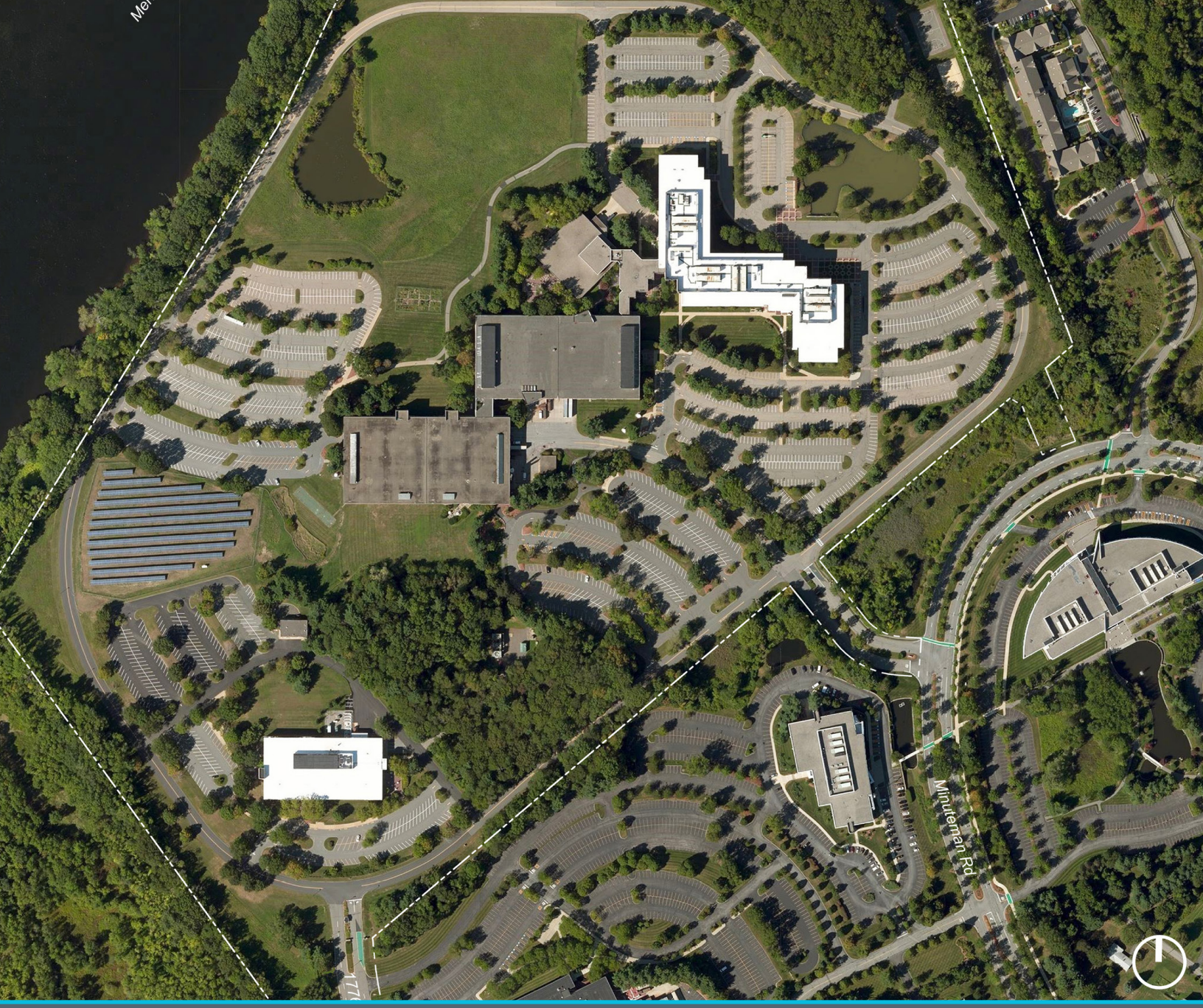


ALEXANDRIA®

SMMA

Expanded Environmental Notification Form

Alexandria Real Estate Equities, Inc.

3000 Minuteman Road
Andover, Massachusetts

August 1, 2022

Expanded Environmental Notification Form (EENF)

Alexandria Real Estate Equities, Inc.
3000 Minuteman Road
Andover, Massachusetts

Prepared by
SMMA

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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: 3000 Minuteman Road			
Street Address: 3000 Minuteman Road			
Municipality: Andover		Watershed: Merrimack	
Universal Transverse Mercator Coordinates: 19 318216 E, 4729233 N		Latitude: 42.694090 Longitude: -71.219390	
Estimated commencement date: Spring 2022		Estimated completion date: Spring 2025	
Project Type: Commercial & Manufacturing		Status of project design: 25 % complete	
Proponent: ARE-MA Region 93, LLC			
Street Address: 26 North Euclid Avenue			
Municipality: Pasadena		State: CA	Zip Code: 91101
Name of Contact Person: Brian Lawlor, PE			
Firm/Agency: SMMA		Street Address: 1000 Massachusetts Ave	
Municipality: Cambridge		State: MA	Zip Code: 02138
Phone: (617) 547-5400	Fax:		E-mail: blawlor@smma.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

(Note: Greenhouse Gas Emissions analysis must be included in the Expanded ENF.)

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

- 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;
- Creation of ten or more acres of impervious area;
- Expansion in discharge to a sewer system of 100,000 or more gpd of sewage.

Which State Agency Permits will the project require?

- State Highway Access Permit and Traffic Signal Regulation from MassDOT

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:

Summary of Project Size & Environmental Impacts	Existing	Change	Total
LAND			
Total site acreage	118.29		
New acres of land altered			
Acres of impervious area	41.46	10.49	51.94
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	726,000	400,000	1,126,000
Number of housing units	0	0	0
Maximum height (feet)	50	0	50 (plus additional height <25% ground floor area)
TRANSPORTATION			
Vehicle trips per day	5,600	1,668	7,268
Parking spaces	2,347	353	2,700 +/-
WASTEWATER			
Water Use (Gallons per day)	49,031	347,899	396,930
Water withdrawal (GPD)	0	0	0
Wastewater generation/treatment (GPD)	49,031	185,097	234,128
Length of water mains (miles)	3.3	0.4	3.7
Length of sewer mains (miles)	1.1	0.3	1.4

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

Has any project on this site been filed with MEPA before?
☒ Yes (EEA # 8929) ☐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 project site is accessed via Minuteman Road and 1776 Drive off River Road in Andover, MA. Existing conditions consist of four buildings totaling 726,000 gross square feet with associated parking areas accessed off a loop road internal to the 118 acres site.

Describe the proposed project and its programmatic and physical elements:
The proposed project includes renovation of the existing four buildings and the link/amenity area, a 100,000 sq
one building, and construction of two buildings of 150,000 sq. ft. each. The total project build out of 1,126,000 sq. ft. will require off-site improvements to signalized intersections to support the increase in traffic generation.

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:
See section 1.6 of the EENF for a description of on-site alternatives.
Alternative 1 proposes larger building footprints for the new construction in compliance with current zoning.
Alternative 2 proposes additional parking and driveway circulation also in compliance with current zoning.
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 project Proponent will design and implement an optimal traffic signal timing, phasing and coordination plan for the River Road traffic signal system. Traffic mitigation measures are described in Section 3 of the EENF.

The master plan has been designed to minimize new impervious coverage including reduced building Footprints and parking ratios. Significant areas of the new impervious area will be porous pavement Including the new parking lot associated with the new buildings (5 and 6). Description of the porous pavement and the extensive list of storm water BMP's (best management practices) is included in Section 2 of the EENF.

The Proponent will pursue a goal of 25% electrification of space heating demand and 20% operational carbon reduction for the new buildings.

The Proponent is pursuing LEED certification for renovations and new construction, with a goal of LEED Silver or better. This will impact the detailed design of many aspects of the project including site and landscape, water, wastewater, building energy and envelope.

If the project is proposed to be constructed in phases, please describe each phase:
Phase 1: Renovation of existing buildings 2, 3, and 4.
Phase 2: Renovation and addition to Building 1.
Phase 3: New construction of Buildings 5 & 6 and associated parking and site improvements.

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 ___ 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_____) ☒No
If yes, does the project involve any demolition or destruction of any listed or inventoried historic or archaeological resources? ☐Yes (Specify_____) ☐No

WATER RESOURCES:
Is there an Outstanding Resource Water (ORW) on or within a half-mile radius of the project site? _X_Yes ___No; if yes, identify the ORW and its location.
- Fishbrook Station Public Water Supply Watershed located south of the project site.

(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? _X_Yes ___No; if yes, identify the water body and pollutant(s) causing the impairment: Fish Passage Barrier, Escherichia Coli (E. Coli), Mercury in Fish Tissue, PCBs in Fish Tissue, and Phosphorus – Total.

Is the project within a medium or high stress basin, as established by the Massachusetts Water Resources Commission? _X__Yes ___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 will comply with the MassDEP Stormwater Management Policy and Town of Andover Stormwater Management Standards for the new construction portions of the proposed project and will comply as a redevelopment project for renovation of the existing buildings and infrastructure.

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?

site (including Release Tracking Number (RTN), cleanup phase, and Response Action Outcome classification):_____N/A_____

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:_____

(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 __X__ No ___ ; 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: _____

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. Yes ___ No ___ ; 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.
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.
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.
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.
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).

6. List of all agencies and persons to whom the proponent circulated the ENF, in accordance with 301 CMR 11.16(2).
7. List of municipal and federal permits and reviews required by the project, as applicable.
8. Printout of output report from RMAT Climate Resilience Design Standards Tool, available here.
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.

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: Creation of ten or more acres of impervious area.

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	7.98	6.38	14.36
Internal roadways	11.23	0.23	11.46
Parking and other paved areas	22.03	4.10	26.12
Other altered areas	58.44	7.69	66.35
Undeveloped areas	18.39	-0.58	17.81
Total: Project Site Acreage	118.29	0.00	118.29

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? _X__ Yes___ No; if yes, does the project involve the release or modification of such restriction? ___ Yes _X__ No; if yes, describe: There are three Preservation Restrictions to Massachusetts Historical Commission established in 1994 in the northern portion of the project site where development is not proposed.

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:

G. Does the project require approval of a new urban renewal plan or a major modification of an existing urban renewal plan under M.G.L.c.121B? Yes ___ No _X__; if yes, describe:

III. Consistency

A. Identify the current municipal comprehensive land use plan
Title: Town of Andover Massachusetts 2012 Master Plan Date February 14, 2012

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

1) economic development:
The Town of Andover Master Plan includes goal statements relative to Land Use and Zoning (LU), Housing (H), Economic Development (ED), Open Spaces (OS), Natural, Historic, and Cultural Resources (NHC), Transportation and Circulation (TC), and Municipal Facilities and Town Services (MF). The Economic Development goals state "a key challenge facing the Town is how to accommodate new growth in the industrial and commercial sector due to the near build-out of existing accessible land that is appropriately zoned." The

Project will revitalize and expand the existing development to attract top talent employees. The Project proposes onsite amenities that may include onsite high-end food services, onsite fitness center, and laundry services. These conveniences and amenities will work towards reducing traffic demands and provide employment opportunities to a range of professions and services. The influx of employees and visitors to the project site will benefit the retail developments in this part of Andover. The employment opportunities and strong tax base the proposed project will provide are consistent with the Town of Andover Master Plan.

2) adequacy of infrastructure:
Refer to Section 3 – Transportation regarding how the Project can be accommodated within the confines of the existing transportation infrastructure in a safe and efficient manner with implementation of the recommendations described.
The Proponent is coordinating with the Town of Andover Department of Public Works and their consultants regarding the adequacy of water and wastewater infrastructure.

2) open space impacts:
There are Conservation Open Spaces located adjacent the Site to the north and west bordering the Merrimack River. The Project will protect the existing landscape buffers around the perimeter of the Site that abut these Open Space areas, as well as the existing pedestrian connections to these areas. The Project will not impact the three onsite Preservation Restriction areas established by the Massachusetts Historical Commission. Refer to Section 2 regarding how the Project will minimize disturbance within the various onsite natural resource buffer zones.

4) compatibility with adjacent land uses:
The Project is located within the Industrial D2 (ID2) Zoning District and proposes uses that are permitted by-right or by Special Permit with the Town of Andover. The project Master Plan proposes development that respects the adjacent residential zoning district by preserving landscape buffers and focusing construction activities away from neighboring properties.

C. Identify the current Regional Policy Plan of the applicable Regional Planning Agency (RPA)
RPA: Merrimack Valley Planning Commission

Title: 2018-2023 Merrimack Valley Comprehensive Economic Development Strategy
Date: June 21, 2018

D. Describe the project's consistency with that plan with regard to:
1) economic development:
The Merrimack Valley (MV) Comprehensive Economic Development Strategy (CEDS) developed a five-year plan focusing on four emerging issues in the region: City and Town Centers, Manufacturing, Natural and Cultural Resources, and Transportation. The Manufacturing vision includes the following three objectives:
1. Brand the Merrimack Valley as the premier location for manufacturing jobs and innovation in the Commonwealth;
2. Provide employees and employers with the training and skill-building necessary to be successful; and
3. Adopt local land use policies and programs that support sustainable manufacturing uses that are integrated into the fabric of the community.

The Project proposes rehabilitation of former buildings for manufacturing use with

amenities that provide employment opportunities for a range of professions and services.

2) adequacy of infrastructure:
Refer to Section 3 – Transportation regarding how the Project can be accommodated within the confines of the existing transportation infrastructure in a safe and efficient manner with implementation of the recommendations described.
The Proponent is coordinating with the Town of Andover Department of Public Works and their consultants regarding the adequacy of water and wastewater infrastructure, including the existing connection to the Greater Lawrence Sanitary District (GLSD).

3) open space impacts:
There are Conservation Open Spaces located adjacent the Site to the north and west bordering the Merrimack River. The Project will protect the existing landscape buffers around the perimeter of the Site that abut these Open Space areas, as well as the existing pedestrian connections to these areas. The Project will not impact the three onsite Preservation Restriction areas established by the Massachusetts Historical Commission. Refer to Section 2 regarding how the Project will minimize disturbance within the various onsite natural resource buffer zones.

RARE SPECIES SECTION

I. Thresholds / Permits

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 all questions A, B and C, proceed to the **Wetlands, Waterways, and Tidelands Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Rare Species section below.

II. Impacts and Permits – N/A

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

4. 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**? _X__ Yes ___ No; if yes, specify which permit: Order of Conditions in accordance with 310 CMR 10.00: Wetlands Protection Act (WPA)

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)? _X__ Yes ___ No; if yes, has a Notice of Intent been filed? _X_ Yes [for the renovation and addition to Building 1 only – future new construction buildings will require filing a Notice of Intent] ___ No; if yes, list the date and MassDEP file number: 090-1391; if yes, has a local Order of Conditions been issued? ___ Yes _X_ No [project is in active public hearing process]; Was the Order of Conditions appealed? ___ Yes ___ No. Will the project require a Variance from the Wetlands regulations? ___ Yes _X_ No.

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

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		
Borderi ng Land Subject to Flooding		
Riverfront Area	5,000 sf – refer to Section 2 Figure	

D. Is any part of the project:

1. proposed as a **limited project**? ___ Yes _X_ No; if yes, what is the area (in sf)?____
2. the construction or alteration of a **dam**? ___ Yes _X_ No; if yes, describe:
3. fill or structure in a **velocity zone** or **regulatory floodway**? ___ Yes _X__ No
4. dredging or disposal of dredged material? ___ Yes _X__ 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 _X__ No
6. subject to a wetlands restriction order? ___ Yes _X__ No; if yes, identify the area (in sf):
7. located in buffer zones? ___Yes _X__No; if yes, how much (in sf) _53,000 sf__

E. Will the project:

1. be subject to a local wetlands ordinance or bylaw? _X__ Yes ___ No
2. alter any federally-protected wetlands not regulated under state law? ___ Yes _X__ 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 _X_ No; if yes, is there a current Chapter 91 License or Permit affecting the project site? ___ Yes _X__ 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 _X__ 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 _X__
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 _X_ 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 _X__ No;
(NOTE: If yes, then the project will be subject to Public Benefit Review and

Determination.)

