or over-excavated to a suitable subgrade, as approved by the on-site geotechnical engineer; and
  - Over-excavations should be backfilled with properly placed and compacted *Structural Fill*.
- The *Clean Granular Fill* base course should not be placed until the subgrade has been reviewed by the on-site geotechnical engineer. Subsequently, the Clean Granular Fill should be compacted to the satisfaction of the geotechnical engineer to 95% of its MPMDD.

6.4 Seismic Considerations

Based on site class definitions of the American Society of Civil Engineers (ASCE) Standard 7-10, Minimum Design Loads for Buildings and Other Structures and the conditions encountered at the test boring locations, the site is classified as:

Site Class D: Stiff Soil Profile.

Liquefaction refers to the loss of strength in saturated cohesionless soils due to the buildup of pore water pressures during cyclic or seismic loading. Based on the conditions encountered at the test boring locations, the site is not considered to be susceptible to liquefaction

6.5 Re-Use of Site Soils

The native Glacial Stratified Deposits are not suitable for re-use as *Structural Fill*. Some of the existing materials may be suitable for re-use as *Common Fill,* provided that the soil can be adequately compacted and is appropriately segregated from excessively silty material, oversized boulders, debris/fragments, and/or otherwise unsuitable materials.

Materials proposed for re-use should be stockpiled on site and bulk samples should be collected and subjected to laboratory testing to demonstrate conformance with the project specifications. Otherwise, these soils may be re-used in areas to be landscaped.

6.6 Construction Monitoring and Quality Control Testing

A qualified engineer or representative should be retained to review the site and subgrade operations, as required by the Massachusetts State Building Code. Similarly, quality control testing, including in-place field density and moisture tests, should be performed to confirm that the specified compaction is achieved. It is recommended that JTC be retained to provide earthwork construction monitoring and quality control testing services.

Quality control testing recommendations are provided as follows:

- During site grading and foundation subgrade preparation, 3 field density tests should be performed for every 5,000 square feet (per lift) of *Structural Fill* placement, at a minimum. At least 3 tests should be performed on each lift of material even if the lift is less than 5,000 square feet;
- During foundation wall backfilling, 3 field density tests should be performed for every 100 linear feet (per lift) of fill placement, at a minimum. At least 3 tests should be performed on each lift of material even if the lift is less than 100 linear feet;
- During placement and compaction of *Clean Granular Fill* as the base course below the floor slab-on-grade and sidewalks, 3 field density tests should be performed for every 5,000 square feet of placement. At least 3 tests should be performed on each lift of material even if the lift is less than 5,000 square feet;
- During placement and compaction of *Common Fill* in pavement areas, 3 field density tests should be performed for every 5,000 square feet of placement. At least 3 tests should be performed on

each lift of material even if the lift is less than 5,000 square feet; and

- During backfilling of utility trenches, at least 1 test should be conducted on *Structural Fill* per 50 linear feet (per lift) of trench.

6.7 Additional Considerations

Additional design recommendations are provided as follows:

- Exterior concrete sidewalks shall be underlain by at least 12 inches of *Clean Granular Fill*. The thickness of the *Clean Granular Fill* should be increased to no less than 18 inches for exterior concrete slabs located adjacent to exterior doorways and ramps to provide additional frost protection at building entry/exit points;
- Roof drains or similar features should be provided to collect roof run-off and prevent ponding near the building. Roof drains and other stormwater controls should not discharge to foundation drains;
- The exterior ground surface adjacent to the building should be sloped away from the building to provide for positive drainage. Similarly, the final surface materials adjacent to the building should be relatively impermeable to reduce the volume of precipitation infiltrating into the subsurface proximate to building foundations. Such impermeable materials include cement concrete, bituminous concrete, and/or vegetated silty/clayey topsoil; and
- Permanent fill or cut slopes should have a maximum slope of 2.5H:1V (horizontal to vertical) or flatter for dry conditions. Permanent fill or cut slopes should be no steeper than 3H:1V for wet/submerged conditions (e.g., stormwater basin) unless a properly designed surface slope stabilization system (e.g. rip rap, geosynthetics) is provided.

Additional construction considerations/recommendations are provided as follows:

- Safe temporary excavation and/or fill slopes are the responsibility of the Contractor. Excavations should be conducted in accordance with local, state, and federal (OSHA) requirements, at a minimum. If an excavation cannot be properly sloped or benched due to space limitations, adjacent structures, and/or seepage, the Contractor should install an engineered shoring system to support the temporary excavation;
- Subgrade conditions will be influenced by excavation methods, precipitation, stormwater management, groundwater control(s), and/or construction activities. Most of the site soils are poorly-drained, moisture-sensitive, and considered susceptible to disturbance when exposed to wet conditions and construction activities. As such, the Contractor shall be aware of these conditions and must take precautions to minimize subgrade disturbance. Such precautions may include diverting storm run-off away from construction areas, reducing traffic in sensitive areas, minimizing the extent of exposed subgrade if inclement weather is forecast, backfilling excavations and footings as soon as practicable, and maintaining an effective dewatering program, as necessary;
- Proper groundwater control and stormwater management are necessary to maintain site stability. Groundwater should be removed in advance of excavation and continuously maintained at least 2 feet below the working construction grade until earthworks and/or backfilling are complete;

- If groundwater seepage and/or wet soils due to shallow groundwater are observed, a ¾-inch minus crushed stone base should be placed atop the exposed subgrade soils. The stone should be immediately placed atop the undisturbed subgrade and then tamped with a plate compactor until exhibiting stable conditions. The stone shall be protected, as required, with a geotextile filter fabric such as Mirafi 140N or equal. The purpose of the stone base is to protect the wet subgrade, facilitate dewatering, and provide a dry/stable base upon which to progress construction; and
- All slopes should be protected from erosion during (and after) construction.

7.0 CLOSING

We trust the contents of this report are responsive to your needs at this time. Should you have any questions or require additional assistance, please do not hesitate to contact our office.

APPENDIX A: LIMITATIONS

Explorations

1. The analyses and recommendations presented in this report are based in part upon the data obtained from widely-spaced subsurface explorations. Subsurface conditions between exploration locations may vary from those encountered at the exploration locations. The nature and extent of variations between explorations may not become evident until construction. If variations appear, it will be necessary to re-evaluate the recommendations of this report.
2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretation of widely-spaced explorations and samples; actual strata transitions are probably more gradual. For specific information, refer to the individual test pit and/or boring logs.
3. Water level readings have been made in the test pits and/or test borings under conditions stated on the logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors differing from the time the measurements were made.

Review

4. It is recommended that John Turner Consulting, Inc. be given the opportunity to review final design drawings and specifications to evaluate the appropriate implementation of the geotechnical engineering recommendations provided herein.
5. In the event that any changes in the nature, design, loading, or location of the proposed areas are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed, and conclusions of the report modified or verified in writing by John Turner Consulting, Inc.

Construction

6. It is recommended that John Turner Consulting, Inc. be retained to provide geotechnical engineering services during the installation phases of the work. This is to observe compliance with the design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

Use of Report

7. This report has been prepared for the exclusive use of the addressee for the noted project. All considerations are based on the available information and is in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.
8. This report has been prepared for this project by John Turner Consulting, Inc. This report was completed for preliminary design purposes and may be limited in its scope to complete an accurate bid. Contractors wishing a copy of the report may secure it with the understanding that its scope is limited to preliminary geotechnical design considerations.

APPENDIX B: RECOMMENDED SOIL GRADATION & COMPACTION SPECIFICATIONS

TABLE 1: Structural Fill

SIEVE SIZE	PERCENT PASSING BY WEIGHT
5-inch	100
¾-inch	60 - 100
No. 4	20 - 80
No. 200	0 - 10

NOTES:

1. For use as structural load support below foundations and within the building pad. Structural Fill placed beneath building foundations should include the Footing Zone of Influence which is defined as that area extending laterally one foot from the edge of the footing then outward and downward at a 1:1.5 (H:V) splay.
2. ¾-inch crushed stone may be used in wet conditions.
3. Structural Fill should be free of construction and demolition debris, frozen soil, organic soil, peat, stumps, brush, trash, and refuse;
4. Structural Fill should not be placed on soft, saturated, or frozen subgrade soils;
5. Structural Fill should be placed in lifts not exceeding 12 inches for heavy vibratory rollers and 8 inches for vibratory plate compactors.
6. Place and compact within ± 3% of optimum moisture content.
7. Compact to at least 95% relative compaction per ASTM D1557.
8. The adequacy of the compaction efforts should be verified by field density testing.

TABLE 2: Clean Granular Fill

Clean SIEVE SIZE	PERCENT PASSING BY WEIGHT
3-inch	100
¾-inch	60 – 90
No. 4	20 – 70
No. 200	2 – 8

NOTES:

9. For minimum 9-inch base below floor slab-on-grade.
10. For minimum 18-inch base for exterior concrete slabs exposed to frost.
11. For minimum 24-inch base at exterior ramps, aprons, and loading bays adjacent to entrances/exit ways.
12. For use as footing and foundation wall backfill.
13. For use as backfill behind unbalanced foundation/retaining walls.
14. Place in lifts not exceeding 12 inches for heavy vibratory rollers and 8 inches for vibratory plate compactors.
15. Place and compact within ± 3% of optimum moisture content.
16. Compact to at least 95% relative compaction per ASTM D1557.
17. Compaction efforts should be verified by field density testing.
18. Compact to at least 95% relative compaction per ASTM D1557 when placed as foundation wall backfill in conjunction with a bond break.
19. Compaction efforts should be verified by field density testing.

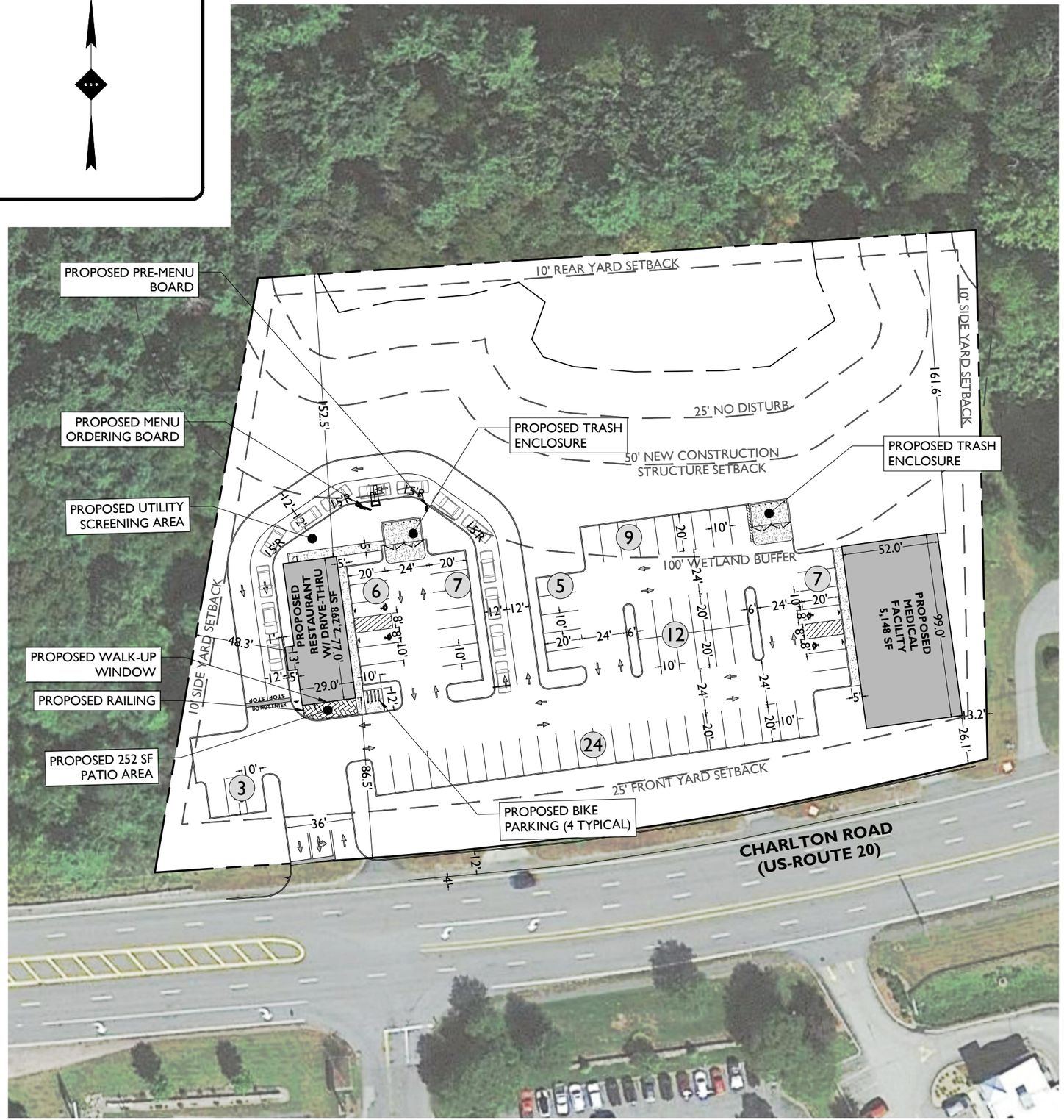
TABLE 3: Common Fill

SIEVE SIZE	PERCENT PASSING BY WEIGHT
6-inch	100
¾-inch	60 – 100
No. 4	20 – 85
No. 200	0 – 25

NOTES:

20. For use as common/subgrade fill in parking areas and roadway embankments.
21. For use as foundation wall backfill if used in conjunction with a bond break and sized/screened to 3-inch minus.
22. Place in lifts not exceeding 12 inches.
23. Maximum stone size should not exceed ½ the actual lift thickness.
24. Compact to at least 92% relative compaction per ASTM D1557 when placed as subgrade fill in parking areas or roadway embankments.
25. Compact to at least 95% relative compaction per ASTM D1557 when placed as foundation wall backfill in conjunction with a bond break.
26. Compaction efforts should be verified by field density testing.

APPENDIX C: SITE PLAN AND TEST BORING LOCATION PLAN



LAND USE AND ZONING

PARCEL ID: 208-02528-212, 208-02528-216, 208-02528-226

COMMERCIAL DISTRICT (C)

PROPOSED USE

RESTAURANT WITH DRIVE-THRU	PERMITTED USE
MEDICAL FACILITY	PERMITTED USE

ZONING REQUIREMENT	REQUIRED	PROPOSED
MINIMUM LOT AREA	1 AC	2.95 AC (128,718 SF)
MINIMUM LOT WIDTH	150 FT	451.4 FT
MINIMUM LOT FRONTAGE	150 FT	451.4 FT
MAXIMUM IMPERVIOUS COVERAGE	70 %	39.2 % (50,523 SF)
MAXIMUM LOT COVERAGE	30 %	5.8 % (7,446 SF)
MAXIMUM HEIGHT	35 FT	< 35 FT
MINIMUM FRONT YARD SETBACK	25 FT	26.1 FT
MINIMUM SIDE YARD SETBACK	10 FT	13.2 FT
MINIMUM REAR YARD SETBACK	10 FT	152.5 FT
MAXIMUM BUILDING HEIGHT	3 STORIES	< 3 STORIES

OFF-STREET PARKING REQUIREMENTS

CODE SECTION	REQUIRED	PROPOSED
§ 300-16.11 B.	MINIMUM PARKING REQUIRED: MEDICAL FACILITY: 1 PER 300 SF OF FLOOR AREA. 5148 SF / 300 SF =18 SPACES RESTAURANT: 1 SPACE FOR EVERY 3 SEATS AND 1 SPACE FOR EVERY EMPLOYEE ON LARGEST SHIFT. 66 SEATS / 3 = 22 SPACES + 8 EMPLOYEES = 30 SPACES TOTAL: 48 SPACES	73 SPACES
§ 300-26.3 A.(1)	MINIMUM PARKING SPACE WIDTH: 10 FT MINIMUM PARKING SPACE DEPTH: 20 FT	10 FT 20 FT
§ 300-16.4 A.(1)	MINIMUM DRIVE AISLE WIDTH: TWO WAY: 24 FT	 24 FT
§ 300-16.9 A.(1)	BUFFERING AND DRIVEWAYS SHALL NOT BE ALLOWED WITHIN THE FRONT SETBACK, AND THE AREA OF THE FRONT SETBACK SHALL BE A BUFFER, AND LANDSCAPED AS SUCH.	COMPLIES
§ 300-16.14 C.(1)	DRIVE-THRU AISLES SHALL HAVE A MINIMUM 10 FT INTERIOR RADIUS AT CURVES AND A MINIMUM 12 FT WIDTH.	15 FT RADIUS 12 FT WIDTH
§ 300-16.14 D.(2)	DRIVE-THRU WINDOWS SHALL PROVIDE 180 FT OF STACKING SPACE.	300.1 FT

60' 0' 60' 120'

GRAPHIC SCALE IN FEET

1" = 60'

STONEFIELD engineering & design

Rutherford, NJ · New York, NY · Boston, MA
Princeton, NJ · Tampa, FL · Detroit, MI
www.stonefieldeng.com

Headquarters: 92 Park Avenue, Rutherford, NJ 07070
Phone 201.340.4468 · Fax 201.340.4472

DEVELOPER:

ALRIG USA

30200 TELEGRAPH ROAD, SUITE 205
BINGHAM FARMS, MI 48025
OFFICE: 248.646.9999
FAX: 248.646.9998

CONCEPT PLAN

PROPOSED MIXED-USE DEVELOPMENT

PARCEL ID: 208-02528-212, 208-02528-216, 208-02528-226
212, 216 & 266 CHARLTON ROAD
TOWN OF STURBRIDGE
WORCESTER COUNTY, MASSACHUSETTS

DRAFT

NOT APPROVED FOR CONSTRUCTION

DRAWN BY:	JR
CHECKED BY:	JA
DATE:	03/31/2022
SCALE: (H)	1" = 60'
PROJECT ID:	BOS-210035

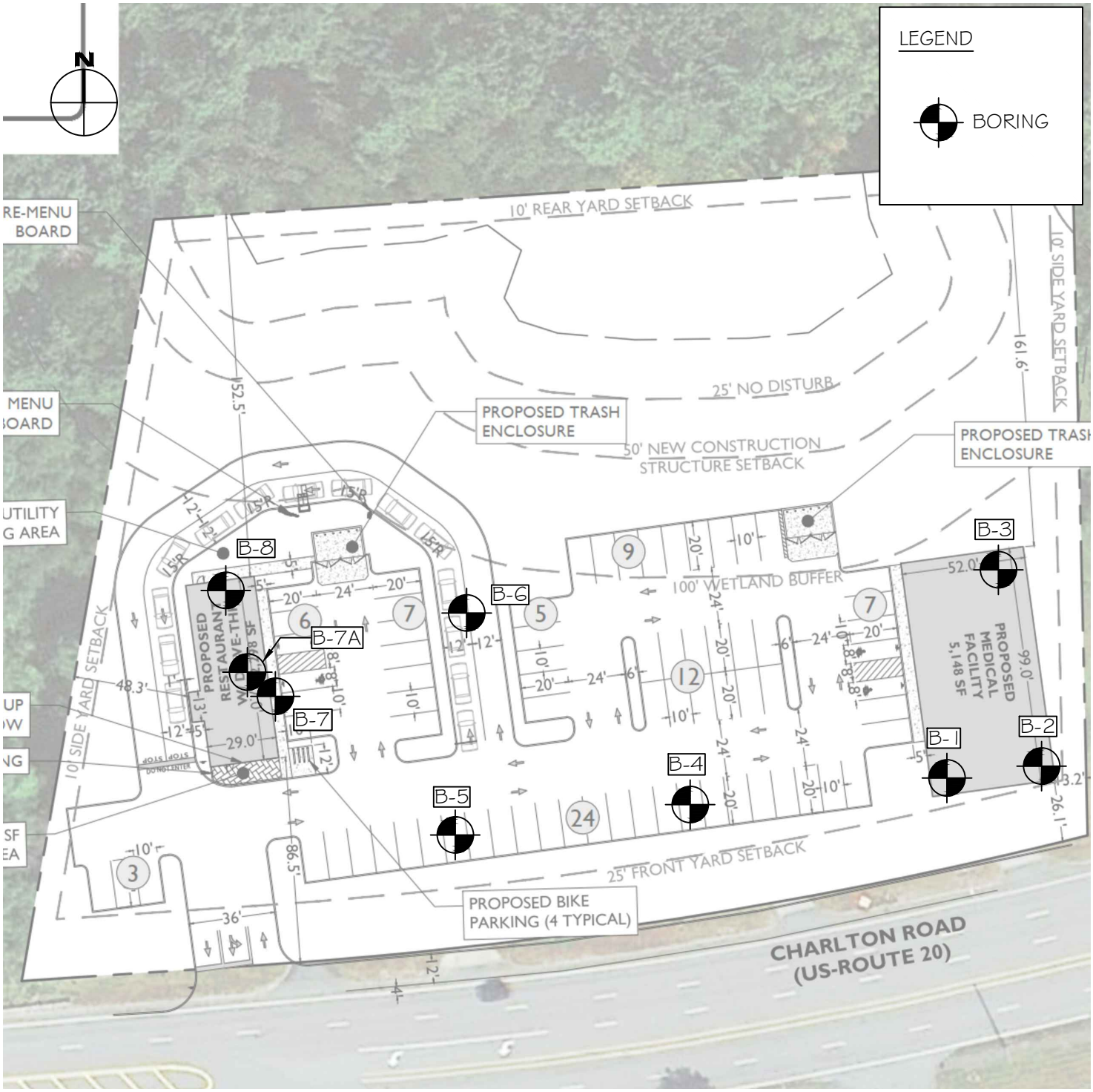
TITLE:

CONCEPT J

SHEET:

J-1

Z:\Boston\BOS\2021\BOS-210035 Alrig - 212, 216 & 266 Charlton Road, Sturbridge, MA\CADD\Concepts\2022-03-31 (HS)-Concept-J, Sturbridge, MA.dwg



Notes:

1. Test borings were performed on June 28, 2022 under the direction of JTC.
2. Test boring locations should be considered approximate.
3. Refer to the Test Boring Logs for the subsurface conditions encountered at each boring location.
4. Basemap source: "Concept J (Overlay)", Prepared by Alrig USA, Sheet # J-2, Dated 3/31/22
5. Drawing Scale: 1 inch = 60 feet

DATE:	6/29/22
JOB #	22-04-059
DRAFT:	TM
DESIGN:	-
REVIEW:	SL
REVISIONS:	

DRAWING NAME: BORING LOCATION PLAN

PROJECT: 212-226 CHARLTON ROAD, STURBRIDGE, MASSACHUSETTS

CLIENT: ALRIG USA, BINGHAM FARMS, MICHIGAN

JOHN TURNER CONSULTING 25 YEARS

DRAWING #: 1

Z:\00 JTC Project Files\2022 Project Folders\22-04 - Geotechnical Engineering\22-04-059_Alrig_212-226 Charlton Road_Sturbridge MA\05_Figures\22-04-

APPENDIX D: TEST BORING LOGS & KEY TO SYMBOLS AND DESCRIPTIONS

TEST BORING LOG — BORING No. B-1

CLIENT:	Alrig USA
PROJECT:	Mixed-Use Development
LOCATION:	212-226 Charlton Road Sturbridge, MA
PROJECT No:	22-04-059
DRILLING Co:	Soil Exploration Corp.
DRILLING DATE:	6/28/2022
DRILLER:	
SURFACE EL:	
JTC REP.:	A.Pryor
RIG:	Geoprobe 6712DT

GROUNDWATER OBSERVATIONS

DATE:	DEPTH (FT):	NOTES:
6/28/2022	13.5	

DRILLING METHOD: TYPE: 3.25" Casing; DEPTH (FT): 0-24

DEPTH (FT)	SAMPLE NO.	REC (IN)	SOIL & ROCK CLASSIFICATION-DESCRIPTION	ELEV (FT)	STRATUM	HAMMER BLOWS (PER 6 IN)	SPT (N)
0-1	SS01	15	**[TOPSOIL]** 3 in. Brown Silty Sand (SM), with organics, roots; medium dense **[SUBSOIL]** 6 in. Brown Silty Sand (SM), gravel; medium dense			7 12 7 6	19
1-2							
2-3	SS02	18	**[GLACIAL STRATIFIED DEPOSITS]** Light brown Silty Sand (SM); gravel; medium dense; -becomes loose			3 3 2 1	5
3-4							
4-5							
5-6	SS03	19				3 2 4 10	6
6-7							
7-8	SS04	10	Tan well-graded Sand (SW) and gravel; dense -seams of very fine sand throughout			8 25 24 17	49
8-9							
9-10							
10-11	SS05	12	Grey-tan Silty Sand (SM); medium dense -mottling			15 10 11 8	21
11-12							
12-13							
13-14			-becomes wet				
14-15							
15-16	SS06	12	Tan well-graded Sand (SW); very coarse; medium dense			4 6 6 8	12
16-17							
17-18							
18-19							
19-20							
20-21	SS07	23	Grey-tan Silty Sand (SM); medium dense			5 6 8 8	14
21-22							
22-23							
23-24							
24-25			Casing refusal, boring terminated at 24 ft				
25-26							
26-27							

REMARKS: Exploration backfilled with drill spoils after completion of drilling.

Standard Penetration Tests (SPT) = 140lbs hammer falling 30 inches (ASTM D1586) S = split-spoon sample; C = rock core sample; U = undisturbed
Blows are per 6 inches with a 24-inch long by 2-inch O.D. by 1 3/8-inch I.D. split spoon sampler unless otherwise noted

REMARKS: *The stratification lines represent the approximate boundary between soil types. The actual transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.*

JOHN TURNER CONSULTING 25 YEARS

TEST BORING LOG — BORING No. B-2

CLIENT:	Alrig USA
PROJECT:	Mixed-Use Development
LOCATION:	212-226 Charlton Road Sturbridge, MA
PROJECT No:	22-04-059
DRILLING Co:	Soil Exploration Corp.
DRILLING DATE:	6/28/2022
DRILLER:	
SURFACE EL:	
JTC REP.:	A.Pryor
RIG:	Geoprobe 6712DT

DRILLING METHOD: TYPE: 3.25" Casing; DEPTH (FT): 21.5

GROUNDWATER OBSERVATIONS

DATE:	DEPTH (FT):	NOTES:
6/28/2022	15	

DEPTH (FT)	SAMPLE NO.	REC (IN)	SOIL & ROCK CLASSIFICATION-DESCRIPTION	ELEV (FT)	STRATUM	HAMMER BLOWS (PER 6 IN)	SPT (N)
0-1	SS01	6	**[TOPSOIL]** Dark brown Silty Sand (SM), with organics, roots; medium dense			6	14
1-2			**[SUBSOIL]** Brown Silty Sand (SM), gravel; medium dense			5 11 9	
2-3	SS02	14	**[GLACIAL STRATIFIED DEPOSITS]** Tan well-graded Sand (SW) and gravel; loose			5	8
3-4			-mottling			4 4 4	
4-5							
5-6	SS03	13				5	8
6-7						4 4 4	
7-8	SS04	14	-becomes medium dense			6	12
8-9						6 6 5	
9-10							
10-11	SS05	20				8	19
11-12						7 12 11	
12-13			Grey-tan Silty Sand (SM); medium dense				
13-14							
14-15							
15-16	SS06	11	-becomes wet			15	23
16-17						11 12 10	
17-18							
18-19							
19-20							
20-21	SS07	3				14	100+
21-22						62 50/3	
22-23			Casing refusal, boring terminated at 21.5 ft				
23-24							
24-25							
25-26							
26-27							

REMARKS: Exploration backfilled with drill spoils after completion of drilling.

