Expanded Environmental Notification Form

Warehouse Development
75 Reed Road

Submitted to:
Executive Office of Energy and Environmental Affairs
MEPA Office
100 Cambridge Street, Suite 900
Boston, MA 02114

Submitted by:
Portman Industrial, LLC
303 Peachtree Center Avenue #575
Atlanta, GA 30303

Prepared by:
Epsilon Associates, Inc.
3 Mill & Main Place, Suite 250
Maynard, MA 01754

In Association with:
Beals Associates, Inc.
Howard Stein Hudson
WSP
GMA Architects
ARCO General Construction

Epsilon ASSOCIATES INC.

August 1, 2022

Epsilon ASSOCIATES INC.

August 1, 2022

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Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Attn: Secretary Bethany Card

Subject: Warehouse Development
75 Reed Road, Hudson MA
Massachusetts Environmental Policy Act Expanded Environmental Notification Form

Dear Secretary Card:

On behalf of Portman Industrial LLC, I am pleased to send you the enclosed Expanded Environmental Notification Form (EENF) for the proposed Warehouse Development Project at 75 Reed Road, Hudson MA (the "Project"). The Project is a proposed warehouse consisting of approximately 1,284,640 square feet of redevelopment includes 190 loading bays, trailer parking for approximately 724 trailers and approximately 446 employee parking spaces.

The Proponent is requesting a Single Environmental Impact Report (SEIR) in accordance with 301 CMR 11.06(8). Included within the EENF is an Alternatives Analysis that compares the Project to a No-Build Alternative, a Zoning-Compliant Alternative, and a Reduced-Build Alternative. The EENF also includes a comprehensive Traffic Impact Study, a Greenhouse Gas Analysis, and a Stormwater Management Report as well as other information to provide a detailed summary and analysis of the Project, including mitigation. Consistent with the *MEPA Public Involvement Protocol for Environmental Justice Populations*, an Environmental Justice Screening Form was distributed to the EEA-provided distribution list. The Proponent distributed flyers to advertise the Project on July 22nd, 2022 to those who may be interested in learning more about the Project and MEPA filing. To date, the Proponent has received one request for information about the Project which relates solely to access to the facility. The EENF provides a comprehensive review of nearby Environmental Justice Populations consistent with the *MEPA Interim Protocol for Analysis of Project Impacts on Environmental Justice Populations.*

The Proponent expects that the EENF will be noticed in the *Environmental Monitor* on Wednesday August 10, 2022 and that comments will be due by September 9, 2022.

Comments can be made online at https://eeaonline.eea.state.ma.us/EEA/PublicComment/Landing/ or sent to:

Secretary Bethany Card
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston MA 02114

If you have any questions about the project, please call me at (978) 461-6215.

Sincerely,

EPSILON ASSOCIATES, INC.

David E. Hewett
Principal

Exapnded Environmental Notification Form

WAREHOUSE DEVELOPMENT

75 REED ROAD

Submitted to:
Executive Office of Energy and Environmental Affairs
MEPA Office
100 Cambridge Street, Suite 900
Boston, Massachusetts 02114

Submitted by:
Portman Industrial, LLC
303 Peachtree Center Avenue #575
Atlanta, GA 30303

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ARCO General Construction

August 1, 2022

Environmental Notification Form

Commonwealth of Massachusetts

Executive Office of Energy and Environmental Affairs
Massachusetts Environmental Policy Act (MEPA) Office

Environmental Notification Form

For Office Use Only

EEA#:

MEPA Analyst:

The information requested on this form must be completed in order to submit a document electronically for review under the Massachusetts Environmental Policy Act, 301 CMR 11.00.

Project Name: **Warehouse Development, 75 Reed Road**		
Street Address: **75 Reed Road**		
Municipality: **Hudson**	Watershed: **SuAsCo (Assabet)**	
Universal Transverse Mercator Coordinates: **Easting: 288777.07965537** **Northing: 4696464.554923**	Latitude: **42.383690** Longitude: **- 71.5333390**	
Estimated commencement date: **09/2023**	Estimated completion date: **11/2024**	
Project Type: **Warehouse/Distribution**	Status of project design: **75**%complete	
Proponent: **Portman Industrial, LLC, Attn: Mike Wurtsbaugh**		
Street Address: **303 Peachtree Center Avenue #575**		
Municipality: **Atlanta**	State: **GA**	Zip Code: **30303**
Name of Contact Person: **Corinne Snowdon**		
Firm/Agency: **Epsilon Associates, Inc.**	Street Address: **3 Mill & Main Place, Suite 250**	
Municipality: **Maynard**	State: **MA**	Zip Code: **01754**
Phone: **(978) 897-7100** Fax: **(978) 897-0099**	E-mail: **csnowdon@epsilonassociates.com**	

Does this project meet or exceed a mandatory EIR threshold (see 301 CMR 11.03)?
☒Yes ☐No

If this is an Expanded Environmental Notification Form (ENF) (see 301 CMR 11.05(7)) or a Notice of Project Change (NPC), are you requesting:

a Single EIR? (see 301 CMR 11.06(8))	☒Yes ☐No
a Rollover EIR? (see 301 CMR 11.06(13))	☐Yes ☒No
a Special Review Procedure? (see 301CMR 11.09)	☐Yes ☒No
a Waiver of mandatory EIR? (see 301 CMR 11.11)	☐Yes ☒No
a Phase I Waiver? (see 301 CMR 11.11)	☐Yes ☒No

Which MEPA review threshold(s) does the project meet or exceed (see 301 CMR 11.03)?

[301 CMR 11.03(1)(a)(2)] - Creation of ten or more acres of impervious area.
[301 CMR 11.03(1)(b)(1)] - Direct alteration of 25 or more acres of land.
[301 CMR 11.03(6)(a)(vii)] - Construction of 1,000 or more New parking spaces at a single location.
[301 CMR 11.03(6)(b)(xiii) - Generation of 2,000 or more New adt on roadways providing access to a single location
[301 CMR 11.03(6)(b)(xiv)] - Generation of 1,000 or more New adt on roadways providing access to a single location and construction of 150 or more New parking spaces at a single location
[301 CMR 11.03(6)(b)(xv)] - Construction of 300 or more New parking spaces at a single location

Which State Agency Permits will the project require?
Massachusetts Department of Transportation (MassDOT): Access Permit
Identify any financial assistance or land transfer from an Agency of the Commonwealth, including the Agency name and the amount of funding or land area in acres: **No Financial Assistance or Land Transfer is needed or being requested for the project.**

Summary of Project Size & Environmental Impacts	Existing	Change	Total
LAND			
Total site acreage	**148.67**		
New acres of land altered		**0**	
Acres of impervious area	**34.42**	**+27.82**	**62.24**
Square feet of new bordering vegetated wetlands alteration		**0**	
Square feet of new other wetland alteration		**0**	
Acres of new non-water dependent use of tidelands or waterways		**0**	
STRUCTURES			
Gross square footage	**417,078**	**+867,562**	**1,284,640**
Number of housing units	**0**	**0**	**0**
Maximum height (feet)	**43.42**	**+11.58**	**55.0**
TRANSPORTATION			
Vehicle trips per day	**163**	**2,073**	**2,236**
Parking spaces: Passenger Vehicle Spaces Trailer Spaces	**1,879** **0**	**-1,433** **+724**	**446** **724**
WASTEWATER			
Water Use (Gallons per day)	**850,000***	**-838,235**	**11,765**
Water withdrawal (GPD)	**350,000***	**-350,000**	**0**
Wastewater generation/treatment (GPD)	**600,000***	**-589,035**	**10,965**
Length of water mains (miles)	**0**	**0**	**0**
Length of sewer mains (miles)	**0**	**0**	**0**

***data obtained from EEA# 12313, NPC filed 1/31/2002.**

Has this project been filed with MEPA before?
☐ Yes (EEA #) ☒No.

Has any project on this site been filed with MEPA before?
☒ Yes **(EEA #s 8881, 12313)** ☐No

GENERAL PROJECT INFORMATION – all proponents must fill out this section

PROJECT DESCRIPTION:

Describe the existing conditions and land uses on the project site:

The property, totaling approximately 149 acres (the "Project Site"), consists of an undeveloped, forested area to the north comprised of approximately 60 acres and a developed area to the south with two industrial/manufacturing use buildings and associated parking occupying the remaining 98 acres. The Project Site features approximately 1,975 feet of frontage on Forest Avenue, approximately 2,600 feet on Marlborough Street, and approximately 300 feet on Reed Road.

An orchard previously occupied the area to the north, which now features large areas of wetland resource areas with drainage swales traveling down slope from south to north and leading into a shallow marsh meadow and large detention basins along the northern boundary of the property. A private-use softball field occupies the northwest corner of the site and is accessed via an unpaved road stemming from Forest Avenue located within an easement area. South of the softball field an area of land approximately 100,000 square feet in size sits atop a ledge with steep, downward slopes along the eastern, northern, and western perimeter.

The southern portion of the property contains two industrial/office buildings (HD-1 and HD-2), which were previously owned and operated by Intel Massachusetts, Inc. These two buildings total 417,000 square feet, with HD-1 containing approximately 302,000 square feet and HD-2 containing approximately 115,000 square feet. Parking areas, totaling roughly 1,900 spaces, surround the buildings to the east, south, and southwest. To the north of the buildings, an area of open space, totaling approximately 21 acres (~915,000 square feet), features landscaped grass, stormwater management improv, and a walking trail. This area formerly housed buildings and parking facilities prior to their demolition in 2018. The topography of this area slopes downward from the southwest corner to the north, east, and west.

The Project Site does not feature any areas identified on the Natural Heritage mapping as Priority Habitat of Rare Species, Estimated Habitat of Rare Wildlife, or Vernal Pools, and no mapped FEMA floodplains. See Attachment A, Figure 3.

Topography across the property is varied and features steep, undeveloped portions of land as well as uniformly graded areas of development. Overall, elevation across the property range from a low of 217 within the stormwater basins adjacent to Forest Avenue to a high of 404 just south of the HD-1 building. The majority of the Project Site ranges from elevation 404 in the westerly portion down to elevation 335 at the Marlborough Street entrance on the east. The floor slabs of the existing buildings are separated by approximately 20 feet in elevation and the parking lots moving from HD-2 to the east are stepped down in increments of roughly 10 feet moving from west to east.

In the area just to the north of the HD-1 and HD-2 buildings, the topography gently rolls from the building sites down to the perimeter road and is mainly vegetated. North of the perimeter road, the topography becomes steep and densely vegetated with wetland fingers throughout. The slopes become steep and exceed 10% in many areas. See Attachment A, Figures 4 and 5.

The northern portion of Project Site features numerous wetland resource areas that originate from drainage flow paths down the natural slope toward the stormwater basin adjacent to Forest Avenue. These areas were previously delineated by others and have recently been confirmed and re-flagged in the field by Beals Associates, Inc. The Massachusetts Wetlands Protection Act imposes a 100-foot regulatory buffer on these resource areas. The Town of Hudson Conservation Commission also regulates a 25-foot no disturb buffer around these resources. Resource areas and associated buffer zones remain undisturbed by development.

Describe the proposed project and its programmatic and physical elements:

The proposed project will consist of a redevelopment of the existing property and is intended to remain generally within the perimeter road that was established long ago. The existing buildings, HD-1 and HD-2 will be demolished, and the developed portions of the Project Site will be regraded to allow the construction of a distribution warehouse facility that will consist of 1,284,640 square feet of building space with 190 loading bays, trailer parking for approximately 724 trailers and approximately 446 employee parking spaces (the "Project"). The only elements of the Project located outside the existing perimeter road will be a remote trailer parking area that will be located just north of the road on the plateau area adjacent to the electrical easement.

Access to the Project Site will continue to be primarily from Reed Road with a secondary passenger vehicle entrance off Marlborough Street. Both access points will be in the same location as the existing driveways. Utilities across the Project Site will be removed and replaced with new infrastructure except for the portions that run to the north over the embankment outside of the current development footprint. Stormwater management facilities will be upgraded with completely new infrastructure that is designed to comply with Massachusetts Department of Environmental Protection ("DEP") standards.

The Project will include new parking facilities for employee passenger vehicles as well as for trailer storage. The project provides 446 passenger parking spaces, 12 of which will be Americans with Disabilities ("ADA") accessible, including four van accessible spaces. Also included in this total are 20 charging stations for electric vehicles. Infrastructure will be in place for this number to expand if a tenant desires. A traffic impact study, which has already been submitted to the Town of Hudson for site plan review, is included in Attachment E as part of the EENF for MEPA review. The study was prepared following Massachusetts Department of Transportation (MassDOT) guidelines for completing a Transportation Impact Assessment (TIA).

The parking will be located on both sides of the building to allow employee access on either the west end or the east end, depending on the final tenant configuration. Each parking lot will also feature ADA compliant spaces centered on the building nearest to the entrances. These spaces are designed to current accessibility standards and are located such that a fully compliant accessible route can be achieved from the parking spaces to the primary building entrances. All standard parking spaces are 9 feet wide by 18 feet deep with a minimum 24-foot drive aisle. ADA compliant parking spaces are 8 feet wide with a 5-foot barrier free space and van accessible spaces are also 8 feet wide with a barrier free space that is 8 feet wide. All ADA compliant spaces are 18 feet deep.

Loading spaces for the building are located along the north and south edges of the proposed structure with approximately 95 spaces on each side. The spaces are designed to be easily accessible for truck drivers and are 14 feet wide by 60 feet deep. The total maneuvering area across the truck apron is 130 feet clear.

The Project provides trailer parking to the north of the proposed building and a single row of trailer parking south of the building and the southerly loading apron. The current layout will allow for approximately 724 trailers to be parked in 12 foot by 55 foot spaces with 70 foot wide access drives for maneuvering.

Stormwater management for the Project has been developed in accordance with the Massachusetts Department of Environmental Protection Stormwater Handbook. The Stormwater Management System has been designed to meet or exceed the Massachusetts Stormwater Standards. Stormwater runoff will be collected through a series of catch basins located throughout the proposed impervious areas of the development. The runoff will then flow through new storm drains to water quality units for Total Suspended Solids ("TSS") removal before entering an outlet control structure leading into subsurface infiltration systems. Clean runoff collected from the building rooftops will flow directly to the same outlet control structures prior to the infiltration systems. These subsurface infiltration systems will be located beneath the impervious areas to the northwest and northeast of the building. Collected runoff will exit the infiltration systems and discharge to either the wetland resource areas north of the proposed development or the existing stormwater outfall that discharges to the large basin adjacent to Forest Avenue.

The redevelopment of the Project Site proposes to reuse very limited portions of the existing stormwater infrastructure. Any runoff that is collected and discharged to or through existing stormwater facilities will be pretreated for sediment removal prior to discharge to these features. The project site has been treated as a Land Use with High Potential Pollutant Loads ("LUHPPL") in accordance with MassDEP standards, and as such receives a higher level of stormwater quality treatment and safeguards than many development sites. In addition, for the purposes of the stormwater management design, the project has been treated as a new development and does not take advantage of a reduction I the standards due to redevelopment.

As a result of the overall design of the system, runoff rates and volumes leaving the system will be reduced for all analyzed storm events based on rainfall data from the New England and New York Extreme Precipitation tables, also known as the Cornell Study.

The existing Project Site features a perimeter loop road that allows full access to the entire developed portion of the property by emergency vehicles. The redeveloped site will maintain this loop road and will continue to provide full 360-degree access to the project site. Emergency vehicles will have full access to all portions of the property and will be able to gain access from either Reed Road or Marlborough Street.

In addition to the full building access, all areas of the loading, trailer parking and employee parking can also be accessed by emergency vehicles of various sizes.

Fire protection for the building will be provided using an onsite fire protection loop that will be fed from the building's fire pump and will draw water from the municipal system and fed back to the site through a pressurized main that will feed the fire hydrants and several fire protection standpipes located around the building. A full fire protection design will be prepared during the building permit phase by a licensed Fire Protection Engineer.

The existing facility features two access points: one on Reed Road and one on Marlborough Street. The Project will retain both access point. The Reed Road access will be reconfigured to allow large trucks to easily navigate the driveway and either proceed directly to the southerly loading apron or navigate around the perimeter road to the northerly loading apron. This access point onto Reed Road will also accommodate passenger vehicles wishing to park at the westerly parking area for employees. The Marlborough Street access point will be for passenger vehicles and emergency vehicles only. No trucks will be allowed to enter or exit the site through this access point.

Trucks will be directed from the Reed Road entrance to either the southerly or northerly loading apron. Trucks will also utilize the loop road to access the various trailer parking areas. Trucks entering the southerly loading area that need to reverse direction will have an opportunity to do so at the easterly end of the apron with a full turning circle that is sized to allow a full 180 degree turn with a WB-67 design vehicle (53' trailer and large highway cab). Trucks entering the northerly loading apron can reverse direction by travelling to either end of the apron and using the secondary entrance/exit to the apron. In the event of an emergency, trailer trucks can circumnavigate the entire building, although those routes will be discouraged.

Trucks will not be allowed to access or leave the property via the Marlborough Street driveway. All truck traffic will be expected to utilize Reed Road to Technology Drive to Route 85C to access the interstate highway system. Trucks should not be using the local roadway network beyond that described above.

Passenger vehicles will access the Project Site via either of the driveways and will fully circumnavigate the site using the loop road. Parking facilities to the east and west sides of the building will be the main destination for passenger vehicles and either access point can be used to leave the site.

Pedestrian access once on the property will be generally limited to travel from parking lots to the main building entrances and will be provided via sidewalks located between the parking facilities and the building faces. Loading and trailer storage areas for many of these types of facilities are secured by the tenant and would preclude a sidewalk around the perimeter loop road.

The Proponent will be work with Town staff to provide routing for a natural trail network throughout the Project Site that will originate near the Reed Road entrance and traverse the undeveloped portions of the property toward Forest Avenue. The trails will provide access to members of the public through the natural areas of the site and will meander through the undeveloped areas in a manner that will preserve as many trees as possible and disturb a minimal amount of ground surface. It is anticipated that the trail material will be stone dust or some other stabilized pervious surface but will not be paved in any way.

Bicycle storage at the facility will be dependent on the individual tenant; however, the Proponent has shown twenty bicycle parking rack spaces on each side of the building for employees wishing to ride bicycles to work.

Solid waste will be handled thought the use of compactors located within the truck loading aprons immediately adjacent to the building. The compactors will be located in areas that will be dictated by the future tenant. These facilities typically locate the compactors in spaces that could otherwise be used for a loading dock. Multiple compactors will likely be utilized and will be operated and maintained by licensed solid waste contractors.

Since these compactors will be located in the truck loading areas adjacent to the building, they will benefit from the screening provided by the topographic changes and sound barrier to the south. Along the north side of the building, the compactor locations will be screened by the elevation changes from the residential properties to the northwest. The line of sight will provide complete screening from these containers.

Portions of the Project Site will be screened from adjoining properties through the use of site grading and, where appropriate, the installation of a noise attenuating fence. The proposed fence will be 15 feet high and will run along most of the southerly truck apron to provide additional screening above and beyond the approximately 20-foot elevation drop from the property line down to the truck apron.

Sections of the loading areas may be fenced in for security purposes. The security fences are generally 8-foot-tall chain link fence with large access gates to allow trucks to circulate through the property.

The east and west elevations of the building will feature a 10-foot-wide concrete sidewalk that will allow employees and visitors to access the main entry points from the parking lot. The sidewalks will be protected by vertical curbing to prevent vehicles from encroaching into the walkways.

Site lighting has been designed to prevent light spillage from the Project Site onto abutting properties. Along the southerly boundary, the photometric analysis shows spillage of 0.1 and 0.2 footcandles at several locations; however, the proposed grade changes and addition of a sound wall were not considered for the noise modeling. Once these elements are considered, light levels at the property line due to the redevelopment of the property will be zero. For the Project, all lighting locations and fixtures will be new. Lithonia LED fixtures that focus light downward will be utilized. These fixtures are "dark sky" compliant and use less energy than the current lighting. Building mounted fixtures will also be LED and directed toward the ground.

The Project will be designed to comply with the Town of Hudson Zoning Bylaw and other local bylaws.

NOTE: The project description should summarize both the project's direct and indirect impacts (including construction period impacts) in terms of their magnitude, geographic extent, duration and frequency, and reversibility, as applicable. It should also discuss the infrastructure requirements of the project and the capacity of the municipal and/or regional infrastructure to sustain these requirements into the future.

Describe the on-site project alternatives (and alternative off-site locations, if applicable), considered by the proponent, including at least one feasible alternative that is allowed under current zoning, and the reasons(s) that they were not selected as the preferred alternative:

The Proponent has thoughtfully developed the proposed uses and layout for the Project. The Town of Hudson Zoning Bylaw allows for multiple and varied uses at the Project Site. Different uses would result in varying levels of impact. The Project is Zoning-compliant, and the Proponent also developed a Zoning-compliant Alternative and a Reduced-build Alternative for the purposes of comparing the potential impacts and benefits that could result from redevelopment of the Project Site. The No-build Alternative is also included in the comparison to serve as a baseline for the analysis of impacts.

<u>No-build Alternative:</u> The No-Build alternative is comprised of the uses that were present during the operation of Intel Massachusetts from 1998 – 2022 and incorporates the existing buildings and infrastructure with no active operations. The prior owner evaluated options for reuse or reoccupation of the buildings, and did not find those alternatives to be feasible. The Project Site would continue to deteriorate without use and maintenance, and the Town would not see direct and incidental benefits from a productive use of the property and infrastructure.

<u>Zoning-compliant Alternative:</u> The Zoning-compliant alternative is comprised of retail uses on the scale of a contemporary shopping mall on the Project Site. One of the existing buildings would remain and be converted to 100% office space. This alternative anticipates smaller building footprints with increased passenger vehicle parking spaces as compared with the other build-alternatives. This alternative is not supported by financial or market analyses.

<u>Reduced-build Alternative</u>. The Reduced-build alternative includes an Industrial/warehouse with a reduced footprint and parking requirements. This use would retain and reuse the existing buildings, which would be converted to office space, on the Project Site. This alternative is not supported by financial or market analyses.

<u>Proposed Project (Preferred Alternative):</u> The Project, which is described in this Expanded ENF, is the preferred and only financially viable project to be considered for advancement by the Proponent. The Project results in reduced trip generation as well as reduced utility demand as compered with the Zoning-compliant alternative. The Project also has a smaller utility demand than the Reduced Build alternative.

<u>Table 1</u> summarizes the impacts of the alternatives.

Alternative	Building gsf	Impervious Area (ac)	Trips (vtpd)	Parking Spaces	Water Demand (gpd)	Waste-water (gpd)
No-build (Existing Uses)	417,078	34.42	4,662	1,995	34,409	31,281
Zoning Compliant	540,219	58.30	16,191	4,277	33,708	30,644
Reduced Build	782,078	45.54	5,144	2,295	38,424	34,931
Proposed Project	1,284,640	62.24	2,236	446 724 trailer	14,131	12,846

NOTE*: The purpose of the alternatives analysis is to consider what effect changing the parameters and/or siting of a project, or components thereof, will have on the environment, keeping in mind that the objective of the MEPA review process is to avoid or minimize damage to the environment to the greatest extent feasible. Examples of alternative projects include alternative site locations, alternative site uses, and alternative site configurations.*

Summarize the mitigation measures proposed to offset the impacts of the preferred alternative:

The Proponent will undertake practicable mitigation efforts to minimize the project's anticipated impacts.

The Proponent will evaluate the need for mitigation based on projected operations identified through the completion of a Traffic Impact Study (TIS) in coordination with MassDOT and the Town of Hudson.

The Project will also include a comprehensive improved stormwater management system that incorporates Best Management Practices (BMP's) sufficient to meet MassDEP Stormwater standards.

Water and sewer demand will be reduced using water conserving fixtures and "water-smart" landscaping measures, as well as rooftop rainwater recapture system.

The Project will employ a variety of sustainable green building design features with an emphasis on minimizing energy usage to reduce greenhouse gas emissions including:

1. **High Performance Building Envelope with 15% improvement over code, including:**
   a. **R-26 Opaque Walls**
   b. **R-30 Roof**
   c. **Triple Glazing at office areas**

2. **High-efficiency gas-fired rooftop units (92% efficiency)**
3. **All-electric heat pump HVAC for office space**
4. **Air-source heat pump domestic water heater for office space**
5. **High-efficiency LED interior lighting with 35% improvement against code (0.30 Watt/sf)**
6. **High-efficiency LED exterior lighting with 65% improvement against code**

If the project is proposed to be constructed in phases, please describe each phase:

The Proponent expects to construct the Project in one phase.

AREAS OF CRITICAL ENVIRONMENTAL CONCERN:

Is the project within or adjacent to an Area of Critical Environmental Concern?

☐ Yes (Specify:)
☒ No

if yes, does the ACEC have an approved Resource Management Plan? ___ Yes __ No;
If yes, describe how the project complies with this plan.

____

Will there be stormwater runoff or discharge to the designated ACEC? __ Yes _X_ No;
If yes, describe and assess the potential impacts of such stormwater runoff/discharge to the designated ACEC.

RARE SPECIES:
Does the project site include Estimated and/or Priority Habitat of State-Listed Rare Species? (see http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/priority_habitat/priority_habitat_home.htm)
☐Yes (Specify__) ☒No

HISTORICAL /ARCHAEOLOGICAL RESOURCES:
Does the project site include any structure, site or district listed in the State Register of Historic Place or the inventory of Historic and Archaeological Assets of the Commonwealth?
☒Yes **(**Specify**: 19-MD-854)** ☐No

If yes, does the project involve any demolition or destruction of any listed or inventoried historic or archaeological resources? ☒Yes ☐No (Specify) **A portion of the mapped unit of 19-MD-854 is on the Project Site.**

WATER RESOURCES:
Is there an Outstanding Resource Water (ORW) on or within a half-mile radius of the project site? ___Yes_**X**_No; if yes, identify the ORW and its location.

(NOTE: Outstanding Resource Waters include Class A public water supplies, their tributaries, and bordering wetlands; active and inactive reservoirs approved by MassDEP; certain waters within Areas of Critical Environmental Concern, and certified vernal pools. Outstanding resource waters are listed in the Surface Water Quality Standards, 314 CMR 4.00.)

Are there any impaired water bodies on or within a half-mile radius of the project site?___Yes_**X**_No; if yes, identify the water body and pollutant(s) causing the impairment:

Is the project within a medium or high stress basin, as established by the Massachusetts Water Resources Commission? __Yes;_**X**_No

STORMWATER MANAGEMENT:
Generally describe the project's stormwater impacts and measures that the project will take to comply with the standards found in MassDEP's Stormwater Management Regulations:
Stormwater management for the Project has been developed in accordance with the Massachusetts Department of Environmental Protection Stormwater Handbook. A summary of the State Standards is included the Stormwater Management Report (Attachment G). The Stormwater Management System has been designed to meet or exceed the Massachusetts Stormwater Standards. Stormwater runoff will be collected through a series of catch basins located throughout the proposed impervious areas of the development. The runoff will then flow through HDPE storm piping to water quality units for TSS removal before entering an outlet control structure leading into subsurface infiltration systems. Clean runoff collected from the building rooftops will flow directly to the same outlet control structures prior to the infiltration systems. These subsurface infiltration systems will be located beneath the impervious areas to the northwest and northeast of the building. Collected runoff will exit the infiltration systems and discharge to either the wetland resource areas north of the proposed development or the existing stormwater outfall that discharges to the large basin adjacent to Forest Avenue.

Standard 1: Untreated discharges
No new stormwater conveyances (e.g., outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

The proposed system will meet this Standard.
Standard 2: Peak rate control and flood prevention

Stormwater management systems must be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.

The proposed system will meet this Standard.

<u>Standard 3: Recharge to Ground water</u>
Loss of annual recharge to ground water shall be eliminated or minimized through the use of infiltration measures, including environmentally sensitive site design, low impact development techniques, best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from the pre-development conditions based on soil type.

The proposed system will exceed this Standard.

<u>Standard 4: 80% TSS Removal</u>
Stormwater management systems must be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS).

The proposed system will exceed this Standard.

<u>Standard 5: Higher Potential Pollutant Loads (HPPL)</u>
For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.

The Project is considered a LUHPPL and will therefore be required to meet or exceed this Standard. The Water Quality system design will exceed this Standard.

<u>Standard 6 Critical Areas</u>
Stormwater discharges to a Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or any other critical area require the use of the specific source control and pollution prevention measures and the specific stormwater best management practices determined by the Department to be suitable for managing discharges to such area, as provided in the Massachusetts Stormwater Handbook.

The Project Site does not discharge to a Critical Area. This Standard does not apply.

<u>Standard 7: Redevelopment</u>
A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural stormwater best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

The Project does not qualify as a redevelopment project since there is an increase in the amount of impervious area; therefor, all Standards will apply as applicable. The Project will be designed as such.

Standard 8: Erosion, Sediment Control
A plan to control construction-related impacts, including erosion sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan), must be developed and implemented.

The Project will meet this Standard.

Standard 9: Operation and Maintenance
A long-term operation and maintenance plan must be developed and implemented to ensure that stormwater management systems function as designed.

An operations and maintenance plan has been developed to include measures to be taken during construction of the Project and for long term operation.

Standard 10 Illicit Discharges
All illicit discharges to the stormwater management system are prohibited.

An Illicit Discharge Compliance Statement will be provided with the overall Stormwater Management Report and will be included in all local filings. The Project will meet this Standard.

MASSACHUSETTS CONTINGENCY PLAN:

Has the project site been, or is it currently being, regulated under M.G.L.c.21E or the Massachusetts Contingency Plan? Yes__ No**X** ; if yes, please describe the current status of the site (including Release Tracking Number (RTN), cleanup phase, and Response Action Outcome classification):

Is there an Activity and Use Limitation (AUL) on any portion of the project site? Yes ___ No_**X**_if yes, describe which portion of the site and how the project will be consistent with the AUL:

Are you aware of any Reportable Conditions at the property that have not yet been assigned an RTN? Yes___ No_**X**_if yes, please describe:

SOLID AND HAZARDOUS WASTE:

If the project will generate solid waste during demolition or construction, describe alternatives considered for re-use, recycling, and disposal of, e.g., asphalt, brick, concrete, gypsum, metal, wood:
The contractor will take an active role regarding the reprocessing and recycling of construction waste. The excavation contracts will include specific requirements to ensure construction procedures allow for the necessary segregation, reprocessing, reuse, and recycling of materials. A Construction Waste Management Plan will be developed to ensure that a minimal amount of waste debris is disposed of in landfills and to pursue the goal of diverting at least 75 percent of project-generated construction waste from landfills. For those materials that cannot be recycled, solid waste will be transported in covered trucks to an approved solid waste facility per the DEP Regulation for Solid Waste Facilities, 310 CMR 16.00. This requirement will be specified in the contract documents.

(NOTE: Asphalt pavement, brick, concrete and metal are banned from disposal at Massachusetts landfills and waste combustion facilities and wood is banned from disposal at Massachusetts landfills. See 310 CMR 19.017 for the complete list of banned materials.)

Will your project disturb asbestos containing materials? Yes _ No **X ;**
if yes, please consult state asbestos requirements at http://mass.gov/MassDEP/air/asbhom01.htm

Describe anti-idling and other measures to limit emissions from construction equipment:
The construction contract will require contractors to use several measures to reduce potential emissions and minimize impacts from construction vehicles including:

- **Encouraging contractors to use construction equipment EPA Tier 4 equipment or equipment retrofitted with diesel emission control devices to the greatest extent practicable.**
- **Using Ultra-Low Sulphur Diesel for all trucks and construction machinery.**
- **Maintaining an "idle free" work zone by providing supplemental electrical equipment along with "just-in-time" delivery methods. On-site idling will be limited to five minutes in accordance with the Massachusetts Anti Idling Law. "No Idling" signs will be posted at all appropriate locations.**
- **Minimizing exposed storage of debris on-site and using wetting agents where needed on a scheduled basis to minimize dust.**
- **Monitoring construction practices to reduce unnecessary transfers and mechanical disturbances of loose materials.**
- **Cleaning streets and sidewalks regularly to minimize dust accumulation.**

DESIGNATED WILD AND SCENIC RIVER:
Is this project site located wholly or partially within a defined river corridor of a federally designated Wild and Scenic River or a state designated Scenic River? Yes ___ No **X ;**
if yes, specify name of river and designation:

If yes, does the project have the potential to impact any of the "outstandingly remarkable" resources of a federally Wild and Scenic River or the stated purpose of a state designated Scenic River? Yes___ No___ ; if yes, specify name of river and designation: _____________;
if yes, will the project will result in any impacts to any of the designated "outstandingly remarkable" resources of the Wild and Scenic River or the stated purposes of a Scenic River. ______ if yes, describe the potential impacts to one or more of the "outstandingly remarkable" resources or stated purposes and mitigation measures proposed.

ATTACHMENTS:

1. List of all attachments to this document.

Attachment A	**Figures**
Attachment B	**Circulation List**
Attachment C	**Anticipated Municipal and Federal Permits**
Attachment D	**Greenhouse Gas Analysis**
Attachment E	**Traffic Impact Study**
Attachment F	**Environmental Justice**
Attachment G	**Stormwater Management Report**
Attachment H	**RMAT Output Report**

2. U.S.G.S. map (good quality color copy, 8-½ x 11 inches or larger, at a scale of 1:24,000) indicating the project location and boundaries. **Attachment A, Figures 1 and 2**

3.. Plan, at an appropriate scale, of existing conditions on the project site and its immediate environs, showing all known structures, roadways and parking lots, railroad rights-of-way, wetlands and water bodies, wooded areas, farmland, steep slopes, public open spaces, and major utilities. **Attachment A, Figure 3**

4 Plan, at an appropriate scale, depicting environmental constraints on or adjacent to the project site such as Priority and/or Estimated Habitat of state-listed rare species, Areas of Critical Environmental Concern, Chapter 91 jurisdictional areas, Article 97 lands, wetland resource area delineations, water supply protection areas, and historic resources and/or districts. **Attachment A, Figures 4 and 5**

5. Plan, at an appropriate scale, of proposed conditions upon completion of project (if construction of the project is proposed to be phased, there should be a site plan showing conditions upon the completion of each phase). **Attachment A, Figure 6**

6. List of all agencies and persons to whom the proponent circulated the ENF, in accordance with 301 CMR 11.16(2). **Attachment B**

7. List of municipal and federal permits and reviews required by the project, as applicable. **Attachment C**

8. Printout of output report from RMAT Climate Resilience Design Standards Tool, available here. **Attachment H**

9. Printout from the EEA EJ Maps Viewer showing the project location relative to Environmental Justice (EJ) Populations located in whole or in part within a 1-mile and 5-mile radius of the project site. **Attachment F**

LAND SECTION – all proponents must fill out this section

I. Thresholds / Permits

A. Does the project meet or exceed any review thresholds related to **land** (see 301 CMR 11.03(1)
X Yes ___ No; if yes, specify each threshold:
[301 CMR 11.03(1)(a)(2)] - Creation of ten or more acres of impervious area.
[301 CMR 11.03(1)(b)(1)] - Direct alteration of 25 or more acres of land.

II. Impacts and Permits

A. Describe, in acres, the current and proposed character of the project site, as follows:

	Existing	Change	Total
Footprint of buildings	**9.57**	**+19.92**	**29.49**
Internal roadways	**5.07**	**-1.18**	**3.89**
Parking and other paved areas	**20.20**	**+8.66**	**28.86**
Other altered areas	**71.14**	**-27.58**	**43.56**
Undeveloped areas	**43.11**	**-0.24**	**42.87**
Total: Project Site Acreage	**148.67**	**0**	**148.67**

B. Has any part of the project site been in active agricultural use in the last five years?
___ Yes **X** No; if yes, how many acres of land in agricultural use (with prime state or locally important agricultural soils) will be converted to nonagricultural use?

C. Is any part of the project site currently or proposed to be in active forestry use?
___ Yes **X** No; if yes, please describe current and proposed forestry activities and indicate whether any part of the site is the subject of a forest management plan approved by the Department of Conservation and Recreation:

D. Does any part of the project involve conversion of land held for natural resources purposes in accordance with Article 97 of the Amendments to the Constitution of the Commonwealth to any purpose not in accordance with Article 97?
___ Yes **X** No; if yes, describe:

E. Is any part of the project site currently subject to a conservation restriction, preservation restriction, agricultural preservation restriction or watershed preservation restriction? ___ Yes **X** No; if yes, does the project involve the release or modification of such restriction? ___ Yes ___ No; if yes, describe:

F. Does the project require approval of a new urban redevelopment project or a fundamental change in an existing urban redevelopment project under M.G.L.c.121A? ___ Yes **X** No; if yes, describe:

III. Consistency

A. Identify the current municipal comprehensive land use plan

Title: **Hudson Master Plan** Date: **November 2014**

B. Describe the project's consistency with that plan with regard to:

1) economic development
The development of the Project will support growth in the area by creating new warehouse and distribution space on large, previously developed property that is now vacant. The Project will create temporary construction jobs and permanent jobs with positive adjacent economic benefits to the businesses which will serve the employees of the facility as well as increased and replacement tax revenues for the town of Hudson.

2) adequacy of infrastructure

The Project is accessed via Reed Road, and a ring road which was developed solely to serve the Project Site. Water and wastewater and electric infrastructure is adequate to service the Project without municipal upgrades.

3) open space impacts

As a redevelopment of existing facilities, the Project will not substantially impact existing open space. Sixty acres of wooded wetland open space will continue to be preserved. Pedestrian trails will also be created in these areas.

4) compatibility with adjacent land uses

As a redevelopment of existing office/manufacturing facilities, the Project will not substantially create new impacts to existing adjacent land uses. Sixty acres of wooded wetland open space buffers will continue to be preserved and pedestrian trails will be developed to connect adjacent land uses. The Project is also compliant with the Town of Hudson Zoning Bylaws.

C. Identify the current Regional Policy Plan of the applicable Regional Planning Agency (RPA)

RPA: **Metropolitan Area Planning Council (MAPC)**

Title: **MetroCommon 2050** Date: **Fall 2021**

D. Describe the project's consistency with that plan with regard to:

1) economic development

The Regional Policy Plan aims to encourage developments that provide a wide array of job opportunities with a variety of career pathways. The Project will contribute to this goal by creating temporary construction jobs and permanent jobs as well as ancillary benefits to the surrounding businesses.

2) adequacy of infrastructure

The Project is accessed via Reed Road, which was created as a ring road solely to serve the Project Site. The Project is located near to major highway access and transportation corridors. Water and wastewater and electric infrastructure is adequate to service the Project without municipal or regional upgrades.

3) open space impacts

As a redevelopment of existing facilities, the Project will not substantially impact existing open space in the community or the region. 60 acres of wooded wetland open space will continue to be preserved.

RARE SPECIES SECTION

I. Thresholds / Permits Epsilon

A. Will the project meet or exceed any review thresholds related to **rare species or habitat** (see 301 CMR 11.03(2))? ___ Yes **_X_** No; if yes, specify, in quantitative terms:

(NOTE: If you are uncertain, it is recommended that you consult with the Natural Heritage and Endangered Species Program (NHESP) prior to submitting the ENF.)

B. Does the project require any state permits related to **rare species or habitat**? ___ Yes **_X_** No

C. Does the project site fall within mapped rare species habitat (Priority or Estimated Habitat?) in the current Massachusetts Natural Heritage Atlas (attach relevant page)? __ Yes **_X_** No

D. If you answered "No" to <u>all</u> questions A, B and C, proceed to the **Wetlands, Waterways, and Tidelands Section**. If you answered "Yes" to <u>either</u> question A or question B, fill out the remainder of the Rare Species section below.

II. Impacts and Permits

A. Does the project site fall within Priority or Estimated Habitat in the current Massachusetts Natural Heritage Atlas (attach relevant page)? __ Yes ___ No. If yes,

1. Have you consulted with the Division of Fisheries and Wildlife Natural Heritage and Endangered Species Program (NHESP)? _ Yes ___No; if yes, have you received a determination as to whether the project will result in the "take" of a rare species? ___ Yes ___ No; if yes, attach the letter of determination to this submission.

2. Will the project "take" an endangered, threatened, and/or species of special concern in accordance with M.G.L. c.131A (see also 321 CMR 10.04)? __ Yes ___ No; if yes, provide a summary of proposed measures to minimize and mitigate rare species impacts

3. Which rare species are known to occur within the Priority or Estimated Habitat?

4. Has the site been surveyed for rare species in accordance with the Massachusetts Endangered Species Act? __ Yes ___ No

5. If your project is within Estimated Habitat, have you filed a Notice of Intent or received an Order of Conditions for this project? ___ Yes ___ No; if yes, did you send a copy of the Notice of Intent to the Natural Heritage and Endangered Species Program, in accordance with the Wetlands Protection Act regulations? ___ Yes ___ No

B. Will the project "take" an endangered, threatened, and/or species of special concern in accordance with M.G.L. c.131A (see also 321 CMR 10.04)? ___ Yes ___ No; if yes, provide a summary of proposed measures to minimize and mitigate impacts to significant habitat:

WETLANDS, WATERWAYS, AND TIDELANDS SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **wetlands, waterways, and tidelands** (see 301 CMR 11.03(3))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits (or a local Order of Conditions) related to **wetlands, waterways, or tidelands**? __ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Water Supply Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Wetlands, Waterways, and Tidelands Section below.

II. Wetlands Impacts and Permits

A. Does the project require a new or amended Order of Conditions under the Wetlands Protection Act (M.G.L. c.131A)? __ Yes ___No; if yes, has a Notice of Intent been filed? ___ Yes __ No; if yes, list the date and MassDEP file number: ______; if yes, has a local Order of Conditions been issued? ___ Yes ___ No; Was the Order of Conditions appealed? ___ Yes ___ No. Will the project require a Variance from the Wetlands regulations? ___ Yes ___ No.

B. Describe any proposed permanent or temporary impacts to wetland resource areas located on the project site:

C. Estimate the extent and type of impact that the project will have on wetland resources, and indicate whether the impacts are temporary or permanent:

Coastal Wetlands	Area (square feet) or Length (linear feet)	Temporary or Permanent Impact?
Land Under the Ocean	________	________
Designated Port Areas	________	________
Coastal Beaches	________	________
Coastal Dunes	________	________
Barrier Beaches	________	________
Coastal Banks	________	________
Rocky Intertidal Shores	________	________
Salt Marshes	________	________
Land Under Salt Ponds	________	________
Land Containing Shellfish	________	________
Fish Runs	________	________
Land Subject to Coastal Storm Flowage	________	________
Inland Wetlands		
Bank (lf)	________	________
Bordering Vegetated Wetlands	________	________
Isolated Vegetated Wetlands	________	________
Land under Water	________	________
Isolated Land Subject to Flooding	________	________
Bordering Land Subject to Flooding	________	________
Riverfront Area	________	________

D. Is any part of the project:

1. proposed as a **limited project**? ___ Yes __ No; if yes, what is the area (in sf)?____
2. the construction or alteration of a **dam**? ___ Yes __ No; if yes, describe:
3. fill or structure in a **velocity zone** or **regulatory floodway**? ___ Yes __ No

4. dredging or disposal of dredged material? ___ Yes __ No; if yes, describe the volume of dredged material and the proposed disposal site:
5. a discharge to an **Outstanding Resource Water (ORW)** or an **Area of Critical Environmental Concern (ACEC)**?__ Yes ___ No
6. subject to a wetlands restriction order? ___ Yes __ No; if yes, identify the area (in sf):
7. located in buffer zones? __ Yes ___No; if yes, how much (in sf) ______

E. Will the project:
1. be subject to a local wetlands ordinance or bylaw? _ Yes ___ No
2. alter any federally-protected wetlands not regulated under state law? ___ Yes __ No; if yes, what is the area (sf)?

III. Waterways and Tidelands Impacts and Permits

A. Does the project site contain waterways or tidelands (including filled former tidelands) that are subject to the Waterways Act, M.G.L.c.91? ___ Yes ___No; if yes, is there a current Chapter 91 License or Permit affecting the project site? ___ Yes ___ No; if yes, list the date and license or permit number and provide a copy of the historic map used to determine extent of filled tidelands:

B. Does the project require a new or modified license or permit under M.G.L.c.91? ___ Yes___No; if yes, how many acres of the project site subject to M.G.L.c.91 will be for non-water-dependent use? Current __ Change ___ Total ___
If yes, how many square feet of solid fill or pile-supported structures (in sf)?

C. For non-water-dependent use projects, indicate the following:
Area of filled tidelands on the site:_____________________
Area of filled tidelands covered by buildings:____________
For portions of site on filled tidelands, list ground floor uses and area of each use:
____
Does the project include new non-water-dependent uses located over flowed tidelands?
Yes ___ No ___
Height of building on filled tidelands________________

Also show the following on a site plan: Mean High Water, Mean Low Water, Water-dependent Use Zone, location of uses within buildings on tidelands, and interior and exterior areas and facilities dedicated for public use, and historic high and historic low water marks.

D. Is the project located on landlocked tidelands? ___ Yes ___No; if yes, describe the project's impact on the public's right to access, use and enjoy jurisdictional tidelands and describe measures the project will implement to avoid, minimize or mitigate any adverse impact:

E. Is the project located in an area where low groundwater levels have been identified by a municipality or by a state or federal agency as a threat to building foundations? ___Yes ___No; if yes, describe the project's impact on groundwater levels and describe measures the project will implement to avoid, minimize or mitigate any adverse impact:

F. Is the project non-water-dependent **and** located on landlocked tidelands **or** waterways or tidelands subject to the Waterways Act **and** subject to a mandatory EIR? ___ Yes ___ No;
(NOTE: If yes, then the project will be subject to Public Benefit Review and Determination.)

G. Does the project include dredging? ___ Yes ___No; if yes, answer the following questions:
What type of dredging? Improvement ___ Maintenance ___ Both ____
What is the proposed dredge volume, in cubic yards (cys) _________
What is the proposed dredge footprint ____length (ft) ___width (ft)____depth (ft);
Will dredging impact the following resource areas?
Intertidal Yes__ No__; if yes, ___ sq ft
Outstanding Resource Waters Yes__ No__; if yes, ___ sq ft

Other resource area (i.e. shellfish beds, eel grass beds) Yes__ No__; if yes __ sq ft

If yes to any of the above, have you evaluated appropriate and practicable steps to: 1) avoidance; 2) if avoidance is not possible, minimization; 3) if either avoidance or minimize is not possible, mitigation?

If no to any of the above, what information or documentation was used to support this determination?

Provide a comprehensive analysis of practicable alternatives for improvement dredging in accordance with 314 CMR 9.07(1)(b). Physical and chemical data of the sediment shall be included in the comprehensive analysis.

Sediment Characterization

Existing gradation analysis results? __Yes ___No: if yes, provide results.

Existing chemical results for parameters listed in 314 CMR 9.07(2)(b)6? ___Yes ____No; if yes, provide results.

Do you have sufficient information to evaluate feasibility of the following management options for dredged sediment? If yes, check the appropriate option.

Beach Nourishment ___
Unconfined Ocean Disposal ___
Confined Disposal:
Confined Aquatic Disposal (CAD) ___
Confined Disposal Facility (CDF) ___
Landfill Reuse in accordance with COMM-97-001 ___
Shoreline Placement ___
Upland Material Reuse____
In-State landfill disposal____
Out-of-state landfill disposal ____
(NOTE: This information is required for a 401 Water Quality Certification.)

IV. Consistency:

A. Does the project have effects on the coastal resources or uses, and/or is the project located within the Coastal Zone? ___ Yes___No; if yes, describe these effects and the projects consistency with the policies of the Office of Coastal Zone Management:

B. Is the project located within an area subject to a Municipal Harbor Plan? ___ Yes ___No; if yes, identify the Municipal Harbor Plan and describe the project's consistency with that plan:

WATER SUPPLY SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **water supply** (see 301 CMR 11.03(4))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **water supply**? ___ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Wastewater Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Water Supply Section below.

II. Impacts and Permits

A. Describe, in gallons per day (gpd), the volume and source of water use for existing and proposed activities at the project site:

	Existing	Change	Total
Municipal or regional water supply	________	________	________
Withdrawal from groundwater	________	________	________
Withdrawal from surface water	________	________	________
Interbasin transfer	________	________	________

(NOTE: Interbasin Transfer approval will be required if the basin and community where the proposed water supply source is located is different from the basin and community where the wastewater from the source will be discharged.)

B. If the source is a municipal or regional supply, has the municipality or region indicated that there is adequate capacity in the system to accommodate the project? ___ Yes ___ No

C. If the project involves a new or expanded withdrawal from a groundwater or surface water source, has a pumping test been conducted? ___ Yes ___ No; if yes, attach a map of the drilling sites and a summary of the alternatives considered and the results. ______________

D. What is the currently permitted withdrawal at the proposed water supply source (in gallons per day)? ______Will the project require an increase in that withdrawal? ___Yes ___No; if yes, then how much of an increase (gpd)? ____________________

E. Does the project site currently contain a water supply well, a drinking water treatment facility, water main, or other water supply facility, or will the project involve construction of a new facility? ___ Yes ___No. If yes, describe existing and proposed water supply facilities at the project site:

	Permitted Flow	Existing Avg Daily Flow	Project Flow	Total
Capacity of water supply well(s) (gpd)	_______	________	________	________
Capacity of water treatment plant (gpd)	_______	________	________	________

F. If the project involves a new interbasin transfer of water, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or proposed?

G. Does the project involve:

1. new water service by the Massachusetts Water Resources Authority or other agency of the Commonwealth to a municipality or water district? ___ Yes ___ No
2 a Watershed Protection Act variance? ___ Yes ___ No; if yes, how many acres of alteration?
3. a non-bridged stream crossing 1,000 or less feet upstream of a public surface drinking water supply for purpose of forest harvesting activities? ___ Yes ___ No

III. Consistency

Describe the project's consistency with water conservation plans or other plans to enhance water resources, quality, facilities and services:

WASTEWATER SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **wastewater** (see 301 CMR 11.03(5))? __ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **wastewater**? ___ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Transportation -- Traffic Generation Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Wastewater Section below.

II. Impacts and Permits

A. Describe the volume (in gallons per day) and type of disposal of wastewater generation for existing and proposed activities at the project site (calculate according to 310 CMR 15.00 for septic systems or 314 CMR 7.00 for sewer systems):

	Existing	Change	Total
Discharge of sanitary wastewater			
Discharge of industrial wastewater			
TOTAL			

	Existing	Change	Total
Discharge to groundwater			
Discharge to outstanding resource water			
Discharge to surface water			
Discharge to municipal or regional wastewater facility			
Total: Project Site Acreage			

B. Is the existing collection system at or near its capacity? ___ Yes __ No; if yes, then describe the measures to be undertaken to accommodate the project's wastewater flows:

C. Is the existing wastewater disposal facility at or near its permitted capacity? ___ Yes __ No; if yes, then describe the measures to be undertaken to accommodate the project's wastewater flows:

D. Does the project site currently contain a wastewater treatment facility, sewer main, or other wastewater disposal facility, or will the project involve construction of a new facility? ___ Yes __ No; if yes, describe as follows:

	Permitted	Existing Avg Daily Flow	Project Flow	Total
Wastewater treatment plant capacity (in gallons per day)				

E. If the project requires an interbasin transfer of wastewater, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or new?
(NOTE: Interbasin Transfer approval may be needed if the basin and community where wastewater will be discharged is different from the basin and community where the source of water supply is located.)

F. Does the project involve new sewer service by the Massachusetts Water Resources Authority (MWRA) or other Agency of the Commonwealth to a municipality or sewer district? ___ Yes __ No

G. Is there an existing facility, or is a new facility proposed at the project site for the storage, treatment, processing, combustion or disposal of sewage sludge, sludge ash, grit, screenings, wastewater reuse (gray water) or other sewage residual materials? ___ Yes ___No; if yes, what is the capacity (tons per day):

	Existing	Change	Total
Storage	________	________	________
Treatment	________	________	________
Processing	________	________	________
Combustion	________	________	________
Disposal	________	________	________

H. Describe the water conservation measures to be undertaken by the project, and other wastewater mitigation, such as infiltration and inflow removal.

III. Consistency

A. Describe measures that the proponent will take to comply with applicable state, regional, and local plans and policies related to wastewater management:

B. If the project requires a sewer extension permit, is that extension included in a comprehensive wastewater management plan? ___ Yes ___ No; if yes, indicate the EEA number for the plan and whether the project site is within a sewer service area recommended or approved in that plan:

TRANSPORTATION SECTION (TRAFFIC GENERATION)

I. Thresholds / Permit

A. Will the project meet or exceed any review thresholds related to **traffic generation** (see 301 CMR 11.03(6))? _X_ Yes ___ No; if yes, specify, in quantitative terms:

[301 CMR 11.03(6)(a)(vii)] - Construction of 1,000 or more New parking spaces at a single location.

[301 CMR 11.03(6)(b)(xiii)] - Generation of 2,000 or more New adt on roadways providing access to a single location.

[301 CMR 11.03(6)(b)(xiv)] - Generation of 1,000 or more New adt on roadways providing access to a single location and construction of 150 or more New parking spaces at a single location.

[301 CMR 11.03(6)(b)(xv)] - Construction of 300 or more New parking spaces at a single location.

B. Does the project require any state permits related to **state-controlled roadways**? _X_ Yes ___ No; if yes, specify which permit: **MassDOT Access Permit**

C. If you answered "No" to both questions A and B, proceed to the **Roadways and Other Transportation Facilities Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Traffic Generation Section below.

II. Traffic Impacts and Permits

A. Describe existing and proposed vehicular traffic generated by activities at the project site:

	Existing	Change	Total
Number of parking spaces	**1,995 auto** **0 trailer**	**-1,549 auto;** **+724 trailer**	**446 auto** **724 trailer**
Number of vehicle trips per day	**163**	**+2,073**	**2,236**

ITE Land Use Code(s): **LUC 150**

B. What is the estimated average daily traffic on roadways serving the site?

Roadway	Existing	Change	Total
1. **Tech Dr, east of Forestvale Road**	**8,570**	**+1,855**	**10,425**
2. **Reed Rd, south of Site Driveway**	**7,110**	**+88**	**7,198**
3. **Marlboro St, south of Site Driveway**	**7,290**	**+103**	**7,393**

C. If applicable, describe proposed mitigation measures on state-controlled roadways that the project proponent will implement:

The Proponent will evaluate the need for mitigation based on projected operations identified to offset impacts at off-site intersections within the study area.

D. How will the project implement and/or promote the use of transit, pedestrian and bicycle facilities and services to provide access to and from the project site?

The Project will include bicycle storage facilities and create new pedestrian trail connections. Because the Project Site is not located near access to transit, the Proponent will work with future tenants to evaluate options to reduce SOV trips.

E. Is there a Transportation Management Association (TMA) that provides transportation demand management (TDM) services in the area of the project site? ____ Yes _X_ No; if yes, describe if and how the project will participate in the TMA:

F. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation facilities?
____ Yes **_X_** No; if yes, generally describe:

G. If the project will penetrate approach airspace of a nearby airport, has the proponent filed a Massachusetts Aeronautics Commission Airspace Review Form (780 CMR 111.7) and a Notice of Proposed Construction or Alteration with the Federal Aviation Administration (FAA) (CFR Title 14 Part 77.13, forms 7460-1 and 7460-2)?

III. Consistency

Describe measures that the proponent will take to comply with municipal, regional, state, and federal plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services:

The site access and circulation will be consistent with municipal, regional, state, and federal plans and policies related to traffic, and transit facilities and services. The proponent will work with the Town of Hudson and MassDOT to identify and implement mitigation, as appropriate, to offset impacts at off-site intersections within the study area. As mentioned above, a traffic impact study, which has already been submitted to the Town of Hudson for site plan review, is included in Attachment E as part of the EENF for MEPA review. The study was prepared following Massachusetts Department of Transportation (MassDOT) guidelines for completing a Transportation Impact Assessment (TIA).

TRANSPORTATION SECTION (ROADWAYS AND OTHER TRANSPORTATION FACILITIES)

I. Thresholds

A. Will the project meet or exceed any review thresholds related to **roadways or other transportation facilities** (see 301 CMR 11.03(6))? __X__ Yes ___ No; if yes, specify, in quantitative terms:

[301 CMR 11.03(6)(a)(vii)] - Construction of 1,000 or more New parking spaces at a single location.

[301 CMR 11.03(6)(b)(xiii) - Generation of 2,000 or more New adt on roadways providing access to a single location

[301 CMR 11.03(6)(b)(xiv)] - Generation of 1,000 or more New adt on roadways providing access to a single location and construction of 150 or more New parking spaces at a single location

[301 CMR 11.03(6)(b)(xv)] - Construction of 300 or more New parking spaces at a single location

B. Does the project require any state permits related to **roadways or other transportation facilities**? __X__ Yes ___ No; if yes, specify which permit: **MassDOT Access Permit**

C. If you answered "No" to both questions A and B, proceed to the **Energy Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Roadways Section below.

II. Transportation Facility Impacts

A. Describe existing and proposed transportation facilities in the immediate vicinity of the project site:

No existing or proposed transportation facilities are in the immediate vicinity of the Project Site.

B. Will the project involve any

1. Alteration of bank or terrain (in linear feet)? __X__ No
2. Cutting of living public shade trees (number)? __X__ No
3. Elimination of stone wall (in linear feet)? __X__ No

III. Consistency -- Describe the project's consistency with other federal, state, regional, and local plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services, including consistency with the applicable regional transportation plan and the Transportation Improvements Plan (TIP), the State Bicycle Plan, and the State Pedestrian Plan:

The site access and circulation will be consistent with municipal, regional, state, and federal plans and policies related to traffic, and transit facilities and services. The Proponent will work with the Town of Hudson and MassDOT to identify and implement mitigation, as appropriate, to offset impacts at off-site intersections within the study area.

ENERGY SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **energy** (see 301 CMR 11.03(7))?
___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **energy**? ___ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Air Quality Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Energy Section below.

II. Impacts and Permits

A. Describe existing and proposed energy generation and transmission facilities at the project site:

	Existing	Change	Total
Capacity of electric generating facility (megawatts)	________	________	________
Length of fuel line (in miles)	________	________	________
Length of transmission lines (in miles)	________	________	________
Capacity of transmission lines (in kilovolts)	________	________	________

B. If the project involves construction or expansion of an electric generating facility, what are:

1. the facility's current and proposed fuel source(s)?
2. the facility's current and proposed cooling source(s)?

C. If the project involves construction of an electrical transmission line, will it be located on a new, unused, or abandoned right of way? ___Yes ___No; if yes, please describe:

D. Describe the project's other impacts on energy facilities and services:

III. Consistency

Describe the project's consistency with state, municipal, regional, and federal plans and policies for enhancing energy facilities and services:

AIR QUALITY SECTION

I. Thresholds

A. Will the project meet or exceed any review thresholds related to **air quality** (see 301 CMR 11.03(8))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **air quality**? ___ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Solid and Hazardous Waste Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Air Quality Section below.

II. Impacts and Permits

A. Does the project involve construction or modification of a major stationary source (see 310 CMR 7.00, Appendix A)? ___ Yes ___ No; if yes, describe existing and proposed emissions (in tons per day) of:

	Existing	Change	Total
Particulate matter	________	________	________
Carbon monoxide	________	________	________
Sulfur dioxide	________	________	________
Volatile organic compounds	________	________	________
Oxides of nitrogen	________	________	________
Lead	________	________	________
Any hazardous air pollutant	________	________	________
Carbon dioxide	________	________	________

B. Describe the project's other impacts on air resources and air quality, including noise impacts:

III. Consistency

A. Describe the project's consistency with the State Implementation Plan:

B. Describe measures that the proponent will take to comply with other federal, state, regional, and local plans and policies related to air resources and air quality:

SOLID AND HAZARDOUS WASTE SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **solid or hazardous waste** (see 301 CMR 11.03(9))? ___ Yes _**X**_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **solid and hazardous waste**? ___ Yes_**X** No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Historical and Archaeological Resources Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Solid and Hazardous Waste Section below.

II. Impacts and Permits

A. Is there any current or proposed facility at the project site for the storage, treatment, processing, combustion or disposal of solid waste? ___ Yes ___ No; if yes, what is the volume (in tons per day) of the capacity:

	Existing	Change	Total
Storage	________	________	________
Treatment, processing	________	________	________
Combustion	________	________	________
Disposal	________	________	________

B. Is there any current or proposed facility at the project site for the storage, recycling, treatment or disposal of hazardous waste? ___ Yes ___ No; if yes, what is the volume (in tons or gallons per day) of the capacity:

	Existing	Change	Total
Storage	________	________	________
Recycling	________	________	________
Treatment	________	________	________
Disposal	________	________	________

C. If the project will generate solid waste (for example, during demolition or construction), describe alternatives considered for re-use, recycling, and disposal:

D. If the project involves demolition, do any buildings to be demolished contain asbestos?
___ Yes ___ No

E. Describe the project's other solid and hazardous waste impacts (including indirect impacts):

III. Consistency

Describe measures that the proponent will take to comply with the State Solid Waste Master Plan:

HISTORICAL AND ARCHAEOLOGICAL RESOURCES SECTION

I. Thresholds / Impacts

A. Have you consulted with the Massachusetts Historical Commission? __ Yes _X_ No; if yes, attach correspondence. For project sites involving lands under water, have you consulted with the Massachusetts Board of Underwater Archaeological Resources? ____Yes ____ No; if yes, attach correspondence.

B. Is any part of the project site a historic structure, or a structure within a historic district, in either case listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? ___ Yes _X_ No; if yes, does the project involve the demolition of all or any exterior part of such historic structure? ___ Yes _X_ No; if yes, please describe:

C Is any part of the project site an archaeological site listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? _X_ Yes ___ No; if yes, does the project involve the destruction of all or any part of such archaeological site?
_X_ Yes __ No; if yes, please describe:

According to MACRIS MAPS 3.2 accessed on July 5, 2022, a very small area of the Project Site is within the mapped unit of archaeological site 19-MD-854. 19-MD-854 is classified as a findspot and the small area of the mapped unit that overlaps the Project Site was at least partially disturbed through the expansion of a parking lot and driveway as well as associated grading and retaining walls on the property in the 1990s. The area was subjected to an archaeological excavation documented in report #2000.

D. If you answered "No" to all parts of both questions A, B and C, proceed to the **Attachments and Certifications** Sections. If you answered "Yes" to any part of either question A or question B, fill out the remainder of the Historical and Archaeological Resources Section below.

II. Impacts

Describe and assess the project's impacts, direct and indirect, on listed or inventoried historical and archaeological resources:

Given the site classification and prior disturbance, impacts to significant archaeological resources are not anticipated. No archaeological survey is proposed, unless requested by the Massachusetts Historical Commission (MHC).

III. Consistency

Describe measures that the proponent will take to comply with federal, state, regional, and local plans and policies related to preserving historical and archaeological resources:

The Proponent is providing the MHC with a copy of this ENF to initiate review under Section 254 / 950 CMR 71 and will work collaboratively with MHC on the review of the Project. The Proponent is committed to fulfilling its obligations for compliance with MHC's regulations. Potential effects, if any, to listed or eligible historic and archaeological resources will be avoided or mitigated in compliance with MHC regulations and policies.

CLIMATE CHANGE ADAPTATION AND RESILIENCY SECTION

This section of the Environmental Notification Form (ENF) solicits information and disclosures related to climate change adaptation and resiliency, in accordance with the MEPA Interim Protocol on Climate Change Adaptation and Resiliency (the "MEPA Interim Protocol"), effective October 1, 2021. The Interim Protocol builds on the analysis and recommendations of the 2018 Massachusetts Integrated State Hazard Mitigation and Climate Adaptation Plan (SHMCAP) and incorporates the efforts of the Resilient Massachusetts Action Team (RMAT), the inter-agency steering committee responsible for implementation, monitoring, and maintenance of the SHMCAP, including the "Climate Resilience Design Standards and Guidelines" project. The RMAT team recently released the RMAT Climate Resilience Design Standards Tool, which is available here.

The MEPA Interim Protocol is intended to gather project-level data in a standardized manner that will both inform the MEPA review process and assist the RMAT team in evaluating the accuracy and effectiveness of the RMAT Climate Resilience Design Standards Tool. Once this testing process is completed, the MEPA Office anticipates developing a formal Climate Change Adaptation and Resiliency Policy through a public stakeholder process. Questions about the RMAT Climate Resilience Design Standards Tool can be directed to rmat@mass.gov.

All Proponents must complete the following section, referencing as appropriate the results of the output report generated by the RMAT Climate Resilience Design Standards Tool and attached to the ENF. In completing this section, Proponents are encouraged, but not required at this time, to utilize the recommended design standards and associated Tier 1/2/3 methodologies outlined in the RMAT Climate Resilience Design Standards Tool to analyze the project design. However, Proponents are requested to respond to a respond to a user feedback survey on the RMAT website or to provide feedback to rmat@mass.gov, which will be used by the RMAT team to further refine the tool. Proponents are also encouraged to consult general guidance and best practices as described in the RMAT Climate Resilience Design Guidelines.

Climate Change Adaptation and Resiliency Strategies

I. Has the project taken measures to adapt to climate change for all of the climate parameters analyzed in the RMAT Climate Resilience Design Standards Tool (sea level rise/storm surge, extreme precipitation (urban or riverine flooding), extreme heat)? **_X_** Yes __ No

Note: Climate adaptation and resiliency strategies include actions that seek to reduce vulnerability to anticipated climate risks and improve resiliency for future climate conditions. Examples of climate adaptation and resiliency strategies include flood barriers, increased stormwater infiltration, living shorelines, elevated infrastructure, increased tree canopy, etc. Projects should address any planning priorities identified by the affected municipality through the Municipal Vulnerability Preparedness (MVP) program or other planning efforts, and should consider a flexible adaptive pathways approach, an adaptation best practice that encourages design strategies that adapt over time to respond to changing climate conditions. General guidance and best practices for designing for climate risk are described in the RMAT Climate Resilience Design Guidelines.

A. If no, explain why.

B. If yes, describe the measures the project will take, including identifying the planning horizon and climate data used in designing project components. If applicable, specify the return period and design storm used (e.g., 100-year, 24-hour storm).

The Project includes extensive stormwater management treatment and control systems that have been designed to ensure the Project development does not result in or contribute to potential flooding in the area. While the Project Site is well above the 100- and 500-year flood plain, it is understood that development and redevelopment of land can often lead to impacts downstream of the overall property. It is important to not only control runoff rates from impervious surfaces, but also to control runoff volumes from

project sites to maintain natural hydrologic balances to the extent possible. For this project, the design team has analyzed the stormwater management system using a 25-year, 24-hour design storm for the overall underground pipe network and a 100-year, 24-hour design storm for the overall stormwater management systems on the site. The design storms are based on precipitation data from the publication titled Extreme Precipitation in New York and New England, also known as the Cornell Study. The precipitation values in this study typically exceed the values recommended by the Massachusetts Stormwater Handbook. A copy of the full stormwater management study is included as Attachment G.

C. Is the project contributing to regional adaptation strategies? __Yes **_X_** No; If yes, describe.

II. Has the Proponent considered alternative locations for the project in light of climate change risks? ___ Yes **_X_** No.

A. If no, explain why.

The Project will not be within existing or expected future mapped floodplain. Resilient features provided in the Project are not site-specific, and therefore alternative locations would not provide additional benefits.

B. If yes, describe alternatives considered.

III. Is the project located in Land Subject to Coastal Storm Flowage (LSCSF) or Bordering Land Subject to Flooding (BLSF) as defined in the Wetlands Protection Act? ____Yes **_X_** No

If yes, describe how/whether proposed changes to the site's topography (including the addition of fill) will result in changes to floodwater flow paths and/or velocities that could impact adjacent properties or the functioning of the floodplain. General guidance on providing this analysis can be found in the CZM/MassDEP Coastal Wetlands Manual, available here.

ENVIRONMENTAL JUSTICE SECTION

Please see Attachment F for more detailed information regarding potential EJ impacts.

I. Identifying Characteristics of EJ Populations

A. If an Environmental Justice (EJ) population has been identified as located in whole or in part within 5 miles of the project site, describe the characteristics of each EJ populations as identified in the EJ Maps Viewer (i.e., the census block group identification number and EJ characteristics of "Minority," "Minority and Income," etc.). Provide a breakdown of those EJ populations within 1 mile of the project site, and those within 5 miles of the site.

		Minority	Income	English Isolation
Within 1 Mile				
Block Group 2	Census Tract 3224	Yes	No	No
Block Group 3	Census Tract 3216	Yes	No	No
Within 5 Miles				
Block Group 1	Census Tract 3216	Yes	No	No
Block Group 1	Census Tract 3213	Yes	No	No
Block Group 2	Census Tract 3211	Yes	No	No
Block Group 2	Census Tract 3212	Yes	No	No
Block Group 2	Census Tract 3213	Yes	No	No
Block Group 2	Census Tract 3215	Yes	Yes	Yes
Block Group 2	Census Tract 3214	Yes	No	No
Block Group 3	Census Tract 3212	Yes	No	No
Block Group 3	Census Tract 3213	Yes	Yes	Yes
Block Group 4	Census Tract 3216	Yes	No	No
Block Group 5	Census Tract 3213	Yes	No	No
Block Group 6	Census Tract 3839.01	Yes	No	No
Block Group 6	Census Tract 3213	Yes	Yes	No

B. Identify all languages identified in the "Languages Spoken in Massachusetts" tab of the EJ Maps Viewer as spoken by 5 percent or more of the EJ population who also identify as not speaking English "very well." The languages should be identified for each census tract located in whole or in part within 1 mile and 5 miles of the project site, regardless of whether such census tract contains any designated EJ populations.

Portuguese or Portuguese Creole, Spanish or Spanish Creole.

C. If the list of languages identified under Section I.B. has been modified with approval of the EEA EJ Director, provide a list of approved languages that the project will use to provide public involvement opportunities during the course of MEPA review. If the list has been expanded by the Proponent (without input from the EEA EJ Director), provide a list of the additional languages that will be used to provide public involvement opportunities during the course of MEPA review as required by Part II of the MEPA Public Involvement Protocol for Environmental Justice Populations ("MEPA EJ Public Involvement Protocol"). If the project is exempt from Part II of the protocol, please specify**. N/A**

II. Potential Effects on EJ Populations

A. If an EJ population has been identified using the EJ Maps Viewer within 1 mile of the project site, describe the likely effects of the project (both adverse and beneficial) on the identified EJ population(s).

The Project will not directly or indirectly, cause damage to the Environment which would affect the EJ population. There will be temporary impacts anticipated from construction and include construction traffic and noise.

The Project does not exceed any MEPA thresholds for a mandatory Environmental Impact Report relative to wastewater (301 CMR 11.03(5)), air emissions (11.03(8)), and solid and hazardous waste (11.03(9)).

The Project will provide both construction and permanent job opportunities for residents in the surrounding communities.

B. If an EJ population has been identified using the EJ Maps Viewer within 5 miles of the project site, will the project: (i) meet or exceed MEPA review thresholds under 301 CMR 11.03(8)(a)-(b) __ Yes _X_ No; or (ii) generate150 or more new average daily trips (adt) of diesel vehicle traffic, excluding public transit trips, over a duration of 1 year or more. _X_ Yes _ _ No

C. If you answered "Yes" to either question in Section II.B., describe the likely effects of the project (both adverse and beneficial) on the identified EJ population(s).

The Project is expected to have positive economic benefits through job creation at what has been a vacant commercial property. The Project is not expected to significantly adversely affect EJ populations in any manner. All truck traffic from the Project will be directed directly to I-495 via Technology Drive and Route 85C, avoiding EJ populations. Some minor increase in truck traffic on I-495 will pass through EJ census blocks on 495 approximately three miles from the Project, however, this increase is not expected to have any material impact on air quality in that area.

III. Public Involvement Activities

A. Provide a description of activities conducted prior to filing to promote public involvement by EJ populations, in accordance with Part II of the MEPA EJ Public Involvement Protocol. In particular:

1. If advance notification was provided under Part II.A., attach a copy of the Environmental Justice Screening Form and provide list of CBOs/tribes contacted (with dates). Copies of email correspondence can be attached in lieu of a separate list.
   Please see the EJ Screening Form and Distribution List in Attachment F.

2. State how CBOs and tribes were informed of ways to request a community meeting, and if any meeting was requested. If public meetings were held, describe any issues of concern that were raised at such meetings, and any steps taken (including modifications to the project design) to address such concerns.

   The EJ Screening Form (sent out in English, Portuguese, and Spanish) advised recipients on how to contact the Proponent via phone or e-mail to request a meeting or ask questions about the Project. No inquiries were received.

   In addition, the Proponent emailed flyers regarding the project to a supplemental list of persons. The flyer showed the location of the project, provided a brief project description, and again advised how to contact the Proponent via phone or email to learn more about the Project. Again, no responses were received.

3. If the project is exempt from Part II of the protocol, please specify. **N/A**

B. Provide below (or attach) a distribution list (if different from the list in Section III.A. above) of CBOs and tribes, or other individuals or entities the Proponent intends to maintain for the notice of the MEPA Site Visit and circulation of other materials and notices during the course of MEPA review.

The Proponent intends to continue to send all pertinent project information to those listed on the EJ Reference List provided by the State EJ Office as well as to all those on the supplemental List also included in Attachment F.

C. Describe (or submit as a separate document) the Proponent's plan to maintain the same level of community engagement throughout the MEPA review process, as conducted prior to filing.

The Proponent intends to continue to send all pertinent project information to those listed on the EJ Reference List provided by the State EJ Office as well as to all those on the supplemental List of local entities also included in Attachment F.

CERTIFICATIONS:

1. The Public Notice of Environmental Review has been/will be published in the following newspapers in accordance with 301 CMR 11.15(1):

   (Name)_**Boston Herald**_________(Date)_**August 1, 2022**

2. This form has been circulated to Agencies and Persons in accordance with 301 CMR 11.16(2).

Signatures:

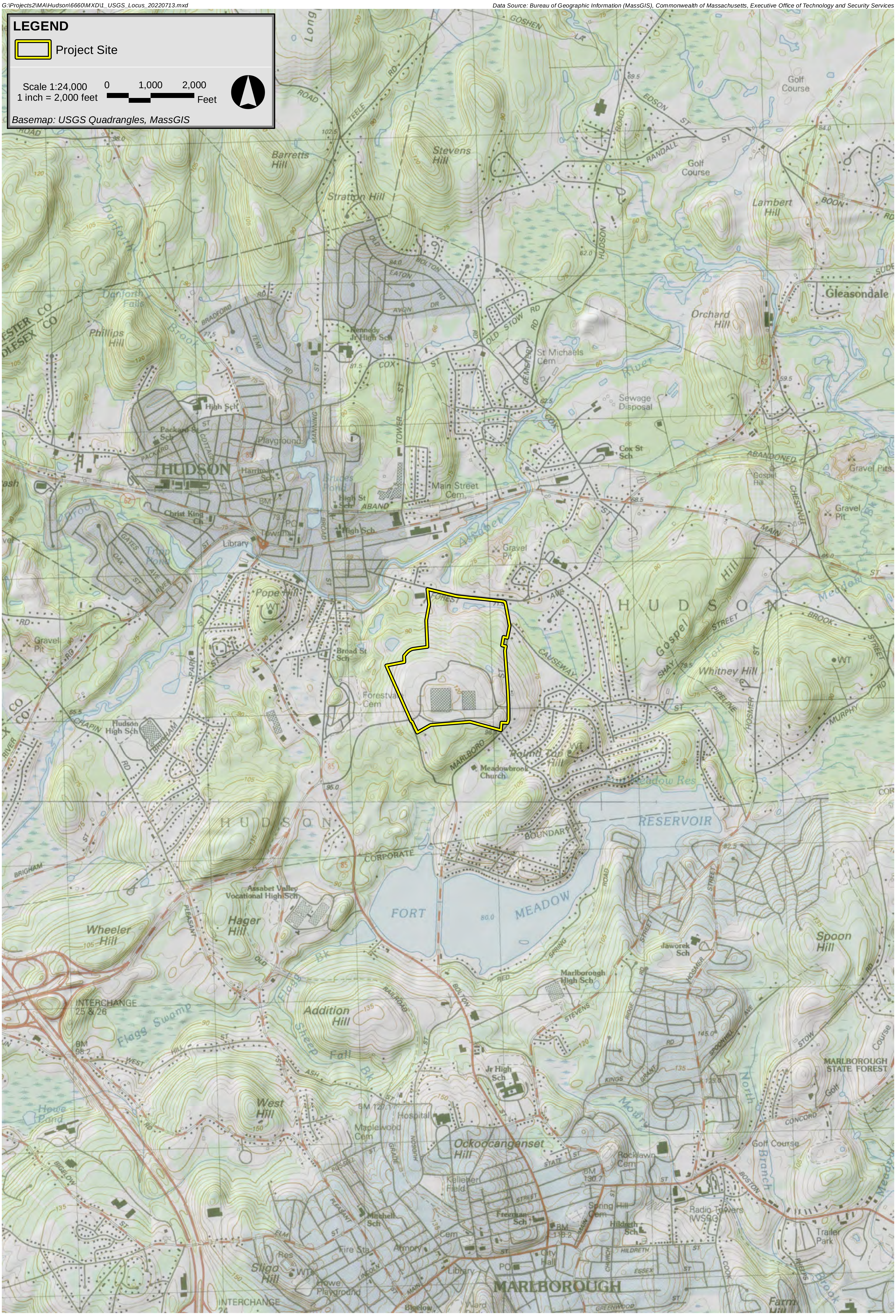
Mike Wurtsbaugh	**David Hewett**
Name (print or type)	Name (print or type)
Portman Industrial, LLC	**Epsilon Associates, Inc.**
Firm/Agency	Firm/Agency
303 Peachtree Center Avenue, #575	**3 Mill and Main Place, Suite 250**
Street	Street
Atlanta, GA 30303	**Maynard, MA 01754**
Municipality/State/Zip	Municipality/State/Zip
(404) 614-5140	**(978) 897-7100**
Phone	Phone

Attachment A

ENF Figures

G:\Projects2\MA\Hudson\6660\MXD\1_USGS_Locus_20220713.mxd

Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services



75 Reed Road **Hudson, Massachusetts**

Figure 1

USGS Locus Map

G:\Projects2\MA\Hudson\6660\MXD\2_Aerial_Locus_20220713.mxd

Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services

75 Reed Road **Hudson, Massachusetts**

Epsilon
ASSOCIATES INC.

Figure 2
Aerial Locus Map

ZONING TABLE	
ZONE: M6 INDUSTRIAL	
DIMENSIONAL CRITERIA	REQUIRED
MINIMUM LOT AREA, S.F.	60,000
MINIMUM LOT FRONTAGE, FT.	150
MINIMUM FRONT YARD, FT.	30
MINIMUM SIDE YARD, FT.	20
MINIMUM REAR YARD, FT.	20
MINIMUM OPEN SPACE*, %	35

NOTES:
- TOTAL PARCEL AREA: 148.66 ACRES
- THE PROPERTY IS LOCATED WITHIN THE M6 INDUSTRIAL ZONING DISTRICT.
- THE PROPERTY DOES NOT CONTAIN ANY FEMA FLOODPLAINS, NHESP PRIORITY HABITATS, AREAS OF CRITICAL ENVIRONMENTAL CONCERN, OR VERNAL POOLS.
- PROPERTY LINES OBTAINED FROM "PLAN OF LAND IN HUDSON, MASSACHUSETTS" DRAWN BY THE BSC GROUP, INC. ON MARCH 20, 1998 AND "PLAN OF LAND IN HUDSON, MASS" DRAWN BY VEO & WHEELER INC. ON FEBRUARY 10, 1968.
- THIS PLAN IS CONCEPTUAL IN NATURE AND HAS BEEN COMPILED BASED ON READILY AVAILABLE RECORD INFORMATION. ACTUAL BOUNDARY, TOPOGRAPHIC AND EXISTING CONDITIONS SURVEY HAS NOT BEEN COMPLETED AT THIS TIME. WETLAND DATA, IF ANY, HAS BEEN OBTAINED THROUGH GIS OR OTHER RECORD SOURCES AND IS NOT THE RESULT OF AN ACTUAL DELINEATION. EVERY EFFORT HAS BEEN MADE TO COMPLY WITH LOCAL ZONING BYLAWS TO THE EXTENT PRACTICAL GIVEN THE ACCURACY LEVEL OF THE BASE INFORMATION. ZONING COMPLIANCE AND DESIGN FEASIBILITY SHOULD CONTINUE TO BE VERIFIED AS THE BASE INFORMATION IS UPDATED TO HIGHER ACCURACY STANDARDS.

75 Reed Road Hudson, Massachusetts

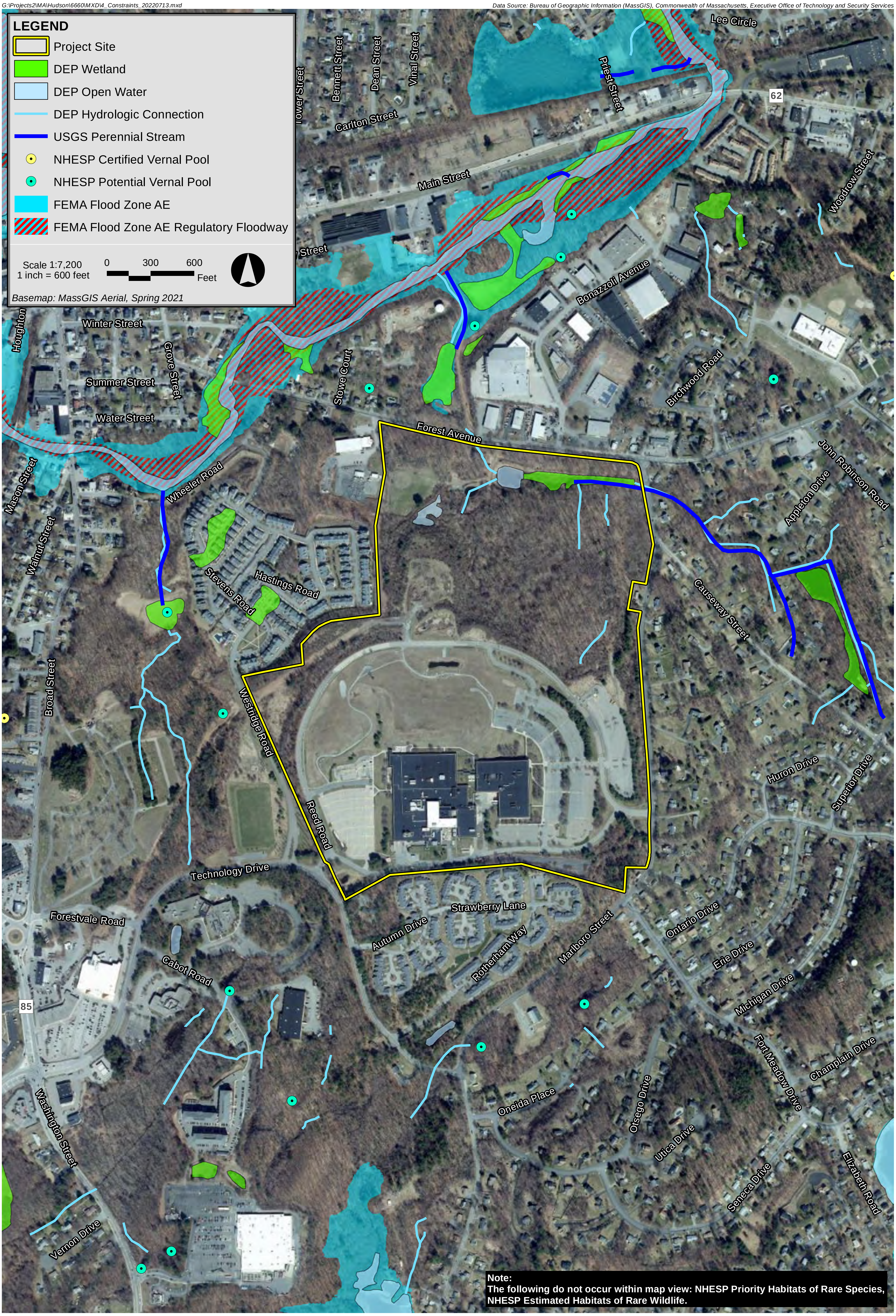
Epsilon ASSOCIATES INC.

Figure 3

Existing Conditions Plan

G:\Projects2\MA\Hudson\6660\MXD\4_Constraints_20220713.mxd

Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services



75 Reed Road Hudson, Massachusetts

Epsilon ASSOCIATES INC.

Figure 4

Environmental Constraints - DEP Wetlands, NHESP Features, and FEMA Flood Zones

G:\Projects2\MA\Hudson\6660\MXD\5_Constraints_20220713.mxd

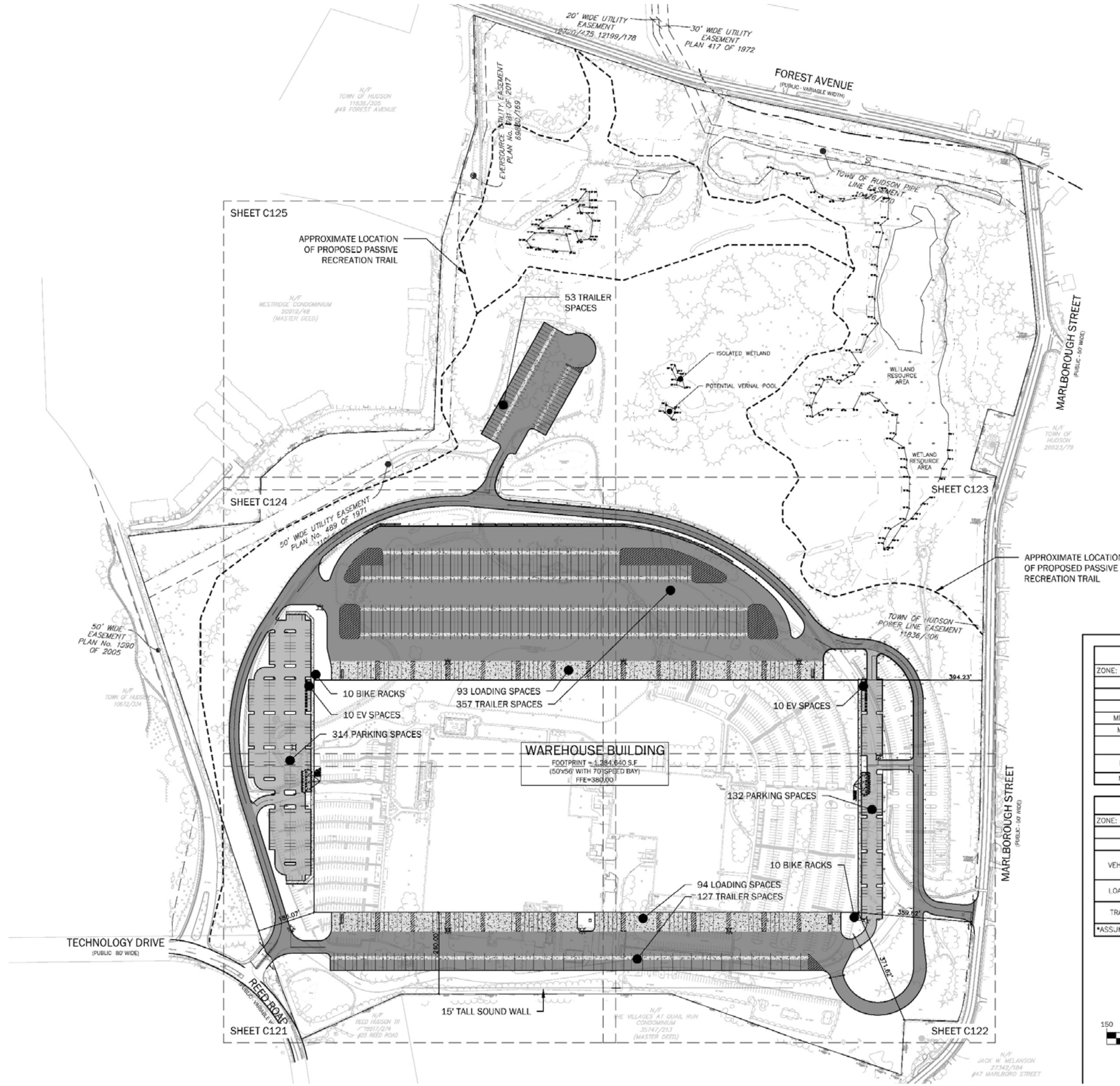
Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services

75 Reed Road Hudson, Massachusetts

Epsilon ASSOCIATES INC.

Figure 5

Environmental Constraints – ACEC, DEP Zone I & II, Article 97 Lands



ZONING TABLE		
ZONE: M6 INDUSTRIAL		
DIMENSIONAL CRITERIA	REQUIRED	PROVIDED
MINIMUM LOT AREA, S.F.	60,000	6,427,585
MINIMUM LOT FRONTAGE, FT.	150	364
MINIMUM FRONT YARD, FT.	30	394
MINIMUM SIDE YARD, FT.	20	260
MINIMUM REAR YARD, FT.	20	185
MINIMUM OPEN SPACE, %	35	58

PARKING SUMMARY		
ZONE: M6 INDUSTRIAL		
USE	REQUIRED	PROVIDED
VEHICLE PARKING	286 SPACES (1 SPACE/3 EMPLOYEES BASED ON THE MAXIMUM NUMBER OF EMPLOYEES*)	446 SPACES
LOADING SPACES	–	187 SPACES
TRAILER SPACES	–	537 SPACES

*ASSUMED 1,500 GFA PER EMPLOYEE (856 EMPLOYEES)

GRAPHIC SCALE
150 0 75 150 300 600
(IN FEET)
1 inch = 150 ft.

75 Reed Road **Hudson, Massachusetts**

Epsilon ASSOCIATES INC.

Figure 6

Site Plan

PLANTING NOTES:

1. THE LANDSCAPE CONTRACTOR SHALL SUPPLY ALL PLANTS IN QUANTITIES SUFFICIENT TO COMPLETE THE WORK SHOWN ON THE PLAN.

2. ANY SUBSTITUTION OF SPECIFIED PLANTS SHALL BE APPROVED BY THE LANDSCAPE ARCHITECT. ONLY NATIVE SPECIES AND/OR VARIETIES WILL BE ACCEPTABLE.

3. ALL TREE, SHRUB, VINE, AND PLANT BED (GROUNDCOVERS, PERENNIALS, BULBS, ETC.) LOCATIONS SHALL BE STAKED OR MARKED BY CONTRACTOR AND THEN APPROVED BY THE LANDSCAPE ARCHITECT IN THE FIELD PRIOR TO PLANTING. CONTRACTOR MUST GIVE A MINIMUM 3 DAY NOTICE BETWEEN STAKING AND PLANTING.

4. CHALK MARK NORTH AT TREE BASE PRIOR TO DIGGING AT NURSERY. REPLANT ON SITE WITH SAME NORTH ORIENTATION FOR ALL TREES.

5. ALL PLANTS INSTALLED SHALL MEET THE SPECIFICATIONS OF THE AMERICAN STANDARD FOR NURSERY STOCK (LATEST ADDITION) AS SET FORTH BY THE AMERICAN NURSERY AND LANDSCAPE ASSOCIATION.

6. ALL PLANTS SHALL BE DELIVERED TO THE SITE FOR REVIEW BY THE LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.

7. THE LANDSCAPE CONTRACTOR IS ADVISED OF THE EXISTENCE OF UNDERGROUND UTILITIES, THE LOCATION OF WHICH SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO ANY EXCAVATION OPERATIONS. SHOULD THE LOCATION OF PROPOSED PLANTINGS CONFLICT WITH ANY OF SAID UTILITIES, ADJUST PLANT LOCATIONS ACCORDINGLY AFTER CONSULTATION WITH THE LANDSCAPE ARCHITECT.

8. PLANTING TREES AND SHRUBS: EXCAVATE PLANTING PITS WITH SLOPING SIDES, AND WITH BOTTOM OF EXCAVATION RAISED IN CENTER FOR DRAINAGE. LOOSEN HARD SUBSOIL IN BOTTOM OF EXCAVATION, AND LOOSEN SOIL ON SIDES OF SLOPES. SET PLANTS IN CENTER OF PIT WITH TOP OF BALL RAISED SLIGHTLY ABOVE FINISH GRADES. PLACE A SETTING LAYER OF COMPACTED PLANTING MIX. REMOVE BURLAP AND WIRE BASKETS FROM TOP OF BALLS. ON SIDES, FOLD BACK WIRE AND REMOVE UPPER PORTIONS OF BURLAP. DO NOT USE PLANT IF ROOT BALL IS CRACKED OR BROKEN. IF CONTAINER, REMOVE CONTAINER AND SCOUR PERIMETER SOIL AND ROOTS. PLACE PLANTING MIX AROUND BALL/CONTAINER IN LAYERS, TAMPING TO ELIMINATE VOIDS AND AIR POCKETS. DO NOT COVER TOP OF ROOT BALL. PRUNE, THIN, AND SHAPE AFTER PLANTING.

9. MULCH PLANTING BEDS AND TREE PITS WITH 3" SHREDDED BARK MULCH OR COMPOST AS SPECIFIED ON THE PLAN.

10. ALL DISTURBED LAWN AREAS TO BE LOAMED AND SEEDED AS NECESSARY AT NO ADDITIONAL COST TO OWNER(S).

11. GRADES SHOWN REPRESENT PROPOSED GRADES PER CONTRACT. CONTRACTOR TO VERIFY GRADES AS NEEDED.

12. PLANT MATERIALS SHALL BE GUARANTEED FOR ONE (1) YEAR AFTER PLANTING. ANY DEAD, UNSIGHTLY, OR UNHEALTHY PLANTS SHALL BE REPLACED IN KIND AT NO COST TO THE OWNER(S).

13. THE CONTRACTOR SHALL REPLACE OR REPAIR TO ORIGINAL CONDITION ANY AND ALL UTILITIES, PAVING, CURBING, ETC., DAMAGED AS A RESULT OF THEIR OPERATIONS AT NO ADDITIONAL COST TO THE OWNER(S).

14. A PRE-CONSTRUCTION MEETING SHALL BE HELD PRIOR TO LANDSCAPE CONTRACTOR BEGINNING CONSTRUCTION OR ORDERING PLANT MATERIALS.

15. PLANTING PLAN IS DIAGRAMMATIC IN NATURE. FINAL PLACEMENT OF PLANTS TO BE APPROVED BY THE LANDSCAPE ARCHITECT IN THE FIELD.

SEEDING NOTES:

1. THE FOLLOWING GENERAL PRACTICES SHALL BE USED TO ESTABLISH LAWNS. FOR MORE DETAILED SPECIFIC REQUIREMENTS, REFER TO PROJECT MANUAL AND WRITTEN EROSION AND SEDIMENTATION CONTROL PLAN:

2. ALL DISTURBED AREAS ON-SITE NOT COVERED BY BUILDINGS OR PAVED AREAS SHALL RECEIVE A MINIMUM OF 4" OF LOAM AND SEEDED, UNLESS DETAILED OR SPECIFIED ELSEWHERE.

3. ALL FINAL SEEDING SHALL BE COMPLETED WITHIN SEVEN (7) DAYS FOLLOWING THE FINAL GRADING.

4. FOR LAWN CONSTRUCTION SPECIFICATIONS, SOIL AMENDMENTS, SEED MIX AND APPLICATION RATES, REFER TO THE PROJECT MANUAL AND THE "EROSION AND SEDIMENTATION CONTROL PLAN".

5. ALL AREAS SHALL BE MULCHED IMMEDIATELY AFTER SEEDING. MULCHING SHALL BE MONITORED. IF MULCHING PROVES TO BE INEFFECTIVE, THEN NETTING AND MATTING SHALL BE USED IN ITS PLACE.

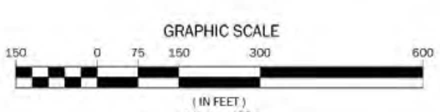
6. CONSTRUCTION SHALL BE PLANNED TO ELIMINATE THE NEED FOR SEEDING BETWEEN OCTOBER 1 AND APRIL 15. DORMANT SEEDING SHALL NOT BE USED UNLESS APPROVED BY OWNER'S REPRESENTATIVE.

7. SHOULD DORMANT SEEDING BE NECESSARY, THE SPECIFIED SEED APPLICATION RATE SHALL BE DOUBLED.

8. FOR LATE SEEDING OR DORMANT SEEDING, ALL FERTILIZING, SEEDING, AND MULCHING SHALL BE DONE ON THE SAME DAY IMMEDIATELY AFTER THE LOAM IS SPREAD. FINAL GRADING SHALL BE LIMITED TO AREAS WHICH CAN BE COMPLETED AND SEEDED THE SAME DAY.

PLANT LIST

QTY	NAME	SCIENTIFIC	SIZE
TREES:			
35	'OCTOBER GLORY' RED MAPLE	ACER RUBRUM 'OCTOBER GLORY'	2.5-2.75" CAL.
35	CELEBRATION MAPLE	ACER X FREEANII 'CELEBRATION'	2.5-2.75" CAL.
34	RED OAK	QUERCUS RUBRA	2.5-2.75" CAL.
34	PIN OAK	QUERCUS PALUSTRIS	2.5-2.75" CAL.
34	'GREEN GABLE' BLACK GUM TREE	NYSSA SYLVATICA 'GREEN GABLE'	2.5-2.75" CAL.
34	'GREENSPIRE' LINDEN	TILIA CORDATA 'GREENSPIRE'	2.5-2.75" CAL.
EVERGREENS:			
23	WHITE SPRUCE	PICEA GLAUCA	8-10 FT HT.
22	NORWAY SPRUCE	PICEA ABIES	8-10 FT HT.
22	RED PINE	PINUS RESINOSA	8-10 FT HT.

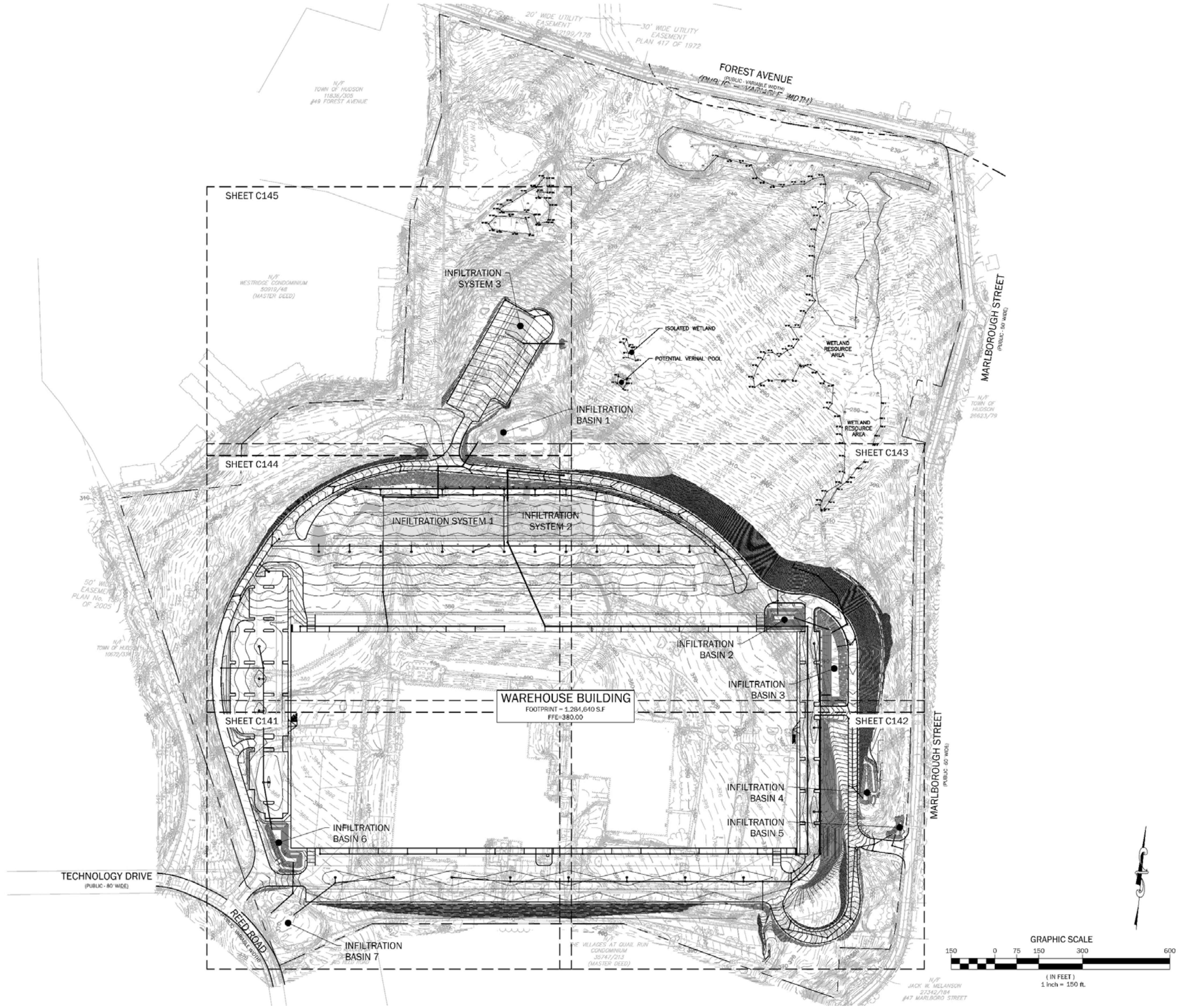


75 Reed Road **Hudson, Massachusetts**

Epsilon ASSOCIATES INC.

Figure 7

Landscape Plan



75 Reed Road Hudson, Massachusetts

Epsilon ASSOCIATES INC.

Figure 8

Stormwater Plan

ZONING TABLE

ZONE: M6 INDUSTRIAL

DIMENSIONAL CRITERIA	REQUIRED
MINIMUM LOT AREA, S.F.	60,000
MINIMUM LOT FRONTAGE, FT.	150
MINIMUM FRONT YARD, FT.	30
MINIMUM SIDE YARD, FT.	20
MINIMUM REAR YARD, FT.	20
MINIMUM OPEN SPACE*, %	35

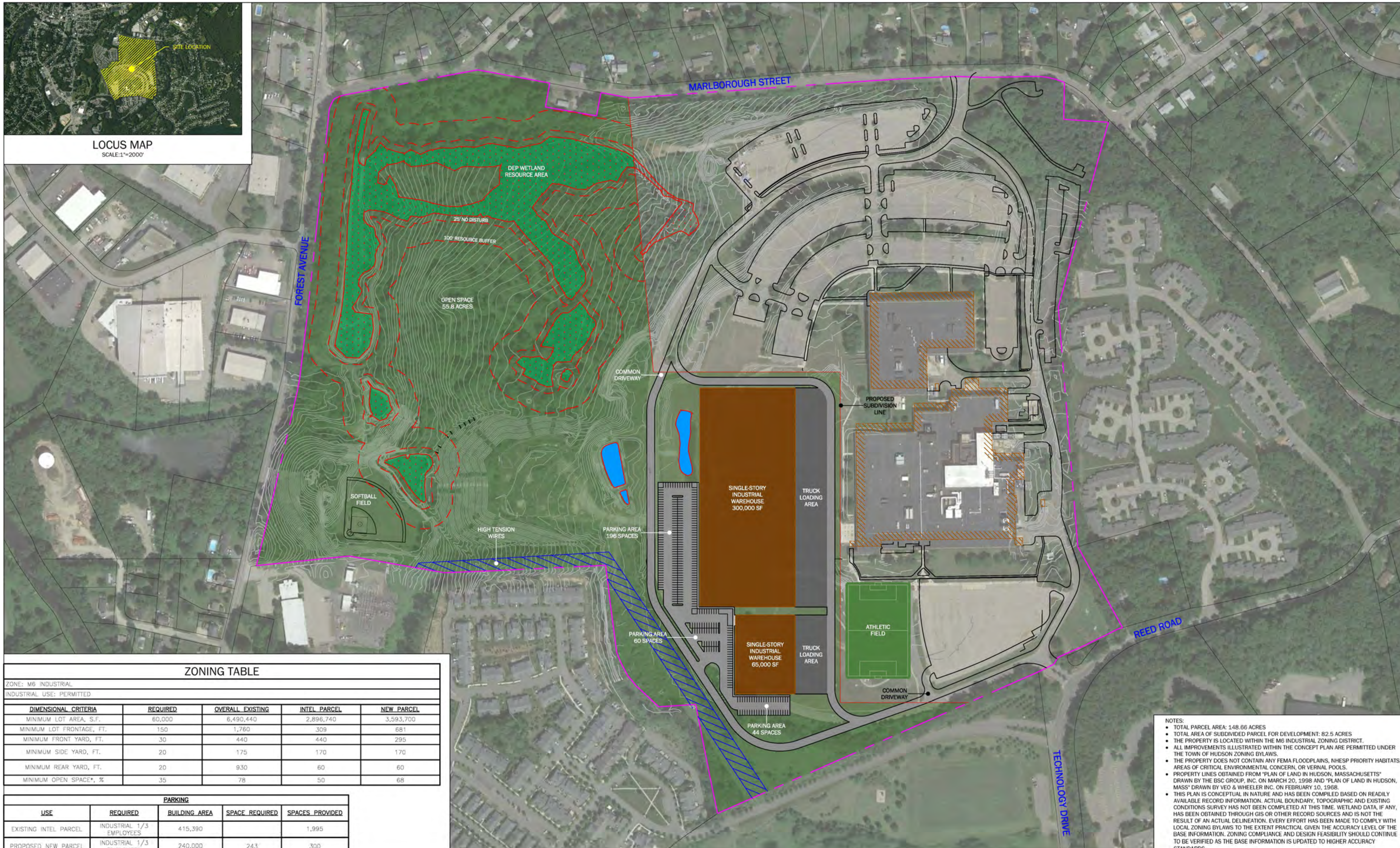
NOTES:

- TOTAL PARCEL AREA: 148.66 ACRES
- THE PROPERTY IS LOCATED WITHIN THE M6 INDUSTRIAL ZONING DISTRICT.
- THE PROPERTY DOES NOT CONTAIN ANY FEMA FLOODPLAINS, NHESP PRIORITY HABITATS, AREAS OF CRITICAL ENVIRONMENTAL CONCERN, OR VERNAL POOLS.
- PROPERTY LINES OBTAINED FROM "PLAN OF LAND IN HUDSON, MASSACHUSETTS" DRAWN BY THE BSC GROUP, INC. ON MARCH 20, 1998 AND "PLAN OF LAND IN HUDSON, MASS" DRAWN BY VEO & WHEELER INC. ON FEBRUARY 10, 1968.
- THIS PLAN IS CONCEPTUAL IN NATURE AND HAS BEEN COMPILED BASED ON READILY AVAILABLE RECORD INFORMATION. ACTUAL BOUNDARY, TOPOGRAPHIC AND EXISTING CONDITIONS SURVEY HAS NOT BEEN COMPLETED AT THIS TIME. WETLAND DATA, IF ANY, HAS BEEN OBTAINED THROUGH GIS OR OTHER RECORD SOURCES AND IS NOT THE RESULT OF AN ACTUAL DELINEATION. EVERY EFFORT HAS BEEN MADE TO COMPLY WITH LOCAL ZONING BYLAWS TO THE EXTENT PRACTICAL GIVEN THE ACCURACY LEVEL OF THE BASE INFORMATION. ZONING COMPLIANCE AND DESIGN FEASIBILITY SHOULD CONTINUE TO BE VERIFIED AS THE BASE INFORMATION IS UPDATED TO HIGHER ACCURACY STANDARDS.

75 Reed Road Hudson, Massachusetts

Figure 9

No-Build Alternative



ZONING TABLE

ZONE: M6 INDUSTRIAL

INDUSTRIAL USE: PERMITTED

DIMENSIONAL CRITERIA	REQUIRED	OVERALL EXISTING	INTEL PARCEL	NEW PARCEL
MINIMUM LOT AREA, S.F.	60,000	6,490,440	2,896,740	3,593,700
MINIMUM LOT FRONTAGE, FT.	150	1,760	309	681
MINIMUM FRONT YARD, FT.	30	440	440	295
MINIMUM SIDE YARD, FT.	20	175	170	170
MINIMUM REAR YARD, FT.	20	930	60	60
MINIMUM OPEN SPACE*, %	35	78	50	68

PARKING

USE	REQUIRED	BUILDING AREA	SPACE REQUIRED	SPACES PROVIDED
EXISTING INTEL PARCEL	INDUSTRIAL 1/3 EMPLOYEES	415,390		1,995
PROPOSED NEW PARCEL	INDUSTRIAL 1/3 EMPLOYEES	240,000	243	300

NOTES:

- TOTAL PARCEL AREA: 148.66 ACRES
- TOTAL AREA OF SUBDIVIDED PARCEL FOR DEVELOPMENT: 82.5 ACRES
- THE PROPERTY IS LOCATED WITHIN THE M6 INDUSTRIAL ZONING DISTRICT.
- ALL IMPROVEMENTS ILLUSTRATED WITHIN THE CONCEPT PLAN ARE PERMITTED UNDER THE TOWN OF HUDSON ZONING BYLAWS.
- THE PROPERTY DOES NOT CONTAIN ANY FEMA FLOODPLAINS, NHESP PRIORITY HABITATS, AREAS OF CRITICAL ENVIRONMENTAL CONCERN, OR VERNAL POOLS.
- PROPERTY LINES OBTAINED FROM "PLAN OF LAND IN HUDSON, MASSACHUSETTS" DRAWN BY THE BSC GROUP, INC. ON MARCH 20, 1998 AND "PLAN OF LAND IN HUDSON, MASS" DRAWN BY VEO & WHEELER INC. ON FEBRUARY 10, 1968.
- THIS PLAN IS CONCEPTUAL IN NATURE AND HAS BEEN COMPILED BASED ON READILY AVAILABLE RECORD INFORMATION. ACTUAL BOUNDARY, TOPOGRAPHIC AND EXISTING CONDITIONS SURVEY HAS NOT BEEN COMPLETED AT THIS TIME. WETLAND DATA, IF ANY, HAS BEEN OBTAINED THROUGH GIS OR OTHER RECORD SOURCES AND IS NOT THE RESULT OF AN ACTUAL DELINEATION. EVERY EFFORT HAS BEEN MADE TO COMPLY WITH LOCAL ZONING BYLAWS TO THE EXTENT PRACTICAL GIVEN THE ACCURACY LEVEL OF THE BASE INFORMATION. ZONING COMPLIANCE AND DESIGN FEASIBILITY SHOULD CONTINUE TO BE VERIFIED AS THE BASE INFORMATION IS UPDATED TO HIGHER ACCURACY STANDARDS.

ZONING TABLE

ZONE: M6 INDUSTRIAL

RETAIL USE: PERMITTED

DIMENSIONAL CRITERIA	REQUIRED	OVERALL EXISTING	INTEL PARCEL	NEW PARCEL
MINIMUM LOT AREA, S.F.	60,000	6,490,440	2,034,352	4,456,188
MINIMUM LOT FRONTAGE, FT.	150	1,760	309	681
MINIMUM FRONT YARD, FT.	30	440	810	145
MINIMUM SIDE YARD, FT.	20	175	320	200
MINIMUM REAR YARD, FT.	20	930	50	50
MINIMUM OPEN SPACE*, %	35	78	56.2	50.4

PARKING

USE	REQUIRED	BUILDING AREA	SPACE REQUIRED	SPACES PROVIDED
EXISTING INTEL PARCEL	INDUSTRIAL 1/3 EMPLOYEES	415,390		1,995
PROPOSED NEW PARCEL	2 SPACES/ ESTABLISHMENT OR 1/200 SF. WHICHEVER IS LARGER PLUS 1/ 3 EMPLOYEES	394,900	2,238	2,361

NOTES:

- TOTAL PARCEL AREA: 148.66 ACRES
- TOTAL AREA OF SUBDIVIDED PARCEL FOR DEVELOPMENT: 102.3 ACRES
- THE PROPERTY IS LOCATED WITHIN THE M6 INDUSTRIAL ZONING DISTRICT.
- ALL IMPROVEMENTS ILLUSTRATED WITHIN THE CONCEPT PLAN ARE PERMITTED UNDER THE TOWN OF HUDSON ZONING BYLAWS.
- THE PROPERTY DOES NOT CONTAIN ANY FEMA FLOODPLAINS, NHESP PRIORITY HABITATS, AREAS OF CRITICAL ENVIRONMENTAL CONCERN, OR VERNAL POOLS.
- PROPERTY LINES OBTAINED FROM "PLAN OF LAND IN HUDSON, MASSACHUSETTS" DRAWN BY THE BSC GROUP, INC. ON MARCH 20, 1998 AND "PLAN OF LAND IN HUDSON, MASS" DRAWN BY VEO & WHEELER INC. ON FEBRUARY 10, 1968.
- THIS PLAN IS CONCEPTUAL IN NATURE AND HAS BEEN COMPILED BASED ON READILY AVAILABLE RECORD INFORMATION. ACTUAL BOUNDARY, TOPOGRAPHIC AND EXISTING CONDITIONS SURVEY HAS NOT BEEN COMPLETED AT THIS TIME. WETLAND DATA, IF ANY, HAS BEEN OBTAINED THROUGH GIS OR OTHER RECORD SOURCES AND IS NOT THE RESULT OF AN ACTUAL DELINEATION. EVERY EFFORT HAS BEEN MADE TO COMPLY WITH LOCAL ZONING BYLAWS TO THE EXTENT PRACTICAL GIVEN THE ACCURACY LEVEL OF THE BASE INFORMATION. ZONING COMPLIANCE AND DESIGN FEASIBILITY SHOULD CONTINUE TO BE VERIFIED AS THE BASE INFORMATION IS UPDATED TO HIGHER ACCURACY STANDARDS.

75 Reed Road Hudson, Massachusetts

Figure 11

Zoning-Compliant Alternative

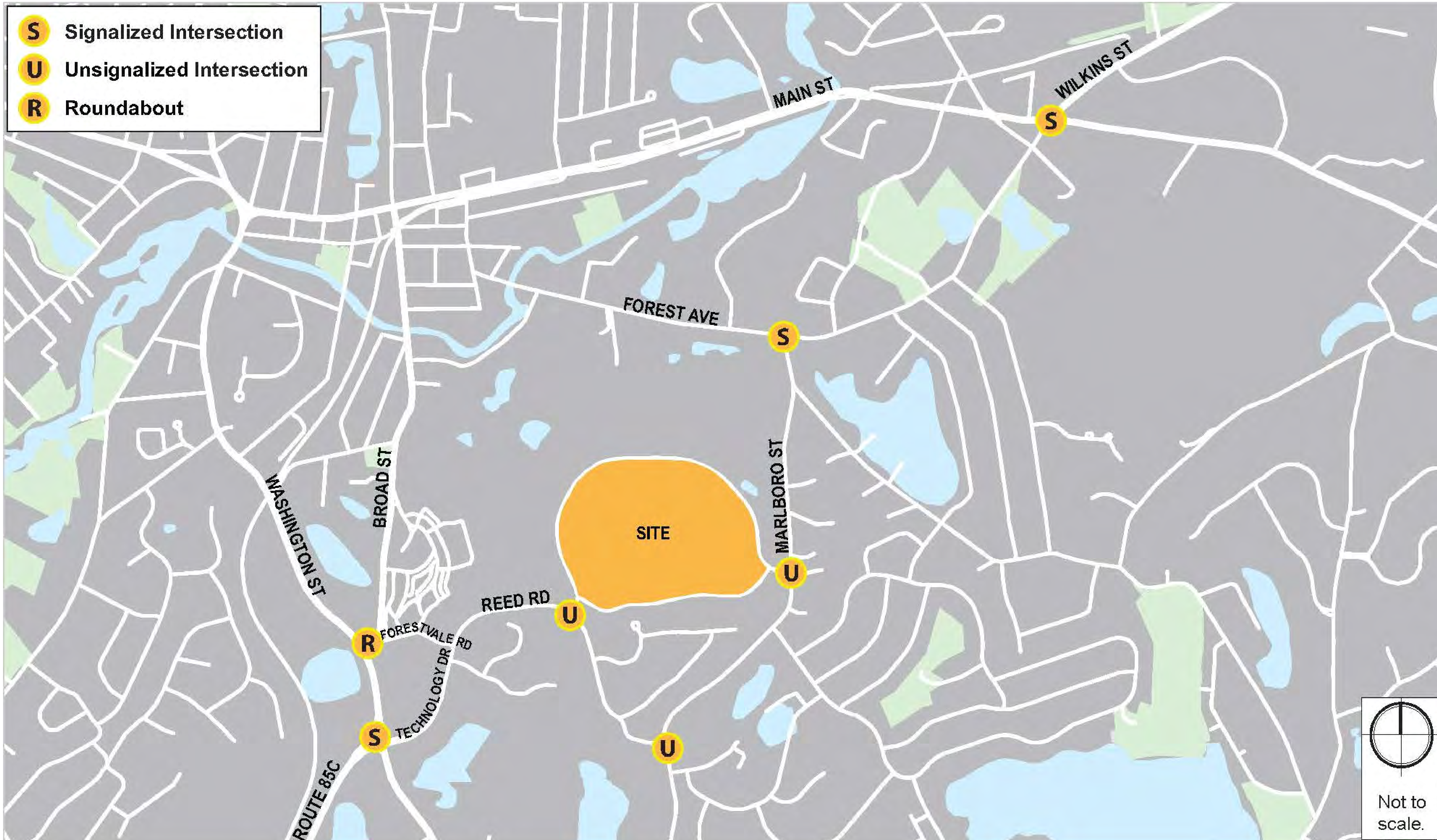


Figure 12
Transportation Context

Attachment B

Circulation List

ATTACHMENT B CIRCULATION LIST

Bethany Card, Secretary
Executive Office of Energy and
Environmental Affairs
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Boston, MA 02114
MEPA@mass.gov

Department of Environmental Protection
Commissioner's Office
One Winter Street
Boston, MA 02108
helena.boccadoro@mass.gov

DEP/Central Region
Attn: MEPA Coordinator
8 New Bond Street
Worcester, MA 01606
Andrea.briggs@mass.gov
joanne.kasperdunne@mass.gov

Massachusetts Department of Transportation
Public/Private Development Unit
10 Park Plaza
Boston, MA 02116
MassDOTPPDU@dot.state.ma.us

Massachusetts Department of Transportation
District #5
Attn: MEPA Coordinator
1000 County Street
Barbara.lachance@dot.state.ma.us

Taunton, MA 02780
amitai.lipton@dot.state.ma.us

Massachusetts Historical Commission
The MA Archives Building
220 Morrissey Boulevard
Boston, MA 02125

Massachusetts Area Planning Commission
60 Temple Place
Boston, MA 02111
mpillsbury@mapc.org
afelix@mapc.org
eweyant@mapc.org
etorres@mapc.org

MEPA Environmental Justice Office
Attn: EEA EJ Director
100 Cambridge Street, Suite 900
Boston, MA 02144
MEPA-EJ@mass.gov

Massachusetts Department of Energy
Resources
Attn: MEPA Coordinator
100 Cambridge Street, Suite 1020
Boston, MA 02114
paul.ormond@mass.gov
brendan.place@mass.gov

Natural Heritage and Endangered Species
Program
1 Rabbit Hill Road
Westborough, MA 01581
Melany.cheeseman@mass.gov
Emily.holt@mass.gov

Town of Hudson Selectboard
78 Main Street
Hudson, MA 01749
jquinn@townofhudson.org

Hudson Planning & Community Development
Department
78 Main Street
Hudson, MA 01749
kjohnson@townofhudson.org

Hudson Conservation Commission
78 Main St
Hudson, MA 01749
phelinek@townofhudson.org

Hudson Health Department
78 Main St
Hudson, MA 01749
m.blakely@townofhudson.org

Hudson Public Works
1 Municipal Dr
Hudson, MA 01749
sklotz@townofhudson.org

Hudson Public Library
3 Washington Street
Hudson, MA 01749
Ashanchez-himes@cwmars.org

Attachment C

Anticipated Municipal and Federal Permits

ATTACHMENT C ANTICIPATED MUNICIPAL AND FEDERAL PERMITS

Agency Name	Permit or Action
Federal	
Environmental Protection Agency	National Pollutant Discharge Elimination System Construction General Permit
Town of Hudson	
Planning Board	Site Plan Review
Building Department	Building Permit

Attachment D

Greenhouse Gas Analysis

ATTACHMENT D GREENHOUSE GAS ANALYSIS

The Proponent is taking assertive, practical steps to reduce carbon emissions while balancing their development goals to create successful facilities. The Project, including the building envelopes and mechanical systems, is designed to minimize energy use to the maximum extent practicable, and with an understanding of the need to reduce carbon emissions.

This Chapter presents a greenhouse gas ("GHG") analysis that complies with the MEPA Greenhouse Gas Emissions Policy and Protocol ("GHG Policy") of May 2010.

1 Introduction and Project Overview

1.1 MEPA Greenhouse Gas Emissions Policy and Protocol

This chapter addresses GHG emissions generated by operation of the Project and associated traffic, and options that may reduce those emissions in accordance with the MEPA GHG Policy. The GHG Policy requires, for certain projects undergoing review by the MEPA Office and required to prepare an EIR, that GHG emissions be quantified and measures to avoid, minimize, or mitigate such emissions be identified. The GHG Policy requires proponents to quantify the impact of proposed mitigation in terms of energy savings and GHG emissions.

The analysis provided herein focuses on emissions of carbon dioxide ("CO_2"). As noted in the GHG Policy, although there are other GHGs, CO_2 is the predominant contributor to global warming. Furthermore, CO_2 is by far the predominant GHG emitted from the types of sources related to the Project, and CO_2 emissions can be calculated for these source types with readily available data.

GHG emissions sources can be categorized into two groups: stationary sources, or emissions related to activities that are stationary on the Project Site; and mobile sources, or emissions related to transportation. Stationary sources can be further broken down into direct sources and indirect sources. Direct sources include GHG emissions from fuel combustion, and indirect sources include GHG emissions associated with electricity and other forms of energy that are imported from off-site power plants via the regional electrical grid or local steam distribution system for use on-site.

The GHG Policy requires the Proponents to calculate and compare the GHG emissions for two cases; base and proposed, each of which considers stationary source and transportation components.

1.2 Stationary Source Methodology

The base case is the baseline from which progress in energy use and GHG emissions reductions is measured. Per the GHG Policy, the baseline is a building designed to meet the applicable state building code ("Code") that is in effect at the time the ENF is filed. That edition of the Code will remain the baseline for all future energy modeling for GHG Policy compliance. The baseline is a reference point from which to measure the effectiveness of energy efficiency improvements in the proposed development.

The current Massachusetts building code is the 9th Edition, amended to incorporate the building energy provisions of International Energy Conservation Code ("IECC") 2015. Massachusetts energy efficiency amendments were adopted February 2020. Because Hudson is a Stretch Code community, the building is subject to the Massachusetts Stretch Code. Stretch Code requires buildings to achieve a 10 percent energy savings compared to ASHRAE 90.1-2013 Appendix G with Massachusetts Amendments. The Massachusetts Stretch Energy Code, based on ASHRAE 90.1-2013, together with the guidance of the modeling protocol of ASHRAE 90.1 Appendix G, defines the baseline for this GHG analysis.

For the stationary sources component, the Proposed Case represents the proposed Project including GHG mitigation measures anticipated to be incorporated into the building design. Please refer to Section 6.2 for the Stationary Source Analysis.

1.3 Mobile Source Methodology

The mobile source GHG analysis was developed using the traffic study conducted by Howard Stein Hudson. Transportation-related GHG emissions are presented for three typical cases: 2021 Existing, 2028 No-Build, and 2028 Build.

For the GHG analysis, the Proponents can only take credit for improvements above and beyond the Project ("base" case). The traffic analysis analyzes the No-Build condition (the expected traffic conditions in 2029, including proposed projects in the area other than the Project) and the Build condition (the No-Build condition plus the Project). To determine the GHG emissions from the Project alone, the difference between the Build condition and the No-Build condition is calculated – this is the Project's "base" case. Any GHG reductions as a result of traffic mitigation that may be proposed on behalf of the Project would be credited to the Project's GHG totals. Please refer to Section 6.3 for the Mobile Source Analysis.

1.4 Project Overview

As described in the EENF form, the Project includes the construction of a single-story warehouse building totaling approximately 1,285,000 square feet. The building is comprised of approximately 90 to 95 percent storage and approximately 5 to 10 percent office/business.

The building and program may evolve as the design progresses.

2 Stationary Sources

As part of the Proponent's due diligence, the Project team has evaluated the practicality of means and measures to minimize GHG emissions from the Project stationary sources, focusing on the following categories:

- Building envelope
- HVAC & mechanical
- Hot water system
- Heat recovery
- Solar PV

This section evaluates the impacts of alternatives for each of these categories. Building energy modeling is then described, followed by a description of incentives.

2.1 Building Envelope

A high-performing building envelope is essential to any emissions reduction strategy. Through an iterative, collaborative process, the Project team has developed a proposed building envelope strategy that maximize energy efficiency, while simultaneously allowing the building to meet its unique objective. The envelope discussed below represents the proposed envelope as currently envisioned. Because envelope specifics are likely to change as design progresses, envelope U-values are presented for discussion purposes only and are not commitments at this time.

The building enclosure for the proposed warehouse facility is the following:

Vertical assemblies of the building:

- 9 inch thick concrete exterior wall construction with surface applied insulation on the interior face for a total of R-25.

Horizontal assemblies of the building:

- R-30 polyisocyanurate insulation board covered by 60-millimeter TPO membrane roofing over steel joists and deck supported by steel interior columns on interior spread footings.
- 8-inch-thick concrete slab on grade with 20 millimeter vapor barrier and 4,000 psi compressive strength.

Openings of the building:

- Exterior dock and ramp drive in doors will be R-7 insulated steel
- At future office areas, storefront glass system with triple-glazed glass will be installed (less than 2% of the vertical area) with U-0.250
- Clerestory glass windows with U-0.250 will be located in the exterior walls above the truck loading dock areas

Because windows account for 2 percent of the proposed building envelope, the proposed envelope performs 16 percent better than the IECC 2018 reference building. Please refer to the attachments at the end of this appendix for additional envelope details and a UA analysis.

2.2 HVAC and Mechanical

The HVAC and mechanical systems design has been thoroughly evaluated for opportunities to reduce GHG emissions. Consistent with recent GHG analyses, the evaluation includes a review of options to maximize the use of electricity as an energy source. This is based on the expectation that the electric grid will continue its downward GHG emissions trend due to a greater reliance on renewable sources, and that electrification of HVAC systems would allow Project GHG emissions to mirror that downward trend. The Project teams have considered available incentives and operational savings in evaluation of these alternatives.

Mechanical Systems

The primary building HVAC system will be rooftop gas fired units which will provide heating of the Warehouses. Outside air will be provided to meet code-minimum ventilation requirements of 0.06 cfm/sf. The indoor heating setpoint will be 55 degrees F.

Warehouse support spaces and office areas (to be fit-out by tenant) will be conditioned by rooftop units with air source heat pump heating. These rooftop units will be installed by a future tenant. The office areas will be conditioned to 70 degrees (heating) and 75 degrees (cooling).

Lighting Systems

Lighting will consist of LED fixtures throughout the buildings. Lighting Power Density (LPD) will be 0.30 Watts per square foot, which represents a 35 percent reduction against the MA 2020 Energy Code baseline of 0.405 W/sf. Occupancy sensors will be provided as required by IECC 2018. Exterior parking lot lighting will be LED fixtures with installed wattage of 31.5 kW, which represents a 10 percent savings against code.

Domestic Hot Water System

Domestic Hot Water within the future office areas will be provided via a hybrid heat pump water heater for restroom faucets. The hybrid heat pump will be air-source with a backup electric coil and storage tank.

2.3 Building Energy Modeling

Building energy modeling was performed by WSP. All modeling was performed using eQuest. The modeled "Baseline Case" is based on ASHRAE 90.1-2013 Appendix G, with three additional Efficiency Package Options in the baseline model per C406.1. The following Packages are included in all modeled cases:

- More efficient HVAC performance in accordance with C406.2
- Reduced lighting power density system in accordance with Section C406.3
- Enhanced envelope performance in accordance with C406.8

Additional model inputs are detailed in the table of modeling input included in the attachments at the end of this appendix.

EUI is a measure of annual building energy use per square foot of conditioned space. EUI values for the Project and Alternatives are summarized in Table 1 which details the results of the modeling that was completed. Compared to a code-compliant building, the "Proposed Case" for the warehouse is expected to decrease GHG emissions by approximately 13.2 percent.

Table 1 Warehouse Energy Modeling Results

		Warehouse								
Modeled Conditioned space	1,284,640	sf								
Design Conditioned space	1,284,640	sf								
Factor	1.0									
		Baseline Case (ASHRAE 90.1-2013, App. G)	**Proposed Heat Only Rooftop Units with Natural Gas Heat and Ventilators**	**Alternate 1 Proposed + R40 Roof**	**Alternate 2 Proposed + ERV**	**Alternate 3 Gas RTU + R-40 Roof + ERV + Reduced Infiltration**	**Alternate 4 Proposed with ASHP (all-electric)**	**Alternate 5 Proposed with 25% ASHP**	**Alternate 6 ASHP + R-40 Roof + ERV + Reduced Infiltration**	**Alternate 7 25% ASHP + R-40 Roof + ERV + Reduced Infiltration**
DIRECT (NATURAL GAS)		MMBtu/yr	MMBtu/yr	MMBtu/yr	MMBtu/yr	MMBtu/yr	MMBtu/yr	MMBtu/yr	MMBtu/yr	MMBtu/yr
Space Heating		9,019	8,670	7,881	6,899	3,862	0	3,180	0	1,693
Domestic Hot Water		0	0	0	0	0	0	0	0	0
	subtotal	9,019	8,670	7,881	6,899	3,862	-	3,180	-	1,693
INDIRECT (ELECTRICITY)		MWh/yr	MWh/yr	MWh/yr	MWh/yr	MWh/yr	MWh/yr	MWh/yr	MWh/yr	MWh/yr
Lights		1453	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050
Misc. Equipment		824	824	824	824	824	824	824	824	824
Space Heating		0	113	111	81	38	1,109	665	533	277
Space Cooling		11	11	11	12	14	11	11	14	14
Pumps & Aux		0	0	0	0	0	0	0	0	0
Vent Fans		313	320	285	434	331	320	320	331	331
Domestic Hot Water		20	9	9	9	9	9	9	9	9
Exterior Lighting		395	138	138	138	138	138	138	138	138
	subtotal	3,016	2,464	2,428	2,548	2,403	3,461	3,017	2,898	2,642
ENERGY USE INDEX	PNNL reference[3]	kBtu/sf/yr	kBtu/sf/yr	kBtu/sf/yr	kBtu/sf/yr	kBtu/sf/yr	kBtu/sf/yr	kBtu/sf/yr	kBtu/sf/yr	kBtu/sf/yr
	22.7	15.0	13.3	12.6	12.1	9.4	9.2	10.5	7.7	8.3
Diff, % (compared to baseline)			**-12%**	**-16%**	**-19%**	**-38%**	**-39%**	**-30%**	**-49%**	**-45%**
GHG EMISSIONS		tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr
Direct	Gas-Burning	479	460	418	366	205	0	169	0	90
Indirect	Electricity	866	708	697	731	690	994	866	832	759
	Total	1,345	1,168	1,115	1,098	895	994	1,035	832	849
	Diff, tpy		**-177**	**-229**	**-247**	**-450**	**-351**	**-310**	**-513**	**-496**
Diff, % (compared to baseline)			**-13.2%**	**-17.1%**	**-18.4%**	**-33.4%**	**-26.1%**	**-23.0%**	**-38.1%**	**-36.9%**
CARBON EMISSION INTENSITY			kg CO_2/sf/yr	kg CO_2/sf/yr	kg CO_2/sf/yr	kg CO_2/sf/yr	kg CO_2/sf/yr	kg CO_2/sf/yr	kg CO_2/sf/yr	kg CO_2/sf/yr
		2022	0.91	0.87	0.85	0.70	0.77	0.81	0.65	0.66
CO_2 Emission Factors:										
Electricity [1]	633	lb/MWh								
Natural Gas [2]	117	lb/MMBtu								

[1] 2019 ISO New England Electric Generator Air Emissions Report
[2] EIA Fuel Emissions Factors, Weighted National Average (1029 Btu/scf)
[3] Pacific Northwest National Laboratory study, Massachusetts Zone 5A, ASHRAE 90.1-2013, Warehouse

2.4 Air-Source Heat Pump Alternatives

The Project team studied the use of air-source heat pumps (ASHPs) for space heating the facility. All of the office spaces will be heated and cooled via ASHPs. The use of ASHPs to heat the warehouse space reduces GHG emissions by 351 metric tons, or 26 percent compared to the code baseline. It does increase utility costs by $63,000 annually compared to the proposed case. The team also studied keeping the gas RTUs in place and supplementing the heating system with ASHPs sized to heat 25% of the peak heating load. This alternative reduces GHG emissions by 310 metric tons, or 23 percent. It increases utility costs by $25,000 annually compared to the proposed case.

The owner obtained preliminary cost information on the purchase and installation of ASHP's and found that the all-electric ASHP scenario increases upfront capital cost by $2.2 million dollars. The 25% ASHP scenario adds $803,000 to upfront capital costs. Neither of these scenarios payback for the owner. Additionally, because Hudson does not participate in the MassSave program, utility incentives are not available to help offset the added upfront cost. For these reasons, ASHPs are financially infeasible and the owner cannot commit to including ASHPs in the warehouse project at this time. The team will continue to evaluate electrification of space heating as the project moves though design.

2.5 Energy Recovery

The Project team studied the use of energy recovery in the warehouse. Adding energy recovery ventilators (ERVs) decreases annual GHG emissions by 247 metric tons, or 18 percent below the baseline case. Annual utility costs would also be decreased by approximately $10,000 prepared to the proposed case. Adding ERVs to various electric alternatives was also studied.

The owner obtained preliminary cost information on the purchase and installation of ERV's and found that the estimated increase in upfront capital cost is $1,080,000 which equates to a simple payback of >100 years. Given this lengthy payback period, the owner cannot commit to including ERV's in the warehouse Project. The team will continue to evaluate energy recovery as the project moves though design.

2.6 Increased Roof Performance

The Project team studied the benefit of increasing the roof's R-value from 30 to 40. Improving the roof to R-40 yields a decrease in carbon emissions of 229 metric tons or 17 percent compared to the code baseline. It also decreases utility cost by $19,000 annually compared to the Proposed case. The improved roof was also studied on serval other modeled scenarios. In all cases, the improved roof performance decreased carbon emissions.

The owner obtained preliminary cost information to improve the roof's R-value from 30 to 40. Currently, half of the building's roof will be constructed as solar-ready with high-density R-30 insulation. To change this half of the roof to high-density R-40 would be an added cost of $2.90 over half of the roof, or 642,500sf. This equals an added cost of $1.8M. The cost to increase the non-solar-ready roof from R-30 to R-40 would be $4.27/sf, or $2.7M. The total cost to increase the roof's R-value from 30 to 40 would be $4.6M. The payback for improving the building's roof performance to R-40 is >100 years. For this reason, increasing the roof's R-value is financially infeasible and the owner cannot commit to doing this at this time. The team will continue to evaluate all envelope performance values as the project moves though design.

2.7 Photovoltaic Ready Construction

The warehouse will be constructed with 50 percent of the roof area as PV ready. This equates to 642,500 square feet of roof space that will be available for a future PV installation, and 128,000 sf beyond what is required by code. The increase in cost to make the roof area structurally capable of supporting a PV system is approximately $0.78 a square foot. To make the remaining 50% of the roof PV-ready would cost an additional $501,000.

Hudson Municipal Light & Power will not purchase electricity back from the Project. Until a tenant is secured and the power needs of the building can be determined, the owner is unable to commit to increasing the solar-ready portion of the roof. It is not financially feasible and it is unlikely that additional roof space could be used for solar generation given the municipal utility.

2.8 Electric Vehicle Charging

The Proponent is committed to supporting the State's mission of transitioning to renewable energy sources by employing electric systems wherever feasible. Although the project is not subject to an Electric Vehicle Readiness Policy, the Proponent is committed to environmental sustainability and recognizes the important role that electric vehicles play in this effort. Currently, the Project includes 20 electric vehicle charging stations, 10 located at each end of the planned warehouse. Additionally, provisions will be made for future EV chargers by increasing the space in the electric room for future additional panels and providing conduits from the building to the area outside at each end of the building to accommodate future chargers.

The Proponents will work closely with the Town of Hudson to agree on appropriate arrangements regarding EV charging and readiness for the project.

2.9 Incentives

As mentioned previously, the Project is located outside of the service areas of MassSave participating utilities. The local electrical supply, Hudson Municipal Light Plant, does not offer any energy incentives at this time.

State Alternative Energy Credits ("AECs") have also been estimated and incorporated into the decision-making process and other alternatives cost analyses. MassCEC incentives have been phased out for heat pump and VRF systems, however the teams will continue to engage with MassCEC to take full advantage of any new incentives that may apply to the Project.

3 Mobile Source Emissions

As part of the GHG analysis, emissions of carbon dioxide from regional traffic associated with the Project were evaluated.

3.1 Traffic GHG Analysis

In accordance with the MEPA GHG Policy, GHG emissions were estimated for mobile sources within the transportation study area (see Attachment E for the transportation analysis). For mobile source GHG emissions, the methodology follows the same methodology that is outlined in MassDEP guidance for mesoscale analyses.[1] The analysis includes a comparison of the future Build condition to the No-Build condition.

A mesoscale GHG analysis predicts the change in regional carbon dioxide equivalents (CO_2e) due to the Project. The analysis includes a comparison of the future Build condition to the No-Build condition. If emissions are greater for the Build condition, reasonable and feasible mitigation measures will be evaluated. The methodology and parameters for the mesoscale GHG analysis follow methodology approved by MassDEP.

The mesoscale analysis performed for this Project predicts the change in regional GHG emissions due to the Project. The total vehicle pollutant burden was estimated for the 2022 Existing condition and the No-Build and Build conditions for year 2029. Traffic conditions are described in more detail in Attachment E.

The EPA has developed an emissions factor model (called MOVES3), and MassDEP provides state-specific inputs required for this model. Therefore, the MOVES3 computer program was used to estimate motor vehicle emissions of greenhouse gases on the roadway network in the Project area. Average hourly emission estimates were calculated using the vehicle count data provided in the transportation study, mileage between intersections, and county-specific model inputs provided by MassDEP.

Traffic volumes provided in Attachment E form the basis of the mesoscale GHG study. Approximately 13 roadway links and 6 intersections were included in the analysis. Peak hour traffic volumes were provided in the traffic analysis. Estimates of average daily traffic (ADT) were made from the peak hour volumes assuming a 10 percent K-Factor. This ADT was then converted into average hourly volumes by simply dividing by 24. Average speed was assumed based on roadway type (typically 10-40 mph for arterial roads) for all links. Distances for the links were estimated with mapping software.

MOVES output emissions are in grams per hour. Since average hourly traffic data were input, emissions in tons per year were calculated assuming a seven-day week for 52 weeks per year.

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1 MassDEP, Guidelines for Performing Mesoscale Analysis of Indirect Sources, May 1991.

For intersection emissions, idle vehicle emission rates were obtained in MOVES3 by using an artificial roadway link with 100 vehicles and a zero miles per hour vehicle speed. The total emissions on this link can be divided by the number of vehicles to get a mass per hour emission rate for idling vehicles. This method is recommended by EPA to get emission factors for air quality concentration analyses of idling vehicles at intersections (microscale analyses).[2] These emission factors were then used with vehicle counts and delay information from the traffic analyses to estimate vehicle emissions at intersections.

The Attachments at the end of this Appendix present the intersection emissions calculations, and the Project-specific link data input into the MOVES3 program.

3.2 Traffic GHG Analysis Results

Table 2 represents the difference between the Existing case and the future No-Build case (i.e., traffic expected without the addition of the Project to the area). Anticipated improvements in vehicle engine and emissions technologies, which are expected to reduce the per-vehicle emission rates, typically reduce future emissions. This results in a 6 percent decrease in GHG.

Table 2 Regional Traffic GHG Emissions Analysis Summary (No-Build)

Pollutant	CO_2e (lbs/day)	CO_2e (tons/yr)
2022 Existing	30,326	5,535
2029 No-Build	28,428	5,188
Difference	-1,899	-346
Difference (%)	-6%	-6%

Table 3 represents the differences between the No-Build case and the Build case (i.e., traffic associated with the addition of the Project to the area without any Proponent-proposed mitigation other than the Proponent's TDM program which is accounted for within the Build condition analysis).

As shown, the 2029 Build condition exhibits a 4 percent increase of CO_2e emissions compared to 2029 No-Build condition. This is due to the increase in vehicular traffic and subsequent increased delay times generated by the proposed Project alone. The increased vehicle volumes produce increased delays at all nearby intersections.

2 U.S. EPA, 2010. Using MOVES in Project-Level Carbon Monoxide Analyses. EPA-420-B-10-041.

Table 3 Regional Traffic GHG Emissions Analysis Summary (Build)

Pollutant	CO_2e (lbs/day)	CO_2e (tons/yr)
2029 No-Build	28,428	5,188
2029 Build	29,695	5,419
Difference	1,267	231
Difference (%)	4%	4%

3.3 Summary

Table 4 shows the details of the mobile source GHG analysis from case to case. Changes are based on the case to the left. Vehicle miles traveled (VMT) represents the approximate mileage of all vehicles traveling on the modeled roadway network, and the net VMT change represents the difference from the prior case. A zero change in VMT means that there are no vehicles added or removed from the network for that case. Net delay represents the time sum of all idle traffic at all network intersections over the course of a day.

Table 4 Regional Traffic GHG Emissions Analysis Summary

	units	2022 Existing	2029 No-Build	2029 Build
Daily VMT	veh-miles/day	34,301	39,354	40,956
Net VMT Change	veh-miles/day	-	5,053	1,602
Net Delay	veh-hrs/day	189	235	259
Net Delay Change	veh-hrs/day	-	47	23
Roadway CO_2e	tpy	5,297	4,930	5,135
Intersection CO_2e	tpy	237	258	284
Net CO_2e Emissions	tpy	5,535	5,188	5,419
Net CO_2e Change	tpy	-	-346	231

GHG emissions between the No-Build and Build conditions are compared to determine the mobile source GHG emissions related to the Project. Table 5 shows the Project-related mobile source GHG emissions.

Table 5 Project Traffic GHG Emissions Analysis Summary

	units	2029 Build minus 2029 No-Build
Daily VMT	veh-miles/day	1602.0
Net Change	veh-miles/day	-
Net Delay	veh-hrs/day	23.4
Net Change	veh-hrs/day	-
Roadway CO_2e	tpy	205
Intersection CO_2e	tpy	26
Total CO_2e Emissions	tpy	231

4 Summary and Mitigation Commitments

4.1 Project GHG Summary

Table 6 presents a summary of the Project GHG emissions for the Baseline and Proposed cases.

Table 6 Project GHG Emissions Summary

	Baseline	Proposed	Difference	
		tons/yr		Percent Change
Stationary Sources	1,345	1,168	-177	-13.2%
Mobile Sources	5,188	5,419	231	4%

4.2 Proponents' Commitments to GHG Reduction

The Proponent has detailed their commitments to mitigate Project GHG emissions. Additional mitigation measures have not been quantified, primarily because the degree of accuracy or the reliability of the quantification method is uncertain.

The Proponent is committed to environmental stewardship. As the Project's design develops further, the Proponent expects that additional technologies described previously, or possibly new technologies developed in the interim period, may be adopted that will further decrease GHG emissions, but these are not yet ripe for selection. The Proponent will encourage the continued evaluation of energy efficiency and renewable energy measures throughout the life of the Project.

The Proponent is committed to the following mitigation elements for the project:

- High performance building envelopes;
- Light or reflective roofs;
- Reduced lighting power densities;

- High-efficiency HVAC equipment;
- High performance exterior lighting;
- Recycling collection areas; and
- Construction waste recycling.

The Proponent has included in the design of the building all feasible GHG emissions mitigation in order to avoid, reduce, minimize, or mitigate damage to the environment.

The Proponent is committed to implementing the energy efficiency and GHG emission reduction measures presented in this analysis but must retain an amount of design flexibility to allow for changes that will inevitably occur as the design of each building progresses. If, during design of the Project, a specific combination of design strategies proves more advantageous from an engineering, economic, or space utilization perspective, the design of the buildings may vary from what has been described herein. Energy performance minima and associated GHG emission reductions will be adhered to.

4.3 Proponents' Commitments to Self-Certification

Upon completion of the building, the Proponent will submit a self-certification to the MEPA Office, prepared in accordance with the GHG Policy. This certification will identify the GHG mitigation measures incorporated into the building and will illustrate the degree of GHG reduction from a Baseline case, as Baseline is defined herein, and how such reductions are achieved. Details of the Proponent's implementation of operational measures will also be included.

Attachment E

Traffic Impact Study

HUDSON, MASSACHUSETTS

Traffic Impact Study

75 Reed Road, Hudson

Prepared for
Town of Hudson

Prepared by
Howard Stein Hudson

July 2022

HOWARD STEIN HUDSON

Engineers + Planners

HOWARD STEIN HUDSON

75 Reed Road, Hudson
Traffic Impact Study

Prepared for
Town of Hudson

Prepared by
Howard Stein Hudson

July 2022

I certify that this transportation study has been prepared under my immediate supervision and that I have experience and training in the field of traffic and transportation engineering.

Signed,

Keri Pyke, P.E., PTOE
MA PE license #47252
Howard Stein Hudson
July 2022

COMMONWEALTH OF MASSACHUSETTS
KERI
PYKE
CIVIL
No. 47252
REGISTERED
PROFESSIONAL ENGINEER

7/21/2022

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Introduction

In accordance with Section 5.10.10 of the Town of Hudson Protective Zoning Bylaws, proponents of major construction projects within the Town must submit a transportation study to the Town as part of the Site Plan submission. ***Howard Stein Hudson (HSH)***, as transportation consultants to Portman Industrial (Proponent), has prepared this study for the Town of Hudson, which presents the traffic impacts associated with the proposed redevelopment of 75 Reed Road, a 149-acre site formerly occupied by the Intel Corporation. The redevelopment includes demolition of the remaining Intel buildings and construction of approximately 1,284,640 square feet (sf) of warehouse space (Project).