G. Does the project include dredging? ___ Yes _X__ 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 _X__ 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 _X__ 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 – N/A

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))? _X__ Yes ___ 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	49,031 gpd	185,097 gpd	234,128 gpd
Discharge of industrial wastewater	0	0	0
TOTAL	49,031 gpd	185,097 gpd	234,128 gpd

	Existing	Change	Total
Discharge to groundwater	0	0	0
Discharge to outstanding resource water	0	0	0
Discharge to surface water	0	0	0
Discharge to municipal or regional wastewater facility	49,031 gpd	185,097 gpd	234,128 gpd
TOTAL	49,031 gpd	185,097 gpd	234,128 gpd

B. Is the existing collection system at or near its capacity? ___ Yes _X__ 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_X _ 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 _X__ No; if yes, describe as follows:

	Permitted	Existing Avg Daily Flow	Project Flow	Total
Wastewater treatment plant capacity (in gallons per day)	53 million gpd	28 million gpd	234,128 gpd	28.2 million gpd

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 _X__ 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 _X__ 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:
The project will include measures to minimize the amount of wastewater generation including water saving plumbing devices. See Section 4.2 for additional water conservation measures that will consequently reduce wastewater discharge. The industrial discharges from the proposed facilities will include pretreatment at the source in accordance with the Greater Lawrence Sanitary District (GLSD) Industrial Discharge Pretreatment Program (IPP) and the Rules and Regulations covering discharge of wastewater. See Section 4.3 for more details regarding wastewater.

B. If the project requires a sewer extension permit, is that extension included in a comprehensive wastewater management plan? ___ Yes _X_ 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))? Yes _X_ No; if yes, specify, in quantitative terms:

301 CMR 11.03 (6)(b)14. – 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; and 301 CMR 11.03 (6)(b)15. – 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:

State Highway Access Permit and Traffic Signal Regulation from MassDOT

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	2,347	+353	2,700
Number of vehicle trips per day	5,600[a]	+1,668	7,268[b]

ITE Land Use Code(s): [a]Based on ITE LUCs 140, *Manufacturing* (613,975 sf)*;* and 760, *Research and Development Center* (464,025 sf)*.*
[b]Based on ITE LUCs 140, *Manufacturing* (251,475 sf)*;* 710, *General Office Building* (342,700 sf)*;* and 760, *Research and Development Center* (83,825 sf)*.*

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

	Roadway	Existing	Change	Total
1.	River Road	15,050	+7,268[a]	22,318
2.				
3.				

[a]The former Philips Health Care campus was essentially vacant in May 2022 at the time that the existing condition traffic volumes were measured on River Road.

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

Access to the Project will continue to be provided by way of the existing driveways that intersect the west side of Minuteman Road approximately 1,450 feet north of River Road and the terminus of 1776 Drive approximately 2,175 feet north of River Road, respectively. The following summarizes the measures that have been incorporated into the design and operation of the shared driveway and internal circulation:

- The driveways serving the Project site should continue to accommodate two-way travel and the turning and maneuvering requirements of service and delivery vehicles, and the largest anticipated responding emergency vehicle as defined by the Andover Fire Department.
- Where perpendicular parking is proposed, the drive aisle behind the parking should be a minimum of 23 feet in order to facilitate parking maneuvers.
- STOP-signs and marked STOP-line should be provided on the individual driveways that

intersect the ring-road that circumnavigates the campus, at the intersection of the ring-road with Minuteman Road and on the 1776 Drive approach to River Road (retain existing traffic control at the intersection).

- All signs and pavement markings to be installed within the Project site should conform to the applicable standards of the *Manual on Uniform Traffic Control Devices* (MUTCD).

- Sidewalks and pedestrian paths are provided within the Project site that extend to or provide access to the existing sidewalk along Minuteman Road.

- Americans with Disabilities Act (ADA)-compliant wheelchair ramps will be provided at all pedestrian crossings that are constructed or modified in conjunction with the Project.

- Signs and landscaping to be installed as a part of the Project within intersection sight triangle areas will be designed and maintained so as not to restrict lines of sight.

- Snow accumulations (windrows) within sight triangle areas will be promptly removed where such accumulations would impede sight lines.

- Consideration will be given to providing electric vehicle (EV) charging stations within the Project site.

Off-Site

River Road Traffic Signal System

Independent of the Project, one or more movements at the intersections that comprise the River Road coordinated traffic signal system are currently or are predicted to operate at or over capacity during the peak-hours. In an effort to improve traffic operations and off-set the predicted impact of the Project, the Project proponent will design and implement an optimal traffic signal timing, phasing and coordination plan for the River Road coordinated traffic signal system inclusive of the following intersections:

- River Road/Minuteman Road/Shattuck Road
- River Road/I-93 Southbound Ramps
- River Road/I-93 Northbound Ramps
- River Road/Old River Road/Federal Street

These improvements will be completed prior to the issuance of a Certificate of Occupancy for any new or expanded building within the Project site, subject to receipt of all necessary rights, permits and approvals, and will include the installation, repair and/or upgrade of traffic signal equipment and associated appurtenances required to provide and maintain coordination of the traffic signal system. With the implementation of an optimal traffic signal timing, phasing and coordination plan, overall motorist delays will be reduced such that no movement operates at or over capacity, an improvement over No-Build conditions.

In addition to the traffic signal timing, phasing and coordination improvements, the Project proponent will reconstruct all non-ADA compliant wheelchair ramps at the subject intersections, replace/upgrade non-ADA complaint pushbuttons and install countdown-type pedestrian indications where such indications are not currently installed. These improvements will also be completed prior to the issuance of a Certificate of Occupancy for any new or expanded building within the Project site, subject to receipt of all necessary rights, permits and approvals.

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 site is served by public transportation services that are provided by the Merrimack Valley Regional Transit Authority (MVRTA). The MVRTA operates bus Route 37, *Beacon Street*, which travels along River Road and Minuteman Road, with a stop located at Springhill Suites by Marriot (north of the Project site), and thereafter to the Buckley Transportation Center in Lawrence where connections can be made to other bus lines. From the Buckley Transportation Center, bus service is provided to Lawrence Station on the Haverhill Line of the Massachusetts Bay Transportation Authority (MBTA) Commuter Rail system with service to North Station in Boston. MVRTA buses operate in a passenger demand service mode and will stop anywhere along the service route where it is safe to pick-up or discharge a passenger.

In an effort to encourage the use of alternative modes of transportation to single-occupant vehicles (SOVs), the following Transportation Demand Management (TDM) measures will be implemented as a part of the Project:

- A transportation coordinator will be assigned for the Project to coordinate the TDM program;
- Information regarding commuting options will be posted in a central location and/or otherwise made available to employees of the Project;
- The transportation coordinator will facilitate a rideshare matching program for employees to encourage carpooling;
- A "welcome packet" will be provided to employees detailing available commuter options and will include the contact information for the transportation coordinator and information to enroll in the employee rideshare program;
- Specific amenities will be provided to discourage off-site trips, including providing a break-room equipped with a microwave and refrigerator; offering direct deposit of paychecks; coordinating with a dry-cleaning service for on-site pick-up and delivery; allowing telecommuting or flexible work schedules; and other such measures to reduce overall traffic volumes and travel during peak traffic volume periods;
- Pedestrian accommodations have been incorporated within the Project site;
- Secure bicycle parking will be provided throughout the Project site and will include exterior bicycle racks and weather protected bicycle parking for each building; and
- A shuttle service will be provided at no ($0) cost to employees of the Project that will provide weekday commuter service between the Project site Andover Station on the Haverhill Line of the MBTA Commuter Rail system. The shuttle service schedule will be coordinate with the arrival and departure of trains from Andover Station, with a minimum of four (4) round trips provided during both the weekday morning and evening peak commuter periods. Off-peak service and service to other commuter hubs will be considered as demand warrants.

C. 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 will the project will participate in the TMA:

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

E. 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)?

Not Applicable

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 Project has been designed to be consistent with municipal, regional, state and federal plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services. A comprehensive TDM program is an integral part of the Project and will be facilitated by a transportation coordinator as a means to reduce the overall traffic and parking demands of the Project. Secure bicycle parking will be provided within the Project site to encourage bicycle commuting. All work to be completed by the Proponent to support the Project will comply with local requirements, and will be designed following Complete Streets design standards to accommodate all roadway users.

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))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

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

B. Will the project involve any

1. Alteration of bank or terrain (in linear feet)? _____
2. Cutting of living public shade trees (number)? _____
3. Elimination of stone wall (in linear feet)? _____

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:

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 – N/A

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 – N/A

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 _X___ 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? ___ Yes _X__ No; if yes, does the project involve the destruction of all or any part of such archaeological site? ___ Yes _X__ No; if yes, please describe:

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.

See Section 1.3 of the EENF for reference to previous MHC review of the site in 1992.

II. Impacts

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

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:

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

A. 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- storm).

Stormwater Management

The resiliency of the buildings relative to future storm events is a critical part of the design. Floor elevations and critical infrastructure are located above the estimated 500-year flood elevation of the Merrimack River. The design team will review on-site impacts for storm events larger than the 100 year 24-hour event when locating building infrastructure such as emergency generators, transformers and chilled water plants for the new construction.
Stormwater recharge is proposed throughout the Project including improvements to existing parking such as the Building 1 parking lot which is currently untreated.
See Section 2 of the EENF for a description of the proposed BMP's for the site. The hydrology of the site for existing and proposed conditions is modeled for the 2yr through 100-year 24-hour storm events and output of the HydroCad files is included in the Appendix of the EENF.

Site Design
As noted previously the Project is minimizing new impervious coverage including proposing porous pavement for the new parking lot north of Buildings 5 and 6 as well as for pedestrian plazas and walkways throughout.
In addition, the design will include extensive plantings and shade trees to mitigate thermal impacts, as well as protection of the vast majority of existing trees. Detailed design has not been completed for Buildings 5 and 6 but a copy of the Landscape Plan which was submitted to the Town of Andover for the Building 1 Addition is attached in Appendix I as a point of reference.

Extreme Heat and Cold Events
The facilities' design includes high performance and SMART systems and energy efficiency goals that strive to reduce the demand on the power grid during extreme heat and cold events

1.HVAC systems:

- Chillers have spare capacity that can be used during extreme heat.
- Boilers have spare capacity that can be used during extreme cold.
- Prioritize Lab temperature control over office space through DDC controls. (Tenant guidelines)
- Load shedding; minimize non-critical loads during extreme temperatures.
- Automatically reset make up air and space terminal cooling equipment cooling supply air temperature up 1 F.
- Capacity to expand resets of heating and cooling to 1-3 degrees within comfort range
- DDC (base bldg.) / Tenant DDC)

2. Electrical and Lighting systems:

- Lighting Controls and programming allowing demand responsiveness (tenant space) (based on Tenant Guidelines)
- Emergency generator –Gas-fired back up generators to support essential laboratory functions.
- Load shedding for non-essential building functions, such as office lighting, office equipment, (Tenant Guidelines)
- Solar PV readiness (future PV installations)

3. Building Enclosure:

- White roof areas on building in compliance with the LEED heat island credit,
- Highly insulated building enclosure
- High performance triple glazing systems supporting heat gain reduction.

C. Is the project contributing to regional adaptation strategies? Yes _X_ No; If yes, describe.
The project energy efficiency and carbon reduction goals, including 25% electrification of the space heating demand, will contribute to Massachusetts goals towards Carbon Neutrality by 2050.

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 Proponent has considered alternative on-site locations for proposed buildings and site features but alternative locations for the project are not feasible.

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

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.

EJ Populations within 5 miles of the Site are listed below

Block Group	Census Tract	County	Town	Criteria	Households with language isolation	Median Household Income	
3	2521.02	Essex	Methuen	Minority	1%	$85,114 (99% of the MA median)	
3	2521.01	Essex	Methuen	Minority	3%	$56,488 (66% of the MA median)	
1	2521.01	Essex	Methuen	Minority	6%	$65,652 (76% of the MA median)	
2	2521.01	Essex	Methuen	Minority	0%	$62,976 (73% of the MA median)	
4	2544.02	Essex	Andover	Minority	5%	$176,645 (206% of the MA median)	
1	3103	Middlesex	Lowell	Minority	21%	$57,273 (67% of the MA median)	
5	3201	Middlesex	Lowell	Minority; Income	6%	49,507 (58% of the MA median)	
4	3102	Middlesex	Lowell	Minority; Income	0%	$40,559 (47% of the MA median)	
2	3102	Middlesex	Lowell	Minority	0%	$95,409 (111% of the MA median)	
3	3102	Middlesex	Lowell	Minority	24%	$69,79 (81% of the MA median)	
5	3102	Middlesex	Lowell	Minority; Income	6%	$49,507 (58% of the MA median)	
3	3125.01	Middlesex	Lowell	Minority	12%	$72,813 (85% of the MA median)	
5	3143.01	Middlesex	Dracut	Income	4%	$41,720 (49% of the MA median)	
2	3143.01	Middlesex	Dracut	Minority; Income	0%	$37,447 (44% of the MA median)	
4	2514	Essex	Lawrence	Minority	0%	$57,250 (67% of the MA median)	
1	2502	Essex	Lawrence	Minority;	23%	$53,079 (62% of	

				Income		the MA median)	
2	2502	Essex	Lawrence	Minority; Income	15%	$39,485 (46% of the MA median)	
3	2502	Essex	Lawrence	Minority; Income	8%	$48,563 (57% of the MA median)	
4	2502	Essex	Lawrence	Minority; Income	3%	$44,583 (52% of the MA median)	
3	2514	Essex	Lawrence	Minority; Income	19%	$50,242 (59% of the MA media)	
5	2515	Essex	Lawrence	Minority; Income	17%	$50,125 (58% of the MA median)	
4	2515	Essex	Lawrence	Minority; Income	0%	$52,500 (61% of the MA median)	
1	2514	Essex	Lawrence	Minority; Income; English isolation	37%	$53,173 (62% of the MA median)	
2	2514	Essex	Lawrence	Minority; Income	23%	$39,653 (46% of the MA median)	
3	2514	Essex	Lawrence	Minority; Income	18%	$43,631 (51% of the MA median)	
1	2515	Essex	Lawrence	Minority	22%	$70,547 (82% of the MA median)	
2	2515	Essex	Lawrence	Minority	23%	$0 (0% of the MA median)	
3	2515	Essex	Lawrence	Minority	10%	$35,500 (41% of the MA median)	
1	2518	Essex	Lawrence	Minority	2%	$82,266 (96% of the MA median)	
2	2518	Essex	Lawrence	Minority	0%	$63,070 (73% of the MA median)	
3	2518	Essex	Lawrence	Minority	18%	$68,182 (79% of the MA median)	
4	2518	Essex	Lawrence	Minority	20%	$0 (0% of the MA median)	
1	2513	Essex	Lawrence	Minority; Income; English isolation	51%	$18,882 (22% of the MA median)	
2	2513	Essex	Lawrence	Minority; Income	24%	$37,468 (44% of the MA median)	
3	2513	Essex	Lawrence	Minority; Income	18%	$43,631 (51% of the MA median)	
2	2523	Essex	Methuen	Minority	19%	$92,333 (108% of the MA median)	
3	2523	Essex	Methuen	Minority	0%	$69,858 (81% of the MA median)	
4	2523	Essex	Methuen	Minority	4%	$0 (0% of the MA median)	
5	2523	Essex	Methuen	Minority;	26%	$27,692 (32% of	