Standard Penetration Tests (SPT) = 140lbs hammer falling 30 inches (ASTM D1586) S = split-spoon sample; C = rock core sample; U = undisturbed
Blows are per 6 inches with a 24-inch long by 2-inch O.D. by 1 3/8-inch I.D. split spoon sampler unless otherwise noted

REMARKS: *The stratification lines represent the approximate boundary between soil types. The actual transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.*

TEST BORING LOG — BORING No. B-3

CLIENT:	Alrig USA
PROJECT:	Mixed-Use Development
LOCATION:	212-226 Charlton Road Sturbridge, MA
PROJECT No:	22-04-059
DRILLING Co:	Soil Exploration Corp.
DRILLING DATE:	6/28/2022
DRILLER:	
SURFACE EL:	
JTC REP.:	A.Pryor
RIG:	Geoprobe 6712DT

GROUNDWATER OBSERVATIONS

DATE:	DEPTH (FT):	NOTES:
6/28/2022	9 ft	

DRILLING METHOD: TYPE: 3.25" Casing; DEPTH (FT): 0-17

DEPTH (FT)	SAMPLE NO.	REC (IN)	SOIL & ROCK CLASSIFICATION-DESCRIPTION	ELEV (FT)	STRATUM	HAMMER BLOWS (PER 6 IN)	SPT (N)
0-1	SS01	11	**[TOPSOIL]** Dark brown Silty Sand (SM); organics; loose			3	5
1-2			**[GLACIAL STRATIFIED DEPOSITS]** Brown Silty Sand (SM); loose			3 2 3	
2-3	SS02	14				5	4
3-4						2 2 2	
4-5							
5-6	SS03	13	-becomes medium dense			8	13
6-7						7 6 9	
7-8	SS04	12	Brown well graded Sand; very coarse; loose -becomes wet			5	9
8-9						5 4 5	
9-10							
10-11	SS05	12				3	3
11-12			-becomes very loose			2 1 2	
12-13							
13-14							
14-15							
15-16	SS06	13	Brown Silty Sand (SM)			14	29
16-17						13 16 12	
17-18			Boring terminated at 17 ft				
18-19							
19-20							
20-21							
21-22							
22-23							
23-24							
24-25							
25-26							
26-27							

REMARKS: Exploration backfilled with drill spoils after completion of drilling.

Standard Penetration Tests (SPT) = 140lbs hammer falling 30 inches (ASTM D1586) S = split-spoon sample; C = rock core sample; U = undisturbed
Blows are per 6 inches with a 24-inch long by 2-inch O.D. by 1 3/8-inch I.D. split spoon sampler unless otherwise noted

REMARKS: *The stratification lines represent the approximate boundary between soil types. The actual transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.*

JOHN TURNER CONSULTING 25 YEARS	TEST BORING LOG	BORING No. B-4
	CLIENT: Alrig USA	
	PROJECT: Mixed-Use Development	
	LOCATION: 212-226 Charlton Road Sturbridge, MA	
	PROJECT No: 22-04-059	
DRILLING Co: Soil Exploration Corp.	DRILLING DATE: 6/28/2022	
DRILLER:	SURFACE EL:	
JTC REP.: A.Pryor	GROUNDWATER OBSERVATIONS	
RIG: Geoprobe 6712DT	DATE: / DEPTH (FT): / NOTES:	
DRILLING METHOD: TYPE: 3.25" Casing / DEPTH (FT): 0-7	6/28/2022 / Not Encountered	

DEPTH (FT)	SAMPLE NO.	REC (IN)	SOIL & ROCK CLASSIFICATION-DESCRIPTION	ELEV (FT)	STRATUM	HAMMER BLOWS (PER 6 IN)	SPT (N)
0-1	SS01	12	**[TOPSOIL]** Dark brown Silty Sand (SM); organics; loose			2 4	9
1-2			**[GLACIAL STRATIFIED DEPOSITS]** Brown Silty Sand (SM) and gravel; loose			5 6	
2-3	SS02	0	-becomes very loose -shattered rock			2 2	4
3-4						2 3	
4-5							
5-6	SS03	14	-becomes orange brown; no gravel; loose			2 1	5
6-7						4 7	
7-8			Boring terminated at 7 ft.				
8-9							
9-10							
10-11							
11-12							
12-13							
13-14							
14-15							
15-16							
16-17							
17-18							
18-19							
19-20							
20-21							
21-22							
22-23							
23-24							
24-25							
25-26							
26-27							

REMARKS: Exploration backfilled with drill spoils after completion of drilling.

Standard Penetration Tests (SPT) = 140lbs hammer falling 30 inches (ASTM D1586) S = split-spoon sample; C = rock core sample; U = undisturbed
Blows are per 6 inches with a 24-inch long by 2-inch O.D. by 1 3/8-inch I.D. split spoon sampler unless otherwise noted

REMARKS: *The stratification lines represent the approximate boundary between soil types. The actual transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.*

TEST BORING LOG — BORING No. B-5

CLIENT:	Alrig USA
PROJECT:	Mixed-Use Development
LOCATION:	212-226 Charlton Road Sturbridge, MA
PROJECT No:	22-04-059
DRILLING Co:	Soil Exploration Corp.
DRILLING DATE:	6/28/2022
DRILLER:	
SURFACE EL:	
JTC REP.:	A.Pryor
RIG:	Geoprobe 6712DT

DRILLING METHOD: TYPE: 3.25" Casing; DEPTH (FT): 0-7

GROUNDWATER OBSERVATIONS

DATE:	DEPTH (FT):	NOTES:
6/28/2022	Not Encountered	

DEPTH (FT)	SAMPLE NO.	REC (IN)	SOIL & ROCK CLASSIFICATION-DESCRIPTION	ELEV (FT)	STRATUM	HAMMER BLOWS (PER 6 IN)	SPT (N)
0-1	SS01	11	**[TOPSOIL]** Brown Silty Sand (SM), with organics, roots; medium dense			1	11
1-2			**[SUBSOIL]** Light brown Silty Sand (SM), dessicated; gravel; medium dense			3 8 11	
2-3	SS02	9	**[GLACIAL STRATIFIED DEPOSITS]** Light brown Silty Sand (SM); gravel; medium dense;			7 5	6
3-4			-becomes loose			1 4	
4-5							
5-6	SS03	2	-shattered rock			4 3	8
6-7						5 8	
7-8			Boring terminated at 7 ft.				
8-9							
9-10							
10-11							
11-12							
12-13							
13-14							
14-15							
15-16							
16-17							
17-18							
18-19							
19-20							
20-21							
21-22							
22-23							
23-24							
24-25							
25-26							
26-27							

REMARKS: Exploration backfilled with drill spoils after completion of drilling.

Standard Penetration Tests (SPT) = 140lbs hammer falling 30 inches (ASTM D1586) S = split-spoon sample; C = rock core sample; U = undisturbed
Blows are per 6 inches with a 24-inch long by 2-inch O.D. by 1 3/8-inch I.D. split spoon sampler unless otherwise noted

REMARKS: *The stratification lines represent the approximate boundary between soil types. The actual transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.*

TEST BORING LOG — BORING No. B-6

CLIENT:	Alrig USA
PROJECT:	Mixed-Use Development
LOCATION:	212-226 Charlton Road Sturbridge, MA
PROJECT No:	22-04-059
DRILLING Co:	Soil Exploration Corp.
DRILLING DATE:	6/28/2022
DRILLER:	
SURFACE EL:	
JTC REP.:	A.Pryor
RIG:	Geoprobe 6712DT

GROUNDWATER OBSERVATIONS

DATE:	DEPTH (FT):	NOTES:
6/28/2022	6	

DRILLING METHOD:	TYPE:	DEPTH (FT):
	3.25" Casing	0-7

DEPTH (FT)	SAMPLE NO.	REC (IN)	SOIL & ROCK CLASSIFICATION-DESCRIPTION	ELEV (FT)	STRATUM	HAMMER BLOWS (PER 6 IN)	SPT (N)
0-1	SS01	11	**[TOPSOIL]** Brown Silty Sand (SM), with organics, roots; medium dense **[SUBSOIL]**			2, 4	9
1-2			Light brown Silty Sand (SM), dessicated; gravel; medium dense **[GLACIAL STRATIFIED DEPOSITS]**			5, 4	
2-3	SS02	15	Light brown Silty Sand (SM); gravel; medium dense; -becomes very loose			4, 1	2
3-4						1, 1	
4-5							
5-6	SS03	16	Tan well graded Sand (SW); mottling; medium dense			8, 8	18
6-7						10, 10	
7-8			Boring terminated at 7 ft.				
8-9							
9-10							
10-11							
11-12							
12-13							
13-14							
14-15							
15-16							
16-17							
17-18							
18-19							
19-20							
20-21							
21-22							
22-23							
23-24							
24-25							
25-26							
26-27							

REMARKS: Exploration backfilled with drill spoils after completion of drilling.

Standard Penetration Tests (SPT) = 140lbs hammer falling 30 inches (ASTM D1586) S = split-spoon sample; C = rock core sample; U = undisturbed
Blows are per 6 inches with a 24-inch long by 2-inch O.D. by 1 3/8-inch I.D. split spoon sampler unless otherwise noted

REMARKS: *The stratification lines represent the approximate boundary between soil types. The actual transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.*

JOHN TURNER CONSULTING 25 YEARS	TEST BORING LOG	BORING No. B-7
	CLIENT: Alrig USA	
	PROJECT: Mixed-Use Development	
	LOCATION: 212-226 Charlton Road Sturbridge, MA	
	PROJECT No: 22-04-059	
DRILLING Co: Soil Exploration Corp.	DRILLING DATE: 6/28/2022	
DRILLER:	SURFACE EL:	
JTC REP.: A.Pryor	GROUNDWATER OBSERVATIONS	
RIG: Geoprobe 6712DT	DATE: / DEPTH (FT): / NOTES:	
DRILLING METHOD: TYPE: 3.25" Casing / DEPTH (FT): 0-9.5	6/28/2022 / 6.5	

DEPTH (FT)	SAMPLE NO.	REC (IN)	SOIL & ROCK CLASSIFICATION-DESCRIPTION	ELEV (FT)	STRATUM	HAMMER BLOWS (PER 6 IN)	SPT (N)
0-1	SS01	13	**[TOPSOIL]** Dark brown Silty Sand (SM); organics; very loose			1	3
1-2			**[GLACIAL STRATIFIED DEPOSITS]** Brown Silty Sand (SM) and gravel; loose			1, 2, 7	
2-3	SS02	0	-becomes very loose Light tan well graded Sand (SW); medium dense			6	18
3-4						9, 9, 25	
4-5							
5-6			Brown Silty Sand (SM) and gravel; dense			30	49
6-7			-becomes wet			20, 29, 50	
7-8	SS03	21					
8-9							
9-10	SS04	5	Casing refusal, boring terminated at 9.5 ft			56, 50/2	50+
10-11							
11-12							
12-13							
13-14							
14-15							
15-16							
16-17							
17-18							
18-19							
19-20							
20-21							
21-22							
22-23							
23-24							
24-25							
25-26							
26-27							

REMARKS: Exploration backfilled with drill spoils after completion of drilling.

Standard Penetration Tests (SPT) = 140lbs hammer falling 30 inches (ASTM D1586) S = split-spoon sample; C = rock core sample; U = undisturbed
Blows are per 6 inches with a 24-inch long by 2-inch O.D. by 1 3/8-inch I.D. split spoon sampler unless otherwise noted

REMARKS: *The stratification lines represent the approximate boundary between soil types. The actual transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.*

JOHN TURNER CONSULTING 25 YEARS	TEST BORING LOG	BORING No.	B-7A
	CLIENT:	Alrig USA	
	PROJECT:	Mixed-Use Development	
	LOCATION:	212-226 Charlton Road Sturbridge, MA	
	PROJECT No:	22-04-059	
DRILLING Co: Soil Exploration Corp.	DRILLING DATE:	6/28/2022	
DRILLER:	SURFACE EL:		
JTC REP.: A.Pryor	GROUNDWATER OBSERVATIONS		
RIG: Geoprobe 6712DT	DATE:	DEPTH (FT):	NOTES:
DRILLING METHOD: TYPE: 3.25" Casing / DEPTH (FT): 0-11	6/28/2022	Not Encountered	

DEPTH (FT)	SAMPLE NO.	REC (IN)	SOIL & ROCK CLASSIFICATION-DESCRIPTION	ELEV (FT)	STRATUM	HAMMER BLOWS (PER 6 IN)	SPT (N)
0-1							
1-2							
2-3							
3-4							
4-5			Drove casing directly to 9 ft				
5-6							
6-7							
7-8							
8-9							
9-10	SS01	12	**[GLACIAL STRATIFIED DEPOSITS]** Brown Silty Sand (SM) and gravel; very dense			34 83 100	100+
10-11							
11-12			Casing refusal, boring terminated at 11 ft				
12-13							
13-14							
14-15							
15-16							
16-17							
17-18							
18-19							
19-20							
20-21							
21-22							
22-23							
23-24							
24-25							
25-26							
26-27							

REMARKS: Exploration backfilled with drill spoils after completion of drilling.

Standard Penetration Tests (SPT) = 140lbs hammer falling 30 inches (ASTM D1586) S = split-spoon sample; C = rock core sample; U = undisturbed
Blows are per 6 inches with a 24-inch long by 2-inch O.D. by 1 3/8-inch I.D. split spoon sampler unless otherwise noted

REMARKS: *The stratification lines represent the approximate boundary between soil types. The actual transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.*

TEST BORING LOG — BORING No. B-8

CLIENT:	Alrig USA
PROJECT:	Mixed-Use Development
LOCATION:	212-226 Charlton Road Sturbridge, MA
PROJECT No:	22-04-059
DRILLING Co:	Soil Exploration Corp.
DRILLING DATE:	6/28/2022
DRILLER:	
SURFACE EL:	
JTC REP.:	A.Pryor
RIG:	Geoprobe 6712DT

DRILLING METHOD: TYPE: 3.25" Casing; DEPTH (FT): 0-12

GROUNDWATER OBSERVATIONS

DATE:	DEPTH (FT):	NOTES:
6/28/2022	6.5	

DEPTH (FT)	SAMPLE NO.	REC (IN)	SOIL & ROCK CLASSIFICATION-DESCRIPTION	ELEV (FT)	STRATUM	HAMMER BLOWS (PER 6 IN)	SPT (N)
0-1	SS01	6	**[TOPSOIL]** Dark brown Silty Sand (SM), with organics, roots; very loose			1	
1-2			**[GLACIAL STRATIFIED DEPOSITS]** Tan well-graded Sand (SW) and gravel; very loose			1/12 1	1
2-3	SS02	13				1 2	4
3-4						2 2	
4-5							
5-6	SS03	19	Grey-brown Silty Sand (SM) and gravel; medium dense				-
6-7			-becomes wet				
7-8	SS04	7				47 60/3	60+
8-9							
9-10							
10-11	SS05	0				60/3	60+
11-12			Casing refusal, boring terminated at 10.3 ft				
12-13							
13-14							
14-15							
15-16							
16-17							
17-18							
18-19							
19-20							
20-21							
21-22							
22-23							
23-24							
24-25							
25-26							
26-27							

REMARKS: Exploration backfilled with drill spoils after completion of drilling.

Standard Penetration Tests (SPT) = 140lbs hammer falling 30 inches (ASTM D1586) S = split-spoon sample; C = rock core sample; U = undisturbed
Blows are per 6 inches with a 24-inch long by 2-inch O.D. by 1 3/8-inch I.D. split spoon sampler unless otherwise noted

REMARKS: *The stratification lines represent the approximate boundary between soil types. The actual transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.*

MAJOR DIVISIONS			SYMBOLS		TYPICAL NAMES
COARSE-GRAINED SOILS OVER 50% > No.200 SIEVE SIZE	GRAVELS MORE THAN 1/2 OF COARSE FRACTION > No.4 SIEVE SIZE	CLEAN GRAVELS WITH LESS THAN 5% FINES	GW		Well-graded gravels or gravel-sand mixtures, little or no fines
			GP		Poorly graded gravels or gravel-sand mixtures, little or no fines
		GRAVELS WITH OVER 15% FINES	GM		Silty gravels, gravel-sand mixtures
			GC		Clayey gravels, gravel-sand-clay mixtures
	SANDS MORE THAN 1/2 OF COARSE FRACTION < No.4 SIEVE SIZE	CLEAN SANDS WITH LESS THAN 5% FINES	SW		Well-graded sand or gravelly sands, little or no fines
			SP		Poorly graded sands or gravelly sands, little or no fines
		SANDS WITH OVER 15% FINES	SM		Silty sand, sand-silt mixtures
			SC		Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS OVER 50% < No.200 SIEVE SIZE	SILTS & CLAYS LIQUID LIMIT 50% OR LESS		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL		Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS LIQUID LIMIT GREATER THAN 50%		MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			CH		Inorganic clays of high plasticity, fat clays
			OH		Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS			PT		Peat and other highly organic soils

JOHN TURNER CONSULTING

KEY TO SYMBOLS AND DESCRIPTIONS

TYPICAL SYMBOLS

- Shelby Tube
- Auger Cuttings
- Standard Split Spoon Sample
- 3" Split Spoon Sample
- Rock Core
- Dynamic Cone Penetrometer
- Vane Shear
- Bulk/Grab Sample
- Geoprobe Sample
- Sonic or Vibro-Core Sample
- Water Table (at time of drilling)
- Water Table (after 24 hours)

SOIL MOISTURE MODIFIERS

Term	Description
Dry	Absence of moisture; dusty, dry to touch
Moist	Damp but no visible water
Wet	Visible free water

The descriptor "damp" should not be used (use "moist").
The descriptor "saturated" should not be used (use "wet").

WELL SYMBOLS

- Recessed Cover Set in Concrete
- Top of Well, Recessed Pipe
- Covered Riser
- Capped Riser w/ Locking Cover
- Pipe Riser
- Concrete Seal
- Gravel Backfill
- Assorted Cuttings
- Bentonite Slurry
- Bentonite Pellets
- Silica Sand, blank PVC
- Slotted Pipe w/ Sand
- Endcap on Pipe Packed in Sand
- Silica Sand, No Pipe (End Plug)

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL	3" to No. 4	76.2 to 4.75
coarse	3" to 3/4"	76.2 to 19.1
fine	3/4" to No. 4	19.1 to 4.75
SAND	No. 4 to No. 200	4.75 to 0.075
coarse	No. 4 to No. 10	4.75 to 2.00
medium	No. 10 to No. 40	2.00 to 0.425
fine	No. 40 to No. 200	0.425 to 0.075
SILT & CLAY	Below No. 200	Below 0.075

RELATIVE DENSITY/CONSISTENCY

Gravel, Sand, and Silt (nonplastic)		Silt (plastic) and Clay		
N-Value	Relative Density	N-Value	Su	Consistency
0 - 4	Very Loose	0 - 2	0 - 250	Very Soft
5 - 10	Loose	3 - 4	251 - 500	Soft
11-30	Medium Dense	5 - 8	501 - 1000	Medium Stiff
31 - 50	Dense	9 - 15	1001 - 2000	Stiff
51 +	Very Dense	16 - 30	2001 - 4000	Very Stiff
		31 +	4001+	Hard

Standard Penetration Testing (SPT) N_{60} based on blows per 12 inches.
WR = Weight of Rods; WH = Weight of Hammer

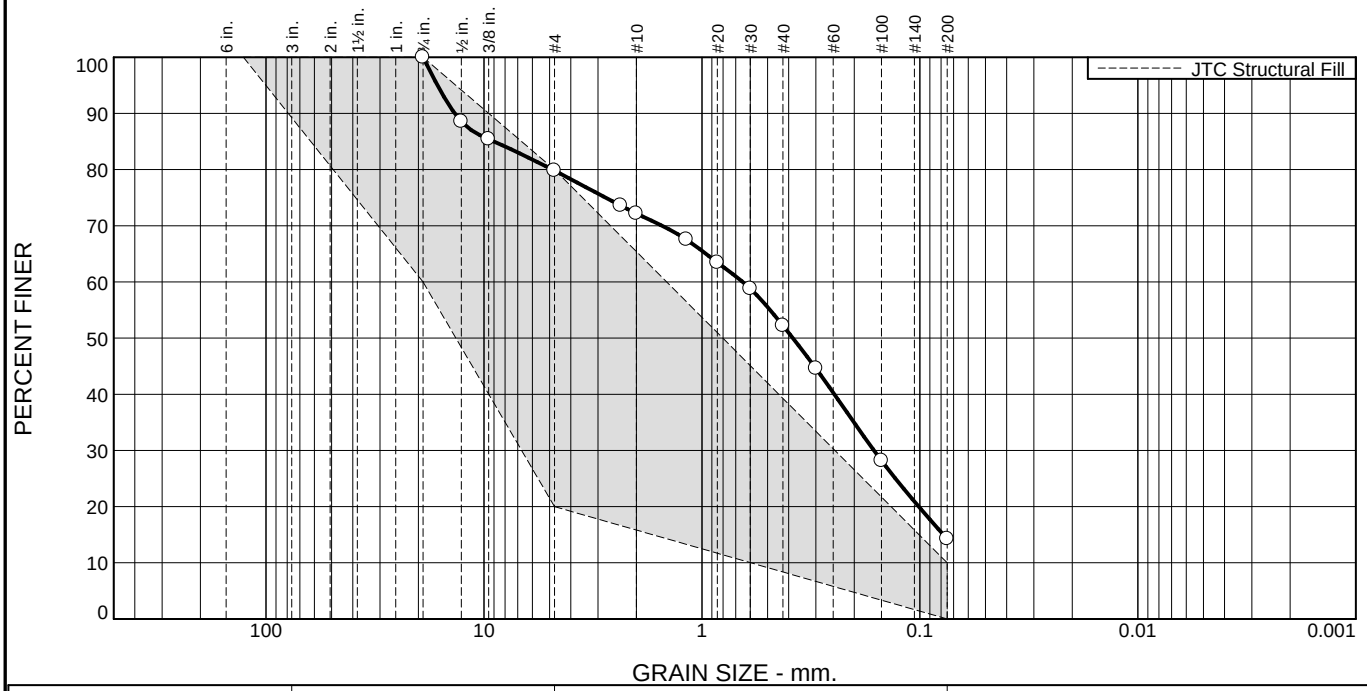
PERCENT OR PORTIONS OF SOIL

Term	Description
Parting:	> 1/16 in.
Seam:	0.5 in. to 1/16 in.
Layer:	12 in. to 0.5 in.
Stratum:	> 12 in.
Pocket:	Small erratic deposit
Lens:	Lenticular deposit
Occasional:	One or less per foot of thickness
Frequent	More than one per foot of thickness
Varved	Alternating seams or layers of silt and/or clay and sometimes f. sand

REFERENCE: UNIFIED SOIL CLASSIFICATION SYSTEM - ASTM D2488-93

APPENDIX E: GEOTECHNICAL LABORATORY TESTING RESULTS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	20.2	7.6	20.0	37.9	14.3	

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0	60.0 - 100.0	
1/2"	88.6		
3/8"	85.4		
#4	79.8	20.0 - 80.0	
#8	73.6		
#10	72.2		
#16	67.5		
#20	63.4		
#30	58.8		
#40	52.2		
#50	44.6		
#100	28.2		
#200	14.3	0.0 - 10.0	X

* JTC Structural Fill

Material Description

Brownish orange silty sand with gravel

Atterberg Limits (ASTM D 4318)

PL= - **LL=** - **PI=** -

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** -

Coefficients

D_{90}= 13.6271 D_{85}= 9.0047 D_{60}= 0.6499
D_{50}= 0.3829 D_{30}= 0.1625 D_{15}= 0.0780
D_{10}= C_u= C_c=

Remarks

Moisture Content= 5.0%

Date Received: 07/07/2022 **Date Tested:** 07/12/2022

Tested By: Matt Watson

Checked By: Eric Tavares

Title: Lab Manager

Location: B-3 SS01
Sample Number: 3522-555 **Depth:** 0-2'

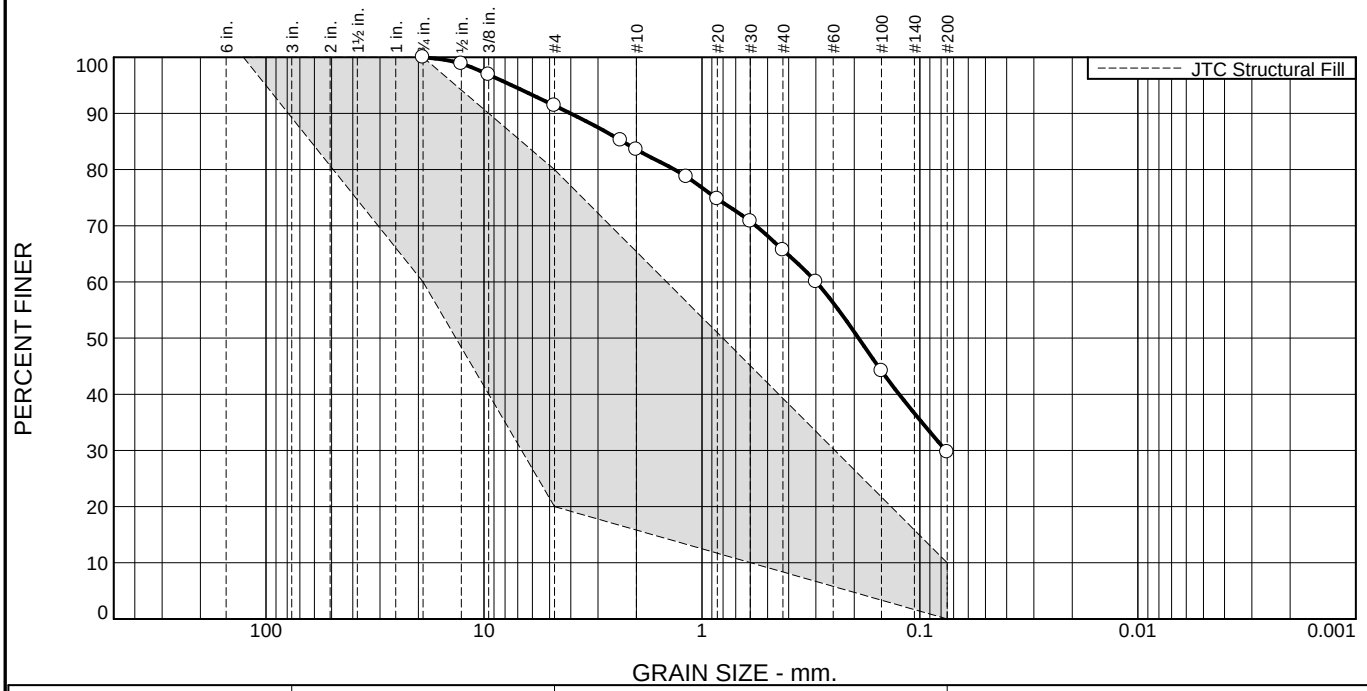
Date Sampled: 06/28/2022

JOHN TURNER CONSULTING

Client: Alrig USA
Project: 212-226 Charlton Road

Project No: 22-04-059 **Figure** 555A

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	8.6	7.8	17.9	36.0	29.7	

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0	60.0 - 100.0	
1/2"	98.9		
3/8"	96.9		
#4	91.4	20.0 - 80.0	X
#8	85.2		
#10	83.6		
#16	78.7		
#20	74.8		
#30	70.8		
#40	65.7		
#50	60.0		
#100	44.2		
#200	29.7	0.0 - 10.0	X