In addition to being submitted to the Town of Hudson, this traffic study will be submitted to the Massachusetts Environmental Policy Act (MEPA) office as part of an Expanded Environmental Notification Form (EENF). This traffic study was prepared following Massachusetts Department of Transportation (MassDOT) guidelines for completing a Transportation Impact Assessment (TIA). Although the site is not adjacent to any MassDOT roadways, MassDOT District 3 (in which Hudson is located) determined that an Indirect Access Permit is required for this Project.

Site History and Project Description

The Project Site is located at 75 Reed Road in Hudson, Massachusetts. The project site is located within the M-6 zone, which is zoned for industrial use. In 1998, the Intel Corporation established their Hudson campus at 75 Reed Road and over the next fifteen years employed up to 1,500 workers. At that time, the site was comprised of three buildings totaling 1.3 million sf of manufacturing and research and development (R&D) space. In 2014, Intel announced the impending closure of the manufacturing facility and by 2017 had demolished the manufacturing building while retaining the R&D operations. Currently, however, the remaining site buildings are vacant and do not generate any appreciable traffic.

The proposed redevelopment includes the demolition of the existing Intel buildings and construction of a new warehouse facility. As is typical for this type of site development, a specific warehouse tenant (or tenants) has not yet been identified. **Table 1** summarizes the Project's proposed development program.

Table 1. Proposed Development Program

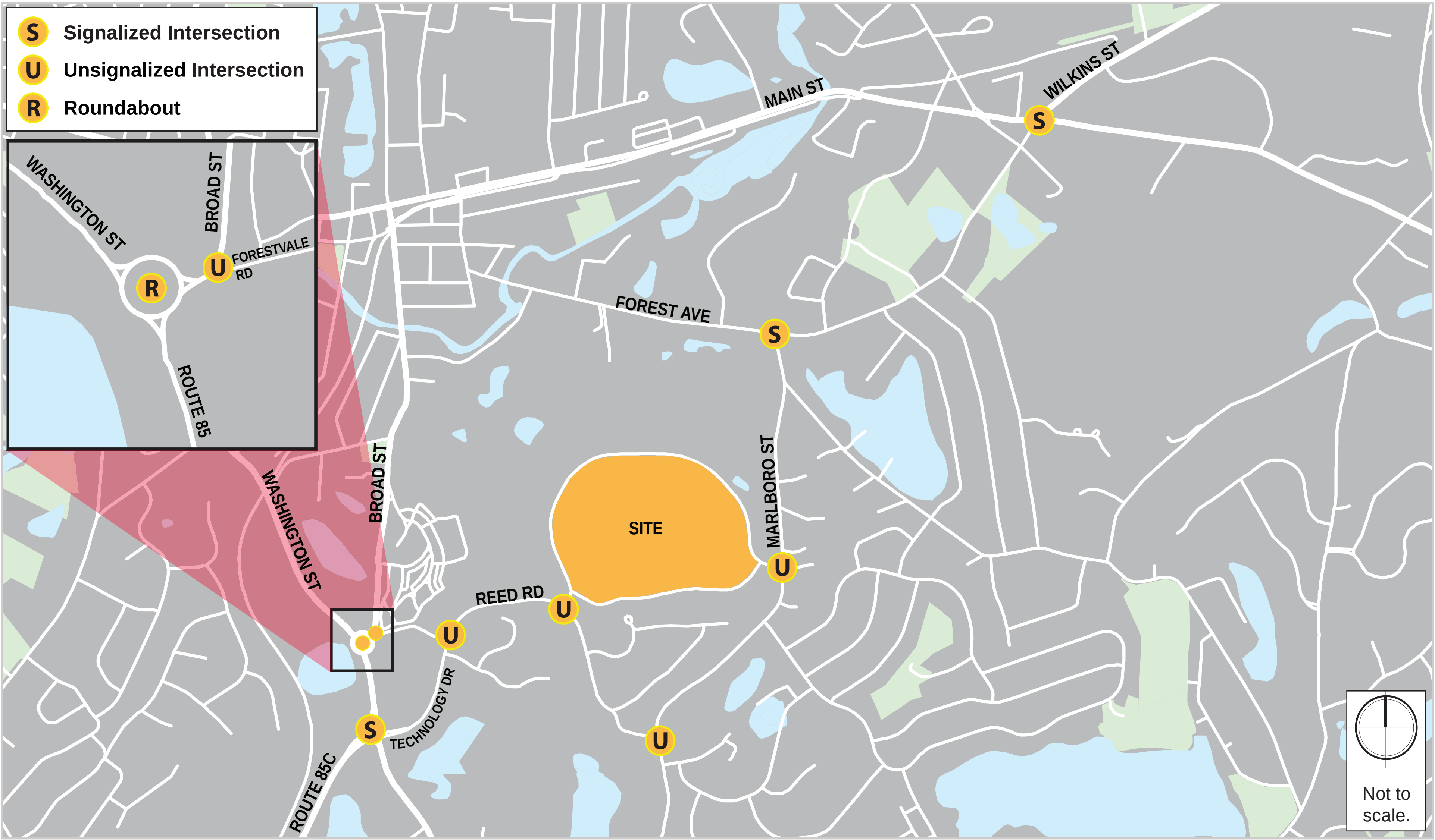
Land Use	Size
Warehouse	1,284,640 sf
Loading Berths	187 spaces
Parking	1,170 spaces
Automobile	446 spaces
Trailer Storage	724 spaces

Study Area

Through discussions with the Town of Hudson and MassDOT, nine intersections were identified as the traffic study area. These are shown in **Figure 1** and listed below:

- Forest Avenue/Marlboro Street (signalized);
- Main Street (Route 62)/Forest Avenue/Wilkins Street(signalized);
- Route 85C/Washington Street/Technology Drive (signalized);
- Reed Road/Site Driveway (unsignalized);
- Marlboro Street/Site Driveway (unsignalized);
- Reed Road/Marlboro Street (unsignalized);
- Broad Street/Forestvale Road (unsignalized);
- Technology Drive/Forestvale Road (unsignalized); and
- Washington Street/Broad Street (roundabout).

Figure 1. *Study Area Intersections*



Summary

Key transportation characteristics of the Project and analysis results include:

- Although the Project Site has been active with Intel uses for most of the last 24 years, the site currently does not generate any appreciable traffic volume. In this traffic study, no credit (reduction) for existing vehicle trips has been taken in the analysis, resulting in a more conservative (higher impact) evaluation.
- During the a.m. peak hour, the Project will generate 218 new automobile trips (168 entering and 50 exiting) and 25 new truck trips (13 entering and 12 exiting); during the p.m. peak hour, the Project will generate 244 new vehicle trips (66 entering and 178 exiting) and 38 new truck trips (20 entering and 18 exiting).
- The capacity analysis results for the nine study area intersections show that the Project will not significantly affect peak hour operations in the study area.
- The Proponent will encourage the future tenant to implement a Transportation Demand Management (TDM) plan to minimize the number of Project vehicle trips on the adjacent roadway network. Key elements of the TDM plan are likely to include provisions of a ridematching/ridesharing program to encourage carpooling and an emergency ride home for employees who participate in ridesharing. The TDM program will be overseen by a designated Transportation Coordinator.
- The Proponent anticipates committing to an annual Transportation Monitoring Program in coordination with MassDOT to confirm the accuracy of the assumptions contained in this traffic report and the effectiveness of the TDM program. Such a monitoring program would commence after building occupancy.

Existing Condition

Existing Roadway Descriptions

The study area includes the following roadways described below, categorized according to the Massachusetts Office of Transportation Planning (OTP) classifications.

Forest Avenue is an urban collector under the Town of Hudson jurisdiction running in an east-west direction in the vicinity of the project site between Grove Street to the west and Main Street (Route 62) to the east. Forest Avenue is a two-way, two-lane roadway with a posted speed limit of 35 miles per hour (mph). No sidewalks, crosswalks, or bicycle lanes exist along the roadway. Parking is not permitted on either side of the roadway.

Marlboro Street is a local roadway under the Town of Hudson jurisdiction running in a generally north-south direction between Forest Avenue to the north and Reed Road to the south. Marlboro Street is a two-way, two-lane roadway with a posted speed limit between 25-35 mph along the roadway. A sidewalk is provided along the east side of the roadway from Oneida Place to Reed Road and the Hudson Seventh-day Adventist Church to Forest Avenue with no crosswalks along the roadway. Parking is not permitted on either side of the roadway.

Main Street (Route 62) is an urban principal arterial under the Town of Hudson jurisdiction and runs generally in an east-west direction between the Washington Street/Fenton Street/Main Street (Route 62) roundabout to the west and State Road, at the Sudbury Town Line, to the east. Main Street (Route 62) is also designated as Route 62, which traverses through 17 Massachusetts towns. Within the Town of Hudson, Main Street (Route 62) is a two-way, two-lane roadway with a posted speed limit of 40 mph. A sidewalk is provided on the north side of the roadway with no crosswalks or bicycle lanes along the highway. Parking is not permitted on either side of the roadway.

Washington Street is an urban principal arterial under the Town of Hudson jurisdiction and runs in a north-south direction between the Main Street (Route 62) roundabout to the north and Bolton Street to the south. Washington Street is a two-way, four-lane roadway with a posted speed limit of 40 mph. Sidewalks are provided along both sides of the roadway with crosswalks at major intersections. Bicycle lanes are not provided along either side of the roadway. Parking is not permitted on either side of the roadway.

Technology Drive is a local roadway under the Town of Hudson jurisdiction and generally runs in an east-west direction between Washington Street to the west and Reed Road to the east. Technology Drive is a two-way, two-lane roadway with a seven-foot breakdown lane in each direction with a posted speed limit of 40 mph. A sidewalk is provided on the east side of the roadway with no crosswalks or bicycle lanes provided. Parking is not permitted on either side of the roadway.

Reed Road is a local roadway under the Town of Hudson jurisdiction running in a northwest-southeast direction between Technology Drive to the northwest and Marlboro Street to the southeast. Reed Road is a two-way, two-lane roadway with a posted speed limit of 35 mph. A sidewalk is provided on the east side of the roadway with no crosswalks or bicycle lanes. Parking is not permitted along either side of the roadway.

Site Driveway is a private roadway on the Project Site that runs in a circular direction providing access to the former Intel parking lots with access from Reed Road and Marlboro Street with a posted speed limit of 20 mph. Along the Site Driveway, no sidewalks, crosswalks, or bicycle lanes are provided. Parking is not permitted along either side of the roadway.

Forestvale Road is a local roadway under the Town of Hudson jurisdiction running in an east-west direction between Broad Street to the west and Technology Drive to the east. Forestvale Road is a two-way, two-lane unmarked roadway with no posted speed limit. Sidewalks, crosswalks, and bicycle lanes are not provided along either side of the roadway. Parking is not permitted along either side of the roadway.

Broad Street is an urban minor arterial under the Town of Hudson jurisdiction running in a north-south direction between Main Street (Route 62) to the north and the Washington Street roundabout to the south. Broad Street is a two-way, two-lane roadway with a posted speed limit of 35 mph. Sidewalks are provided along either side of the roadway, and there are no crosswalks or bicycle lanes. Parking is not permitted along either side of the roadway.

Route 85C is an urban principal arterial under MassDOT jurisdiction and runs in a predominantly northeast-southwest direction between I-495 in the southwest and Washington Street in the northeast. Route 85C is a two-way, two- to four-lane roadway with a posted speed limit of 50 mph. Sidewalks are not provided along either side of the roadway; a crosswalk is provided across the northeast terminus of the roadway where it intersects with Washington Street. Bicycle lanes are not provided along either side of the roadway. Parking is not permitted along either side of the roadway.

Existing Intersection Descriptions

Forest Avenue/Marlboro Street is a signalized intersection with four approaches. The Forest Avenue eastbound approach consists of shared through/right-turn lane. The Forest Avenue westbound approach consists of an exclusive left-turn lane with approximately 185 feet of storage and an exclusive through lane. The Marlboro Street northbound approach consists of an exclusive left-turn lane and an exclusive right-turn lane with approximately 180 feet of storage. The Apple County Plaza commercial driveway southbound approach consists of an approximately 20-foot-wide one-way southbound shared left-turn/through/right-turn lane. Sidewalks are provided along all approaches, except the commercial driveway, with crosswalks at the eastbound and northbound approaches. Parking is not permitted along any approach.

Main Street (Route 62)/Forest Avenue/Wilkins Street is a signalized intersection with four approaches. The Main Street (Route 62) eastbound approach consists of an exclusive left-turn lane with approximately 60 feet of storage and a shared through/right turn lane. The Main Street (Route 62) westbound approach both consists of an exclusive left-turn lane with approximately 175 feet of storage and a shared through/right turn lane. The Forest Avenue northbound approach consist of an exclusive right-turn lane with 250-feet and 60-feet of storage, respectively. The Wilkins Street southbound approach both consists of an exclusive right-turn lane with 60-feet of storage, respectively. Sidewalks and crosswalks are not provided along any approach. Parking is not permitted along any approach.

Route 85C/Washington Street/Technology Drive is a signalized intersection with four approaches. The Route 85C eastbound approach consists of two exclusive left-turn lanes with approximately 350 feet of storage, an exclusive through lane, and a shared through/right-turn lane. The Technology Drive westbound approach consists of an exclusive left-turn lane with approximately 175 feet of storage, two exclusive through lanes, and an exclusive right-turn lane with approximately 175 feet of storage. The Washington Street northbound approach consists of two exclusive left-turn lanes with approximately 350 feet of storage, an exclusive through lane, and a shared through/right-turn lane. The Washington Street southbound approach consists of an exclusive left-turn lane with approximately 215 feet of storage, two exclusive through lanes, and a channelized right-turn lane under yield control. Sidewalks are provided along the westbound, northbound, and southbound approaches with crosswalks across all approaches. Parking is not permitted along any approach.

Reed Road/Site Driveway is an unsignalized intersection with three approaches. The Reed Road eastbound approach consists of an exclusive left-turn lane with approximately 75 feet of storage and an exclusive through lane. The Reed Road westbound approach consists of a shared through/right-turn lane. The Site Driveway southbound approach is stop-controlled and consists of an exclusive left-turn lane and an exclusive right-turn lane. A sidewalk is provided along the westbound approach. Curb ramps are provided across the Site Driveway southbound approach, but no crosswalk is provided. Parking is not permitted along any of the approaches.

Marlboro Street/Site Driveway is an unsignalized intersection with four approaches. The Site Driveway eastbound approach is stop-controlled and consists of an exclusive left-turn lane and an exclusive right-turn lane. The westbound approach is a residential driveway that serves two homes and consists of a shared left/through/right-turn lane. The Marlboro Street northbound approach is not controlled and consists of a shared left/through/right lane. The Marlboro Street southbound approach is not controlled and consists of a shared left/through/right-turn lane. A sidewalk is provided along the northbound approach with no crosswalks or curb ramps across any approach. Parking is not permitted along any approach.

Reed Road/Marlboro Street is an unsignalized intersection with three approaches. An overhead intersection control beacon exists at the intersection. The beacon flashes yellow for both Marlboro Street approaches and red for the Reed Road approach. The Reed Road eastbound approach is stop-controlled and consists of an exclusive left-turn lane and an exclusive right-turn lane with approximately 85 feet of storage. The Marlboro Street northbound approach is not controlled and consists of a shared left-turn/through lane. The Marlboro Street southbound approach is not controlled and consists of a shared through/right-turn lane. Sidewalks are provided on the northbound and southbound approaches with no crosswalks across any approach. Parking is not permitted along any approach.

Broad Street/Forestvale Road is an unsignalized intersection with three approaches. The Forestvale Road westbound approach is stop-controlled and consists of a shared left/right-turn lane. The Broad Street northbound approach is not controlled and consists of a shared through/right-turn lane. The Broad Street southbound approach is not controlled and consists of a shared left-turn/through lane. Sidewalks are provided along both sides of all approaches. A crosswalk and associated curb ramps are provided across the Forestvale Road westbound approach. Parking is not permitted along any approach.

Technology Drive/Forestvale Road is an unsignalized intersection with three approaches. The Forestvale Road eastbound approach is stop-controlled and consists of an approximately 20-foot-wide unmarked lane that operates as one exclusive right-turn lane with approximately 25 feet of storage and one exclusive left-turn lane. The Technology Drive northbound approach consists of a left-turn/through lane. The Technology Drive southbound approach consists of a through/right-turn lane. Sidewalks are provided along the eastbound and westbound approaches, but the westbound sidewalk ends at the intersection. Parking is not permitted along any approach.

Washington Street/Broad Street is an unsignalized four-legged roundabout with splitter islands on the three main approaches. The fourth approach is a commercial driveway. All approaches are yield controlled. Crosswalks and curb ramps are provided across all approaches. Parking is not permitted along any approach.

Existing Traffic Data

Typically, the baseline transportation conditions in the vicinity of the Project are established through a targeted data collection program. The recent COVID-19 pandemic, however, has changed vehicle travel and subsequently affected the procedure to determine baseline traffic volumes. On March 15, 2022, traffic counts were conducted at eight of the nine study intersections. Counts at the ninth intersection were conducted on June 1, 2022. Turning movement counts (TMCs) were conducted during the weekday a.m. and p.m. peak periods (7:00 – 9:00 a.m. and 4:00 – 6:00 p.m., respectively) and included automobile, truck, pedestrian, and bicycle movements.

The 2022 TMC data was compared to data collected before the pandemic in November 2019 at the intersections of Route 85C/Washington Street/Technology Drive and Washington Street/Broad Street. The 2022 count data were approximately 8% lower than the November 2019 data; therefore, the 2022 data were increased by 8% to establish baseline traffic volumes. According to MassDOT's Weekday Seasonal Factors Report for urban arterials and collectors, traffic volumes in March and

June are shown to be slightly above average. To be conservative, no seasonal factors were applied to the baseline traffic volumes.

An automatic traffic recorder (ATR) is a device that continuously records the number, speed, and class of vehicles on a roadway for a given period. ATR counts were conducted at both study area driveways on March 15, 2022. ATR counts were also conducted at Technology Drive, east of Forestvale Road for a 72-hour period from Tuesday, May 10, 2022, to Thursday, May 12, 2022.

Detailed traffic count data are provided in **Appendix A**. **Figure 2** and **Figure 3** present the Existing Condition intersection volumes for the weekday a.m. peak hour and weekday p.m. peak hour, respectively.

Figure 2. *Existing Condition Traffic Volumes, Weekday a.m. Peak Hour*

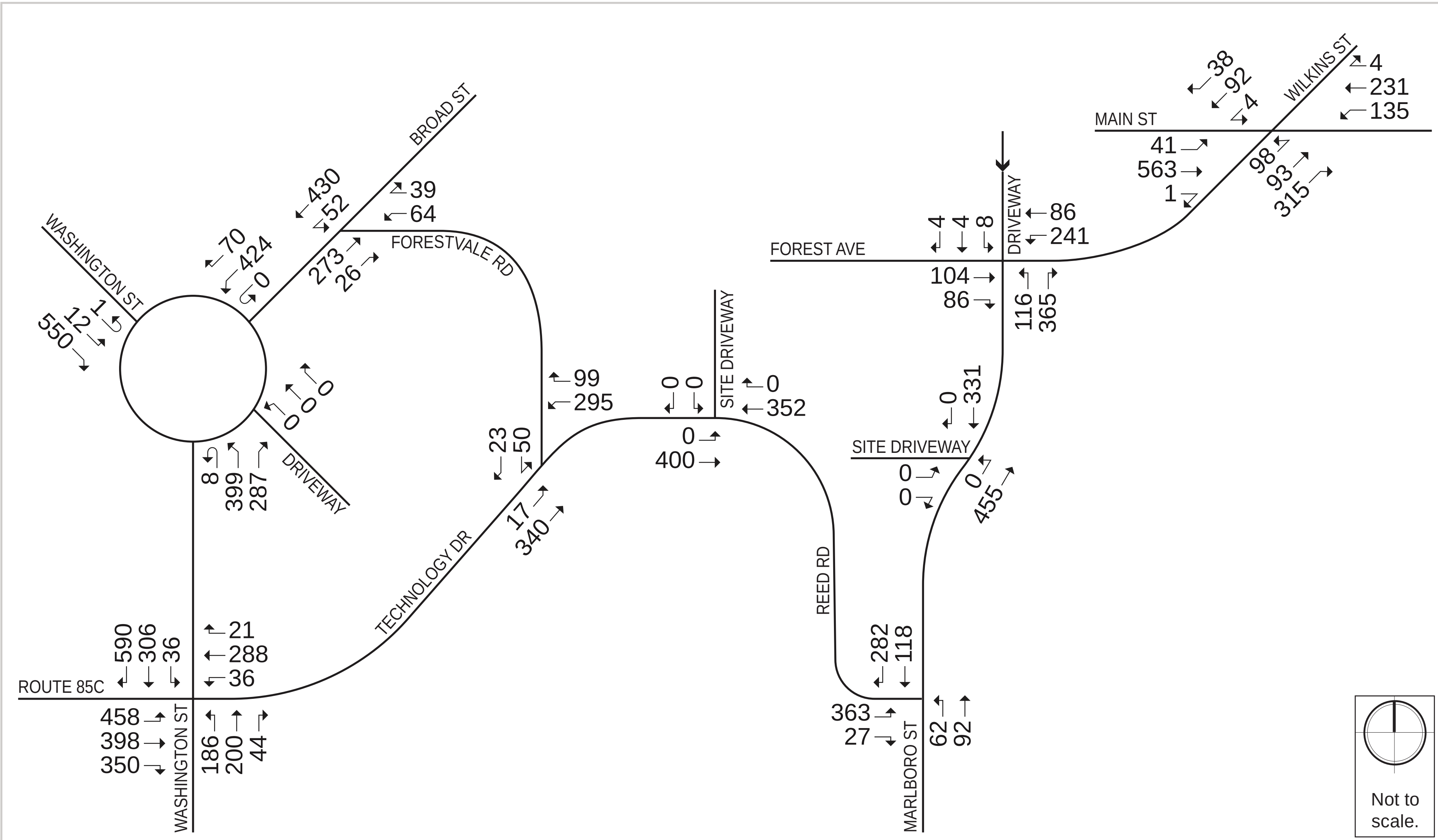
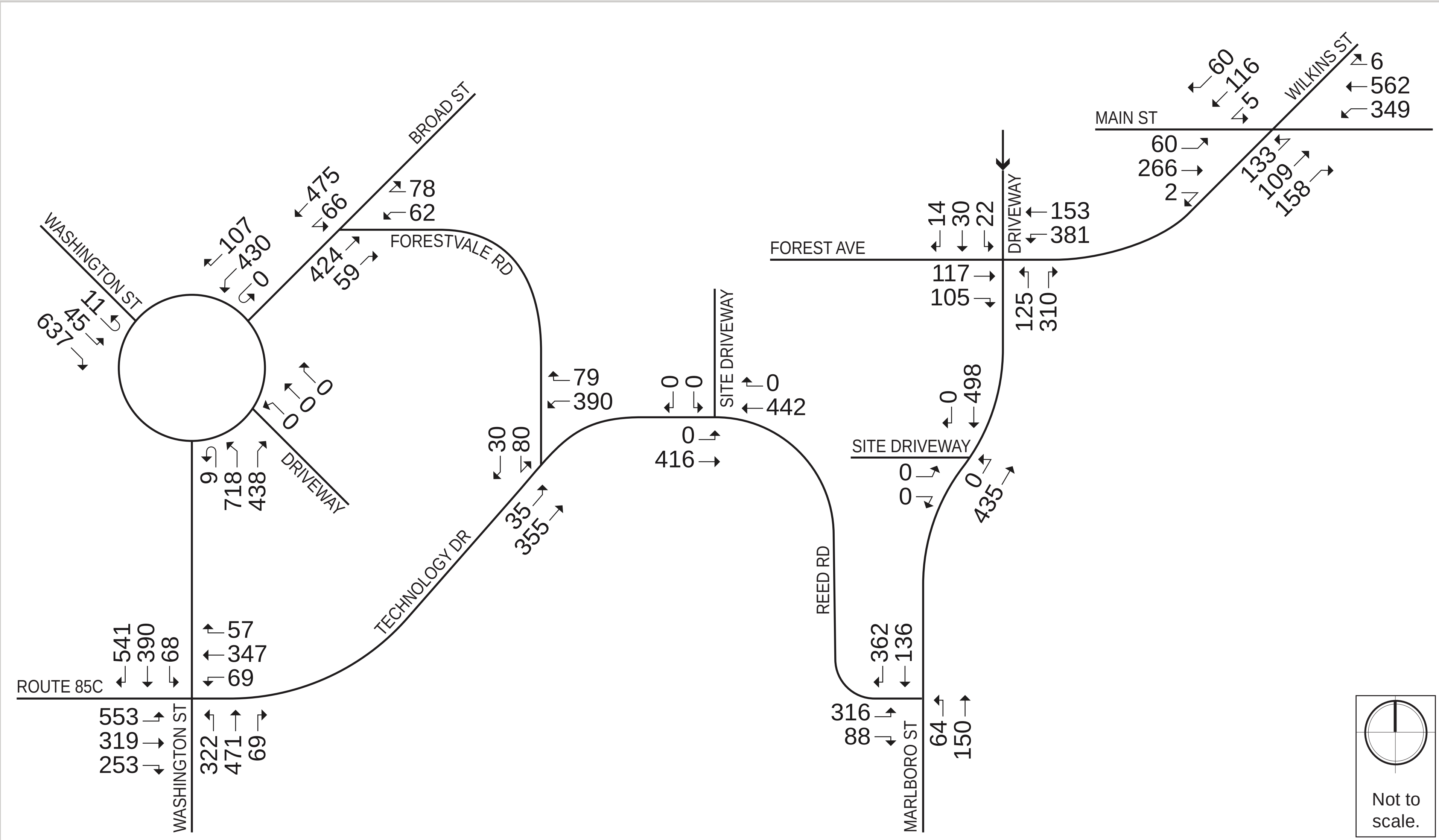


Figure 3. *Existing Condition Traffic Volumes, Weekday p.m. Peak Hour*



Crash History

To understand safety conditions at the study intersections, the study team obtained the last three full years (2017-2019) of available crash data from MassDOT. In MassDOT District 3, where the Project Site is located, the average numbers of crashes are 0.89 and 0.61 crashes per million entering vehicles (MEV) at signalized and unsignalized intersections, respectively. Typically, study intersections with higher-than-average crash rates should be studied further by the jurisdictional agency.

Table 2 shows the crash summary information, including the number per location and the associated crash rates. No crashes were reported to have occurred at the study area intersection of Marlboro Street at the Project Site Driveway and shared residential driveway. The crash rates at three of the nine intersections are above the District 3 average rate.

Table 2. Crash History at Study Intersections, 2017-2019

Characteristic	Signalized			Unsignalized				Round about
	Forest Avenue/ Marlboro Street	Main Street/ Forest Avenue/ Wilkins Street	Route 85C/ Washington Street/	Reed Road/ Site Driveway	Reed Road/ Marlboro Street	Forestvale Road/Broad Street	Forestvale Road/Technology Drive	Washington Street/ Broad Street
Year								
2017	3	11	8	1	3	1	0	8
2018	3	7	12	0	8	1	0	6
2019	2	10	13	1	1	0	1	9
Crash Type								
Angle	3	7	11	0	3	1	0	6
Rear-end	3	15	14	0	1	1	1	3
Single vehicle	1	1	1	2	5	0	0	1
Sideswipe	1	3	7	0	2	0	0	13
Head-on	0	2	0	0	1	0	0	0
Crash Severity								
Property Damage Only	7	19	27	1	10	2	1	21
Non-Fatal Injury	1	8	6	1	1	0	0	2
Unknown	0	1	0	0	1	0	0	0
Weather								
Clear	7	19	19	2	8	0	0	16
Cloudy	0	5	8	0	3	1	1	4
Rain	1	3	5	0	0	1	0	3
Snow	0	1	1	0	1	0	0	0
Total Crashes	8	28	33	2	12	2	1	23
Crash Rate[1]	0.56	1.36	0.84	0.20	0.95	0.21	0.10	0.87
District Average	0.89			0.61				

[1] Crash rate = Crashes per million entering vehicles (MEV)
Grey shading indicates a crash rate above the District Average

The signalized intersection of Main Street/Forest Avenue/Wilkins Street was estimated to have a crash rate of 1.36 per MEV. Most of the crashes reported to have occurred at this intersection were due to driver error and not related to the design of the intersection. Below is a summary of the driver contributing factors reported for each of the 28 total crashes that occurred at this intersection:

- Nine were reported to have been caused by a distracted or inattentive driver;
- Five were reported to have been caused by a driver failing to yield the right of way;
- Five were reported to have occurred with no improper driving;
- Four were reported to have been caused by a driver following too closely;
- Two were reported to have been caused by a driver driving too fast for conditions;
- One was reported to have been caused by a driver failing to keep in the proper lane;
- One was reported to have been caused by a driver making an improper turn; and
- One was reported to have occurred without a definitive cause.

The unsignalized intersection of Marlboro Street at Reed Road was estimated to have a crash rate of 0.95 per MEV. Most of the crashes reported to have occurred at this intersection were due to driver error, and one quarter of the crashes were reported to have occurred with no improper driving. Below is a summary of the driver contributing factors reported for each of the 12 total crashes that occurred at this intersection:

- Three were reported to have been caused by a distracted or inattentive driver;
- Three were reported to have been caused by a driver failing to yield the right of way;
- Three were reported to have occurred with no improper driving;
- One was due to a driver operating the vehicle in an erratic, reckless, careless, negligent, or aggressive manner;
- One was due to a driver failing to keep in the proper lane or running off the road; and
- One was reported without a definitive cause.

The unsignalized roundabout intersection of Washington Street (Route 85) at Broad Street was estimated to have a crash rate of 0.87 per MEV. Most of the crashes reported to have occurred at this intersection were due to driver error and not related to the design of the intersection. Below is a summary of the driver contributing factors reported for each of the 23 total crashes that occurred at this intersection:

- Seven were reported to have been caused by a driver following too closely;
- Three were reported to have been caused by a driver disregarding traffic signs, signals, or roadway markings;
- Three were reported to have been caused by a distracted or inattentive driver;
- Two were reported to have been caused by a driver failing to yield the right of way;
- Two were reported to have been caused by a driver making an improper turn;

- One was reported to have been caused by a driver driving too fast for conditions;
- One was reported to have been caused by a driver suffering emotional distress;
- One was reported to have been caused by a driver failing to keep in the proper lane;
- One was due to a driver operating the vehicle in an erratic, reckless, careless, negligent, or aggressive manner;
- One was reported to have been caused by a driver making an improper turn; and
- One was reported to have occurred with no improper driving.

While most crashes at these three study area intersections were reported to have occurred as a result of driver error, the study team will continue to review the crash data with the Town of Hudson to identify existing safety issues at these locations. Note that no crash resulted in a fatality, and no pedestrians or cyclists were reported to have been involved in any of these crashes. Crash rate worksheets are provided in **Appendix B**.

Existing Pedestrian and Bicycle Conditions

Satisfactory pedestrian accommodations are generally provided within the Project study area. Sidewalks of sufficient width are generally provided along at least one side of every study area roadway. Crosswalks and wheelchair ramps provided at some of the intersections. Within the study area, no bicycle facilities are provided along any of the roadways.

For this study, pedestrian counts and bicycle turning movement counts were collected during peak hours at the study intersections. As shown in **Figure 4**, pedestrian activity is low within the study area with a high of one pedestrian per hour during the a.m. peak period and a high of five pedestrians per hour during the p.m. peak period. **Figure 5** shows the bicycle volumes at each study area intersection. While minimal bicycle activity was observed during the a.m. and p.m. peak hours, such activity would likely be higher during warmer weather.

Figure 4. ***Existing Condition Pedestrian Volumes, Weekday a.m. and p.m. Peak Hours***

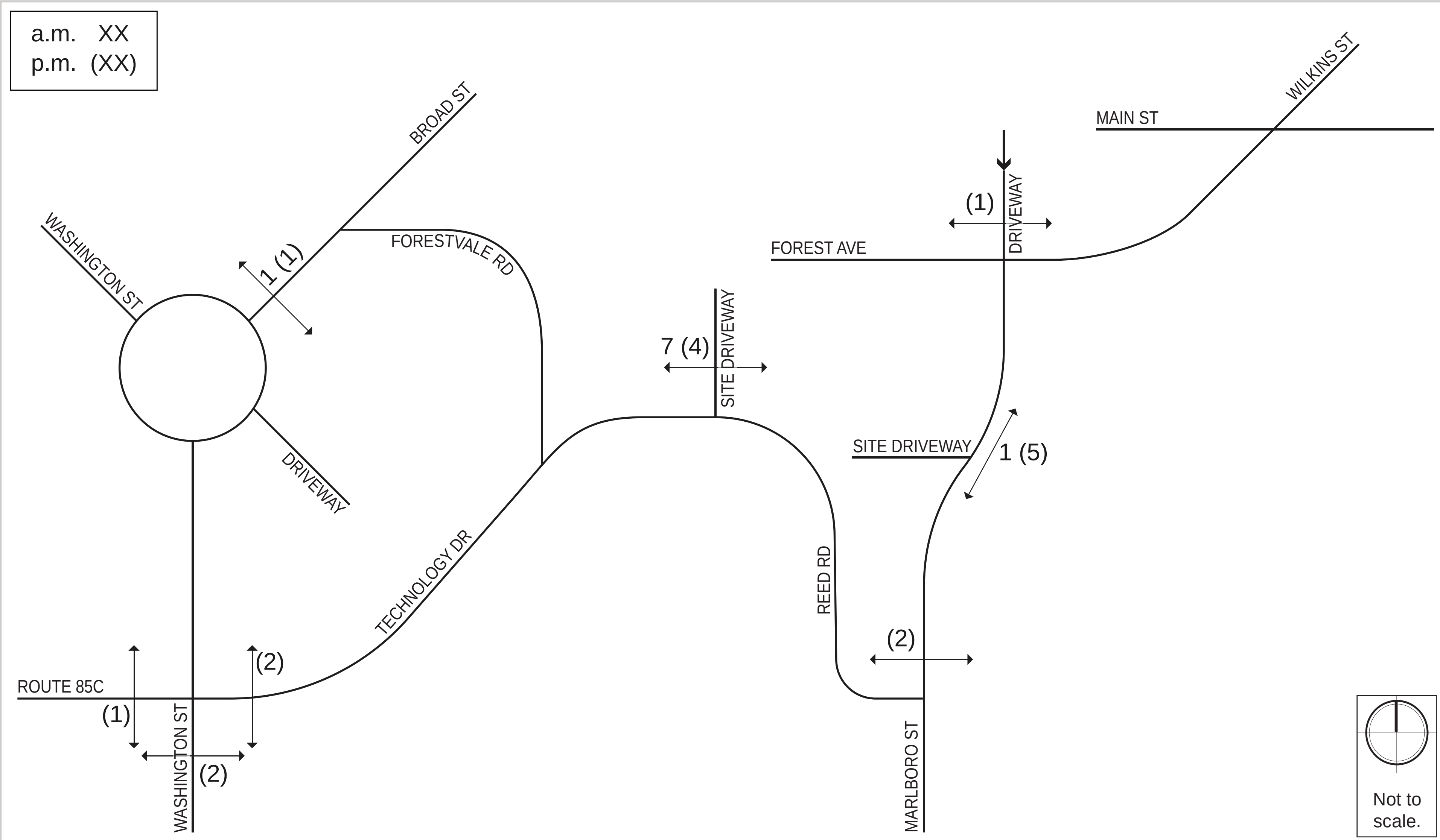
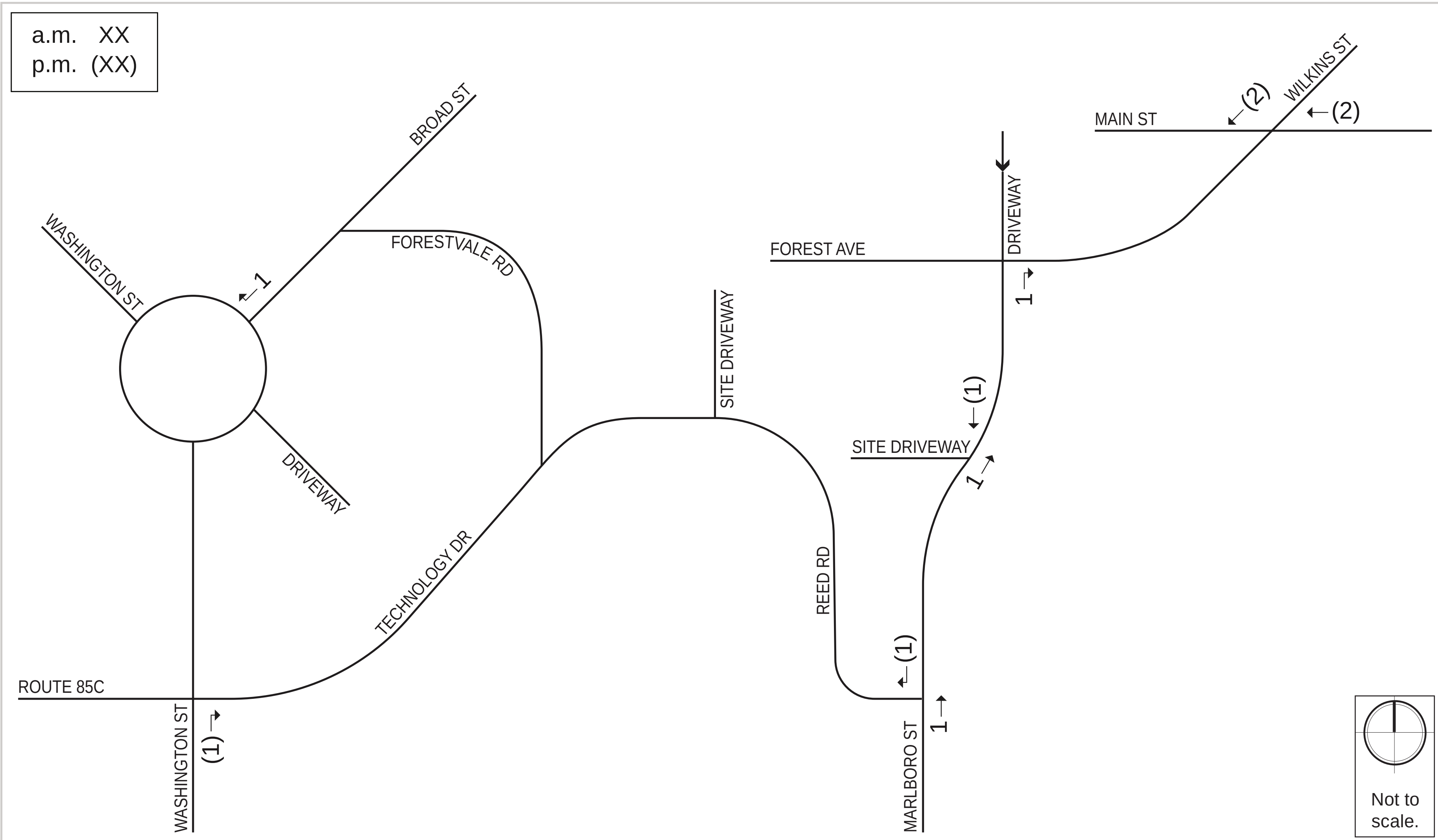


Figure 5. *Existing Condition Bicycle Volumes, Weekday a.m. and p.m. Peak Hours*



Existing Public Transportation

The Project area is served by the MetroWest Regional Transit Authority (MWRTA). The MWRTA Route 15 bus stops at the Stop and Shop located at 10 Technology Drive, which is approximately a 10-minute (one-half mile) walk from the Project Site. The MWRTA service is summarized in **Table 3**. and mapped in **Figure 6**.

Table 3. Bus Service in Study Area

Bus Service	Description	Weekday Peak Hour headway (minutes)[1]
Route 15	Blandin Hub – Highland Commons	70

[1] Headway is the time between vehicles. Source MWRTA 2021.
Note that headways reflect COVID-19 schedule modifications.

Figure 6. *Public Transportation*

No-build (2029) Condition

For transportation impact analyses, standard practice is to evaluate two future conditions: No-build Condition (without the proposed project) and Build Condition (with the project). Typically, these conditions are projected to a future date seven years from the Existing Condition year. For this study, Year 2029 has been designated as the future year.

Traffic Growth

The traffic volumes under the No-build Condition are independent of the proposed Project and include existing traffic plus new traffic resulting from general background growth and identified new projects in the area.

GENERAL BACKGROUND GROWTH

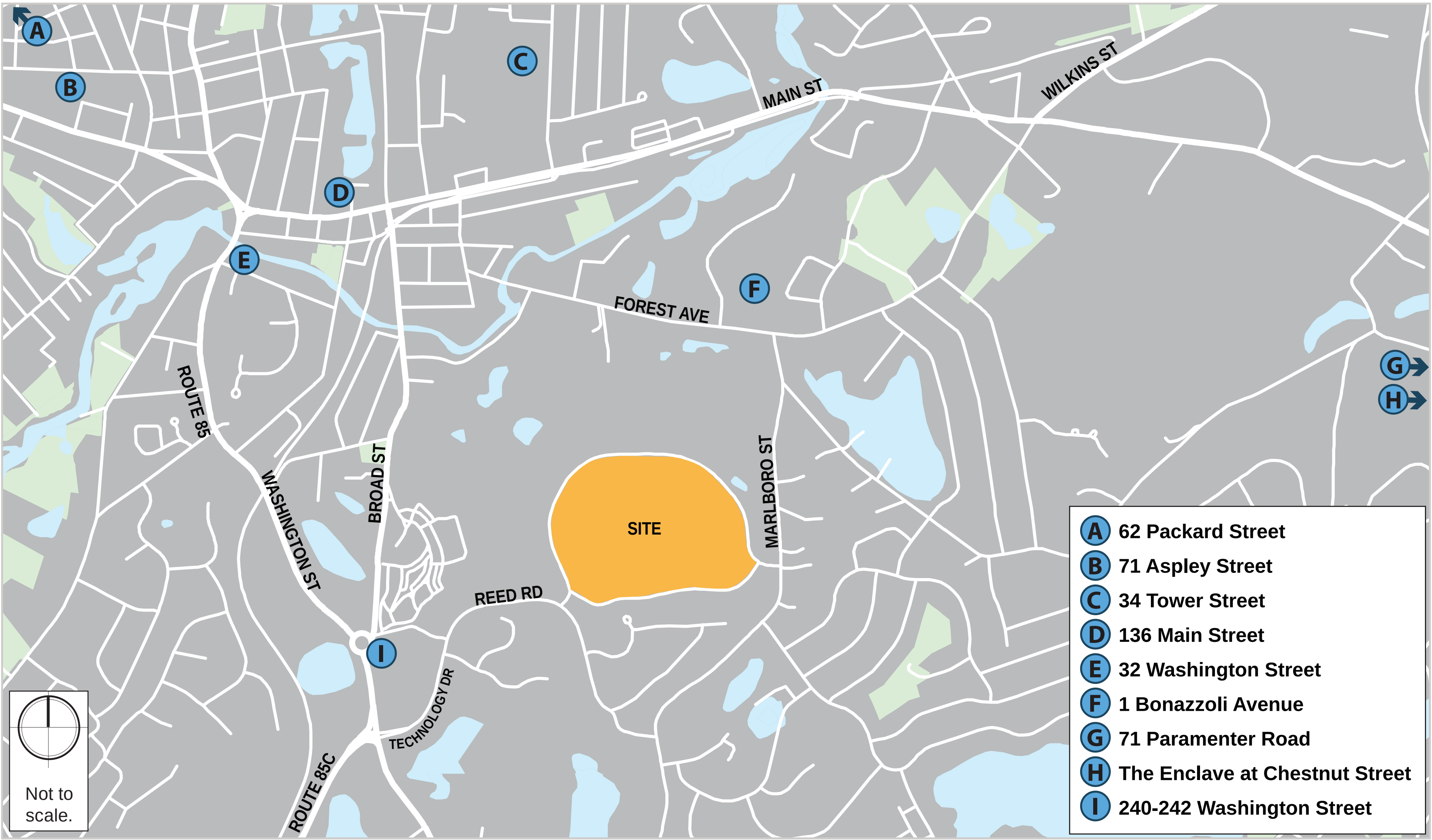
Based on the Hudson Master Plan and a review of recent and historic traffic data collected, and to account for any additional unforeseen traffic growth, a one percent (1%) annual growth rate was applied to the existing intersection volumes over seven years to account for background growth by 2029.

SPECIFIC DEVELOPMENT

Traffic volumes associated with larger and/or closer known development projects can affect traffic patterns throughout the study area within the future analysis time horizon. Based on discussion with Hudson's Director of Planning and Community Development, the planned projects listed below and shown in **Figure 7** were identified for inclusion in the future conditions. Trips associated with the projects listed below were incorporated directly into the future peak hour traffic model:

- **34 Tower Street** – 166 market-rate multi-family units and 30 affordable multi-family units;
- **1 Bonazzoli Drive** – 26,200-sf industrial warehouse building; and
- **240-242 Washington Street** – A six-pump self-service gas station with a 4,820-sf freestanding convenience store.

Figure 7. *Specific Area Developments*



Because of relatively small number of associated trips or distance from the Project's study area intersections, the activity associated with the projects listed below are assumed to be reflected in the one percent (1%) annual background growth factor:

- **62 Packard Street** – 40 affordable multi-family units;
- **71 Aspley Street** – 19 market-rate multi-family units and 4 affordable multi-family units;
- **136 Main Street –** 27 multi-family units, commercial, and restaurant uses;
- **71 Parmenter Road** – 10,000-sf warehouse building;
- **The Enclave at Chestnut Street** – 64 age-restricted townhouse units; and
- **32 Washington Street** – 40 multi-family units.

Proposed Infrastructure Improvements

A review of on-going studies and planned improvements to roadway, bicycle, and pedestrian facilities was conducted to understand future transportation changes in the study area. Currently, no improvements are planned that will impact the study area intersections.

No-build (2029) Traffic Volumes

The 1% per year annual growth rate, compounded annually, was applied to the Existing Condition traffic volumes, then the traffic associated with the specific developments were added to develop the No-build (2029) Condition traffic volumes. The No-build (2029) Condition traffic volumes are shown in **Figure 8** and **Figure 9** for the a.m. and p.m. peak hours, respectively.

Figure 8. *No-build (2029) Condition Traffic Volumes, Weekday a.m. Peak Hour*

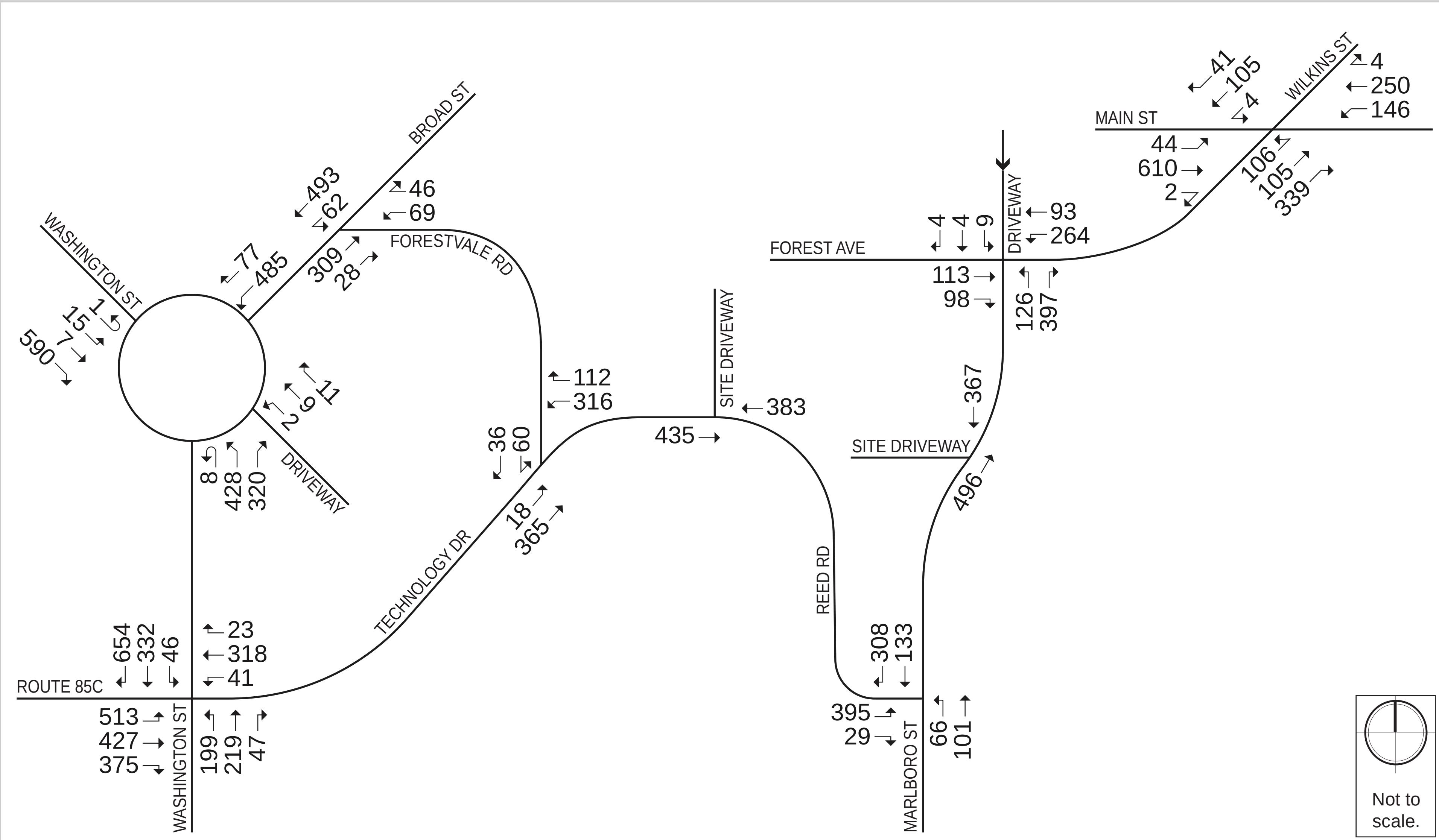
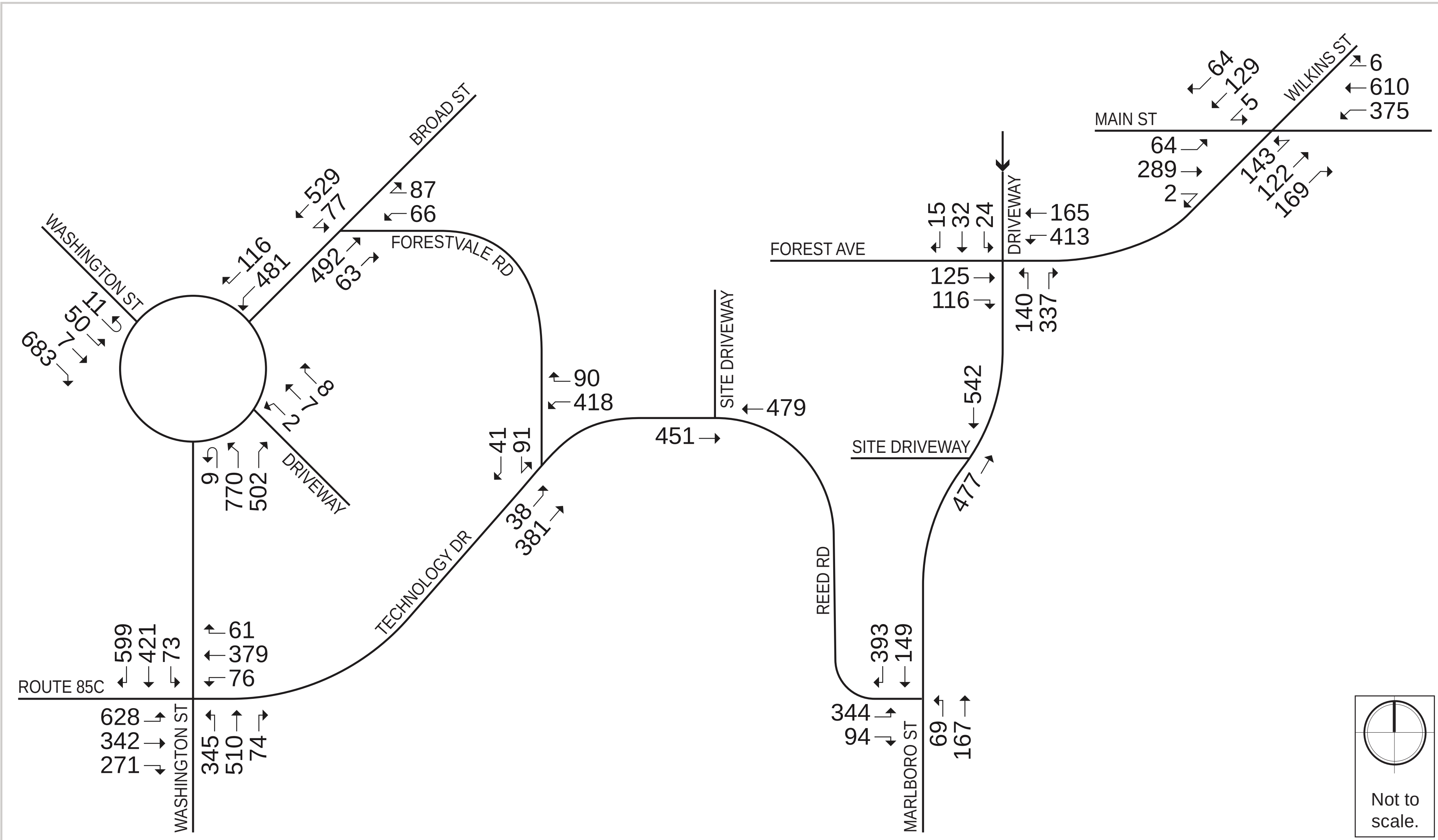


Figure 9. *No-build (2029) Condition Traffic Volumes, Weekday p.m. Peak Hour*



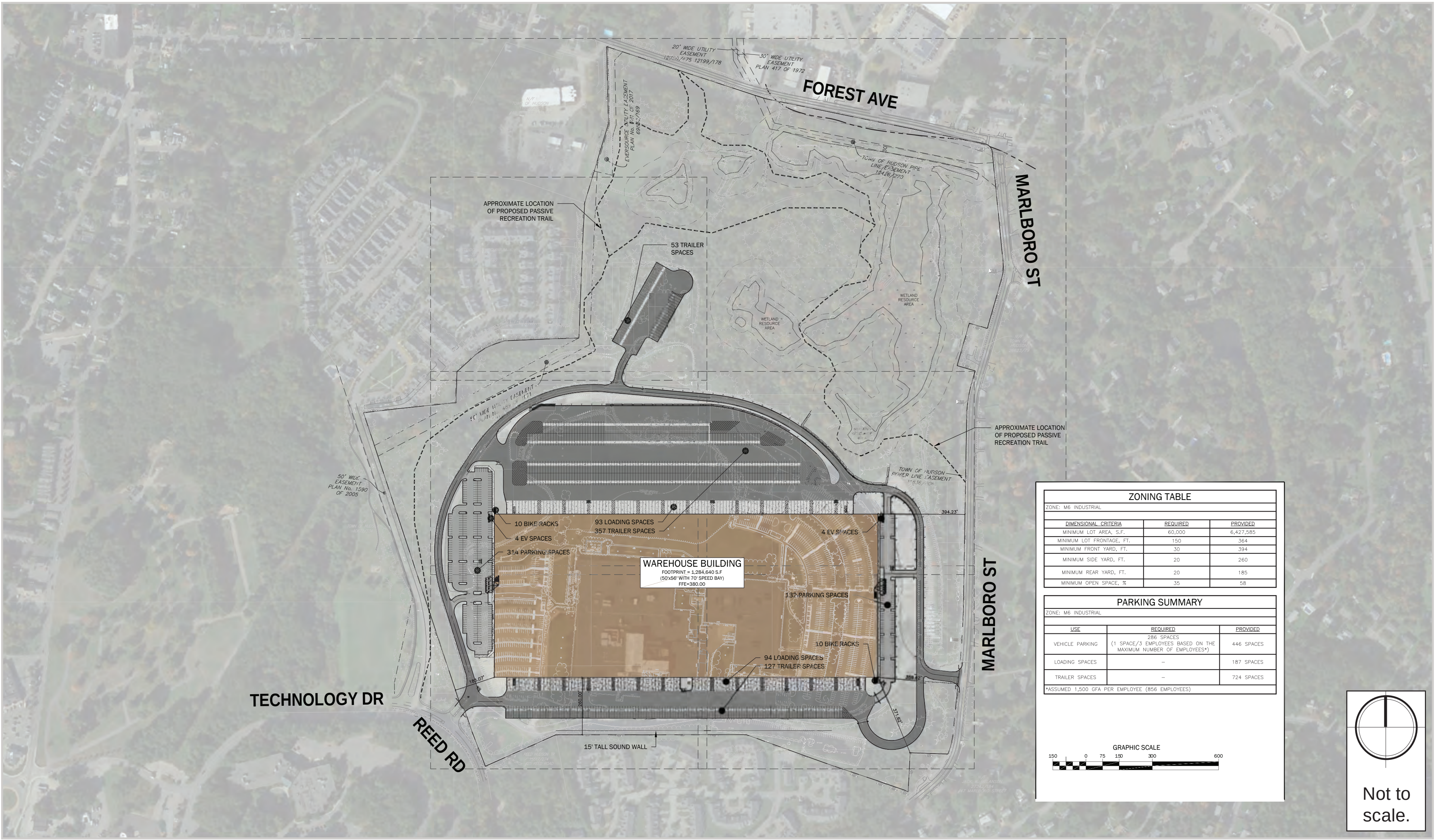
Build (2029) Condition

The Project Site Plan is shown in **Figure 10**. The Project includes demolition of the remaining Intel buildings and construction of approximately 1,284,640 sf of warehouse space. A specific warehouse tenant (or tenants) has not yet been identified. The Project will retain the existing Site Driveways at Reed Road to the southwest and at Marlboro Street to the east.

Parking

The Project will provide a total of approximately 446 automobile parking spaces on-site in surface lots for employee and visitor use. The warehouse will have approximately 187 loading berths adjacent to the building for transferring goods on and off trucks. Additionally, the site will have approximately 724 trailer storage spaces. Employee automobile trips will use either the Site Driveway at Reed Road or the Site Driveway at Marlboro Street, while truck trips will be restricted to the Site Driveway at Reed Road to travel to and from the I-495 corridor, via Technology Drive and Route 85C.

Figure 10. ***Site Plan***



ZONING TABLE		
ZONE: M6 INDUSTRIAL		
DIMENSIONAL CRITERIA	REQUIRED	PROVIDED
MINIMUM LOT AREA, S.F.	60,000	6,427,585
MINIMUM LOT FRONTAGE, FT.	150	364
MINIMUM FRONT YARD, FT.	30	394
MINIMUM SIDE YARD, FT.	20	260
MINIMUM REAR YARD, FT.	20	185
MINIMUM OPEN SPACE, %	35	58

PARKING SUMMARY		
ZONE: M6 INDUSTRIAL		
USE	REQUIRED	PROVIDED
VEHICLE PARKING	286 SPACES (1 SPACE/3 EMPLOYEES BASED ON THE MAXIMUM NUMBER OF EMPLOYEES*)	446 SPACES
LOADING SPACES	–	187 SPACES
TRAILER SPACES	–	724 SPACES

*ASSUMED 1,500 GFA PER EMPLOYEE (856 EMPLOYEES)

Trip Generation Methodology

Trip generation is a complex, multi-step process that produces an estimate of vehicle trips and, if applicable, transit trips, walk trips, and bicycle trips associated with a proposed development. A project's location and proximity to different travel modes determine how people will travel to and from a project site.

Trip generation estimates were based on data published in the latest Institute of Transportation Engineers (ITE) *Trip Generation Manual, 11th Edition*. Because the Project tenant is not known at this time, the study team examined several ITE Land Use Codes (LUCs) for warehouse/industrial uses and reviewed other environmental permitting submissions. The study team chose ITE LUC 150, Warehousing, because it reflects one of the higher trip-generating categories and has typically been adopted in recent environmental filings to MEPA and local communities.

- Land Use Code 150 – Warehousing. ITE defines the land use as a building "primarily devoted to the storage of materials, but it may also include office and maintenance areas." Calculations of the number of trips use ITE's average rate per 1,000 sf.

ITE provides data to estimate the total number of "unadjusted" vehicle trips associated with a project. In urban settings, trips are often "adjusted" to reflect alternative travel modes, such as transit use, walking, and bicycling. For this Project site, however, most trips are expected to be completed by vehicle and, therefore, no adjustments were made.

Existing Trip Generation

When assessing a site with existing, active land uses, it is standard practice to estimate existing trips and subtract those trips from the projected new future trips. The result of this process yields "net new" trips that become the basis for the traffic analysis.

In 1998, the Intel Corporation established their Hudson campus at 75 Reed Road and over the next fifteen years employed up to 1,500 workers. At that time, the site was comprised of three buildings totaling 1.3 million sf of manufacturing and R&D space. In 2014, Intel announced the impending closure of the manufacturing facility and by 2017 had demolished the manufacturing building while retaining the R&D operations. Currently, however, the remaining site buildings are vacant and do not generate any appreciable traffic and therefore no credit (reduction) for existing vehicle trips has been taken in the analysis of the Build (2029) Condition, resulting in a more conservative (higher impact) evaluation.

Project Trip Generation

The vehicle trip generation associated with the Project includes an estimate of automobile trips, mostly related to employees, and truck trips, related to the movement of goods. The trip generation of the Project is summarized in **Table 4**. Detailed trip generation information is provided in the **Appendix C**.

Table 4. Project Trip Generation

Period/Direction		Automobile Trips	Truck Trips	Total Vehicle Trips
Daily	In	733	385	1,118
	Out	733	385	1,118
	Total	1,466	770	2,236
a.m. Peak Hour	In	155	13	168
	Out	38	12	50
	Total	193	25	218
p.m. Peak Hour	In	46	20	66
	Out	160	18	178
	Total	206	38	244

As shown in **Table 4**, the proposed warehouse is expected to generate approximately 2,236 daily weekday vehicle trips (1,118 entering and 1,118 exiting), of which 218 would occur during the weekday a.m. peak hour (168 entering and 50 exiting) and 244 would occur during the weekday p.m. peak hour (66 entering and 178 exiting).

Vehicle Trip Distribution

A vehicle trip distribution pattern identifies the various travel paths for vehicles arriving at a project site and the corresponding departure travel paths. New vehicle trips generated by the Project Site will include both employee automobiles and trucks transporting goods. The trip distribution pattern for employee automobile trips is based on worker town-of-residence information from the Hudson Master Plan and travel time information available from the Google Maps application. The automobile trip distribution is shown in **Figure 11**. The truck trip distribution is based on the Proponent's knowledge of origin and destination travel patterns of potential industrial tenants and the study team's knowledge of the local roadway network. The truck trip distribution is shown in **Figure 12**.

Figure 11. *Automobile Trip Distribution*

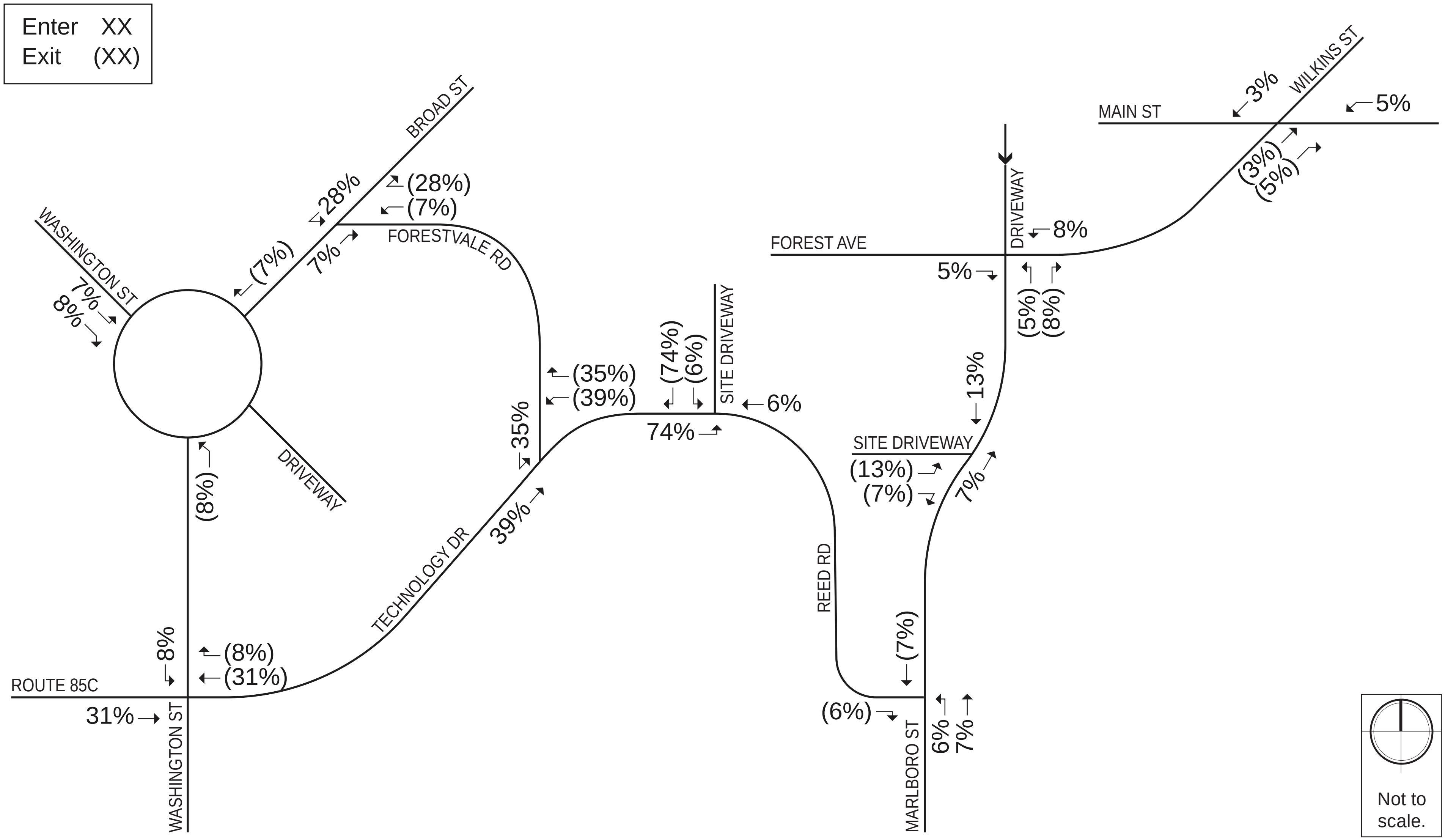
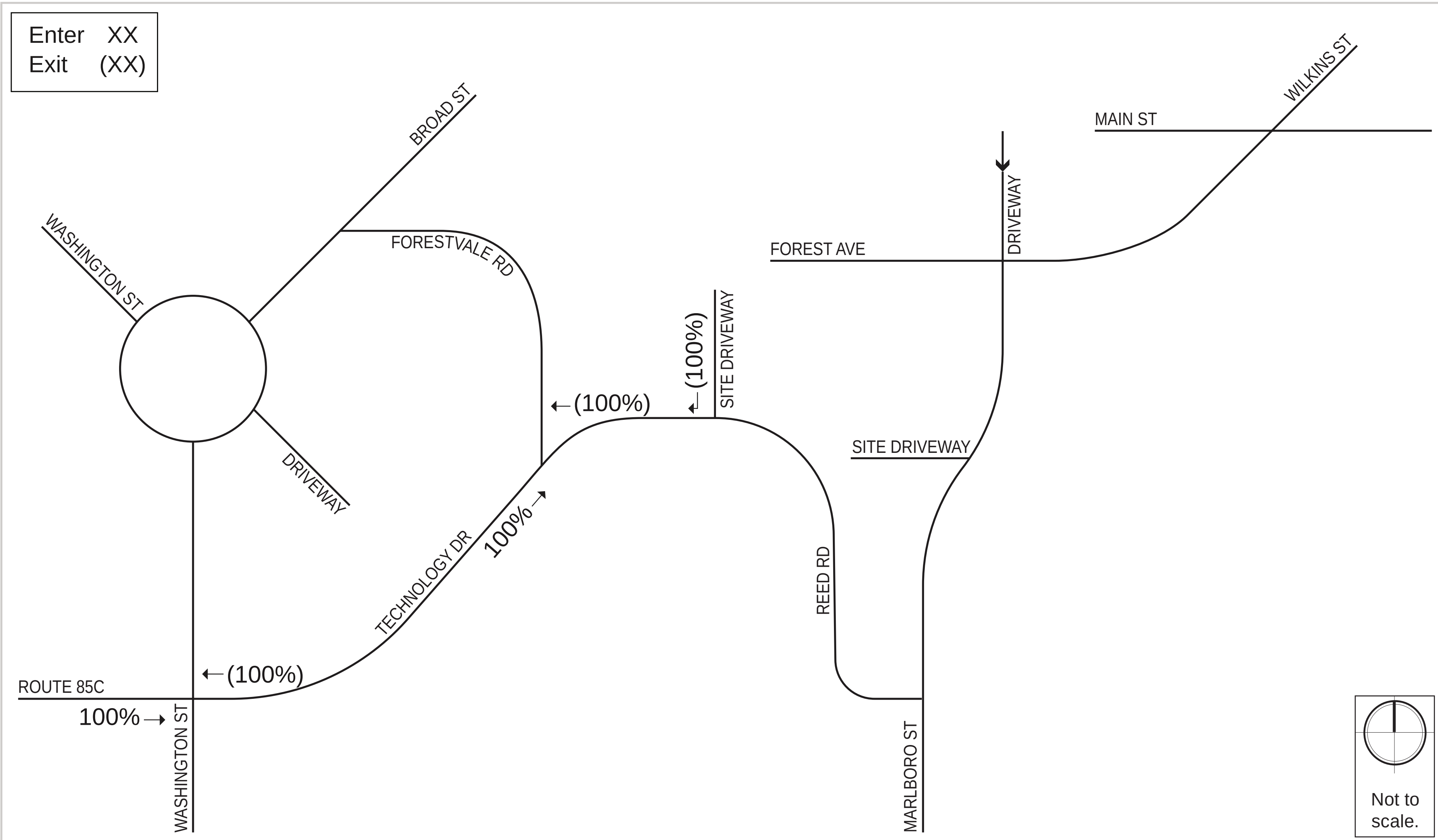


Figure 12. ***Truck Trip Distribution***



Build Traffic Volumes

The Project-generated vehicle trips were distributed throughout the study area according to the trip distribution patterns. The Project-generated automobile trips at the study area intersections are shown for the weekday a.m. peak hour and the weekday p.m. peak hour in **Figure 13** and **Figure 14**, respectively, and the truck trips are shown for the weekday a.m. peak hour and the weekday p.m. peak hour in **Figure 15** and **Figure 16**, respectively.

The trip assignments were added to the No-build (2029) Condition traffic volumes to produce the Build (2029) Condition traffic volumes. The Build (2029) Condition a.m. and p.m. peak hour traffic volumes are shown in **Figure 17** and **Figure 18**, respectively.

Figure 13. ***Project-generated Automobile Trips, Weekday a.m. Peak Hour***

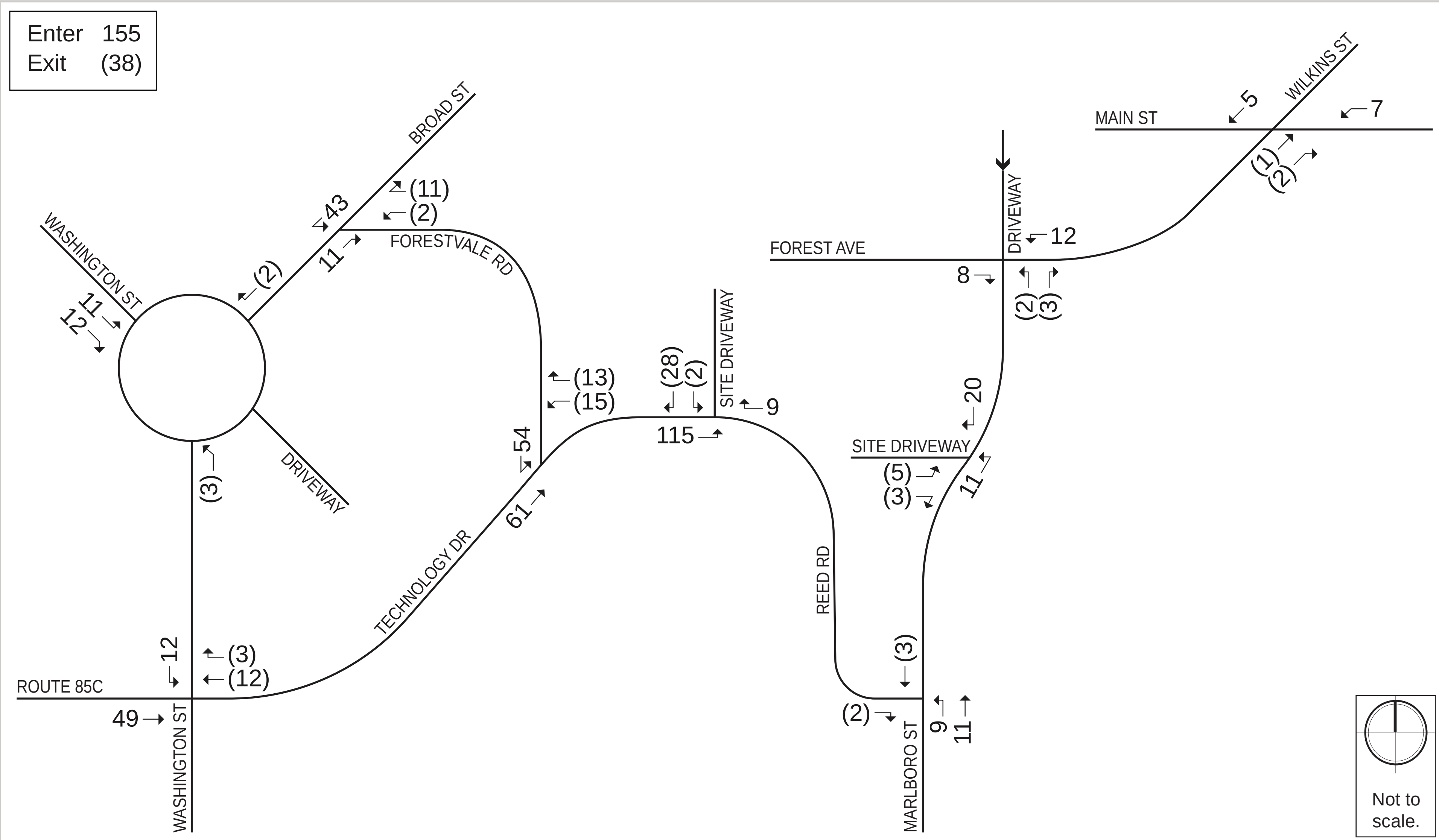


Figure 14. *Project-generated Automobile Trips, Weekday p.m. Peak Hour*

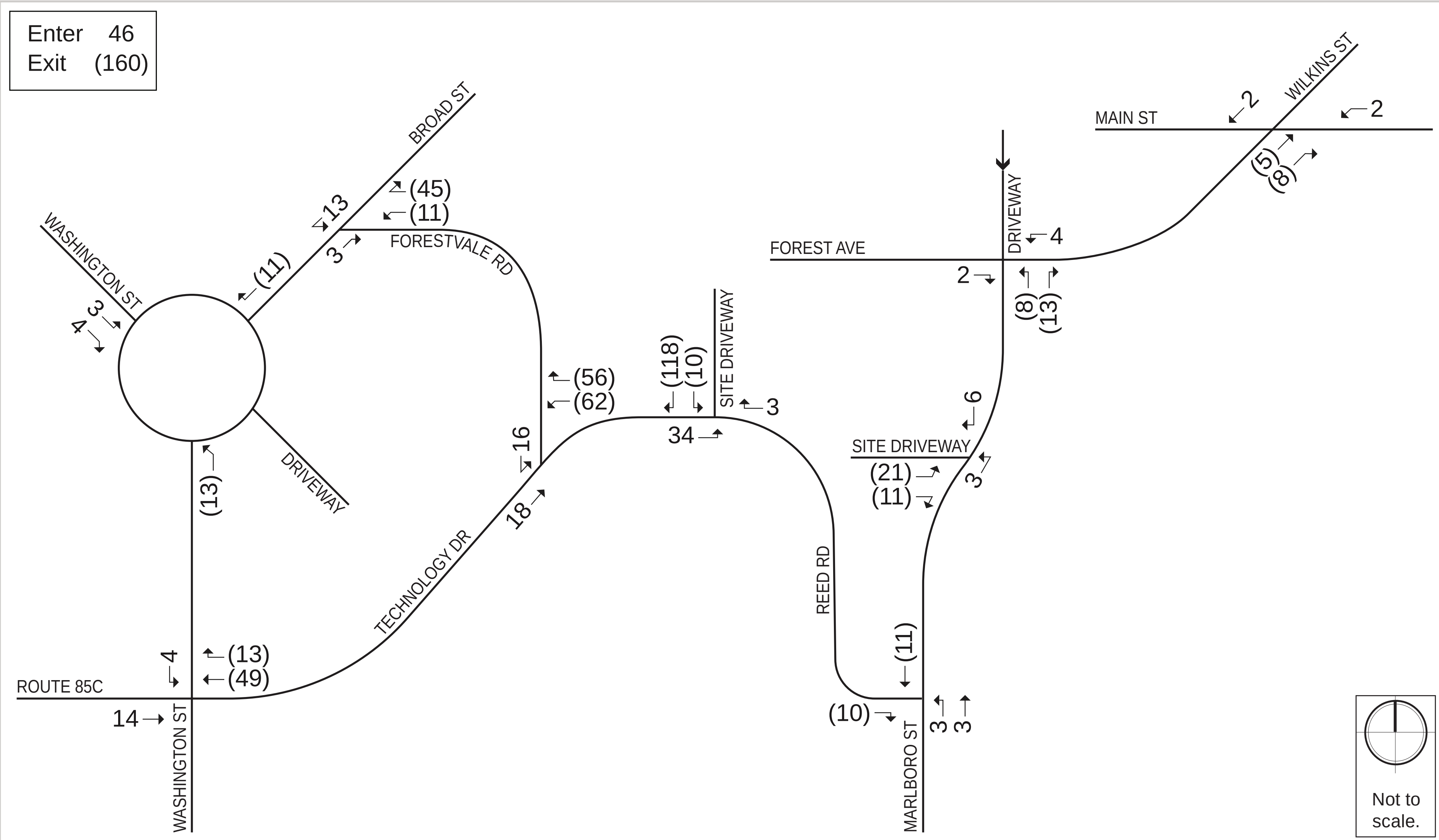


Figure 15. *Project-generated Truck Trips, Weekday a.m. Peak Hour*

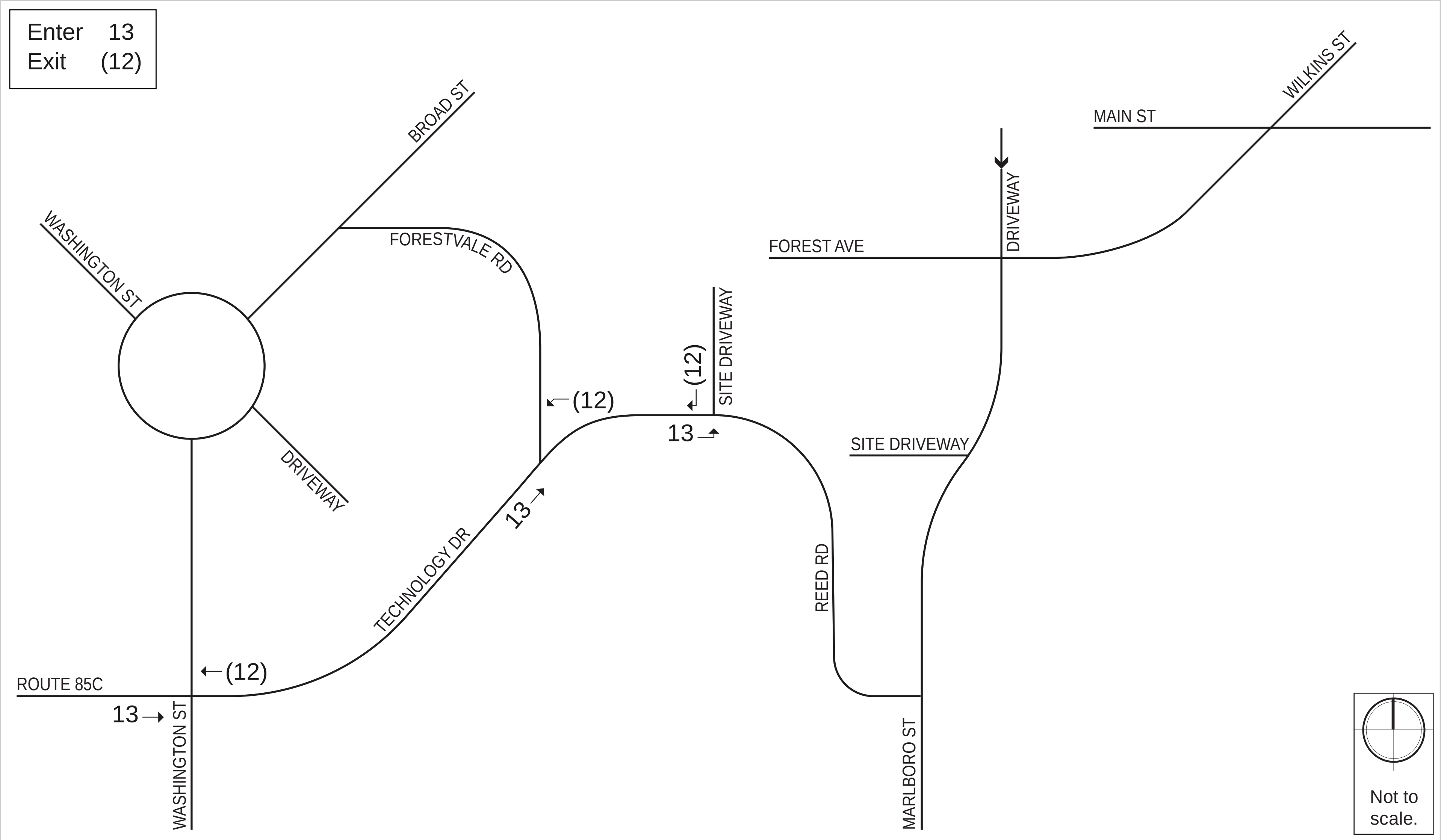


Figure 16. *Project Generated Truck Trips, Weekday p.m. Peak hour*

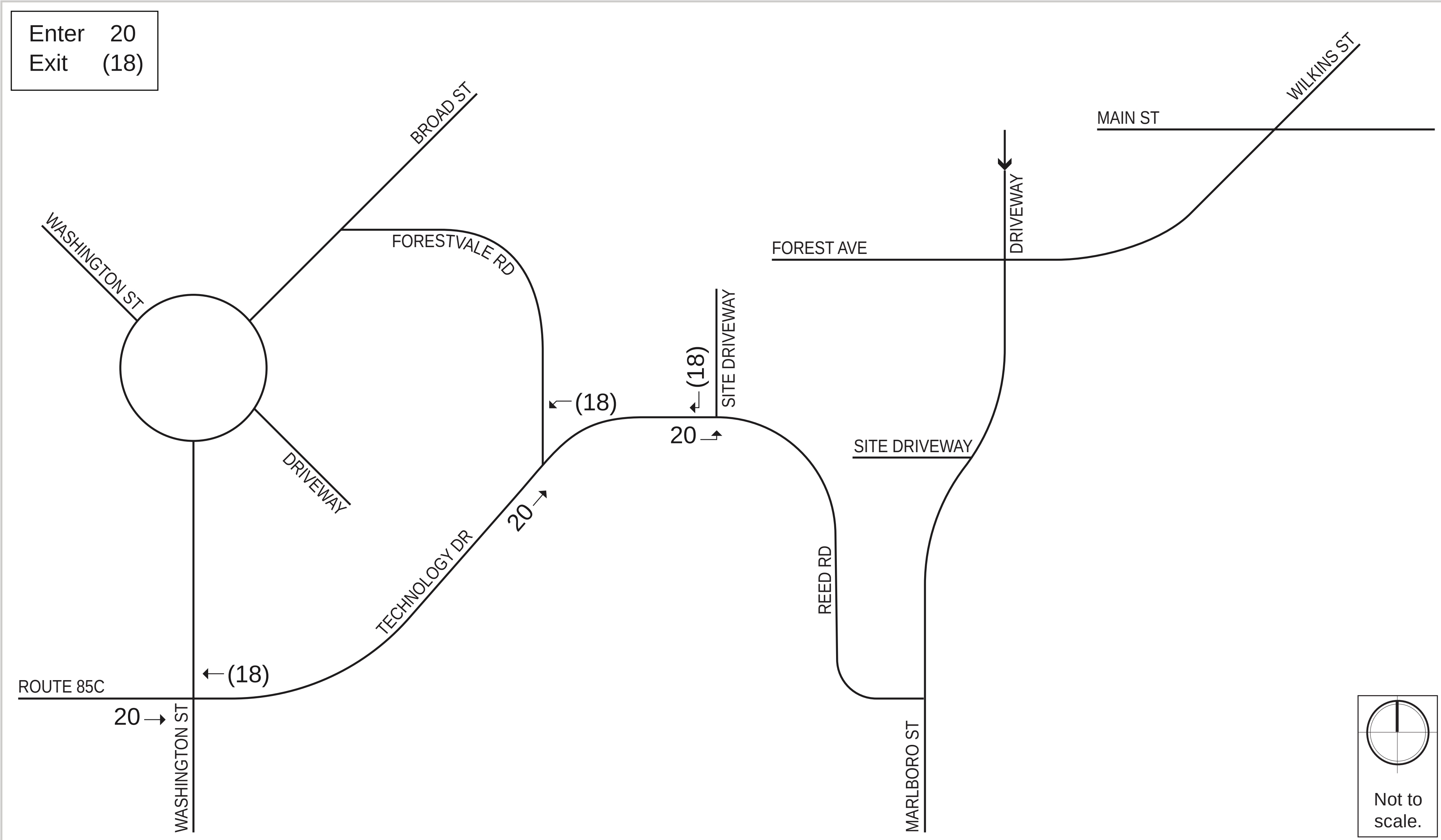


Figure 17. ***Build (2029) Condition Traffic Volumes, Weekday a.m. Peak Hour***

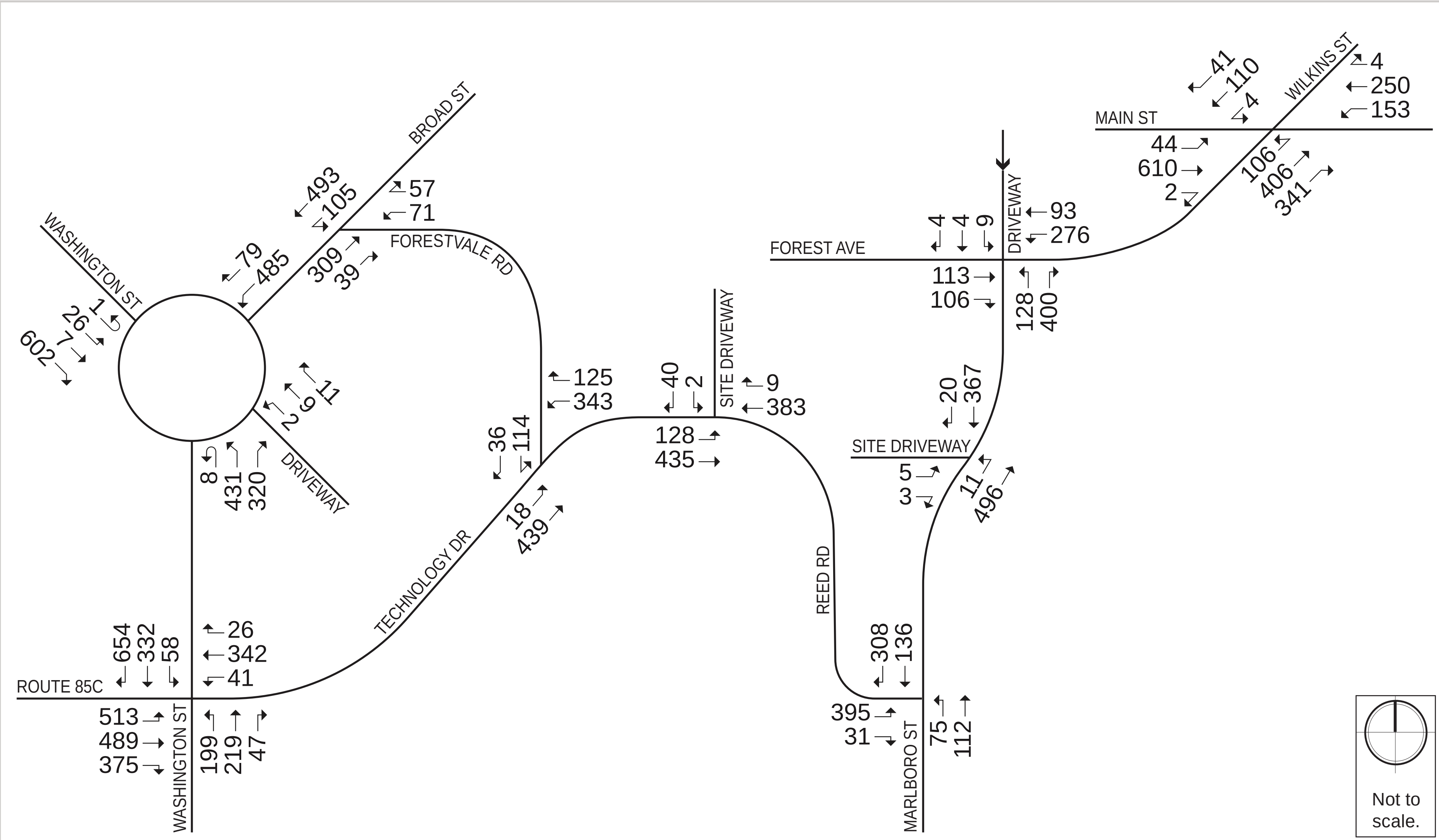
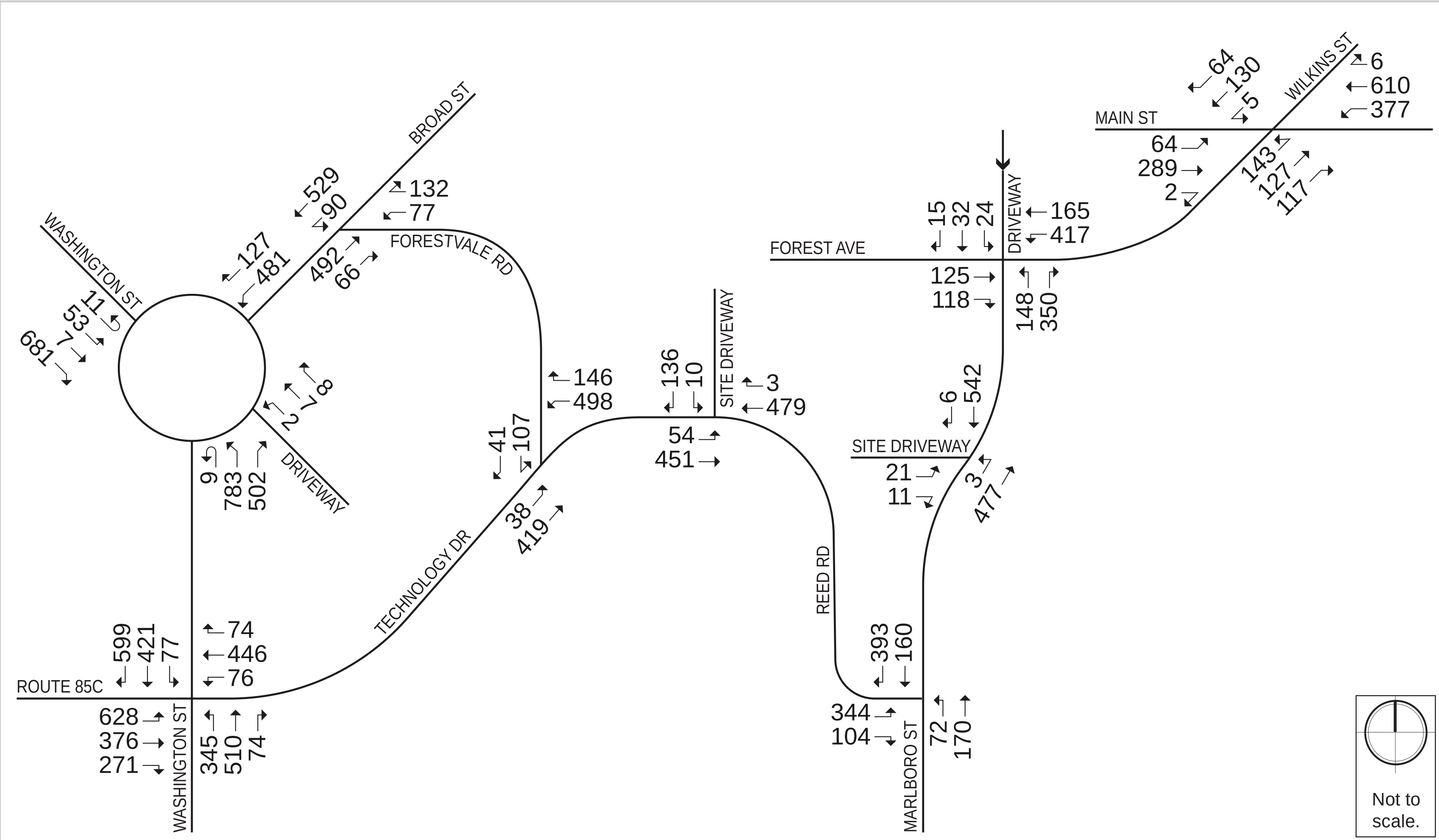


Figure 18. *Build (2029) Condition Traffic Volumes, Weekday p.m. Peak Hour*



Signal Warrant Analysis

A signal warrant analysis was conducted at the unsignalized intersection of Reed Road/Site Driveway. For the signal warrant analysis, ATR counts taken on Reed Road adjacent to the Site Driveway were utilized. The ATR counts were taken for a 72-hour period from Tuesday, March 15, 2022, through Thursday, March 17, 2022. The three days of ATR counts were averaged and the COVID-19 adjustment factor of 8% was applied to increase the volumes.

The entering and exiting volumes throughout a typical weekday from the Site Driveway were calculated using the ITE Hourly Distribution of Entering and Exiting Vehicle Trips by Land Use for Warehousing (LUC 150). The traffic signal warrant analysis was based on Chapter 4C of the *2009 Manual on Uniform Traffic Control Devices (MUTCD).* Typically, traffic signal warrants are conducted at unsignalized intersections that may need to be signalized. The study evaluates the following nine traffic signal warrants as part of the proposed work:

- Warrant 1 – Eight-Hour Vehicular Volume;
- Warrant 2 – Four-Hour Vehicular Volume;
- Warrant 3 – Peak Hour Volume;
- Warrant 4 – Pedestrian Volume;
- Warrant 5 – School Crossing;
- Warrant 6 – Coordinated Signal System;
- Warrant 7 – Crash Experience;
- Warrant 8 – Roadway Network; and
- Warrant 9 – Intersection Near a Grade Crossing.

It should be noted that meeting one or more warrants is required to justify the installation of a traffic signal. However, the satisfaction of one or more traffic signal warrants does not in itself require the installation of a traffic control signal. A summary of the traffic signal warrant analysis is presented in **Table 5**, and the traffic signal warrant analysis sheets are contained in **Appendix D**.

Table 5. Signal Warrant Analysis Summary at Reed Road/Site Driveway

Warrant Description	Applicable?	Met?
Warrant 1 – Eight-Hour Vehicular Volume	Yes	No
Warrant 2 – Four-Hour Vehicular Volume	Yes	No
Warrant 3 – Peak Hour Volume	Yes	Yes
Warrant 4 – Pedestrian Volume	No	No
Warrant 5 – School Crossing	No	No
Warrant 6 – Coordinated Signal System	No	No
Warrant 7 – Crash Experience	No	No
Warrant 8 – Roadway Network	No	No
Warrant 9 – Intersection Near a Grade Crossing	No	No

The warrants applicable for assessment at this location include Warrant 1 – Eight-Hour Volume, Warrant 2 – Four-Hour Volume, and Warrant 3 – Peak Hour Volume.

The analysis shows that only Warrant 3 – Peak Hour Volume is met. However, the MUTCD specifies in Section 4C.01 that the satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal. The intersection was evaluated to determine whether the traffic control would improve the overall safety or operations of the intersection. The crash history at the intersection presented no existing safety concerns and the minor street movements operate at LOS D or better in the future condition as shown in **Table 7** and **Table 8** with minimal delay on the mainline.

Consequently, these results indicate that a signal is not warranted at the Reed Road/Site Driveway because the volumes only exceed the necessary threshold during one hour of the day and the intersection does not present any safety or operational concerns.

Vehicle Operations Analysis

The measure of effectiveness for evaluating traffic operations is level of service (LOS), which is determined by assessing average delay incurred by vehicles at intersections and along intersection approaches. Trafficware's Synchro (version 11) software was used to calculate average delay and associated LOS at the study area signalize and unsignalized intersections. This software is based on the traffic operational analysis methodology of the Transportation Research Board's *Highway Capacity Manual (HCM), 6th Edition*. However, depending on the signal phasing at the intersection (i.e., more than eight phases, specialized non-NEMA phasing, etc.), HCM 6th Edition outputs through Synchro are not always feasible. In such cases, Synchro can provide the 2010 HCM outputs, something allowed by MassDOT due to the software restrictions.

For the roundabout at Washington Street/Broad Street, SIDRA traffic modelling software was used to conduct operational analysis. SIDRA is based on the HCM methodologies, and the roundabout delay and LOS outputs correspond to those of an unsignalized intersection.

LOS designations are based on average delay per vehicle for all vehicles entering an intersection. **Table 6** displays the intersection level of service criteria. LOS A indicates the most favorable condition, with minimum traffic delay, while LOS F represents the worst condition. LOS E or F, however, is often typical for a stop-controlled minor street that intersects a major roadway.

Table 6. Level of Service Criteria

Level of Service	Average Stopped Delay (seconds/vehicle)	
	Signalized Intersection	Unsignalized Intersection/ Roundabout
A	≤10	≤10
B	>10 and ≤20	>10 and ≤15
C	>20 and ≤35	>15 and ≤25
D	>35 and ≤55	>25 and ≤35
E	>55 and ≤80	>35 and ≤50
F	>80	>50

In addition to delay and LOS, the operational capacity, and vehicle queues, as described below, are calculated, and used to further quantify traffic operations at intersections.

- The volume-to-capacity ratio (v/c ratio) is a measure of congestion at an intersection approach. A v/c ratio below one indicates that the intersection approach has adequate capacity to process the arriving traffic volumes over the course of an hour. A v/c ratio of one or greater indicates that the traffic volume on the intersection approach exceeds capacity.
- The 50th percentile queue length, measured in feet, represents the average of the vehicle queue upstream from the stop line during 50% of all signal cycles.
- The 95th percentile queue length, measured in feet, represents the farthest extent of the vehicle queue (to the last stopped vehicle) upstream from the stop line during 5% of all signal

cycles. The 95th percentile queue will not be seen during each cycle. The queue would be this long only 5% of the time and would typically occur during peak hours.

Table 7 and **Table 8** present the a.m. and p.m. peak hour capacity analysis, respectively, for the study area intersections under each analysis condition: Existing Condition, No-build (2029) Condition, and the Build (2029) Condition. The detailed analysis sheets are provided in **Appendix E**.

Table 7. Capacity Analysis Summary, Weekday a.m. Peak Hour

Intersection/Movement	Existing Condition					No-build (2029) Condition					Build (2029) Condition				
	LOS	Delay (s)	V/C Ratio	50th % Queue (ft.)	95th % Queue (ft.)	LOS	Delay (s)	V/C Ratio	50th % Queue (ft.)	95th % Queue (ft.)	LOS	Delay (s)	V/C Ratio	50th % Queue (ft.)	95th % Queue (ft.)
Signalized															
Forest Avenue/Marlboro Street	A	9.8	-	-	-	B	10.2	-	-	-	B	10.4	-	-	-
EB Forest Ave left/thru/right	B	13.0	0.27	49	94	B	13.5	0.30	56	105	B	13.4	0.31	57	108
WB Forest Ave left	B	10.8	0.42	66	100	B	11.6	0.48	73	110	B	12.1	0.51	79	115
WB Forest Ave thru/right	A	7.7	0.09	21	39	A	7.7	0.10	23	41	A	7.7	0.10	23	41
NB Marlboro St left	C	25.1	0.32	52	98	C	25.7	0.35	57	106	C	25.8	0.35	58	108
NB Marlboro St right	A	2.9	0.42	0	43	A	2.9	0.45	0	44	A	3.0	0.45	0	44
SB Driveway left/thru/right	B	17.4	0.05	7	16	B	17.6	0.05	7	17	B	17.6	0.05	7	17
Main Street (Route 62)/Forest Avenue/ Wilkins Street	C	21.8	-	-	-	C	24.4	-	-	-	C	24.7	-	-	-
EB Main St left	A	8.0	0.08	11	24	A	8.1	0.09	12	26	A	8.1	0.09	12	26
EB Main St thru/right	C	27.2	0.72	329	453	C	30.1	0.78	374	513	C	30.1	0.78	374	513
WB Main Street left	B	12.9	0.47	43	62	B	16.2	0.58	47	67	B	17.4	0.60	49	70
WB Main Street thru	B	17.9	0.33	115	151	B	18.3	0.36	126	164	B	18.3	0.36	126	164
WB Main Street right	A	0.0	0.01	0	0	A	0.0	0.01	0	0	A	0.0	0.01	0	0
NB Forest Ave left/thru	D	41.5	0.60	127	202	D	46.5	0.69	144	228	D	47.6	0.71	146	#232
NB Forest Ave right	A	7.5	0.54	9	74	B	10.8	0.59	34	116	B	11.1	0.60	36	119
SB Wilkins St left/thru	C	33.0	0.31	80	94	C	33.7	0.35	91	105	C	34.0	0.37	96	109
SB Wilkins St right	A	5.4	0.09	0	11	A	5.3	0.09	0	11	A	5.3	0.09	0	11
Route 85C/Washington Street/ Technology Drive	C	25.9	-	-	-	C	29.4	-	-	-	C	30.5	-	-	-
EB Route 85C left I left	C	32.8	0.69	107	182	C	34.6	0.71	129	217	D	36.6	0.73	137	219
EB Route 85C thru I thru/right	B	19.4	0.62	143	231	C	22.6	0.69	166	270	C	21.9	0.68	180	309
WB Technology Dr left	D	38.8	0.25	18	53	D	42.3	0.28	22	63	D	48.7	0.37	24	63
WB Technology Dr thru I thru	C	33.2	0.56	75	131	D	35.9	0.59	90	155	C	34.5	0.56	97	167
WB Technology Dr right	A	0.2	0.06	0	0	A	0.3	0.06	0	0	A	0.3	0.07	0	0
NB Washington St left I left	E	61.3	0.81	50	#132	F	85.6	0.94	58	#156	F	94.2	0.97	61	#157
NB Washington St thru I thru/right	C	27.7	0.35	59	109	C	30.2	0.39	70	127	C	34.4	0.49	74	127
SB Washington St left	C	33.7	0.18	16	49	D	36.1	0.24	23	59	D	37.8	0.29	30	72
SB Washington St thru I thru	C	29.6	0.49	72	122	C	31.2	0.51	84	135	C	32.7	0.53	89	137
SB Washington St right	B	10.1	0.78	0	98	B	10.4	0.80	0	104	B	10.7	0.81	0	105
Unsignalized															
Reed Road/Site Driveway	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB Reed Rd left	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	8.7	0.13	-	11
EB Reed Rd thru	A	0.0	0.26	-	0	A	0.0	0.28	-	0	A	0.0	0.28	-	0
WB Reed Rd thru/right	A	0.0	0.24	-	0	A	0.0	0.26	-	0	A	0.0	0.26	-	0
SB Site Driveway left	A	0.0	0.00	-	0	A	0.0	0.00	-	0	D	26.0	0.04	-	3
SB Site Driveway right	A	0.0	0.00	-	0	A	0.0	0.00	-	0	B	12.9	0.26	-	26

Intersection/Movement	Existing Condition					No-build (2029) Condition					Build (2029) Condition				
	LOS	Delay (s)	V/C Ratio	50th % Queue (ft.)	95th % Queue (ft.)	LOS	Delay (s)	V/C Ratio	50th % Queue (ft.)	95th % Queue (ft.)	LOS	Delay (s)	V/C Ratio	50th % Queue (ft.)	95th % Queue (ft.)
Marlboro Street/Site Driveway	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB Site Driveway left	A	0.0	0.00	-	0	A	0.0	0.00	-	0	C	24.0	0.10	-	8
EB Site Driveway right	A	0.0	0.00	-	0	A	0.0	0.00	-	0	B	11.2	0.02	-	2
WB Shared Driveway left/right	C	15.2	0.01	-	0	C	16.5	0.01	-	0	C	17.4	0.01	-	1
NB Marlboro St left/thru	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.3	0.01	-	1
SB Marlboro St thru/right	A	0.0	0.24	-	0	A	0.0	0.27	-	0	A	0.0	0.28	-	0
Reed Road/Marlboro Street	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB Reed Rd left	C	22.3	0.66	-	121	D	29.2	0.76	-	169	D	34.0	0.80	-	191
EB Reed Rd right	A	9.1	0.03	-	3	A	9.3	0.04	-	3	A	9.3	0.04	-	3
NB Marlboro St left/thru	A	3.7	0.06	-	5	A	3.8	0.07	-	6	A	3.9	0.08	-	6
SB Marlboro St thru	A	0.0	0.08	-	0	A	0.0	0.09	-	0	A	0.0	0.09	-	0
SB Marlboro St right	A	0.0	0.19	-	0	A	0.0	0.21	-	0	A	0.0	0.21	-	0
Broad Street/Forestvale Road	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WB Forestvale Rd left/right	C	18.2	0.29	-	30	C	22.2	0.38	-	42	D	27.0	0.46	-	58
NB Broad St thru/right	A	0.0	0.19	-	0	A	0.0	0.22	-	0	A	0.0	0.22	-	0
SB Broad St left/thru	A	1.3	0.05	-	4	A	1.5	0.06	-	4	A	2.4	0.10	-	8
Technology Drive/Forestvale Road	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB Forestvale Rd left | right	B	14.9	0.15	-	13	C	15.7	0.20	-	18	C	23.7	0.44	-	55
NB Technology Dr left/thru	A	0.5	0.02	-	1	A	0.6	0.02	-	1	A	0.6	0.02	-	1
SB Technology Dr thru/right	A	0.0	0.25	-	0	A	0.0	0.27	-	0	A	0.0	0.30	-	0
Roundabout															
Washington Street/Broad Street	A	5.7	-	46	83	A	7.1	-	70	127	A	7.2	-	71	129
Washington St SEB u-turn/left/thru	A	6.2	0.02	1	1	A	7.3	0.04	1	3	A	7.6	0.07	2	4
Washington St SEB right	A	0.0	0.32	0	0	A	0.0	0.34	0	0	A	0.0	0.35	0	0
Washington St NB u-turn/left	A	5.9	0.30	15	27	A	6.3	0.33	17	31	A	6.4	0.33	18	32
Washington St NB thru/right	A	5.5	0.30	15	27	A	5.9	0.33	17	31	A	6.1	0.33	18	32
Broad St SB u-turn/left/thru	B	12.5	0.58	46	83	C	16.6	0.69	70	127	C	16.9	0.70	71	129
Broad St SB right	A	5.6	0.11	4	6	A	6.0	0.12	4	8	A	6.1	0.13	4	8
Driveway WB u-turn/left/thru/right	A	5.2	0.01	1	1	A	5.9	0.04	1	2	A	6.1	0.04	1	2

95th percentile queues do not clear after two cycles. Actual queues may be longer.
Grey shading indicates LOS E or F under the Existing Condition or a decrease to LOS E or LOS F in the No-build or Build Condition.

Table 8. Capacity Analysis Summary, Weekday p.m. Peak Hour

Intersection/Movement	Existing Condition					No-build (2029) Condition					Build (2029) Condition				
	LOS	Delay (s)	V/C Ratio	50th % Queue (ft.)	95th % Queue (ft.)	LOS	Delay (s)	V/C Ratio	50th % Queue (ft.)	95th % Queue (ft.)	LOS	Delay (s)	V/C Ratio	50th % Queue (ft.)	95th % Queue (ft.)
Signalized															
Forest Avenue/Marlboro Street	B	13.5	-	-	-	B	15.5	-	-	-	B	15.8	-	-	-
EB Forest Ave left/thru/right	B	14.7	0.35	73	116	B	15.2	0.38	82	127	B	15.2	0.39	82	128
WB Forest Ave left	B	18.7	0.72	115	166	C	24.4	0.81	128	#199	C	25.2	0.82	130	#207
WB Forest Ave thru/right	A	8.2	0.16	38	64	A	8.3	0.17	42	68	A	8.3	0.17	42	68
NB Marlboro St left	C	25.1	0.32	54	103	C	25.9	0.37	62	114	C	26.4	0.39	66	120
NB Marlboro St right	A	2.7	0.36	0	41	A	2.7	0.38	0	43	A	2.8	0.40	0	43
SB Driveway left/thru/right	B	18.8	0.13	22	53	B	19.0	0.14	25	57	B	19.0	0.14	25	57
Main Street (Route 62)/Forest Avenue/ Wilkins Avenue	C	23.2	-	-	-	C	26.0	-	-	-	C	26.2	-	-	-
EB Main St left	A	8.8	0.18	16	32	A	9.3	0.22	18	34	A	9.3	0.22	18	34
EB Main St thru/right	B	18.1	0.34	123	179	B	18.5	0.37	136	195	B	18.5	0.37	136	195
WB Main Street left	B	15.4	0.62	114	169	B	18.2	0.69	125	185	B	18.4	0.70	126	185
WB Main Street thru	C	25.9	0.69	313	447	C	28.3	0.75	355	506	C	28.3	0.75	355	506
WB Main Street right	A	0.0	0.01	0	0	A	0.0	0.01	0	0	A	0.0	0.01	0	0
NB Forest Ave left/thru	D	47.9	0.73	165	#279	E	56.5	0.82	186	#329	E	58.0	0.84	190	#338
NB Forest Ave right	A	9.0	0.34	12	65	B	10.5	0.36	20	77	B	10.7	0.38	22	81
SB Wilkins St left/thru	C	32.4	0.28	74	123	C	32.9	0.31	83	134	C	32.9	0.31	83	135
SB Wilkins St right	A	5.1	0.10	0	25	A	5.0	0.11	0	26	A	5.0	0.11	0	26
Route 85C/Washington Street/ Technology Drive	D	38.4	-	-	-	D	41.1	-	-	-	D	42.5	-	-	-
EB Route 85C left I left	D	46.2	0.78	182	#389	D	47.4	0.80	221	#474	D	49.3	0.82	225	#474
EB Route 85C thru I thru/right	C	32.4	0.65	158	289	C	34.7	0.67	186	316	D	36.1	0.69	206	347
WB Technology Dr left	D	45.3	0.29	44	118	D	45.8	0.30	50	129	D	46.3	0.30	51	129
WB Technology Dr thru I thru	D	50.3	0.72	132	233	D	54.3	0.78	153	#265	E	56.8	0.83	185	#344
WB Technology Dr right	A	0.9	0.17	0	0	A	0.9	0.17	0	0	A	1.0	0.20	0	0
NB Washington St left I left	D	51.6	0.68	103	#246	E	57.3	0.75	120	#272	E	59.0	0.77	121	#272
NB Washington St thru I thru/right	D	41.2	0.64	170	#374	D	44.1	0.70	197	#424	D	45.3	0.71	200	#424
SB Washington St left	E	56.7	0.42	42	119	E	63.0	0.50	49	#131	E	65.2	0.54	52	#141
SB Washington St thru I thru	D	48.0	0.68	124	#277	D	52.5	0.74	145	#311	D	54.0	0.75	148	#311
SB Washington St right	B	11.7	0.77	0	131	B	12.3	0.80	0	142	B	12.4	0.80	0	142
Unsignalized															
Reed Road/Site Driveway	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB Reed Rd left	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	8.7	0.06	-	5
EB Reed Rd thru	A	0.0	0.28	-	0	A	0.0	0.31	-	0	A	0.0	0.31	-	0
WB Reed Rd thru/right	A	0.0	0.29	-	0	A	0.0	0.31	-	0	A	0.0	0.31	-	0
SB Site Driveway left	A	0.0	0.00	-	0	A	0.0	0.00	-	0	C	24.5	0.08	-	6
SB Site Driveway right	A	0.0	0.00	-	0	A	0.0	0.00	-	0	C	16.3	0.40	-	49

Intersection/Movement	Existing Condition					No-build (2029) Condition					Build (2029) Condition				
	LOS	Delay (s)	V/C Ratio	50th % Queue (ft.)	95th % Queue (ft.)	LOS	Delay (s)	V/C Ratio	50th % Queue (ft.)	95th % Queue (ft.)	LOS	Delay (s)	V/C Ratio	50th % Queue (ft.)	95th % Queue (ft.)
Marlboro Street/Site Driveway	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB Site Driveway left	A	0.0	0.00	-	0	A	0.0	0.00	-	0	D	32.9	0.25	-	23
EB Site Driveway right	A	0.0	0.00	-	0	A	0.0	0.00	-	0	B	12.9	0.05	-	4
WB Shared Driveway left/right	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.0	0.00	-	0
NB Marlboro St left/thru	A	0.0	0.00	-	0	A	0.0	0.00	-	0	A	0.1	0.00	-	0
SB Marlboro St thru/right	A	0.0	0.34	-	0	A	0.0	0.38	-	0	A	0.0	0.38	-	0
Reed Road/Marlboro Street	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB Reed Rd left	C	24.6	0.66	-	121	D	33.8	0.78	-	172	E	37.3	0.80	-	185
EB Reed Rd right	A	9.5	0.11	-	9	A	9.6	0.12	-	10	A	9.8	0.13	-	11
NB Marlboro St left/thru	A	3.1	0.07	-	6	A	3.2	0.08	-	7	A	3.3	0.08	-	7
SB Marlboro St thru	A	0.0	0.09	-	0	A	0.0	0.10	-	0	A	0.0	0.11	-	0
SB Marlboro St right	A	0.0	0.24	-	0	A	0.0	0.26	-	0	A	0.0	0.26	-	0
Broad Street/Forestvale Road	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WB Forestvale Rd left/right	D	26.2	0.48	-	61	E	39.5	0.63	-	98	F	60.1	0.83	-	170
NB Broad St thru/right	A	0.0	0.31	-	0	A	0.0	0.35	-	0	A	0.0	0.36	-	0
SB Broad St left/thru	A	1.8	0.07	-	6	A	2.2	0.09	-	7	A	2.5	0.10	-	8
Technology Drive/Forestvale Road	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB Forestvale Rd left | right	C	19.8	0.30	-	32	C	22.4	0.38	-	44	D	34.3	0.56	-	80
NB Technology Dr left/thru	A	1.1	0.04	-	3	A	1.2	0.04	-	3	A	1.3	0.05	-	4
SB Technology Dr thru/right	A	0.0	0.30	-	0	A	0.0	0.32	-	0	A	0.0	0.41	-	0
Roundabout															
Washington Street/Broad Street	A	9.4	-	82	149	B	13.7	-	163	297	B	14.0	-	175	318
Washington St SEB u-turn/left/thru	A	5.8	0.08	2	4	A	6.7	0.11	3	6	A	6.8	0.11	4	6
Washington St SEB right	A	0.0	0.36	0	0	A	0.0	0.38	0	0	A	0.0	0.38	0	0
Washington St NB u-turn/left	A	8.8	0.53	40	73	B	10.1	0.59	51	92	B	10.3	0.60	52	95
Washington St NB thru/right	A	8.8	0.53	40	73	B	10.1	0.59	51	93	B	10.3	0.60	52	95
Broad St SB u-turn/left/thru	C	24.4	0.75	82	149	E	43.4	0.91	163	297	E	46.6	0.92	175	318
Broad St SB right	A	9.2	0.21	8	14	B	10.5	0.25	10	18	B	11.2	0.28	11	20
Driveway WB u-turn/left/thru/right	A	9.6	0.01	1	1	B	12.1	0.06	2	3	B	12.4	0.06	2	3

95th percentile queues do not clear after two cycles. Actual queues may be longer.
Grey shading indicates LOS E or F under the Existing Condition or a decrease to LOS E or LOS F in the No-build or Build Condition.

Signalized Intersections Traffic Operations

As shown in **Table 7** and **Table 8**, the signalized intersections and most approaches operate at acceptable levels of service (LOS D or better) during both peak periods, with the exception of the following:

MAIN STREET (ROUTE 62)/FOREST AVENUE/WILKINS STREET

- p.m. peak hour
  - Under the No-build (2029) Condition, the Forest Avenue northbound left-turn/through approach will deteriorate from LOS D to LOS E. Under the Build (2029) Condition, this approach remains at LOS E, with changes in delay, 50th percentile queue, and 95th percentile queue from the No-build Condition of two seconds, four feet, and nine feet, respectively, indicating that the Project will not impact p.m. peak hour operations on this approach.

ROUTE 85C/WASHINGTON STREET/TECHNOLOGY DRIVE

- a.m. peak hour
  - Under the Existing Condition all individual approaches operate at LOS D or better except the two Washington Street northbound left turn lanes which operate at LOS E. Under the No-build (2029) condition, this lane group will operate at LOS F. Under the Build (2029) Condition, this lane group will still operate at LOS F, but the changes in delay, 50th percentile queue, and 95th percentile queue from the No-build (2029) Condition will be 8.6 seconds, three feet, and one foot, respectively, indicating that the Project will not impact a.m. peak hour operations on this approach.

- p.m. peak hour
  - Under the Existing Condition, the Washington Street southbound left operates at LOS E and will continue at LOS E under No-build (2029) and Build (2029) conditions. The changes in delay, average queue, and 95th percentile queue from the No-build (2029) Condition will be 2.2 seconds, three feet, and 10 feet, respectively, indicating that the Project will not impact p.m. peak hour operations on this approach.
  - Under the No-Build (2029) condition, the two Washington Street northbound left lanes will deteriorate from LOS D to LOS E. Under the Build Condition, this approach will still operate at LOS E, but the changes in delay, average queue, and 95th percentile queue from the No-build Condition will be 1.7 seconds, one foot, and zero feet, respectively, indicating that the Project will not impact p.m. peak hour operations on this approach.

- Under the Build (2029) condition, the two Technology Drive westbound through lanes will deteriorate from LOS D to LOS E. The changes in delay, average queue, and 95th percentile queue from the No-build (2029) Condition will be 2.4 seconds, 22 feet (approximately one car length), and 79 feet (approximately three car lengths), respectively, indicating that the Project will not impact p.m. peak hour operations on this approach.

Unsignalized Intersections Traffic Operations

As shown in **Table 7** and **Table 8**, most approaches at the unsignalized intersections and roundabout operate at acceptable levels of service (LOS D or better) during both peak periods, with the exception of the following:

REED ROAD/MARLBORO STREET

- p.m. peak hour
  - Under the Build (2029) Condition, the Reed Road eastbound approach will deteriorate from LOS D to LOS E. The changes in delay and 95th percentile queue from the No-build (2029) Condition will be 3.5 seconds and 13 feet, respectively, indicating that the Project will not impact p.m. peak hour operations on this approach.

BROAD STREET/FORESTVALE ROAD

- p.m. peak hour
  - Under the No-build (2029) Condition, the Forestvale Road westbound left/thru lane will deteriorate from LOS D to LOS E.
  - Under the Build (2029) Condition, the approach will deteriorate from LOS E to LOS F. The changes in delay and 95th percentile queue from the No-build (2029) Condition will be 20.6 seconds and 72 feet (approximately three car lengths), respectively. The resulting operation under the Build (2029) Condition is considered acceptable given that the 95th percentile queue, which occurs about 5% of the time during the peak hour, will only increase from four to seven vehicles.

Summary of Vehicle Operations

In summary, the capacity analysis results presented above for the signalized, unsignalized, and roundabout locations indicate that the Project will not significantly affect peak hour operations in the study area.

Transportation Demand Management

Although the Project will not impact traffic operations in the study area, the Proponent will encourage the future tenant to establish a Transportation Demand Management (TDM) plan in an effort to minimize single-occupant vehicles on the adjacent transportation network. The use of alternative travel modes such as riding transit, bicycling, or walking, however, is expected to be minimal because of the Project Site's location. No transit service or bicycle facilities are nearby and while sidewalks exist along Reed Road and Technology Drive, they do not connect to much other nearby development. The Proponent anticipates the following TDM elements may be established by the future tenant:

- Designate a Transportation Coordinator who will oversee implementation of TDM plan;
- Provide an employee ride matching/ridesharing program to encourage carpooling;
- Provide an emergency Guaranteed Ride Home program for employees who participate in ridesharing; and
- Provide materials about the TDM program to employees initially at their orientation and routinely through web-based information, print materials, and promotional events.

The Proponent anticipates the future tenant will provide on-site employee amenities that will reduce the need for off-site employee travel during the workday. These amenities may include breakrooms and lunchrooms equipped with refrigerators, coffee machines, and microwaves.

Transportation Monitoring Programs

The study team anticipates MassDOT will require commitment to an annual Transportation Monitoring Program to commence after building occupancy for a specified number of years. The monitoring program will likely include documentation of the following:

- Overall TDM program description;
- On-site employee amenities;
- Project trip generation based on site traffic data collection; and
- Employee travel mode shares and employee participation in ridesharing as gathered from an employee survey.

Conclusion

Key transportation characteristics of the Project and analysis results include:

- Although the Project Site has been active with Intel uses for most of the last 24 years, the site currently does not generate any appreciable traffic volume. In this traffic study, no credit (reduction) for existing vehicle trips has been taken in the analysis, resulting in a more conservative (higher impact) evaluation.
- During the a.m. peak hour, the Project will generate 218 new automobile trips (168 entering and 50 exiting) and 25 new truck trips (13 entering and 12 exiting); during the p.m. peak hour, the Project will generate 244 new vehicle trips (66 entering and 178 exiting) and 38 new truck trips (20 entering and 18 exiting).
- The capacity analysis results for the nine study area intersections show that the Project will not significantly affect peak hour operations in the study area.
- The Proponent will encourage the future tenant to implement a TDM plan to minimize the number of Project vehicle trips on the adjacent roadway network.
- Key elements of the TDM plan are likely to include provisions of a ridematching/ridesharing program to encourage carpooling and an emergency ride home for employees who participate in ridesharing. The TDM program will be overseen by a designated Transportation Coordinator.
- The Proponent anticipates committing to an annual Transportation Monitoring Program in coordination with MassDOT to confirm the accuracy of the assumptions contained in this traffic report and the effectiveness of the TDM program. Such a monitoring program would commence after building occupancy

HOWARD STEIN HUDSON

Engineers + Planners

Appendix A

Peak Hour Vehicle, Pedestrian, and Bicycle Counts

Client:	Emma Parisi, EIT
Project #:	882_002_HSH
BTD #:	Location A
Location:	Hudson, MA
Street 1:	Washington Street
Street 2:	Technology Drive & 85C
Count Date:	3/15/2022
Day of Week:	Tuesday
Weather:	Clouds & Sun, 50°F

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PASSENGER CARS & HEAVY VEHICLES COMBINED

	Washington Street Northbound				Washington Street Southbound				85C Eastbound				Technology Drive Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	37	34	8	0	1	59	121	0	66	79	69	0	6	39	1
7:15 AM	0	45	53	8	0	7	68	155	0	104	100	85	0	6	59	3
7:30 AM	0	49	42	8	0	3	67	165	0	104	66	106	0	11	80	5
7:45 AM	0	52	51	11	0	13	80	114	0	111	116	77	0	9	78	4
8:00 AM	0	26	39	14	0	10	68	112	0	105	89	56	0	7	51	7
8:15 AM	0	25	47	7	0	14	63	123	0	101	74	44	0	7	72	8
8:30 AM	0	35	48	3	0	13	67	108	0	96	65	46	0	12	58	6
8:45 AM	0	18	79	10	0	12	78	53	0	96	75	56	0	8	44	6

	Washington Street Northbound				Washington Street Southbound				85C Eastbound				Technology Drive Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	0	62	120	12	0	21	75	123	0	93	65	43	0	13	91	14
4:15 PM	0	51	93	18	0	22	87	124	0	128	86	65	0	15	91	8
4:30 PM	0	80	99	21	0	18	88	130	0	105	77	51	0	12	90	19
4:45 PM	0	67	126	17	0	23	87	116	0	153	76	61	0	16	59	7
5:00 PM	0	68	103	19	0	11	82	127	0	116	67	55	0	18	106	13
5:15 PM	0	83	108	7	0	11	104	128	0	138	77	67	0	18	75	14
5:30 PM	0	73	105	24	0	15	103	125	0	101	67	38	0	23	81	7
5:45 PM	0	74	95	7	0	11	92	108	0	120	39	25	0	8	53	7

AM PEAK HOUR 7:15 AM to 8:15 AM	Washington Street Northbound				Washington Street Southbound				85C Eastbound				Technology Drive Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**172**	**185**	**41**	**0**	**33**	**283**	**546**	**0**	**424**	**371**	**324**	**0**	**33**	**268**	**19**
PHF	**0.87**				**0.92**				**0.92**				**0.83**			
HV %	**0.0%**	**9.3%**	**4.3%**	**12.2%**	**0.0%**	**0.0%**	**3.9%**	**3.3%**	**0.0%**	**4.0%**	**3.8%**	**2.2%**	**0.0%**	**0.0%**	**1.9%**	**5.3%**

PM PEAK HOUR 4:30 PM to 5:30 PM	Washington Street Northbound				Washington Street Southbound				85C Eastbound				Technology Drive Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**298**	**436**	**64**	**0**	**63**	**361**	**501**	**0**	**512**	**297**	**234**	**0**	**64**	**330**	**53**
PHF	**0.95**				**0.95**				**0.90**				**0.82**			
HV %	**0.0%**	**0.0%**	**0.5%**	**1.6%**	**0.0%**	**0.0%**	**1.7%**	**1.6%**	**0.0%**	**1.2%**	**1.0%**	**0.4%**	**0.0%**	**0.0%**	**0.9%**	**0.0%**

Client:	Emma Parisi, EIT
Project #:	882_002_HSH
BTD #:	Location A
Location:	Hudson, MA
Street 1:	Washington Street
Street 2:	Technology Drive & 85C
Count Date:	3/15/2022
Day of Week:	Tuesday
Weather:	Clouds & Sun, 50°F

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HEAVY VEHICLES

	Washington Street Northbound				Washington Street Southbound				85C Eastbound				Technology Drive Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	1	1	0	0	0	0	4	0	1	2	2	0	0	1	0
7:15 AM	0	12	2	4	0	0	3	5	0	6	6	2	0	0	3	0
7:30 AM	0	2	1	0	0	0	2	6	0	3	1	4	0	0	0	0
7:45 AM	0	2	2	0	0	0	2	4	0	5	3	0	0	0	1	1
8:00 AM	0	0	3	1	0	0	4	3	0	3	4	1	0	0	1	0
8:15 AM	0	0	3	1	0	1	1	3	0	4	1	2	0	0	2	1
8:30 AM	0	2	3	0	0	1	2	3	0	3	1	2	0	0	2	0
8:45 AM	0	4	6	1	0	0	3	5	0	3	3	3	0	0	1	0

	Washington Street Northbound				Washington Street Southbound				85C Eastbound				Technology Drive Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	0	1	3	0	0	0	1	4	0	3	2	0	0	0	1	0
4:15 PM	0	1	0	0	0	0	0	3	0	2	3	0	0	0	0	0
4:30 PM	0	0	1	1	0	0	1	2	0	1	2	0	0	0	3	0
4:45 PM	0	0	1	0	0	0	1	3	0	1	0	0	0	0	0	0
5:00 PM	0	0	0	0	0	0	2	2	0	2	0	0	0	0	0	0
5:15 PM	0	0	0	0	0	0	2	1	0	2	1	1	0	0	0	0
5:30 PM	0	2	1	1	0	0	0	2	0	1	0	0	0	0	1	0
5:45 PM	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0

AM PEAK HOUR 7:15 AM to 8:15 AM	Washington Street Northbound				Washington Street Southbound				85C Eastbound				Technology Drive Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**16**	**8**	**5**	**0**	**0**	**11**	**18**	**0**	**17**	**14**	**7**	**0**	**0**	**5**	**1**
PHF	**0.40**				**0.91**				**0.68**				**0.50**			

PM PEAK HOUR 4:00 PM to 5:00 PM	Washington Street Northbound				Washington Street Southbound				85C Eastbound				Technology Drive Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**2**	**5**	**1**	**0**	**0**	**3**	**12**	**0**	**7**	**7**	**0**	**0**	**0**	**4**	**0**
PHF	**0.50**				**0.75**				**0.70**				**0.33**			

Client: Emma Parisi, EIT
Project #: 882_002_HSH
BTD #: Location A
Location: Hudson, MA
Street 1: Washington Street
Street 2: Technology Drive & 85C
Count Date: 3/15/2022
Day of Week: Tuesday
Weather: Clouds & Sun, 50°F

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PEDESTRIANS & BICYCLES

	Washington Street Northbound				Washington Street Southbound				85C Eastbound				Technology Drive Westbound			
Start Time	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Washington Street Northbound				Washington Street Southbound				85C Eastbound				Technology Drive Westbound			
Start Time	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	1
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
5:15 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AM PEAK HOUR[1] 7:15 AM to 8:15 AM	Washington Street Northbound				Washington Street Southbound				85C Eastbound				Technology Drive Westbound			
	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PM PEAK HOUR[1] 4:30 PM to 5:30 PM	Washington Street Northbound				Washington Street Southbound				85C Eastbound				Technology Drive Westbound			
	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
	0	0	1	0	0	0	0	2	0	0	0	1	0	0	0	2

[1] *NOTE: Peak hour summaries here correspond to peak hours identified for passenger cars and heavy vehicles combined.*

Client:	Emma Parisi, EIT
Project #:	882_002_HSH
BTD #:	Location B
Location:	Hudson, MA
Street 1:	Marlboro Street
Street 2:	Reed Road
Count Date:	3/15/2022
Day of Week:	Tuesday
Weather:	Clouds & Sun, 50°F

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PASSENGER CARS & HEAVY VEHICLES COMBINED

	Marlboro Street Northbound				Marlboro Street Southbound				Reed Road Eastbound				Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	17	18	0	0	0	27	39	0	66	0	4	0	0	0	0
7:15 AM	0	15	16	0	0	0	35	70	0	83	0	5	0	0	0	0
7:30 AM	0	13	27	0	0	0	30	76	0	77	0	4	0	0	0	0
7:45 AM	0	15	20	0	0	0	28	57	0	87	0	9	0	0	0	0
8:00 AM	0	16	24	0	0	0	16	58	0	89	0	7	0	0	0	0
8:15 AM	0	14	21	0	0	0	27	63	0	77	0	11	0	0	0	0
8:30 AM	0	13	24	0	0	0	11	68	0	57	0	10	0	0	0	0
8:45 AM	0	6	10	0	0	0	30	42	0	64	0	10	0	0	0	0

	Marlboro Street Northbound				Marlboro Street Southbound				Reed Road Eastbound				Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	0	14	36	0	0	0	26	88	0	59	0	17	0	0	0	0
4:15 PM	0	15	37	0	0	0	36	82	0	79	0	23	0	0	0	0
4:30 PM	0	15	36	0	0	0	29	102	0	69	0	14	0	0	0	0
4:45 PM	0	12	29	0	0	0	32	75	0	77	0	19	0	0	0	0
5:00 PM	0	18	38	0	0	0	32	76	0	68	0	26	0	0	0	0
5:15 PM	0	11	25	0	0	0	25	97	0	74	0	16	0	0	0	0
5:30 PM	0	13	36	0	0	0	35	81	0	66	0	25	0	0	0	0
5:45 PM	0	14	25	0	0	0	32	75	0	56	0	19	0	0	0	0

AM PEAK HOUR 7:15 AM to 8:15 AM	Marlboro Street Northbound				Marlboro Street Southbound				Reed Road Eastbound				Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**59**	**87**	**0**	**0**	**0**	**109**	**261**	**0**	**336**	**0**	**25**	**0**	**0**	**0**	**0**
PHF	**0.91**				**0.87**				**0.94**				**0.00**			
HV %	**0.0%**	**1.7%**	**8.0%**	**0.0%**	**0.0%**	**0.0%**	**3.7%**	**1.5%**	**0.0%**	**3.9%**	**0.0%**	**8.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**

PM PEAK HOUR 4:15 PM to 5:15 PM	Marlboro Street Northbound				Marlboro Street Southbound				Reed Road Eastbound				Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**60**	**140**	**0**	**0**	**0**	**129**	**335**	**0**	**293**	**0**	**82**	**0**	**0**	**0**	**0**
PHF	**0.89**				**0.89**				**0.92**				**0.00**			
HV %	**0.0%**	**1.7%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**3.9%**	**1.5%**	**0.0%**	**1.0%**	**0.0%**	**1.2%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**

Client:	Emma Parisi, EIT
Project #:	882_002_HSH
BTD #:	Location B
Location:	Hudson, MA
Street 1:	Marlboro Street
Street 2:	Reed Road
Count Date:	3/15/2022
Day of Week:	Tuesday
Weather:	Clouds & Sun, 50°F

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HEAVY VEHICLES

	Marlboro Street Northbound				Marlboro Street Southbound				Reed Road Eastbound				Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	1	0	0	0	0	2	1	0	0	0	0	0	0	0	0
7:15 AM	0	0	1	0	0	0	0	2	0	3	0	1	0	0	0	0
7:30 AM	0	0	1	0	0	0	2	0	0	3	0	0	0	0	0	0
7:45 AM	0	1	1	0	0	0	1	0	0	2	0	0	0	0	0	0
8:00 AM	0	0	4	0	0	0	1	2	0	5	0	1	0	0	0	0
8:15 AM	0	0	2	0	0	0	0	3	0	0	0	0	0	0	0	0
8:30 AM	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	1	2	0	2	0	0	0	0	0	0

	Marlboro Street Northbound				Marlboro Street Southbound				Reed Road Eastbound				Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	0	0	2	0	0	0	1	0	0	2	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	2	1	0	2	0	1	0	0	0	0
4:30 PM	0	0	0	0	0	0	2	3	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0
5:00 PM	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
5:15 PM	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	2	2	0	1	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AM PEAK HOUR 7:15 AM to 8:15 AM	Marlboro Street Northbound				Marlboro Street Southbound				Reed Road Eastbound				Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**1**	**7**	**0**	**0**	**0**	**4**	**4**	**0**	**13**	**0**	**2**	**0**	**0**	**0**	**0**
PHF	**0.50**				**0.67**				**0.63**				**0.00**			

PM PEAK HOUR 4:00 PM to 5:00 PM	Marlboro Street Northbound				Marlboro Street Southbound				Reed Road Eastbound				Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**0**	**2**	**0**	**0**	**0**	**6**	**4**	**0**	**5**	**0**	**1**	**0**	**0**	**0**	**0**
PHF	**0.25**				**0.50**				**0.50**				**0.00**			

Client:	Emma Parisi, EIT
Project #:	882_002_HSH
BTD #:	Location B
Location:	Hudson, MA
Street 1:	Marlboro Street
Street 2:	Reed Road
Count Date:	3/15/2022
Day of Week:	Tuesday
Weather:	Clouds & Sun, 50°F

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PEDESTRIANS & BICYCLES

	Marlboro Street				Marlboro Street				Reed Road							
	Northbound				Southbound				Eastbound				Westbound			
Start Time	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Marlboro Street				Marlboro Street				Reed Road							
	Northbound				Southbound				Eastbound				Westbound			
Start Time	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0

AM PEAK HOUR[1]	Marlboro Street				Marlboro Street				Reed Road							
7:15 AM	Northbound				Southbound				Eastbound				Westbound			
to	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
8:15 AM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PM PEAK HOUR[1]	Marlboro Street				Marlboro Street				Reed Road							
4:15 PM	Northbound				Southbound				Eastbound				Westbound			
to	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
5:15 PM	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0

[1] *NOTE: Peak hour summaries here correspond to peak hours identified for passenger cars and heavy vehicles combined.*

Client:	Emma Parisi, EIT
Project #:	882_002_HSH
BTD #:	Location C
Location:	Hudson, MA
Street 1:	Reed Road
Street 2:	Intel Driveway
Count Date:	3/15/2022
Day of Week:	Tuesday
Weather:	Clouds & Sun, 50°F

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PASSENGER CARS & HEAVY VEHICLES COMBINED

	Northbound				Intel Driveway Southbound				Reed Road Eastbound				Reed Road Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	0	0	0	0	1	0	3	0	2	72	0	0	0	59	0
7:15 AM	0	0	0	0	0	0	0	0	0	1	86	0	0	0	83	0
7:30 AM	0	0	0	0	0	0	0	1	0	0	82	0	0	0	94	0
7:45 AM	0	0	0	0	0	0	0	0	0	1	100	0	0	0	70	2
8:00 AM	0	0	0	0	0	0	0	0	0	1	102	0	0	0	79	0
8:15 AM	0	0	0	0	0	0	0	2	0	0	82	0	0	0	83	3
8:30 AM	0	0	0	0	0	0	0	1	0	1	67	0	0	0	89	0
8:45 AM	0	0	0	0	0	0	0	0	0	3	80	0	0	0	51	1
9:00 AM	0	0	0	0	0	0	0	2	0	0	43	0	0	0	48	1
9:15 AM	0	0	0	0	0	0	0	0	0	0	42	0	0	0	40	0
9:30 AM	0	0	0	0	0	0	0	0	0	1	60	0	0	0	39	0
9:45 AM	0	0	0	0	0	0	0	0	0	0	40	0	0	0	45	0
10:00 AM	0	0	0	0	0	0	0	1	0	3	41	0	0	0	42	0
10:15 AM	0	0	0	0	0	0	0	1	0	0	35	0	0	0	46	0
10:30 AM	0	0	0	0	0	0	0	1	0	0	32	0	0	0	36	0
10:45 AM	0	0	0	0	0	0	0	0	0	0	50	0	0	0	35	1
11:00 AM	0	0	0	0	0	0	0	2	0	1	39	0	0	0	35	0
11:15 AM	0	0	0	0	0	0	0	1	0	1	36	0	0	0	43	1
11:30 AM	0	0	0	0	0	0	0	0	0	0	47	0	0	0	47	0
11:45 AM	0	0	0	0	0	0	0	1	0	1	43	0	0	0	41	0
12:00 PM	0	0	0	0	0	0	0	1	0	1	67	0	0	0	39	0
12:15 PM	0	0	0	0	0	0	0	0	0	2	63	0	0	0	39	0
12:30 PM	0	0	0	0	0	0	0	2	0	0	52	0	0	0	52	1
12:45 PM	0	0	0	0	0	0	0	0	0	1	64	0	0	0	47	0
1:00 PM	0	0	0	0	0	0	0	0	0	0	34	0	0	0	43	0
1:15 PM	0	0	0	0	0	0	0	1	0	0	35	0	0	0	48	0
1:30 PM	0	0	0	0	0	0	0	0	0	1	44	0	0	0	49	0
1:45 PM	0	0	0	0	0	0	0	0	0	0	48	0	0	0	54	0
2:00 PM	0	0	0	0	0	0	0	1	0	1	55	0	0	0	50	1
2:15 PM	0	0	0	0	0	0	0	0	0	1	74	0	0	0	42	0
2:30 PM	0	0	0	0	0	1	0	3	0	1	69	0	0	0	73	0
2:45 PM	0	0	0	0	0	0	0	2	0	7	73	0	0	0	81	0
3:00 PM	0	0	0	0	0	0	0	8	0	1	61	0	0	0	77	0
3:15 PM	0	0	0	0	0	0	0	3	0	0	62	0	0	0	103	0
3:30 PM	0	0	0	0	0	2	0	1	0	2	72	0	0	0	102	0
3:45 PM	0	0	0	0	0	0	0	1	0	1	83	0	0	0	78	0
4:00 PM	0	0	0	0	0	0	0	0	0	0	78	0	0	0	107	0
4:15 PM	0	0	0	0	0	0	0	3	0	0	113	0	0	0	101	1
4:30 PM	0	0	0	0	0	0	0	1	0	0	93	0	0	0	113	0
4:45 PM	0	0	0	0	0	1	0	1	0	2	86	0	0	0	96	0
5:00 PM	0	0	0	0	0	0	0	4	0	0	93	0	0	0	99	0
5:15 PM	0	0	0	0	0	0	0	3	0	2	90	0	0	0	109	0
5:30 PM	0	0	0	0	0	0	0	3	0	1	108	0	0	0	94	0
5:45 PM	0	0	0	0	0	1	0	0	0	0	79	0	0	0	71	0

AM PEAK HOUR	Northbound				Intel Driveway Southbound				Reed Road Eastbound				Reed Road Westbound			
7:15 AM to	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
8:15 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**3**	**370**	**0**	**0**	**0**	**326**	**2**
PHF	**0.00**				**0.25**				**0.91**				**0.87**			
HV %	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**4.3%**	**0.0%**	**0.0%**	**0.0%**	**1.5%**	**0.0%**

MID PEAK HOUR	Northbound				Intel Driveway Southbound				Reed Road Eastbound				Reed Road Westbound			
12:00 PM to	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
1:00 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**4**	**246**	**0**	**0**	**0**	**177**	**1**
PHF	**0.00**				**0.38**				**0.92**				**0.84**			
HV %	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**33.3%**	**0.0%**	**25.0%**	**4.5%**	**0.0%**	**0.0%**	**0.0%**	**5.1%**	**0.0%**

PM PEAK HOUR	Northbound				Intel Driveway Southbound				Reed Road Eastbound				Reed Road Westbound			
4:15 PM to	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
5:15 PM	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**9**	**0**	**2**	**385**	**0**	**0**	**0**	**409**	**1**
PHF	**0.00**				**0.63**				**0.86**				**0.91**			
HV %	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**11.1%**	**0.0%**	**0.0%**	**1.3%**	**0.0%**	**0.0%**	**0.0%**	**1.2%**	**100.0%**

Client:	Emma Parisi, EIT
Project #:	882_002_HSH
BTD #:	Location C
Location:	Hudson, MA
Street 1:	Reed Road
Street 2:	Intel Driveway
Count Date:	3/15/2022
Day of Week:	Tuesday
Weather:	Clouds & Sun, 50°F

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HEAVY VEHICLES

	Northbound				Intel Driveway Southbound				Reed Road Eastbound				Reed Road Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	4	0	0	0	2	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	3	0	0	0	1	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	6	0	0	0	2	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	3	0	0	0	1	1
9:00 AM	0	0	0	0	0	0	0	2	0	0	2	0	0	0	3	0
9:15 AM	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0
9:30 AM	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0
9:45 AM	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0
10:00 AM	0	0	0	0	0	0	0	1	0	1	3	0	0	0	1	0
10:15 AM	0	0	0	0	0	0	0	1	0	0	2	0	0	0	2	0
10:30 AM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
10:45 AM	0	0	0	0	0	0	0	0	0	0	4	0	0	0	2	0
11:00 AM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
11:15 AM	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0
11:30 AM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	5	0
11:45 AM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
12:00 PM	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	0
12:15 PM	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
12:30 PM	0	0	0	0	0	0	0	1	0	0	4	0	0	0	5	0
12:45 PM	0	0	0	0	0	0	0	0	0	0	4	0	0	0	1	0
1:00 PM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3	0
1:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
1:30 PM	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	0
1:45 PM	0	0	0	0	0	0	0	0	0	0	2	0	0	0	3	0
2:00 PM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2:15 PM	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
2:30 PM	0	0	0	0	0	0	0	0	0	0	3	0	0	0	2	0
2:45 PM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
3:00 PM	0	0	0	0	0	0	0	0	0	0	3	0	0	0	4	0
3:15 PM	0	0	0	0	0	0	0	0	0	0	2	0	0	0	6	0
3:30 PM	0	0	0	0	0	1	0	0	0	1	4	0	0	0	2	0
3:45 PM	0	0	0	0	0	0	0	0	0	0	5	0	0	0	3	0
4:00 PM	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	1	0	0	3	0	0	0	0	1
4:30 PM	0	0	0	0	0	0	0	0	0	0	2	0	0	0	3	0
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0

AM PEAK HOUR	Northbound				Intel Driveway Southbound				Reed Road Eastbound				Reed Road Westbound			
7:15 AM to	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
8:15 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**16**	**0**	**0**	**0**	**5**	**0**
PHF	**0.00**				**0.00**				**0.67**				**0.63**			

MID PEAK HOUR	Northbound				Intel Driveway Southbound				Reed Road Eastbound				Reed Road Westbound			
12:00 PM to	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
1:00 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**11**	**0**	**0**	**0**	**9**	**0**
PHF	**0.00**				**0.25**				**0.75**				**0.45**			

PM PEAK HOUR	Northbound				Intel Driveway Southbound				Reed Road Eastbound				Reed Road Westbound			
3:00 PM to	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**14**	**0**	**0**	**0**	**15**	**0**
PHF	**0.00**				**0.25**				**0.75**				**0.63**			

Client:	Emma Parisi, EIT
Project #:	882_002_HSH
BTD #:	Location C
Location:	Hudson, MA
Street 1:	Reed Road
Street 2:	Intel Driveway
Count Date:	3/15/2022
Day of Week:	Tuesday
Weather:	Clouds & Sun, 50°F

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PEDESTRIANS & BICYCLES

	Northbound				Intel Driveway Southbound				Reed Road Eastbound				Reed Road Westbound			
Start Time	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:15 AM	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
9:30 AM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
9:45 AM	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
11:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00 PM	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0
12:15 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
12:30 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
12:45 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
1:00 PM	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
1:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:30 PM	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
1:45 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2:00 PM	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
2:15 PM	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0
2:30 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2:45 PM	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
3:00 PM	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:30 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
3:45 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AM PEAK HOUR	Northbound				Intel Driveway Southbound				Reed Road Eastbound				Reed Road Westbound			
7:15 AM to	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

MID PEAK HOUR	Northbound				Intel Driveway Southbound				Reed Road Eastbound				Reed Road Westbound			
12:00 PM to	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
1:00 PM	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0

PM PEAK HOUR	Northbound				Intel Driveway Southbound				Reed Road Eastbound				Reed Road Westbound			
4:15 PM to	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
5:15 PM	0	0	0	0	0	0	0	4	0	0	0	0	0	1	0	0

NOTE: Peak hour summaries here correspond to peak hours identified for passenger cars and heavy vehicles combined.