				Income; English isolation		the MA median)	
1	2503	Essex	Lawrence	Minority; Income; English isolation	30%	$44,103 (51% of the MA median)	
1	2517	Essex	Lawrence	Minority; English isolation	44%	$60,739 (71% of the MA median)	
2	2517	Essex	Lawrence	Minority	6%	$97,941 ($114% of the MA median)	
3	2517	Essex	Lawrence	Minority; English isolation	31%	$0 (0% of the MA median)	
4	2517	Essex	Lawrence	Minority; Income; English isolation	29%	$53,021 (62% of the MA median)	
1	2516	Essex	Lawrence	Minority	8%	$65,579 (76% of the MA median)	
2	2516	Essex	Lawrence	Minority; Income; English isolation	26%	$54,063 (63% of the MA median)	
3	2516	Essex	Lawrence	Minority; Income; English isolation	33%	$35,882 (42% of the MA median)	
4	2516	Essex	Lawrence	Minority	16%	$67,950 (79% of the MA median)	
1	2501	Essex	Lawrence	Minority; Income; English isolation	47%	$22,682 (26% of the MA median)	
1	2508	Essex	Lawrence	Minority; Income	13%	$44,028 (51% of the MA median)	
2	2508	Essex	Lawrence	Minority	18%	$57,632 (67% of the MA median)	
3	2508	Essex	Lawrence	Minority; Income	13%	$34,623 (40% of the MA median)	
4	2508	Essex	Lawrence	Minority; Income	5%	$52,847 (62% of the MA median)	
5	2508	Essex	Lawrence	Minority; Income; English isolation	36%	$53,430 (62% of the MA median)	
1	2507	Essex	Lawrence	Minority; Income; English	35%	$45,637 (53% of the MA median)	

				isolation			
2	2507	Essex	Lawrence	Minority; Income; English isolation	42%	$52,222 (61% of the MA median)	
3	2507	Essex	Lawrence	Minority; English isolation	54%	$66,607 (78% of the MA median)	
1	2509	Essex	Lawrence	Minority; Income; English isolation	35%	$42,500 (50% of the MA median)	
1	2524	Essex	Methuen	Minority	13%	$66,288 (77% of the MA median)	
2	2524	Essex	Methuen	Minority; Income	13%	$48,528 (57% of the MA median)	
3	2524	Essex	Methuen	Minority; Income; English isolation	36%	$26,111 (30% of the MA median)	
1	2510	Essex	Lawrence	Minority; Income; English isolation	34%	$52,434 (61% of the MA median)	
1	2511	Essex	Lawrence	Minority; Income; English isolation	35%	$15,481 (18% of the MA median)	
2	2511	Essex	Lawrence	Minority; Income	24%	$28,125 (33% of the MA median)	
3	2511	Essex	Lawrence	Minority; English isolation	60%	$76,047 (89% of the MA median)	
1	2512	Essex	Lawrence	Minority; Income; English isolation	46%	$24,773 (29% of the MA median)	
1	2504	Essex	Lawrence	Minority; Income	23%	$35,625 (42% of the MA median)	
2	2504	Essex	Lawrence	Minority; Income; English isolation	43%	$40,809 (48% of the MA median)	
3	2504	Essex	Lawrence	Minority; English isolation	60%	$0 (0% of the MA median)	
3	2532.02	Essex	North Andover	Minority	0%	$0 (0% of the MA median)	
4	2532.02	Essex	North Andover	Minority	7%	$86,739 (101% of the MA median)	

2	2532.02	Essex	North Andover	Minority	4%	$100,673 ($117% of the MA median)	
1	2505	Essex	Minority; Income	Minority; Income	20%	$40,867 (48% of the MA median)	
2	2505	Essex	Lawrence	Minority; Income; English isolation	67%	$41,316 (48% of the MA median)	
3	2505	Essex	Lawrence	Minority; Income; English isolation	31%	$51,176 (60% of the MA median)	
1	2526.02	Essex	Methuen	Minority	6%	$69,926 (81% of the MA median)	
1	2526.03	Essex	Methuen	Minority	5%	$95,110 (111% of the MA median)	
3	2526.02	Essex	Methuen	Minority	5%	$143,417 (167% of the MA median)	
3	2526.01	Essex	Methuen	Minority	6%	$89,688 (104% of the MA median)	
1	2506	Essex	Lawrence	Minority; English isolation	31%	$61,027 (71% of the MA median)	
2	2506	Essex	Lawrence	Minority; Income; English isolation	36%	$47,917 (56% of the MA median)	
3	2506	Essex	Lawrence	Minority; Income; English isolation	38%	$36,964 (43% of the MA median)	
4	2506	Essex	Lawrence	Minority; English isolation	36%	$70,085 (82% of the MA median)	
1	2525.01	Essex	Methuen	Minority	4%	$66,378 (77% of the MA median)	
2	2525.01	Essex	Methuen	Minority; Income	2%	$48,793 (57% of the MA median)	
3	2525.01	Essex	Methuen	Minority	6%	$80,906 (94% of the MA median)	
1	2525.02	Essex	Methuen	Minority	0%	$79,211 (92% of the MA median)	
3	2525.02	Essex	Methuen	Minority	2%	$107,031 (125% of the MA median)	
4	2525.02	Essex	Methuen	Minority; Income	6%	$53,167 (62% of the MA median)	
5	2531	Essex	North Andover	Minority	0%	$81,486 (95% of the MA median)	

EJ Populations within 1 mile of the Site are listed below

Block Group	Census Tract	County	Town	Criteria	Households with language isolation	Median Household Income
4	2544.02	Essex	Andover	Minority	5%	$176,645 (206% of the MA median)
3	2521.01	Essex	Methuen	Minority	3%	$56,488 (66% of the MA median)
1	2521.01	Essex	Methuen	Minority	6%	$65,652 (76% of the MA median)
3	2521.02	Essex	Methuen	Minority	1%	$85,114 (99% of the MA median)

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.

Using the EJ Maps Viewer that identifies "Languages Spoken in Massachusetts," the Proponent found that there are 23 groups with 5% or more of the population who do not speak English very well within five miles of the Project site. The languages are as follows:

- Spanish or Spanish Creole
- MonKhmer/Cambodian

The locations of these populations is shown on attached Figures 7.1 and 7.2.

Note that none of these groups that are within one mile of the Project Site.

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.

The Project will continue to provide public involvement opportunities in English and Spanish.

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).

Likely effects of the Project include

- Increased vehicle emissions from project associated traffic
- Temporary impacts to air quality/noise during construction
- Increased noise levels during construction and from ongoing operations at the site

The proposed Project will provide economic benefits to the surrounding town and community through the form of an increase in employment opportunities and new taxes.

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. ___ Yes _X__ 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).

N/A

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.

   Environmental Justice Screening Form and transmittal are attached. The Screening Form was distributed electronically to the individuals and organizations noted on June 15, 2022.

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.

   CBOs and tribes were provided with contact information on the Screen Form to request additional information about the project as well as a meeting with the Proponent or Proponent's representatives.

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.

A distribution list is attached as requested in Section III.A.

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 hold public meetings to inform interested members of the public about the Project and answer any questions that may arise. The date and time of the meeting will be sent to the outreach contact list as well as posted physically in locations around the community.

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) Eagle Tribune (Date) August 8, 2022

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

Signatures:

		8/1/2022	
Date	Signature of Responsible Officer or Proponent	Date	Signature of person preparing ENF (if different from above)

Dante Angelucci	Brian Lawlor, PE
Name (print or type)	Name (print or type)
ARE-MA Region 93, LLC	SMMA
Firm/Agency	Firm/Agency
26 North Euclid Avenue	1000 Massachusetts Avenue
Street	Street
Pasadena, CA 91101	Cambridge, MA 02138
Municipality/State/Zip	Municipality/State/Zip
(617) 252-4964	(617) 547-5400
Phone	Phone

1 Project Description and Alternatives

1.1 Introduction
1.2 Existing Site Conditions
1.3 Previous MEPA Review and Status
1.4 Project Description
1.5 Anticipated Permits and Approvals
1.6 Project Alternatives

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Project Description and Alternatives

1.1 Introduction

The Project Proponent is Alexandria Real Estate Equities (ARE).

The Project is the phased expansion of the 3000 Minuteman Road campus. At full buildout the gross floor area of buildings on the campus will increase from 726,000sf (existing) to approximately 1,126,000sf. The campus will focus on life science uses particularly cGMP manufacturing with laboratory space and supporting functions. It is intended that the campus will be part of a cluster in the region developing Cell and Gene Therapy (C&GT) technologies. ARE intends to pursue LEED certification (LEED v4 Core and Shell) for renovations and new construction.

The existing conditions and proposed master plan expansion are shown on Figures 1.2 and 1.3.

The Project is subject to MEPA review because it requires an Access Permit from MassDOT and exceeds the ENF threshold for average daily trips.

The Project will create approximately 10 acres of new impervious coverage.

The Project will generate more than 100,000 gpd of wastewater discharge to sewer during peak flow days.

Because the project requires an Agency Action and is located within a mile of an Environmental Justice population it requires an EIR filing.

The Proponent is requesting a Single EIR (SEIR).

1.2 Existing and Proposed Campus Program

Table 1.1 Existing and Proposed Building Gross Floor Areas

Building	Existing GSF	Proposed GSF
Building 1	86,000 SF	86,000 SF
Building 1 Addition	_	100,000 SF
Building 2	164,100 SF	164,100 SF
Building 3	171,200 SF	171,200 SF
Building 4	256,700 SF	256,700 SF
Link + Amenities Building	48,200 SF	48,200 SF
Building 5	_	150,000 SF
Building 6	_	150,000 SF
Central Utility Plant	_	0
Total	**726,000 SF**	**1,126,000 SF**

Table 1.2 Existing and Proposed Building Use

Building	Existing Use	Proposed Use
Building 1	Office	Research Lab and Office
Building 1 Addition	_	cGMP manufacturing
Building 2	Electronics Manufacturing/Office	cGMP manufacturing
Building 3	Electronics Manufacturing/Office	cGMP manufacturing
Building 4	R&D office/lab	Research Lab
Link + Amenities Building	Lobby, Cafeteria/office	Lobby, cafeteria, fitness, office
Building 5	_	cGMP manufacturing
Building 6	_	cGMP manufacturing
Central Utility Plant	_	Chilled water plant

For master planning purposes the program for the new buildings (Building 1 Addition, Building 5, and Building 6) is as follows:

- cGMP manufacturing
- cGMP warehouse
- Support and Research Labs
- Office

As tenants are identified ARE will design and provide spaces for their specific rograms.

	Existing	Proposed	Increase
Surface Parking	2,347	2,700	353
Impervious Coverage	41.24 Ac.	51.94 Ac.	10.7 Ac.

1.3 Previous MEPA Review and Status

The property was previously subject to review under MEPA for a two-phase expansion of the campus (EOEA #8929) in 1992. The first phase of the expansion was constructed in the 1990's and the second phase remains unbuilt.

The ENF was filed in January 1992. The Secretary issued Certificates on the DEIR on December 16, 1992, and FEIR dated March 13, 1993. A copy of the DEIR and FEIR Certificates are included in Appendix J.

The 1992 filing and associated certificates described the following scope:

- Phase 1 (Built): 270,000sf 3-story Research and Development building and 900 parking spaces (Building 4).
- Phase 2 (Unbuilt): 180,000sf Research and Development building and 600 parking spaces.

ARE met with the MEPA office in January 2022 to review the filing history and it was determined that the currently proposed Project requires a new ENF.

The MEPA office issued an Advisory Opinion in April 2022 which confirmed that renovations of the existing buildings can proceed without a separate filing. The renovations do not result in an increase in traffic and therefore do not require the issuance of a State Highway Access Permit.

1.3.1 Previous MHC Review

The 1993 FEIR Certificate notes that the Phase 2 work was not fully designed at the time of review and therefore continued coordination with MHC was required in order to avoid impacts. The limits of disturbance for the current Project are further set back from the specific locations identified and surveyed in 1992. The Proponent has prepared a figure comparing the current Project with the 1992 study areas which will be forwarded to MHC. Correspondence from MHC is included as Appendix B.

1.3.2 Existing Site Conditions

Existing Conditions are shown on Figure 1.2.

The Property is 118 Ac, bounded to the north and west by the Merrimack River, to the southwest by the Albert Retelle Reservation and by Minuteman Road to the east. The site has informal trails through the wooded bank of the Merrimack which are part of the Deer Jump trail system that follows the river for several miles.

Vehicular access to the site is from Minuteman Drive. The entrance drive connects to a loop road which circulates through the site and provides connection to each of the buildings and parking areas.

The site includes a pedestrian link from Building 2 to Building 1 which includes a “boardwalk” pedestrian connection which will be maintained and will become part of the planned pedestrian connectivity for the campus.

Wetlands resources on site are described in Section 2 of the EENF.

The areas and program of the existing buildings are listed above in Tables 1.1 and 1.2.

1.4 Project Description

1.4.1 Proposed Development

The proposed project is the phased renovation and expansion of the 3000 Minuteman Road campus. The existing campus was developed for microelectronics research development and manufacturing by Hewlett-Packard. The site was most recently expanded in 1994 with the construction of Building 4 and has been occupied by Philips Electronics (aka Philips Healthcare) since that time.

ARE acquired the property in 2021 and seeks to reposition the campus as part of a life science cluster in the Commonwealth focused on research and manufacturing of cell and gene (C&G) technologies. The Project includes the renovation of all existing buildings and construction of approximately 400,000sf of new space. The renovation of the existing buildings for life science uses will result in decreased parking and traffic generation compared with the previous uses and will include new mechanical, electrical and plumbing systems meeting the requirements of the Stretch Energy Code. ARE intends that all renovations and new construction will achieve LEED v4 Core and Shell certification with a goal of LEED Silver where feasible. New construction will include an addition to Building 1 (100,000gsf) and two new buildings, Buildings 5 and 6 (each150,000gsf). All new construction is currently programed for cGMP manufacturing.

The primary design goals for the campus expansion are as follows:

1. Re-use existing buildings and infrastructure to the maximum extent possible.

   As noted, the existing buildings were designed for microelectronic R&D/Manufacturing but are being repurposed for life science use. The repurposing requires significant upgrades to building envelopes and systems to comply with the Energy Code and to meet sustainability goals but will preserve the building structures and envelope as much as possible.

2. Deliver the program area while minimizing new impervious coverage. Two primary strategies have been used to minimize impervious coverage and parking demand:

   - ARE received a variance from the Andover ZBA in 2021 to enable the Planning Board to reduce parking ratios for life science uses at this campus. This allows for the development of the proposed master plan with a parking ratio of approximately 2.4 spaces/1000sf which will result in reduced parking demand and traffic generation.

   - The planned cGMP processes are stacked to avoid single-story manufacturing buildings. Conceptually the buildings are programmed with stacked manufacturing and lab to minimize floor plate sizes,

3. Select technologies that minimize water demand

   ARE is selecting operations and systems to minimize water demand for building systems and operations. ARE is working with the Town of Andover to analyze any impacts to the municipal system or any required mitigation measures. Discussion of water and sewer reduction strategies are outlined in Section 4 of this EENF.

4. Select systems and technologies that minimize energy use and carbon footprint.

   ARE has analyzed operating procedures such as manufacturing air changes, heating, cooling and exhaust systems to select efficient systems complying with the Stretch Energy Code and LEED requirements. ARE's commitment to 25% electrification for space heating of the new buildings and overall goal of 20% operational carbon reduction for new buildings is outlined in Section 5 of this EENF.

1.4.2 Phasing

The project timetable will be dependent on lease terms with future life science tenants however the anticipated sequence is generally as follows:

1. Interior demolition of Buildings 3 and 4 (ongoing)
2. Core and Shell renovations to Buildings 3 and 4
3. Core and Shell renovations to Building 2 and the Link
4. Core and Shell renovation to Building 1 and construction of the Building 1 Addition
5. Tenant fitup of Buildings 3,4, 1 and 2
6. Site improvements such as realignment of entry drive
7. Core and Shell construction of Buildings 5 and 6
8. Tenant fitup of Buildings 5 and 6

1.5 Anticipated Permits and Approvals

The following permits are anticipate for the Project.

Permit	Comment
Planning Board/Special Permit application for Building 1 Addition	In progress
Planning Board/Special Permit application for Buildings 5, 6 and CUP	2022-2023
ANRAD and Notice of Intent for Building 1	In progress
ANRAD and Notices of Intent for Buildings 5, 6 and CUP	2022/2023
MassDOT Highway Access Permit	2023

1.6 Project Alternatives

1.6.1 No-build Alternative

- The no-build condition is not economically viable. The campus is currently under-utilized and not aligned with current market demand.
- The existing buildings have outdated MEP systems which do meet performance requirements for the current tenant market and do not comply with current energy standards.
- One of the advantages of redevelopment is the opportunity to provide stormwater management BMPs for the existing untreated pavement areas. The Notice of Intent and Site Plan application for Building 1 for example provided detailed design of proposed BMPs. The BMPs for the Master Plan are described in Section 2.
- In the no-build scenario a higher percentage of Building 1 and 3 would remain as office functions with greater parking demand and traffic generation.

1.6.2 Build Alternative 1 – 150ksf single-story footprints for Buildings 5 and 6 with expanded parking

Alternative 1 is shown on Figure 1.4. This Alternative represents a conventional arrangement for cGMP manufacturing for the two new buildings where the manufacturing suites and supporting lab areas are located on a single floor. The footprints shown for Buildings 5 and 6 are 150,000 sf. Alternative 1 complies with the Dimensional Requirements of the Zoning Code however ARE and the development team determined that there were environmental benefits to stacking the program and reducing the footprints by 50% as shown on the proposed site Master Plan.

The footprints in Alternative 1 reduce the open space in the center of the site and impact the views to and from the river.

The footprint for Building 6 in this Alternative is within the buffer zone of a wetlands resource and partly within the Riverfront Zone

Alternative 1 included additional parking south of Building 6 and in addition included a driveway connection from Building 1 to the loop road within the Riverfront. This driveway connection was removed from the Building 1 site plan during preparation of the Notice of Intent application for the Building 1 project.

The additional impervious coverage shown on Alternative 1 compared with the Preferred Master Plan (Figure 1.3) is approximately 3 Ac.