* JTC Structural Fill

Material Description

Brown silty sand

Atterberg Limits (ASTM D 4318)

PL= - **LL=** - **PI=** -

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** -

Coefficients

D_{90}= 4.0058 D_{85}= 2.3104 D_{60}= 0.2993
D_{50}= 0.1913 D_{30}= 0.0761 D_{15}=
D_{10}= C_u= C_c=

Remarks

Moisture content= 10.2%

Date Received: 07/07/2022 **Date Tested:** 07/12/2022

Tested By: Matt Watson

Checked By: Eric Tavares

Title: Lab Manager

Location: B-7 SS03 **Date Sampled:** 06/28/2022
Sample Number: 3522-556 **Depth:** 5'-7'

JOHN TURNER CONSULTING

Client: Alrig USA
Project: 212-226 Charlton Road

Project No: 22-04-059 **Figure** 556A

APPENDIX F: SITE PHOTOGRAPHS

JOHN TURNER CONSULTING

PHOTO LOG

John Turner Consulting, Inc.	Site Location: 212-226 Charlton Road Sturbridge, MA

Photo No. 1	Date: 6/28/2022

Description: Site North Facing 1

Photo No. 2	Date: 6/28/2022

Description: Site Northwest Facing

Photo No. 3	Date: 6/28/2022

Description: Site North Facing 2

Photo No. 4	Date: 6/28/2022

Description: Drilling Rig

JOHN TURNER CONSULTING

John Turner Consulting, Inc.	Site Location: 212-226 Charlton Road Sturbridge, MA

Photo No. 5	Date: 6/28/2022

Description: B-2 (15-17 ft)

Photo No. 6	Date: 6/28/2022

Description: B-3 (0-2 ft)

Photo No. 7	Date: 6/28/2022

Description: B-6 (2-4 ft)

Photo No. 8	Date: 6/28/2022

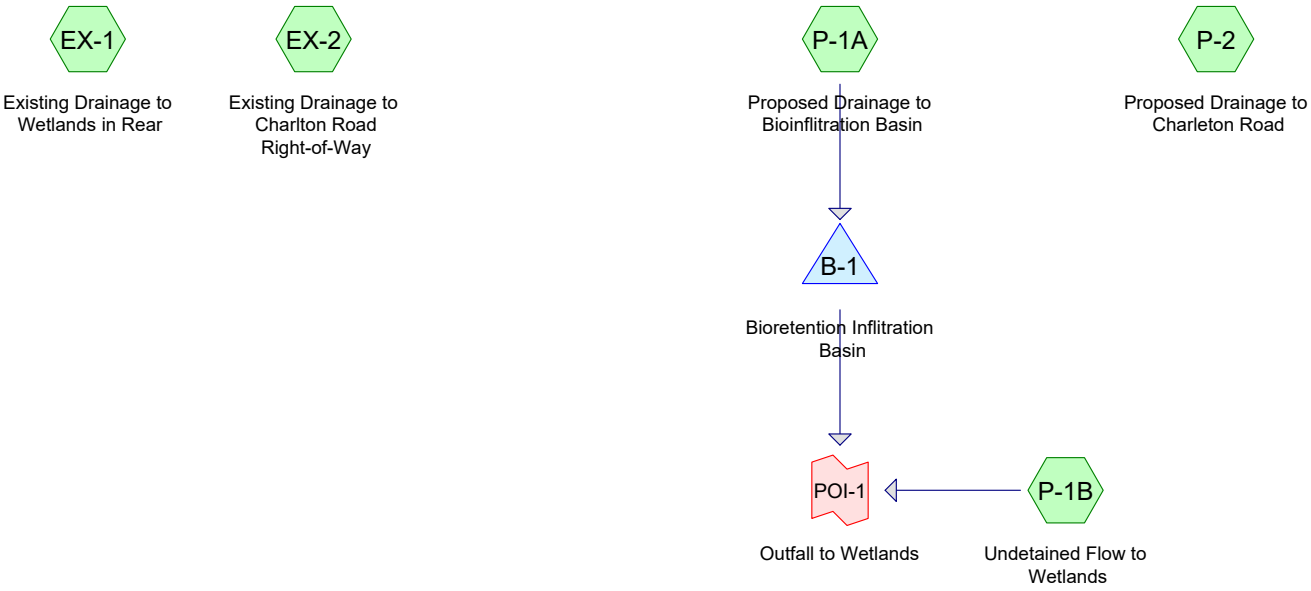
Description: B-7 (5-7 ft)

APPENDIX C
HYDROLOGIC & HYDRAULIC CALCULATIONS

INVENTORY

C-1: HYDROCAD NODE SCHEMATIC DIAGRAM

C-2: HYDROCAD HYDROLOGIC CALCULATIONS



Subcat Reach Pond Link

Routing Diagram for 2023-05-16_HydroCAD
Prepared by Stonefield Engineering & Design, Printed 5/19/2023

Summary for Subcatchment EX-1: Existing Drainage to Wetlands in Rear

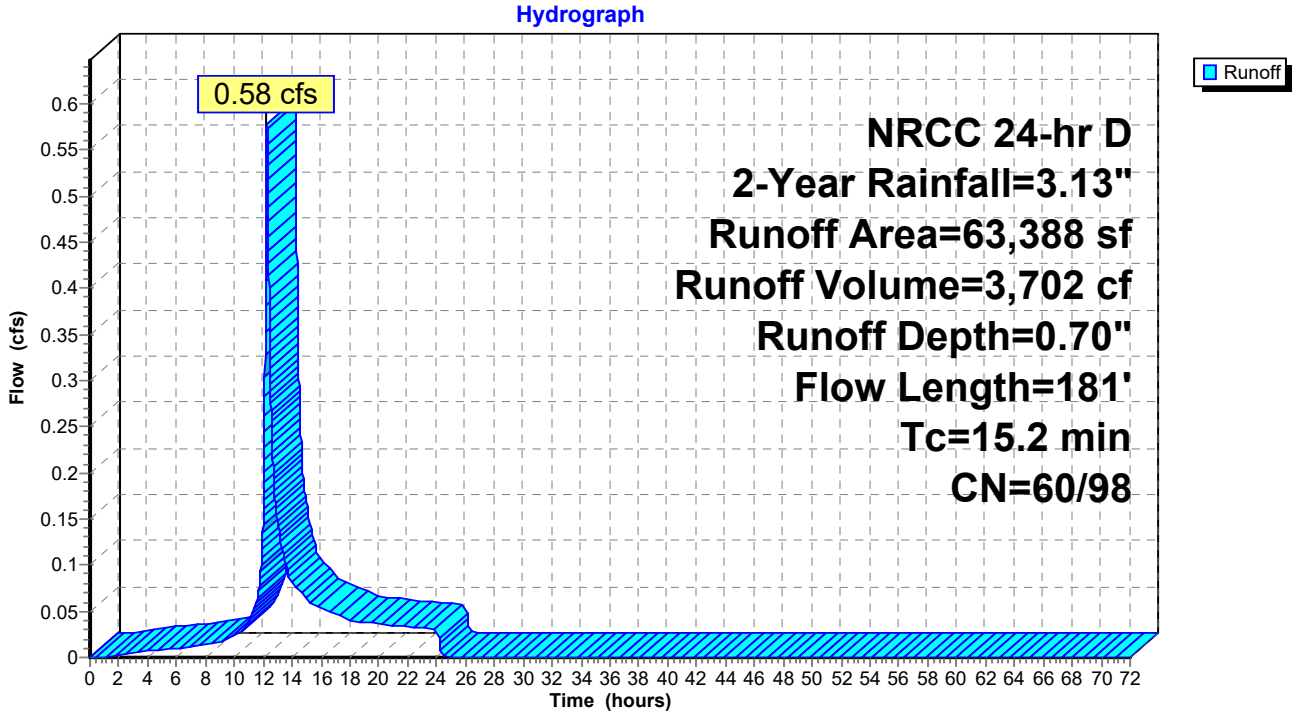
Runoff = 0.58 cfs @ 12.25 hrs, Volume= 3,702 cf, Depth= 0.70"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 2-Year Rainfall=3.13"

	Area (sf)	CN	Description
	11,309	55	Woods, Good, HSG B
	44,033	61	>75% Grass cover, Good, HSG B
*	8,046	98	Impervious Area
	63,388	65	Weighted Average
	55,342	60	87.31% Pervious Area
	8,046	98	12.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.9	100	0.0585	0.12		**Sheet Flow, 100 LF Sheet Flow (1-2)** Woods: Light underbrush n= 0.400 P2= 3.22"
1.3	81	0.0445	1.05		**Shallow Concentrated Flow, 191 LF SCF (2-3)** Woodland Kv= 5.0 fps
15.2	181	Total			

Subcatchment EX-1: Existing Drainage to Wetlands in Rear



Hydrograph for Subcatchment EX-1: Existing Drainage to Wetlands in Rear

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	0.00
2.00	0.09	0.00	0.01	0.00
4.00	0.20	0.00	0.07	0.01
6.00	0.32	0.00	0.16	0.01
8.00	0.48	0.00	0.30	0.01
10.00	0.70	0.00	0.51	0.02
12.00	1.50	0.00	1.28	**0.15**
14.00	2.43	0.15	2.20	**0.08**
16.00	2.65	0.22	2.42	0.05
18.00	2.81	0.27	2.58	0.04
20.00	2.93	0.31	2.70	0.04
22.00	3.04	0.35	2.80	0.03
24.00	**3.13**	**0.38**	**2.90**	0.03
26.00	3.13	0.38	2.90	0.00
28.00	3.13	0.38	2.90	0.00
30.00	3.13	0.38	2.90	0.00
32.00	3.13	0.38	2.90	0.00
34.00	3.13	0.38	2.90	0.00
36.00	3.13	0.38	2.90	0.00
38.00	3.13	0.38	2.90	0.00
40.00	3.13	0.38	2.90	0.00
42.00	3.13	0.38	2.90	0.00
44.00	3.13	0.38	2.90	0.00
46.00	3.13	0.38	2.90	0.00
48.00	3.13	0.38	2.90	0.00
50.00	3.13	0.38	2.90	0.00
52.00	3.13	0.38	2.90	0.00
54.00	3.13	0.38	2.90	0.00
56.00	3.13	0.38	2.90	0.00
58.00	3.13	0.38	2.90	0.00
60.00	3.13	0.38	2.90	0.00
62.00	3.13	0.38	2.90	0.00
64.00	3.13	0.38	2.90	0.00
66.00	3.13	0.38	2.90	0.00
68.00	3.13	0.38	2.90	0.00
70.00	3.13	0.38	2.90	0.00
72.00	3.13	0.38	2.90	0.00

Summary for Subcatchment EX-2: Existing Drainage to Charlton Road Right-of-Way

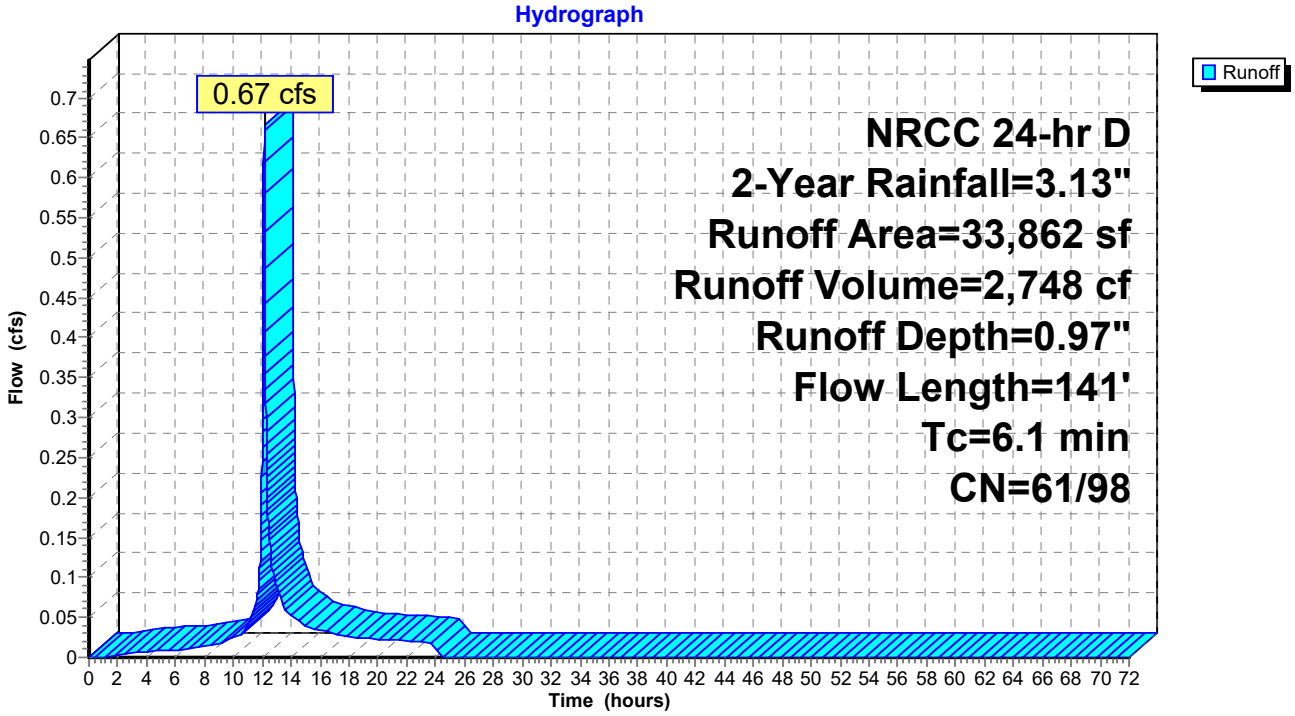
Runoff = 0.67 cfs @ 12.14 hrs, Volume= 2,748 cf, Depth= 0.97"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 2-Year Rainfall=3.13"

	Area (sf)	CN	Description
	532	55	Woods, Good, HSG B
	25,715	61	>75% Grass cover, Good, HSG B
*	7,615	98	Impervious Area
	33,862	69	Weighted Average
	26,247	61	77.51% Pervious Area
	7,615	98	22.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	73	0.0410	0.21		**Sheet Flow, 73 LF Sheet Flow (1-2)** Grass: Short n= 0.150 P2= 3.22"
0.4	68	0.0180	2.72		**Shallow Concentrated Flow, 68 LF SCF (2-3)** Paved Kv= 20.3 fps
6.1	141	Total			

Subcatchment EX-2: Existing Drainage to Charlton Road Right-of-Way



Hydrograph for Subcatchment EX-2: Existing Drainage to Charlton Road Right-of-Way

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	0.00
2.00	0.09	0.00	0.01	0.00
4.00	0.20	0.00	0.07	0.01
6.00	0.32	0.00	0.16	0.01
8.00	0.48	0.00	0.30	0.01
10.00	0.70	0.00	0.51	0.02
12.00	1.50	0.01	1.28	**0.28**
14.00	2.43	0.18	2.20	**0.05**
16.00	2.65	0.24	2.42	0.03
18.00	2.81	0.30	2.58	0.03
20.00	2.93	0.34	2.70	0.02
22.00	3.04	0.38	2.80	0.02
24.00	**3.13**	**0.42**	**2.90**	0.02
26.00	3.13	0.42	2.90	0.00
28.00	3.13	0.42	2.90	0.00
30.00	3.13	0.42	2.90	0.00
32.00	3.13	0.42	2.90	0.00
34.00	3.13	0.42	2.90	0.00
36.00	3.13	0.42	2.90	0.00
38.00	3.13	0.42	2.90	0.00
40.00	3.13	0.42	2.90	0.00
42.00	3.13	0.42	2.90	0.00
44.00	3.13	0.42	2.90	0.00
46.00	3.13	0.42	2.90	0.00
48.00	3.13	0.42	2.90	0.00
50.00	3.13	0.42	2.90	0.00
52.00	3.13	0.42	2.90	0.00
54.00	3.13	0.42	2.90	0.00
56.00	3.13	0.42	2.90	0.00
58.00	3.13	0.42	2.90	0.00
60.00	3.13	0.42	2.90	0.00
62.00	3.13	0.42	2.90	0.00
64.00	3.13	0.42	2.90	0.00
66.00	3.13	0.42	2.90	0.00
68.00	3.13	0.42	2.90	0.00
70.00	3.13	0.42	2.90	0.00
72.00	3.13	0.42	2.90	0.00

Summary for Subcatchment P-1A: Proposed Drainage to Bioinflitration Basin

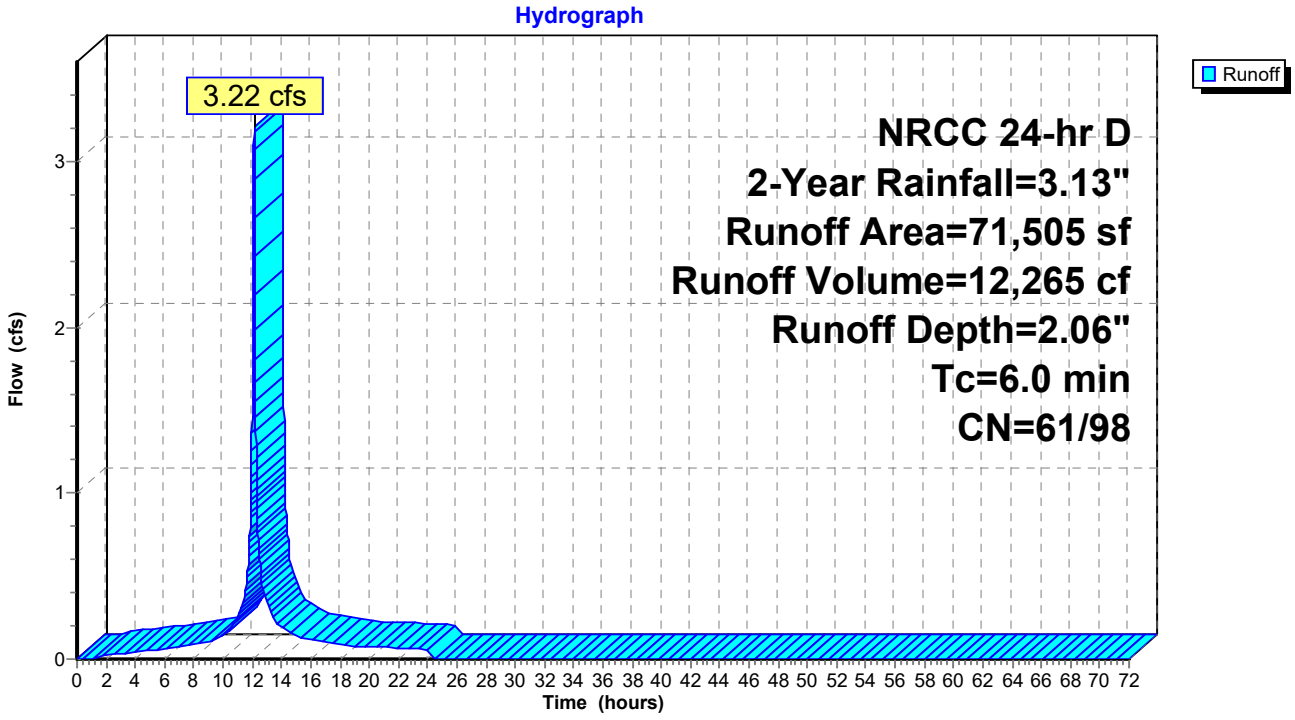
Runoff = 3.22 cfs @ 12.13 hrs, Volume= 12,265 cf, Depth= 2.06"
Routed to Pond B-1 : Bioretention Inflitration Basin

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 2-Year Rainfall=3.13"

Area (sf)	CN	Description
47,324	98	Paved parking, HSG B
24,181	61	>75% Grass cover, Good, HSG B
71,505	85	Weighted Average
24,181	61	33.82% Pervious Area
47,324	98	66.18% Impervious Area

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

Subcatchment P-1A: Proposed Drainage to Bioinflitration Basin



Hydrograph for Subcatchment P-1A: Proposed Drainage to Bioinflitration Basin

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	0.00
2.00	0.09	0.00	0.01	0.02
4.00	0.20	0.00	0.07	0.04
6.00	0.32	0.00	0.16	0.06
8.00	0.48	0.00	0.30	0.09
10.00	0.70	0.00	0.51	0.15
12.00	1.50	0.01	1.28	**1.65**
14.00	2.43	0.18	2.20	**0.19**
16.00	2.65	0.24	2.42	0.12
18.00	2.81	0.30	2.58	0.08
20.00	2.93	0.34	2.70	0.07
22.00	3.04	0.38	2.80	0.07
24.00	**3.13**	**0.42**	**2.90**	0.06
26.00	3.13	0.42	2.90	0.00
28.00	3.13	0.42	2.90	0.00
30.00	3.13	0.42	2.90	0.00
32.00	3.13	0.42	2.90	0.00
34.00	3.13	0.42	2.90	0.00
36.00	3.13	0.42	2.90	0.00
38.00	3.13	0.42	2.90	0.00
40.00	3.13	0.42	2.90	0.00
42.00	3.13	0.42	2.90	0.00
44.00	3.13	0.42	2.90	0.00
46.00	3.13	0.42	2.90	0.00
48.00	3.13	0.42	2.90	0.00
50.00	3.13	0.42	2.90	0.00
52.00	3.13	0.42	2.90	0.00
54.00	3.13	0.42	2.90	0.00
56.00	3.13	0.42	2.90	0.00
58.00	3.13	0.42	2.90	0.00
60.00	3.13	0.42	2.90	0.00
62.00	3.13	0.42	2.90	0.00
64.00	3.13	0.42	2.90	0.00
66.00	3.13	0.42	2.90	0.00
68.00	3.13	0.42	2.90	0.00
70.00	3.13	0.42	2.90	0.00
72.00	3.13	0.42	2.90	0.00

Summary for Subcatchment P-1B: Undetained Flow to Wetlands

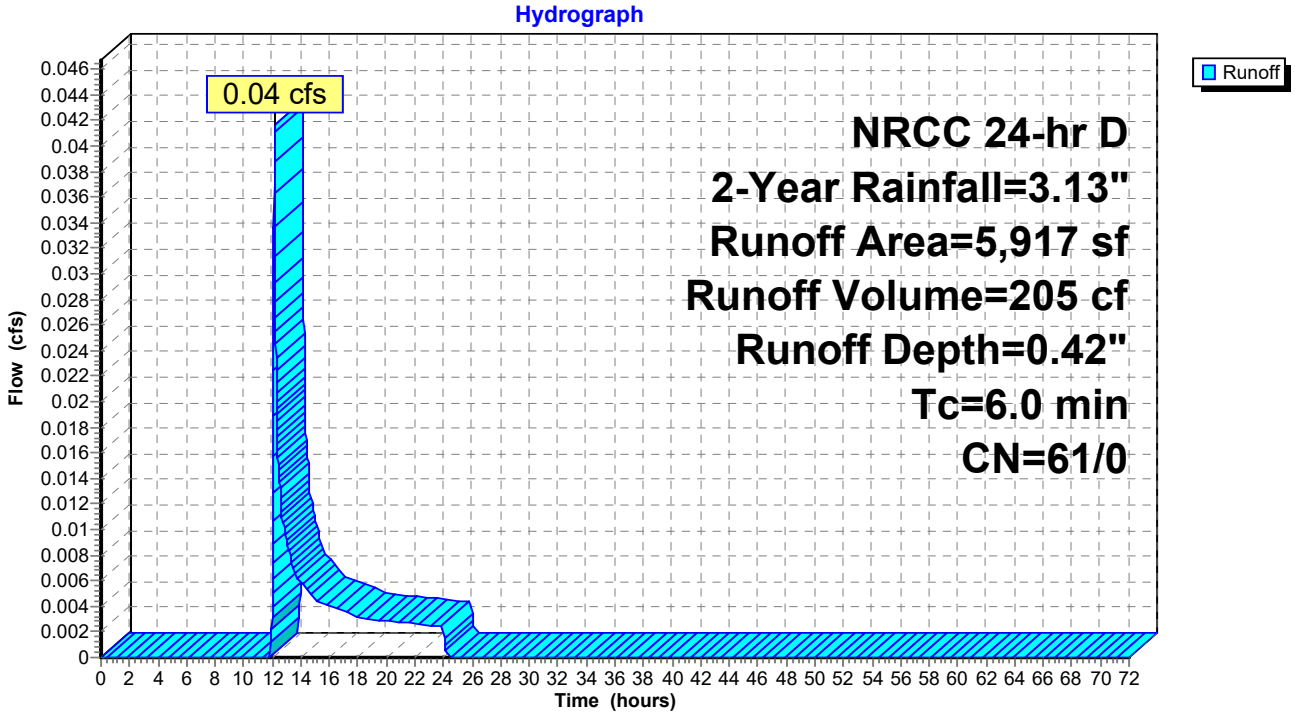
Runoff = 0.04 cfs @ 12.15 hrs, Volume= 205 cf, Depth= 0.42"
Routed to Link POI-1 : Outfall to Wetlands

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 2-Year Rainfall=3.13"

Area (sf)	CN	Description
5,917	61	>75% Grass cover, Good, HSG B
5,917	61	100.00% Pervious Area

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

Subcatchment P-1B: Undetained Flow to Wetlands



Hydrograph for Subcatchment P-1B: Undetained Flow to Wetlands

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	**0.00**	0.00
2.00	0.09	0.00	0.00	0.00
4.00	0.20	0.00	0.00	0.00
6.00	0.32	0.00	0.00	0.00
8.00	0.48	0.00	0.00	0.00
10.00	0.70	0.00	0.00	0.00
12.00	1.50	0.01	0.00	**0.01**
14.00	2.43	0.18	0.00	**0.01**
16.00	2.65	0.24	0.00	0.00
18.00	2.81	0.30	0.00	0.00
20.00	2.93	0.34	0.00	0.00
22.00	3.04	0.38	0.00	0.00
24.00	**3.13**	**0.42**	0.00	0.00
26.00	3.13	0.42	0.00	0.00
28.00	3.13	0.42	0.00	0.00
30.00	3.13	0.42	0.00	0.00
32.00	3.13	0.42	0.00	0.00
34.00	3.13	0.42	0.00	0.00
36.00	3.13	0.42	0.00	0.00
38.00	3.13	0.42	0.00	0.00
40.00	3.13	0.42	0.00	0.00
42.00	3.13	0.42	0.00	0.00
44.00	3.13	0.42	0.00	0.00
46.00	3.13	0.42	0.00	0.00
48.00	3.13	0.42	0.00	0.00
50.00	3.13	0.42	0.00	0.00
52.00	3.13	0.42	0.00	0.00
54.00	3.13	0.42	0.00	0.00
56.00	3.13	0.42	0.00	0.00
58.00	3.13	0.42	0.00	0.00
60.00	3.13	0.42	0.00	0.00
62.00	3.13	0.42	0.00	0.00
64.00	3.13	0.42	0.00	0.00
66.00	3.13	0.42	0.00	0.00
68.00	3.13	0.42	0.00	0.00
70.00	3.13	0.42	0.00	0.00
72.00	3.13	0.42	0.00	0.00