Client:	Emma Parisi, EIT
Project #:	882_002_HSH
BTD #:	Location D
Location:	Hudson, MA
Street 1:	Marlboro Street
Street 2:	Intel Driveway
Count Date:	3/15/2022
Day of Week:	Tuesday
Weather:	Clouds & Sun, 50°F

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PASSENGER CARS & HEAVY VEHICLES COMBINED

	Marlboro Street Northbound				Marlboro Street Southbound				Intel Driveway Eastbound				Residential Driveway Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	0	83	0	0	0	50	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	95	0	0	0	72	0	0	1	0	0	0	0	0	1
7:30 AM	0	0	100	0	0	0	86	0	0	0	0	0	0	1	0	0
7:45 AM	0	2	87	0	0	0	67	1	0	0	0	0	0	0	0	0
8:00 AM	0	0	105	1	0	0	49	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	87	0	0	0	73	1	0	0	0	0	0	0	0	0
8:30 AM	0	1	76	0	0	0	67	3	0	1	0	0	0	0	0	0
8:45 AM	0	0	67	0	0	0	57	0	0	0	0	0	0	0	0	0
9:00 AM	0	0	47	0	0	0	52	0	0	0	0	0	0	0	0	0
9:15 AM	0	0	39	0	0	0	40	0	0	0	0	0	0	0	0	0
9:30 AM	0	0	50	0	0	0	34	0	0	0	0	0	0	0	0	0
9:45 AM	0	0	39	0	0	0	39	1	0	0	0	0	0	0	0	0
10:00 AM	0	0	51	0	0	0	29	0	0	1	0	0	0	0	0	0
10:15 AM	0	1	33	0	0	0	44	0	0	0	0	0	0	0	0	0
10:30 AM	0	0	30	0	0	0	30	0	0	0	0	0	0	0	0	0
10:45 AM	0	0	34	0	0	0	26	0	0	0	0	0	0	0	0	0
11:00 AM	0	1	49	0	0	0	38	0	0	0	0	0	0	0	0	0
11:15 AM	0	0	32	0	0	0	33	0	0	0	0	0	0	0	0	0
11:30 AM	0	0	36	0	0	0	35	0	0	0	0	1	0	0	0	0
11:45 AM	0	0	39	0	0	0	39	0	0	0	0	1	0	0	0	0
12:00 PM	0	0	57	0	0	0	42	0	0	0	0	0	0	0	0	0
12:15 PM	0	0	58	0	0	0	42	1	0	1	0	1	0	0	0	0
12:30 PM	0	1	45	0	0	0	41	1	0	1	0	0	0	0	0	0
12:45 PM	0	0	56	0	0	0	38	0	0	0	0	0	0	0	0	0
1:00 PM	0	0	34	0	0	0	40	0	0	0	0	0	0	0	0	0
1:15 PM	0	0	28	0	0	0	41	0	0	0	0	0	0	0	0	0
1:30 PM	0	0	34	0	0	0	40	3	0	0	0	0	0	1	0	0
1:45 PM	0	0	54	0	0	0	44	0	0	0	0	0	0	0	0	0
2:00 PM	0	0	44	0	0	0	51	0	0	0	0	0	0	0	0	0
2:15 PM	0	0	56	0	0	0	45	0	0	2	0	0	0	0	0	0
2:30 PM	0	0	74	0	0	0	72	0	0	1	0	0	0	0	0	0
2:45 PM	0	0	65	0	0	0	84	1	0	1	0	0	0	0	0	0
3:00 PM	0	0	50	1	0	0	87	1	0	2	0	0	0	0	0	0
3:15 PM	0	0	60	0	0	0	110	0	0	0	0	1	0	0	0	0
3:30 PM	0	0	82	0	0	0	109	0	0	0	0	0	0	0	0	0
3:45 PM	0	1	86	0	0	0	80	2	0	0	0	1	0	0	0	0
4:00 PM	0	0	68	0	0	0	123	2	0	0	0	2	0	0	0	0
4:15 PM	0	0	83	0	0	0	101	0	0	0	0	0	0	0	0	0
4:30 PM	0	1	88	0	0	0	111	0	0	1	0	1	0	0	0	0
4:45 PM	0	0	91	0	0	0	85	1	0	0	0	0	0	0	0	0
5:00 PM	0	0	81	1	0	0	101	0	0	2	0	1	0	0	0	0
5:15 PM	0	0	82	0	0	0	107	0	0	2	0	0	0	0	0	0
5:30 PM	0	0	80	0	0	0	101	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	66	0	0	0	63	0	0	0	0	0	0	0	0	0

AM PEAK HOUR 7:15 AM to 8:15 AM	Marlboro Street Northbound				Marlboro Street Southbound				Intel Driveway Eastbound				Residential Driveway Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**2**	**387**	**1**	**0**	**0**	**274**	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**1**
PHF	**0.92**				**0.80**				**0.25**				**0.50**			
HV %	**0.0%**	**0.0%**	**3.9%**	**0.0%**	**0.0%**	**0.0%**	**2.6%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**

MID PEAK HOUR 12:00 PM to 1:00 PM	Marlboro Street Northbound				Marlboro Street Southbound				Intel Driveway Eastbound				Residential Driveway Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**1**	**216**	**0**	**0**	**0**	**163**	**2**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**0**
PHF	**0.94**				**0.96**				**0.38**				**0.00**			
HV %	**0.0%**	**0.0%**	**7.9%**	**0.0%**	**0.0%**	**0.0%**	**11.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**

PM PEAK HOUR 4:00 PM to 5:00 PM	Marlboro Street Northbound				Marlboro Street Southbound				Intel Driveway Eastbound				Residential Driveway Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**1**	**330**	**0**	**0**	**0**	**420**	**3**	**0**	**1**	**0**	**3**	**0**	**0**	**0**	**0**
PHF	**0.91**				**0.85**				**0.50**				**0.00**			
HV %	**0.0%**	**0.0%**	**2.4%**	**0.0%**	**0.0%**	**0.0%**	**2.1%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**

Client:	Emma Parisi, EIT
Project #:	882_002_HSH
BTD #:	Location D
Location:	Hudson, MA
Street 1:	Marlboro Street
Street 2:	Intel Driveway
Count Date:	3/15/2022
Day of Week:	Tuesday
Weather:	Clouds & Sun, 50°F

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HEAVY VEHICLES

	Marlboro Street Northbound				Marlboro Street Southbound				Intel Driveway Eastbound				Residential Driveway Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	3	0	0	0	2	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0
8:00 AM	0	0	7	0	0	0	3	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	6	0	0	0	3	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	3	0	0	0	3	0	0	0	0	0	0	0	0	0
9:00 AM	0	0	3	0	0	0	6	0	0	0	0	0	0	0	0	0
9:15 AM	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
9:30 AM	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0
9:45 AM	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
10:00 AM	0	0	5	0	0	0	2	0	0	0	0	0	0	0	0	0
10:15 AM	0	0	4	0	0	0	3	0	0	0	0	0	0	0	0	0
10:30 AM	0	0	3	0	0	0	2	0	0	0	0	0	0	0	0	0
10:45 AM	0	0	4	0	0	0	4	0	0	0	0	0	0	0	0	0
11:00 AM	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0
11:15 AM	0	0	2	0	0	0	5	0	0	0	0	0	0	0	0	0
11:30 AM	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00 PM	0	0	5	0	0	0	4	0	0	0	0	0	0	0	0	0
12:15 PM	0	0	3	0	0	0	5	0	0	0	0	0	0	0	0	0
12:30 PM	0	0	5	0	0	0	4	0	0	0	0	0	0	0	0	0
12:45 PM	0	0	4	0	0	0	5	0	0	0	0	0	0	0	0	0
1:00 PM	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0
1:15 PM	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0
1:30 PM	0	0	4	0	0	0	2	0	0	0	0	0	0	0	0	0
1:45 PM	0	0	5	0	0	0	3	0	0	0	0	0	0	0	0	0
2:00 PM	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0
2:15 PM	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0
2:30 PM	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0
2:45 PM	0	0	2	0	0	0	3	0	0	0	0	0	0	0	0	0
3:00 PM	0	0	4	0	0	0	4	0	0	0	0	0	0	0	0	0
3:15 PM	0	0	4	0	0	0	7	0	0	0	0	0	0	0	0	0
3:30 PM	0	0	3	0	0	0	2	0	0	0	0	0	0	0	0	0
3:45 PM	0	0	5	0	0	0	2	0	0	0	0	0	0	0	0	0
4:00 PM	0	0	4	0	0	0	1	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	2	0	0	0	3	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0
4:45 PM	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0
5:00 PM	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
5:15 PM	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0

AM PEAK HOUR	Marlboro Street Northbound				Marlboro Street Southbound				Intel Driveway Eastbound				Residential Driveway Westbound			
7:30 AM to	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
8:30 AM	**0**	**0**	**19**	**0**	**0**	**0**	**9**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
PHF	**0.68**				**0.75**				**0.00**				**0.00**			

MID PEAK HOUR	Marlboro Street Northbound				Marlboro Street Southbound				Intel Driveway Eastbound				Residential Driveway Westbound			
12:00 PM to	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
1:00 PM	**0**	**0**	**17**	**0**	**0**	**0**	**18**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
PHF	**0.85**				**0.90**				**0.00**				**0.00**			

PM PEAK HOUR	Marlboro Street Northbound				Marlboro Street Southbound				Intel Driveway Eastbound				Residential Driveway Westbound			
3:00 PM to	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	**0**	**0**	**16**	**0**	**0**	**0**	**15**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
PHF	**0.80**				**0.54**				**0.00**				**0.00**			

Client:	Emma Parisi, EIT
Project #:	882_002_HSH
BTD #:	Location D
Location:	Hudson, MA
Street 1:	Marlboro Street
Street 2:	Intel Driveway
Count Date:	3/15/2022
Day of Week:	Tuesday
Weather:	Clouds & Sun, 50°F

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PEDESTRIANS & BICYCLES

	Marlboro Street Northbound				Marlboro Street Southbound				Intel Driveway Eastbound				Residential Driveway Westbound			
Start Time	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
9:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:30 AM	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
9:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
10:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45 AM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
11:15 AM	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1
11:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
12:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:00 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
1:15 PM	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0
1:30 PM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
3:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:00 PM	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AM PEAK HOUR 7:15 AM to 8:15 AM	Marlboro Street Northbound				Marlboro Street Southbound				Intel Driveway Eastbound				Residential Driveway Westbound			
	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1

MID PEAK HOUR 12:00 PM to 1:00 PM	Marlboro Street Northbound				Marlboro Street Southbound				Intel Driveway Eastbound				Residential Driveway Westbound			
	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2

PM PEAK HOUR 4:00 PM to 5:00 PM	Marlboro Street Northbound				Marlboro Street Southbound				Intel Driveway Eastbound				Residential Driveway Westbound			
	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	5

NOTE: Peak hour summaries here correspond to peak hours identified for passenger cars and heavy vehicles combined.

Client: Emma Parisi, EIT
Project #: 882_002_HSH
BTD #: Location E
Location: Hudson, MA
Street 1: Forest Ave
Street 2: Marlboro Street
Count Date: 3/15/2022
Day of Week: Tuesday
Weather: Clouds & Sun, 50°F

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PASSENGER CARS & HEAVY VEHICLES COMBINED

	Marlboro Street Northbound				Apple Country Plaza Drive Southbound				Forest Ave Eastbound				Forest Ave Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	27	0	72	0	1	1	2	0	0	15	12	0	43	22	0
7:15 AM	0	38	0	87	0	1	0	1	0	0	24	19	0	64	25	0
7:30 AM	0	25	0	88	0	3	0	1	0	0	21	24	0	69	15	0
7:45 AM	0	22	0	78	0	1	2	0	0	0	22	20	0	48	15	0
8:00 AM	0	22	0	86	0	2	2	2	0	0	29	17	0	43	25	0
8:15 AM	0	25	0	79	0	1	2	0	0	0	27	14	0	66	30	0
8:30 AM	0	17	0	74	0	2	0	0	0	0	27	17	0	51	34	0
8:45 AM	0	16	0	59	0	1	0	0	0	0	18	12	0	46	14	0

	Marlboro Street Northbound				Apple Country Plaza Drive Southbound				Forest Ave Eastbound				Forest Ave Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	0	23	0	66	0	7	5	3	0	0	24	20	0	104	40	0
4:15 PM	0	31	0	73	0	4	8	5	0	0	27	22	0	90	31	0
4:30 PM	0	27	0	74	0	7	8	0	0	0	27	35	0	87	28	0
4:45 PM	0	35	0	75	0	2	7	5	0	0	30	20	0	75	43	0
5:00 PM	0	25	0	73	0	2	4	0	0	0	17	42	0	79	49	0
5:15 PM	0	32	0	67	0	4	5	2	0	0	23	37	0	81	28	0
5:30 PM	0	24	0	77	0	4	12	5	0	0	15	32	0	74	34	0
5:45 PM	0	29	0	53	0	3	1	0	0	0	12	22	0	44	23	0

AM PEAK HOUR 7:15 AM to 8:15 AM	Marlboro Street Northbound				Apple Country Plaza Drive Southbound				Forest Ave Eastbound				Forest Ave Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**107**	**0**	**339**	**0**	**7**	**4**	**4**	**0**	**0**	**96**	**80**	**0**	**224**	**80**	**0**
PHF	**0.89**				**0.63**				**0.96**				**0.85**			
HV %	**0.0%**	**4.7%**	**0.0%**	**3.2%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**2.1%**	**7.5%**	**0.0%**	**2.2%**	**3.8%**	**0.0%**

PM PEAK HOUR 4:00 PM to 5:00 PM	Marlboro Street Northbound				Apple Country Plaza Drive Southbound				Forest Ave Eastbound				Forest Ave Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**116**	**0**	**288**	**0**	**20**	**28**	**13**	**0**	**0**	**108**	**97**	**0**	**356**	**142**	**0**
PHF	**0.92**				**0.90**				**0.83**				**0.86**			
HV %	**0.0%**	**1.7%**	**0.0%**	**2.4%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.9%**	**4.1%**	**0.0%**	**1.1%**	**2.1%**	**0.0%**

Client:	Emma Parisi, EIT
Project #:	882_002_HSH
BTD #:	Location E
Location:	Hudson, MA
Street 1:	Forest Ave
Street 2:	Marlboro Street
Count Date:	3/15/2022
Day of Week:	Tuesday
Weather:	Clouds & Sun, 50°F

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HEAVY VEHICLES

	Marlboro Street Northbound				Apple Country Plaza Drive Southbound				Forest Ave Eastbound				Forest Ave Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	1	0	0	0	0	0	0	0	0	2	1	0	2	2	0
7:15 AM	0	1	0	2	0	0	0	0	0	0	1	1	0	1	0	0
7:30 AM	0	1	0	2	0	0	0	0	0	0	0	3	0	1	0	0
7:45 AM	0	2	0	2	0	0	0	0	0	0	0	2	0	0	0	0
8:00 AM	0	1	0	5	0	0	0	0	0	0	1	0	0	3	3	0
8:15 AM	0	2	0	6	0	0	0	0	0	0	0	1	0	2	0	0
8:30 AM	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0
8:45 AM	0	0	0	3	0	0	0	0	0	0	0	0	0	3	0	0

	Marlboro Street Northbound				Apple Country Plaza Drive Southbound				Forest Ave Eastbound				Forest Ave Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	0	1	0	5	0	0	0	0	0	0	0	1	0	1	3	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	1	2	0	2	0	0
4:30 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM	0	1	0	1	0	0	0	0	0	0	0	1	0	1	0	0
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0
5:30 PM	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0

AM PEAK HOUR 7:30 AM to 8:30 AM	Marlboro Street Northbound				Apple Country Plaza Drive Southbound				Forest Ave Eastbound				Forest Ave Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**6**	**0**	**15**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**6**	**0**	**6**	**3**	**0**
PHF	**0.66**				**0.00**				**0.58**				**0.38**			

PM PEAK HOUR 4:00 PM to 5:00 PM	Marlboro Street Northbound				Apple Country Plaza Drive Southbound				Forest Ave Eastbound				Forest Ave Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**2**	**0**	**7**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**4**	**0**	**4**	**3**	**0**
PHF	**0.38**				**0.00**				**0.42**				**0.44**			

Client:	Emma Parisi, EIT
Project #:	882_002_HSH
BTD #:	Location E
Location:	Hudson, MA
Street 1:	Forest Ave
Street 2:	Marlboro Street
Count Date:	3/15/2022
Day of Week:	Tuesday
Weather:	Clouds & Sun, 50°F

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PEDESTRIANS & BICYCLES

	Marlboro Street Northbound				Apple Country Plaza Drive Southbound				Forest Ave Eastbound				Forest Ave Westbound			
Start Time	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Marlboro Street Northbound				Apple Country Plaza Drive Southbound				Forest Ave Eastbound				Forest Ave Westbound			
Start Time	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0
5:15 PM	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AM PEAK HOUR[1]	Marlboro Street Northbound				Apple Country Plaza Drive Southbound				Forest Ave Eastbound				Forest Ave Westbound			
7:15 AM to 8:15 AM	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

PM PEAK HOUR[1]	Marlboro Street Northbound				Apple Country Plaza Drive Southbound				Forest Ave Eastbound				Forest Ave Westbound			
4:00 PM to 5:00 PM	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0

[1] *NOTE: Peak hour summaries here correspond to peak hours identified for passenger cars and heavy vehicles combined.*

Client:	Emma Parisi, EIT
Project #:	882_002_HSH
BTD #:	Location F
Location:	Hudson, MA
Street 1:	Main Street
Street 2:	Forest Ave & Wilkins Street
Count Date:	3/15/2022
Day of Week:	Tuesday
Weather:	Clouds & Sun, 50°F

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PASSENGER CARS & HEAVY VEHICLES COMBINED

	Forest Ave Northbound				Wilkins Street Southbound				Main Street Eastbound				Main Street Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	10	14	64	0	0	13	8	0	5	132	1	0	21	57	1
7:15 AM	0	26	22	86	0	2	34	12	0	7	135	0	0	31	76	0
7:30 AM	0	21	18	84	0	2	21	8	0	12	147	0	0	27	53	0
7:45 AM	0	20	26	49	0	0	13	8	0	7	121	1	0	39	48	0
8:00 AM	0	24	20	73	0	0	18	7	0	12	118	0	0	28	37	4
8:15 AM	0	23	19	58	0	1	20	10	0	11	114	0	0	31	62	0
8:30 AM	0	12	11	46	0	4	15	9	0	6	89	0	0	20	58	2
8:45 AM	0	13	10	48	0	0	15	12	0	17	87	2	0	15	62	0

	Forest Ave Northbound				Wilkins Street Southbound				Main Street Eastbound				Main Street Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	0	32	25	37	0	1	29	11	0	15	54	1	0	94	141	1
4:15 PM	0	26	29	29	0	1	28	13	0	11	63	0	0	84	145	2
4:30 PM	0	33	24	46	0	0	22	17	0	11	75	1	0	83	119	2
4:45 PM	0	32	24	34	0	3	31	15	0	19	54	0	0	62	115	1
5:00 PM	0	29	29	33	0	1	23	15	0	13	67	0	0	78	130	1
5:15 PM	0	29	20	29	0	1	30	19	0	12	67	0	0	72	124	3
5:30 PM	0	24	21	46	0	0	25	10	0	14	48	1	0	77	116	0
5:45 PM	0	27	20	23	0	2	18	8	0	19	37	2	0	36	97	0

AM PEAK HOUR 7:15 AM to 8:15 AM	Forest Ave Northbound				Wilkins Street Southbound				Main Street Eastbound				Main Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**91**	**86**	**292**	**0**	**4**	**86**	**35**	**0**	**38**	**521**	**1**	**0**	**125**	**214**	**4**
PHF	**0.88**				**0.65**				**0.88**				**0.80**			
HV %	**0.0%**	**2.2%**	**3.5%**	**3.4%**	**0.0%**	**25.0%**	**3.5%**	**14.3%**	**0.0%**	**15.8%**	**4.4%**	**0.0%**	**0.0%**	**4.0%**	**6.1%**	**25.0%**

PM PEAK HOUR 4:00 PM to 5:00 PM	Forest Ave Northbound				Wilkins Street Southbound				Main Street Eastbound				Main Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**123**	**102**	**146**	**0**	**5**	**110**	**56**	**0**	**56**	**246**	**2**	**0**	**323**	**520**	**6**
PHF	**0.90**				**0.87**				**0.87**				**0.90**			
HV %	**0.0%**	**0.8%**	**2.0%**	**4.8%**	**0.0%**	**0.0%**	**0.0%**	**3.6%**	**0.0%**	**0.0%**	**2.8%**	**0.0%**	**0.0%**	**1.9%**	**1.7%**	**0.0%**

Client: Emma Parisi, EIT
Project #: 882_002_HSH
BTD #: Location F
Location: Hudson, MA
Street 1: Main Street
Street 2: Forest Ave & Wilkins Street
Count Date: 3/15/2022
Day of Week: Tuesday
Weather: Clouds & Sun, 50°F

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HEAVY VEHICLES

	Forest Ave Northbound				Wilkins Street Southbound				Main Street Eastbound				Main Street Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	1	0	1	0	0	0	2	0	0	5	1	0	0	1	0
7:15 AM	0	1	0	3	0	0	1	1	0	1	5	0	0	0	7	0
7:30 AM	0	1	0	2	0	1	1	0	0	0	5	0	0	0	2	0
7:45 AM	0	0	1	1	0	0	1	1	0	2	4	0	0	2	3	0
8:00 AM	0	0	2	4	0	0	0	3	0	3	9	0	0	3	1	1
8:15 AM	0	3	2	1	0	1	0	3	0	1	3	0	0	2	6	0
8:30 AM	0	0	0	2	0	2	1	1	0	2	5	0	0	0	6	2
8:45 AM	0	2	0	1	0	0	0	2	0	1	5	0	0	1	8	0

	Forest Ave Northbound				Wilkins Street Southbound				Main Street Eastbound				Main Street Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	0	1	1	3	0	0	0	0	0	0	3	0	0	2	3	0
4:15 PM	0	0	1	1	0	0	0	1	0	0	1	0	0	1	2	0
4:30 PM	0	0	0	2	0	0	0	1	0	0	1	0	0	3	3	0
4:45 PM	0	0	0	1	0	0	0	0	0	0	2	0	0	0	1	0
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0
5:30 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0
5:45 PM	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0

AM PEAK HOUR 8:00 AM to 9:00 AM	Forest Ave Northbound				Wilkins Street Southbound				Main Street Eastbound				Main Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**5**	**4**	**8**	**0**	**3**	**1**	**9**	**0**	**7**	**22**	**0**	**0**	**6**	**21**	**3**
PHF	**0.71**				**0.81**				**0.60**				**0.83**			

PM PEAK HOUR 4:00 PM to 5:00 PM	Forest Ave Northbound				Wilkins Street Southbound				Main Street Eastbound				Main Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**1**	**2**	**7**	**0**	**0**	**0**	**2**	**0**	**0**	**7**	**0**	**0**	**6**	**9**	**0**
PHF	**0.50**				**0.50**				**0.58**				**0.63**			

Client: Emma Parisi, EIT
Project #: 882_002_HSH
BTD #: Location F
Location: Hudson, MA
Street 1: Main Street
Street 2: Forest Ave & Wilkins Street
Count Date: 3/15/2022
Day of Week: Tuesday
Weather: Clouds & Sun, 50°F

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PEDESTRIANS & BICYCLES

	Forest Ave Northbound				Wilkins Street Southbound				Main Street Eastbound				Main Street Westbound			
Start Time	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Forest Ave Northbound				Wilkins Street Southbound				Main Street Eastbound				Main Street Westbound			
Start Time	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
4:15 PM	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:15 PM	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AM PEAK HOUR[1]	Forest Ave Northbound				Wilkins Street Southbound				Main Street Eastbound				Main Street Westbound			
7:15 AM to	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PM PEAK HOUR[1]	Forest Ave Northbound				Wilkins Street Southbound				Main Street Eastbound				Main Street Westbound			
4:00 PM to	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
5:00 PM	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0

[1] *NOTE: Peak hour summaries here correspond to peak hours identified for passenger cars and heavy vehicles combined.*

Client: Emma Parisi, EIT
Project #: 882_002_HSH
BTD #: Location G1
Location: Hudson, MA
Street 1: Washington Street
Street 2: Broad Street
Count Date: 3/15/2022
Day of Week: Tuesday
Weather: Clouds & Sun, 50°F

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PASSENGER CARS & HEAVY VEHICLES COMBINED

	Washington Street Northbound				Broad Street Southbound				Washington Street Southeastbound				Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	5	59	41	0	0	0	76	16	1	5	105	0	0	0	0	0
7:15 AM	2	86	68	0	0	0	115	25	0	2	132	0	0	0	0	0
7:30 AM	2	98	63	0	0	0	108	16	1	3	138	0	0	0	0	0
7:45 AM	1	102	68	0	0	0	91	11	0	3	126	0	0	0	0	0
8:00 AM	2	83	67	0	0	0	78	13	0	3	113	0	0	0	0	0
8:15 AM	2	87	73	0	1	0	80	20	0	4	141	0	0	0	0	0
8:30 AM	3	85	67	0	1	0	86	20	0	4	115	0	0	0	0	0
8:45 AM	3	122	70	0	0	0	51	11	0	4	92	0	0	0	0	0

	Washington Street Northbound				Broad Street Southbound				Washington Street Southeastbound				Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	2	151	91	0	0	0	120	18	4	9	99	0	0	0	0	0
4:15 PM	9	169	100	0	0	0	98	15	0	14	116	0	0	0	0	0
4:30 PM	3	164	93	0	0	0	107	27	0	8	149	0	0	0	0	0
4:45 PM	2	179	123	0	0	0	94	18	3	10	136	0	0	0	0	0
5:00 PM	3	161	92	0	0	0	89	25	5	12	152	0	0	0	0	0
5:15 PM	0	161	96	0	0	0	95	25	2	12	153	0	0	0	0	0
5:30 PM	5	156	81	0	0	0	103	27	3	11	152	0	0	0	0	0
5:45 PM	0	142	104	0	0	0	81	25	1	6	133	0	0	0	0	0

AM PEAK HOUR 7:15 AM to 8:15 AM	Washington Street Northbound				Broad Street Southbound				Washington Street Southeastbound				Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	7	**369**	**266**	**0**	**0**	**0**	**392**	**65**	**1**	**11**	**509**	**0**	**0**	**0**	**0**	**0**
PHF	**0.94**				**0.82**				**0.92**				**0.00**			
HV %	**14.3%**	**4.9%**	**3.4%**	**0.0%**	**0.0%**	**0.0%**	**2.6%**	**6.2%**	**0.0%**	**27.3%**	**3.1%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**

PM PEAK HOUR 4:30 PM to 5:30 PM	Washington Street Northbound				Broad Street Southbound				Washington Street Southeastbound				Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	8	**665**	**404**	**0**	**0**	**0**	**385**	**95**	**10**	**42**	**590**	**0**	**0**	**0**	**0**	**0**
PHF	**0.89**				**0.90**				**0.95**				**0.00**			
HV %	**0.0%**	**0.5%**	**1.5%**	**0.0%**	**0.0%**	**0.0%**	**1.0%**	**3.2%**	**10.0%**	**2.4%**	**2.4%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**

Client:	Emma Parisi, EIT
Project #:	882_002_HSH
BTD #:	Location G1
Location:	Hudson, MA
Street 1:	Washington Street
Street 2:	Broad Street
Count Date:	3/15/2022
Day of Week:	Tuesday
Weather:	Clouds & Sun, 50°F

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HEAVY VEHICLES

	Washington Street Northbound				Broad Street Southbound				Washington Street Southeastbound				Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	1	1	0	0	0	1	1	0	0	1	0	0	0	0	0
7:15 AM	0	3	4	0	0	0	4	1	0	1	4	0	0	0	0	0
7:30 AM	1	4	2	0	0	0	3	2	0	1	3	0	0	0	0	0
7:45 AM	0	7	1	0	0	0	2	1	0	1	3	0	0	0	0	0
8:00 AM	0	4	2	0	0	0	1	0	0	0	6	0	0	0	0	0
8:15 AM	0	3	4	0	0	0	2	0	0	0	3	0	0	0	0	0
8:30 AM	0	4	2	0	0	0	2	0	0	0	6	0	0	0	0	0
8:45 AM	1	6	2	0	0	0	2	0	0	1	6	0	0	0	0	0

	Washington Street Northbound				Broad Street Southbound				Washington Street Southeastbound				Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	0	4	0	0	0	0	4	1	0	0	1	0	0	0	0	0
4:15 PM	0	1	2	0	0	0	3	0	0	0	1	0	0	0	0	0
4:30 PM	0	0	2	0	0	0	0	2	0	0	3	0	0	0	0	0
4:45 PM	0	1	1	0	0	0	2	0	1	0	4	0	0	0	0	0
5:00 PM	0	0	2	0	0	0	1	1	0	1	6	0	0	0	0	0
5:15 PM	0	2	1	0	0	0	1	0	0	0	1	0	0	0	0	0
5:30 PM	0	2	0	0	0	0	1	0	0	0	1	0	0	0	0	0
5:45 PM	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0

AM PEAK HOUR 7:15 AM to 8:15 AM	Washington Street Northbound				Broad Street Southbound				Washington Street Southeastbound				Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	1	**18**	**9**	**0**	**0**	**0**	**10**	**4**	**0**	**3**	**16**	**0**	**0**	**0**	**0**	**0**
PHF	**0.88**				**0.70**				**0.79**				**0.00**			

PM PEAK HOUR 4:15 PM to 5:15 PM	Washington Street Northbound				Broad Street Southbound				Washington Street Southeastbound				Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**2**	**7**	**0**	**0**	**0**	**6**	**3**	**1**	**1**	**14**	**0**	**0**	**0**	**0**	**0**
PHF	**0.75**				**0.75**				**0.57**				**0.00**			

Client:	Emma Parisi, EIT
Project #:	882_002_HSH
BTD #:	Location G1
Location:	Hudson, MA
Street 1:	Washington Street
Street 2:	Broad Street
Count Date:	3/15/2022
Day of Week:	Tuesday
Weather:	Clouds & Sun, 50°F

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PEDESTRIANS & BICYCLES

	Washington Street Northbound				Broad Street Southbound				Washington Street Southeastbound				Westbound			
Start Time	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Washington Street Northbound				Broad Street Southbound				Washington Street Southeastbound				Westbound			
Start Time	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AM PEAK HOUR[1]	Washington Street Northbound				Broad Street Southbound				Washington Street Southeastbound				Westbound			
7:15 AM to	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
8:15 AM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0

PM PEAK HOUR[1]	Washington Street Northbound				Broad Street Southbound				Washington Street Southeastbound				Westbound			
4:30 PM to	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
5:30 PM	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0

[1] *NOTE: Peak hour summaries here correspond to peak hours identified for passenger cars and heavy vehicles combined.*

Client:	Emma Parisi, EIT
Project #:	882_002_HSH
BTD #:	Location G3
Location:	Hudson, MA
Street 1:	Driveway at Rotary
Street 2:	Washington Street/Broad Street
Count Date:	3/15/2022
Day of Week:	Tuesday
Weather:	Clouds & Sun, 50°F

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PASSENGER CARS & HEAVY VEHICLES COMBINED

	Driveway at Rotary				Driveway at Rotary			
Start Time	-	-	In	-	-	-	Out	-
7:00 AM	-	-	0	-	-	-	0	-
7:15 AM	-	-	0	-	-	-	0	-
7:30 AM	-	-	0	-	-	-	0	-
7:45 AM	-	-	0	-	-	-	0	-
8:00 AM	-	-	0	-	-	-	0	-
8:15 AM	-	-	0	-	-	-	0	-
8:30 AM	-	-	0	-	-	-	0	-
8:45 AM	-	-	0	-	-	-	0	-

	Driveway at Rotary				Driveway at Rotary			
Start Time	-	-	In	-	-	-	Out	-
4:00 PM	-	-	0	-	-	-	0	-
4:15 PM	-	-	0	-	-	-	0	-
4:30 PM	-	-	0	-	-	-	0	-
4:45 PM	-	-	0	-	-	-	0	-
5:00 PM	-	-	0	-	-	-	0	-
5:15 PM	-	-	0	-	-	-	0	-
5:30 PM	-	-	0	-	-	-	0	-
5:45 PM	-	-	0	-	-	-	0	-

AM PEAK HOUR 7:00 AM to 8:00 AM	Driveway at Rotary				Driveway at Rotary			
	-	-	In	-	-	-	Out	-
	0	**0**	**0**	**0**	**0**	**0**	**0**	**0**
PHF	**0.00**				**0.00**			
HV %	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**

PM PEAK HOUR 4:00 PM to 5:00 PM	Driveway at Rotary				Driveway at Rotary			
	-	-	In	-	-	-	Out	-
	0	**0**	**0**	**0**	**0**	**0**	**0**	**0**
PHF	**0.00**				**0.00**			
HV %	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**

Client: Emma Parisi, EIT
Project #: 882_002_HSH
BTD #: Location G3
Location: Hudson, MA
Street 1: Driveway at Rotary
Street 2: Washington Street/Broad Street
Count Date: 3/15/2022
Day of Week: Tuesday
Weather: Clouds & Sun, 50°F

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HEAVY VEHICLES

	Driveway at Rotary				Driveway at Rotary			
Start Time	-	-	In	-	-	-	Out	-
7:00 AM	-	-	0	-	-	-	0	-
7:15 AM	-	-	0	-	-	-	0	-
7:30 AM	-	-	0	-	-	-	0	-
7:45 AM	-	-	0	-	-	-	0	-
8:00 AM	-	-	0	-	-	-	0	-
8:15 AM	-	-	0	-	-	-	0	-
8:30 AM	-	-	0	-	-	-	0	-
8:45 AM	-	-	0	-	-	-	0	-

	Driveway at Rotary				Driveway at Rotary			
Start Time	-	-	In	-	-	-	Out	-
4:00 PM	-	-	0	-	-	-	0	-
4:15 PM	-	-	0	-	-	-	0	-
4:30 PM	-	-	0	-	-	-	0	-
4:45 PM	-	-	0	-	-	-	0	-
5:00 PM	-	-	0	-	-	-	0	-
5:15 PM	-	-	0	-	-	-	0	-
5:30 PM	-	-	0	-	-	-	0	-
5:45 PM	-	-	0	-	-	-	0	-

AM PEAK HOUR 7:00 AM to 8:00 AM	Driveway at Rotary				Driveway at Rotary			
	-	-	In	-	-	-	Out	-
	0	**0**	**0**	**0**	**0**	**0**	**0**	**0**
PHF	**0.00**				**0.00**			

PM PEAK HOUR 4:00 PM to 5:00 PM	Driveway at Rotary				Driveway at Rotary			
	-	-	In	-	-	-	Out	-
	0	**0**	**0**	**0**	**0**	**0**	**0**	**0**
PHF	**0.00**				**0.00**			

Client: Emma Parisi, EIT
Project #: 882_002_HSH
BTD #: Location G2
Location: Hudson, MA
Street 1: Broad Street
Street 2: Forestvale Road
Count Date: 3/15/2022
Day of Week: Tuesday
Weather: Clouds & Sun, 50°F

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PASSENGER CARS & HEAVY VEHICLES COMBINED

	Broad Street Northbound				Broad Street Southbound				Eastbound				Forestvale Road Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	0	41	5	0	3	77	0	0	0	0	0	0	15	0	8
7:15 AM	0	0	66	4	0	5	116	0	0	0	0	0	0	24	0	8
7:30 AM	0	0	60	6	0	12	112	0	0	0	0	0	0	12	0	8
7:45 AM	0	0	62	9	0	19	95	0	0	0	0	0	0	7	0	10
8:00 AM	0	0	65	5	0	12	75	0	0	0	0	0	0	16	0	10
8:15 AM	0	0	69	8	0	9	85	0	0	0	0	0	0	15	0	8
8:30 AM	0	0	61	10	0	9	87	0	0	0	0	0	0	19	0	9
8:45 AM	0	0	70	4	0	16	53	0	0	0	0	0	0	9	0	8

	Broad Street Northbound				Broad Street Southbound				Eastbound				Forestvale Road Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	0	0	85	15	0	10	130	0	0	0	0	0	0	8	0	18
4:15 PM	0	0	98	16	0	22	98	0	0	0	0	0	0	15	0	22
4:30 PM	0	0	88	13	0	15	116	0	0	0	0	0	0	18	0	17
4:45 PM	0	0	122	11	0	14	96	0	0	0	0	0	0	16	0	15
5:00 PM	0	0	91	13	0	16	99	0	0	0	0	0	0	15	0	27
5:15 PM	0	0	92	16	0	16	103	0	0	0	0	0	0	17	0	12
5:30 PM	0	0	73	19	0	16	115	0	0	0	0	0	0	15	0	11
5:45 PM	0	0	101	9	0	10	88	0	0	0	0	0	0	18	0	10

AM PEAK HOUR 7:15 AM to 8:15 AM	Broad Street Northbound				Broad Street Southbound				Eastbound				Forestvale Road Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**0**	**253**	**24**	**0**	**48**	**398**	**0**	**0**	**0**	**0**	**0**	**0**	**59**	**0**	**36**
PHF	**0.98**				**0.90**				**0.00**				**0.74**			
HV %	**0.0%**	**0.0%**	**3.6%**	**12.5%**	**0.0%**	**4.2%**	**3.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**3.4%**	**0.0%**	**2.8%**

PM PEAK HOUR 4:00 PM to 5:00 PM	Broad Street Northbound				Broad Street Southbound				Eastbound				Forestvale Road Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**0**	**393**	**55**	**0**	**61**	**440**	**0**	**0**	**0**	**0**	**0**	**0**	**57**	**0**	**72**
PHF	**0.84**				**0.89**				**0.00**				**0.87**			
HV %	**0.0%**	**0.0%**	**1.3%**	**0.0%**	**0.0%**	**0.0%**	**2.3%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**3.5%**	**0.0%**	**1.4%**

Client: Emma Parisi, EIT
Project #: 882_002_HSH
BTD #: Location G2
Location: Hudson, MA
Street 1: Broad Street
Street 2: Forestvale Road
Count Date: 3/15/2022
Day of Week: Tuesday
Weather: Clouds & Sun, 50°F

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HEAVY VEHICLES

	Broad Street Northbound				Broad Street Southbound				Eastbound				Forestvale Road Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0
7:15 AM	0	0	4	1	0	1	5	0	0	0	0	0	0	0	0	1
7:30 AM	0	0	2	1	0	0	4	0	0	0	0	0	0	1	0	0
7:45 AM	0	0	1	1	0	1	2	0	0	0	0	0	0	1	0	0
8:00 AM	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	4	0	0	1	2	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	2	1	0	0	2	0	0	0	0	0	0	0	0	1

	Broad Street Northbound				Broad Street Southbound				Eastbound				Forestvale Road Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	1
4:15 PM	0	0	2	0	0	0	3	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0
4:45 PM	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0
5:00 PM	0	0	2	1	0	0	1	0	0	0	0	0	0	1	0	0
5:15 PM	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

AM PEAK HOUR 7:00 AM to 8:00 AM	Broad Street Northbound				Broad Street Southbound				Eastbound				Forestvale Road Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**0**	**8**	**3**	**0**	**2**	**12**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**1**
PHF	**0.55**				**0.58**				**0.00**				**1.00**			

PM PEAK HOUR 4:00 PM to 5:00 PM	Broad Street Northbound				Broad Street Southbound				Eastbound				Forestvale Road Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**0**	**5**	**0**	**0**	**0**	**10**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**1**
PHF	**0.63**				**0.50**				**0.00**				**0.38**			

Client:	Emma Parisi, EIT
Project #:	882_002_HSH
BTD #:	Location G2
Location:	Hudson, MA
Street 1:	Broad Street
Street 2:	Forestvale Road
Count Date:	3/15/2022
Day of Week:	Tuesday
Weather:	Clouds & Sun, 50°F

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PEDESTRIANS & BICYCLES

	Broad Street Northbound				Broad Street Southbound				Eastbound				Forestvale Road Westbound			
Start Time	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Broad Street Northbound				Broad Street Southbound				Eastbound				Forestvale Road Westbound			
Start Time	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
4:00 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AM PEAK HOUR[1] 7:15 AM to 8:15 AM	Broad Street Northbound				Broad Street Southbound				Eastbound				Forestvale Road Westbound			
	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

PM PEAK HOUR[1] 4:00 PM to 5:00 PM	Broad Street Northbound				Broad Street Southbound				Eastbound				Forestvale Road Westbound			
	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

[1] *NOTE: Peak hour summaries here correspond to peak hours identified for passenger cars and heavy vehicles combined.*

Client: Emma Parisi
Project #: 953_001_HSH
BTD #: Location 1
Location: Hudson, MA
Street 1: Technology Drive
Street 2: Forestvale Road
Count Date: 6/1/2022
Day of Week: Wednesday
Weather: Cloudy, 60°F

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PASSENGER CARS & HEAVY VEHICLES COMBINED

	Technology Drive Northbound				Technology Drive Southbound				Forestvale Road Eastbound				Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	2	80	0	0	0	56	20	0	4	0	1	0	0	0	0
7:15 AM	0	5	78	0	0	0	65	21	0	5	0	6	0	0	0	0
7:30 AM	0	4	68	0	0	0	78	16	0	10	0	5	0	0	0	0
7:45 AM	0	4	87	0	0	0	76	30	0	11	0	4	0	0	0	0
8:00 AM	0	4	76	0	0	0	60	25	0	14	0	7	0	0	0	0
8:15 AM	0	4	87	0	0	0	60	21	0	11	0	5	0	0	0	0
8:30 AM	0	2	64	0	0	0	58	14	0	14	0	6	0	0	0	0
8:45 AM	0	1	50	0	0	0	45	27	0	16	0	4	0	0	0	0

	Technology Drive Northbound				Technology Drive Southbound				Forestvale Road Eastbound				Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	0	4	70	0	0	0	79	22	0	14	0	5	0	0	0	0
4:15 PM	0	10	77	0	0	0	77	22	0	26	0	8	0	0	0	0
4:30 PM	0	2	89	0	0	0	74	21	0	17	0	1	0	0	0	0
4:45 PM	0	8	75	0	0	0	87	15	0	18	0	7	0	0	0	0
5:00 PM	0	9	76	0	0	0	95	19	0	22	0	6	0	0	0	0
5:15 PM	0	6	94	0	0	0	92	18	0	17	0	9	0	0	0	0
5:30 PM	0	9	86	0	0	0	95	21	0	17	0	6	0	0	0	0
5:45 PM	0	3	62	0	0	0	64	27	0	16	0	4	0	0	0	0

AM PEAK HOUR 7:30 AM to 8:30 AM	Technology Drive Northbound				Technology Drive Southbound				Forestvale Road Eastbound				Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**16**	**318**	**0**	**0**	**0**	**274**	**92**	**0**	**46**	**0**	**21**	**0**	**0**	**0**	**0**
PHF	**0.92**				**0.86**				**0.80**				**0.00**			
HV %	**0.0%**	**12.5%**	**6.0%**	**0.0%**	**0.0%**	**0.0%**	**1.8%**	**2.2%**	**0.0%**	**2.2%**	**0.0%**	**9.5%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**

PM PEAK HOUR 4:45 PM to 5:45 PM	Technology Drive Northbound				Technology Drive Southbound				Forestvale Road Eastbound				Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**32**	**331**	**0**	**0**	**0**	**369**	**73**	**0**	**74**	**0**	**28**	**0**	**0**	**0**	**0**
PHF	**0.91**				**0.95**				**0.91**				**0.00**			
HV %	**0.0%**	**0.0%**	**1.2%**	**0.0%**	**0.0%**	**0.0%**	**0.5%**	**2.7%**	**0.0%**	**2.7%**	**0.0%**	**3.6%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**

Client:	Emma Parisi
Project #:	953_001_HSH
BTD #:	Location 1
Location:	Hudson, MA
Street 1:	Technology Drive
Street 2:	Forestvale Road
Count Date:	6/1/2022
Day of Week:	Wednesday
Weather:	Cloudy, 60°F

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HEAVY VEHICLES

	Technology Drive Northbound				Technology Drive Southbound				Forestvale Road Eastbound				Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	0	2	0	0	0	6	1	0	0	0	0	0	0	0	0
7:15 AM	0	1	0	0	0	0	4	0	0	0	0	1	0	0	0	0
7:30 AM	0	1	5	0	0	0	1	0	0	1	0	1	0	0	0	0
7:45 AM	0	0	3	0	0	0	1	2	0	0	0	0	0	0	0	0
8:00 AM	0	0	6	0	0	0	1	0	0	0	0	0	0	0	0	0
8:15 AM	0	1	5	0	0	0	2	0	0	0	0	1	0	0	0	0
8:30 AM	0	0	4	0	0	0	5	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	1	0	0	0	3	0	0	1	0	0	0	0	0	0

	Technology Drive Northbound				Technology Drive Southbound				Forestvale Road Eastbound				Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	0	0	2	0	0	0	4	1	0	0	0	1	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
4:30 PM	0	1	0	0	0	0	1	0	0	1	0	1	0	0	0	0
4:45 PM	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
5:00 PM	0	0	2	0	0	0	1	2	0	0	0	0	0	0	0	0
5:15 PM	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0
5:30 PM	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0

AM PEAK HOUR 7:30 AM to 8:30 AM	Technology Drive Northbound				Technology Drive Southbound				Forestvale Road Eastbound				Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**2**	**19**	**0**	**0**	**0**	**5**	**2**	**0**	**1**	**0**	**2**	**0**	**0**	**0**	**0**
PHF	**0.88**				**0.58**				**0.38**				**0.00**			

PM PEAK HOUR 4:00 PM to 5:00 PM	Technology Drive Northbound				Technology Drive Southbound				Forestvale Road Eastbound				Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**1**	**2**	**0**	**0**	**0**	**6**	**1**	**0**	**1**	**0**	**4**	**0**	**0**	**0**	**0**
PHF	**0.38**				**0.35**				**0.63**				**0.00**			

Client: Emma Parisi
Project #: 953_001_HSH
BTD #: Location 1
Location: Hudson, MA
Street 1: Technology Drive
Street 2: Forestvale Road
Count Date: 6/1/2022
Day of Week: Wednesday
Weather: Cloudy, 60°F

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PEDESTRIANS & BICYCLES

	Technology Drive Northbound				Technology Drive Southbound				Forestvale Road Eastbound				Westbound			
Start Time	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Technology Drive Northbound				Technology Drive Southbound				Forestvale Road Eastbound				Westbound			
Start Time	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AM PEAK HOUR[1] 7:30 AM to 8:30 AM	Technology Drive Northbound				Technology Drive Southbound				Forestvale Road Eastbound				Westbound			
	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PM PEAK HOUR[1] 4:45 PM to 5:45 PM	Technology Drive Northbound				Technology Drive Southbound				Forestvale Road Eastbound				Westbound			
	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0

[1] *NOTE: Peak hour summaries here correspond to peak hours identified for passenger cars and heavy vehicles combined.*

Volume Report

Job 934_001_HSH_ATR
Area Hudson, MA
Location Technology Drive, east of Forestvale Road

BOSTON TRAFFIC DATA
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Tuesday, May 10, 2022

Time	Total		EB		WB		Time	Total		EB		WB	
0000	6		4		2		1200	106		61		45	
0015	3		3		0		1215	106		54		52	
0030	11		7		4		1230	119		54		65	
0045	3	23	1	15	2	8	1245	106	437	56	225	50	212
0100	4		1		3		1300	82		41		41	
0115	2		0		2		1315	110		54		56	
0130	2		1		1		1330	98		53		45	
0145	3	11	3	5	0	6	1345	117	407	67	215	50	192
0200	4		1		3		1400	129		59		70	
0215	2		0		2		1415	140		71		69	
0230	1		0		1		1430	154		77		77	
0245	2	9	2	3	0	6	1445	163	586	88	295	75	291
0300	0		0		0		1500	183		98		85	
0315	1		0		1		1515	167		73		94	
0330	4		2		2		1530	190		82		108	
0345	1	6	0	2	1	4	1545	192	732	84	337	108	395
0400	7		3		4		1600	181		79		102	
0415	10		7		3		1615	199		107		92	
0430	16		8		8		1630	179		93		86	
0445	24	57	12	30	12	27	1645	197	756	95	374	102	382
0500	16		6		10		1700	228		125		103	
0515	31		16		15		1715	225		106		119	
0530	36		22		14		1730	195		96		99	
0545	67	150	48	92	19	58	1745	160	808	81	408	79	400
0600	89		55		34		1800	153		78		75	
0615	89		57		32		1815	128		68		60	
0630	139		103		36		1830	133		72		61	
0645	138	455	85	300	53	155	1845	98	512	55	273	43	239
0700	172		83		89		1900	116		64		52	
0715	193		98		95		1915	88		49		39	
0730	183		91		92		1930	72		35		37	
0745	193	741	97	369	96	372	1945	76	352	52	200	24	152
0800	176		94		82		2000	75		46		29	
0815	167		90		77		2015	69		39		30	
0830	154		72		82		2030	69		46		23	
0845	131	628	71	327	60	301	2045	41	254	27	158	14	96
0900	114		58		56		2100	38		27		11	
0915	101		51		50		2115	39		29		10	
0930	96		56		40		2130	48		29		19	
0945	94	405	43	208	51	197	2145	34	159	12	97	22	62
1000	80		50		30		2200	28		15		13	
1015	106		58		48		2215	28		21		7	
1030	107		53		54		2230	27		13		14	
1045	85	378	47	208	38	170	2245	11	94	10	59	1	35
1100	95		45		50		2300	20		12		8	
1115	101		42		59		2315	15		10		5	
1130	111		59		52		2330	15		9		6	
1145	135	442	62	208	73	234	2345	5	55	4	35	1	20
							Total	**8457**		**4443**		**4014**	

Speed Report

Job 934_001_HSH_ATR
Area Hudson, MA
Location Technology Drive, east of Forestvale Road
Dir Eastbound
Tuesday, May 10, 2022

BOSTON TRAFFIC DATA
PO BOX 1723, Framingham, MA 01701
Office: 978-746-1259
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Time	Total	Speed Bins (mph)															
		0 5	5 10	10 15	15 20	20 25	25 30	30 35	35 40	40 45	45 50	50 55	55 60	60 65	65 70	70 75	75 80
0000	15	0	0	0	0	0	4	5	5	1	0	0	0	0	0	0	0
0100	5	0	0	0	0	0	0	1	3	1	0	0	0	0	0	0	0
0200	3	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0
0300	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
0400	30	0	0	0	0	0	2	8	15	5	0	0	0	0	0	0	0
0500	92	0	0	0	0	0	1	22	44	23	2	0	0	0	0	0	0
0600	300	0	0	0	0	2	29	120	118	29	2	0	0	0	0	0	0
0700	369	0	0	0	1	3	44	173	137	11	0	0	0	0	0	0	0
0800	327	0	0	0	0	4	31	152	128	10	2	0	0	0	0	0	0
0900	208	0	0	0	0	0	24	105	69	10	0	0	0	0	0	0	0
1000	208	0	0	0	0	5	28	113	54	8	0	0	0	0	0	0	0
1100	208	0	0	0	0	1	34	113	49	11	0	0	0	0	0	0	0
1200	225	0	0	0	0	0	25	117	73	10	0	0	0	0	0	0	0
1300	215	0	0	0	0	3	31	96	72	13	0	0	0	0	0	0	0
1400	295	0	0	0	0	6	45	149	87	8	0	0	0	0	0	0	0
1500	337	0	0	0	2	5	43	179	97	11	0	0	0	0	0	0	0
1600	374	0	0	0	0	6	32	211	111	13	1	0	0	0	0	0	0
1700	408	0	0	0	0	2	44	215	128	18	1	0	0	0	0	0	0
1800	273	0	0	0	0	1	19	133	109	10	1	0	0	0	0	0	0
1900	200	0	0	0	0	0	19	94	78	9	0	0	0	0	0	0	0
2000	158	0	0	0	1	2	14	78	53	8	2	0	0	0	0	0	0
2100	97	0	0	0	0	2	11	42	36	6	0	0	0	0	0	0	0
2200	59	0	0	0	0	0	10	26	19	3	0	1	0	0	0	0	0
2300	35	0	0	0	0	0	3	10	17	4	1	0	0	0	0	0	0
Total	**4443**	**0**	**0**	**0**	**4**	**42**	**493**	**2166**	**1503**	**222**	**12**	**1**	**0**	**0**	**0**	**0**	**0**
	100.00%	**0.00%**	**0.00%**	**0.00%**	**0.09%**	**0.95%**	**11.10%**	**48.75%**	**33.83%**	**5.00%**	**0.27%**	**0.02%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**

Maximum = 53.7 mph, Minimum = 15.5 mph, Mean = 34.1 mph
85% Speed = 37.69 mph, 95% Speed = 40.09 mph, Median = 34.11 mph
10 mph Pace = 29 - 39, Number in Pace = 3761 (84.65%)
Variance = 13.34, Standard Deviation = 3.65 mph

Speed Report

Job 934_001_HSH_ATR
Area Hudson, MA
Location Technology Drive, east of Forestvale Road
Dir Westbound
Tuesday, May 10, 2022

BOSTON TRAFFIC DATA
PO BOX 1723, Framingham, MA 01701
Office: 978-746-1259
DataRequest@BostonTrafficData.com
www.BostonTrafficData.com

Time	Total	Speed Bins (mph)															
		0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
		5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
0000	8	0	0	0	0	0	0	2	5	1	0	0	0	0	0	0	0
0100	6	0	0	0	0	0	0	1	3	2	0	0	0	0	0	0	0
0200	6	0	0	0	0	0	0	0	4	2	0	0	0	0	0	0	0
0300	4	0	0	0	0	0	1	0	0	2	0	1	0	0	0	0	0
0400	27	0	0	0	0	1	0	5	16	3	1	1	0	0	0	0	0
0500	58	0	0	0	0	0	1	14	29	13	1	0	0	0	0	0	0
0600	155	0	0	0	0	1	2	45	90	16	1	0	0	0	0	0	0
0700	372	0	0	0	0	1	7	133	212	17	2	0	0	0	0	0	0
0800	301	0	0	0	0	2	9	82	185	23	0	0	0	0	0	0	0
0900	197	0	0	0	0	0	6	88	94	9	0	0	0	0	0	0	0
1000	170	0	0	0	0	1	8	66	82	13	0	0	0	0	0	0	0
1100	234	0	0	0	0	1	7	89	126	10	1	0	0	0	0	0	0
1200	212	0	0	0	1	1	9	82	100	18	1	0	0	0	0	0	0
1300	192	0	0	0	0	2	12	67	91	20	0	0	0	0	0	0	0
1400	291	0	0	0	0	2	7	107	153	18	4	0	0	0	0	0	0
1500	395	0	0	0	0	1	6	135	218	35	0	0	0	0	0	0	0
1600	382	0	0	0	2	0	7	115	239	17	2	0	0	0	0	0	0
1700	400	1	0	0	1	3	8	153	218	15	1	0	0	0	0	0	0
1800	239	0	0	0	1	0	7	83	129	18	1	0	0	0	0	0	0
1900	152	0	0	0	0	2	3	39	93	13	2	0	0	0	0	0	0
2000	96	0	0	0	0	0	3	29	50	13	1	0	0	0	0	0	0
2100	62	0	0	0	0	0	0	16	42	4	0	0	0	0	0	0	0
2200	35	0	0	0	0	0	1	10	20	4	0	0	0	0	0	0	0
2300	20	0	0	0	0	0	0	5	9	5	1	0	0	0	0	0	0
Total	**4014**	**1**	**0**	**0**	**5**	**18**	**104**	**1366**	**2208**	**291**	**19**	**2**	**0**	**0**	**0**	**0**	**0**
	100.00%	**0.02%**	**0.00%**	**0.00%**	**0.12%**	**0.45%**	**2.59%**	**34.03%**	**55.01%**	**7.25%**	**0.47%**	**0.05%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**

Maximum = 51.1 mph, Minimum = 0.9 mph, Mean = 35.8 mph
85% Speed = 38.87 mph, 95% Speed = 40.82 mph, Median = 35.96 mph
10 mph Pace = 30 - 40, Number in Pace = 3613 (90.01%)
Variance = 10.56, Standard Deviation = 3.25 mph

Classification Report

Job # 934_001_HSH_ATR
Area Hudson, MA
Location Technology Drive, east of Forestvale Road
Direction Eastbound
Tuesday, May 10, 2022

BOSTON TRAFFIC DATA
PO BOX 1723, Framingham, MA 01701
Office: 978-746-1259
DataRequests@BostonTrafficData.com
www.BostonTrafficData.com

Time	Total	Class 1 Motorcycle	Class 2 Passenger Car	Class 3 Vans, Pick up Trucks	Class 4 Bus	Class 5 2 Axle 6 Tires	Class 6 3 Axle Unit	Class 7 4 Axles or more Unit	Class 8 3 or 4 Axle Trailer	Class 9 5 Axle Trailer	Class 10 6 Axle or more Trailer	Class 11 5 Axle or less Multi-Trailer	Class 12 6 Axle Multi-Trailer	Class 13 7 Axle or more Multi-Trailer
0000	15	0	12	2	0	0	0	0	0	1	0	0	0	0
0100	5	0	2	1	1	0	0	0	0	1	0	0	0	0
0200	3	0	1	1	1	0	0	0	0	0	0	0	0	0
0300	2	0	2	0	0	0	0	0	0	0	0	0	0	0
0400	30	0	21	8	0	0	0	0	0	1	0	0	0	0
0500	92	0	75	15	0	1	0	0	0	1	0	0	0	0
0600	300	0	239	54	4	1	2	0	0	0	0	0	0	0
0700	369	1	312	48	2	0	1	0	0	4	0	0	0	1
0800	327	1	263	58	2	2	0	0	0	1	0	0	0	0
0900	208	1	175	28	1	2	1	0	0	0	0	0	0	0
1000	208	1	174	28	1	1	1	0	0	1	1	0	0	0
1100	208	0	177	18	0	7	1	0	0	4	1	0	0	0
1200	225	1	195	23	3	2	1	0	0	0	0	0	0	0
1300	215	2	188	20	1	0	2	0	0	1	1	0	0	0
1400	295	1	252	34	4	1	1	0	0	2	0	0	0	0
1500	337	1	299	32	2	1	1	0	0	1	0	0	0	0
1600	374	2	345	23	1	1	2	0	0	0	0	0	0	0
1700	408	0	366	41	0	0	0	0	0	1	0	0	0	0
1800	273	0	242	30	1	0	0	0	0	0	0	0	0	0
1900	200	1	180	19	0	0	0	0	0	0	0	0	0	0
2000	158	0	146	12	0	0	0	0	0	0	0	0	0	0
2100	97	0	94	2	0	1	0	0	0	0	0	0	0	0
2200	59	0	54	5	0	0	0	0	0	0	0	0	0	0
2300	35	0	31	4	0	0	0	0	0	0	0	0	0	0
Total	**4443**	**12**	**3845**	**506**	**24**	**20**	**13**	**0**	**0**	**19**	**3**	**0**	**0**	**1**
	100.00%	**0.27%**	**86.54%**	**11.39%**	**0.54%**	**0.45%**	**0.29%**	**0.00%**	**0.00%**	**0.43%**	**0.07%**	**0.00%**	**0.00%**	**0.02%**

Classification Report

Job # 934_001_HSH_ATR
Area Hudson, MA
Location Technology Drive, east of Forestvale Road
Direction Westbound
Tuesday, May 10, 2022

BOSTON TRAFFIC DATA

Time	Total	Class 1 Motorcycle	Class 2 Passenger Car	Class 3 Vans, Pick up Trucks	Class 4 Bus	Class 5 2 Axle 6 Tires	Class 6 3 Axle Unit	Class 7 4 Axles or more Unit	Class 8 3 or 4 Axle Trailer	Class 9 5 Axle Trailer	Class 10 6 Axle or more Trailer	Class 11 5 Axle or less Multi-Trailer	Class 12 6 Axle Multi-Trailer	Class 13 7 Axle or more Multi-Trailer
0000	8	0	6	1	0	0	0	0	0	1	0	0	0	0
0100	6	0	5	1	0	0	0	0	0	0	0	0	0	0
0200	6	0	3	0	1	0	1	0	0	1	0	0	0	0
0300	4	0	4	0	0	0	0	0	0	0	0	0	0	0
0400	27	0	18	9	0	0	0	0	0	0	0	0	0	0
0500	58	0	46	9	0	0	1	0	0	2	0	0	0	0
0600	155	0	132	19	0	0	2	0	0	2	0	0	0	0
0700	372	1	325	39	4	0	0	0	0	3	0	0	0	0
0800	301	1	264	29	1	2	0	1	0	3	0	0	0	0
0900	197	0	172	18	2	1	3	0	0	1	0	0	0	0
1000	170	0	150	15	1	1	1	0	0	2	0	0	0	0
1100	234	0	196	28	2	3	2	0	0	2	0	0	0	1
1200	212	0	179	24	2	2	2	0	0	3	0	0	0	0
1300	192	1	168	16	4	1	1	0	0	1	0	0	0	0
1400	291	1	248	39	1	0	2	0	0	0	0	0	0	0
1500	395	0	339	49	3	3	0	0	0	1	0	0	0	0
1600	382	0	328	52	1	0	1	0	0	0	0	0	0	0
1700	400	1	359	40	0	0	0	0	0	0	0	0	0	0
1800	239	0	211	25	2	0	0	0	1	0	0	0	0	0
1900	152	1	132	19	0	0	0	0	0	0	0	0	0	0
2000	96	0	88	8	0	0	0	0	0	0	0	0	0	0
2100	62	1	52	9	0	0	0	0	0	0	0	0	0	0
2200	35	0	30	5	0	0	0	0	0	0	0	0	0	0
2300	20	0	20	0	0	0	0	0	0	0	0	0	0	0
Total	**4014**	**7**	**3475**	**454**	**24**	**13**	**16**	**1**	**1**	**22**	**0**	**0**	**0**	**1**
	100.00%	**0.17%**	**86.57%**	**11.31%**	**0.60%**	**0.32%**	**0.40%**	**0.02%**	**0.02%**	**0.55%**	**0.00%**	**0.00%**	**0.00%**	**0.02%**

Volume Report

Job 934_001_HSH_ATR
Area Hudson, MA
Location Technology Drive, east of Forestvale Road

BOSTON TRAFFIC DATA
PO BOX 1723, Framingham, MA 01701
Office: 978-746-1259
DataRequest@BostonTrafficData.com
www.BostonTrafficData.com

Wednesday, May 11, 2022

Time	Total		EB		WB		Time	Total		EB		WB	
0000	5		4		1		1200	112		61		51	
0015	4		4		0		1215	137		76		61	
0030	6		3		3		1230	146		67		79	
0045	3	18	1	12	2	6	1245	109	504	57	261	52	243
0100	1		0		1		1300	105		53		52	
0115	5		2		3		1315	117		62		55	
0130	2		1		1		1330	123		66		57	
0145	1	9	0	3	1	6	1345	137	482	58	239	79	243
0200	3		1		2		1400	126		63		63	
0215	6		3		3		1415	137		70		67	
0230	2		2		0		1430	151		78		73	
0245	0	11	0	6	0	5	1445	160	574	76	287	84	287
0300	0		0		0		1500	185		81		104	
0315	3		1		2		1515	160		77		83	
0330	3		1		2		1530	200		85		115	
0345	7	13	3	5	4	8	1545	223	768	110	353	113	415
0400	4		2		2		1600	207		88		119	
0415	13		6		7		1615	195		98		97	
0430	10		4		6		1630	170		82		88	
0445	11	38	4	16	7	22	1645	182	754	92	360	90	394
0500	23		12		11		1700	225		95		130	
0515	31		18		13		1715	206		104		102	
0530	41		17		24		1730	171		86		85	
0545	58	153	37	84	21	69	1745	157	759	87	372	70	387
0600	84		55		29		1800	141		75		66	
0615	112		75		37		1815	124		61		63	
0630	126		84		42		1830	108		52		56	
0645	138	460	93	307	45	153	1845	105	478	62	250	43	228
0700	156		79		77		1900	105		59		46	
0715	199		92		107		1915	88		44		44	
0730	183		104		79		1930	83		52		31	
0745	195	733	110	385	85	348	1945	86	362	50	205	36	157
0800	167		100		67		2000	58		39		19	
0815	169		82		87		2015	85		53		32	
0830	156		76		80		2030	50		37		13	
0845	136	628	74	332	62	296	2045	53	246	30	159	23	87
0900	100		56		44		2100	42		27		15	
0915	105		47		58		2115	38		25		13	
0930	94		53		41		2130	24		13		11	
0945	79	378	40	196	39	182	2145	34	138	25	90	9	48
1000	103		51		52		2200	26		15		11	
1015	111		60		51		2215	20		15		5	
1030	112		58		54		2230	16		12		4	
1045	112	438	52	221	60	217	2245	8	70	7	49	1	21
1100	104		50		54		2300	18		14		4	
1115	111		59		52		2315	7		5		2	
1130	118		63		55		2330	9		5		4	
1145	121	454	65	237	56	217	2345	4	38	3	27	1	11
							Total	**8506**		**4456**		**4050**	

Speed Report

Job 934_001_HSH_ATR
Area Hudson, MA
Location Technology Drive, east of Forestvale Road
Dir Eastbound
Wednesday, May 11, 2022

BOSTON
TRAFFIC DATA
PO BOX 1723, Framingham, MA 01701
Office: 978-746-1259
DataRequest@BostonTrafficData.com
www.BostonTrafficData.com

Time	Total	Speed Bins (mph)															
		0 5	5 10	10 15	15 20	20 25	25 30	30 35	35 40	40 45	45 50	50 55	55 60	60 65	65 70	70 75	75 80
0000	12	0	0	0	0	1	4	4	2	1	0	0	0	0	0	0	0
0100	3	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0
0200	6	0	0	0	0	0	1	2	3	0	0	0	0	0	0	0	0
0300	5	0	0	0	0	1	0	1	3	0	0	0	0	0	0	0	0
0400	16	0	0	0	0	1	2	2	8	3	0	0	0	0	0	0	0
0500	84	0	0	0	0	0	0	28	43	12	1	0	0	0	0	0	0
0600	307	0	0	0	0	2	28	142	115	20	0	0	0	0	0	0	0
0700	385	0	0	0	0	6	56	173	138	11	1	0	0	0	0	0	0
0800	332	0	0	0	0	9	25	165	116	15	2	0	0	0	0	0	0
0900	196	0	0	0	0	2	15	98	79	2	0	0	0	0	0	0	0
1000	221	0	0	0	0	1	34	103	80	3	0	0	0	0	0	0	0
1100	237	0	0	0	0	3	33	98	91	12	0	0	0	0	0	0	0
1200	261	0	0	0	1	6	37	129	76	12	0	0	0	0	0	0	0
1300	239	0	1	10	33	48	59	70	18	0	0	0	0	0	0	0	0
1400	287	0	1	0	2	7	40	142	75	19	1	0	0	0	0	0	0
1500	353	0	0	0	1	7	39	191	103	11	1	0	0	0	0	0	0
1600	360	0	0	0	2	3	29	192	123	10	1	0	0	0	0	0	0
1700	372	0	1	0	0	2	29	198	138	4	0	0	0	0	0	0	0
1800	250	0	0	0	2	5	24	119	90	9	1	0	0	0	0	0	0
1900	205	0	0	0	0	4	27	97	68	9	0	0	0	0	0	0	0
2000	159	0	0	0	0	1	27	84	42	4	1	0	0	0	0	0	0
2100	90	0	0	0	0	0	15	45	22	8	0	0	0	0	0	0	0
2200	49	0	0	0	0	1	6	30	11	1	0	0	0	0	0	0	0
2300	27	0	0	0	0	0	5	10	9	3	0	0	0	0	0	0	0
Total	**4456**	**0**	**3**	**10**	**41**	**110**	**535**	**2124**	**1455**	**169**	**9**	**0**	**0**	**0**	**0**	**0**	**0**
	100.00%	**0.00%**	**0.07%**	**0.22%**	**0.92%**	**2.47%**	**12.01%**	**47.67%**	**32.65%**	**3.79%**	**0.20%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**

Maximum = 47.9 mph, Minimum = 8.7 mph, Mean = 33.5 mph
85% Speed = 37.30 mph, 95% Speed = 39.59 mph, Median = 33.89 mph
10 mph Pace = 29 - 39, Number in Pace = 3667 (82.29%)
Variance = 18.18, Standard Deviation = 4.26 mph

Speed Report

Job 934_001_HSH_ATR
Area Hudson, MA
Location Technology Drive, east of Forestvale Road
Dir Westbound
Wednesday, May 11, 2022

BOSTON TRAFFIC DATA
PO BOX 1723, Framingham, MA 01701
Office: 978-746-1259
DataRequest@BostonTrafficData.com
www.BostonTrafficData.com

Time	Total	Speed Bins (mph)															
		0 5	5 10	10 15	15 20	20 25	25 30	30 35	35 40	40 45	45 50	50 55	55 60	60 65	65 70	70 75	75 80
0000	6	0	0	0	0	0	1	1	3	0	1	0	0	0	0	0	0
0100	6	0	0	0	0	0	0	0	4	2	0	0	0	0	0	0	0
0200	5	0	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0
0300	8	0	0	0	0	0	1	1	5	0	1	0	0	0	0	0	0
0400	22	0	0	0	0	0	0	6	14	1	1	0	0	0	0	0	0
0500	69	0	0	0	0	0	1	21	37	10	0	0	0	0	0	0	0
0600	153	0	0	0	0	3	5	48	85	12	0	0	0	0	0	0	0
0700	348	0	0	0	0	1	23	104	193	24	3	0	0	0	0	0	0
0800	296	0	0	0	1	1	6	102	164	21	1	0	0	0	0	0	0
0900	182	0	0	0	0	0	5	92	78	6	1	0	0	0	0	0	0
1000	217	0	0	0	0	0	12	74	117	14	0	0	0	0	0	0	0
1100	217	0	0	1	0	1	13	61	115	25	1	0	0	0	0	0	0
1200	243	0	0	0	1	1	14	89	124	14	0	0	0	0	0	0	0
1300	243	0	0	0	9	41	56	83	51	3	0	0	0	0	0	0	0
1400	287	0	1	0	2	6	25	101	121	25	6	0	0	0	0	0	0
1500	415	0	0	0	0	4	13	142	218	38	0	0	0	0	0	0	0
1600	394	0	0	0	0	0	8	140	218	28	0	0	0	0	0	0	0
1700	387	0	0	0	0	0	11	110	244	22	0	0	0	0	0	0	0
1800	228	0	0	0	0	1	5	101	97	23	1	0	0	0	0	0	0
1900	157	0	0	0	0	2	2	46	87	20	0	0	0	0	0	0	0
2000	87	0	0	0	0	0	2	32	44	8	1	0	0	0	0	0	0
2100	48	0	0	0	0	0	2	12	27	7	0	0	0	0	0	0	0
2200	21	0	0	0	0	0	0	8	10	3	0	0	0	0	0	0	0
2300	11	0	0	0	0	1	2	2	3	3	0	0	0	0	0	0	0
Total	**4050**	**0**	**1**	**1**	**13**	**62**	**207**	**1379**	**2061**	**309**	**17**	**0**	**0**	**0**	**0**	**0**	**0**
	100.00%	**0.00%**	**0.02%**	**0.02%**	**0.32%**	**1.53%**	**5.11%**	**34.05%**	**50.89%**	**7.63%**	**0.42%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**

Maximum = 48.6 mph, Minimum = 9.7 mph, Mean = 35.4 mph
85% Speed = 38.77 mph, 95% Speed = 40.82 mph, Median = 35.57 mph
10 mph Pace = 31 - 41, Number in Pace = 3477 (85.85%)
Variance = 14.62, Standard Deviation = 3.82 mph

Classification Report

Job # 934_001_HSH_ATR
Area Hudson, MA
Location Technology Drive, east of Forestvale Road
Direction Eastbound
Wednesday, May 11, 2022

BOSTON
TRAFFIC DATA

Time	Total	Class 1 Motorcycle	Class 2 Passenger Car	Class 3 Vans, Pick up Trucks	Class 4 Bus	Class 5 2 Axle 6 Tires	Class 6 3 Axle Unit	Class 7 4 Axles or more Unit	Class 8 3 or 4 Axle Trailer	Class 9 5 Axle Trailer	Class 10 6 Axle or more Trailer	Class 11 5 Axle or less Multi-Trailer	Class 12 6 Axle Multi-Trailer	Class 13 7 Axle or more Multi-Trailer
0000	12	0	9	2	0	0	0	0	0	1	0	0	0	0
0100	3	0	2	0	0	0	0	0	0	1	0	0	0	0
0200	6	0	5	0	1	0	0	0	0	0	0	0	0	0
0300	5	0	2	2	0	0	0	0	0	1	0	0	0	0
0400	16	0	11	4	1	0	0	0	0	0	0	0	0	0
0500	84	0	62	21	0	0	0	0	0	1	0	0	0	0
0600	307	0	242	57	4	0	2	0	0	2	0	0	0	0
0700	385	0	314	64	1	0	3	1	0	2	0	0	0	0
0800	332	2	287	36	5	1	1	0	0	0	0	0	0	0
0900	196	2	171	15	4	1	2	0	0	1	0	0	0	0
1000	221	0	183	29	1	2	2	0	0	4	0	0	0	0
1100	237	0	203	29	1	1	2	0	0	1	0	0	0	0
1200	261	1	223	30	2	1	3	1	0	0	0	0	0	0
1300	239	1	205	26	2	3	0	0	0	2	0	0	0	0
1400	287	1	239	36	5	4	1	0	0	1	0	0	0	0
1500	353	1	313	30	3	2	2	0	0	2	0	0	0	0
1600	360	0	316	43	0	0	1	0	0	0	0	0	0	0
1700	372	1	335	35	1	0	0	0	0	0	0	0	0	0
1800	250	0	235	15	0	0	0	0	0	0	0	0	0	0
1900	205	1	180	24	0	0	0	0	0	0	0	0	0	0
2000	159	1	144	14	0	0	0	0	0	0	0	0	0	0
2100	90	0	74	14	0	0	2	0	0	0	0	0	0	0
2200	49	0	46	3	0	0	0	0	0	0	0	0	0	0
2300	27	0	26	1	0	0	0	0	0	0	0	0	0	0
Total	**4456**	**11**	**3827**	**530**	**31**	**15**	**21**	**2**	**0**	**19**	**0**	**0**	**0**	**0**
	100.00%	**0.25%**	**85.88%**	**11.89%**	**0.70%**	**0.34%**	**0.47%**	**0.04%**	**0.00%**	**0.43%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**

Classification Report

Job # 934_001_HSH_ATR
Area Hudson, MA
Location Technology Drive, east of Forestvale Road
Direction Westbound
Wednesday, May 11, 2022

BOSTON
TRAFFIC DATA
PO BOX 1723, Framingham, MA 01701
Office: 978-746-1259
DataRequests@BostonTrafficData.com
www.BostonTrafficData.com

Time	Total	Class 1 Motorcycle	Class 2 Passenger Car	Class 3 Vans, Pick up Trucks	Class 4 Bus	Class 5 2 Axle 6 Tires	Class 6 3 Axle Unit	Class 7 4 Axles or more Unit	Class 8 3 or 4 Axle Trailer	Class 9 5 Axle Trailer	Class 10 6 Axle or more Trailer	Class 11 5 Axle or less Multi-Trailer	Class 12 6 Axle Multi-Trailer	Class 13 7 Axle or more Multi-Trailer
0000	6	0	5	0	0	0	0	0	0	1	0	0	0	0
0100	6	0	6	0	0	0	0	0	0	0	0	0	0	0
0200	5	0	3	1	0	0	0	0	0	1	0	0	0	0
0300	8	0	7	1	0	0	0	0	0	0	0	0	0	0
0400	22	0	17	4	0	0	0	0	0	1	0	0	0	0
0500	69	0	58	10	0	0	1	0	0	0	0	0	0	0
0600	153	0	125	20	0	2	4	0	0	2	0	0	0	0
0700	348	2	307	29	4	1	1	0	0	4	0	0	0	0
0800	296	0	269	25	1	0	1	0	0	0	0	0	0	0
0900	182	1	158	18	3	1	1	0	0	0	0	0	0	0
1000	217	0	193	17	1	0	3	0	0	3	0	0	0	0
1100	217	0	196	18	0	1	1	0	0	1	0	0	0	0
1200	243	0	207	31	3	0	2	0	0	0	0	0	0	0
1300	243	1	197	35	3	2	4	0	0	1	0	0	0	0
1400	287	0	246	36	2	1	2	0	0	0	0	0	0	0
1500	415	2	357	49	4	2	1	0	0	0	0	0	0	0
1600	394	0	341	48	1	1	3	0	0	0	0	0	0	0
1700	387	1	353	33	0	0	0	0	0	0	0	0	0	0
1800	228	2	195	29	2	0	0	0	0	0	0	0	0	0
1900	157	0	134	23	0	0	0	0	0	0	0	0	0	0
2000	87	0	76	10	0	1	0	0	0	0	0	0	0	0
2100	48	0	44	3	0	0	1	0	0	0	0	0	0	0
2200	21	0	18	3	0	0	0	0	0	0	0	0	0	0
2300	11	0	10	1	0	0	0	0	0	0	0	0	0	0
Total	**4050**	**9**	**3522**	**444**	**24**	**12**	**25**	**0**	**0**	**14**	**0**	**0**	**0**	**0**
	100.00%	**0.22%**	**86.96%**	**10.96%**	**0.59%**	**0.30%**	**0.62%**	**0.00%**	**0.00%**	**0.35%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**

Volume Report

Job 934_001_HSH_ATR
Area Hudson, MA
Location Technology Drive, east of Forestvale Road

BOSTON
TRAFFIC DATA
PO BOX 1723, Framingham, MA 01701
Office: 978-746-1259
DataRequest@BostonTrafficData.com
www.BostonTrafficData.com

Thursday, May 12, 2022

Time	Total		EB		WB			Time	Total		EB		WB	
0000	8		6		2			1200	126		55		71	
0015	3		2		1			1215	113		61		52	
0030	6		3		3			1230	132		74		58	
0045	2	19	1	12	1	7		1245	122	493	71	261	51	232
0100	7		3		4			1300	111		51		60	
0115	7		5		2			1315	115		58		57	
0130	1		0		1			1330	129		55		74	
0145	0	15	0	8	0	7		1345	127	482	64	228	63	254
0200	4		2		2			1400	143		74		69	
0215	2		1		1			1415	154		84		70	
0230	1		0		1			1430	164		81		83	
0245	2	9	2	5	0	4		1445	159	620	75	314	84	306
0300	1		1		0			1500	162		71		91	
0315	2		1		1			1515	201		87		114	
0330	2		0		2			1530	207		97		110	
0345	1	6	1	3	0	3		1545	189	759	81	336	108	423
0400	4		2		2			1600	166		88		78	
0415	9		4		5			1615	199		92		107	
0430	11		4		7			1630	203		105		98	
0445	16	40	9	19	7	21		1645	236	804	118	403	118	401
0500	23		14		9			1700	187		77		110	
0515	26		15		11			1715	183		91		92	
0530	46		23		23			1730	181		95		86	
0545	68	163	42	94	26	69		1745	165	716	85	348	80	368
0600	84		53		31			1800	154		80		74	
0615	86		60		26			1815	131		60		71	
0630	133		87		46			1830	121		59		62	
0645	132	435	83	283	49	152		1845	102	508	52	251	50	257
0700	159		88		71			1900	101		62		39	
0715	193		108		85			1915	88		50		38	
0730	180		81		99			1930	83		50		33	
0745	198	730	115	392	83	338		1945	66	338	43	205	23	133
0800	163		92		71			2000	76		43		33	
0815	162		77		85			2015	69		38		31	
0830	160		82		78			2030	59		42		17	
0845	157	642	79	330	78	312		2045	53	257	28	151	25	106
0900	116		61		55			2100	61		47		14	
0915	107		55		52			2115	43		23		20	
0930	110		60		50			2130	41		30		11	
0945	132	465	60	236	72	229		2145	37	182	19	119	18	63
1000	101		56		45			2200	19		9		10	
1015	104		47		57			2215	23		12		11	
1030	125		65		60			2230	29		18		11	
1045	108	438	49	217	59	221		2245	12	83	8	47	4	36
1100	97		40		57			2300	28		18		10	
1115	115		59		56			2315	14		10		4	
1130	126		68		58			2330	5		3		2	
1145	141	479	81	248	60	231		2345	7	54	3	34	4	20
								Total	**8737**		**4544**		**4193**	

Speed Report

Job 934_001_HSH_ATR
Area Hudson, MA
Location Technology Drive, east of Forestvale Road
Dir Eastbound
Thursday, May 12, 2022

BOSTON TRAFFIC DATA
PO BOX 1723, Framingham, MA 01701
Office: 978-746-1259
DataRequest@BostonTrafficData.com
www.BostonTrafficData.com

Time	Total	Speed Bins (mph)															
		0 5	5 10	10 15	15 20	20 25	25 30	30 35	35 40	40 45	45 50	50 55	55 60	60 65	65 70	70 75	75 80
0000	12	0	0	0	0	1	3	3	2	1	2	0	0	0	0	0	0
0100	8	0	0	0	0	0	0	2	4	2	0	0	0	0	0	0	0
0200	5	0	0	0	0	0	0	3	1	1	0	0	0	0	0	0	0
0300	3	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0
0400	19	0	0	0	0	1	0	4	12	1	1	0	0	0	0	0	0
0500	94	0	0	0	0	0	4	33	47	8	2	0	0	0	0	0	0
0600	283	0	0	0	0	2	22	110	125	23	1	0	0	0	0	0	0
0700	392	0	0	0	0	1	48	202	125	14	2	0	0	0	0	0	0
0800	330	0	0	0	2	9	35	170	99	15	0	0	0	0	0	0	0
0900	236	0	0	0	0	5	38	110	77	6	0	0	0	0	0	0	0
1000	217	0	0	0	1	5	27	118	59	5	2	0	0	0	0	0	0
1100	248	0	0	0	0	3	42	114	79	10	0	0	0	0	0	0	0
1200	261	0	0	0	0	3	46	153	52	7	0	0	0	0	0	0	0
1300	228	0	0	2	1	3	26	105	79	12	0	0	0	0	0	0	0
1400	314	0	0	0	1	0	27	163	108	13	2	0	0	0	0	0	0
1500	336	0	0	0	0	5	40	166	115	10	0	0	0	0	0	0	0
1600	403	0	0	0	2	6	41	208	136	9	1	0	0	0	0	0	0
1700	348	0	0	0	0	2	30	181	118	14	3	0	0	0	0	0	0
1800	251	0	0	0	1	5	22	127	81	13	2	0	0	0	0	0	0
1900	205	0	0	0	0	4	19	96	74	11	1	0	0	0	0	0	0
2000	151	0	0	0	0	2	21	84	39	4	1	0	0	0	0	0	0
2100	119	0	0	0	0	2	23	58	32	3	0	1	0	0	0	0	0
2200	47	0	0	0	0	0	5	24	18	0	0	0	0	0	0	0	0
2300	34	0	0	0	0	3	1	18	6	6	0	0	0	0	0	0	0
Total	**4544**	**0**	**0**	**2**	**8**	**62**	**520**	**2253**	**1490**	**188**	**20**	**1**	**0**	**0**	**0**	**0**	**0**
	100.00%	**0.00%**	**0.00%**	**0.04%**	**0.18%**	**1.36%**	**11.44%**	**49.58%**	**32.79%**	**4.14%**	**0.44%**	**0.02%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**

Maximum = 50.9 mph, Minimum = 10.2 mph, Mean = 33.9 mph
85% Speed = 37.41 mph, 95% Speed = 39.87 mph, Median = 33.89 mph
10 mph Pace = 29 - 39, Number in Pace = 3808 (83.80%)
Variance = 14.24, Standard Deviation = 3.77 mph

Speed Report

Job 934_001_HSH_ATR
Area Hudson, MA
Location Technology Drive, east of Forestvale Road
Dir Westbound
Thursday, May 12, 2022

BOSTON TRAFFIC DATA
PO BOX 1723, Framingham, MA 01701
Office: 978-746-1259
DataRequest@BostonTrafficData.com
www.BostonTrafficData.com

Time	Total	Speed Bins (mph)															
		0 5	5 10	10 15	15 20	20 25	25 30	30 35	35 40	40 45	45 50	50 55	55 60	60 65	65 70	70 75	75 80
0000	7	0	0	0	0	0	1	1	1	2	2	0	0	0	0	0	0
0100	7	0	0	0	0	0	0	2	3	2	0	0	0	0	0	0	0
0200	4	0	0	0	0	0	0	1	2	1	0	0	0	0	0	0	0
0300	3	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0
0400	21	0	0	0	0	0	0	5	9	5	2	0	0	0	0	0	0
0500	69	0	0	0	0	0	0	19	38	8	2	2	0	0	0	0	0
0600	152	0	0	0	0	2	10	34	87	18	1	0	0	0	0	0	0
0700	338	0	0	0	0	0	7	114	181	32	4	0	0	0	0	0	0
0800	312	0	0	0	1	0	10	119	164	17	1	0	0	0	0	0	0
0900	229	0	1	0	0	2	8	81	120	17	0	0	0	0	0	0	0
1000	221	0	0	0	0	1	14	78	101	27	0	0	0	0	0	0	0
1100	231	0	0	0	0	1	6	85	121	17	1	0	0	0	0	0	0
1200	232	0	0	0	0	2	8	83	112	24	3	0	0	0	0	0	0
1300	254	0	0	0	0	2	12	97	116	26	1	0	0	0	0	0	0
1400	306	0	1	0	0	2	11	110	164	16	2	0	0	0	0	0	0
1500	423	0	0	1	0	0	10	123	246	39	4	0	0	0	0	0	0
1600	401	0	0	0	0	4	13	152	203	29	0	0	0	0	0	0	0
1700	368	0	0	0	1	1	10	133	192	31	0	0	0	0	0	0	0
1800	257	0	0	0	0	2	7	117	116	14	1	0	0	0	0	0	0
1900	133	0	0	0	0	1	6	47	64	13	2	0	0	0	0	0	0
2000	106	0	0	0	0	2	4	49	44	6	1	0	0	0	0	0	0
2100	63	0	0	0	0	0	3	26	27	7	0	0	0	0	0	0	0
2200	36	0	0	0	0	0	2	9	23	2	0	0	0	0	0	0	0
2300	20	0	0	0	0	0	2	5	9	3	1	0	0	0	0	0	0
Total	**4193**	**0**	**2**	**1**	**2**	**22**	**144**	**1490**	**2144**	**357**	**29**	**2**	**0**	**0**	**0**	**0**	**0**
	100.00%	**0.00%**	**0.05%**	**0.02%**	**0.05%**	**0.52%**	**3.43%**	**35.54%**	**51.13%**	**8.51%**	**0.69%**	**0.05%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**

Maximum = 51.2 mph, Minimum = 8.2 mph, Mean = 35.8 mph
85% Speed = 38.98 mph, 95% Speed = 41.16 mph, Median = 35.74 mph
10 mph Pace = 31 - 41, Number in Pace = 3686 (87.91%)
Variance = 11.96, Standard Deviation = 3.46 mph

Classification Report

Job # 934_001_HSH_ATR
Area Hudson, MA
Location Technology Drive, east of Forestvale Road
Direction Eastbound
Thursday, May 12, 2022

Time	Total	Class 1 Motorcycle	Class 2 Passenger Car	Class 3 Vans, Pick up Trucks	Class 4 Bus	Class 5 2 Axle 6 Tires	Class 6 3 Axle Unit	Class 7 4 Axles or more Unit	Class 8 3 or 4 Axle Trailer	Class 9 5 Axle Trailer	Class 10 6 Axle or more Trailer	Class 11 5 Axle or less Multi-Trailer	Class 12 6 Axle Multi-Trailer	Class 13 7 Axle or more Multi-Trailer
0000	12	0	11	0	0	0	0	0	0	1	0	0	0	0
0100	8	0	6	1	0	0	0	0	0	1	0	0	0	0
0200	5	0	5	0	0	0	0	0	0	0	0	0	0	0
0300	3	0	2	0	0	0	0	0	0	1	0	0	0	0
0400	19	0	14	4	0	0	0	0	0	1	0	0	0	0
0500	94	0	70	22	1	0	0	0	0	1	0	0	0	0
0600	283	1	210	64	2	0	5	0	0	1	0	0	0	0
0700	392	0	317	70	0	0	2	0	0	2	1	0	0	0
0800	330	2	298	20	5	0	2	1	0	2	0	0	0	0
0900	236	2	185	39	3	3	1	1	0	2	0	0	0	0
1000	217	3	187	22	0	1	2	0	0	1	0	0	0	1
1100	248	1	204	36	2	0	2	1	0	2	0	0	0	0
1200	261	0	212	40	4	1	1	1	0	2	0	0	0	0
1300	228	3	194	19	3	4	4	0	0	1	0	0	0	0
1400	314	2	282	27	0	1	1	1	0	0	0	0	0	0
1500	336	1	287	34	6	2	4	0	1	1	0	0	0	0
1600	403	3	353	45	0	1	0	1	0	0	0	0	0	0
1700	348	3	305	37	1	1	1	0	0	0	0	0	0	0
1800	251	2	222	25	0	2	0	0	0	0	0	0	0	0
1900	205	2	178	24	0	0	1	0	0	0	0	0	0	0
2000	151	1	132	18	0	0	0	0	0	0	0	0	0	0
2100	119	0	107	12	0	0	0	0	0	0	0	0	0	0
2200	47	0	44	3	0	0	0	0	0	0	0	0	0	0
2300	34	0	29	4	1	0	0	0	0	0	0	0	0	0
Total	**4544**	**26**	**3854**	**566**	**28**	**16**	**26**	**6**	**1**	**19**	**1**	**0**	**0**	**1**
	100.00%	**0.57%**	**84.82%**	**12.46%**	**0.62%**	**0.35%**	**0.57%**	**0.13%**	**0.02%**	**0.42%**	**0.02%**	**0.00%**	**0.00%**	**0.02%**

BOSTON TRAFFIC DATA
PO BOX 1723, Framingham, MA 01701
Office: 978-746-1259
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Classification Report

Job # 934_001_HSH_ATR
Area Hudson, MA
Location Technology Drive, east of Forestvale Road
Direction Westbound
Thursday, May 12, 2022

BOSTON TRAFFIC DATA

Time	Total	Class 1 Motorcycle	Class 2 Passenger Car	Class 3 Vans, Pick up Trucks	Class 4 Bus	Class 5 2 Axle 6 Tires	Class 6 3 Axle Unit	Class 7 4 Axles or more Unit	Class 8 3 or 4 Axle Trailer	Class 9 5 Axle Trailer	Class 10 6 Axle or more Trailer	Class 11 5 Axle or less Multi-Trailer	Class 12 6 Axle Multi-Trailer	Class 13 7 Axle or more Multi-Trailer
0000	7	0	6	0	0	0	0	0	0	1	0	0	0	0
0100	7	0	7	0	0	0	0	0	0	0	0	0	0	0
0200	4	0	3	0	0	0	0	0	0	1	0	0	0	0
0300	3	0	3	0	0	0	0	0	0	0	0	0	0	0
0400	21	0	15	5	0	0	0	0	0	1	0	0	0	0
0500	69	0	57	9	0	0	1	0	0	2	0	0	0	0
0600	152	1	118	24	0	1	4	1	0	3	0	0	0	0
0700	338	1	294	35	4	2	1	0	0	1	0	0	0	0
0800	312	1	276	29	1	0	3	1	0	1	0	0	0	0
0900	229	0	208	17	1	0	1	2	0	0	0	0	0	0
1000	221	1	187	24	5	0	2	0	0	2	0	0	0	0
1100	231	3	191	30	1	0	3	0	0	3	0	0	0	0
1200	232	2	185	40	3	1	0	0	0	1	0	0	0	0
1300	254	2	214	28	1	3	2	1	0	3	0	0	0	0
1400	306	5	263	31	2	0	3	1	0	1	0	0	0	0
1500	423	2	354	58	5	2	2	0	0	0	0	0	0	0
1600	401	1	344	53	0	2	0	0	0	1	0	0	0	0
1700	368	1	330	36	0	0	1	0	0	0	0	0	0	0
1800	257	1	225	30	1	0	0	0	0	0	0	0	0	0
1900	133	0	112	19	0	2	0	0	0	0	0	0	0	0
2000	106	1	95	10	0	0	0	0	0	0	0	0	0	0
2100	63	2	55	6	0	0	0	0	0	0	0	0	0	0
2200	36	0	30	6	0	0	0	0	0	0	0	0	0	0
2300	20	0	20	0	0	0	0	0	0	0	0	0	0	0
Total	**4193**	**24**	**3592**	**490**	**24**	**13**	**23**	**6**	**0**	**21**	**0**	**0**	**0**	**0**
	100.00%	**0.57%**	**85.67%**	**11.69%**	**0.57%**	**0.31%**	**0.55%**	**0.14%**	**0.00%**	**0.50%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**

HOWARD STEIN HUDSON

Engineers + Planners

Appendix B

Crash Worksheets

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Hudson COUNT DATE : 3/15/2022

DISTRICT : 3 UNSIGNALIZED : SIGNALIZED : X

~ INTERSECTION DATA ~

MAJOR STREET : Forest Ave

MINOR STREET(S) : Marlboro Street

INTERSECTION DIAGRAM
(Label Approaches)

PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES :	404	61	205	498		**1,168**

" K " FACTOR :	**0.090**	INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME :	**12,978**

TOTAL # OF CRASHES :	8	# OF YEARS :	3	AVERAGE # OF CRASHES PER YEAR (**A**) :	**2.67**

CRASH RATE CALCULATION : **0.56**

RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments :

Project Title & Date: 75 Reed Road, Hudson

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Hudson COUNT DATE : 3/15/2022

DISTRICT : 3 UNSIGNALIZED : SIGNALIZED : X

~ INTERSECTION DATA ~

MAJOR STREET : Main Street

MINOR STREET(S) : Forest Ave

INTERSECTION DIAGRAM
(Label Approaches)

North

PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES :	371	171	304	849		**1,695**

" K " FACTOR : **0.090**

INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **18,833**

TOTAL # OF CRASHES : 28 # OF YEARS : 3 AVERAGE # OF CRASHES PER YEAR (**A**) : **9.33**

CRASH RATE CALCULATION : **1.36** RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments :

Project Title & Date: 75 Reed Road, Hudson

Moving Massachusetts Forward. massDOT Highway

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Hudson

COUNT DATE : 3/15/2022

DISTRICT : 3

UNSIGNALIZED :

SIGNALIZED : X

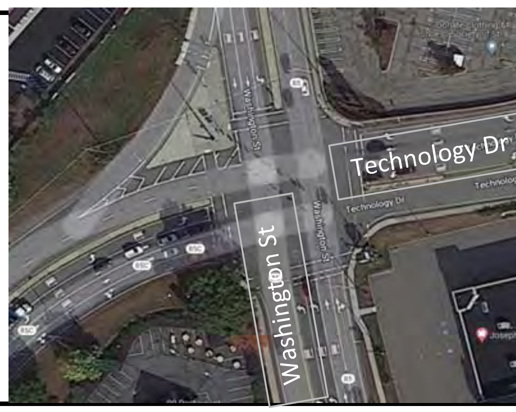
~ INTERSECTION DATA ~

MAJOR STREET : Washington Street

MINOR STREET(S) : Technology Drive

INTERSECTION DIAGRAM (Label Approaches)

North



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES :	798	925	1,043	447		**3,213**

" K " FACTOR :	**0.090**	INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME :	**35,700**
TOTAL # OF CRASHES :	33	# OF YEARS : 3	AVERAGE # OF CRASHES PER YEAR (**A**) : **11.00**

CRASH RATE CALCULATION : **0.84**

RATE = $\frac{(A * 1,000,000)}{(V * 365)}$

Comments :

Project Title & Date: 75 Reed Road, Hudson

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Hudson COUNT DATE : 3/15/2022

DISTRICT : 3 UNSIGNALIZED : X SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Reed Road

MINOR STREET(S) : Project Driveway

INTERSECTION DIAGRAM
(Label Approaches)

PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES :		10	387	410		**807**

" K " FACTOR : **0.090** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **8,967**

TOTAL # OF CRASHES : 2 # OF YEARS : 3 AVERAGE # OF CRASHES PER YEAR (**A**) : **0.67**

CRASH RATE CALCULATION : 0.20 RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments :

Project Title & Date: 75 Reed Road, Hudson

Moving Massachusetts Forward. massDOT Highway

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Hudson

COUNT DATE : 3/15/2022

DISTRICT : 3

UNSIGNALIZED : X

SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Marlboro Street

MINOR STREET(S) : Reed Road

INTERSECTION DIAGRAM
(Label Approaches)

North

PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES :	200	464	375			1,039

" K " FACTOR : **0.090**

INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **11,544**

TOTAL # OF CRASHES : 12

OF YEARS : 3

AVERAGE # OF CRASHES PER YEAR (**A**) : **4.00**

CRASH RATE CALCULATION : **0.95**

$$RATE = \frac{(A * 1{,}000{,}000)}{(V * 365)}$$

Comments :

Project Title & Date: 75 Reed Road, Hudson

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Hudson　　COUNT DATE : 3/15/2022

DISTRICT : 3　　UNSIGNALIZED : X　　SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Washington St

MINOR STREET(S) : Broad St

INTERSECTION DIAGRAM

(Label Approaches)

North

PEAK HOUR VOLUMES

APPROACH :	**1**	**2**	**3**	**4**	**5**	**Total Peak Hourly Approach Volume**
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES :	1,069	480	632			**2,181**

" K " FACTOR :	**0.090**	INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME :	**24,233**
TOTAL # OF CRASHES :	23	# OF YEARS : 3	AVERAGE # OF CRASHES PER YEAR (**A**) : **7.67**

CRASH RATE CALCULATION : **0.87**

$$RATE = \frac{(A * 1,000,000)}{(V * 365)}$$

Comments :

Project Title & Date: 75 Reed Road, Hudson

Moving Massachusetts Forward. massDOT Highway

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Hudson COUNT DATE : 6/1/2022

DISTRICT : 3 UNSIGNALIZED : X SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Technology Drive

MINOR STREET(S) : Forestvale Road

INTERSECTION DIAGRAM (Label Approaches)

North

PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES :	334	366	67			**767**

" K " FACTOR : **0.090** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **8,522**

TOTAL # OF CRASHES : 2 # OF YEARS : 3 AVERAGE # OF CRASHES PER YEAR (**A**) : **0.67**

CRASH RATE CALCULATION : **0.21** RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments :

Project Title & Date: 75 Reed Road, Hudson

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Hudson

COUNT DATE : 3/15/2022

DISTRICT : 3

UNSIGNALIZED : X

SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Broad Street

MINOR STREET(S) : Forestvale Road

INTERSECTION DIAGRAM

(Label Approaches)

North

PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES :	277	446	94			**817**

" K " FACTOR : **0.090**

INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **9,078**

TOTAL # OF CRASHES : 1

\# OF YEARS : 3

AVERAGE # OF CRASHES PER YEAR (**A**) : **0.33**

CRASH RATE CALCULATION : 0.10

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(V * 365)}$$

Comments :

Project Title & Date: 75 Reed Road, Hudson

Appendix C

Trip Generation

75 Reed Road, Hudson
Trip Generation Assessment

HOWARD STEIN HUDSON
27-Jun-2022

Land Use	Size	Category	Directional Split	Average Trip Rate	Unadjusted Vehicle Trips	Non-Primary Vehicle Trips	Primary Vehicle Trips	Total Trips
Daily Peak Hour								
Warehousing	1,284.64	Total		1.740	2,236	0	**2,236**	**2,236**
vehicles[1]	KSF	In	50%	0.870	1,118	0	**1,118**	**1,118**
		Out	50%	0.870	1,118	0	**1,118**	**1,118**
trucks[2]	1,284.64	Total		0.600	770	0	**770**	**770**
	KSF	In	50%	0.300	385	0	**385**	**385**
		Out	50%	0.300	385	0	**385**	**385**
Total Autos for Warehouse		Total			**1,466**		**1,466**	**1,466**
		In			**733**		**733**	**733**
		Out			**733**		**733**	**733**
AM Peak Hour								
Warehousing	1,284.64	Total		0.17	218	0	**218**	**218**
vehicles[1]	KSF	In	77%	0.131	168	0	**168**	**168**
		Out	23%	0.039	50	0	**50**	**50**
trucks[2]	1,284.64	Total		0.02	25	0	**25**	**25**
	KSF	In	52%	0.010	13	0	**13**	**13**
		Out	48%	0.010	12	0	**12**	**12**
Total Autos for Warehouse		Total			**193**		**193**	**193**
		In			**155**		**155**	**155**
		Out			**38**		**38**	**38**
PM Peak Hour								
Warehousing[5]	1,284.64	Total		0.19	244	0	**244**	**244**
vehicles[1]	KSF	In	27%	0.051	66	0	**66**	**66**
		Out	73%	0.139	178	0	**178**	**178**
trucks[2]	1,284.64	Total		0.03	38	0	**38**	**38**
	KSF	In	52%	0.016	20	0	**20**	**20**
		Out	48%	0.014	18	0	**18**	**18**
Total Autos for Warehouse		Total			**206**		**206**	**206**
		In			**46**		**46**	**46**
		Out			**160**		**160**	**160**

1. ITE Trip Generation Manual, 10th Edition, LUC 150 (Warehousing), average rate for all vehicles
2. ITE Trip Generation Manual, 10th Edition LUC 150 (Warehousing), average rate for trucks

HOWARD STEIN HUDSON

Engineers + Planners

Appendix D

Signal Warrant Analysis

Traffic Signal Warrant Analysis Workbook

STUDY AND ANALYSIS INFORMATION

Municipality:	Hudson	**Analysis Date:**	6/21/2022
County:		**Conducted By:**	ARB
		Agency/Company Name:	HSH

Analysis Information

Data Collection Date: 3/15-3/17, 2022

Is the intersection in a built-up area of an isolated community of <10,000 population? No

Major Street Information

Major Street Name and Route Number: Reed Road
Major Street Approach #1 Direction: E-Bound
Major Street Approach #2 Direction: W-Bound

Number of Lanes for Moving Traffic on Each Major Street Approach: 1 **LANE(S)**
Speed Limit or 85th Percentile Speed on the Major Street: 40.2 **MPH**

Minor Street Information

Minor Street Name and Route Number: Site Driveway
Minor Street Approach #1 Direction: S-Bound
Minor Street Approach #2 Direction: N-Bound

Number of Lanes for Moving Traffic on Each Minor Street Approach: 1 **LANE(S)**

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS - COMMONWEALTH AVE AT ASH STREET

	Applicable?	Warrant Met?
Warrant 1, Eight-Hour Vehicular Volume	**Yes**	**No**
Warrant 2, Four-Hour Vehicular Volume	**Yes**	**No**
Warrant 3, Peak Hour	**Yes**	**Yes**

CALCULATED VOLUME DATA PER 1-HOUR INTERVAL, PER APPROACH					
Time Interval		Major Street Approach #1	Major Street Approach #2	Major Street Combined	Minor Street Approach #1
		E-Bound	W-Bound		S-Bound
Being At	End Of	Volume	Volume	Total Volume	Volume
12:00 AM	12:59 AM	13	5	18	3
1:00 AM	1:59 AM	9	5	14	9
2:00 AM	2:59 AM	5	3	8	4
3:00 AM	3:59 AM	8	4	12	5
4:00 AM	4:59 AM	34	17	51	13
5:00 AM	5:59 AM	109	62	171	19
6:00 AM	6:59 AM	329	189	518	24
7:00 AM	7:59 AM	439	296	735	42
8:00 AM	8:59 AM	365	295	660	44
9:00 AM	9:59 AM	238	177	415	49
10:00 AM	10:59 AM	214	169	383	55
11:00 AM	11:59 AM	230	175	405	68
12:00 PM	12:59 PM	306	211	517	67
1:00 PM	1:59 PM	256	216	472	49
2:00 PM	2:59 PM	329	266	595	49
3:00 PM	3:59 PM	340	327	667	107
4:00 PM	4:59 PM	381	353	734	146
5:00 PM	5:59 PM	378	355	733	75
6:00 PM	6:59 PM	259	233	492	32
7:00 PM	7:59 PM	183	166	349	8
8:00 PM	8:59 PM	126	126	252	4
9:00 PM	9:59 PM	105	104	209	9
10:00 PM	10:59 PM	60	52	112	3
11:00 PM	11:59 PM	28	23	51	11

MUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME (REED ROAD AT SITE DRIVEWAY)

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	1 Lane
Minor Street:	1 Lane

Built-up Isolated Community With Less Than 10,000 Population or Above 40 MPH on Major Street?	Yes

Combination of Conditions A and B Necessary?*: No

**Only applicable for Warrant 1 if after an adequate trial of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems. See Section 4C.02 of the 2009 MUTCD for application.*

Condition A - Minimum Vehicular Volume

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor street approach (one direction only)			
Major Street	Minor Street	100%	80%	70%	56%	100%	80%	70%	56%
1	1	500	400	350	280	150	120	105	84
2 or More	1	600	480	420	336	150	120	105	84
2 or More	2 or More	600	480	420	336	200	160	140	112
1	2 or More	500	400	350	280	200	160	140	112

Condition B - Interruption of Continuous Traffic

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor street approach (one direction only)			
Major Street	Minor Street	100%	80%	70%	56%	100%	80%	70%	56%
1	1	750	600	525	420	75	60	53	42
2 or More	1	900	720	630	504	75	60	53	42
2 or More	2 or More	900	720	630	504	100	80	70	56
1	2 or More	750	600	525	420	100	80	70	56

Condition A Evaluation

Number of Unique Hours Met: 2 **Condition A Satisfied?** No

Condition B Evaluation

Number of Unique Hours Met: 3 **Condition B Satisfied?** No

Combination of Condition A and Condition B Evaluation

Number of Unique Hours Met for Condition A: N/A

Number of Unique Hours Met for Condition B: N/A

Combination of Condition A and Condition B Satisfied? N/A

MUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME (REED ROAD AT SITE DRIVEWAY)

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	1 Lane
Minor Street:	1 Lane

Total Number of Unique Hours Met On Figure 4C-2
3

Built-up Isolated Community With Less Than 10,000 Population or Above 40 MPH on Major Street?	Yes

Hourly Vehicular Volume			
Hour Interval Beginning At	**Major Street Combined Vehicles Per Hour (VPH)**	**Highest Minor Street Approach Vehicles Per Hour (VPH)**	**Hour Met?**
6:00 AM	518	24	Not Met
7:00 AM	735	42	Not Met
8:00 AM	660	44	Not Met
9:00 AM	415	49	Not Met
10:00 AM	383	55	Not Met
11:00 AM	405	68	Not Met
12:00 PM	517	67	Not Met
1:00 PM	472	49	Not Met
2:00 PM	595	49	Not Met
3:00 PM	667	107	Met
4:00 PM	734	146	Met
5:00 PM	733	75	Met
6:00 PM	492	32	Not Met

MUTCD WARRANT 3, PEAK HOUR (REED ROAD AT SITE DRIVEWAY)

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	1 Lane
Minor Street:	1 Lane

Built-up Isolated Community With Less Than 10,000 Population or Above 40 MPH on Major Street?	Yes
Is this signal warrant being applied for an unusual case, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time?	Yes

Indicate whether all three of the following conditions for the same 1 hour (any four consecutive 15-minute periods) of an average day are present*	
Does the total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceed 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach?	No
Does the volume on the same minor-street approach (one direction only) equal or exceed 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes?	Yes
Does the total entering volume serviced during the hour equal or exceed 650 vehicles per hour for intersection with three approaches or 800 vehicles per hour for intersections with four or more approaches?	Yes
**If applicable, attach all supporting calculations and documentation.*	

Total Number of Unique Hours Met On Figure 4C-4
1

Hourly Vehicular Volume			
Hour Interval Beginning At	**Major Street Combined Vehicles Per Hour (VPH)**	**Highest Minor Street Approach Vehicles Per Hour (VPH)**	**Hour Met?**
6:00 AM	518	24	Not Met
7:00 AM	735	42	Not Met
8:00 AM	660	44	Not Met
9:00 AM	415	49	Not Met
10:00 AM	383	55	Not Met
11:00 AM	405	68	Not Met
12:00 PM	517	67	Not Met
1:00 PM	472	49	Not Met
2:00 PM	595	49	Not Met
3:00 PM	667	107	Not Met
4:00 PM	734	146	Met
5:00 PM	733	75	Not Met
6:00 PM	492	32	Not Met

Appendix E

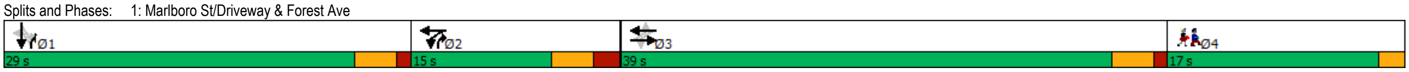
Intersection Level of Service Reports

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø4
Lane Configurations													
Traffic Volume (vph)	0	104	86	241	86	0	116	0	365	8	4	4	
Future Volume (vph)	0	104	86	241	86	0	116	0	365	8	4	4	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	0		0	185		0	0		180	0		0	
Storage Lanes	0		0	1		0	1		1	0		0	
Taper Length (ft)	25			25			25			25			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.939							0.850		0.968		
Flt Protected				0.950			0.950				0.975		
Satd. Flow (prot)	0	1704	0	1770	1827	0	1736	0	1568	0	1793	0	
Flt Permitted				0.598			0.741				0.975		
Satd. Flow (perm)	0	1704	0	1114	1827	0	1354	0	1568	0	1793	0	
Right Turn on Red			Yes			Yes			Yes			Yes	
Satd. Flow (RTOR)		46							410		6		
Link Speed (mph)		35			35			35			35		
Link Distance (ft)		268			525			555			135		
Travel Time (s)		5.2			10.2			10.8			2.6		
Peak Hour Factor	0.96	0.96	0.96	0.85	0.85	0.85	0.89	0.89	0.89	0.63	0.63	0.63	
Heavy Vehicles (%)	0%	2%	8%	2%	4%	0%	4%	0%	3%	0%	0%	0%	
Adj. Flow (vph)	0	108	90	284	101	0	130	0	410	13	6	6	
Shared Lane Traffic (%)													
Lane Group Flow (vph)	0	198	0	284	101	0	130	0	410	0	25	0	
Turn Type		NA		D.P+P	NA		D.Pm		pt+ov	Perm	NA		
Protected Phases		3		2	2 3				1 2		1		4
Permitted Phases	3			3			1			1			
Detector Phase	3	3		2	2 3		1		1 2	1	1		
Switch Phase													
Minimum Initial (s)	35.0	35.0		10.0			25.0			25.0	25.0		7.0
Minimum Split (s)	39.0	39.0		15.0			29.0			29.0	29.0		17.0
Total Split (s)	39.0	39.0		15.0			29.0			29.0	29.0		17.0
Total Split (%)	39.0%	39.0%		15.0%			29.0%			29.0%	29.0%		17%
Maximum Green (s)	35.0	35.0		10.0			25.0			25.0	25.0		15.0
Yellow Time (s)	3.0	3.0		3.0			3.0			3.0	3.0		2.0
All-Red Time (s)	1.0	1.0		2.0			1.0			1.0	1.0		0.0
Lost Time Adjust (s)		0.0		0.0			0.0				0.0		
Total Lost Time (s)		4.0		5.0			4.0				4.0		
Lead/Lag	Lead	Lead		Lag			Lead			Lead	Lead		Lag
Lead-Lag Optimize?	Yes	Yes		Yes			Yes			Yes	Yes		Yes
Vehicle Extension (s)	3.0	3.0		3.0			3.0			3.0	3.0		3.0
Recall Mode	Max	Max		Min			Min			Min	Min		None
Walk Time (s)													7.0
Flash Dont Walk (s)													8.0
Pedestrian Calls (#/hr)													0
Act Effct Green (s)		35.0		44.0	49.0		25.0		40.0		25.0		
Actuated g/C Ratio		0.42		0.53	0.59		0.30		0.48		0.30		
v/c Ratio		0.27		0.42	0.09		0.32		0.42		0.05		
Control Delay		13.0		10.8	7.7		25.1		2.9		17.4		
Queue Delay		0.0		0.0	0.0		0.0		0.0		0.0		
Total Delay		13.0		10.8	7.7		25.1		2.9		17.4		
LOS		B		B	A		C		A		B		
Approach Delay		13.0			10.0			8.2			17.4		
Approach LOS		B			A			A			B		
Queue Length 50th (ft)		49		66	21		52		0		7		
Queue Length 95th (ft)		94		100	39		98		43		16		
Internal Link Dist (ft)		188			445			475			55		
Turn Bay Length (ft)				185					180				
Base Capacity (vph)		745		669	1078		407		968		544		
Starvation Cap Reductn		0		0	0		0		0		0		
Spillback Cap Reductn		0		0	0		0		0		0		
Storage Cap Reductn		0		0	0		0		0		0		
Reduced v/c Ratio		0.27		0.42	0.09		0.32		0.42		0.05		

Intersection Summary

Area Type: Other
Cycle Length: 100
Actuated Cycle Length: 83
Natural Cycle: 100
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.42
Intersection Signal Delay: 9.8 Intersection LOS: A
Intersection Capacity Utilization 82.6% ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 1: Marlboro St/Driveway & Forest Ave



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	41	563	1	135	231	4	98	92	315	4	92	38
Future Volume (vph)	41	563	1	135	231	4	98	92	315	4	92	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	75		0	175		0	0		100	65		0
Storage Lanes	1		0	1		1	0		1	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt						0.850			0.850			0.850
Flt Protected	0.950			0.950				0.975			0.998	
Satd. Flow (prot)	1570	1827	0	1736	1792	1292	0	1799	1568	0	1808	1583
Flt Permitted	0.522			0.216				0.737			0.987	
Satd. Flow (perm)	862	1827	0	395	1792	1292	0	1360	1568	0	1789	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						83			341			58
Link Speed (mph)		40			40			35			35	
Link Distance (ft)		181			313			301			336	
Travel Time (s)		3.1			5.3			5.9			6.5	
Peak Hour Factor	0.88	0.88	0.88	0.80	0.80	0.80	0.88	0.88	0.88	0.65	0.65	0.65
Heavy Vehicles (%)	15%	4%	0%	4%	6%	25%	2%	4%	3%	25%	4%	2%
Adj. Flow (vph)	47	640	1	169	289	5	111	105	358	6	142	58
Shared Lane Traffic (%)												
Lane Group Flow (vph)	47	641	0	169	289	5	0	216	358	0	148	58
Turn Type	pm+pt	NA		pm+pt	NA	Prot	Perm	NA	Prot	Perm	NA	pt+ov
Protected Phases	3	1		3	1	1		2	2		2	2 3
Permitted Phases	1			1			2			2		
Minimum Split (s)	15.0	56.0		15.0	56.0	56.0	34.0	34.0	34.0	34.0	34.0	
Total Split (s)	15.0	56.0		15.0	56.0	56.0	34.0	34.0	34.0	34.0	34.0	
Total Split (%)	14.3%	53.3%		14.3%	53.3%	53.3%	32.4%	32.4%	32.4%	32.4%	32.4%	
Maximum Green (s)	10.0	51.0		10.0	51.0	51.0	28.0	28.0	28.0	28.0	28.0	
Yellow Time (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0	5.0		6.0	6.0		6.0	
Lead/Lag		Lead			Lead	Lead	Lag	Lag	Lag	Lag	Lag	
Lead-Lag Optimize?		Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Act Effct Green (s)	61.0	51.0		61.0	51.0	51.0		28.0	28.0		28.0	43.0
Actuated g/C Ratio	0.58	0.49		0.58	0.49	0.49		0.27	0.27		0.27	0.41
v/c Ratio	0.08	0.72		0.47	0.33	0.01		0.60	0.54		0.31	0.09
Control Delay	8.0	27.2		12.9	17.9	0.0		41.5	7.5		33.0	5.4
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Delay	8.0	27.2		12.9	17.9	0.0		41.5	7.5		33.0	5.4
LOS	A	C		B	B	A		D	A		C	A
Approach Delay		25.9			15.9			20.3			25.2	
Approach LOS		C			B			C			C	
Queue Length 50th (ft)	11	329		43	115	0		127	9		80	0
Queue Length 95th (ft)	24	453		62	151	0		202	74		94	11
Internal Link Dist (ft)		101			233			221			256	
Turn Bay Length (ft)	75			175					100			
Base Capacity (vph)	568	887		357	870	670		362	668		477	682
Starvation Cap Reductn	0	0		0	0	0		0	0		0	0
Spillback Cap Reductn	0	0		0	0	0		0	0		0	0
Storage Cap Reductn	0	0		0	0	0		0	0		0	0
Reduced v/c Ratio	0.08	0.72		0.47	0.33	0.01		0.60	0.54		0.31	0.09

Intersection Summary

Area Type: Other
Cycle Length: 105
Actuated Cycle Length: 105
Offset: 0 (0%), Referenced to phase 2:NBSB, Start of Green
Natural Cycle: 105
Control Type: Pretimed
Maximum v/c Ratio: 0.72
Intersection Signal Delay: 21.8 — Intersection LOS: C
Intersection Capacity Utilization 103.3% — ICU Level of Service G
Analysis Period (min) 15

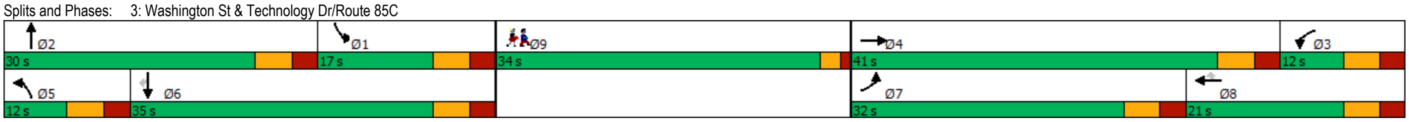
Splits and Phases: 2: Forest Ave & Main Street

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø9
Lane Configurations													
Traffic Volume (vph)	458	398	350	36	288	21	186	200	44	36	306	590	
Future Volume (vph)	458	398	350	36	288	21	186	200	44	36	306	590	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	350		0	230		215	300		0	215		175	
Storage Lanes	2		0	1		0	2		0	1		1	
Taper Length (ft)	150			25			200			25			
Lane Util. Factor	0.97	0.95	0.95	1.00	0.95	1.00	0.97	0.95	0.95	1.00	0.95	1.00	
Frt		0.930				0.850		0.973				0.850	
Flt Protected	0.950			0.950			0.950			0.950			
Satd. Flow (prot)	3367	3257	0	1805	3539	1538	3213	3331	0	1805	3471	1568	
Flt Permitted	0.950			0.950			0.950			0.950			
Satd. Flow (perm)	3367	3257	0	1805	3539	1538	3213	3331	0	1805	3471	1568	
Right Turn on Red			Yes			Yes			Yes			Yes	
Satd. Flow (RTOR)		161				195		17				641	
Link Speed (mph)		40			40			40			40		
Link Distance (ft)		654			348			535			467		
Travel Time (s)		11.1			5.9			9.1			8.0		
Peak Hour Factor	0.92	0.92	0.92	0.83	0.83	0.83	0.87	0.87	0.87	0.92	0.92	0.92	
Heavy Vehicles (%)	4%	4%	2%	0%	2%	5%	9%	4%	12%	0%	4%	3%	
Adj. Flow (vph)	498	433	380	43	347	25	214	230	51	39	333	641	
Shared Lane Traffic (%)													
Lane Group Flow (vph)	498	813	0	43	347	25	214	281	0	39	333	641	
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA		Prot	NA	Perm	
Protected Phases	7	4		3	8		5	2		1	6		9
Permitted Phases						8						6	
Detector Phase	7	4		3	8	8	5	2		1	6	6	
Switch Phase													
Minimum Initial (s)	6.0	10.0		6.0	10.0	10.0	6.0	10.0		6.0	10.0	10.0	1.0
Minimum Split (s)	12.0	16.0		12.0	16.0	16.0	12.0	16.0		12.0	35.0	35.0	34.0
Total Split (s)	32.0	41.0		12.0	21.0	21.0	12.0	30.0		17.0	35.0	35.0	34.0
Total Split (%)	23.9%	30.6%		9.0%	15.7%	15.7%	9.0%	22.4%		12.7%	26.1%	26.1%	25%
Maximum Green (s)	26.0	35.0		6.0	15.0	15.0	6.0	24.0		11.0	29.0	29.0	31.0
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	2.0
All-Red Time (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	
Total Lost Time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	
Lead/Lag	Lead	Lead		Lag	Lag	Lag	Lead	Lead		Lag	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0
Recall Mode	None	None		None	None	None	None	Min		None	Min	Min	None
Walk Time (s)											7.0	7.0	7.0
Flash Dont Walk (s)											22.0	22.0	24.0
Pedestrian Calls (#/hr)											0	0	0
Act Effct Green (s)	16.0	27.5		7.2	13.1	13.1	6.1	17.6		8.7	14.6	14.6	
Actuated g/C Ratio	0.22	0.37		0.10	0.18	0.18	0.08	0.24		0.12	0.20	0.20	
v/c Ratio	0.69	0.62		0.25	0.56	0.06	0.81	0.35		0.18	0.49	0.78	
Control Delay	32.8	19.4		38.8	33.2	0.2	61.3	27.7		33.7	29.6	10.1	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	
Total Delay	32.8	19.4		38.8	33.2	0.2	61.3	27.7		33.7	29.6	10.1	
LOS	C	B		D	C	A	E	C		C	C	B	
Approach Delay		24.5			31.8			42.2			17.4		
Approach LOS		C			C			D			B		
Queue Length 50th (ft)	107	143		18	75	0	50	59		16	72	0	
Queue Length 95th (ft)	182	231		53	131	0	#132	109		49	122	98	
Internal Link Dist (ft)		574			268			455			387		
Turn Bay Length (ft)	350			230		215	300			215		175	
Base Capacity (vph)	1200	1646		174	728	471	264	1107		286	1380	1009	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	0	
Reduced v/c Ratio	0.41	0.49		0.25	0.48	0.05	0.81	0.25		0.14	0.24	0.64	

Intersection Summary

Area Type: Other
Cycle Length: 134
Actuated Cycle Length: 74.3
Natural Cycle: 120
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 25.9 — Intersection LOS: C
Intersection Capacity Utilization 65.2% — ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Washington St & Technology Dr/Route 85C



Movement	EBL	EBT	WBT	WBR	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	0	400	352	0	0	0
Future Volume (Veh/h)	0	400	352	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.91	0.91	0.87	0.87	0.25	0.25
Hourly flow rate (vph)	0	440	405	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	405				845	405
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	405				845	405
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1165				336	650

Direction, Lane #	EB 1	EB 2	WB 1	SW 1	SW 2
Volume Total	0	440	405	0	0
Volume Left	0	0	0	0	0
Volume Right	0	0	0	0	0
cSH	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.26	0.24	0.00	0.00
Queue Length 95th (ft)	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0
Lane LOS				A	A
Approach Delay (s)	0.0		0.0	0.0	
Approach LOS				A	

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	24.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	1	0	1	0	455	0	0	331	0
Future Volume (Veh/h)	0	0	0	1	0	1	0	455	0	0	331	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.25	0.92	0.25	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.80	0.80
Hourly flow rate (vph)	0	0	0	1	0	1	0	495	0	0	414	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	910	909	414	909	909	495	414			495		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	910	909	414	909	909	495	414			495		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			100		
cM capacity (veh/h)	257	275	643	256	275	575	1156			1069		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	0	0	2	495	414
Volume Left	0	0	1	0	0
Volume Right	0	0	1	0	0
cSH	1700	1700	354	1156	1700
Volume to Capacity	0.00	0.00	0.01	0.00	0.24
Queue Length 95th (ft)	0	0	0	0	0
Control Delay (s)	0.0	0.0	15.2	0.0	0.0
Lane LOS	A	A	C		
Approach Delay (s)	0.0		15.2	0.0	0.0
Approach LOS	A		C		

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	33.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	363	27	62	92	118	282
Future Volume (Veh/h)	363	27	62	92	118	282
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.94	0.94	0.91	0.91	0.87	0.87
Hourly flow rate (vph)	386	29	68	101	136	324
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	373	136	460			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	373	136	460			
tC, single (s)	6.4	6.3	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.4	2.2			
p0 queue free %	34	97	94			
cM capacity (veh/h)	585	897	1101			

Direction, Lane #	EB 1	EB 2	NB 1	SB 1	SB 2
Volume Total	386	29	169	136	324
Volume Left	386	0	68	0	0
Volume Right	0	29	0	0	324
cSH	585	897	1101	1700	1700
Volume to Capacity	0.66	0.03	0.06	0.08	0.19
Queue Length 95th (ft)	121	3	5	0	0
Control Delay (s)	22.3	9.1	3.7	0.0	0.0
Lane LOS	C	A	A		
Approach Delay (s)	21.3		3.7	0.0	
Approach LOS	C				

Intersection Summary			
Average Delay	9.1		
Intersection Capacity Utilization	41.7%	ICU Level of Service	A
Analysis Period (min)	15		

MOVEMENT SUMMARY

Site: 101 [Washington Street at Broad Street_Existing AM (Site Folder: General)]

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: Washington Street														
3u	U	8	14.3	9	14.3	0.296	5.9	LOS A	1.6	42.0	0.13	0.04	0.13	27.9
3a	L1	399	4.9	424	4.9	0.296	5.6	LOS A	1.6	42.4	0.13	0.04	0.13	28.4
8	T1	287	3.4	305	3.4	0.296	5.5	LOS A	1.6	42.4	0.13	0.04	0.13	31.8
18	R2	1	0.0	1	0.0	0.296	5.4	LOS A	1.6	42.4	0.13	0.04	0.13	24.4
Approach		695	4.4	739	4.4	0.296	5.6	LOS A	1.6	42.4	0.13	0.04	0.13	30.0
East: Gas Station Driveway														
1u	U	1	0.0	1	0.0	0.006	5.2	LOS A	0.0	0.5	0.55	0.41	0.55	7.7
1	L2	1	0.0	1	0.0	0.006	5.2	LOS A	0.0	0.5	0.55	0.41	0.55	27.1
16a	R1	1	0.0	1	0.0	0.006	5.2	LOS A	0.0	0.5	0.55	0.41	0.55	27.8
16	R2	1	0.0	1	0.0	0.006	5.2	LOS A	0.0	0.5	0.55	0.41	0.55	28.9
Approach		4	0.0	4	0.0	0.006	5.2	LOS A	0.0	0.5	0.55	0.41	0.55	25.3
North: Broad Street														
7u	U	1	0.0	1	0.0	0.583	12.4	LOS B	4.9	125.5	0.68	0.84	1.09	30.9
7	L2	1	0.0	1	0.0	0.583	12.4	LOS B	4.9	125.5	0.68	0.84	1.09	22.8
4	T1	424	2.6	517	2.6	0.583	12.5	LOS B	4.9	125.5	0.68	0.84	1.09	28.8
14b	R3	70	6.2	85	6.2	0.108	5.6	LOS A	0.4	9.9	0.48	0.41	0.48	30.3
Approach		496	3.1	605	3.1	0.583	11.5	LOS B	4.9	125.5	0.65	0.78	1.00	29.0
NorthWest: Washington Street														
7ux	U	1	0.0	1	0.0	0.024	4.9	LOS A	0.1	2.3	0.54	0.41	0.54	29.5
7bx	L3	12	27.3	13	27.3	0.024	6.2	LOS A	0.1	2.3	0.54	0.41	0.54	29.8
7ax	L1	1	3.1	1	3.1	0.024	5.0	LOS A	0.1	2.3	0.54	0.41	0.54	22.4
14ax	R1	550	0.0	598	0.0	0.318	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	36.8
Approach		564	0.6	613	0.6	0.318	0.2	LOS A	0.1	2.3	0.01	0.01	0.01	36.4
All Vehicles		1759	2.8	1962	2.8	0.583	5.7	LOS A	4.9	125.5	0.26	0.26	0.36	31.0

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

QUEUE ANALYSIS

Site: 101 [Washington Street at Broad Street_Existing AM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Queues (Distance)

Lane Number	Contin. Lane	Deg. Satn v/c	Prog. Factor (Queue)	Overflow Queue (ft)	Back of Queue (ft) Av.	Back of Queue (ft) 95%	Queue at Start of Green (ft) Av.	Queue at Start of Green (ft) 95%	Cycle Average Queue (ft) Av.	Cycle Average Queue (ft) 95%	Queue Storage Ratio Av.	Queue Storage Ratio 95%	Prob. Block. %	Prob. SL Ov. %	Ov. Lane No.
South: Washington Street															
Lane 1		0.296	1.000	0.0	16.9	42.0	NA	NA	14.9	27.0	0.02	0.05	0.0	NA	NA
Lane 2		0.296	1.000	0.0	17.0	42.4	NA	NA	14.8	26.8	0.02	0.05	0.0	NA	NA
Approach		0.296			17.0	42.4	NA	NA	14.9	27.0	0.02	0.05			
East: Gas Station Driveway															
Lane 1		0.006	1.000	0.0	0.2	0.5	NA	NA	0.2	0.3	0.02	0.05	0.0	NA	NA
Approach		0.006			0.2	0.5	NA	NA	0.2	0.3	0.02	0.05			
North: Broad Street															
Lane 1		0.583	1.000	14.5	50.5	125.5	NA	NA	45.9	83.2	0.03	0.06	0.0	NA	NA
Lane 2		0.108	1.000	0.0	4.0	9.9	NA	NA	3.5	6.4	0.08	0.20	NA	0.0	1
Approach		0.583			50.5	125.5	NA	NA	45.9	83.2	0.03	0.06			
NorthWest: Washington Street															
Lane 1		0.024	1.000	0.0	0.9	2.3	NA	NA	0.8	1.4	0.00	0.00	0.0	NA	NA
Lane 2	Y	0.318	1.000	0.0	0.0	0.0	NA	NA	0.0	0.0	0.00	0.00	0.0	NA	NA
Approach		0.318			0.9	2.3	NA	NA	0.8	1.4	0.00	0.00			
Intersection		0.583			50.5	125.5	NA	NA	45.9	83.2	0.03	0.06			

Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.

Lane Queues (Vehicles)

Lane Number	Contin. Lane	Deg. Satn v/c	Prog. Factor (Queue)	Overflow Queue (veh)	Back of Queue (veh) Av.	Back of Queue (veh) 95%	Queue at Start of Green (veh) Av.	Queue at Start of Green (veh) 95%	Cycle Average Queue (veh) Av.	Cycle Average Queue (veh) 95%	Queue Storage Ratio Av.	Queue Storage Ratio 95%	Prob. Block. %	Prob. SL Ov. %	Ov. Lane No.
South: Washington Street															
Lane 1		0.296	1.000	0.0	0.7	1.6	NA	NA	0.6	1.0	0.02	0.05	0.0	NA	NA
Lane 2		0.296	1.000	0.0	0.7	1.6	NA	NA	0.6	1.0	0.02	0.05	0.0	NA	NA
Approach		0.296			0.7	1.6	NA	NA	0.6	1.0	0.02	0.05			
East: Gas Station Driveway															
Lane 1		0.006	1.000	0.0	0.0	0.0	NA	NA	0.0	0.0	0.02	0.05	0.0	NA	NA
Approach		0.006			0.0	0.0	NA	NA	0.0	0.0	0.02	0.05			
North: Broad Street															
Lane 1		0.583	1.000	0.6	2.0	4.9	NA	NA	1.8	3.3	0.03	0.06	0.0	NA	NA
Lane 2		0.108	1.000	0.0	0.2	0.4	NA	NA	0.1	0.2	0.08	0.20	NA	0.0	1
Approach		0.583			2.0	4.9	NA	NA	1.8	3.3	0.03	0.06			
NorthWest: Washington Street															
Lane 1		0.024	1.000	0.0	0.0	0.1	NA	NA	0.0	0.0	0.00	0.00	0.0	NA	NA
Lane 2	Y	0.318	1.000	0.0	0.0	0.0	NA	NA	0.0	0.0	0.00	0.00	0.0	NA	NA
Approach		0.318			0.0	0.1	NA	NA	0.0	0.0	0.00	0.00			

Intersection	0.583		2.0	4.9	NA	NA	1.8	3.3	0.03	0.06

Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.

Continuous Lane Performance

Lane Number	Deg. Satn v/c	Unint. Speed mph	Unint. Travel Delay sec	Hdwy sec	Spacing ft	Aver. Vehicle Length ft	Occup. Time sec	Space Time sec	Space Occup. Ratio %	Time Occup. Ratio %	Density veh/mi	Density pc/mi	LOS (Density Method)
South: Washington Street													
This approach does not have any continuous lanes													
East: Gas Station Driveway													
This approach does not have any continuous lanes													
North: Broad Street													
This approach does not have any continuous lanes													
NorthWest: Washington Street													
Lane 2	0.318	39.9	0.1	6.02	352.1	17.0	0.68	5.34	4.8	11.3	15.0	15.0	LOS B

Midblock Effective Detection Zone Length = 7 ft

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	64	39	273	26	52	430
Future Volume (Veh/h)	64	39	273	26	52	430
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	70	42	297	28	57	467
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	892	311			325	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	892	311			325	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	77	94			95	
cM capacity (veh/h)	298	729			1235	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	112	325	524
Volume Left	70	0	57
Volume Right	42	28	0
cSH	383	1700	1235
Volume to Capacity	0.29	0.19	0.05
Queue Length 95th (ft)	30	0	4
Control Delay (s)	18.2	0.0	1.3
Lane LOS	C		A
Approach Delay (s)	18.2	0.0	1.3
Approach LOS	C		

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	57.4%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	50	23	17	340	295	99
Future Volume (Veh/h)	50	23	17	340	295	99
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	54	25	18	370	321	108
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		2				
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	781	375	429			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	781	375	429			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	85	96	98			
cM capacity (veh/h)	358	671	1130			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	79	388	429
Volume Left	54	18	0
Volume Right	25	0	108
cSH	523	1130	1700
Volume to Capacity	0.15	0.02	0.25
Queue Length 95th (ft)	13	1	0
Control Delay (s)	14.9	0.5	0.0
Lane LOS	B	A	
Approach Delay (s)	14.9	0.5	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	41.7%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø4
Lane Configurations													
Traffic Volume (vph)	0	117	105	381	153	0	125	0	310	22	30	14	
Future Volume (vph)	0	117	105	381	153	0	125	0	310	22	30	14	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	0		0	185		0	0		180	0		0	
Storage Lanes	0		0	1		0	1		1	0		0	
Taper Length (ft)	25			25			25			25			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.936							0.850		0.970		
Flt Protected				0.950			0.950				0.984		
Satd. Flow (prot)	0	1736	0	1787	1863	0	1770	0	1583	0	1814	0	
Flt Permitted				0.520			0.753				0.984		
Satd. Flow (perm)	0	1736	0	978	1863	0	1403	0	1583	0	1814	0	
Right Turn on Red			Yes			Yes			Yes			Yes	
Satd. Flow (RTOR)		50							337		13		
Link Speed (mph)		35			35			35			35		
Link Distance (ft)		268			525			555			135		
Travel Time (s)		5.2			10.2			10.8			2.6		
Peak Hour Factor	0.83	0.83	0.83	0.86	0.86	0.86	0.92	0.92	0.92	0.90	0.90	0.90	
Heavy Vehicles (%)	0%	1%	4%	1%	2%	0%	2%	0%	2%	0%	0%	0%	
Adj. Flow (vph)	0	141	127	443	178	0	136	0	337	24	33	16	
Shared Lane Traffic (%)													
Lane Group Flow (vph)	0	268	0	443	178	0	136	0	337	0	73	0	
Turn Type		NA		D.P+P	NA		D.Pm		pt+ov	Perm	NA		
Protected Phases		3		2	2 3				1 2		1		4
Permitted Phases	3			3			1			1			
Detector Phase	3	3		2	2 3		1		1 2	1	1		
Switch Phase													
Minimum Initial (s)	35.0	35.0		10.0			25.0			25.0	25.0		7.0
Minimum Split (s)	39.0	39.0		15.0			29.0			29.0	29.0		17.0
Total Split (s)	39.0	39.0		15.0			29.0			29.0	29.0		17.0
Total Split (%)	39.0%	39.0%		15.0%			29.0%			29.0%	29.0%		17%
Maximum Green (s)	35.0	35.0		10.0			25.0			25.0	25.0		15.0
Yellow Time (s)	3.0	3.0		3.0			3.0			3.0	3.0		2.0
All-Red Time (s)	1.0	1.0		2.0			1.0			1.0	1.0		0.0
Lost Time Adjust (s)		0.0		0.0			0.0				0.0		
Total Lost Time (s)		4.0		5.0			4.0				4.0		
Lead/Lag	Lead	Lead		Lag			Lead			Lead	Lead		Lag
Lead-Lag Optimize?	Yes	Yes		Yes			Yes			Yes	Yes		Yes
Vehicle Extension (s)	3.0	3.0		3.0			3.0			3.0	3.0		3.0
Recall Mode	Max	Max		Min			Min			Min	Min		None
Walk Time (s)													7.0
Flash Dont Walk (s)													8.0
Pedestrian Calls (#/hr)													0
Act Effct Green (s)		35.0		44.0	49.0		25.0		40.0		25.0		
Actuated g/C Ratio		0.42		0.53	0.59		0.30		0.48		0.30		
v/c Ratio		0.35		0.72	0.16		0.32		0.36		0.13		
Control Delay		14.7		18.7	8.2		25.1		2.7		18.8		
Queue Delay		0.0		0.0	0.0		0.0		0.0		0.0		
Total Delay		14.7		18.7	8.2		25.1		2.7		18.8		
LOS		B		B	A		C		A		B		
Approach Delay		14.7			15.7			9.1			18.8		
Approach LOS		B			B			A			B		
Queue Length 50th (ft)		73		115	38		54		0		22		
Queue Length 95th (ft)		116		166	64		103		41		53		
Internal Link Dist (ft)		188			445			475			55		
Turn Bay Length (ft)				185					180				
Base Capacity (vph)		760		615	1099		422		937		555		
Starvation Cap Reductn		0		0	0		0		0		0		
Spillback Cap Reductn		0		0	0		0		0		0		
Storage Cap Reductn		0		0	0		0		0		0		
Reduced v/c Ratio		0.35		0.72	0.16		0.32		0.36		0.13		

Intersection Summary

Area Type: Other
Cycle Length: 100
Actuated Cycle Length: 83
Natural Cycle: 100
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.72
Intersection Signal Delay: 13.5 Intersection LOS: B
Intersection Capacity Utilization 81.9% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 1: Marlboro St/Driveway & Forest Ave

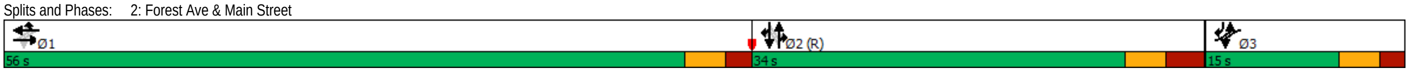
Ø1	Ø2	Ø3	Ø4
29 s	15 s	39 s	17 s

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	60	266	2	349	562	6	133	109	158	5	116	60
Future Volume (vph)	60	266	2	349	562	6	133	109	158	5	116	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	75		0	175		0	0		100	65		0
Storage Lanes	1		0	1		1	0		1	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.999				0.850			0.850			0.850
Flt Protected	0.950			0.950				0.973			0.998	
Satd. Flow (prot)	1805	1843	0	1770	1863	1615	0	1822	1538	0	1896	1553
Flt Permitted	0.230			0.504				0.742			0.984	
Satd. Flow (perm)	437	1843	0	939	1863	1615	0	1390	1538	0	1870	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						83			153			69
Link Speed (mph)		40			40			35			35	
Link Distance (ft)		181			313			301			336	
Travel Time (s)		3.1			5.3			5.9			6.5	
Peak Hour Factor	0.87	0.87	0.87	0.90	0.90	0.90	0.90	0.90	0.90	0.87	0.87	0.87
Heavy Vehicles (%)	0%	3%	0%	2%	2%	0%	1%	2%	5%	0%	0%	4%
Adj. Flow (vph)	69	306	2	388	624	7	148	121	176	6	133	69
Shared Lane Traffic (%)												
Lane Group Flow (vph)	69	308	0	388	624	7	0	269	176	0	139	69
Turn Type	pm+pt	NA		pm+pt	NA	Prot	Perm	NA	Prot	Perm	NA	pt+ov
Protected Phases	3	1		3	1	1		2	2		2	2 3
Permitted Phases	1			1			2			2		
Minimum Split (s)	15.0	56.0		15.0	56.0	56.0	34.0	34.0	34.0	34.0	34.0	
Total Split (s)	15.0	56.0		15.0	56.0	56.0	34.0	34.0	34.0	34.0	34.0	
Total Split (%)	14.3%	53.3%		14.3%	53.3%	53.3%	32.4%	32.4%	32.4%	32.4%	32.4%	
Maximum Green (s)	10.0	51.0		10.0	51.0	51.0	28.0	28.0	28.0	28.0	28.0	
Yellow Time (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0	5.0		6.0	6.0		6.0	
Lead/Lag		Lead			Lead	Lead	Lag	Lag	Lag	Lag	Lag	
Lead-Lag Optimize?		Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Act Effct Green (s)	61.0	51.0		61.0	51.0	51.0		28.0	28.0		28.0	43.0
Actuated g/C Ratio	0.58	0.49		0.58	0.49	0.49		0.27	0.27		0.27	0.41
v/c Ratio	0.18	0.34		0.62	0.69	0.01		0.73	0.34		0.28	0.10
Control Delay	8.8	18.1		15.4	25.9	0.0		47.9	9.0		32.4	5.1
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Delay	8.8	18.1		15.4	25.9	0.0		47.9	9.0		32.4	5.1
LOS	A	B		B	C	A		D	A		C	A
Approach Delay		16.4			21.7			32.5			23.3	
Approach LOS		B			C			C			C	
Queue Length 50th (ft)	16	123		114	313	0		165	12		74	0
Queue Length 95th (ft)	32	179		169	447	0		#279	65		123	25
Internal Link Dist (ft)		101			233			221			256	
Turn Bay Length (ft)	75			175					100			
Base Capacity (vph)	384	895		624	904	827		370	522		498	676
Starvation Cap Reductn	0	0		0	0	0		0	0		0	0
Spillback Cap Reductn	0	0		0	0	0		0	0		0	0
Storage Cap Reductn	0	0		0	0	0		0	0		0	0
Reduced v/c Ratio	0.18	0.34		0.62	0.69	0.01		0.73	0.34		0.28	0.10

Intersection Summary

Area Type: Other
Cycle Length: 105
Actuated Cycle Length: 105
Offset: 0 (0%), Referenced to phase 2:NBSB, Start of Green
Natural Cycle: 105
Control Type: Pretimed
Maximum v/c Ratio: 0.73
Intersection Signal Delay: 23.2 Intersection LOS: C
Intersection Capacity Utilization 103.3% ICU Level of Service G
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: Forest Ave & Main Street

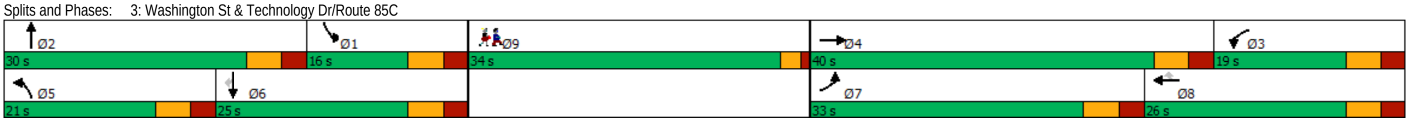


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø9
Lane Configurations													
Traffic Volume (vph)	553	319	253	69	347	57	322	471	69	68	390	541	
Future Volume (vph)	553	319	253	69	347	57	322	471	69	68	390	541	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	350		0	230		215	300		0	215		175	
Storage Lanes	2		0	1		0	2		0	1		1	
Taper Length (ft)	150			25			200			25			
Lane Util. Factor	0.97	0.95	0.95	1.00	0.95	1.00	0.97	0.95	0.95	1.00	0.95	1.00	
Frt		0.934				0.850		0.981				0.850	
Flt Protected	0.950			0.950			0.950			0.950			
Satd. Flow (prot)	3467	3353	0	1805	3574	1615	3502	3532	0	1805	3539	1583	
Flt Permitted	0.950			0.950			0.950			0.950			
Satd. Flow (perm)	3467	3353	0	1805	3574	1615	3502	3532	0	1805	3539	1583	
Right Turn on Red			Yes			Yes			Yes			Yes	
Satd. Flow (RTOR)		138				188		10				569	
Link Speed (mph)		40			40			40			40		
Link Distance (ft)		654			348			535			467		
Travel Time (s)		11.1			5.9			9.1			8.0		
Peak Hour Factor	0.90	0.90	0.90	0.82	0.82	0.82	0.95	0.95	0.95	0.95	0.95	0.95	
Heavy Vehicles (%)	1%	1%	0%	0%	1%	0%	0%	0%	2%	0%	2%	2%	
Adj. Flow (vph)	614	354	281	84	423	70	339	496	73	72	411	569	
Shared Lane Traffic (%)													
Lane Group Flow (vph)	614	635	0	84	423	70	339	569	0	72	411	569	
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA		Prot	NA	Perm	
Protected Phases	7	4		3	8		5	2		1	6		9
Permitted Phases						8						6	
Detector Phase	7	4		3	8	8	5	2		1	6	6	
Switch Phase													
Minimum Initial (s)	6.0	10.0		6.0	10.0	10.0	6.0	10.0		6.0	10.0	10.0	1.0
Minimum Split (s)	12.0	16.0		12.0	16.0	16.0	12.0	16.0		12.0	25.0	25.0	34.0
Total Split (s)	33.0	40.0		19.0	26.0	26.0	21.0	30.0		16.0	25.0	25.0	34.0
Total Split (%)	23.7%	28.8%		13.7%	18.7%	18.7%	15.1%	21.6%		11.5%	18.0%	18.0%	24%
Maximum Green (s)	27.0	34.0		13.0	20.0	20.0	15.0	24.0		10.0	19.0	19.0	31.0
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	2.0
All-Red Time (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	
Total Lost Time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	
Lead/Lag	Lead	Lead		Lag	Lag	Lag	Lead	Lead		Lag	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0
Recall Mode	None	None		None	None	None	None	Min		None	Min	Min	None
Walk Time (s)											7.0	7.0	7.0
Flash Dont Walk (s)											12.0	12.0	24.0
Pedestrian Calls (#/hr)											5	5	5
Act Effct Green (s)	23.1	26.5		16.2	16.5	16.5	14.3	25.1		9.7	17.4	17.4	
Actuated g/C Ratio	0.23	0.26		0.16	0.16	0.16	0.14	0.25		0.10	0.17	0.17	
v/c Ratio	0.78	0.65		0.29	0.72	0.17	0.68	0.64		0.42	0.68	0.77	
Control Delay	46.2	32.4		45.3	50.3	0.9	51.6	41.2		56.7	48.0	11.7	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	
Total Delay	46.2	32.4		45.3	50.3	0.9	51.6	41.2		56.7	48.0	11.7	
LOS	D	C		D	D	A	D	D		E	D	B	
Approach Delay		39.2			43.6			45.1			29.0		
Approach LOS		D			D			D			C		
Queue Length 50th (ft)	182	158		44	132	0	103	170		42	124	0	
Queue Length 95th (ft)	#389	289		118	233	0	#246	#374		119	#277	131	
Internal Link Dist (ft)		574			268			455			387		
Turn Bay Length (ft)	350			230		215	300			215		175	
Base Capacity (vph)	960	1268		322	733	480	538	932		192	689	766	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	0	
Reduced v/c Ratio	0.64	0.50		0.26	0.58	0.15	0.63	0.61		0.38	0.60	0.74	

Intersection Summary

Area Type: Other
Cycle Length: 139
Actuated Cycle Length: 101.2
Natural Cycle: 120
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 38.4 Intersection LOS: D
Intersection Capacity Utilization 67.3% ICU Level of Service C
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Washington St & Technology Dr/Route 85C



Movement	EBL	EBT	WBT	WBR	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	0	416	442	0	0	0
Future Volume (Veh/h)	0	416	442	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.86	0.86	0.91	0.91	0.63	0.63
Hourly flow rate (vph)	0	484	486	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	486				970	486
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	486				970	486
tC, single (s)	4.1				6.4	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.4
p0 queue free %	100				100	100
cM capacity (veh/h)	1087				283	563

Direction, Lane #	EB 1	EB 2	WB 1	SW 1	SW 2
Volume Total	0	484	486	0	0
Volume Left	0	0	0	0	0
Volume Right	0	0	0	0	0
cSH	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.28	0.29	0.00	0.00
Queue Length 95th (ft)	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0
Lane LOS				A	A
Approach Delay (s)	0.0		0.0	0.0	
Approach LOS				A	

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	26.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	435	0	0	498	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	435	0	0	498	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.50	0.92	0.50	0.92	0.92	0.92	0.91	0.91	0.92	0.92	0.85	0.85
Hourly flow rate (vph)	0	0	0	0	0	0	0	478	0	0	586	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1064	1064	586	1064	1064	478	586			478		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1064	1064	586	1064	1064	478	586			478		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			100		
cM capacity (veh/h)	202	223	514	201	223	587	999			1084		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	0	0	0	478	586
Volume Left	0	0	0	0	0
Volume Right	0	0	0	0	0
cSH	1700	1700	1700	999	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.34
Queue Length 95th (ft)	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0
Lane LOS	A	A	A		
Approach Delay (s)	0.0		0.0	0.0	0.0
Approach LOS	A		A		

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	29.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	316	88	64	150	136	362
Future Volume (Veh/h)	316	88	64	150	136	362
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	343	96	72	169	153	407
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	466	153	560			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	466	153	560			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	34	89	93			
cM capacity (veh/h)	517	896	1011			

Direction, Lane #	EB 1	EB 2	NB 1	SB 1	SB 2
Volume Total	343	96	241	153	407
Volume Left	343	0	72	0	0
Volume Right	0	96	0	0	407
cSH	517	896	1011	1700	1700
Volume to Capacity	0.66	0.11	0.07	0.09	0.24
Queue Length 95th (ft)	121	9	6	0	0
Control Delay (s)	24.6	9.5	3.1	0.0	0.0
Lane LOS	C	A	A		
Approach Delay (s)	21.3		3.1	0.0	
Approach LOS	C				

Intersection Summary			
Average Delay	8.2		
Intersection Capacity Utilization	46.1%	ICU Level of Service	A
Analysis Period (min)	15		

QUEUE ANALYSIS

Site: 101 [Washington Street at Broad Street_Existing PM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Queues (Distance)

Lane Number	Contin. Lane	Deg. Satn v/c	Prog. Factor (Queue)	Overflow Queue (ft)	Back of Queue (ft) Av.	Back of Queue (ft) 95%	Queue at Start of Green (ft) Av.	Queue at Start of Green (ft) 95%	Cycle Average Queue (ft) Av.	Cycle Average Queue (ft) 95%	Queue Storage Ratio Av.	Queue Storage Ratio 95%	Prob. Block. %	Prob. SL Ov. %	Ov. Lane No.
South: Washington Street															
Lane 1		0.531	1.000	0.0	42.3	105.0	NA	NA	40.3	73.1	0.05	0.13	0.0	NA	NA
Lane 2		0.531	1.000	0.0	41.9	104.2	NA	NA	40.5	73.4	0.05	0.13	0.0	NA	NA
Approach		0.531			42.3	105.0	NA	NA	40.5	73.4	0.05	0.13			
East: Gas Station Driveway															
Lane 1		0.011	1.000	0.0	0.4	0.9	NA	NA	0.3	0.5	0.04	0.09	0.0	NA	NA
Approach		0.011			0.4	0.9	NA	NA	0.3	0.5	0.04	0.09			
North: Broad Street															
Lane 1		0.751	1.000	31.5	74.7	185.6	NA	NA	82.1	148.9	0.04	0.09	0.0	NA	NA
Lane 2		0.212	1.000	0.0	8.3	20.6	NA	NA	7.8	14.2	0.17	0.41	NA	0.0	1
Approach		0.751			74.7	185.6	NA	NA	82.1	148.9	0.04	0.09			
NorthWest: Washington Street															
Lane 1		0.078	1.000	0.0	3.3	8.3	NA	NA	2.4	4.3	0.00	0.01	0.0	NA	NA
Lane 2	Y	0.356	1.000	0.0	0.0	0.0	NA	NA	0.0	0.0	0.00	0.00	0.0	NA	NA
Approach		0.356			3.3	8.3	NA	NA	2.4	4.3	0.00	0.01			
Intersection		0.751			74.7	185.6	NA	NA	82.1	148.9	0.05	0.13			

Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.