1.6.3 Build Alternative 2 – Larger office area percentage/increased parking ratios

Alternative 2 is shown on Figure 1.5 and represents one of several options which demonstrated a higher parking ratio for the campus. This additional parking would have been required to support a higher office percentage by example which would also have resulted in increased traffic generation. As noted, the Town granted a Variance to ARE to allow flexibility in the parking ratio consistent with the proposed life science uses.

One of the new parking areas in Alternative 2 northeast of Building 1 is located within a wooded wetland buffer zone.

1.6.3 Preferred Alternative

The Preferred Alternative is shown on Figure 1.3. The preferred site plan achieves the following goals:

- Enables reuse and renovation of existing buildings.
- Creates the highest and best use for economic growth for the campus and community.
- Minimizes traffic generation
- Consistent with Town's economic development goals.
- Minimizes new impervious coverage
- Maximizes separation to wetlands and removes a section of the loop road from the Riverfront Area.
- The reduced footprints in the Preferred Master Plan contribute to preserving the open space in the center of the site and opening the views to the river.
- The reduced footprint in the Preferred Master Plan increases the setbacks from the wetlands north of Building 6 and removed the footprint from the Riverfront Zone.

Figures



SCALE: 1:2500

1.1 - USGS Locus

3000 Minuteman Road, Andover, Massachusetts

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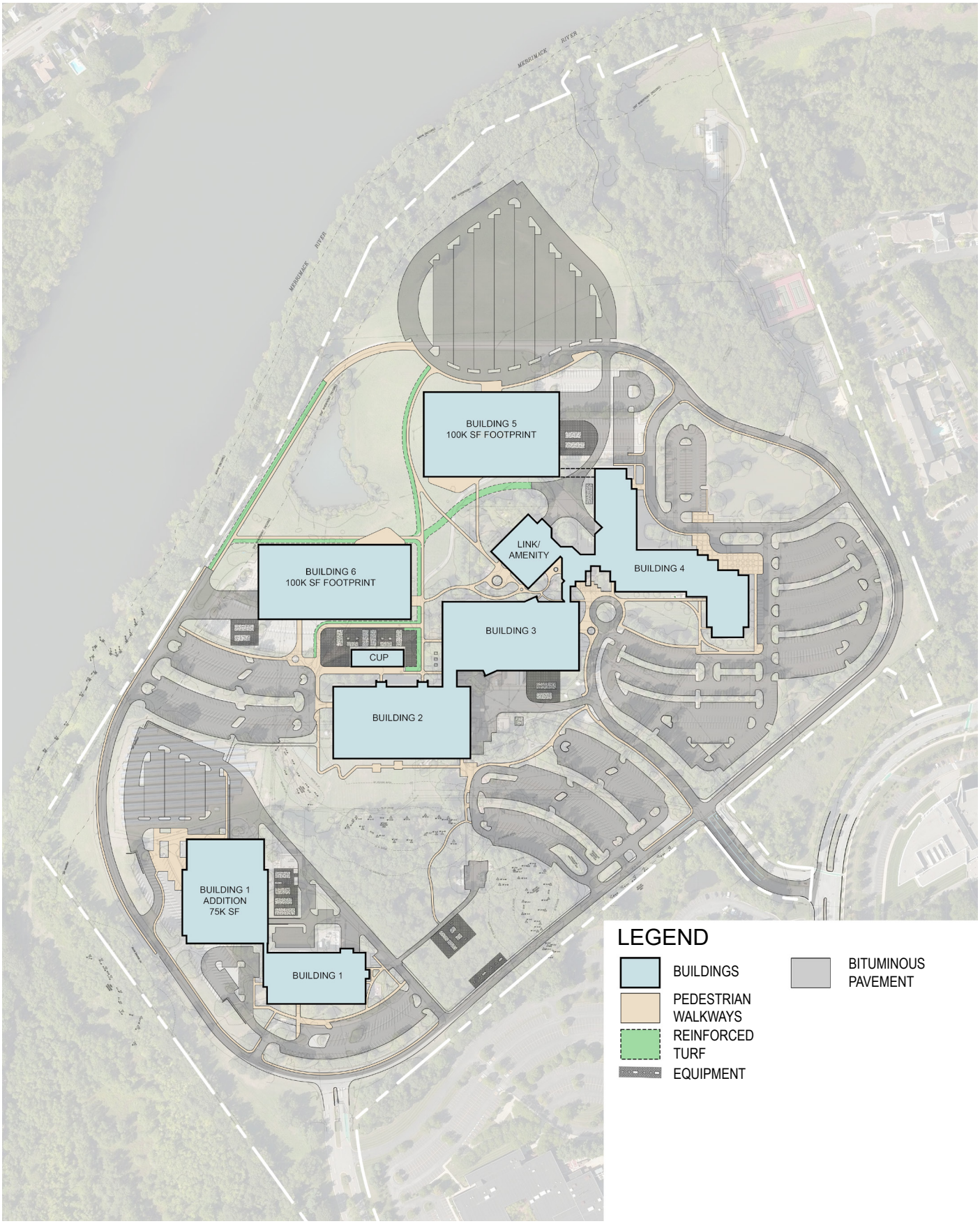


1.2 - Existing Conditions Aerial

3000 Minuteman Road, Andover, Massachusetts

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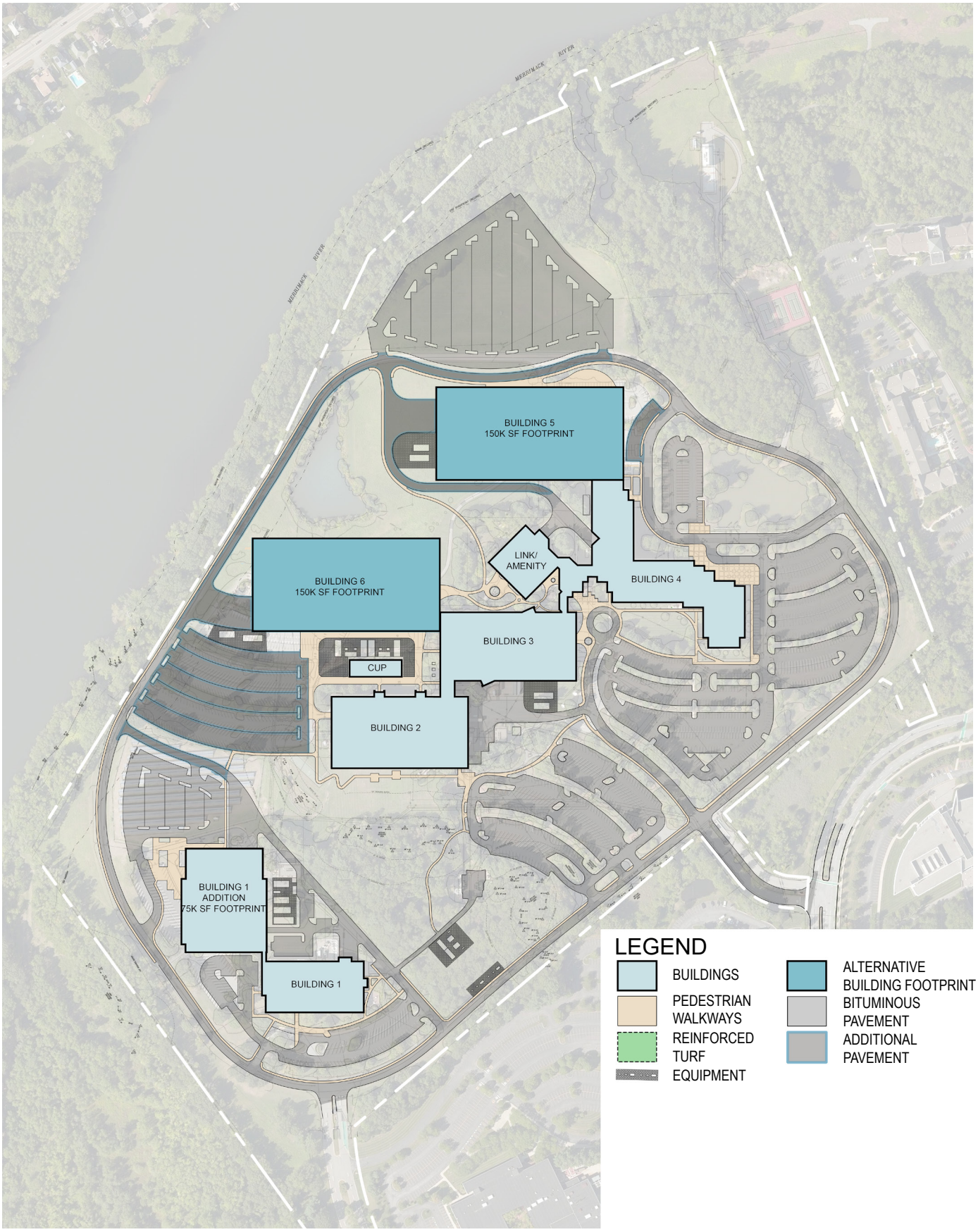


1.3 - Project Master Plan

3000 Minuteman Road, Andover, Massachusetts

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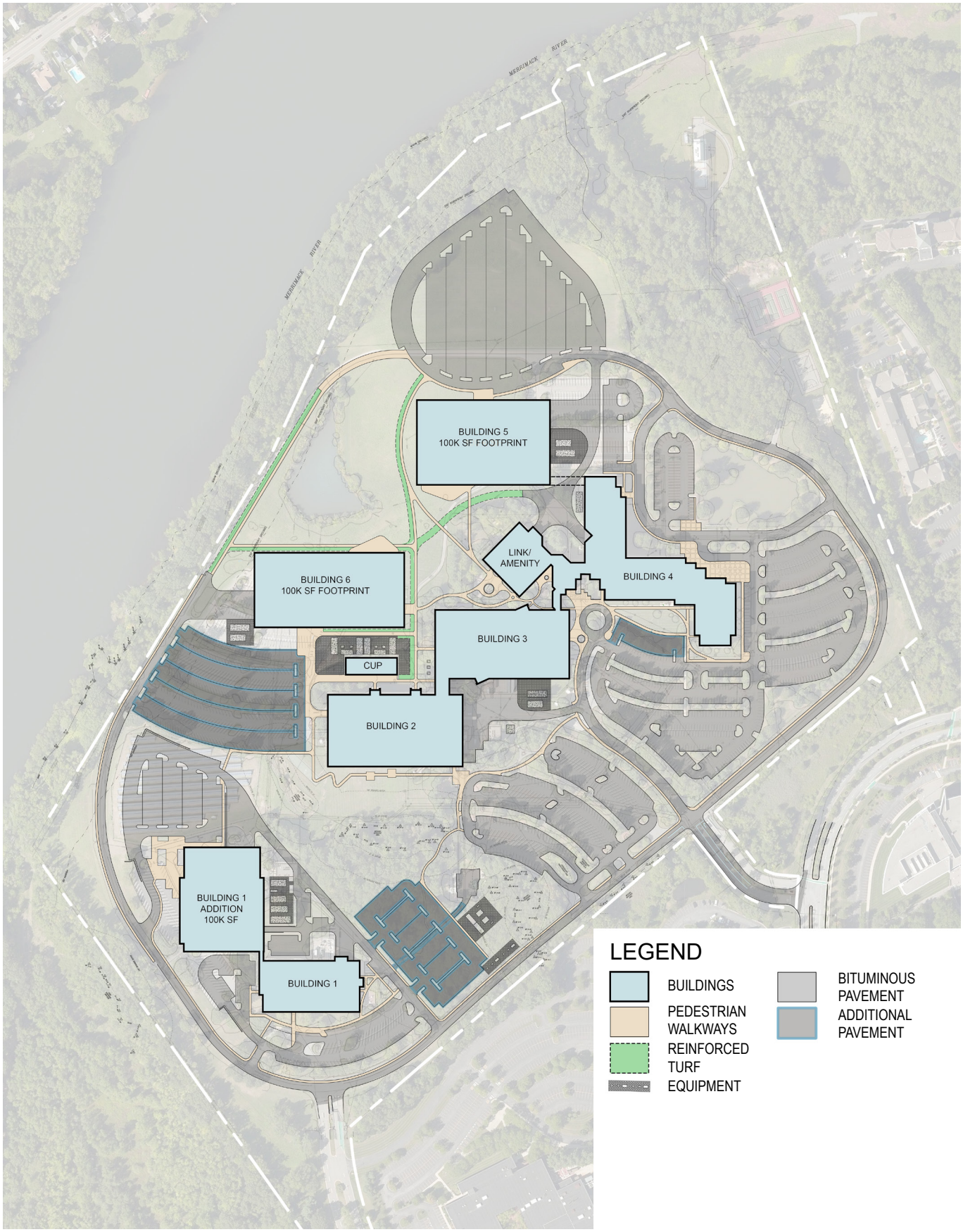


1.4 - Project Master Plan
Alternative 1 Larger Building Footprints

3000 Minuteman Road, Andover, Massachusetts

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1.5 - Project Master Plan
Alternative 2 Increased Parking

3000 Minuteman Road, Andover, Massachusetts

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Natural Resources and Water Quality

2

2.1 Introduction
2.2 Rare Species
2.3 Floodplains
2.4 Wetlands
2.5 Riverfront Area
2.6 Groundwater
2.7 Stormwater Management
2.8 Alternatives

Natural Resources and Water Quality

2.1 Introduction

The project site is bound to the north and west by the Merrimack River and contains several wetland resources areas and series of stormwater collection and detention systems that flow to the river. The northern portion of the site contains Spindle Creek which discharges to the river.

Stormwater runoff from the existing development flows either directly to the Merrimack River or through one of two man-made siltation ponds that are now considered wetland resource areas, with eventual discharge to the river:

- The wetland located north of Building 4 was previously referred to as “Siltation Pond A” which was enlarged and enhanced as part of the 1993 Phase I redevelopment to serve as a wet pond, “pretreatment marsh”, and aesthetic site amenity. The prior redevelopment constructed a separate “pretreatment marsh” located west of Spindle Creek which treated runoff that could not be routed to the wet pond.
- The wetland located between Buildings 2, 3 and 4 and the Merrimack River was previously referred to as “Siltation Pond B” which was not altered as part of the 1993 Phase I redevelopment and which is used as a source of irrigation for the development.

2.2 Rare Species

The project site does not fall within Priority or Estimated Habitat in the current Massachusetts Natural Heritage Atlas (15th edition, 2021) produced by MassWildlife’s Natural Heritage and Endangered Species Program (NHESP).

2.3 Floodplains

The boundaries of the Flood Hazard Overlay District include all special flood hazard areas designated Zone A or Zone AE (1% annual chance flood, or 100-year flood) on the Essex County Flood Insurance Rate Map (FIRM). Firm map number 25009C0203F (effective date July 3, 2012) indicates floodway areas in Zone AE along the bank of the Merrimack River and into the wetland system in the northern portion of the site with base flood elevations ranging between 53-54 ft. No portion of the existing or proposed development extends into the Zone AE regulatory floodway. The map also indicates a Zone X (0.2% annual flood chance flood, or 500-year flood), which extends further into the site between the riverbank and a portion of the loop road near the rear Building 2 parking area and in the northern portion of the site surrounding the wetlands and north of the athletic courts. While Zone X is not regulated, the proposed design has intentionally avoided disturbance within this area. A small section of the existing access drive northeast of Building 4 is within Zone X, which will remain in place in the proposed design. However, no new impervious within Zone X is proposed.

2.4 Wetlands

2.4.1 Wetland Resource Areas

Wetland resource areas across the campus were delineated by AECOM in 2019. A portion of the wetland resource areas adjacent to Building 1 were re-delineated between November 2021 and January

2022 by Beals Associates, Inc. An Order of Resource Area Delineation (ORAD) was issued by the Andover Conservation Commission in March of 2022 confirming the delineations completed by Beals Associates, Inc.

The remainder of the wetland resource areas on the project site will be subject to an Abbreviated Notice of Resource Area Delineation (ANRAD), Request for Determination of Applicability (RDA), or Notice of Intent (NOI) filing with the Town of Andover Conservation Commission as the buildings are developed.

Wetland resources as defined by the Massachusetts Wetland Protection Act that are present on the site include:

- Bordering Vegetated Wetlands (BVW)
- Bank
- Riverfront Area (RA)
- Land Under Water Bodies and Waterways (LUWW)
- Isolated Land Subject to Flooding (ILSF)

2.4.2 Protection

Erosional and Sediment Control Measures

An erosion and sedimentation control program will minimize the risk of impacts to wetland resource areas during construction of the Project. The program incorporates Best Management Practices specified in the guidelines developed by the DEP and the United States Environmental Protection Agency (US EPA) and complies with the requirements of the National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges from Construction Activities. These measures include the installation of temporary erosion and sedimentation controls and construction sequencing. Areas of exposed soil will be kept to a minimum, and permanent vegetative cover (or binder coat of pavement) will be established after final grading or as soon as practicable. Erosion and sediment control measure proposed for site preparation and development phases will include the following components.