Summary for Subcatchment P-2: Proposed Drainage to Charleton Road

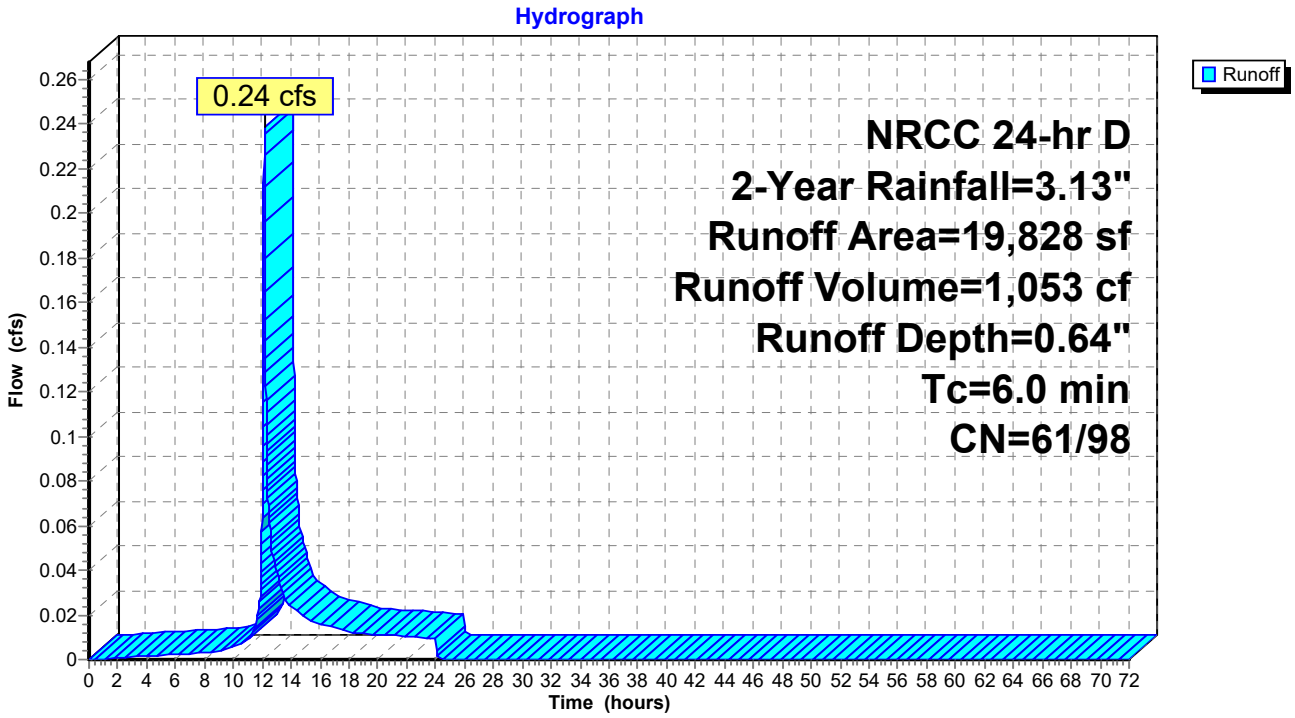
Runoff = 0.24 cfs @ 12.14 hrs, Volume= 1,053 cf, Depth= 0.64"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 2-Year Rainfall=3.13"

Area (sf)	CN	Description
18,056	61	>75% Grass cover, Good, HSG B
1,772	98	Paved parking, HSG B
19,828	64	Weighted Average
18,056	61	91.06% Pervious Area
1,772	98	8.94% Impervious Area

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

Subcatchment P-2: Proposed Drainage to Charleton Road



Hydrograph for Subcatchment P-2: Proposed Drainage to Charleton Road

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	0.00
2.00	0.09	0.00	0.01	0.00
4.00	0.20	0.00	0.07	0.00
6.00	0.32	0.00	0.16	0.00
8.00	0.48	0.00	0.30	0.00
10.00	0.70	0.00	0.51	0.01
12.00	1.50	0.01	1.28	**0.08**
14.00	2.43	0.18	2.20	**0.02**
16.00	2.65	0.24	2.42	0.02
18.00	2.81	0.30	2.58	0.01
20.00	2.93	0.34	2.70	0.01
22.00	3.04	0.38	2.80	0.01
24.00	**3.13**	**0.42**	**2.90**	0.01
26.00	3.13	0.42	2.90	0.00
28.00	3.13	0.42	2.90	0.00
30.00	3.13	0.42	2.90	0.00
32.00	3.13	0.42	2.90	0.00
34.00	3.13	0.42	2.90	0.00
36.00	3.13	0.42	2.90	0.00
38.00	3.13	0.42	2.90	0.00
40.00	3.13	0.42	2.90	0.00
42.00	3.13	0.42	2.90	0.00
44.00	3.13	0.42	2.90	0.00
46.00	3.13	0.42	2.90	0.00
48.00	3.13	0.42	2.90	0.00
50.00	3.13	0.42	2.90	0.00
52.00	3.13	0.42	2.90	0.00
54.00	3.13	0.42	2.90	0.00
56.00	3.13	0.42	2.90	0.00
58.00	3.13	0.42	2.90	0.00
60.00	3.13	0.42	2.90	0.00
62.00	3.13	0.42	2.90	0.00
64.00	3.13	0.42	2.90	0.00
66.00	3.13	0.42	2.90	0.00
68.00	3.13	0.42	2.90	0.00
70.00	3.13	0.42	2.90	0.00
72.00	3.13	0.42	2.90	0.00

Summary for Pond B-1: Bioretention Inflitration Basin

Inflow Area = 71,505 sf, 66.18% Impervious, Inflow Depth = 2.06" for 2-Year event
Inflow = 3.22 cfs @ 12.13 hrs, Volume= 12,265 cf
Outflow = 0.28 cfs @ 13.25 hrs, Volume= 12,265 cf, Atten= 91%, Lag= 67.4 min
Discarded = 0.28 cfs @ 13.25 hrs, Volume= 12,265 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link POI-1 : Outfall to Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 580.72' @ 13.25 hrs Surf.Area= 5,456 sf Storage= 3,734 cf

Plug-Flow detention time= 96.8 min calculated for 12,264 cf (100% of inflow)
Center-of-Mass det. time= 96.8 min (871.6 - 774.8)

Volume	Invert	Avail.Storage	Storage Description
#1	580.00'	11,344 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

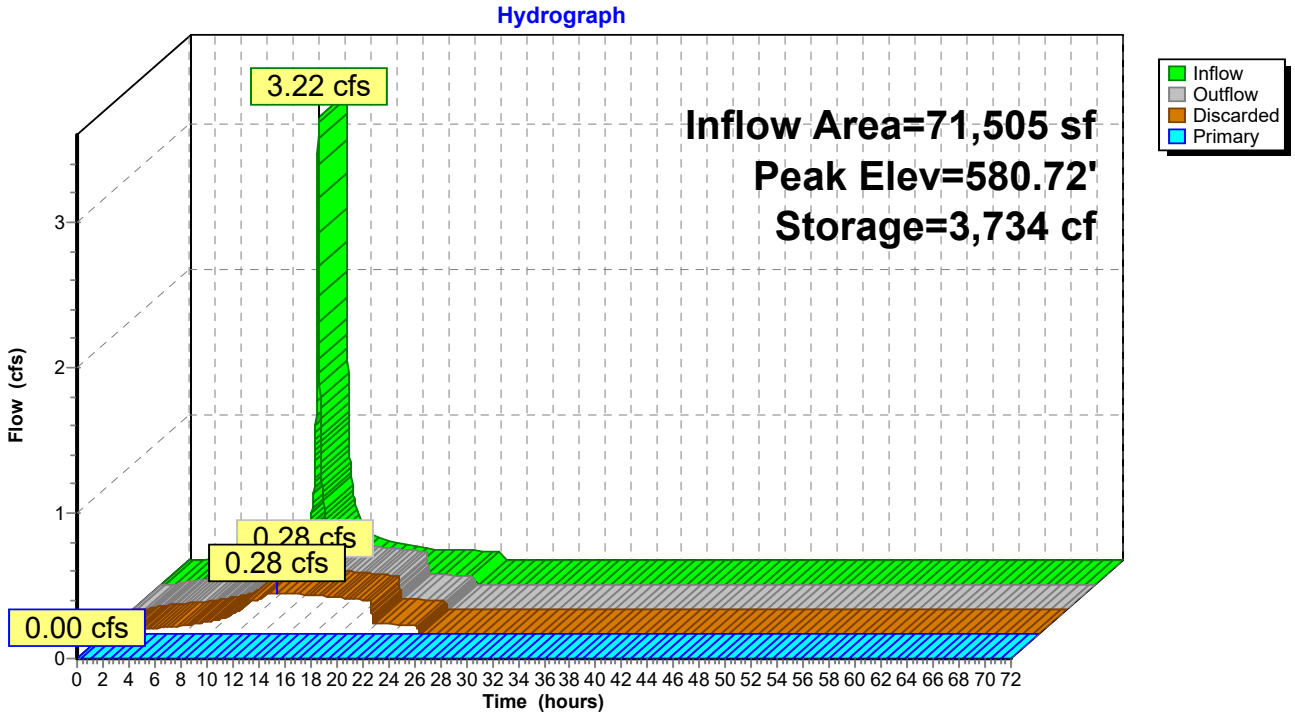
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
580.00	4,909	508.0	0	0	4,909
581.00	5,676	524.1	5,288	5,288	6,328
582.00	6,445	537.4	6,056	11,344	7,571

Device	Routing	Invert	Outlet Devices
#1	Primary	580.00'	**12.0" Round Culvert** L= 4.0' Ke= 0.050 Inlet / Outlet Invert= 580.00' / 579.00' S= 0.2500 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	580.80'	**15.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	581.30'	**24.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Discarded	580.00'	**2.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 574.00' Phase-In= 0.01'
#5	Device 1	581.80'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.28 cfs @ 13.25 hrs HW=580.72' (Free Discharge)
└**4=Exfiltration** (Controls 0.28 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=580.00' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Controls 0.00 cfs)
├**2=Orifice/Grate** (Controls 0.00 cfs)
├**3=Orifice/Grate** (Controls 0.00 cfs)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond B-1: Bioretention Inflitration Basin



Hydrograph for Pond B-1: Bioretention Inflitration Basin

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
0.00	0.00	0	580.00	0.00	0.00	**0.00**
2.00	0.02	4	580.00	0.02	0.02	0.00
4.00	0.04	9	580.00	0.04	0.04	0.00
6.00	0.06	12	580.00	0.06	0.06	0.00
8.00	0.09	19	580.00	0.09	0.09	0.00
10.00	0.15	32	580.01	0.15	0.15	0.00
12.00	**1.65**	**1,053**	**580.21**	**0.24**	**0.24**	0.00
14.00	**0.19**	**3,581**	**580.69**	**0.28**	**0.28**	0.00
16.00	0.12	2,657	580.52	0.27	0.27	0.00
18.00	0.08	1,523	580.30	0.25	0.25	0.00
20.00	0.07	353	580.07	0.23	0.23	0.00
22.00	0.07	14	580.00	0.07	0.07	0.00
24.00	0.06	13	580.00	0.06	0.06	0.00
26.00	0.00	0	580.00	0.00	0.00	0.00
28.00	0.00	0	580.00	0.00	0.00	0.00
30.00	0.00	0	580.00	0.00	0.00	0.00
32.00	0.00	0	580.00	0.00	0.00	0.00
34.00	0.00	0	580.00	0.00	0.00	0.00
36.00	0.00	0	580.00	0.00	0.00	0.00
38.00	0.00	0	580.00	0.00	0.00	0.00
40.00	0.00	0	580.00	0.00	0.00	0.00
42.00	0.00	0	580.00	0.00	0.00	0.00
44.00	0.00	0	580.00	0.00	0.00	0.00
46.00	0.00	0	580.00	0.00	0.00	0.00
48.00	0.00	0	580.00	0.00	0.00	0.00
50.00	0.00	0	580.00	0.00	0.00	0.00
52.00	0.00	0	580.00	0.00	0.00	0.00
54.00	0.00	0	580.00	0.00	0.00	0.00
56.00	0.00	0	580.00	0.00	0.00	0.00
58.00	0.00	0	580.00	0.00	0.00	0.00
60.00	0.00	0	580.00	0.00	0.00	0.00
62.00	0.00	0	580.00	0.00	0.00	0.00
64.00	0.00	0	580.00	0.00	0.00	0.00
66.00	0.00	0	580.00	0.00	0.00	0.00
68.00	0.00	0	580.00	0.00	0.00	0.00
70.00	0.00	0	580.00	0.00	0.00	0.00
72.00	0.00	0	580.00	0.00	0.00	0.00

Stage-Discharge for Pond B-1: Bioretention Inflitration Basin

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
580.00	0.00	0.00	0.00
580.02	0.23	0.23	0.00
580.04	0.23	0.23	0.00
580.06	0.23	0.23	0.00
580.08	0.23	0.23	0.00
580.10	0.23	0.23	0.00
580.12	0.24	0.24	0.00
580.14	0.24	0.24	0.00
580.16	0.24	0.24	0.00
580.18	0.24	0.24	0.00
580.20	0.24	0.24	0.00
580.22	0.24	0.24	0.00
580.24	0.24	0.24	0.00
580.26	0.25	0.25	0.00
580.28	0.25	0.25	0.00
580.30	0.25	0.25	0.00
580.32	0.25	0.25	0.00
580.34	0.25	0.25	0.00
580.36	0.25	0.25	0.00
580.38	0.26	0.26	0.00
580.40	0.26	0.26	0.00
580.42	0.26	0.26	0.00
580.44	0.26	0.26	0.00
580.46	0.26	0.26	0.00
580.48	0.26	0.26	0.00
580.50	0.26	0.26	0.00
580.52	0.27	0.27	0.00
580.54	0.27	0.27	0.00
580.56	0.27	0.27	0.00
580.58	0.27	0.27	0.00
580.60	0.27	0.27	0.00
580.62	0.27	0.27	0.00
580.64	0.28	0.28	0.00
580.66	0.28	0.28	0.00
580.68	0.28	0.28	0.00
580.70	0.28	0.28	0.00
580.72	0.28	0.28	0.00
580.74	0.28	0.28	0.00
580.76	0.28	0.28	0.00
580.78	0.29	0.29	0.00
580.80	0.29	0.29	0.00
580.82	0.30	0.29	0.01
580.84	0.32	0.29	0.03
580.86	0.35	0.29	0.06
580.88	0.38	0.29	0.09
580.90	0.42	0.30	0.13
580.92	0.46	0.30	0.17
580.94	0.51	0.30	0.21
580.96	0.56	0.30	0.26
580.98	0.61	0.30	0.31
581.00	0.66	0.30	0.36
581.02	0.72	0.30	0.41
581.04	0.78	0.31	0.47
581.06	0.84	0.31	0.53
581.08	0.88	0.31	0.57
581.10	0.93	0.31	0.61
581.12	0.96	0.31	0.65
581.14	1.00	0.31	0.69
581.16	1.04	0.32	0.72
581.18	1.07	0.32	0.75
581.20	1.10	0.32	0.78
581.22	1.13	0.32	0.81
581.24	1.16	0.32	0.84
581.26	1.19	0.32	0.87
581.28	1.22	0.33	0.89
581.30	1.24	0.33	0.92
581.32	1.29	0.33	0.96
581.34	1.35	0.33	1.02
581.36	1.42	0.33	1.08
581.38	1.49	0.33	1.16
581.40	1.57	0.34	1.24
581.42	1.66	0.34	1.32
581.44	1.75	0.34	1.41
581.46	1.85	0.34	1.51
581.48	1.95	0.34	1.61
581.50	2.06	0.34	1.71
581.52	2.17	0.34	1.82
581.54	2.28	0.35	1.93
581.56	2.39	0.35	2.04
581.58	2.48	0.35	2.13
581.60	2.57	0.35	2.22
581.62	2.65	0.35	2.30
581.64	2.72	0.35	2.37
581.66	2.80	0.36	2.44
581.68	2.87	0.36	2.51
581.70	2.93	0.36	2.57
581.72	3.00	0.36	2.64
581.74	3.06	0.36	2.70
581.76	3.12	0.36	2.76
581.78	3.18	0.37	2.82
581.80	3.24	0.37	2.87
581.82	3.33	0.37	2.96
581.84	3.44	0.37	3.07
581.86	3.57	0.37	3.20
581.88	3.72	0.37	3.34
581.90	3.87	0.38	3.49
581.92	4.03	0.38	3.65
581.94	4.20	0.38	3.83
581.96	4.38	0.38	4.00
581.98	4.57	0.38	4.19
582.00	**4.77**	**0.38**	**4.38**

Stage-Area-Storage for Pond B-1: Bioretention Inflitration Basin

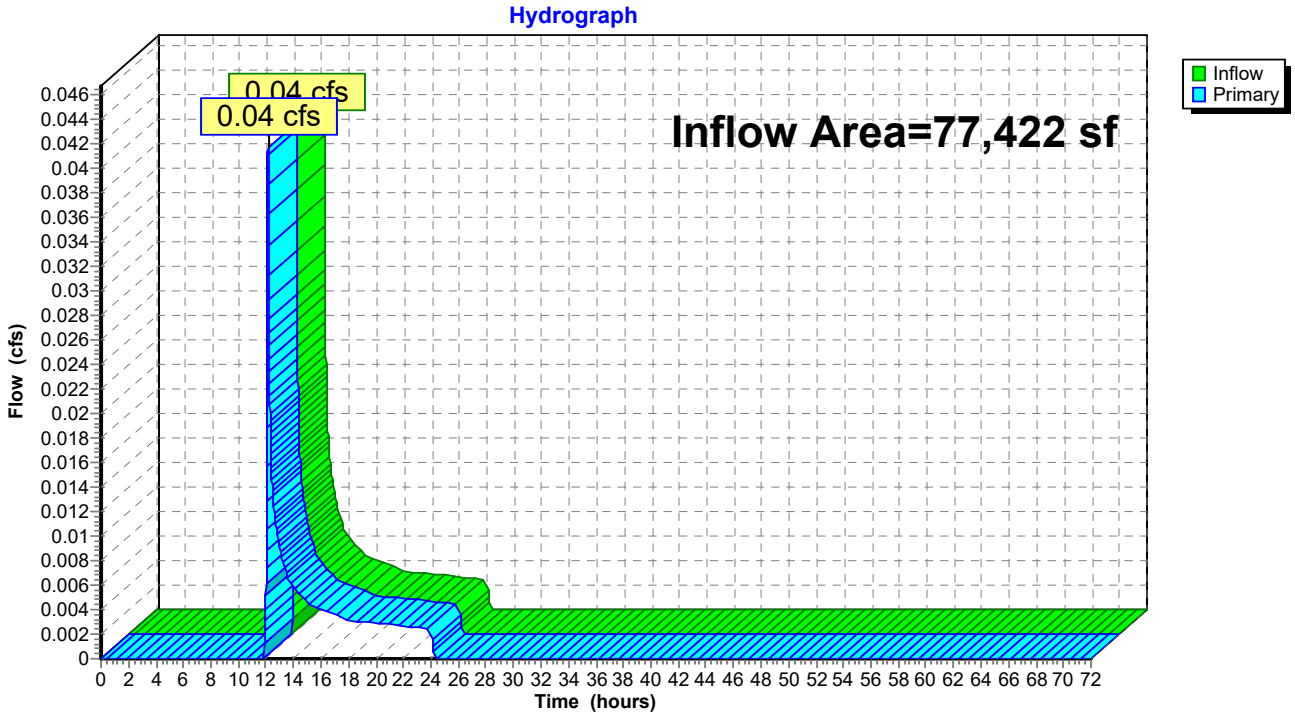
Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
580.00	4,909	0
580.02	4,924	98
580.04	4,939	197
580.06	4,953	296
580.08	4,968	395
580.10	4,983	495
580.12	4,998	594
580.14	5,013	695
580.16	5,028	795
580.18	5,043	896
580.20	5,058	997
580.22	5,073	1,098
580.24	5,088	1,200
580.26	5,103	1,301
580.28	5,118	1,404
580.30	5,133	1,506
580.32	5,148	1,609
580.34	5,164	1,712
580.36	5,179	1,816
580.38	5,194	1,919
580.40	5,209	2,023
580.42	5,224	2,128
580.44	5,240	2,232
580.46	5,255	2,337
580.48	5,270	2,442
580.50	5,286	2,548
580.52	5,301	2,654
580.54	5,316	2,760
580.56	5,332	2,867
580.58	5,347	2,973
580.60	5,363	3,080
580.62	5,378	3,188
580.64	5,393	3,296
580.66	5,409	3,404
580.68	5,425	3,512
580.70	5,440	3,621
580.72	5,456	3,730
580.74	5,471	3,839
580.76	5,487	3,948
580.78	5,502	4,058
580.80	5,518	4,168
580.82	5,534	4,279
580.84	5,550	4,390
580.86	5,565	4,501
580.88	5,581	4,612
580.90	5,597	4,724
580.92	5,613	4,836
580.94	5,628	4,949
580.96	5,644	5,061
580.98	5,660	5,175
581.00	5,676	5,288
581.02	5,691	5,402
581.04	5,706	5,515
581.06	5,721	5,630
581.08	5,736	5,744
581.10	5,751	5,859
581.12	5,766	5,974
581.14	5,781	6,090
581.16	5,796	6,206
581.18	5,811	6,322
581.20	5,826	6,438
581.22	5,841	6,555
581.24	5,856	6,672
581.26	5,871	6,789
581.28	5,886	6,907
581.30	5,902	7,024
581.32	5,917	7,143
581.34	5,932	7,261
581.36	5,947	7,380
581.38	5,962	7,499
581.40	5,978	7,618
581.42	5,993	7,738
581.44	6,008	7,858
581.46	6,024	7,978
581.48	6,039	8,099
581.50	6,054	8,220
581.52	6,070	8,341
581.54	6,085	8,463
581.56	6,101	8,585
581.58	6,116	8,707
581.60	6,132	8,829
581.62	6,147	8,952
581.64	6,163	9,075
581.66	6,178	9,199
581.68	6,194	9,322
581.70	6,209	9,446
581.72	6,225	9,571
581.74	6,240	9,695
581.76	6,256	9,820
581.78	6,272	9,946
581.80	6,287	10,071
581.82	6,303	10,197
581.84	6,319	10,323
581.86	6,334	10,450
581.88	6,350	10,577
581.90	6,366	10,704
581.92	6,382	10,831
581.94	6,397	10,959
581.96	6,413	11,087
581.98	6,429	11,216
582.00	**6,445**	**11,344**

Summary for Link POI-1: Outfall to Wetlands

Inflow Area = 77,422 sf, 61.12% Impervious, Inflow Depth = 0.03" for 2-Year event
Inflow = 0.04 cfs @ 12.15 hrs, Volume= 205 cf
Primary = 0.04 cfs @ 12.15 hrs, Volume= 205 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link POI-1: Outfall to Wetlands



Hydrograph for Link POI-1: Outfall to Wetlands

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	**0.00**	0.00
1.00	0.00	0.00	0.00
2.00	0.00	0.00	0.00
3.00	0.00	0.00	0.00
4.00	0.00	0.00	0.00
5.00	0.00	0.00	0.00
6.00	0.00	0.00	0.00
7.00	0.00	0.00	0.00
8.00	0.00	0.00	0.00
9.00	0.00	0.00	0.00
10.00	0.00	0.00	0.00
11.00	0.00	0.00	0.00
12.00	**0.01**	0.00	**0.01**
13.00	**0.01**	0.00	**0.01**
14.00	0.01	0.00	0.01
15.00	0.00	0.00	0.00
16.00	0.00	0.00	0.00
17.00	0.00	0.00	0.00
18.00	0.00	0.00	0.00
19.00	0.00	0.00	0.00
20.00	0.00	0.00	0.00
21.00	0.00	0.00	0.00
22.00	0.00	0.00	0.00
23.00	0.00	0.00	0.00
24.00	0.00	0.00	0.00
25.00	0.00	0.00	0.00
26.00	0.00	0.00	0.00
27.00	0.00	0.00	0.00
28.00	0.00	0.00	0.00
29.00	0.00	0.00	0.00
30.00	0.00	0.00	0.00
31.00	0.00	0.00	0.00
32.00	0.00	0.00	0.00
33.00	0.00	0.00	0.00
34.00	0.00	0.00	0.00
35.00	0.00	0.00	0.00
36.00	0.00	0.00	0.00
37.00	0.00	0.00	0.00
38.00	0.00	0.00	0.00
39.00	0.00	0.00	0.00
40.00	0.00	0.00	0.00
41.00	0.00	0.00	0.00
42.00	0.00	0.00	0.00
43.00	0.00	0.00	0.00
44.00	0.00	0.00	0.00
45.00	0.00	0.00	0.00
46.00	0.00	0.00	0.00
47.00	0.00	0.00	0.00
48.00	0.00	0.00	0.00
49.00	0.00	0.00	0.00
50.00	0.00	0.00	0.00
51.00	0.00	0.00	0.00
52.00	0.00	0.00	0.00
53.00	0.00	0.00	0.00
54.00	0.00	0.00	0.00
55.00	0.00	0.00	0.00
56.00	0.00	0.00	0.00
57.00	0.00	0.00	0.00
58.00	0.00	0.00	0.00
59.00	0.00	0.00	0.00
60.00	0.00	0.00	0.00
61.00	0.00	0.00	0.00
62.00	0.00	0.00	0.00
63.00	0.00	0.00	0.00
64.00	0.00	0.00	0.00
65.00	0.00	0.00	0.00
66.00	0.00	0.00	0.00
67.00	0.00	0.00	0.00
68.00	0.00	0.00	0.00
69.00	0.00	0.00	0.00
70.00	0.00	0.00	0.00
71.00	0.00	0.00	0.00
72.00	0.00	0.00	0.00