Lane Queues (Vehicles)

Lane Number	Contin. Lane	Deg. Satn v/c	Prog. Factor (Queue)	Overflow Queue (veh)	Back of Queue (veh) Av.	Back of Queue (veh) 95%	Queue at Start of Green (veh) Av.	Queue at Start of Green (veh) 95%	Cycle Average Queue (veh) Av.	Cycle Average Queue (veh) 95%	Queue Storage Ratio Av.	Queue Storage Ratio 95%	Prob. Block. %	Prob. SL Ov. %	Ov. Lane No.
South: Washington Street															
Lane 1		0.531	1.000	0.0	1.7	4.2	NA	NA	1.6	2.9	0.05	0.13	0.0	NA	NA
Lane 2		0.531	1.000	0.0	1.7	4.1	NA	NA	1.6	2.9	0.05	0.13	0.0	NA	NA
Approach		0.531			1.7	4.2	NA	NA	1.6	2.9	0.05	0.13			
East: Gas Station Driveway															
Lane 1		0.011	1.000	0.0	0.0	0.0	NA	NA	0.0	0.0	0.04	0.09	0.0	NA	NA
Approach		0.011			0.0	0.0	NA	NA	0.0	0.0	0.04	0.09			
North: Broad Street															
Lane 1		0.751	1.000	1.3	3.0	7.4	NA	NA	3.3	5.9	0.04	0.09	0.0	NA	NA
Lane 2		0.212	1.000	0.0	0.3	0.8	NA	NA	0.3	0.6	0.17	0.41	NA	0.0	1
Approach		0.751			3.0	7.4	NA	NA	3.3	5.9	0.04	0.09			
NorthWest: Washington Street															
Lane 1		0.078	1.000	0.0	0.1	0.3	NA	NA	0.1	0.2	0.00	0.01	0.0	NA	NA
Lane 2	Y	0.356	1.000	0.0	0.0	0.0	NA	NA	0.0	0.0	0.00	0.00	0.0	NA	NA
Approach		0.356			0.1	0.3	NA	NA	0.1	0.2	0.00	0.01			

Intersection	0.751		3.0	7.4	NA	NA	3.3	5.9	0.05	0.13

Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.

Continuous Lane Performance

Lane Number	Deg. Satn v/c	Unint. Speed mph	Unint. Travel Delay sec	Hdwy sec	Spacing ft	Aver. Vehicle Length ft	Occup. Time sec	Space Time sec	Space Occup. Ratio %	Time Occup. Ratio %	Density veh/mi	Density pc/mi	LOS (Density Method)
South: Washington Street													
This approach does not have any continuous lanes													
East: Gas Station Driveway													
This approach does not have any continuous lanes													
North: Broad Street													
This approach does not have any continuous lanes													
NorthWest: Washington Street													
Lane 2	0.356	39.8	0.1	5.37	313.8	17.0	0.68	4.69	5.4	12.7	16.8	16.8	LOS B

Midblock Effective Detection Zone Length = 7 ft

MOVEMENT SUMMARY

Site: 101 [Washington Street at Broad Street_Existing PM (Site Folder: General)]

Site Category: (None)
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: Washington Street														
3u	U	9	0.0	10	0.0	0.531	8.8	LOS A	4.2	105.0	0.34	0.16	0.34	27.2
3a	L1	718	0.5	807	0.5	0.531	8.8	LOS A	4.2	105.0	0.34	0.16	0.34	27.1
8	T1	438	1.5	492	1.5	0.531	8.8	LOS A	4.1	104.2	0.34	0.16	0.34	30.0
18	R2	1	0.0	1	0.0	0.531	8.8	LOS A	4.1	104.2	0.34	0.16	0.34	21.5
Approach		1166	0.9	1310	0.9	0.531	8.8	LOS A	4.2	105.0	0.34	0.16	0.34	28.4
East: Gas Station Driveway														
1u	U	1	0.0	1	0.0	0.011	9.6	LOS A	0.0	0.9	0.73	0.68	0.73	6.1
1	L2	1	0.0	1	0.0	0.011	9.6	LOS A	0.0	0.9	0.73	0.68	0.73	23.0
16a	R1	1	0.0	1	0.0	0.011	9.6	LOS A	0.0	0.9	0.73	0.68	0.73	24.2
16	R2	1	0.0	1	0.0	0.011	9.6	LOS A	0.0	0.9	0.73	0.68	0.73	26.6
Approach		4	0.0	4	0.0	0.011	9.6	LOS A	0.0	0.9	0.73	0.68	0.73	22.1
North: Broad Street														
7u	U	1	0.0	1	0.0	0.751	24.4	LOS C	7.4	185.6	0.88	1.24	1.92	27.3
7	L2	1	0.0	1	0.0	0.751	24.4	LOS C	7.4	185.6	0.88	1.24	1.92	19.2
4	T1	430	1.0	478	1.0	0.751	24.4	LOS C	7.4	185.6	0.88	1.24	1.92	24.6
14b	R3	107	3.2	119	3.2	0.212	9.2	LOS A	0.8	20.6	0.66	0.66	0.66	29.0
Approach		539	1.4	599	1.4	0.751	21.4	LOS C	7.4	185.6	0.83	1.13	1.67	25.4
NorthWest: Washington Street														
7ux	U	11	10.0	12	10.0	0.078	5.8	LOS A	0.3	8.3	0.56	0.46	0.56	28.6
7bx	L3	45	2.4	47	2.4	0.078	5.4	LOS A	0.3	8.3	0.56	0.46	0.56	30.2
7ax	L1	1	2.4	1	2.4	0.078	5.4	LOS A	0.3	8.3	0.56	0.46	0.56	22.6
14ax	R1	637	0.0	671	0.0	0.356	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	36.8
Approach		694	0.3	731	0.3	0.356	0.5	LOS A	0.3	8.3	0.05	0.04	0.05	35.7
All Vehicles		2403	0.8	2644	0.8	0.751	9.4	LOS A	7.4	185.6	0.37	0.35	0.56	28.8

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	62	78	424	59	66	475
Future Volume (Veh/h)	62	78	424	59	66	475
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	67	85	461	64	72	516
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1153	493			525	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1153	493			525	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	67	85			93	
cM capacity (veh/h)	203	576			1042	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	152	525	588
Volume Left	67	0	72
Volume Right	85	64	0
cSH	318	1700	1042
Volume to Capacity	0.48	0.31	0.07
Queue Length 95th (ft)	61	0	6
Control Delay (s)	26.2	0.0	1.8
Lane LOS	D		A
Approach Delay (s)	26.2	0.0	1.8
Approach LOS	D		

Intersection Summary			
Average Delay	4.0		
Intersection Capacity Utilization	72.8%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	80	30	35	355	390	79
Future Volume (Veh/h)	80	30	35	355	390	79
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	87	33	38	386	424	86
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		2				
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	929	467	510			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	929	467	510			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	70	94	96			
cM capacity (veh/h)	286	596	1055			

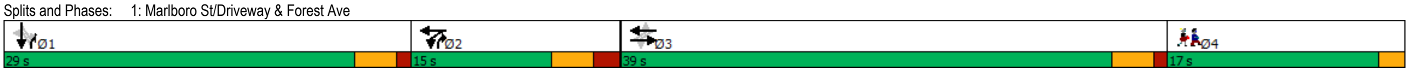
Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	120	424	510
Volume Left	87	38	0
Volume Right	33	0	86
cSH	395	1055	1700
Volume to Capacity	0.30	0.04	0.30
Queue Length 95th (ft)	32	3	0
Control Delay (s)	19.8	1.1	0.0
Lane LOS	C	A	
Approach Delay (s)	19.8	1.1	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	58.9%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø4
Lane Configurations													
Traffic Volume (vph)	0	113	98	264	93	0	126	0	397	9	4	4	
Future Volume (vph)	0	113	98	264	93	0	126	0	397	9	4	4	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	0		0	185		0	0		180	0		0	
Storage Lanes	0		0	1		0	1		1	0		0	
Taper Length (ft)	25			25			25			25			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.937							0.850		0.969		
Flt Protected				0.950			0.950				0.974		
Satd. Flow (prot)	0	1699	0	1770	1827	0	1736	0	1568	0	1793	0	
Flt Permitted				0.573			0.740				0.974		
Satd. Flow (perm)	0	1699	0	1067	1827	0	1352	0	1568	0	1793	0	
Right Turn on Red			Yes			Yes			Yes			Yes	
Satd. Flow (RTOR)		48							446		6		
Link Speed (mph)		35			35			35			35		
Link Distance (ft)		268			525			555			135		
Travel Time (s)		5.2			10.2			10.8			2.6		
Peak Hour Factor	0.96	0.96	0.96	0.85	0.85	0.85	0.89	0.89	0.89	0.63	0.63	0.63	
Heavy Vehicles (%)	0%	2%	8%	2%	4%	0%	4%	0%	3%	0%	0%	0%	
Adj. Flow (vph)	0	118	102	311	109	0	142	0	446	14	6	6	
Shared Lane Traffic (%)													
Lane Group Flow (vph)	0	220	0	311	109	0	142	0	446	0	26	0	
Turn Type		NA		D.P+P	NA		D.Pm		pt+ov	Perm	NA		
Protected Phases		3		2	2 3				1 2		1		4
Permitted Phases	3			3			1			1			
Detector Phase	3	3		2	2 3		1		1 2	1	1		
Switch Phase													
Minimum Initial (s)	35.0	35.0		10.0			25.0			25.0	25.0		7.0
Minimum Split (s)	39.0	39.0		15.0			29.0			29.0	29.0		17.0
Total Split (s)	39.0	39.0		15.0			29.0			29.0	29.0		17.0
Total Split (%)	39.0%	39.0%		15.0%			29.0%			29.0%	29.0%		17%
Maximum Green (s)	35.0	35.0		10.0			25.0			25.0	25.0		15.0
Yellow Time (s)	3.0	3.0		3.0			3.0			3.0	3.0		2.0
All-Red Time (s)	1.0	1.0		2.0			1.0			1.0	1.0		0.0
Lost Time Adjust (s)		0.0		0.0			0.0				0.0		
Total Lost Time (s)		4.0		5.0			4.0				4.0		
Lead/Lag	Lead	Lead		Lag			Lead			Lead	Lead		Lag
Lead-Lag Optimize?	Yes	Yes		Yes			Yes			Yes	Yes		Yes
Vehicle Extension (s)	3.0	3.0		3.0			3.0			3.0	3.0		3.0
Recall Mode	Max	Max		Min			Min			Min	Min		None
Walk Time (s)													7.0
Flash Dont Walk (s)													8.0
Pedestrian Calls (#/hr)													0
Act Effct Green (s)		35.0		44.0	49.0		25.0		40.0		25.0		
Actuated g/C Ratio		0.42		0.53	0.59		0.30		0.48		0.30		
v/c Ratio		0.30		0.48	0.10		0.35		0.45		0.05		
Control Delay		13.5		11.6	7.7		25.7		2.9		17.6		
Queue Delay		0.0		0.0	0.0		0.0		0.0		0.0		
Total Delay		13.5		11.6	7.7		25.7		2.9		17.6		
LOS		B		B	A		C		A		B		
Approach Delay		13.5			10.6			8.4			17.6		
Approach LOS		B			B			A			B		
Queue Length 50th (ft)		56		73	23		57		0		7		
Queue Length 95th (ft)		105		110	41		106		44		17		
Internal Link Dist (ft)		188			445			475			55		
Turn Bay Length (ft)				185					180				
Base Capacity (vph)		744		650	1078		407		986		544		
Starvation Cap Reductn		0		0	0		0		0		0		
Spillback Cap Reductn		0		0	0		0		0		0		
Storage Cap Reductn		0		0	0		0		0		0		
Reduced v/c Ratio		0.30		0.48	0.10		0.35		0.45		0.05		

Intersection Summary	
Area Type: Other	
Cycle Length: 100	
Actuated Cycle Length: 83	
Natural Cycle: 100	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.48	
Intersection Signal Delay: 10.2	Intersection LOS: B
Intersection Capacity Utilization 84.6%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 1: Marlboro St/Driveway & Forest Ave



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	44	610	2	146	250	4	106	105	339	4	105	41
Future Volume (vph)	44	610	2	146	250	4	106	105	339	4	105	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	75		0	175		0	0		100	65		0
Storage Lanes	1		0	1		1	0		1	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt						0.850			0.850			0.850
Flt Protected	0.950			0.950				0.976			0.998	
Satd. Flow (prot)	1570	1827	0	1736	1792	1292	0	1800	1568	0	1810	1583
Flt Permitted	0.499			0.173				0.704			0.988	
Satd. Flow (perm)	824	1827	0	316	1792	1292	0	1299	1568	0	1792	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						83			319			63
Link Speed (mph)		40			40			35			35	
Link Distance (ft)		181			313			301			336	
Travel Time (s)		3.1			5.3			5.9			6.5	
Peak Hour Factor	0.88	0.88	0.88	0.80	0.80	0.80	0.88	0.88	0.88	0.65	0.65	0.65
Heavy Vehicles (%)	15%	4%	0%	4%	6%	25%	2%	4%	3%	25%	4%	2%
Adj. Flow (vph)	50	693	2	183	313	5	120	119	385	6	162	63
Shared Lane Traffic (%)												
Lane Group Flow (vph)	50	695	0	183	313	5	0	239	385	0	168	63
Turn Type	pm+pt	NA		pm+pt	NA	Prot	Perm	NA	Prot	Perm	NA	pt+ov
Protected Phases	3	1		3	1	1		2	2		2	2 3
Permitted Phases	1			1			2			2		
Minimum Split (s)	15.0	56.0		15.0	56.0	56.0	34.0	34.0	34.0	34.0	34.0	
Total Split (s)	15.0	56.0		15.0	56.0	56.0	34.0	34.0	34.0	34.0	34.0	
Total Split (%)	14.3%	53.3%		14.3%	53.3%	53.3%	32.4%	32.4%	32.4%	32.4%	32.4%	
Maximum Green (s)	10.0	51.0		10.0	51.0	51.0	28.0	28.0	28.0	28.0	28.0	
Yellow Time (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0	5.0		6.0	6.0		6.0	
Lead/Lag		Lead			Lead	Lead	Lag	Lag	Lag	Lag	Lag	
Lead-Lag Optimize?		Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Act Effct Green (s)	61.0	51.0		61.0	51.0	51.0		28.0	28.0		28.0	43.0
Actuated g/C Ratio	0.58	0.49		0.58	0.49	0.49		0.27	0.27		0.27	0.41
v/c Ratio	0.09	0.78		0.58	0.36	0.01		0.69	0.59		0.35	0.09
Control Delay	8.1	30.1		16.2	18.3	0.0		46.5	10.8		33.7	5.3
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Delay	8.1	30.1		16.2	18.3	0.0		46.5	10.8		33.7	5.3
LOS	A	C		B	B	A		D	B		C	A
Approach Delay		28.7			17.4			24.5			26.0	
Approach LOS		C			B			C			C	
Queue Length 50th (ft)	12	374		47	126	0		144	34		91	0
Queue Length 95th (ft)	26	513		67	164	0		228	116		105	11
Internal Link Dist (ft)		101			233			221			256	
Turn Bay Length (ft)	75			175					100			
Base Capacity (vph)	549	887		318	870	670		346	652		477	685
Starvation Cap Reductn	0	0		0	0	0		0	0		0	0
Spillback Cap Reductn	0	0		0	0	0		0	0		0	0
Storage Cap Reductn	0	0		0	0	0		0	0		0	0
Reduced v/c Ratio	0.09	0.78		0.58	0.36	0.01		0.69	0.59		0.35	0.09

Intersection Summary

Area Type: Other
Cycle Length: 105
Actuated Cycle Length: 105
Offset: 0 (0%), Referenced to phase 2:NBSB, Start of Green
Natural Cycle: 105
Control Type: Pretimed
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 24.4 Intersection LOS: C
Intersection Capacity Utilization 103.3% ICU Level of Service G
Analysis Period (min) 15

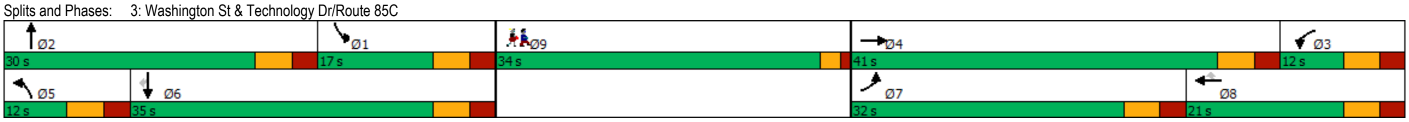
Splits and Phases: 2: Forest Ave & Main Street

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø9
Lane Configurations													
Traffic Volume (vph)	513	427	375	41	318	23	199	219	47	46	332	654	
Future Volume (vph)	513	427	375	41	318	23	199	219	47	46	332	654	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	350		0	230		215	300		0	215		175	
Storage Lanes	2		0	1		0	2		0	1		1	
Taper Length (ft)	150			25			200			25			
Lane Util. Factor	0.97	0.95	0.95	1.00	0.95	1.00	0.97	0.95	0.95	1.00	0.95	1.00	
Frt		0.930				0.850		0.974				0.850	
Flt Protected	0.950			0.950			0.950			0.950			
Satd. Flow (prot)	3367	3257	0	1805	3539	1538	3213	3336	0	1805	3471	1568	
Flt Permitted	0.950			0.950			0.950			0.950			
Satd. Flow (perm)	3367	3257	0	1805	3539	1538	3213	3336	0	1805	3471	1568	
Right Turn on Red			Yes			Yes			Yes			Yes	
Satd. Flow (RTOR)		161				195		17				711	
Link Speed (mph)		40			40			40			40		
Link Distance (ft)		654			348			535			467		
Travel Time (s)		11.1			5.9			9.1			8.0		
Peak Hour Factor	0.92	0.92	0.92	0.83	0.83	0.83	0.87	0.87	0.87	0.92	0.92	0.92	
Heavy Vehicles (%)	4%	4%	2%	0%	2%	5%	9%	4%	12%	0%	4%	3%	
Adj. Flow (vph)	558	464	408	49	383	28	229	252	54	50	361	711	
Shared Lane Traffic (%)													
Lane Group Flow (vph)	558	872	0	49	383	28	229	306	0	50	361	711	
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA		Prot	NA	Perm	
Protected Phases	7	4		3	8		5	2		1	6		9
Permitted Phases						8						6	
Detector Phase	7	4		3	8	8	5	2		1	6	6	
Switch Phase													
Minimum Initial (s)	6.0	10.0		6.0	10.0	10.0	6.0	10.0		6.0	10.0	10.0	1.0
Minimum Split (s)	12.0	16.0		12.0	16.0	16.0	12.0	16.0		12.0	35.0	35.0	34.0
Total Split (s)	32.0	41.0		12.0	21.0	21.0	12.0	30.0		17.0	35.0	35.0	34.0
Total Split (%)	23.9%	30.6%		9.0%	15.7%	15.7%	9.0%	22.4%		12.7%	26.1%	26.1%	25%
Maximum Green (s)	26.0	35.0		6.0	15.0	15.0	6.0	24.0		11.0	29.0	29.0	31.0
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	2.0
All-Red Time (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	
Total Lost Time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	
Lead/Lag	Lead	Lead		Lag	Lag	Lag	Lead	Lead		Lag	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0
Recall Mode	None	None		None	None	None	None	Min		None	Min	Min	None
Walk Time (s)											7.0	7.0	7.0
Flash Dont Walk (s)											22.0	22.0	24.0
Pedestrian Calls (#/hr)											0	0	0
Act Effct Green (s)	18.6	28.4		7.9	14.7	14.7	6.1	18.4		9.5	16.3	16.3	
Actuated g/C Ratio	0.23	0.35		0.10	0.18	0.18	0.08	0.23		0.12	0.20	0.20	
v/c Ratio	0.71	0.69		0.28	0.59	0.06	0.94	0.39		0.24	0.51	0.80	
Control Delay	34.6	22.6		42.3	35.9	0.3	85.6	30.2		36.1	31.2	10.4	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	
Total Delay	34.6	22.6		42.3	35.9	0.3	85.6	30.2		36.1	31.2	10.4	
LOS	C	C		D	D	A	F	C		D	C	B	
Approach Delay		27.3			34.4			53.9			18.2		
Approach LOS		C			C			D			B		
Queue Length 50th (ft)	129	166		22	90	0	58	70		23	84	0	
Queue Length 95th (ft)	217	270		63	155	0	#156	127		59	135	104	
Internal Link Dist (ft)		574			268			455			387		
Turn Bay Length (ft)	350			230		215	300			215		175	
Base Capacity (vph)	1109	1534		177	674	450	244	1039		276	1275	1025	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	0	
Reduced v/c Ratio	0.50	0.57		0.28	0.57	0.06	0.94	0.29		0.18	0.28	0.69	

Intersection Summary

Area Type: Other
Cycle Length: 134
Actuated Cycle Length: 80.2
Natural Cycle: 130
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.94
Intersection Signal Delay: 29.4 Intersection LOS: C
Intersection Capacity Utilization 70.0% ICU Level of Service C
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Washington St & Technology Dr/Route 85C



Movement	EBL	EBT	WBT	WBR	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	0	435	383	0	0	0
Future Volume (Veh/h)	0	435	383	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.91	0.91	0.87	0.87	0.25	0.25
Hourly flow rate (vph)	0	478	440	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	440				918	440
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	440				918	440
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1131				304	621

Direction, Lane #	EB 1	EB 2	WB 1	SW 1	SW 2
Volume Total	0	478	440	0	0
Volume Left	0	0	0	0	0
Volume Right	0	0	0	0	0
cSH	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.28	0.26	0.00	0.00
Queue Length 95th (ft)	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0
Lane LOS				A	A
Approach Delay (s)	0.0		0.0	0.0	
Approach LOS				A	

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	26.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	1	0	1	0	496	0	0	367	0
Future Volume (Veh/h)	0	0	0	1	0	1	0	496	0	0	367	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.25	0.92	0.25	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.80	0.80
Hourly flow rate (vph)	0	0	0	1	0	1	0	539	0	0	459	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	999	998	459	998	998	539	459			539		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	999	998	459	998	998	539	459			539		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			100		
cM capacity (veh/h)	224	244	606	223	244	542	1113			1029		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	0	0	2	539	459
Volume Left	0	0	1	0	0
Volume Right	0	0	1	0	0
cSH	1700	1700	316	1113	1700
Volume to Capacity	0.00	0.00	0.01	0.00	0.27
Queue Length 95th (ft)	0	0	0	0	0
Control Delay (s)	0.0	0.0	16.5	0.0	0.0
Lane LOS	A	A	C		
Approach Delay (s)	0.0		16.5	0.0	0.0
Approach LOS	A		C		

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	36.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	395	29	66	101	133	308
Future Volume (Veh/h)	395	29	66	101	133	308
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.94	0.94	0.91	0.91	0.87	0.87
Hourly flow rate (vph)	420	31	73	111	153	354
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	410	153	507			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	410	153	507			
tC, single (s)	6.4	6.3	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.4	2.2			
p0 queue free %	24	96	93			
cM capacity (veh/h)	553	878	1058			

Direction, Lane #	EB 1	EB 2	NB 1	SB 1	SB 2
Volume Total	420	31	184	153	354
Volume Left	420	0	73	0	0
Volume Right	0	31	0	0	354
cSH	553	878	1058	1700	1700
Volume to Capacity	0.76	0.04	0.07	0.09	0.21
Queue Length 95th (ft)	169	3	6	0	0
Control Delay (s)	29.2	9.3	3.8	0.0	0.0
Lane LOS	D	A	A		
Approach Delay (s)	27.8		3.8	0.0	
Approach LOS	D				

Intersection Summary			
Average Delay	11.6		
Intersection Capacity Utilization	47.9%	ICU Level of Service	A
Analysis Period (min)	15		

MOVEMENT SUMMARY

Site: 101 [Washington Street at Broad Street_No Build AM (Site Folder: General)]

Site Category: (None)
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: Washington Street														
3u	U	8	14.3	9	14.3	0.327	6.3	LOS A	1.9	49.0	0.18	0.06	0.18	27.7
3a	L1	428	4.9	455	4.9	0.327	6.0	LOS A	1.9	49.4	0.18	0.06	0.18	28.1
8	T1	320	3.4	340	3.4	0.327	5.9	LOS A	1.9	49.4	0.18	0.06	0.18	31.6
18	R2	1	0.0	1	0.0	0.327	5.8	LOS A	1.9	49.4	0.18	0.06	0.18	24.2
Approach		757	4.4	805	4.4	0.327	6.0	LOS A	1.9	49.4	0.18	0.06	0.18	29.8
East: Gas Station Driveway														
1u	U	1	0.0	1	0.0	0.038	5.9	LOS A	0.1	3.3	0.58	0.53	0.58	5.7
1	L2	2	0.0	2	0.0	0.038	5.9	LOS A	0.1	3.3	0.58	0.53	0.58	28.4
16a	R1	9	0.0	10	0.0	0.038	5.9	LOS A	0.1	3.3	0.58	0.53	0.58	29.0
16	R2	11	0.0	12	0.0	0.038	5.9	LOS A	0.1	3.3	0.58	0.53	0.58	29.6
Approach		23	0.0	25	0.0	0.038	5.9	LOS A	0.1	3.3	0.58	0.53	0.58	28.9
North: Broad Street														
7u	U	1	0.0	1	0.0	0.693	16.5	LOS C	7.8	199.6	0.78	1.09	1.52	29.5
7	L2	1	0.0	1	0.0	0.693	16.5	LOS C	7.8	199.6	0.78	1.09	1.52	21.4
4	T1	485	2.6	591	2.6	0.693	16.6	LOS C	7.8	199.6	0.78	1.09	1.52	27.2
14b	R3	77	6.2	94	6.2	0.124	6.0	LOS A	0.4	11.5	0.51	0.45	0.51	30.1
Approach		564	3.1	688	3.1	0.693	15.2	LOS C	7.8	199.6	0.74	1.00	1.38	27.5
NorthWest: Washington Street														
7ux	U	1	0.0	1	0.0	0.044	5.9	LOS A	0.2	4.5	0.61	0.51	0.61	29.3
7bx	L3	15	27.3	16	27.3	0.044	7.3	LOS A	0.2	4.5	0.61	0.51	0.61	29.7
7ax	L1	7	3.1	8	3.1	0.044	6.0	LOS A	0.2	4.5	0.61	0.51	0.61	22.1
14ax	R1	590	0.0	641	0.0	0.341	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	36.8
Approach		613	0.7	666	0.7	0.341	0.3	LOS A	0.2	4.5	0.02	0.02	0.02	36.2
All Vehicles		1957	2.8	2184	2.8	0.693	7.1	LOS A	7.8	199.6	0.31	0.35	0.51	30.2

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

QUEUE ANALYSIS

Site: 101 [Washington Street at Broad Street_No Build AM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Queues (Distance)

Lane Number	Contin. Lane	Deg. Satn v/c	Prog. Factor (Queue)	Overflow Queue (ft)	Back of Queue (ft) Av.	Back of Queue (ft) 95%	Queue at Start of Green (ft) Av.	Queue at Start of Green (ft) 95%	Cycle Average Queue (ft) Av.	Cycle Average Queue (ft) 95%	Queue Storage Ratio Av.	Queue Storage Ratio 95%	Prob. Block. %	Prob. SL Ov. %	Ov. Lane No.
South: Washington Street															
Lane 1		0.327	1.000	0.0	19.7	49.0	NA	NA	17.3	31.4	0.02	0.06	0.0	NA	NA
Lane 2		0.327	1.000	0.0	19.9	49.4	NA	NA	17.2	31.2	0.02	0.06	0.0	NA	NA
Approach		0.327			19.9	49.4	NA	NA	17.3	31.4	0.02	0.06			
East: Gas Station Driveway															
Lane 1		0.038	1.000	0.0	1.3	3.3	NA	NA	1.0	1.9	0.13	0.33	0.0	NA	NA
Approach		0.038			1.3	3.3	NA	NA	1.0	1.9	0.13	0.33			
North: Broad Street															
Lane 1		0.693	1.000	29.3	80.3	199.6	NA	NA	69.9	126.8	0.04	0.10	0.0	NA	NA
Lane 2		0.124	1.000	0.0	4.6	11.5	NA	NA	4.1	7.5	0.09	0.23	NA	0.0	1
Approach		0.693			80.3	199.6	NA	NA	69.9	126.8	0.04	0.10			
NorthWest: Washington Street															
Lane 1		0.044	1.000	0.0	1.8	4.5	NA	NA	1.4	2.5	0.00	0.00	0.0	NA	NA
Lane 2	Y	0.341	1.000	0.0	0.0	0.0	NA	NA	0.0	0.0	0.00	0.00	0.0	NA	NA
Approach		0.341			1.8	4.5	NA	NA	1.4	2.5	0.00	0.00			
Intersection		0.693			80.3	199.6	NA	NA	69.9	126.8	0.13	0.33			

Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.

Lane Queues (Vehicles)

Lane Number	Contin. Lane	Deg. Satn v/c	Prog. Factor (Queue)	Overflow Queue (veh)	Back of Queue (veh) Av.	Back of Queue (veh) 95%	Queue at Start of Green (veh) Av.	Queue at Start of Green (veh) 95%	Cycle Average Queue (veh) Av.	Cycle Average Queue (veh) 95%	Queue Storage Ratio Av.	Queue Storage Ratio 95%	Prob. Block. %	Prob. SL Ov. %	Ov. Lane No.
South: Washington Street															
Lane 1		0.327	1.000	0.0	0.8	1.9	NA	NA	0.7	1.2	0.02	0.06	0.0	NA	NA
Lane 2		0.327	1.000	0.0	0.8	1.9	NA	NA	0.7	1.2	0.02	0.06	0.0	NA	NA
Approach		0.327			0.8	1.9	NA	NA	0.7	1.2	0.02	0.06			
East: Gas Station Driveway															
Lane 1		0.038	1.000	0.0	0.1	0.1	NA	NA	0.0	0.1	0.13	0.33	0.0	NA	NA
Approach		0.038			0.1	0.1	NA	NA	0.0	0.1	0.13	0.33			
North: Broad Street															
Lane 1		0.693	1.000	1.1	3.1	7.8	NA	NA	2.7	5.0	0.04	0.10	0.0	NA	NA
Lane 2		0.124	1.000	0.0	0.2	0.4	NA	NA	0.2	0.3	0.09	0.23	NA	0.0	1
Approach		0.693			3.1	7.8	NA	NA	2.7	5.0	0.04	0.10			
NorthWest: Washington Street															
Lane 1		0.044	1.000	0.0	0.1	0.2	NA	NA	0.0	0.1	0.00	0.00	0.0	NA	NA
Lane 2	Y	0.341	1.000	0.0	0.0	0.0	NA	NA	0.0	0.0	0.00	0.00	0.0	NA	NA
Approach		0.341			0.1	0.2	NA	NA	0.0	0.1	0.00	0.00			

Intersection	0.693	3.1	7.8	NA	NA	2.7	5.0	0.13	0.33

Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.

Continuous Lane Performance

Lane Number	Deg. Satn v/c	Unint. Speed mph	Unint. Travel Delay sec	Hdwy sec	Spacing ft	Aver. Vehicle Length ft	Occup. Time sec	Space Time sec	Space Occup. Ratio %	Time Occup. Ratio %	Density veh/mi	Density pc/mi	LOS (Density Method)
South: Washington Street													
This approach does not have any continuous lanes													
East: Gas Station Driveway													
This approach does not have any continuous lanes													
North: Broad Street													
This approach does not have any continuous lanes													
NorthWest: Washington Street													
Lane 2	0.341	39.9	0.1	5.61	328.2	17.0	0.68	4.93	5.2	12.2	16.1	16.1	LOS B

Midblock Effective Detection Zone Length = 7 ft

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	69	46	309	28	62	493
Future Volume (Veh/h)	69	46	309	28	62	493
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	75	50	336	30	67	536
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1021	351			366	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1021	351			366	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	70	93			94	
cM capacity (veh/h)	247	692			1193	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	125	366	603
Volume Left	75	0	67
Volume Right	50	30	0
cSH	333	1700	1193
Volume to Capacity	0.38	0.22	0.06
Queue Length 95th (ft)	42	0	4
Control Delay (s)	22.2	0.0	1.5
Lane LOS	C		A
Approach Delay (s)	22.2	0.0	1.5
Approach LOS	C		

Intersection Summary			
Average Delay	3.4		
Intersection Capacity Utilization	64.0%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	60	36	18	365	316	112
Future Volume (Veh/h)	60	36	18	365	316	112
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	65	39	20	397	343	122
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		2				
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	841	404	465			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	841	404	465			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	80	94	98			
cM capacity (veh/h)	329	647	1096			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	104	417	465
Volume Left	65	20	0
Volume Right	39	0	122
cSH	526	1096	1700
Volume to Capacity	0.20	0.02	0.27
Queue Length 95th (ft)	18	1	0
Control Delay (s)	15.7	0.6	0.0
Lane LOS	C	A	
Approach Delay (s)	15.7	0.6	0.0
Approach LOS	C		

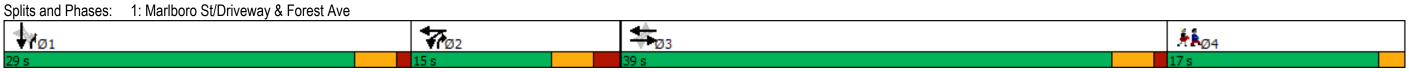
Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	43.9%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø4
Lane Configurations													
Traffic Volume (vph)	0	125	116	413	165	0	140	0	337	24	32	15	
Future Volume (vph)	0	125	116	413	165	0	140	0	337	24	32	15	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	0		0	185		0	0		180	0		0	
Storage Lanes	0		0	1		0	1		1	0		0	
Taper Length (ft)	25			25			25			25			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.935							0.850		0.971		
Flt Protected				0.950			0.950				0.983		
Satd. Flow (prot)	0	1734	0	1787	1863	0	1770	0	1583	0	1814	0	
Flt Permitted				0.494			0.741				0.983		
Satd. Flow (perm)	0	1734	0	929	1863	0	1380	0	1583	0	1814	0	
Right Turn on Red			Yes			Yes			Yes			Yes	
Satd. Flow (RTOR)		51							366		13		
Link Speed (mph)		35			35			35			35		
Link Distance (ft)		268			525			555			135		
Travel Time (s)		5.2			10.2			10.8			2.6		
Peak Hour Factor	0.83	0.83	0.83	0.86	0.86	0.86	0.92	0.92	0.92	0.90	0.90	0.90	
Heavy Vehicles (%)	0%	1%	4%	1%	2%	0%	2%	0%	2%	0%	0%	0%	
Adj. Flow (vph)	0	151	140	480	192	0	152	0	366	27	36	17	
Shared Lane Traffic (%)													
Lane Group Flow (vph)	0	291	0	480	192	0	152	0	366	0	80	0	
Turn Type		NA		D.P+P	NA		D.Pm		pt+ov	Perm	NA		
Protected Phases		3		2	2 3				1 2		1		4
Permitted Phases	3			3			1			1			
Detector Phase	3	3		2	2 3		1		1 2	1	1		
Switch Phase													
Minimum Initial (s)	35.0	35.0		10.0			25.0			25.0	25.0		7.0
Minimum Split (s)	39.0	39.0		15.0			29.0			29.0	29.0		17.0
Total Split (s)	39.0	39.0		15.0			29.0			29.0	29.0		17.0
Total Split (%)	39.0%	39.0%		15.0%			29.0%			29.0%	29.0%		17%
Maximum Green (s)	35.0	35.0		10.0			25.0			25.0	25.0		15.0
Yellow Time (s)	3.0	3.0		3.0			3.0			3.0	3.0		2.0
All-Red Time (s)	1.0	1.0		2.0			1.0			1.0	1.0		0.0
Lost Time Adjust (s)		0.0		0.0			0.0				0.0		
Total Lost Time (s)		4.0		5.0			4.0				4.0		
Lead/Lag	Lead	Lead		Lag			Lead			Lead	Lead		Lag
Lead-Lag Optimize?	Yes	Yes		Yes			Yes			Yes	Yes		Yes
Vehicle Extension (s)	3.0	3.0		3.0			3.0			3.0	3.0		3.0
Recall Mode	Max	Max		Min			Min			Min	Min		None
Walk Time (s)													7.0
Flash Dont Walk (s)													8.0
Pedestrian Calls (#/hr)													0
Act Effct Green (s)		35.0		44.0	49.0		25.0		40.0		25.0		
Actuated g/C Ratio		0.42		0.53	0.59		0.30		0.48		0.30		
v/c Ratio		0.38		0.81	0.17		0.37		0.38		0.14		
Control Delay		15.2		24.4	8.3		25.9		2.7		19.0		
Queue Delay		0.0		0.0	0.0		0.0		0.0		0.0		
Total Delay		15.2		24.4	8.3		25.9		2.7		19.0		
LOS		B		C	A		C		A		B		
Approach Delay		15.2			19.8			9.5			19.0		
Approach LOS		B			B			A			B		
Queue Length 50th (ft)		82		128	42		62		0		25		
Queue Length 95th (ft)		127		#199	68		114		43		57		
Internal Link Dist (ft)		188			445			475			55		
Turn Bay Length (ft)				185					180				
Base Capacity (vph)		760		595	1099		415		952		555		
Starvation Cap Reductn		0		0	0		0		0		0		
Spillback Cap Reductn		0		0	0		0		0		0		
Storage Cap Reductn		0		0	0		0		0		0		
Reduced v/c Ratio		0.38		0.81	0.17		0.37		0.38		0.14		

Intersection Summary

Area Type: Other
Cycle Length: 100
Actuated Cycle Length: 83
Natural Cycle: 100
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 15.5 Intersection LOS: B
Intersection Capacity Utilization 83.7% ICU Level of Service E
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Marlboro St/Driveway & Forest Ave



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	64	289	2	375	610	6	143	122	169	5	129	64
Future Volume (vph)	64	289	2	375	610	6	143	122	169	5	129	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	75		0	175		0	0		100	65		0
Storage Lanes	1		0	1		1	0		1	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.999				0.850			0.850			0.850
Flt Protected	0.950			0.950				0.974			0.998	
Satd. Flow (prot)	1805	1843	0	1770	1863	1615	0	1824	1538	0	1896	1553
Flt Permitted	0.187			0.479				0.718			0.985	
Satd. Flow (perm)	355	1843	0	892	1863	1615	0	1345	1538	0	1872	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						83			149			74
Link Speed (mph)		40			40			35			35	
Link Distance (ft)		181			313			301			336	
Travel Time (s)		3.1			5.3			5.9			6.5	
Peak Hour Factor	0.87	0.87	0.87	0.90	0.90	0.90	0.90	0.90	0.90	0.87	0.87	0.87
Heavy Vehicles (%)	0%	3%	0%	2%	2%	0%	1%	2%	5%	0%	0%	4%
Adj. Flow (vph)	74	332	2	417	678	7	159	136	188	6	148	74
Shared Lane Traffic (%)												
Lane Group Flow (vph)	74	334	0	417	678	7	0	295	188	0	154	74
Turn Type	pm+pt	NA		pm+pt	NA	Prot	Perm	NA	Prot	Perm	NA	pt+ov
Protected Phases	3	1		3	1	1		2	2		2	2 3
Permitted Phases	1			1			2			2		
Minimum Split (s)	15.0	56.0		15.0	56.0	56.0	34.0	34.0	34.0	34.0	34.0	
Total Split (s)	15.0	56.0		15.0	56.0	56.0	34.0	34.0	34.0	34.0	34.0	
Total Split (%)	14.3%	53.3%		14.3%	53.3%	53.3%	32.4%	32.4%	32.4%	32.4%	32.4%	
Maximum Green (s)	10.0	51.0		10.0	51.0	51.0	28.0	28.0	28.0	28.0	28.0	
Yellow Time (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0	5.0		6.0	6.0		6.0	
Lead/Lag		Lead			Lead	Lead	Lag	Lag	Lag	Lag	Lag	
Lead-Lag Optimize?		Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Act Effct Green (s)	61.0	51.0		61.0	51.0	51.0		28.0	28.0		28.0	43.0
Actuated g/C Ratio	0.58	0.49		0.58	0.49	0.49		0.27	0.27		0.27	0.41
v/c Ratio	0.22	0.37		0.69	0.75	0.01		0.82	0.36		0.31	0.11
Control Delay	9.3	18.5		18.2	28.3	0.0		56.5	10.5		32.9	5.0
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Delay	9.3	18.5		18.2	28.3	0.0		56.5	10.5		32.9	5.0
LOS	A	B		B	C	A		E	B		C	A
Approach Delay		16.8			24.3			38.6			23.8	
Approach LOS		B			C			D			C	
Queue Length 50th (ft)	18	136		125	355	0		186	20		83	0
Queue Length 95th (ft)	34	195		185	506	0		#329	77		134	26
Internal Link Dist (ft)		101			233			221			256	
Turn Bay Length (ft)	75			175					100			
Base Capacity (vph)	344	895		601	904	827		358	519		499	679
Starvation Cap Reductn	0	0		0	0	0		0	0		0	0
Spillback Cap Reductn	0	0		0	0	0		0	0		0	0
Storage Cap Reductn	0	0		0	0	0		0	0		0	0
Reduced v/c Ratio	0.22	0.37		0.69	0.75	0.01		0.82	0.36		0.31	0.11

Intersection Summary

Area Type: Other
Cycle Length: 105
Actuated Cycle Length: 105
Offset: 0 (0%), Referenced to phase 2:NBSB, Start of Green
Natural Cycle: 105
Control Type: Pretimed
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 26.0 Intersection LOS: C
Intersection Capacity Utilization 128.3% ICU Level of Service H
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

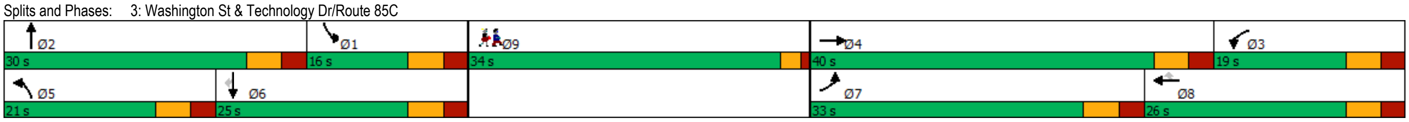
Splits and Phases: 2: Forest Ave & Main Street

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø9
Lane Configurations													
Traffic Volume (vph)	628	342	271	76	379	61	345	510	74	73	421	599	
Future Volume (vph)	628	342	271	76	379	61	345	510	74	73	421	599	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	350		0	230		215	300		0	215		175	
Storage Lanes	2		0	1		0	2		0	1		1	
Taper Length (ft)	150			25			200			25			
Lane Util. Factor	0.97	0.95	0.95	1.00	0.95	1.00	0.97	0.95	0.95	1.00	0.95	1.00	
Frt		0.934				0.850		0.981				0.850	
Flt Protected	0.950			0.950			0.950			0.950			
Satd. Flow (prot)	3467	3353	0	1805	3574	1615	3502	3532	0	1805	3539	1583	
Flt Permitted	0.950			0.950			0.950			0.950			
Satd. Flow (perm)	3467	3353	0	1805	3574	1615	3502	3532	0	1805	3539	1583	
Right Turn on Red			Yes			Yes			Yes			Yes	
Satd. Flow (RTOR)		136				188		10				631	
Link Speed (mph)		40			40			40			40		
Link Distance (ft)		654			348			535			467		
Travel Time (s)		11.1			5.9			9.1			8.0		
Peak Hour Factor	0.90	0.90	0.90	0.82	0.82	0.82	0.95	0.95	0.95	0.95	0.95	0.95	
Heavy Vehicles (%)	1%	1%	0%	0%	1%	0%	0%	0%	2%	0%	2%	2%	
Adj. Flow (vph)	698	380	301	93	462	74	363	537	78	77	443	631	
Shared Lane Traffic (%)													
Lane Group Flow (vph)	698	681	0	93	462	74	363	615	0	77	443	631	
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA		Prot	NA	Perm	
Protected Phases	7	4		3	8		5	2		1	6		9
Permitted Phases						8						6	
Detector Phase	7	4		3	8	8	5	2		1	6	6	
Switch Phase													
Minimum Initial (s)	6.0	10.0		6.0	10.0	10.0	6.0	10.0		6.0	10.0	10.0	1.0
Minimum Split (s)	12.0	16.0		12.0	16.0	16.0	12.0	16.0		12.0	25.0	25.0	34.0
Total Split (s)	33.0	40.0		19.0	26.0	26.0	21.0	30.0		16.0	25.0	25.0	34.0
Total Split (%)	23.7%	28.8%		13.7%	18.7%	18.7%	15.1%	21.6%		11.5%	18.0%	18.0%	24%
Maximum Green (s)	27.0	34.0		13.0	20.0	20.0	15.0	24.0		10.0	19.0	19.0	31.0
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	2.0
All-Red Time (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	
Total Lost Time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	
Lead/Lag	Lead	Lead		Lag	Lag	Lag	Lead	Lead		Lag	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0
Recall Mode	None	None		None	None	None	None	Min		None	Min	Min	None
Walk Time (s)											7.0	7.0	7.0
Flash Dont Walk (s)											12.0	12.0	24.0
Pedestrian Calls (#/hr)											5	5	5
Act Effct Green (s)	27.5	29.8		18.6	18.2	18.2	15.0	27.0		9.3	18.5	18.5	
Actuated g/C Ratio	0.25	0.27		0.17	0.17	0.17	0.14	0.25		0.09	0.17	0.17	
v/c Ratio	0.80	0.67		0.30	0.78	0.17	0.75	0.70		0.50	0.74	0.80	
Control Delay	47.4	34.7		45.8	54.3	0.9	57.3	44.1		63.0	52.5	12.3	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	
Total Delay	47.4	34.7		45.8	54.3	0.9	57.3	44.1		63.0	52.5	12.3	
LOS	D	C		D	D	A	E	D		E	D	B	
Approach Delay		41.1			46.8			49.0			31.2		
Approach LOS		D			D			D			C		
Queue Length 50th (ft)	221	186		50	153	0	120	197		49	145	0	
Queue Length 95th (ft)	#474	316		129	#265	0	#272	#424		#131	#311	142	
Internal Link Dist (ft)		574			268			455			387		
Turn Bay Length (ft)	350			230		215	300			215		175	
Base Capacity (vph)	874	1249		335	668	454	491	883		168	628	800	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	0	
Reduced v/c Ratio	0.80	0.55		0.28	0.69	0.16	0.74	0.70		0.46	0.71	0.79	

Intersection Summary

Area Type: Other
Cycle Length: 139
Actuated Cycle Length: 108.9
Natural Cycle: 130
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 41.1 — Intersection LOS: D
Intersection Capacity Utilization 72.4% — ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Washington St & Technology Dr/Route 85C



Movement	EBL	EBT	WBT	WBR	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	0	451	479	0	0	0
Future Volume (Veh/h)	0	451	479	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.86	0.86	0.91	0.91	0.63	0.63
Hourly flow rate (vph)	0	524	526	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	526				1050	526
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	526				1050	526
tC, single (s)	4.1				6.4	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.4
p0 queue free %	100				100	100
cM capacity (veh/h)	1051				254	534

Direction, Lane #	EB 1	EB 2	WB 1	SW 1	SW 2
Volume Total	0	524	526	0	0
Volume Left	0	0	0	0	0
Volume Right	0	0	0	0	0
cSH	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.31	0.31	0.00	0.00
Queue Length 95th (ft)	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0
Lane LOS				A	A
Approach Delay (s)	0.0		0.0	0.0	
Approach LOS				A	

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	28.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	477	0	0	542	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	477	0	0	542	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.50	0.92	0.50	0.92	0.92	0.92	0.91	0.91	0.92	0.92	0.85	0.85
Hourly flow rate (vph)	0	0	0	0	0	0	0	524	0	0	638	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1162	1162	638	1162	1162	524	638			524		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1162	1162	638	1162	1162	524	638			524		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			100		
cM capacity (veh/h)	174	195	480	172	195	553	956			1043		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	0	0	0	524	638
Volume Left	0	0	0	0	0
Volume Right	0	0	0	0	0
cSH	1700	1700	1700	956	1700
Volume to Capacity	0.00	0.00	0.01	0.00	0.38
Queue Length 95th (ft)	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0
Lane LOS	A	A	A		
Approach Delay (s)	0.0		0.0	0.0	0.0
Approach LOS	A		A		

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	31.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	344	94	69	167	149	393
Future Volume (Veh/h)	344	94	69	167	149	393
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	374	102	78	188	167	442
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	511	167	609			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	511	167	609			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	22	88	92			
cM capacity (veh/h)	482	880	970			

Direction, Lane #	EB 1	EB 2	NB 1	SB 1	SB 2
Volume Total	374	102	266	167	442
Volume Left	374	0	78	0	0
Volume Right	0	102	0	0	442
cSH	482	880	970	1700	1700
Volume to Capacity	0.78	0.12	0.08	0.10	0.26
Queue Length 95th (ft)	172	10	7	0	0
Control Delay (s)	33.8	9.6	3.2	0.0	0.0
Lane LOS	D	A	A		
Approach Delay (s)	28.6		3.2	0.0	
Approach LOS	D				

Intersection Summary			
Average Delay	10.7		
Intersection Capacity Utilization	49.5%	ICU Level of Service	A
Analysis Period (min)	15		

MOVEMENT SUMMARY

Site: 101 [Washington Street at Broad Street_No Build PM (Site Folder: General)]

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: Washington Street														
3u	U	9	0.0	10	0.0	0.591	10.1	LOS B	5.2	130.0	0.42	0.21	0.42	26.4
3a	L1	770	0.5	865	0.5	0.591	10.1	LOS B	5.2	130.0	0.42	0.21	0.42	26.4
8	T1	502	1.5	564	1.5	0.591	10.1	LOS B	5.1	128.8	0.42	0.21	0.42	29.5
18	R2	1	0.0	1	0.0	0.591	10.1	LOS B	5.1	128.8	0.42	0.21	0.42	20.7
Approach		1282	0.9	1440	0.9	0.591	10.1	LOS B	5.2	130.0	0.42	0.21	0.42	27.8
East: Gas Station Driveway														
1u	U	1	0.0	1	0.0	0.060	12.1	LOS B	0.2	5.1	0.78	0.78	0.78	4.1
1	L2	2	0.0	2	0.0	0.060	12.1	LOS B	0.2	5.1	0.78	0.78	0.78	22.0
16a	R1	7	0.0	8	0.0	0.060	12.1	LOS B	0.2	5.1	0.78	0.78	0.78	23.4
16	R2	8	0.0	9	0.0	0.060	12.1	LOS B	0.2	5.1	0.78	0.78	0.78	26.2
Approach		18	0.0	20	0.0	0.060	12.1	LOS B	0.2	5.1	0.78	0.78	0.78	24.4
North: Broad Street														
7u	U	1	0.0	1	0.0	0.906	43.4	LOS E	13.6	342.1	0.97	1.70	3.09	23.0
7	L2	1	0.0	1	0.0	0.906	43.4	LOS E	13.6	342.1	0.97	1.70	3.09	15.4
4	T1	481	1.0	534	1.0	0.906	43.5	LOS E	13.6	342.1	0.97	1.70	3.09	19.9
14b	R3	116	3.2	129	3.2	0.249	10.5	LOS B	1.0	24.7	0.69	0.69	0.69	28.5
Approach		599	1.4	666	1.4	0.906	37.1	LOS E	13.6	342.1	0.92	1.50	2.63	21.2
NorthWest: Washington Street														
7ux	U	11	10.0	12	10.0	0.105	6.7	LOS A	0.5	11.8	0.63	0.55	0.63	28.3
7bx	L3	50	2.4	53	2.4	0.105	6.4	LOS A	0.5	11.8	0.63	0.55	0.63	29.9
7ax	L1	7	2.4	7	2.4	0.105	6.4	LOS A	0.5	11.8	0.63	0.55	0.63	22.2
14ax	R1	683	0.0	719	0.0	0.382	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	36.8
Approach		751	0.3	791	0.3	0.382	0.7	LOS A	0.5	11.8	0.06	0.05	0.06	35.6
All Vehicles		2650	0.8	2916	0.9	0.906	13.7	LOS B	13.6	342.1	0.44	0.47	0.83	26.8

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

QUEUE ANALYSIS

Site: 101 [Washington Street at Broad Street_No Build PM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Queues (Distance)

Lane Number	Contin. Lane	Deg. Satn v/c	Prog. Factor (Queue)	Overflow Queue (ft)	Back of Queue (ft) Av.	Back of Queue (ft) 95%	Queue at Start of Green (ft) Av.	Queue at Start of Green (ft) 95%	Cycle Average Queue (ft) Av.	Cycle Average Queue (ft) 95%	Queue Storage Ratio Av.	Queue Storage Ratio 95%	Prob. Block. %	Prob. SL Ov. %	Ov. Lane No.
South: Washington Street															
Lane 1		0.591	1.000	0.0	52.3	130.0	NA	NA	50.8	92.1	0.07	0.16	0.0	NA	NA
Lane 2		0.591	1.000	0.0	51.8	128.8	NA	NA	51.0	92.5	0.06	0.16	0.0	NA	NA
Approach		0.591			52.3	130.0	NA	NA	51.0	92.5	0.07	0.16			
East: Gas Station Driveway															
Lane 1		0.060	1.000	0.0	2.0	5.1	NA	NA	1.6	3.0	0.20	0.51	0.0	NA	NA
Approach		0.060			2.0	5.1	NA	NA	1.6	3.0	0.20	0.51			
North: Broad Street															
Lane 1		0.906	1.000	78.0	137.7	342.1	NA	NA	163.4	296.5	0.07	0.17	0.0	NA	NA
Lane 2		0.249	1.000	0.0	9.9	24.7	NA	NA	9.7	17.5	0.20	0.49	NA	0.0	1
Approach		0.906			137.7	342.1	NA	NA	163.4	296.5	0.07	0.17			
NorthWest: Washington Street															
Lane 1		0.105	1.000	0.0	4.8	11.8	NA	NA	3.3	6.0	0.00	0.01	0.0	NA	NA
Lane 2	Y	0.382	1.000	0.0	0.0	0.0	NA	NA	0.0	0.0	0.00	0.00	0.0	NA	NA
Approach		0.382			4.8	11.8	NA	NA	3.3	6.0	0.00	0.01			
Intersection		0.906			137.7	342.1	NA	NA	163.4	296.5	0.20	0.51			

Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.

Lane Queues (Vehicles)

Lane Number	Contin. Lane	Deg. Satn v/c	Prog. Factor (Queue)	Overflow Queue (veh)	Back of Queue (veh) Av.	Back of Queue (veh) 95%	Queue at Start of Green (veh) Av.	Queue at Start of Green (veh) 95%	Cycle Average Queue (veh) Av.	Cycle Average Queue (veh) 95%	Queue Storage Ratio Av.	Queue Storage Ratio 95%	Prob. Block. %	Prob. SL Ov. %	Ov. Lane No.
South: Washington Street															
Lane 1		0.591	1.000	0.0	2.1	5.2	NA	NA	2.0	3.7	0.07	0.16	0.0	NA	NA
Lane 2		0.591	1.000	0.0	2.1	5.1	NA	NA	2.0	3.7	0.06	0.16	0.0	NA	NA
Approach		0.591			2.1	5.2	NA	NA	2.0	3.7	0.07	0.16			
East: Gas Station Driveway															
Lane 1		0.060	1.000	0.0	0.1	0.2	NA	NA	0.1	0.1	0.20	0.51	0.0	NA	NA
Approach		0.060			0.1	0.2	NA	NA	0.1	0.1	0.20	0.51			
North: Broad Street															
Lane 1		0.906	1.000	3.1	5.5	13.6	NA	NA	6.5	11.8	0.07	0.17	0.0	NA	NA
Lane 2		0.249	1.000	0.0	0.4	1.0	NA	NA	0.4	0.7	0.20	0.49	NA	0.0	1
Approach		0.906			5.5	13.6	NA	NA	6.5	11.8	0.07	0.17			
NorthWest: Washington Street															
Lane 1		0.105	1.000	0.0	0.2	0.5	NA	NA	0.1	0.2	0.00	0.01	0.0	NA	NA
Lane 2	Y	0.382	1.000	0.0	0.0	0.0	NA	NA	0.0	0.0	0.00	0.00	0.0	NA	NA
Approach		0.382			0.2	0.5	NA	NA	0.1	0.2	0.00	0.01			

Intersection	0.906	5.5	13.6	NA	NA	6.5	11.8	0.20	0.51

Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.

Continuous Lane Performance

Lane Number	Deg. Satn v/c	Unint. Speed mph	Unint. Travel Delay sec	Hdwy sec	Spacing ft	Aver. Vehicle Length ft	Occup. Time sec	Space Time sec	Space Occup. Ratio %	Time Occup. Ratio %	Density veh/mi	Density pc/mi	LOS (Density Method)
South: Washington Street													
This approach does not have any continuous lanes													
East: Gas Station Driveway													
This approach does not have any continuous lanes													
North: Broad Street													
This approach does not have any continuous lanes													
NorthWest: Washington Street													
Lane 2	0.382	39.8	0.1	5.01	292.5	17.0	0.68	4.32	5.8	13.7	18.1	18.1	LOS C

Midblock Effective Detection Zone Length = 7 ft

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	66	87	492	63	77	529
Future Volume (Veh/h)	66	87	492	63	77	529
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	72	95	535	68	84	575
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1312	569			603	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1312	569			603	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	55	82			91	
cM capacity (veh/h)	160	522			975	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	167	603	659
Volume Left	72	0	84
Volume Right	95	68	0
cSH	264	1700	975
Volume to Capacity	0.63	0.35	0.09
Queue Length 95th (ft)	98	0	7
Control Delay (s)	39.5	0.0	2.2
Lane LOS	E		A
Approach Delay (s)	39.5	0.0	2.2
Approach LOS	E		

Intersection Summary				
Average Delay		5.6		
Intersection Capacity Utilization		80.8%	ICU Level of Service	D
Analysis Period (min)		15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	91	41	38	381	418	90
Future Volume (Veh/h)	91	41	38	381	418	90
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	99	45	41	414	454	98
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		2				
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	999	503	552			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	999	503	552			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	62	92	96			
cM capacity (veh/h)	259	569	1018			

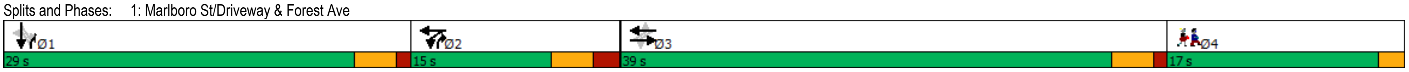
Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	144	455	552
Volume Left	99	41	0
Volume Right	45	0	98
cSH	377	1018	1700
Volume to Capacity	0.38	0.04	0.32
Queue Length 95th (ft)	44	3	0
Control Delay (s)	22.4	1.2	0.0
Lane LOS	C	A	
Approach Delay (s)	22.4	1.2	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	3.3		
Intersection Capacity Utilization	63.4%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø4
Lane Configurations													
Traffic Volume (vph)	0	113	106	276	93	0	128	0	400	9	4	4	
Future Volume (vph)	0	113	106	276	93	0	128	0	400	9	4	4	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	0		0	185		0	0		180	0		0	
Storage Lanes	0		0	1		0	1		1	0		0	
Taper Length (ft)	25			25			25			25			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.935							0.850		0.969		
Flt Protected				0.950			0.950				0.974		
Satd. Flow (prot)	0	1694	0	1770	1827	0	1736	0	1568	0	1793	0	
Flt Permitted				0.564			0.740				0.974		
Satd. Flow (perm)	0	1694	0	1051	1827	0	1352	0	1568	0	1793	0	
Right Turn on Red			Yes			Yes			Yes			Yes	
Satd. Flow (RTOR)		52							449		6		
Link Speed (mph)		35			35			35			35		
Link Distance (ft)		268			525			555			135		
Travel Time (s)		5.2			10.2			10.8			2.6		
Peak Hour Factor	0.96	0.96	0.96	0.85	0.85	0.85	0.89	0.89	0.89	0.63	0.63	0.63	
Heavy Vehicles (%)	0%	2%	8%	2%	4%	0%	4%	0%	3%	0%	0%	0%	
Adj. Flow (vph)	0	118	110	325	109	0	144	0	449	14	6	6	
Shared Lane Traffic (%)													
Lane Group Flow (vph)	0	228	0	325	109	0	144	0	449	0	26	0	
Turn Type		NA		D.P+P	NA		D.Pm		pt+ov	Perm	NA		
Protected Phases		3		2	2 3				1 2		1		4
Permitted Phases	3			3			1			1			
Detector Phase	3	3		2	2 3		1		1 2	1	1		
Switch Phase													
Minimum Initial (s)	35.0	35.0		10.0			25.0			25.0	25.0		7.0
Minimum Split (s)	39.0	39.0		15.0			29.0			29.0	29.0		17.0
Total Split (s)	39.0	39.0		15.0			29.0			29.0	29.0		17.0
Total Split (%)	39.0%	39.0%		15.0%			29.0%			29.0%	29.0%		17%
Maximum Green (s)	35.0	35.0		10.0			25.0			25.0	25.0		15.0
Yellow Time (s)	3.0	3.0		3.0			3.0			3.0	3.0		2.0
All-Red Time (s)	1.0	1.0		2.0			1.0			1.0	1.0		0.0
Lost Time Adjust (s)		0.0		0.0			0.0				0.0		
Total Lost Time (s)		4.0		5.0			4.0				4.0		
Lead/Lag	Lead	Lead		Lag			Lead			Lead	Lead		Lag
Lead-Lag Optimize?	Yes	Yes		Yes			Yes			Yes	Yes		Yes
Vehicle Extension (s)	3.0	3.0		3.0			3.0			3.0	3.0		3.0
Recall Mode	Max	Max		Min			Min			Min	Min		None
Walk Time (s)													7.0
Flash Dont Walk (s)													8.0
Pedestrian Calls (#/hr)													0
Act Effct Green (s)		35.0		44.0	49.0		25.0		40.0		25.0		
Actuated g/C Ratio		0.42		0.53	0.59		0.30		0.48		0.30		
v/c Ratio		0.31		0.51	0.10		0.35		0.45		0.05		
Control Delay		13.4		12.1	7.7		25.8		3.0		17.6		
Queue Delay		0.0		0.0	0.0		0.0		0.0		0.0		
Total Delay		13.4		12.1	7.7		25.8		3.0		17.6		
LOS		B		B	A		C		A		B		
Approach Delay		13.4			11.0			8.5			17.6		
Approach LOS		B			B			A			B		
Queue Length 50th (ft)		57		78	23		58		0		7		
Queue Length 95th (ft)		108		115	41		108		44		17		
Internal Link Dist (ft)		188			445			475			55		
Turn Bay Length (ft)				185					180				
Base Capacity (vph)		744		643	1078		407		988		544		
Starvation Cap Reductn		0		0	0		0		0		0		
Spillback Cap Reductn		0		0	0		0		0		0		
Storage Cap Reductn		0		0	0		0		0		0		
Reduced v/c Ratio		0.31		0.51	0.10		0.35		0.45		0.05		

Intersection Summary
Area Type: Other
Cycle Length: 100
Actuated Cycle Length: 83
Natural Cycle: 100
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.51
Intersection Signal Delay: 10.4 Intersection LOS: B
Intersection Capacity Utilization 84.8% ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 1: Marlboro St/Driveway & Forest Ave



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	44	610	2	153	250	4	106	106	341	4	110	41
Future Volume (vph)	44	610	2	153	250	4	106	106	341	4	110	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	75		0	175		0	0		100	65		0
Storage Lanes	1		0	1		1	0		1	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt						0.850			0.850			0.850
Flt Protected	0.950			0.950				0.976			0.998	
Satd. Flow (prot)	1570	1827	0	1736	1792	1292	0	1800	1568	0	1811	1583
Flt Permitted	0.499			0.173				0.692			0.988	
Satd. Flow (perm)	824	1827	0	316	1792	1292	0	1277	1568	0	1793	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						83			319			63
Link Speed (mph)		40			40			35			35	
Link Distance (ft)		181			313			301			336	
Travel Time (s)		3.1			5.3			5.9			6.5	
Peak Hour Factor	0.88	0.88	0.88	0.80	0.80	0.80	0.88	0.88	0.88	0.65	0.65	0.65
Heavy Vehicles (%)	15%	4%	0%	4%	6%	25%	2%	4%	3%	25%	4%	2%
Adj. Flow (vph)	50	693	2	191	313	5	120	120	388	6	169	63
Shared Lane Traffic (%)												
Lane Group Flow (vph)	50	695	0	191	313	5	0	240	388	0	175	63
Turn Type	pm+pt	NA		pm+pt	NA	Prot	Perm	NA	Prot	Perm	NA	pt+ov
Protected Phases	3	1		3	1	1		2	2		2	2 3
Permitted Phases	1			1			2			2		
Minimum Split (s)	15.0	56.0		15.0	56.0	56.0	34.0	34.0	34.0	34.0	34.0	
Total Split (s)	15.0	56.0		15.0	56.0	56.0	34.0	34.0	34.0	34.0	34.0	
Total Split (%)	14.3%	53.3%		14.3%	53.3%	53.3%	32.4%	32.4%	32.4%	32.4%	32.4%	
Maximum Green (s)	10.0	51.0		10.0	51.0	51.0	28.0	28.0	28.0	28.0	28.0	
Yellow Time (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0	5.0		6.0	6.0		6.0	
Lead/Lag		Lead			Lead	Lead	Lag	Lag	Lag	Lag	Lag	
Lead-Lag Optimize?		Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Act Effct Green (s)	61.0	51.0		61.0	51.0	51.0		28.0	28.0		28.0	43.0
Actuated g/C Ratio	0.58	0.49		0.58	0.49	0.49		0.27	0.27		0.27	0.41
v/c Ratio	0.09	0.78		0.60	0.36	0.01		0.71	0.60		0.37	0.09
Control Delay	8.1	30.1		17.4	18.3	0.0		47.6	11.1		34.0	5.3
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Delay	8.1	30.1		17.4	18.3	0.0		47.6	11.1		34.0	5.3
LOS	A	C		B	B	A		D	B		C	A
Approach Delay		28.7			17.8			25.0			26.4	
Approach LOS		C			B			C			C	
Queue Length 50th (ft)	12	374		49	126	0		146	36		96	0
Queue Length 95th (ft)	26	513		70	164	0		#232	119		109	11
Internal Link Dist (ft)		101			233			221			256	
Turn Bay Length (ft)	75			175					100			
Base Capacity (vph)	549	887		318	870	670		340	652		478	685
Starvation Cap Reductn	0	0		0	0	0		0	0		0	0
Spillback Cap Reductn	0	0		0	0	0		0	0		0	0
Storage Cap Reductn	0	0		0	0	0		0	0		0	0
Reduced v/c Ratio	0.09	0.78		0.60	0.36	0.01		0.71	0.60		0.37	0.09

Intersection Summary
Area Type: Other
Cycle Length: 105
Actuated Cycle Length: 105
Offset: 0 (0%), Referenced to phase 2:NBSB, Start of Green
Natural Cycle: 105
Control Type: Pretimed
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 24.7 Intersection LOS: C
Intersection Capacity Utilization 103.3% ICU Level of Service G
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

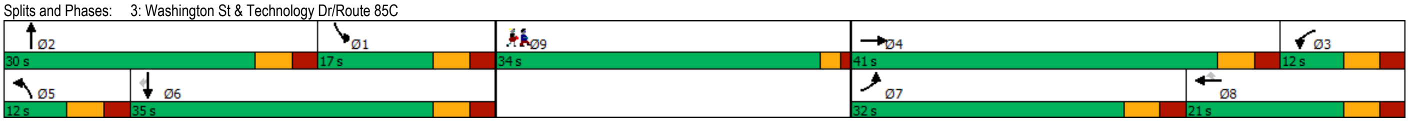
Splits and Phases: 2: Forest Ave & Main Street

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø9
Lane Configurations	↰↰	↑↱		↰	↑↑	↱	↰↰	↑↱		↰	↑↑	↱	
Traffic Volume (vph)	513	489	375	41	342	26	199	219	47	58	332	654	
Future Volume (vph)	513	489	375	41	342	26	199	219	47	58	332	654	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	350		0	230		215	300		0	215		175	
Storage Lanes	2		0	1		0	2		0	1		1	
Taper Length (ft)	150			25			200			25			
Lane Util. Factor	0.97	0.95	0.95	1.00	0.95	1.00	0.97	0.95	0.95	1.00	0.95	1.00	
Frt		0.935				0.850		0.974				0.850	
Flt Protected	0.950			0.950			0.950			0.950			
Satd. Flow (prot)	3367	3273	0	1805	3539	1538	3213	3336	0	1805	3471	1568	
Flt Permitted	0.950			0.950			0.950			0.950			
Satd. Flow (perm)	3367	3273	0	1805	3539	1538	3213	3336	0	1805	3471	1568	
Right Turn on Red			Yes			Yes			Yes			Yes	
Satd. Flow (RTOR)		140				195		17				711	
Link Speed (mph)		40			40			40			40		
Link Distance (ft)		654			348			535			467		
Travel Time (s)		11.1			5.9			9.1			8.0		
Peak Hour Factor	0.92	0.92	0.92	0.83	0.83	0.83	0.87	0.87	0.87	0.92	0.92	0.92	
Heavy Vehicles (%)	4%	4%	2%	0%	2%	5%	9%	4%	12%	0%	4%	3%	
Adj. Flow (vph)	558	532	408	49	412	31	229	252	54	63	361	711	
Shared Lane Traffic (%)													
Lane Group Flow (vph)	558	940	0	49	412	31	229	306	0	63	361	711	
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA		Prot	NA	Perm	
Protected Phases	7	4		3	8		5	2		1	6		9
Permitted Phases						8						6	
Detector Phase	7	4		3	8	8	5	2		1	6	6	
Switch Phase													
Minimum Initial (s)	6.0	10.0		6.0	10.0	10.0	6.0	10.0		6.0	10.0	10.0	1.0
Minimum Split (s)	12.0	16.0		12.0	16.0	16.0	12.0	16.0		12.0	35.0	35.0	34.0
Total Split (s)	32.0	41.0		12.0	21.0	21.0	12.0	30.0		17.0	35.0	35.0	34.0
Total Split (%)	23.9%	30.6%		9.0%	15.7%	15.7%	9.0%	22.4%		12.7%	26.1%	26.1%	25%
Maximum Green (s)	26.0	35.0		6.0	15.0	15.0	6.0	24.0		11.0	29.0	29.0	31.0
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	2.0
All-Red Time (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	
Total Lost Time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	
Lead/Lag	Lead	Lead		Lag	Lag	Lag	Lead	Lead		Lag	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0
Recall Mode	None	None		None	None	None	None	Min		None	Min	Min	None
Walk Time (s)											7.0	7.0	7.0
Flash Dont Walk (s)											22.0	22.0	24.0
Pedestrian Calls (#/hr)											0	0	0
Act Effct Green (s)	18.7	32.7		6.1	17.2	17.2	6.1	15.2		10.1	16.4	16.4	
Actuated g/C Ratio	0.23	0.40		0.07	0.21	0.21	0.07	0.18		0.12	0.20	0.20	
v/c Ratio	0.73	0.68		0.37	0.56	0.07	0.97	0.49		0.29	0.53	0.81	
Control Delay	36.6	21.9		48.7	34.5	0.3	94.2	34.4		37.8	32.7	10.7	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	
Total Delay	36.6	21.9		48.7	34.5	0.3	94.2	34.4		37.8	32.7	10.7	
LOS	D	C		D	C	A	F	C		D	C	B	
Approach Delay		27.4			33.8			60.0			19.2		
Approach LOS		C			C			E			B		
Queue Length 50th (ft)	137	180		24	97	0	61	74		30	89	0	
Queue Length 95th (ft)	219	309		63	167	0	#157	127		72	137	105	
Internal Link Dist (ft)		574			268			455			387		
Turn Bay Length (ft)	350			230		215	300			215		175	
Base Capacity (vph)	1072	1483		132	737	474	236	993		267	1233	1015	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	0	
Reduced v/c Ratio	0.52	0.63		0.37	0.56	0.07	0.97	0.31		0.24	0.29	0.70	

Intersection Summary

Area Type: Other
Cycle Length: 134
Actuated Cycle Length: 82.7
Natural Cycle: 130
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.97
Intersection Signal Delay: 30.5 Intersection LOS: C
Intersection Capacity Utilization 70.6% ICU Level of Service C
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Washington St & Technology Dr/Route 85C



Movement	EBL	EBT	WBT	WBR	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	128	435	383	9	2	40
Future Volume (Veh/h)	128	435	383	9	2	40
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.91	0.91	0.87	0.87	0.25	0.25
Hourly flow rate (vph)	141	478	440	10	8	160
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	450				1205	445
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	450				1205	445
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	87				96	74
cM capacity (veh/h)	1121				179	617

Direction, Lane #	EB 1	EB 2	WB 1	SW 1	SW 2
Volume Total	141	478	450	8	160
Volume Left	141	0	0	8	0
Volume Right	0	0	10	0	160
cSH	1121	1700	1700	179	617
Volume to Capacity	0.13	0.28	0.26	0.04	0.26
Queue Length 95th (ft)	11	0	0	3	26
Control Delay (s)	8.7	0.0	0.0	26.0	12.9
Lane LOS	A			D	B
Approach Delay (s)	2.0		0.0	13.5	
Approach LOS				B	

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	41.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	0	3	1	0	1	11	496	0	0	367	20
Future Volume (Veh/h)	5	0	3	1	0	1	11	496	0	0	367	20
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.25	0.92	0.25	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.80	0.80
Hourly flow rate (vph)	20	0	12	1	0	1	12	539	0	0	459	25
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1036	1034	472	1046	1047	539	484			539		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1036	1034	472	1046	1047	539	484			539		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	90	100	98	100	100	100	99			100		
cM capacity (veh/h)	210	229	596	200	226	542	1089			1029		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	20	12	2	551	484
Volume Left	20	0	1	12	0
Volume Right	0	12	1	0	25
cSH	210	596	293	1089	1700
Volume to Capacity	0.10	0.02	0.01	0.01	0.28
Queue Length 95th (ft)	8	2	1	1	0
Control Delay (s)	24.0	11.2	17.4	0.3	0.0
Lane LOS	C	B	C	A	
Approach Delay (s)	19.2		17.4	0.3	0.0
Approach LOS	C		C		

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	44.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	395	31	75	112	136	308
Future Volume (Veh/h)	395	31	75	112	136	308
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.94	0.94	0.91	0.91	0.87	0.87
Hourly flow rate (vph)	420	33	82	123	156	354
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	443	156	510			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	443	156	510			
tC, single (s)	6.4	6.3	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.4	2.2			
p0 queue free %	20	96	92			
cM capacity (veh/h)	524	874	1055			

Direction, Lane #	EB 1	EB 2	NB 1	SB 1	SB 2
Volume Total	420	33	205	156	354
Volume Left	420	0	82	0	0
Volume Right	0	33	0	0	354
cSH	524	874	1055	1700	1700
Volume to Capacity	0.80	0.04	0.08	0.09	0.21
Queue Length 95th (ft)	191	3	6	0	0
Control Delay (s)	34.0	9.3	3.9	0.0	0.0
Lane LOS	D	A	A		
Approach Delay (s)	32.2		3.9	0.0	
Approach LOS	D				

Intersection Summary			
Average Delay	13.2		
Intersection Capacity Utilization	49.1%	ICU Level of Service	A
Analysis Period (min)	15		

MOVEMENT SUMMARY

Site: 101 [Washington Street at Broad Street_Build AM (Site Folder: General)]

Site Category: (None)
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: Washington Street														
3u	U	8	14.3	9	14.3	0.333	6.4	LOS A	1.9	50.1	0.22	0.09	0.22	27.6
3a	L1	431	4.9	459	4.9	0.333	6.1	LOS A	2.0	50.5	0.22	0.09	0.22	28.1
8	T1	320	3.4	340	3.4	0.333	6.1	LOS A	2.0	50.5	0.22	0.09	0.22	31.5
18	R2	1	0.0	1	0.0	0.333	6.0	LOS A	2.0	50.5	0.22	0.09	0.22	24.0
Approach		760	4.4	809	4.4	0.333	6.1	LOS A	2.0	50.5	0.22	0.09	0.22	29.8
East: Gas Station Driveway														
1u	U	1	0.0	1	0.0	0.039	6.1	LOS A	0.1	3.4	0.59	0.54	0.59	5.6
1	L2	2	0.0	2	0.0	0.039	6.1	LOS A	0.1	3.4	0.59	0.54	0.59	28.2
16a	R1	9	0.0	10	0.0	0.039	6.1	LOS A	0.1	3.4	0.59	0.54	0.59	28.9
16	R2	11	0.0	12	0.0	0.039	6.1	LOS A	0.1	3.4	0.59	0.54	0.59	29.5
Approach		23	0.0	25	0.0	0.039	6.1	LOS A	0.1	3.4	0.59	0.54	0.59	28.8
North: Broad Street														
7u	U	1	0.0	1	0.0	0.699	16.8	LOS C	8.0	203.9	0.79	1.11	1.55	29.4
7	L2	1	0.0	1	0.0	0.699	16.8	LOS C	8.0	203.9	0.79	1.11	1.55	21.3
4	T1	485	2.6	591	2.6	0.699	16.9	LOS C	8.0	203.9	0.79	1.11	1.55	27.0
14b	R3	79	6.2	96	6.2	0.128	6.1	LOS A	0.5	12.0	0.52	0.45	0.52	30.1
Approach		566	3.1	690	3.1	0.699	15.4	LOS C	8.0	203.9	0.75	1.02	1.40	27.4
NorthWest: Washington Street														
7ux	U	1	0.0	1	0.0	0.067	6.2	LOS A	0.2	6.9	0.62	0.54	0.62	28.9
7bx	L3	26	27.3	28	27.3	0.067	7.6	LOS A	0.2	6.9	0.62	0.54	0.62	29.4
7ax	L1	7	3.1	8	3.1	0.067	6.3	LOS A	0.2	6.9	0.62	0.54	0.62	21.8
14ax	R1	602	0.0	654	0.0	0.348	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	36.8
Approach		636	1.2	691	1.2	0.348	0.5	LOS A	0.2	6.9	0.03	0.03	0.03	36.0
All Vehicles		1985	2.9	2215	2.9	0.699	7.2	LOS A	8.0	203.9	0.33	0.36	0.53	30.1

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

QUEUE ANALYSIS

Site: 101 [Washington Street at Broad Street_Build AM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Queues (Distance)

Lane Number	Contin. Lane	Deg. Satn v/c	Prog. Factor (Queue)	Overflow Queue (ft)	Back of Queue (ft) Av.	Back of Queue (ft) 95%	Queue at Start of Green (ft) Av.	Queue at Start of Green (ft) 95%	Cycle Average Queue (ft) Av.	Cycle Average Queue (ft) 95%	Queue Storage Ratio Av.	Queue Storage Ratio 95%	Prob. Block. %	Prob. SL Ov. %	Ov. Lane No.
South: Washington Street															
Lane 1		0.333	1.000	0.0	20.1	50.1	NA	NA	17.8	32.3	0.03	0.06	0.0	NA	NA
Lane 2		0.333	1.000	0.0	20.3	50.5	NA	NA	17.7	32.1	0.03	0.06	0.0	NA	NA
Approach		0.333			20.3	50.5	NA	NA	17.8	32.3	0.03	0.06			
East: Gas Station Driveway															
Lane 1		0.039	1.000	0.0	1.4	3.4	NA	NA	1.1	1.9	0.14	0.34	0.0	NA	NA
Approach		0.039			1.4	3.4	NA	NA	1.1	1.9	0.14	0.34			
North: Broad Street															
Lane 1		0.699	1.000	30.2	82.1	203.9	NA	NA	71.3	129.3	0.04	0.10	0.0	NA	NA
Lane 2		0.128	1.000	0.0	4.8	12.0	NA	NA	4.3	7.8	0.10	0.24	NA	0.0	1
Approach		0.699			82.1	203.9	NA	NA	71.3	129.3	0.04	0.10			
NorthWest: Washington Street															
Lane 1		0.067	1.000	0.0	2.8	6.9	NA	NA	2.2	4.0	0.00	0.01	0.0	NA	NA
Lane 2	Y	0.348	1.000	0.0	0.0	0.0	NA	NA	0.0	0.0	0.00	0.00	0.0	NA	NA
Approach		0.348			2.8	6.9	NA	NA	2.2	4.0	0.00	0.01			
Intersection		0.699			82.1	203.9	NA	NA	71.3	129.3	0.14	0.34			

Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.

Lane Queues (Vehicles)

Lane Number	Contin. Lane	Deg. Satn v/c	Prog. Factor (Queue)	Overflow Queue (veh)	Back of Queue (veh) Av.	Back of Queue (veh) 95%	Queue at Start of Green (veh) Av.	Queue at Start of Green (veh) 95%	Cycle Average Queue (veh) Av.	Cycle Average Queue (veh) 95%	Queue Storage Ratio Av.	Queue Storage Ratio 95%	Prob. Block. %	Prob. SL Ov. %	Ov. Lane No.
South: Washington Street															
Lane 1		0.333	1.000	0.0	0.8	1.9	NA	NA	0.7	1.2	0.03	0.06	0.0	NA	NA
Lane 2		0.333	1.000	0.0	0.8	2.0	NA	NA	0.7	1.2	0.03	0.06	0.0	NA	NA
Approach		0.333			0.8	2.0	NA	NA	0.7	1.2	0.03	0.06			
East: Gas Station Driveway															
Lane 1		0.039	1.000	0.0	0.1	0.1	NA	NA	0.0	0.1	0.14	0.34	0.0	NA	NA
Approach		0.039			0.1	0.1	NA	NA	0.0	0.1	0.14	0.34			
North: Broad Street															
Lane 1		0.699	1.000	1.2	3.2	8.0	NA	NA	2.8	5.1	0.04	0.10	0.0	NA	NA
Lane 2		0.128	1.000	0.0	0.2	0.5	NA	NA	0.2	0.3	0.10	0.24	NA	0.0	1
Approach		0.699			3.2	8.0	NA	NA	2.8	5.1	0.04	0.10			
NorthWest: Washington Street															
Lane 1		0.067	1.000	0.0	0.1	0.2	NA	NA	0.1	0.1	0.00	0.01	0.0	NA	NA
Lane 2	Y	0.348	1.000	0.0	0.0	0.0	NA	NA	0.0	0.0	0.00	0.00	0.0	NA	NA
Approach		0.348			0.1	0.2	NA	NA	0.1	0.1	0.00	0.01			

Intersection	0.699		3.2	8.0	NA	NA	2.8	5.1	0.14	0.34

Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.

Continuous Lane Performance

Lane Number	Deg. Satn v/c	Unint. Speed mph	Unint. Travel Delay sec	Hdwy sec	Spacing ft	Aver. Vehicle Length ft	Occup. Time sec	Space Time sec	Space Occup. Ratio %	Time Occup. Ratio %	Density veh/mi	Density pc/mi	LOS (Density Method)
South: Washington Street													
This approach does not have any continuous lanes													
East: Gas Station Driveway													
This approach does not have any continuous lanes													
North: Broad Street													
This approach does not have any continuous lanes													
NorthWest: Washington Street													
Lane 2	0.348	39.9	0.1	5.50	321.6	17.0	0.68	4.82	5.3	12.4	16.4	16.4	LOS B

Midblock Effective Detection Zone Length = 7 ft

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	71	57	309	39	105	493
Future Volume (Veh/h)	71	57	309	39	105	493
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	77	62	336	42	114	536
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1121	357			378	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1121	357			378	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	63	91			90	
cM capacity (veh/h)	206	687			1180	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	139	378	650
Volume Left	77	0	114
Volume Right	62	42	0
cSH	300	1700	1180
Volume to Capacity	0.46	0.22	0.10
Queue Length 95th (ft)	58	0	8
Control Delay (s)	27.0	0.0	2.4
Lane LOS	D		A
Approach Delay (s)	27.0	0.0	2.4
Approach LOS	D		

Intersection Summary			
Average Delay	4.6		
Intersection Capacity Utilization	67.8%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	114	36	18	439	343	125
Future Volume (Veh/h)	114	36	18	439	343	125
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	124	39	20	477	373	136
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		2				
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	958	441	509			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	958	441	509			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	56	94	98			
cM capacity (veh/h)	280	616	1056			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	163	497	509
Volume Left	124	20	0
Volume Right	39	0	136
cSH	368	1056	1700
Volume to Capacity	0.44	0.02	0.30
Queue Length 95th (ft)	55	1	0
Control Delay (s)	23.7	0.6	0.0
Lane LOS	C	A	
Approach Delay (s)	23.7	0.6	0.0
Approach LOS	C		

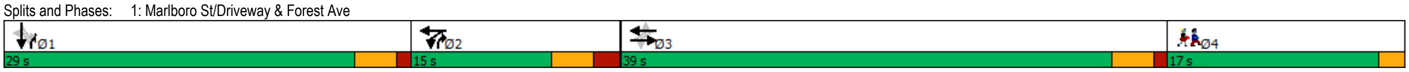
Intersection Summary			
Average Delay	3.5		
Intersection Capacity Utilization	50.7%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø4
Lane Configurations													
Traffic Volume (vph)	0	125	118	417	165	0	148	0	350	24	32	15	
Future Volume (vph)	0	125	118	417	165	0	148	0	350	24	32	15	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	0		0	185		0	0		180	0		0	
Storage Lanes	0		0	1		0	1		1	0		0	
Taper Length (ft)	25			25			25			25			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.935							0.850		0.971		
Flt Protected				0.950			0.950				0.983		
Satd. Flow (prot)	0	1734	0	1787	1863	0	1770	0	1583	0	1814	0	
Flt Permitted				0.492			0.741				0.983		
Satd. Flow (perm)	0	1734	0	926	1863	0	1380	0	1583	0	1814	0	
Right Turn on Red			Yes			Yes			Yes			Yes	
Satd. Flow (RTOR)		52							380		13		
Link Speed (mph)		35			35			35			35		
Link Distance (ft)		268			525			555			135		
Travel Time (s)		5.2			10.2			10.8			2.6		
Peak Hour Factor	0.83	0.83	0.83	0.86	0.86	0.86	0.92	0.92	0.92	0.90	0.90	0.90	
Heavy Vehicles (%)	0%	1%	4%	1%	2%	0%	2%	0%	2%	0%	0%	0%	
Adj. Flow (vph)	0	151	142	485	192	0	161	0	380	27	36	17	
Shared Lane Traffic (%)													
Lane Group Flow (vph)	0	293	0	485	192	0	161	0	380	0	80	0	
Turn Type		NA		D.P+P	NA		D.Pm		pt+ov	Perm	NA		
Protected Phases		3		2	2 3				1 2		1		4
Permitted Phases	3			3			1			1			
Detector Phase	3	3		2	2 3		1		1 2	1	1		
Switch Phase													
Minimum Initial (s)	35.0	35.0		10.0			25.0			25.0	25.0		7.0
Minimum Split (s)	39.0	39.0		15.0			29.0			29.0	29.0		17.0
Total Split (s)	39.0	39.0		15.0			29.0			29.0	29.0		17.0
Total Split (%)	39.0%	39.0%		15.0%			29.0%			29.0%	29.0%		17%
Maximum Green (s)	35.0	35.0		10.0			25.0			25.0	25.0		15.0
Yellow Time (s)	3.0	3.0		3.0			3.0			3.0	3.0		2.0
All-Red Time (s)	1.0	1.0		2.0			1.0			1.0	1.0		0.0
Lost Time Adjust (s)		0.0		0.0			0.0				0.0		
Total Lost Time (s)		4.0		5.0			4.0				4.0		
Lead/Lag	Lead	Lead		Lag			Lead			Lead	Lead		Lag
Lead-Lag Optimize?	Yes	Yes		Yes			Yes			Yes	Yes		Yes
Vehicle Extension (s)	3.0	3.0		3.0			3.0			3.0	3.0		3.0
Recall Mode	Max	Max		Min			Min			Min	Min		None
Walk Time (s)													7.0
Flash Dont Walk (s)													8.0
Pedestrian Calls (#/hr)													0
Act Effct Green (s)		35.0		44.0	49.0		25.0		40.0		25.0		
Actuated g/C Ratio		0.42		0.53	0.59		0.30		0.48		0.30		
v/c Ratio		0.39		0.82	0.17		0.39		0.40		0.14		
Control Delay		15.2		25.2	8.3		26.4		2.8		19.0		
Queue Delay		0.0		0.0	0.0		0.0		0.0		0.0		
Total Delay		15.2		25.2	8.3		26.4		2.8		19.0		
LOS		B		C	A		C		A		B		
Approach Delay		15.2			20.4			9.8			19.0		
Approach LOS		B			C			A			B		
Queue Length 50th (ft)		82		130	42		66		0		25		
Queue Length 95th (ft)		128		#207	68		120		43		57		
Internal Link Dist (ft)		188			445			475			55		
Turn Bay Length (ft)				185					180				
Base Capacity (vph)		761		594	1099		415		959		555		
Starvation Cap Reductn		0		0	0		0		0		0		
Spillback Cap Reductn		0		0	0		0		0		0		
Storage Cap Reductn		0		0	0		0		0		0		
Reduced v/c Ratio		0.39		0.82	0.17		0.39		0.40		0.14		

Intersection Summary

Area Type: Other
Cycle Length: 100
Actuated Cycle Length: 83
Natural Cycle: 100
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 15.8 Intersection LOS: B
Intersection Capacity Utilization 83.9% ICU Level of Service E
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Marlboro St/Driveway & Forest Ave



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	64	289	2	377	610	6	143	127	177	5	130	64
Future Volume (vph)	64	289	2	377	610	6	143	127	177	5	130	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	75		0	175		0	0		100	65		0
Storage Lanes	1		0	1		1	0		1	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.999				0.850			0.850			0.850
Flt Protected	0.950			0.950				0.974			0.998	
Satd. Flow (prot)	1805	1843	0	1770	1863	1615	0	1824	1538	0	1896	1553
Flt Permitted	0.187			0.479				0.719			0.985	
Satd. Flow (perm)	355	1843	0	892	1863	1615	0	1346	1538	0	1872	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						83			154			74
Link Speed (mph)		40			40			35			35	
Link Distance (ft)		181			313			301			336	
Travel Time (s)		3.1			5.3			5.9			6.5	
Peak Hour Factor	0.87	0.87	0.87	0.90	0.90	0.90	0.90	0.90	0.90	0.87	0.87	0.87
Heavy Vehicles (%)	0%	3%	0%	2%	2%	0%	1%	2%	5%	0%	0%	4%
Adj. Flow (vph)	74	332	2	419	678	7	159	141	197	6	149	74
Shared Lane Traffic (%)												
Lane Group Flow (vph)	74	334	0	419	678	7	0	300	197	0	155	74
Turn Type	pm+pt	NA		pm+pt	NA	Prot	Perm	NA	Prot	Perm	NA	pt+ov
Protected Phases	3	1		3	1	1		2	2		2	2 3
Permitted Phases	1			1			2			2		
Minimum Split (s)	15.0	56.0		15.0	56.0	56.0	34.0	34.0	34.0	34.0	34.0	
Total Split (s)	15.0	56.0		15.0	56.0	56.0	34.0	34.0	34.0	34.0	34.0	
Total Split (%)	14.3%	53.3%		14.3%	53.3%	53.3%	32.4%	32.4%	32.4%	32.4%	32.4%	
Maximum Green (s)	10.0	51.0		10.0	51.0	51.0	28.0	28.0	28.0	28.0	28.0	
Yellow Time (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0	5.0		6.0	6.0		6.0	
Lead/Lag		Lead			Lead	Lead	Lag	Lag	Lag	Lag	Lag	
Lead-Lag Optimize?		Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Act Effct Green (s)	61.0	51.0		61.0	51.0	51.0		28.0	28.0		28.0	43.0
Actuated g/C Ratio	0.58	0.49		0.58	0.49	0.49		0.27	0.27		0.27	0.41
v/c Ratio	0.22	0.37		0.70	0.75	0.01		0.84	0.38		0.31	0.11
Control Delay	9.3	18.5		18.4	28.3	0.0		58.0	10.7		32.9	5.0
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Delay	9.3	18.5		18.4	28.3	0.0		58.0	10.7		32.9	5.0
LOS	A	B		B	C	A		E	B		C	A
Approach Delay		16.8			24.3			39.3			23.9	
Approach LOS		B			C			D			C	
Queue Length 50th (ft)	18	136		126	355	0		190	22		83	0
Queue Length 95th (ft)	34	195		185	506	0		#338	81		135	26
Internal Link Dist (ft)		101			233			221			256	
Turn Bay Length (ft)	75			175					100			
Base Capacity (vph)	344	895		601	904	827		358	523		499	679
Starvation Cap Reductn	0	0		0	0	0		0	0		0	0
Spillback Cap Reductn	0	0		0	0	0		0	0		0	0
Storage Cap Reductn	0	0		0	0	0		0	0		0	0
Reduced v/c Ratio	0.22	0.37		0.70	0.75	0.01		0.84	0.38		0.31	0.11

Intersection Summary

Area Type: Other
Cycle Length: 105
Actuated Cycle Length: 105
Offset: 0 (0%), Referenced to phase 2:NBSB, Start of Green
Natural Cycle: 105
Control Type: Pretimed
Maximum v/c Ratio: 0.84
Intersection Signal Delay: 26.2 Intersection LOS: C
Intersection Capacity Utilization 128.4% ICU Level of Service H
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

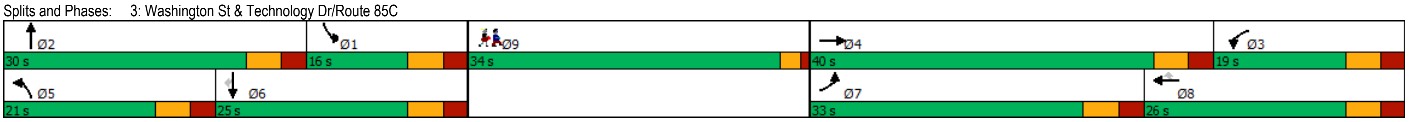
Splits and Phases: 2: Forest Ave & Main Street

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø9
Lane Configurations													
Traffic Volume (vph)	628	376	271	76	446	74	345	510	74	77	421	599	
Future Volume (vph)	628	376	271	76	446	74	345	510	74	77	421	599	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	350		0	230		215	300		0	215		175	
Storage Lanes	2		0	1		0	2		0	1		1	
Taper Length (ft)	150			25			200			25			
Lane Util. Factor	0.97	0.95	0.95	1.00	0.95	1.00	0.97	0.95	0.95	1.00	0.95	1.00	
Frt		0.937				0.850		0.981				0.850	
Flt Protected	0.950			0.950			0.950			0.950			
Satd. Flow (prot)	3467	3363	0	1805	3574	1615	3502	3532	0	1805	3539	1583	
Flt Permitted	0.950			0.950			0.950			0.950			
Satd. Flow (perm)	3467	3363	0	1805	3574	1615	3502	3532	0	1805	3539	1583	
Right Turn on Red			Yes			Yes			Yes			Yes	
Satd. Flow (RTOR)		124				188		10				631	
Link Speed (mph)		40			40			40			40		
Link Distance (ft)		654			348			535			467		
Travel Time (s)		11.1			5.9			9.1			8.0		
Peak Hour Factor	0.90	0.90	0.90	0.82	0.82	0.82	0.95	0.95	0.95	0.95	0.95	0.95	
Heavy Vehicles (%)	1%	1%	0%	0%	1%	0%	0%	0%	2%	0%	2%	2%	
Adj. Flow (vph)	698	418	301	93	544	90	363	537	78	81	443	631	
Shared Lane Traffic (%)													
Lane Group Flow (vph)	698	719	0	93	544	90	363	615	0	81	443	631	
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA		Prot	NA	Perm	
Protected Phases	7	4		3	8		5	2		1	6		9
Permitted Phases						8						6	
Detector Phase	7	4		3	8	8	5	2		1	6	6	
Switch Phase													
Minimum Initial (s)	6.0	10.0		6.0	10.0	10.0	6.0	10.0		6.0	10.0	10.0	1.0
Minimum Split (s)	12.0	16.0		12.0	16.0	16.0	12.0	16.0		12.0	25.0	25.0	34.0
Total Split (s)	33.0	40.0		19.0	26.0	26.0	21.0	30.0		16.0	25.0	25.0	34.0
Total Split (%)	23.7%	28.8%		13.7%	18.7%	18.7%	15.1%	21.6%		11.5%	18.0%	18.0%	24%
Maximum Green (s)	27.0	34.0		13.0	20.0	20.0	15.0	24.0		10.0	19.0	19.0	31.0
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	2.0
All-Red Time (s)	2.5	2.5		2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	
Total Lost Time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	
Lead/Lag	Lead	Lead		Lag	Lag	Lag	Lead	Lead		Lag	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0
Recall Mode	None	None		None	None	None	None	Min		None	Min	Min	None
Walk Time (s)											7.0	7.0	7.0
Flash Dont Walk (s)											12.0	12.0	24.0
Pedestrian Calls (#/hr)											5	5	5
Act Effct Green (s)	27.4	31.5		18.8	20.3	20.3	15.0	26.9		9.3	18.5	18.5	
Actuated g/C Ratio	0.25	0.28		0.17	0.18	0.18	0.14	0.24		0.08	0.17	0.17	
v/c Ratio	0.82	0.69		0.30	0.83	0.20	0.77	0.71		0.54	0.75	0.80	
Control Delay	49.3	36.1		46.3	56.8	1.0	59.0	45.3		65.2	54.0	12.4	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	
Total Delay	49.3	36.1		46.3	56.8	1.0	59.0	45.3		65.2	54.0	12.4	
LOS	D	D		D	E	A	E	D		E	D	B	
Approach Delay		42.6			48.5			50.4			32.1		
Approach LOS		D			D			D			C		
Queue Length 50th (ft)	225	206		51	185	0	121	200		52	148	0	
Queue Length 95th (ft)	#474	347		129	#344	0	#272	#424		#141	#311	142	
Internal Link Dist (ft)		574			268			455			387		
Turn Bay Length (ft)	350			230		215	300			215		175	
Base Capacity (vph)	855	1253		331	653	448	480	863		164	614	796	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	0	
Reduced v/c Ratio	0.82	0.57		0.28	0.83	0.20	0.76	0.71		0.49	0.72	0.79	

Intersection Summary

Area Type: Other
Cycle Length: 139
Actuated Cycle Length: 110.9
Natural Cycle: 140
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 42.5 Intersection LOS: D
Intersection Capacity Utilization 74.3% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Washington St & Technology Dr/Route 85C



Movement	EBL	EBT	WBT	WBR	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	54	451	479	3	10	136
Future Volume (Veh/h)	54	451	479	3	10	136
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.86	0.86	0.91	0.91	0.63	0.63
Hourly flow rate (vph)	63	524	526	3	16	216
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	529				1178	528
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	529				1178	528
tC, single (s)	4.1				6.4	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.4
p0 queue free %	94				92	60
cM capacity (veh/h)	1048				200	533

Direction, Lane #	EB 1	EB 2	WB 1	SW 1	SW 2
Volume Total	63	524	529	16	216
Volume Left	63	0	0	16	0
Volume Right	0	0	3	0	216
cSH	1048	1700	1700	200	533
Volume to Capacity	0.06	0.31	0.31	0.08	0.40
Queue Length 95th (ft)	5	0	0	6	49
Control Delay (s)	8.7	0.0	0.0	24.5	16.3
Lane LOS	A			C	C
Approach Delay (s)	0.9		0.0	16.8	
Approach LOS				C	

Intersection Summary			
Average Delay	3.3		
Intersection Capacity Utilization	42.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	21	0	11	0	0	0	3	477	0	0	542	6
Future Volume (Veh/h)	21	0	11	0	0	0	3	477	0	0	542	6
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.50	0.92	0.50	0.92	0.92	0.92	0.91	0.91	0.92	0.92	0.85	0.85
Hourly flow rate (vph)	42	0	22	0	0	0	3	524	0	0	638	7
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1172	1172	642	1194	1175	524	645			524		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1172	1172	642	1194	1175	524	645			524		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	75	100	95	100	100	100	100			100		
cM capacity (veh/h)	171	192	478	156	191	553	950			1043		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	42	22	0	527	645
Volume Left	42	0	0	3	0
Volume Right	0	22	0	0	7
cSH	171	478	1700	950	1700
Volume to Capacity	0.25	0.05	0.01	0.00	0.38
Queue Length 95th (ft)	23	4	0	0	0
Control Delay (s)	32.9	12.9	0.0	0.1	0.0
Lane LOS	D	B	A	A	
Approach Delay (s)	26.0		0.0	0.1	0.0
Approach LOS	D		A		

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	38.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	344	104	72	170	160	393
Future Volume (Veh/h)	344	104	72	170	160	393
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	374	113	81	191	180	442
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	533	180	622			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	533	180	622			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	20	87	92			
cM capacity (veh/h)	466	865	959			

Direction, Lane #	EB 1	EB 2	NB 1	SB 1	SB 2
Volume Total	374	113	272	180	442
Volume Left	374	0	81	0	0
Volume Right	0	113	0	0	442
cSH	466	865	959	1700	1700
Volume to Capacity	0.80	0.13	0.08	0.11	0.26
Queue Length 95th (ft)	185	11	7	0	0
Control Delay (s)	37.3	9.8	3.3	0.0	0.0
Lane LOS	E	A	A		
Approach Delay (s)	30.9		3.3	0.0	
Approach LOS	D				

Intersection Summary			
Average Delay	11.5		
Intersection Capacity Utilization	50.4%	ICU Level of Service	A
Analysis Period (min)	15		

MOVEMENT SUMMARY

Site: 101 [Washington Street at Broad Street_Build PM (Site Folder: General)]

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: Washington Street														
3u	U	9	0.0	10	0.0	0.599	10.3	LOS B	5.3	133.1	0.43	0.22	0.43	26.3
3a	L1	783	0.5	880	0.5	0.599	10.3	LOS B	5.3	133.1	0.43	0.22	0.43	26.3
8	T1	502	1.5	564	1.5	0.599	10.3	LOS B	5.2	131.8	0.43	0.22	0.43	29.4
18	R2	1	0.0	1	0.0	0.599	10.3	LOS B	5.2	131.8	0.43	0.22	0.43	20.6
Approach		1295	0.9	1455	0.9	0.599	10.3	LOS B	5.3	133.1	0.43	0.22	0.43	27.7
East: Gas Station Driveway														
1u	U	1	0.0	1	0.0	0.061	12.4	LOS B	0.2	5.2	0.79	0.79	0.79	4.1
1	L2	2	0.0	2	0.0	0.061	12.4	LOS B	0.2	5.2	0.79	0.79	0.79	21.8
16a	R1	7	0.0	8	0.0	0.061	12.4	LOS B	0.2	5.2	0.79	0.79	0.79	23.1
16	R2	8	0.0	9	0.0	0.061	12.4	LOS B	0.2	5.2	0.79	0.79	0.79	26.0
Approach		18	0.0	20	0.0	0.061	12.4	LOS B	0.2	5.2	0.79	0.79	0.79	24.2
North: Broad Street														
7u	U	1	0.0	1	0.0	0.921	46.6	LOS E	14.4	363.8	0.98	1.76	3.26	22.5
7	L2	1	0.0	1	0.0	0.921	46.6	LOS E	14.4	363.8	0.98	1.76	3.26	14.9
4	T1	481	1.0	534	1.0	0.921	46.6	LOS E	14.4	363.8	0.98	1.76	3.26	19.3
14b	R3	127	3.2	141	3.2	0.278	11.2	LOS B	1.1	28.1	0.70	0.71	0.72	28.2
Approach		610	1.5	678	1.5	0.921	39.3	LOS E	14.4	363.8	0.92	1.54	2.73	20.7
NorthWest: Washington Street														
7ux	U	11	10.0	12	10.0	0.109	6.8	LOS A	0.5	12.4	0.63	0.55	0.63	28.2
7bx	L3	53	2.4	56	2.4	0.109	6.4	LOS A	0.5	12.4	0.63	0.55	0.63	29.9
7ax	L1	7	2.4	7	2.4	0.109	6.4	LOS A	0.5	12.4	0.63	0.55	0.63	22.1
14ax	R1	687	0.0	723	0.0	0.384	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	36.8
Approach		758	0.3	798	0.3	0.384	0.7	LOS A	0.5	12.4	0.06	0.05	0.06	35.5
All Vehicles		2681	0.9	2950	0.9	0.921	14.3	LOS B	14.4	363.8	0.45	0.48	0.86	26.5

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

QUEUE ANALYSIS

Site: 101 [Washington Street at Broad Street_Build PM (Site Folder: General)]

Site Category: (None)
Roundabout

Lane Queues (Distance)

Lane Number	Contin. Lane	Deg. Satn v/c	Prog. Factor (Queue)	Overflow Queue (ft)	Back of Queue (ft) Av.	Back of Queue (ft) 95%	Queue at Start of Green (ft) Av.	Queue at Start of Green (ft) 95%	Cycle Average Queue (ft) Av.	Cycle Average Queue (ft) 95%	Queue Storage Ratio Av.	Queue Storage Ratio 95%	Prob. Block. %	Prob. SL Ov. %	Ov. Lane No.
South: Washington Street															
Lane 1		0.599	1.000	0.0	53.5	133.1	NA	NA	52.3	94.9	0.07	0.17	0.0	NA	NA
Lane 2		0.599	1.000	0.0	53.0	131.8	NA	NA	52.5	95.3	0.07	0.16	0.0	NA	NA
Approach		0.599			53.5	133.1	NA	NA	52.5	95.3	0.07	0.17			
East: Gas Station Driveway															
Lane 1		0.061	1.000	0.0	2.1	5.2	NA	NA	1.7	3.1	0.21	0.52	0.0	NA	NA
Approach		0.061			2.1	5.2	NA	NA	1.7	3.1	0.21	0.52			
North: Broad Street															
Lane 1		0.921	1.000	85.6	146.4	363.8	NA	NA	175.2	317.9	0.07	0.18	0.0	NA	NA
Lane 2		0.278	1.000	0.2	11.3	28.1	NA	NA	11.3	20.4	0.23	0.56	NA	0.0	1
Approach		0.921			146.4	363.8	NA	NA	175.2	317.9	0.07	0.18			
NorthWest: Washington Street															
Lane 1		0.109	1.000	0.0	5.0	12.4	NA	NA	3.5	6.3	0.00	0.01	0.0	NA	NA
Lane 2	Y	0.384	1.000	0.0	0.0	0.0	NA	NA	0.0	0.0	0.00	0.00	0.0	NA	NA
Approach		0.384			5.0	12.4	NA	NA	3.5	6.3	0.00	0.01			
Intersection		0.921			146.4	363.8	NA	NA	175.2	317.9	0.21	0.52			

Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.

Lane Queues (Vehicles)

Lane Number	Contin. Lane	Deg. Satn v/c	Prog. Factor (Queue)	Overflow Queue (veh)	Back of Queue (veh) Av.	Back of Queue (veh) 95%	Queue at Start of Green (veh) Av.	Queue at Start of Green (veh) 95%	Cycle Average Queue (veh) Av.	Cycle Average Queue (veh) 95%	Queue Storage Ratio Av.	Queue Storage Ratio 95%	Prob. Block. %	Prob. SL Ov. %	Ov. Lane No.
South: Washington Street															
Lane 1		0.599	1.000	0.0	2.1	5.3	NA	NA	2.1	3.8	0.07	0.17	0.0	NA	NA
Lane 2		0.599	1.000	0.0	2.1	5.2	NA	NA	2.1	3.8	0.07	0.16	0.0	NA	NA
Approach		0.599			2.1	5.3	NA	NA	2.1	3.8	0.07	0.17			
East: Gas Station Driveway															
Lane 1		0.061	1.000	0.0	0.1	0.2	NA	NA	0.1	0.1	0.21	0.52	0.0	NA	NA
Approach		0.061			0.1	0.2	NA	NA	0.1	0.1	0.21	0.52			
North: Broad Street															
Lane 1		0.921	1.000	3.4	5.8	14.4	NA	NA	7.0	12.6	0.07	0.18	0.0	NA	NA
Lane 2		0.278	1.000	0.0	0.4	1.1	NA	NA	0.4	0.8	0.23	0.56	NA	0.0	1
Approach		0.921			5.8	14.4	NA	NA	7.0	12.6	0.07	0.18			
NorthWest: Washington Street															
Lane 1		0.109	1.000	0.0	0.2	0.5	NA	NA	0.1	0.2	0.00	0.01	0.0	NA	NA
Lane 2	Y	0.384	1.000	0.0	0.0	0.0	NA	NA	0.0	0.0	0.00	0.00	0.0	NA	NA
Approach		0.384			0.2	0.5	NA	NA	0.1	0.2	0.00	0.01			

Intersection	0.921	5.8	14.4	NA	NA	7.0	12.6	0.21	0.52

Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.

Continuous Lane Performance

Lane Number	Deg. Satn v/c	Unint. Speed mph	Unint. Travel Delay sec	Hdwy sec	Spacing ft	Aver. Vehicle Length ft	Occup. Time sec	Space Time sec	Space Occup. Ratio %	Time Occup. Ratio %	Density veh/mi	Density pc/mi	LOS (Density Method)
South: Washington Street													
This approach does not have any continuous lanes													
East: Gas Station Driveway													
This approach does not have any continuous lanes													
North: Broad Street													
This approach does not have any continuous lanes													
NorthWest: Washington Street													
Lane 2	0.384	39.8	0.1	4.98	290.8	17.0	0.68	4.29	5.8	13.7	18.2	18.2	LOS C

Midblock Effective Detection Zone Length = 7 ft

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	77	132	492	66	90	529
Future Volume (Veh/h)	77	132	492	66	90	529
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	84	143	535	72	98	575
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1342	571			607	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1342	571			607	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	44	73			90	
cM capacity (veh/h)	151	520			971	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	227	607	673
Volume Left	84	0	98
Volume Right	143	72	0
cSH	273	1700	971
Volume to Capacity	0.83	0.36	0.10
Queue Length 95th (ft)	170	0	8
Control Delay (s)	60.1	0.0	2.5
Lane LOS	F		A
Approach Delay (s)	60.1	0.0	2.5
Approach LOS	F		

Intersection Summary			
Average Delay	10.2		
Intersection Capacity Utilization	85.1%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	107	41	38	419	498	146
Future Volume (Veh/h)	107	41	38	419	498	146
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	116	45	41	455	541	159
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		2				
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1158	620	700			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1158	620	700			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	44	91	95			
cM capacity (veh/h)	207	488	897			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	161	496	700
Volume Left	116	41	0
Volume Right	45	0	159
cSH	287	897	1700
Volume to Capacity	0.56	0.05	0.41
Queue Length 95th (ft)	80	4	0
Control Delay (s)	34.3	1.3	0.0
Lane LOS	D	A	
Approach Delay (s)	34.3	1.3	0.0
Approach LOS	D		

Intersection Summary			
Average Delay	4.5		
Intersection Capacity Utilization	66.1%	ICU Level of Service	C
Analysis Period (min)	15		

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Attachment F

Environmental Justice

ATTACHMENT F ENVIRONMENTAL JUSTICE

This report addresses the MEPA Public Involvement Protocol for Environmental Justice Populations (the "EJ Involvement Protocol") and the MEPA Interim Protocol for Analysis of Project Impacts on Environmental Justice Populations (the "EJ Analysis Protocol"), both with an effective date of January 1, 2022, and follows the applicable sections of the new protocols.

The Project is expected to result in greater than 150 daily diesel truck trips and therefore requires an analysis of EJ populations within a 5-mile radius, which will henceforth be described as the designated geographic area ("DGA"). This chapter provides historical or existing sources of environmental pollution in the area, including an evaluation of vulnerable health criteria, potential sources of pollution, and an evaluation of climate change adaptation.

A discussion of the nature and severity of impacts is provided herein. This section addresses the expectation that trucks will mainly use the regional roadway network, greatly limiting travel through residential areas, and provides a qualitative discussion of air quality impacts from diesel trucks. The evaluation of air emissions impacts from diesel trucks concludes that the magnitude of impact in the residential EJ areas is very small, and the highest concentrations of air pollutants (which are also small) would occur in the non-residential EJ areas.

F.1 Designated Geographic Area

MEPA has classified areas of Massachusetts regarding whether they meet the criteria of an EJ Population by using the United States Census data to determine whether a block group meets one or more of the following criteria:

1. The annual median household income is not more than 65% of the statewide annual median household income;
2. Minority groups comprise 40% or more of the population;
3. 25% or more of households lack English language proficiency;
4. Minority groups comprise 25% or more of the population and the annual median household income of the municipality in which the neighborhood is located does not exceed 150% of the statewide annual median household income; or
5. The Secretary of Energy and Environmental Affairs has determined that a particular neighborhood should be designated as an EJ population.

Table F-1 lists the identified EJ Block Groups and their characteristics within one and five miles of the Project.

Table F-1 EJ Block Groups

		Municipality	Minority	Income	English Isolation
	Within 1 Mile				
Block Group 2	Census Tract 3224	Hudson	Yes	No	No
Block Group 3	Census Tract 3216	Marlborough	Yes	No	No
	Within 5 Miles				
Block Group 1	Census Tract 3216	Marlborough	Yes	No	No
Block Group 1	Census Tract 3213	Marlborough	Yes	No	No
Block Group 2	Census Tract 3211	Marlborough	Yes	No	No
Block Group 2	Census Tract 3212	Marlborough	Yes	No	No
Block Group 2	Census Tract 3213	Marlborough	Yes	No	No
Block Group 2	Census Tract 3215	Marlborough	Yes	Yes	Yes
Block Group 2	Census Tract 3214	Marlborough	Yes	No	No
Block Group 3	Census Tract 3212	Marlborough	Yes	No	No
Block Group 3	Census Tract 3213	Marlborough	Yes	Yes	Yes
Block Group 4	Census Tract 3216	Marlborough	Yes	No	No
Block Group 5	Census Tract 3213	Marlborough	Yes	No	No
Block Group 6	Census Tract 3839.01	Framingham	Yes	No	No
Block Group 6	Census Tract 3213	Marlborough	Yes	Yes	No

The 5-mile radius DGA around the Project Site is used as the basis for analyzing potential Project impacts and for public outreach purposes. The DGA is shown on the map as part of the EJ Screening Form included in this attachment.

F.2 Community Engagement

The Proponent emailed an EJ Screening Form (including translations in Portuguese and Spanish) to the EJ Reference List provided by the State EJ Office. The EJ Screening Form and EJ Reference List are included as part of this Attachment to the ENF. As of the date of filing, the Proponent had not received any inquiries or comments from anyone contacted.

In addition to the EJ Reference List provided by the State, the Proponent also sent emails directly to approximately 40 other entities comprising civic organizations, churches, libraries, schools, businesses, residential associations (i.e., apartment complexes, condominium associations), municipal departments, and environmental organizations. The list of those contacted is included as part of this attachment These entities were sent a flyer showing the location of the project and providing a brief project description and contact information to request a meeting. As of the date of filing, the Proponent has received one response from an individual on the above-referenced list. That response was related to a request for access to the facility, and will be addressed by the Proponent.

The entities on the EJ Reference List and those that were included in supplemental outreach were also provided a copy of this ENF via email at the same time this ENF was submitted electronically to the MEPA Office.

Figure F-1	Designated Geographic Area (5-mile Radius)

F.2 Enhanced Analysis Overview

The EJ Analysis Protocol applies "for any project that is likely to cause damage to the environment and is located within a distance of one mile of an EJ population; provided, that for a project that impacts air quality, such environmental impact report shall be required if the project is likely to cause damage to the environment and is located within a distance of five miles of an environmental justice population."

Under the EJ Analysis Protocol, the analysis must include:

- An assessment of existing unfair or inequitable environmental burdens on the EJ population.
- An assessment of the Project's impacts to determine disproportionate adverse effect (if existing unfair or inequitable environmental burdens exist) on the EJ population.
- An analysis of the Project to determine Climate Change Effects (if existing unfair or inequitable environmental burdens exist).
- Mitigation and Section 61 Findings (if the Project impacts causes a disproportionate adverse effect or Climate Change Effects on the EJ population).

The Project is not anticipated to have a disproportionate adverse effect on EJ populations within the DGA or have climate change effects that would impact nearby EJ populations.

F.4 Assessment of Existing or Inequitable Environmental Burden

In order to determine whether EJ Populations have experienced existing unfair or inequitable environmental burdens within the DGA, the Proponent looked (1) the rates of four vulnerable health criteria as it relates to statewide averages, (2) existing past and current polluting activities, (3) a review of the RMAT Climate Resilience Output Tool, and (5) any specific concerns raised or feedback received during pre-filing consultations from CBOs, tribes or other individuals. Each of these steps are described in detail below along with an assessment of the specific results for the EJ populations within the DGA.

F.4.1 Vulnerable Health Criteria

The vulnerable health EJ criteria are four environmentally related health indicators to identify populations with evidence of higher-than-average rates of environmentally related health outcomes. Multiple terms are used to describe the vulnerable health EJ criteria as it relates to the EJ populations. These terms are defined and described below.

The vulnerable health EJ criteria are reported for a population in a specific area. The area can be a state, town, or census tract. Census tracts are small, relatively permanent areas of land with a population typically between 1,200 – 8,000 people. Health criteria are reported as rates, or the number of people with the identified condition divided by the population in consideration. The DPH EJ tool compares the community rate, or the town or census tract of interest, to the statewide rate, or the rate for the population of Massachusetts.

As described above, the first step is to determine whether EJ populations within the DGA have experienced higher rates of four different vulnerable health criteria when compared to the statewide rate. The MA DPH EJ tool provides information on four different vulnerable health criteria: heart attack hospitalizations, childhood blood lead exposure, low birth weight, and childhood asthma for the most recent five-year period of available data. It should be noted that each of these datasets are available at different geographies, heart attack hospitalizations and childhood asthma are available at the community level, while low birth weight and childhood blood lead exposure are available at the census tract level. Each of these specific criteria are described below along with the results of the analysis for the designated geographic area.

Heart Attack Hospitalizations

As described on the MA DPH website, heart attack hospitalization is a criterion used to identify vulnerable health EJ populations. Exposure to air pollution can increase the risk for heart attack and other forms of heart disease, and it is indicative of a serious chronic illness that can lead to disability, decreased quality of life and premature death. People living in EJ areas have higher than average heart attack hospitalization rates when compared to other communities.

Heart attack hospitalization data is based on data collected from all hospitals in Massachusetts and reflects individuals greater than 35 years of age who have been admitted to the hospital for a heart attack. The vulnerable health criterion for heart attack hospitalizations is the most recent five-year average age-adjusted rate of hospitalization for myocardial infarction that is equal to or greater than 100% of the state rate. This indicator is available at the community, or town-wide, level.

Within the DGA at the community level, none of the towns (Hudson, Marlborough, or Framingham) meet the vulnerable health criterion for heart attack hospitalizations.

Childhood Blood Lead Levels

As described on the MA DPH website, childhood lead exposure is a criterion used to identify vulnerable health EJ populations because lead exposure disproportionately impacts lower income communities and communities of color, and childhood exposure to relatively low levels can cause severe and irreversible health effects, including damage to a child's mental and physical development.

Childhood Blood Lead Level data is based on data collected as part of the Massachusetts Lead Poisoning Prevention and Control Act which is a state law that requires all children to be screened each year for lead poisoning through age three and children in high-risk communities must be screened through age four. The vulnerable health criterion for Childhood Blood Lead Level is the five-year average prevalence of elevated (≥5 ug/dL estimated confirmed) childhood blood lead levels (ages 9-47 months) that is equal to or greater than 110% the state prevalence. This indicator is available at the community and census tract level.

At the community level, none of the towns within the DGA meet the vulnerable health criterion for childhood blood lead levels.

Low Birth Weight

As described on the MA DPH website, low birth weight (LBW) is a criterion used to identify vulnerable health EJ populations because exposure to environmental contaminants can increase the risk of delivering a LBW baby and LBW is a significant predictor of maternal and infant health. Women of color and women of low income have a higher risk of delivering a LBW baby. LBW can increase the risk of infant mortality and morbidity, health problems throughout childhood, developing cognitive disorders, developmental delay and chronic diseases as an adult such as cardiovascular diseases and type 2 diabetes.

LBW data are collected by the Registry of Vital Records and Statistics. Medical data, such as birth weight and gestational age, are based on information supplied by hospitals and birthing facilities. The vulnerable health criterion for LBW is the five-year average low birth weight rate among full-term births that is equal to or greater than 110% of the statewide rate. This indicator is available at both the community and census tract level.

At the community level, none of the towns within the DGA meet the vulnerable health criterion for low birth weight.

Childhood Asthma

As described on the MA DPH website, childhood asthma is a criterion used to identify vulnerable health EJ populations because people of color and low-income individuals are at greater risk for asthma exacerbations due to increased exposure to asthma triggers. Uncontrolled asthma can impact an individual's overall health and wellbeing. For example, uncontrolled asthma can reduce activity levels, negatively impact cardiovascular fitness, and increase school absenteeism.

Childhood asthma data are based on data collected from all hospitals in Massachusetts and reflects children between the ages of 5 and 14 years of age that have visited an emergency room for treatment for asthma. The vulnerable health criterion for childhood asthma is the five-year average rate of emergency department visits for childhood (5-14 years) asthma that is equal to or greater than 110% of the state rate. This indicator is available at the community, or town-wide, level.

Framingham is the only town within the DGA that meets the vulnerable health criterion for pediatric asthma emergency department visits.

Vulnerable Health Criteria Summary

There are no vulnerabilities identified in the immediate project vicinity; Hudson does not meet any of the vulnerable health criteria. At the community level, within the broader 5-mile DGA, the only vulnerable health criterion exceeded is pediatric asthma emergency department visits in Framingham.

F.4.2 Potential Sources of Pollution

As described in the EJ Analysis Protocol, the next step of the existing environmental burden analysis focuses on other potential sources of pollution within the boundaries of the EJ population. Layers from the DPH EJ Tool were downloaded into ArcGIS and a five-mile buffer drawn around the Project Site boundary. Each of the resulting layers were used to develop a narrative of the number of types of facilities and infrastructure for the EJ populations in the DGA as well as used to survey the enforcement history. When available, enforcement histories and facility histories were searched in the Energy & Environmental Affairs Data Portal (EEA portal).[1]

Below is a narrative discussion of the information gleaned using the mapping layers listed above in the MA DPH EJ Tool. It is important to note that while some of the facilities are located outside the DGA, they are all established within EJ block groups that are located within whole or part of the 5-mile radius.

MassDEP Major Air and Waste Facilities

MassDEP major air and waste facilities are facilities that have air operating permits, treat, store, generate or recycle large quantities of hazardous waste, or utilize large quantities of toxics. These facilities are further specified in the following sections and include airports, facilities with air permits, draft NPDES permits, hazardous waste, treatment, storage, recycling, or disposal facilities, large quantity generators, large quantity toxic users, land disposal of solid waste, and toxics release inventory sites .

The review found one Air Permit (in Hudson), one Airport (Marlborough), 11 large quantity generators (one in Hudson, the rest in Marlborough), seven large quantity toxic users all in Marlborough, and six toxic release inventory sites (all in Marlborough).

M.G.L. c. 21E Sites

21E sites are sites that have experienced a release of a hazardous material above a certain threshold. Once a release is reported to MassDEP it must be cleaned up within a year or it is classified as Tier I, Tier ID, or Tier II. A Tier I site poses an immediate hazard, a Tier 1D site has not

[1] https://eeaonline.eea.state.ma.us/Portal/#!/home

posed a permanent solution or final classification of the site while a Tier II site does not meet the criteria for an immediate hazard. There are nine M.G.L. c. 21E sites within the DGA. One near the center of Hudson and the rest in Marlborough.

Tier II Facilities

A facility is required to submit a Tier II report to emergency response agencies if it uses over a certain threshold of hazardous chemicals during a calendar year. The purpose of Tier reports is to help facilitate emergency response in the event the fire department would need to respond to an emergency at the facility.

Within the DGA, there are 29 "Tier II" toxics use reporting facilities. One is located in Hudson, and the rest are in Marlborough.

MassDEP sites with AULs

An Activity Use Limitation (AUL) provides notice of the presence of oil and/or hazardous material contamination remaining at the location after a cleanup has been conducted pursuant to Chapter 21E and the MCP. The AUL is a legal document that identifies activities and uses of the property that may and may not occur, as well as the property owner's obligation and maintenance conditions that must be followed to ensure the safe use of the property.

There are eight MassDEP sites with an AUL within the DGA, two in Hudson, and the rest in Marlborough.

MassDEP Groundwater Discharge Permits

This dataset contains the locations of permitted discharges of groundwater. This includes discharges from: Sanitary sewage in excess of 10,000 gallons per day (gpd), coin operated laundromats, car washes, industrial facilities, and reclaimed water (used in cooling towers and other closed-loop systems, no actual discharge).

No groundwater discharge permits were found within the DGA.

Wastewater Treatment Plants

The MA DPH tool provide information on facilities that have received a National Pollutant Discharge Elimination System (NPDES) permit. NPDES is a permit for facilities that treat wastewater. There are no facilities located within five miles that hold a draft or final NPDES permit.

MassDEP Public Water Suppliers

This dataset contains locations of public community surface and groundwater supply sources based on data available in the MassDEP's Water Quality Testing System database for tracking water supply data. A community water system refers to the public water system which services at least 25 year-round residents. There are no public water suppliers within the DGA.

Underground Storage Tanks

The MassDEP regulates the registration, installation, operation, maintenance, inspection, and closure of petroleum fuel and hazardous substance of underground storage tank (UST) systems.

As part of the UST program, there are 19 underground storage tanks (USTs) within the DGA. Four are in Hudson and the remainder in Marlborough. No UST is proposed as part of the Project.

EPA Facilities

EPA facilities are defined as Toxic Release Inventory (TRI) facilities. TRI facilities use and/or release over a certain threshold of toxic chemicals to the environment. There are 777 individual chemicals and 33 chemical categories covered by the TRI program.[2] There are 17 EPA facilities within the DGA. Two are in Hudson and the remainder in Marlborough.

Road Infrastructure

Road infrastructure includes Massachusetts Department of Transportation (MassDOT) roads and bike lanes or shared use pathways. Major routes within the DGA include I-495, I-290, Routes 85, 117, 62, 85C, 20, and 30.

MBTA Bus and Rapid Transit

The Massachusetts Bay Transit Authority data includes all MBTA bus routes, stops, commuter rails, commuter rail stations, parking lots, and rapid transit stops. There are no MBTA facilities within five-miles of the Project Site.

Other Transportation Infrastructure

Other transportation infrastructure includes airports, freight yards, water taxis, railroad tracks, and ferry routes. Kalander Field Airport is located just beyond the DGA limit in Marlborough. There are also several railroad tracks within the DGA, two of which carry freight for CSX.

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[2] https://enviro.epa.gov/facts/tri/ef-facilities/#/Facility/01082KNZKS20COM

There are no water taxis, ferry routes, or freight yards within five miles of the Project Site. The truck access route from the I-495/I-290 Interchange to the Project site does not cross any railroad track and the proposed Project is not anticipated to impact the railroad track in any way as a part of this Project.

Regional Transit Agencies

The Worcester RTA and the Metrowest RTA serve parts of DGA. There are 13 RTA bus stops within the DGA. The Route 15 bus of the Metrowest RTA makes stops in Hudson.

Energy Generation and Supply

The Energy Generation and Supply layer includes nuclear power plants, power plants, and transmission lines from Massachusetts Geographic Information Systems (MassGIS) and the United States Geological Survey (USGS) databases. There is one power plant located on Cherry Street in Hudson less than a mile from the Project site. The database also reports three transmission lines within the DGA.

F.4.3 Climate Adaptation (RMAT)

As described below, the RMAT Tool provides the proposed Project with information about sea level rise/storm surge, heat, and extreme precipitation impacts.

> Third, Proponents should consult the standard output report generated from the RMAT Climate Resilience Design Standards Tool (the “RMAT Tool”),9 which is required as an attachment to the ENF/EENF.10 Proponents should identify in the EIR whether the RMAT Tool indicates a “High” risk rating for sea level rise/storm surge or extreme precipitation (urban or riverine flooding) as applied to the project location. A “High” risk rating for these parameters could be an indicator of elevated climate risks for EJ populations that immediately surround the project site (meaning all EJ populations located in whole or in part within the project boundaries). The risk rating for the “extreme heat” parameter should not be used as a definitive indicator of elevated climate risks.

The RMAT tool denotes the proposed Project would be considered “High” for extreme precipitation – urban flooding and Extreme Heat. The RMAT tool determined the Project Site maintains a “High” risk rating for extreme precipitation – urban flooding due to multiple factors, including increased impervious area, maximum annual rainfall exceeds 10 inches within the overall Project’s useful life, and existing impervious area of the Project Site is between 10% and 50%. The RMAT tool notes that there is no historic flooding at the Project Site.

The RMAT tool determined the Project Site maintains a “High” risk rating for extreme precipitation – riverine flooding due to multiple factors, including part of the Project is within a mapped FEMA floodplain, outside of the Massachusetts Coast Flood Risk Model and part of the

Project is within 500 feet of a waterbody less than 20 feet above the waterbody. The tool notes no historic riverine flooding at the Project Site and the Project is not likely susceptible to riverine erosion.

The Project also received a “High” risk rating for extreme heat from multiple factors, including 30+ days increase in days over 90 degrees Fahrenheit within the Project’s useful life, increased impervious area, existing trees are being removed as part of the proposed Project, existing impervious area of the Project Site is between 10% and 50%, and the Project is located within 100 feet of an existing water body. The “High” risk rating for extreme heat has been determined not be a definitive indicator of elevated climate risks, in accordance with the MEPA Interim Protocol for Analysis of Project Impacts on Environmental Justice Populations, and therefore has not been included in the impact analysis presented in this report.

There is no risk for Sea Level Rise/Storm Surge as the Project is located at roughly 400 feet elevation and is approximately 26 miles from the nearest open ocean (Boston Harbor). The Proponent has taken sufficient measures to ensure the Project Site and the surrounding properties will not be burdened by flooding from stormwater, as described in the ENF. Additionally, only the northernmost portion of the Project Site falls within a FEMA recognized flood zone, however the FEMA flood zone is Zone X; The area determined to be outside of the 500-yeat flood and protected by levee from the 100-year flood. Therefore, the site is not at increased risk of flooding due to the existing floodway. Please refer to Attachment H of the EENF for the RMAT Tool Report.

F.5 Analysis of Project Impacts to Determine Disproportionate Adverse Public Health Effects

F.5.1 Air Quality Context

Air quality impacts from a project can be viewed within the context of the overall regional air quality to assess whether any additional project-related emissions will significantly contribute to the air quality in the project location and cause air pollutant concentrations to exceed available health-based air quality standards.

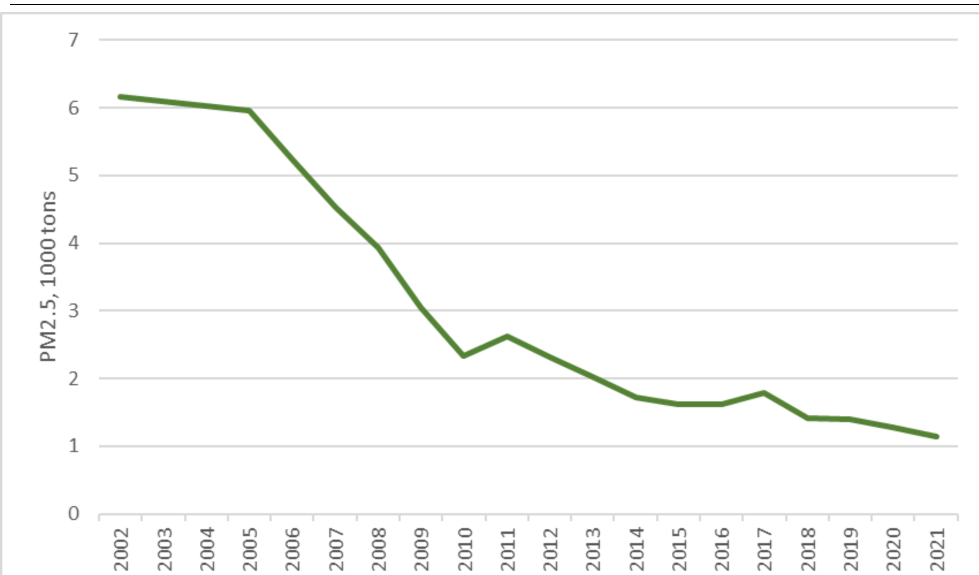
The Proponent anticipates that air quality impacts from the project will be related to some increase in vehicle traffic and specifically diesel truck traffic. The primary air pollutant of concern from diesel trucks are particulates ($PM_{2.5}$). Therefore, to provide air quality context, the Proponent evaluated two key sources of information: estimated particulate emissions from on-road vehicles (which include trucks) and estimated $PM_{2.5}$ concentrations at the nearest air monitoring site (which include contributions from diesel trucks). $PM_{2.5}$ data were selected because it is a greater health hazard due to its smaller size.

Emission trends for $PM_{2.5}$ from on-road highway vehicles were reviewed to obtain an overall understanding of current emission patterns. The emissions data is collected and reported by the US EPA[3] and summarized in Table F-2. As can be observed, the Massachusetts air emissions from vehicle traffic have fallen dramatically in recent years, with reductions in excess of 80%, largely due to vehicle emissions regulations that have served to reduce these emissions. In particular, Federal pollution regulations for medium and heavy-duty trucks have tightened significantly over time[4] , as shown in Table F-3 for PM. Full implementation of the 2007 standards combined with the use of Ultra-Low Sulfur Diesel (ULSD) has served to dramatically reduce air emissions from MHD trucks. Modern MHD vehicles meet emissions standards through engine design and aftertreatment technologies.

Table F-2 PM Emission Limits for MHD Trucks

Year	Emission Limit, Grams per Brake Horsepower Hour (g/bhp-hr)
1988	0.6
1990	0.6
1991	0.25
1994	0.10
1998	0.10
2007	0.01

Table F-3 State-wide Emissions of Fine Particulate Matter ($PM_{2.5}$) from Onroad Vehicles in 1000 tons[5]



3 https://www.epa.gov/air-emissions-inventories/air-pollutant-emissions-trends-data
4 https://dieselnet.com/standards/us/hd.php
5 https://www.epa.gov/air-emissions-inventories/air-pollutant-emissions-trends-data

To evaluate the related impacts on air pollutant concentrations in Massachusetts, the Proponent obtained the air pollutant concentration information from monitoring stations across the state.[6] The nearest air monitoring stations for $PM_{2.5}$ is in Worcester about 16 miles southwest from the site location.

Under the Clean Air Act, US EPA regulates six air pollutants for which there are health-based National Ambient Air Quality Standards (NAAQS), including $PM_{2.5}$. These standards "provide public health protection, including protecting the health of 'sensitive' populations such as asthmatics, children, and the elderly." [7] US EPA reports air pollution concentrations with respect to how the health-based NAAQS are defined. These are called the design values. The NAAQS for $PM_{2.5}$ are shown in Table F-4. There are two different NAAQS, one that corresponds to short-term exposures and one for long term exposures. For $PM_{2.5}$, the design value for short-term exposures is the 98th percentile of the maximum daily (24-hour) concentration, averaged over three years and for long-term exposures it is the annual mean, averaged over three years.

Table F-4 National Ambient Air Quality Standards (NAAQS) for Fine Particulate Matter ($PM_{2.5}$)

Air Pollutant	NAAQS	Definition
24-hour	35 µg/m^3	98th percentile of daily max, averaged over 3 years
Annual	12 µg/m^3	annual mean, averaged over 3 years

Table F-5 shows the annual design values for $PM_{2.5}$ at the Worcester monitoring station for the years 2004 through 2019. Table F-6 shows the short-term (24-hour) design values for $PM_{2.5}$ at the Worcester monitoring stations for the years 2004 through 2019. The tables show that air quality has improved over time for both the long-term and short-term metrics at the nearest monitoring stations and the most recent measurements are well below the NAAQS. This is consistent with the decreased emissions for these air pollutants for on-road vehicles.

Overall, the emission and air quality trends are improving for the area around the project site as shown by our air quality analysis. Importantly, for the main air pollutant of concern, $PM_{2.5}$, concentrations are well below health-protective NAAQS. Based on experience with similar projects and given the improvements in background air quality conditions, the Proponent anticipate that project-related contributions will be minor and will not contribute to air pollutant concentrations that would result in an exceedance of the NAAQS.