Temporary Construction Entrance

A temporary construction entrance consisting of 6 inches of gravel over a filter fabric will be installed to minimize the migration of sediment on and off the site by construction equipment.

Straw Wattle

Staked compost socks will be installed around the perimeter of the site to prevent the migration of sediment on and off the site from overland flow.

Sediment Bag at Catch Basins

Sediment bags will be installed in existing and newly constructed catch basins to capture and remove sediment in stormwater runoff prior to discharge from the site.

Temporary Diversion Swales with Check Dams

Swales will be installed prior to major earth disturbance to convey runoff to temporary sediment basins. The contractor will modify the location of the swales according to construction sequencing.

Temporary Sediment Basins

Temporary sediment basins will receive runoff from the diversion swales and will provide detention to allow sediment to settle out of the runoff prior to discharge. The temporary basins are sized to provide a

sediment trap volume equal to 3,600 cf per acre of treatment area. The temporary basins are shown on the plans with overflow outlet control structures routed to flared end sections.

Stormwater Pollution Prevention Plan (SWPPP)

The project construction will disturb over one acre; therefore the Petitioner will seek coverage of an EPA NPDES Construction General Permit (CGP) and will submit a SWPPP under separate cover for the DPW to review. The SWPPP will provide the contractor with the framework for reducing soil erosion and minimizing pollutants in storm water during the construction phase.

2.4.3 Impacts

The proposed project does not include temporary or permanent impacts to wetland resource areas. Temporary and permanent impacts within the 100 ft buffer will be subject to the Wetlands Protection Act and require a permit filing with the Town of Andover Conservation Commission.

Work within the 100-ft buffer zone to BVW includes installation of erosion and sediment controls, grading, installation of utilities and drainage, constructing or redeveloping portions of the pedestrian and vehicular circulation and parking areas, and portions of the proposed buildings.

2.5 Riverfront Area

2.5.1 Protection

Protection of the Riverfront Area associated with the Merrimack River has been a goal during the master planning of the proposed project. The existing bank, treeline, vegetation, and stormwater outfalls will be preserved.

2.5.2 Impacts

Impacts within the Riverfront Area will primarily be redevelopment of previously disturbed areas. Proposed improvements with the Riverfront Area will aim to reduce impervious cover, install native vegetation to supplement the existing vegetation, and install Low Impact Design (LID) stormwater best management practices. Site grading will be designed so that no loss of flood storage occurs. No new stormwater outfalls will be introduced within the Riverfront Area. Approximately 5,000 square feet of new impervious cover is proposed within the Riverfront Area, the majority of which will occur in the outer 100-feet. This affects less than 1% of the total Riverfront Area on the site.

2.6 Groundwater

Haley & Aldrich geotechnical engineers performed test pits in select locations onsite to determine seasonal high groundwater and infiltration characteristics of the underlying soils to influence stormwater management design. Where seasonal high indicators and other evidence of groundwater was encountered, groundwater was estimated to be 3 ft to 8 ft below existing grades. The project will anticipate this groundwater table and construction phase dewatering for the design and installation of buildings, infrastructure, and stormwater management systems.

2.7 Stormwater Management

The proposed stormwater management plan provides treatment, detention, and infiltration of stormwater in accordance with the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Standards and Town of Andover regulations. Best Management Practices (BMPs), including Low Impact

Development (LID) BMPs, are designed in accordance with the MassDEP Stormwater Handbook. The stormwater design utilizes two existing siltation ponds described above, as well as proposed BMPs, including three subsurface infiltration systems, three subsurface detention systems, and approximately 7.5 acres of porous pavement.

To confirm the capacities of existing and proposed stormwater BMPs and ensure the stormwater design meets all DEP and town requirements, the existing and proposed conditions were modeled using HydroCAD 10.

2.7.1 Hydrologic Conditions

The property discharges to 6 design points, which represent flow to various individual wetlands, specific point discharges directly to the Merrimack River, and overland sheet flow directly to the river. Hydrologically, all 6 design points ultimately connect to the river; however, the design points were modeled individually to ensure the proposed conditions match the existing dispersion of runoff as accurately as possible. The proposed project utilizes all existing discharge points and does not create any new point discharges to wetlands or to the river.

Design Point 1

Design Point 1 is a 48" RCP culvert, which discharges directly to the Merrimack River. In existing conditions, the culvert collects runoff from Building 1, the surrounding parking and amenities, the solar field, and a portion of the parking lot west of Building 2. All runoff within this existing catchment area is collected via closed pipe network without treatment or any stormwater mitigation.

The proposed Masterplan design adds two subsurface infiltration systems, two subsurface detention systems, portions of porous pavement, and water quality treatment units prior to discharging to the existing culvert.

Design Point 2

Design Point 2 is the 24" RCP outlet from the large existing siltation pond northwest of Buildings 2 and 3. In existing conditions, runoff from Building 2 and 3 roofs as well as flow from the associated parking and amenity areas is collected via pipe network and routed directly to the pond without pretreatment.

The proposed Masterplan design adds proprietary pretreatment units to the pipe network to reduce sediment loading to the pond and incorporates porous pavement and a subsurface infiltration system to provide groundwater recharge and reduce flow rates to the pond.

Design Point 3

Design Point 3 represents all flow to the wetland along the eastern edge of the property, which discharges to the Merrimack River via a narrow hydrologic connection at the northern tip of the wetland. In existing conditions, Design Point 3 includes overland flow from the predominantly undeveloped area surrounding the wetland, piped flow from a portion of the loop road directly to the wetland, and overflow from the siltation pond east of Building 4 via a 2'x6' concrete box culvert under the loop road.

The proposed Masterplan design adds proprietary pretreatment units to the pipe network to reduce sediment loading to the pond and incorporates a subsurface detention system to reduce peak flow rates to the pond.

Design Point 4

Design Point 4 represents all overland sheet flow directly from the property to the Merrimack River. In both existing and proposed conditions, the only sheet flow directly to the river is from undeveloped

areas between the outer loop road and the northwest edge of the property. No runoff from impervious areas sheet flows directly to the river.

Design Point 5

Design Point 5 represents all overland flow to the bordering vegetated wetland west of the property. This design point includes the long access drive at the southwest end of the campus, which sheet flows to a swale along the western side of the drive. The portion of the property which discharges to Design Point 5 remains unchanged from existing to proposed conditions.

Design Point 6

Design Point 6 represents all overland flow to the bordering vegetated wetland southeast of the property, adjacent to the campus's main entrance. A very small portion of the property discharges to this design point and remains minimally changed from existing to proposed conditions.

2.7.2 Compliance with DEP Stormwater Management Standards

Standard 1 – Untreated Stormwater

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

The project utilizes all existing outfalls to the Merrimack River and surrounding wetlands. Descriptions of each of these outfalls (Design Points) is provided in Section 2.5.1 Hydrologic Conditions above. Therefore, the project is in compliance with Standard 1.

Standard 2 – Post-Development Peak Discharge Rates

Standard 2 states: Stormwater management systems must be designed so that post-development peak rate discharge rates do not exceed pre-development peak discharge rates.

The proposed project is designed so that post-development peak discharge rates do not exceed the pre-development rates for the 2-, 10-, 25-, and 100-year storm events. Peak flow attenuation is achieved through use of porous pavement, as well as six subsurface systems. The subsurface systems are designed to provide recharge as well as peak flow reduction where separation to seasonal high groundwater is favorable. Where the groundwater table is too high to allow for recharge, the systems are designed to provide detention only. The existing and proposed hydrologic conditions were modeled using HydroCAD to compare existing and proposed conditions. A summary table of pre-development and post-development peak discharge rates is provided below. Hydrology maps are included at the end of this section, and the full HydroCAD reports are included in Appendix C.

Peak Discharge Rate Summary Table [cfs]

Design Point	2-year (3.11")		10-year (4.91")		25-year (6.03")		100-year (7.76")	
	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
DP-1	48.52	42.49	99.29	89.10	131.99	119.61	182.83	177.07
DP-2	4.32	4.27	17.45	16.88	23.88	23.01	51.05	35.11
DP-3	0.85	0.83	7.05	6.77	18.05	16.48	41.56	38.62
DP-4	0.00	0.00	0.02	0.02	0.09	0.08	0.95	0.89
DP-5	7.04	7.04	23.10	23.10	34.88	34.88	54.51	54.51
DP-6	1.92	1.41	4.71	3.78	6.61	5.43	9.65	8.11

The current proposal is in compliance with Standard 2.

Standard 3 – Recharge to Groundwater

Standard 3 states: Loss of annual recharge to groundwater should be minimized through the use of infiltration measures to the maximum extent practicable. The annual recharge from the post-development site should approximate the annual recharge from the pre-development or existing site conditions, based on soil types.

The project achieves groundwater recharge via three proposed subsurface infiltration systems and approximately 7.5 acres of proposed porous pavement. The locations of these BMPs are shown on the Proposed Hydrology Map.

The required recharge volume calculations are based on the existing hydrological soil groups of the site and the increase in impervious surfaces proposed by the project. The site is composed primarily of hydrological soil group A and B soils, based on the NRCS soil survey and geotechnical analysis. The NRCS web soil survey map, highlighting the distribution of soil types across the campus, is included in Appendix C. The subsurface infiltration systems have been located within the areas of the site with HSG A soils to ensure maximum infiltration rates. Geotechnical investigations indicated seasonal high groundwater levels 3-8 feet below existing grades. The subsurface systems have therefore also been located in areas of maximum fill to maintain a minimum two feet of separation to ESHGW, per regulation.

The Recharge BMPs have been sized to infiltrate more than 0.60 inches of runoff over 72 hours, with an infiltration rate of 1.02 in/hour (Rawls rate for sandy loam). The combined porous pavement areas and contributing impervious areas to the recharge systems exceeds the net increased impervious area from existing to proposed conditions.

Recharge sizing and draw-down calculations can be found Appendix C. The project's provided required recharge volume is in compliance with Standard 3 for redevelopment projects.

Standard 4 – Removal of Total Suspended Solids

Standard 4 states: For new development, stormwater management systems must be designed to remove 80% of the average annual load (post-development conditions) of Total Suspended Solids (TSS). It is presumed that this standard is met when: (a) Suitable nonstructural practices for source control and pollution prevention are implemented; (b) Stormwater management best practices (BMPs) are sized to capture the prescribed runoff volume; and (c) Stormwater management BMPs are maintained as designed.

Removal of Total Suspended Solids (TSS) at the site is accomplished through a variety of Stormwater BMPs, as well as proprietary treatment devices. The proprietary units are sized to achieve minimum 80% TSS removal from a 1" water quality event, where used as standalone treatment practices. The three subsurface infiltration systems and two existing siltation ponds (i.e. wet basins) provide 80% TSS removal when combined with pretreatment that achieves minimum 44% TSS removal. Therefore, the proprietary treatment devices used in tandem with these BMPs are sized to provide minimum 44% TSS removal. Porous Pavement also provides 80% TSS removal. TSS removal rate spreadsheets for typical treatment trains on site have been provided in Appendix C.

The current proposal is in compliance with Standard 4.

Standard 5 – Land Uses with Higher Potential Pollutant Loads

Standard 5 states: Stormwater discharges from areas with higher potential pollutant loads require the use of specific stormwater management BMPs. The use of infiltration practices without pretreatment is prohibited.

The Andover town stormwater regulations require that all treatment devices shall be sized to treat 1-inch of runoff; therefore, the proposed pretreatment units have been sized to meet the requirements for a Land Use with Higher Potential Pollutant Loads.

The proposal is in compliance with Standard 5.

Standard 6 – Critical Areas

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

The site not within a critical area. The proposal is in compliance with Standard 6.

Standard 7 – Redevelopment Projects

Standard 7 states: 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 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 majority of the project site qualifies as a redevelopment project; therefore, the site has been designed to meet Standards 2-6 only to the maximum extent practicable. The entire site has been designed to achieve peak flow attenuation from existing to proposed conditions, and hydrodynamic separators are proposed where other BMPs are not feasible to ensure 80% TSS removal is achieved within the entire limit of work. Therefore Standards 2 and 4 are fully met. Recharge is provided for the increased impervious area on site, and the systems are sized to exceed the minimum recharge volume to the maximum extent practicable.

The proposal is in compliance with Standard 6.

Standard 8 – Erosion and Sedimentation Controls

Standard 8 states: Erosion and sediment controls must be implemented to prevent impacts during construction or land disturbance activities.

The erosion and sedimentation control program minimizes the risk of impacts to resource areas and adjacent properties during construction of the Project. The program incorporates BMPs specified in the guidelines developed by MassDEP and the United States Environmental Protection Agency (US EPA) and complies with the requirements of the National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges from Construction Activities. These measures include the installation of temporary erosion and sedimentation controls and construction sequencing. Areas of exposed soil will be kept to a minimum, and permanent vegetative cover (or binder coat of pavement) will be established after final grading or as soon as practicable.

The following erosion and sediment controls will be implemented to prevent impacts during construction or land disturbance activities:

- Silt fence barriers
- Straw bales
- Vegetative slope stabilization
- Temporary swales and sedimentation basins
- Construction entrances

A Stormwater Pollution Prevention Plan (SWPPP) will be prepared for this project and will be submitted as part of the National Pollutant Discharge Elimination System (NPDES) permit process.

The current proposal is in compliance with Standard 8.

Standard 9 – Operation and Maintenance Plan

Standard 9 states: All stormwater management systems must have an operation and maintenance plan to ensure that systems function as designed.

A post-construction operation and maintenance plan will be provided for the proposed development prior to any construction activities. The current proposal is in compliance with Standard 9.

Standard 10 – Illicit Discharges

Standard 10 states: All illicit discharges to the stormwater management system are prohibited.

There are no known or suspected illicit discharges to the stormwater management system at the project site. The project complies with Standard 10.

2.7.3 Compliance with Town of Andover Stormwater Management Standards

The project site has been designed in accordance with the Town of Andover Stormwater Regulations. The design implements LID strategies, including maintaining the existing basins and adding porous pavement, subsurface recharge systems, and proprietary treatment practices, all of which meet the town's intent for climate change resiliency in stormwater design.

In addition to the MassDEP Stormwater Standards above, the Andover regulations include additional requirements for pollutant removal. In accordance with the requirements for a redevelopment project, the site has been designed to achieve minimum 50% phosphorus removal from the total proposed impervious area within the limit of work. Phosphorus removal is achieved through three subsurface infiltration systems, porous pavement, two existing siltation ponds, and non-structural practices such as street sweeping and catch basin cleaning. Removal efficiency tables for each type of BMP on site, as well as calculations demonstrating the phosphorus loads, removal rates, and overall phosphorus reduction are provided in Appendix C.

2.7.4 Low Impact Development

The Project implements a variety of low impact stormwater strategies. The proposed stormwater management design implements a significant amount of porous pavement, including a network of walkways and plazas across the site and new parking area north of building 5. Porous pavement is an optimal design strategy given the groundwater profile of the site. Porous pavement is a shallower stormwater management strategy than other alternatives, which allows the design to achieve the necessary separation to groundwater to maximize infiltration and reduce risks associated with groundwater mounding. Additionally, the existing topography in the field where the new parking lot is proposed is relatively flat. Porous pavement allows the parking lot to drain directly into the soils below

with minimal pavement slopes, which in turn minimizes grading around the perimeter of the parking lot and reduces disturbance in the adjacent natural resource areas.

Several low impact strategies already exist on site and will be maintained as part of the proposed development. These include two large, constructed siltation ponds, which provide sediment removal and peak flow attenuation prior to discharging to the river and adjacent wetlands. One of the ponds also acts as a water supply source for campus irrigation, which reduces potable water usage and further mitigates stormwater outflow volume.

The hydrologic analysis and modeling of existing conditions determined that the large siltation pond northwest of Buildings 2 and 3 meets or exceeds its capacity in extreme flood conditions such as the 100-year storm event. The proposed stormwater design includes implementing strategies upgradient of the pond, such as subsurface recharge, porous pavement, and pretreatment water quality units. These strategies reduce sediment loading and peak flow volumes to the pond, to help ensure that the pond will continue to provide adequate capacity for future storm volumes.