Summary for Subcatchment EX-1: Existing Drainage to Wetlands in Rear

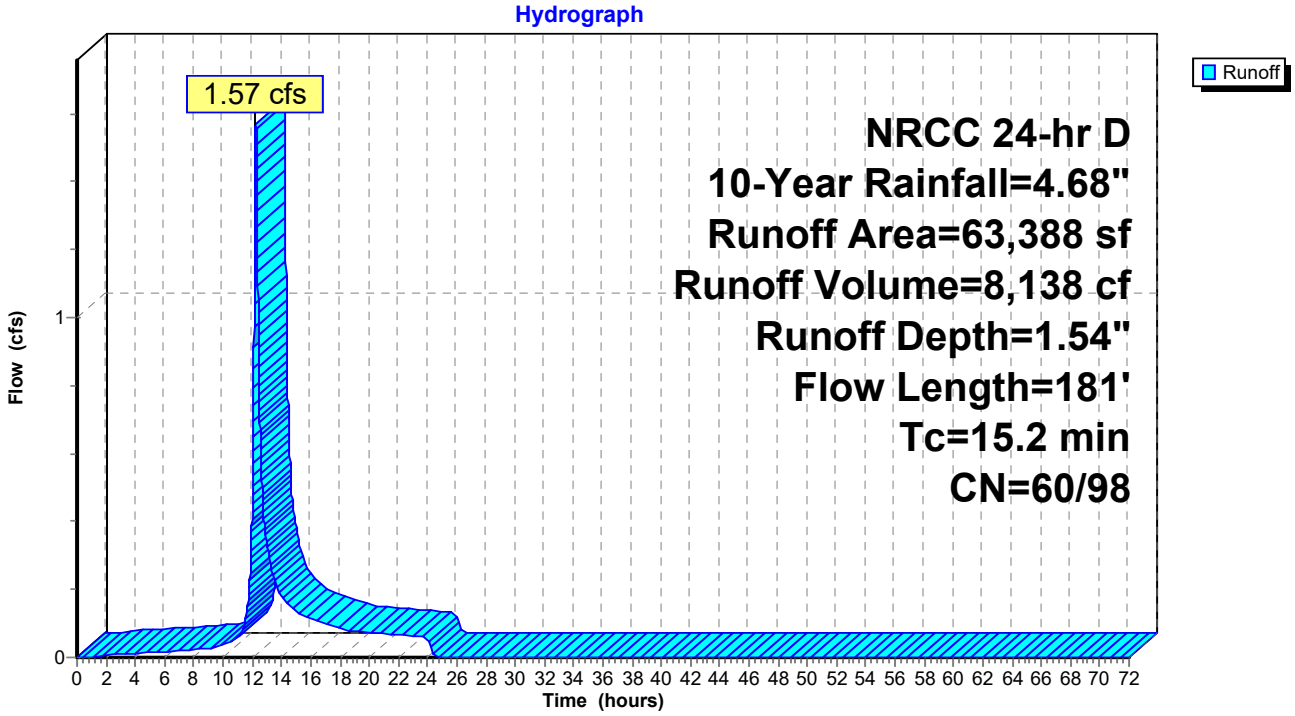
Runoff = 1.57 cfs @ 12.24 hrs, Volume= 8,138 cf, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-Year Rainfall=4.68"

	Area (sf)	CN	Description
	11,309	55	Woods, Good, HSG B
	44,033	61	>75% Grass cover, Good, HSG B
*	8,046	98	Impervious Area
	63,388	65	Weighted Average
	55,342	60	87.31% Pervious Area
	8,046	98	12.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.9	100	0.0585	0.12		**Sheet Flow, 100 LF Sheet Flow (1-2)** Woods: Light underbrush n= 0.400 P2= 3.22"
1.3	81	0.0445	1.05		**Shallow Concentrated Flow, 191 LF SCF (2-3)** Woodland Kv= 5.0 fps
15.2	181	Total			

Subcatchment EX-1: Existing Drainage to Wetlands in Rear



Hydrograph for Subcatchment EX-1: Existing Drainage to Wetlands in Rear

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	0.00
2.00	0.14	0.00	0.03	0.01
4.00	0.30	0.00	0.15	0.01
6.00	0.48	0.00	0.30	0.02
8.00	0.71	0.00	0.52	0.02
10.00	1.05	0.00	0.84	0.04
12.00	2.24	0.11	2.01	**0.45**
14.00	3.63	0.59	3.40	**0.18**
16.00	3.97	0.75	3.73	0.11
18.00	4.20	0.86	3.96	0.08
20.00	4.38	0.95	4.14	0.07
22.00	4.54	1.04	4.30	0.07
24.00	**4.68**	**1.12**	**4.44**	0.06
26.00	4.68	1.12	4.44	0.00
28.00	4.68	1.12	4.44	0.00
30.00	4.68	1.12	4.44	0.00
32.00	4.68	1.12	4.44	0.00
34.00	4.68	1.12	4.44	0.00
36.00	4.68	1.12	4.44	0.00
38.00	4.68	1.12	4.44	0.00
40.00	4.68	1.12	4.44	0.00
42.00	4.68	1.12	4.44	0.00
44.00	4.68	1.12	4.44	0.00
46.00	4.68	1.12	4.44	0.00
48.00	4.68	1.12	4.44	0.00
50.00	4.68	1.12	4.44	0.00
52.00	4.68	1.12	4.44	0.00
54.00	4.68	1.12	4.44	0.00
56.00	4.68	1.12	4.44	0.00
58.00	4.68	1.12	4.44	0.00
60.00	4.68	1.12	4.44	0.00
62.00	4.68	1.12	4.44	0.00
64.00	4.68	1.12	4.44	0.00
66.00	4.68	1.12	4.44	0.00
68.00	4.68	1.12	4.44	0.00
70.00	4.68	1.12	4.44	0.00
72.00	4.68	1.12	4.44	0.00

Summary for Subcatchment EX-2: Existing Drainage to Charlton Road Right-of-Way

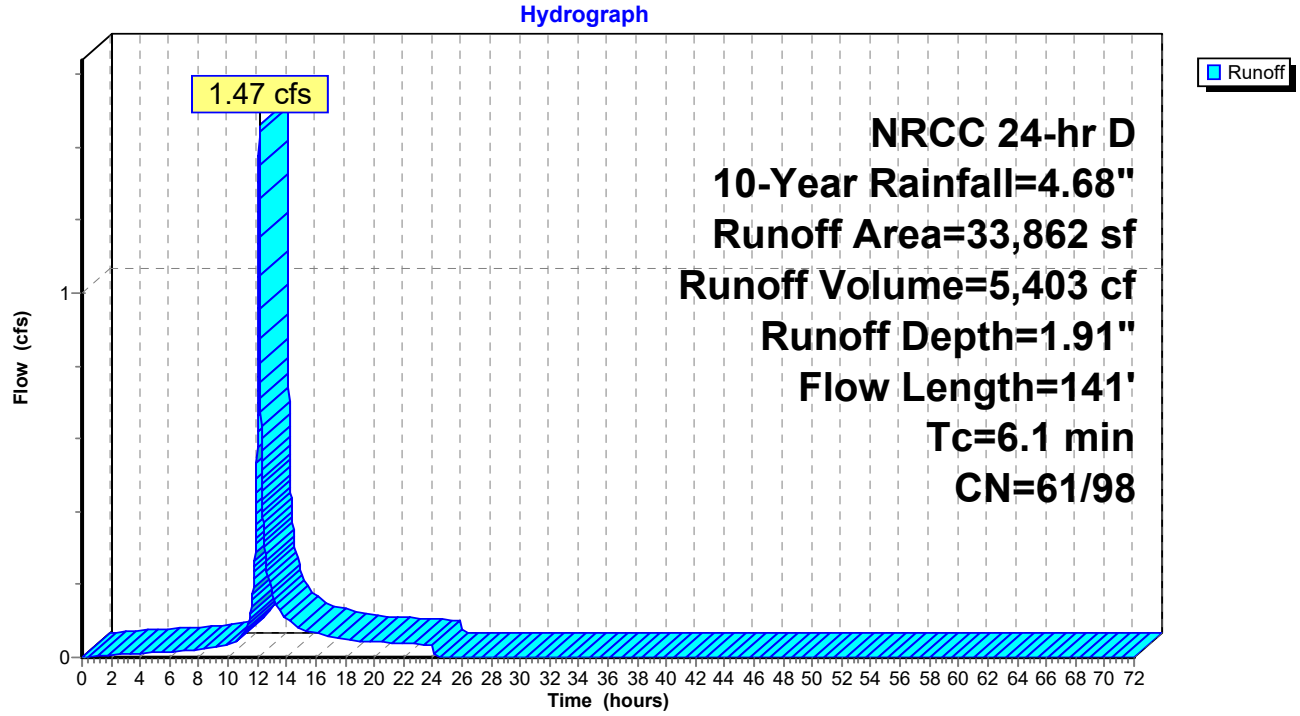
Runoff = 1.47 cfs @ 12.13 hrs, Volume= 5,403 cf, Depth= 1.91"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-Year Rainfall=4.68"

	Area (sf)	CN	Description
	532	55	Woods, Good, HSG B
	25,715	61	>75% Grass cover, Good, HSG B
*	7,615	98	Impervious Area
	33,862	69	Weighted Average
	26,247	61	77.51% Pervious Area
	7,615	98	22.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	73	0.0410	0.21		**Sheet Flow, 73 LF Sheet Flow (1-2)** Grass: Short n= 0.150 P2= 3.22"
0.4	68	0.0180	2.72		**Shallow Concentrated Flow, 68 LF SCF (2-3)** Paved Kv= 20.3 fps
6.1	141	Total			

Subcatchment EX-2: Existing Drainage to Charlton Road Right-of-Way



Hydrograph for Subcatchment EX-2: Existing Drainage to Charlton Road Right-of-Way

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	0.00
2.00	0.14	0.00	0.03	0.01
4.00	0.30	0.00	0.15	0.01
6.00	0.48	0.00	0.30	0.01
8.00	0.71	0.00	0.52	0.02
10.00	1.05	0.00	0.84	0.04
12.00	2.24	0.13	2.01	**0.66**
14.00	3.63	0.63	3.40	**0.10**
16.00	3.97	0.80	3.73	0.07
18.00	4.20	0.92	3.96	0.05
20.00	4.38	1.01	4.14	0.04
22.00	4.54	1.10	4.30	0.04
24.00	**4.68**	**1.18**	**4.44**	0.04
26.00	4.68	1.18	4.44	0.00
28.00	4.68	1.18	4.44	0.00
30.00	4.68	1.18	4.44	0.00
32.00	4.68	1.18	4.44	0.00
34.00	4.68	1.18	4.44	0.00
36.00	4.68	1.18	4.44	0.00
38.00	4.68	1.18	4.44	0.00
40.00	4.68	1.18	4.44	0.00
42.00	4.68	1.18	4.44	0.00
44.00	4.68	1.18	4.44	0.00
46.00	4.68	1.18	4.44	0.00
48.00	4.68	1.18	4.44	0.00
50.00	4.68	1.18	4.44	0.00
52.00	4.68	1.18	4.44	0.00
54.00	4.68	1.18	4.44	0.00
56.00	4.68	1.18	4.44	0.00
58.00	4.68	1.18	4.44	0.00
60.00	4.68	1.18	4.44	0.00
62.00	4.68	1.18	4.44	0.00
64.00	4.68	1.18	4.44	0.00
66.00	4.68	1.18	4.44	0.00
68.00	4.68	1.18	4.44	0.00
70.00	4.68	1.18	4.44	0.00
72.00	4.68	1.18	4.44	0.00

Summary for Subcatchment P-1A: Proposed Drainage to Bioinflitration Basin

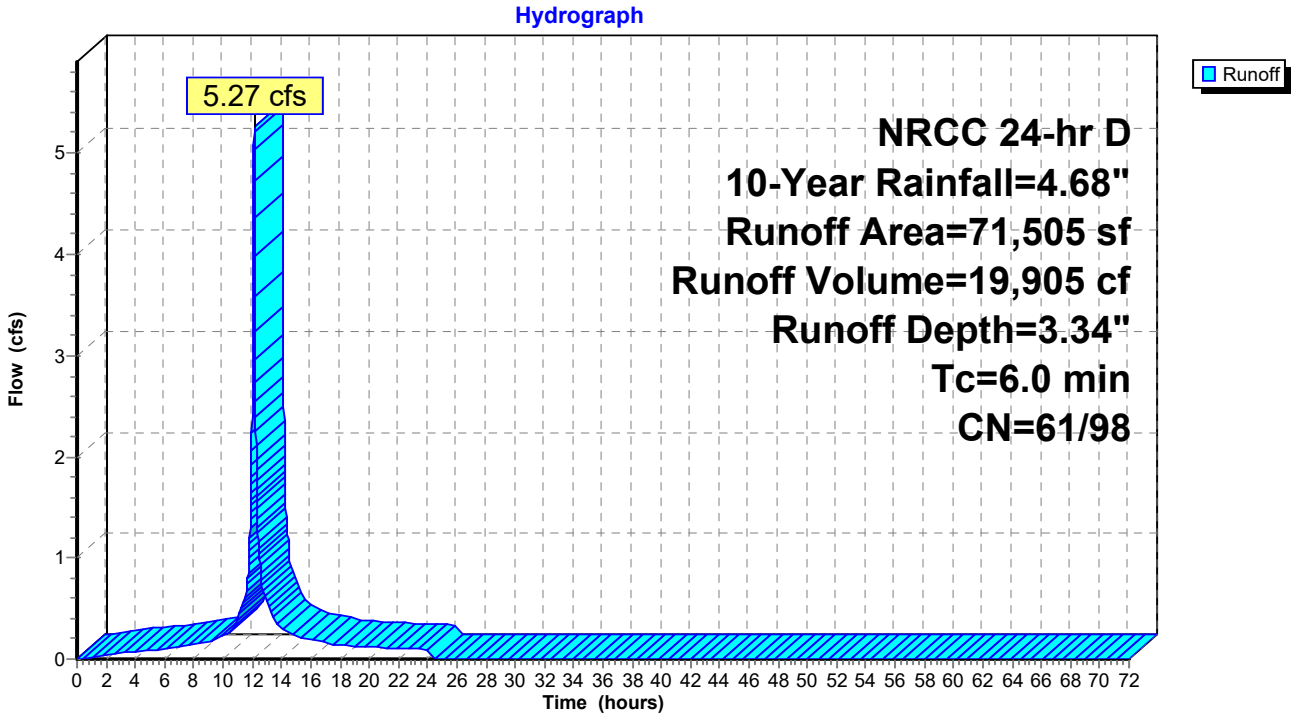
Runoff = 5.27 cfs @ 12.13 hrs, Volume= 19,905 cf, Depth= 3.34"
Routed to Pond B-1 : Bioretention Inflitration Basin

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-Year Rainfall=4.68"

Area (sf)	CN	Description
47,324	98	Paved parking, HSG B
24,181	61	>75% Grass cover, Good, HSG B
71,505	85	Weighted Average
24,181	61	33.82% Pervious Area
47,324	98	66.18% Impervious Area

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

Subcatchment P-1A: Proposed Drainage to Bioinflitration Basin



Hydrograph for Subcatchment P-1A: Proposed Drainage to Bioinflitration Basin

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	0.00
2.00	0.14	0.00	0.03	0.04
4.00	0.30	0.00	0.15	0.07
6.00	0.48	0.00	0.30	0.09
8.00	0.71	0.00	0.52	0.14
10.00	1.05	0.00	0.84	0.23
12.00	2.24	0.13	2.01	**2.71**
14.00	3.63	0.63	3.40	**0.31**
16.00	3.97	0.80	3.73	0.19
18.00	4.20	0.92	3.96	0.14
20.00	4.38	1.01	4.14	0.12
22.00	4.54	1.10	4.30	0.11
24.00	**4.68**	**1.18**	**4.44**	0.10
26.00	4.68	1.18	4.44	0.00
28.00	4.68	1.18	4.44	0.00
30.00	4.68	1.18	4.44	0.00
32.00	4.68	1.18	4.44	0.00
34.00	4.68	1.18	4.44	0.00
36.00	4.68	1.18	4.44	0.00
38.00	4.68	1.18	4.44	0.00
40.00	4.68	1.18	4.44	0.00
42.00	4.68	1.18	4.44	0.00
44.00	4.68	1.18	4.44	0.00
46.00	4.68	1.18	4.44	0.00
48.00	4.68	1.18	4.44	0.00
50.00	4.68	1.18	4.44	0.00
52.00	4.68	1.18	4.44	0.00
54.00	4.68	1.18	4.44	0.00
56.00	4.68	1.18	4.44	0.00
58.00	4.68	1.18	4.44	0.00
60.00	4.68	1.18	4.44	0.00
62.00	4.68	1.18	4.44	0.00
64.00	4.68	1.18	4.44	0.00
66.00	4.68	1.18	4.44	0.00
68.00	4.68	1.18	4.44	0.00
70.00	4.68	1.18	4.44	0.00
72.00	4.68	1.18	4.44	0.00

Summary for Subcatchment P-1B: Undetained Flow to Wetlands

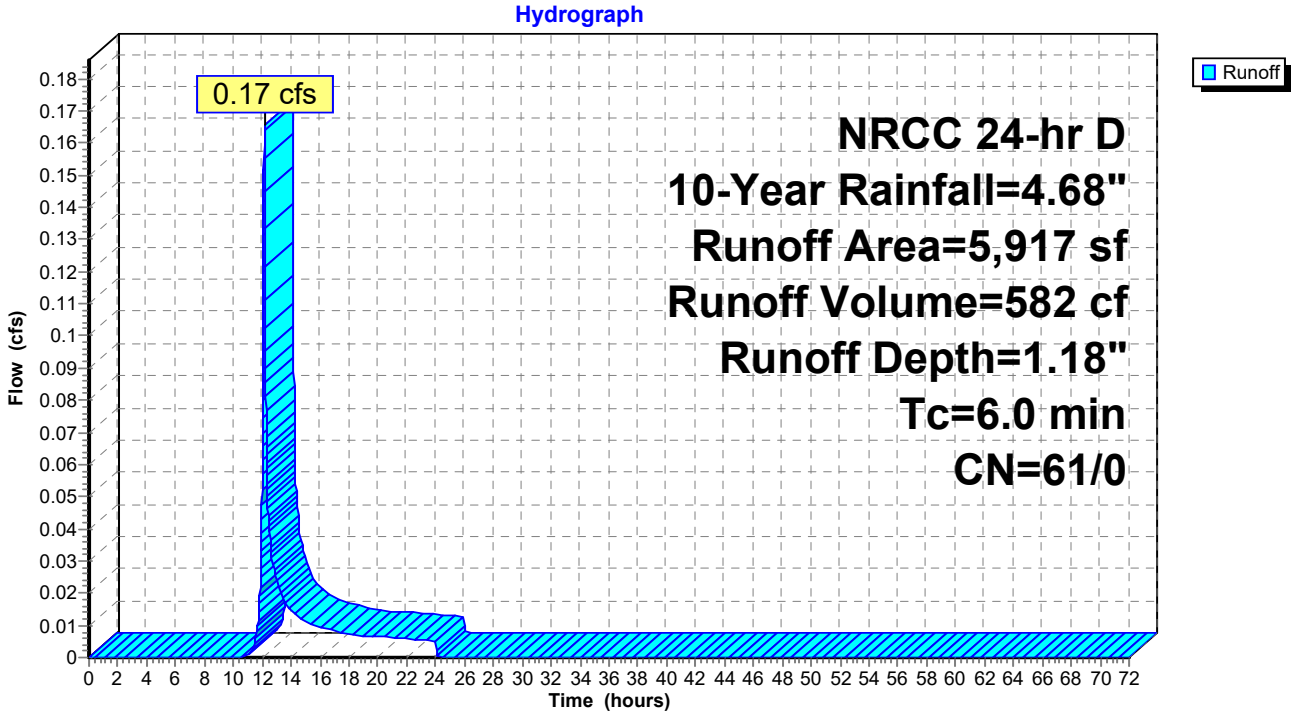
Runoff = 0.17 cfs @ 12.14 hrs, Volume= 582 cf, Depth= 1.18"
Routed to Link POI-1 : Outfall to Wetlands

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-Year Rainfall=4.68"

Area (sf)	CN	Description
5,917	61	>75% Grass cover, Good, HSG B
5,917	61	100.00% Pervious Area

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

Subcatchment P-1B: Undetained Flow to Wetlands



Hydrograph for Subcatchment P-1B: Undetained Flow to Wetlands

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	**0.00**	0.00
2.00	0.14	0.00	0.00	0.00
4.00	0.30	0.00	0.00	0.00
6.00	0.48	0.00	0.00	0.00
8.00	0.71	0.00	0.00	0.00
10.00	1.05	0.00	0.00	0.00
12.00	2.24	0.13	0.00	**0.06**
14.00	3.63	0.63	0.00	**0.01**
16.00	3.97	0.80	0.00	0.01
18.00	4.20	0.92	0.00	0.01
20.00	4.38	1.01	0.00	0.01
22.00	4.54	1.10	0.00	0.01
24.00	**4.68**	**1.18**	0.00	0.01
26.00	4.68	1.18	0.00	0.00
28.00	4.68	1.18	0.00	0.00
30.00	4.68	1.18	0.00	0.00
32.00	4.68	1.18	0.00	0.00
34.00	4.68	1.18	0.00	0.00
36.00	4.68	1.18	0.00	0.00
38.00	4.68	1.18	0.00	0.00
40.00	4.68	1.18	0.00	0.00
42.00	4.68	1.18	0.00	0.00
44.00	4.68	1.18	0.00	0.00
46.00	4.68	1.18	0.00	0.00
48.00	4.68	1.18	0.00	0.00
50.00	4.68	1.18	0.00	0.00
52.00	4.68	1.18	0.00	0.00
54.00	4.68	1.18	0.00	0.00
56.00	4.68	1.18	0.00	0.00
58.00	4.68	1.18	0.00	0.00
60.00	4.68	1.18	0.00	0.00
62.00	4.68	1.18	0.00	0.00
64.00	4.68	1.18	0.00	0.00
66.00	4.68	1.18	0.00	0.00
68.00	4.68	1.18	0.00	0.00
70.00	4.68	1.18	0.00	0.00
72.00	4.68	1.18	0.00	0.00

Summary for Subcatchment P-2: Proposed Drainage to Charleton Road

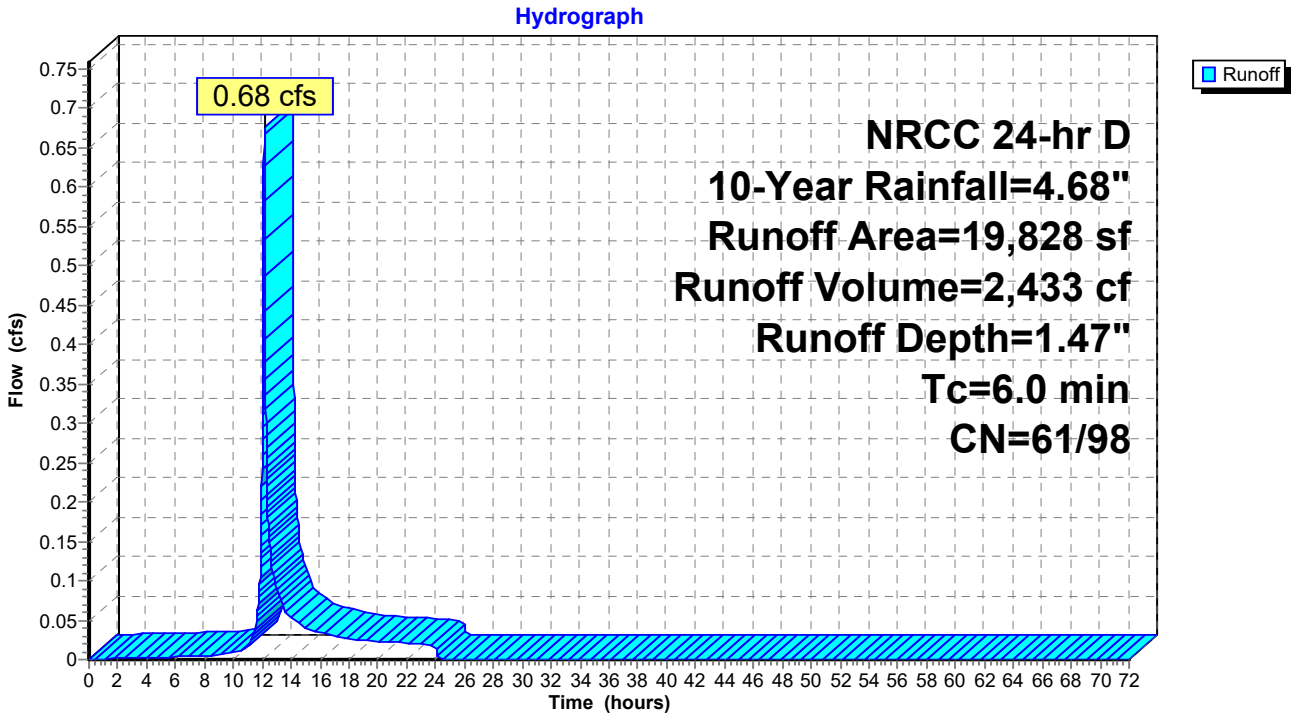
Runoff = 0.68 cfs @ 12.14 hrs, Volume= 2,433 cf, Depth= 1.47"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-Year Rainfall=4.68"

Area (sf)	CN	Description
18,056	61	>75% Grass cover, Good, HSG B
1,772	98	Paved parking, HSG B
19,828	64	Weighted Average
18,056	61	91.06% Pervious Area
1,772	98	8.94% Impervious Area

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

Subcatchment P-2: Proposed Drainage to Charleton Road



Hydrograph for Subcatchment P-2: Proposed Drainage to Charleton Road

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	0.00
2.00	0.14	0.00	0.03	0.00
4.00	0.30	0.00	0.15	0.00
6.00	0.48	0.00	0.30	0.00
8.00	0.71	0.00	0.52	0.01
10.00	1.05	0.00	0.84	0.01
12.00	2.24	0.13	2.01	**0.28**
14.00	3.63	0.63	3.40	**0.05**
16.00	3.97	0.80	3.73	0.03
18.00	4.20	0.92	3.96	0.03
20.00	4.38	1.01	4.14	0.02
22.00	4.54	1.10	4.30	0.02
24.00	**4.68**	**1.18**	**4.44**	0.02
26.00	4.68	1.18	4.44	0.00
28.00	4.68	1.18	4.44	0.00
30.00	4.68	1.18	4.44	0.00
32.00	4.68	1.18	4.44	0.00
34.00	4.68	1.18	4.44	0.00
36.00	4.68	1.18	4.44	0.00
38.00	4.68	1.18	4.44	0.00
40.00	4.68	1.18	4.44	0.00
42.00	4.68	1.18	4.44	0.00
44.00	4.68	1.18	4.44	0.00
46.00	4.68	1.18	4.44	0.00
48.00	4.68	1.18	4.44	0.00
50.00	4.68	1.18	4.44	0.00
52.00	4.68	1.18	4.44	0.00
54.00	4.68	1.18	4.44	0.00
56.00	4.68	1.18	4.44	0.00
58.00	4.68	1.18	4.44	0.00
60.00	4.68	1.18	4.44	0.00
62.00	4.68	1.18	4.44	0.00
64.00	4.68	1.18	4.44	0.00
66.00	4.68	1.18	4.44	0.00
68.00	4.68	1.18	4.44	0.00
70.00	4.68	1.18	4.44	0.00
72.00	4.68	1.18	4.44	0.00