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6 Air Quality Design Values | US EPA
7 https://www.epa.gov/criteria-air-pollutants/naaqs-table

Table F.5 **Annual Design Values for Fine Particulate Matter ($PM_{2.5}$) at the Worcester Monitoring Station. (The relevant NAAQS is noted by the red line) (Source: Air Quality Design Values | US EPA)**

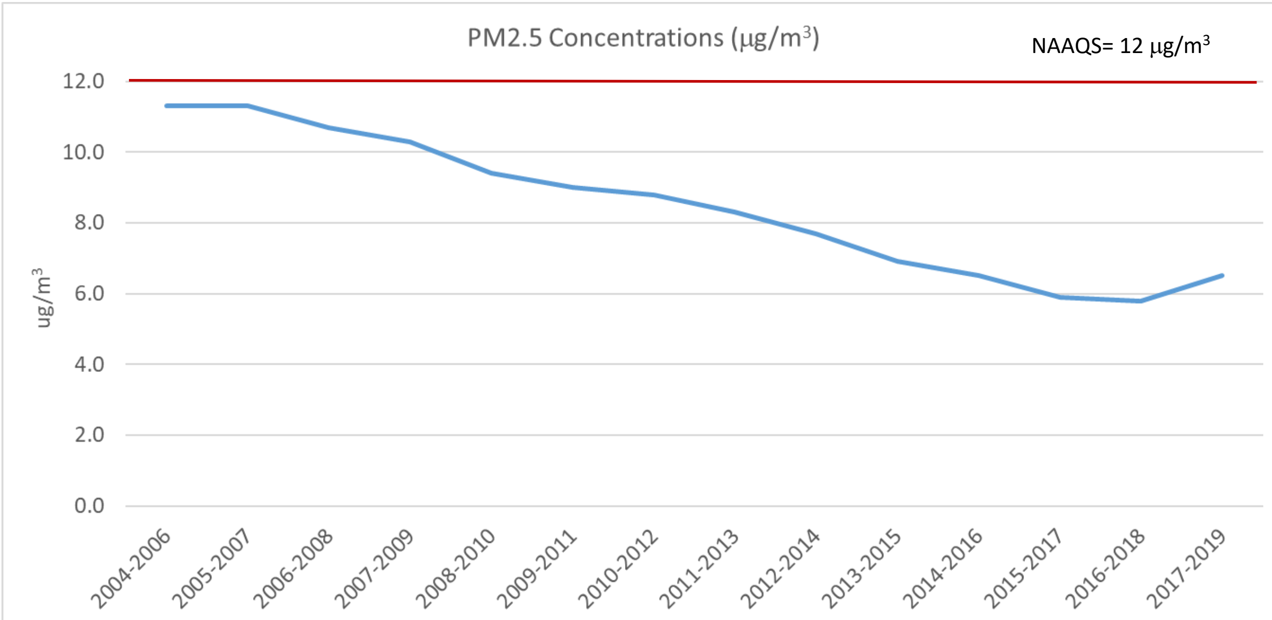
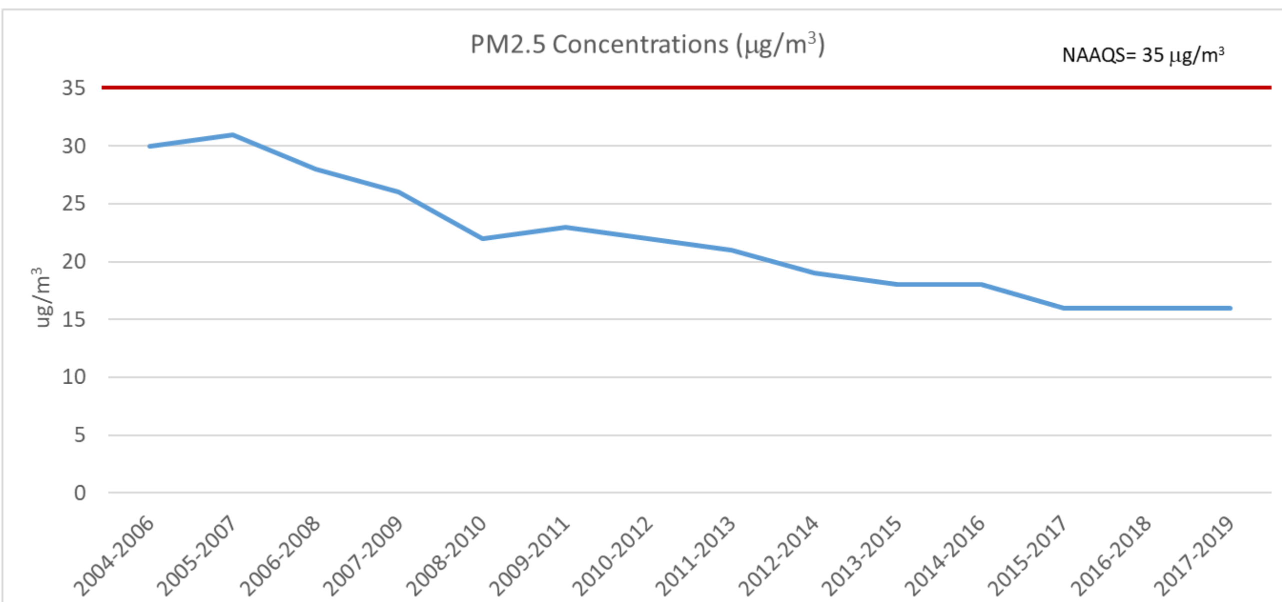


Table F-6 **Short-term Design Values for Fine Particulate Matter ($PM_{2.5}$) at the Worcester Monitoring Station. (The relevant NAAQS is noted by the red line) (Source: Air Quality Design Values | US EPA)**



F.5.2 Traffic Proximity and Volume Impacts

As part of the greenhouse gas analysis, the Proponent conducted an assessment of model source emissions, following the same methodology outlined in MassDEP guidance for mesoscale analyses. It was determined that the 2029 Mitigated Build condition exhibits a 28 percent increase of CO_2 emissions compared to the 2029 Build condition. This change is the result of increased vehicle volumes producing longer delays at all nearby intersections, even with the addition of the new signal at the Site drive to help improve traffic flow, and this increased idling time resulting in greater idling emissions.

However, none of the EJ populations are located close enough to the Project Site to potentially experience any direct impacts: these emissions are anticipated to be diffused and any impacts would affect both EJ and non-EJ communities.

Most vehicles are anticipated to use Route 3 and Middlesex Road to travel to the Project Site. While there is an EJ population within 5 miles of the Site that is located along Route 3, Block Group 4, Census Tract 3181, the Proponent is committed to implementing Transportation Demand Management (TDM) measures to minimize automobile usage and Project related traffic impacts. The Proponent will also be required to conduct an annual traffic monitoring program to evaluate the assumptions made in the DEIR, the adequacy of the mitigation measures, and to determine the effectiveness of the TDM program. Additionally, the Proponent will develop an integrated multimodal mitigation package intended to improve vehicular traffic operations while supporting increased use of walking, bicycling, and transit by residents. Please refer to Sections 7.5.2, 7.6, and 7.7 for additional information about these anticipated mitigation measures.

New diesel vehicle traffic is anticipated to also utilize Route 85C and Technology Road as the primary travel route to the Project Site from the I-495/I-290 Interchange, both on weekdays and weekends. There are no EJ populations directly along this route, the nearest being Block Group 2, Census Track 3224, located approximately located to the north in the center of Hudson. Hudson did not meet any of the criteria for vulnerable populations in the DPH Screening tool.

Farther away along the probable truck routes within the DGA, the only EJ populations that would be directly impacted (i.e., the truck route passes directly through EJ Block Group) would be on I-495 south, approximately three miles from the site in the vicinity of the I-495/Route 20 Interchange. These are Block Group 2, Census Tract 3214, Block Group 2, Census Tract 3215, and Block Group 3, Census Tract 3213. All three are in Marlborough. Marlborough did not meet any of the criteria for vulnerable populations in the DPH Screening tool.

For reasons described in greater detail in Section F.4.1, the Project is not anticipated to materially exacerbate this community's existing burden. Tighter Federal pollution regulations for medium and heavy duty (MHD) trucks and the use of Ultra-Low Sulfur Diesel (ULSD) has served to dramatically reduce air emissions from MHD trucks. Air quality has improved over time for both the long-term and short-term metrics at the air monitoring stations closest to the Project Site and the most recent measurements are well below the NAAQS. For these reasons, the Proponent anticipates project-related contributions will be minor and will not contribute to air pollutant concentrations that would result in an exceedance of the NAAQS; therefore, the increase in diesel vehicle trips is not anticipated to significantly affect the surrounding EJ populations in the DGA or materially exacerbate any existing burdens.

The Proponent also points out that within the 5-mile DGA, the likely truck routes, including Technology Drive, Route 85C, Route 290, and I-495 have a combined total length of roughly 15.2 miles. Of this, only 2.0 miles pass directly through EJ Block Groups, those being the three listed above in Marlborough. Although Route 85 is not expected to be used by trucks, if it were to be, only approximately 2.3 miles of a total of approximately 9.2 miles within the DGA passes directly through EJ Block Groups. Thus, the Proponent feels that any impacts that do occur would not be disproportionate to EJ populations.

The additional truck traffic on Routes such as I-495 and I-290 will represent only a small fraction of the overall daily truck traffic on those highways. The incremental increase is not expected to have any significant impact.

Lastly of the 78.5 square miles encompassed within the 5-mile DGA, only approximately ten square miles fall within EJ Block Groups, further suggesting that the impact to air quality will not disproportionally impact EJ populations.

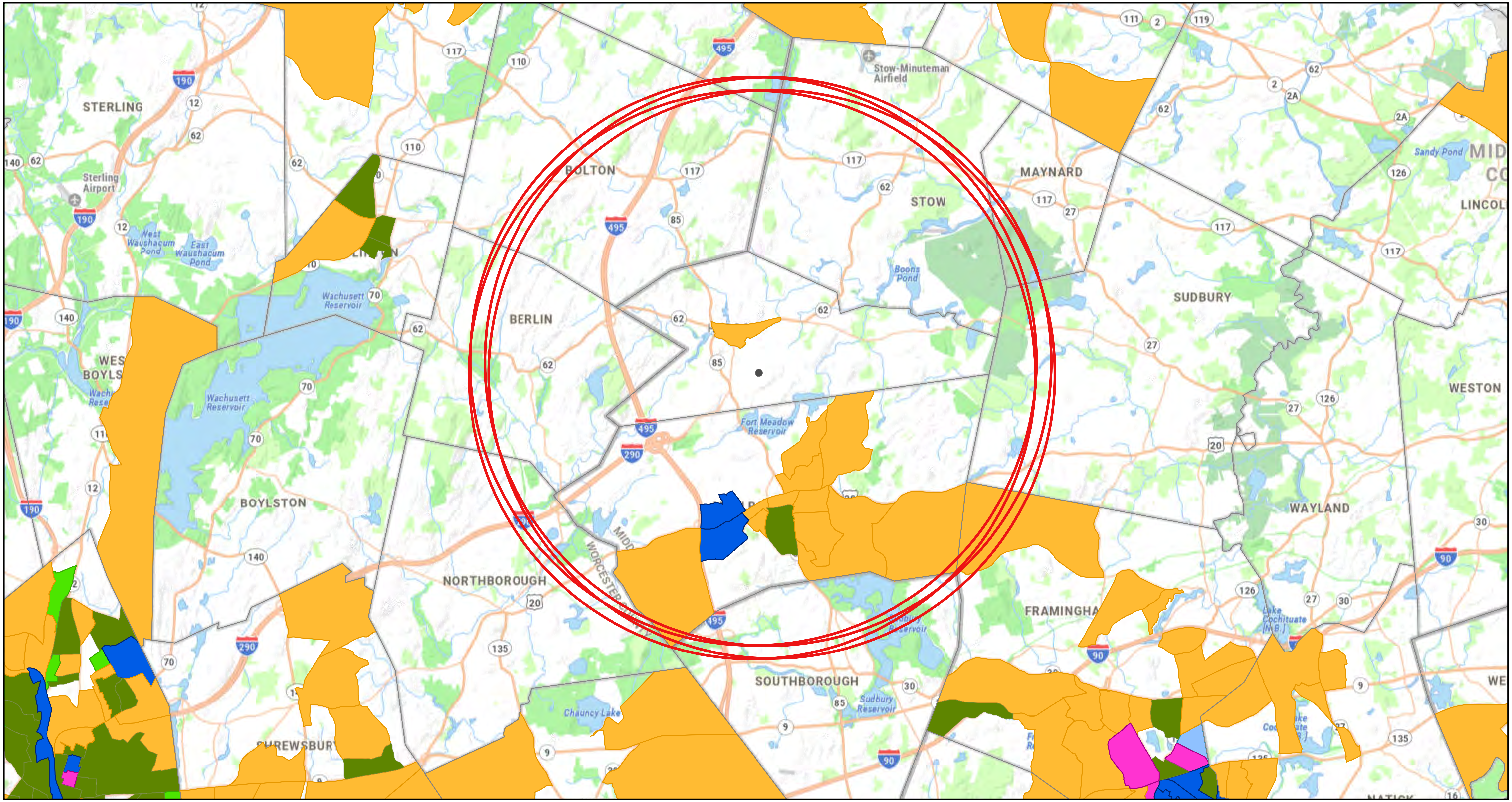
F.5.3 Construction Air Quality Impacts

Air quality impacts due to construction activities will be short-term. The total construction period is expected to last approximately 14 months. Anticipated air quality impacts include the creation of fugitive dust and emission of diesel exhaust. There are extensive mitigation measures in place to control dust and diesel emissions and ensure that construction activities create minimal impact to the surrounding communities.

F.5.4 Permits Intended to Protect Public Health

None of the required Permits for the project contain performance standards intended to protect public health.

Environmental Justice Populations: 5-Mile Radius



6/10/2022, 9:14:28 AM

1:144,448

0 1.25 2.5 5 mi

0 2 4 8 km

Override 1

EJ 2020 with criteria explanation

Minority: the block group minority population is >= 40%, or the block group minority population is >= 25% and the median household income of the municipality the block group is in is < 150% of the Massachusetts median household income

Income: at least 25% of households have a median household income 65% or less than the state median household income

Language isolation: 25% or more of households do not include anyone older than 14 who speaks English very well

Minority and income

Minority and English isolation

Minority, income and English isolation

MassGIS

MA Executive Office of Energy and Environmental Affairs
EEA GIS | MassGIS |

Statewide Environmental Justice Community Based Organizations

First Name	Last Name	Title	Phone	Email	Affiliation
Julia	Blatt	Executive Director	(617) 714-4272	danielledolan@massriversalliance.org juliablatt@massriversalliance.org	Mass Rivers Alliance
Andrea	Nyamekye	Associate Director	508-505-6748	Andrea@n2nma.org elvis@n2nma.org	Neighbor to Neighbor
Ben	Hellerstein	MA State Director	617-747-4368	ben@environmentmassachusetts.org	Environment Massachusetts
Claire	B.W. Muller	Movement Building Director	508 308-9261	claire@uumassaction.org	Unitarian Universalist Mass Action Network
Cindy	Luppi	New England Director	617-338-8131 x208	cluppi@cleanwater.org	Clean Water Action
Deb	Pasternak	Director, MA Chapter	617-423-5775	deb.pasternak@sierraclub.org	Sierra Club MA
Heather	Clish	Director of Conservation & Recreation Policy	(617) 523-0655	hclish@outdoors.org	Appalachian Mountain Club
Heidi	Ricci	Director of Policy	Not Provided	hricci@massaudubon.org	Mass Audubon
Kelly	Boling	MA & RI State Director	(617) 367-6200	kelly.boling@tpl.org	The Trust for Public Land
Kerry	Bowie	Board President	Not Provided	kerry@msaadapartners.com	Browning the GreenSpace
Linda	Orel	Director of Policy	617-360-1857	lorel@thetrustees.org	The Trustees of Reservations
Nancy	Goodman	Vice President for Policy	Not Provided	ngoodman@environmentalleague.org	Environmental League of MA
Pat	Stanton	Project Manager	Not Provided	pstanton@e4thefuture.org	E4TheFuture
Rob	Moir	Executive Director	Not Provided	rob@oceanriver.org	Ocean River Institute
Robb	Johnson	Executive Director	(978) 443-2233	robb@massland.org	Mass Land Trust Coalition
Sarah	Dooling	Executive Director	Not Provided	sarah@massclimateaction.net	Mass Climate Action Network (MCAN)
Staci	Rubin	Senior Attorney	617 350-0990	srubin@clf.org	Conservation Law Foundation
Sylvia	Broude	Executive Director	617 292-4821	sylvia@communityactionworks.org	Community Action Works
Winston	Vaughan	Director of Climate Solutions	Not Provided	wvaughan@hcwh.org	Healthcare without Harm

Indigenous Organizations					
First Name	Last Name	Title	Phone	Email	Affiliation
Alma	Gordon	President	Not Provided	tribalcouncil@chappaquiddick-wampanoag.org	Chappaquiddick Tribe of the Wampanoag Nation
Cheryll	Toney Holley	Chair	774-317-9138	crwritings@aol.com	Nipmuc Nation (Hassanamisco Nipmucs)
John	Peters, Jr.	Executive Director	617-573-1292	john.peters@mass.gov	Massachusetts Commission on Indian Affairs (MCIA)
Kenneth	White	Council Chairman	508-347-7829	acw1213@verizon.net	Chaubunagungamaug Nipmuck Indian Council
Melissa	Ferretti	Chair	(508) 304-5023	melissa@herringpondtribe.org	Herring Pond Wampanoag Tribe
Patricia	D. Rocker	Council Chair	Not Provided	rockerpatriciad@verizon.net	Chappaquiddick Tribe of the Wampanoag Nation, Whale Clan
Raquel	Halsey	Executive Director	(617) 232-0343	rhalsey@naicob.org	North American Indian Center of Boston
Cora	Pierce	Not Provided	Not Provided	Coradot@yahooe.com	Pocassett Wampanoag Tribe
Elizabth	Soloman	Not Provided	Not Provided	Solomon.Elizabeth.e@gmail.om	Massachusetts Tribe at Ponkapoag

Federally Recognized Tribes					
First	**Last**	**Title**	**Phone**	**Email**	**Affiliation**
Bettina	Washington	Tribal Historic Preservation Officer	508-560-9014	thpo@wampanoagtribe-nsn.gov	Wampanoag Tribe of Gay Head (Aquinnah)
Bonney	Hartley	Historic Preservation Manager	413-884-6048	bonney.hartley@mohican-nsn.gov	Stockbridge-Munsee Tribe
Brian	Weeden	Chair	774-413-0520	Brian.Weeden@mwtribe-nsn.gov	Mashpee Wampanoag Tribe

Attachment G

Stormwater Management Report

Stormwater Management Report

Submitted pursuant to the
Massachusetts Stormwater Standards

July 2022

75 Reed Road
Hudson, Massachusetts

<u>Prepared for</u>

PORTMAN INDUSTRIAL LLC

303 Peachtree Center Avenue #575
Atlanta, GA 30303

<u>Prepared by</u>

BEALS · ASSOCIATES INC.
2 PARK PLAZA, SUITE 200, BOSTON, MA 02116
PHONE: 617-242-1120

Contents

0. Executive Summary

The proposed warehouse facility project located at 75 Reed Road in Hudson Massachusetts is a project being proposed by Portman Industrial LLC. The proposed project will be constructed on a 149 acre parcel of land identified by the Town of Hudson as Tax Map 41, Lot 33. The site is abutted by dense residential developments to the northwest and south with single family residential parcels abutting along Marlboro Street at the eastern edge of the property. Commercial and industrial uses abut the subject property to the north and northwest and a grass athletic field abuts to the southwest.

The site is currently partially developed featuring two industrial/manufacturing use buildings and associated parking to the south and a forested area to the north. The developed portion of the site collects stormwater runoff through catch basin and relays it to on-site basins or discharge to the northern forested area. The forested area contains a number of swales that direct the runoff to wetland resource areas and additional basins and ponding areas along the northern portion of the property.

The proposed warehouse facility will be a single-story high building with approximately 1,284,640 square feet of gross building area. The project will include 446 vehicular parking spaces, 537 trailer storage spaces and 187 loading docks. The development utilizes the existing entrances and ring road with changes in grade along the norther portion of the ring road. Truck access will be directed through the entrance located at Reed Road while passenger vehicles will also be able to access the site at the entrance on Marlboro Street.

Topography across the site varies with flatter developed portions and steep slopes as they grade back into the forested area to the north. Overall, the site ranges for a low point of 217 along Forest Avenue to a high of 404 south of the existing HD-1 building. The two existing buildings show a difference in floor slab elevations of roughly 20 feet and stepped parking lots to make up for grade as they drop down to 335 at the Marlboro Street entrance.

The NRCS Soil Survey for Middlesex County identifies the soils within the project area as Paxton fine sandy loam and Udorthents-Urban land complex. The site is currently developed as the Intel HD1 building, and the soils are heavily disturbed. A geotechnical report prepared by Geo Engineers, and provides a detailed analysis of the soils encountered within the property.

Untreated runoff on the existing development is intercepted by catch basins and directed to basins constructed during the development of the property and direct discharges to swales that drain towards the wetland resource areas to the north.

The proposed project will feature treatment of runoff through deep sump catch basins and proprietary hydrodynamic separators. The treated runoff will be directed to a series of groundwater recharge facilities, which will further enhance water quality. Excess runoff will be discharged to the existing basins and ultimately the surrounding natural resource areas. The result of this effort will be a reduction in both rate and volume of runoff as well as a minimum of 80% removal of suspended solids.

Standard 1 – No Untreated Discharges or Erosion to Wetlands

This standard has been met by providing treatment to all proposed impervious surfaces and points of discharge on the site. Calculations have been provided throughout the report to confirm this. **Standard 1 has been met.**

Standard 2 – Peak Rate Attenuation

The proposed project reduces the rate of runoff to the point of analysis through the use of onsite stormwater management facilities. Complete runoff calculations for the 2-, and 10- year storm events have been provided, and flooding that will occur within the site development during the 100-year storm event is anticipated to be acceptable to the property owner. The rainfall utilized is based on the Cornell rainfall data, and a copy of the rainfall data has been included in the Appendix. **Standard 2 has been met.**

Standard 3 – Stormwater Recharge

Calculations have been provided to demonstrate the total recharge volume of the project meets this standard. **Standard 3 has been met**

Standard 4 – Water Quality

The project features various Best Management Practices and proprietary devices to improve the quality of the stormwater runoff prior to discharge. Calculations demonstrating that the runoff has been treated to remove a minimum of 80% of the Total Suspended Solids (TSS) has been included in the report. **Standard 4 has been met.**

Standard 5 – Land Uses with Higher Potential Pollution Loads

The project is considered a Land Use with Higher Potential Pollution Load. Additional water quality treatment has been provided for a 1” storm event. **Standard 5 has been met.**

Standard 6 – Critical Areas

The project site is not located within a critical area. **Standard 6 is not applicable.**

Standard 7 – Redevelopment

The project is not a redevelopment. **Standard 7 does not apply.**

Standard 8 – Construction Period Controls

A complete erosion control plan and narrative has been provided. **Standard 8 has been met.**

Standard 9 – Operation and Maintenance Plan

The project documentation includes a complete Stormwater Operation and Maintenance Manual for the site. This manual meets all MA DEP checklist requirements. **Standard 9 has been met.**

Standard 10 – Illicit Discharges to Drainage System

The report includes a signed illicit discharge statement in Appendix B. **Standard 10 has been met.**

Based on the documentation and calculations in this report, the project meets or exceeds Commonwealth of Massachusetts Stormwater Standards.

1. Massachusetts Stormwater Standards

a. Standard 1 – No Untreated Discharges or Erosion to Wetlands

Stormwater Management Standard 1 requires that there be no new stormwater conveyances that would discharge untreated stormwater to or cause erosion to waters or wetlands of the Commonwealth. The proposed development utilizes the existing outfall locations and basins while reducing the rate and volume that each of these areas receive.

The proposed project will feature treatment of runoff through deep sump catch basins, proprietary hydrodynamic separators, and infiltration systems, both subsurface and open air. The treated runoff will be directed to a series of groundwater recharge facilities, which will further enhance water quality. Excess runoff will be discharged to the existing basins and ultimately the surrounding natural resource areas. The result of this effort will be a reduction in both rate and volume of runoff as well as a minimum of 80% removal of suspended solids.

As a result of this, it can be stated that stormwater runoff from impervious areas will be treated through stormwater management devices and will not result in erosion in or adjacent to waters or wetlands of the Commonwealth. **Massachusetts Stormwater Standard 1 has been met.**

b. Standard 2 – Peak Rate Attenuation

The Peak Rate Attenuation Standard requires that stormwater management systems be designed such that post development peak discharge rates do not exceed predevelopment discharge rates. The only time this standard may be waived is for discharges to land subject to coastal storm flowage. The project site does not fall into this category. Subsurface infiltration systems have been designed at various locations across the project site.

Predevelopment Model

The predevelopment model analyzes the flow from the development area and the discharge through existing outfalls to various locations on the site. Various plans including as-built data, existing conditions plans, and surveys were utilized to determine the discharge locations of the site, and certain outfalls were identified as points of analysis as discussed in this report.

Methodology

The Town of Hudson does not provide a requirement for what source of rainfall to use; however, many communities throughout the Commonwealth have been requesting the utilization of higher rainfall data found in the NRCS Atlas 14 dataset or even the Extreme Precipitation in New England (“Cornell”) data sets. For the purpose of these hydrologic analyses for the pre- and post-development conditions the Cornell study was used as the 2-, 10-. And 100- year storm event rainfall data.

RAINFALL	
STORM EVENT	Cornell
2-YEAR	3.13”
10-YEAR	4.67”
100-YEAR	8.32”

The HydroCAD computer program was used in the analyses. This program determines the critical points of the overall drainage system and uses SCS TR-20 methodologies for evaluation of the anticipated conditions at these points. Travel times, storage capacity and the effects of hydraulic head are considered for analysis within the program. The model uses reservoirs and pipes to model actual conditions and can assess storage and kinematic effects.

The drainage system is represented by a system network consisting of four basic components in the model.

- Subcatchment: A relatively homogenous area of land that drains into a single reach or pond. Each subcatchment generates a hydrograph.
- Reach: A uniform stream, channel or pipe which conveys water from one point to another reach or pond. The outflow of each reach is determined by a hydrograph routing calculation.
- Pond: A pond, swamp, dam, catch basin, manhole or other impoundment which fill with water from one or more sources and empties in a manner determined by weir, culvert or other device(s) at tis outlet. A pond may empty into a reach or another pond. The outflow of the pond is also determined by a hydrograph routing calculation.
- Link: A multi-purpose mechanism for introducing a hydrograph from outside the diagram, either by manual entry, file import, or linkage to another diagram. A link also allows the diversion and/or scaling of a hydrograph. In this analysis, the links are simply used to compute the confluence of the various hydrographs at the points of analyses.

After identifying each of the components, the system may be represented by a routing diagram such as that shown in the computations in the appendices to this report.

<u>Soils</u>

The NRCS Soil Survey for Middlesex County identifies the soils within the project area as Paxton fine sandy loam and Udorthents-Urban land complex. The site is currently developed as the Intel HD1 building, and the soils are heavily disturbed. In the geotechnical report prepared by Geo Engineers, varying subsurface conditions were encountered across the site, and generally consist of the following:

- Surface materials: Within the paved portions of the Site, the asphalt concrete in the parking lots was approximately 2 to 6 inches thick. In landscaped areas, topsoil was encountered with a thickness between approximately 3 to 18 inches.

- Fill: Fill: Processed fill consisting of demolition debris (BUD material), reworked glacial till, or a combination of both was encountered across the Site beneath the surface materials. The fill generally ranged in thickness from 5 to 12 feet and extended up to 15 feet bgs or more in GEO-7 (20.2 ft), GEO-TP-105 (15'), and GEO-TP-107 (17 ft). The fill primarily consists of fine to coarse silty sand with varying amounts of gravel, generally ranging in density from medium dense to very dense. Loose layers of fill were observed in GEO-12 and GEO-17B to approximately 5 to 10 feet bgs, respectively. Non-soil constituents within the fill layer included varying amounts of brick, concrete, coal, glass, ash, wood, rubber, asphalt, wood, plastic, metal, rebar, and ceramics. Based on the BUD agreement, a significant amount of dense-graded, crushed, concrete fill was used as backfill after demolition of the previous buildings. The crushed concrete fill was observed within GEO-TP-104 and GEO-TP-105 at approximately 3 feet bgs and ranged in thickness from approximately 4.5 to 12 feet before encountering refusal on presumed concrete slabs and/or foundations. Buried foundations and slabs are prevalent in the areas of the former buildings.

- Buried Topsoil: A discontinuous layer of buried topsoil material was encountered in GEO-5 and GEO-9, at depths of approximately 6 feet bgs and 5 feet bgs, respectively. Where encountered, the buried topsoil was approximately 4 to 5 feet thick and consisted of silt with varying amounts of sand and gravel with trace organics.

- Organic Deposit (Peat): A discontinuous later of fibrous peat was encountered in GEO-TP-104 and GEO-TP-105 at approximate depths of 2.5 feet bgs and 12 feet bgs, respectively. Where encountered, the fibrous peat was approximately 3 to 12 inches thick.

- Natural Soil Deposits: A discontinuous layer of medium dense to dense silty sand was encountered beneath the fill. Loose pockets of silty sand were encountered in GEO-4 from 15 to 20 feet bgs, GEO-18A from 10 to 15 feet bgs, and GEO-28 from 10 to 15 feet bgs. The natural silty sand consists of fine to coarse silty sand with variable amounts of gravel. The natural silty sand layer varied in thickness between approximately 4 to 15 feet and was encountered at depths between 5 to 11 feet bgs.

- Glacial Till: Glacial till was encountered below the natural silty sand layer (where encountered) or directly below the fill. The top of the till layer was encountered between approximately 5 feet and 20 feet bgs. The glacial till consists of a medium dense to very dense, fine to coarse silty sand with varying amounts of gravel and trace clay.

- Weathered Bedrock: Weathered rock was encountered below the glacial till layer in GEO-9, GEO-12, GEO-13, GEO-15, GEO-17B, GEO-30, GEO-35, GEO-101 and GEO-102. The weathered bedrock layer varied in thickness from approximately 2 to 15 feet thick. The top of the weathered bedrock, where encountered, was between approximately 7.5 to 30 feet bgs. Refusal on possible bedrock was encountered in the southwest corner of the Site at GEO-19, GEO-31/31A, GEO-32/32A.

Based on these observations, the soils across the project area were identified as HSG B.

Time of Concentration

Time of Concentration flow paths were developed using TR-55 methodologies. Sheet flow was limited to no more than 50 feet in length. The minimum time of concentration used for this analysis was 6.0 minutes.

Runoff Curve Numbers

The runoff curve numbers for the various soil types and land use covers were initially developed in accordance with TR-55 methodologies.

Points of Analyses

For this project, six points of analysis were identified at the locations of the existing stormwater management infrastructure. Three of the points of analysis can be identified through existing manhole structures or an existing pipe run. The remaining points of analysis can be identified by existing basins and a discharge point to a swale that ultimately lead to the northern wetland resource areas. These six analysis points capture the proposed development of the project. HydroCAD calculations for these points of analysis are included in the appendices.

Post-development Methodology

The post development stormwater management system uses subsurface infiltration systems to handle certain areas of surface runoff produced by the sidewalks, roadways, parking areas, and buildings. There are a total of three subsurface infiltration systems and three infiltration basin proposed within the project area. The infiltration rates being utilized in the model are the Rawls Rates for a Loamy Sand Texture Class with an infiltration rate of 2.41 inches per hour.

Pre-development Subcatchments

Tributary to Point of Analysis #1		
Subcatchment ID	Total Area, acres	Runoff Curve Number
Catchment 1	3.57	94
Catchment 2	8.37	82
Catchment 3	0.90	57
P.O.A. Totals		
	12.84	84 (P.O.A. composite)

Tributary to Point of Analysis #2		
Subcatchment ID	Total Area, acres	Runoff Curve Number
Catchment 9	16.85	79
Catchment 12	2.65	98
Catchment 13	3.18	98
P.O.A. Totals		
	22.68	84 (P.O.A. composite)

Tributary to Point of Analysis #3		
Subcatchment ID	Total Area, acres	Runoff Curve Number
Catchment 4	1.14	65
Catchment 5	11.43	52
Catchment 6	11.84	63
Catchment 14	3.74	98
P.O.A. Totals		
	28.15	63 (P.O.A. composite)

Tributary to Point of Analysis #4		
Subcatchment ID	Total Area, acres	Runoff Curve Number
Catchment 11	7.44	60
P.O.A. Totals		
	7.44	60 (P.O.A. composite)

Tributary to Point of Analysis #5		
Subcatchment ID	Total Area, acres	Runoff Curve Number
Catchment 7	7.39	80
Catchment 8	1.29	78
P.O.A. Totals		
	8.68	80 (P.O.A. composite)

Tributary to Point of Analysis #6		
Subcatchment ID	Total Area, acres	Runoff Curve Number
Catchment 10	3.11	68
P.O.A. Totals		
	3.11	68 (P.O.A. composite)

Post-development Subcatchments

Tributary to Point of Analysis #1		
Subcatchment ID	Total Area, acres	Runoff Curve Number
Catchment 1S	2.68	61
Catchment 8S	1.19	75
Catchment 9S	11.11	85
P.O.A. Totals		
	14.98	80 (P.O.A. composite)

Tributary to Point of Analysis #2		
Subcatchment ID	Total Area, acres	Runoff Curve Number
Catchment 3S	22.12	98
P.O.A. Totals		
	22.12	98 (P.O.A. composite)

Tributary to Point of Analysis #3		
Subcatchment ID	Total Area, acres	Runoff Curve Number
Catchment 2S	3.47	73
Catchment 4S	25.05	97
P.O.A. Totals		
	28.52	94 (P.O.A. composite)

Tributary to Point of Analysis #4		
Subcatchment ID	Total Area, acres	Runoff Curve Number
Catchment 7S	1.88	98
Catchment 10S	5.80	58
P.O.A. Totals		
	7.68	68 (P.O.A. composite)

Tributary to Point of Analysis #5		
Subcatchment ID	Total Area, acres	Runoff Curve Number
Catchment 5SA	3.14	81
Catchment 5SB	3.60	89
Catchment 5SC	0.98	85
P.O.A. Totals		
	7.72	85 (P.O.A. composite)

Tributary to Point of Analysis #6		
Subcatchment ID	Total Area, acres	Runoff Curve Number
Catchment 6SA	2.94	70
Catchment 6SB	0.42	74
P.O.A. Totals		
	3.36	71 (P.O.A. composite)

Stormwater Runoff Calculations

In order to compare the existing conditions to design flow rates and volumes, our office set up a simple model to compute the flow rates and volumes. This model does not factor in individual manhole and pipe lengths but takes an overview approach by providing for the existing developed area of the site. By using this as a baseline, a comparison can be made to the design project that will check to ensure anticipated flow rates and volumes are not being exceeded to the existing ponds and discharge points. Due to the proposed design requiring some additional areas of cut, the post-development watershed area has increased to include these areas sloping down to the development. Because these area areas of cut that would reduce the overall area of the adjacent watershed without altering surface cover, our office did not feel it was necessary to analyze these watersheds since their peak rates and volumes would be reduced through a decrease in drainage area.

The results of the overall stormwater modeling indicate the following:

Peak Runoff Rates and Overall Volumes – Point of Analysis #1					
		Existing Development		Post-Development	
Storm	Rainfall	Rate, cfs	Surface Runoff Volume, acre-ft.	Rate, cfs	Surface Runoff Volume, acre-ft
2-Year	3.13”	24.42	1.793	0.93	0.102
10-Year	4.67”	43.14	3.199	11.94	1.298
100-Year	8.62”	89.14	6.804	62.97	4.993

Peak Runoff Rates and Overall Volumes – Point of Analysis #2					
		Existing Development		Post-Development	
Storm	Rainfall	Rate, cfs	Surface Runoff Volume, acre-ft.	Rate, cfs	Surface Runoff Volume, acre-ft
2-Year	3.13”	37.99	3.212	32.53	1.649
10-Year	4.67”	68.16	5.693	64.22	3.800
100-Year	8.62”	143.64	12.081	143.54	9.173

Peak Runoff Rates and Overall Volumes – Point of Analysis #3					
		Existing Development		Post-Development	
Storm	Rainfall	Rate, cfs	Surface Runoff Volume, acre-ft.	Rate, cfs	Surface Runoff Volume, acre-ft
2-Year	3.13”	12.83	1.439	3.55	0.332
10-Year	4.67”	25.20	2.806	11.58	2.585
100-Year	8.62”	62.28	8.117	62.19	9.575

Peak Runoff Rates and Overall Volumes – Point of Analysis #4					
		Existing Development		Post-Development	
Storm	Rainfall	Rate, cfs	Surface Runoff Volume, acre-ft.	Rate, cfs	Surface Runoff Volume, acre-ft
2-Year	3.13”	1.71	0.237	1.45	0.162
10-Year	4.67”	8.02	0.690	7.92	0.639
100-Year	8.62”	29.34	2.217	29.19	2.202

Peak Runoff Rates and Overall Volumes – Point of Analysis #5					
		Existing Development		Post-Development	
Storm	Rainfall	Rate, cfs	Surface Runoff Volume, acre-ft.	Rate, cfs	Surface Runoff Volume, acre-ft
2-Year	3.13”	7.14	0.962	6.72	0.724
10-Year	4.67”	9.81	1.867	9.68	1.529
100-Year	8.62”	18.31	4.261	14.95	3.659

Peak Runoff Rates and Overall Volumes – Point of Analysis #6					
		Existing Development		Post-Development	
Storm	Rainfall	Rate, cfs	Surface Runoff Volume, acre-ft.	Rate, cfs	Surface Runoff Volume, acre-ft
2-Year	3.13”	1.74	0.180	1.71	0.207
10-Year	4.67”	4.74	0.427	3.01	0.485
100-Year	8.62”	13.52	1.167	13.42	1.303

Based on the results above and the discussion of the pre- and post- development methodology, the project meets the goal for the runoff rates and volumes of the 2- 10-, and 100-year storm events. As shown in the table above, the proposed discharge rates and generally the volumes have been reduced during the 2-, 10-, and 100-year storm events. **This Standard has been met.**

c. Standard 3 – Stormwater Recharge

Standard 3 of the Massachusetts Stormwater Handbook states that loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

The first step in documenting compliance with this Standard is to compute the required recharge volume for the soil type that the site impacts. One component of this calculation is to determine the total area of new impervious surface over each soil type on the site. Since the site is a redevelopment, and impervious areas are being reduced, it can be said that stormwater recharge will be provided from the introduction of open space areas.

The required volume of recharge is expressed as:

$$Rv = F \times \text{Impervious Area}$$

Where F is a factor dependent on Hydrologic Soil Groups. In this case, the onsite soils are Hydrologic Group B soils, therefore, F is 0.35 inches. Applying this to the impervious site area yields:

$$Rv_1 = (0.35'') \times (1\ \text{ft}/12'') \times (2{,}770{,}198) = 80{,}797\ \text{Cubic-Feet}$$

Sufficient runoff must be directed to the infiltration BMPs to ensure infiltration of the Required Recharge Volume. In some cases, such as the proposed project, only a portion of the site's impervious area can be directed to the BMPs. As a result, the infiltration BMPs may not be able to capture sufficient rainfall on an average annual basis to meet the Required Recharge Volume. In this case, designers can either redesign the site so that runoff from more of the impervious areas located on the site are directed to the infiltration BMPs, or increase the storage capacity of the infiltration BMPs so that they may capture more of the runoff from the impervious surfaces located within the contributing area. In no case shall runoff from less than 65% of the site's impervious cover be directed to the BMPs intended to infiltrate the Required Recharge Volume. When less than 65% of impervious surfaces on a site are directed to infiltration BMPs, the system cannot capture sufficient runoff to infiltrate the Required Recharge Volume.

The total area not draining to infiltration systems is 234,315 S.F., which accounts for approximately 9% of the total impervious area. Since the recharge areas that will be used to satisfy this requirement do not capture 100% of the impervious site area, an adjustment factor must be included in the calculations. This factor is known as the Capture Area Adjustment factor and is expressed as the ratio of overall impervious area to the impervious area to the recharge system.

$$\text{Capture Area Adjustment} = \frac{\textit{Total Impervious Area}}{(\textit{Total Impervious Area} - \textit{Area not draining to Infiltration Systems})}$$

$$\text{Capture Area Adjustment} = \frac{2{,}770{,}198}{(2{,}770{,}198 - 2\quad{,}315)} = 1.09$$

$$\text{Adjusted Recharge Volume} = 1.09 \times 80{,}797\ \text{ft}^3 = 88{,}068\ \text{ft}^3$$

The project features infiltration systems designed to infiltrate stormwater to provide the required recharge volume. The total available volume within each infiltration system with the corresponding impervious area is shown in the table below.

Name of System(s)	Contributing Impervious Area (Square-Feet)	Unadjusted Static Volume Required (Cubic-Feet)	Static Recharge Provided (Cubic-Feet)
Infiltration System 1	1,056,987	30,829	101,632
Infiltration System 2	963,480	28,101	41,509
Infiltration System 3	82,071	2,394	7,924
Infiltration Basin 2/3	294,780	8,598	39,793
Infiltration Basin 4	19,582	571	5,245
Infiltration Basin 6	118,983	3,470	3,847
Total	2,535,883	65,545	199,950

*Infiltration Basins 1 and 2 are existing basins and have seen a reduction in the runoff rate and volume received during post-development conditions.

As demonstrated in the table above, there is 199,950 cubic-feet of static volume provided within the infiltration systems, which exceeds the required recharge volume of 88,068 cubic-feet by 111,882 cubic-feet.

Drawdown times have been analyzed for these systems as well. Per Massachusetts Stormwater Management Standards, the infiltration BMP (best management practice) must drain within 72 hours for the recharge volume. To determine whether an infiltration BMP will drain within 72 hours, the formula below has been used.

$$\text{Time}_{\text{drawdown}} = \frac{Rv}{(K)*(Bottom\ Area)}$$

Where:

Rv=Storage Volume

K = Saturated Hydraulic Conductivity for the Static Method utilizing Rawls Rates of the in-situ saturated hydraulic conductivity.

Bottom Area = Bottom area of the recharge structure.

Table 2 – Drawdown Time

Name of System	Storage Volume (R_v)	Saturated Hydraulic Conductivity (K)	Bottom Area of Recharge Structure	Drawdown Time (Hours)
Infiltration System 1	101,632	2.41	68,778	7.35
Infiltration System 2	41,509	2.41	39,720	5.20
Infiltration System 3	7,924	2.41	5,680	6.95

Table 2 – Drawdown Time				
Name of System	**Storage Volume (R_v)**	**Saturated Hydraulic Conductivity (K)**	**Bottom Area of Recharge Structure**	**Drawdown Time (Hours)**
Infiltration Basin 2/3	39,793	2.41	5,459	36.30
Infiltration Basin 4	5,245	2.41	1,024	25.50
Infiltration Basin 6	3,847	2.41	3,291	5.82

As documented above, **this standard has been met.**

d. Standard 4 – Water Quality

Massachusetts Stormwater Standard 4 requires stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS) and 44% of TSS in high infiltrative soils. In order to meet this criterion, BMPs must be designed into the overall site to provide treatment of runoff from impervious areas. Design criteria for many of these BMPs are based on a water quality volume of either ½" or 1", depending on several criteria for the project and site location. Water quality volumes must be based on a volume of 1/2" or 1" for each BMP when calculating effectiveness. The proposed project is considered a LUHPPL, and 1" must be used for each BMP.

Treatment trains for the project have been computed using the Massachusetts DEP TSS Removal Worksheets based on the DEP removal credits for properly designed and implemented measures. There is a minimum of 44% TSS removal prior to infiltration or recharge. The various treatment devices include:

- Deep Sump Catch Basins (25% TSS Removal)
- HydroInternational Hydrodynamic Separators (80% TSS Removal)
- Subsurface Infiltration Systems (80% TSS Removal)

Deep Sump Catch Basins
The Massachusetts Stormwater Handbook allows for 25% TSS removal provided the structures have four-foot-deep sumps and hoods at the outlet pipe. The project plans and details account for this feature.

Hydro International Hydrodynamic Separators
Hydro International Hydrodynamic Separators are proprietary devices that are individually sized based on peak flow criteria in conjunction with the impervious tributary area. Massachusetts previously had a Stormwater Technology Evaluation Project (MASTEP). This program has since been discontinued, and Massachusetts no longer has a mechanism to evaluate the effectiveness of proprietary devices to treat for water quality. As shown on the Parameter Brief included in Appendix G, the devices are capable of achieving an 80% removal efficiency for particles having a mean particle size (d_{50}) of 125 microns. The units will provide 80% TSS removal at 100% of the design flow rate.

Treatment Flow Rates

The treatment flow rate equals 1” times the impervious area of the post-development site. This water quality volume can be converted to a discharge rate that is used for sizing flow for manufactured proprietary stormwater treatment practices. Since the site is considered a LUHPPPL according to Standard 5, the water quality volume/flow rate is determined using 1” of runoff. The flow rate is calculated using the following equation:

$$Q_{1.0} = qu * A * WQV$$

$$Q_{1.0} = Flow\ rate\ associated\ with\ the\ first\ inch\ of\ runoff$$

qu=the unit peak discharge, in csm/in.

A = impervious surface drainage area (in square miles)

WQV= Water quality volume in watershed inches (1 inch in this case)

In order to achieve 80% TSS removal, the entire water quality storm event must pass through the water quality units.

Table 3 – Water Quality Flow Rate

Structure Name	Unit peak discharge ‘qu’ (csm/in)	Impervious Drainage Area ‘A’ (sq-miles)	$Q_{1.0}$ (cfs)	Model	Model’s TSS Treatment Flow Rate (cfs)
WQU 1	750	4.27×10^{-3}	3.20	FD-6HC	3.38
WQU 2	750	8.42×10^{-3}	6.31	FD-10HC	9.38
WQU 3	750	8.54×10^{-3}	6.41	FD-10HC	9.38
WQU 4	750	9.45×10^{-3}	7.08	FD-10HC	9.38
WQU 5	750	2.94×10^{-3}	2.21	FD-5HC	2.35
WQU 6	750	4.62×10^{-4}	0.35	FD-4HC	1.50
WQU 7	750	8.37×10^{-4}	0.63	FD-4HC	1.50
WQU 8	750	7.02×10^{-4}	0.53	FD-4HC	1.50
WQU 9	750	9.99×10^{-3}	7.49	FD-10HC	9.38
WQU 10	750	1.72×10^{-4}	0.13	FD-4HC	1.50
WQU 11	750	2.89×10^{-4}	0.22	FD-4HC	1.50
WQU 12	750	6.44×10^{-4}	0.48	FD-4HC	1.50
WQU 13	750	8.08×10^{-4}	0.61	FD-4HC	1.50

Infiltration Systems

The Massachusetts Stormwater Handbook allows for 80% TSS removal under the Subsurface Structure guidelines. In an area classified as a LUHPPL, 44% TSS removal is required prior to discharging to infiltration systems. All runoff entering the infiltration systems for this project comes from “clean” roof runoff or has achieved a minimum of 44% TSS removal through deep sump catch basins and sediment forebays/water quality units.

Infiltration systems must be designed to hold 1” of impervious area runoff in order to receive 80% TSS removal. Runoff from rooftops is considered clean, and do not require a water quality volume. The runoff from impervious surfaces with exception to the roof runoff receive a minimum of 44% TSS removal prior to discharging into the infiltration systems.

As demonstrated in Table 3, the required water quality flow rate and water quality volume has been accommodated within each water quality unit (WQU).

This Standard has been met.

e. Standard 5 – Land Uses with Higher Potential Pollution Loads

This project features a land use with higher potential pollution loads. As demonstrated in Table 3 above, the required water quality flow rates have been accommodated for 1” of runoff within each water quality unit (WQU). **This Standard has been met.**

f. Standard 6 – Critical Areas

Standards 6 applies to Zone IIs, Interim Wellhead Protection Areas or near or to other Critical Areas: Shellfish Growing Areas, Bathing Beaches, Outstanding Resource Waters, Special Resource Waters, and Cold-Water Fisheries.

The discharge locations across the site were constructed as part of the Intel Development, and none of the discharge locations are defined as critical areas. **This Standard does not apply.**

g. Standard 7 – Redevelopment

The project is not considered a redevelopment. **This Standard does not apply.**

h. Standard 8 – Construction Period Controls

Pollution prevention and erosion and sedimentation control measures will be implemented during all construction phases of the project. Control measures will address construction related impacts and land disturbance activities. Erosion Control Plans are included in the plan set and incorporates the use of silt fences along the downstream slope of the property. Silt sacks will be installed in existing catch basins within the public roadways prevent sediment accumulation within them. **This standard has been met.**

i. Standard 9 – Operation and Maintenance Plan

For this project, a Long-Term Operations and Maintenance manual has been developed under separate cover. This manual has been developed for the property owner and operator to maintain records of all required inspections and maintenance activities as the project site is operated in the future. The requirements listed in the Massachusetts Stormwater Checklist have been incorporated into the Manual. **This Standard has been met.**

j. Standard 10 – Illicit Discharges to Drainage System

This standard requires a signed statement regarding illicit discharges. A stamped and signed statement reading the following is included in the appendices.

> The stormwater management system is the system for conveying, treating, and infiltrating stormwater on-site, including stormwater best management practices and any pipes intended to transport stormwater to the groundwater, a surface water, or municipal separate storm sewer system. Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. Notwithstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing and water used to clean residential buildings without detergents.
>
> It is our belief and understanding, to the best of our knowledge, that there are no known illicit discharges on the site at 75 Reed Road in Hudson, Massachusetts.

Standard 10 also requires that, in addition to the Illicit Discharge Compliance Statement, a site map, drawn to scale, must identify the location of all systems conveying stormwater on the site and display that no connections between these systems and any waste management system exist. Engineering drawings accompanying this report display the location of all stormwater management components. These drawings serve as site maps and establish that no illicit discharges are proposed for this project. **This Standard has been met.**

4. Appendices

Appendix A – Massachusetts Stormwater 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.

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

COMMONWEALTH OF MASSACHUSETTS
TODD P.
MOREY
CIVIL
No. 48865
REGISTERED
PROFESSIONAL ENGINEER

7.19.2022

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): Subsurface Infiltration Systems

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 (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 (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 (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 (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.

Appendix B – Illicit Discharge Compliance Statement

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Phone: 617-242-1120

ILLICIT DISCHARGE STATEMENT

The stormwater management system is the system for conveying and detaining stormwater on-site, including stormwater best management practices and any pipes intended to transport stormwater to the groundwater, a surface water, or municipal separate storm sewer system. Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. Notwithstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing and water used to clean residential buildings without detergents.

It is our belief and understanding, to the best of our knowledge, that there are no known illicit discharges on the site at 75 Reed Road in Hudson, Massachusetts.

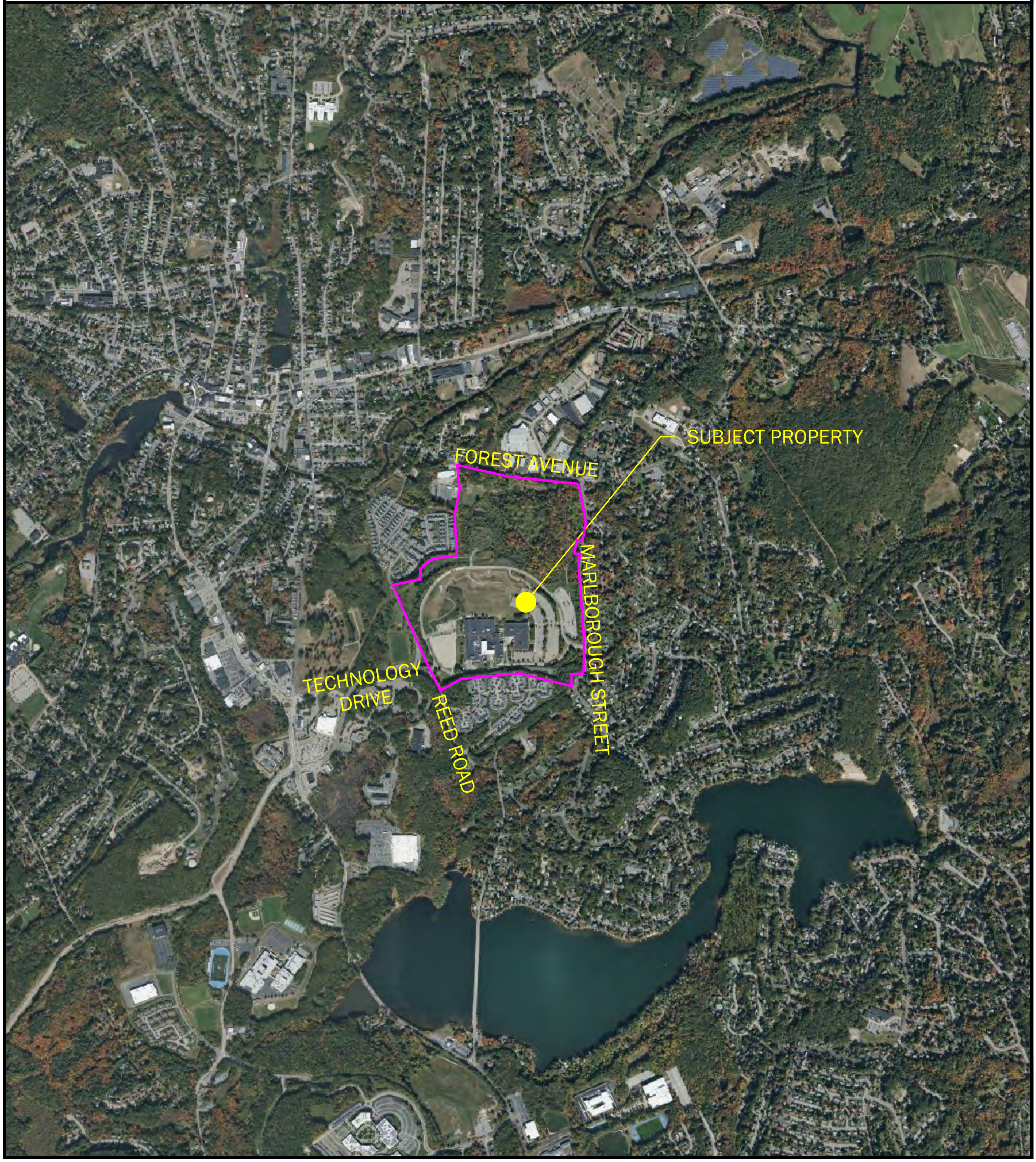
COMMONWEALTH OF MASSACHUSETTS
TODD P. MOREY
CIVIL
No. 48865
REGISTERED
PROFESSIONAL ENGINEER

7.19.2022

Todd P. Morey, P.E. | Date | Massachusetts 48865

Appendix C – Location Maps and Figures

REFERENCES:
PROPERTY LINE INFORMATION OBTAINED FROM SURVEY NAMED "3-24-22-#75 REED ROAD - HUDSON". AERIAL PHOTOGRAPHY OBTAINED FROM GOOGLE IMAGERY.



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PORTMAN INDUSTRIAL

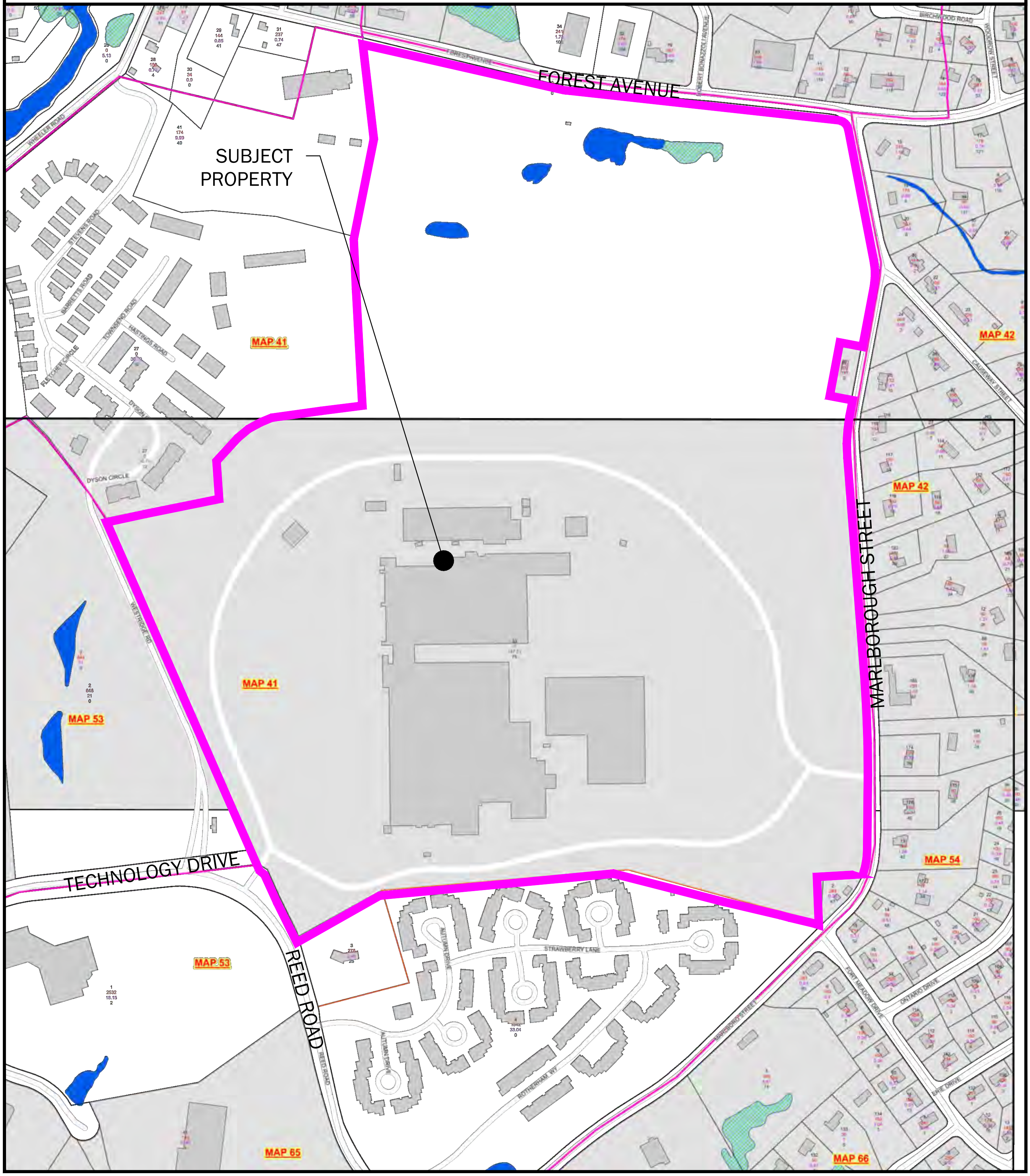
Aerial Map

75 Reed Road
Hudson, Massachusetts

Figure 1
Date: June 2022

SCALE: 1"=2000'
0 1000 2000

REFERENCES:
PROPERTY LINE INFORMATION OBTAINED FROM SURVEY NAMED "3-24-22-#75 REED ROAD - HUDSON". TAX MAP WAS OBTAINED FROM TOWN OF HUDSON TAX MAP.



BEALS·ASSOCIATES INC. 2 PARK PLAZA SUITE 200 BOSTON, MA 02116 PHONE: 617-242-1120 •PLANNING •ENGINEERING •PERMITTING •MANAGEMENT	Tax Map	Figure 2 Date: June 2022
PORTMAN INDUSTRIAL	75 Reed Road Hudson, Massachusetts	SCALE: 1'=500' 0 250 500

REFERENCES: PROPERTY LINE INFORMATION WAS OBTAINED FROM SURVEY NAMED "3-24-22-#75 REED ROAD - HUDSON". USGS MAP WAS OBTAINED FROM USGS HUDSON MASSACHUSETTS TOPOGRAPHIC MAP DATED 2021.

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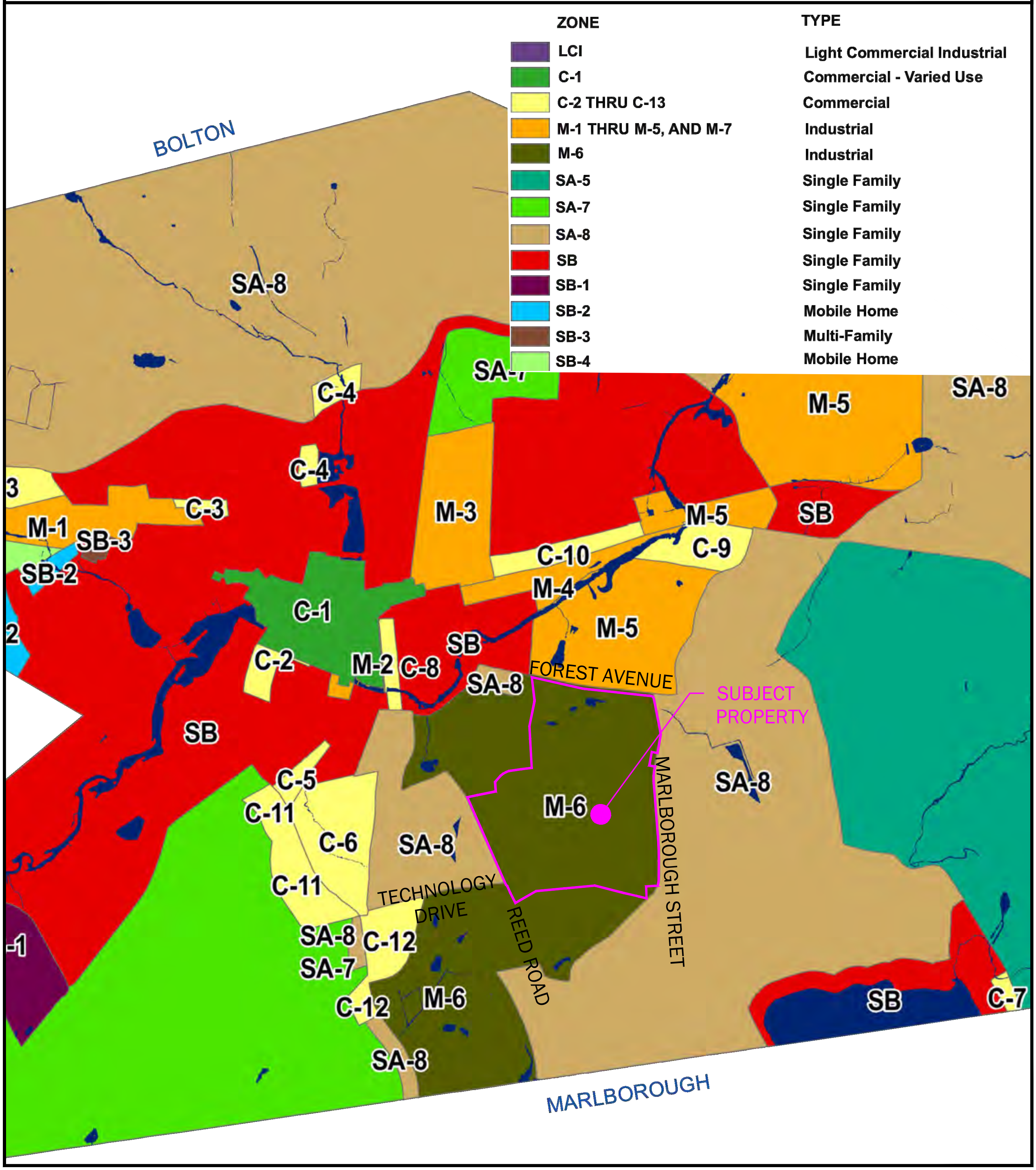
USGS Topographic Map

75 Reed Road
Hudson, Massachusetts

Figure 3
Date: June 2022

SCALE: 1"=2000'
0 1000 2000

REFERENCES:
PROPERTY LINE INFORMATION OBTAINED FROM SURVEY NAMED "3-24-22-#75 REED ROAD - HUDSON". ZONING MAP WAS OBTAINED FROM TOWN OF HUDSON GIS DATABASE.



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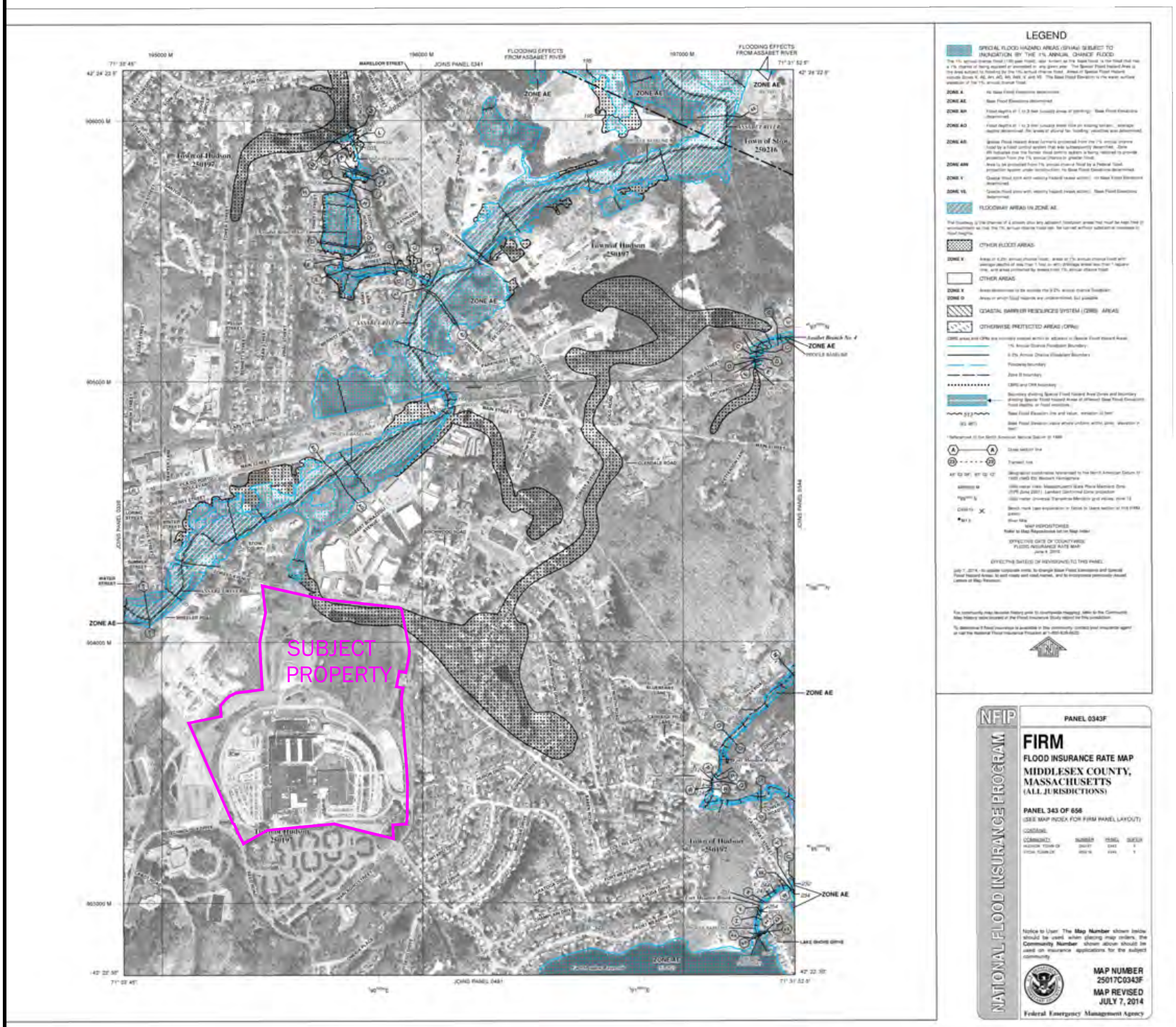
Zoning Map

75 Reed Road
Hudson, Massachusetts

Figure 4
Date: June 2022

SCALE: 1"=2000'
0 1000 2000

REFERENCES:
PROPERTY LINE INFORMATION OBTAINED FROM SURVEY NAMED "3-24-22-#75 REED ROAD - HUDSON". FEMA FLOODPLAIN INFORMATION WAS OBTAINED FROM FEMA FLOOD MAP SERVICE. FEMA MAP # 25017C0343F.



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FEMA Map

75 Reed Road
Hudson, Massachusetts

Figure 5
Date: June 2022

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Water	1.0	0.3%
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	3.8	1.3%
51A	Swansea muck, 0 to 1 percent slopes	0.2	0.1%
53A	Freetown muck, ponded, 0 to 1 percent slopes	2.6	0.9%
103C	Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes	3.3	1.1%
104C	Hollis-Rock outcrop-Charlton complex, 0 to 15 percent slopes	3.9	1.3%
104D	Hollis-Rock outcrop-Charlton complex, 15 to 25 percent slopes	2.0	0.7%
253B	Hinckley loamy sand, 3 to 8 percent slopes	14.8	4.9%
253E	Hinckley loamy sand, 25 to 35 percent slopes	21.7	7.3%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	3.6	1.2%
305C	Paxton fine sandy loam, 8 to 15 percent slopes	76.5	25.6%
305D	Paxton fine sandy loam, 15 to 25 percent slopes	0.0	0.0%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	12.9	4.3%
311B	Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony	11.6	3.9%
405B	Charlton fine sandy loam, 3 to 8 percent slopes	9.1	3.1%
623C	Woodbridge-Urban land complex, 3 to 15 percent slopes	2.4	0.8%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	29.2	9.8%
654	Udorthents, loamy	2.2	0.7%
655	Udorthents, wet substratum	14.0	4.7%
656	Udorthents-Urban land complex	84.1	28.1%
Totals for Area of Interest		**299.0**	**100.0%**

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NRCS Legend

75 Reed Road
Hudson, Massachusetts

Figure 6
Date: June 2022

REFERENCES:
PROPERTY LINE INFORMATION WAS OBTAINED FROM SURVEY NAMED "3-24-22-#75 REED ROAD - HUDSON". SOIL MAP AND MAP UNITS WERE OBTAINED FROM NRCS WEB SOIL SURVEY.

Custom Soil Resource Report
Soil Map

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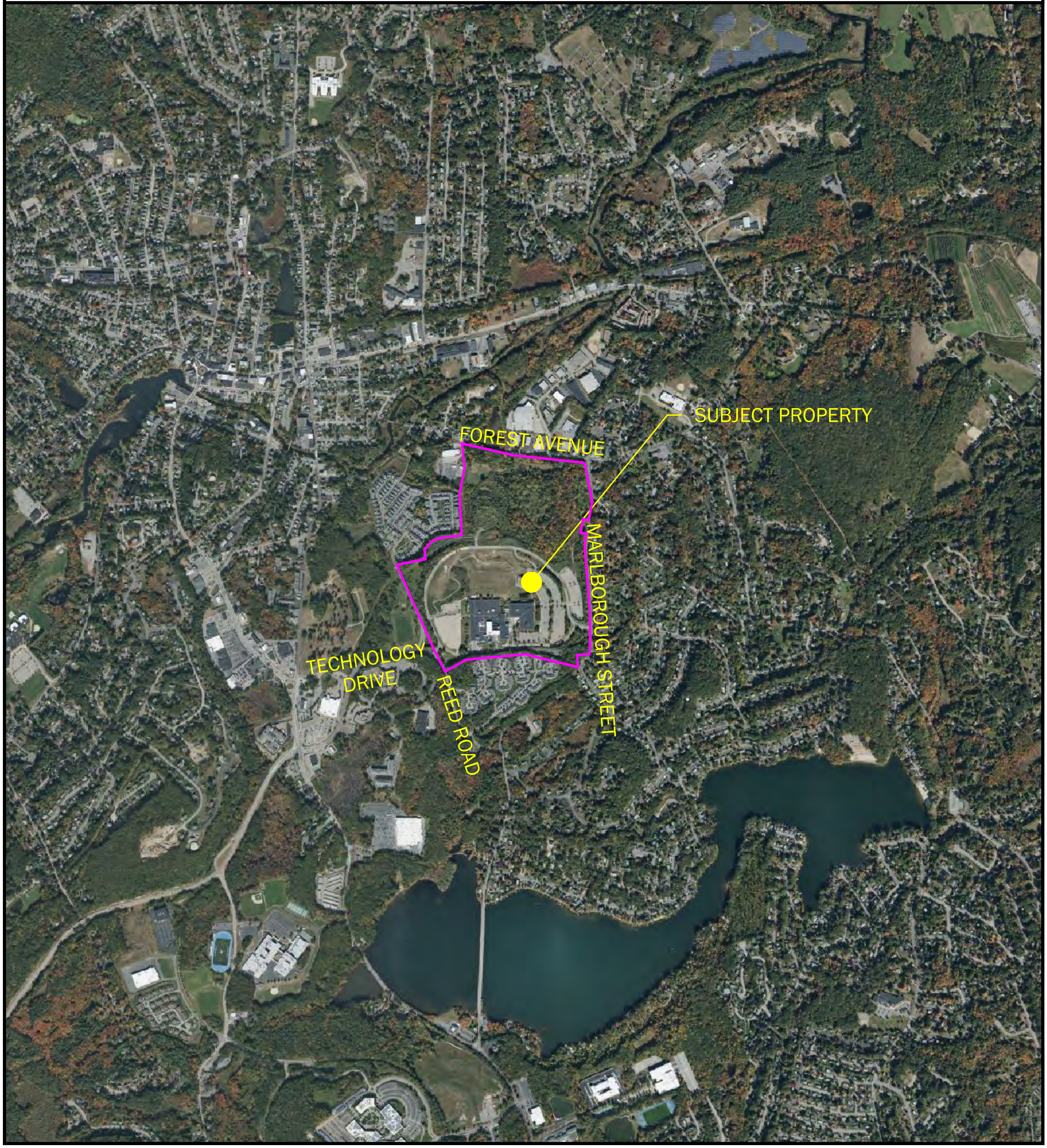
NRCS Map

75 Reed Road
Hudson, Massachusetts

Figure 6A
Date: June 2022

SCALE: N.T.S.

REFERENCES:
PROPERTY LINE INFORMATION OBTAINED FROM SURVEY NAMED "3-24-22-#75 REED ROAD - HUDSON". AERIAL PHOTOGRAPHY OBTAINED FROM GOOGLE IMAGERY.
NOTE:
THERE ARE NO NHESP PRIORITY HABITATS OF RARE SPECIES, ESTIMATED HABITATS OF RARE WILDLIFE, CERTIFIED VERNAL POOL, NOR POTENTIAL VERNAL POOL WITHIN THE PROJECT VICINITY BASED ON THE 2017 MAPPING.



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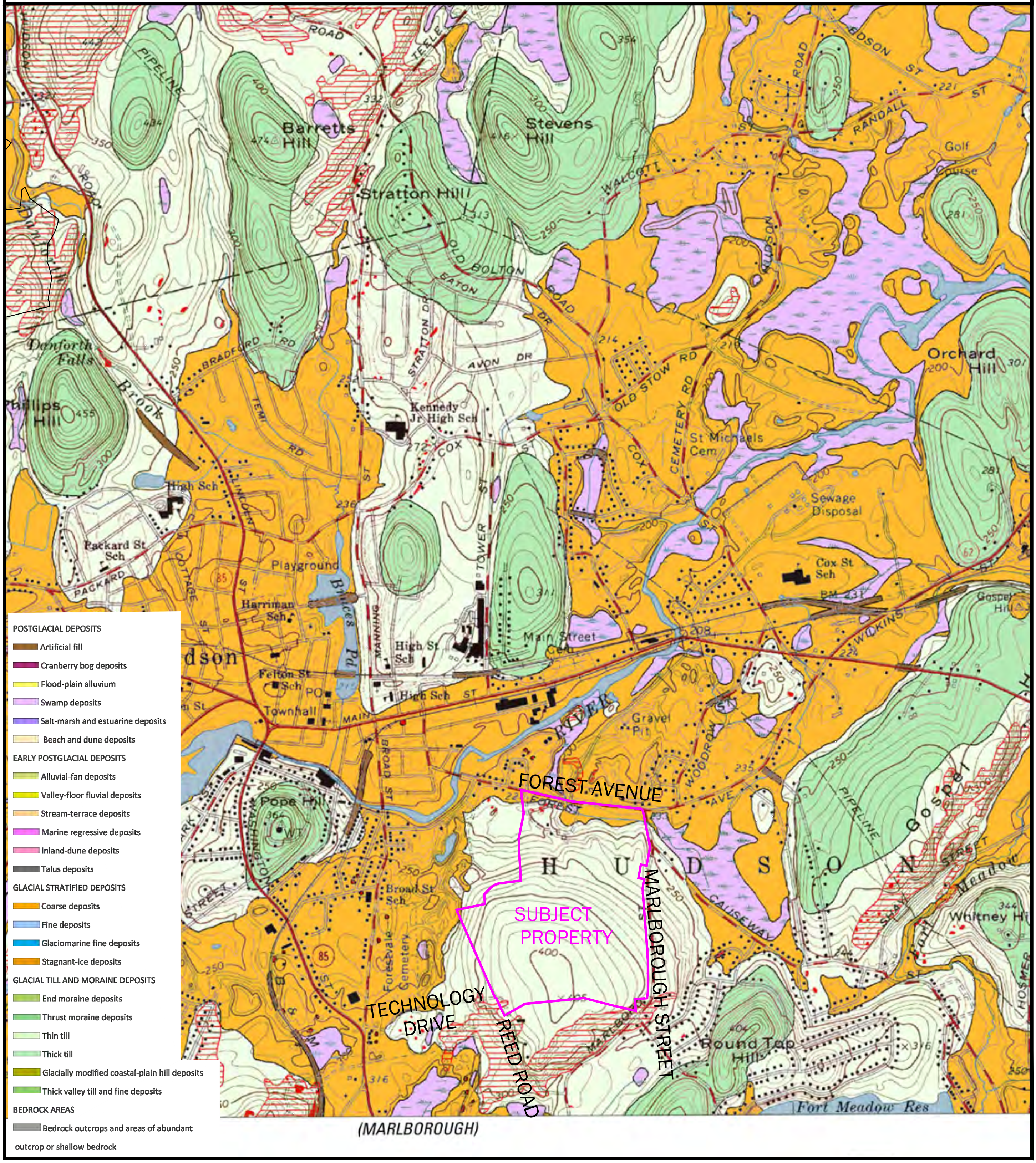
NHESP Map

75 Reed Road
Hudson, Massachusetts

Figure 7
Date: June 2022

SCALE: 1"=2000'
0 1000 2000

REFERENCES:
PROPERTY LINE INFORMATION WAS OBTAINED FROM SURVEY NAMED "3-24-22-#75 REED ROAD - HUDSON". SURFICIAL GEOLOGY INFORMATION WAS OBTAINED FROM SCIENTIFIC INVESTIGATIONS MAP 3402 QUADRANGLE 91—HUDSON.



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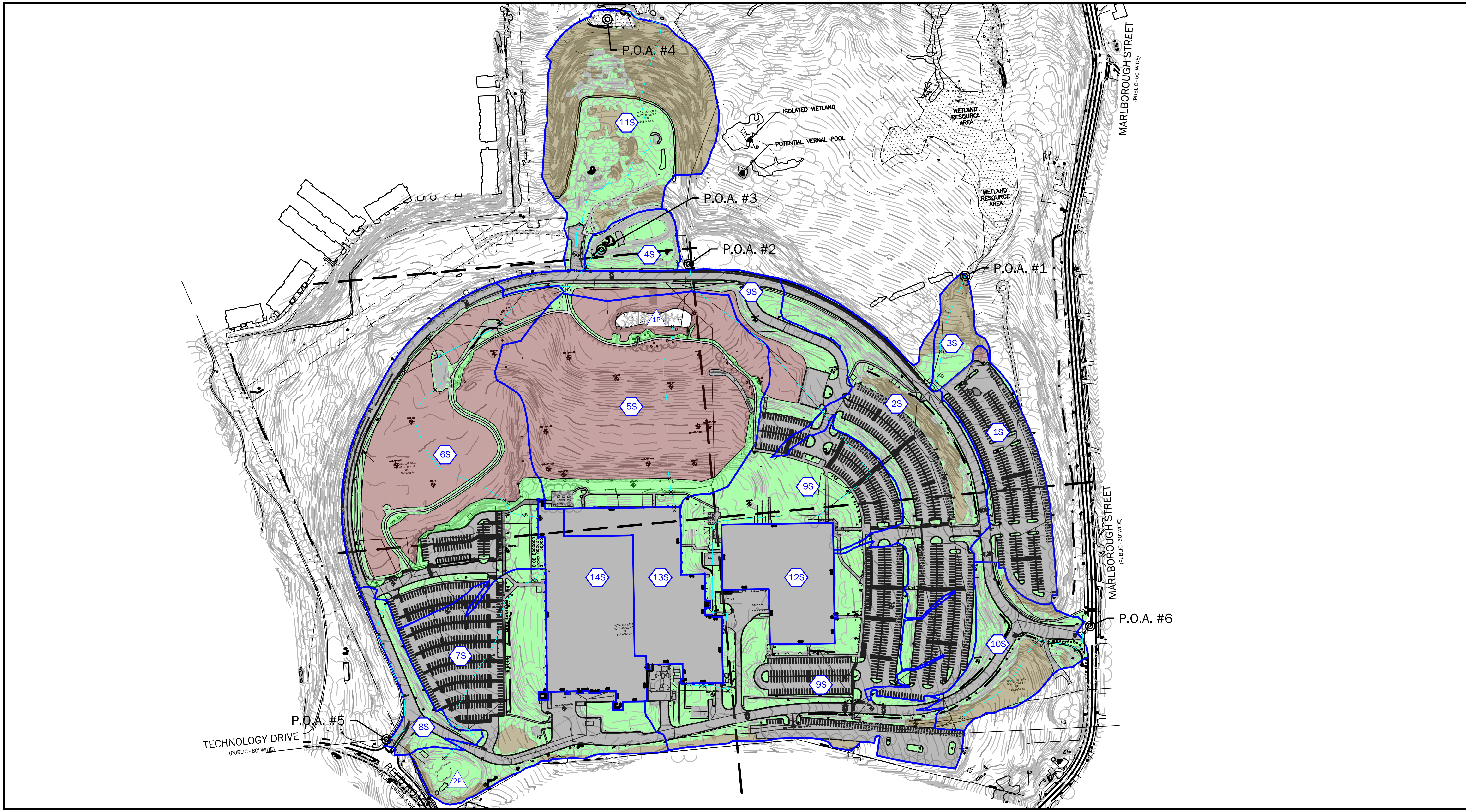
Surficial Geology Map

75 Reed Road
Hudson, Massachusetts

Figure 8
Date: June 2022

SCALE: 1"=2000'
0 1000 2000

Appendix D – Watershed Maps



PATH:H:\C-1144.01 Hudson\Autocad\Design Development\Predevelopment Watershed Map.dwg

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75 Reed Road

Hudson, MA

SCALE: 1"=300'

300 0 150 300 600

Sheet Title:

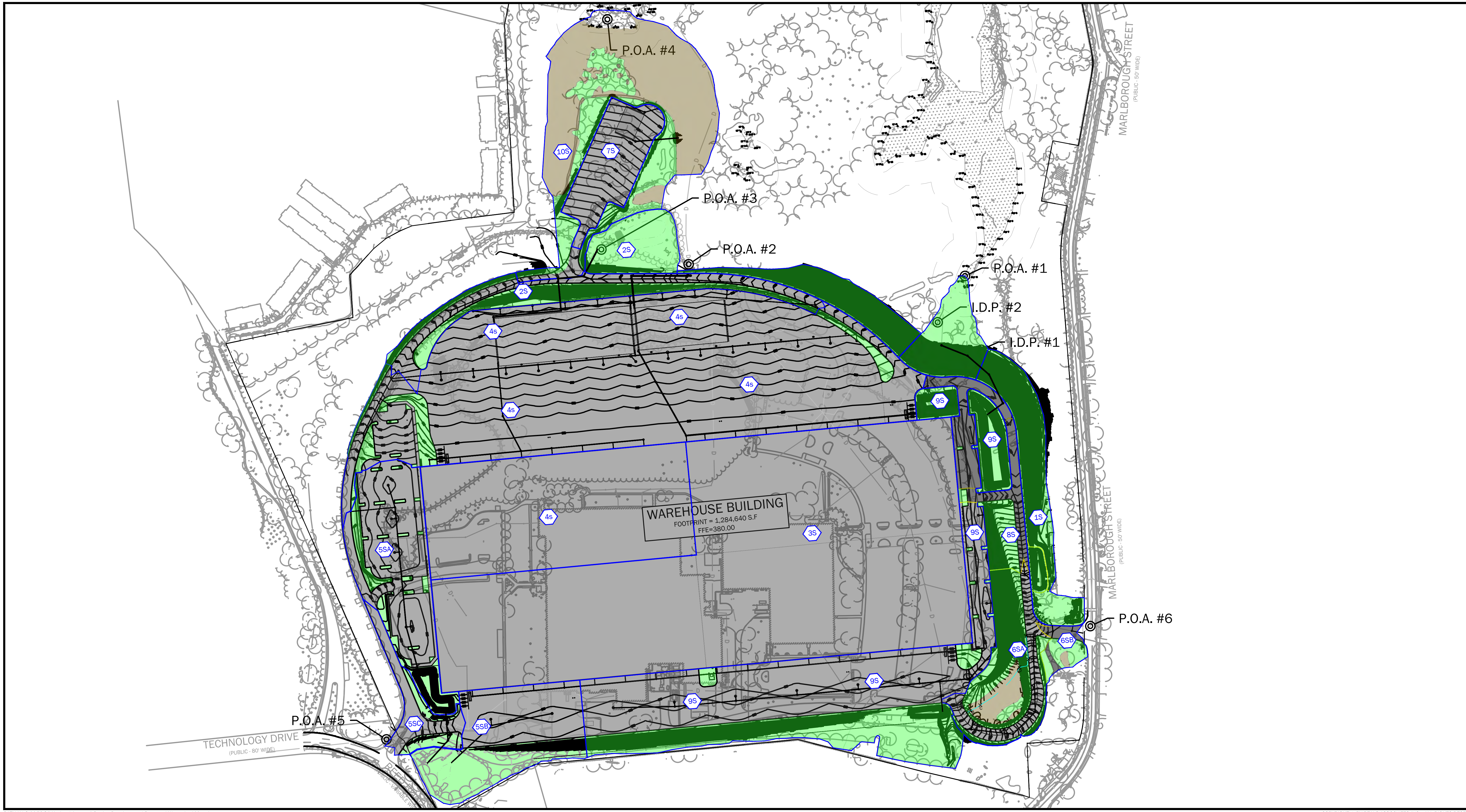
Predevelopment Watershed Map

Sheet No:

C.1

Date:

July 19, 2022



PATH:H:\C-1144.01 Hudson\Autocad\Design Development\Proposed Watershed Map.dwg

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75 Reed Road
Hudson, MA

SCALE: 1"=300'
300 0 150 300 600

Sheet Title:
Postdevelopment Watershed Map

Sheet No:
C.2

Date:
July 19, 2022

Appendix E – NRCS Soils Data & Geotechnical Report

United States Department of Agriculture

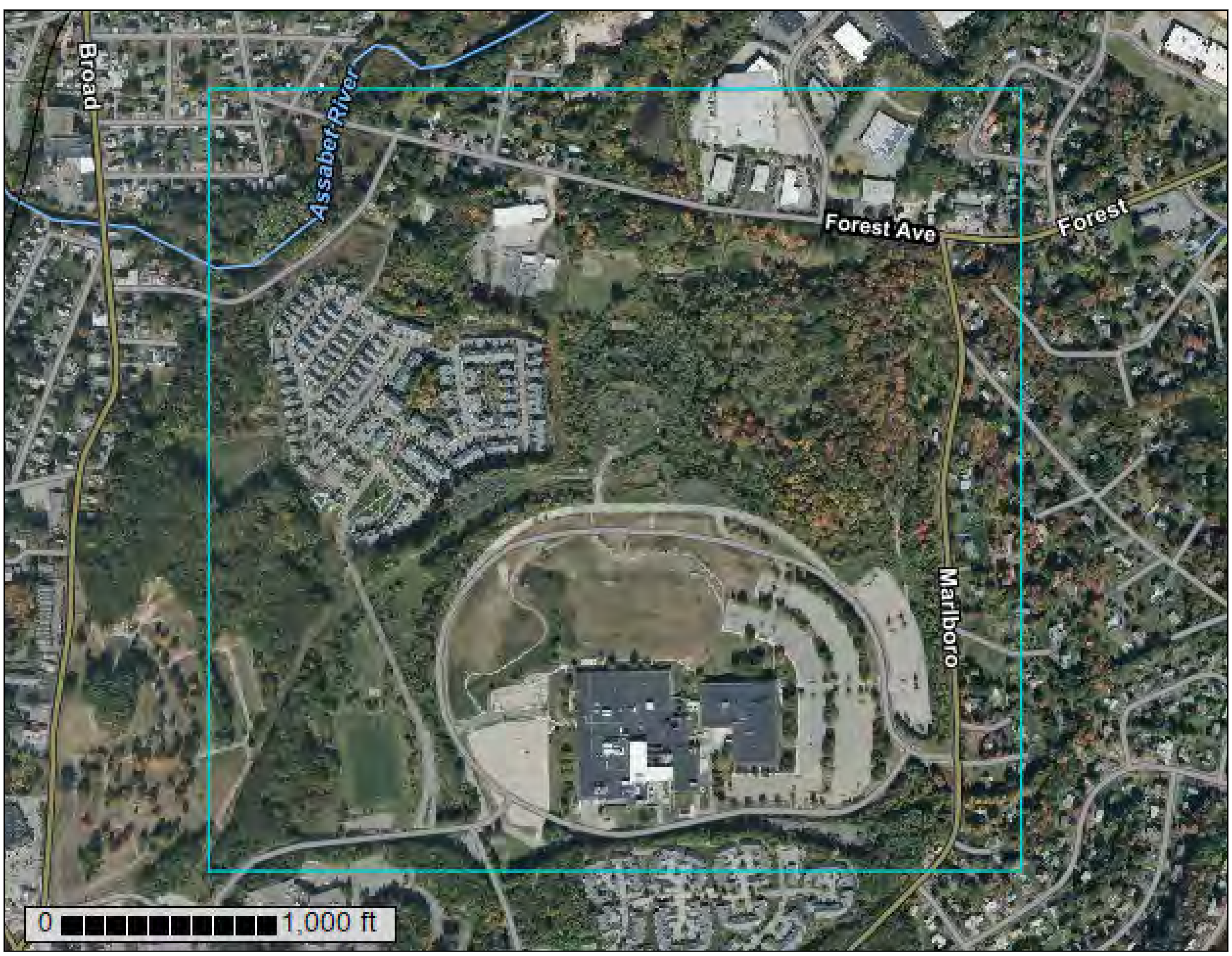
NRCS

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
Middlesex County, Massachusetts

75 Reed Road Hudson MA



July 18, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:9,380 if printed on A landscape (11" x 8.5") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N 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: Middlesex County, Massachusetts
Survey Area Data: Version 21, Sep 2, 2021

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

Date(s) aerial images were photographed: Sep 9, 2020—Oct 15, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Water	1.6	0.5%
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	4.7	1.5%
51A	Swansea muck, 0 to 1 percent slopes	0.7	0.2%
53A	Freetown muck, ponded, 0 to 1 percent slopes	3.5	1.1%
103C	Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes	0.7	0.2%
104C	Hollis-Rock outcrop-Charlton complex, 0 to 15 percent slopes	0.8	0.2%
104D	Hollis-Rock outcrop-Charlton complex, 15 to 25 percent slopes	0.8	0.3%
253B	Hinckley loamy sand, 3 to 8 percent slopes	20.8	6.6%
253C	Hinckley loamy sand, 8 to 15 percent slopes	0.9	0.3%
253E	Hinckley loamy sand, 25 to 35 percent slopes	27.8	8.8%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	3.6	1.1%
305C	Paxton fine sandy loam, 8 to 15 percent slopes	78.4	24.7%
305D	Paxton fine sandy loam, 15 to 25 percent slopes	0.0	0.0%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	12.9	4.1%
311B	Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony	5.4	1.7%
405B	Charlton fine sandy loam, 3 to 8 percent slopes	9.1	2.9%
623C	Woodbridge-Urban land complex, 3 to 15 percent slopes	0.3	0.1%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	42.2	13.3%
654	Udorthents, loamy	4.8	1.5%
655	Udorthents, wet substratum	14.0	4.4%
656	Udorthents-Urban land complex	84.0	26.5%
Totals for Area of Interest		**316.9**	**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 development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Middlesex County, Massachusetts

1—Water

Map Unit Setting

National map unit symbol: 996p
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Setting

Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear

6A—Scarboro mucky fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2svky
Elevation: 0 to 1,320 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Scarboro

Setting

Landform: Drainageways, outwash deltas, outwash terraces, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy glaciofluvial deposits derived from schist and/or sandy glaciofluvial deposits derived from gneiss and/or sandy glaciofluvial deposits derived from granite

Typical profile

Oe - 0 to 3 inches: mucky peat
A - 3 to 11 inches: mucky fine sandy loam

Cg1 - 11 to 21 inches: sand
Cg2 - 21 to 65 inches: gravelly coarse sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (1.42 to 14.17 in/hr)
Depth to water table: About 0 to 2 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F144AY031MA - Very Wet Outwash
Hydric soil rating: Yes

Minor Components

Swansea

Percent of map unit: 10 percent
Landform: Bogs, swamps
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Wareham

Percent of map unit: 5 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Walpole

Percent of map unit: 5 percent
Landform: Deltas, depressions, outwash terraces, depressions, outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, talf, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

51A—Swansea muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2trl2
Elevation: 0 to 1,140 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: Not prime farmland

Map Unit Composition

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

Description of Swansea

Setting

Landform: Bogs, swamps
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material over loose sandy and gravelly glaciofluvial deposits

Typical profile

Oa1 - 0 to 24 inches: muck
Oa2 - 24 to 34 inches: muck
Cg - 34 to 79 inches: coarse sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
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: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 16.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydrologic Soil Group: B/D
Ecological site: F144AY043MA - Acidic Organic Wetlands
Hydric soil rating: Yes

Minor Components

Freetown

Percent of map unit: 10 percent
Landform: Bogs, swamps
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

53A—Freetown muck, ponded, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2t2qc
Elevation: 0 to 1,140 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: Not prime farmland

Map Unit Composition

Freetown, ponded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Freetown, Ponded

Setting

Landform: Kettles, marshes, depressions, depressions, bogs, swamps
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave

Across-slope shape: Concave
Parent material: Highly decomposed organic material

Typical profile
Oe - 0 to 2 inches: mucky peat
Oa - 2 to 79 inches: muck

Properties and qualities
Slope: 0 to 1 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
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: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 19.2 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: F144AY043MA - Acidic Organic Wetlands
Hydric soil rating: Yes

Minor Components

Whitman, ponded
Percent of map unit: 5 percent
Landform: Depressions on ground moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro
Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea, ponded
Percent of map unit: 5 percent
Landform: Bogs, swamps, marshes, depressions, depressions, kettles
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

103C—Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2wzp1
Elevation: 0 to 1,390 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: Not prime farmland

Map Unit Composition

Charlton, extremely stony, and similar soils: 50 percent
Hollis, extremely stony, and similar soils: 20 percent
Rock outcrop: 10 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton, Extremely Stony

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 4 inches: fine sandy loam
Bw - 4 to 27 inches: gravelly fine sandy loam
C - 27 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: More than 80 inches
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: Moderate (about 8.7 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

Description of Hollis, Extremely Stony

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 7 inches: gravelly fine sandy loam
Bw - 7 to 16 inches: gravelly fine sandy loam
2R - 16 to 26 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 8 to 23 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 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: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Ridges, hills
Parent material: Igneous and metamorphic rock

Typical profile

R - 0 to 79 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)

Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Woodbridge, extremely stony

Percent of map unit: 8 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Canton, extremely stony

Percent of map unit: 5 percent
Landform: Moraines, hills, ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Chatfield, extremely stony

Percent of map unit: 5 percent
Landform: Ridges, hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Ridgebury, extremely stony

Percent of map unit: 2 percent
Landform: Hills, drainageways, drumlins, depressions, ground moraines
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

104C—Hollis-Rock outcrop-Charlton complex, 0 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w69p
Elevation: 0 to 1,270 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: Not prime farmland

Map Unit Composition

Hollis, extremely stony, and similar soils: 35 percent
Rock outcrop: 25 percent
Charlton, extremely stony, and similar soils: 25 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hollis, Extremely Stony

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Summit, backslope, shoulder
Landform position (three-dimensional): Side slope, nose slope, crest
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 7 inches: gravelly fine sandy loam
Bw - 7 to 16 inches: gravelly fine sandy loam
2R - 16 to 26 inches: bedrock

Properties and qualities

Slope: 0 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 8 to 23 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 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: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Ridges, hills
Parent material: Igneous and metamorphic rock

Typical profile

R - 0 to 79 inches: bedrock

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Charlton, Extremely Stony

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 4 inches: fine sandy loam
Bw - 4 to 27 inches: gravelly fine sandy loam
C - 27 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: More than 80 inches
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: Moderate (about 8.7 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

Canton, extremely stony

Percent of map unit: 7 percent
Landform: Moraines, hills, ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Chatfield, extremely stony

Percent of map unit: 6 percent
Landform: Ridges, hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Scituate, extremely stony

Percent of map unit: 1 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Footslope, backslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Montauk, extremely stony

Percent of map unit: 1 percent
Landform: Hills, recessionial moraines, ground moraines, drumlins
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

104D—Hollis-Rock outcrop-Charlton complex, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: 98yh
Elevation: 0 to 1,530 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Hollis and similar soils: 35 percent
Rock outcrop: 30 percent
Charlton and similar soils: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hollis

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Crest, head slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable, shallow loamy basal till over granite and gneiss

Typical profile

H1 - 0 to 2 inches: fine sandy loam
H2 - 2 to 14 inches: fine sandy loam
H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 25 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 8 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 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 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Parent material: Granite and gneiss

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s

Description of Charlton

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable loamy eolian deposits over friable loamy basal till derived from granite and gneiss

Typical profile

H1 - 0 to 5 inches: fine sandy loam
H2 - 5 to 22 inches: sandy loam
H3 - 22 to 65 inches: gravelly sandy loam

Properties and qualities

Slope: 15 to 25 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 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: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Canton

Percent of map unit: 10 percent
Landform: Hills
Landform position (two-dimensional): Shoulder, summit

Landform position (three-dimensional): Head slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Montauk

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Nose slope, head slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Unnamed

Percent of map unit: 2 percent

253B—Hinckley loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svm8
Elevation: 0 to 1,430 feet
Mean annual precipitation: 36 to 53 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Hinckley and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Outwash deltas, outwash terraces, kames, kame terraces, moraines, eskers, outwash plains
Landform position (two-dimensional): Summit, backslope, footslope, shoulder
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, riser, tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand

Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 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: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 8 percent
Landform: Outwash deltas, outwash terraces, moraines, eskers, kames, outwash plains, kame terraces
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, riser, tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Outwash deltas, outwash terraces, moraines, outwash plains, kame terraces
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, base slope, head slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: No

Agawam

Percent of map unit: 2 percent
Landform: Outwash deltas, outwash terraces, moraines, eskers, kames, outwash plains, kame terraces
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Crest, base slope, side slope, nose slope, riser, tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave

Hydric soil rating: No

253C—Hinckley loamy sand, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2svm9
Elevation: 0 to 1,480 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: Farmland of statewide importance

Map Unit Composition

Hinckley and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Outwash deltas, outwash terraces, moraines, eskers, kames, outwash plains, kame terraces
Landform position (two-dimensional): Shoulder, toeslope, footslope, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand
Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 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 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Sudbury

Percent of map unit: 5 percent
Landform: Outwash deltas, moraines, outwash plains, kame terraces, outwash terraces
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: No

Windsor

Percent of map unit: 5 percent
Landform: Moraines, eskers, kames, outwash deltas, outwash terraces, outwash plains, kame terraces
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent
Landform: Kames, outwash plains, outwash terraces, moraines, eskers
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Side slope, crest, head slope, nose slope, riser
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

253E—Hinckley loamy sand, 25 to 35 percent slopes

Map Unit Setting

National map unit symbol: 2svmf
Elevation: 0 to 1,200 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: Not prime farmland

Map Unit Composition

Hinckley and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Outwash deltas, outwash terraces, moraines, eskers, kames, outwash plains, kame terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand
Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 25 to 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 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 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 10 percent
Landform: Moraines, eskers, kames, outwash deltas, outwash terraces, outwash plains, kame terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Crest, head slope, nose slope, side slope, riser
Down-slope shape: Concave, convex, linear

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

Merrimac

Percent of map unit: 3 percent
Landform: Kame terraces, outwash terraces, kames, outwash plains, moraines, eskers
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, crest, head slope, nose slope, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Sudbury

Percent of map unit: 2 percent
Landform: Outwash deltas, moraines, outwash plains, kame terraces, outwash terraces
Landform position (two-dimensional): Backslope, footslope, toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: No

254B—Merrimac fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyqs
Elevation: 0 to 1,290 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

Merrimac and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Outwash plains, outwash terraces, moraines, eskers, kames
Landform position (two-dimensional): Backslope, footslope, summit, shoulder
Landform position (three-dimensional): Side slope, crest, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Minor Components

Hinckley

Percent of map unit: 5 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Windsor

Percent of map unit: 3 percent
Landform: Deltas, outwash plains, outwash terraces, dunes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Riser, tread
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex

Hydric soil rating: No

Agawam

Percent of map unit: 2 percent
Landform: Outwash plains, outwash terraces, moraines, stream terraces, eskers, kames
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

305C—Paxton fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w66y
Elevation: 0 to 1,320 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: Farmland of statewide importance

Map Unit Composition

Paxton and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paxton

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 8 inches: fine sandy loam
Bw1 - 8 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: fine sandy loam
Cd - 26 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 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 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Charlton

Percent of map unit: 7 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Woodbridge

Percent of map unit: 6 percent
Landform: Hills, drumlins, ground moraines
Landform position (two-dimensional): Footslope, summit, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury

Percent of map unit: 2 percent
Landform: Drumlins, drainageways, depressions, ground moraines, hills
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: Yes

305D—Paxton fine sandy loam, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: 2w67j
Elevation: 0 to 1,450 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: Not prime farmland

Map Unit Composition

Paxton and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paxton

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 8 inches: fine sandy loam
Bw1 - 8 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: fine sandy loam
Cd - 26 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 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 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Charlton

Percent of map unit: 8 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Woodbridge

Percent of map unit: 6 percent
Landform: Hills, drumlins, ground moraines

Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury

Percent of map unit: 1 percent
Landform: Drumlins, depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: Yes

307C—Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w676
Elevation: 0 to 1,490 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: Not prime farmland

Map Unit Composition

Paxton, extremely stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paxton, Extremely Stony

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 10 inches: fine sandy loam
Bw1 - 10 to 17 inches: fine sandy loam
Bw2 - 17 to 28 inches: fine sandy loam
Cd - 28 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent

Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 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 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Charlton, extremely stony

Percent of map unit: 8 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Woodbridge, extremely stony

Percent of map unit: 6 percent
Landform: Hills, drumlins, ground moraines
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury, extremely stony

Percent of map unit: 1 percent
Landform: Drumlins, depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

311B—Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2t2qr

Elevation: 0 to 1,440 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: Farmland of statewide importance

Map Unit Composition

Woodbridge, very stony, and similar soils: 82 percent
Minor components: 18 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodbridge, Very Stony

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope, footslope, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 9 inches: fine sandy loam
Bw1 - 9 to 20 inches: fine sandy loam
Bw2 - 20 to 32 inches: fine sandy loam
Cd - 32 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 19 to 27 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 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C/D
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Minor Components

Paxton, very stony

Percent of map unit: 10 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Crest, side slope

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

Ridgebury, very stony
Percent of map unit: 8 percent
Landform: Hills, drainageways, drumlins, depressions, ground moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

405B—Charlton fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2wh0n
Elevation: 0 to 1,440 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

Charlton and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton

Setting

Landform: Ridges, ground moraines, hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest, nose slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw - 7 to 22 inches: gravelly fine sandy loam
C - 22 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
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: Moderate (about 6.9 inches)

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

Minor Components

Sutton
Percent of map unit: 8 percent
Landform: Hills, ground moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Paxton
Percent of map unit: 5 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Leicester
Percent of map unit: 1 percent
Landform: Depressions, drainageways
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Chatfield
Percent of map unit: 1 percent
Landform: Ridges, hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

623C—Woodbridge-Urban land complex, 3 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w68b
Elevation: 0 to 550 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

Woodbridge and similar soils: 58 percent
Urban land: 28 percent
Minor components: 14 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodbridge

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope, footslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 18 inches: fine sandy loam
Bw2 - 18 to 30 inches: fine sandy loam
Cd - 30 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 30 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 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D

Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Description of Urban Land

Typical profile
M - 0 to 10 inches: cemented material

Properties and qualities
Slope: 3 to 15 percent
Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Paxton
Percent of map unit: 9 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury
Percent of map unit: 5 percent
Landform: Hills, drainageways, drumlins, depressions, ground moraines
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: Yes

626B—Merrimac-Urban land complex, 0 to 8 percent slopes

Map Unit Setting
National map unit symbol: 2tyr9
Elevation: 0 to 820 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days

Farmland classification: Not prime farmland

Map Unit Composition

Merrimac and similar soils: 45 percent
Urban land: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Outwash plains, outwash terraces, moraines, eskers, kames
Landform position (two-dimensional): Backslope, footslope, summit, shoulder
Landform position (three-dimensional): Side slope, crest, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: cemented material

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Hinckley

Percent of map unit: 5 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, crest, head slope, side slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Windsor

Percent of map unit: 5 percent
Landform: Outwash terraces, dunes, outwash plains, deltas
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

654—Udorthents, loamy

Map Unit Setting

National map unit symbol: vr1l
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Udorthents, Loamy

Setting

Parent material: Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

Properties and qualities

Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Minor Components

Udorthents, sandy

Percent of map unit: 10 percent
Hydric soil rating: No

Urban land

Percent of map unit: 5 percent
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Udorthents, wet substratum

Percent of map unit: 5 percent
Hydric soil rating: Yes

655—Udorthents, wet substratum

Map Unit Setting

National map unit symbol: vr1n
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents, wet substratum, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Wet Substratum

Setting

Parent material: Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Minor Components

Urban land

Percent of map unit: 8 percent
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Freetown

Percent of map unit: 4 percent
Landform: Depressions, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 3 percent
Landform: Depressions, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

656—Udorthents-Urban land complex

Map Unit Setting

National map unit symbol: 995k
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 45 percent
Urban land: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Parent material: Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land

Minor Components

Canton

Percent of map unit: 10 percent
Landform: Hills
Landform position (two-dimensional): Backslope, toeslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent
Landform: Terraces, plains
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Paxton

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex

Hydric soil rating: No

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Geotechnical Engineering Report

75 Reed Road
Hudson, Massachusetts 01749

for
Portman Industrial LLC

April 22, 2022

GeoEngineers USA

Geotechnical Engineering Report

75 Reed Road
Hudson, Massachusetts 01749

for
Portman Industrial LLC

April 22, 2022

GeoEngineers USA

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Boston, Massachusetts 02114
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Geotechnical Engineering Report

75 Reed Road
Hudson, Massachusetts 01749

File No. 25394-004-00

April 22, 2022

Prepared for:

Portman Industrial LLC
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Attention: Mr. Ken Skinner

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APPENDICES

EXECUTIVE SUMMARY

This report has been prepared by GeoEngineers USA, PC (GeoEngineers) on behalf of Portman Industrial LLC (Portman, Client) in support of the construction of a single one-story warehouse building and supplemental parking, access drives and loading docks for the redevelopment project located at 75 Reed Road in Hudson, Massachusetts (the Site). This report is subject to the attached Limitations and Guidelines for Use in Appendix A.

Based on information provided to us and our analysis of the subsurface conditions, we recommend the building be supported by conventional, shallow spread footings and a slab-on-grade following implementation of ground improvement methods. Given the nature of the soil and the size of the site, the ground improvement methods should include the following – treatment of the eastern site area using deep dynamic compaction (DDC), over-excavation and replacement of fill material in the eastern portion of the Site (note this is anticipated to be a limited area considering the eastern portion of the site will be cut approximately 15 to 20 feet to achieve the proposed site grades), and removal of the existing building foundations (and basement slab) and backfilling of the area with compacted Structural Fill. Additional details are provided in Section 6 of this report.

Additional design considerations for the preparation of the pavement areas and design of retaining walls are provided herein.

1.0 INTRODUCTION

This report presents the results of GeoEngineers USA PC (GeoEngineers) geotechnical engineering services on behalf of Portman Industrial LLC (Portman, Client) for the 75 Reed Road project located in Hudson, Massachusetts (the Site). The property is bounded by Forest Avenue to the north, Marlboro Street to the east, Westridge Road to the west, and private properties along Strawberry Lane to the south. The Site is shown relative to surrounding physical features in Figure 1, Locus Map, and Figure 2, Exploration Location Plan.

The purpose of this report is to provide geotechnical engineering recommendations for the design and construction of the planned redevelopment. GeoEngineers' geotechnical engineering services have been completed in general accordance with our proposal dated December 13, 2021, and your email authorization of additional services on April 4, 2022. This report is subject to the attached Limitations in Appendix A.

2.0 EXISTING CONDITIONS

The site consists of two active buildings on the southern portion of the property, paved parking lots to the east, west, and southeast of the buildings, and landscaped areas to the north of the buildings. The existing buildings, Intel HD1 and Intel HD2, are occupied by Intel Corporation (Intel). Foundation plans indicate HD1 is constructed with a finished floor level at approximately elevation (El.) 402 feet with a partial basement at approximately El. 392 feet, and a partial subbasement at approximately El. 387 feet. Foundation plans for HD2 indicate a finished floor elevation at approximately El. 397 feet with a basement level at approximately El. 383 feet (the basement below HD2 covers approximately two thirds of the building). Elevations noted in this report are referenced to the National Geodetic Vertical Datum (NAD83).

In addition to the existing buildings, Intel occupied multiple buildings north of Intel HD1 and Intel HD2 that were demolished as recently as 2018. The approximate limits of the former (now razed) buildings are shown on Figure 2.

According to personnel at Intel, the building superstructures were demolished; however, the foundation walls, footings, and slabs remain. The slabs were reportedly perforated to allow drainage and the foundation walls were removed to at least 3 feet below current finished grade. The basements and utility tunnels of the former buildings were backfilled with the demolition debris with a maximum particle size of 4 to 6 inches under a Beneficial Use Determination (BUD) approved by MassDEP. It is unclear from available data how the BUD material was placed (i.e. lift thickness and compactive effort); however, photographs from demolition indicate that a smooth drum roller was used to compact the soil, and our test pit subsurface program completed in April 2022 indicated most of the fill material was generally consistent, where present.

Based on our review of available plans from CH2M Hill dated January 2016, as much as 30 to 35 feet of fill was placed to backfill former utility tunnels which are currently below proposed paved areas. The grading plans included with the BUD application indicate as much as 20 feet (or more) of fill is present in isolated areas below the proposed building footprint.

Existing grades across the site within the redevelopment areas vary from approximately El. 331 feet to 404 feet. Within the proposed building footprint, the lowest elevation is approximately El. 332 feet in the northeastern corner, and elevations vary between approximately El. 380 feet to El. 404 feet throughout the rest of the building with the highest elevation in the center. Areas of supplemental parking, access drives and loading docks have elevations that vary across the site with the lowest elevations along the eastern portion of the site between El. 332 feet to El. 352 feet. Generally, the paved areas are between El. 370 feet to El. 385 feet with the exception of the southern portion of the site that has approximate elevations between 390 feet and 400 feet.

Numerous site utilities – both active and abandoned – remain present below the parking, landscaped and building areas. Copies of the BUD agreement and historical structural plans were provided to GeoEngineers and can be provided upon request.

3.0 PROJECT DESCRIPTION

Based on the grading plans provided to us by Beals Associates, Inc. (Beals) of Boston, Massachusetts, and dated March 22, 2022, we understand the site concept includes demolition of the existing Intel HD1 and Intel HD2 buildings and construction of one single-story warehouse building. The building footprint is approximately 1.3 million (MM) square feet with a proposed finished floor elevation (FFE) of 380 feet. Parking lots, access drives and loading docks are also proposed to supplement the warehouse structure. The proposed redevelopment is shown in Figure 2.

It is our understanding that the proposed building will be constructed at-grade with no basements.

Based on conceptual plans provided to us by Beals, two stormwater infiltration systems may be constructed in the northwest and eastern portions of the Site to manage stormwater runoff.

Based on the plans, we understand that cut areas will range between 5 to 25 feet, and fill areas ranging between 5 to 40 feet will be required to achieve proposed site grades. Cut areas on the order of 20 to 25 feet are located on the eastern, central, and southeastern portions of the proposed building and southern portion of the proposed paved areas. Meanwhile, fill areas on the order of 30 to 40 feet are located on the northeastern portion of the proposed building and paved areas. The site grading plan requires several retaining walls to achieve the proposed grading. The locations are shown on Figure 2. Wall heights vary from approximately 12 feet to 40 feet.

4.0 SUBSURFACE EXPLORATION PROGRAM BY GEOENGINEERS

The explorations were conducted to evaluate subsurface conditions, the thickness and quality of the fill material, presence of bedrock, and the ability to re-use the existing fill material. The subsurface exploration program conducted by GeoEngineers consisted of the following:

- Thirty-five borings, GEO-1 through GEO-35, were advanced to depths between approximately 4.5 to 32 feet belowground surface(bgs) in January 2022. Note one location, GEO-11, encountered refusal at approximately 3 inches bgs after several attempts and the boring was abandoned;
- Seven test pits, GEO-TP-101 through GEO-TP-107, were excavated to depths between approximately 3 to 17 feet bgs in April 2022. Note that one location, GEO-TP-103, was conducted as two separate locations and has an off-set location designated as GEO-103A; and,

- Four additional test borings (completed with a combination of augers and air-hammer probes), GEO-101 through GEO-104, were advanced to depths between approximately 12.5 to 24 feet bgs in April 2022 to confirm the presence of shallow bedrock or boulders at or near previous boring locations that encountered shallow refusal.

The boring, test pit, and air-hammer programs were completed between January and April 2022 as noted above and on Figure 2. Additional details on the programs are provided in subsequent sections. The approximate locations of the explorations are shown in Figure 2. Logs of the subsurface explorations are provided in Appendix B.

4.1. Geotechnical Boring Program

The test borings were advanced by Soil X Corp. (Soil X) of Leominster, Massachusetts, and were completed using a combination of truck-mounted and track-mounted drill rigs equipped with continuous-flight, hollow-stem auger drilling equipment. As noted above, an air-hammer attachment was used in the GEO-100 series borings to advance through boulders. The borings were continuously monitored by a representative from our firm who examined and classified the soils encountered, obtained representative soil samples, observed groundwater conditions (if encountered), and prepared a detailed log of each exploration.

The soils encountered in the borings were sampled at ground surface and generally at 5-foot vertical intervals thereafter with a 2-inch outside-diameter split-barrel standard penetration test (SPT) sampler. Split-spoon samples and SPTs were performed in general accordance with ASTM D1586. The disturbed samples were obtained by driving the sampler 24 inches into the soil with a 140-pound automatic hammer free-falling 30 inches. The number of blows required for each 6 inches of penetration was recorded. The blow count ("N-value") of the soil was calculated as the number of blows required for the middle 12 inches of penetration. This resistance, or N-value, provides a measure of the relative density of granular soils and the relative consistency of cohesive soils. Where very dense soil conditions precluded driving the full 24 inches, the penetration resistance for the partial penetration was entered on the logs. The blow counts are shown on the boring logs at the respective sample depths.

Where refusal was encountered in the borings, the boring was terminated at the depth of refusal and recorded on the detailed boring log. Refusal is defined as the inability to advance the boring or test pit with the auger or test pit bucket.

Soils encountered in the borings were visually classified in general accordance with the classification system described in Figure B-1 in Appendix B. A key to the boring log symbols is also presented in Figure B-1. The logs of the borings are presented in Figures B-2 through B-36. The boring logs are based on our interpretation of the field and laboratory data and indicate the various types of soils and groundwater conditions encountered. The logs also indicate the depths at which these soils or their characteristics change, although the change may actually be gradual. If the change occurred between samples, it was interpreted. The densities noted on the boring logs are based on the blow count data obtained in the borings and judgment based on the conditions encountered.

Observations of groundwater conditions, if encountered, were made during drilling. The groundwater conditions encountered during drilling are presented on the boring logs. Groundwater conditions observed during drilling represent a short-term condition and may or may not be representative of the long-term groundwater conditions at the site. Groundwater conditions observed during drilling should be considered approximate.

4.2. Geotechnical Air-Hammer Program

Supplemental borings were advanced by Crawford Drilling Services (CDS) of Westminster, Massachusetts, using a track-mounted drill rig equipped with continuous-flight, hollow-stem auger drilling equipment and air hammering equipment. The borings were continuously monitored by a representative from our firm.

The air-hammer borings were specifically advanced at or near previous test boring locations to further evaluate the presence of bedrock/boulders where the previous boring encountered shallow refusal, or to collect additional subsurface information to inform site excavations (cut depths and/or stormwater management areas). The air-hammer was advanced approximately 5 feet beyond the refusal depth. If refusal persisted, we inferred this to identify bedrock. If air hammering advanced through the obstruction, drilling continued and soil was generally sampled in the same manner as specified herein. The logs of the additional test borings are presented in Figures B-37 through B-40 in Appendix A.

4.3. Geotechnical Test Pit Program

Test pits were excavated by Machine Time, LLC (Machine Time) of Hudson, New Hampshire and were excavated using a Komatsu PC210 Excavator. The test pits were continuously monitored by a representative from our firm who examined and classified the soils encountered, obtained representative soil samples, observed groundwater conditions (if encountered) and prepared a detailed log of each exploration. Upon completion of the test pits, the excavations were backfilled with excavated material in lifts and compacted using the excavator bucket. The logs of the test pits are presented in Figures B-41 through B-48 in Appendix B.

5.0 SUBSURFACE CONDITIONS

5.1. Subsurface Soil Conditions

GeoEngineers' understanding of subsurface conditions at the Site is based on the subsurface investigation programs by us. The subsurface conditions are summarized below from the ground surface down.

- **Surface Materials:** Within the paved portions of the Site, the asphalt concrete in the parking lots was approximately 2 to 6 inches thick. In landscaped areas, topsoil was encountered with a thickness between approximately 3 to 18 inches.
- **Fill:** Processed fill consisting of demolition debris (BUD material), reworked glacial till, or a combination of both was encountered across the Site beneath the surface materials. The fill generally ranged in thickness from 5 to 12 feet and extended up to 15 feet bgs or more in GEO-7 (20.2 ft), GEO-TP-105 (15'), and GEO-TP-107 (17 ft). The fill primarily consists of fine to coarse silty sand with varying amounts of gravel, generally ranging in density from medium dense to very dense. Loose layers of fill were observed in GEO-12 and GEO-17B to approximately 5 to 10 feet bgs, respectively. Non-soil constituents within the fill layer included varying amounts of brick, concrete, coal, glass, ash, wood, rubber, asphalt, wood, plastic, metal, rebar, and ceramics. Based on the BUD agreement, a significant amount of dense-graded, crushed, concrete fill was used as backfill after demolition of the previous buildings. The crushed concrete fill was observed within GEO-TP-104 and GEO-TP-105 at approximately 3 feet bgs

and ranged in thickness from approximately 4.5 to 12 feet before encountering refusal on presumed concrete slabs and/or foundations. Buried foundations and slabs are prevalent in the areas of the former buildings.

- **Buried Topsoil:** A discontinuous layer of buried topsoil material was encountered in GEO-5 and GEO-9, at depths of approximately 6 feet bgs and 5 feet bgs, respectively. Where encountered, the buried topsoil was approximately 4 to 5 feet thick and consisted of silt with varying amounts of sand and gravel with trace organics.
- **Organic Deposit (Peat):** A discontinuous later of fibrous peat was encountered in GEO-TP-104 and GEO-TP-105 at approximate depths of 2.5 feet bgs and 12 feet bgs, respectively. Where encountered, the fibrous peat was approximately 3 to 12 inches thick.
- **Natural Soil Deposits:** A discontinuous layer of medium dense to dense silty sand was encountered beneath the fill. Loose pockets of silty sand were encountered in GEO-4 from 15 to 20 feet bgs, GEO-18A from 10 to 15 feet bgs, and GEO-28 from 10 to 15 feet bgs. The natural silty sand consists of fine to coarse silty sand with variable amounts of gravel. The natural silty sand layer varied in thickness between approximately 4 to 15 feet and was encountered at depths between 5 to 11 feet bgs.
- **Glacial Till:** Glacial till was encountered below the natural silty sand layer (where encountered) or directly below the fill. The top of the till layer was encountered between approximately 5 feet and 20 feet bgs. The glacial till consists of a medium dense to very dense, fine to coarse silty sand with varying amounts of gravel and trace clay.
- **Weathered Bedrock:** Weathered rock was encountered below the glacial till layer in GEO-9, GEO-12, GEO-13, GEO-15, GEO-17B, GEO-30, GEO-35, GEO-101 and GEO-102. The weathered bedrock layer varied in thickness from approximately 2 to 15 feet thick. The top of the weathered bedrock, where encountered, was between approximately 7.5 to 30 feet bgs. Refusal on possible bedrock was encountered in the southwest corner of the Site at GEO-19, GEO-31/31A, GEO-32/32A.

  Equipment refusals, or the inability to advance the hollow-stem augers or excavator, were encountered at numerous locations throughout the Site from approximately 3 to 25 feet bgs. Refusals are indicative of large boulders with the glacial till stratum, demolition debris in the fill, former foundations, or possible bedrock. Refer to the logs of the geotechnical borings presented in Figures A-2 through A-48 in Appendix A.

The approximate locations of the explorations are presented in Figure 2.

5.2. Groundwater Conditions

Groundwater was not observed in the explorations except for at GEO-18A, GEO-23, GEO-30 and GEO-35, where it was present between 5 and 25 feet bgs, as noted on the logs and Figure 2. Additionally, perched groundwater was encountered in GEO-TP-103 at 8 feet bgs, GEO-TP-106 at 4 feet bgs, and GEO-TP-107 at 11 feet bgs.

Groundwater is not anticipated to be present within the top 15 feet of existing grade within the proposed building pad. It is possible that groundwater observed in the borings in the landscaped portion of the site is related to past filling activities and may also represent perched conditions as indicated in the test pits.

It should be noted that groundwater levels will vary depending on seasonal variations in temperature and precipitation and can also be influenced by subsurface utilities, construction activities and other factors.

6.0 GEOTECHNICAL RECOMMENDATIONS

Below is a summary of the primary geotechnical considerations associated with design and redevelopment of the Site. Additional details are provided in subsequent sections of this report:

- The proposed building can be supported by conventional shallow, spread footings and a slab-on-grade following improvement of the fill as noted herein. Considering that most of the fill material on the western portion of the site will be excavated to achieve the proposed site grades, we recommend that the fill be improved as follows:
    - Following demolition of the existing building and prior to placing raise-in-grade fill, the existing fill within the eastern portion of the proposed building (and extending 5 feet beyond the building pad) could remain in-place following treatment of the fill by deep dynamic compaction (DDC). The DDC program should be designed by a specialty foundation contractor based on an improvement depth of 15 feet. Due to the nature of the fill and natural soils, we recommend multiple phases and/or passes of dynamic compaction throughout the area to allow for the dissipation of excess pore water (hydrostatic) pressure. Following application of DDC, the area should be re-graded, the craters filled with onsite fill, and compacted to allow for construction of a slab-on-grade and spread footings, as discussed further below. The limits of the DDC treatment area are shown on Figure 2 and are based on the proposed finished floor elevation of El. 380 feet and the observed depth of fill from the subsurface explorations.
        - Given the distance from abutters and elevated site grades, we do not anticipate vibrations from DDC would be disruptive. In addition, we anticipate the craters created from the tamper could be filled with the existing material and recompacted in place.
        - Following completion of DDC, additional test borings should be advanced to confirm the improved density of the fill and that further densification is not required.
    - On the western portion of the Site, most of the fill will be removed to achieve the proposed finished grade, as such, we estimate that a limited amount of shallow, excavate-and-replace will be required to allow for construction of footings on natural soil, or structural fill placed over natural soil. The approximate limits of over-excavation are shown on Figure 2.
    - In the central portion of the Site, the existing building and former building foundations should be removed in their entirety and filled with compacted, structural fill.
    - The existing utilities within the proposed building footprint should be removed in their entirety.
- In future pavement areas, the remnants of the former building foundations may remain in-placed provided they do not impact the construction of future pavement and/or subsurface utilities; however, foundations should be removed within 3 feet of finished grade to allow for construction of the pavement section. Similarly, existing utilities may either be removed in their entirety or filled with flowable fill.
- Removal of bedrock may be necessary to achieve the proposed finished grade of parking areas as shown in Figure 2. We anticipate that bedrock could be removed through controlled blasting or mechanical means, such as excavation or hoe-ramming. Controlled blasting should be completed in

accordance with 527 CMR 1.00. Bedrock should be removed to at least 3 feet below proposed grade and 12 inches below the bottom of utilities to allow for construction of the pavement section and/or allow for installation of subsurface utilities.

- We recommend that the existing on-site fill and BUD fill be reused to the extent practical.
    - Fill material in proposed pavement areas may remain in place (not over-excavated) provided it is proof-compacted and any soft and/or loose zones (including organic layers) are excavated in their entirety, backfilled, and compacted as specified herein. Former foundations within three feet of finished grade should be removed and former utilities shall be removed or filled with flowable fill.
    - The granular on-site fill (including processed BUD material) can be re-used as backfill provided it meets the specifications herein and it is placed and compacted in accordance with recommendations herein. Fill containing organics and/or debris are considered unsuitable for reuse in proposed building and pavement areas.
    - Similarly, sound, structural concrete from the demolition of the existing buildings and former foundations can be processed and re-used to backfill the basements and as general raise-in-grade in building and pavement areas provided it meets the specifications herein. Concrete from block masonry walls should not be re-used on site.
    - The asphalt pavement can be reclaimed and re-used as reclaimed stabilized base course below the pavement. Asphalt should not be reused below building areas.
    - The materials will need to be processed to meet the requirements set forth in Massachusetts Department of Transportation (MassDOT) “Standard Specifications for Highways and Bridges” and MassDEP’s Asphalt, Brick and Concrete (ABC) Policy. Please note that the re-use of on-site ABC material requires a 30-day (prior) notification to the local Board of Health. Concrete containing paint or coatings shall not be re-used on site, and steel reinforcing, etc. shall be removed during the processing of the material.
- Dewatering is not anticipated as construction would be completed above the groundwater table. If groundwater is encountered, groundwater would need to be managed using pumps in filtered sumps and recharged onto the site.

6.1. Shallow Foundations

We recommend that the building be supported on shallow spread foundations bearing on natural soils or structural fill placed over natural soils. Placement of the foundations should follow the application of DDC as described herein (and after post-DDC borings are performed to confirm the densification of the fill material). Over-excavation of fill material is not required in areas treated by DDC.

Please note that some over-excavation of the existing fill material will be necessary in the eastern portion of the Site to allow for construction of footings on the natural soil or on structural fill placed over natural soil. Additional construction recommendations for subgrade preparation are provided in section 6.5 “Earthwork”. Areas of over-excavation and DDC are shown on Figure 2.

6.1.1. Deep Dynamic Compaction (DDC)

DDC is a ground improvement method that uses large, heavy, steel (or concrete) drop weights (referred to as tampers) to impart energy into the ground surface and improve bearing capacity. Typically, the tampers are dropped multiple times at heights of 30 feet or greater, on a grid pattern. Multiple passes are required.

The DDC program should be designed by the specialty foundation contractor based on the subsurface conditions at the site with a target treatment depth of at least 15 feet. The contractor's submittal should be signed by a professional engineer registered in the Commonwealth of Massachusetts and provided to the project Geotechnical Engineer for review.

Post confirmatory drilling should be performed by the Geotechnical Engineer to evaluate the performance of the DDC and confirm densification of the fill material.

6.1.2. Allowable Bearing Pressure

For foundations constructed as recommended in this report, we recommend using a net allowable bearing pressure of 4 kips per square foot (ksf). The allowable soil bearing pressure applies to the total of dead and long-term live loads.

6.1.3. Foundation Dimensions

The minimum recommended lateral dimension for isolated spread footings is 36 inches, while continuous wall footings should be at least 18 inches wide. Footings in areas exposed to freezing temperatures should be founded at least 4 feet below exterior finished grade for frost protection. Interior footings, in areas not exposed to freezing temperatures, should be at least 24 inches below finished floor grade, or depth that provides at least 12 inches between top of footing and finished floor elevation, whichever is deeper.

6.1.4. Settlement

Provided that the soil subgrade is prepared as recommended herein, we estimate that the total post-construction settlement will be less than 1 inch. Differential settlements are estimated to be less than 0.5 inches between adjacent columns but will vary based on live load distribution and column spacing.

6.2. Slab-on-Grade

Provided the subgrade soils are prepared as recommended herein, the slab should consist of a soil supported slab-on-grade. The base course layer directly below the slab should consist of 12 inches of Gravel Fill as specified herein. For slabs designed as a beam on an elastic foundation, a modulus of subgrade reaction of 150 PCI may be used for subgrade soils prepared as recommended.

6.3. Bedrock Removal

Bedrock removal within the proposed building footprint is not anticipated; however, in the event where proposed finished grades or grades for foundation elements cannot be achieved by traditional excavation methods (by bucket or hoe-ramming), controlled blasting could be used to removed bedrock. It is recommended that bedrock be removed to at least 12 inches below the bottom of utility corridors and foundations so that they are supported by a cushion of compacted soil to limit the potential for differential settlement due to hard spots. In parking areas, where bedrock is encountered, we recommend the bedrock be removed at least 3 feet below the finished grade to allow for the construction of the pavement section and drainage of surface water infiltration (or perched water trapped on the top of the bedrock surface).

Blasting, if required, will need to be conducted in accordance with local, state and federal laws, notably including 527 Code of Massachusetts Regulations (CMR) 1.00. We also recommend vibration monitoring to establish a baseline vibration level prior to blasting and to evaluate peak particle velocities (PPV) during blasting to ensure the requirements of 527 CMR 1.00 are met. If possible, based on the construction sequence, we recommend that blasting be completed prior to the construction of the building foundations and finishes to limit vibration of the proposed structures. Specifically, the PPV of ground vibration at the nearest structure or active underground utility should be kept within the United States Bureau of Mines (USBM) RI 8507.

6.4. Material Reuse and Processing

6.4.1. Existing Fill Material

It is our opinion that the excavated BUD material and on-site granular fill may be suitable for reuse provided the material is processed to meet the specifications for raise in grade fill (Structural Fill). The material is recommended to be used as general raise in grade material within 12 inches of the proposed finished floor elevation. BUD material should not be placed below footings and not used as the base course for the slab-on-grade. Placement of the BUD material within the excavations should be conducted in 12-inch-thick loose lifts and compacted with at least eight passes of a 10-ton vibratory roller. The processed rock fill gradation is reproduced in the following table.

Sieve Size	Percent Passing By Weight
4-inch	100
1.5-inch	70-100
¾-inch	50-85
No. 4	30-55
No. 50	8-24
No. 200	3-10

Natural soils generated from on-site cuts are anticipated to consist of granular soil and/or glacial till soils.

6.4.2. Reuse of Asphalt and Concrete Materials

A large quantity of asphalt pavement exists at the Site that should be pulverized and mixed with the underlying base course material to produce Reclaimed Pavement Borrow material which could be used as base course for the proposed pavement areas. Existing asphalt should be reclaimed and stripped prior to placing raise-in-grade fill or cutting the Site to grade.

In addition, the demolition for the existing buildings and slabs on grade is expected to generate a large volume of waste concrete. Processed asphalt or concrete material is recommended to meet the gradation as set forth by Reclaimed Pavement borrow, MassDOT Item M1.09.0-1.

6.5. Seismic Site Class and Design Parameters

Based on the 2015 International Building Code (IBC) and the Massachusetts State Building Code 9th Edition (MSBC9), we recommend the following parameters for seismic site class, design short period spectral response acceleration (S_{DS}), and design 1-second period spectral response acceleration (S_{D1}) for the project site. The site is underlain by fill, natural soil deposits, glacial till and bedrock. It is GeoEngineers' opinion that the Site is best characterized as Site Class D.

2015 IBC Parameter	Recommended Value
Seismic Site Class	D
Design Short Period Spectral Response Acceleration, S_{DS} (percent g)	0.210
Design 1-Second Period Spectral Response Acceleration, S_{D1} (percent g)	0.109

6.5.1. Liquefaction Potential

The soils encountered in the proposed buildings are not considered susceptible to liquefaction based on the criteria set forth in Section 1806.4 of MSBC9.

6.6. Earthwork

6.6.1. Subgrade Preparation

The following paragraphs describe the recommended earthwork procedures for preparation of the building areas.

- Foundations and underground utilities to be abandoned, and existing concrete and pavement, should be removed from the proposed building areas in their entirety. Existing organic topsoil at the surface should be cleared and grubbed.
- After removing the unsuitable materials described above, the surface of the inorganic soils within the building footprint and 5 feet beyond the exterior walls should be proof compacted with at least 10 passes of a 10-ton vibratory roller (or equivalent effort) under the observation of a qualified geotechnical engineer, or his/her representative. Any soft or loose zones identified by proof compaction should be evaluated by excavation and replaced with compacted Structural Fill as specified herein.
    - Proof-compaction is required in the DDC area to create a stable pad for the crane.
- Following excavation of the existing foundations and slabs and former foundations and slabs – the existing basements should be backfilled with compacted structural fill up to proposed finished grade as specified herein.
- Prior to placement of raise-in-grade fill, the eastern portion of the site should be treated with DDC to the approximate limits shown on Figure 2. The DDC program should be designed by a specialty contractor and submitted or review by the project geotechnical engineer.
    - Following treatment of DDC, the DDC area should be re-graded up to the bottom of base course elevation. The fill should be placed and compacted as specified herein.
    - Over-excavation of fill material is not required in areas treated by DDC prior to construction footings or prior to placing the base course for the slab-on-grade.

- In areas, where excavation and replacement of fill is recommended prior to constructing foundations, the existing fill material (including buried organic topsoil) should be removed from the zone of influence (ZOI) of the footings in its entirety (down to a subgrade consisting of inorganic, natural, granular soil). For construction purposes, the ZOI is defined as the area within a line projecting outward and downward from the outside edge of the proposed footing at a 1H:1V (horizontal to vertical) slope. Fill material present in the buildings outside the ZOI may remain in place provided it is prepared as specified herein.
- The excavated site soil may be re-used as backfill provided it meets the requirements for Structural Fill provided herein. The fill should be placed in 12-inch-thick loose lifts and compacted to at least 95 percent of its maximum dry density (MDD) as determined by ASTM International (ASTM) D1557 Method C (modified proctor).
- Temporary cut slopes for the over-excavation of fill material below proposed footings for building foundations should be conducted at a 2H:1V slope to maintain a safe excavation. The footing subgrade (at the bottom of the over-excavation) should be proof compacted, prior to the placement of raise-in-grade fill, with at least six passes of a 1,000-pound vibratory plate compactor. This proof-compaction may be waived by the geotechnical engineer if the excavation to footing subgrade was performed with a smooth-edge bucket and the subgrade was not disturbed by the excavation.

For the slab-on-grade, following DDC treatment, the subgrade should be proof-compacted with at least six passes of a 10-ton vibratory roller. Any soft or loose areas identified during proof-compaction should be over-excavated and replaced with Structural Fill as specified herein. The top 12 inches of fill directly below the slab should consist of dense-graded crushed stone (Mass DOT Item No. M2.01.7) and compacted as specified herein.

- In proposed pavement areas, the existing asphalt, topsoil, foundations, slabs, and site utilities should be removed in their entirety. Where existing, deep utilities are present in proposed parking areas, it is acceptable to completely fill the utility with flowable fill and abandon the utility in-place.

  The exposed subgrade for future parking areas should be proof-compacted with at least six passes of a 10-ton vibratory roller (or equivalent effort) under the observation of a qualified geotechnical engineer, or his/her representative is recommended. Any soft or loose areas identified by the proof-compaction should be removed in their entirety and replaced with Structural Fill as specified herein.

  General raise-in-grade fill in parking areas should consist of Structural Fill and placed and compacted as specified herein. The base course layer for the pavement may consist of Structural Fill or Reclaimed Pavement Borrow.
- In the event, boulders are observed at the proposed subgrade elevation, the boulders should be removed in their entirety and replaced with compacted Structural Fill as specified herein. Where bedrock is present at the subgrade, the bedrock should be removed to at least 12 inches below foundations and at least 3 feet below pavement grades.

6.6.2. Structural Fill

Fill placed to directly below and within the ZOI of foundations, within 5 feet of the bottom of slab elevation, behind retaining walls, within 5 feet of utilities (bottom and sides), and within 5 feet of finished grade for pavements and sidewalks should consist of Structural Fill as described below:

- Structural Fill used as base course for the building slab should meet the requirements of Dense-Graded Crushed Stone (1½-inch minus crushed stone) or Gravel Borrow – Type B, MASSDOT, Items M2.01.7-1 or M1.03.0 Type B, respectively.
- Structural fill placed as base course below pavements and sidewalks should meet the requirements of Dense-Graded Crushed Stone (1½-inch minus crushed stone - Type B, MASSDOT, Items M2.01.7-1), Gravel Borrow (M1.03.0 - Type B), or Reclaimed Pavement Borrow (M1.09.0-1)
- Structural Fill placed as backfill of over-excavation below footings and within the ZOI of footings, and as general raise-in-grade fill in non-building areas (below base course) should consist of the following:

Sieve Size	Percent Passing By Weight
4-inch	100
1.5-inch	70-100
¾-inch	50-85
No. 4	30-55
No. 50	8-24
No. 200	3-10

- Structural fill placed within irregularly shaped utility trenches or trenches not accessible to compaction equipment should consist of Controlled Density Fill (CDF) consisting of high slump Portland cement concrete with a compressive strength less than 150 pci at 28 days, otherwise the trench should be backfilled in accordance with the project specifications.
- Structural fill placed to stabilize footing subgrades, if needed, and for the proposed stormwater basins crushed stone layers should meet the requirements of Crushed Stone (¾-inch crushed gravel), MASSDOT, Item M2.01.4. Crushed Stone should be compacted with at least six passes of a 1,000-pound vibratory plate compactor, or until visibly firm and stable, as determined by the Geotechnical Engineer, or his/her qualified representative.
- Concrete from footings and foundation walls can be re-used as fill below the building slab and parking areas provided it is processed to meet the requirements for M1.03.0 Type B or M2.01.7 specified herein. Processed concrete should not include masonry block, but only sound, structural concrete from the demolition of footings, foundation retaining walls and slabs. Structural Fill placed more than 5 feet below buildings (outside the ZOI of foundations) and more than 5 feet below paved areas and utilities, should consist of the BUD material as described herein.

6.6.3. Structural Fill Placement and Compaction Criteria

Structural fill should be mechanically compacted to a firm, non-yielding (stable) condition. Structural fill should be placed in loose lifts approximately 12 inches thick. Each lift should be conditioned to the proper moisture content and compacted as specified herein before placing subsequent lifts. Structural fill should be compacted to the following criteria:

- Structural fill placed in building areas (below and around foundations or supporting slab-on-grade floors) and in pavement and sidewalk areas (including utility trench backfill) should be compacted to at least 95 percent of the MDD estimated in general accordance with ASTM D 1557 Method C, Modified Proctor.

6.6.4. Weather Considerations

The on-site fill soils contain a sufficient percentage of fines (silt) and should be considered sensitive to moisture. When the moisture content of these soils is more than a few percent above the optimum moisture content, these soils become unstable, and operation of equipment on these soils and compaction of these soils is difficult. Additionally, disturbance of near-surface soils should be expected if earthwork is completed during periods of wet weather. During wet weather, we recommend the following:

- The ground surface in and around the work area should be graded so that surface water is directed away from the work area. The ground surface should be graded such that areas of ponded water do not develop. The contractor should take measures to prevent surface water from collecting in excavations and trenches. Measures should be implemented to remove surface water from the work area.
- Slopes with exposed soils should be covered with plastic sheeting or similar means.
- The site soils should not be left uncompacted and exposed to moisture. Sealing the surficial soils by rolling with a smooth-drum roller prior to periods of precipitation will reduce the extent to which these soils become wet or unstable.
- Construction traffic should be restricted to specific areas of the site, preferably areas that are surfaced with materials not susceptible to wet weather disturbance.
- Construction activities should be scheduled so that the length of time that soils are left exposed to moisture is reduced to the extent practicable.
- Footings and backfill should not be placed over a subgrade with standing water or that is frozen. In the event that standing water is present on the subgrade, the water should be removed from the surface and any soft and yielding soils should be removed or allowed to dry prior to the placement of backfill. In the event that the subgrade is frozen, the soil that is frozen should be removed, or thawed and re-compacted prior to placement of backfill.

6.7. Retaining Wall Design Recommendations

We anticipate the proposed retaining walls will be designed as segmental retaining walls with geogrid reinforcing. The retaining wall designer should use the following parameters for their design. The designer should provide a submittal for review by the project Geotechnical Engineer.

	Unit Weight (pcf)	Friction Angle (degrees)
Retained Soil	125	32
Reinforced Soil (structural fill)	130	34
Foundation soil (compacted fill or compacted structural fill	130	34
The wall foundation should be designed based on the bearing pressure and seismic site class as specified herein and in consideration of the MSBC 9th Ed.		

6.8. Excess Soil Management

The excess soil that may be generated during earthwork may need to be characterized with environmental analytical laboratory testing prior to off-site disposal – depending on the requirements of the facility that will receive the soil. Soil disposal should be performed in compliance with local, state, and federal regulations, the environmental regulations set forth by MassDEP.

6.9. Pavement Design and Subgrade Preparation

6.9.1. Subgrade Preparation

Parking area and access drive pavement subgrades should be prepared as described previously in the Earthwork section of this report. In addition to these requirements, we recommend that the prepared subgrade be proof-compacted as specified herein. If soft or loose soils are encountered, such unsuitable subgrade soils should be over-excavated in their entirety and replaced with Structural Fill as specified herein.

6.9.2. Portland Cement Concrete Pavement

We understand that Portland cement concrete (PCC) pavement might be used in all areas except for employee automobile parking areas. We recommend that these pavements consist of at least 6 inches of PCC over 12 inches of base course. If the concrete pavement will have doweled joints, we recommend that the concrete thickness be increased by an amount equal to the diameter of the dowels. The base course should be compacted to at least 95 percent of the MDD (ASTM D 1557).

We recommend that the PCC pavements incorporate construction joints and/or crack control joints that are spaced maximum distances of 12 feet apart, center-to-center, in both the longitudinal and transverse directions. Crack control joints may be created by placing an insert or groove into the fresh concrete surface during finishing or by saw-cutting the concrete after it has initially set-up. We recommend that the depths of the crack control joints be approximately one-fourth the thickness of the concrete; or about 1½ inches deep for the recommended concrete thickness of 6 inches. We also recommend that the crack control joints be sealed with an appropriate sealant to help restrict water infiltration into the joints.

6.9.3. Asphalt Concrete Pavement for Parking Areas

The pavement design is intended to strike a balance between performance and cost in consideration of the soil available at the Site and anticipated traffic loads (passenger vehicles). We recommend the following (minimum) flexible pavement cross-sections for heavy-duty applications.

Layer	Thickness
Asphalt Wearing Course (MassDOT Item M3.11.03)	1.5 inches
Asphalt Binder Course (MassDOT Item M3.11.03)	2.5 inches

Layer	Thickness
Pavement Base Course (Reclaimed Pavement Borrow, MassDOT Item M1.09.0-1, or Processed Gravel for Subbase, MassDOT Item M1.03.1, or Dense-Graded Crushed Stone, MassDOT Item M2.01.7)	12 inches

6.10. Recommended Additional Geotechnical Services

GeoEngineers should be retained to review the project plans and specifications when complete to confirm that our design recommendations have been implemented as intended.

During construction, GeoEngineers should be present to observe DDC, post DDC confirmatory borings, over-excavation of the fill and determine suitable subgrades for building foundations, and observe placement and compaction of structural backfill. The purposes of GeoEngineers construction phase services are to confirm that the subsurface conditions are consistent with those observed in the explorations and other reasons described in Appendix B, Report Limitations and Guidelines for Use.

7.0 LIMITATIONS

We have prepared this report for the exclusive use of Portman Industrial LLC and their authorized agents for the 75 Reed Road project in Hudson, Massachusetts.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

Please refer to Appendix B, "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.

8.0 REFERENCES

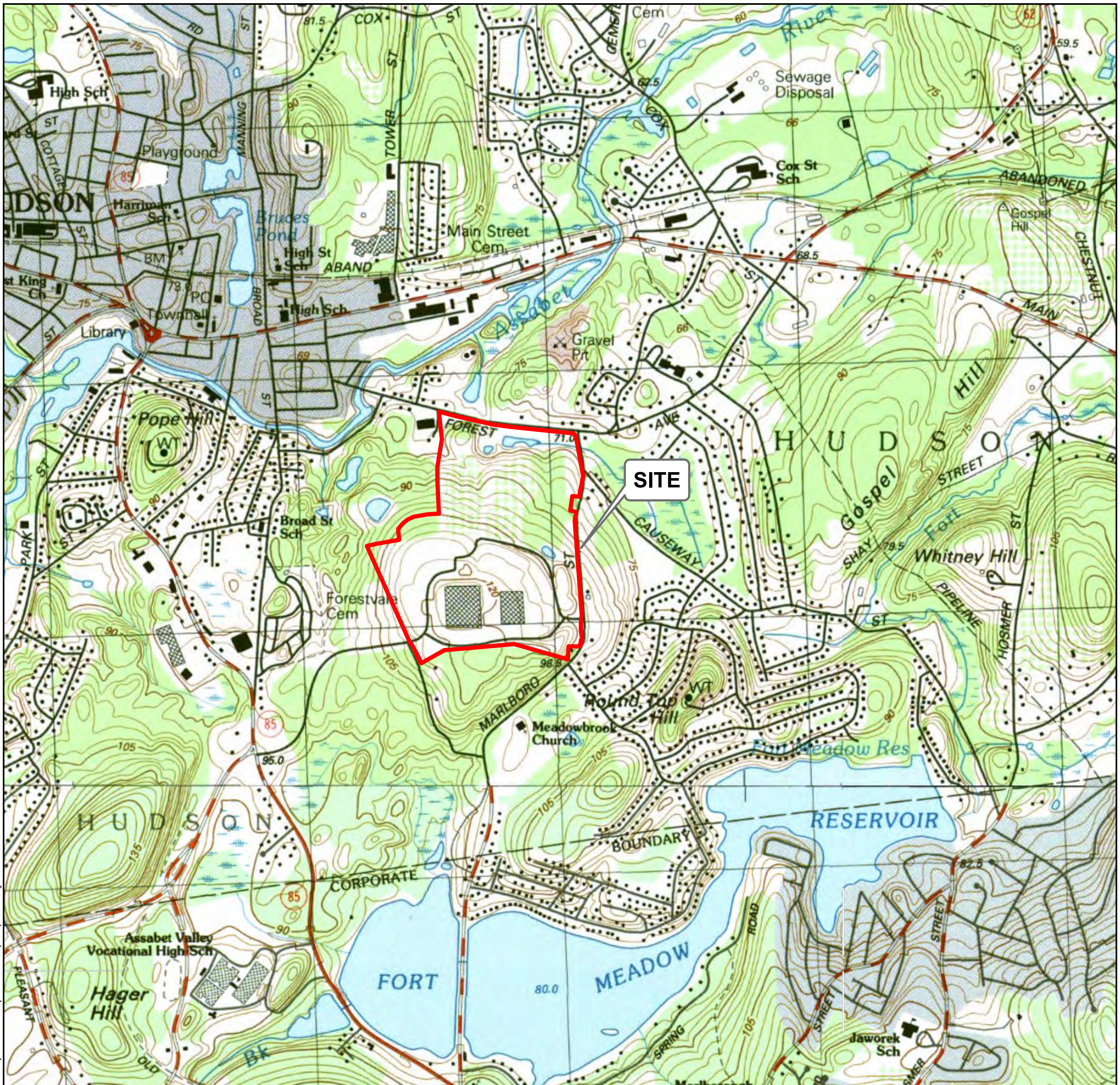
Commonwealth of Massachusetts Department of Transportation (MASSDOT), 2021, "Standard Specifications for Highways and Bridges."