In addition to the existing siltation ponds, a series of wetlands cutting through the center of the property between buildings 1 and 2 act as a vegetated stormwater conveyance channel, which collects runoff from adjacent parking areas as well as discharge from a culvert connected to an offsite stormwater channel west of the property. While vegetated channels do not provide storage or groundwater recharge, they provide TSS removal and peak flow attenuation compared to traditional piped drainage networks.

Much of the project involves redevelopment of existing infrastructure that will remain largely in place. Existing parking areas to remain are already equipped with traditional catch basins and piped drainage networks. Replacing these systems with bioswales and other low impact strategies would require significant disruption to existing adjacent landscape islands including loss of trees, as discussed in the section below. Reusing the existing infrastructure also ensures the design meets the existing invert elevations at the pipe network discharge points, such as the flared end sections to the siltation ponds and the outlet culverts to the river and surrounding river. By matching existing inverts and pipe capacities, the design can reuse existing pipes within the wetland buffers and riverfront area and eliminate trenching and earthwork disturbances for new pipes. The proposed hydrology map highlights how the new stormwater BMPs and drainage pipes tie into the existing pipe network.

2.8 Alternatives

Some of the alternative stormwater management strategies considered for this site include:

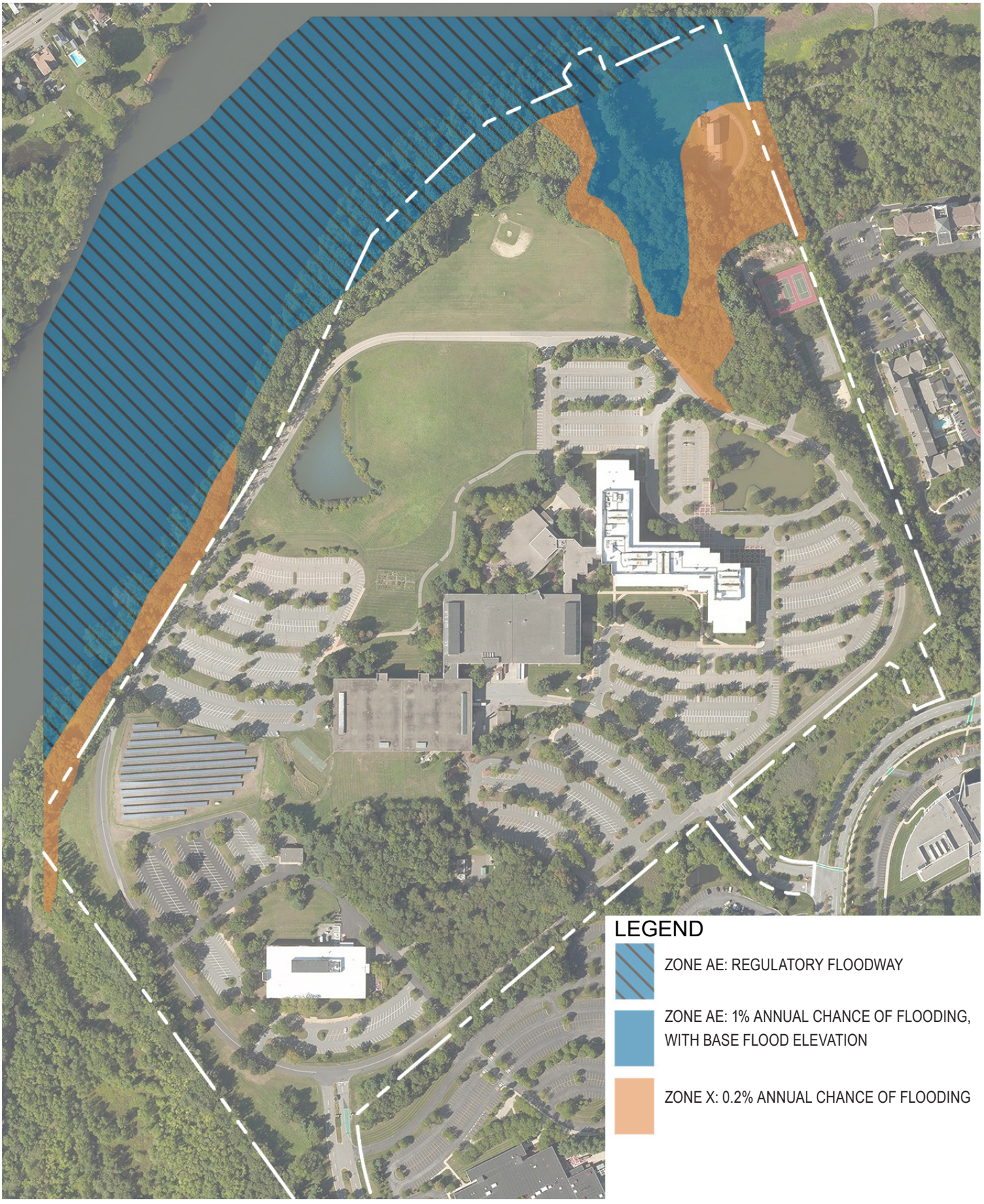
- Bioretention Areas/ Rain Gardens
- Bioswales in lieu of traditional catch basin and pipe networks
- Additional Stormwater Basins
- Expanding existing siltation ponds to increase capacity

These strategies present challenges for the site due to potential disruption to existing landscaping and natural resource areas, seasonal high groundwater levels but will be reviewed as part of the detailed design for Buildings 5 and 6.

The proposed site design reuses much of the existing drainage infrastructure to maintain existing landscape islands and preserve existing mature trees, which provide beneficial site shading and already-established biodiversity. The site design also protects and expands existing outdoor amenity spaces, pedestrian accessibility, and interconnection with the surrounding natural resources. The stormwater management strategies selected for the site take these additional sustainability goals into consideration.

The Project will include a combination of BMPs in the areas of new construction and will implement improvements to the water quality systems as part of all site renovations.

Figures

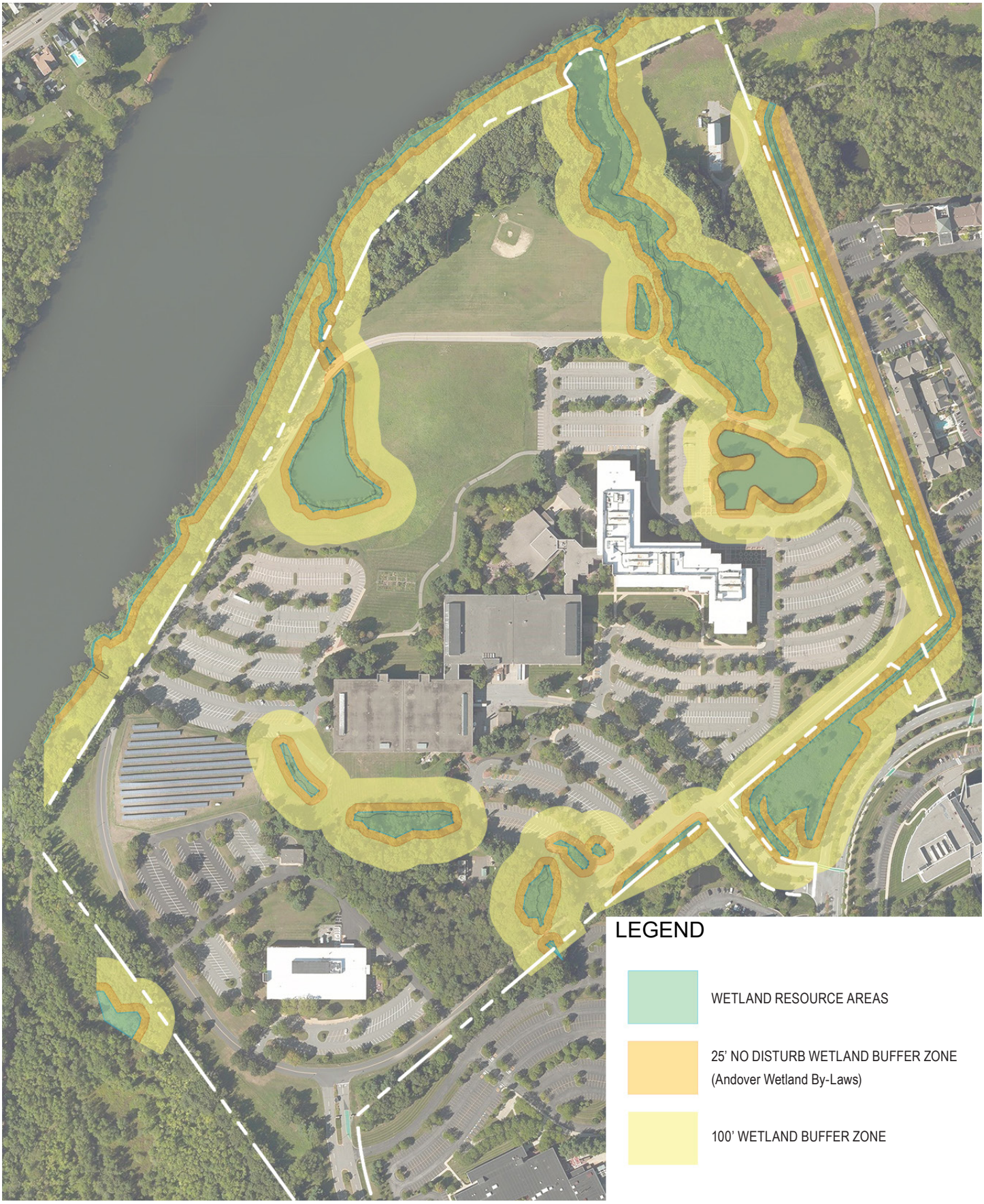


2.1 - FEMA Floodplain

3000 Minuteman Road, Andover, Massachusetts

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2.2 - Wetland Resource Areas

3000 Minuteman Road, Andover, Massachusetts

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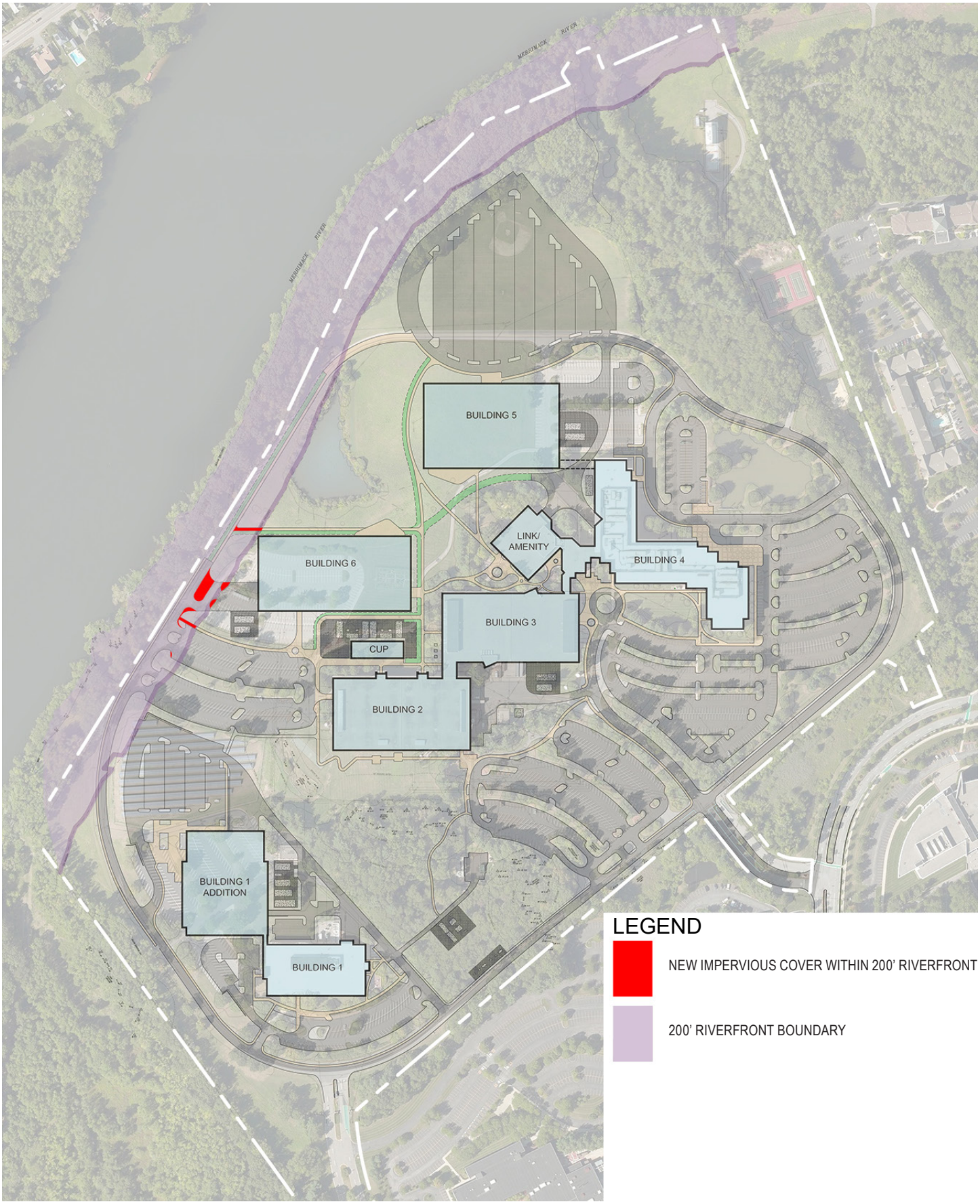


2.3 - Riverfront Area

3000 Minuteman Road, Andover, Massachusetts

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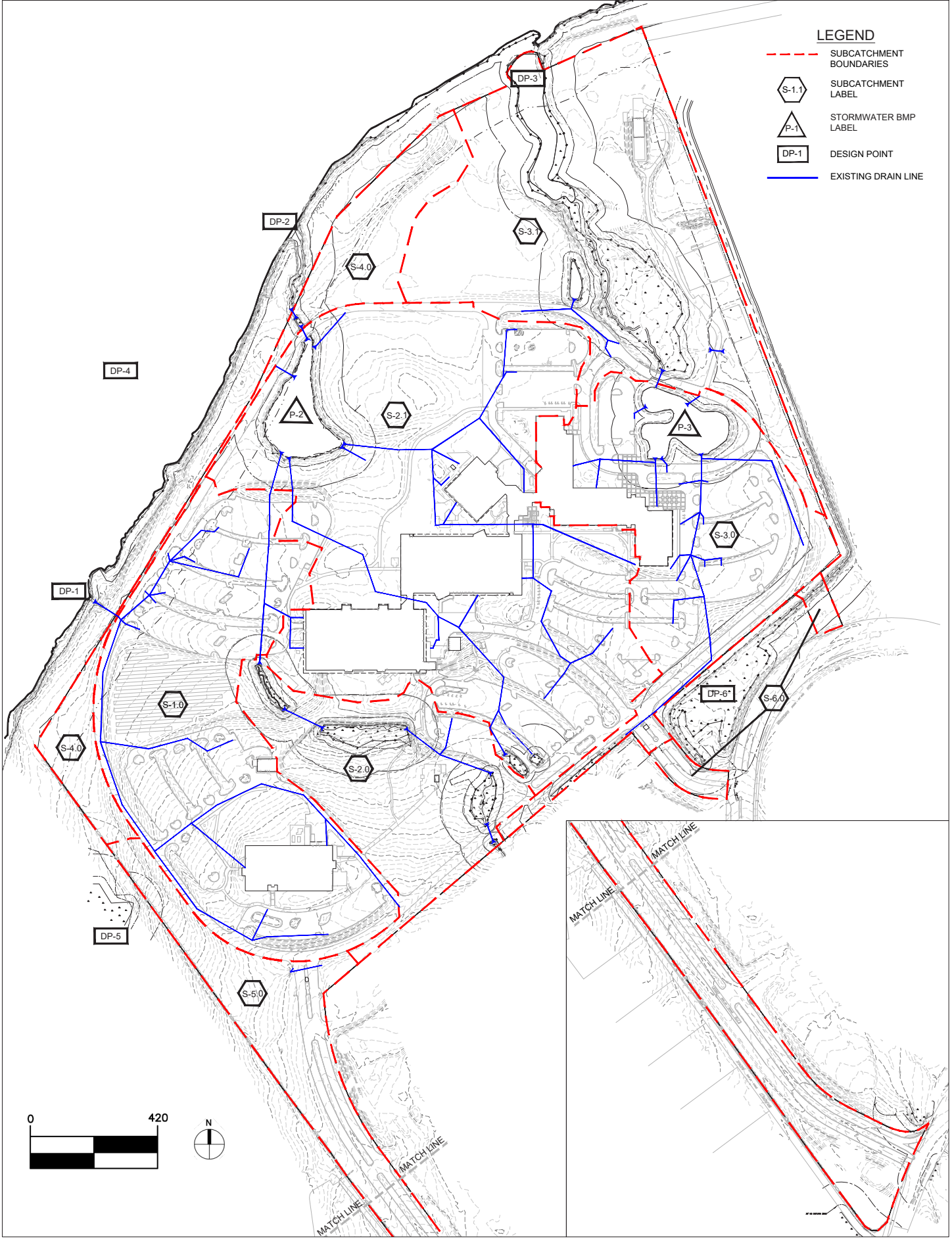