Summary for Pond B-1: Bioretention Inflitration Basin

Inflow Area = 71,505 sf, 66.18% Impervious, Inflow Depth = 3.34" for 10-Year event
Inflow = 5.27 cfs @ 12.13 hrs, Volume= 19,905 cf
Outflow = 0.93 cfs @ 12.55 hrs, Volume= 19,905 cf, Atten= 82%, Lag= 24.9 min
Discarded = 0.31 cfs @ 12.55 hrs, Volume= 16,847 cf
Primary = 0.62 cfs @ 12.55 hrs, Volume= 3,058 cf
Routed to Link POI-1 : Outfall to Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 581.10' @ 12.55 hrs Surf.Area= 5,751 sf Storage= 5,863 cf

Plug-Flow detention time= 114.6 min calculated for 19,902 cf (100% of inflow)
Center-of-Mass det. time= 114.5 min (885.7 - 771.2)

Volume	Invert	Avail.Storage	Storage Description
#1	580.00'	11,344 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

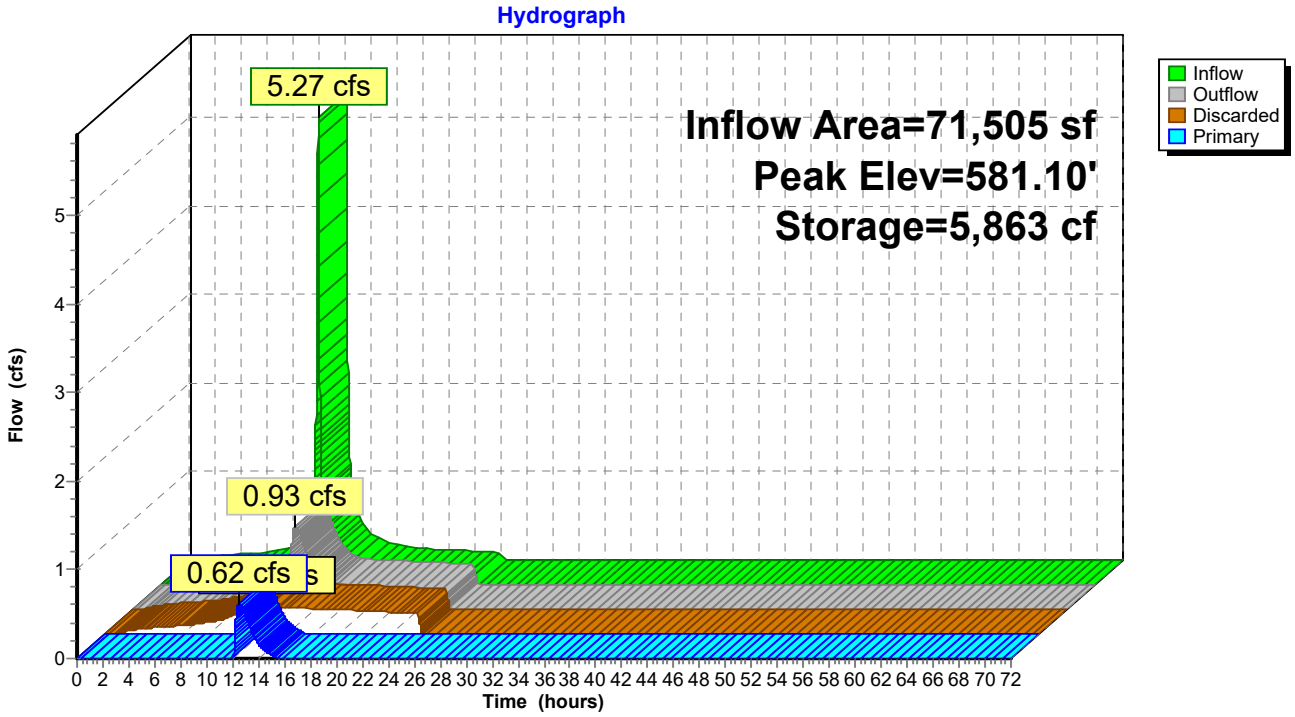
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
580.00	4,909	508.0	0	0	4,909
581.00	5,676	524.1	5,288	5,288	6,328
582.00	6,445	537.4	6,056	11,344	7,571

Device	Routing	Invert	Outlet Devices
#1	Primary	580.00'	**12.0" Round Culvert** L= 4.0' Ke= 0.050 Inlet / Outlet Invert= 580.00' / 579.00' S= 0.2500 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	580.80'	**15.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	581.30'	**24.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Discarded	580.00'	**2.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 574.00' Phase-In= 0.01'
#5	Device 1	581.80'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.31 cfs @ 12.55 hrs HW=581.10' (Free Discharge)
└**4=Exfiltration** (Controls 0.31 cfs)

Primary OutFlow Max=0.62 cfs @ 12.55 hrs HW=581.10' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.62 cfs of 4.19 cfs potential flow)
├**2=Orifice/Grate** (Orifice Controls 0.62 cfs @ 1.97 fps)
├**3=Orifice/Grate** (Controls 0.00 cfs)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond B-1: Bioretention Inflitration Basin



Hydrograph for Pond B-1: Bioretention Inflitration Basin

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
0.00	0.00	0	580.00	0.00	0.00	0.00
2.00	0.04	9	580.00	0.04	0.04	0.00
4.00	0.07	16	580.00	0.07	0.07	0.00
6.00	0.09	20	580.00	0.09	0.09	0.00
8.00	0.14	30	580.01	0.14	0.14	0.00
10.00	0.23	49	580.01	0.23	0.23	0.00
12.00	**2.71**	**2,317**	**580.46**	**0.26**	**0.26**	**0.00**
14.00	**0.31**	**4,812**	**580.92**	**0.45**	**0.30**	**0.16**
16.00	0.19	4,059	580.78	0.29	0.29	0.00
18.00	0.14	3,211	580.62	0.27	0.27	0.00
20.00	0.12	2,202	580.43	0.26	0.26	0.00
22.00	0.11	1,203	580.24	0.24	0.24	0.00
24.00	0.10	212	580.04	0.23	0.23	0.00
26.00	0.00	0	580.00	0.00	0.00	0.00
28.00	0.00	0	580.00	0.00	0.00	0.00
30.00	0.00	0	580.00	0.00	0.00	0.00
32.00	0.00	0	580.00	0.00	0.00	0.00
34.00	0.00	0	580.00	0.00	0.00	0.00
36.00	0.00	0	580.00	0.00	0.00	0.00
38.00	0.00	0	580.00	0.00	0.00	0.00
40.00	0.00	0	580.00	0.00	0.00	0.00
42.00	0.00	0	580.00	0.00	0.00	0.00
44.00	0.00	0	580.00	0.00	0.00	0.00
46.00	0.00	0	580.00	0.00	0.00	0.00
48.00	0.00	0	580.00	0.00	0.00	0.00
50.00	0.00	0	580.00	0.00	0.00	0.00
52.00	0.00	0	580.00	0.00	0.00	0.00
54.00	0.00	0	580.00	0.00	0.00	0.00
56.00	0.00	0	580.00	0.00	0.00	0.00
58.00	0.00	0	580.00	0.00	0.00	0.00
60.00	0.00	0	580.00	0.00	0.00	0.00
62.00	0.00	0	580.00	0.00	0.00	0.00
64.00	0.00	0	580.00	0.00	0.00	0.00
66.00	0.00	0	580.00	0.00	0.00	0.00
68.00	0.00	0	580.00	0.00	0.00	0.00
70.00	0.00	0	580.00	0.00	0.00	0.00
72.00	0.00	0	580.00	0.00	0.00	0.00

Stage-Discharge for Pond B-1: Bioretention Inflitration Basin

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
580.00	0.00	0.00	0.00
580.02	0.23	0.23	0.00
580.04	0.23	0.23	0.00
580.06	0.23	0.23	0.00
580.08	0.23	0.23	0.00
580.10	0.23	0.23	0.00
580.12	0.24	0.24	0.00
580.14	0.24	0.24	0.00
580.16	0.24	0.24	0.00
580.18	0.24	0.24	0.00
580.20	0.24	0.24	0.00
580.22	0.24	0.24	0.00
580.24	0.24	0.24	0.00
580.26	0.25	0.25	0.00
580.28	0.25	0.25	0.00
580.30	0.25	0.25	0.00
580.32	0.25	0.25	0.00
580.34	0.25	0.25	0.00
580.36	0.25	0.25	0.00
580.38	0.26	0.26	0.00
580.40	0.26	0.26	0.00
580.42	0.26	0.26	0.00
580.44	0.26	0.26	0.00
580.46	0.26	0.26	0.00
580.48	0.26	0.26	0.00
580.50	0.26	0.26	0.00
580.52	0.27	0.27	0.00
580.54	0.27	0.27	0.00
580.56	0.27	0.27	0.00
580.58	0.27	0.27	0.00
580.60	0.27	0.27	0.00
580.62	0.27	0.27	0.00
580.64	0.28	0.28	0.00
580.66	0.28	0.28	0.00
580.68	0.28	0.28	0.00
580.70	0.28	0.28	0.00
580.72	0.28	0.28	0.00
580.74	0.28	0.28	0.00
580.76	0.28	0.28	0.00
580.78	0.29	0.29	0.00
580.80	0.29	0.29	0.00
580.82	0.30	0.29	0.01
580.84	0.32	0.29	0.03
580.86	0.35	0.29	0.06
580.88	0.38	0.29	0.09
580.90	0.42	0.30	0.13
580.92	0.46	0.30	0.17
580.94	0.51	0.30	0.21
580.96	0.56	0.30	0.26
580.98	0.61	0.30	0.31
581.00	0.66	0.30	0.36
581.02	0.72	0.30	0.41
581.04	0.78	0.31	0.47
581.06	0.84	0.31	0.53
581.08	0.88	0.31	0.57
581.10	0.93	0.31	0.61
581.12	0.96	0.31	0.65
581.14	1.00	0.31	0.69
581.16	1.04	0.32	0.72
581.18	1.07	0.32	0.75
581.20	1.10	0.32	0.78
581.22	1.13	0.32	0.81
581.24	1.16	0.32	0.84
581.26	1.19	0.32	0.87
581.28	1.22	0.33	0.89
581.30	1.24	0.33	0.92
581.32	1.29	0.33	0.96
581.34	1.35	0.33	1.02
581.36	1.42	0.33	1.08
581.38	1.49	0.33	1.16
581.40	1.57	0.34	1.24
581.42	1.66	0.34	1.32
581.44	1.75	0.34	1.41
581.46	1.85	0.34	1.51
581.48	1.95	0.34	1.61
581.50	2.06	0.34	1.71
581.52	2.17	0.34	1.82
581.54	2.28	0.35	1.93
581.56	2.39	0.35	2.04
581.58	2.48	0.35	2.13
581.60	2.57	0.35	2.22
581.62	2.65	0.35	2.30
581.64	2.72	0.35	2.37
581.66	2.80	0.36	2.44
581.68	2.87	0.36	2.51
581.70	2.93	0.36	2.57
581.72	3.00	0.36	2.64
581.74	3.06	0.36	2.70
581.76	3.12	0.36	2.76
581.78	3.18	0.37	2.82
581.80	3.24	0.37	2.87
581.82	3.33	0.37	2.96
581.84	3.44	0.37	3.07
581.86	3.57	0.37	3.20
581.88	3.72	0.37	3.34
581.90	3.87	0.38	3.49
581.92	4.03	0.38	3.65
581.94	4.20	0.38	3.83
581.96	4.38	0.38	4.00
581.98	4.57	0.38	4.19
582.00	**4.77**	**0.38**	**4.38**

Stage-Area-Storage for Pond B-1: Bioretention Inflitration Basin

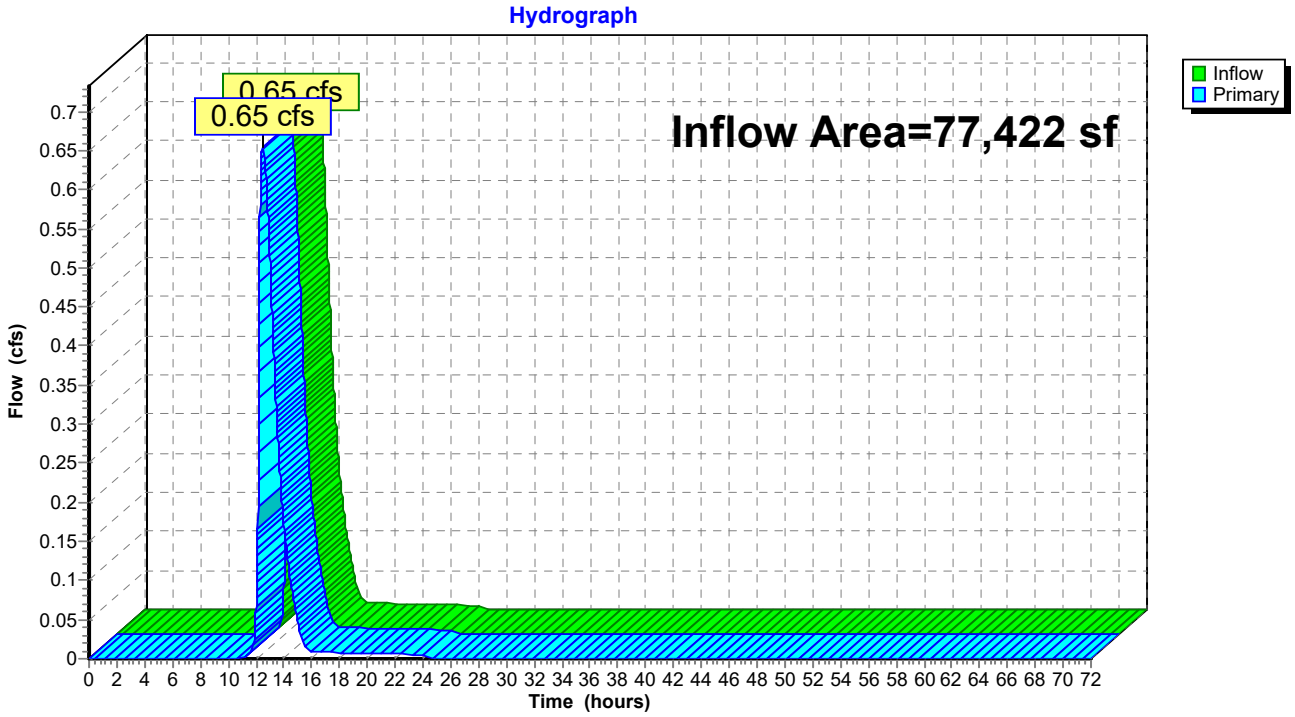
Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
580.00	4,909	0
580.02	4,924	98
580.04	4,939	197
580.06	4,953	296
580.08	4,968	395
580.10	4,983	495
580.12	4,998	594
580.14	5,013	695
580.16	5,028	795
580.18	5,043	896
580.20	5,058	997
580.22	5,073	1,098
580.24	5,088	1,200
580.26	5,103	1,301
580.28	5,118	1,404
580.30	5,133	1,506
580.32	5,148	1,609
580.34	5,164	1,712
580.36	5,179	1,816
580.38	5,194	1,919
580.40	5,209	2,023
580.42	5,224	2,128
580.44	5,240	2,232
580.46	5,255	2,337
580.48	5,270	2,442
580.50	5,286	2,548
580.52	5,301	2,654
580.54	5,316	2,760
580.56	5,332	2,867
580.58	5,347	2,973
580.60	5,363	3,080
580.62	5,378	3,188
580.64	5,393	3,296
580.66	5,409	3,404
580.68	5,425	3,512
580.70	5,440	3,621
580.72	5,456	3,730
580.74	5,471	3,839
580.76	5,487	3,948
580.78	5,502	4,058
580.80	5,518	4,168
580.82	5,534	4,279
580.84	5,550	4,390
580.86	5,565	4,501
580.88	5,581	4,612
580.90	5,597	4,724
580.92	5,613	4,836
580.94	5,628	4,949
580.96	5,644	5,061
580.98	5,660	5,175
581.00	5,676	5,288
581.02	5,691	5,402
581.04	5,706	5,515
581.06	5,721	5,630
581.08	5,736	5,744
581.10	5,751	5,859
581.12	5,766	5,974
581.14	5,781	6,090
581.16	5,796	6,206
581.18	5,811	6,322
581.20	5,826	6,438
581.22	5,841	6,555
581.24	5,856	6,672
581.26	5,871	6,789
581.28	5,886	6,907
581.30	5,902	7,024
581.32	5,917	7,143
581.34	5,932	7,261
581.36	5,947	7,380
581.38	5,962	7,499
581.40	5,978	7,618
581.42	5,993	7,738
581.44	6,008	7,858
581.46	6,024	7,978
581.48	6,039	8,099
581.50	6,054	8,220
581.52	6,070	8,341
581.54	6,085	8,463
581.56	6,101	8,585
581.58	6,116	8,707
581.60	6,132	8,829
581.62	6,147	8,952
581.64	6,163	9,075
581.66	6,178	9,199
581.68	6,194	9,322
581.70	6,209	9,446
581.72	6,225	9,571
581.74	6,240	9,695
581.76	6,256	9,820
581.78	6,272	9,946
581.80	6,287	10,071
581.82	6,303	10,197
581.84	6,319	10,323
581.86	6,334	10,450
581.88	6,350	10,577
581.90	6,366	10,704
581.92	6,382	10,831
581.94	6,397	10,959
581.96	6,413	11,087
581.98	6,429	11,216
582.00	**6,445**	**11,344**

Summary for Link POI-1: Outfall to Wetlands

Inflow Area = 77,422 sf, 61.12% Impervious, Inflow Depth = 0.56" for 10-Year event
Inflow = 0.65 cfs @ 12.53 hrs, Volume= 3,640 cf
Primary = 0.65 cfs @ 12.53 hrs, Volume= 3,640 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link POI-1: Outfall to Wetlands



Hydrograph for Link POI-1: Outfall to Wetlands

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	**0.00**	0.00
1.00	0.00	0.00	0.00
2.00	0.00	0.00	0.00
3.00	0.00	0.00	0.00
4.00	0.00	0.00	0.00
5.00	0.00	0.00	0.00
6.00	0.00	0.00	0.00
7.00	0.00	0.00	0.00
8.00	0.00	0.00	0.00
9.00	0.00	0.00	0.00
10.00	0.00	0.00	0.00
11.00	0.00	0.00	0.00
12.00	**0.06**	0.00	**0.06**
13.00	**0.51**	0.00	**0.51**
14.00	0.17	0.00	0.17
15.00	0.05	0.00	0.05
16.00	0.01	0.00	0.01
17.00	0.01	0.00	0.01
18.00	0.01	0.00	0.01
19.00	0.01	0.00	0.01
20.00	0.01	0.00	0.01
21.00	0.01	0.00	0.01
22.00	0.01	0.00	0.01
23.00	0.01	0.00	0.01
24.00	0.01	0.00	0.01
25.00	0.00	0.00	0.00
26.00	0.00	0.00	0.00
27.00	0.00	0.00	0.00
28.00	0.00	0.00	0.00
29.00	0.00	0.00	0.00
30.00	0.00	0.00	0.00
31.00	0.00	0.00	0.00
32.00	0.00	0.00	0.00
33.00	0.00	0.00	0.00
34.00	0.00	0.00	0.00
35.00	0.00	0.00	0.00
36.00	0.00	0.00	0.00
37.00	0.00	0.00	0.00
38.00	0.00	0.00	0.00
39.00	0.00	0.00	0.00
40.00	0.00	0.00	0.00
41.00	0.00	0.00	0.00
42.00	0.00	0.00	0.00
43.00	0.00	0.00	0.00
44.00	0.00	0.00	0.00
45.00	0.00	0.00	0.00
46.00	0.00	0.00	0.00
47.00	0.00	0.00	0.00
48.00	0.00	0.00	0.00
49.00	0.00	0.00	0.00
50.00	0.00	0.00	0.00
51.00	0.00	0.00	0.00
52.00	0.00	0.00	0.00
53.00	0.00	0.00	0.00
54.00	0.00	0.00	0.00
55.00	0.00	0.00	0.00
56.00	0.00	0.00	0.00
57.00	0.00	0.00	0.00
58.00	0.00	0.00	0.00
59.00	0.00	0.00	0.00
60.00	0.00	0.00	0.00
61.00	0.00	0.00	0.00
62.00	0.00	0.00	0.00
63.00	0.00	0.00	0.00
64.00	0.00	0.00	0.00
65.00	0.00	0.00	0.00
66.00	0.00	0.00	0.00
67.00	0.00	0.00	0.00
68.00	0.00	0.00	0.00
69.00	0.00	0.00	0.00
70.00	0.00	0.00	0.00
71.00	0.00	0.00	0.00
72.00	0.00	0.00	0.00

Summary for Subcatchment EX-1: Existing Drainage to Wetlands in Rear

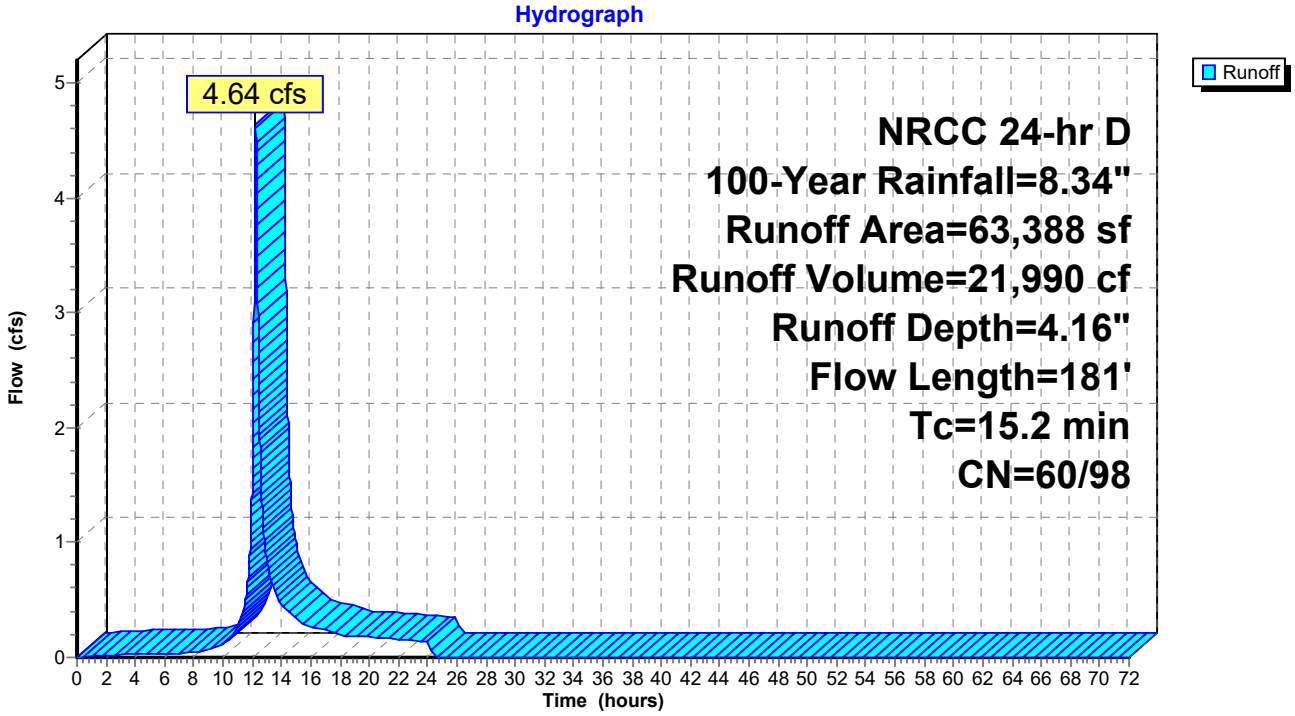
Runoff = 4.64 cfs @ 12.24 hrs, Volume= 21,990 cf, Depth= 4.16"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 100-Year Rainfall=8.34"

	Area (sf)	CN	Description
	11,309	55	Woods, Good, HSG B
	44,033	61	>75% Grass cover, Good, HSG B
*	8,046	98	Impervious Area
	63,388	65	Weighted Average
	55,342	60	87.31% Pervious Area
	8,046	98	12.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.9	100	0.0585	0.12		**Sheet Flow, 100 LF Sheet Flow (1-2)** Woods: Light underbrush n= 0.400 P2= 3.22"
1.3	81	0.0445	1.05		**Shallow Concentrated Flow, 191 LF SCF (2-3)** Woodland Kv= 5.0 fps
15.2	181	Total			

Subcatchment EX-1: Existing Drainage to Wetlands in Rear



Hydrograph for Subcatchment EX-1: Existing Drainage to Wetlands in Rear

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	0.00
2.00	0.25	0.00	0.11	0.02
4.00	0.54	0.00	0.35	0.03
6.00	0.86	0.00	0.65	0.03
8.00	1.27	0.00	1.06	0.04
10.00	1.87	0.04	1.65	0.13
12.00	4.00	0.76	3.76	**1.57**
14.00	6.47	2.24	6.23	**0.45**
16.00	7.07	2.65	6.83	0.27
18.00	7.48	2.95	7.24	0.20
20.00	7.80	3.19	7.56	0.17
22.00	8.09	3.40	7.85	0.16
24.00	**8.34**	**3.59**	**8.10**	0.14
26.00	8.34	3.59	8.10	0.00
28.00	8.34	3.59	8.10	0.00
30.00	8.34	3.59	8.10	0.00
32.00	8.34	3.59	8.10	0.00
34.00	8.34	3.59	8.10	0.00
36.00	8.34	3.59	8.10	0.00
38.00	8.34	3.59	8.10	0.00
40.00	8.34	3.59	8.10	0.00
42.00	8.34	3.59	8.10	0.00
44.00	8.34	3.59	8.10	0.00
46.00	8.34	3.59	8.10	0.00
48.00	8.34	3.59	8.10	0.00
50.00	8.34	3.59	8.10	0.00
52.00	8.34	3.59	8.10	0.00
54.00	8.34	3.59	8.10	0.00
56.00	8.34	3.59	8.10	0.00
58.00	8.34	3.59	8.10	0.00
60.00	8.34	3.59	8.10	0.00
62.00	8.34	3.59	8.10	0.00
64.00	8.34	3.59	8.10	0.00
66.00	8.34	3.59	8.10	0.00
68.00	8.34	3.59	8.10	0.00
70.00	8.34	3.59	8.10	0.00
72.00	8.34	3.59	8.10	0.00