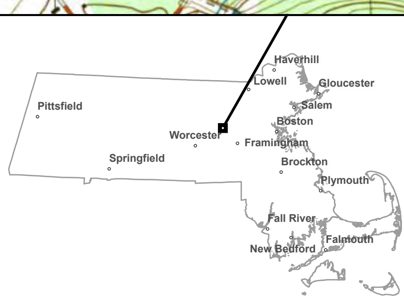
International Code Council, 2015, "International Building Code."

Massachusetts State Building Code, 2018, "780 CMR Ninth Edition."

Massachusetts Contingency Plan (MCP), 310 CMR 40.0000.

FIGURES





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Feet

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers USA, P.C. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers USA, P.C. and will serve as the official record of this communication.

Data Source: ESRI/MassGIS & USGS Quadrangle Maps:
Hudson ,Marlborough, Massachusetts REV: 1988

Horizontal Projection: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
Vertical Units: Meters

Locus Map

Geotechnical Engineering Report
75 Reed Road
Hudson, Massachusetts

GeoEngineers USA

Figure 1

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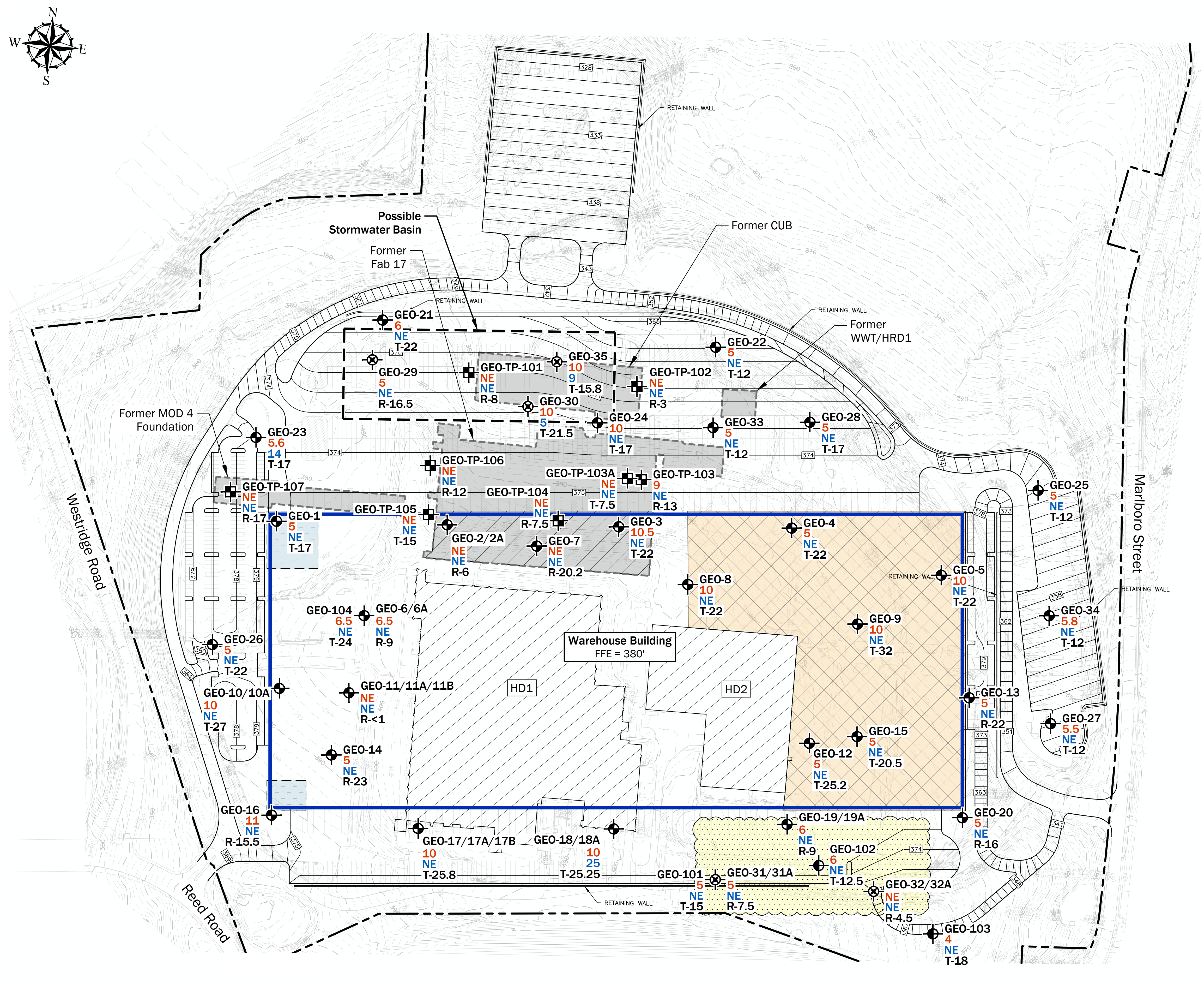

Legend

- Site Boundary
- Proposed Building
- Proposed Stormwater Area
- Former Building (Demolished 2018)
- GEO-101 — Boring by GeoEngineers, April 2022
- GEO-TP-101 — Test Pit by GeoEngineers, April 2022
- GEO-1 — Boring by GeoEngineers, January 2022
- GEO-29 — Stormwater Boring by GeoEngineers, January 2022
- 10 — Depth to Top of Natural (ft)
- 5 — Depth to Groundwater (ft)
- T — Termination Depth (ft)
- R — Refusal Depth (ft)
- NE — Not Encountered

Recommendations:

- Approximate areas of of over excavation of existing fill material for proposed footings and foundation walls. Prepare the subgrade as specified in the Geotechnical Report.
- Recommended area where dynamic compaction should be performed on the existing fill. After treatment, the existing fill may remain in place.
- Recommended area where bedrock should be removed at least 3 feet below finished grade. The actual extent of the bedrock requiring removal could vary from the approximate limit shown on this plan.
- Recommended area of the removal of existing slabs and footings. Prepare subgrade as specified in the Geotechnical Report.

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers USA, P.C. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers USA, P.C. and will serve as the official record of this communication.

Source(s): Base map from Beals Associates, Inc., dated 3/22/2022

Projection: MA State Plane, Mainland Zone, NAD83, US Foot

250 0 250
Feet

Exploration Location Plan

Geotechnical Engineering Report
75 Reed Road
Hudson, Massachusetts

GeoEngineers USA

Figure 2

APPENDICES

APPENDIX A
Report Limitations and Guidelines for Use

APPENDIX A
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

Geotechnical Services are Performed for Specific Purposes, Persons and Projects

This report has been prepared for Portman Industrial LLC and their authorized agents for the 75 Reed Road project in Hudson, Massachusetts. The information contained herein is not applicable to other sites or projects.

GeoEngineers structures our services to meet the specific needs of our clients. For example, a geotechnical or geologic study conducted for a civil engineer or architect may not fulfill the needs of a construction contractor or even another civil engineer or architect that are involved in the same project. Because each geotechnical or geologic study is unique, each geotechnical engineering or geologic report is unique, prepared solely for the specific client and project site. Our report is prepared for the exclusive use of our Client. No other party may rely on the product of our services unless we agree in advance to such reliance in writing. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions. Within the limitations of scope, schedule and budget, our services have been executed in accordance with our Agreement with the Client and generally accepted geotechnical practices in this area at the time this report was prepared. This report should not be applied for any purpose or project except the one originally contemplated.

Read These Provisions Closely

Some clients, design professionals and contractors may not recognize that the geoscience practices (geotechnical engineering or geology) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. GeoEngineers includes these explanatory “limitations” provisions in our reports to help reduce such risks. Please confer with GeoEngineers if you are unclear how these “Report Limitations and Guidelines for Use” apply to your project or site.

A Geotechnical Engineering or Geologic Report is based on a Unique Set of Project-Specific Factors

This report has been prepared for the 75 Reed Road project in Hudson, Massachusetts. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, it is important not to rely on this report if it was:

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1 Developed based on material provided by GBA, GeoProfessional Business Association; www.geoprofessional.org.

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

For example, changes that can affect the applicability of this report include those that affect:

- the function of the proposed structure;
- elevation, configuration, location, orientation or weight of the proposed structure;
- composition of the design team; or
- project ownership.

If changes occur after the date of this report, GeoEngineers cannot be responsible for any consequences of such changes in relation to this report unless we have been given the opportunity to review our interpretations and recommendations. Based on that review, we can provide written modifications or confirmation, as appropriate.

Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by man-made events such as construction on or adjacent to the site, new information or technology that becomes available subsequent to the report date, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. If more than a few months have passed since issuance of our report or work product, or if any of the described events may have occurred, please contact GeoEngineers before applying this report for its intended purpose so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

Most Geotechnical and Geologic Findings are Professional Opinions

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies the specific subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied its professional judgment to render an informed opinion about subsurface conditions at other locations. Actual subsurface conditions may differ, sometimes significantly, from the opinions presented in this report. Our report, conclusions and interpretations are not a warranty of the actual subsurface conditions.

Geotechnical Engineering Report Recommendations are Not Final

We have developed the following recommendations based on data gathered from subsurface investigation(s). These investigations sample just a small percentage of a site to create a snapshot of the subsurface conditions elsewhere on the site. Such sampling on its own cannot provide a complete and accurate view of subsurface conditions for the entire site. Therefore, the recommendations included in this report are preliminary and should not be considered final. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers cannot assume responsibility or liability for the recommendations in this report if we do not perform construction observation.

We recommend that you allow sufficient monitoring, testing and consultation during construction by GeoEngineers to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes if the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective means of managing the risks associated with unanticipated conditions. If another party performs field observation and confirms our expectations, the other party must take full responsibility for both the observations and recommendations. Please note, however, that another party would lack our project-specific knowledge and resources.

A Geotechnical Engineering or Geologic Report Could Be Subject to Misinterpretation

Misinterpretation of this report by members of the design team or by contractors can result in costly problems. GeoEngineers can help reduce the risks of misinterpretation by conferring with appropriate members of the design team after submitting the report, reviewing pertinent elements of the design team's plans and specifications, participating in pre-bid and preconstruction conferences, and providing construction observation.

Do Not Redraw the Exploration Logs

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. The logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Photographic or electronic reproduction is acceptable, but separating logs from the report can create a risk of misinterpretation.

Give Contractors a Complete Report and Guidance

Some owners and design professionals believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering or geologic report, but preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with GeoEngineers and/or to conduct additional study to obtain the specific types of information they need or prefer. A pre-bid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might an owner be in a position to give contractors the best information available, while requiring them to at least share the financial responsibilities stemming from unanticipated conditions. Further, a contingency for unanticipated conditions should be included in your project budget and schedule.

Contractors are Responsible for Site Safety on Their Own Construction Projects

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and adjacent properties.

Geotechnical, Geologic and Environmental Reports Should Not Be Interchanged

The equipment, techniques and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding a specific project.

Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants, and no conclusions or inferences should be drawn regarding Biological Pollutants as they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria and viruses, and/or any of their byproducts.

A Client that desires these specialized services is advised to obtain them from a consultant who offers services in this specialized field.

Information Provided by Others

GeoEngineers has relied upon certain data or information provided or compiled by others in the performance of our services. Although we use sources that we reasonably believe to be trustworthy, GeoEngineers cannot warrant or guarantee the accuracy or completeness of information provided or compiled by others.

APPENDIX B
Subsurface Exploration Logs

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS				SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% RETAINED ON NO. 200 SIEVE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)			GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
					GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)			GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
					GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)			SW	WELL-GRADED SANDS, GRAVELLY SANDS
					SP	POORLY-GRADED SANDS, GRAVELLY SAND
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)			SM	SILTY SANDS, SAND - SILT MIXTURES
					SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50			ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
					CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
					OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
					CH	INORGANIC CLAYS OF HIGH PLASTICITY
					OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS					PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

Sampler Symbol Descriptions

- 2.4-inch I.D. split barrel
- Standard Penetration Test (SPT)
- Shelby tube
- Piston
- Direct-Push
- Bulk or grab
- Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	SOD	Sod/Forest Duff
	TS	Topsoil

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

Laboratory / Field Tests

%F	Percent fines
%G	Percent gravel
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DD	Dry density
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
Mohs	Mohs hardness scale
ND	Non-Detect
OC	Organic content
PM	Permeability or hydraulic conductivity Plasticity
PI	index
PL	Point lead test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
UU	Unconsolidated undrained triaxial compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

Key to Exploration Logs

GeoEngineers USA

Figure B-1

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	1/25/2022	1/25/2022	17	AAA	ERH	Soil Exploration Corporation	Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum	380.5 / NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	B-57 mobile drill
Easting (X) / Northing (Y)	640762 / 2964426	System Datum	MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
380	0		21	76		S-1A		TS	Topsoil			
						S-1B		SM	Brown to gray fine to coarse silty sand with gravel, coal ash and very few crushed brick particles (very dense, moist) (fill)			
						S-1C		SP	Light brown fine to coarse sand with silt and gravel (very dense, moist) (fill)			
375	5		18	46		S-2		SM	Brown to gray fine to coarse silty sand with gravel and redox staining (dense, moist) (till)			
370	10		24	64		S-3			Becomes trace gravel and very dense			
365	15		24	47		S-4			Becomes dense with few severely weathered rock fragments			

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-1

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-2
Sheet 1 of 1

Drilled — Start: 1/25/2022 — End: 1/25/2022	Total Depth (ft): 6	Logged By: AAA Checked By: ERH	Driller: Soil Exploration Corporation	Drilling Method: Hollow-stem Auger
Surface Elevation (ft): 389 Vertical Datum: NAVD88	Hammer Data: Autohammer 140 (lbs) / 5 (in) Drop		Drilling Equipment: B-57 mobile drill	
Easting (X): 641186 Northing (Y): 2964457	System Datum: MA State Plane Mainland NAD83 (feet)		Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0		19	24		S-1A		TS	Topsoil			
						S-1B		SP	Brown to gray fine to coarse sand and gravel with trace silt, trace coal particles and trace brick particles (medium dense, moist) (fill)			
385												
	5		13	145		S-2		SP	Gray fine to coarse sand and gravel with crushed construction debris consisting of concrete, coal, asphalt and brick (very dense, moist) (fill)			GEO-2 encountered auger refusal at 5½ feet below ground surface; GEO-2A was offset 7 feet east and drilled to 5 feet below ground surface

Boring terminated at approximately 6 feet below ground surface due to auger refusal

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-2A

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Drilled	Start 1/25/2022	End 1/25/2022	Total Depth (ft) 22	Logged By AAA / Checked By ERH	Driller Soil Exploration Corporation	Drilling Method Hollow-stem Auger

Surface Elevation (ft) 384 Vertical Datum NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment B-57 mobile drill
Easting (X) 641613 Northing (Y) 2964493	System Datum	MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0		18	20		S-1		TS	Topsoil			
						S-2		SP	Brown to gray fine to coarse sand and gravel with trace silt, very few asphalt pieces and trace redox staining (medium dense, moist) (fill)			
380												
	5		15	32		S-3		SP	Gray fine to coarse sand and gravel with wood chips, plastic bag debris and crushed construction debris consisting of concrete, brick, asphalt and coal (dense, moist) (fill)			
375												
	10		19	33		S-4A		SP-SM	Brown to gray fine to coarse sand with silt and gravel (dense, moist) (fill)			
						S-4B		SW	Gray fine to coarse sand and trace silt (moist)			
370												
	15		24	48		S-5		SM	Gray fine to medium silty sand with trace gravel and redox staining (dense, moist) (till)			
365												
	20		24	67		S-6		SM	Gray fine to medium silty sand with trace gravel, frequent severely weathered rock fragments and redox staining (very dense, moist) (till)			

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-3

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Drilled	Start 1/27/2022	End 1/27/2022	Total Depth (ft)	22	Logged By HKC Checked By ERH	Driller	Soil Exploration Corporation	Drilling Method	Hollow-stem Auger

Surface Elevation (ft) Vertical Datum	371 NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	B-57 mobile drill
Easting (X) Northing (Y)	642043 2964531	System Datum	MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	FIELD DATA: Recovered (in)	FIELD DATA: Blows/foot	FIELD DATA: Collected Sample	FIELD DATA: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0		17	75		S-1		AC	Approximately 2 inches of asphalt concrete pavement			
370								SW-SM	Brown fine to coarse sand with silt and gravel (very dense, moist) (fill)			
365	5		18	22		S-2		SM	Dark brown fine to coarse silty sand with gravel (medium dense, moist)			
360	10		14	19		S-3						
355	15		20	9		S-4		SM	Brown fine to medium silty sand with trace gravel (loose, moist)			
350	20		12	99		S-5		SM	Brown fine to coarse silty sand with gravel and redox staining (very dense, moist) (till)			

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-4

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-5
Sheet 1 of 1

Drilled	Start 1/27/2022	End 1/27/2022	Total Depth (ft) 22	Logged By HKC / Checked By ERH	Driller Soil Exploration Corporation	Drilling Method Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum	355.5 / NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	B-57 mobile drill
Easting (X) / Northing (Y)	642426 / 2964450	System Datum	MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
355	0		14	26		S-1		AC	Approximately 2½ inches of asphalt concrete pavement			
								SM	Gray-brown fine to coarse silty sand with gravel and very few asphalt pieces (medium dense, moist) (fill)			
350	5		16	14		S-2			Becomes brown, no asphalt pieces			
								TS	Dark brown silt, trace sand and trace gravel (very stiff, moist) (buried topsoil; fill)			
345	10		24	18		S-3		SM	Gray-brown fine to coarse silty sand with trace gravel (medium dense, moist)			
340	15		23	46		S-4		SM	Gray fine to coarse silty sand with gravel, redox staining (dense, moist) (till)			
335	20		24	98		S-5			Becomes very dense and gray			

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-5

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Drilled	Start 1/28/2022	End 1/28/2022	Total Depth (ft)	9	Logged By HKC Checked By ERH	Driller	Soil Exploration Corporation	Drilling Method	Hollow-stem Auger

Surface Elevation (ft) Vertical Datum	397 NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	B-57 mobile drill
Easting (X) Northing (Y)	641002 2964212	System Datum	MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	
Notes:					

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0							SP-SM	Brown fine to coarse sand with silt and gravel (moist) (fill)			GEO-6 was pre-cleared to 31 inches below ground surface before refusal on an 8- to 12-inch water main; GEO-6A was offset 5 feet south and pre-cleared to 6 feet below ground surface Both locations were backfilled with sand to ground surface and finished with asphalt patch
395												
	5											
390			19	24		S-1A		SM	Brown-dark brown fine to coarse silty sand with gravel, organic matter and frequent coal pieces (medium dense, moist) (fill)			
						S-1B		SW	Brown fine to coarse silty sand with gravel and redox staining (medium dense, moist) (till)			

Boring terminated at approximately 9 feet below ground surface due to auger refusal

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-6A

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Drilled	Start 1/25/2022	End 1/25/2022	Total Depth (ft) 20.25	Logged By AAA / Checked By ERH	Driller Soil Exploration Corporation	Drilling Method Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum	395 / NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	B-57 mobile drill
Easting (X) / Northing (Y)	641414 / 2964426	System Datum	MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
395	0		18	25		S-1A		SM	Brown to light brown fine silty sand with organic matter (moist) (fill)			
						S-1B		SP	Brown to gray fine to coarse sand with gravel, coal ash and brick particles (medium dense, moist) (fill)			
390	5		16	27		S-2		SP-SM	Gray fine to coarse sand and gravel with silt, numerous crushed concrete pieces and few asphalt pieces (medium dense, moist) (fill)			
385	10		15	13		S-3			With few coal pieces, few wire pieces and very few thread pieces			
380	15		19	27		S-4						
375	20		2	75/2"		S-5		SM	Gray fine to coarse silty sand with gravel and few root pieces (very dense, moist) (reworked till; fill)			

Boring terminated at approximately 20¼ feet below ground surface due to auger refusal

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-7

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Drilled	Start 1/25/2022	End 1/25/2022	Total Depth (ft) 22	Logged By AAA / Checked By ERH	Driller Soil Exploration Corporation	Drilling Method Hollow-stem Auger

Surface Elevation (ft) 393 / Vertical Datum NAVD88	Hammer Data: Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment: B-57 mobile drill
Easting (X) 641799 / Northing (Y) 2964367	System Datum: MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0		18	25		S-1A		TS	Topsoil			
390						S-1B		SP-SM	Light brown to gray fine to coarse silty sand and gravel with trace ash particles and trace redox staining (medium dense, moist) (fill)			
	5		10	64		S-2		CR	Crushed rock of varying colors and types			
385												
	10		22	14		S-3		SM	Brown fine to medium silty sand with trace gravel and redox staining (medium dense, moist) (till)			
380												
	15		15	43		S-4			Becomes gray and dense			
375												
	20		24	88		S-5			Becomes fine to coarse silty sand and very dense			

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-8

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Drilled	Start 1/25/2022	End 1/25/2022	Total Depth (ft) 32	Logged By HKC / Checked By ERH	Driller: Soil Exploration Corporation	Drilling Method: Hollow-stem Auger

Surface Elevation (ft) 370.5 / Vertical Datum NAVD88	Hammer Data: Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment: B-57 mobile drill
Easting (X) 642230 / Northing (Y) 2964309	System Datum: MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration

Notes:

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Sample Name / Testing	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
370	0	22	60	S-1	AC	Approximately 3 inches of asphalt concrete pavement			
					SP-SM	Brown -gray fine to coarse sand with silt, gravel, very few asphalt pieces and very few coal pieces (very dense, moist) (fill)			
365	5	16	14	S-2	SM	Dark brown fine to coarse silt with sand and trace gravel (medium dense, moist) (buried topsoil; fill)			
360	10	20	15	S-3	SM-ML	Brown fine to coarse silty sand with gravel and trace clay (medium dense, moist)			
355	15	23	38	S-4	SM	Brown-gray fine to coarse silty sand with gravel and redox staining (dense, moist) (till)			
350	20	0	54	S-5					No sample recovery, rock stuck in split-spoon
345	25	0	45	S-6					No sample recovery
	30								

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-9

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-10

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
340	30		23	58		S-7		Bedrock	Gray severely weathered rock (very dense, moist)			

Log of Boring GEO-9 (continued)

GeoEngineers USA

Project: 75 Reed Road

Project Location: Hudson, Massachusetts

Project Number: 25394-004-00

Figure B-10

Sheet 2 of 2

Drilled	Start 1/28/2022	End 1/28/2022	Total Depth (ft)	27	Logged By ERH Checked By ERH	Driller	Soil Exploration Corporation	Drilling Method	Hollow-stem Auger

Surface Elevation (ft) Vertical Datum	392 NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	Track mounted rig
Easting (X) Northing (Y)	640808 2964011	System Datum	MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
392	0							SP-SM	Brown fine to coarse sand with silt and gravel (moist) (fill)			GEO-10 was pre-cleared to 5 feet below ground surface; GEO-10A was offset 8 feet east and pre-cleared to 6 feet below ground surface Both locations were backfilled with sand and finished with asphalt patch
390												
	5	X	5	18		S-1		SP	Gray/brown fine to coarse sand and gravel with silt, frequent coal pieces (medium dense, moist) (fill)			
385												
	10	X	17	30		S-2		SM	Gray/brown fine to coarse silty sand with gravel (dense, moist) (till)			
380												
	15	X	24	38		S-3			With redox staining			
375												
	20	X	24	59		S-4			Becomes very dense			
370												
	25	X	24	50		S-5						
365												

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-10

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-11
Sheet 1 of 1

Drilled	Start 1/27/2022	End 1/27/2022	Total Depth (ft)	0.25	Logged By ERH/FA Checked By ERH	Driller Soil Exploration Corporation	Drilling Method NA

Surface Elevation (ft) 396 Vertical Datum NAVD88	Hammer Data NA	Drilling Equipment NA	
Easting (X) 640982 Northing (Y) 2964017	System MA State Plane Mainland Datum NAD83 (feet)	Groundwater not observed at time of exploration	
Notes:			

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0								GEO-11 encountered refusal 3 inches below ground surface on concrete; GEO-11A was offset 5 feet east and encountered refusal 3 inches below ground surface on concrete GEO-11B was offset 5 feet south and encountered refusal 3 inches below ground surface on concrete; all locations were finished with asphalt patches Boring terminated at less than 1 foot below ground surface due to presence of large concrete slab			

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-11

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Drilled	Start 1/28/2022	End 1/28/2022	Total Depth (ft) 25.25	Logged By FA / Checked By ERH	Driller Soil Exploration Corporation	Drilling Method Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum	380.5 / NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	B-57 mobile drill
Easting (X) / Northing (Y)	642139 / 2964001	System Datum	MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
380	0	17	7		S-1	TS	Topsoil			
						SM	Dark brown fine to coarse silty sand with gravel and few roots (loose, moist) (fill)			
375	5	24	26		S-2	SM	Brown fine to coarse silty sand with gravel (medium dense, moist) (till)			
370	10	12	109		S-3		Becomes brown to gray and very dense			
365	15	6	100/6"		S-4	Bedrock	Brown to gray severely weathered rock with redox staining (very dense, moist)			
360	20	6	100/6"		S-5					
	25	3	87/3"		S-6					

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-12

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-13
Sheet 1 of 1

Drilled Start 1/25/2022 End 1/25/2022	Total Depth (ft) 22	Logged By HKC Checked By ERH	Driller Soil Exploration Corporation	Drilling Method Hollow-stem Auger
Surface Elevation (ft) 361.5 Vertical Datum NAVD88	Hammer Data Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment B-57 mobile drill	
Easting (X) 642525 Northing (Y) 2964152	System Datum MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	
Notes:			

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0	18	31		S-1	AC	Approximately 4 inches of asphalt concrete pavement			
360						SM	Dark brown to brown fine to coarse silty sand with gravel, very few asphalt pieces and very few brick particles (dense, moist) (fill)			
355	5	18	68		S-2	SM	Brown fine to medium silty sand with trace gravel (very dense, moist) (till)			
350	10	23	45		S-3	SM	Gray fine to coarse silt with trace sand, some gravel and redox (dense, moist)			
345	15	24	66		S-4	Bedrock	Gray severely weathered rock with redox staining (very dense, moist)			
340	20	5	100/6"		S-5					

Boring terminated at approximately 22 feet below ground surface due to auger refusal

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-13

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Date:4/22/22 Path:P:\25\25394004\GINT\2539400400.GPJ DBLibrary/Library:GEOUSA_DF_STD_US.GLB/GEI8_GEOTECH_STANDARD_%F_NO_GW

Drilled	Start 1/28/2022	End 1/28/2022	Total Depth (ft)	23	Logged By PS/ERH, Checked By ERH	Driller	Soil Exploration Corporation	Drilling Method	Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum	391 / NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	Truck mounted rig
Easting (X) / Northing (Y)	640954 / 2963858	System Datum	MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
391	0							AC	Approximately 6 inches of asphalt concrete pavement			
390			21	15		S-1		SM	Dark brown fine to corse silty sand with gravel and few asphalt pieces (medium dense, moist) (fill)			
385	5		24	26		S-2		SM	Brown fine to medium silty sand with gravel (medium dense, moist) (till)			
380	10		0	20		S-3			No recovery			
375	15		15	23		S-4		SM/ML	Brown/gray silt and clay with sand and trace gravel (medium dense, moist) (till)			
370	20		17	100		S-5		SM	Gray fine to coarse silty sand with gravel and frequent weathered rock fragments (very dense, moist) (till)			

Boring terminated at approximately 23 feet below ground surface due to auger refusal

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Date:4/22/22 Path:P:\25\25394004\GINT\2539400400.GPJ DBLibrary/Library:GEOUSA_DF_STD_US.GLB/GEI8_GEOTECH_STANDARD_%F_NO_GW

Log of Boring GEO-14

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Drilled Start 1/25/2022, End 1/25/2022	Total Depth (ft) 20.5	Logged By HKC; Checked By ERH	Driller Soil Exploration Corporation	Drilling Method Hollow-stem Auger

Surface Elevation (ft) 376; Vertical Datum NAVD88	Hammer Data: Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment: B-57 mobile drill
Easting (X) 642255; Northing (Y) 2964029	System Datum: MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0		18	18		S-1		AC	Approximately 3 inches of asphalt concrete pavement			
375								SP-SM	Brown fine to coarse silty sand with gravel and few asphalt pieces (medium dense, moist) (fill)			
370	5		22	24		S-2		SM	Brown-gray fine to medium silty sand with trace gravel (medium dense, moist) (till)			
365	10		22	39		S-3			Becomes fine to coarse silty sand with gravel and dense			
360	15		8	51		S-4		Bedrock	Gray severely weathered rock (very dense, moist)			
	20			51		S-5			Very dense, no recovery			

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-15

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Drilled	Start 1/28/2022	End 1/28/2022	Total Depth (ft) 15.5	Logged By ERH / Checked By ERH	Driller Soil Exploration Corporation	Drilling Method Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum: 383.5 / NAVD88	Hammer Data: Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment: Track mounted rig	
Easting (X) / Northing (Y): 640819 / 2963694	System Datum: MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0		12	19		S-1		AC	Approximately 6 inches of asphalt concrete pavement			
380								SM	Brown to dark brown fine to corse silty sand with gravel, some asphalt pieces and trace brick pieces (medium dense, moist) (fill)			
	5		14	42		S-2		SM	Brown fine to coarse silty sand with gravel, redox staining, very few wood pieces and very few coal pieces (dense, moist) (fill)			
375												
	10		7	80		S-3		GP-GM	Gray fine to coarse gravel with silt and sand (very dense, moist) (fill)			
								SP-SM	Brown fine to coarse sand and gravel with silt (very dense, moist) (till)			
370												
	15		4	82/5"		S-4		SM	Orange/brown fine to coarse silty sand with trace gravel and redox staining (very dense, moist) (till)			

Boring terminated at approximately 15½ feet below ground surface due to auger refusal

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-16

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-17
Sheet 1 of 1

Drilled	Start 1/28/2022	End 1/28/2022	Total Depth (ft)	25.75	Logged By ERH Checked By ERH	Driller	Soil Exploration Corporation	Drilling Method	Hollow-stem Auger

Surface Elevation (ft) Vertical Datum	396.5 NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	Track mounted rig
Easting (X) Northing (Y)	641187 2963696	System Datum	MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
395	0							SM	Brown fine to coarse sand with silt, gravel , few brick pieces, few asphalt pieces and few concrete pieces (moist) (fill)			GEO-17 was pre-cleared to 3 feet below ground surface before refusal on an electrical line encased in concrete; GEO-17A was pre-cleared 5 feet west to 3 feet below ground surface before refusal on the same electrical line. On 1/27/22, GEO-17B was offset 7 feet northwest of GEO-17 and pre-cleared to 6 feet below ground surface; all three locations were backfilled with sand to ground surface and finished with asphalt patch
390	5		3	8		S-1		SM	Gray/brown fine to coarse silty sand with gravel and asphalt pieces (loose, moist) (fill)			
385	10		20	12		S-2		SM	Brown fine to coarse silty sand with gravel and redox staining (medium dense, moist)			
380	15		24	28		S-3		SM	Brown fine to coarse silty sand with gravel and few weathered rock fragments (medium dense, moist) (till)			
375	20		9	111/9"		S-4		Bedrock	Gray severely weathered rock (very dense, moist)			
	25		7	70/10"		S-5						

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-17B

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Drilled	Start 1/28/2022	End 1/28/2022	Total Depth (ft) 25.25	Logged By ERH / Checked By ERH	Driller Soil Exploration Corporation	Drilling Method Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum	400 / NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop
Drilling Equipment	Track mounted rig		
Easting (X) / Northing (Y)	641673 / 2963742	System Datum	MA State Plane Mainland NAD83 (feet)
See "Remarks" section for groundwater observed			

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
400	0							SP-SM	Brown fine to coarse sand with silt, gravel, few brick pieces, few wood pieces and very few cloth pieces (moist) (fill)			GEO-18 was pre-cleared to 2½ feet below ground surface before refusal on debris; GEO-18A was offset 6 feet south and pre-cleared to 6 feet below ground surface; both GEO-18 and GEO-18A were backfilled with sand to ground surface
395	5											
		X	3	16		S-1		SM	Gray-brown fine to coarse silty sand with gravel and very few coal pieces (medium dense, moist) (fill)			
390	10	X	14	8		S-2		SM	Brown fine to coarse silty sand with trace gravel (loose, moist)			
385	15	X	21	22		S-3		SM	Orange-brown fine to coarse silty sand and gravel (medium dense, moist)			
380	20	X	10	107		S-4		SM	Gray fine to medium silty sand and gravel (very dense, moist) (till)			
375	25	X	2	62/2"		S-5		GM	Gray fine to coarse gravel and sand with silt and weathered bedrock (very dense, wet)			Groundwater observed at approximately 25 feet below ground surface during drilling

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

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Log of Boring GEO-18A

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Drilled	Start 1/28/2022	End 1/28/2022	Total Depth (ft)	9	Logged By HKC	Checked By ERH	Driller Soil Exploration Corporation	Drilling Method Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum	383 / NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	B-57 mobile drill
Easting (X) / Northing (Y)	642102 / 2963794	System Datum	MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
383	0							SP-SM	Brown fine to coarse sand with silt and gravel (moist) (fill)			GEO-19 was pre-cleared to 6 feet below ground surface; GEO-19A was offset 7 feet northeast and pre-cleared to 6 feet below ground surface Both locations were backfilled with sand to ground surface and finished with asphalt patch
380												
	5											
			6	89/6"		S-1		SW	Brown fine to coarse sand with silt, gravel, and frequent weathered rock fragments (very dense, moist) (till)			
375												

Boring terminated at approximately 9 feet below ground surface due to auger refusal; refusal at 8 feet below ground surface at adjacent pre-cleared hole

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-19

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-20
Sheet 1 of 1

Drilled	Start 1/28/2022	End 1/28/2022	Total Depth (ft)	16	Logged By HKC / Checked By ERH	Driller Soil Exploration Corporation	Drilling Method Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum	367 / NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop
Drilling Equipment	B-57 mobile drill		
Easting (X) / Northing (Y)	642537 / 2963853	System Datum	MA State Plane Mainland NAD83 (feet)
Groundwater not observed at time of exploration			

Notes:

FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0		17	11		S-1		TS	Approximately 3 inches of topsoil			
365								SM	Dark brown fine to coarse silty sand with trace gravel, few ash particles and organic matter (medium dense, moist) (fill)			
360	5		22	61		S-2		SM	Gray-brown fine to coarse silty sand with gravel and redox staining (very dense, moist) (till)			
355	10		23	46		S-3			Becomes dense			
	15		10	90/10"		S-4		SW-SM	Gray fine to coarse sand with silt, gravel, frequent severely weathered rock fragments and redox staining (very dense, moist) (till)			

Boring terminated at approximately 16 feet below ground surface due to auger refusal

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-20

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Drilled	Start 1/26/2022	End 1/26/2022	Total Depth (ft)	22	Logged By AAA	Checked By ERH	Driller	Soil Exploration Corporation	Drilling Method	Hollow-stem Auger

Surface Elevation (ft) Vertical Datum	367.5 NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	B-57 mobile drill
Easting (X) Northing (Y)	640977 2964950	System Datum	MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0		21	54		S-1		TS	Topsoil			
365								SP-SM	Light brown fine to coarse silty sand with gravel and organic matter (very dense, moist) (fill)			
	5		22	21		S-2A		SP-SM	Light brown to black fine to coarse silty sand and gravel with few coal ash particles (medium dense, moist) (fill)			
360						S-2B		SM	Light brown to gray fine to medium silty sand with gravel (medium dense, moist)			
	10		24	20		S-3			Becomes with trace redox staining			
355												
	15		24	18		S-4						
350												
	20		20	51		S-5		SM	Gray fine to coarse silty sand with gravel (very dense, moist) (till)			

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-21

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Drilled	Start 1/27/2022	End 1/27/2022	Total Depth (ft)	12	Logged By HKC / Checked By ERH	Driller	Soil Exploration Corporation	Drilling Method	Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum	346 / NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	B-57 mobile drill
Easting (X) / Northing (Y)	641811 / 2964962	System Datum	MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0		21	71		S-1		AC	Approximately 3 inches of asphalt concrete pavement			
345								SW-SM	Brown fine to coarse silty sand and gravel with few asphalt pieces (very dense, moist) (fill)			
340	5		24	21		S-2		SM	Gray fine to coarse silty sand with gravel (medium dense, moist)			
335	10		21	67		S-3		SM	Gray fine to coarse silty sand with gravel and redox staining (very dense, moist) (till)			

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-22

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-23
Sheet 1 of 1

Drilled	Start 1/26/2022	End 1/28/2022	Total Depth (ft)	17	Logged By AAA/FA Checked By ERH	Driller	Soil Exploration Corporation	Drilling Method	Hollow-stem Auger

Surface Elevation (ft) Vertical Datum	378.5 NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	B-57 mobile drill
Easting (X) Northing (Y)	640691 2964629	System Datum	MA State Plane Mainland NAD83 (feet)	See "Remarks" section for groundwater observed	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0		21	29		S-1		TS	Topsoil			
								SM	Brown to gray silty sand with gravel and organic matter (medium dense, moist) (fill)			
								SM	Light brown fine silty sand with trace gravel (medium dense, moist) (buried subsoil; fill)			
375												
	5		21	30		S-2		CR	White crushed rock			
								SM	Brown to gray fine to medium silty sand with gravel and redox staining (dense, moist) (till)			
370												
	10		24	56		S-3			Becomes very dense and no redox staining			
365												Groundwater observed at approximately 14 feet below ground surface during drilling
	15		24	49		S-4			Becomes dense and wet			

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-23

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-24
Sheet 1 of 1

Drilled	Start 1/26/2022	End 1/26/2022	Total Depth (ft) 17	Logged By AAA / Checked By ERH	Driller Soil Exploration Corporation	Drilling Method Hollow-stem Auger

Surface Elevation (ft) 362 / Vertical Datum NAVD88	Hammer Data: Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment: B-57 mobile drill
Easting (X) 641535 / Northing (Y) 2964746	System Datum: MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0		18	11		S-1		TS	Topsoil			
360								SM	Brown fine to coarse silty sand with trace gravel and few asphalt pieces (medium dense, moist) (fill)			
	5		20	19		S-2		SM	Brown fine to coarse silty sand with gravel and few coal pieces (medium dense, moist) (fill)			
355												
	10		24	35		S-3		SM	Gray silt with sand and trace gravel (dense, moist) (till)			
350												
	15		24	41		S-4		SM	Gray fine to medium silty sand with trace gravel (dense, moist) (till)			
345												

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-24

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-25
Sheet 1 of 1

Drilled	Start 1/27/2022	End 1/27/2022	Total Depth (ft)	12	Logged By HKC	Checked By ERH	Driller	Soil Exploration Corporation	Drilling Method	Hollow-stem Auger

Surface Elevation (ft) 334 Vertical Datum NAVD88	Hammer Data: Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	B-57 mobile drill
Easting (X) 642647 Northing (Y) 2964684	System Datum: MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0		12	80		S-1		AC	Approximately 2½ inches of asphalt concrete pavement			Spoon refusal 1½ inches
								SW-SM	Brown fine to coarse sand with silt and gravel (very dense, moist) (fill)			
330												
	5		18	45		S-2		SM	Brown fine to coarse silty sand with gravel, few weathered rock fragments and redox staining (dense, moist) (till)			
325												
	10		12	94		S-3			Becomes very dense			

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-25

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-26
Sheet 1 of 1

Drilled	Start 1/28/2022	End 1/28/2022	Total Depth (ft)	22	Logged By FA	Checked By ERH	Driller	Soil Exploration Corporation	Drilling Method	Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum	385.5 / NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	B-57 mobile drill
Easting (X) / Northing (Y)	640631 / 2964104	System Datum	MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	
Notes:					

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
385	0		18	19		S-1		TS	Topsoil			
								SP-SM	Dark brown fine to coarse sand with silt, gravel, frequent asphalt pieces and very few roots (medium dense, moist) (fill)			
380	5		24	68		S-2		SM	Gray fine to coarse silty sand with gravel (very dense, moist) (till)			
375	10		4	103/8"		S-3		SP-SM	Brown fine to coarse sand and gravel with silt and redox staining (very dense, moist) (till)			
370	15		24	36		S-4		SM	Gray fine to coarse silty sand with gravel (dense, moist) (till)			
365	20		23	44		S-5						

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-26

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Drilled	Start 1/27/2022	End 1/27/2022	Total Depth (ft)	12	Logged By HKC	Checked By ERH	Driller	Soil Exploration Corporation	Drilling Method	Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum	352 / NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	B-57 mobile drill
Easting (X) / Northing (Y)	642733 / 2964108	System Datum	MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0		20	107		S-1		AC	Approximately 3 inches of asphalt concrete pavement			
350								SM	Brown fine to coarse silty sand with gravel (very dense, moist) (fill)			
	5		24	10		S-2			Becomes with trace wood fibers and medium dense			
345								SM	Brown fine to coarse silty sand with trace gravel (medium dense, moist)			
	10		15	100		S-3		SM	Brown fine to coarse silty sand with gravel (very dense, moist) (till)			
340												

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-27

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-28
Sheet 1 of 1

Drilled	Start 1/27/2022	End 1/27/2022	Total Depth (ft)	17	Logged By HKC / Checked By ERH	Driller Soil Exploration Corporation	Drilling Method Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum	359 / NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	B-57 mobile drill
Easting (X) / Northing (Y)	642063 / 2964799	System Datum	MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0		15	25		S-1		TS	Approximately 6 inches of topsoil			
								SM	Brown fine to coarse silty sand with gravel and few crushed brick particles (medium dense, moist) (fill)			
355												
	5		12	30		S-2		SM	Brown fine to coarse silty sand with gravel (dense, moist)			
350												
	10		8	10		S-3			Becomes loose			
345												
	15		18	24		S-4			Becomes medium dense			

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-28

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-29
Sheet 1 of 1

Drilled	Start 1/26/2022	End 1/26/2022	Total Depth (ft) 16.5	Logged By AAA / Checked By ERH	Driller Soil Exploration Corporation	Drilling Method Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum	370.5 / NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	B-57 mobile drill
Easting (X) / Northing (Y)	640961 / 2964849	System Datum	MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
370	0		20	27		S-1A		TS	Topsoil			
						S-1B		SP-SM	Orange-brown fine to coarse sand with silt, gravel and few asphalt pieces (medium dense, moist) (fill)			
365	5		24	18		S-2		SM	Gray fine to coarse silty sand with gravel and redox staining (medium dense, moist) (till)			
360	10		24	29		S-3						
355	15		14	110/18"		S-4			Becomes very dense			

Boring terminated at approximately 16½ feet below ground surface due to auger refusal

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-29

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-30
Sheet 1 of 1

Drilled	Start 1/26/2022	End 1/26/2022	Total Depth (ft) 21.5	Logged By AAA Checked By ERH	Driller Soil Exploration Corporation	Drilling Method Hollow-stem Auger

Surface Elevation (ft) 358 Vertical Datum NAVD88	Hammer Data Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment B-57 mobile drill
Easting (X) 641359 Northing (Y) 2964770	System Datum MA State Plane Mainland NAD83 (feet)	See "Remarks" section for groundwater observed

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0		20	29		S-1		TS	Topsoil			
355								SP-SM	Brown to gray fine to coarse sand with silt, gravel, few crushed concrete fragments, very few root pieces and very few wood pieces (medium dense, moist) (fill)			
	5		14	80		S-2		SP-SM	Gray fine to coarse sand with silt and gravel (very dense, wet) (fill)			Groundwater observed at approximately 5 feet below ground surface during drilling.
350												
	10		18	10		S-3		SM	Gray fine to coarse silty sand with gravel and frequent weathered rock fragments (medium dense, wet)			
345												
	15		18	171		S-4		Bedrock	Gray severely weathered rock			
340												
	20		18	149		S-5						

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-30

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-31
Sheet 1 of 1

Drilled	Start 1/28/2022	End 1/28/2022	Total Depth (ft) 7.5	Logged By HKC / Checked By ERH	Driller Soil Exploration Corporation	Drilling Method Hollow-stem Auger

Surface Elevation (ft) 393 / Vertical Datum NAVD88	Hammer Data: Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment: B-57 mobile drill	
Easting (X) 641937 / Northing (Y) 2963640	System Datum: MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0		21	67		S-1		AC	Approximately 2½ inches of asphalt concrete pavement			
390								SW-SM	Brown fine to coarse sand with silt and gravel (very dense, moist) (fill)			
	5		16	30		S-2A S-2B		SM	Gray fine to coarse silty sand with gravel, redox staining and few severely weathered rock fragments (medium dense, moist) (till) Becomes trace gravel			

Boring terminated at approximately 7½ feet below ground surface due to auger refusal; offset 5 feet north, auger refusal at 6½ feet below ground surface

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-31

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Drilled	Start 1/28/2022	End 1/28/2022	Total Depth (ft)	4.5	Logged By HKC	Checked By ERH	Driller	Soil Exploration Corporation	Drilling Method	Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum	375 / NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	B-57 mobile drill
Easting (X) / Northing (Y)	642334 / 2963649	System Datum	MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0		18	20		S-1		AC	Approximately 2½ inches of asphalt concrete pavement			
								SW-SM	Brown fine to coarse sand with silt and gravel (medium dense, moist) (fill)			

Boring terminated at approximately 4½ feet below ground surface due to auger refusal; offset 5 feet east, auger refusal at 3½ feet below ground surface

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-32

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Drilled	Start 1/28/2022	End 1/28/2022	Total Depth (ft)	12	Logged By FA Checked By ERH	Driller	Soil Exploration Corporation	Drilling Method	Hollow-stem Auger

Surface Elevation (ft) Vertical Datum	366.5 NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	B-57 mobile drill
Easting (X) Northing (Y)	641824 2964762	System Datum	MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0		24	58		S-1		TS	Topsoil			
365								SP-SM	Brown to gray fine to coarse silty sand with gravel and few plant fibers (very dense, moist) (fill)			
	5		16	26		S-2		SP-SM	Brown fine to coarse silty sand with gravel (medium dense, moist)			
360												
	10		24	27		S-3		SM	Gray fine to coarse silty sand with gravel (medium dense, moist) (till)			
355												

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-33

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-34
Sheet 1 of 1

Drilled	Start 1/27/2022	End 1/27/2022	Total Depth (ft)	12	Logged By HKC Checked By ERH	Driller Soil Exploration Corporation	Drilling Method	Hollow-stem Auger

Surface Elevation (ft) Vertical Datum	345 NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	B-57 mobile drill
Easting (X) Northing (Y)	642704 2964375	System Datum	MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0		22	58		S-1		AC	Approximately 4 inches of asphalt concrete pavement			
								SM	Dark brown fine to coarse silty sand with trace gravel (very dense, moist) (fill)			
340	5		22	14		S-2A			Becomes with few brick pieces, very few root pieces and medium dense			
						S-2B		SM	Brown fine to coarse silty sand with gravel (medium dense, moist)			
335	10		24	26		S-3						

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-34

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-35
Sheet 1 of 1

Drilled	Start 1/28/2022	End 1/28/2022	Total Depth (ft) 15.75	Logged By FA Checked By ERH	Driller Soil Exploration Corporation	Drilling Method Hollow-stem Auger

Surface Elevation (ft) 355 Vertical Datum NAVD88	Hammer Data Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment B-57 mobile drill
Easting (X) 641420 Northing (Y) 2964888	System Datum MA State Plane Mainland NAD83 (feet)	See "Remarks" section for groundwater observed

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0		20	17		S-1		TS	Topsoil			
								SP-SM	Brown fine to coarse sand with silt, gravel, few wood chips and few roots (medium dense, moist) (fill)			
350	5		20	18		S-2		SP-SM	Brown fine to coarse sand with silt, gravel, few concrete pieces, few reclaimed asphalt pieces and very few brick fragments (medium dense, moist) (fill)			Groundwater observed at approximately 9 feet below ground surface during drilling.
345	10		20	26		S-3		SM	Gray fine to coarse silty sand with gravel (medium dense, wet) (till)			
340	15		6	125/9"		S-4		Bedrock	Gray highly weathered rock (very dense, wet)			

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-35

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Drilled	Start: 4/6/2022	End: 4/6/2022	Total Depth (ft)	15	Logged By: AAA	Checked By: ERH	Driller	Crawford Drilling Services	Drilling Method	Hollow-stem Auger

Surface Elevation (ft) Vertical Datum	393 NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	CME-55 Rubber-track ATV drill rig
Easting (X) Northing (Y)	641937 2963640	System Datum	MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0								Refer to geotechnical boring GEO-31/31A for geologic description from 0 feet to 6 feet below ground surface			
390	5								Auger refusal; air hammer used to advance from 6 feet to 7 feet			
385			12	132		S-1		SP-SM	Brown fine to medium sand with silt, frequent severely weathered rock fragments and redox staining (very dense, moist) (fill)			
								BEDROCK	Gray severely weathered rock			
380	10							BEDROCK	Auger refusal; air hammer used to advance from 10 feet to 15 feet below ground surface			
	15								Boring terminated at approximately 15 feet below ground surface, 7 feet into bedrock			

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-101

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-37
Sheet 1 of 1

Drilled	Start 4/6/2022	End 4/6/2022	Total Depth (ft) 12.5	Logged By AAA / Checked By ERH	Driller Crawford Drilling Services	Drilling Method Hollow-stem Auger

Surface Elevation (ft) 381 Vertical Datum NAVD88	Hammer Data: Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment: CME-55 Rubber-track ATV drill rig
Easting (X) 642191 Northing (Y) 2963700	System Datum: MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval / Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
381 (380 at 1 ft)	0							Refer to geotechnical boring GEO-19/19A for geologic description from 0 feet to 7½ feet below ground surface			
375 (at 6 ft)	5										
	7.5						BEDROCK	Auger refusal; air hammer used to advance from 7½ feet to 12½ feet below ground surface			
370 (at 11 ft)	10										

Boring terminated at approximately 12½ feet below ground surface, 5 feet into bedrock

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-102

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	4/6/2022	4/6/2022	18	AAA	ERH	Crawford Drilling Services	Hollow-stem Auger

Surface Elevation (ft) Vertical Datum	380 NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	CME-55 Rubber-track ATV drill rig
Easting (X) Northing (Y)	642491 2963557	System Datum	MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0							AC	Approximately 3 inches of asphalt concrete pavement			
		X	17	31		S-1		SM	Brown to gray fine to coarse silty sand with gravel (dense, moist) (fill)			
375	5								Auger refusal; air hammer used to advance from 4 feet to 8 feet below ground surface			
370	10	X	17	30		S-2		SM	Light brown fine to coarse silty sand with gravel, redox staining (dense, moist) (till)			
									Auger refusal; air hammer used to advance from 13 feet to 15½ feet below ground surface			
365	15	X	16	61		S-3		SP-SM	Brown fine to medium sand with silt, frequent severely weathered rock fragments, redox staining (very dense, moist) (till)			

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-103

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-39
Sheet 1 of 1

Drilled	Start 4/6/2022	End 4/6/2022	Total Depth (ft) 24	Logged By AAA, Checked By ERH	Driller Crawford Drilling Services	Drilling Method Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum	397 / NAVD88	Hammer Data	Autohammer 140 (lbs) / 5 (in) Drop	Drilling Equipment	CME-55 Rubber-track ATV drill rig
Easting (X) / Northing (Y)	641002 / 2964212	System Datum	MA State Plane Mainland NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
397	0								Refer to geotechnical boring GEO-6/6A for geologic description from 0 feet to 9 feet below ground surface			
382	15	X	14	44		S-1		SP-SM	Light brown fine to medium sand with silt and gravel (dense, moist) (till)			
380	17								Auger refusal on possible goulders; air hammer used to advance from 17 feet to 22 feet below ground surface			
375	22	X	24	32		S-2		SM	Light brown to gray fine to medium silty sand, trace gravel (dense, moist) (till)			

Elevation scale: 395, 390, 385, 380, 375. Depth scale: 0, 5, 10, 15, 20.

Note: See Figure B-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Boring GEO-104

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-40
Sheet 1 of 1

Date Excavated 4/6/2022	Total Depth (ft) 8	Logged By FA Checked By ERH	Excavator Equipment Komatsu PC210	Groundwater not observed Caving not observed

Surface Elevation (ft) 361 Vertical Datum NAVD88	Easting (X) 641204 Northing (Y) 2964841	Coordinate System MA State Plane Mainland Horizontal Datum NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
361	0				TS	Topsoil			
360 – 353	1 – 8	6 – 8	G-1		SP-SM	Dark brown fine to coarse sand with silt and gravel, frequent metal, rebar, concrete, brick and asphalt pieces, frequent rubber fragments (moist) (fill)			Few cobbles up to 12 inches

Test pit terminated at approximately 8 feet below ground surface due to refusal on a concrete slab

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Test Pit GEO-TP-101

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-41
Sheet 1 of 1

Date Excavated	4/6/2022	Total Depth (ft)	3	Logged By FA Checked By ERH	Excavator Equipment Komatsu PC210	Groundwater not observed Caving not observed

Surface Elevation (ft) Vertical Datum	356 NAVD88	Easting (X) Northing (Y)	641625 2964846	Coordinate System Horizontal Datum	MA State Plane Mainland NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					TS	Topsoil			
355, 354, 353	1, 2, 3				GP-GM	Brown fine to coarse gravel with silt and sand, frequent concrete, metal, asphalt, ceramic and plastic pieces (moist) (fill)			

Test pit terminated at approximately 3 feet below ground surface due to refusal on concrete slab

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Test Pit GEO-TP-102

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Date Excavated	4/6/2022	Total Depth (ft)	13	Logged By FA Checked By ERH	Excavator Equipment Komatsu PC210	See "Remarks" section for groundwater observed Caving not observed

Surface Elevation (ft) Vertical Datum	378 NAVD88	Easting (X) Northing (Y)	641658 2964616	Coordinate System Horizontal Datum	MA State Plane Mainland NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0				TS	Topsoil			
377	1				SP-SM	Brown fine to coarse sand with silt and gravel, frequent asphalt, metal pieces, concrete (moist to wet) (fill)			
376	2								
375	3								
374	4								
373	5								Disconnected drain pipe at 5 feet below ground surface Crushed stone from 5 to 8 feet in northern and eastern walls
372	6								
371	7								
370	8								Perched groundwater observed at 8 feet below ground surface during drilling
369	9				SM	Brown fine to coarse silty sand with gravel (wet) (till)			
368	10								
367	11								
366	12		G-1						Very difficult excavation effort from 12 to 13 feet below ground surface
365	13								

Test pit terminated at approximately 13 feet below ground surface due to refusal in glacial till

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Test Pit GEO-TP-103

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Date Excavated	4/6/2022	Total Depth (ft)	7.5	Logged By	FA	Excavator		Groundwater not observed
				Checked By	ERH	Equipment	Komatsu PC210	Caving not observed

Surface Elevation (ft)	378	Easting (X)	641623	Coordinate System	MA State Plane Mainland
Vertical Datum	NAVD88	Northing (Y)	2964616	Horizontal Datum	NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					TS	Topsoil			
377	1				SP-SM	Brown fine to corse sand with silt and gravel, occasional wood, bricks, metal and concrete pieces (moist) (fill)			
376	2								
375	3								
374	4								Bedding sand for utilities was observed in the central portion of the test pit at 4 feet below ground surface
373	5								
372	6								
371	7								A concrete structure was observed under the sand, likely a utility at 7 feet below ground surface

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Test Pit GEO-TP-103A

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-44
Sheet 1 of 1

Date Excavated	4/6/2022	Total Depth (ft)	7.5	Logged By FA Checked By ERH	Excavator Equipment Komatsu PC210	Groundwater not observed Caving not observed

Surface Elevation (ft) Vertical Datum	383 NAVD88	Easting (X) Northing (Y)	641461 2964494	Coordinate System Horizontal Datum	MA State Plane Mainland NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					TS	Topsoil			
382 381 380	1 2 3				SP-SM	Dark brown fine to coarse sand with silt and gravel, occasional plastic pieces, wood fragments and concrete pieces (moist) (fill)			A discontinuous layer of fibrous peat varying in thickness from 3 to 12 inches observed at approximately2½ to 3 feet below ground surface Excavation effort very difficult from 3 feet to 7½ feet below ground surface
379 378 377 376	4 5 6 7		G-1		GP	Gray fine to coarse gravel with sand, occasional plastic pieces, wood fragments, brick and concrete pieces (moist) (crushed concrete fill)			

Test pit terminated at approximately 7½ feet below ground surface due to refusal on a concrete slab

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Test Pit GEO-TP-104

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-45
Sheet 1 of 1

Date Excavated 4/6/2022	Total Depth (ft) 15	Logged By FA Checked By ERH	Excavator Equipment Komatsu PC210	Groundwater not observed Caving not observed

Surface Elevation (ft) 391 Vertical Datum NAVD88	Easting (X) 641138 Northing (Y) 2964478	Coordinate System MA State Plane Mainland Horizontal Datum NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
391	0				TS	Topsoil			
390	1				SP-SM	Brown fine to coarse sand with silt and gravel, occasional wood pieces, plastic fragments, brick pieces and concrete pieces (moist) (fill)			
389	2								
388	3				GP-GM	Gray fine to coarse gravel with silt and sand, occasional plastic, metal and wood pieces (moist) (crushed concrete fill)			
387	4								Foundation wall observed at 4 feet below ground surface in the western wall of the test pit; concrete slab observed at 4 feet below ground surface in the eastern portion of the test pit
386	5		G-1						
385	6								
384	7								
383	8								
382	9								
381	10								
380	11								
379	12								A discontinuous layer of fibrous peat varying in thickness from 3 to 12 inches observed at approximately 12 feet below ground surface
378	13								
377	14								
376	15								

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Test Pit GEO-TP-105

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Figure B-46
Sheet 1 of 1

Date Excavated	4/6/2022	Total Depth (ft)	12	Logged By FA Checked By ERH	Excavator Equipment Komatsu PC210	See "Remarks" section for groundwater observed Caving not observed

Surface Elevation (ft) Vertical Datum	387 NAVD88	Easting (X) Northing (Y)	641130 2964600	Coordinate System Horizontal Datum	MA State Plane Mainland NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
387–386	0–1				TS	Topsoil			
386–383	1–4				SP-SM	Brown fine to coarse sand with silt and gravel, occasional metal, plastic pieces and brick pieces (moist) (fill)			Light brown fine to medium silty sand with gravel observed behind foundation wall from 1 to 4 feet below ground surface
383–377	4–10				GP-GM	Gray fine to coarse gravel with silt and sand, frequent metal, occasional plastic, brick and wood pieces (moist) (crushed concrete fill)			Foundation wall observed at 4 feet below ground surface in the west wall of test pit Perched groundwater observed at approximately 4 feet below ground surface (rainy weather)
377–375	10–12		G-1		SP-SM	Light brown fine to coarse sand with silt and gravel and occasional wood pieces (moist) (fill)			

Test pit terminated at approximately 12 feet below ground surface due to refusal on a concrete slab

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Test Pit GEO-TP-106

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Date Excavated	4/6/2022	Total Depth (ft)	17	Logged By	FA	Excavator
				Checked By	ERH	Equipment Komatsu PC210

See "Remarks" section for groundwater observed
See "Remarks" section for caving observed

Surface Elevation (ft)	380	Easting (X)	640641	Coordinate System	MA State Plane Mainland
Vertical Datum	NAVD88	Northing (Y)	2964488	Horizontal Datum	NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0				TS	Topsoil			
379–366	0.5–14				SP-SM	Brown fine to coarse sand with silt and gravel, occasional plastic, brick, concrete, wood and metal pieces (moist) (fill)			
374	6								3½ by 3 foot boulders observed at approximately 6 feet below ground surface
372	8								Occasional cobbles up to 12 inches
371	9								Caving observed at 9 feet below ground surface
369	11								Perched groundwater observed at approximately 11 feet below ground surface
366–363	14–17		G-1		GP	Gray fine to coarse gravel with silt and sand and occasional brick pieces (moist) (dense-graded fill)			

Test pit terminated at approximately 17 feet below ground surface due to refusal on a concrete slab

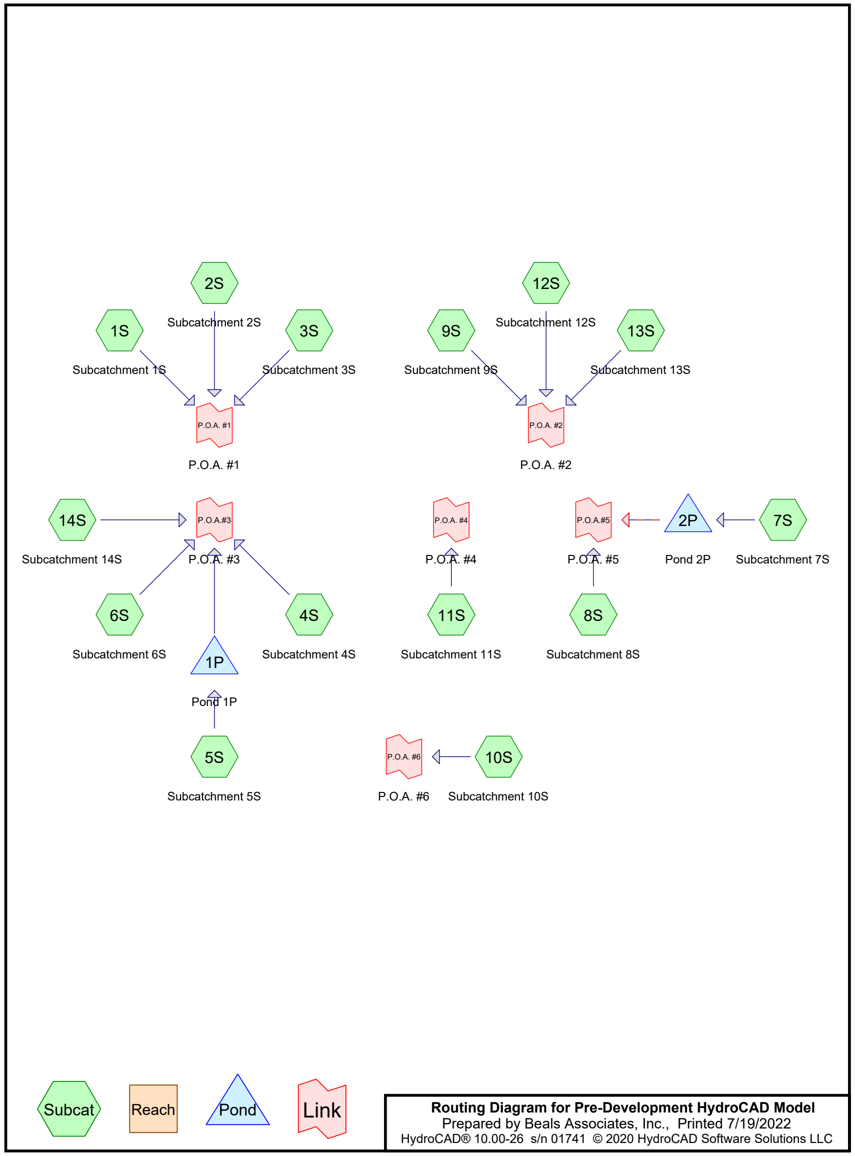
Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Test Pit GEO-TP-107

GeoEngineers USA

Project: 75 Reed Road
Project Location: Hudson, Massachusetts
Project Number: 25394-004-00

Appendix F – Calculations



Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
23.695	61	>75% Grass cover, Good, HSG B (1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S)
0.821	48	Brush (9S)
15.676	48	Brush, Good, HSG B (1S, 5S, 6S)
0.255	98	Detention Pond (5S)
0.588	96	Gravel (4S, 5S, 6S, 9S, 11S)
34.399	98	Impervious (1S, 2S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S, 12S, 13S, 14S)
0.182	98	Water Surface, HSG A (4S, 11S)
7.291	55	Woods, Good, HSG B (2S, 3S, 7S, 8S, 9S, 10S, 11S)
82.908	**74**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.182	HSG A	4S, 11S
46.663	HSG B	1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S
0.000	HSG C	
0.000	HSG D	
36.063	Other	1S, 2S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S, 12S, 13S, 14S
82.908		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	23.695	0.000	0.000	0.000	23.695	>75% Grass cover, Good	1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S
0.000	0.000	0.000	0.000	0.821	0.821	Brush	9S
0.000	15.676	0.000	0.000	0.000	15.676	Brush, Good	1S, 5S, 6S
0.000	0.000	0.000	0.000	0.255	0.255	Detention Pond	5S
0.000	0.000	0.000	0.000	0.588	0.588	Gravel	4S, 5S, 6S, 9S, 11S
0.000	0.000	0.000	0.000	34.399	34.399	Impervious	1S, 2S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S, 12S, 13S, 14S
0.182	0.000	0.000	0.000	0.000	0.182	Water Surface	4S, 11S
0.000	7.291	0.000	0.000	0.000	7.291	Woods, Good	2S, 3S, 7S, 8S, 9S, 10S, 11S
0.182	**46.663**	**0.000**	**0.000**	**36.063**	**82.908**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Subcatchment 1S Runoff Area=155,713 sf 90.36% Impervious Runoff Depth=2.48"
Tc=6.0 min CN=94 Runoff=9.95 cfs 0.738 af

Subcatchment 2S: Subcatchment 2S Runoff Area=364,553 sf 58.28% Impervious Runoff Depth=1.48"
Tc=6.0 min CN=82 Runoff=14.48 cfs 1.034 af

Subcatchment 3S: Subcatchment 3S Runoff Area=39,042 sf 0.00% Impervious Runoff Depth=0.29"
Flow Length=388' Tc=15.7 min CN=57 Runoff=0.11 cfs 0.021 af

Subcatchment 4S: Subcatchment 4S Runoff Area=49,545 sf 5.36% Impervious Runoff Depth=0.57"
Flow Length=84' Tc=6.0 min CN=65 Runoff=0.58 cfs 0.054 af

Subcatchment 5S: Subcatchment 5S Runoff Area=498,052 sf 3.51% Impervious Runoff Depth=0.16"
Flow Length=597' Tc=8.6 min CN=52 Runoff=0.47 cfs 0.149 af

Subcatchment 6S: Subcatchment 6S Runoff Area=515,662 sf 23.11% Impervious Runoff Depth=0.49"
Flow Length=1,447' Tc=16.7 min CN=63 Runoff=3.41 cfs 0.482 af

Subcatchment 7S: Subcatchment 7S Runoff Area=321,750 sf 52.49% Impervious Runoff Depth=1.35"
Flow Length=835' Tc=14.1 min CN=80 Runoff=8.91 cfs 0.830 af

Subcatchment 8S: Subcatchment 8S Runoff Area=56,372 sf 46.95% Impervious Runoff Depth=1.22"
Flow Length=541' Tc=8.0 min CN=78 Runoff=1.69 cfs 0.132 af

Subcatchment 9S: Subcatchment 9S Runoff Area=734,034 sf 49.98% Impervious Runoff Depth=1.28"
Flow Length=2,216' Tc=9.5 min CN=79 Runoff=22.08 cfs 1.804 af

Subcatchment 10S: Subcatchment 10S Runoff Area=135,441 sf 23.71% Impervious Runoff Depth=0.69"
Flow Length=610' Tc=11.9 min CN=68 Runoff=1.74 cfs 0.180 af

Subcatchment 11S: Subcatchment 11S Runoff Area=324,210 sf 4.17% Impervious Runoff Depth=0.38"
Flow Length=1,206' Tc=7.4 min CN=60 Runoff=1.71 cfs 0.237 af

Subcatchment 12S: Subcatchment 12S Runoff Area=115,319 sf 100.00% Impervious Runoff Depth=2.90"
Tc=6.0 min CN=98 Runoff=8.04 cfs 0.639 af

Subcatchment 13S: Subcatchment 13S Runoff Area=138,712 sf 100.00% Impervious Runoff Depth=2.90"
Tc=6.0 min CN=98 Runoff=9.67 cfs 0.769 af

Subcatchment 14S: Subcatchment 14S Runoff Area=163,047 sf 100.00% Impervious Runoff Depth=2.90"
Tc=6.0 min CN=98 Runoff=11.37 cfs 0.904 af

Pond 1P: Pond 1P Peak Elev=349.76' Storage=241 cf Inflow=0.47 cfs 0.149 af
Discarded=0.28 cfs 0.149 af Primary=0.00 cfs 0.000 af Outflow=0.28 cfs 0.149 af

Pond 2P: Pond 2P Peak Elev=370.19' Storage=2,172 cf Inflow=8.91 cfs 0.830 af
Primary=6.20 cfs 0.830 af Secondary=0.00 cfs 0.000 af Outflow=6.20 cfs 0.830 af

Link P.O.A. #1: P.O.A. #1 Inflow=24.42 cfs 1.793 af
Primary=24.42 cfs 1.793 af

Link P.O.A. #2: P.O.A. #2 Inflow=37.99 cfs 3.212 af
Primary=37.99 cfs 3.212 af

Link P.O.A. #4: P.O.A. #4 Inflow=1.71 cfs 0.237 af
Primary=1.71 cfs 0.237 af

Link P.O.A. #6: P.O.A. #6 Inflow=1.74 cfs 0.180 af
Primary=1.74 cfs 0.180 af

Link P.O.A.#3: P.O.A. #3 Inflow=12.83 cfs 1.439 af
Primary=12.83 cfs 1.439 af

Link P.O.A.#5: P.O.A. #5 Inflow=7.14 cfs 0.962 af
Primary=7.14 cfs 0.962 af

Total Runoff Area = 82.908 ac Runoff Volume = 7.972 af Average Runoff Depth = 1.15"
57.98% Pervious = 48.072 ac 42.02% Impervious = 34.835 ac

Summary for Subcatchment 1S: Subcatchment 1S

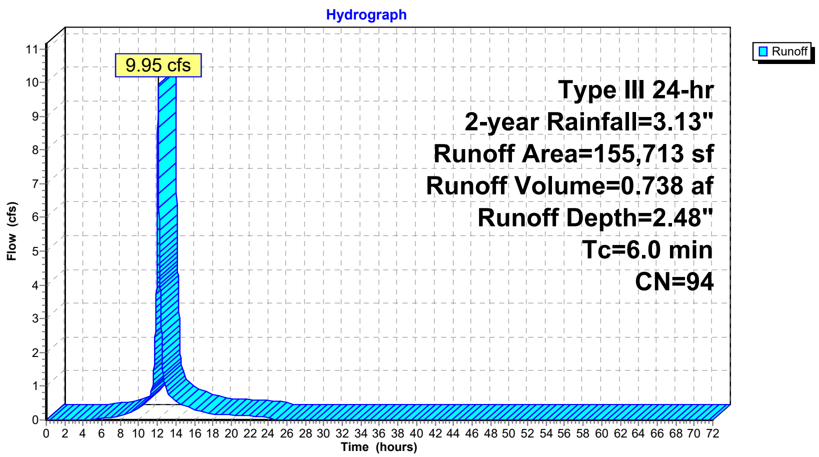
Runoff = 9.95 cfs @ 12.08 hrs, Volume= 0.738 af, Depth= 2.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
*	140,700	98	Impervious
	12,979	61	>75% Grass cover, Good, HSG B
	2,034	48	Brush, Good, HSG B
	155,713	94	Weighted Average
	15,013		9.64% Pervious Area
	140,700		90.36% Impervious Area

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

Subcatchment 1S: Subcatchment 1S



Summary for Subcatchment 2S: Subcatchment 2S

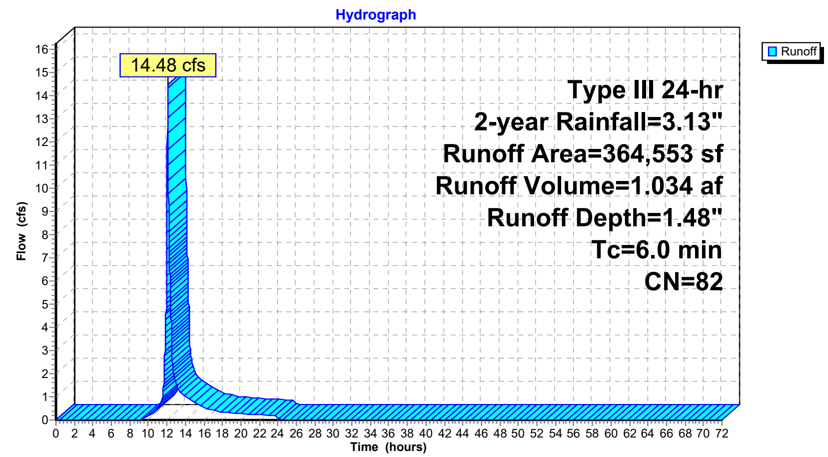
Runoff = 14.48 cfs @ 12.09 hrs, Volume= 1.034 af, Depth= 1.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
*	212,468	98	Impervious
	122,388	61	>75% Grass cover, Good, HSG B
	29,697	55	Woods, Good, HSG B
	364,553	82	Weighted Average
	152,085		41.72% Pervious Area
	212,468		58.28% Impervious Area

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

Subcatchment 2S: Subcatchment 2S



Summary for Subcatchment 3S: Subcatchment 3S

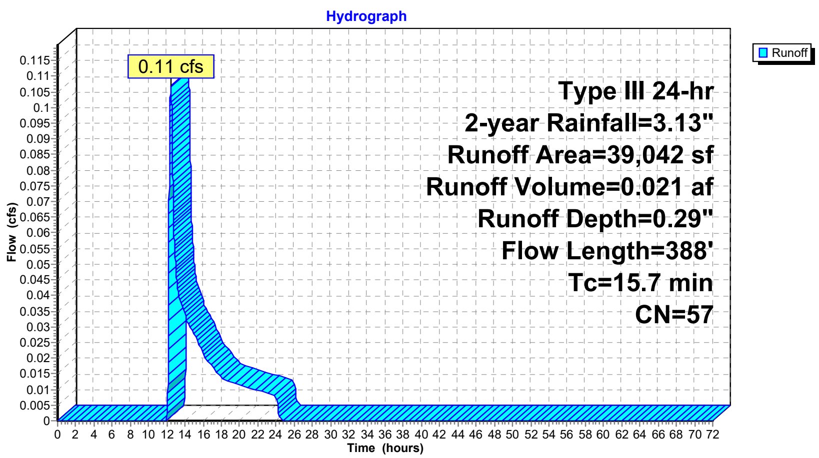
Runoff = 0.11 cfs @ 12.44 hrs, Volume= 0.021 af, Depth= 0.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

Area (sf)	CN	Description
12,659	61	>75% Grass cover, Good, HSG B
26,383	55	Woods, Good, HSG B
39,042	57	Weighted Average
39,042		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	50	0.0100	0.08		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.4	78	0.0390	2.96		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
4.4	260	0.0385	0.98		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
15.7	388	Total			

Subcatchment 3S: Subcatchment 3S



Summary for Subcatchment 4S: Subcatchment 4S

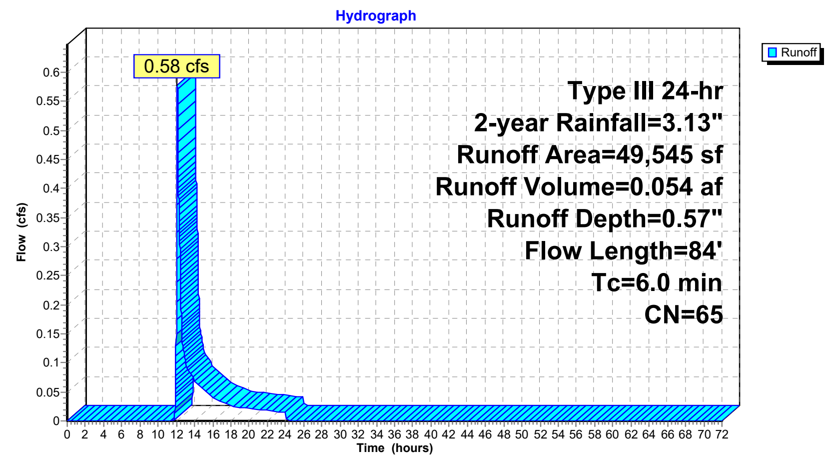
Runoff = 0.58 cfs @ 12.11 hrs, Volume= 0.054 af, Depth= 0.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
*	2,294	96	Gravel
	44,594	61	>75% Grass cover, Good, HSG B
*	1,961	98	Impervious
	696	98	Water Surface, HSG A
	49,545	65	Weighted Average
	46,888		94.64% Pervious Area
	2,657		5.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.1200	0.21		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.1	34	0.3200	8.49		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
1.9					**Direct Entry,**
6.0	84	Total			

Subcatchment 4S: Subcatchment 4S



Summary for Subcatchment 5S: Subcatchment 5S

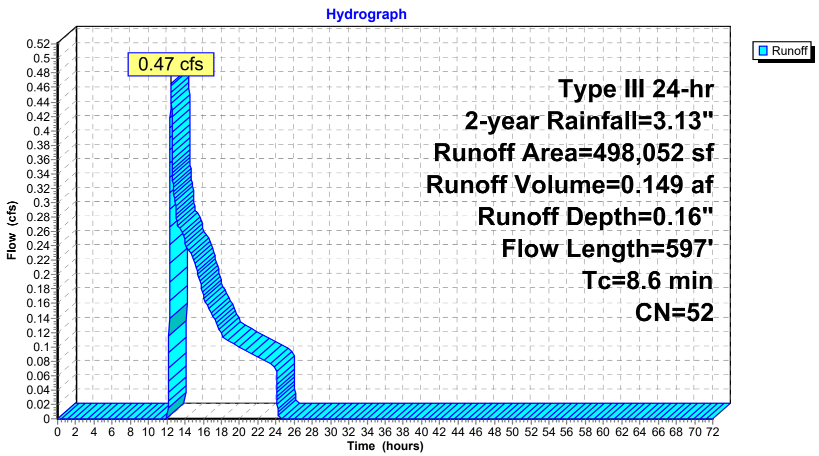
Runoff = 0.47 cfs @ 12.47 hrs, Volume= 0.149 af, Depth= 0.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
*	6,396	98	Impervious
*	11,090	98	Detention Pond
*	9,733	96	Gravel
	65,901	61	>75% Grass cover, Good, HSG B
	404,932	48	Brush, Good, HSG B
	498,052	52	Weighted Average
	480,566		96.49% Pervious Area
	17,486		3.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	50	0.1000	0.19		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.3	44	0.0230	2.27		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
3.9	503	0.0960	2.17		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
8.6	597	Total			

Subcatchment 5S: Subcatchment 5S



Summary for Subcatchment 6S: Subcatchment 6S

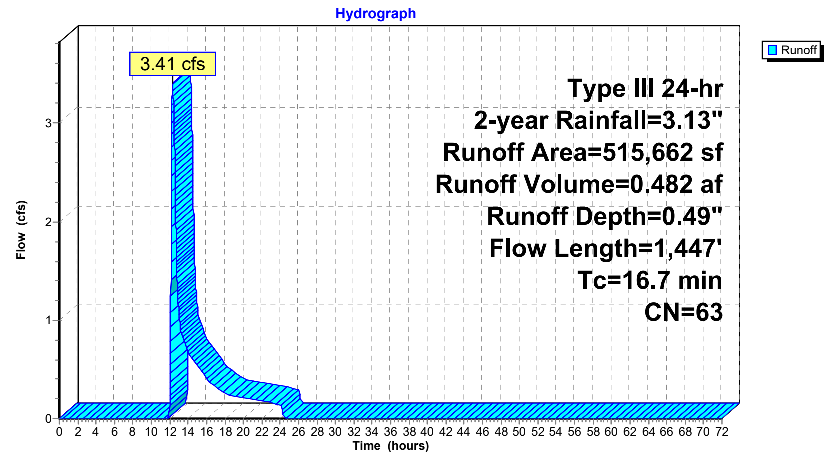
Runoff = 3.41 cfs @ 12.30 hrs, Volume= 0.482 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
*	119,180	98	Impervious
*	8,092	96	Gravel
	112,490	61	>75% Grass cover, Good, HSG B
	275,900	48	Brush, Good, HSG B
	515,662	63	Weighted Average
	396,482		76.89% Pervious Area
	119,180		23.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.3	90	0.1110	5.00		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
8.3	540	0.0240	1.08		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
1.3	119	0.0084	1.48		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
0.5	648	0.0430	20.48	100.52	**Pipe Channel, E-F** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.011 Concrete pipe, straight & clean
16.7	1,447	Total			

Subcatchment 6S: Subcatchment 6S



Summary for Subcatchment 7S: Subcatchment 7S

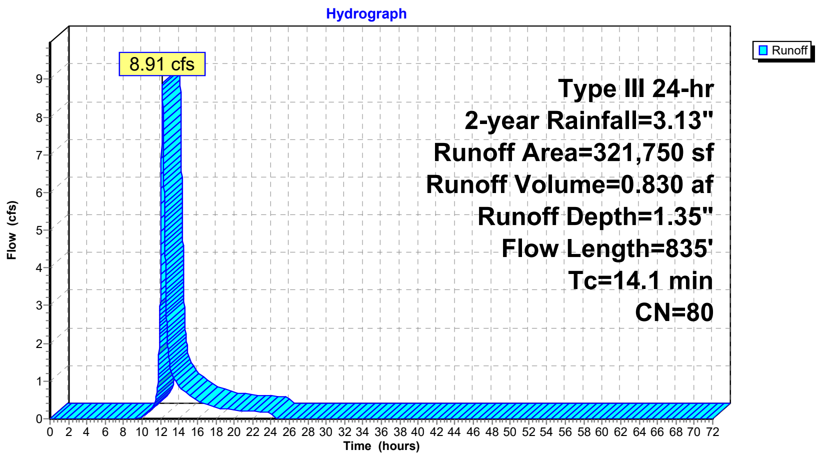
Runoff = 8.91 cfs @ 12.20 hrs, Volume= 0.830 af, Depth= 1.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
*	168,873	98	Impervious
	132,418	61	>75% Grass cover, Good, HSG B
	20,459	55	Woods, Good, HSG B
	321,750	80	Weighted Average
	152,877		47.51% Pervious Area
	168,873		52.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	50	0.0100	0.08		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.7	116	0.0300	2.60		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
2.2	475	0.0316	3.61		**Shallow Concentrated Flow, C-D** Paved Kv= 20.3 fps
0.3	194	0.0515	12.17	9.56	**Pipe Channel, D-E** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
14.1	835	Total			

Subcatchment 7S: Subcatchment 7S



Summary for Subcatchment 8S: Subcatchment 8S

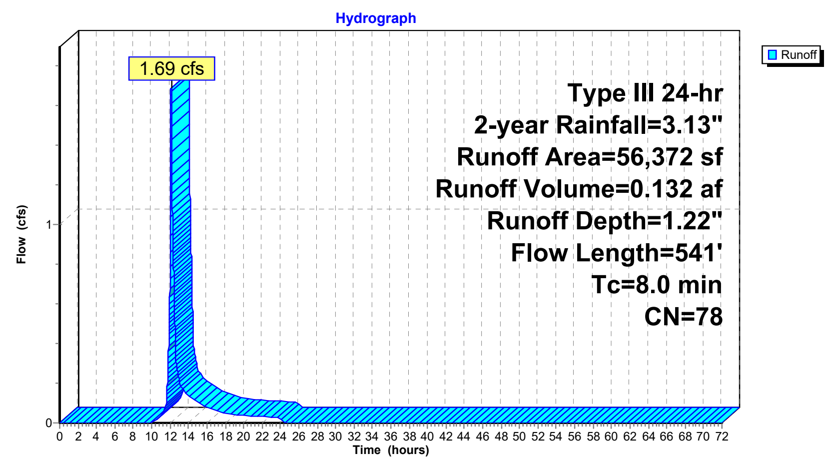
Runoff = 1.69 cfs @ 12.12 hrs, Volume= 0.132 af, Depth= 1.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
*	26,468	98	Impervious
	29,195	61	>75% Grass cover, Good, HSG B
	709	55	Woods, Good, HSG B
	56,372	78	Weighted Average
	29,904		53.05% Pervious Area
	26,468		46.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0300	0.12		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.4	108	0.0395	4.03		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
0.6	383	0.0370	10.31	8.10	**Pipe Channel, C-D** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
8.0	541	Total			

Subcatchment 8S: Subcatchment 8S



Summary for Subcatchment 9S: Subcatchment 9S

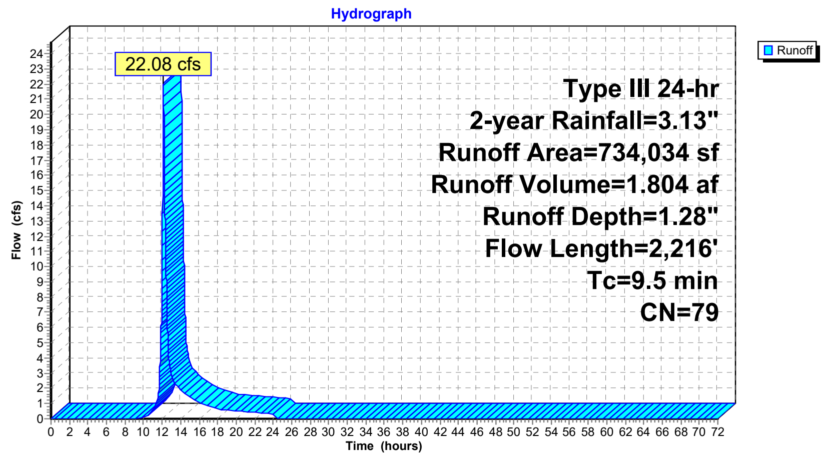
Runoff = 22.08 cfs @ 12.14 hrs, Volume= 1.804 af, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
*	366,867	98	Impervious
	320,040	61	>75% Grass cover, Good, HSG B
	11,163	55	Woods, Good, HSG B
*	35,773	48	Brush
*	191	96	Gravel
	734,034	79	Weighted Average
	367,167		50.02% Pervious Area
	366,867		49.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.6	94	0.0319	2.68		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
2.6	2,072	0.0250	13.46	42.27	**Pipe Channel, C-D** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
9.5	2,216	Total			

Subcatchment 9S: Subcatchment 9S



Summary for Subcatchment 10S: Subcatchment 10S

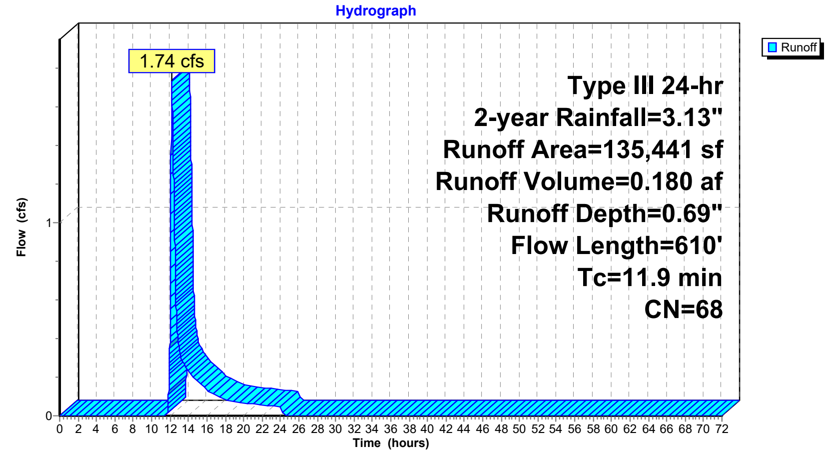
Runoff = 1.74 cfs @ 12.19 hrs, Volume= 0.180 af, Depth= 0.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
*	32,115	98	Impervious
	61,706	61	>75% Grass cover, Good, HSG B
	41,620	55	Woods, Good, HSG B
	135,441	68	Weighted Average
	103,326		76.29% Pervious Area
	32,115		23.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0800	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.13"
3.9	351	0.0910	1.51		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.1	24	0.1250	5.30		**Shallow Concentrated Flow, C-D** Grassed Waterway Kv= 15.0 fps
0.0	20	0.0500	11.99	9.42	**Pipe Channel, D-E** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.6	105	0.0200	2.89	4.82	**Parabolic Channel, E-F** W=10.00' D=0.25' Area=1.7 sf Perim=10.0' n= 0.022 Earth, clean & straight
0.1	60	0.0233	8.18	6.43	**Pipe Channel, F-G** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
11.9	610	Total			

Subcatchment 10S: Subcatchment 10S



Summary for Subcatchment 11S: Subcatchment 11S

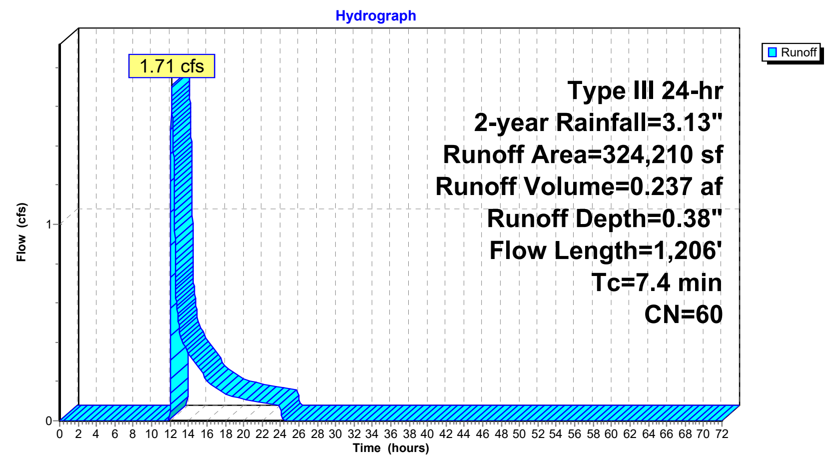
Runoff = 1.71 cfs @ 12.16 hrs, Volume= 0.237 af, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
*	5,303	96	Gravel
	117,793	61	>75% Grass cover, Good, HSG B
*	6,302	98	Impervious
	7,233	98	Water Surface, HSG A
	187,579	55	Woods, Good, HSG B
	324,210	60	Weighted Average
	310,675		95.83% Pervious Area
	13,535		4.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	50	0.1200	2.43		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.13"
0.7	216	0.0694	5.35		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
3.1	537	0.0370	2.89		**Shallow Concentrated Flow, C-D** Grassed Waterway Kv= 15.0 fps
3.3	403	0.1700	2.06		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
7.4	1,206	Total			

Subcatchment 11S: Subcatchment 11S



Summary for Subcatchment 12S: Subcatchment 12S

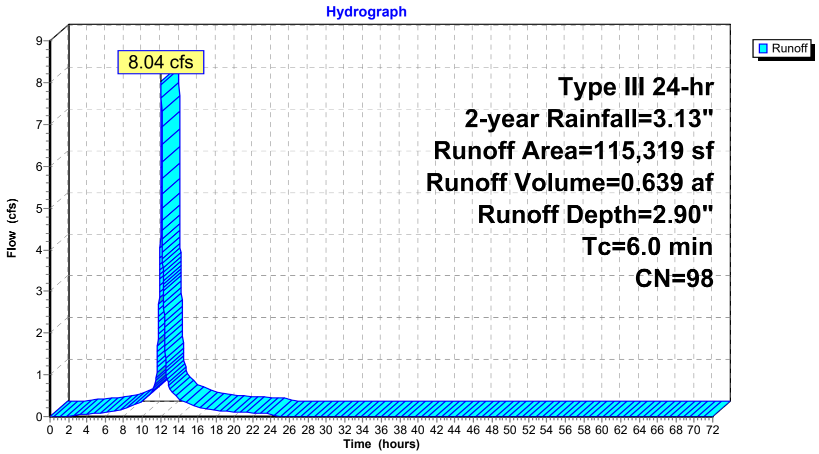
Runoff = 8.04 cfs @ 12.08 hrs, Volume= 0.639 af, Depth= 2.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
*	115,319	98	Impervious
	115,319		100.00% Impervious Area

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

Subcatchment 12S: Subcatchment 12S



Summary for Subcatchment 13S: Subcatchment 13S

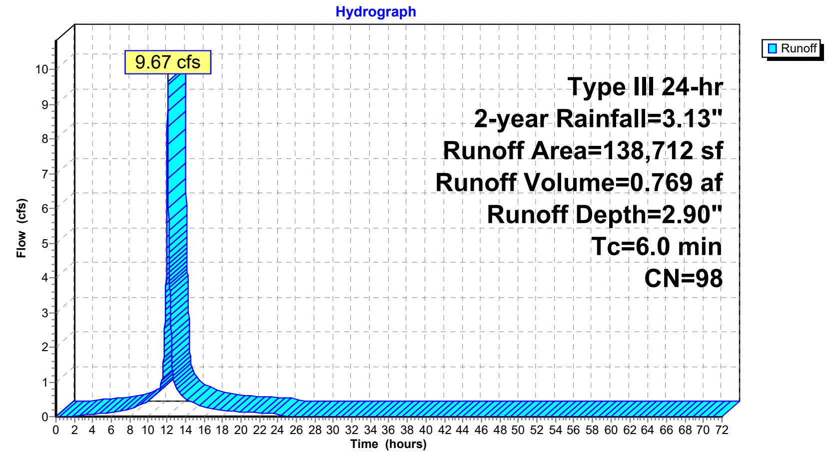
Runoff = 9.67 cfs @ 12.08 hrs, Volume= 0.769 af, Depth= 2.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
*	138,712	98	Impervious
	138,712		100.00% Impervious Area

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

Subcatchment 13S: Subcatchment 13S



Summary for Subcatchment 14S: Subcatchment 14S

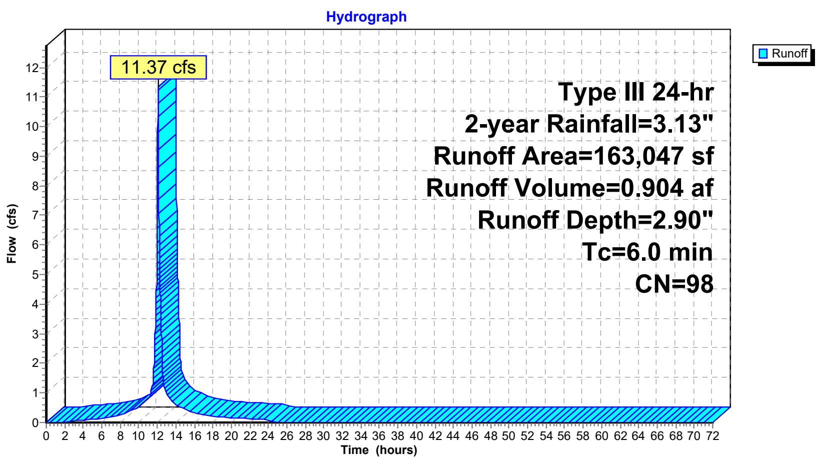
Runoff = 11.37 cfs @ 12.08 hrs, Volume= 0.904 af, Depth= 2.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
*	163,047	98	Impervious
	163,047		100.00% Impervious Area

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

Subcatchment 14S: Subcatchment 14S



Summary for Pond 1P: Pond 1P

Inflow Area = 11.434 ac, 3.51% Impervious, Inflow Depth = 0.16" for 2-year event
Inflow = 0.47 cfs @ 12.47 hrs, Volume= 0.149 af
Outflow = 0.28 cfs @ 13.04 hrs, Volume= 0.149 af, Atten= 39%, Lag= 34.1 min
Discarded = 0.28 cfs @ 13.04 hrs, Volume= 0.149 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 349.76' @ 13.04 hrs Surf.Area= 5,068 sf Storage= 241 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 5.0 min (998.7 - 993.6)

Volume	Invert	Avail.Storage	Storage Description
#1	349.70'	67,191 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

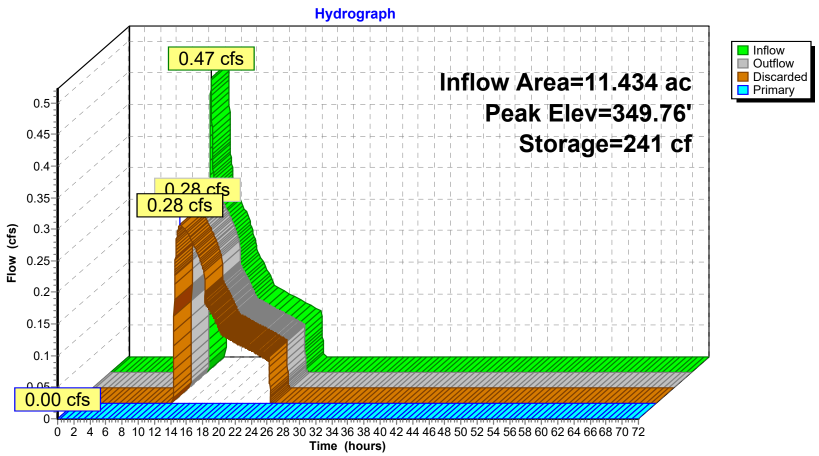
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
349.70	3,651	0	0
350.00	11,353	2,251	2,251
351.00	13,056	12,205	14,455
352.00	15,614	14,335	28,790
353.00	18,669	17,142	45,932
354.00	23,850	21,260	67,191

Device	Routing	Invert	Outlet Devices
#1	Primary	345.50'	**24.0" Round Culvert** L= 131.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 345.50' / 343.40' S= 0.0160 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf
#2	Device 1	350.60'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	352.47'	**2.5" x 2.5" Horiz. Orifice/Grate X 36.00** C= 0.600 in 24.0" x 24.0" Grate (39% open area) Limited to weir flow at low heads
#4	Discarded	349.70'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.28 cfs @ 13.04 hrs HW=349.76' (Free Discharge)
└─**4=Exfiltration** (Exfiltration Controls 0.28 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=349.70' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.00 cfs of 34.71 cfs potential flow)
 ├─**2=Orifice/Grate** (Controls 0.00 cfs)
 └─**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: Pond 1P



Summary for Pond 2P: Pond 2P

Inflow Area = 7.386 ac, 52.49% Impervious, Inflow Depth = 1.35" for 2-year event
Inflow = 8.91 cfs @ 12.20 hrs, Volume= 0.830 af
Outflow = 6.20 cfs @ 12.38 hrs, Volume= 0.830 af, Atten= 30%, Lag= 10.5 min
Primary = 6.20 cfs @ 12.38 hrs, Volume= 0.830 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 370.19' @ 12.38 hrs Surf.Area= 3,900 sf Storage= 2,172 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 1.5 min (852.9 - 851.4)

Volume	Invert	Avail.Storage	Storage Description
#1	368.00'	53,283 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

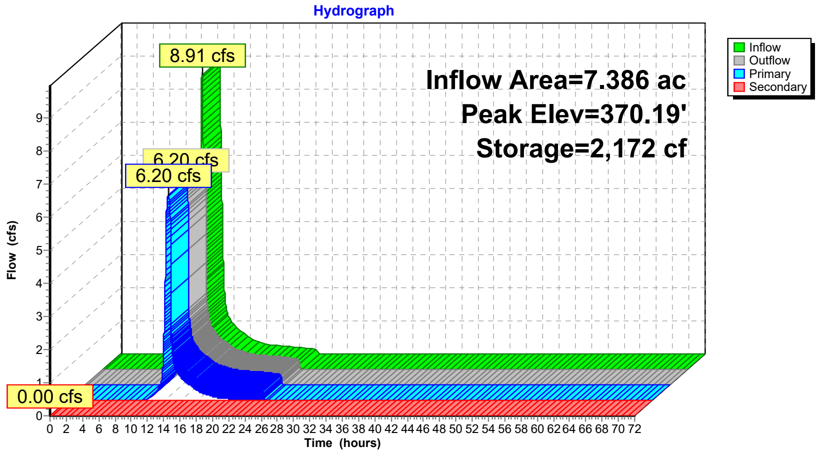
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
368.00	47	65.0	0	0	47
369.00	236	74.0	129	129	168
370.00	3,056	310.0	1,380	1,510	7,383
371.00	8,615	394.0	5,601	7,111	12,102
372.00	12,842	440.0	10,658	17,769	15,183
373.00	18,271	569.0	15,477	33,246	25,553
374.00	21,857	579.0	20,037	53,283	26,632

Device	Routing	Invert	Outlet Devices
#1	Primary	367.00'	**12.0" Round Culvert** L= 134.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 367.00' / 360.80' S= 0.0463 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Secondary	373.00'	**13.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=6.20 cfs @ 12.38 hrs HW=370.19' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 6.20 cfs @ 7.90 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=368.00' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: Pond 2P

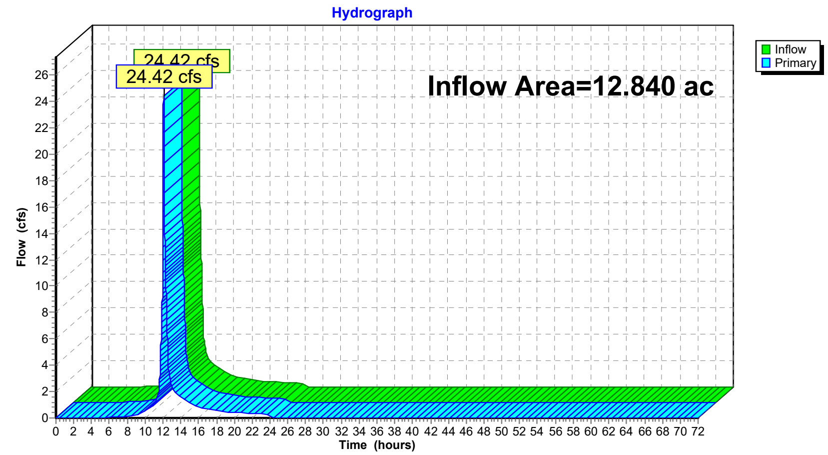


Summary for Link P.O.A. #1: P.O.A. #1

Inflow Area = 12.840 ac, 63.14% Impervious, Inflow Depth = 1.68" for 2-year event
Inflow = 24.42 cfs @ 12.09 hrs, Volume= 1.793 af
Primary = 24.42 cfs @ 12.09 hrs, Volume= 1.793 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #1: P.O.A. #1

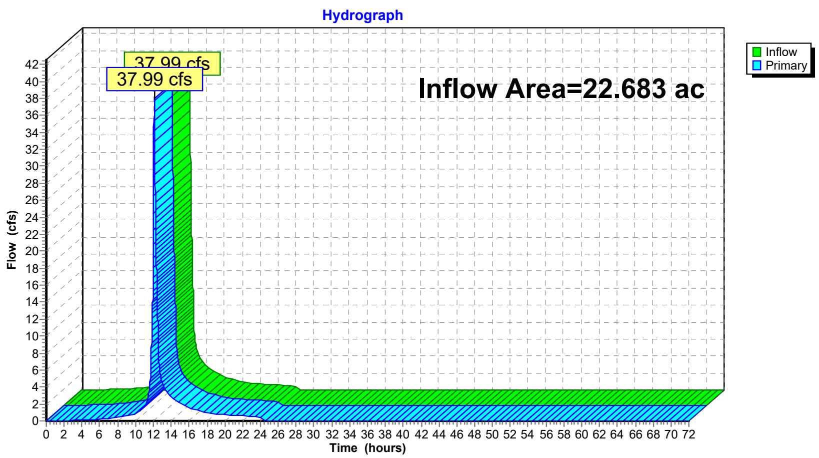


Summary for Link P.O.A. #2: P.O.A. #2

Inflow Area = 22.683 ac, 62.84% Impervious, Inflow Depth = 1.70" for 2-year event
Inflow = 37.99 cfs @ 12.11 hrs, Volume= 3.212 af
Primary = 37.99 cfs @ 12.11 hrs, Volume= 3.212 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #2: P.O.A. #2

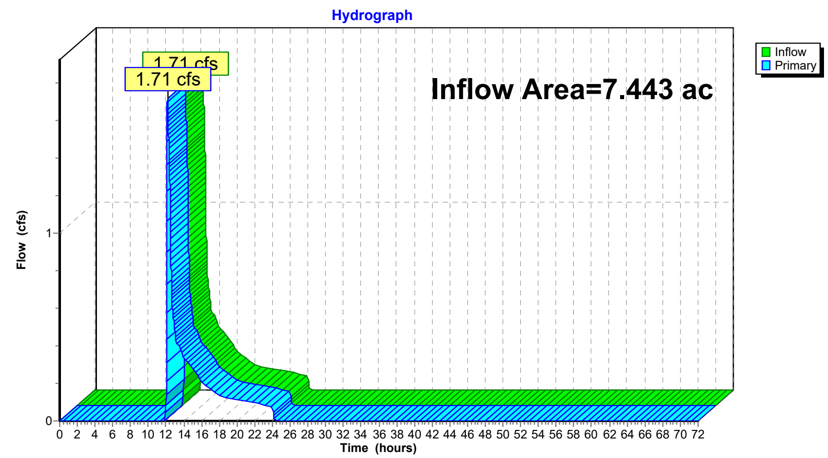


Summary for Link P.O.A. #4: P.O.A. #4

Inflow Area = 7.443 ac, 4.17% Impervious, Inflow Depth = 0.38" for 2-year event
Inflow = 1.71 cfs @ 12.16 hrs, Volume= 0.237 af
Primary = 1.71 cfs @ 12.16 hrs, Volume= 0.237 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #4: P.O.A. #4

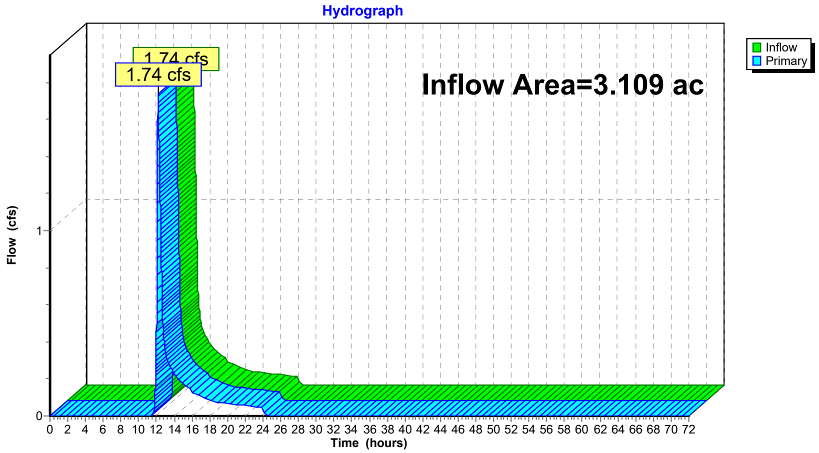


Summary for Link P.O.A. #6: P.O.A. #6

Inflow Area = 3.109 ac, 23.71% Impervious, Inflow Depth = 0.69" for 2-year event
Inflow = 1.74 cfs @ 12.19 hrs, Volume= 0.180 af
Primary = 1.74 cfs @ 12.19 hrs, Volume= 0.180 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #6: P.O.A. #6

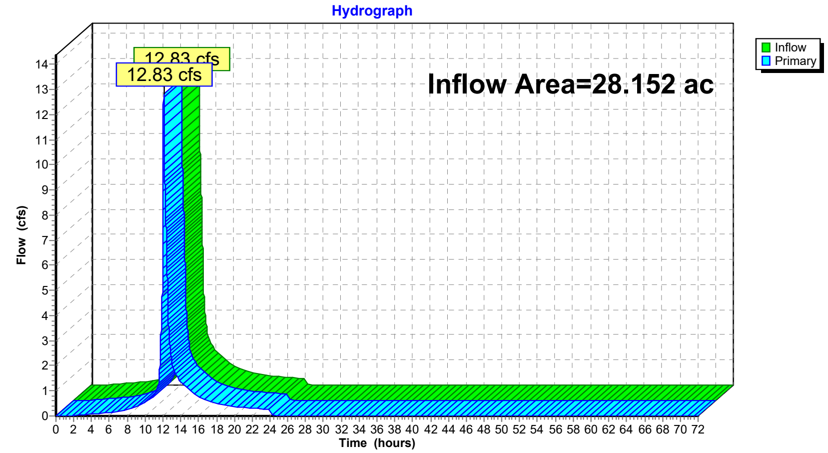


Summary for Link P.O.A.#3: P.O.A. #3

Inflow Area = 28.152 ac, 24.66% Impervious, Inflow Depth = 0.61" for 2-year event
Inflow = 12.83 cfs @ 12.09 hrs, Volume= 1.439 af
Primary = 12.83 cfs @ 12.09 hrs, Volume= 1.439 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A.#3: P.O.A. #3

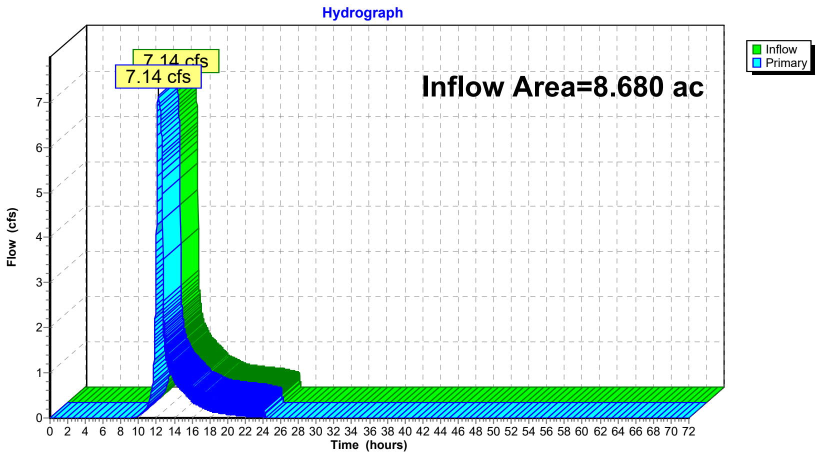


Summary for Link P.O.A.#5: P.O.A. #5

Inflow Area = 8.680 ac, 51.66% Impervious, Inflow Depth = 1.33" for 2-year event
Inflow = 7.14 cfs @ 12.18 hrs, Volume= 0.962 af
Primary = 7.14 cfs @ 12.18 hrs, Volume= 0.962 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A.#5: P.O.A. #5



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Subcatchment 1S Runoff Area=155,713 sf 90.36% Impervious Runoff Depth=3.98"
Tc=6.0 min CN=94 Runoff=15.59 cfs 1.186 af

Subcatchment 2S: Subcatchment 2S Runoff Area=364,553 sf 58.28% Impervious Runoff Depth=2.79"
Tc=6.0 min CN=82 Runoff=27.31 cfs 1.943 af

Subcatchment 3S: Subcatchment 3S Runoff Area=39,042 sf 0.00% Impervious Runoff Depth=0.93"
Flow Length=388' Tc=15.7 min CN=57 Runoff=0.58 cfs 0.070 af

Subcatchment 4S: Subcatchment 4S Runoff Area=49,545 sf 5.36% Impervious Runoff Depth=1.44"
Flow Length=84' Tc=6.0 min CN=65 Runoff=1.80 cfs 0.136 af

Subcatchment 5S: Subcatchment 5S Runoff Area=498,052 sf 3.51% Impervious Runoff Depth=0.66"
Flow Length=597' Tc=8.6 min CN=52 Runoff=5.10 cfs 0.630 af

Subcatchment 6S: Subcatchment 6S Runoff Area=515,662 sf 23.11% Impervious Runoff Depth=1.30"
Flow Length=1,447' Tc=16.7 min CN=63 Runoff=11.89 cfs 1.287 af

Subcatchment 7S: Subcatchment 7S Runoff Area=321,750 sf 52.49% Impervious Runoff Depth=2.61"
Flow Length=835' Tc=14.1 min CN=80 Runoff=17.50 cfs 1.605 af

Subcatchment 8S: Subcatchment 8S Runoff Area=56,372 sf 46.95% Impervious Runoff Depth=2.43"
Flow Length=541' Tc=8.0 min CN=78 Runoff=3.44 cfs 0.262 af

Subcatchment 9S: Subcatchment 9S Runoff Area=734,034 sf 49.98% Impervious Runoff Depth=2.52"
Flow Length=2,216' Tc=9.5 min CN=79 Runoff=44.21 cfs 3.538 af

Subcatchment 10S: Subcatchment 10S Runoff Area=135,441 sf 23.71% Impervious Runoff Depth=1.65"
Flow Length=610' Tc=11.9 min CN=68 Runoff=4.74 cfs 0.427 af

Subcatchment 11S: Subcatchment 11S Runoff Area=324,210 sf 4.17% Impervious Runoff Depth=1.11"
Flow Length=1,206' Tc=7.4 min CN=60 Runoff=8.02 cfs 0.690 af

Subcatchment 12S: Subcatchment 12S Runoff Area=115,319 sf 100.00% Impervious Runoff Depth=4.43"
Tc=6.0 min CN=98 Runoff=12.08 cfs 0.978 af

Subcatchment 13S: Subcatchment 13S Runoff Area=138,712 sf 100.00% Impervious Runoff Depth=4.43"
Tc=6.0 min CN=98 Runoff=14.54 cfs 1.177 af

Subcatchment 14S: Subcatchment 14S Runoff Area=163,047 sf 100.00% Impervious Runoff Depth=4.43"
Tc=6.0 min CN=98 Runoff=17.09 cfs 1.383 af

Pond 1P: Pond 1P Peak Elev=350.59' Storage=9,262 cf Inflow=5.10 cfs 0.630 af
Discarded=0.69 cfs 0.630 af Primary=0.00 cfs 0.000 af Outflow=0.69 cfs 0.630 af

Pond 2P: Pond 2P Peak Elev=371.45' Storage=11,431 cf Inflow=17.50 cfs 1.605 af
Primary=7.52 cfs 1.605 af Secondary=0.00 cfs 0.000 af Outflow=7.52 cfs 1.605 af

Link P.O.A. #1: P.O.A. #1	Inflow=43.14 cfs 3.199 af Primary=43.14 cfs 3.199 af
Link P.O.A. #2: P.O.A. #2	Inflow=68.16 cfs 5.693 af Primary=68.16 cfs 5.693 af
Link P.O.A. #4: P.O.A. #4	Inflow=8.02 cfs 0.690 af Primary=8.02 cfs 0.690 af
Link P.O.A. #6: P.O.A. #6	Inflow=4.74 cfs 0.427 af Primary=4.74 cfs 0.427 af
Link P.O.A.#3: P.O.A. #3	Inflow=25.20 cfs 2.806 af Primary=25.20 cfs 2.806 af
Link P.O.A.#5: P.O.A. #5	Inflow=9.81 cfs 1.867 af Primary=9.81 cfs 1.867 af

Total Runoff Area = 82.908 ac Runoff Volume = 15.313 af Average Runoff Depth = 2.22"
57.98% Pervious = 48.072 ac 42.02% Impervious = 34.835 ac

Summary for Subcatchment 1S: Subcatchment 1S

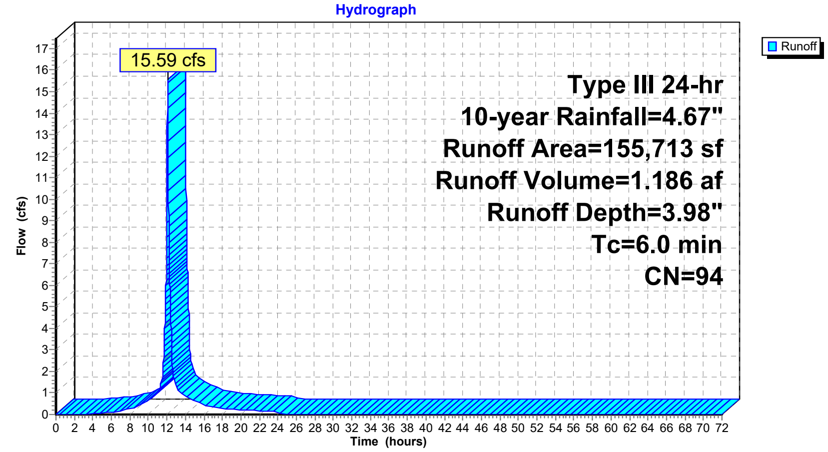
Runoff = 15.59 cfs @ 12.08 hrs, Volume= 1.186 af, Depth= 3.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
*	140,700	98	Impervious
	12,979	61	>75% Grass cover, Good, HSG B
	2,034	48	Brush, Good, HSG B
	155,713	94	Weighted Average
	15,013		9.64% Pervious Area
	140,700		90.36% Impervious Area

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

Subcatchment 1S: Subcatchment 1S



Summary for Subcatchment 2S: Subcatchment 2S

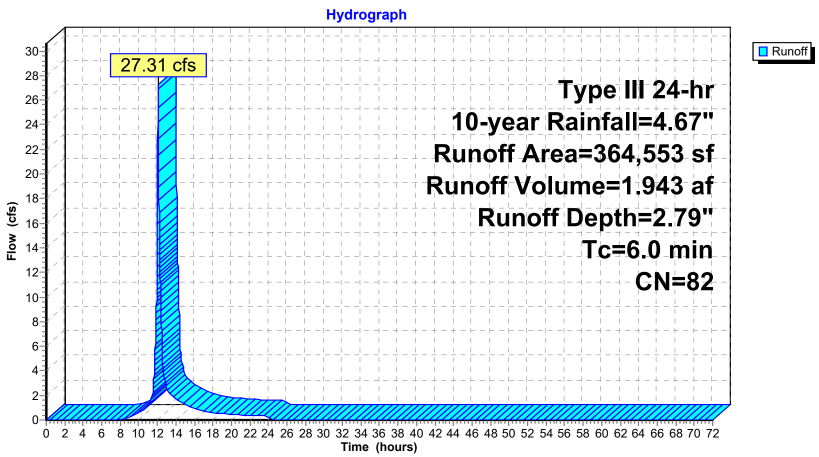
Runoff = 27.31 cfs @ 12.09 hrs, Volume= 1.943 af, Depth= 2.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
*	212,468	98	Impervious
	122,388	61	>75% Grass cover, Good, HSG B
	29,697	55	Woods, Good, HSG B
	364,553	82	Weighted Average
	152,085		41.72% Pervious Area
	212,468		58.28% Impervious Area

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

Subcatchment 2S: Subcatchment 2S



Summary for Subcatchment 3S: Subcatchment 3S

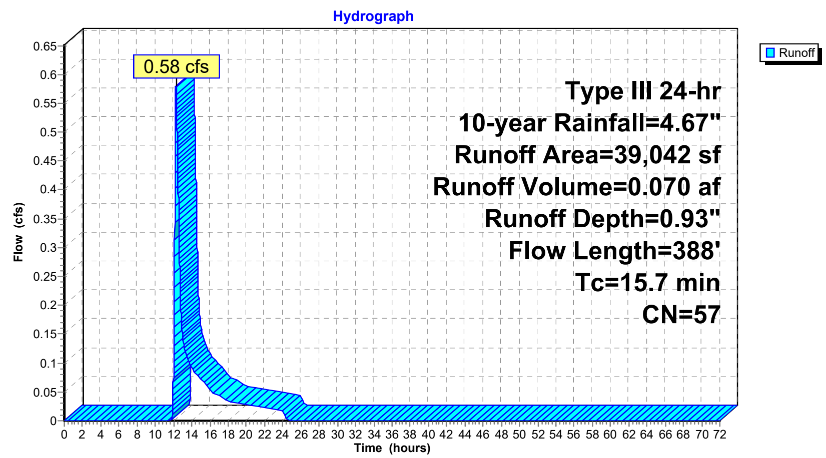
Runoff = 0.58 cfs @ 12.26 hrs, Volume= 0.070 af, Depth= 0.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

Area (sf)	CN	Description
12,659	61	>75% Grass cover, Good, HSG B
26,383	55	Woods, Good, HSG B
39,042	57	Weighted Average
39,042		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	50	0.0100	0.08		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.4	78	0.0390	2.96		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
4.4	260	0.0385	0.98		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
15.7	388	Total			

Subcatchment 3S: Subcatchment 3S



Summary for Subcatchment 4S: Subcatchment 4S

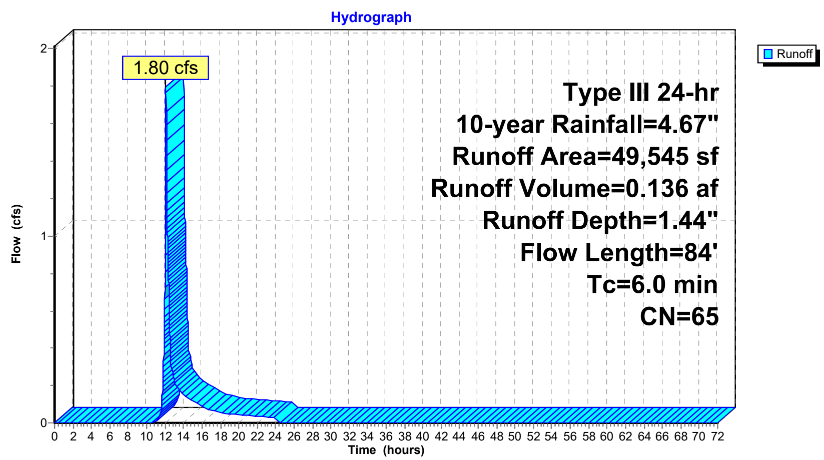
Runoff = 1.80 cfs @ 12.10 hrs, Volume= 0.136 af, Depth= 1.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
*	2,294	96	Gravel
	44,594	61	>75% Grass cover, Good, HSG B
*	1,961	98	Impervious
	696	98	Water Surface, HSG A
	49,545	65	Weighted Average
	46,888		94.64% Pervious Area
	2,657		5.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.1200	0.21		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.1	34	0.3200	8.49		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
1.9					**Direct Entry,**
6.0	84	Total			

Subcatchment 4S: Subcatchment 4S



Summary for Subcatchment 5S: Subcatchment 5S

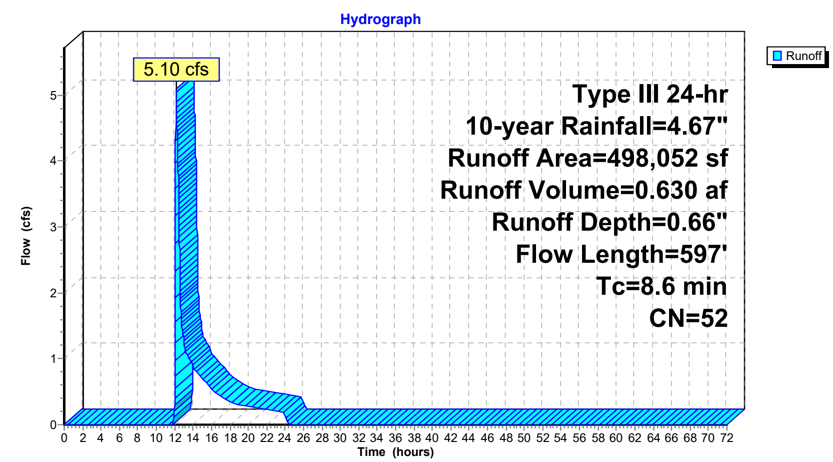
Runoff = 5.10 cfs @ 12.16 hrs, Volume= 0.630 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
*	6,396	98	Impervious
*	11,090	98	Detention Pond
*	9,733	96	Gravel
	65,901	61	>75% Grass cover, Good, HSG B
	404,932	48	Brush, Good, HSG B
	498,052	52	Weighted Average
	480,566		96.49% Pervious Area
	17,486		3.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	50	0.1000	0.19		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.3	44	0.0230	2.27		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
3.9	503	0.0960	2.17		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
8.6	597	Total			

Subcatchment 5S: Subcatchment 5S



Summary for Subcatchment 6S: Subcatchment 6S

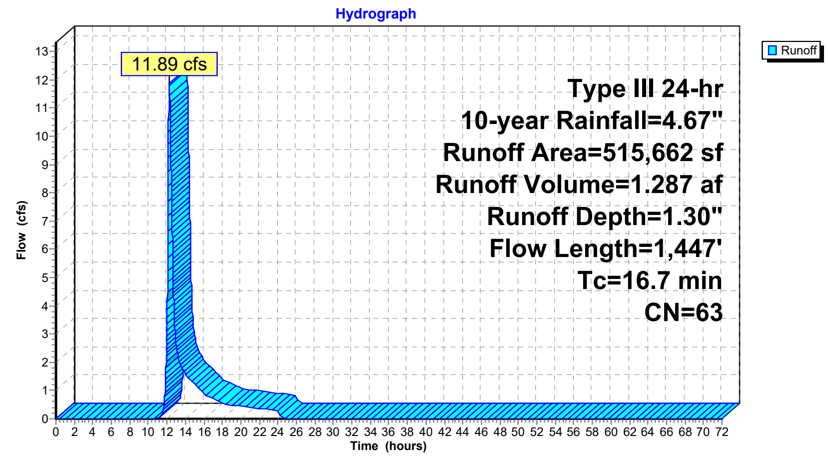
Runoff = 11.89 cfs @ 12.26 hrs, Volume= 1.287 af, Depth= 1.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
*	119,180	98	Impervious
*	8,092	96	Gravel
	112,490	61	>75% Grass cover, Good, HSG B
	275,900	48	Brush, Good, HSG B
	515,662	63	Weighted Average
	396,482		76.89% Pervious Area
	119,180		23.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.3	90	0.1110	5.00		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
8.3	540	0.0240	1.08		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
1.3	119	0.0084	1.48		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
0.5	648	0.0430	20.48	100.52	**Pipe Channel, E-F** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.011 Concrete pipe, straight & clean
16.7	1,447	Total			

Subcatchment 6S: Subcatchment 6S



Summary for Subcatchment 7S: Subcatchment 7S

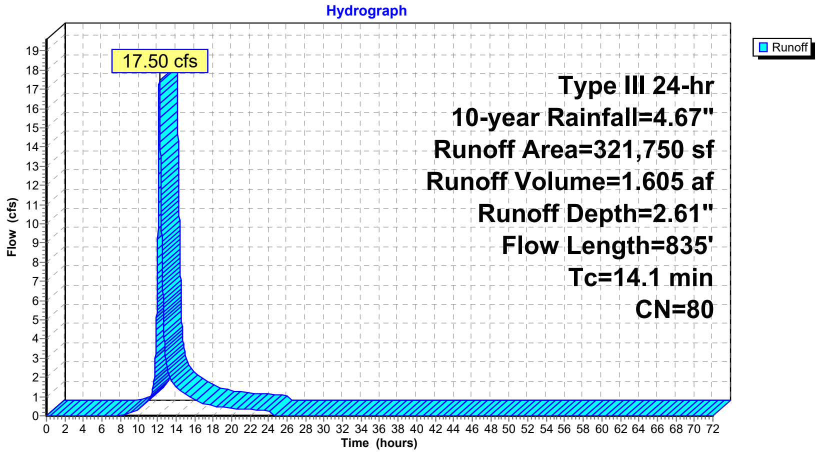
Runoff = 17.50 cfs @ 12.20 hrs, Volume= 1.605 af, Depth= 2.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
*	168,873	98	Impervious
	132,418	61	>75% Grass cover, Good, HSG B
	20,459	55	Woods, Good, HSG B
	321,750	80	Weighted Average
	152,877		47.51% Pervious Area
	168,873		52.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	50	0.0100	0.08		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.7	116	0.0300	2.60		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
2.2	475	0.0316	3.61		**Shallow Concentrated Flow, C-D** Paved Kv= 20.3 fps
0.3	194	0.0515	12.17	9.56	**Pipe Channel, D-E** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
14.1	835	Total			

Subcatchment 7S: Subcatchment 7S



Summary for Subcatchment 8S: Subcatchment 8S

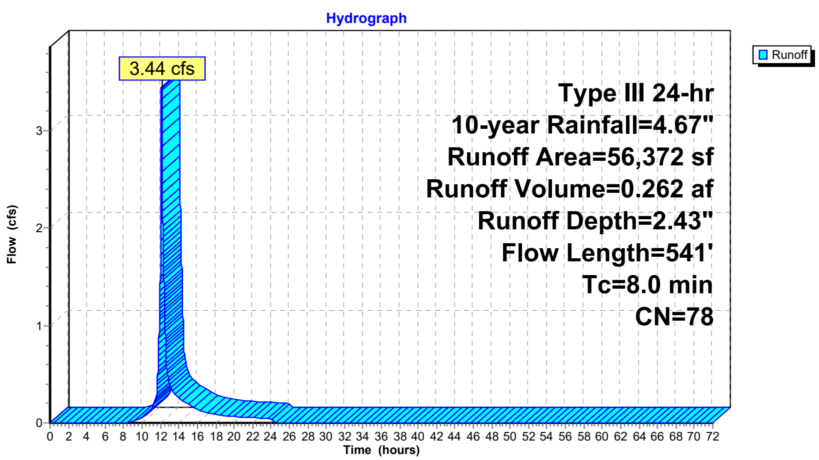
Runoff = 3.44 cfs @ 12.12 hrs, Volume= 0.262 af, Depth= 2.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
*	26,468	98	Impervious
	29,195	61	>75% Grass cover, Good, HSG B
	709	55	Woods, Good, HSG B
	56,372	78	Weighted Average
	29,904		53.05% Pervious Area
	26,468		46.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0300	0.12		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.4	108	0.0395	4.03		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
0.6	383	0.0370	10.31	8.10	**Pipe Channel, C-D** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
8.0	541	Total			

Subcatchment 8S: Subcatchment 8S



Summary for Subcatchment 9S: Subcatchment 9S

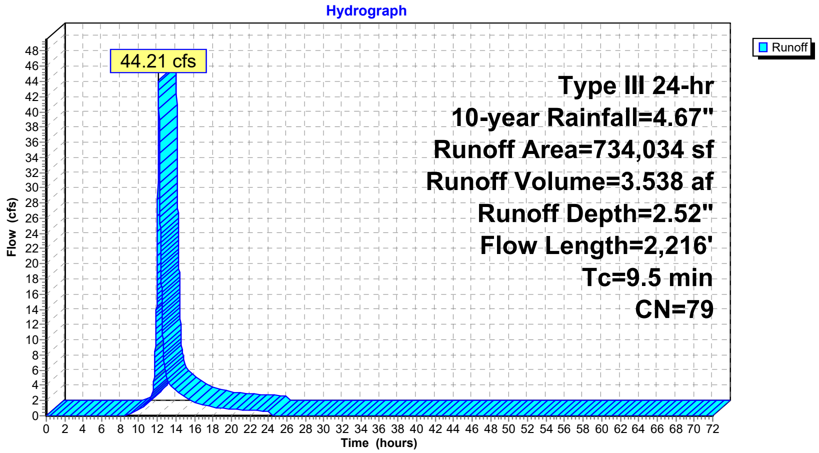
Runoff = 44.21 cfs @ 12.13 hrs, Volume= 3.538 af, Depth= 2.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
*	366,867	98	Impervious
	320,040	61	>75% Grass cover, Good, HSG B
	11,163	55	Woods, Good, HSG B
*	35,773	48	Brush
*	191	96	Gravel
	734,034	79	Weighted Average
	367,167		50.02% Pervious Area
	366,867		49.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.6	94	0.0319	2.68		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
2.6	2,072	0.0250	13.46	42.27	**Pipe Channel, C-D** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
9.5	2,216	Total			

Subcatchment 9S: Subcatchment 9S



Summary for Subcatchment 10S: Subcatchment 10S

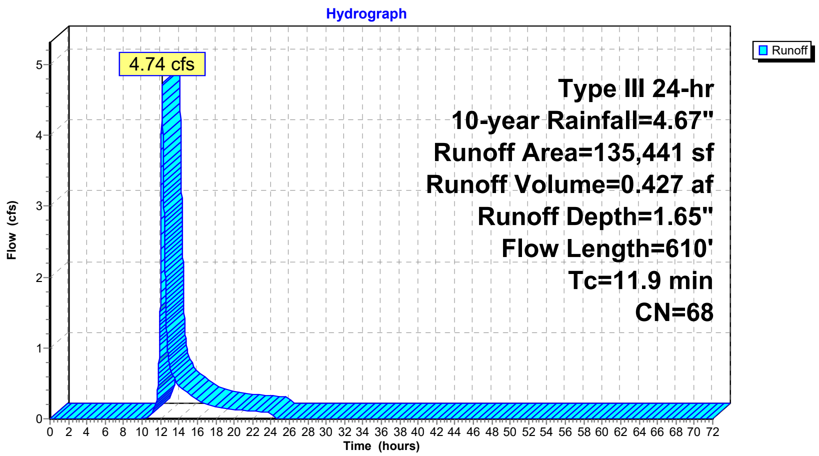
Runoff = 4.74 cfs @ 12.18 hrs, Volume= 0.427 af, Depth= 1.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
*	32,115	98	Impervious
	61,706	61	>75% Grass cover, Good, HSG B
	41,620	55	Woods, Good, HSG B
	135,441	68	Weighted Average
	103,326		76.29% Pervious Area
	32,115		23.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0800	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.13"
3.9	351	0.0910	1.51		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.1	24	0.1250	5.30		**Shallow Concentrated Flow, C-D** Grassed Waterway Kv= 15.0 fps
0.0	20	0.0500	11.99	9.42	**Pipe Channel, D-E** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.6	105	0.0200	2.89	4.82	**Parabolic Channel, E-F** W=10.00' D=0.25' Area=1.7 sf Perim=10.0' n= 0.022 Earth, clean & straight
0.1	60	0.0233	8.18	6.43	**Pipe Channel, F-G** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
11.9	610	Total			

Subcatchment 10S: Subcatchment 10S



Summary for Subcatchment 11S: Subcatchment 11S

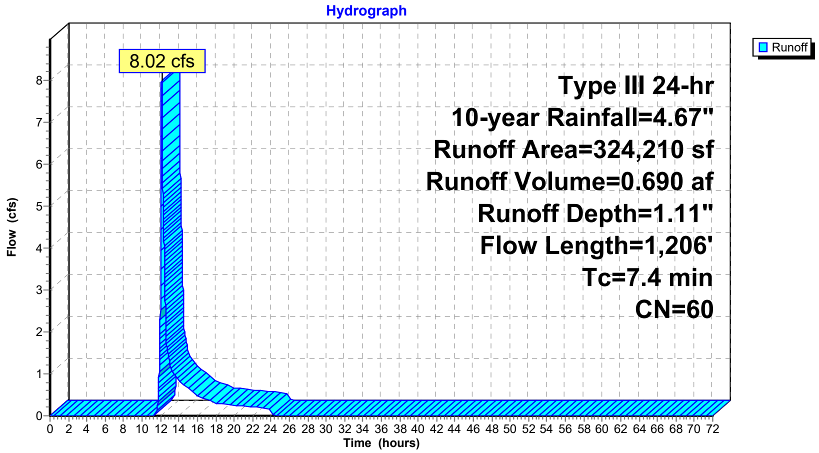
Runoff = 8.02 cfs @ 12.12 hrs, Volume= 0.690 af, Depth= 1.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
*	5,303	96	Gravel
	117,793	61	>75% Grass cover, Good, HSG B
*	6,302	98	Impervious
	7,233	98	Water Surface, HSG A
	187,579	55	Woods, Good, HSG B
	324,210	60	Weighted Average
	310,675		95.83% Pervious Area
	13,535		4.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	50	0.1200	2.43		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.13"
0.7	216	0.0694	5.35		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
3.1	537	0.0370	2.89		**Shallow Concentrated Flow, C-D** Grassed Waterway Kv= 15.0 fps
3.3	403	0.1700	2.06		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
7.4	1,206	Total			

Subcatchment 11S: Subcatchment 11S



Summary for Subcatchment 12S: Subcatchment 12S

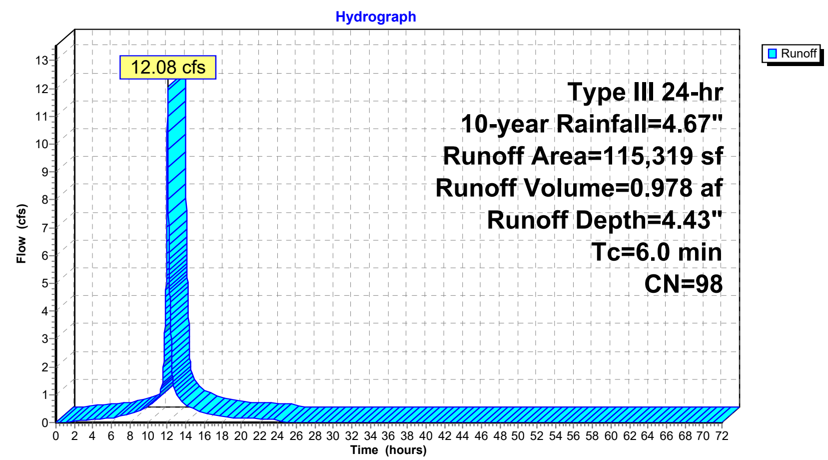
Runoff = 12.08 cfs @ 12.08 hrs, Volume= 0.978 af, Depth= 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
*	115,319	98	Impervious
	115,319		100.00% Impervious Area

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

Subcatchment 12S: Subcatchment 12S



Summary for Subcatchment 13S: Subcatchment 13S

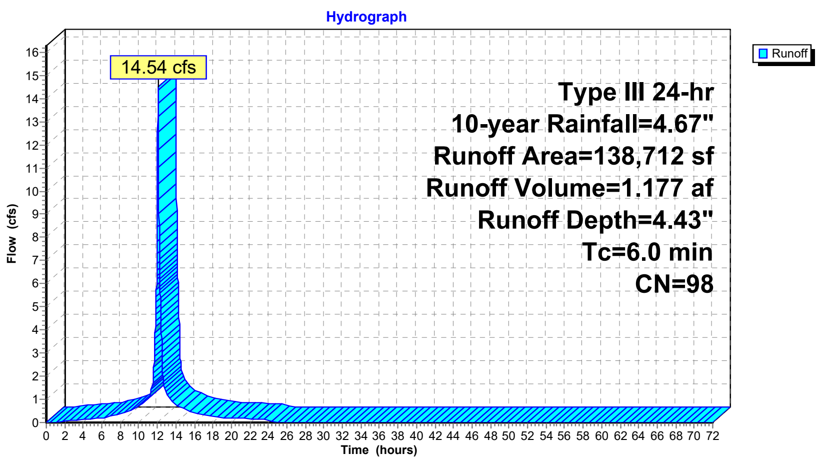
Runoff = 14.54 cfs @ 12.08 hrs, Volume= 1.177 af, Depth= 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
*	138,712	98	Impervious
	138,712		100.00% Impervious Area

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

Subcatchment 13S: Subcatchment 13S



Summary for Subcatchment 14S: Subcatchment 14S

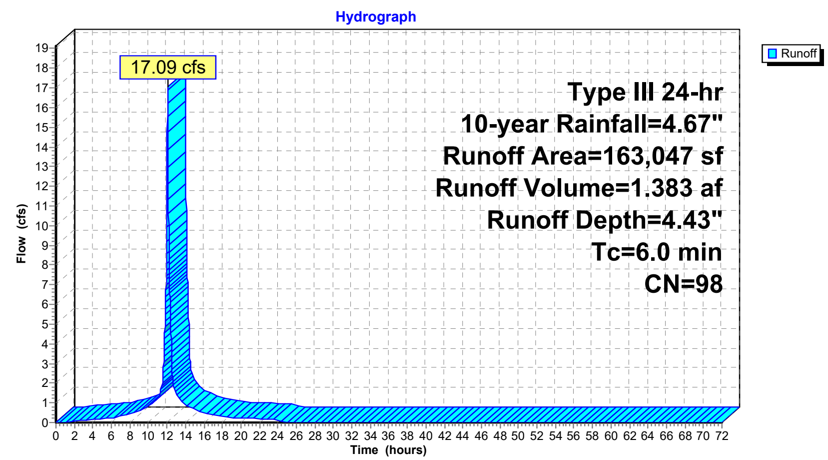
Runoff = 17.09 cfs @ 12.08 hrs, Volume= 1.383 af, Depth= 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
*	163,047	98	Impervious
	163,047		100.00% Impervious Area

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

Subcatchment 14S: Subcatchment 14S



Summary for Pond 1P: Pond 1P

Inflow Area = 11.434 ac, 3.51% Impervious, Inflow Depth = 0.66" for 10-year event
Inflow = 5.10 cfs @ 12.16 hrs, Volume= 0.630 af
Outflow = 0.69 cfs @ 15.13 hrs, Volume= 0.630 af, Atten= 86%, Lag= 178.1 min
Discarded = 0.69 cfs @ 15.13 hrs, Volume= 0.630 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 350.59' @ 15.13 hrs Surf.Area= 12,360 sf Storage= 9,262 cf

Plug-Flow detention time= 149.4 min calculated for 0.630 af (100% of inflow)
Center-of-Mass det. time= 149.4 min (1,065.2 - 915.8)

Volume	Invert	Avail.Storage	Storage Description
#1	349.70'	67,191 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

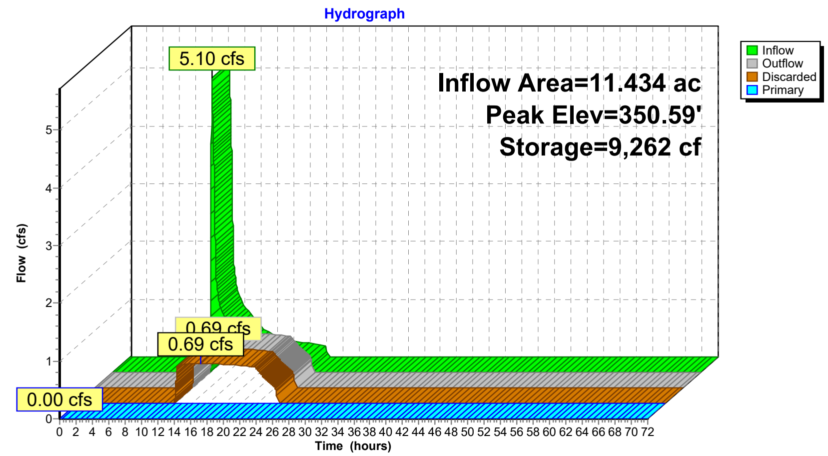
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
349.70	3,651	0	0
350.00	11,353	2,251	2,251
351.00	13,056	12,205	14,455
352.00	15,614	14,335	28,790
353.00	18,669	17,142	45,932
354.00	23,850	21,260	67,191

Device	Routing	Invert	Outlet Devices
#1	Primary	345.50'	**24.0" Round Culvert** L= 131.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 345.50' / 343.40' S= 0.0160 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf
#2	Device 1	350.60'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	352.47'	**2.5" x 2.5" Horiz. Orifice/Grate X 36.00** C= 0.600 in 24.0" x 24.0" Grate (39% open area) Limited to weir flow at low heads
#4	Discarded	349.70'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.69 cfs @ 15.13 hrs HW=350.59' (Free Discharge)
└─**4=Exfiltration** (Exfiltration Controls 0.69 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=349.70' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.00 cfs of 34.71 cfs potential flow)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: Pond 1P



Summary for Pond 2P: Pond 2P

Inflow Area = 7.386 ac, 52.49% Impervious, Inflow Depth = 2.61" for 10-year event
Inflow = 17.50 cfs @ 12.20 hrs, Volume= 1.605 af
Outflow = 7.52 cfs @ 12.54 hrs, Volume= 1.605 af, Atten= 57%, Lag= 20.4 min
Primary = 7.52 cfs @ 12.54 hrs, Volume= 1.605 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 371.45' @ 12.54 hrs Surf.Area= 10,431 sf Storage= 11,431 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 8.0 min (840.3 - 832.3)

Volume	Invert	Avail.Storage	Storage Description
#1	368.00'	53,283 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

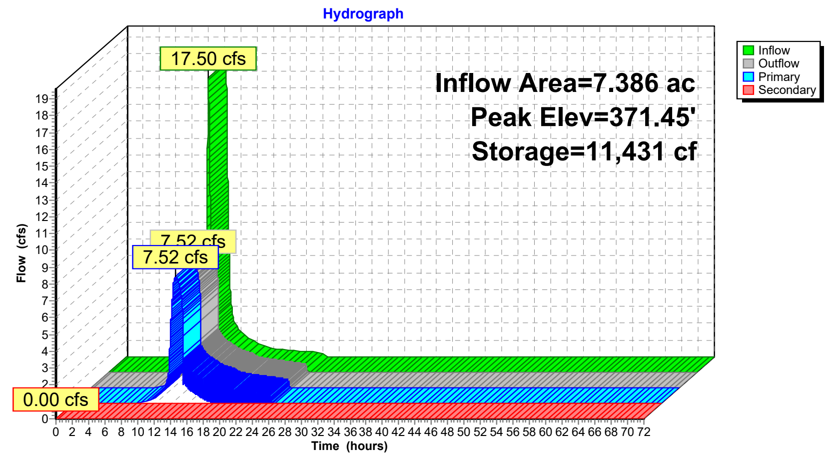
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
368.00	47	65.0	0	0	47
369.00	236	74.0	129	129	168
370.00	3,056	310.0	1,380	1,510	7,383
371.00	8,615	394.0	5,601	7,111	12,102
372.00	12,842	440.0	10,658	17,769	15,183
373.00	18,271	569.0	15,477	33,246	25,553
374.00	21,857	579.0	20,037	53,283	26,632

Device	Routing	Invert	Outlet Devices
#1	Primary	367.00'	**12.0" Round Culvert** L= 134.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 367.00' / 360.80' S= 0.0463 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Secondary	373.00'	**13.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=7.52 cfs @ 12.54 hrs HW=371.45' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 7.52 cfs @ 9.57 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=368.00' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: Pond 2P