2.4 - Riverfront Area Impacts

3000 Minuteman Road, Andover, Massachusetts

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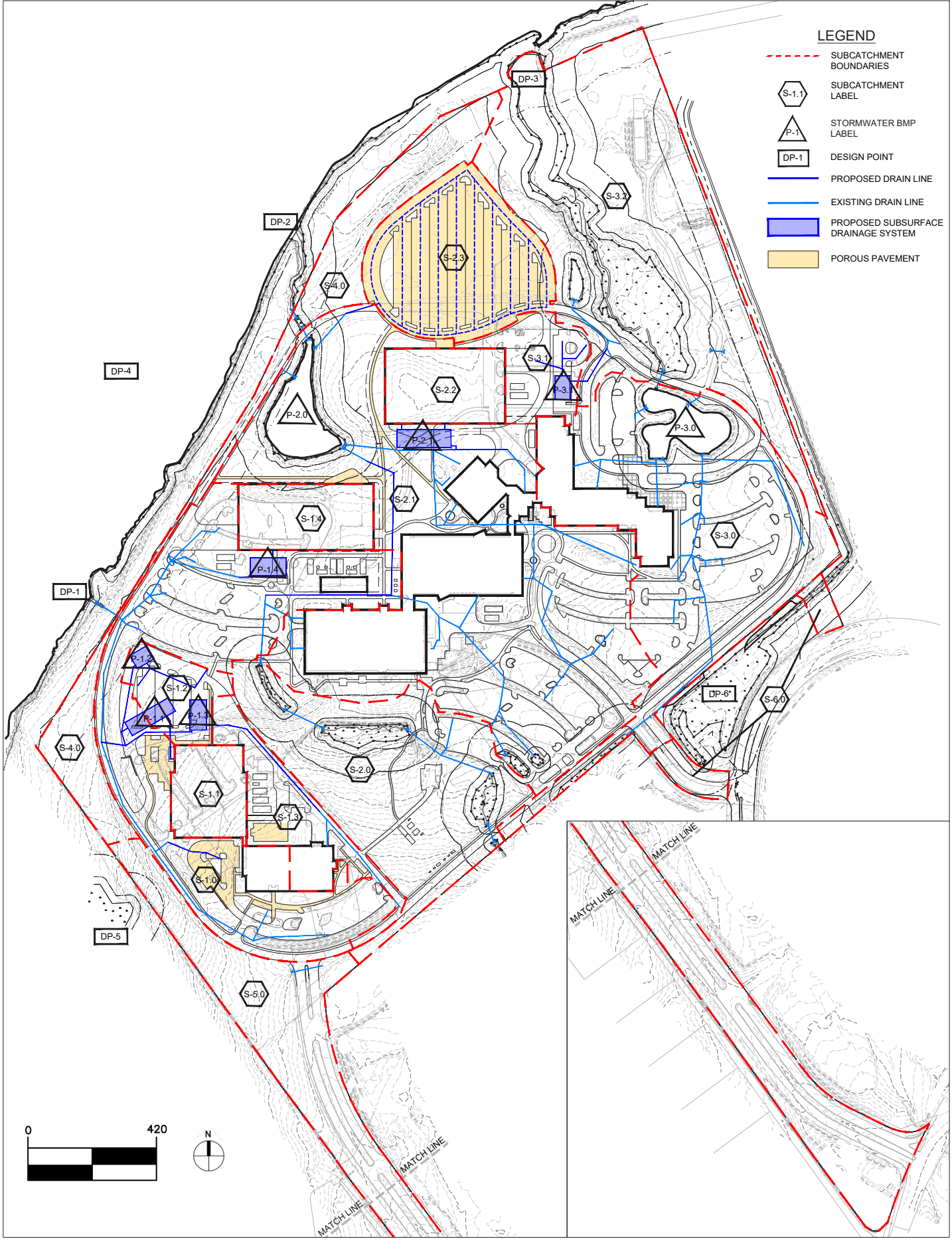


2.5 - Existing Hydrology Map

3000 Minuteman Road, Andover, Massachusetts

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2.6 - Proposed Hydrology Map

3000 Minuteman Road, Andover, Massachusetts

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Transportation 3

3.1 Introduction

See Appendix D for Transportation Impact Assessment (TIA)

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Transportation

3.1 Introduction

Vanasse & Associates, Inc. (VAI) has conducted a Transportation Impact Assessment (TIA) in order to determine the potential impacts on the transportation infrastructure associated with the renovation and expansion of the former Philips Healthcare campus located at 3000 Minuteman Road in Andover, Massachusetts, to accommodate laboratory/current Good Manufacturing Practice (cGMP) uses (hereafter referred to as the "Project"). This assessment was prepared in consultation with the Town of Andover and the Massachusetts Department of Transportation (MassDOT) and was performed in accordance with MassDOT's *Transportation Impact Assessment (TIA) Guidelines* and the standards of the Traffic Engineering and Transportation Planning professions for the preparation of such reports.

See Appendix D for the complete Transportation Impact Assessment (TIA).

Based on this assessment, we have concluded the following with respect to the Project:

1. Using trip-generation statistics published by the Institute of Transportation Engineers (ITE)1 for similar functional areas to those that will be associated with the campus redevelopment (research and development (R&D) and manufacturing space for trip-generation purposes), the Project is expected to generate approximately 7,268 vehicle trips on an average weekday (two-way volume over the operational day of the Project), with approximately 822 vehicle trips expected during the weekday morning peak-hour and 933 vehicle trips expected during the weekday evening peak-hour;
2. In comparison to the former Philips Healthcare (aka Philips Electronics) campus at full occupancy, the Project is expected to generate approximately 77 *additional* vehicle trips during the weekday morning peak-hour and 175 *additional* vehicle trips during the weekday evening peak-hour, with a total of 1,668 *additional* vehicle trips expected over the operational day of the Project;
3. The Project will not result in a significant impact (increase) on motorist delays or vehicle queuing over Existing or anticipated future conditions without the Project (No-Build conditions); however, it was noted that one or more movements at the study intersections are predicted to operate at or over capacity (defined as a level-of-service (LOS) "E" or "F", respectively) independent of the Project. Project-related impacts were generally defined as an increase in average motorist delay that resulted in a corresponding increase in vehicle queuing of up to three (3) vehicles. Specific improvements will be advanced as a part of other development projects in the area or have been recommended as a part of the Project to improve traffic operations;
4. No apparent safety deficiencies were noted with respect to the motor vehicle crash history at the study intersections; and
5. Lines of sight to and from the Project site driveway intersections were found to exceed the recommended minimum distances for the intersections to operate in a safe and efficient manner based on the appropriate approach speed.

In consideration of the above, we have concluded that the Project can be accommodated within the confines of the existing transportation infrastructure in a safe and efficient manner with implementation of the recommendations that follow.

[1]*Trip Generation*, 11th Edition; Institute of Transportation Engineers; Washington, DC; 2021.

Recommendations

A detailed transportation improvement program has been developed that is designed to provide safe and efficient access to the Project site and address any deficiencies identified at off-site locations evaluated in conjunction with this study. The following improvements have been recommended as a part of this evaluation and, where applicable, will be completed in conjunction with the Project subject to receipt of all necessary rights, permits, and approvals.

Project Access

Access to the Project will continue to be provided by way of the existing driveways that intersect the west side of Minuteman Road approximately 1,450 feet north of River Road and the terminus of 1776 Drive approximately 2,175 feet north of River Road, respectively. The following recommendations are offered with respect to the design and operation of the Project site access and internal circulation, many of which are reflected on the site plans:

- The driveways serving the Project site should continue to accommodate two-way travel and the turning and maneuvering requirements of service and delivery vehicles, and the largest anticipated responding emergency vehicle as defined by the Andover Fire Department.
- Where perpendicular parking is proposed, the drive aisle behind the parking should be a minimum of 23 feet in order to facilitate parking maneuvers.
- STOP-signs and marked STOP-line should be provided on the individual driveways that intersect the ring-road that circumnavigates the campus, at the intersection of the ring-road with Minuteman Road and on the 1776 Drive approach to River Road (retain existing traffic control at the intersection).
- All signs and pavement markings to be installed within the Project site should conform to the applicable standards of the *Manual on Uniform Traffic Control Devices* (MUTCD).[2]
- Sidewalks and pedestrian paths are provided within the Project site that extend to or provide access to the existing sidewalk along Minuteman Road.
- Americans with Disabilities Act (ADA)-compliant wheelchair ramps will be provided at all pedestrian crossings that are constructed or modified in conjunction with the Project.
- Signs and landscaping to be installed as a part of the Project within intersection sight triangle areas will be designed and maintained so as not to restrict lines of sight.
- Snow accumulations (windrows) within sight triangle areas will be promptly removed where such accumulations would impede sight lines.
- Consideration will be given to providing electric vehicle (EV) charging stations within the Project site.

[2]*Manual on Uniform Traffic Control Devices (MUTCD)*; Federal Highway Administration; Washington, D.C.; 2009.

Off Site

River Road Traffic Signal System

Independent of the Project, one or more movements at the intersections that comprise the River Road coordinated traffic signal system are currently or are predicted to operate at or over capacity during the peak-hours. In an effort to improve traffic operations and off-set the predicted impact of the Project, the Project proponent will design and implement an optimal traffic signal timing, phasing and coordination plan for the River Road coordinated traffic signal system inclusive of the following intersections:

- River Road/Minuteman Road/Shattuck Road
- River Road/I-93 Southbound Ramps
- River Road/I-93 Northbound Ramps
- River Road/Old River Road/Federal Street

These improvements will be completed prior to the issuance of a Certificate of Occupancy for any new or expanded building within the Project site, subject to receipt of all necessary rights, permits and approvals, and will include the installation, repair and/or upgrade of traffic signal equipment and associated appurtenances required to provide and maintain coordination of the traffic signal system. With the implementation of an optimal traffic signal timing, phasing and coordination plan, overall motorist delays will be reduced such that no movement operates at or over capacity, an improvement over No-Build conditions.

In addition to the traffic signal timing, phasing and coordination improvements, the Project proponent will reconstruct all non-ADA compliant wheelchair ramps at the subject intersections, replace/upgrade non-ADA complaint pushbuttons and install countdown-type pedestrian indications where such indications are not currently installed. These improvements will also be completed prior to the issuance of a Certificate of Occupancy for any new or expanded building within the Project site, subject to receipt of all necessary rights, permits and approvals.

Transportation Demand Management

The Project site is served by public transportation services that are provided by the Merrimack Valley Regional Transit Authority (MVRTA). The MVRTA operates bus Route 37, Beacon Street, which travels along River Road and Minuteman Road, with a stop located at Springhill Suites by Marriot (north of the Project site), and thereafter to the Buckley Transportation Center in Lawrence where connections can be made to other bus lines. From the Buckley Transportation Center, bus service is provided to Lawrence Station on the Haverhill Line of the Massachusetts Bay Transportation Authority (MBTA) Commuter Rail system with service to North Station in Boston. MVRTA buses operate in a passenger demand service mode and will stop anywhere along the service route where it is safe to pick-up or discharge a passenger.

In an effort to encourage the use of alternative modes of transportation to single-occupant vehicles (SOVs), the following Transportation Demand Management (TDM) measures will be implemented as a part of the Project:

- A transportation coordinator will be assigned for the Project to coordinate the TDM program;
- Information regarding public transportation services, maps, schedules and fare information will be posted in a central location and/or otherwise made available to employees;
- The transportation coordinator will facilitate a rideshare matching program for employees to encourage carpooling;

- A “welcome packet” will be provided to new employees detailing available commuter options and will include the contact information for the transportation coordinator and information to enroll in the employee rideshare program;
- Specific amenities will be provided to discourage off-site trips, including providing a breakroom equipped with a microwave and refrigerator; offering direct deposit of paychecks; coordinating with a dry-cleaning service for on-site pick-up and delivery; allowing telecommuting or flexible work schedules; and other such measures to reduce overall traffic volumes and travel during peak traffic volume periods;
- Pedestrian accommodations have been incorporated into the Project site;
- Secure bicycle parking will be provided throughout the Project site and will include exterior bicycle racks and weather protected bicycle parking for each building; and
- A shuttle service will be provided at no ($0) cost to employees of the Project that will provide weekday commuter service between the Project site Andover Station on the Haverhill Line of the MBTA Commuter Rail system. The shuttle service schedule will be coordinate with the arrival and departure of trains from Andover Station, with a minimum of four (4) round trips provided during both the weekday morning and evening peak commuter periods. Off-peak service and service to other commuter hubs will be considered as demand warrants.

With implementation of the aforementioned recommendations, safe and efficient access will be provided to the Project site and the Project can be accommodated within the confines of the existing and improved transportation system.

Traffic Monitoring Program

The Proponent will conduct a post-development traffic monitoring and employee survey program in order to evaluate the success and to refine the elements of the TDM program, and to validate the trip projections and parking demands for the Project. The monitoring program will include:

1. Obtaining traffic-volume information over a continuous seven-day, weeklong period on the driveway serving the Project site along Minuteman Road and 1776 Drive;
2. Performing manual turning movement and vehicle classification counts at the Project site driveway intersections with Minuteman Road and 1776 Drive, and at the intersections of River Road at Minuteman Road and Shattuck Road and River Road at 1776 Drive during the weekday morning (7:00 to 9:00 AM) and weekday evening (4:00 to 6:00 PM) peak periods; and
3. Evaluating motor vehicle crash data at the intersections of River Road at Minuteman Road and Shattuck Road and River Road at 1776 Drive.

The monitoring program will commence six (6) months after issuance of the Certificate of Occupancy for the Project and will continue on an annual basis thereafter for a period not to exceed 5-years after completion of the Project. The results of the monitoring program will be summarized in a report to be provided to the Town of Andover and MassDOT within 2-months after the completion of the data collection effort. The report will document: i) traffic volumes associated with the Project; ii) motorist delays, vehicle queuing, crash severity and calculated crash rates at the intersections of River Road at Minuteman Road and Shattuck Road and River Road at 1776 Drive; and iii) the elements of the TDM program that have been implemented and use of alternative modes of transportation to single-occupant vehicles.

Water and Wastewater 4

4.1 Introduction
4.2 Water Demand
4.3 Wastewater Generation
4.4 Conclusion and Mitigation Summary

Water and Wastewater

4.1 Introduction

The Proponent is developing designs for the base building MEP systems to minimize water demand and wastewater discharge. In addition, the Proponent is engaged in discussions with the Town of Andover to mitigate any potential impacts to the municipal systems.

4.2 Water Demand

4.2.1 Existing Water Demand and Infrastructure

The campus utilizes the Town of Andover water supply as its source for domestic and fire protection needs. There are two points of connection to the municipal water system, each with individual water meter pits and backflow prevention. Out of the meter pits, separate water main loops begin for fire protection (10") and domestic service (8"). Landscape irrigation is primarily sourced from an on-site constructed pond, Siltation Pond B. A secondary source for irrigation is provided via a reserve connection to the municipal water supply. Refer to Figure 4.1 Existing Water Network.

The Town of Andover's water supply comes primarily from Haggetts Pond (PWS3009000-01S) and is supplemented with additional waters from Fish Brook (PWS3009000-02S) and the Merrimack River (PWS3009000-03S). The water is treated and distributed throughout the town from the Town of Andover Water Treatment Plant located at 397 Lowell Street, Andover, MA.

As described in Section 1, the existing building uses include office, electronics manufacturing, and R&D laboratory. Water consumption data between the years of 2017 and 2020 for the campus was reviewed but represented inconsistent levels of building occupancy. An assumed water demand of 120% of Title 5 sewer discharge is used in Table 4.1 below to estimate baseline water consumption for the existing buildings based on the historic uses.

Table 4.1 – Existing Water System Demands

	Avg. Daily Flow (GPD)
Building 1	7,740
Building 2	12,286
Building 3	12,816
Building 4	23,103
Link	2,892
TOTAL	**58,837**

4.2.2 Future Water Demand

The future water demands associated with the renovated Buildings 1, 2, 3, 4, and Link as well as new Buildings 1A, 5, 6, and CUP were calculated by the design team. The Average Daily water demand for the campus is estimated at 396,930 GPD. Peak water use for the Project is based on a peak-cooling (e.g., mid-July) scenario. The Peak demand for the campus is 903 gpm. Domestic use for the occupied buildings is expected to peak around midday (e.g., lunchtime preparation and toilet flushing) and peak cooling is expected late afternoon.