Summary for Subcatchment EX-2: Existing Drainage to Charlton Road Right-of-Way

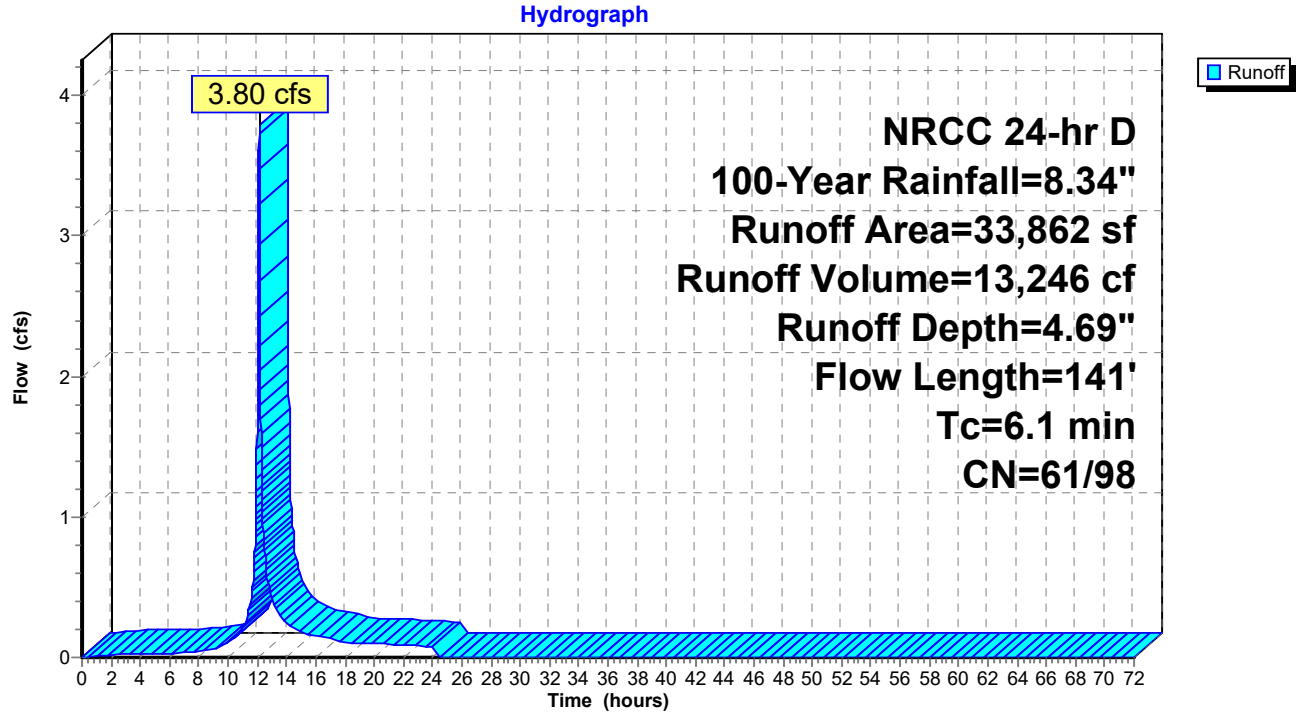
Runoff = 3.80 cfs @ 12.13 hrs, Volume= 13,246 cf, Depth= 4.69"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 100-Year Rainfall=8.34"

	Area (sf)	CN	Description
	532	55	Woods, Good, HSG B
	25,715	61	>75% Grass cover, Good, HSG B
*	7,615	98	Impervious Area
	33,862	69	Weighted Average
	26,247	61	77.51% Pervious Area
	7,615	98	22.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	73	0.0410	0.21		**Sheet Flow, 73 LF Sheet Flow (1-2)** Grass: Short n= 0.150 P2= 3.22"
0.4	68	0.0180	2.72		**Shallow Concentrated Flow, 68 LF SCF (2-3)** Paved Kv= 20.3 fps
6.1	141	Total			

Subcatchment EX-2: Existing Drainage to Charlton Road Right-of-Way



Hydrograph for Subcatchment EX-2: Existing Drainage to Charlton Road Right-of-Way

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	0.00
2.00	0.25	0.00	0.11	0.02
4.00	0.54	0.00	0.35	0.02
6.00	0.86	0.00	0.65	0.03
8.00	1.27	0.00	1.06	0.04
10.00	1.87	0.05	1.65	0.10
12.00	4.00	0.81	3.76	**1.83**
14.00	6.47	2.33	6.23	**0.24**
16.00	7.07	2.75	6.83	0.15
18.00	7.48	3.05	7.24	0.11
20.00	7.80	3.29	7.56	0.10
22.00	8.09	3.51	7.85	0.09
24.00	**8.34**	**3.71**	**8.10**	0.08
26.00	8.34	3.71	8.10	0.00
28.00	8.34	3.71	8.10	0.00
30.00	8.34	3.71	8.10	0.00
32.00	8.34	3.71	8.10	0.00
34.00	8.34	3.71	8.10	0.00
36.00	8.34	3.71	8.10	0.00
38.00	8.34	3.71	8.10	0.00
40.00	8.34	3.71	8.10	0.00
42.00	8.34	3.71	8.10	0.00
44.00	8.34	3.71	8.10	0.00
46.00	8.34	3.71	8.10	0.00
48.00	8.34	3.71	8.10	0.00
50.00	8.34	3.71	8.10	0.00
52.00	8.34	3.71	8.10	0.00
54.00	8.34	3.71	8.10	0.00
56.00	8.34	3.71	8.10	0.00
58.00	8.34	3.71	8.10	0.00
60.00	8.34	3.71	8.10	0.00
62.00	8.34	3.71	8.10	0.00
64.00	8.34	3.71	8.10	0.00
66.00	8.34	3.71	8.10	0.00
68.00	8.34	3.71	8.10	0.00
70.00	8.34	3.71	8.10	0.00
72.00	8.34	3.71	8.10	0.00

Summary for Subcatchment P-1A: Proposed Drainage to Bioinflitration Basin

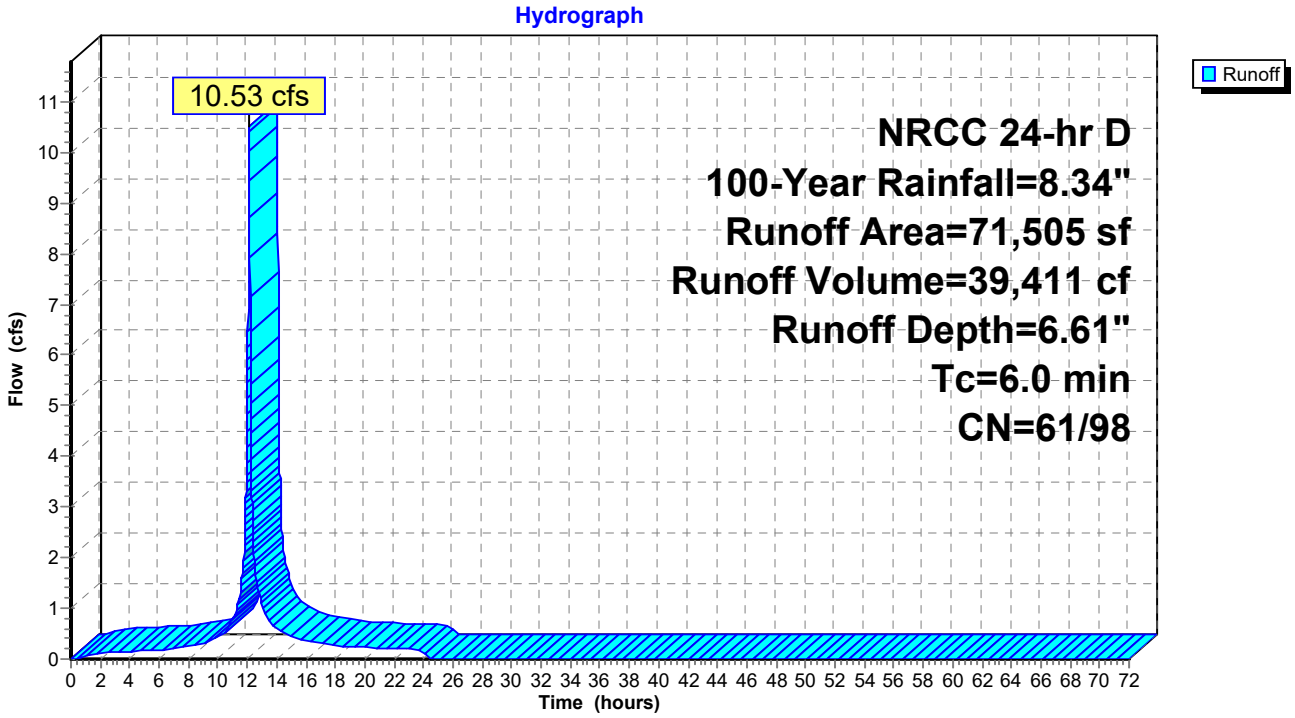
Runoff = 10.53 cfs @ 12.13 hrs, Volume= 39,411 cf, Depth= 6.61"
Routed to Pond B-1 : Bioretention Inflitration Basin

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 100-Year Rainfall=8.34"

Area (sf)	CN	Description
47,324	98	Paved parking, HSG B
24,181	61	>75% Grass cover, Good, HSG B
71,505	85	Weighted Average
24,181	61	33.82% Pervious Area
47,324	98	66.18% Impervious Area

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

Subcatchment P-1A: Proposed Drainage to Bioinflitration Basin



Hydrograph for Subcatchment P-1A: Proposed Drainage to Bioinflitration Basin

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	0.00
2.00	0.25	0.00	0.11	0.11
4.00	0.54	0.00	0.35	0.15
6.00	0.86	0.00	0.65	0.18
8.00	1.27	0.00	1.06	0.26
10.00	1.87	0.05	1.65	0.45
12.00	4.00	0.81	3.76	**5.45**
14.00	6.47	2.33	6.23	**0.60**
16.00	7.07	2.75	6.83	0.37
18.00	7.48	3.05	7.24	0.26
20.00	7.80	3.29	7.56	0.23
22.00	8.09	3.51	7.85	0.21
24.00	**8.34**	**3.71**	**8.10**	0.18
26.00	8.34	3.71	8.10	0.00
28.00	8.34	3.71	8.10	0.00
30.00	8.34	3.71	8.10	0.00
32.00	8.34	3.71	8.10	0.00
34.00	8.34	3.71	8.10	0.00
36.00	8.34	3.71	8.10	0.00
38.00	8.34	3.71	8.10	0.00
40.00	8.34	3.71	8.10	0.00
42.00	8.34	3.71	8.10	0.00
44.00	8.34	3.71	8.10	0.00
46.00	8.34	3.71	8.10	0.00
48.00	8.34	3.71	8.10	0.00
50.00	8.34	3.71	8.10	0.00
52.00	8.34	3.71	8.10	0.00
54.00	8.34	3.71	8.10	0.00
56.00	8.34	3.71	8.10	0.00
58.00	8.34	3.71	8.10	0.00
60.00	8.34	3.71	8.10	0.00
62.00	8.34	3.71	8.10	0.00
64.00	8.34	3.71	8.10	0.00
66.00	8.34	3.71	8.10	0.00
68.00	8.34	3.71	8.10	0.00
70.00	8.34	3.71	8.10	0.00
72.00	8.34	3.71	8.10	0.00

Summary for Subcatchment P-1B: Undetained Flow to Wetlands

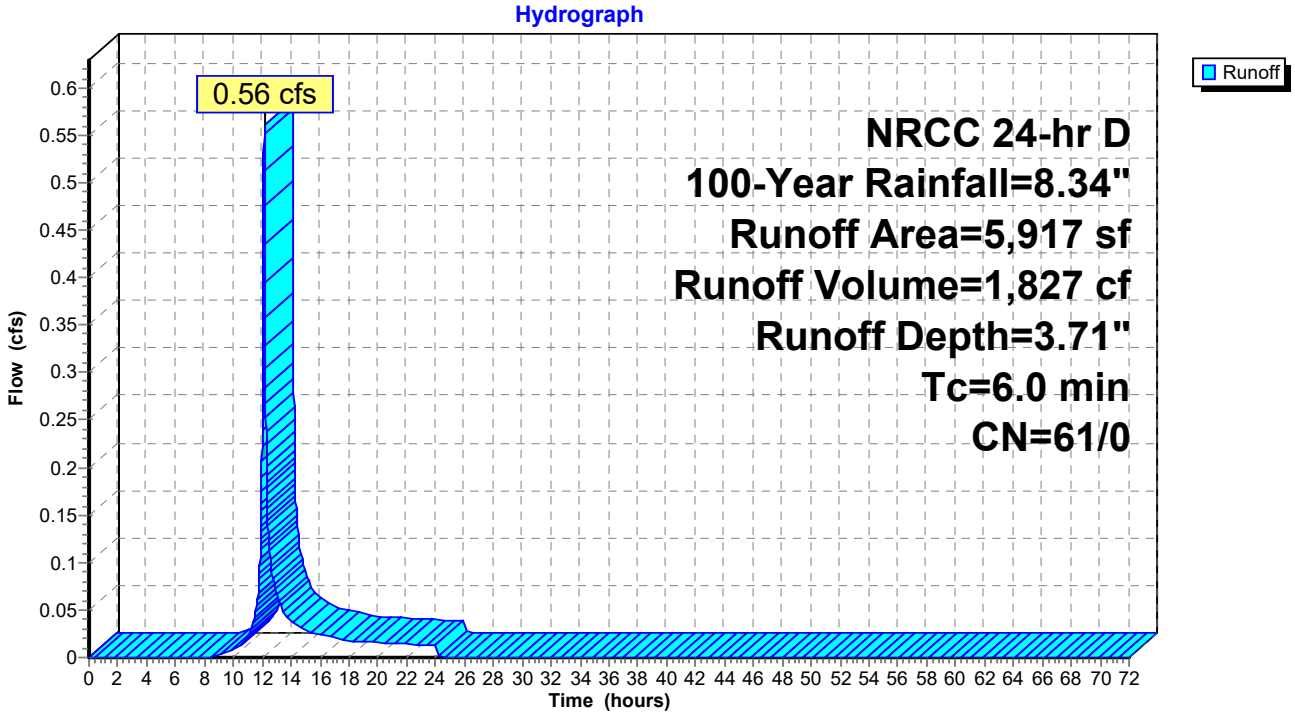
Runoff = 0.56 cfs @ 12.13 hrs, Volume= 1,827 cf, Depth= 3.71"
Routed to Link POI-1 : Outfall to Wetlands

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 100-Year Rainfall=8.34"

Area (sf)	CN	Description
5,917	61	>75% Grass cover, Good, HSG B
5,917	61	100.00% Pervious Area

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

Subcatchment P-1B: Undetained Flow to Wetlands



Hydrograph for Subcatchment P-1B: Undetained Flow to Wetlands

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	**0.00**	0.00
2.00	0.25	0.00	0.00	0.00
4.00	0.54	0.00	0.00	0.00
6.00	0.86	0.00	0.00	0.00
8.00	1.27	0.00	0.00	0.00
10.00	1.87	0.05	0.00	0.01
12.00	4.00	0.81	0.00	**0.26**
14.00	6.47	2.33	0.00	**0.04**
16.00	7.07	2.75	0.00	0.02
18.00	7.48	3.05	0.00	0.02
20.00	7.80	3.29	0.00	0.02
22.00	8.09	3.51	0.00	0.01
24.00	**8.34**	**3.71**	0.00	0.01
26.00	8.34	3.71	0.00	0.00
28.00	8.34	3.71	0.00	0.00
30.00	8.34	3.71	0.00	0.00
32.00	8.34	3.71	0.00	0.00
34.00	8.34	3.71	0.00	0.00
36.00	8.34	3.71	0.00	0.00
38.00	8.34	3.71	0.00	0.00
40.00	8.34	3.71	0.00	0.00
42.00	8.34	3.71	0.00	0.00
44.00	8.34	3.71	0.00	0.00
46.00	8.34	3.71	0.00	0.00
48.00	8.34	3.71	0.00	0.00
50.00	8.34	3.71	0.00	0.00
52.00	8.34	3.71	0.00	0.00
54.00	8.34	3.71	0.00	0.00
56.00	8.34	3.71	0.00	0.00
58.00	8.34	3.71	0.00	0.00
60.00	8.34	3.71	0.00	0.00
62.00	8.34	3.71	0.00	0.00
64.00	8.34	3.71	0.00	0.00
66.00	8.34	3.71	0.00	0.00
68.00	8.34	3.71	0.00	0.00
70.00	8.34	3.71	0.00	0.00
72.00	8.34	3.71	0.00	0.00

Summary for Subcatchment P-2: Proposed Drainage to Charleton Road

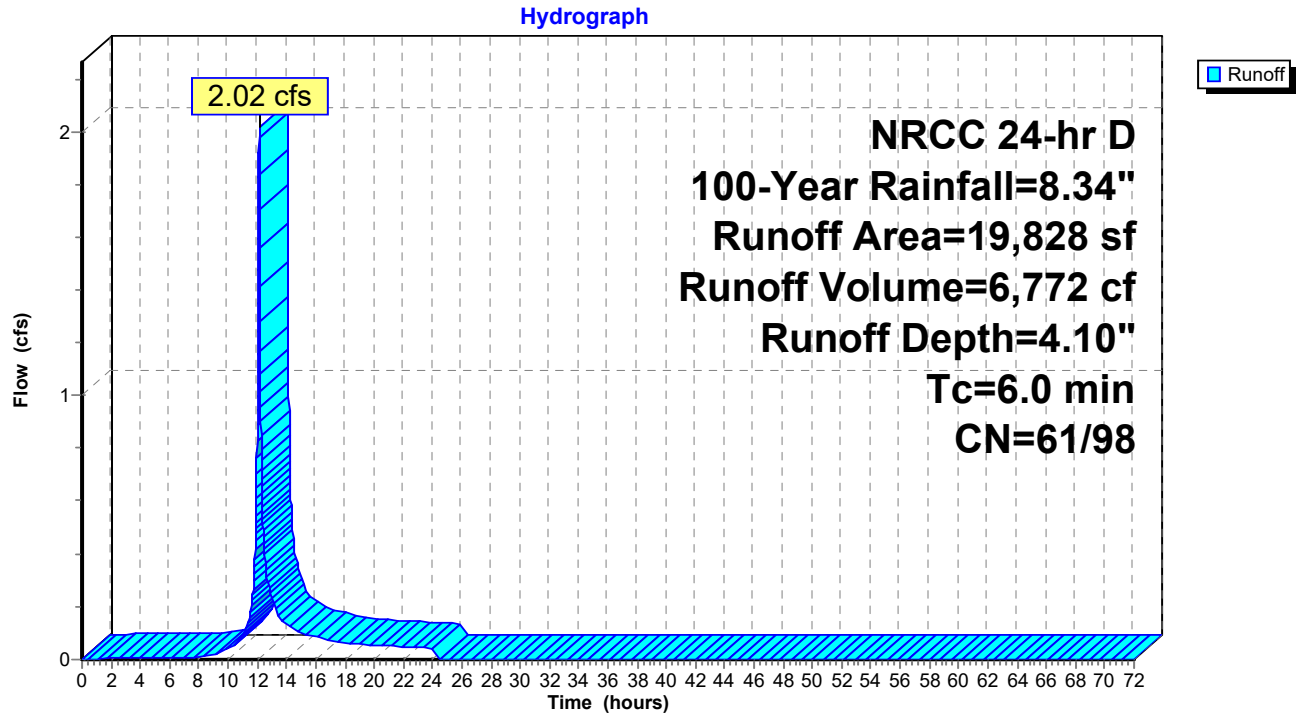
Runoff = 2.02 cfs @ 12.13 hrs, Volume= 6,772 cf, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 100-Year Rainfall=8.34"

Area (sf)	CN	Description
18,056	61	>75% Grass cover, Good, HSG B
1,772	98	Paved parking, HSG B
19,828	64	Weighted Average
18,056	61	91.06% Pervious Area
1,772	98	8.94% Impervious Area

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

Subcatchment P-2: Proposed Drainage to Charleton Road



Hydrograph for Subcatchment P-2: Proposed Drainage to Charleton Road

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	0.00
2.00	0.25	0.00	0.11	0.00
4.00	0.54	0.00	0.35	0.01
6.00	0.86	0.00	0.65	0.01
8.00	1.27	0.00	1.06	0.01
10.00	1.87	0.05	1.65	0.04
12.00	4.00	0.81	3.76	**0.95**
14.00	6.47	2.33	6.23	**0.13**
16.00	7.07	2.75	6.83	0.08
18.00	7.48	3.05	7.24	0.06
20.00	7.80	3.29	7.56	0.05
22.00	8.09	3.51	7.85	0.05
24.00	**8.34**	**3.71**	**8.10**	0.04
26.00	8.34	3.71	8.10	0.00
28.00	8.34	3.71	8.10	0.00
30.00	8.34	3.71	8.10	0.00
32.00	8.34	3.71	8.10	0.00
34.00	8.34	3.71	8.10	0.00
36.00	8.34	3.71	8.10	0.00
38.00	8.34	3.71	8.10	0.00
40.00	8.34	3.71	8.10	0.00
42.00	8.34	3.71	8.10	0.00
44.00	8.34	3.71	8.10	0.00
46.00	8.34	3.71	8.10	0.00
48.00	8.34	3.71	8.10	0.00
50.00	8.34	3.71	8.10	0.00
52.00	8.34	3.71	8.10	0.00
54.00	8.34	3.71	8.10	0.00
56.00	8.34	3.71	8.10	0.00
58.00	8.34	3.71	8.10	0.00
60.00	8.34	3.71	8.10	0.00
62.00	8.34	3.71	8.10	0.00
64.00	8.34	3.71	8.10	0.00
66.00	8.34	3.71	8.10	0.00
68.00	8.34	3.71	8.10	0.00
70.00	8.34	3.71	8.10	0.00
72.00	8.34	3.71	8.10	0.00

Summary for Pond B-1: Bioretention Inflitration Basin

Inflow Area = 71,505 sf, 66.18% Impervious, Inflow Depth = 6.61" for 100-Year event
Inflow = 10.53 cfs @ 12.13 hrs, Volume= 39,411 cf
Outflow = 4.25 cfs @ 12.26 hrs, Volume= 39,411 cf, Atten= 60%, Lag= 7.7 min
Discarded = 0.38 cfs @ 12.26 hrs, Volume= 23,417 cf
Primary = 3.87 cfs @ 12.26 hrs, Volume= 15,994 cf
Routed to Link POI-1 : Outfall to Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 581.94' @ 12.26 hrs Surf.Area= 6,401 sf Storage= 10,990 cf

Plug-Flow detention time= 105.2 min calculated for 39,411 cf (100% of inflow)
Center-of-Mass det. time= 105.2 min (871.4 - 766.2)

Volume	Invert	Avail.Storage	Storage Description
#1	580.00'	11,344 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

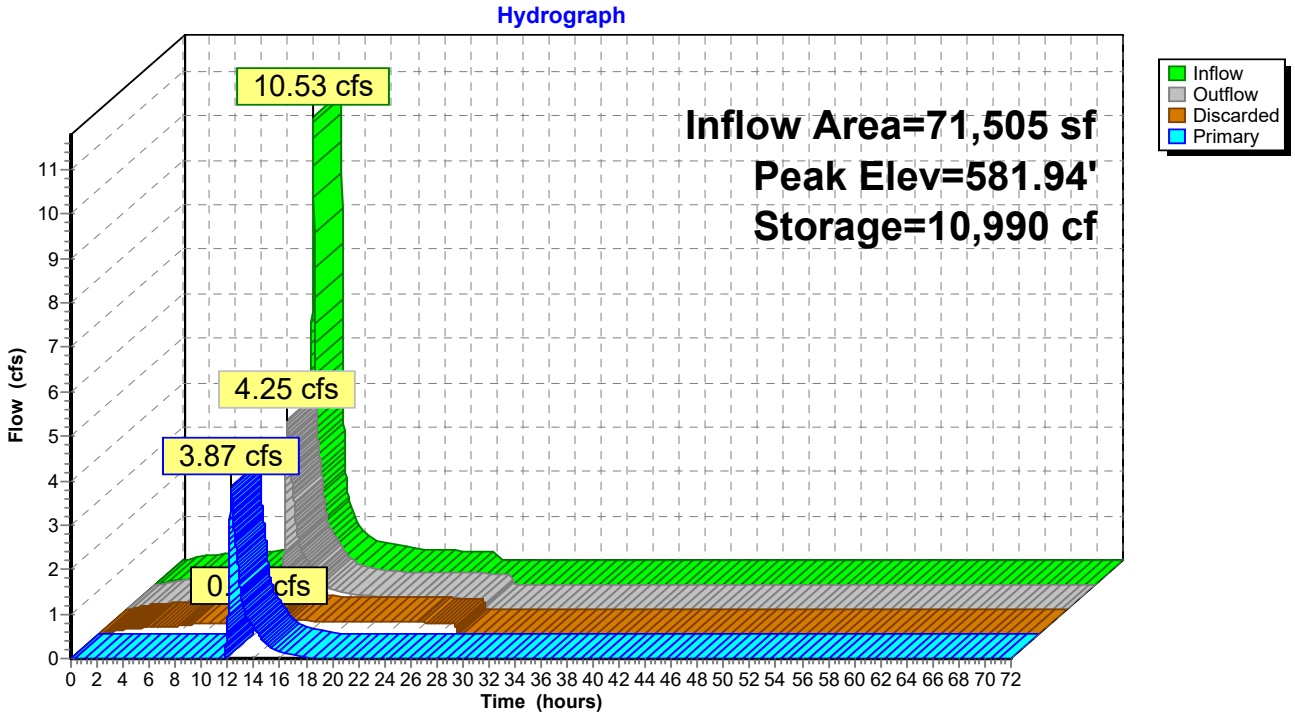
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
580.00	4,909	508.0	0	0	4,909
581.00	5,676	524.1	5,288	5,288	6,328
582.00	6,445	537.4	6,056	11,344	7,571

Device	Routing	Invert	Outlet Devices
#1	Primary	580.00'	**12.0" Round Culvert** L= 4.0' Ke= 0.050 Inlet / Outlet Invert= 580.00' / 579.00' S= 0.2500 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	580.80'	**15.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	581.30'	**24.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Discarded	580.00'	**2.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 574.00' Phase-In= 0.01'
#5	Device 1	581.80'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.38 cfs @ 12.26 hrs HW=581.94' (Free Discharge)
└**4=Exfiltration** (Controls 0.38 cfs)

Primary OutFlow Max=3.87 cfs @ 12.26 hrs HW=581.94' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 3.87 cfs of 6.49 cfs potential flow)
├**2=Orifice/Grate** (Orifice Controls 1.52 cfs @ 4.86 fps)
├**3=Orifice/Grate** (Orifice Controls 1.73 cfs @ 3.46 fps)
└**5=Broad-Crested Rectangular Weir** (Weir Controls 0.62 cfs @ 1.07 fps)