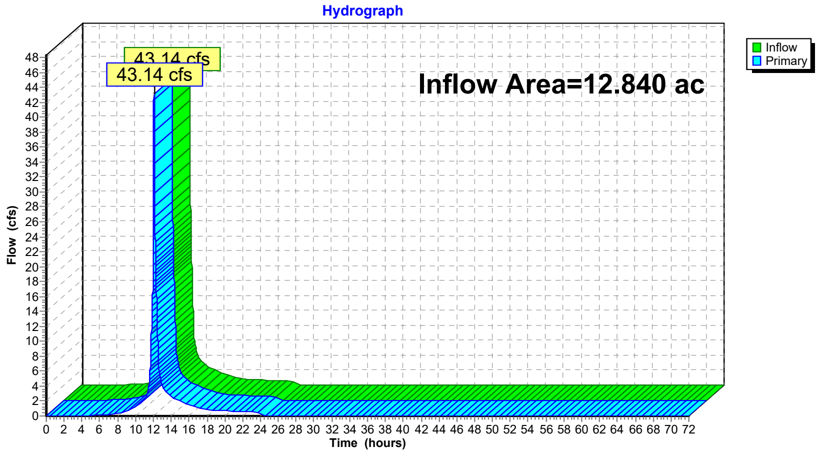


Summary for Link P.O.A. #1: P.O.A. #1

Inflow Area = 12.840 ac, 63.14% Impervious, Inflow Depth = 2.99" for 10-year event
Inflow = 43.14 cfs @ 12.09 hrs, Volume= 3.199 af
Primary = 43.14 cfs @ 12.09 hrs, Volume= 3.199 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #1: P.O.A. #1

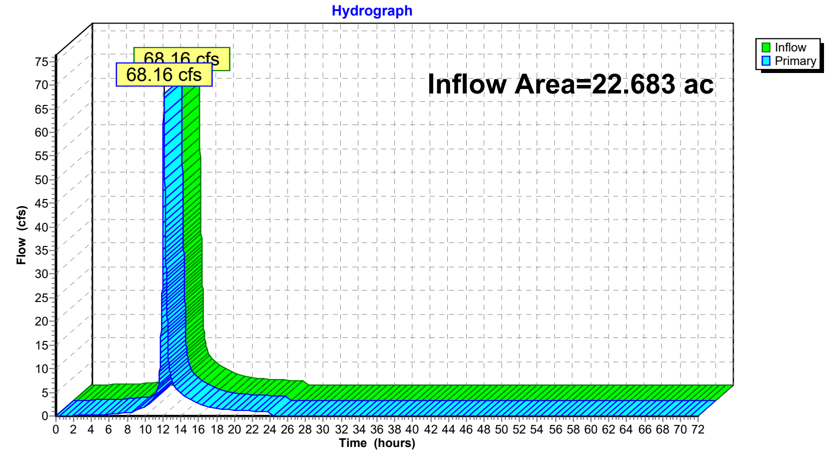


Summary for Link P.O.A. #2: P.O.A. #2

Inflow Area = 22.683 ac, 62.84% Impervious, Inflow Depth = 3.01" for 10-year event
Inflow = 68.16 cfs @ 12.11 hrs, Volume= 5.693 af
Primary = 68.16 cfs @ 12.11 hrs, Volume= 5.693 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #2: P.O.A. #2

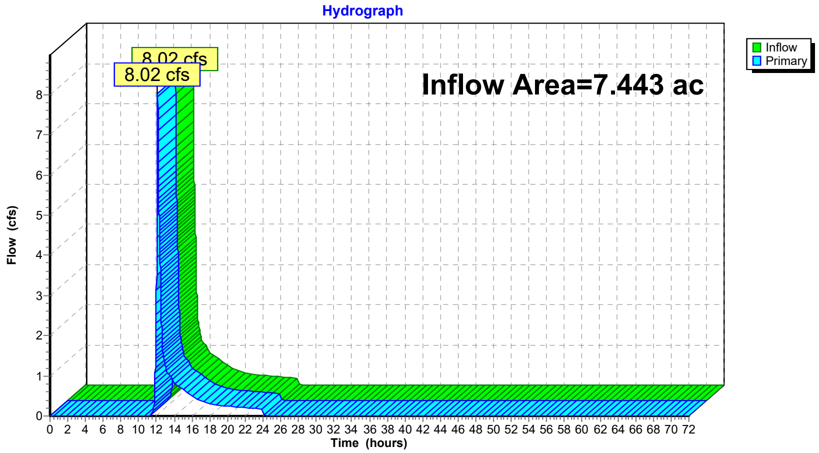


Summary for Link P.O.A. #4: P.O.A. #4

Inflow Area = 7.443 ac, 4.17% Impervious, Inflow Depth = 1.11" for 10-year event
Inflow = 8.02 cfs @ 12.12 hrs, Volume= 0.690 af
Primary = 8.02 cfs @ 12.12 hrs, Volume= 0.690 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #4: P.O.A. #4

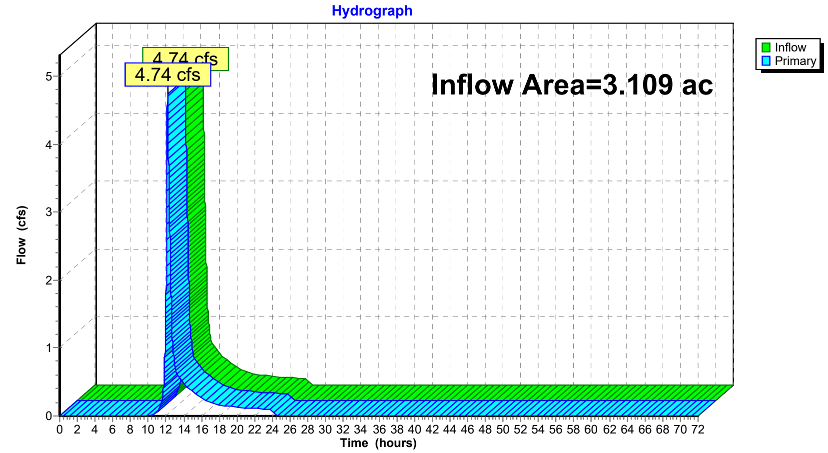


Summary for Link P.O.A. #6: P.O.A. #6

Inflow Area = 3.109 ac, 23.71% Impervious, Inflow Depth = 1.65" for 10-year event
Inflow = 4.74 cfs @ 12.18 hrs, Volume= 0.427 af
Primary = 4.74 cfs @ 12.18 hrs, Volume= 0.427 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #6: P.O.A. #6

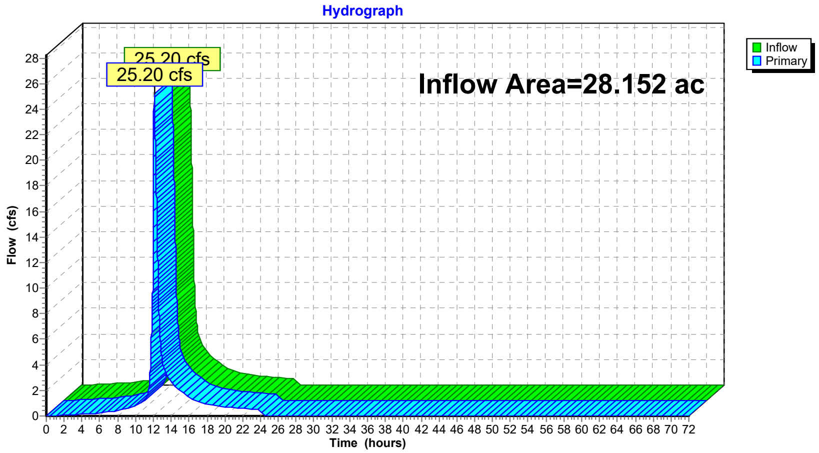


Summary for Link P.O.A.#3: P.O.A. #3

Inflow Area = 28.152 ac, 24.66% Impervious, Inflow Depth = 1.20" for 10-year event
Inflow = 25.20 cfs @ 12.10 hrs, Volume= 2.806 af
Primary = 25.20 cfs @ 12.10 hrs, Volume= 2.806 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A.#3: P.O.A. #3

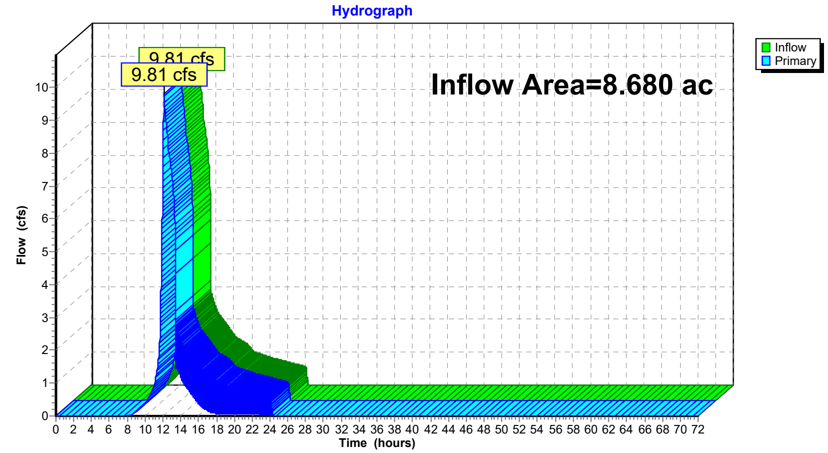


Summary for Link P.O.A.#5: P.O.A. #5

Inflow Area = 8.680 ac, 51.66% Impervious, Inflow Depth = 2.58" for 10-year event
Inflow = 9.81 cfs @ 12.14 hrs, Volume= 1.867 af
Primary = 9.81 cfs @ 12.14 hrs, Volume= 1.867 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A.#5: P.O.A. #5



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Subcatchment 1S Runoff Area=155,713 sf 90.36% Impervious Runoff Depth=7.60"
Tc=6.0 min CN=94 Runoff=28.71 cfs 2.264 af

Subcatchment 2S: Subcatchment 2S Runoff Area=364,553 sf 58.28% Impervious Runoff Depth=6.16"
Tc=6.0 min CN=82 Runoff=58.97 cfs 4.299 af

Subcatchment 3S: Subcatchment 3S Runoff Area=39,042 sf 0.00% Impervious Runoff Depth=3.23"
Flow Length=388' Tc=15.7 min CN=57 Runoff=2.45 cfs 0.241 af

Subcatchment 4S: Subcatchment 4S Runoff Area=49,545 sf 5.36% Impervious Runoff Depth=4.15"
Flow Length=84' Tc=6.0 min CN=65 Runoff=5.53 cfs 0.394 af

Subcatchment 5S: Subcatchment 5S Runoff Area=498,052 sf 3.51% Impervious Runoff Depth=2.67"
Flow Length=597' Tc=8.6 min CN=52 Runoff=30.82 cfs 2.543 af

Subcatchment 6S: Subcatchment 6S Runoff Area=515,662 sf 23.11% Impervious Runoff Depth=3.92"
Flow Length=1,447' Tc=16.7 min CN=63 Runoff=39.24 cfs 3.869 af

Subcatchment 7S: Subcatchment 7S Runoff Area=321,750 sf 52.49% Impervious Runoff Depth=5.93"
Flow Length=835' Tc=14.1 min CN=80 Runoff=39.18 cfs 3.647 af

Subcatchment 8S: Subcatchment 8S Runoff Area=56,372 sf 46.95% Impervious Runoff Depth=5.69"
Flow Length=541' Tc=8.0 min CN=78 Runoff=7.96 cfs 0.613 af

Subcatchment 9S: Subcatchment 9S Runoff Area=734,034 sf 49.98% Impervious Runoff Depth=5.81"
Flow Length=2,216' Tc=9.5 min CN=79 Runoff=100.56 cfs 8.154 af

Subcatchment 10S: Subcatchment 10S Runoff Area=135,441 sf 23.71% Impervious Runoff Depth=4.51"
Flow Length=610' Tc=11.9 min CN=68 Runoff=13.52 cfs 1.167 af

Subcatchment 11S: Subcatchment 11S Runoff Area=324,210 sf 4.17% Impervious Runoff Depth=3.58"
Flow Length=1,206' Tc=7.4 min CN=60 Runoff=29.34 cfs 2.217 af

Subcatchment 12S: Subcatchment 12S Runoff Area=115,319 sf 100.00% Impervious Runoff Depth=8.08"
Tc=6.0 min CN=98 Runoff=21.63 cfs 1.783 af

Subcatchment 13S: Subcatchment 13S Runoff Area=138,712 sf 100.00% Impervious Runoff Depth=8.08"
Tc=6.0 min CN=98 Runoff=26.02 cfs 2.144 af

Subcatchment 14S: Subcatchment 14S Runoff Area=163,047 sf 100.00% Impervious Runoff Depth=8.08"
Tc=6.0 min CN=98 Runoff=30.58 cfs 2.520 af

Pond 1P: Pond 1P Peak Elev=352.77' Storage=41,773 cf Inflow=30.82 cfs 2.543 af
Discarded=1.00 cfs 1.209 af Primary=5.45 cfs 1.334 af Outflow=6.46 cfs 2.543 af

Pond 2P: Pond 2P Peak Elev=373.35' Storage=39,775 cf Inflow=39.18 cfs 3.647 af
Primary=9.14 cfs 3.440 af Secondary=7.13 cfs 0.207 af Outflow=16.27 cfs 3.647 af

Link P.O.A. #1: P.O.A. #1 Inflow=89.14 cfs 6.804 af
Primary=89.14 cfs 6.804 af

Link P.O.A. #2: P.O.A. #2 Inflow=143.64 cfs 12.081 af
Primary=143.64 cfs 12.081 af

Link P.O.A. #4: P.O.A. #4 Inflow=29.34 cfs 2.217 af
Primary=29.34 cfs 2.217 af

Link P.O.A. #6: P.O.A. #6 Inflow=13.52 cfs 1.167 af
Primary=13.52 cfs 1.167 af

Link P.O.A.#3: P.O.A. #3 Inflow=62.28 cfs 8.117 af
Primary=62.28 cfs 8.117 af

Link P.O.A.#5: P.O.A. #5 Inflow=18.31 cfs 4.261 af
Primary=18.31 cfs 4.261 af

Total Runoff Area = 82.908 ac Runoff Volume = 35.856 af Average Runoff Depth = 5.19"
57.98% Pervious = 48.072 ac 42.02% Impervious = 34.835 ac

Summary for Subcatchment 1S: Subcatchment 1S

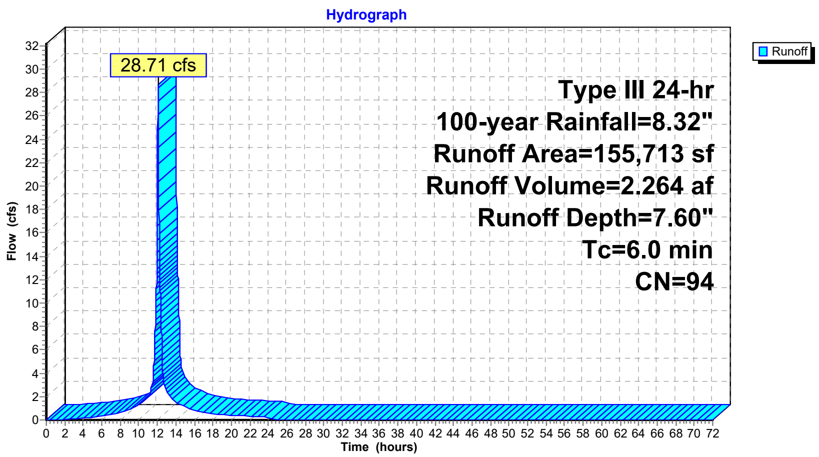
Runoff = 28.71 cfs @ 12.08 hrs, Volume= 2.264 af, Depth= 7.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
*	140,700	98	Impervious
	12,979	61	>75% Grass cover, Good, HSG B
	2,034	48	Brush, Good, HSG B
	155,713	94	Weighted Average
	15,013		9.64% Pervious Area
	140,700		90.36% Impervious Area

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

Subcatchment 1S: Subcatchment 1S



Summary for Subcatchment 2S: Subcatchment 2S

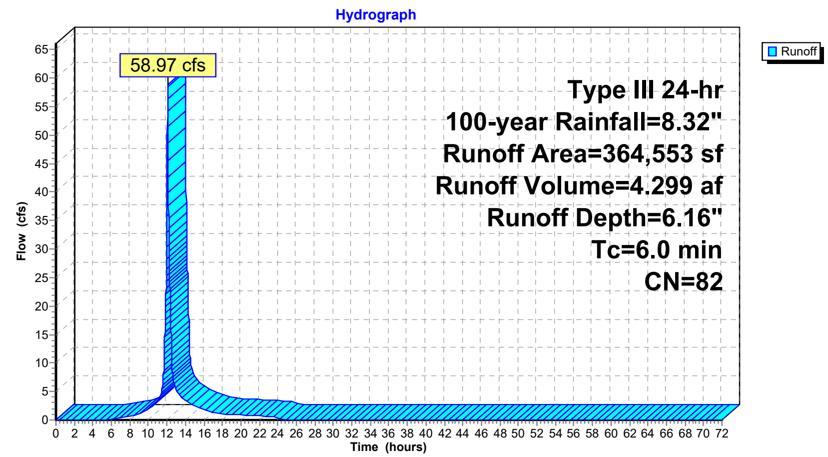
Runoff = 58.97 cfs @ 12.09 hrs, Volume= 4.299 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
*	212,468	98	Impervious
	122,388	61	>75% Grass cover, Good, HSG B
	29,697	55	Woods, Good, HSG B
	364,553	82	Weighted Average
	152,085		41.72% Pervious Area
	212,468		58.28% Impervious Area

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

Subcatchment 2S: Subcatchment 2S



Summary for Subcatchment 3S: Subcatchment 3S

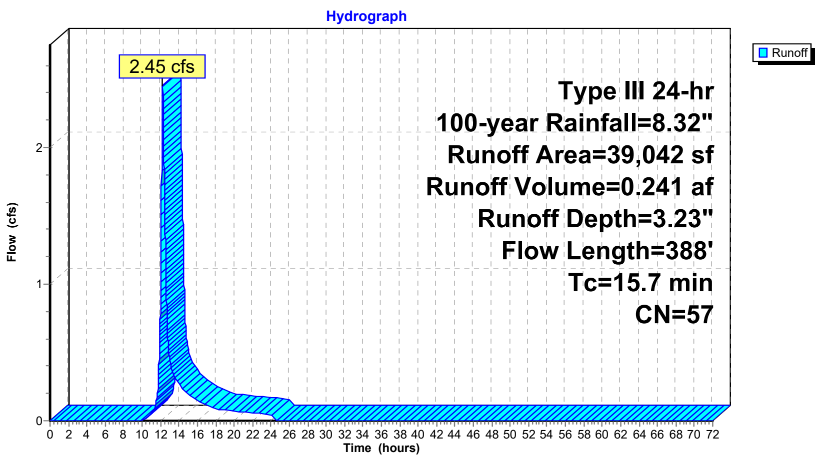
Runoff = 2.45 cfs @ 12.23 hrs, Volume= 0.241 af, Depth= 3.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

Area (sf)	CN	Description
12,659	61	>75% Grass cover, Good, HSG B
26,383	55	Woods, Good, HSG B
39,042	57	Weighted Average
39,042		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	50	0.0100	0.08		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.4	78	0.0390	2.96		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
4.4	260	0.0385	0.98		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
15.7	388	Total			

Subcatchment 3S: Subcatchment 3S



Summary for Subcatchment 4S: Subcatchment 4S

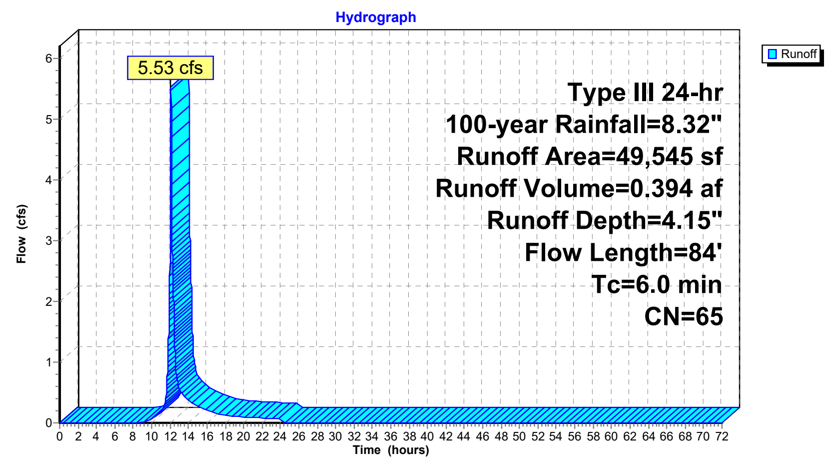
Runoff = 5.53 cfs @ 12.09 hrs, Volume= 0.394 af, Depth= 4.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
*	2,294	96	Gravel
	44,594	61	>75% Grass cover, Good, HSG B
*	1,961	98	Impervious
	696	98	Water Surface, HSG A
	49,545	65	Weighted Average
	46,888		94.64% Pervious Area
	2,657		5.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.1200	0.21		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.1	34	0.3200	8.49		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
1.9					**Direct Entry,**
6.0	84	Total			

Subcatchment 4S: Subcatchment 4S



Summary for Subcatchment 5S: Subcatchment 5S

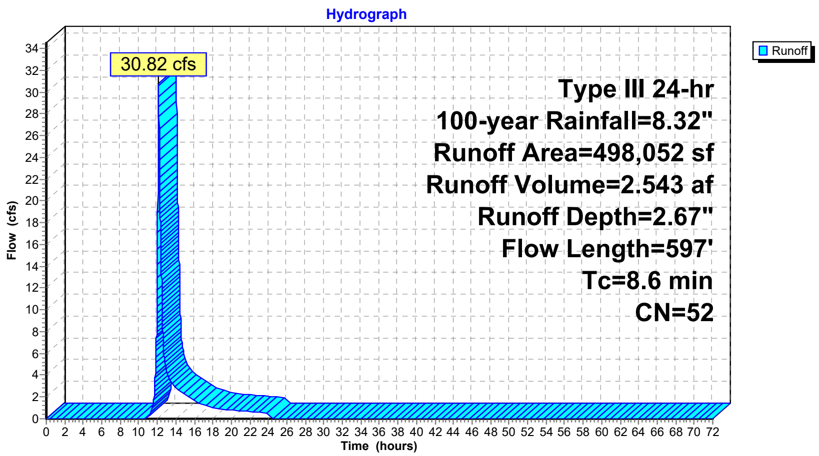
Runoff = 30.82 cfs @ 12.13 hrs, Volume= 2.543 af, Depth= 2.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
*	6,396	98	Impervious
*	11,090	98	Detention Pond
*	9,733	96	Gravel
	65,901	61	>75% Grass cover, Good, HSG B
	404,932	48	Brush, Good, HSG B
	498,052	52	Weighted Average
	480,566		96.49% Pervious Area
	17,486		3.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	50	0.1000	0.19		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.3	44	0.0230	2.27		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
3.9	503	0.0960	2.17		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
8.6	597	Total			

Subcatchment 5S: Subcatchment 5S



Summary for Subcatchment 6S: Subcatchment 6S

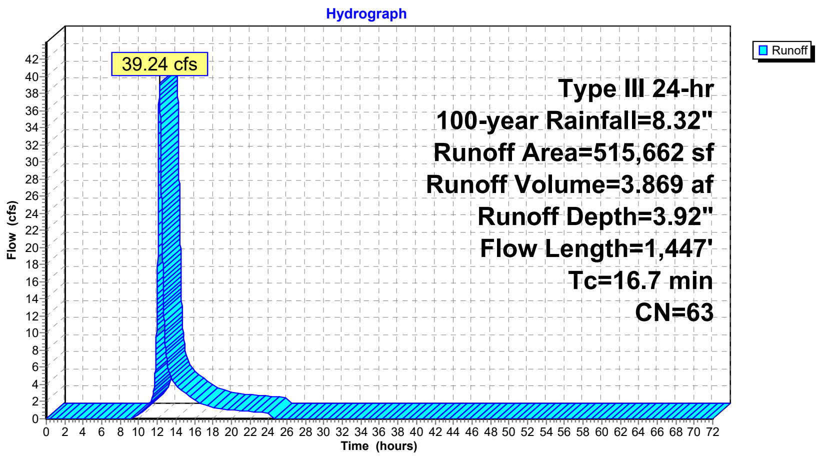
Runoff = 39.24 cfs @ 12.23 hrs, Volume= 3.869 af, Depth= 3.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
*	119,180	98	Impervious
*	8,092	96	Gravel
	112,490	61	>75% Grass cover, Good, HSG B
	275,900	48	Brush, Good, HSG B
	515,662	63	Weighted Average
	396,482		76.89% Pervious Area
	119,180		23.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.3	90	0.1110	5.00		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
8.3	540	0.0240	1.08		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
1.3	119	0.0084	1.48		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
0.5	648	0.0430	20.48	100.52	**Pipe Channel, E-F** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.011 Concrete pipe, straight & clean
16.7	1,447	Total			

Subcatchment 6S: Subcatchment 6S



Summary for Subcatchment 7S: Subcatchment 7S

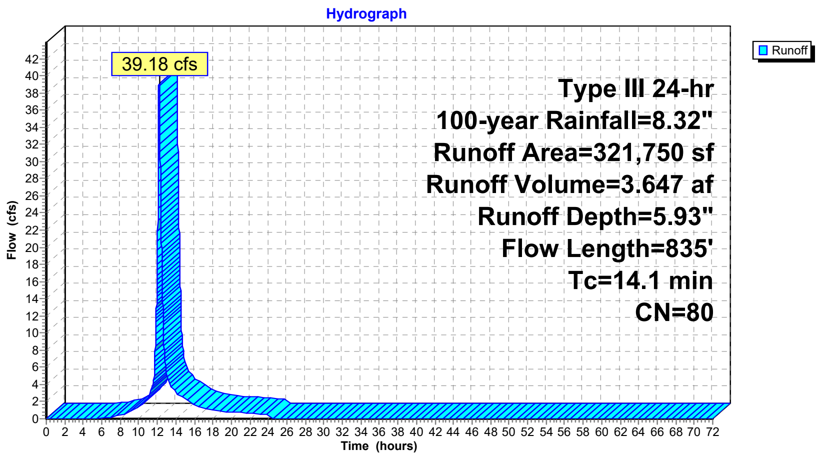
Runoff = 39.18 cfs @ 12.19 hrs, Volume= 3.647 af, Depth= 5.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
*	168,873	98	Impervious
	132,418	61	>75% Grass cover, Good, HSG B
	20,459	55	Woods, Good, HSG B
	321,750	80	Weighted Average
	152,877		47.51% Pervious Area
	168,873		52.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	50	0.0100	0.08		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.7	116	0.0300	2.60		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
2.2	475	0.0316	3.61		**Shallow Concentrated Flow, C-D** Paved Kv= 20.3 fps
0.3	194	0.0515	12.17	9.56	**Pipe Channel, D-E** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
14.1	835	Total			

Subcatchment 7S: Subcatchment 7S



Summary for Subcatchment 8S: Subcatchment 8S

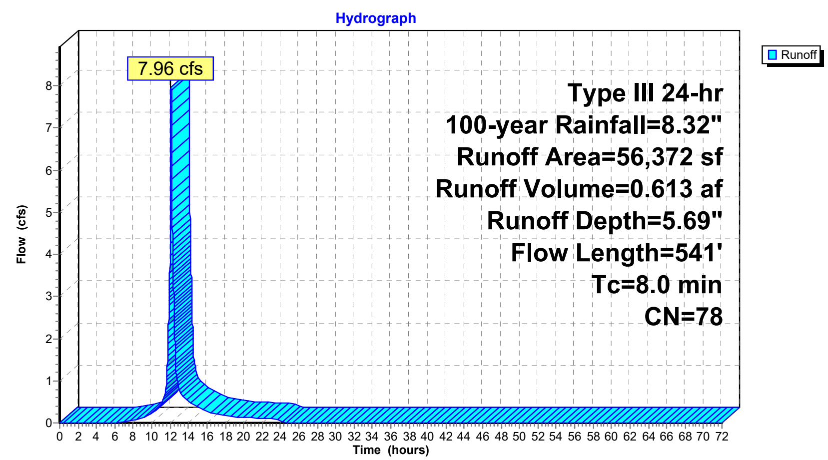
Runoff = 7.96 cfs @ 12.11 hrs, Volume= 0.613 af, Depth= 5.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
*	26,468	98	Impervious
	29,195	61	>75% Grass cover, Good, HSG B
	709	55	Woods, Good, HSG B
	56,372	78	Weighted Average
	29,904		53.05% Pervious Area
	26,468		46.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0300	0.12		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.4	108	0.0395	4.03		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
0.6	383	0.0370	10.31	8.10	**Pipe Channel, C-D** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
8.0	541	Total			

Subcatchment 8S: Subcatchment 8S



Summary for Subcatchment 9S: Subcatchment 9S

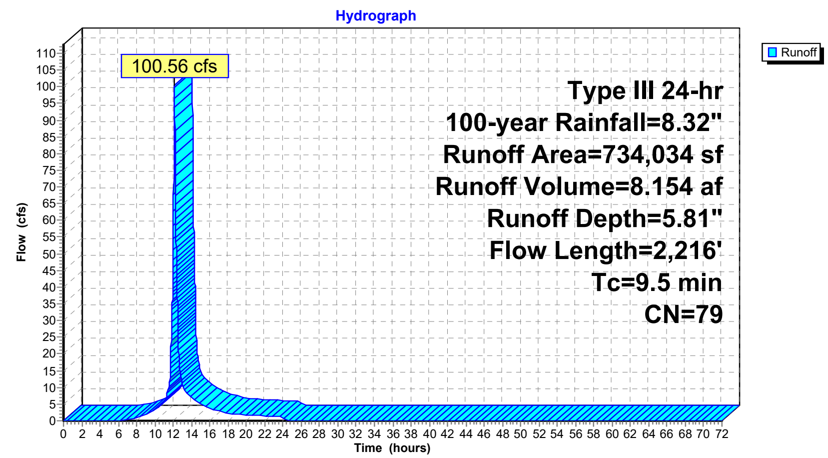
Runoff = 100.56 cfs @ 12.13 hrs, Volume= 8.154 af, Depth= 5.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
*	366,867	98	Impervious
	320,040	61	>75% Grass cover, Good, HSG B
	11,163	55	Woods, Good, HSG B
*	35,773	48	Brush
*	191	96	Gravel
	734,034	79	Weighted Average
	367,167		50.02% Pervious Area
	366,867		49.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.6	94	0.0319	2.68		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
2.6	2,072	0.0250	13.46	42.27	**Pipe Channel, C-D** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
9.5	2,216	Total			

Subcatchment 9S: Subcatchment 9S



Summary for Subcatchment 10S: Subcatchment 10S

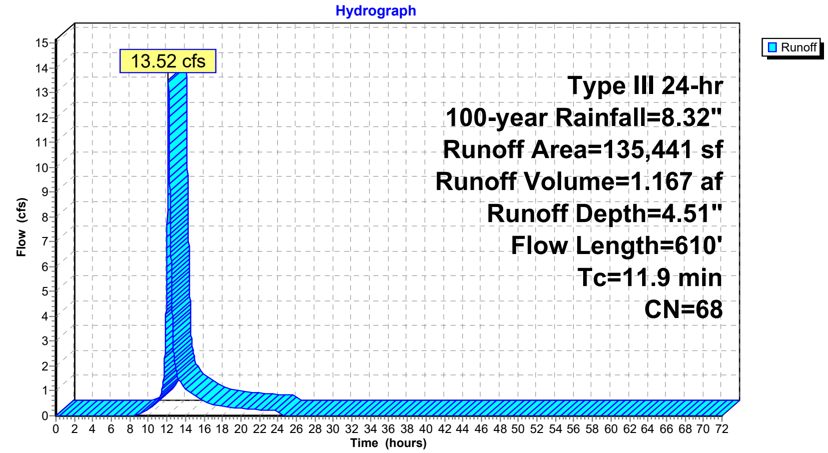
Runoff = 13.52 cfs @ 12.17 hrs, Volume= 1.167 af, Depth= 4.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
*	32,115	98	Impervious
	61,706	61	>75% Grass cover, Good, HSG B
	41,620	55	Woods, Good, HSG B
	135,441	68	Weighted Average
	103,326		76.29% Pervious Area
	32,115		23.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0800	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.13"
3.9	351	0.0910	1.51		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.1	24	0.1250	5.30		**Shallow Concentrated Flow, C-D** Grassed Waterway Kv= 15.0 fps
0.0	20	0.0500	11.99	9.42	**Pipe Channel, D-E** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
0.6	105	0.0200	2.89	4.82	**Parabolic Channel, E-F** W=10.00' D=0.25' Area=1.7 sf Perim=10.0' n= 0.022 Earth, clean & straight
0.1	60	0.0233	8.18	6.43	**Pipe Channel, F-G** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
11.9	610	Total			

Subcatchment 10S: Subcatchment 10S



Summary for Subcatchment 11S: Subcatchment 11S

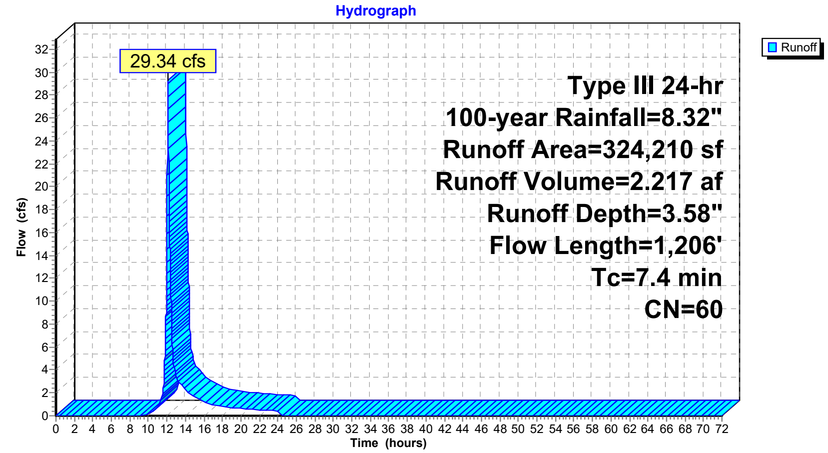
Runoff = 29.34 cfs @ 12.11 hrs, Volume= 2.217 af, Depth= 3.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
*	5,303	96	Gravel
	117,793	61	>75% Grass cover, Good, HSG B
*	6,302	98	Impervious
	7,233	98	Water Surface, HSG A
	187,579	55	Woods, Good, HSG B
	324,210	60	Weighted Average
	310,675		95.83% Pervious Area
	13,535		4.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	50	0.1200	2.43		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.13"
0.7	216	0.0694	5.35		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
3.1	537	0.0370	2.89		**Shallow Concentrated Flow, C-D** Grassed Waterway Kv= 15.0 fps
3.3	403	0.1700	2.06		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
7.4	1,206	Total			

Subcatchment 11S: Subcatchment 11S



Summary for Subcatchment 12S: Subcatchment 12S

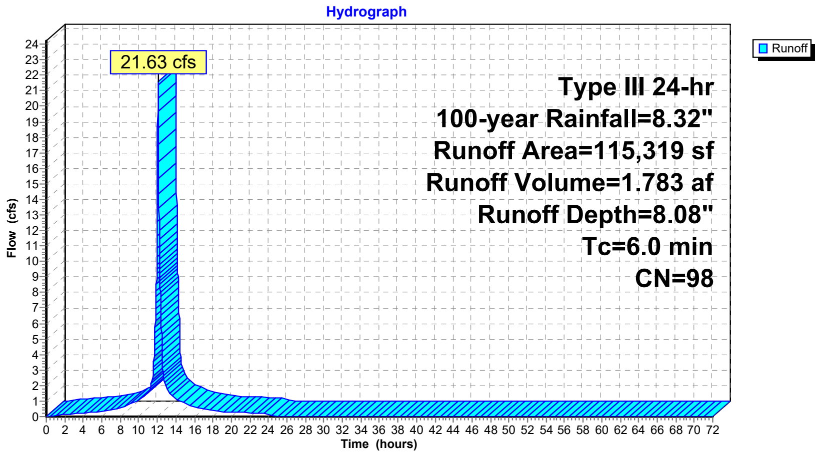
Runoff = 21.63 cfs @ 12.08 hrs, Volume= 1.783 af, Depth= 8.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
*	115,319	98	Impervious
	115,319		100.00% Impervious Area

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

Subcatchment 12S: Subcatchment 12S



Summary for Subcatchment 13S: Subcatchment 13S

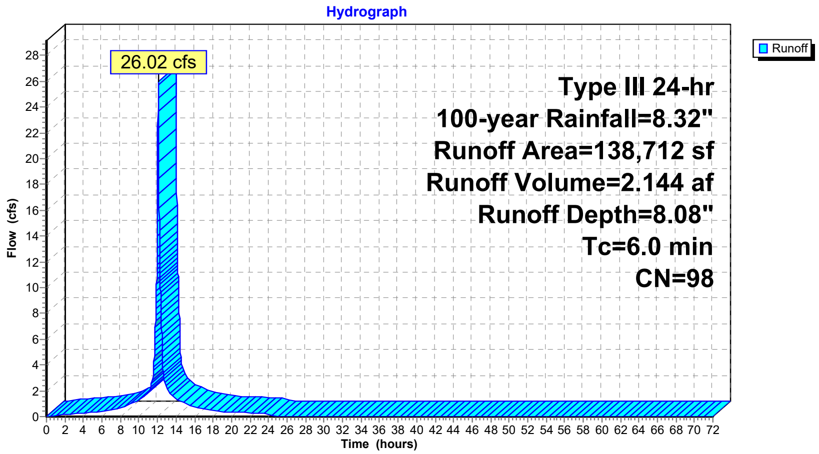
Runoff = 26.02 cfs @ 12.08 hrs, Volume= 2.144 af, Depth= 8.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
*	138,712	98	Impervious
	138,712		100.00% Impervious Area

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

Subcatchment 13S: Subcatchment 13S



Summary for Subcatchment 14S: Subcatchment 14S

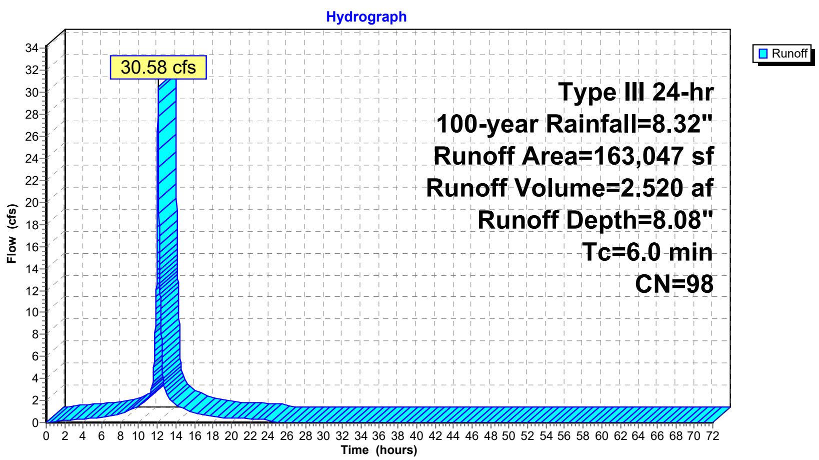
Runoff = 30.58 cfs @ 12.08 hrs, Volume= 2.520 af, Depth= 8.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
*	163,047	98	Impervious
	163,047		100.00% Impervious Area

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

Subcatchment 14S: Subcatchment 14S



Summary for Pond 1P: Pond 1P

Inflow Area = 11.434 ac, 3.51% Impervious, Inflow Depth = 2.67" for 100-year event
Inflow = 30.82 cfs @ 12.13 hrs, Volume= 2.543 af
Outflow = 6.46 cfs @ 12.65 hrs, Volume= 2.543 af, Atten= 79%, Lag= 31.2 min
Discarded = 1.00 cfs @ 12.65 hrs, Volume= 1.209 af
Primary = 5.45 cfs @ 12.65 hrs, Volume= 1.334 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 352.77' @ 12.65 hrs Surf.Area= 17,976 sf Storage= 41,773 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 206.4 min (1,071.5 - 865.1)

Volume	Invert	Avail.Storage	Storage Description
#1	349.70'	67,191 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

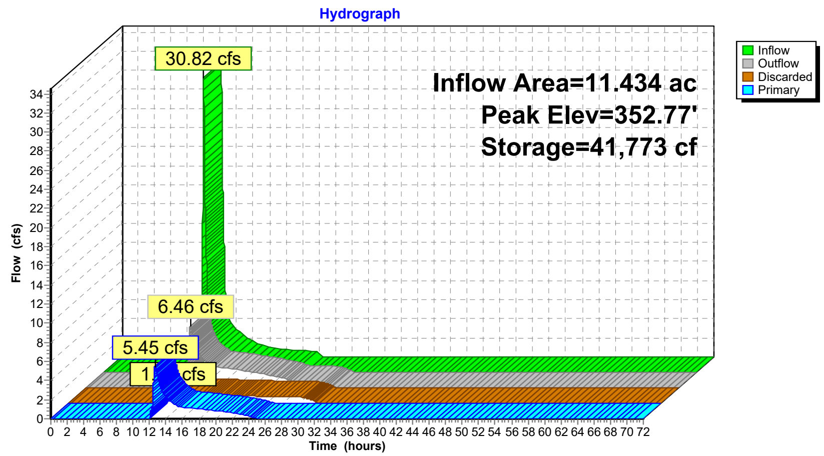
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
349.70	3,651	0	0
350.00	11,353	2,251	2,251
351.00	13,056	12,205	14,455
352.00	15,614	14,335	28,790
353.00	18,669	17,142	45,932
354.00	23,850	21,260	67,191

Device	Routing	Invert	Outlet Devices
#1	Primary	345.50'	**24.0" Round Culvert** L= 131.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 345.50' / 343.40' S= 0.0160 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf
#2	Device 1	350.60'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	352.47'	**2.5" x 2.5" Horiz. Orifice/Grate X 36.00** C= 0.600 in 24.0" x 24.0" Grate (39% open area) Limited to weir flow at low heads
#4	Discarded	349.70'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.00 cfs @ 12.65 hrs HW=352.77' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 1.00 cfs)

Primary OutFlow Max=5.45 cfs @ 12.65 hrs HW=352.77' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 5.45 cfs of 45.45 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 1.31 cfs @ 6.68 fps)
  └**3=Orifice/Grate** (Orifice Controls 4.14 cfs @ 2.65 fps)

Pond 1P: Pond 1P



Summary for Pond 2P: Pond 2P

Inflow Area = 7.386 ac, 52.49% Impervious, Inflow Depth = 5.93" for 100-year event
Inflow = 39.18 cfs @ 12.19 hrs, Volume= 3.647 af
Outflow = 16.27 cfs @ 12.53 hrs, Volume= 3.647 af, Atten= 58%, Lag= 20.2 min
Primary = 9.14 cfs @ 12.53 hrs, Volume= 3.440 af
Secondary = 7.13 cfs @ 12.53 hrs, Volume= 0.207 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 373.35' @ 12.53 hrs Surf.Area= 19,475 sf Storage= 39,775 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 24.8 min (833.8 - 808.9)

Volume	Invert	Avail.Storage	Storage Description
#1	368.00'	53,283 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

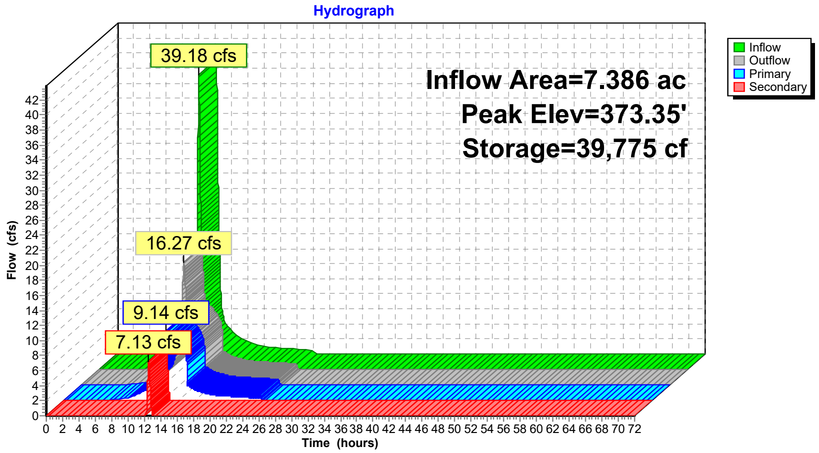
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
368.00	47	65.0	0	0	47
369.00	236	74.0	129	129	168
370.00	3,056	310.0	1,380	1,510	7,383
371.00	8,615	394.0	5,601	7,111	12,102
372.00	12,842	440.0	10,658	17,769	15,183
373.00	18,271	569.0	15,477	33,246	25,553
374.00	21,857	579.0	20,037	53,283	26,632

Device	Routing	Invert	Outlet Devices
#1	Primary	367.00'	**12.0" Round Culvert** L= 134.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 367.00' / 360.80' S= 0.0463 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Secondary	373.00'	**13.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=9.14 cfs @ 12.53 hrs HW=373.35' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 9.14 cfs @ 11.64 fps)

Secondary OutFlow Max=7.13 cfs @ 12.53 hrs HW=373.35' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 7.13 cfs @ 1.58 fps)

Pond 2P: Pond 2P

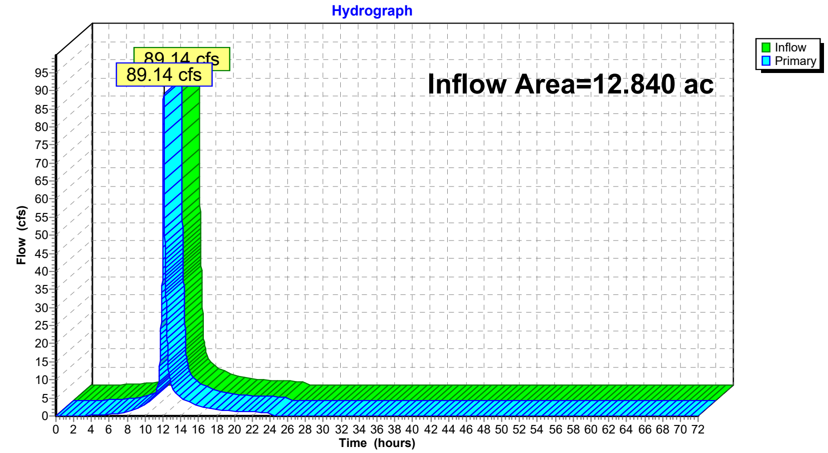


Summary for Link P.O.A. #1: P.O.A. #1

Inflow Area = 12.840 ac, 63.14% Impervious, Inflow Depth = 6.36" for 100-year event
Inflow = 89.14 cfs @ 12.09 hrs, Volume= 6.804 af
Primary = 89.14 cfs @ 12.09 hrs, Volume= 6.804 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #1: P.O.A. #1

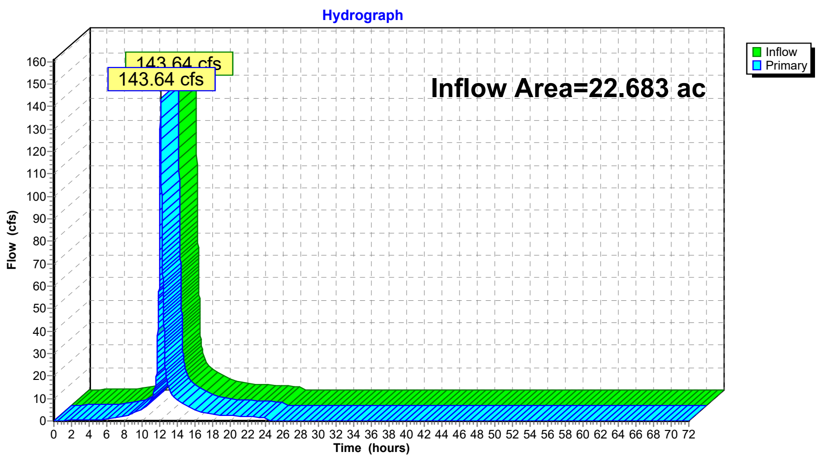


Summary for Link P.O.A. #2: P.O.A. #2

Inflow Area = 22.683 ac, 62.84% Impervious, Inflow Depth = 6.39" for 100-year event
Inflow = 143.64 cfs @ 12.11 hrs, Volume= 12.081 af
Primary = 143.64 cfs @ 12.11 hrs, Volume= 12.081 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #2: P.O.A. #2

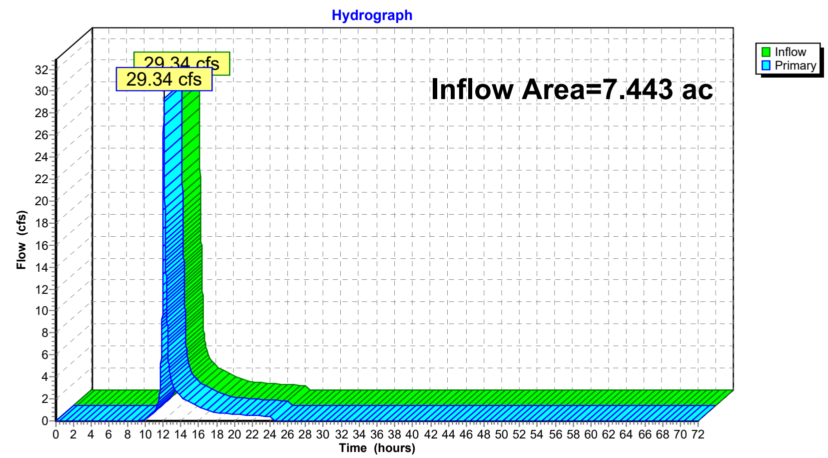


Summary for Link P.O.A. #4: P.O.A. #4

Inflow Area = 7.443 ac, 4.17% Impervious, Inflow Depth = 3.58" for 100-year event
Inflow = 29.34 cfs @ 12.11 hrs, Volume= 2.217 af
Primary = 29.34 cfs @ 12.11 hrs, Volume= 2.217 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #4: P.O.A. #4

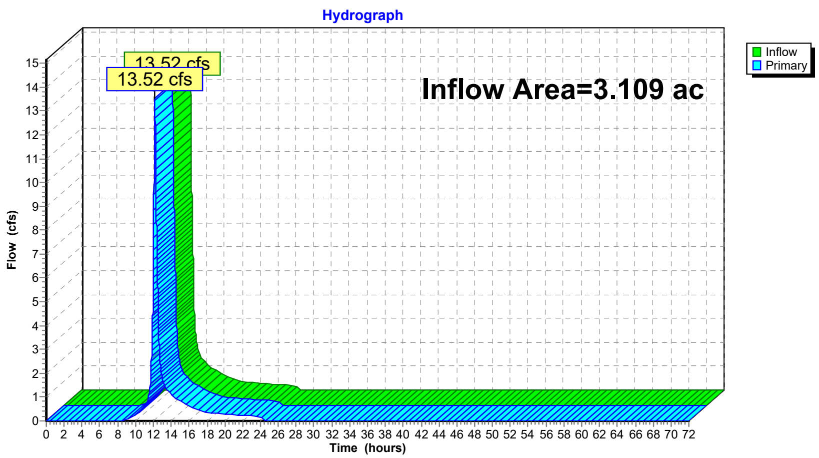


Summary for Link P.O.A. #6: P.O.A. #6

Inflow Area = 3.109 ac, 23.71% Impervious, Inflow Depth = 4.51" for 100-year event
Inflow = 13.52 cfs @ 12.17 hrs, Volume= 1.167 af
Primary = 13.52 cfs @ 12.17 hrs, Volume= 1.167 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #6: P.O.A. #6

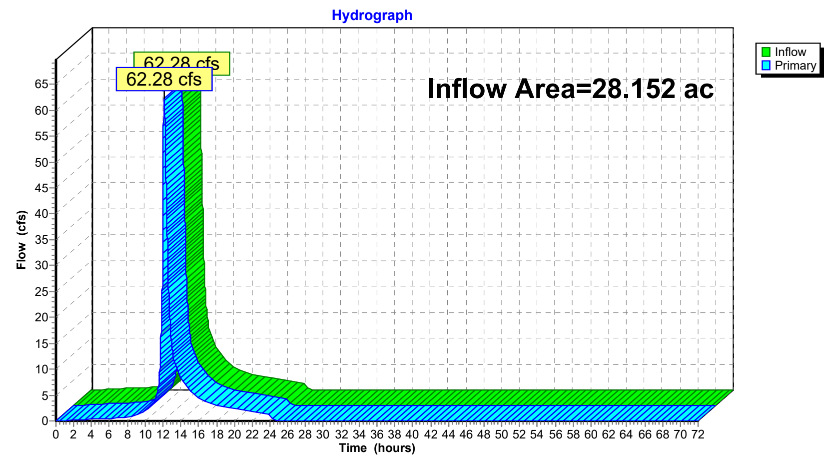


Summary for Link P.O.A.#3: P.O.A. #3

Inflow Area = 28.152 ac, 24.66% Impervious, Inflow Depth = 3.46" for 100-year event
Inflow = 62.28 cfs @ 12.12 hrs, Volume= 8.117 af
Primary = 62.28 cfs @ 12.12 hrs, Volume= 8.117 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A.#3: P.O.A. #3

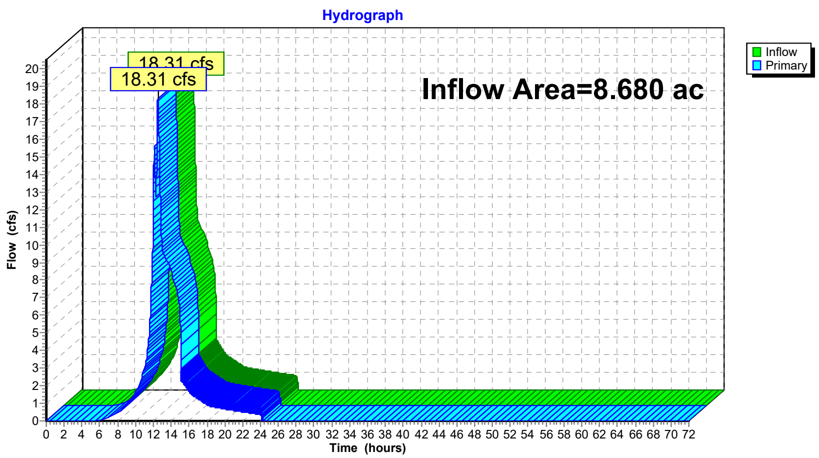


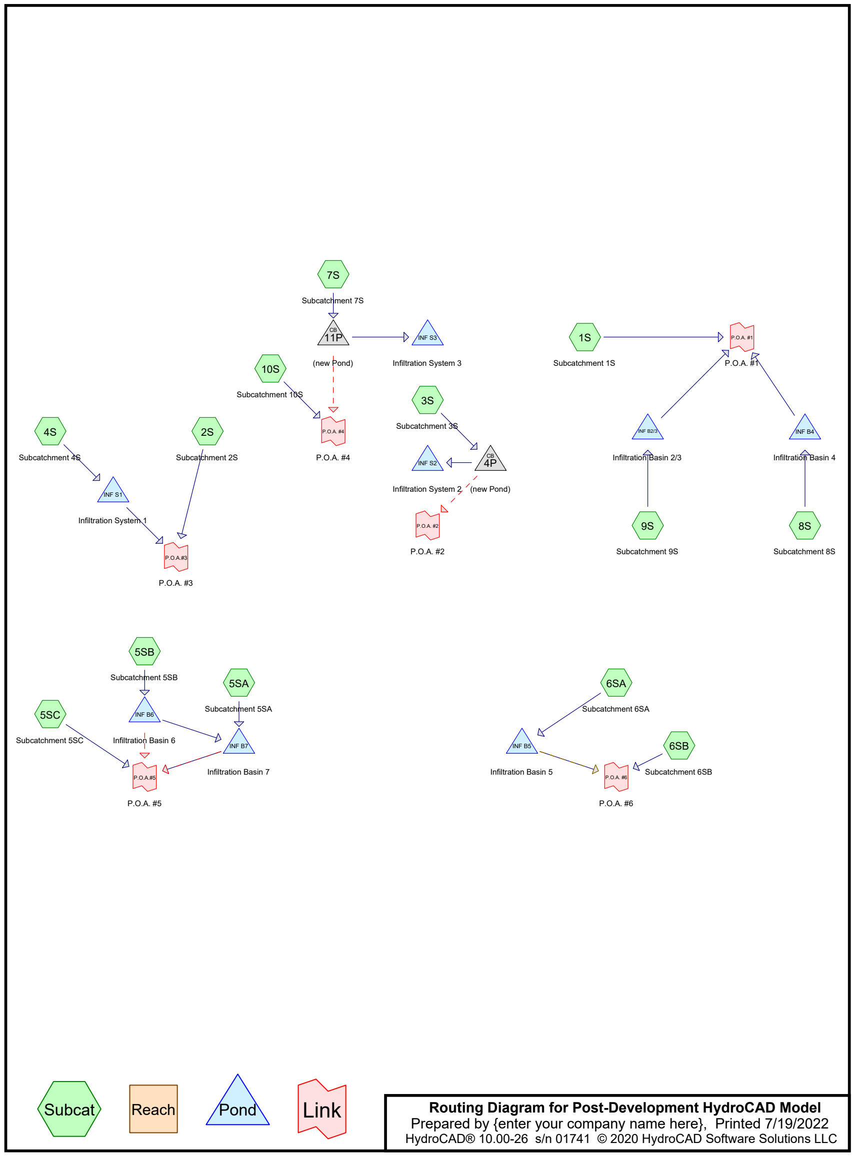
Summary for Link P.O.A.#5: P.O.A. #5

Inflow Area = 8.680 ac, 51.66% Impervious, Inflow Depth = 5.89" for 100-year event
Inflow = 18.31 cfs @ 12.50 hrs, Volume= 4.261 af
Primary = 18.31 cfs @ 12.50 hrs, Volume= 4.261 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A.#5: P.O.A. #5





Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
17.173	61	>75% Grass cover, Good, HSG B (1S, 2S, 4S, 5SA, 5SB, 5SC, 6SA, 6SB, 8S, 9S, 10S)
62.821	98	Impervious (2S, 3S, 4S, 5SA, 5SB, 5SC, 6SA, 6SB, 7S, 8S, 9S)
0.166	98	Water Surface, HSG A (10S)
4.227	55	Woods, Good, HSG B (6SA, 6SB, 10S)
84.387	**88**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.166	HSG A	10S
21.400	HSG B	1S, 2S, 4S, 5SA, 5SB, 5SC, 6SA, 6SB, 8S, 9S, 10S
0.000	HSG C	
0.000	HSG D	
62.821	Other	2S, 3S, 4S, 5SA, 5SB, 5SC, 6SA, 6SB, 7S, 8S, 9S
84.387		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	17.173	0.000	0.000	0.000	17.173	>75% Grass cover, Good	1S, 2S, 4S, 5SA, 5SB, 5SC, 6SA, 6SB, 8S, 9S, 10S
0.000	0.000	0.000	0.000	62.821	62.821	Impervious	2S, 3S, 4S, 5SA, 5SB, 5SC, 6SA, 6SB, 7S, 8S, 9S
0.166	0.000	0.000	0.000	0.000	0.166	Water Surface	10S
0.000	4.227	0.000	0.000	0.000	4.227	Woods, Good	6SA, 6SB, 10S
0.166	**21.400**	**0.000**	**0.000**	**62.821**	**84.387**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Subcatchment1S Runoff Area=116,630 sf 0.00% Impervious Runoff Depth=0.42"
Tc=0.0 min CN=61 Runoff=0.93 cfs 0.093 af

Subcatchment2S: Subcatchment2S Runoff Area=150,970 sf 31.43% Impervious Runoff Depth=0.94"
Tc=6.0 min CN=73 Runoff=3.55 cfs 0.271 af

Subcatchment3S: Subcatchment3S Runoff Area=963,480 sf 100.00% Impervious Runoff Depth=2.90"
Tc=6.0 min CN=98 Runoff=67.17 cfs 5.341 af

Subcatchment4S: Subcatchment4S Runoff Area=1,090,999 sf 96.88% Impervious Runoff Depth=2.79"
Flow Length=84' Tc=6.0 min CN=97 Runoff=74.86 cfs 5.817 af

Subcatchment5SA: Subcatchment5SA Runoff Area=136,848 sf 53.26% Impervious Runoff Depth=1.41"
Tc=6.0 min CN=81 Runoff=5.17 cfs 0.370 af

Subcatchment5SB: Subcatchment5SB Runoff Area=156,781 sf 75.89% Impervious Runoff Depth=2.02"
Tc=6.0 min CN=89 Runoff=8.47 cfs 0.605 af

Subcatchment5SC: Subcatchment5SC Runoff Area=42,867 sf 64.05% Impervious Runoff Depth=1.70"
Tc=6.0 min CN=85 Runoff=1.96 cfs 0.139 af

Subcatchment6SA: Subcatchment6SA Runoff Area=128,221 sf 25.22% Impervious Runoff Depth=0.79"
Flow Length=352' Tc=12.6 min CN=70 Runoff=1.92 cfs 0.193 af

Subcatchment6SB: Subcatchment6SB Runoff Area=18,252 sf 36.60% Impervious Runoff Depth=0.99"
Tc=6.0 min CN=74 Runoff=0.46 cfs 0.035 af

Subcatchment7S: Subcatchment7S Runoff Area=82,071 sf 100.00% Impervious Runoff Depth=2.90"
Tc=6.0 min CN=98 Runoff=5.72 cfs 0.455 af

Subcatchment8S: Subcatchment8S Runoff Area=51,944 sf 37.70% Impervious Runoff Depth=1.05"
Tc=6.0 min CN=75 Runoff=1.40 cfs 0.104 af

Subcatchment9S: Subcatchment9S Runoff Area=484,041 sf 63.75% Impervious Runoff Depth=1.70"
Tc=6.0 min CN=85 Runoff=22.14 cfs 1.572 af

Subcatchment10S: Subcatchment10S Runoff Area=252,780 sf 2.86% Impervious Runoff Depth=0.32"
Flow Length=1,206' Tc=7.4 min CN=58 Runoff=0.89 cfs 0.153 af

Pond 4P: (new Pond) Peak Elev=364.16' Inflow=67.17 cfs 5.341 af
Primary=34.64 cfs 3.692 af Secondary=32.53 cfs 1.649 af Outflow=67.17 cfs 5.341 af

Pond 11P: (new Pond) Peak Elev=322.57' Inflow=5.72 cfs 0.455 af
Primary=4.84 cfs 0.446 af Secondary=0.89 cfs 0.009 af Outflow=5.72 cfs 0.455 af

Pond INF B2/3: Infiltration Basin 2/3 Peak Elev=370.93' Storage=40,320 cf Inflow=22.14 cfs 1.572 af
Discarded=0.89 cfs 1.563 af Primary=0.10 cfs 0.009 af Outflow=0.99 cfs 1.572 af

Pond INF B4: Infiltration Basin 4 Peak Elev=349.29' Storage=1,947 cf Inflow=1.40 cfs 0.104 af
Discarded=0.11 cfs 0.104 af Primary=0.00 cfs 0.000 af Outflow=0.11 cfs 0.104 af

Pond INF B5: Infiltration Basin 5 Peak Elev=332.11' Storage=570 cf Inflow=1.92 cfs 0.193 af
Discarded=0.04 cfs 0.021 af Primary=1.48 cfs 0.172 af Secondary=0.00 cfs 0.000 af Outflow=1.53 cfs 0.193 af

Pond INF B6: Infiltration Basin 6 Peak Elev=373.80' Storage=10,509 cf Inflow=8.47 cfs 0.605 af
Discarded=0.30 cfs 0.391 af Primary=2.05 cfs 0.214 af Secondary=0.00 cfs 0.000 af Outflow=2.35 cfs 0.605 af

Pond INF B7: Infiltration Basin 7 Peak Elev=369.18' Storage=196 cf Inflow=5.23 cfs 0.584 af
Primary=4.90 cfs 0.584 af Secondary=0.00 cfs 0.000 af Outflow=4.90 cfs 0.584 af

Pond INF S1: Infiltration System 1 Peak Elev=359.31' Storage=113,580 cf Inflow=74.86 cfs 5.817 af
Discarded=3.84 cfs 5.757 af Primary=0.32 cfs 0.061 af Outflow=4.16 cfs 5.818 af

Pond INF S2: Infiltration System 2 Peak Elev=359.48' Storage=71,303 cf Inflow=34.64 cfs 3.692 af
Outflow=2.22 cfs 3.692 af

Pond INF S3: Infiltration System 3 Peak Elev=321.84' Storage=8,154 cf Inflow=4.84 cfs 0.446 af
Outflow=0.32 cfs 0.446 af

Link P.O.A.#1: P.O.A.#1 Inflow=0.93 cfs 0.102 af
Primary=0.93 cfs 0.102 af

Link P.O.A.#2: P.O.A.#2 Inflow=32.53 cfs 1.649 af
Primary=32.53 cfs 1.649 af

Link P.O.A.#4: P.O.A.#4 Inflow=1.45 cfs 0.162 af
Primary=1.45 cfs 0.162 af

Link P.O.A.#6: P.O.A.#6 Inflow=1.71 cfs 0.207 af
Primary=1.71 cfs 0.207 af

Link P.O.A.#3: P.O.A.#3 Inflow=3.55 cfs 0.332 af
Primary=3.55 cfs 0.332 af

Link P.O.A.#5: P.O.A.#5 Inflow=6.72 cfs 0.724 af
Primary=6.72 cfs 0.724 af

Total Runoff Area = 84.387 ac Runoff Volume = 15.149 af Average Runoff Depth = 2.15"
25.36% Pervious = 21.400 ac 74.64% Impervious = 62.987 ac

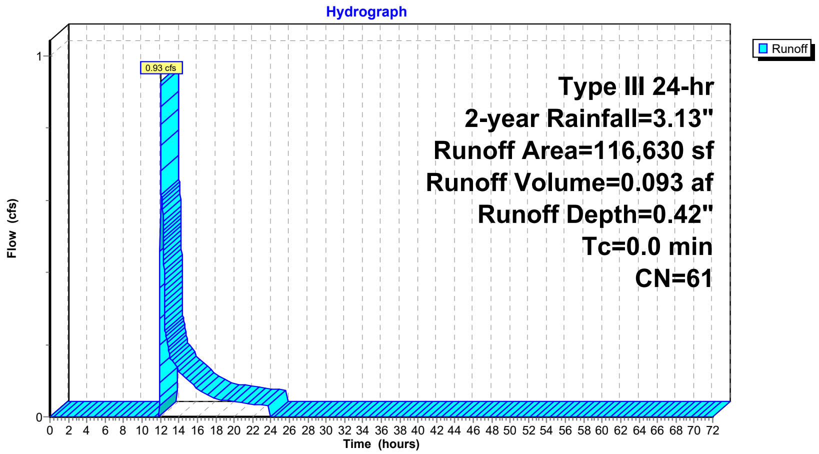
Summary for Subcatchment 1S: Subcatchment 1S

Runoff = 0.93 cfs @ 12.03 hrs, Volume= 0.093 af, Depth= 0.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

Area (sf)	CN	Description
116,630	61	>75% Grass cover, Good, HSG B
116,630		100.00% Pervious Area

Subcatchment 1S: Subcatchment 1S



Summary for Subcatchment 2S: Subcatchment 2S

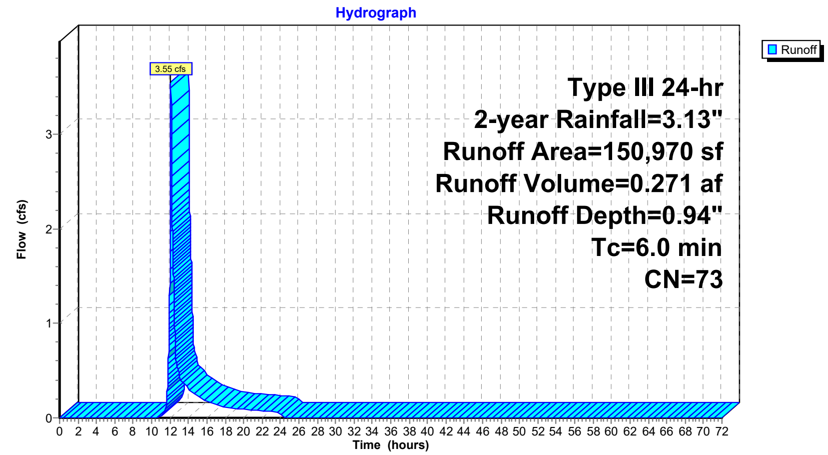
Runoff = 3.55 cfs @ 12.10 hrs, Volume= 0.271 af, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
*	47,452	98	Impervious
	103,518	61	>75% Grass cover, Good, HSG B
	150,970	73	Weighted Average
	103,518		68.57% Pervious Area
	47,452		31.43% Impervious Area

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

Subcatchment 2S: Subcatchment 2S



Summary for Subcatchment 3S: Subcatchment 3S

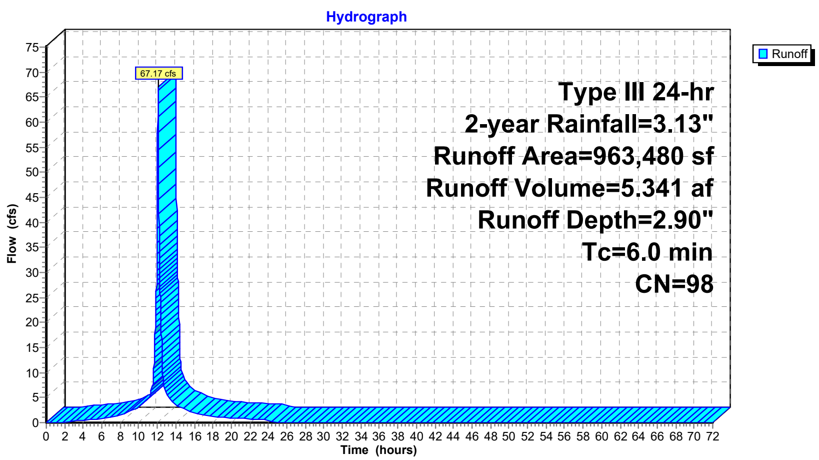
Runoff = 67.17 cfs @ 12.08 hrs, Volume= 5.341 af, Depth= 2.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
*	963,480	98	Impervious
	963,480		100.00% Impervious Area

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

Subcatchment 3S: Subcatchment 3S



Summary for Subcatchment 4S: Subcatchment 4S

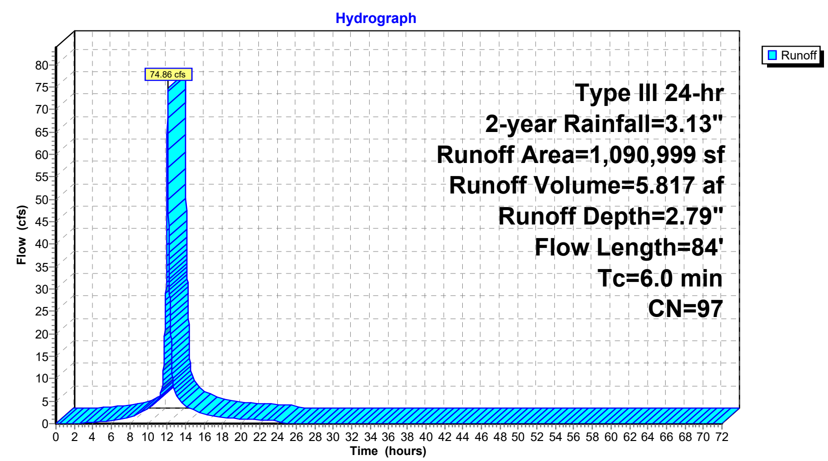
Runoff = 74.86 cfs @ 12.08 hrs, Volume= 5.817 af, Depth= 2.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
	34,012	61	>75% Grass cover, Good, HSG B
*	1,056,987	98	Impervious
	1,090,999	97	Weighted Average
	34,012		3.12% Pervious Area
	1,056,987		96.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.1200	0.21		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.1	34	0.3200	8.49		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
1.9					**Direct Entry,**
6.0	84	Total			

Subcatchment 4S: Subcatchment 4S



Summary for Subcatchment 5SA: Subcatchment 5SA

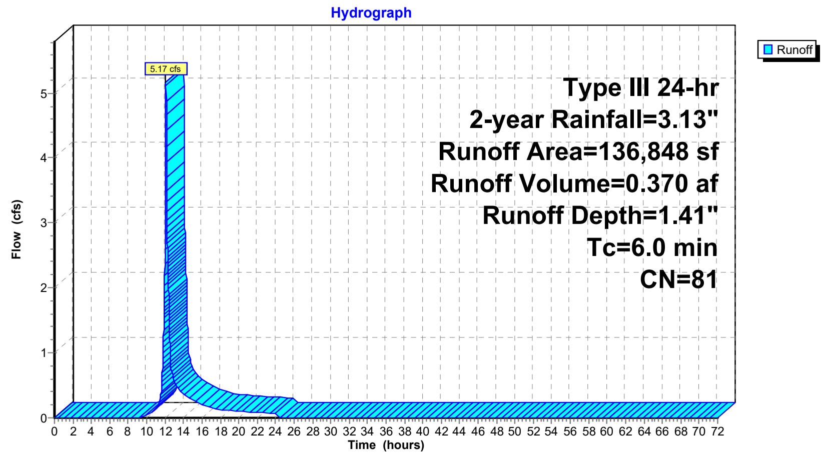
Runoff = 5.17 cfs @ 12.09 hrs, Volume= 0.370 af, Depth= 1.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
*	72,885	98	Impervious
	63,963	61	>75% Grass cover, Good, HSG B
	136,848	81	Weighted Average
	63,963		46.74% Pervious Area
	72,885		53.26% Impervious Area

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

Subcatchment 5SA: Subcatchment 5SA



Summary for Subcatchment 5SB: Subcatchment 5SB

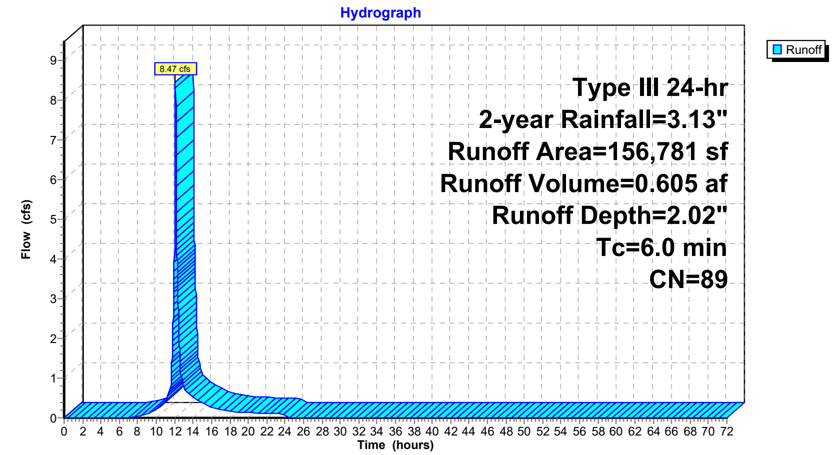
Runoff = 8.47 cfs @ 12.09 hrs, Volume= 0.605 af, Depth= 2.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
*	118,983	98	Impervious
	37,798	61	>75% Grass cover, Good, HSG B
	156,781	89	Weighted Average
	37,798		24.11% Pervious Area
	118,983		75.89% Impervious Area

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

Subcatchment 5SB: Subcatchment 5SB



Summary for Subcatchment 5SC: Subcatchment 5SC

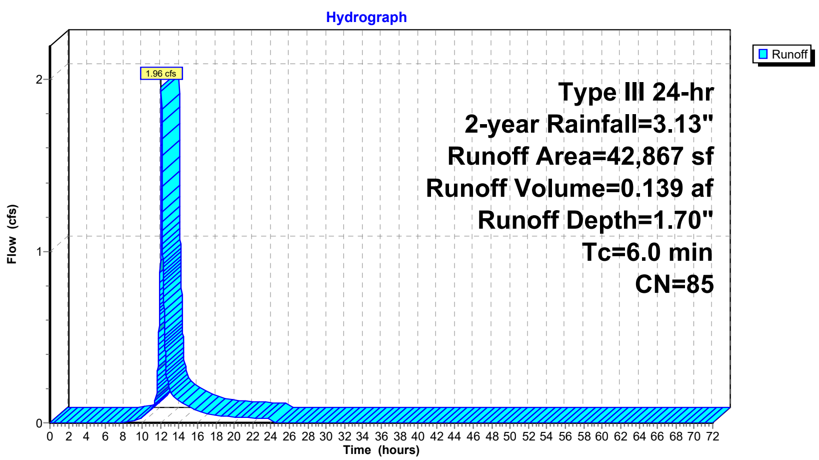
Runoff = 1.96 cfs @ 12.09 hrs, Volume= 0.139 af, Depth= 1.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
*	27,458	98	Impervious
	15,409	61	>75% Grass cover, Good, HSG B
	42,867	85	Weighted Average
	15,409		35.95% Pervious Area
	27,458		64.05% Impervious Area

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

Subcatchment 5SC: Subcatchment 5SC



Summary for Subcatchment 6SA: Subcatchment 6SA

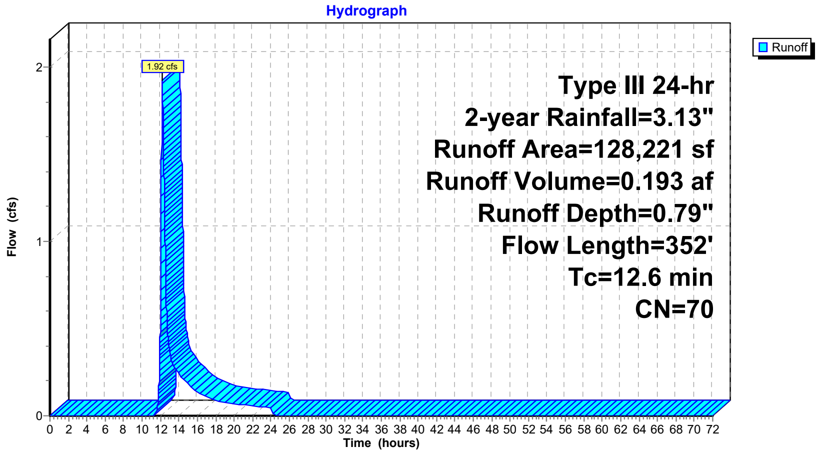
Runoff = 1.92 cfs @ 12.19 hrs, Volume= 0.193 af, Depth= 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
*	32,335	98	Impervious
	79,319	61	>75% Grass cover, Good, HSG B
	16,567	55	Woods, Good, HSG B
	128,221	70	Weighted Average
	95,886		74.78% Pervious Area
	32,335		25.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	7	0.0400	0.09		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
8.4	43	0.0400	0.09		**Sheet Flow, B-C** Woods: Light underbrush n= 0.400 P2= 3.13"
2.4	177	0.0620	1.24		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
0.2	49	0.3300	4.02		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
0.3	76	0.0588	4.92		**Shallow Concentrated Flow, E-F** Paved Kv= 20.3 fps
12.6	352	Total			

Subcatchment 6SA: Subcatchment 6SA



Summary for Subcatchment 6SB: Subcatchment 6SB

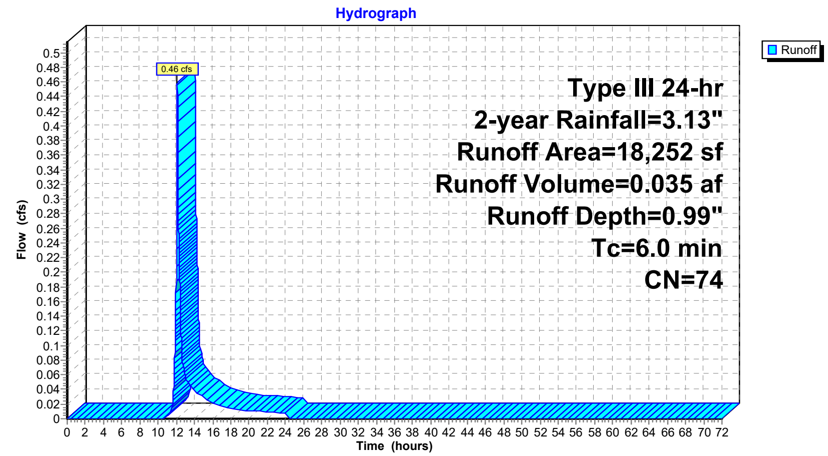
Runoff = 0.46 cfs @ 12.10 hrs, Volume= 0.035 af, Depth= 0.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
*	6,681	98	Impervious
	10,466	61	>75% Grass cover, Good, HSG B
	1,105	55	Woods, Good, HSG B
	18,252	74	Weighted Average
	11,571		63.40% Pervious Area
	6,681		36.60% Impervious Area

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

Subcatchment 6SB: Subcatchment 6SB



Summary for Subcatchment 7S: Subcatchment 7S

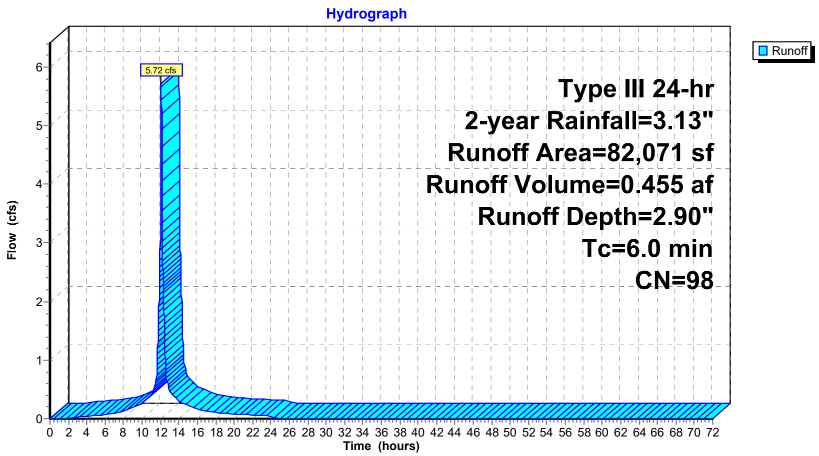
Runoff = 5.72 cfs @ 12.08 hrs, Volume= 0.455 af, Depth= 2.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
*	82,071	98	Impervious
	82,071		100.00% Impervious Area

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

Subcatchment 7S: Subcatchment 7S



Summary for Subcatchment 8S: Subcatchment 8S

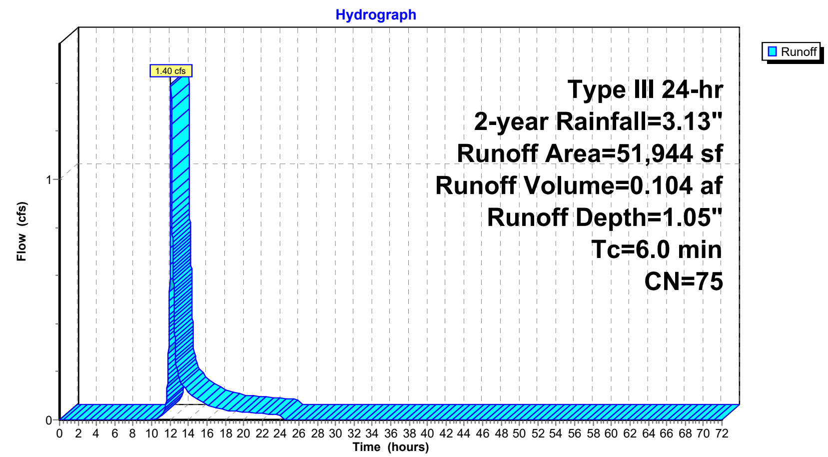
Runoff = 1.40 cfs @ 12.10 hrs, Volume= 0.104 af, Depth= 1.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
*	19,582	98	Impervious
	32,362	61	>75% Grass cover, Good, HSG B
	51,944	75	Weighted Average
	32,362		62.30% Pervious Area
	19,582		37.70% Impervious Area

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

Subcatchment 8S: Subcatchment 8S



Summary for Subcatchment 9S: Subcatchment 9S

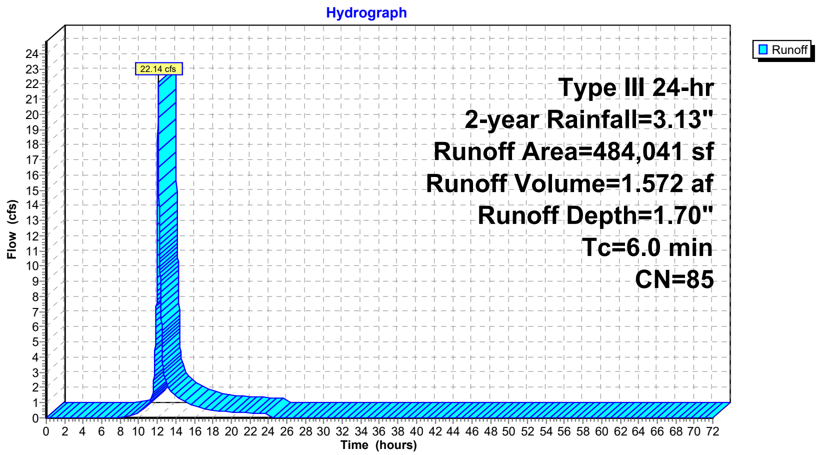
Runoff = 22.14 cfs @ 12.09 hrs, Volume= 1.572 af, Depth= 1.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

	Area (sf)	CN	Description
*	308,574	98	Impervious
	175,467	61	>75% Grass cover, Good, HSG B
	484,041	85	Weighted Average
	175,467		36.25% Pervious Area
	308,574		63.75% Impervious Area

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

Subcatchment 9S: Subcatchment 9S



Summary for Subcatchment 10S: Subcatchment 10S

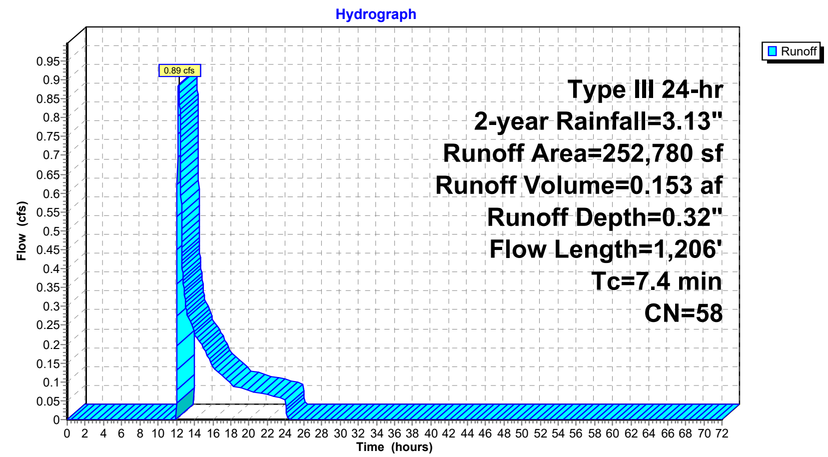
Runoff = 0.89 cfs @ 12.29 hrs, Volume= 0.153 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.13"

Area (sf)	CN	Description
79,107	61	>75% Grass cover, Good, HSG B
7,233	98	Water Surface, HSG A
166,440	55	Woods, Good, HSG B
252,780	58	Weighted Average
245,547		97.14% Pervious Area
7,233		2.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	50	0.1200	2.43		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.13"
0.7	216	0.0694	5.35		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
3.1	537	0.0370	2.89		**Shallow Concentrated Flow, C-D** Grassed Waterway Kv= 15.0 fps
3.3	403	0.1700	2.06		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
7.4	1,206	Total			

Subcatchment 10S: Subcatchment 10S



Summary for Pond 4P: (new Pond)

Inflow Area = 22.118 ac,100.00% Impervious, Inflow Depth = 2.90" for 2-year event
Inflow = 67.17 cfs @ 12.08 hrs, Volume= 5.341 af
Outflow = 67.17 cfs @ 12.08 hrs, Volume= 5.341 af, Atten= 0%, Lag= 0.0 min
Primary = 34.64 cfs @ 12.08 hrs, Volume= 3.692 af
Secondary = 32.53 cfs @ 12.08 hrs, Volume= 1.649 af

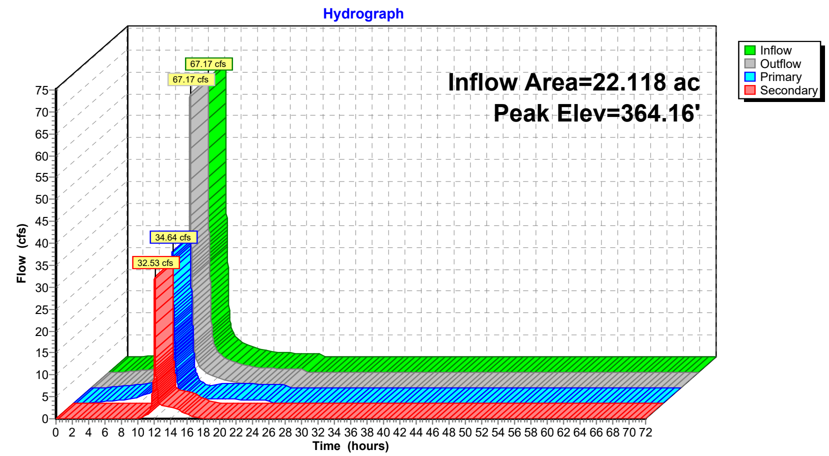
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 364.16' @ 12.08 hrs

Device	Routing	Invert	Outlet Devices
#1	Secondary	358.75'	**48.0" Round Culvert** L= 125.0' Ke= 0.500 Inlet / Outlet Invert= 358.75' / 348.75' S= 0.0800 '/' Cc= 0.900 n= 0.010, Flow Area= 12.57 sf
#2	Device 1	358.60'	**7.0" Vert. Orifice/Grate X 3.00** C= 0.600
#3	Device 1	359.50'	**8.0" Vert. Orifice/Grate X 2.00** C= 0.600
#4	Device 1	363.15'	**5.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)
#5	Primary	357.92'	**24.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 357.92' / 357.92' S= 0.0000 '/' Cc= 0.900 n= 0.010, Flow Area= 3.14 sf

Primary OutFlow Max=34.62 cfs @ 12.08 hrs HW=364.16' TW=358.53' (Dynamic Tailwater)
└─**5=Culvert** (Inlet Controls 34.62 cfs @ 11.02 fps)

Secondary OutFlow Max=32.43 cfs @ 12.08 hrs HW=364.16' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 32.43 cfs of 111.72 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 8.86 cfs @ 11.05 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 6.99 cfs @ 10.01 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Weir Controls 16.58 cfs @ 3.29 fps)

Pond 4P: (new Pond)



Summary for Pond 11P: (new Pond)

Inflow Area =	1.884 ac,100.00% Impervious,	Inflow Depth = 2.90"	for 2-year event	
Inflow =	5.72 cfs @	12.08 hrs, Volume=	0.455 af	
Outflow =	5.72 cfs @	12.08 hrs, Volume=	0.455 af,	Atten= 0%, Lag= 0.0 min
Primary =	4.84 cfs @	12.08 hrs, Volume=	0.446 af	
Secondary =	0.89 cfs @	12.09 hrs, Volume=	0.009 af	

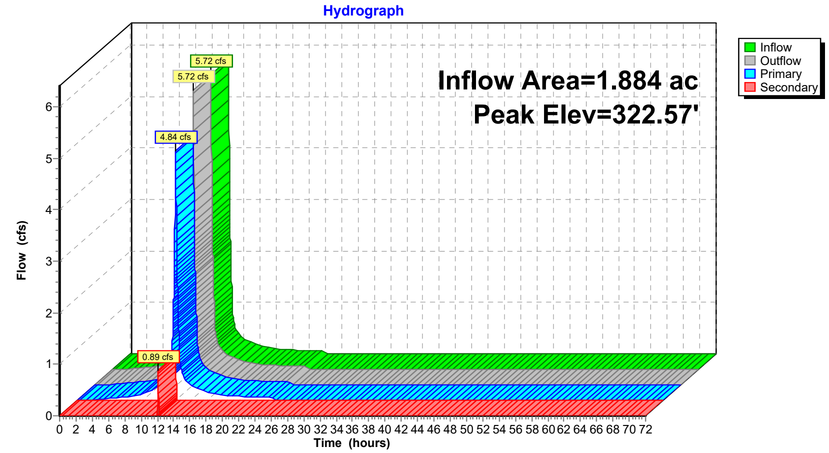
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 322.57' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Secondary	321.80'	**15.0" Round Culvert** L= 125.0' Ke= 0.500 Inlet / Outlet Invert= 321.80' / 321.00' S= 0.0064 '/' Cc= 0.900 n= 0.010, Flow Area= 1.23 sf
#2	Device 1	321.80'	**7.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	322.60'	**6.5" Vert. Orifice/Grate** C= 0.600
#4	Device 1	326.00'	**5.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)
#5	Primary	319.92'	**12.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 319.92' / 319.92' S= 0.0000 '/' Cc= 0.900 n= 0.010, Flow Area= 0.79 sf

Primary OutFlow Max=4.79 cfs @ 12.08 hrs HW=322.55' TW=320.94' (Dynamic Tailwater)
└─**5=Culvert** (Inlet Controls 4.79 cfs @ 6.10 fps)

Secondary OutFlow Max=0.89 cfs @ 12.09 hrs HW=322.56' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.89 cfs of 2.34 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.89 cfs @ 3.31 fps)
  ├─**3=Orifice/Grate** (Controls 0.00 cfs)
  └─**4=Sharp-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond 11P: (new Pond)



Summary for Pond INF B2/3: Infiltration Basin 2/3

Inflow Area = 11.112 ac, 63.75% Impervious, Inflow Depth = 1.70" for 2-year event
Inflow = 22.14 cfs @ 12.09 hrs, Volume= 1.572 af
Outflow = 0.99 cfs @ 15.34 hrs, Volume= 1.572 af, Atten= 96%, Lag= 195.1 min
Discarded = 0.89 cfs @ 15.34 hrs, Volume= 1.563 af
Primary = 0.10 cfs @ 15.34 hrs, Volume= 0.009 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 370.93' @ 15.34 hrs Surf.Area= 16,021 sf Storage= 40,320 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 535.5 min (1,362.5 - 827.1)

Volume	Invert	Avail.Storage	Storage Description
#1	369.00'	26,782 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	367.00'	65,194 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		91,976 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
369.00	2,109	0	0
370.00	2,783	2,446	2,446
371.00	3,528	3,156	5,602
372.00	4,348	3,938	9,540
373.00	5,244	4,796	14,336
374.00	6,207	5,726	20,061
375.00	7,234	6,721	26,782

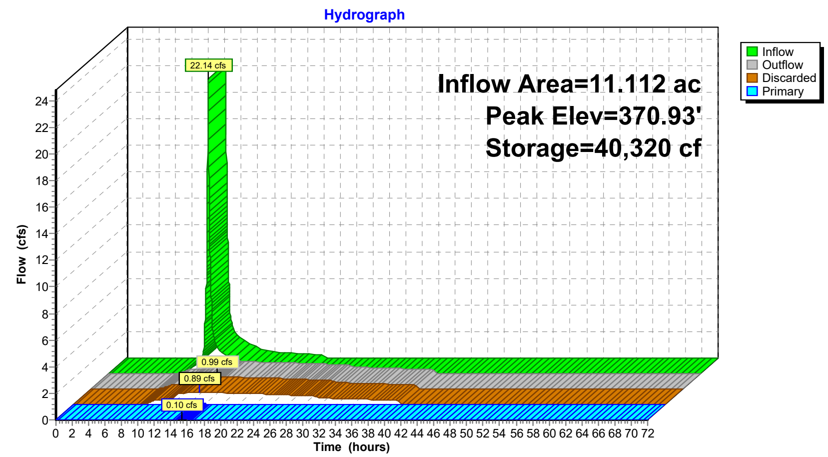
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
367.00	5,459	0	0
368.00	7,106	6,283	6,283
369.00	8,886	7,996	14,279
370.00	10,741	9,814	24,092
371.00	12,672	11,707	35,799
372.00	14,679	13,676	49,474
373.00	16,761	15,720	65,194

Device	Routing	Invert	Outlet Devices
#1	Discarded	367.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	358.00'	**24.0" Round Culvert** L= 78.0' Ke= 0.500 Inlet / Outlet Invert= 358.00' / 353.00' S= 0.0641 '/' Cc= 0.900 n= 0.011, Flow Area= 3.14 sf
#3	Device 2	370.90'	**5.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)

Discarded OutFlow Max=0.89 cfs @ 15.34 hrs HW=370.93' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.89 cfs)

Primary OutFlow Max=0.10 cfs @ 15.34 hrs HW=370.93' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.10 cfs of 52.25 cfs potential flow)
└**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.10 cfs @ 0.59 fps)

Pond INF B2/3: Infiltration Basin 2/3



Summary for Pond INF B4: Infiltration Basin 4

Inflow Area = 1.192 ac, 37.70% Impervious, Inflow Depth = 1.05" for 2-year event
Inflow = 1.40 cfs @ 12.10 hrs, Volume= 0.104 af
Outflow = 0.11 cfs @ 14.04 hrs, Volume= 0.104 af, Atten= 92%, Lag= 116.5 min
Discarded = 0.11 cfs @ 14.04 hrs, Volume= 0.104 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 349.29' @ 14.04 hrs Surf.Area= 1,998 sf Storage= 1,947 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 203.7 min (1,063.9 - 860.2)

Volume	Invert	Avail.Storage	Storage Description
#1	348.00'	10,401 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

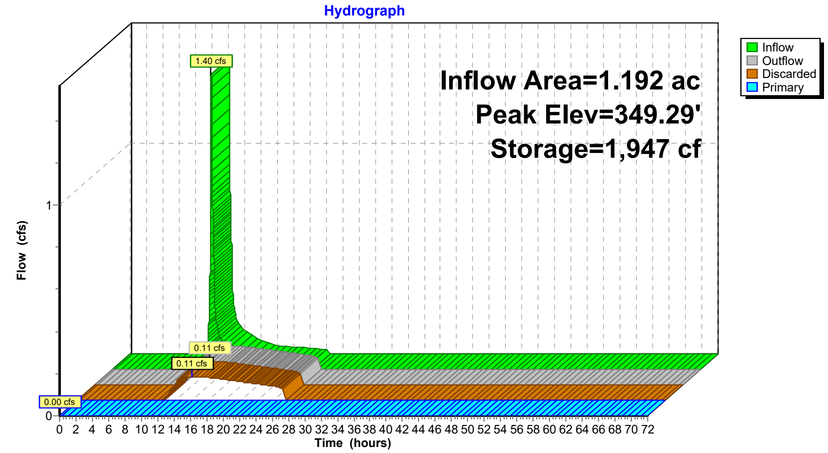
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
348.00	1,024	0	0
349.00	1,766	1,395	1,395
350.00	2,558	2,162	3,557
351.00	3,407	2,983	6,540
352.00	4,315	3,861	10,401

Device	Routing	Invert	Outlet Devices
#1	Discarded	348.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	350.60'	**10.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.11 cfs @ 14.04 hrs HW=349.29' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=348.00' TW=0.00' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond INF B4: Infiltration Basin 4



Summary for Pond INF B5: Infiltration Basin 5

Inflow Area = 2.944 ac, 25.22% Impervious, Inflow Depth = 0.79" for 2-year event
Inflow = 1.92 cfs @ 12.19 hrs, Volume= 0.193 af
Outflow = 1.53 cfs @ 12.33 hrs, Volume= 0.193 af, Atten= 21%, Lag= 8.0 min
Discarded = 0.04 cfs @ 12.33 hrs, Volume= 0.021 af
Primary = 1.48 cfs @ 12.33 hrs, Volume= 0.172 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 332.11' @ 12.33 hrs Surf.Area= 777 sf Storage= 570 cf

Plug-Flow detention time= 6.2 min calculated for 0.193 af (100% of inflow)
Center-of-Mass det. time= 6.2 min (889.7 - 883.5)

Volume	Invert	Avail.Storage	Storage Description
#1	331.00'	7,829 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	3,331.00'	1,060 cf	**36.0" Round Pipe Storage**-Impervious L= 150.0'
		8,889 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
331.00	257	0	0
332.00	717	487	487
333.00	1,261	989	1,476
334.00	1,866	1,564	3,040
335.00	2,533	2,200	5,239
336.00	2,646	2,590	7,829

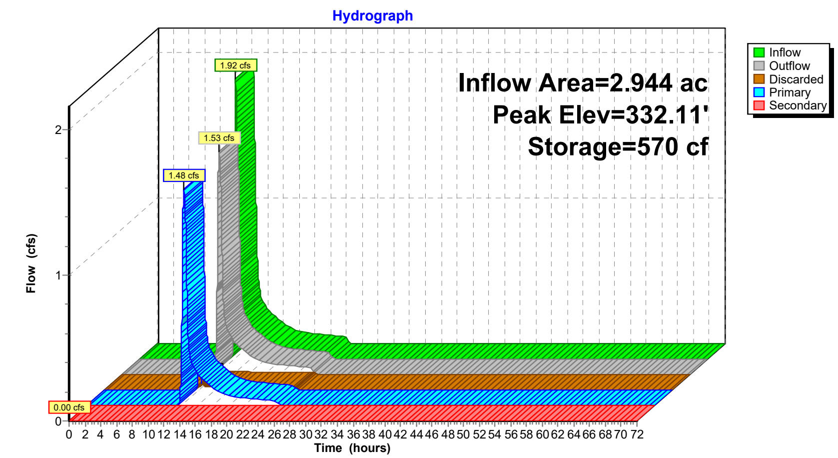
Device	Routing	Invert	Outlet Devices
#1	Discarded	331.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	331.00'	**12.0" Round Culvert** L= 25.0' Ke= 0.500 Inlet / Outlet Invert= 331.00' / 328.80' S= 0.0880 '/' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#3	Device 2	331.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	334.25'	**5.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)
#5	Secondary	330.00'	**12.0" Round Culvert** L= 25.0' Ke= 0.500 Inlet / Outlet Invert= 330.00' / 329.30' S= 0.0280 '/' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#6	Device 5	333.79'	**2.5" x 2.5" Horiz. Orifice/Grate X 72.00** C= 0.600 in 24.0" x 48.0" Grate (39% open area) Limited to weir flow at low heads

Discarded OutFlow Max=0.04 cfs @ 12.33 hrs HW=332.11' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=1.48 cfs @ 12.33 hrs HW=332.11' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 1.48 cfs of 2.96 cfs potential flow)
  └**3=Orifice/Grate** (Orifice Controls 1.48 cfs @ 4.25 fps)
  └**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=331.00' TW=0.00' (Dynamic Tailwater)
└**5=Culvert** (Passes 0.00 cfs of 2.67 cfs potential flow)
  └**6=Orifice/Grate** (Controls 0.00 cfs)

Pond INF B5: Infiltration Basin 5



Summary for Pond INF B6: Infiltration Basin 6

Inflow Area =	3.599 ac, 75.89% Impervious, Inflow Depth = 2.02" for 2-year event		
Inflow =	8.47 cfs @ 12.09 hrs,	Volume=	0.605 af
Outflow =	2.35 cfs @ 12.45 hrs,	Volume=	0.605 af, Atten= 72%, Lag= 21.7 min
Discarded =	0.30 cfs @ 12.45 hrs,	Volume=	0.391 af
Primary =	2.05 cfs @ 12.45 hrs,	Volume=	0.214 af
Secondary =	0.00 cfs @ 0.00 hrs,	Volume=	0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 373.80' @ 12.45 hrs Surf.Area= 5,392 sf Storage= 10,509 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 223.0 min (1,035.0 - 812.0)

Volume	Invert	Avail.Storage	Storage Description
#1	371.00'	34,138 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)
371.00	2,226	339.0	0	0	2,226
372.00	3,291	365.0	2,741	2,741	3,725
373.00	4,432	391.0	3,847	6,589	5,334
374.00	5,648	416.0	5,028	11,616	6,989
375.00	6,927	436.0	6,277	17,893	8,410
376.00	8,267	456.0	7,587	25,480	9,899
377.00	9,054	397.0	8,658	34,138	13,926

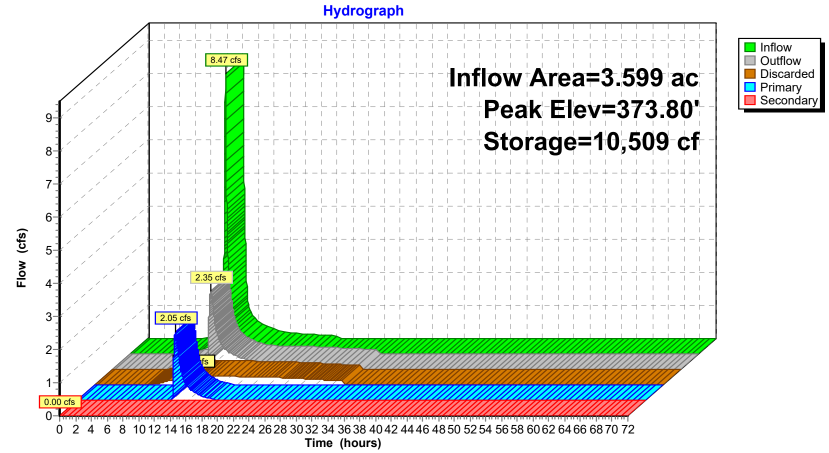
Device	Routing	Invert	Outlet Devices
#1	Discarded	371.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	372.00'	**24.0" Round Culvert** L= 182.0' Ke= 0.500 Inlet / Outlet Invert= 372.00' / 368.00' S= 0.0220 '/' Cc= 0.900 n= 0.010, Flow Area= 3.14 sf
#3	Device 2	373.00'	**12.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	374.50'	**5.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)
#5	Secondary	375.50'	**10.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.30 cfs @ 12.45 hrs HW=373.80' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.30 cfs)

Primary OutFlow Max=2.05 cfs @ 12.45 hrs HW=373.80' TW=368.47' (Dynamic Tailwater)
└─**2=Culvert** (Passes 2.05 cfs of 13.60 cfs potential flow)
  ├─**3=Orifice/Grate** (Orifice Controls 2.05 cfs @ 3.04 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=371.00' TW=0.00' (Dynamic Tailwater)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond INF B6: Infiltration Basin 6



Summary for Pond INF B7: Infiltration Basin 7

Inflow Area = 6.741 ac, 65.34% Impervious, Inflow Depth = 1.04" for 2-year event
Inflow = 5.23 cfs @ 12.10 hrs, Volume= 0.584 af
Outflow = 4.90 cfs @ 12.14 hrs, Volume= 0.584 af, Atten= 6%, Lag= 2.6 min
Primary = 4.90 cfs @ 12.14 hrs, Volume= 0.584 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 369.18' @ 12.14 hrs Surf.Area= 512 sf Storage= 196 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.1 min (825.4 - 825.3)

Volume	Invert	Avail.Storage	Storage Description
#1	368.00'	53,283 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

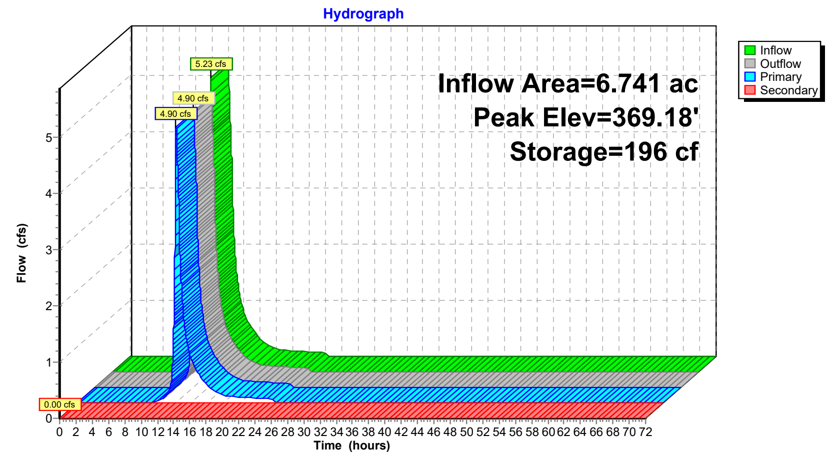
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
368.00	47	65.0	0	0	47
369.00	236	74.0	129	129	168
370.00	3,056	310.0	1,380	1,510	7,383
371.00	8,615	394.0	5,601	7,111	12,102
372.00	12,842	440.0	10,658	17,769	15,183
373.00	18,271	569.0	15,477	33,246	25,553
374.00	21,857	579.0	20,037	53,283	26,632

Device	Routing	Invert	Outlet Devices
#1	Primary	367.00'	**12.0" Round Culvert** L= 134.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 367.00' / 360.80' S= 0.0463 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Secondary	373.00'	**13.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=4.90 cfs @ 12.14 hrs HW=369.18' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 4.90 cfs @ 6.24 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=368.00' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond INF B7: Infiltration Basin 7



Summary for Pond INF S1: Infiltration System 1

Inflow Area = 25.046 ac, 96.88% Impervious, Inflow Depth = 2.79" for 2-year event
Inflow = 74.86 cfs @ 12.08 hrs, Volume= 5.817 af
Outflow = 4.16 cfs @ 13.91 hrs, Volume= 5.818 af, Atten= 94%, Lag= 109.8 min
Discarded = 3.84 cfs @ 11.09 hrs, Volume= 5.757 af
Primary = 0.32 cfs @ 13.91 hrs, Volume= 0.061 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 359.31' @ 13.91 hrs Surf.Area= 68,776 sf Storage= 113,580 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 243.2 min (1,009.8 - 766.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	357.00'	107,003 cf	**155.67'W x 441.82'L x 6.75'H Field A** 464,239 cf Overall - 196,730 cf Embedded = 267,509 cf x 40.0% Voids
#2A	357.75'	196,730 cf	**ADS_StormTech MC-4500 +Cap** x 1836 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 1836 Chambers in 17 Rows Cap Storage= +35.7 cf x 2 x 17 rows = 1,213.8 cf
		303,734 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	359.10'	**36.0" Round Culvert** L= 125.0' Ke= 0.500 Inlet / Outlet Invert= 359.10' / 348.75' S= 0.0828 '/' Cc= 0.900 n= 0.010, Flow Area= 7.07 sf
#2	Discarded	357.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=3.84 cfs @ 11.09 hrs HW=357.07' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 3.84 cfs)

Primary OutFlow Max=0.32 cfs @ 13.91 hrs HW=359.31' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 0.32 cfs @ 1.54 fps)

Pond INF S1: Infiltration System 1 - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 17 rows = 1,213.8 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

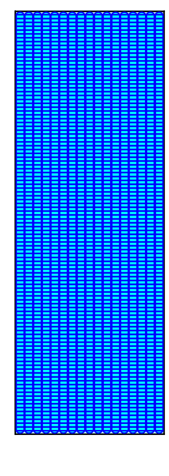
108 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 439.82' Row Length +12.0" End Stone x 2 = 441.82' Base Length
17 Rows x 100.0" Wide + 9.0" Spacing x 16 + 12.0" Side Stone x 2 = 155.67' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

1,836 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 17 Rows = 196,730.2 cf Chamber Storage

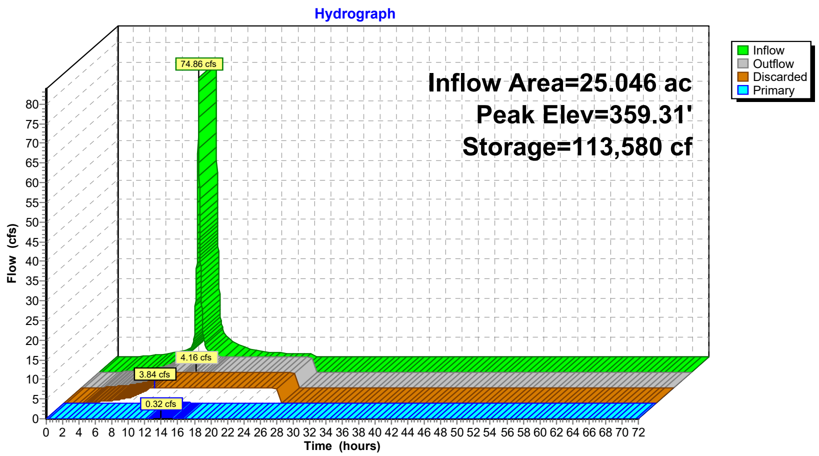
464,238.9 cf Field - 196,730.2 cf Chambers = 267,508.6 cf of Stone x 40.0% Voids = 107,003.5 cf Stone Storage

Chamber Storage + Stone Storage = 303,733.7 cf = 6.973 af
Overall Storage Efficiency = 65.4%
Overall System Size = 441.82' x 155.67' x 6.75'

1,836 Chambers
17,194.0 cy Field
9,907.7 cy Stone



Pond INF S1: Infiltration System 1



Summary for Pond INF S2: Infiltration System 2

Inflow Area = 22.118 ac,100.00% Impervious, Inflow Depth = 2.00" for 2-year event
Inflow = 34.64 cfs @ 12.08 hrs, Volume= 3.692 af
Outflow = 2.22 cfs @ 9.82 hrs, Volume= 3.692 af, Atten= 94%, Lag= 0.0 min
Discarded = 2.22 cfs @ 9.82 hrs, Volume= 3.692 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 359.48' @ 13.07 hrs Surf.Area= 39,719 sf Storage= 71,303 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 229.8 min (974.9 - 745.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	357.00'	62,087 cf	**137.50'W x 288.87'L x 6.75'H Field A** 268,104 cf Overall - 112,886 cf Embedded = 155,218 cf x 40.0% Voids
#2A	357.75'	112,886 cf	**ADS_StormTech MC-4500 +Cap** x 1050 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 1050 Chambers in 15 Rows Cap Storage= +35.7 cf x 2 x 15 rows = 1,071.0 cf
		174,973 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	357.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=2.22 cfs @ 9.82 hrs HW=357.07' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 2.22 cfs)

Pond INF S2: Infiltration System 2 - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 15 rows = 1,071.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

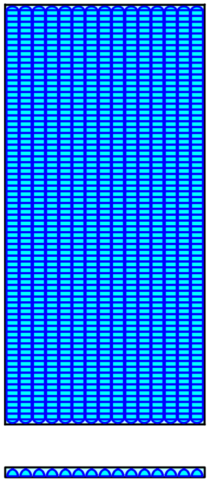
70 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 286.87' Row Length +12.0" End Stone x 2 = 288.87' Base Length
15 Rows x 100.0" Wide + 9.0" Spacing x 14 + 12.0" Side Stone x 2 = 137.50' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

1,050 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 15 Rows = 112,886.0 cf Chamber Storage

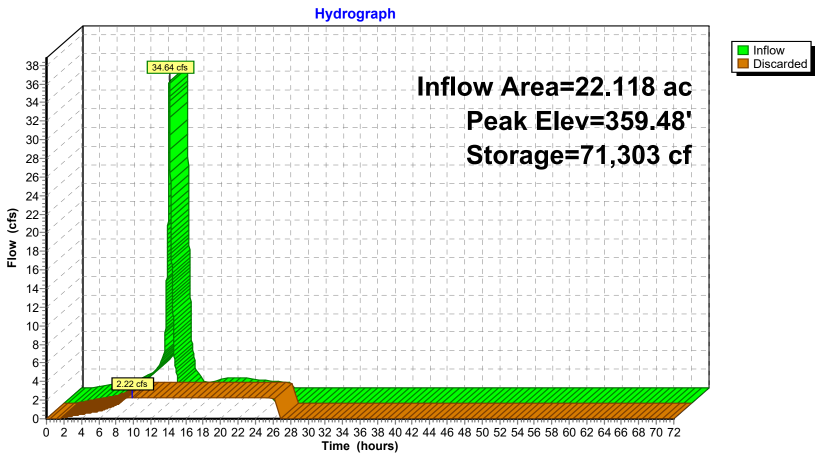
268,104.4 cf Field - 112,886.0 cf Chambers = 155,218.4 cf Stone x 40.0% Voids = 62,087.4 cf Stone Storage

Chamber Storage + Stone Storage = 174,973.3 cf = 4.017 af
Overall Storage Efficiency = 65.3%
Overall System Size = 288.87' x 137.50' x 6.75'

1,050 Chambers
9,929.8 cy Field
5,748.8 cy Stone



Pond INF S2: Infiltration System 2



Summary for Pond INF S3: Infiltration System 3

Inflow Area = 1.884 ac,100.00% Impervious, Inflow Depth = 2.84" for 2-year event
Inflow = 4.84 cfs @ 12.08 hrs, Volume= 0.446 af
Outflow = 0.32 cfs @ 11.18 hrs, Volume= 0.446 af, Atten= 93%, Lag= 0.0 min
Discarded = 0.32 cfs @ 11.18 hrs, Volume= 0.446 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 321.84' @ 13.85 hrs Surf.Area= 5,680 sf Storage= 8,154 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 206.0 min (963.3 - 757.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	319.75'	9,174 cf	**64.83'W x 87.62'L x 6.75'H Field A** 38,343 cf Overall - 15,408 cf Embedded = 22,935 cf x 40.0% Voids
#2A	320.50'	15,408 cf	**ADS_StormTech MC-4500 +Cap** x 140 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 140 Chambers in 7 Rows Cap Storage= +35.7 cf x 2 x 7 rows = 499.8 cf
		24,582 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	319.75'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.32 cfs @ 11.18 hrs HW=319.82' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.32 cfs)

Pond INF S3: Infiltration System 3 - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 7 rows = 499.8 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

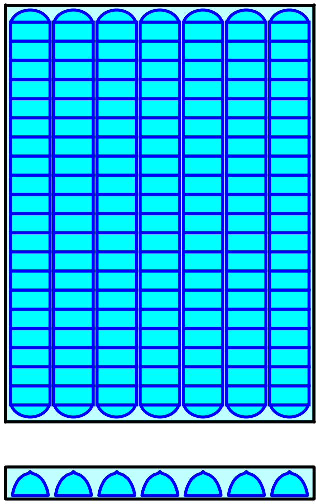
20 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 85.62' Row Length +12.0" End Stone x 2 = 87.62' Base Length
7 Rows x 100.0" Wide + 9.0" Spacing x 6 + 12.0" Side Stone x 2 = 64.83' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

140 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 7 Rows = 15,408.5 cf Chamber Storage

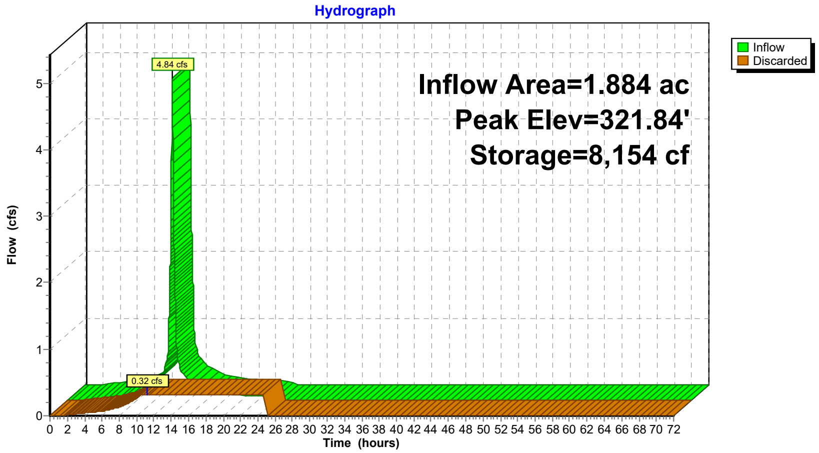
38,343.2 cf Field - 15,408.5 cf Chambers = 22,934.8 cf of Stone x 40.0% Voids = 9,173.9 cf of Stone Storage

Chamber Storage + Stone Storage = 24,582.4 cf = 0.564 af
Overall Storage Efficiency = 64.1%
Overall System Size = 87.62' x 64.83' x 6.75'

140 Chambers
1,420.1 cy Field
849.4 cy Stone



Pond INF S3: Infiltration System 3

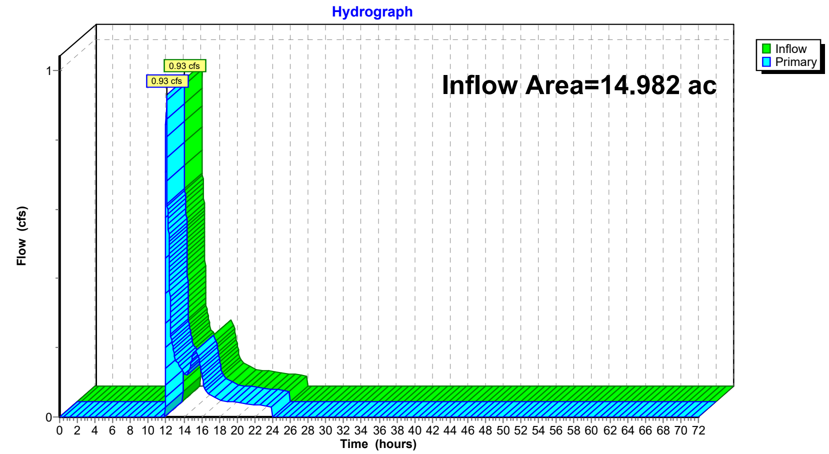


Summary for Link P.O.A. #1: P.O.A. #1

Inflow Area =	14.982 ac, 50.28% Impervious, Inflow Depth = 0.08" for 2-year event	
Inflow =	0.93 cfs @ 12.03 hrs, Volume=	0.102 af
Primary =	0.93 cfs @ 12.03 hrs, Volume=	0.102 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #1: P.O.A. #1

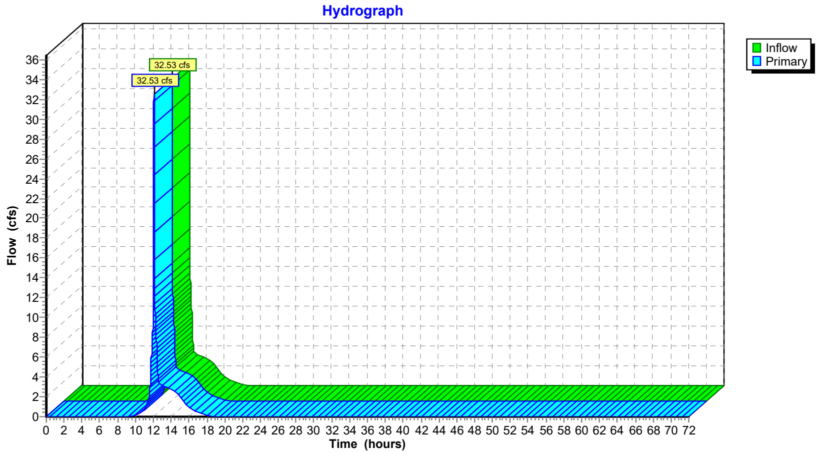


Summary for Link P.O.A. #2: P.O.A. #2

Inflow = 32.53 cfs @ 12.08 hrs, Volume= 1.649 af
Primary = 32.53 cfs @ 12.08 hrs, Volume= 1.649 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #2: P.O.A. #2

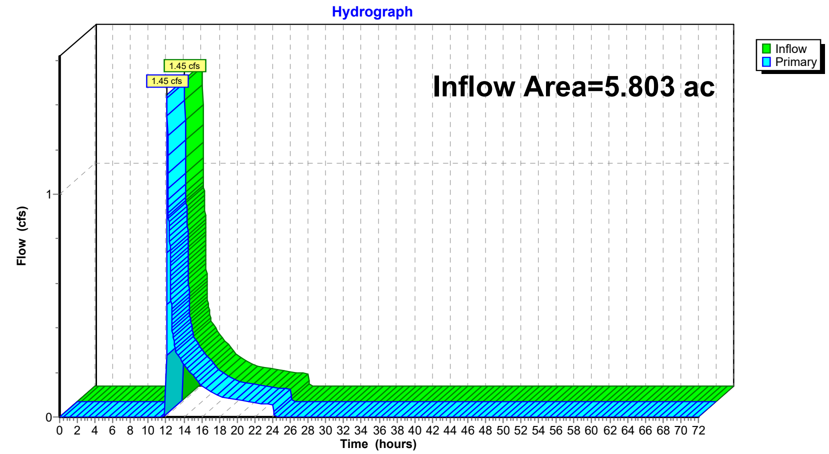


Summary for Link P.O.A. #4: P.O.A. #4

Inflow Area = 5.803 ac, 2.86% Impervious, Inflow Depth = 0.33" for 2-year event
Inflow = 1.45 cfs @ 12.12 hrs, Volume= 0.162 af
Primary = 1.45 cfs @ 12.12 hrs, Volume= 0.162 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #4: P.O.A. #4

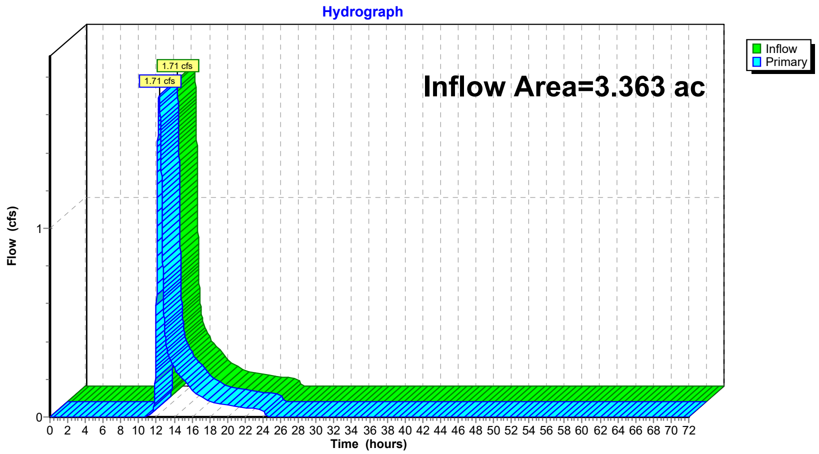


Summary for Link P.O.A. #6: P.O.A. #6

Inflow Area = 3.363 ac, 26.64% Impervious, Inflow Depth = 0.74" for 2-year event
Inflow = 1.71 cfs @ 12.30 hrs, Volume= 0.207 af
Primary = 1.71 cfs @ 12.30 hrs, Volume= 0.207 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #6: P.O.A. #6

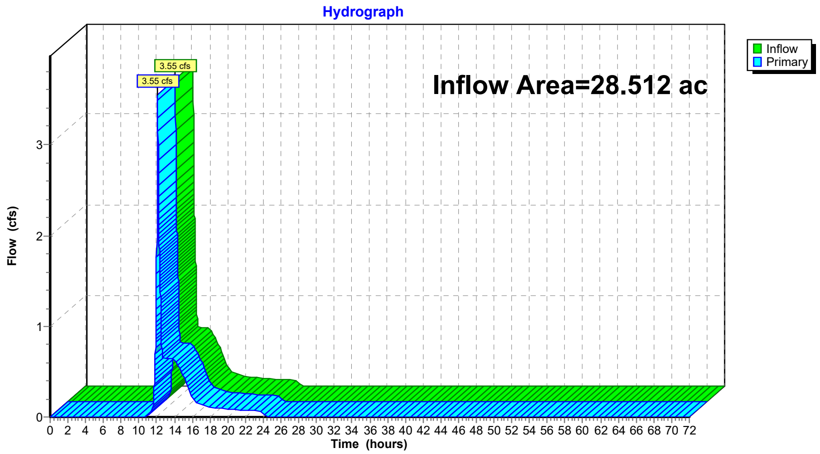


Summary for Link P.O.A.#3: P.O.A. #3

Inflow Area = 28.512 ac, 88.93% Impervious, Inflow Depth = 0.14" for 2-year event
Inflow = 3.55 cfs @ 12.10 hrs, Volume= 0.332 af
Primary = 3.55 cfs @ 12.10 hrs, Volume= 0.332 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A.#3: P.O.A. #3

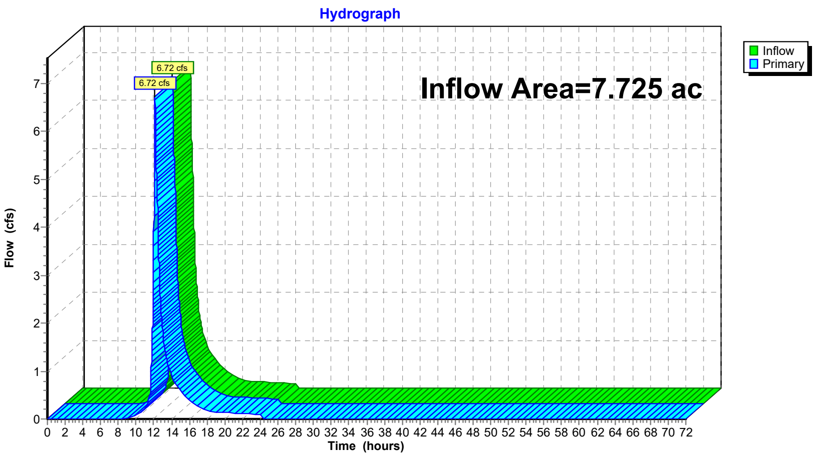


Summary for Link P.O.A.#5: P.O.A. #5

Inflow Area = 7.725 ac, 65.18% Impervious, Inflow Depth = 1.12" for 2-year event
Inflow = 6.72 cfs @ 12.11 hrs, Volume= 0.724 af
Primary = 6.72 cfs @ 12.11 hrs, Volume= 0.724 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A.#5: P.O.A. #5



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Subcatchment1S Runoff Area=116,630 sf 0.00% Impervious Runoff Depth=1.18"
Tc=0.0 min CN=61 Runoff=3.99 cfs 0.262 af

Subcatchment2S: Subcatchment2S Runoff Area=150,970 sf 31.43% Impervious Runoff Depth=2.02"
Tc=6.0 min CN=73 Runoff=8.14 cfs 0.585 af

Subcatchment3S: Subcatchment3S Runoff Area=963,480 sf 100.00% Impervious Runoff Depth=4.43"
Tc=6.0 min CN=98 Runoff=100.97 cfs 8.172 af

Subcatchment4S: Subcatchment4S Runoff Area=1,090,999 sf 96.88% Impervious Runoff Depth=4.32"
Flow Length=84' Tc=6.0 min CN=97 Runoff=113.43 cfs 9.013 af

Subcatchment5SA: Subcatchment5SA Runoff Area=136,848 sf 53.26% Impervious Runoff Depth=2.70"
Tc=6.0 min CN=81 Runoff=9.93 cfs 0.706 af

Subcatchment5SB: Subcatchment5SB Runoff Area=156,781 sf 75.89% Impervious Runoff Depth=3.46"
Tc=6.0 min CN=89 Runoff=14.23 cfs 1.037 af

Subcatchment5SC: Subcatchment5SC Runoff Area=42,867 sf 64.05% Impervious Runoff Depth=3.06"
Tc=6.0 min CN=85 Runoff=3.51 cfs 0.251 af

Subcatchment6SA: Subcatchment6SA Runoff Area=128,221 sf 25.22% Impervious Runoff Depth=1.80"
Flow Length=352' Tc=12.6 min CN=70 Runoff=4.85 cfs 0.440 af

Subcatchment6SB: Subcatchment6SB Runoff Area=18,252 sf 36.60% Impervious Runoff Depth=2.10"
Tc=6.0 min CN=74 Runoff=1.03 cfs 0.073 af

Subcatchment7S: Subcatchment7S Runoff Area=82,071 sf 100.00% Impervious Runoff Depth=4.43"
Tc=6.0 min CN=98 Runoff=8.60 cfs 0.696 af

Subcatchment8S: Subcatchment8S Runoff Area=51,944 sf 37.70% Impervious Runoff Depth=2.18"
Tc=6.0 min CN=75 Runoff=3.04 cfs 0.217 af

Subcatchment9S: Subcatchment9S Runoff Area=484,041 sf 63.75% Impervious Runoff Depth=3.06"
Tc=6.0 min CN=85 Runoff=39.64 cfs 2.838 af

Subcatchment10S: Subcatchment10S Runoff Area=252,780 sf 2.86% Impervious Runoff Depth=0.99"
Flow Length=1,206' Tc=7.4 min CN=58 Runoff=5.32 cfs 0.480 af

Pond 4P: (new Pond) Peak Elev=365.17' Inflow=100.97 cfs 8.172 af
Primary=36.81 cfs 4.372 af Secondary=64.22 cfs 3.800 af Outflow=100.97 cfs 8.172 af

Pond 11P: (new Pond) Peak Elev=323.85' Inflow=8.60 cfs 0.696 af
Primary=5.80 cfs 0.537 af Secondary=2.81 cfs 0.159 af Outflow=8.60 cfs 0.696 af

Pond INF B2/3: Infiltration Basin 2/3 Peak Elev=371.66' Storage=52,773 cf Inflow=39.64 cfs 2.838 af
Discarded=1.01 cfs 1.802 af Primary=10.91 cfs 1.036 af Outflow=11.92 cfs 2.838 af

Pond INF B4: Infiltration Basin 4 Peak Elev=350.51' Storage=4,959 cf Inflow=3.04 cfs 0.217 af
Discarded=0.17 cfs 0.217 af Primary=0.00 cfs 0.000 af Outflow=0.17 cfs 0.217 af

Pond INF B5: Infiltration Basin 5 Peak Elev=333.77' Storage=2,619 cf Inflow=4.85 cfs 0.440 af
Discarded=0.10 cfs 0.029 af Primary=2.62 cfs 0.412 af Secondary=0.00 cfs 0.000 af Outflow=2.72 cfs 0.440 af

Pond INF B6: Infiltration Basin 6 Peak Elev=374.71' Storage=15,946 cf Inflow=14.23 cfs 1.037 af
Discarded=0.37 cfs 0.465 af Primary=5.75 cfs 0.572 af Secondary=0.00 cfs 0.000 af Outflow=6.11 cfs 1.037 af

Pond INF B7: Infiltration Basin 7 Peak Elev=370.94' Storage=6,639 cf Inflow=13.18 cfs 1.278 af
Primary=7.02 cfs 1.278 af Secondary=0.00 cfs 0.000 af Outflow=7.02 cfs 1.278 af

Pond INF S1: Infiltration System 1 Peak Elev=360.31' Storage=169,997 cf Inflow=113.43 cfs 9.013 af
Discarded=3.84 cfs 7.013 af Primary=10.02 cfs 2.000 af Outflow=13.85 cfs 9.013 af

Pond INF S2: Infiltration System 2 Peak Elev=360.49' Storage=103,413 cf Inflow=36.81 cfs 4.372 af
Outflow=2.22 cfs 4.373 af

Pond INF S3: Infiltration System 3 Peak Elev=322.39' Storage=10,733 cf Inflow=5.80 cfs 0.537 af
Outflow=0.32 cfs 0.537 af

Link P.O.A. #1: P.O.A. #1 Inflow=11.94 cfs 1.298 af
Primary=11.94 cfs 1.298 af

Link P.O.A. #2: P.O.A. #2 Inflow=64.22 cfs 3.800 af
Primary=64.22 cfs 3.800 af

Link P.O.A. #4: P.O.A. #4 Inflow=7.92 cfs 0.639 af
Primary=7.92 cfs 0.639 af

Link P.O.A. #6: P.O.A. #6 Inflow=3.01 cfs 0.485 af
Primary=3.01 cfs 0.485 af

Link P.O.A.#3: P.O.A. #3 Inflow=11.58 cfs 2.585 af
Primary=11.58 cfs 2.585 af

Link P.O.A.#5: P.O.A. #5 Inflow=9.68 cfs 1.529 af
Primary=9.68 cfs 1.529 af

Total Runoff Area = 84.387 ac Runoff Volume = 24.771 af Average Runoff Depth = 3.52"
25.36% Pervious = 21.400 ac 74.64% Impervious = 62.987 ac

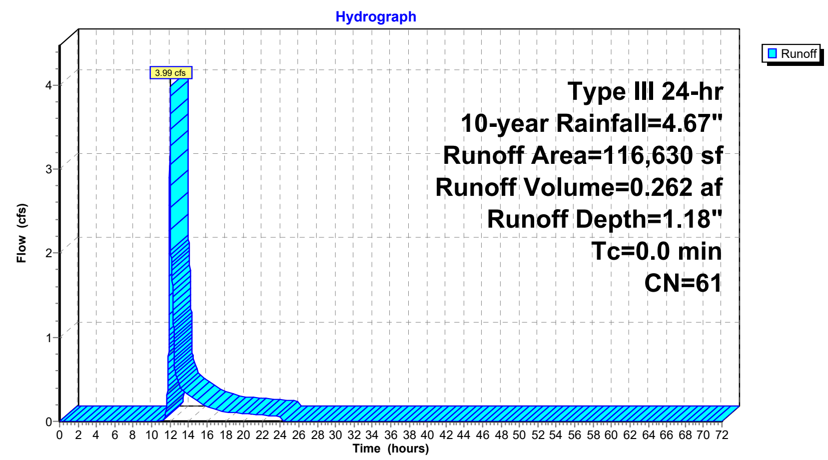
Summary for Subcatchment 1S: Subcatchment 1S

Runoff = 3.99 cfs @ 12.00 hrs, Volume= 0.262 af, Depth= 1.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

Area (sf)	CN	Description
116,630	61	>75% Grass cover, Good, HSG B
116,630		100.00% Pervious Area

Subcatchment 1S: Subcatchment 1S



Summary for Subcatchment 2S: Subcatchment 2S

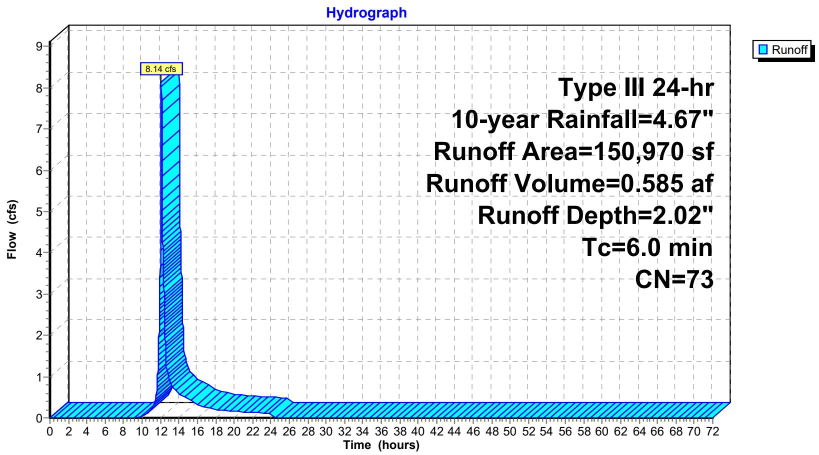
Runoff = 8.14 cfs @ 12.09 hrs, Volume= 0.585 af, Depth= 2.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
*	47,452	98	Impervious
	103,518	61	>75% Grass cover, Good, HSG B
	150,970	73	Weighted Average
	103,518		68.57% Pervious Area
	47,452		31.43% Impervious Area

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

Subcatchment 2S: Subcatchment 2S



Summary for Subcatchment 3S: Subcatchment 3S

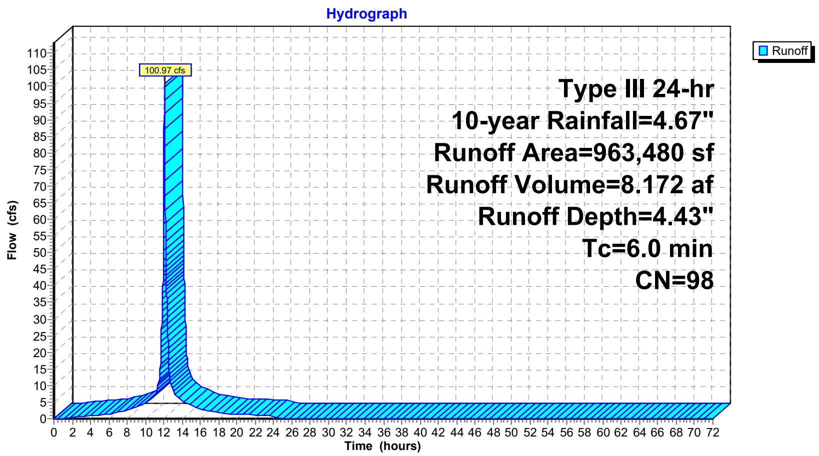
Runoff = 100.97 cfs @ 12.08 hrs, Volume= 8.172 af, Depth= 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
*	963,480	98	Impervious
	963,480		100.00% Impervious Area

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

Subcatchment 3S: Subcatchment 3S



Summary for Subcatchment 4S: Subcatchment 4S

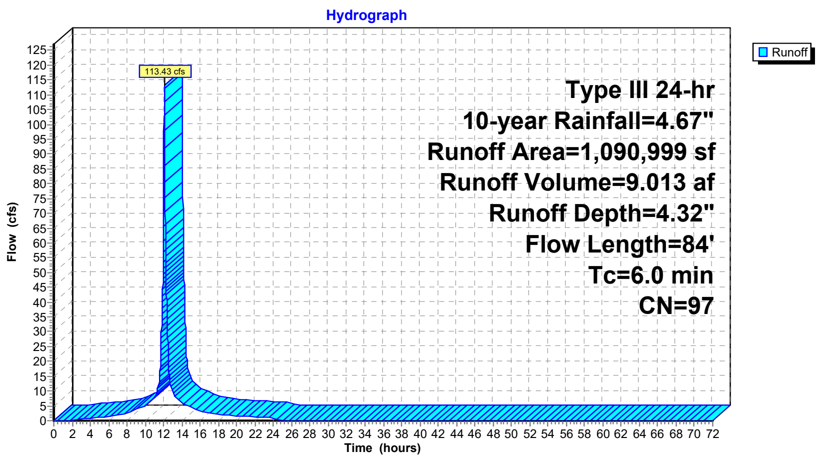
Runoff = 113.43 cfs @ 12.08 hrs, Volume= 9.013 af, Depth= 4.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
	34,012	61	>75% Grass cover, Good, HSG B
*	1,056,987	98	Impervious
	1,090,999	97	Weighted Average
	34,012		3.12% Pervious Area
	1,056,987		96.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.1200	0.21		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.1	34	0.3200	8.49		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
1.9					**Direct Entry,**
6.0	84	Total			

Subcatchment 4S: Subcatchment 4S



Summary for Subcatchment 5SA: Subcatchment 5SA

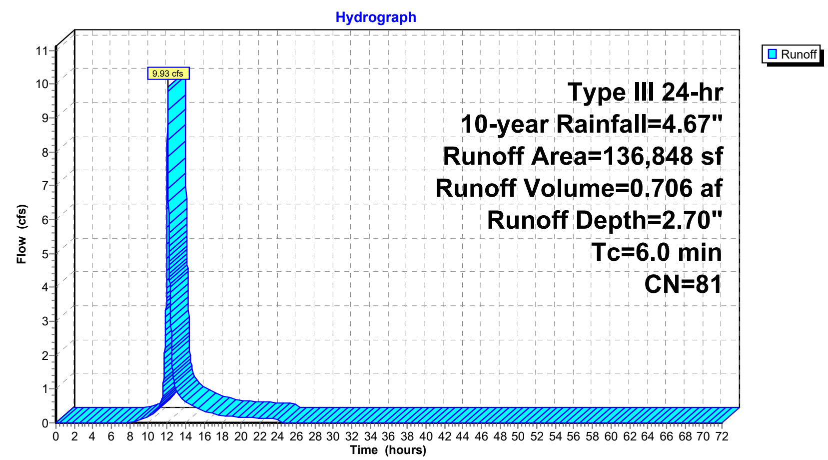
Runoff = 9.93 cfs @ 12.09 hrs, Volume= 0.706 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
*	72,885	98	Impervious
	63,963	61	>75% Grass cover, Good, HSG B
	136,848	81	Weighted Average
	63,963		46.74% Pervious Area
	72,885		53.26% Impervious Area

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

Subcatchment 5SA: Subcatchment 5SA



Summary for Subcatchment 5SB: Subcatchment 5SB

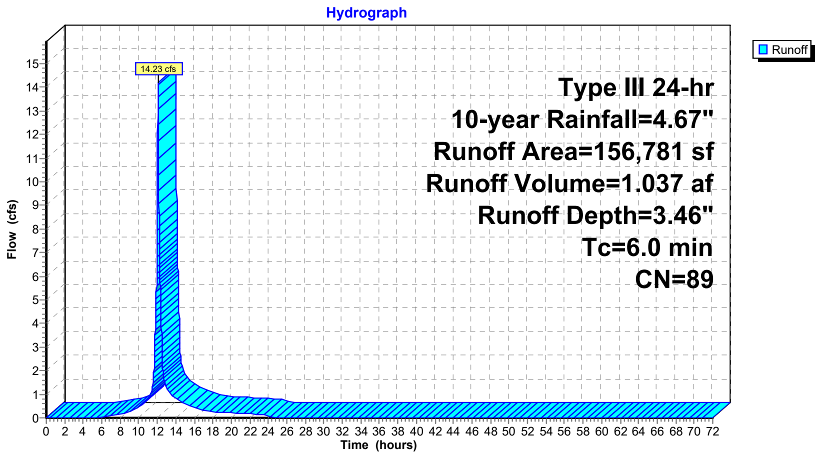
Runoff = 14.23 cfs @ 12.09 hrs, Volume= 1.037 af, Depth= 3.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
*	118,983	98	Impervious
	37,798	61	>75% Grass cover, Good, HSG B
	156,781	89	Weighted Average
	37,798		24.11% Pervious Area
	118,983		75.89% Impervious Area

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

Subcatchment 5SB: Subcatchment 5SB



Summary for Subcatchment 5SC: Subcatchment 5SC

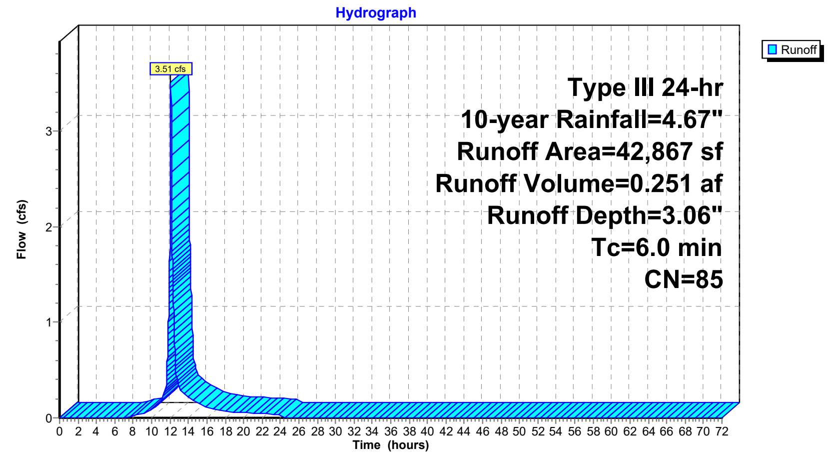
Runoff = 3.51 cfs @ 12.09 hrs, Volume= 0.251 af, Depth= 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
*	27,458	98	Impervious
	15,409	61	>75% Grass cover, Good, HSG B
	42,867	85	Weighted Average
	15,409		35.95% Pervious Area
	27,458		64.05% Impervious Area