Pond B-1: Bioretention Inflitration Basin



Hydrograph for Pond B-1: Bioretention Inflitration Basin

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
0.00	0.00	0	580.00	0.00	0.00	0.00
2.00	0.11	23	580.00	0.11	0.11	0.00
4.00	0.15	32	580.01	0.15	0.15	0.00
6.00	0.18	38	580.01	0.18	0.18	0.00
8.00	0.26	83	580.02	0.23	0.23	0.00
10.00	0.45	774	580.16	0.24	0.24	0.00
12.00	**5.45**	**6,550**	**581.22**	**1.13**	**0.32**	**0.81**
14.00	**0.60**	**6,120**	**581.15**	**1.01**	**0.31**	**0.70**
16.00	0.37	4,764	580.91	0.44	0.30	0.14
18.00	0.26	4,368	580.84	0.32	0.29	0.03
20.00	0.23	4,016	580.77	0.29	0.29	0.00
22.00	0.21	3,559	580.69	0.28	0.28	0.00
24.00	0.18	2,968	580.58	0.27	0.27	0.00
26.00	0.00	1,175	580.24	0.24	0.24	0.00
28.00	0.00	0	580.00	0.00	0.00	0.00
30.00	0.00	0	580.00	0.00	0.00	0.00
32.00	0.00	0	580.00	0.00	0.00	0.00
34.00	0.00	0	580.00	0.00	0.00	0.00
36.00	0.00	0	580.00	0.00	0.00	0.00
38.00	0.00	0	580.00	0.00	0.00	0.00
40.00	0.00	0	580.00	0.00	0.00	0.00
42.00	0.00	0	580.00	0.00	0.00	0.00
44.00	0.00	0	580.00	0.00	0.00	0.00
46.00	0.00	0	580.00	0.00	0.00	0.00
48.00	0.00	0	580.00	0.00	0.00	0.00
50.00	0.00	0	580.00	0.00	0.00	0.00
52.00	0.00	0	580.00	0.00	0.00	0.00
54.00	0.00	0	580.00	0.00	0.00	0.00
56.00	0.00	0	580.00	0.00	0.00	0.00
58.00	0.00	0	580.00	0.00	0.00	0.00
60.00	0.00	0	580.00	0.00	0.00	0.00
62.00	0.00	0	580.00	0.00	0.00	0.00
64.00	0.00	0	580.00	0.00	0.00	0.00
66.00	0.00	0	580.00	0.00	0.00	0.00
68.00	0.00	0	580.00	0.00	0.00	0.00
70.00	0.00	0	580.00	0.00	0.00	0.00
72.00	0.00	0	580.00	0.00	0.00	0.00

Stage-Discharge for Pond B-1: Bioretention Inflitration Basin

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
580.00	0.00	0.00	0.00
580.02	0.23	0.23	0.00
580.04	0.23	0.23	0.00
580.06	0.23	0.23	0.00
580.08	0.23	0.23	0.00
580.10	0.23	0.23	0.00
580.12	0.24	0.24	0.00
580.14	0.24	0.24	0.00
580.16	0.24	0.24	0.00
580.18	0.24	0.24	0.00
580.20	0.24	0.24	0.00
580.22	0.24	0.24	0.00
580.24	0.24	0.24	0.00
580.26	0.25	0.25	0.00
580.28	0.25	0.25	0.00
580.30	0.25	0.25	0.00
580.32	0.25	0.25	0.00
580.34	0.25	0.25	0.00
580.36	0.25	0.25	0.00
580.38	0.26	0.26	0.00
580.40	0.26	0.26	0.00
580.42	0.26	0.26	0.00
580.44	0.26	0.26	0.00
580.46	0.26	0.26	0.00
580.48	0.26	0.26	0.00
580.50	0.26	0.26	0.00
580.52	0.27	0.27	0.00
580.54	0.27	0.27	0.00
580.56	0.27	0.27	0.00
580.58	0.27	0.27	0.00
580.60	0.27	0.27	0.00
580.62	0.27	0.27	0.00
580.64	0.28	0.28	0.00
580.66	0.28	0.28	0.00
580.68	0.28	0.28	0.00
580.70	0.28	0.28	0.00
580.72	0.28	0.28	0.00
580.74	0.28	0.28	0.00
580.76	0.28	0.28	0.00
580.78	0.29	0.29	0.00
580.80	0.29	0.29	0.00
580.82	0.30	0.29	0.01
580.84	0.32	0.29	0.03
580.86	0.35	0.29	0.06
580.88	0.38	0.29	0.09
580.90	0.42	0.30	0.13
580.92	0.46	0.30	0.17
580.94	0.51	0.30	0.21
580.96	0.56	0.30	0.26
580.98	0.61	0.30	0.31
581.00	0.66	0.30	0.36
581.02	0.72	0.30	0.41
581.04	0.78	0.31	0.47
581.06	0.84	0.31	0.53
581.08	0.88	0.31	0.57
581.10	0.93	0.31	0.61
581.12	0.96	0.31	0.65
581.14	1.00	0.31	0.69
581.16	1.04	0.32	0.72
581.18	1.07	0.32	0.75
581.20	1.10	0.32	0.78
581.22	1.13	0.32	0.81
581.24	1.16	0.32	0.84
581.26	1.19	0.32	0.87
581.28	1.22	0.33	0.89
581.30	1.24	0.33	0.92
581.32	1.29	0.33	0.96
581.34	1.35	0.33	1.02
581.36	1.42	0.33	1.08
581.38	1.49	0.33	1.16
581.40	1.57	0.34	1.24
581.42	1.66	0.34	1.32
581.44	1.75	0.34	1.41
581.46	1.85	0.34	1.51
581.48	1.95	0.34	1.61
581.50	2.06	0.34	1.71
581.52	2.17	0.34	1.82
581.54	2.28	0.35	1.93
581.56	2.39	0.35	2.04
581.58	2.48	0.35	2.13
581.60	2.57	0.35	2.22
581.62	2.65	0.35	2.30
581.64	2.72	0.35	2.37
581.66	2.80	0.36	2.44
581.68	2.87	0.36	2.51
581.70	2.93	0.36	2.57
581.72	3.00	0.36	2.64
581.74	3.06	0.36	2.70
581.76	3.12	0.36	2.76
581.78	3.18	0.37	2.82
581.80	3.24	0.37	2.87
581.82	3.33	0.37	2.96
581.84	3.44	0.37	3.07
581.86	3.57	0.37	3.20
581.88	3.72	0.37	3.34
581.90	3.87	0.38	3.49
581.92	4.03	0.38	3.65
581.94	4.20	0.38	3.83
581.96	4.38	0.38	4.00
581.98	4.57	0.38	4.19
582.00	**4.77**	**0.38**	**4.38**

Stage-Area-Storage for Pond B-1: Bioretention Inflitration Basin

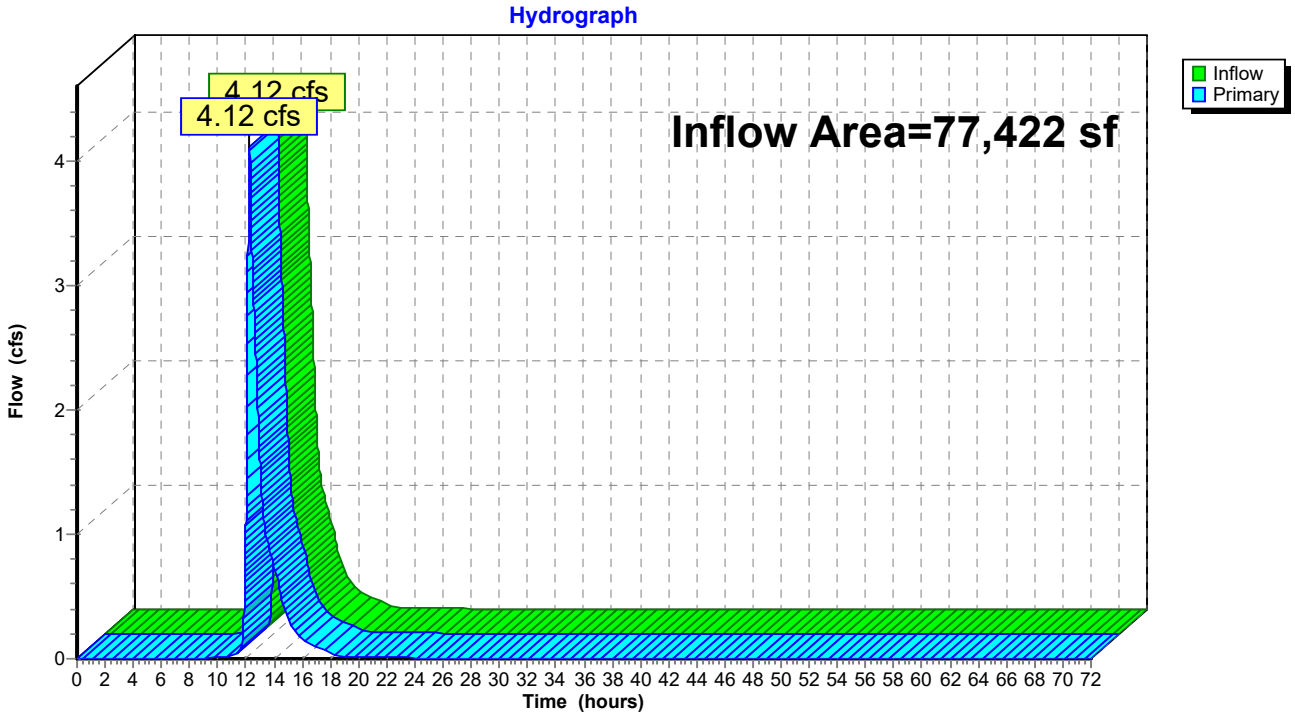
Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
580.00	4,909	0
580.02	4,924	98
580.04	4,939	197
580.06	4,953	296
580.08	4,968	395
580.10	4,983	495
580.12	4,998	594
580.14	5,013	695
580.16	5,028	795
580.18	5,043	896
580.20	5,058	997
580.22	5,073	1,098
580.24	5,088	1,200
580.26	5,103	1,301
580.28	5,118	1,404
580.30	5,133	1,506
580.32	5,148	1,609
580.34	5,164	1,712
580.36	5,179	1,816
580.38	5,194	1,919
580.40	5,209	2,023
580.42	5,224	2,128
580.44	5,240	2,232
580.46	5,255	2,337
580.48	5,270	2,442
580.50	5,286	2,548
580.52	5,301	2,654
580.54	5,316	2,760
580.56	5,332	2,867
580.58	5,347	2,973
580.60	5,363	3,080
580.62	5,378	3,188
580.64	5,393	3,296
580.66	5,409	3,404
580.68	5,425	3,512
580.70	5,440	3,621
580.72	5,456	3,730
580.74	5,471	3,839
580.76	5,487	3,948
580.78	5,502	4,058
580.80	5,518	4,168
580.82	5,534	4,279
580.84	5,550	4,390
580.86	5,565	4,501
580.88	5,581	4,612
580.90	5,597	4,724
580.92	5,613	4,836
580.94	5,628	4,949
580.96	5,644	5,061
580.98	5,660	5,175
581.00	5,676	5,288
581.02	5,691	5,402
581.04	5,706	5,515
581.06	5,721	5,630
581.08	5,736	5,744
581.10	5,751	5,859
581.12	5,766	5,974
581.14	5,781	6,090
581.16	5,796	6,206
581.18	5,811	6,322
581.20	5,826	6,438
581.22	5,841	6,555
581.24	5,856	6,672
581.26	5,871	6,789
581.28	5,886	6,907
581.30	5,902	7,024
581.32	5,917	7,143
581.34	5,932	7,261
581.36	5,947	7,380
581.38	5,962	7,499
581.40	5,978	7,618
581.42	5,993	7,738
581.44	6,008	7,858
581.46	6,024	7,978
581.48	6,039	8,099
581.50	6,054	8,220
581.52	6,070	8,341
581.54	6,085	8,463
581.56	6,101	8,585
581.58	6,116	8,707
581.60	6,132	8,829
581.62	6,147	8,952
581.64	6,163	9,075
581.66	6,178	9,199
581.68	6,194	9,322
581.70	6,209	9,446
581.72	6,225	9,571
581.74	6,240	9,695
581.76	6,256	9,820
581.78	6,272	9,946
581.80	6,287	10,071
581.82	6,303	10,197
581.84	6,319	10,323
581.86	6,334	10,450
581.88	6,350	10,577
581.90	6,366	10,704
581.92	6,382	10,831
581.94	6,397	10,959
581.96	6,413	11,087
581.98	6,429	11,216
582.00	**6,445**	**11,344**

Summary for Link POI-1: Outfall to Wetlands

Inflow Area = 77,422 sf, 61.12% Impervious, Inflow Depth = 2.76" for 100-Year event
Inflow = 4.12 cfs @ 12.25 hrs, Volume= 17,821 cf
Primary = 4.12 cfs @ 12.25 hrs, Volume= 17,821 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link POI-1: Outfall to Wetlands



Hydrograph for Link POI-1: Outfall to Wetlands

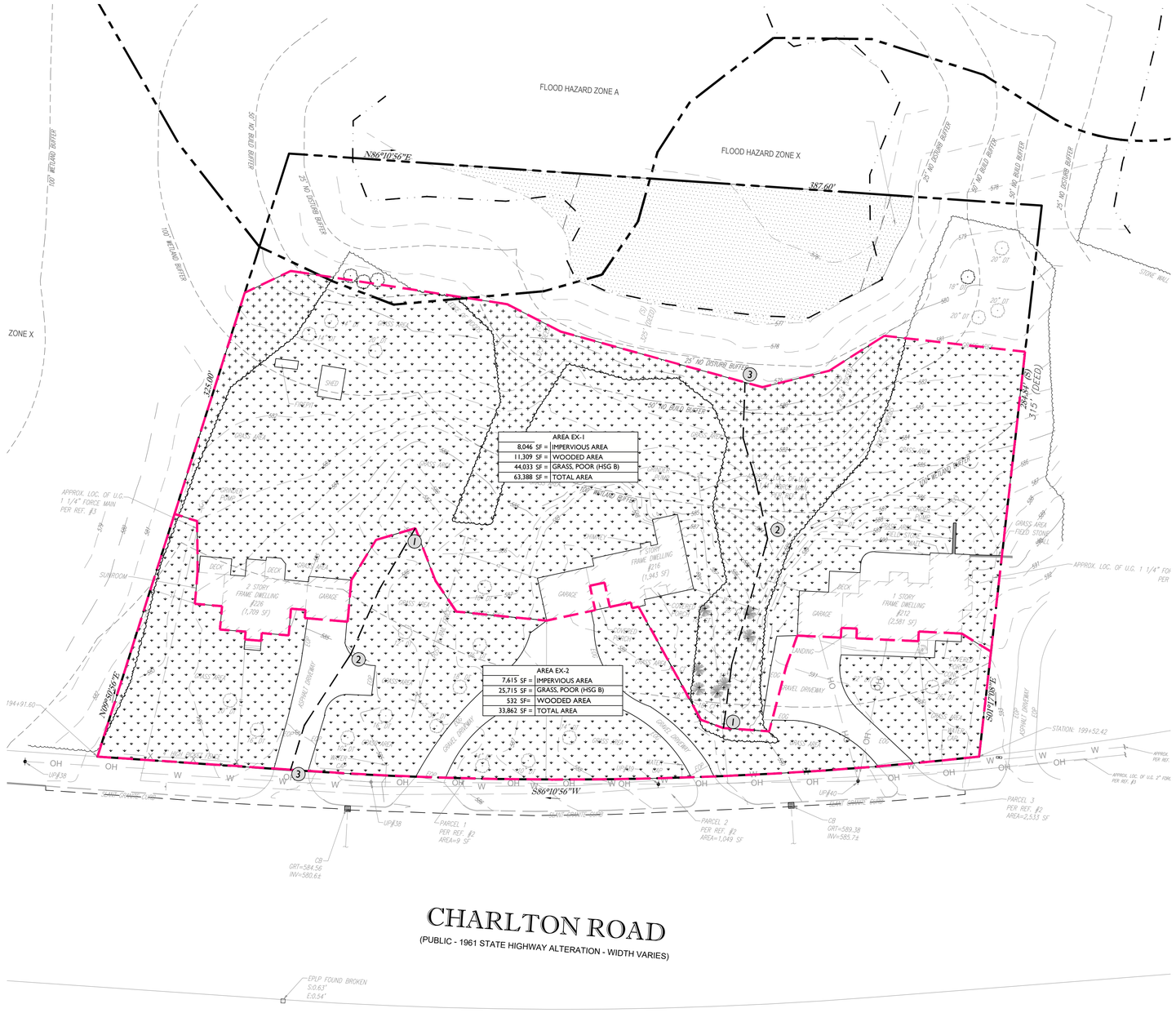
Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	**0.00**	0.00
1.00	0.00	0.00	0.00
2.00	0.00	0.00	0.00
3.00	0.00	0.00	0.00
4.00	0.00	0.00	0.00
5.00	0.00	0.00	0.00
6.00	0.00	0.00	0.00
7.00	0.00	0.00	0.00
8.00	0.00	0.00	0.00
9.00	0.00	0.00	0.00
10.00	0.01	0.00	0.01
11.00	0.02	0.00	0.02
12.00	**1.07**	0.00	**1.07**
13.00	**1.56**	0.00	**1.56**
14.00	0.73	0.00	0.73
15.00	0.33	0.00	0.33
16.00	0.17	0.00	0.17
17.00	0.10	0.00	0.10
18.00	0.05	0.00	0.05
19.00	0.02	0.00	0.02
20.00	0.02	0.00	0.02
21.00	0.01	0.00	0.01
22.00	0.01	0.00	0.01
23.00	0.01	0.00	0.01
24.00	0.01	0.00	0.01
25.00	0.00	0.00	0.00
26.00	0.00	0.00	0.00
27.00	0.00	0.00	0.00
28.00	0.00	0.00	0.00
29.00	0.00	0.00	0.00
30.00	0.00	0.00	0.00
31.00	0.00	0.00	0.00
32.00	0.00	0.00	0.00
33.00	0.00	0.00	0.00
34.00	0.00	0.00	0.00
35.00	0.00	0.00	0.00
36.00	0.00	0.00	0.00
37.00	0.00	0.00	0.00
38.00	0.00	0.00	0.00
39.00	0.00	0.00	0.00
40.00	0.00	0.00	0.00
41.00	0.00	0.00	0.00
42.00	0.00	0.00	0.00
43.00	0.00	0.00	0.00
44.00	0.00	0.00	0.00
45.00	0.00	0.00	0.00
46.00	0.00	0.00	0.00
47.00	0.00	0.00	0.00
48.00	0.00	0.00	0.00
49.00	0.00	0.00	0.00
50.00	0.00	0.00	0.00
51.00	0.00	0.00	0.00
52.00	0.00	0.00	0.00
53.00	0.00	0.00	0.00
54.00	0.00	0.00	0.00
55.00	0.00	0.00	0.00
56.00	0.00	0.00	0.00
57.00	0.00	0.00	0.00
58.00	0.00	0.00	0.00
59.00	0.00	0.00	0.00
60.00	0.00	0.00	0.00
61.00	0.00	0.00	0.00
62.00	0.00	0.00	0.00
63.00	0.00	0.00	0.00
64.00	0.00	0.00	0.00
65.00	0.00	0.00	0.00
66.00	0.00	0.00	0.00
67.00	0.00	0.00	0.00
68.00	0.00	0.00	0.00
69.00	0.00	0.00	0.00
70.00	0.00	0.00	0.00
71.00	0.00	0.00	0.00
72.00	0.00	0.00	0.00

APPENDIX D
DRAINAGE AREA MAPS

INVENTORY

SHEET 1 OF 2: EXISTING DRAINAGE AREA MAP

SHEET 2 OF 2: PROPOSED DRAINAGE AREA MAP



SYMBOL / DESCRIPTION

SYMBOL	DESCRIPTION
	PROPERTY LINE
	EXISTING DRAINAGE AREA
	EXISTING PERVIOUS AREA
	EXISTING WOODED AREA
1 — — — — — 2	EXISTING TIME OF CONCENTRATION PATH

30' 0' 30' 60'

GRAPHIC SCALE IN FEET

1" = 30'

ISSUE	DATE	BY	DESCRIPTION
5	05/16/2023	KO	FOR MUNICIPAL SUBMISSION
4	04/06/2023	JR	REVISED PER NEW BUILDING ELEVATIONS
3	01/31/2023	JR	FOR CONSERVATION COMMISSION SUBMISSION
2	01/06/2023	JR	FOR DOT SUBMISSION
1	11/02/2022	JR	FOR DOT SUBMISSION

NOT APPROVED FOR CONSTRUCTION

STONEFIELD engineering & design

Rutherford, NJ · New York, NY · Boston, MA
Princeton, NJ · Tampa, FL · Detroit, MI
www.stonefieldeng.com

120 Washington Street, Suite 210, Salem, MA 01970
Phone 617.203.2076

SITE PLANS

ALRIG USA DEVELOPMENTS

PROPOSED MULTI-TENANT DEVELOPMENT

MAP: 208 LOTS: 214, 216 & 212
212, 216 & 224 CHARLTON ROAD
TOWN OF STURBRIDGE
WORCESTER COUNTY, MASSACHUSETTS

JAKE MODESTOW, P.E.
MASSACHUSETTS LICENSE No. 55253
LICENSED PROFESSIONAL ENGINEER

STONEFIELD engineering & design

SCALE: 1" = 30' | PROJECT ID: BOS-210035

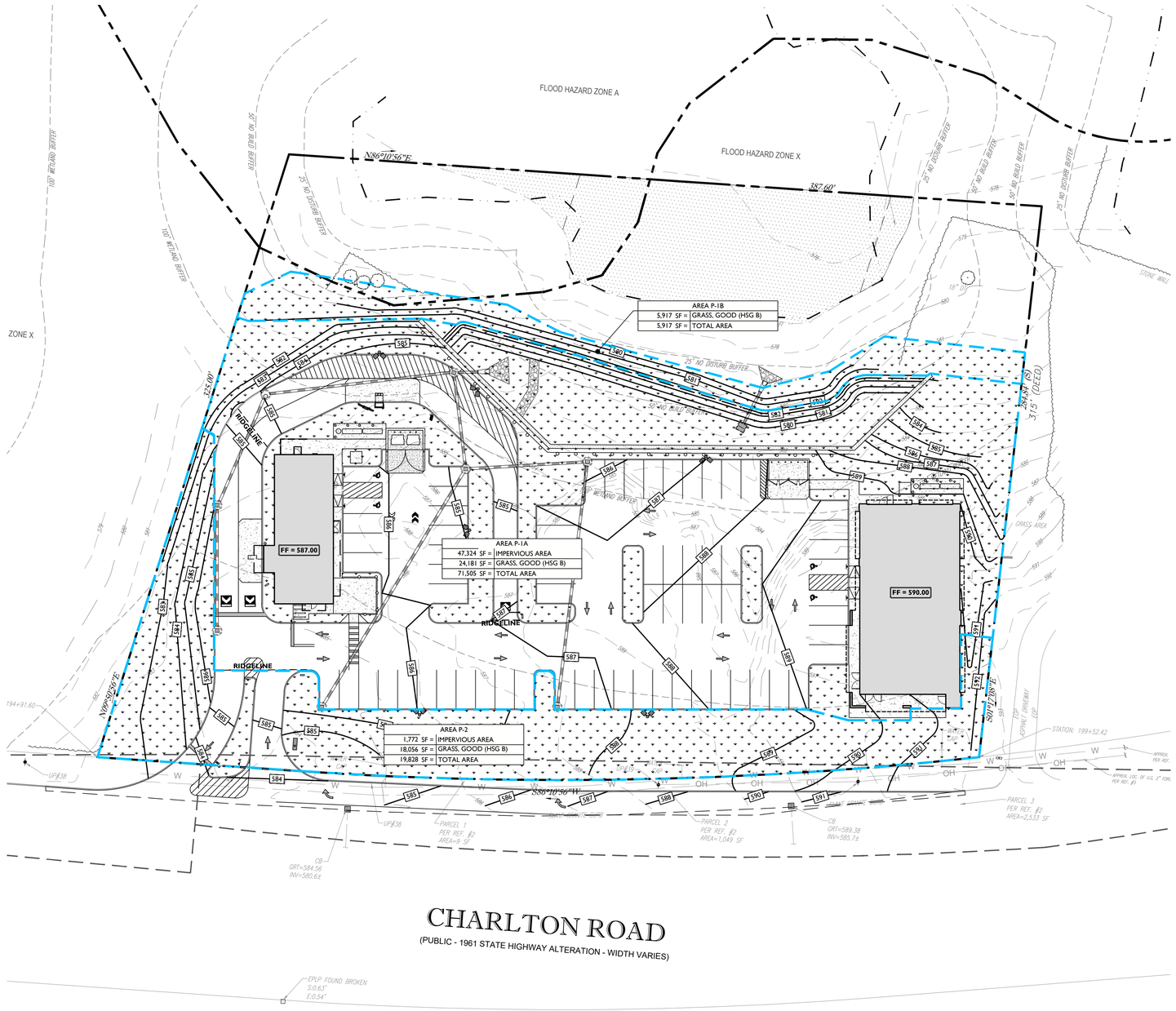
TITLE:

EXISTING DRAINAGE AREA MAP

DRAWING:

1 OF 2

Z:\BOS\PROJECTS\2021\BOS-210035 ALRIG - 212, 216 & 224 CHARLTON ROAD, STURBRIDGE, MA\CAD\EXHIBITS\2023-05-16_DRAINAGE AREA MAP.DWG



SYMBOL / DESCRIPTION

- PROPERTY LINE
- PROPOSED DRAINAGE AREA
- PROPOSED PERVIOUS AREA

GRAPHIC SCALE IN FEET
1" = 30'

ISSUE	DATE	BY	DESCRIPTION
5	05/16/2023	KO	FOR MUNICIPAL SUBMISSION
4	04/06/2023	JR	REVISED PER NEW BUILDING ELEVATIONS
3	01/31/2023	JR	FOR CONSERVATION COMMISSION SUBMISSION
2	01/06/2023	JR	FOR DOT SUBMISSION
1	11/02/2022	JR	FOR DOT SUBMISSION

NOT APPROVED FOR CONSTRUCTION

STONEFIELD engineering & design
Rutherford, NJ · New York, NY · Boston, MA
Princeton, NJ · Tampa, FL · Detroit, MI
www.stonefieldeng.com
120 Washington Street, Suite 210, Salem, MA 01970
Phone 617.203.2076

SITE PLANS

ALRIG USA DEVELOPMENTS

PROPOSED MULTI-TENANT DEVELOPMENT

MAP: 208 LOTS: 214, 216 & 212
212, 214 & 226 CHARLTON ROAD
TOWN OF STURBRIDGE
WORCESTER COUNTY, MASSACHUSETTS

ALRIG USA

JAKE MODESTOW, P.E.
MASSACHUSETTS LICENSE No. 55253
LICENSED PROFESSIONAL ENGINEER

STONEFIELD engineering & design

SCALE: 1" = 30' | PROJECT ID: BOS-210035

TITLE:

PROPOSED DRAINAGE AREA MAP

DRAWING:

2 OF 2

Z:\BOSTON\BOS\2021\BOS-210035 ALRIG - 212, 214 & 216 CHARLTON ROAD, STURBRIDGE, MA\CAD\DWG\PLOT\2023.05-14_DRAINAGE AREA MAP.DWG

APPENDIX E
TSS REMOVAL CALCULATIONS

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: 212,216,226 Charlton Road, Sturbridge, MA

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Sediment Forebay	0.25	0.75	0.19	0.56
Infiltration Basin	0.80	0.56	0.45	0.11
	0.00	0.11	0.00	0.11
	0.00	0.11	0.00	0.11

Total TSS Removal = 89%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: BOS-210035
Prepared By: JWR
Date: 5/16/2023

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

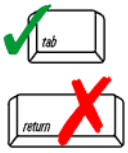
APPENDIX F
STORMWATER MANAGEMENT CHECKLIST

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☒ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☒ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☒ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☒ Other (describe): Aboveground Infiltration System with sediment forebay pretreatment.

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☒ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☒ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☒ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☒ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

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

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☒ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☒ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

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

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☐ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.