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

Subcatchment 5SC: Subcatchment 5SC



Summary for Subcatchment 6SA: Subcatchment 6SA

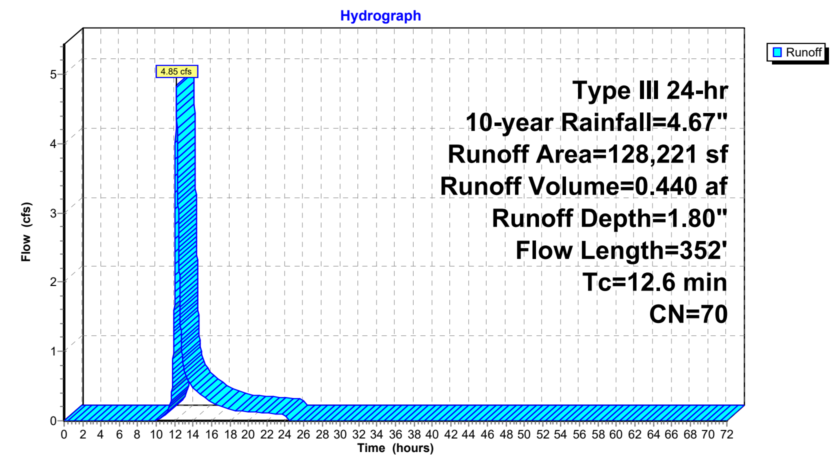
Runoff = 4.85 cfs @ 12.18 hrs, Volume= 0.440 af, Depth= 1.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
*	32,335	98	Impervious
	79,319	61	>75% Grass cover, Good, HSG B
	16,567	55	Woods, Good, HSG B
	128,221	70	Weighted Average
	95,886		74.78% Pervious Area
	32,335		25.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	7	0.0400	0.09		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
8.4	43	0.0400	0.09		**Sheet Flow, B-C** Woods: Light underbrush n= 0.400 P2= 3.13"
2.4	177	0.0620	1.24		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
0.2	49	0.3300	4.02		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
0.3	76	0.0588	4.92		**Shallow Concentrated Flow, E-F** Paved Kv= 20.3 fps
12.6	352	Total			

Subcatchment 6SA: Subcatchment 6SA



Summary for Subcatchment 6SB: Subcatchment 6SB

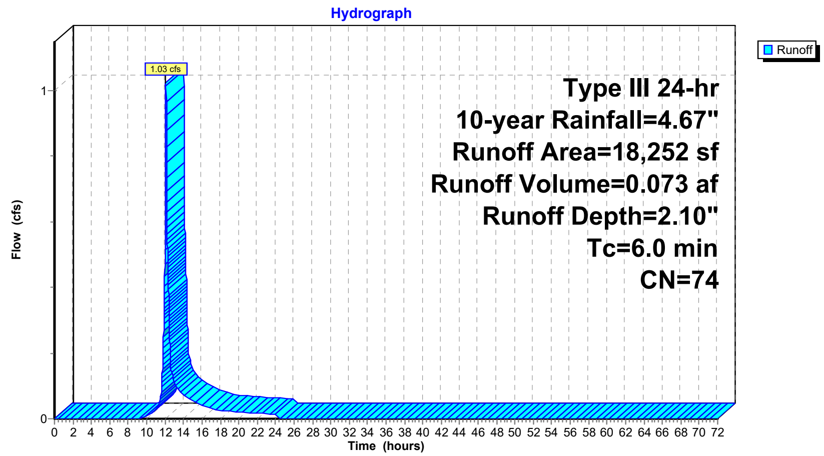
Runoff = 1.03 cfs @ 12.09 hrs, Volume= 0.073 af, Depth= 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
*	6,681	98	Impervious
	10,466	61	>75% Grass cover, Good, HSG B
	1,105	55	Woods, Good, HSG B
	18,252	74	Weighted Average
	11,571		63.40% Pervious Area
	6,681		36.60% Impervious Area

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

Subcatchment 6SB: Subcatchment 6SB



Summary for Subcatchment 7S: Subcatchment 7S

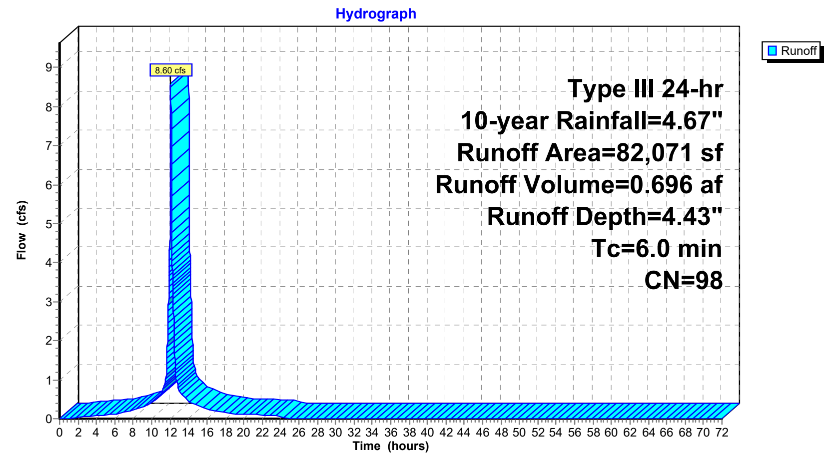
Runoff = 8.60 cfs @ 12.08 hrs, Volume= 0.696 af, Depth= 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
*	82,071	98	Impervious
	82,071		100.00% Impervious Area

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

Subcatchment 7S: Subcatchment 7S



Summary for Subcatchment 8S: Subcatchment 8S

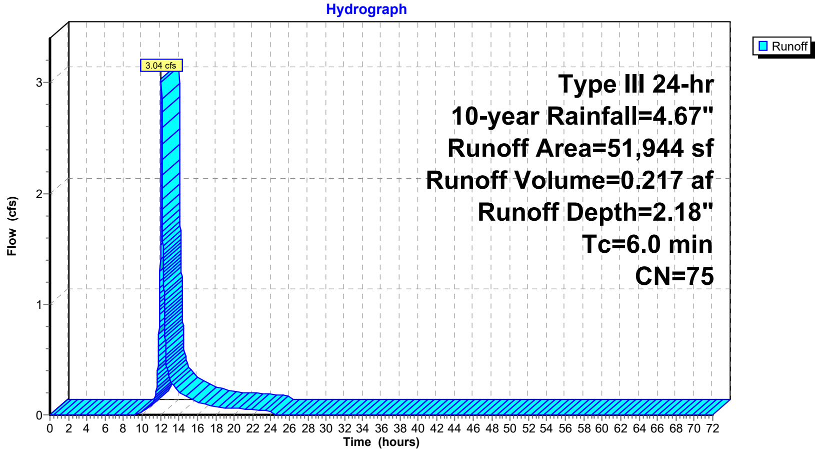
Runoff = 3.04 cfs @ 12.09 hrs, Volume= 0.217 af, Depth= 2.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
*	19,582	98	Impervious
	32,362	61	>75% Grass cover, Good, HSG B
	51,944	75	Weighted Average
	32,362		62.30% Pervious Area
	19,582		37.70% Impervious Area

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

Subcatchment 8S: Subcatchment 8S



Summary for Subcatchment 9S: Subcatchment 9S

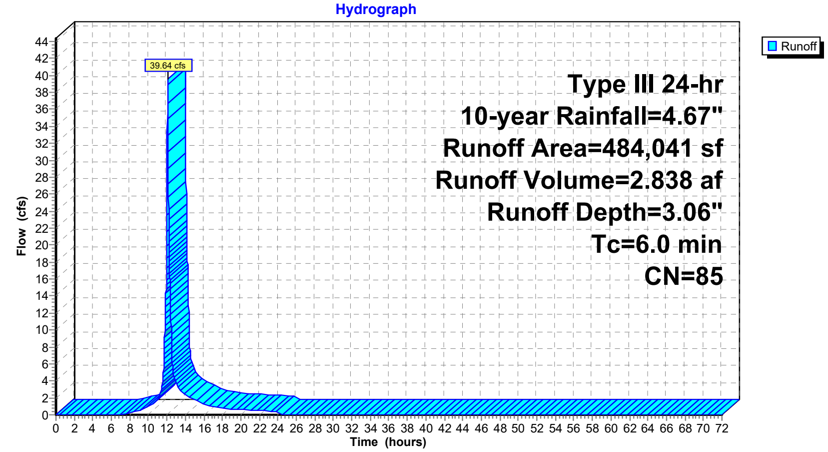
Runoff = 39.64 cfs @ 12.09 hrs, Volume= 2.838 af, Depth= 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

	Area (sf)	CN	Description
*	308,574	98	Impervious
	175,467	61	>75% Grass cover, Good, HSG B
	484,041	85	Weighted Average
	175,467		36.25% Pervious Area
	308,574		63.75% Impervious Area

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

Subcatchment 9S: Subcatchment 9S



Summary for Subcatchment 10S: Subcatchment 10S

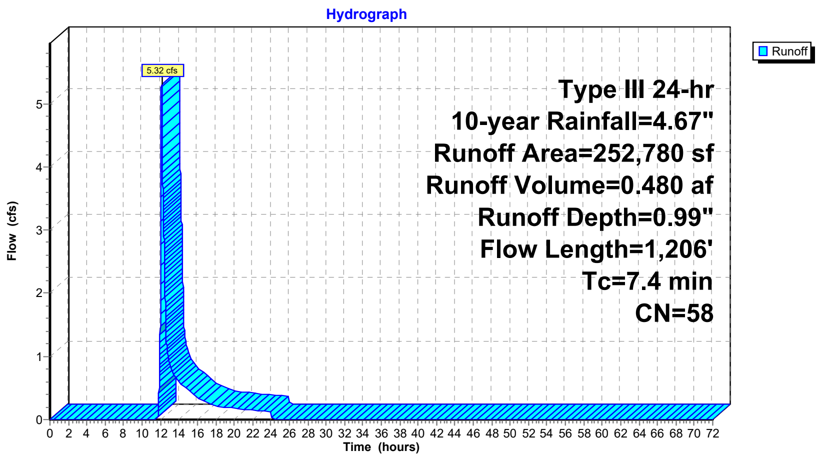
Runoff = 5.32 cfs @ 12.12 hrs, Volume= 0.480 af, Depth= 0.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.67"

Area (sf)	CN	Description
79,107	61	>75% Grass cover, Good, HSG B
7,233	98	Water Surface, HSG A
166,440	55	Woods, Good, HSG B
252,780	58	Weighted Average
245,547		97.14% Pervious Area
7,233		2.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	50	0.1200	2.43		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.13"
0.7	216	0.0694	5.35		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
3.1	537	0.0370	2.89		**Shallow Concentrated Flow, C-D** Grassed Waterway Kv= 15.0 fps
3.3	403	0.1700	2.06		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
7.4	1,206	Total			

Subcatchment 10S: Subcatchment 10S



Summary for Pond 4P: (new Pond)

Inflow Area = 22.118 ac,100.00% Impervious, Inflow Depth = 4.43" for 10-year event
Inflow = 100.97 cfs @ 12.08 hrs, Volume= 8.172 af
Outflow = 100.97 cfs @ 12.08 hrs, Volume= 8.172 af, Atten= 0%, Lag= 0.0 min
Primary = 36.81 cfs @ 12.07 hrs, Volume= 4.372 af
Secondary = 64.22 cfs @ 12.08 hrs, Volume= 3.800 af

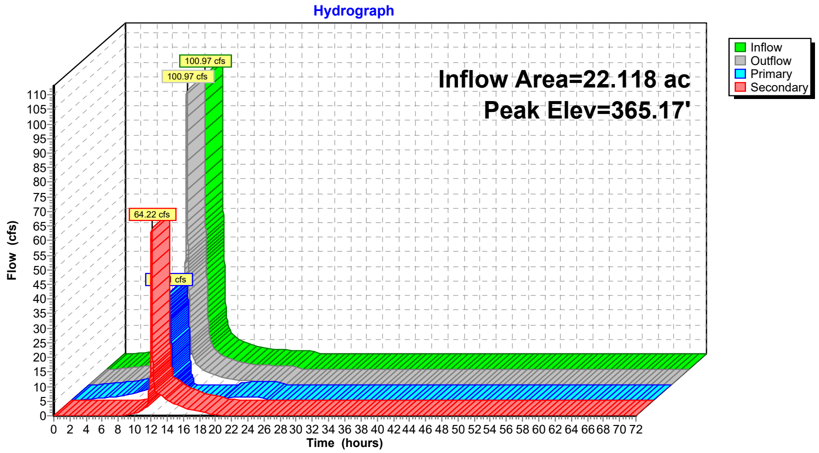
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 365.17' @ 12.08 hrs

Device	Routing	Invert	Outlet Devices
#1	Secondary	358.75'	**48.0" Round Culvert** L= 125.0' Ke= 0.500 Inlet / Outlet Invert= 358.75' / 348.75' S= 0.0800 '/' Cc= 0.900 n= 0.010, Flow Area= 12.57 sf
#2	Device 1	358.60'	**7.0" Vert. Orifice/Grate X 3.00** C= 0.600
#3	Device 1	359.50'	**8.0" Vert. Orifice/Grate X 2.00** C= 0.600
#4	Device 1	363.15'	**5.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)
#5	Primary	357.92'	**24.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 357.92' / 357.92' S= 0.0000 '/' Cc= 0.900 n= 0.010, Flow Area= 3.14 sf

Primary OutFlow Max=36.67 cfs @ 12.07 hrs HW=365.14' TW=359.27' (Dynamic Tailwater)
└5=Culvert (Inlet Controls 36.67 cfs @ 11.67 fps)

Secondary OutFlow Max=64.05 cfs @ 12.08 hrs HW=365.16' TW=0.00' (Dynamic Tailwater)
└1=Culvert (Passes 64.05 cfs of 127.08 cfs potential flow)
 ├2=Orifice/Grate (Orifice Controls 9.67 cfs @ 12.06 fps)
 ├3=Orifice/Grate (Orifice Controls 7.76 cfs @ 11.11 fps)
 └4=Sharp-Crested Rectangular Weir (Weir Controls 46.62 cfs @ 4.64 fps)

Pond 4P: (new Pond)



Summary for Pond 11P: (new Pond)

Inflow Area = 1.884 ac,100.00% Impervious, Inflow Depth = 4.43" for 10-year event
Inflow = 8.60 cfs @ 12.08 hrs, Volume= 0.696 af
Outflow = 8.60 cfs @ 12.08 hrs, Volume= 0.696 af, Atten= 0%, Lag= 0.0 min
Primary = 5.80 cfs @ 12.08 hrs, Volume= 0.537 af
Secondary = 2.81 cfs @ 12.09 hrs, Volume= 0.159 af

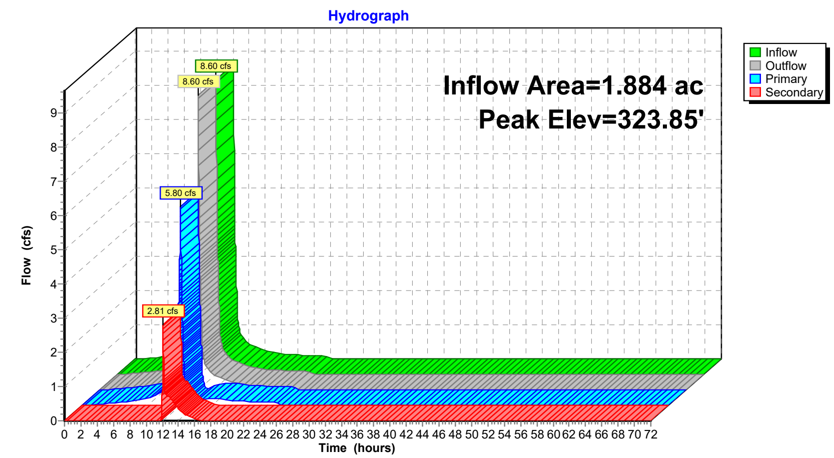
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 323.85' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Secondary	321.80'	**15.0" Round Culvert** L= 125.0' Ke= 0.500 Inlet / Outlet Invert= 321.80' / 321.00' S= 0.0064 '/' Cc= 0.900 n= 0.010, Flow Area= 1.23 sf
#2	Device 1	321.80'	**7.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	322.60'	**6.5" Vert. Orifice/Grate** C= 0.600
#4	Device 1	326.00'	**5.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)
#5	Primary	319.92'	**12.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 319.92' / 319.92' S= 0.0000 '/' Cc= 0.900 n= 0.010, Flow Area= 0.79 sf

Primary OutFlow Max=5.75 cfs @ 12.08 hrs HW=323.84' TW=321.53' (Dynamic Tailwater)
└5=**Culvert** (Inlet Controls 5.75 cfs @ 7.32 fps)

Secondary OutFlow Max=2.80 cfs @ 12.09 hrs HW=323.85' TW=0.00' (Dynamic Tailwater)
└1=**Culvert** (Passes 2.80 cfs of 6.93 cfs potential flow)
  ├2=**Orifice/Grate** (Orifice Controls 1.71 cfs @ 6.38 fps)
  ├3=**Orifice/Grate** (Orifice Controls 1.10 cfs @ 4.76 fps)
  └4=**Sharp-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond 11P: (new Pond)



Summary for Pond INF B2/3: Infiltration Basin 2/3

Inflow Area = 11.112 ac, 63.75% Impervious, Inflow Depth = 3.06" for 10-year event
Inflow = 39.64 cfs @ 12.09 hrs, Volume= 2.838 af
Outflow = 11.92 cfs @ 12.42 hrs, Volume= 2.838 af, Atten= 70%, Lag= 20.1 min
Discarded = 1.01 cfs @ 12.42 hrs, Volume= 1.802 af
Primary = 10.91 cfs @ 12.42 hrs, Volume= 1.036 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 371.66' @ 12.42 hrs Surf.Area= 18,076 sf Storage= 52,773 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 362.0 min (1,172.2 - 810.2)

Volume	Invert	Avail.Storage	Storage Description
#1	369.00'	26,782 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	367.00'	65,194 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		91,976 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
369.00	2,109	0	0
370.00	2,783	2,446	2,446
371.00	3,528	3,156	5,602
372.00	4,348	3,938	9,540
373.00	5,244	4,796	14,336
374.00	6,207	5,726	20,061
375.00	7,234	6,721	26,782

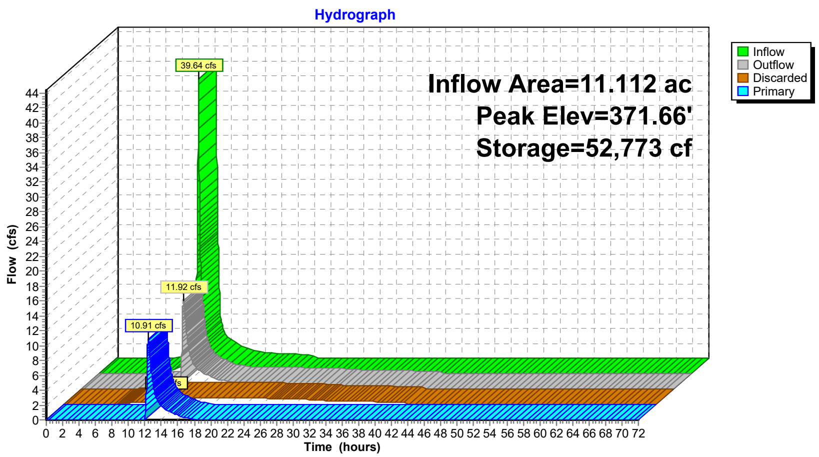
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
367.00	5,459	0	0
368.00	7,106	6,283	6,283
369.00	8,886	7,996	14,279
370.00	10,741	9,814	24,092
371.00	12,672	11,707	35,799
372.00	14,679	13,676	49,474
373.00	16,761	15,720	65,194

Device	Routing	Invert	Outlet Devices
#1	Discarded	367.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	358.00'	**24.0" Round Culvert** L= 78.0' Ke= 0.500 Inlet / Outlet Invert= 358.00' / 353.00' S= 0.0641 '/' Cc= 0.900 n= 0.011, Flow Area= 3.14 sf
#3	Device 2	370.90'	**5.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)

Discarded OutFlow Max=1.01 cfs @ 12.42 hrs HW=371.66' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.01 cfs)

Primary OutFlow Max=10.91 cfs @ 12.42 hrs HW=371.66' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Passes 10.91 cfs of 53.83 cfs potential flow)
  └─**3=Sharp-Crested Rectangular Weir** (Weir Controls 10.91 cfs @ 2.86 fps)

Pond INF B2/3: Infiltration Basin 2/3



Summary for Pond INF B4: Infiltration Basin 4

Inflow Area =	1.192 ac, 37.70% Impervious, Inflow Depth = 2.18" for 10-year event			
Inflow =	3.04 cfs @	12.09 hrs, Volume=	0.217 af	
Outflow =	0.17 cfs @	14.90 hrs, Volume=	0.217 af,	Atten= 95%, Lag= 168.4 min
Discarded =	0.17 cfs @	14.90 hrs, Volume=	0.217 af	
Primary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 350.51' @ 14.90 hrs Surf.Area= 2,987 sf Storage= 4,959 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 360.7 min (1,198.9 - 838.2)

Volume	Invert	Avail.Storage	Storage Description
#1	348.00'	10,401 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

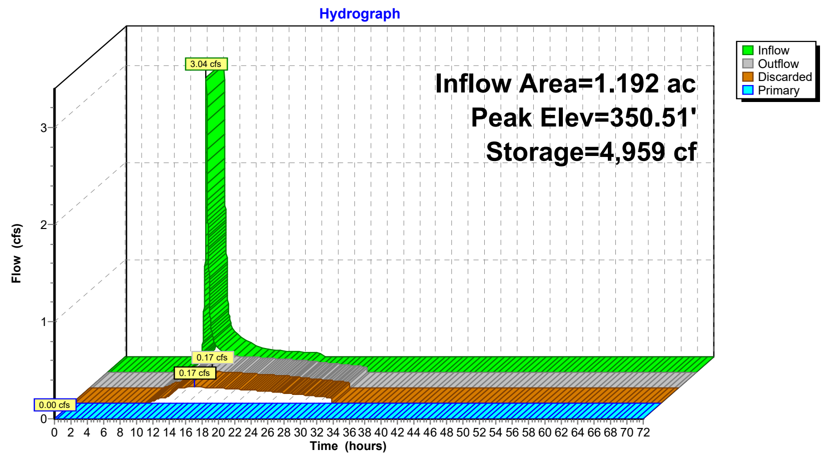
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
348.00	1,024	0	0
349.00	1,766	1,395	1,395
350.00	2,558	2,162	3,557
351.00	3,407	2,983	6,540
352.00	4,315	3,861	10,401

Device	Routing	Invert	Outlet Devices
#1	Discarded	348.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	350.60'	**10.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.17 cfs @ 14.90 hrs HW=350.51' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=348.00' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond INF B4: Infiltration Basin 4



Summary for Pond INF B5: Infiltration Basin 5

Inflow Area = 2.944 ac, 25.22% Impervious, Inflow Depth = 1.80" for 10-year event
Inflow = 4.85 cfs @ 12.18 hrs, Volume= 0.440 af
Outflow = 2.72 cfs @ 12.44 hrs, Volume= 0.440 af, Atten= 44%, Lag= 15.3 min
Discarded = 0.10 cfs @ 12.44 hrs, Volume= 0.029 af
Primary = 2.62 cfs @ 12.44 hrs, Volume= 0.412 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 333.77' @ 12.44 hrs Surf.Area= 1,724 sf Storage= 2,619 cf

Plug-Flow detention time= 8.7 min calculated for 0.440 af (100% of inflow)
Center-of-Mass det. time= 8.7 min (866.2 - 857.5)

Volume	Invert	Avail.Storage	Storage Description
#1	331.00'	7,829 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	3,331.00'	1,060 cf	**36.0" Round Pipe Storage**-Impervious L= 150.0'
		8,889 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
331.00	257	0	0
332.00	717	487	487
333.00	1,261	989	1,476
334.00	1,866	1,564	3,040
335.00	2,533	2,200	5,239
336.00	2,646	2,590	7,829

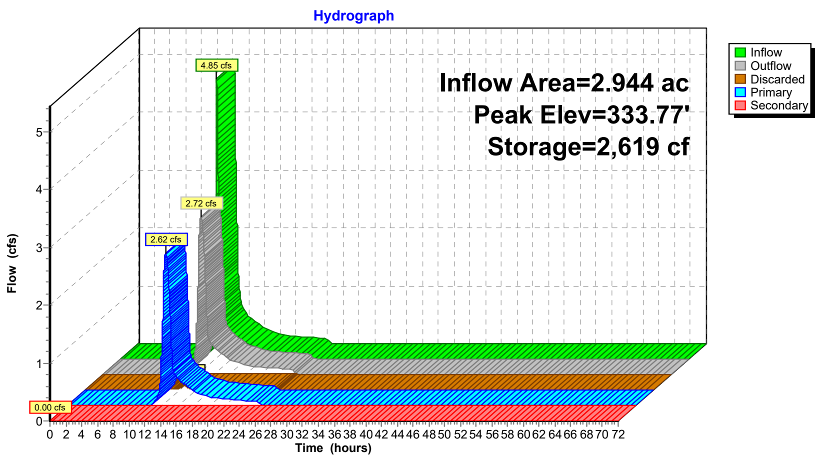
Device	Routing	Invert	Outlet Devices
#1	Discarded	331.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	331.00'	**12.0" Round Culvert** L= 25.0' Ke= 0.500 Inlet / Outlet Invert= 331.00' / 328.80' S= 0.0880 '/' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#3	Device 2	331.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	334.25'	**5.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)
#5	Secondary	330.00'	**12.0" Round Culvert** L= 25.0' Ke= 0.500 Inlet / Outlet Invert= 330.00' / 329.30' S= 0.0280 '/' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#6	Device 5	333.79'	**2.5" x 2.5" Horiz. Orifice/Grate X 72.00** C= 0.600 in 24.0" x 48.0" Grate (39% open area) Limited to weir flow at low heads

Discarded OutFlow Max=0.10 cfs @ 12.44 hrs HW=333.77' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.10 cfs)

Primary OutFlow Max=2.62 cfs @ 12.44 hrs HW=333.77' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Passes 2.62 cfs of 5.69 cfs potential flow)
  ├─**3=Orifice/Grate** (Orifice Controls 2.62 cfs @ 7.51 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=331.00' TW=0.00' (Dynamic Tailwater)
└─**5=Culvert** (Passes 0.00 cfs of 2.67 cfs potential flow)
  └─**6=Orifice/Grate** (Controls 0.00 cfs)

Pond INF B5: Infiltration Basin 5



Summary for Pond INF B6: Infiltration Basin 6

Inflow Area =	3.599 ac, 75.89% Impervious, Inflow Depth = 3.46" for 10-year event			
Inflow =	14.23 cfs @	12.09 hrs, Volume=	1.037 af	
Outflow =	6.11 cfs @	12.28 hrs, Volume=	1.037 af,	Atten= 57%, Lag= 11.9 min
Discarded =	0.37 cfs @	12.28 hrs, Volume=	0.465 af	
Primary =	5.75 cfs @	12.28 hrs, Volume=	0.572 af	
Secondary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 374.71' @ 12.28 hrs Surf.Area= 6,544 sf Storage= 15,946 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 166.9 min (963.7 - 796.8)

Volume	Invert	Avail.Storage	Storage Description
#1	371.00'	34,138 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)
371.00	2,226	339.0	0	0	2,226
372.00	3,291	365.0	2,741	2,741	3,725
373.00	4,432	391.0	3,847	6,589	5,334
374.00	5,648	416.0	5,028	11,616	6,989
375.00	6,927	436.0	6,277	17,893	8,410
376.00	8,267	456.0	7,587	25,480	9,899
377.00	9,054	397.0	8,658	34,138	13,926

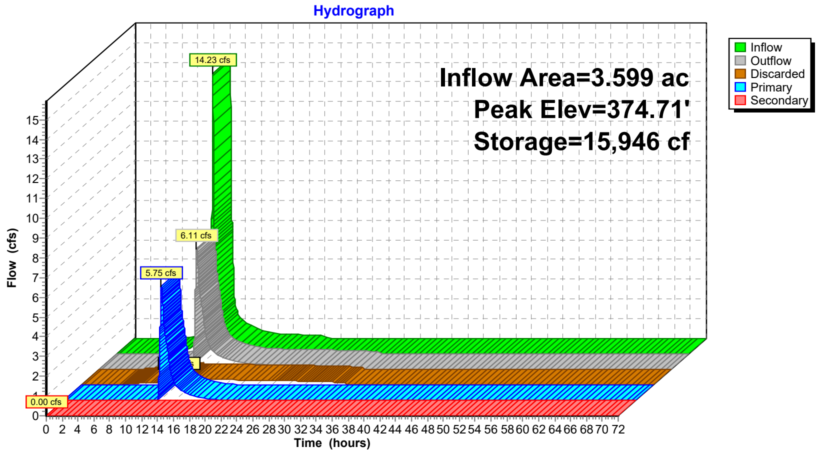
Device	Routing	Invert	Outlet Devices
#1	Discarded	371.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	372.00'	**24.0" Round Culvert** L= 182.0' Ke= 0.500 Inlet / Outlet Invert= 372.00' / 368.00' S= 0.0220 '/' Cc= 0.900 n= 0.010, Flow Area= 3.14 sf
#3	Device 2	373.00'	**12.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	374.50'	**5.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)
#5	Secondary	375.50'	**10.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.37 cfs @ 12.28 hrs HW=374.71' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.37 cfs)

Primary OutFlow Max=5.74 cfs @ 12.28 hrs HW=374.71' TW=370.78' (Dynamic Tailwater)
└─**2=Culvert** (Passes 5.74 cfs of 19.79 cfs potential flow)
  ├─**3=Orifice/Grate** (Orifice Controls 4.16 cfs @ 5.30 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Weir Controls 1.58 cfs @ 1.50 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=371.00' TW=0.00' (Dynamic Tailwater)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond INF B6: Infiltration Basin 6



Summary for Pond INF B7: Infiltration Basin 7

Inflow Area = 6.741 ac, 65.34% Impervious, Inflow Depth = 2.28" for 10-year event
Inflow = 13.18 cfs @ 12.10 hrs, Volume= 1.278 af
Outflow = 7.02 cfs @ 12.48 hrs, Volume= 1.278 af, Atten= 47%, Lag= 23.2 min
Primary = 7.02 cfs @ 12.48 hrs, Volume= 1.278 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 370.94' @ 12.48 hrs Surf.Area= 8,229 sf Storage= 6,639 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 5.5 min (816.0 - 810.4)

Volume	Invert	Avail.Storage	Storage Description
#1	368.00'	53,283 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

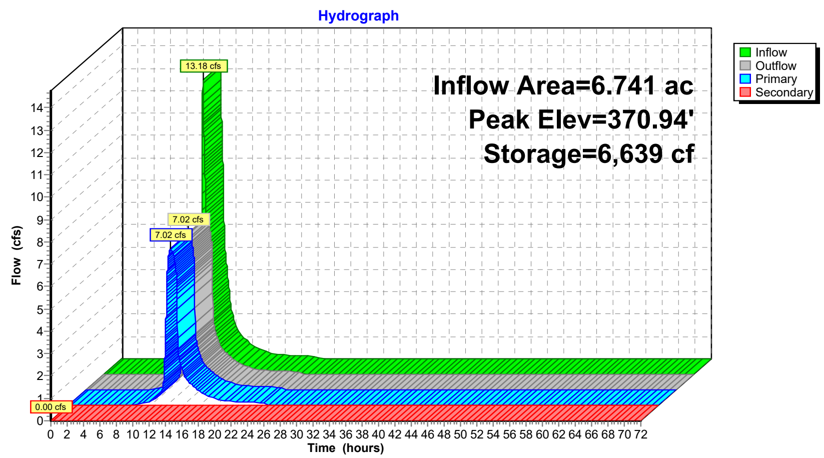
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
368.00	47	65.0	0	0	47
369.00	236	74.0	129	129	168
370.00	3,056	310.0	1,380	1,510	7,383
371.00	8,615	394.0	5,601	7,111	12,102
372.00	12,842	440.0	10,658	17,769	15,183
373.00	18,271	569.0	15,477	33,246	25,553
374.00	21,857	579.0	20,037	53,283	26,632

Device	Routing	Invert	Outlet Devices
#1	Primary	367.00'	**12.0" Round Culvert** L= 134.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 367.00' / 360.80' S= 0.0463 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Secondary	373.00'	**13.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=7.02 cfs @ 12.48 hrs HW=370.94' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 7.02 cfs @ 8.94 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=368.00' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond INF B7: Infiltration Basin 7



Summary for Pond INF S1: Infiltration System 1

Inflow Area = 25.046 ac, 96.88% Impervious, Inflow Depth = 4.32" for 10-year event
Inflow = 113.43 cfs @ 12.08 hrs, Volume= 9.013 af
Outflow = 13.85 cfs @ 12.64 hrs, Volume= 9.013 af, Atten= 88%, Lag= 33.5 min
Discarded = 3.84 cfs @ 9.89 hrs, Volume= 7.013 af
Primary = 10.02 cfs @ 12.64 hrs, Volume= 2.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 360.31' @ 12.64 hrs Surf.Area= 68,776 sf Storage= 169,997 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 237.6 min (994.8 - 757.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	357.00'	107,003 cf	**155.67'W x 441.82'L x 6.75'H Field A**
			464,239 cf Overall - 196,730 cf Embedded = 267,509 cf x 40.0% Voids
#2A	357.75'	196,730 cf	**ADS_StormTech MC-4500 +Cap** x 1836 Inside #1
			Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
			Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
			1836 Chambers in 17 Rows
			Cap Storage= +35.7 cf x 2 x 17 rows = 1,213.8 cf
		303,734 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	359.10'	**36.0" Round Culvert** L= 125.0' Ke= 0.500
			Inlet / Outlet Invert= 359.10' / 348.75' S= 0.0828 '/' Cc= 0.900
			n= 0.010, Flow Area= 7.07 sf
#2	Discarded	357.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=3.84 cfs @ 9.89 hrs HW=357.07' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 3.84 cfs)

Primary OutFlow Max=10.02 cfs @ 12.64 hrs HW=360.31' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 10.02 cfs @ 3.75 fps)

Pond INF S1: Infiltration System 1 - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 17 rows = 1,213.8 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

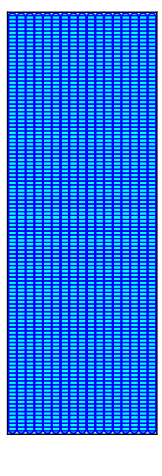
108 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 439.82' Row Length +12.0" End Stone x 2 = 441.82' Base Length
17 Rows x 100.0" Wide + 9.0" Spacing x 16 + 12.0" Side Stone x 2 = 155.67' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

1,836 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 17 Rows = 196,730.2 cf Chamber Storage

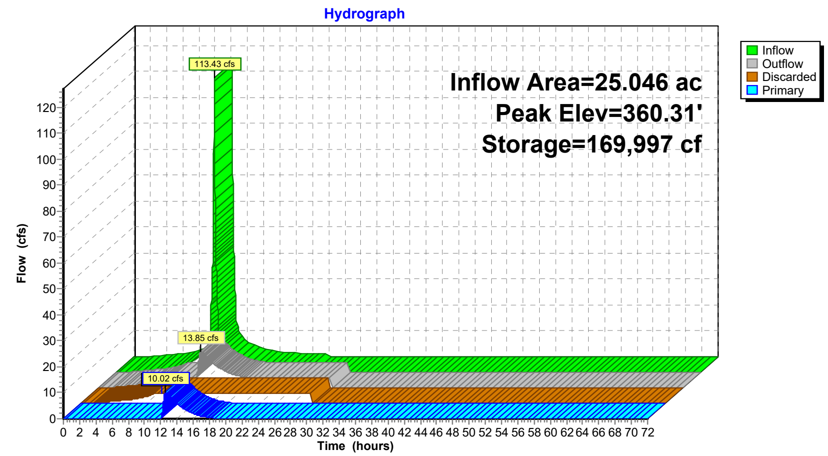
464,238.9 cf Field - 196,730.2 cf Chambers = 267,508.6 cf Stone x 40.0% Voids = 107,003.5 cf Stone Storage

Chamber Storage + Stone Storage = 303,733.7 cf = 6.973 af
Overall Storage Efficiency = 65.4%
Overall System Size = 441.82' x 155.67' x 6.75'

1,836 Chambers
17,194.0 cy Field
9,907.7 cy Stone



Pond INF S1: Infiltration System 1



Summary for Pond INF S2: Infiltration System 2

Inflow Area = 22.118 ac,100.00% Impervious, Inflow Depth = 2.37" for 10-year event
Inflow = 36.81 cfs @ 12.07 hrs, Volume= 4.372 af
Outflow = 2.22 cfs @ 8.57 hrs, Volume= 4.373 af, Atten= 94%, Lag= 0.0 min
Discarded = 2.22 cfs @ 8.57 hrs, Volume= 4.373 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 360.49' @ 12.85 hrs Surf.Area= 39,719 sf Storage= 103,413 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 291.8 min (988.2 - 696.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	357.00'	62,087 cf	**137.50'W x 288.87'L x 6.75'H Field A** 268,104 cf Overall - 112,886 cf Embedded = 155,218 cf x 40.0% Voids
#2A	357.75'	112,886 cf	**ADS_StormTech MC-4500 +Cap** x 1050 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 1050 Chambers in 15 Rows Cap Storage= +35.7 cf x 2 x 15 rows = 1,071.0 cf
		174,973 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	357.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=2.22 cfs @ 8.57 hrs HW=357.07' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 2.22 cfs)

Pond INF S2: Infiltration System 2 - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 15 rows = 1,071.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

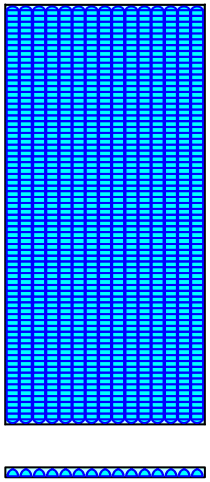
70 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 286.87' Row Length +12.0" End Stone x 2 = 288.87' Base Length
15 Rows x 100.0" Wide + 9.0" Spacing x 14 + 12.0" Side Stone x 2 = 137.50' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

1,050 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 15 Rows = 112,886.0 cf Chamber Storage

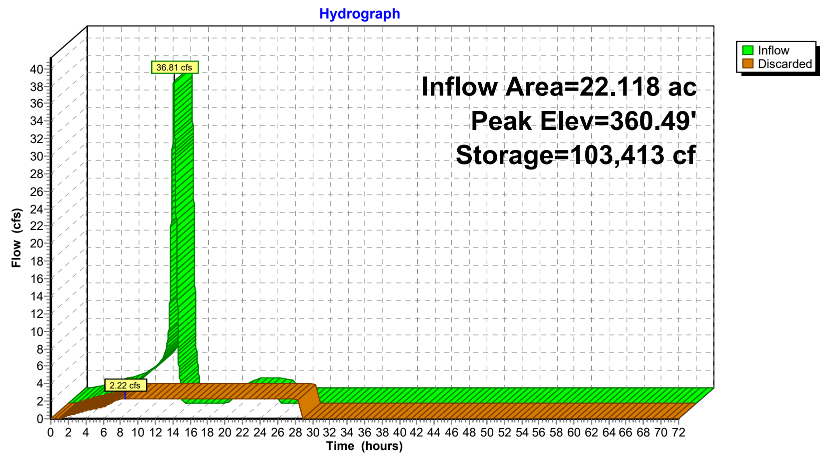
268,104.4 cf Field - 112,886.0 cf Chambers = 155,218.4 cf of Stone x 40.0% Voids = 62,087.4 cf Stone Storage

Chamber Storage + Stone Storage = 174,973.3 cf = 4.017 af
Overall Storage Efficiency = 65.3%
Overall System Size = 288.87' x 137.50' x 6.75'

1,050 Chambers
9,929.8 cy Field
5,748.8 cy Stone



Pond INF S2: Infiltration System 2



Summary for Pond INF S3: Infiltration System 3

Inflow Area = 1.884 ac,100.00% Impervious, Inflow Depth = 3.42" for 10-year event
Inflow = 5.80 cfs @ 12.08 hrs, Volume= 0.537 af
Outflow = 0.32 cfs @ 10.03 hrs, Volume= 0.537 af, Atten= 95%, Lag= 0.0 min
Discarded = 0.32 cfs @ 10.03 hrs, Volume= 0.537 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 322.39' @ 12.65 hrs Surf.Area= 5,680 sf Storage= 10,733 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 239.0 min (976.9 - 737.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	319.75'	9,174 cf	**64.83'W x 87.62'L x 6.75'H Field A** 38,343 cf Overall - 15,408 cf Embedded = 22,935 cf x 40.0% Voids
#2A	320.50'	15,408 cf	**ADS_StormTech MC-4500 +Cap** x 140 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 140 Chambers in 7 Rows Cap Storage= +35.7 cf x 2 x 7 rows = 499.8 cf
		24,582 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	319.75'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.32 cfs @ 10.03 hrs HW=319.82' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.32 cfs)

Pond INF S3: Infiltration System 3 - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 7 rows = 499.8 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

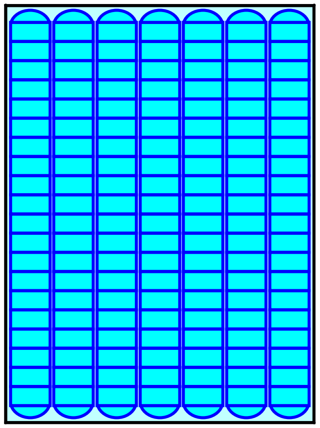
20 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 85.62' Row Length +12.0" End Stone x 2 = 87.62' Base Length
7 Rows x 100.0" Wide + 9.0" Spacing x 6 + 12.0" Side Stone x 2 = 64.83' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

140 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 7 Rows = 15,408.5 cf Chamber Storage

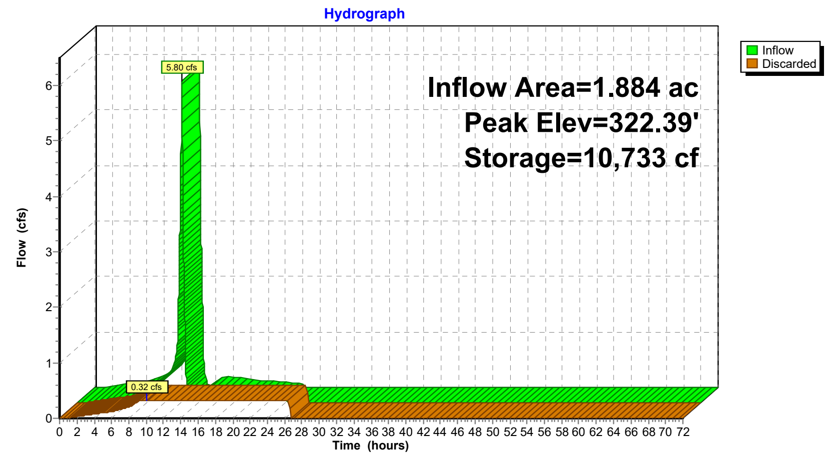
38,343.2 cf Field - 15,408.5 cf Chambers = 22,934.8 cf of Stone x 40.0% Voids = 9,173.9 cf Stone Storage

Chamber Storage + Stone Storage = 24,582.4 cf = 0.564 af
Overall Storage Efficiency = 64.1%
Overall System Size = 87.62' x 64.83' x 6.75'

140 Chambers
1,420.1 cy Field
849.4 cy Stone



Pond INF S3: Infiltration System 3

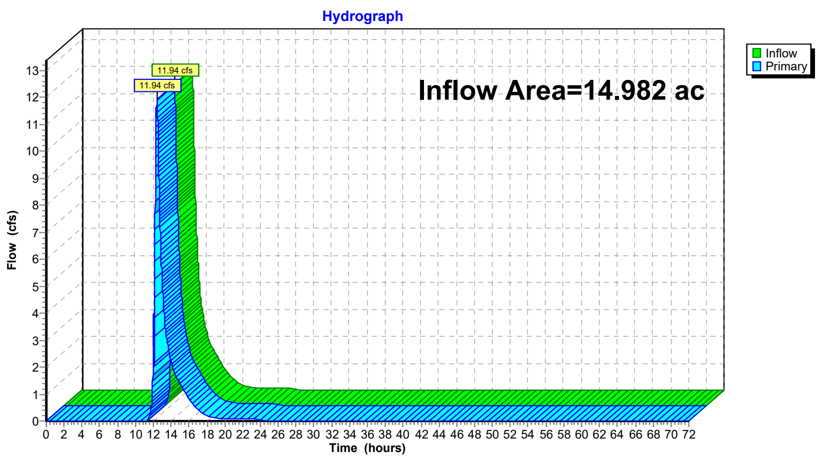


Summary for Link P.O.A. #1: P.O.A. #1

Inflow Area = 14.982 ac, 50.28% Impervious, Inflow Depth = 1.04" for 10-year event
Inflow = 11.94 cfs @ 12.40 hrs, Volume= 1.298 af
Primary = 11.94 cfs @ 12.40 hrs, Volume= 1.298 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #1: P.O.A. #1

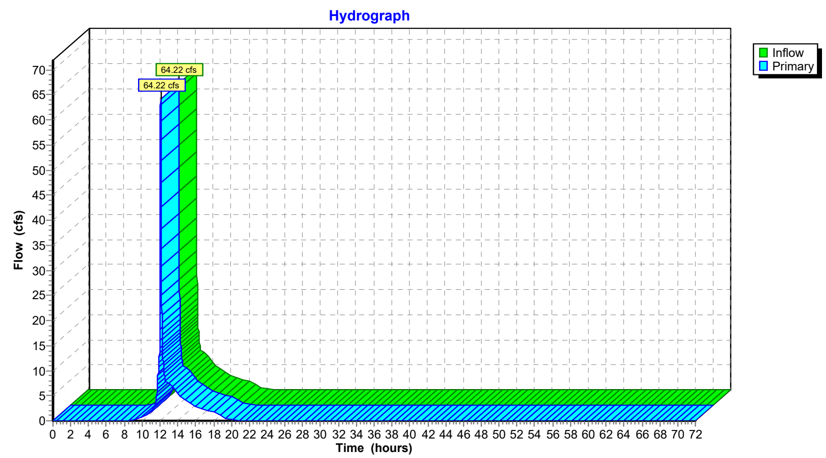


Summary for Link P.O.A. #2: P.O.A. #2

Inflow = 64.22 cfs @ 12.08 hrs, Volume= 3.800 af
Primary = 64.22 cfs @ 12.08 hrs, Volume= 3.800 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #2: P.O.A. #2

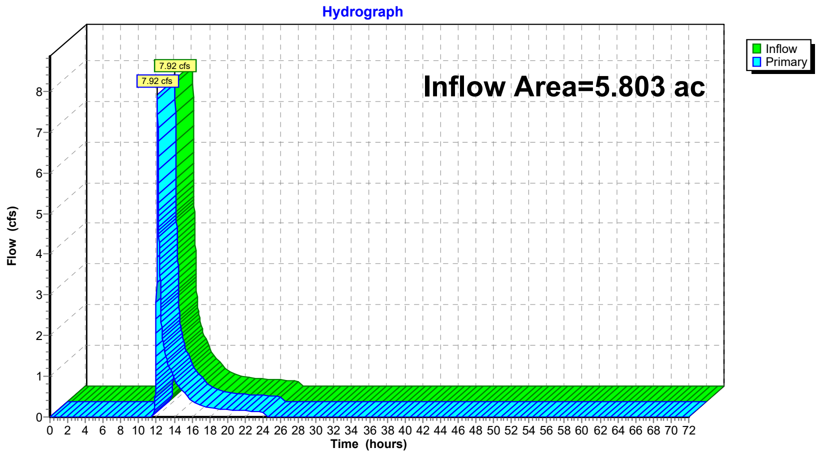


Summary for Link P.O.A. #4: P.O.A. #4

Inflow Area = 5.803 ac, 2.86% Impervious, Inflow Depth = 1.32" for 10-year event
Inflow = 7.92 cfs @ 12.11 hrs, Volume= 0.639 af
Primary = 7.92 cfs @ 12.11 hrs, Volume= 0.639 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #4: P.O.A. #4

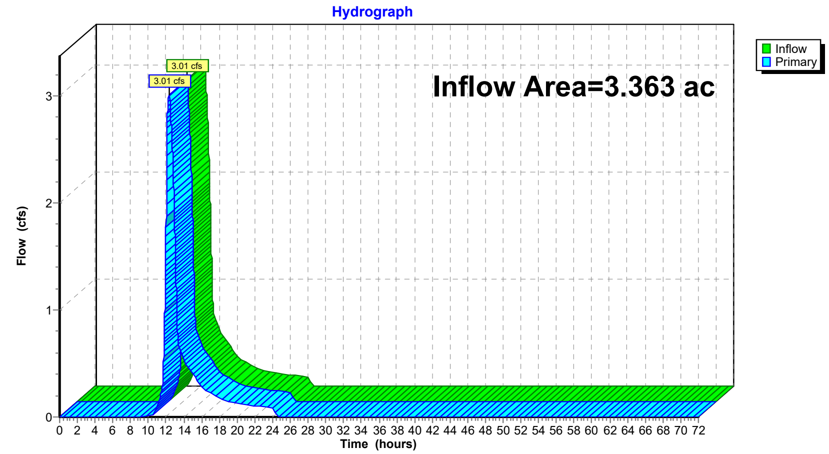


Summary for Link P.O.A. #6: P.O.A. #6

Inflow Area = 3.363 ac, 26.64% Impervious, Inflow Depth = 1.73" for 10-year event
Inflow = 3.01 cfs @ 12.33 hrs, Volume= 0.485 af
Primary = 3.01 cfs @ 12.33 hrs, Volume= 0.485 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #6: P.O.A. #6

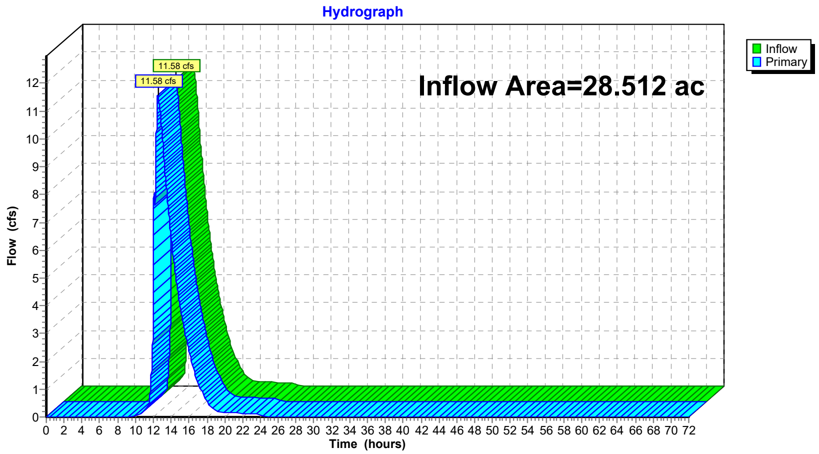


Summary for Link P.O.A.#3: P.O.A. #3

Inflow Area = 28.512 ac, 88.93% Impervious, Inflow Depth = 1.09" for 10-year event
Inflow = 11.58 cfs @ 12.51 hrs, Volume= 2.585 af
Primary = 11.58 cfs @ 12.51 hrs, Volume= 2.585 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A.#3: P.O.A. #3

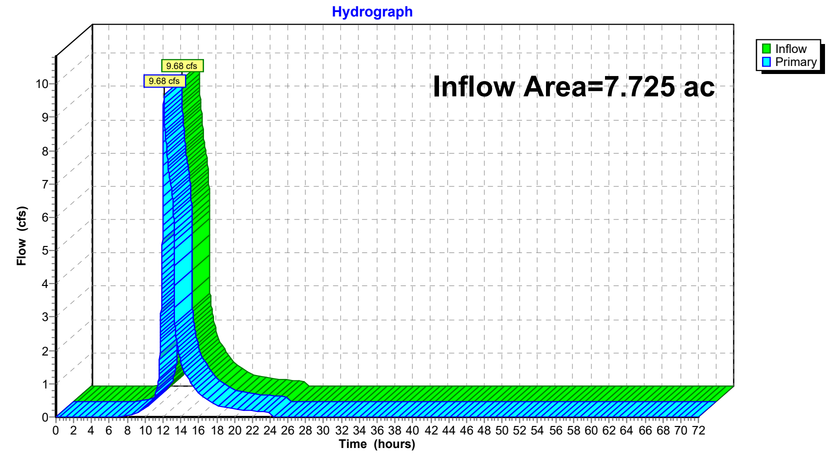


Summary for Link P.O.A.#5: P.O.A. #5

Inflow Area = 7.725 ac, 65.18% Impervious, Inflow Depth = 2.38" for 10-year event
Inflow = 9.68 cfs @ 12.10 hrs, Volume= 1.529 af
Primary = 9.68 cfs @ 12.10 hrs, Volume= 1.529 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A.#5: P.O.A. #5



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Subcatchment1S Runoff Area=116,630 sf 0.00% Impervious Runoff Depth=3.69"
Tc=0.0 min CN=61 Runoff=14.06 cfs 0.823 af

Subcatchment2S: Subcatchment2S Runoff Area=150,970 sf 31.43% Impervious Runoff Depth=5.09"
Tc=6.0 min CN=73 Runoff=20.66 cfs 1.471 af

Subcatchment3S: Subcatchment3S Runoff Area=963,480 sf 100.00% Impervious Runoff Depth=8.08"
Tc=6.0 min CN=98 Runoff=180.71 cfs 14.893 af

Subcatchment4S: Subcatchment4S Runoff Area=1,090,999 sf 96.88% Impervious Runoff Depth=7.96"
Flow Length=84' Tc=6.0 min CN=97 Runoff=204.06 cfs 16.614 af

Subcatchment5SA: Subcatchment5SA Runoff Area=136,848 sf 53.26% Impervious Runoff Depth=6.04"
Tc=6.0 min CN=81 Runoff=21.79 cfs 1.583 af

Subcatchment5SB: Subcatchment5SB Runoff Area=156,781 sf 75.89% Impervious Runoff Depth=7.00"
Tc=6.0 min CN=89 Runoff=27.74 cfs 2.100 af

Subcatchment5SC: Subcatchment5SC Runoff Area=42,867 sf 64.05% Impervious Runoff Depth=6.52"
Tc=6.0 min CN=85 Runoff=7.24 cfs 0.535 af

Subcatchment6SA: Subcatchment6SA Runoff Area=128,221 sf 25.22% Impervious Runoff Depth=4.74"
Flow Length=352' Tc=12.6 min CN=70 Runoff=13.22 cfs 1.163 af

Subcatchment6SB: Subcatchment6SB Runoff Area=18,252 sf 36.60% Impervious Runoff Depth=5.21"
Tc=6.0 min CN=74 Runoff=2.55 cfs 0.182 af

Subcatchment7S: Subcatchment7S Runoff Area=82,071 sf 100.00% Impervious Runoff Depth=8.08"
Tc=6.0 min CN=98 Runoff=15.39 cfs 1.269 af

Subcatchment8S: Subcatchment8S Runoff Area=51,944 sf 37.70% Impervious Runoff Depth=5.33"
Tc=6.0 min CN=75 Runoff=7.42 cfs 0.530 af

Subcatchment9S: Subcatchment9S Runoff Area=484,041 sf 63.75% Impervious Runoff Depth=6.52"
Tc=6.0 min CN=85 Runoff=81.72 cfs 6.040 af

Subcatchment10S: Subcatchment10S Runoff Area=252,780 sf 2.86% Impervious Runoff Depth=3.35"
Flow Length=1,206' Tc=7.4 min CN=58 Runoff=21.25 cfs 1.618 af

Pond 4P: (new Pond) Peak Elev=367.00' Inflow=180.71 cfs 14.893 af
Primary=37.22 cfs 5.720 af Secondary=143.54 cfs 9.173 af Outflow=180.71 cfs 14.893 af

Pond 11P: (new Pond) Peak Elev=326.37' Inflow=15.39 cfs 1.269 af
Primary=7.14 cfs 0.685 af Secondary=8.35 cfs 0.584 af Outflow=15.39 cfs 1.269 af

Pond INF B2/3: Infiltration Basin 2/3 Peak Elev=373.06' Storage=79,835 cf Inflow=81.72 cfs 6.040 af
Discarded=1.23 cfs 2.113 af Primary=51.83 cfs 3.927 af Outflow=53.06 cfs 6.040 af

Pond INF B4: Infiltration Basin 4 Peak Elev=350.96' Storage=6,417 cf Inflow=7.42 cfs 0.530 af
Discarded=0.19 cfs 0.288 af Primary=5.92 cfs 0.242 af Outflow=6.11 cfs 0.530 af

Pond INF B5: Infiltration Basin 5 Peak Elev=334.46' Storage=3,968 cf Inflow=13.22 cfs 1.163 af
Discarded=0.12 cfs 0.042 af Primary=4.54 cfs 0.860 af Secondary=7.53 cfs 0.261 af Outflow=12.19 cfs 1.163 af

Pond INF B6: Infiltration Basin 6 Peak Elev=375.48' Storage=21,404 cf Inflow=27.74 cfs 2.100 af
Discarded=0.42 cfs 0.558 af Primary=21.31 cfs 1.541 af Secondary=0.00 cfs 0.000 af Outflow=21.73 cfs 2.100 af

Pond INF B7: Infiltration Basin 7 Peak Elev=373.22' Storage=37,328 cf Inflow=40.88 cfs 3.124 af
Primary=9.04 cfs 3.035 af Secondary=3.57 cfs 0.089 af Outflow=12.61 cfs 3.124 af

Pond INF S1: Infiltration System 1 Peak Elev=363.20' Storage=288,536 cf Inflow=204.06 cfs 16.614 af
Discarded=3.84 cfs 8.511 af Primary=54.85 cfs 8.104 af Outflow=58.69 cfs 16.615 af

Pond INF S2: Infiltration System 2 Peak Elev=362.98' Storage=162,664 cf Inflow=37.22 cfs 5.720 af
Outflow=2.22 cfs 5.721 af

Pond INF S3: Infiltration System 3 Peak Elev=324.03' Storage=17,716 cf Inflow=7.14 cfs 0.685 af
Outflow=0.32 cfs 0.685 af

Link P.O.A.#1: P.O.A.#1 Inflow=62.97 cfs 4.993 af
Primary=62.97 cfs 4.993 af

Link P.O.A.#2: P.O.A.#2 Inflow=143.54 cfs 9.173 af
Primary=143.54 cfs 9.173 af

Link P.O.A.#4: P.O.A.#4 Inflow=29.19 cfs 2.202 af
Primary=29.19 cfs 2.202 af

Link P.O.A.#6: P.O.A.#6 Inflow=13.42 cfs 1.303 af
Primary=13.42 cfs 1.303 af

Link P.O.A.#3: P.O.A.#3 Inflow=62.19 cfs 9.575 af
Primary=62.19 cfs 9.575 af

Link P.O.A.#5: P.O.A.#5 Inflow=14.95 cfs 3.659 af
Primary=14.95 cfs 3.659 af

Total Runoff Area = 84.387 ac Runoff Volume = 48.820 af Average Runoff Depth = 6.94"
25.36% Pervious = 21.400 ac 74.64% Impervious = 62.987 ac

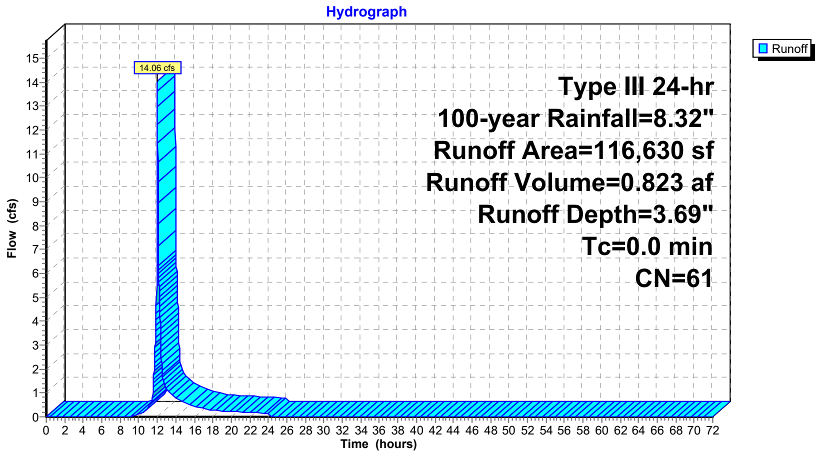
Summary for Subcatchment 1S: Subcatchment 1S

Runoff = 14.06 cfs @ 12.00 hrs, Volume= 0.823 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

Area (sf)	CN	Description
116,630	61	>75% Grass cover, Good, HSG B
116,630		100.00% Pervious Area

Subcatchment 1S: Subcatchment 1S



Summary for Subcatchment 2S: Subcatchment 2S

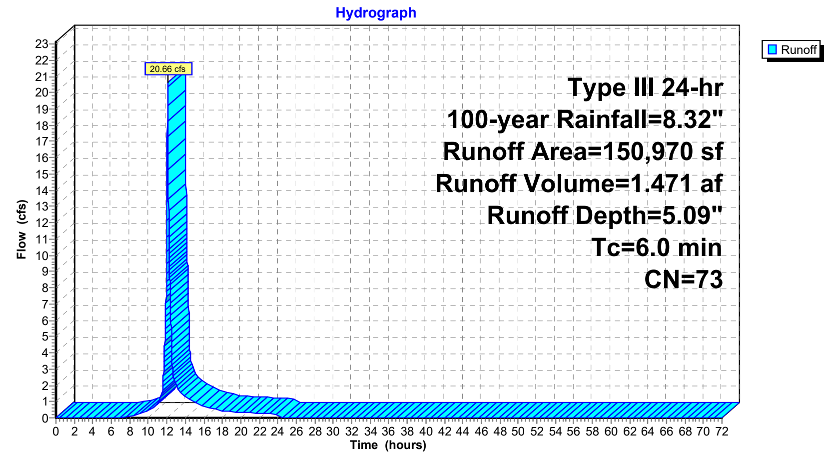
Runoff = 20.66 cfs @ 12.09 hrs, Volume= 1.471 af, Depth= 5.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
*	47,452	98	Impervious
	103,518	61	>75% Grass cover, Good, HSG B
	150,970	73	Weighted Average
	103,518		68.57% Pervious Area
	47,452		31.43% Impervious Area

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

Subcatchment 2S: Subcatchment 2S



Summary for Subcatchment 3S: Subcatchment 3S

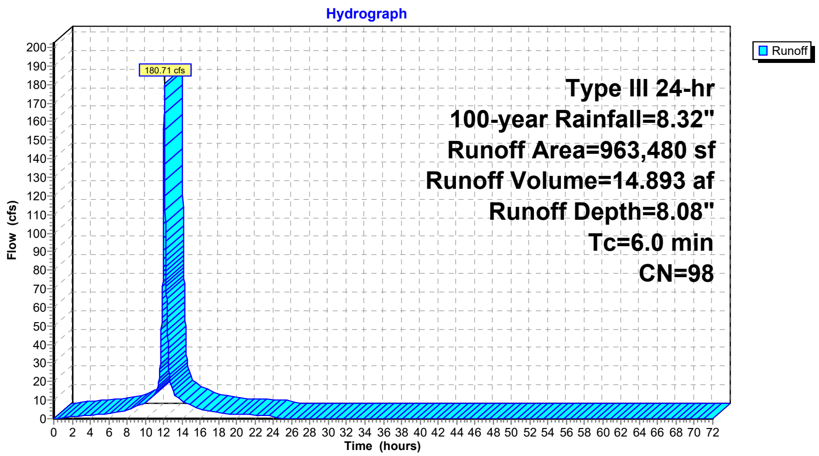
Runoff = 180.71 cfs @ 12.08 hrs, Volume= 14.893 af, Depth= 8.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
*	963,480	98	Impervious
	963,480		100.00% Impervious Area

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

Subcatchment 3S: Subcatchment 3S



Summary for Subcatchment 4S: Subcatchment 4S

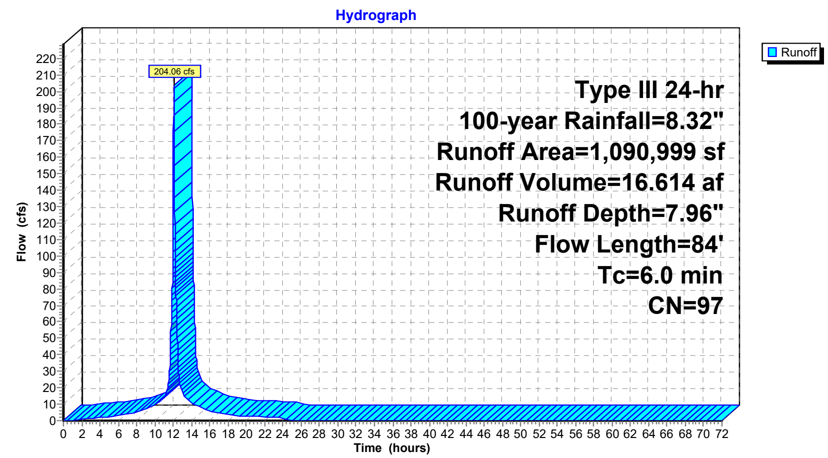
Runoff = 204.06 cfs @ 12.08 hrs, Volume= 16.614 af, Depth= 7.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
	34,012	61	>75% Grass cover, Good, HSG B
*	1,056,987	98	Impervious
	1,090,999	97	Weighted Average
	34,012		3.12% Pervious Area
	1,056,987		96.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.1200	0.21		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
0.1	34	0.3200	8.49		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
1.9					**Direct Entry,**
6.0	84	Total			

Subcatchment 4S: Subcatchment 4S



Summary for Subcatchment 5SA: Subcatchment 5SA

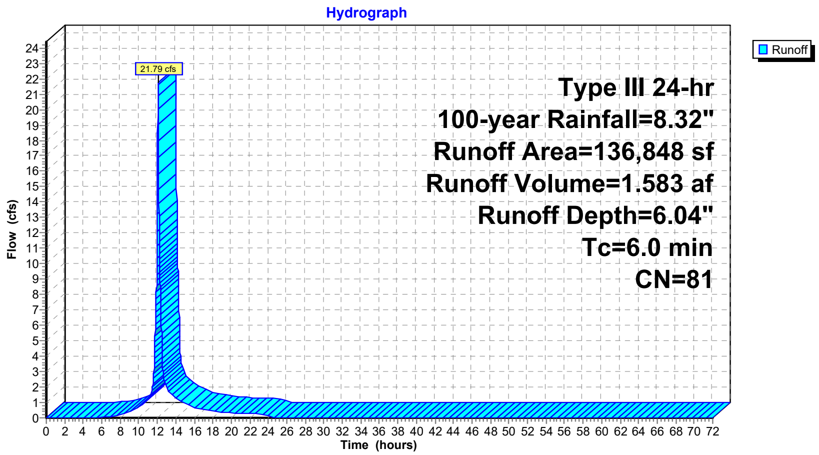
Runoff = 21.79 cfs @ 12.09 hrs, Volume= 1.583 af, Depth= 6.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
*	72,885	98	Impervious
	63,963	61	>75% Grass cover, Good, HSG B
	136,848	81	Weighted Average
	63,963		46.74% Pervious Area
	72,885		53.26% Impervious Area

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

Subcatchment 5SA: Subcatchment 5SA



Summary for Subcatchment 5SB: Subcatchment 5SB

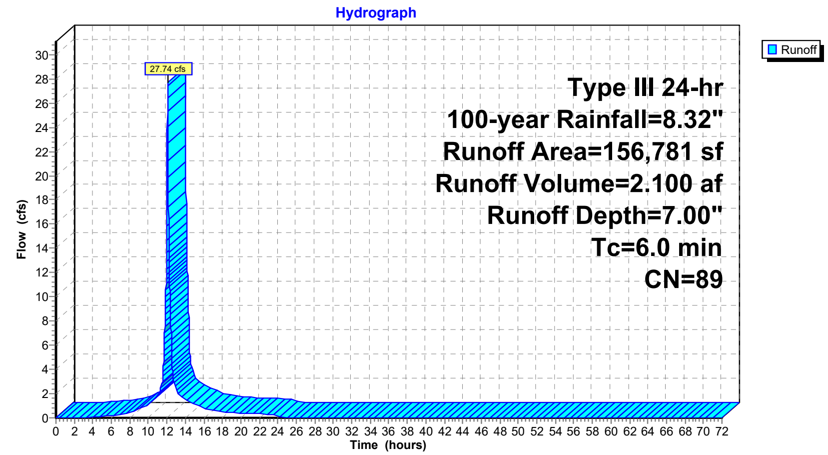
Runoff = 27.74 cfs @ 12.08 hrs, Volume= 2.100 af, Depth= 7.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
*	118,983	98	Impervious
	37,798	61	>75% Grass cover, Good, HSG B
	156,781	89	Weighted Average
	37,798		24.11% Pervious Area
	118,983		75.89% Impervious Area

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

Subcatchment 5SB: Subcatchment 5SB



Summary for Subcatchment 5SC: Subcatchment 5SC

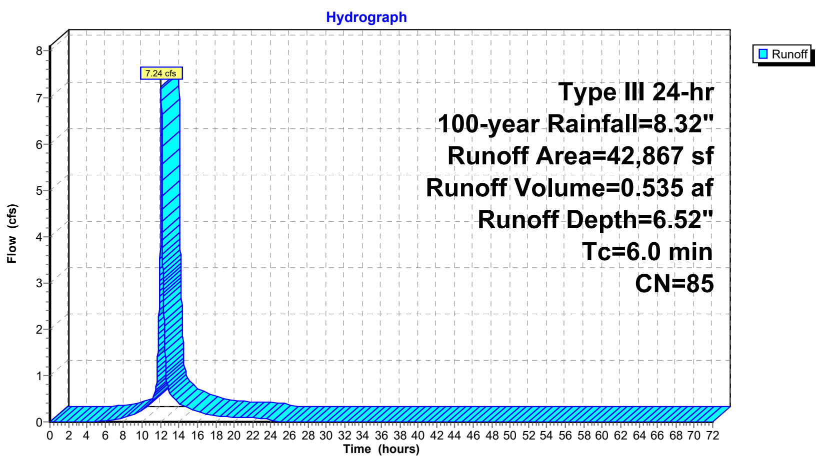
Runoff = 7.24 cfs @ 12.08 hrs, Volume= 0.535 af, Depth= 6.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
*	27,458	98	Impervious
	15,409	61	>75% Grass cover, Good, HSG B
	42,867	85	Weighted Average
	15,409		35.95% Pervious Area
	27,458		64.05% Impervious Area

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

Subcatchment 5SC: Subcatchment 5SC



Summary for Subcatchment 6SA: Subcatchment 6SA

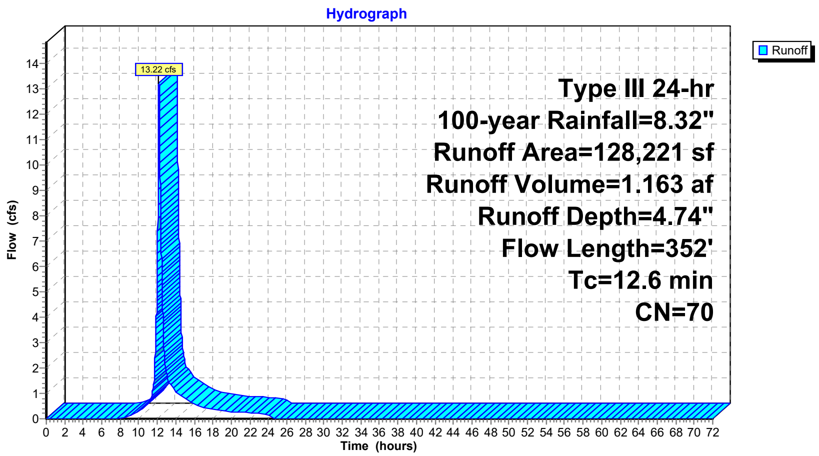
Runoff = 13.22 cfs @ 12.17 hrs, Volume= 1.163 af, Depth= 4.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
*	32,335	98	Impervious
	79,319	61	>75% Grass cover, Good, HSG B
	16,567	55	Woods, Good, HSG B
	128,221	70	Weighted Average
	95,886		74.78% Pervious Area
	32,335		25.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	7	0.0400	0.09		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.13"
8.4	43	0.0400	0.09		**Sheet Flow, B-C** Woods: Light underbrush n= 0.400 P2= 3.13"
2.4	177	0.0620	1.24		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
0.2	49	0.3300	4.02		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
0.3	76	0.0588	4.92		**Shallow Concentrated Flow, E-F** Paved Kv= 20.3 fps
12.6	352	Total			

Subcatchment 6SA: Subcatchment 6SA



Summary for Subcatchment 6SB: Subcatchment 6SB

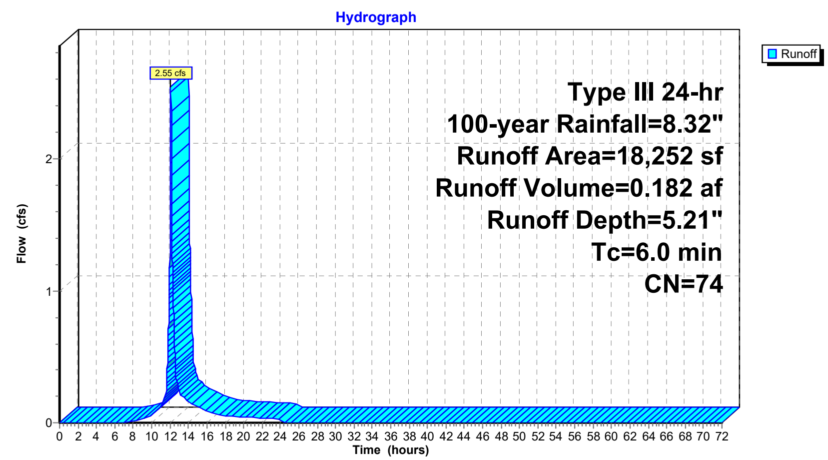
Runoff = 2.55 cfs @ 12.09 hrs, Volume= 0.182 af, Depth= 5.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
*	6,681	98	Impervious
	10,466	61	>75% Grass cover, Good, HSG B
	1,105	55	Woods, Good, HSG B
	18,252	74	Weighted Average
	11,571		63.40% Pervious Area
	6,681		36.60% Impervious Area

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

Subcatchment 6SB: Subcatchment 6SB



Summary for Subcatchment 7S: Subcatchment 7S

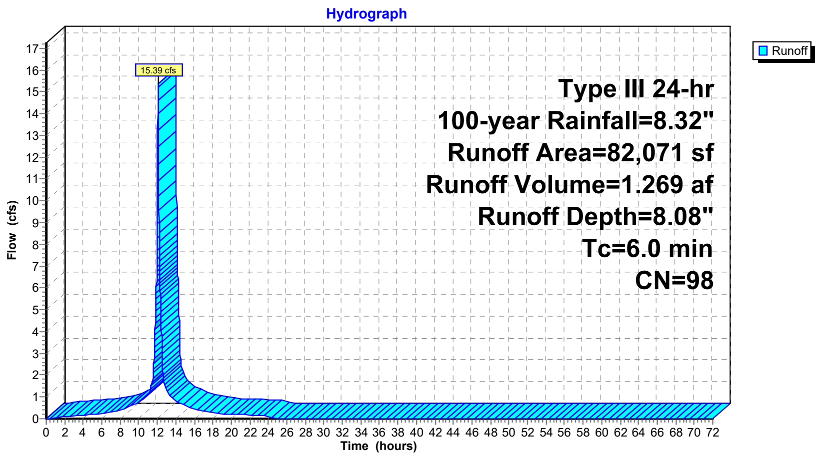
Runoff = 15.39 cfs @ 12.08 hrs, Volume= 1.269 af, Depth= 8.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
*	82,071	98	Impervious
	82,071		100.00% Impervious Area

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

Subcatchment 7S: Subcatchment 7S



Summary for Subcatchment 8S: Subcatchment 8S

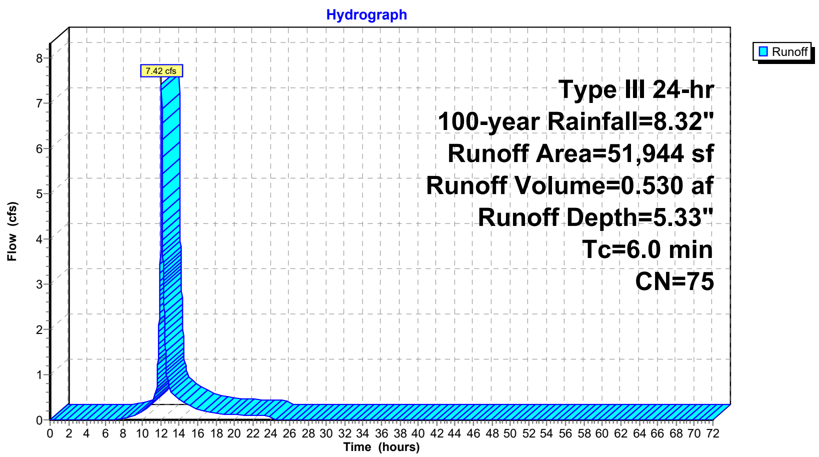
Runoff = 7.42 cfs @ 12.09 hrs, Volume= 0.530 af, Depth= 5.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
*	19,582	98	Impervious
	32,362	61	>75% Grass cover, Good, HSG B
	51,944	75	Weighted Average
	32,362		62.30% Pervious Area
	19,582		37.70% Impervious Area

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

Subcatchment 8S: Subcatchment 8S



Summary for Subcatchment 9S: Subcatchment 9S

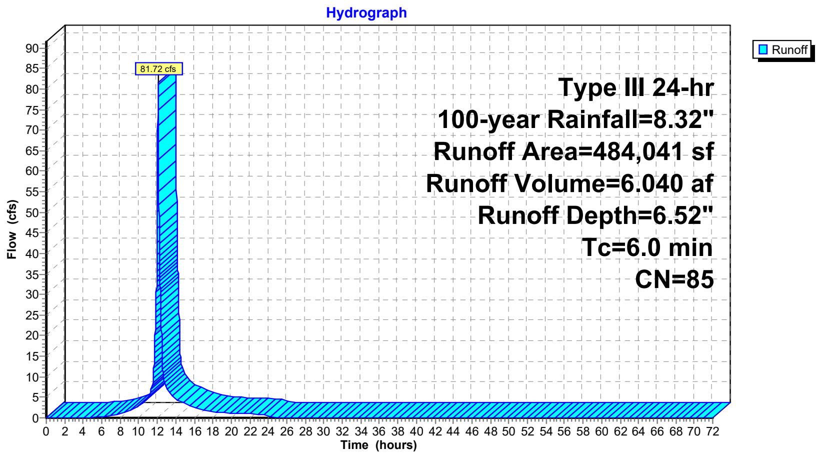
Runoff = 81.72 cfs @ 12.08 hrs, Volume= 6.040 af, Depth= 6.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

	Area (sf)	CN	Description
*	308,574	98	Impervious
	175,467	61	>75% Grass cover, Good, HSG B
	484,041	85	Weighted Average
	175,467		36.25% Pervious Area
	308,574		63.75% Impervious Area

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

Subcatchment 9S: Subcatchment 9S



Summary for Subcatchment 10S: Subcatchment 10S

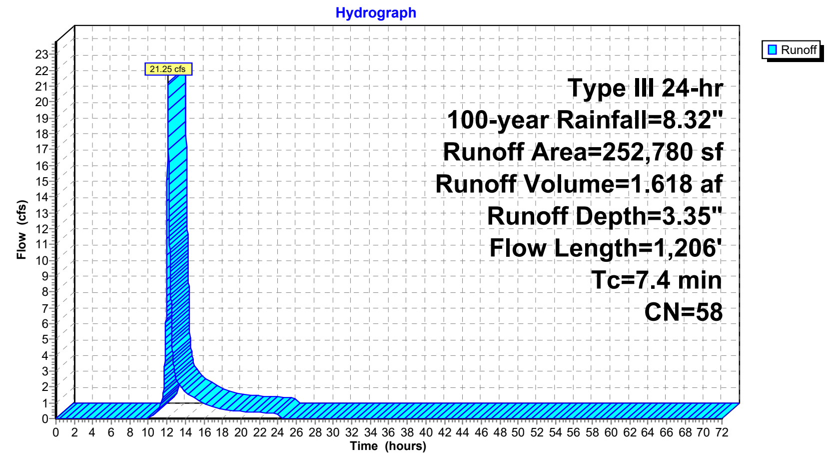
Runoff = 21.25 cfs @ 12.11 hrs, Volume= 1.618 af, Depth= 3.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.32"

Area (sf)	CN	Description
79,107	61	>75% Grass cover, Good, HSG B
7,233	98	Water Surface, HSG A
166,440	55	Woods, Good, HSG B
252,780	58	Weighted Average
245,547		97.14% Pervious Area
7,233		2.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	50	0.1200	2.43		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.13"
0.7	216	0.0694	5.35		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
3.1	537	0.0370	2.89		**Shallow Concentrated Flow, C-D** Grassed Waterway Kv= 15.0 fps
3.3	403	0.1700	2.06		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
7.4	1,206	Total			

Subcatchment 10S: Subcatchment 10S



Summary for Pond 4P: (new Pond)

Inflow Area = 22.118 ac,100.00% Impervious, Inflow Depth = 8.08" for 100-year event
Inflow = 180.71 cfs @ 12.08 hrs, Volume= 14.893 af
Outflow = 180.71 cfs @ 12.08 hrs, Volume= 14.893 af, Atten= 0%, Lag= 0.0 min
Primary = 37.22 cfs @ 12.08 hrs, Volume= 5.720 af
Secondary = 143.54 cfs @ 12.08 hrs, Volume= 9.173 af

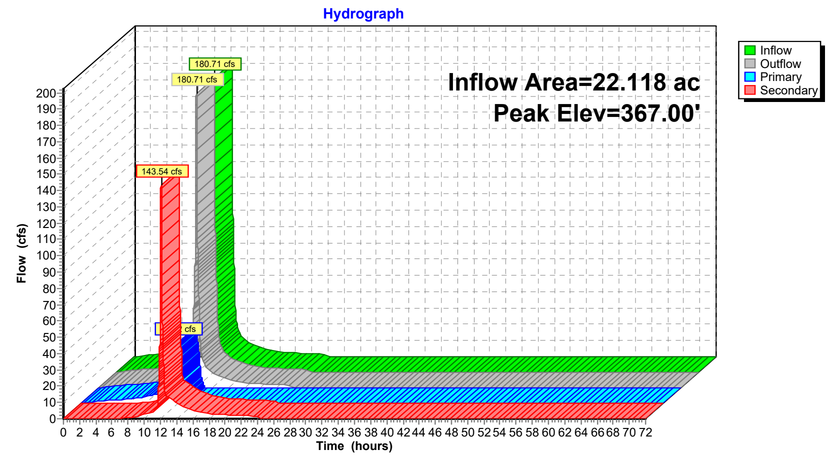
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 367.00' @ 12.08 hrs

Device	Routing	Invert	Outlet Devices
#1	Secondary	358.75'	**48.0" Round Culvert** L= 125.0' Ke= 0.500 Inlet / Outlet Invert= 358.75' / 348.75' S= 0.0800 '/' Cc= 0.900 n= 0.010, Flow Area= 12.57 sf
#2	Device 1	358.60'	**7.0" Vert. Orifice/Grate X 3.00** C= 0.600
#3	Device 1	359.50'	**8.0" Vert. Orifice/Grate X 2.00** C= 0.600
#4	Device 1	363.15'	**5.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)
#5	Primary	357.92'	**24.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 357.92' / 357.92' S= 0.0000 '/' Cc= 0.900 n= 0.010, Flow Area= 3.14 sf

Primary OutFlow Max=37.07 cfs @ 12.08 hrs HW=366.98' TW=360.97' (Dynamic Tailwater)
└─**5=Culvert** (Inlet Controls 37.07 cfs @ 11.80 fps)

Secondary OutFlow Max=143.25 cfs @ 12.08 hrs HW=366.99' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 143.25 cfs of 151.20 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 10.99 cfs @ 13.71 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 9.00 cfs @ 12.89 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Weir Controls 123.26 cfs @ 6.41 fps)

Pond 4P: (new Pond)



Summary for Pond 11P: (new Pond)

Inflow Area = 1.884 ac,100.00% Impervious, Inflow Depth = 8.08" for 100-year event
Inflow = 15.39 cfs @ 12.08 hrs, Volume= 1.269 af
Outflow = 15.39 cfs @ 12.08 hrs, Volume= 1.269 af, Atten= 0%, Lag= 0.0 min
Primary = 7.14 cfs @ 12.05 hrs, Volume= 0.685 af
Secondary = 8.35 cfs @ 12.09 hrs, Volume= 0.584 af

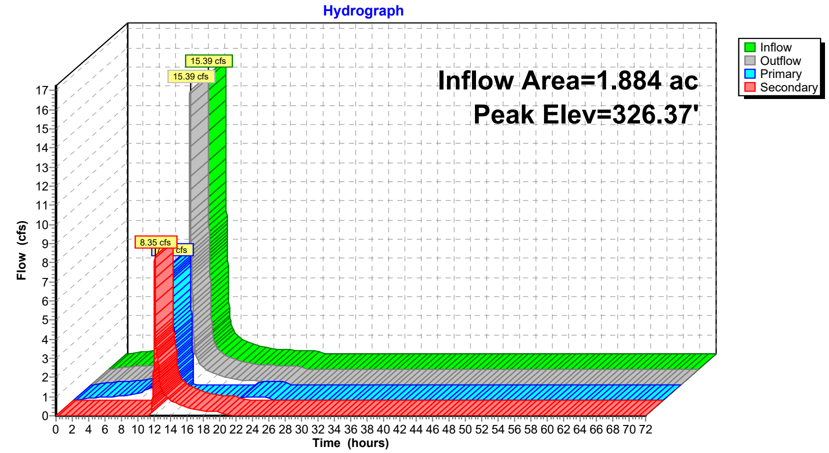
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 326.37' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Secondary	321.80'	**15.0" Round Culvert** L= 125.0' Ke= 0.500 Inlet / Outlet Invert= 321.80' / 321.00' S= 0.0064 '/' Cc= 0.900 n= 0.010, Flow Area= 1.23 sf
#2	Device 1	321.80'	**7.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	322.60'	**6.5" Vert. Orifice/Grate** C= 0.600
#4	Device 1	326.00'	**5.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)
#5	Primary	319.92'	**12.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 319.92' / 319.92' S= 0.0000 '/' Cc= 0.900 n= 0.010, Flow Area= 0.79 sf

Primary OutFlow Max=7.08 cfs @ 12.05 hrs HW=326.27' TW=322.76' (Dynamic Tailwater)
└─**5=Culvert** (Inlet Controls 7.08 cfs @ 9.02 fps)

Secondary OutFlow Max=8.32 cfs @ 12.09 hrs HW=326.36' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 8.32 cfs of 11.12 cfs potential flow)
├─**2=Orifice/Grate** (Orifice Controls 2.66 cfs @ 9.95 fps)
├─**3=Orifice/Grate** (Orifice Controls 2.07 cfs @ 9.00 fps)
└─**4=Sharp-Crested Rectangular Weir** (Weir Controls 3.59 cfs @ 1.97 fps)

Pond 11P: (new Pond)



Summary for Pond INF B2/3: Infiltration Basin 2/3

Inflow Area = 11.112 ac, 63.75% Impervious, Inflow Depth = 6.52" for 100-year event
Inflow = 81.72 cfs @ 12.08 hrs, Volume= 6.040 af
Outflow = 53.06 cfs @ 12.18 hrs, Volume= 6.040 af, Atten= 35%, Lag= 5.5 min
Discarded = 1.23 cfs @ 12.18 hrs, Volume= 2.113 af
Primary = 51.83 cfs @ 12.18 hrs, Volume= 3.927 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 373.06' @ 12.18 hrs Surf.Area= 22,061 sf Storage= 79,835 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 210.2 min (999.3 - 789.2)

Volume	Invert	Avail.Storage	Storage Description
#1	369.00'	26,782 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	367.00'	65,194 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		91,976 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
369.00	2,109	0	0
370.00	2,783	2,446	2,446
371.00	3,528	3,156	5,602
372.00	4,348	3,938	9,540
373.00	5,244	4,796	14,336
374.00	6,207	5,726	20,061
375.00	7,234	6,721	26,782

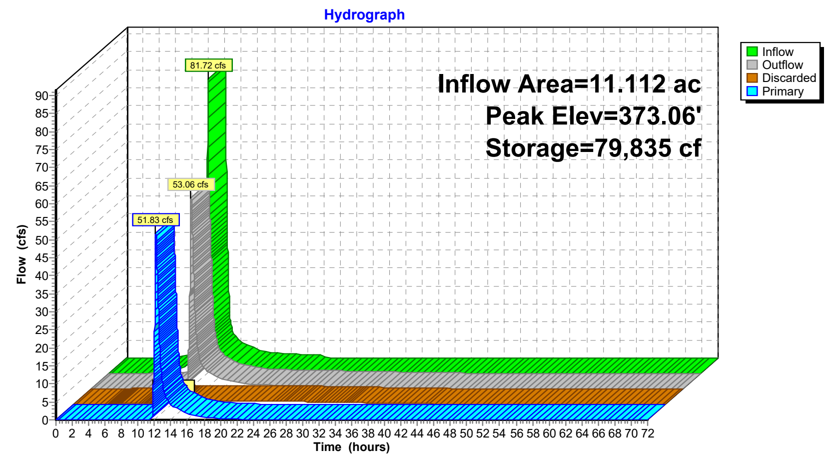
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
367.00	5,459	0	0
368.00	7,106	6,283	6,283
369.00	8,886	7,996	14,279
370.00	10,741	9,814	24,092
371.00	12,672	11,707	35,799
372.00	14,679	13,676	49,474
373.00	16,761	15,720	65,194

Device	Routing	Invert	Outlet Devices
#1	Discarded	367.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	358.00'	**24.0" Round Culvert** L= 78.0' Ke= 0.500 Inlet / Outlet Invert= 358.00' / 353.00' S= 0.0641 '/' Cc= 0.900 n= 0.011, Flow Area= 3.14 sf
#3	Device 2	370.90'	**5.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)

Discarded OutFlow Max=1.23 cfs @ 12.18 hrs HW=373.06' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 1.23 cfs)

Primary OutFlow Max=51.75 cfs @ 12.18 hrs HW=373.06' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 51.75 cfs of 56.71 cfs potential flow)
└**3=Sharp-Crested Rectangular Weir** (Weir Controls 51.75 cfs @ 4.80 fps)

Pond INF B2/3: Infiltration Basin 2/3



Summary for Pond INF B4: Infiltration Basin 4

Inflow Area = 1.192 ac, 37.70% Impervious, Inflow Depth = 5.33" for 100-year event
Inflow = 7.42 cfs @ 12.09 hrs, Volume= 0.530 af
Outflow = 6.11 cfs @ 12.14 hrs, Volume= 0.530 af, Atten= 18%, Lag= 3.3 min
Discarded = 0.19 cfs @ 12.14 hrs, Volume= 0.288 af
Primary = 5.92 cfs @ 12.14 hrs, Volume= 0.242 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 350.96' @ 12.14 hrs Surf.Area= 3,376 sf Storage= 6,417 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 214.7 min (1,027.3 - 812.5)

Volume	Invert	Avail.Storage	Storage Description
#1	348.00'	10,401 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

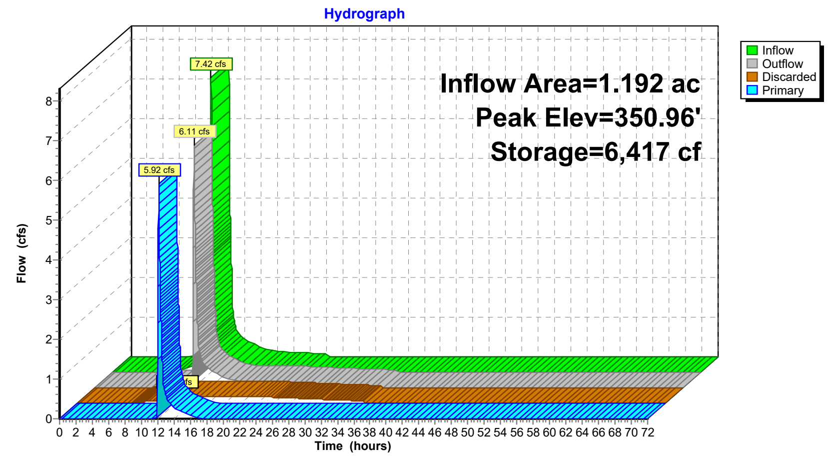
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
348.00	1,024	0	0
349.00	1,766	1,395	1,395
350.00	2,558	2,162	3,557
351.00	3,407	2,983	6,540
352.00	4,315	3,861	10,401

Device	Routing	Invert	Outlet Devices
#1	Discarded	348.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	350.60'	**10.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.19 cfs @ 12.14 hrs HW=350.96' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=5.91 cfs @ 12.14 hrs HW=350.96' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 5.91 cfs @ 1.63 fps)

Pond INF B4: Infiltration Basin 4



Summary for Pond INF B5: Infiltration Basin 5

Inflow Area = 2.944 ac, 25.22% Impervious, Inflow Depth = 4.74" for 100-year event
Inflow = 13.22 cfs @ 12.17 hrs, Volume= 1.163 af
Outflow = 12.19 cfs @ 12.23 hrs, Volume= 1.163 af, Atten= 8%, Lag= 3.3 min
Discarded = 0.12 cfs @ 12.23 hrs, Volume= 0.042 af
Primary = 4.54 cfs @ 12.23 hrs, Volume= 0.860 af
Secondary = 7.53 cfs @ 12.23 hrs, Volume= 0.261 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 334.46' @ 12.23 hrs Surf.Area= 2,173 sf Storage= 3,968 cf

Plug-Flow detention time= 7.1 min calculated for 1.163 af (100% of inflow)
Center-of-Mass det. time= 7.1 min (836.3 - 829.2)

Volume	Invert	Avail.Storage	Storage Description
#1	331.00'	7,829 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	3,331.00'	1,060 cf	**36.0" Round Pipe Storage** -Impervious L= 150.0'
		8,889 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
331.00	257	0	0
332.00	717	487	487
333.00	1,261	989	1,476
334.00	1,866	1,564	3,040
335.00	2,533	2,200	5,239
336.00	2,646	2,590	7,829

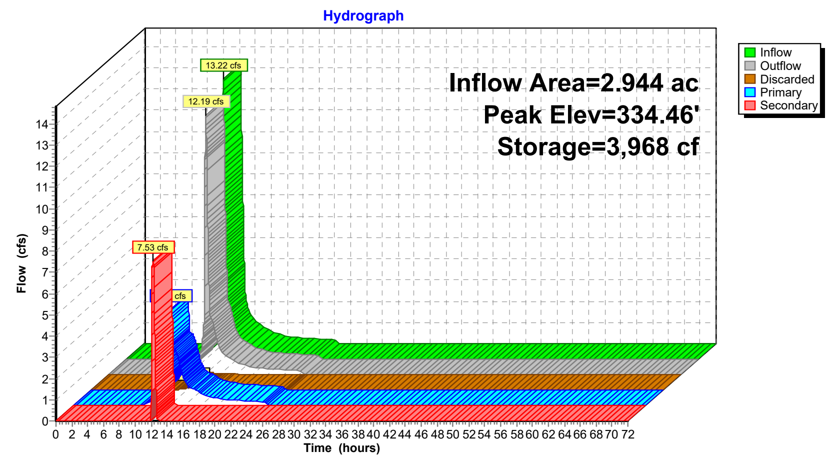
Device	Routing	Invert	Outlet Devices
#1	Discarded	331.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	331.00'	**12.0" Round Culvert** L= 25.0' Ke= 0.500 Inlet / Outlet Invert= 331.00' / 328.80' S= 0.0880 '/' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#3	Device 2	331.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	334.25'	**5.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)
#5	Secondary	330.00'	**12.0" Round Culvert** L= 25.0' Ke= 0.500 Inlet / Outlet Invert= 330.00' / 329.30' S= 0.0280 '/' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#6	Device 5	333.79'	**2.5" x 2.5" Horiz. Orifice/Grate X 72.00** C= 0.600 in 24.0" x 48.0" Grate (39% open area) Limited to weir flow at low heads

Discarded OutFlow Max=0.12 cfs @ 12.23 hrs HW=334.46' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=4.54 cfs @ 12.23 hrs HW=334.46' TW=0.00' (Dynamic Tailwater)
2=Culvert (Passes 4.54 cfs of 6.51 cfs potential flow)
3=Orifice/Grate (Orifice Controls 2.97 cfs @ 8.51 fps)
4=Sharp-Crested Rectangular Weir (Weir Controls 1.57 cfs @ 1.50 fps)

Secondary OutFlow Max=7.52 cfs @ 12.23 hrs HW=334.46' TW=0.00' (Dynamic Tailwater)
5=Culvert (Inlet Controls 7.52 cfs @ 9.58 fps)
6=Orifice/Grate (Passes 7.52 cfs of 12.31 cfs potential flow)

Pond INF B5: Infiltration Basin 5



Summary for Pond INF B6: Infiltration Basin 6

Inflow Area = 3.599 ac, 75.89% Impervious, Inflow Depth = 7.00" for 100-year event
Inflow = 27.74 cfs @ 12.08 hrs, Volume= 2.100 af
Outflow = 21.73 cfs @ 12.15 hrs, Volume= 2.100 af, Atten= 22%, Lag= 3.7 min
Discarded = 0.42 cfs @ 12.15 hrs, Volume= 0.558 af
Primary = 21.31 cfs @ 12.15 hrs, Volume= 1.541 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 375.48' @ 12.15 hrs Surf.Area= 7,562 sf Storage= 21,404 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 108.6 min (886.5 - 777.9)

Volume	Invert	Avail.Storage	Storage Description
#1	371.00'	34,138 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)
371.00	2,226	339.0	0	0	2,226
372.00	3,291	365.0	2,741	2,741	3,725
373.00	4,432	391.0	3,847	6,589	5,334
374.00	5,648	416.0	5,028	11,616	6,989
375.00	6,927	436.0	6,277	17,893	8,410
376.00	8,267	456.0	7,587	25,480	9,899
377.00	9,054	397.0	8,658	34,138	13,926

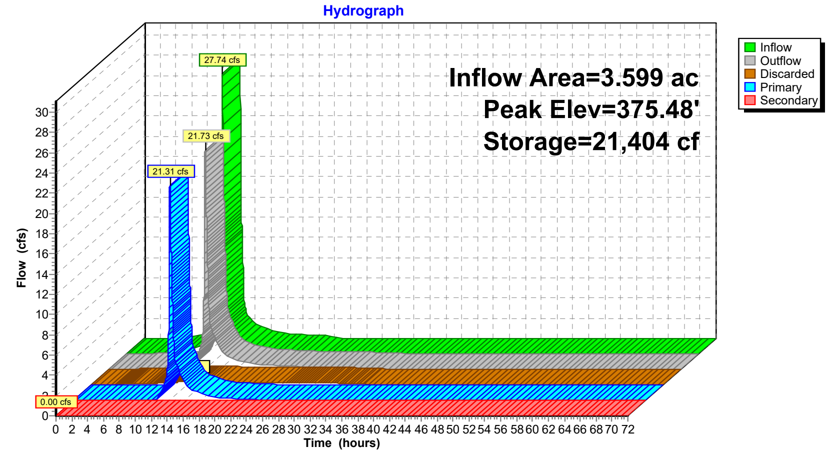
Device	Routing	Invert	Outlet Devices
#1	Discarded	371.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	372.00'	**24.0" Round Culvert** L= 182.0' Ke= 0.500 Inlet / Outlet Invert= 372.00' / 368.00' S= 0.0220 '/' Cc= 0.900 n= 0.010, Flow Area= 3.14 sf
#3	Device 2	373.00'	**12.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	374.50'	**5.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)
#5	Secondary	375.50'	**10.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.42 cfs @ 12.15 hrs HW=375.48' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.42 cfs)

Primary OutFlow Max=21.29 cfs @ 12.15 hrs HW=375.48' TW=372.19' (Dynamic Tailwater)
└─**2=Culvert** (Passes 21.29 cfs of 23.84 cfs potential flow)
  ├─**3=Orifice/Grate** (Orifice Controls 5.33 cfs @ 6.78 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Weir Controls 15.96 cfs @ 3.24 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=371.00' TW=0.00' (Dynamic Tailwater)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond INF B6: Infiltration Basin 6



Summary for Pond INF B7: Infiltration Basin 7

Inflow Area = 6.741 ac, 65.34% Impervious, Inflow Depth = 5.56" for 100-year event
Inflow = 40.88 cfs @ 12.11 hrs, Volume= 3.124 af
Outflow = 12.61 cfs @ 12.51 hrs, Volume= 3.124 af, Atten= 69%, Lag= 24.0 min
Primary = 9.04 cfs @ 12.51 hrs, Volume= 3.035 af
Secondary = 3.57 cfs @ 12.51 hrs, Volume= 0.089 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 373.22' @ 12.51 hrs Surf.Area= 19,028 sf Storage= 37,328 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 28.3 min (825.7 - 797.5)

Volume	Invert	Avail.Storage	Storage Description
#1	368.00'	53,283 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

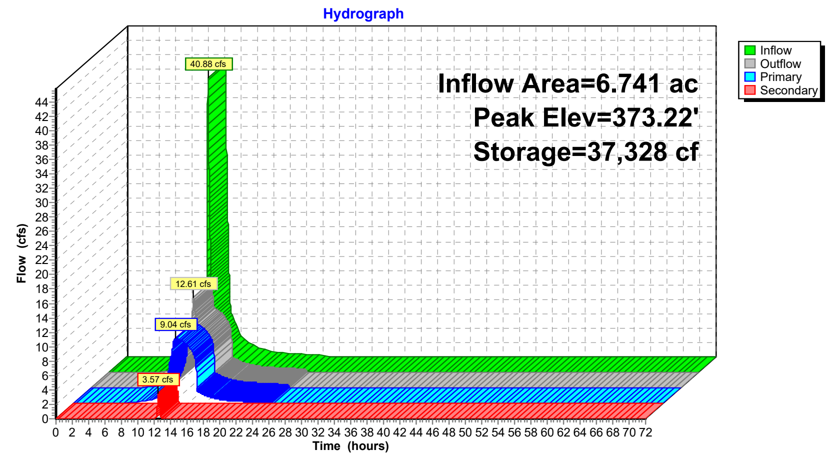
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
368.00	47	65.0	0	0	47
369.00	236	74.0	129	129	168
370.00	3,056	310.0	1,380	1,510	7,383
371.00	8,615	394.0	5,601	7,111	12,102
372.00	12,842	440.0	10,658	17,769	15,183
373.00	18,271	569.0	15,477	33,246	25,553
374.00	21,857	579.0	20,037	53,283	26,632

Device	Routing	Invert	Outlet Devices
#1	Primary	367.00'	**12.0" Round Culvert** L= 134.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 367.00' / 360.80' S= 0.0463 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Secondary	373.00'	**13.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=9.04 cfs @ 12.51 hrs HW=373.22' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 9.04 cfs @ 11.51 fps)

Secondary OutFlow Max=3.57 cfs @ 12.51 hrs HW=373.22' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 3.57 cfs @ 1.25 fps)

Pond INF B7: Infiltration Basin 7



Summary for Pond INF S1: Infiltration System 1

Inflow Area = 25.046 ac, 96.88% Impervious, Inflow Depth = 7.96" for 100-year event
Inflow = 204.06 cfs @ 12.08 hrs, Volume= 16.614 af
Outflow = 58.69 cfs @ 12.41 hrs, Volume= 16.615 af, Atten= 71%, Lag= 19.6 min
Discarded = 3.84 cfs @ 7.92 hrs, Volume= 8.511 af
Primary = 54.85 cfs @ 12.41 hrs, Volume= 8.104 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 363.20' @ 12.41 hrs Surf.Area= 68,776 sf Storage= 288,536 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 185.4 min (931.9 - 746.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	357.00'	107,003 cf	**155.67'W x 441.82'L x 6.75'H Field A** 464,239 cf Overall - 196,730 cf Embedded = 267,509 cf x 40.0% Voids
#2A	357.75'	196,730 cf	**ADS_StormTech MC-4500 +Cap** x 1836 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 1836 Chambers in 17 Rows Cap Storage= +35.7 cf x 2 x 17 rows = 1,213.8 cf
		303,734 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	359.10'	**36.0" Round Culvert** L= 125.0' Ke= 0.500 Inlet / Outlet Invert= 359.10' / 348.75' S= 0.0828 '/' Cc= 0.900 n= 0.010, Flow Area= 7.07 sf
#2	Discarded	357.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=3.84 cfs @ 7.92 hrs HW=357.07' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 3.84 cfs)

Primary OutFlow Max=54.85 cfs @ 12.41 hrs HW=363.20' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 54.85 cfs @ 7.76 fps)

Pond INF S1: Infiltration System 1 - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 17 rows = 1,213.8 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

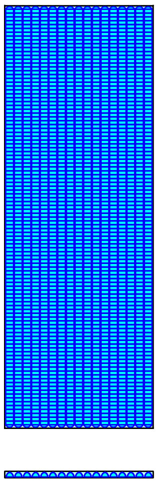
108 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 439.82' Row Length +12.0" End Stone x 2 = 441.82' Base Length
17 Rows x 100.0" Wide + 9.0" Spacing x 16 + 12.0" Side Stone x 2 = 155.67' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

1,836 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 17 Rows = 196,730.2 cf Chamber Storage

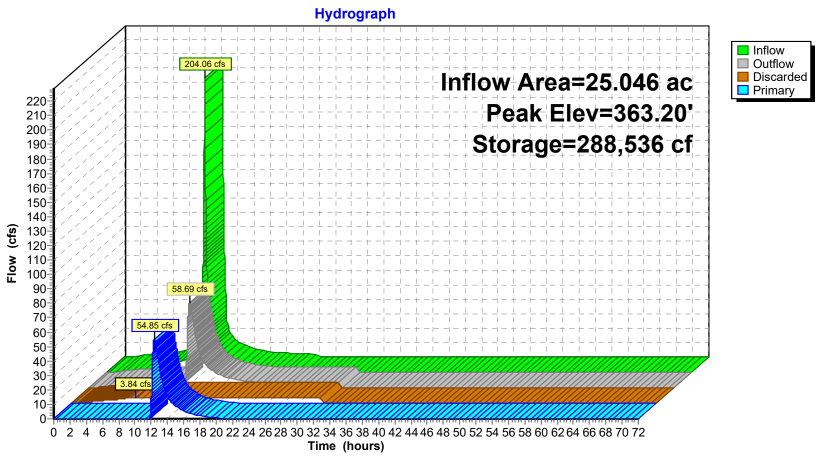
464,238.9 cf Field - 196,730.2 cf Chambers = 267,508.6 cf of Stone x 40.0% Voids = 107,003.5 cf Stone Storage

Chamber Storage + Stone Storage = 303,733.7 cf = 6.973 af
Overall Storage Efficiency = 65.4%
Overall System Size = 441.82' x 155.67' x 6.75'

1,836 Chambers
17,194.0 cy Field
9,907.7 cy Stone



Pond INF S1: Infiltration System 1



Summary for Pond INF S2: Infiltration System 2

Inflow Area = 22.118 ac,100.00% Impervious, Inflow Depth = 3.10" for 100-year event
Inflow = 37.22 cfs @ 12.08 hrs, Volume= 5.720 af
Outflow = 2.22 cfs @ 5.85 hrs, Volume= 5.721 af, Atten= 94%, Lag= 0.0 min
Discarded = 2.22 cfs @ 5.85 hrs, Volume= 5.721 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 362.98' @ 12.95 hrs Surf.Area= 39,719 sf Storage= 162,664 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 473.6 min (1,066.1 - 592.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	357.00'	62,087 cf	**137.50'W x 288.87'L x 6.75'H Field A** 268,104 cf Overall - 112,886 cf Embedded = 155,218 cf x 40.0% Voids
#2A	357.75'	112,886 cf	**ADS_StormTech MC-4500 +Cap** x 1050 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 1050 Chambers in 15 Rows Cap Storage= +35.7 cf x 2 x 15 rows = 1,071.0 cf
		174,973 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	357.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=2.22 cfs @ 5.85 hrs HW=357.07' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 2.22 cfs)

Pond INF S2: Infiltration System 2 - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 15 rows = 1,071.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

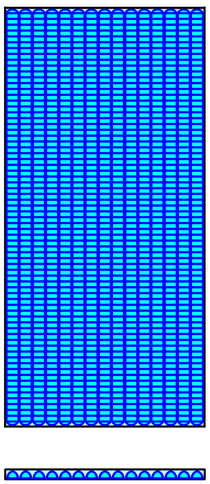
70 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 286.87' Row Length +12.0" End Stone x 2 = 288.87' Base Length
15 Rows x 100.0" Wide + 9.0" Spacing x 14 + 12.0" Side Stone x 2 = 137.50' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

1,050 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 15 Rows = 112,886.0 cf Chamber Storage

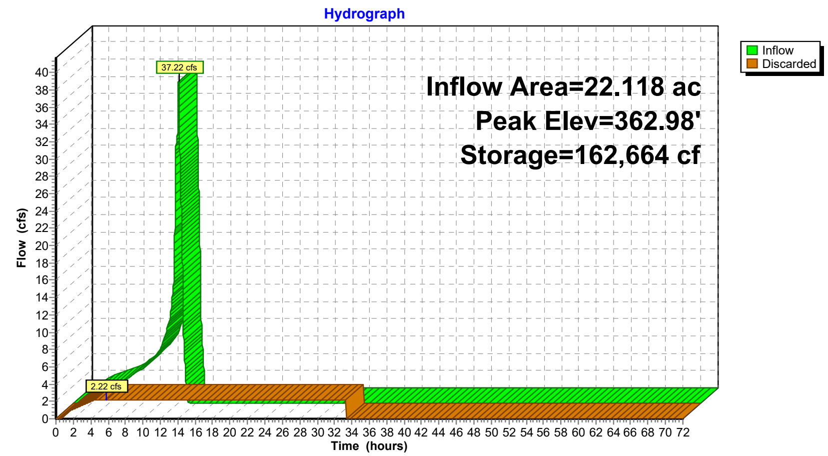
268,104.4 cf Field - 112,886.0 cf Chambers = 155,218.4 cf of Stone x 40.0% Voids = 62,087.4 cf Stone Storage

Chamber Storage + Stone Storage = 174,973.3 cf = 4.017 af
Overall Storage Efficiency = 65.3%
Overall System Size = 288.87' x 137.50' x 6.75'

1,050 Chambers
9,929.8 cy Field
5,748.8 cy Stone



Pond INF S2: Infiltration System 2



Summary for Pond INF S3: Infiltration System 3

Inflow Area = 1.884 ac,100.00% Impervious, Inflow Depth = 4.36" for 100-year event
Inflow = 7.14 cfs @ 12.05 hrs, Volume= 0.685 af
Outflow = 0.32 cfs @ 8.13 hrs, Volume= 0.685 af, Atten= 96%, Lag= 0.0 min
Discarded = 0.32 cfs @ 8.13 hrs, Volume= 0.685 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 324.03' @ 12.49 hrs Surf.Area= 5,680 sf Storage= 17,716 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 344.3 min (1,005.3 - 661.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	319.75'	9,174 cf	**64.83'W x 87.62'L x 6.75'H Field A** 38,343 cf Overall - 15,408 cf Embedded = 22,935 cf x 40.0% Voids
#2A	320.50'	15,408 cf	**ADS_StormTech MC-4500 +Cap** x 140 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 140 Chambers in 7 Rows Cap Storage= +35.7 cf x 2 x 7 rows = 499.8 cf
		24,582 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	319.75'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.32 cfs @ 8.13 hrs HW=319.82' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.32 cfs)

Pond INF S3: Infiltration System 3 - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 7 rows = 499.8 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

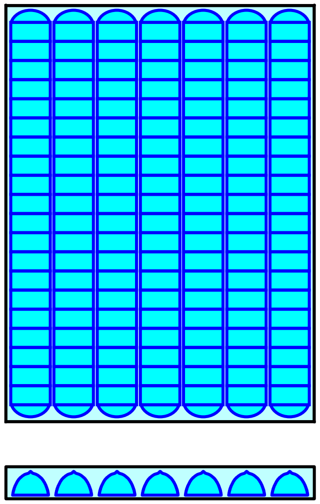
20 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 85.62' Row Length +12.0" End Stone x 2 = 87.62' Base Length
7 Rows x 100.0" Wide + 9.0" Spacing x 6 + 12.0" Side Stone x 2 = 64.83' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

140 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 7 Rows = 15,408.5 cf Chamber Storage

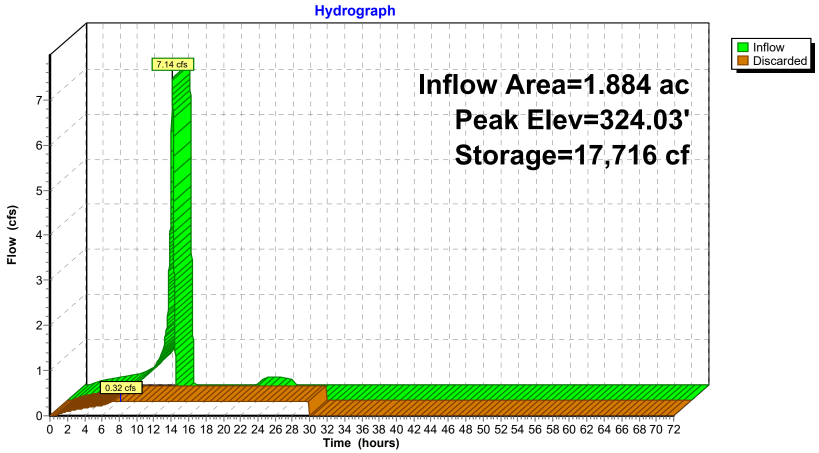
38,343.2 cf Field - 15,408.5 cf Chambers = 22,934.8 cf of Stone x 40.0% Voids = 9,173.9 cf Stone Storage

Chamber Storage + Stone Storage = 24,582.4 cf = 0.564 af
Overall Storage Efficiency = 64.1%
Overall System Size = 87.62' x 64.83' x 6.75'

140 Chambers
1,420.1 cy Field
849.4 cy Stone



Pond INF S3: Infiltration System 3

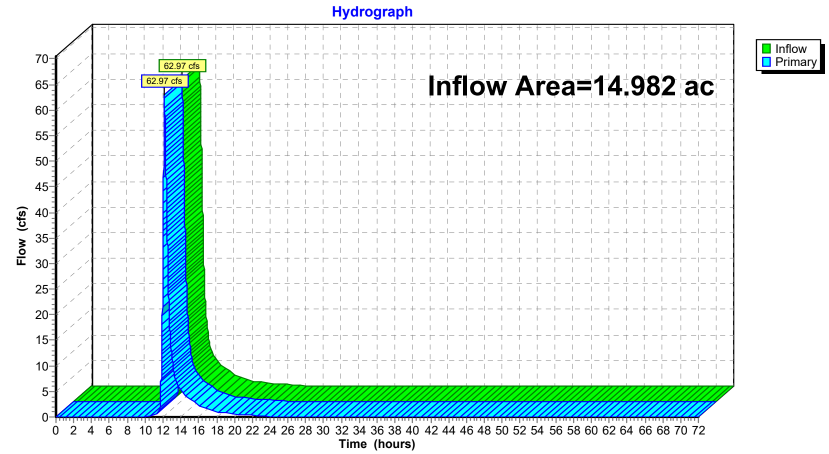


Summary for Link P.O.A. #1: P.O.A. #1

Inflow Area = 14.982 ac, 50.28% Impervious, Inflow Depth = 4.00" for 100-year event
Inflow = 62.97 cfs @ 12.17 hrs, Volume= 4.993 af
Primary = 62.97 cfs @ 12.17 hrs, Volume= 4.993 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #1: P.O.A. #1

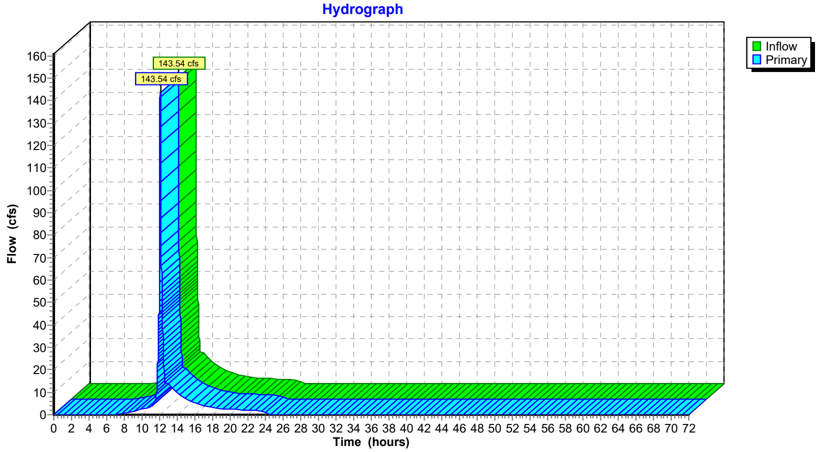


Summary for Link P.O.A. #2: P.O.A. #2

Inflow = 143.54 cfs @ 12.08 hrs, Volume= 9.173 af
Primary = 143.54 cfs @ 12.08 hrs, Volume= 9.173 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #2: P.O.A. #2

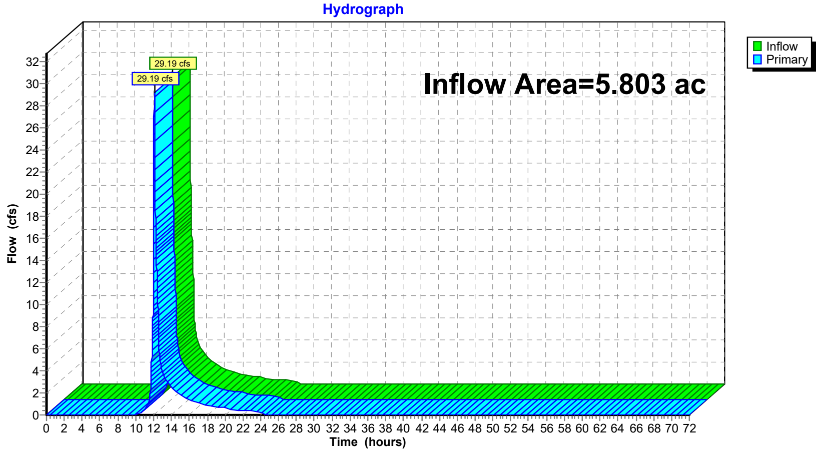


Summary for Link P.O.A. #4: P.O.A. #4

Inflow Area = 5.803 ac, 2.86% Impervious, Inflow Depth = 4.55" for 100-year event
Inflow = 29.19 cfs @ 12.10 hrs, Volume= 2.202 af
Primary = 29.19 cfs @ 12.10 hrs, Volume= 2.202 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #4: P.O.A. #4

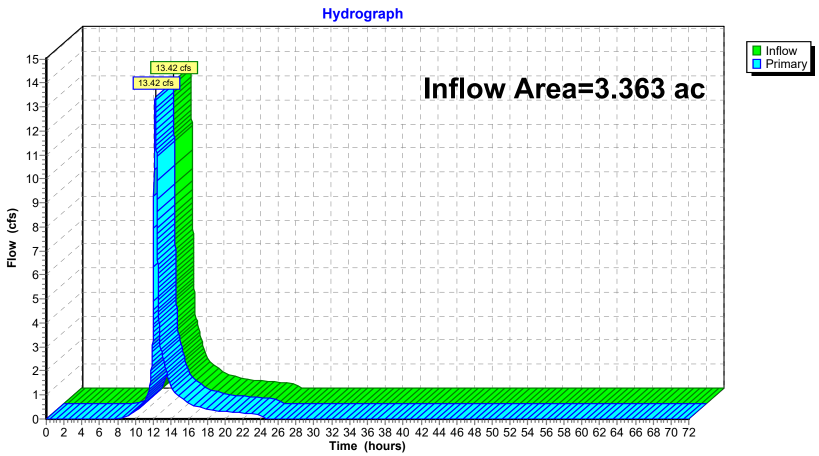


Summary for Link P.O.A. #6: P.O.A. #6

Inflow Area = 3.363 ac, 26.64% Impervious, Inflow Depth = 4.65" for 100-year event
Inflow = 13.42 cfs @ 12.22 hrs, Volume= 1.303 af
Primary = 13.42 cfs @ 12.22 hrs, Volume= 1.303 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A. #6: P.O.A. #6

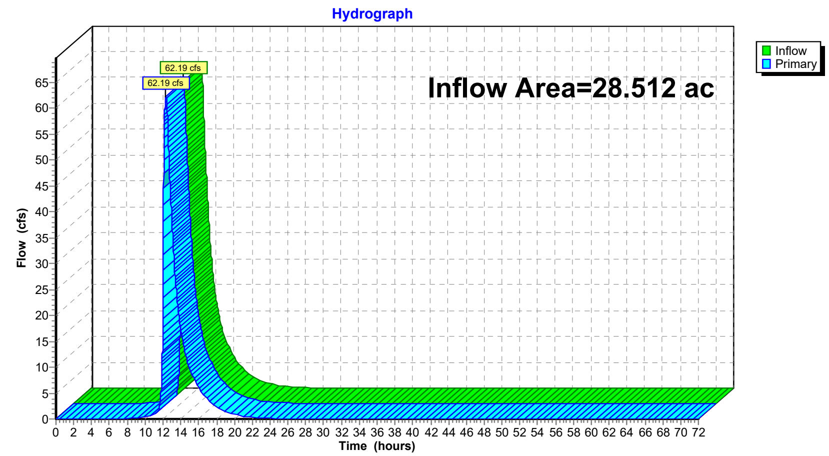


Summary for Link P.O.A.#3: P.O.A. #3

Inflow Area = 28.512 ac, 88.93% Impervious, Inflow Depth = 4.03" for 100-year event
Inflow = 62.19 cfs @ 12.34 hrs, Volume= 9.575 af
Primary = 62.19 cfs @ 12.34 hrs, Volume= 9.575 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A.#3: P.O.A. #3

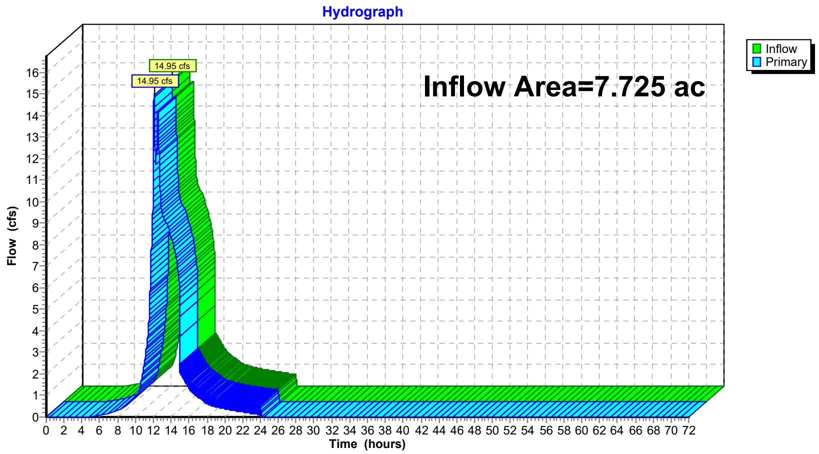


Summary for Link P.O.A.#5: P.O.A. #5

Inflow Area = 7.725 ac, 65.18% Impervious, Inflow Depth = 5.68" for 100-year event
Inflow = 14.95 cfs @ 12.09 hrs, Volume= 3.659 af
Primary = 14.95 cfs @ 12.09 hrs, Volume= 3.659 af, Atten= 0%, Lag= 0.0 min

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

Link P.O.A.#5: P.O.A. #5



Appendix G – TSS Calculation and Documentation

BEALS • ASSOCIATES INC.
2 Park Plaza, Suite 200, Boston, MA 02116
Phone: 617-242-1120

Project ID	Prepared By	Checked By	Date
C-1144.01	DPH	TPM	July, 2022

Title TSS Removal Calculations

TSS Removal Calculation Worksheet

Location: Treatment Train 1

B BMP	C TSS Removal Rate	D Starting TSS Load	E TSS Removed (C x D)	F Remaining Load (D - E)
Deep Sump Catch Basin	25%	100%	25%	75%
Hydro International FD (Proprietary Devices)	80%	75%	60%	15%

Total TSS Removal 85%

TSS Removal Calculation Worksheet

Location: Treatment Train 2

B BMP	C TSS Removal Rate	D Starting TSS Load	E TSS Removed (C x D)	F Remaining Load (D - E)
Deep Sump Catch Basin	25%	100%	25%	75%
Hydro International FD (Proprietary Devices)	80%	75%	60%	15%
Subsurface Infiltration System	80%	15%	12%	3%

Total TSS Removal 97%

TSS Removal Calculation Worksheet

Location: Treatment Train 3

B BMP	C TSS Removal Rate	D Starting TSS Load	E TSS Removed (C x D)	F Remaining Load (D - E)
Deep Sump Catch Basin	25%	100%	25%	75%
Hydro International FD (Proprietary Devices)	80%	75%	60%	15%
Infiltration Basin	80%	15%	12%	3%

Total TSS Removal 97%

Technical Abstract
First Defense® - High Capacity

NJCAT Verified 80% TSS Removal for 50 to 150 µm Particle Size Range

Introduction

Hydro International has a state-of-the-art hydraulics and test facility that is used both to develop products and to evaluate performance. Through controlled testing using industry standard test protocols, Hydro's treatment products are evaluated under varying hydraulic and sediment load conditions. With a known drainage area or water quality flow rate, these test results are used to benchmark treatment objectives and to select the correct model size.

A common stormwater treatment goal for manufactured treatment devices is to reduce the Total Suspended Solids (TSS) concentration by at least 80%. To comply with this goal, a silica-based test sand with known particle size gradation (PSD) and density is injected into the treatment system at different flow rates. With known TSS concentrations and particle sizes before and after treatment, efficiency curves are plotted and used to predict TSS reductions for a range of particle sizes.

OK110 Silica Test Sand

U.S. Silica OK110 is a common test sand that has been used by the industry but is no longer available. However, its PSD can be modelled from a blend of silica sands having a wide range of particle sizes. This abstract summarizes test results based on a particle size range similar to OK110 for the First Defense® High Capacity (FDHC). All test protocols and results have been independently verified by the New Jersey Corporation for Advanced Technology (NJCAT). The full report can be viewed at: FDHC_PSD_Removal_Verification_Report_9-16.pdf

First Defense High Capacity (FDHC)

The FDHC (Figure 1) has patented flow modifying internal components that create a gentle swirling flow path within the Vortex Chamber. The rotating flow creates low energy vortex forces that supplement gravitational settling forces to enhance separation of pollutants.

The internal components are fit into precast manholes to collect runoff as part of typical drainage network system. During rain events, flow enters either from a surface inlet grate or inlet pipe. As flow enters the manhole, components divert flow and pollutants into a Vortex Chamber beneath a separation module, that includes both Inlet\Outlet Chutes and Bypass Weirs. The internal Bypass Weirs divert peak flows over the separation module and away from the Vortex Chamber where pollutants are collecting. This prevents high velocities from re-suspending captured pollutants during infrequent but large storm events.

Capable of providing high pollutant removals for a wide range of flow rates and pipe sizes, the FDHC can be installed ether online or offline depending on pipes and peak flows. Its efficiency and simplicity make it economical to install and maintain.

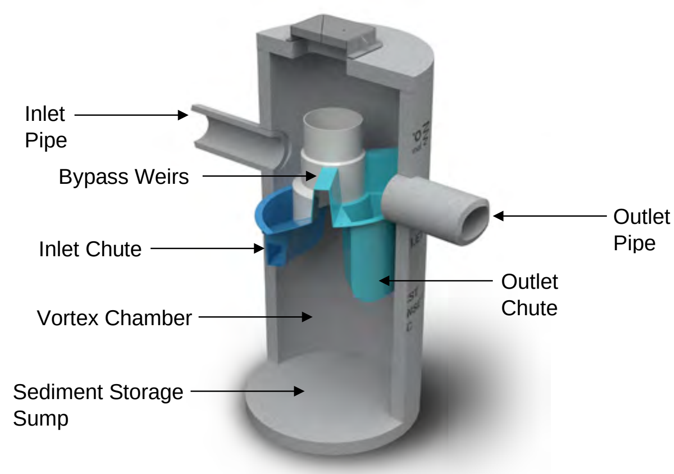


Figure 1 - First Defense High Capacity

Laboratory Testing Arrangement

The laboratory setup (Figure 2) consisted of a recirculating closed loop system with an 8-inch (200 mm) submersible Flygt pump that conveyed water from a 23,000 gal (87,064 L) reservoir through a PVC pipe network to the 4-ft (1.2m) FDHC. The flow rate of the pump was controlled by a GE Fuji Electric AF-300 P11 Adjustable Frequency Drive and measured by an EMCO Flow Systems 4411e Electromagnetic Flow Transmitter. Test sand was injected into the incoming flow stream using a volumetric screw feeder situated 10-ft prior to entering the test unit.

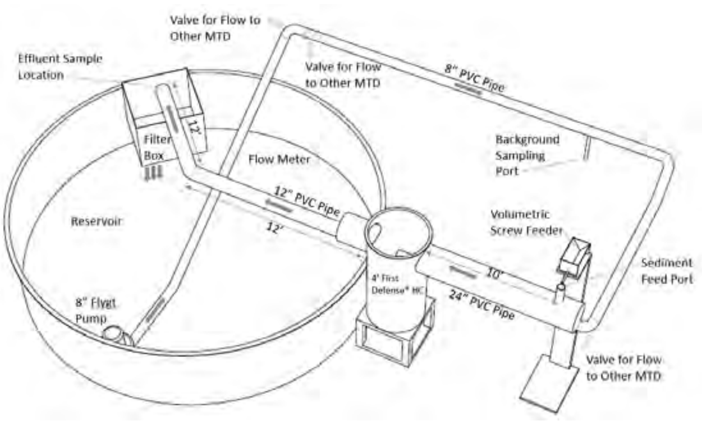


Figure 2 - Setup of the Portland, Maine hydraulic testing facility

Test Sediment

The feed sediment injected into the inlet during removal efficiency testing was a blend of commercially available silica sands ranging from 2 µm to 1,000 µm. The PSD of the test sediment was analyzed by an independent laboratory in accordance with ASTM D 422-63.

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First Defense® - High Capacity

To evaluate the performance consistent with OK110 test sand, results were analyzed from the particle sizes range of 50 µm to 150 µm (D_{50}=108µm). A comparison between the 50 – 150 µm range and OK110 gradation is shown in Figure 3. The 50 – 150 µm test sand gradation is overall finer than OK110 between 50 µm and 100 µm. For example, the test sand had 15% finer than 75 µm compared to the OK110 PSD that had only 3% less than 75 microns. Given that finer particles are more difficult to remove, performance results for 50 to 150 µm PSD is considered conservative.

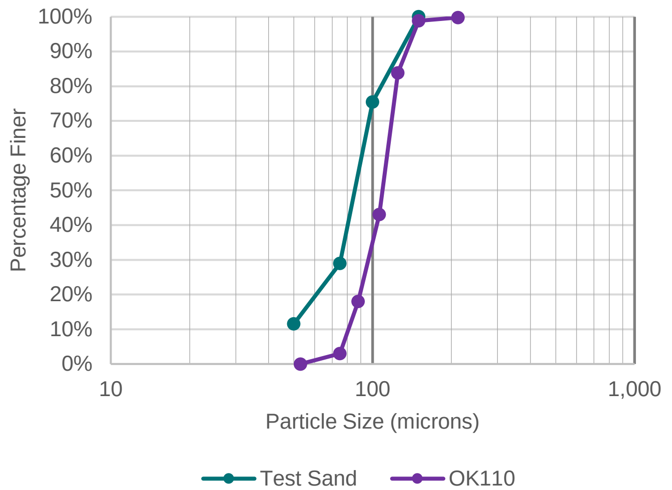


Figure 3 - Particle Size Distribution Comparison

Removal Efficiency Testing

Removal efficiency testing with the feed sediment was conducted in accordance with Section 5 of the NJDEP Laboratory Protocol for Manufactured Treatment Devices. Five flow rates ranging from 0.38 cfs to 1.88 cfs were tested to assess the performance trend.

The test sediment was fed into the flow stream at a rate that was equivalent to 200 mg/L. The average influent TSS concentration was calculated using the total sediment mass and volume of water added during dosing. The influent concentration for each particle size band was calculated using the percentage of particles in each particle size band and known average inlet concentration. Three time-spaced effluent grab samples were composited and analyzed using laser diffraction (ISO 13320) to evaluate the effluent particle sizes.

Table 1 – 50 – 150 µm Particle Size Range Test Results

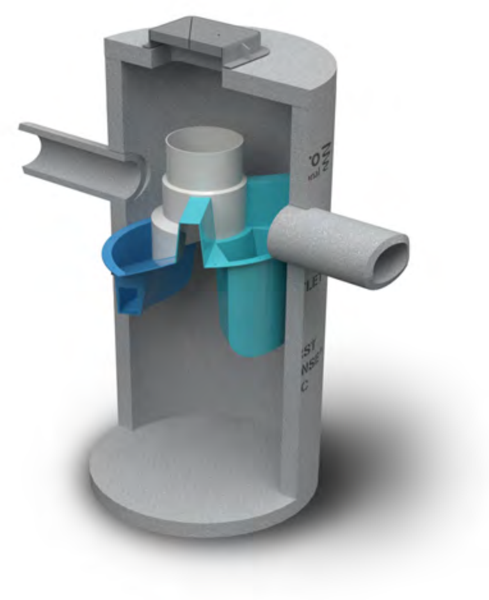
Flow	Inlet Mass	Outlet Mass	Removal
cfs (L/s)	grams	grams	%
0.38 (10.8)	1,554.6	107.1	93.1
0.75 (21.2)	1,761.0	150.8	91.4
1.13 (32.0)	1,872.8	127.2	93.2
1.5 (42.5)	2,203.2	226.7	89.7
1.88 (53.2)	2,366.6	303.8	87.2

The average effluent sediment concentration of the three composited samples was also measured for each flow rate in accordance with ASTM D3977-97. The effluent concentration for each particle size band was then calculated using the average effluent composite concentration and percentage of particles in each particle size band.

Percent removed at each of the five tested flow rates is shown in Table 1. Inlet concentrations of the OK110 particle size range varied from 79-84 mg/L compared to 4-8.5 mg/L at the outlet. As expected, the highest concentration measured at the outlet was at the highest tested flow rate of 1.88 cfs (53.2 L/s). In general, the 4-ft FDHC removed greater than 85% of the OK110 particle size range for all tested flow rates. Table 2 provides "Treatment Flow Rates" for the available models.

Table 2 – FDHC Treatment Flow Rate for > 85% OK110

Model:	FD-3HC	FD-4HC	FD-5HC	FD-6HC	FD-8HC
Size:	3 ft (900 mm)	4 ft (1.2 m)	5 ft (1.5 m)	6 ft (1.8 m)	8 ft (2.4m)
cfs:	1.06	1.88	2.94	4.23	7.52
L/s:	30.02	53.2	83.3	119.8	212.9



For design purposes the selected model's Treatment Flow Rate must be equal or greater to the site's required Water Quality Flow Rate. The peak flow rate and maximum pipe size must be considered to determine whether an online or offline configuration is appropriate. Full removal curves are available on request.

Refer First Defense product information brochure or visit https://www.hydro-int.com/en/products/first-defense for more information

Hydro International

Appendix H – Operation and Maintenance Control Plan

Available under separate cover

Attachment H

RMAT Output Report

RMAT Climate Resilience Design Standards Tool Project Report

Portman Intel Site Hudson
Date Created: 7/22/2022 11:59:15 AM   Created By: agood9412   Download

Project Summary

Link to Project

Estimated Construction Cost: $120000000.00
End of Life Year: 2084
Project within mapped Environmental Justice neighborhood: No

Ecosystem Benefits	Scores
Project Score	Low
Exposure	**Scores**
Sea Level Rise/Storm Surge	Not Exposed
Extreme Precipitation - Urban Flooding	High Exposure
Extreme Precipitation - Riverine Flooding	High Exposure
Extreme Heat	High Exposure

Asset Summary

Number of Assets: 1

Asset Risk	Sea Level Rise/Storm Surge	Extreme Precipitation - Urban Flooding	Extreme Precipitation - Riverine Flooding	Extreme Heat
Warehouse Facility	Low Risk	High Risk	High Risk	High Risk

Project Outputs

	Target Planning Horizon	Intermediate Planning Horizon	Percentile	Return Period	Tier
Sea Level Rise/Storm Surge					
Warehouse Facility					
Extreme Precipitation					
Warehouse Facility	2070			100-yr (1%)	Tier 3
Extreme Heat					
Warehouse Facility	2070		90th		Tier 3

Scoring Rationale - Exposure

Sea Level Rise/Storm Surge

This project received a "Not Exposed" because of the following:

- Not located within the predicted mean high water shoreline by 2030
- No historic coastal flooding at project site
- Not located within the Massachusetts Coast Flood Risk Model (MC-FRM)

Extreme Precipitation - Urban Flooding

This project received a "High Exposure" because of the following:

- Increased impervious area
- Maximum annual daily rainfall exceeds 10 inches within the overall project's useful life
- No historic flooding at project site

- Existing impervious area of the project site is between 10% and 50%

Extreme Precipitation - Riverine Flooding

This project received a "High Exposure" because of the following:

- Part of the project is within a mapped FEMA floodplain, outside of the Massachusetts Coast Flood Risk Model (MC-FRM)
- Part of the project is within 500ft of a waterbody and less than 20ft above the waterbody
- No historic riverine flooding at project site
- Project is not likely susceptible to riverine erosion

Extreme Heat

This project received a "High Exposure" because of the following:

- 30+ days increase in days over 90 deg. F within project's useful life
- Increased impervious area
- Existing trees are being removed as part of the proposed project
- Existing impervious area of the project site is between 10% and 50%
- Located within 100 ft of existing water body

Scoring Rationale - Asset Risk Scoring

Asset - Warehouse Facility
Primary asset criticality factors influencing risk ratings for this asset:

- Asset can be inaccessible/inoperable more than a week after natural hazard event without consequences
- Less than 1,000 people would be directly affected by the loss/inoperability of the asset
- Inoperability of the asset would not be expected to result in injuries
- Cost to replace is greater than $100 million
- There are no hazardous materials in the asset

Project Design Standards Output

Asset: Warehouse Facility — Building/Facility

Sea Level Rise/Storm Surge — Low Risk

Applicable Design Criteria

Projected Tidal Datums: No
Projected Water Surface Elevation: No
Projected Wave Action Water Elevation: No
Projected Wave Heights: No
Projected Duration of Flooding: No
Projected Design Flood Velocity: No
Projected Scour & Erosion: No

Extreme Precipitation — High Risk

Target Planning Horizon: 2070
Return Period: 100-yr (1%)

Applicable Design Criteria

Tiered Methodology: Tier 3

Projected Total Precipitation Depth & Peak Intensity for 24-hr Design Storms: Yes

Asset Name	Recommended Planning Horizon	Recommended Return Period (Design Storm)	Projected 24-hr Total Precipitation Depth (inches)	Step-by-Step Methodology for Peak Intensity
Warehouse Facility	2070	100-Year (1%)	10.7	Downloadable Methodology PDF

Limitations: While precipitation depth is useful for project planning and design, rainfall distribution and peak intensity of the design storm is recommended to also be considered. Lower-intensity, longer-duration storms allow time for infiltration and reduce the load on the infrastructure system over the duration of the storm. Higher-intensity, shorter-duration storms often have higher runoff volumes because the water does not have enough time to infiltrate and infrastructure systems (e.g., catch basins) and may overflow or back up during such storms. In the Northeast, short -duration high intensity rain events are becoming more frequent, and there is often little early warning for these events, making it difficult to plan operationally. These events can result in the rapid inundation of the asset project location. Design should consider both short- and long-duration precipitation events and how they may impact the asset.

The precipitation values provided by this Tool (version 1) are recommended to inform planning and design, but they do not guarantee that the asset will be protected from or be able to withstand an extreme precipitation event. The planning, design, and review guidance accompanying these values is general and projects are encouraged to do their own due diligence to understand the vulnerability of their asset.

Projected Riverine Peak Discharge & Peak Flood Elevation: Yes

Extreme Heat	High Risk

Target Planning Horizon: 2070
Percentile: 90th Percentile

Applicable Design Criteria

Tiered Methodology: Tier 3

Projected Annual/Summer/Winter Average Temperatures: Yes
Projected Heat Index: Yes
Projected Growing Degree Days: No
Projected Days Per Year With Max Temp > 95°F, >90°F, <32°F: Yes
Projected Number of Heat Waves Per Year & Average Heat Wave Duration: Yes
Projected Cooling Degree Days & Heating Degree Days (base = 65°F): Yes

Project Inputs

Core Project Information

Name:	Portman Intel Site Hudson
Given the expected useful life of the project, through what year do you estimate the project to last (i.e. before a major reconstruction/renovation)?	2084
Location of Project:	Hudson
Estimated Capital Cost:	$120,000,000
Who is the Submitting Entity?	Private Other Portman Industrial, LLC Mike Wurtsbaugh (mwurtsbaugh@portmanindustrial.com)
Is this project being submitted as part of a state grant application?	No
Which grant program?	
What stage are you in your project lifecycle?	Planning
Is climate resiliency a core objective of this project?	No
Is this project being submitted as part of the state capital planning process?	No
Is this project being submitted as part of a regulatory review process or permitting?	Yes
Brief Project Description:	Please refer to the ENF for a Project Description
Project Submission Comments:	

Project Ecosystem Benefits

Factors Influencing Output

✓ Project reduces storm damage
✓ Project protects public water supply
✓ Project recharges groundwater
✓ Project improves water quality

Factors to Improve Output

✓ Incorporate nature-based solutions that may provide flood protection
✓ Incorporate strategies that reduce carbon emissions
✓ Incorporate green infrastructure to filter stormwater
✓ Incorporate nature-based solutions that sequester carbon carbon
✓ Increase biodiversity, protect critical habitat for species, manage invasive populations, and/or provide connectivity to other habitats
✓ Preserve, enhance, and/or restore coastal shellfish habitats
✓ Incorporate vegetation that provides pollinator habitat
✓ Identify opportunities to remediate existing sources of pollution
✓ Provide opportunities for passive and/or active recreation through open space
✓ Increase plants, trees, and/or other vegetation to provide oxygen production
✓ Mitigate atmospheric greenhouse gas concentrations and other toxic air pollutants through nature-based solutions
✓ Identify opportunities to prevent pollutants from impacting ecosystems
✓ Incorporate education and/or protect cultural resources as part of your project

Is the primary purpose of this project ecological restoration?

No

Project Benefits

Provides flood protection through nature-based solutions	No
Reduces storm damage	Yes

Recharges groundwater	Yes
Protects public water supply	Yes
Filters stormwater using green infrastructure	No
Improves water quality	Yes
Promotes decarbonization	No
Enables carbon sequestration	No
Provides oxygen production	No
Improves air quality	No
Prevents pollution	No
Remediates existing sources of pollution	No
Protects fisheries, wildlife, and plant habitat	No
Protects land containing shellfish	No
Provides pollinator habitat	No
Provides recreation	No
Provides cultural resources/education	No

Project Climate Exposure

Is the primary purpose of this project ecological restoration?	No
Does the project site have a history of coastal flooding?	No
Does the project site have a history of flooding during extreme precipitation events (unrelated to water/sewer damages)?	No
Does the project site have a history of riverine flooding?	No
Does the project result in a net increase in impervious area of the site?	Yes
Are existing trees being removed as part of the proposed project?	Yes

Project Assets

Asset: Warehouse Facility
Asset Type: Typically Occupied
Asset Sub-Type: Non-residential building (office, commercial, retail)
Construction Type: New Construction
Construction Year: 2024
Useful Life: 60

Identify the length of time the asset can be inaccessible/inoperable without significant consequences.
Building may be inaccessible/inoperable more than a week after natural hazard event without consequences
Identify the geographic area directly affected by permanent loss or significant inoperability of the building/facility.
Impacts limited to site only
Identify the population directly served that would be affected by the permanent loss of use or inoperability of the building/facility.
Less than 1,000 people
Identify if the building/facility provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
The building/facility does not provide services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
If the building/facility became inoperable for longer than acceptable in Question 1, how, if at all, would it be expected to impact people's health and safety?
Inoperability of the building/facility would not be expected to result in injuries
If there are hazardous materials in your building/facility, what are the extent of impacts related to spills/releases of these materials?
There are no hazardous materials in the building/facility
If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts on other facilities, assets, and/or infrastructure?
Minor – Inoperability will not likely affect other facilities, assets, or buildings
If this building/facility was damaged beyond repair, how much would it approximately cost to replace?
Greater than or equal to $100 million
Is this a recreational facility which can be vacated during a natural hazard event?
No
If the building/facility became inoperable for longer than acceptable in Question 1, what are the public and/or social services impacts?
Many alternative programs and/or services are available to support the community
If the building/facility became inoperable for longer than acceptable in Question 1, what are the environmental impacts related to natural resources?
No impact on surrounding natural resources is expected
If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts to government services (i.e. the building is not able to serve or operate its intended users or function)?
Loss of building is not expected to reduce the ability to maintain government services.
If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts to loss of confidence in government (i.e. the building is not able to serve or operate its intended users or function)?
No Impact

Report Comments

N/A