The largest water demand on the system is the Central Utility Plant (CUP), which uses water-cooled chillers to provide cooling for each of the buildings. The CUP accounts for approximately 54% of the total campus system demand. Refer to Table 4.2 Proposed Water System Demands.

The Proponent us currently evaluating centralized versus distributed options for the chilled water systems. Centralized or distributed (local to each building) will not impact the total demand.

Table 4.2 – Proposed Water System Demands

	Avg. Daily Flow (GPD)	Peak Flow (GPM)
Building 1	14,620	82
Building 1A	21,100	94
Building 2	28,845	103
Building 3	29,200	92
Building 4	22,915	108
Building 5	28,805	91
Building 6	28,805	110
Link	8,125	75
CUP	214,515	494
TOTAL	**396,930**	**903**

The existing use of Siltation Pond B for irrigation is proposed to remain.

The capacity (available pressures and flows) of the proposed water system was evaluated using WaterCAD. Hydrant flow tests completed in February 2022 indicated residual pressures and flows of 118 psi and 1,600 gpm. Pipe sizes were based on available record plans. All pipes were assumed to be ductile iron. A reduced Hazen-Williams Coefficient of 110 was used for record existing-to-remain pipes to account for capacity loss. New pipes are modeled with a Hazen-Williams Coefficient of 130, per industry standards. Head losses across general purpose valves were approximated using typical pump head loss curves.

The results of the hydraulic model indicate that under peak day, peak flow conditions (and ignoring the non-concurrency of the CUP cooling loads), the campus water system would still have a minimum pressure of 86 PSI at the highest elevation of the model. This indicates there is adequate capacity in the campus water system for the Project.

The Town of Andover is currently undertaking a study to evaluate of the impacts of the proposed buildout on the municipal system and identify potential mitigation. The Proponent has provided the Town and their consulting engineer with available capacity, demand, and operating assumptions.

4.2.3 Water Conservation Measures

To reduce peak water demand at the CUP, the team has selected high-efficiency chillers, best-in-class tower design with drift eliminators, and advanced water filtration to increase condenser water cycles of concentration and reduce blowdown. The CUP has been designed with a water-side economizer to provide free cooling during winter months with low load, allowing the towers to be bypassed and eliminating water use in those periods.

From a programming perspective, the proponent has reduced the basis-of-design GMP clean space air changes per hour (ACH) from 40 to 30 to further reduce cooling demand (and thus water demand) at the

CUP. Further tenant limitations have been put in place to reduce the planned lab and office cooling demands, reducing the overall expected CUP size. Demand reductions associated with the above measures are not reflected in the demand calculations presented herein.

Water conservation measures under consideration for the future Buildings 5 and 6 include rainwater harvesting, grey water recycling, AHU condensate collection, and low-flow plumbing fixtures. Potential applications under consideration for condensate and rainwater reuse include boiler feedwater, cooling tower feedwater and irrigation use. Deployment of these water reuse measures are not reflected in the water demand calculations presented herein.

4.3 Wastewater Generation

4.3.1 Existing Wastewater Generation and Infrastructure

Sanitary sewage from the campus ultimately discharges to the Greater Lawrence Sanitary District (GLSD) and its treatment facility in the Town of North Andover. There is a 30-foot-wide permanent sewer easement along the west end of the parcel which crosses from west to east just north of Pond B. The easement contains a 24" polyvinyl chloride (PVC) municipal sewer main which transitions to an 18" vitrified clay (VC) pipe prior to crossing the on-site wetland in the northeastern corner of the parcel. The 18" municipal main turns north and connects to a sewer manhole which begins the Town of Andover west side interceptor. The west side interceptor is a 36" reinforced concrete pipe at this point of connection and runs east along the Merrimack River, conveying sanitary sewerage to the GLSD.

The private sewer for the campus connects to the municipal sewer main in two locations north of Building 4 and the Link Building. Refer to Figure 4.3 Existing Sewer Network.

There are no known structural or operational issues with the west side interceptor, therefore the connection points to the municipal main within the property can be reasonably used as design "end points" at which to evaluate the impacts of the proposed buildout. The wastewater treatment facility in North Andover has a design and permitted capacity of 53 MGD and an approximate current operating rate of 28 MGD, therefore there is adequate capacity available at the treatment plant.

Sewer flows in the municipal main were based on the Town of Andover Sanitary Sewer Master Plan report completed by CDM Smith in 2016 and supplemented by additional calculations as required. Additional flows not included in the report were calculated assuming 3 persons/household and 110 gallons/person/day. Average daily flows of greater than 30,000 GPD were assigned a peaking factor of 2.5. Average daily flows of less than 30,000 GPD were assigned a peaking factor of 3.0. The resulting average daily and peak flows were 1.07 MGD and 1,136 GPM, respectively.

Although the buildings on the campus are not currently fully occupied, full occupancy was assumed in order to evaluate the impacts of the proposed buildout beyond the potential existing sewer flows. Title 5 System Sewage Flow Design Criteria (310 CMR 15.203) were used to calculate the theoretical demands. Peak flow was calculated by assuming 24 working hours and a peaking factor of 4. Under theorectical fully-occupied existing peak flow conditions, the 18” VC sewer main would be 51-56% full.

The 18” vitrified clay municipal main that crosses the onsite wetlands was camera-scoped in March 2022 to evaluate its condition. The video inspection was conducted along five sections of pipe beginning and ending at sewer manholes. The result of the video inspection found the system to be in generally good condition. Certain sections of pipe were identified as having small amounts of groundwater infiltration through joints. These sections of pipe are being further evaluated to determine the best approach to reduce infiltration.

4.3.2 Future Wastewater Generation

The campus redevelopment will generate domestic and industrial discharges to the Andover sanitary sewer collection system and the Greater Lawrence Sanitary District (GLSD) wastewater treatment facility. The industrial discharges from the proposed facilities will include pretreatment at the source in accordance with the GLSD Industrial Discharge Pretreatment Program (IPP) and the Rules and Regulations covering discharge of wastewater.

The proposed plan for the campus includes reusing the two existing connections to the municipal main as well as adding two additional connections. The additional connections will reduce overall sewer pipe length and reroute existing sanitary lines which pass under and nearby to wetland resource areas. Refer to Figure 4.2 Proposed Sewer Network.

Title 5 criteria were supplemented by lab and clean room wash water demands to approximate the sewer demands for the proposed buildout, as summarized in Table 4.3. For Buildings 2, 3, 5, and 6, where the programmed manufacturing floor space is 25% of the square footage, it was assumed that 20% of the personnel would be working in the manufacturing portion of the building. Peak flow was calculated by assuming 24 working hours and a peaking factor of 4.

Table 4.3 – Sewer Demands

	Existing		Proposed	
Building	**Avg. Daily Flow (GPD)**	**Peak Flow (GPM)**	**Avg. Daily Flow (GPD)**	**Peak Flow (GPM)**
Building 1	6,450	18	15,050	42
Building 1A	-	-	3,750	10
Building 2	10,239	28	22,731	63
Building 3	10,680	30	23,730	66
Building 4	19,253	53	34,673	96
Building 5	-	-	20,813	58
Building 6	-	-	20,813	58
Link	22,120	61	17,500	49
CUP	-	-	75,080	150
Total	68,741	191	234,138	592

Under theoretical fully-occupied, full buildout, and peak flow conditions, the 18” VC would be 66-73% full. Refer to Table 4.4 for peak flow pipe capacity calculations.

Table 4.4 – Municipal Sewer Main Capacity Summary

Leg	Length (ft)	Size (in)	Slope	V, Existing (fps)	V, Proposed (fps)	Q/Qf, Existing	Q/Qf, Proposed
1	427	24	0.02%	1.2	1.2	62%	65%
2	400	24	0.05%	1.6	1.7	42%	57%
3	913	24	0.14%	2.3	2.5	25%	34%
4	335	18	0.2%	2.4	2.6	56%	73%
5	333	18	1.3%	4.6	5.1	25%	33%
6	718	18	0.3%	2.8	3.1	51%	66%

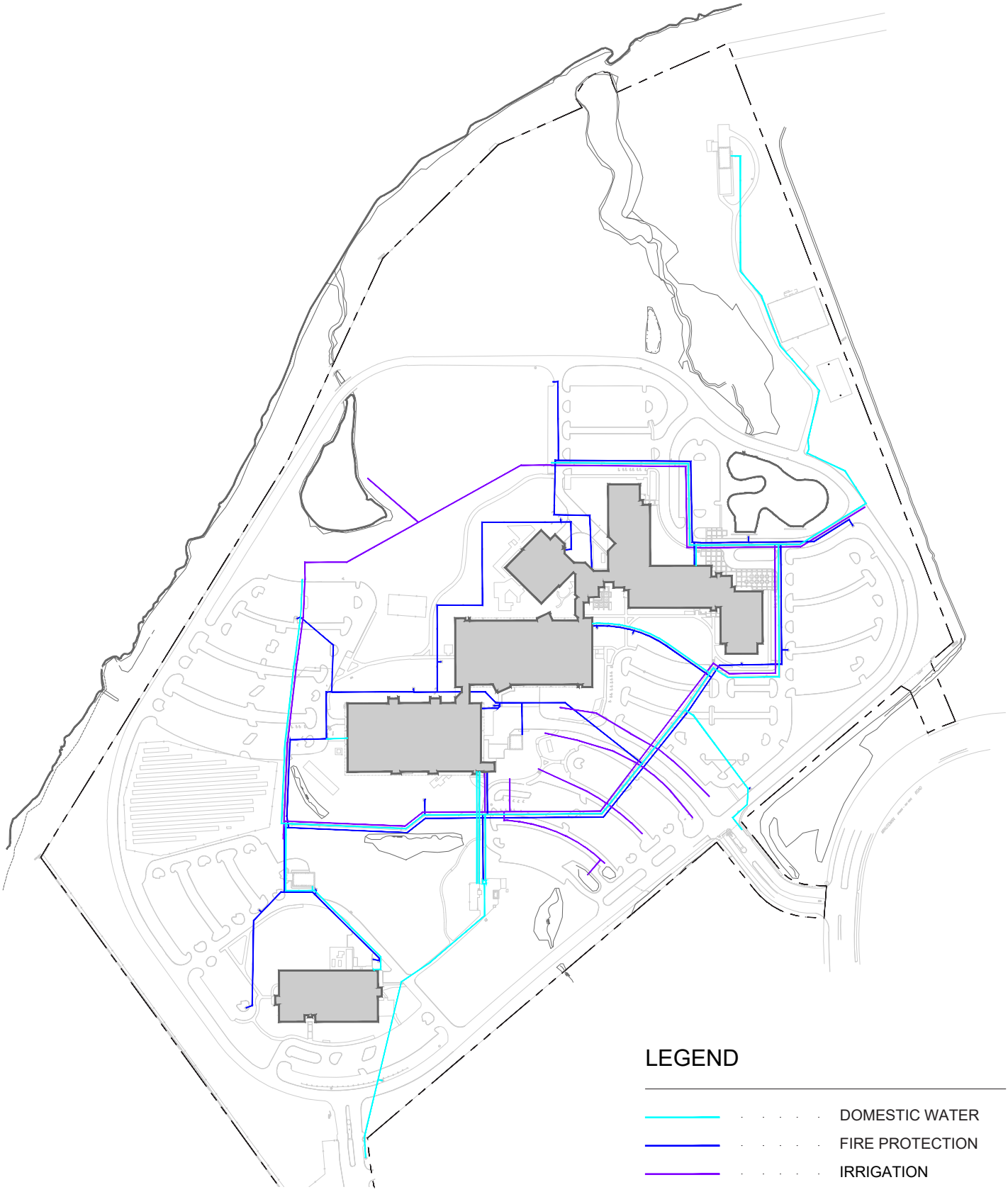
4.4 Conclusion and Mitigation Summary

The average daily sewer flow from the campus is estimated at 234,000 GPD. The existing vitrified clay pipes on campus will be replaced with polyvinyl chloride pipes, in accordance with current standards.

There is no expected adverse impact on the on-site municipal main, which operates between 50-60% full under existing peak flow conditions. Under highly-conservative proposed peak flow conditions (i.e. peak cooling conditions in July and buildings fully occupied), the municipal main would operate between 66-73% full. This indicates the existing main is capable of handling the additional flow without requiring replacement or redesign.

Mitigation measures include reduced water demand as described in Section 4.2.3 as well as compliance with the Town's 4:1 inflow and infiltration mitigation requirement.

Figures

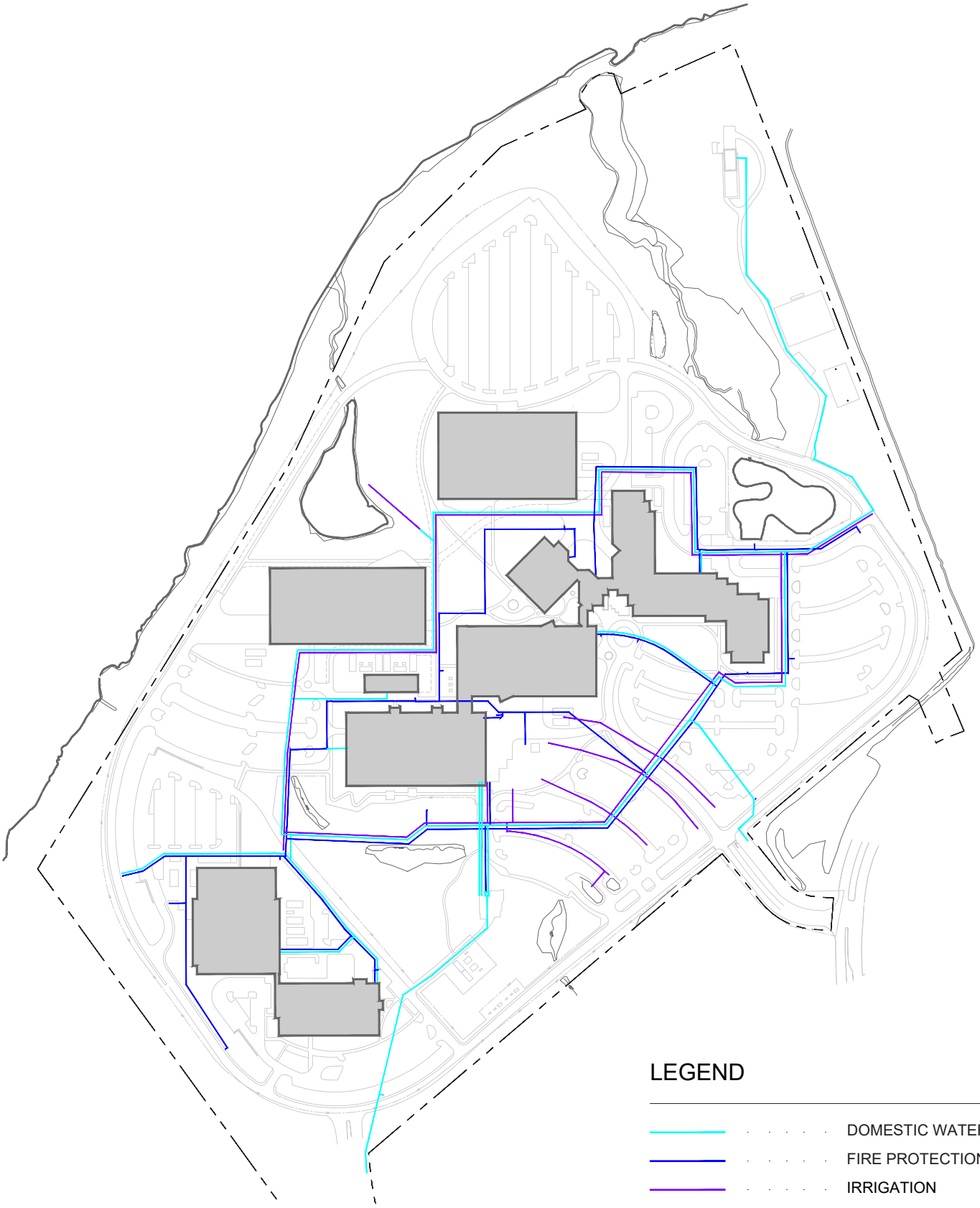


4.1 - Existing Water System

3000 Minuteman Road, Andover, Massachusetts

ALEXANDRIA

SMMA

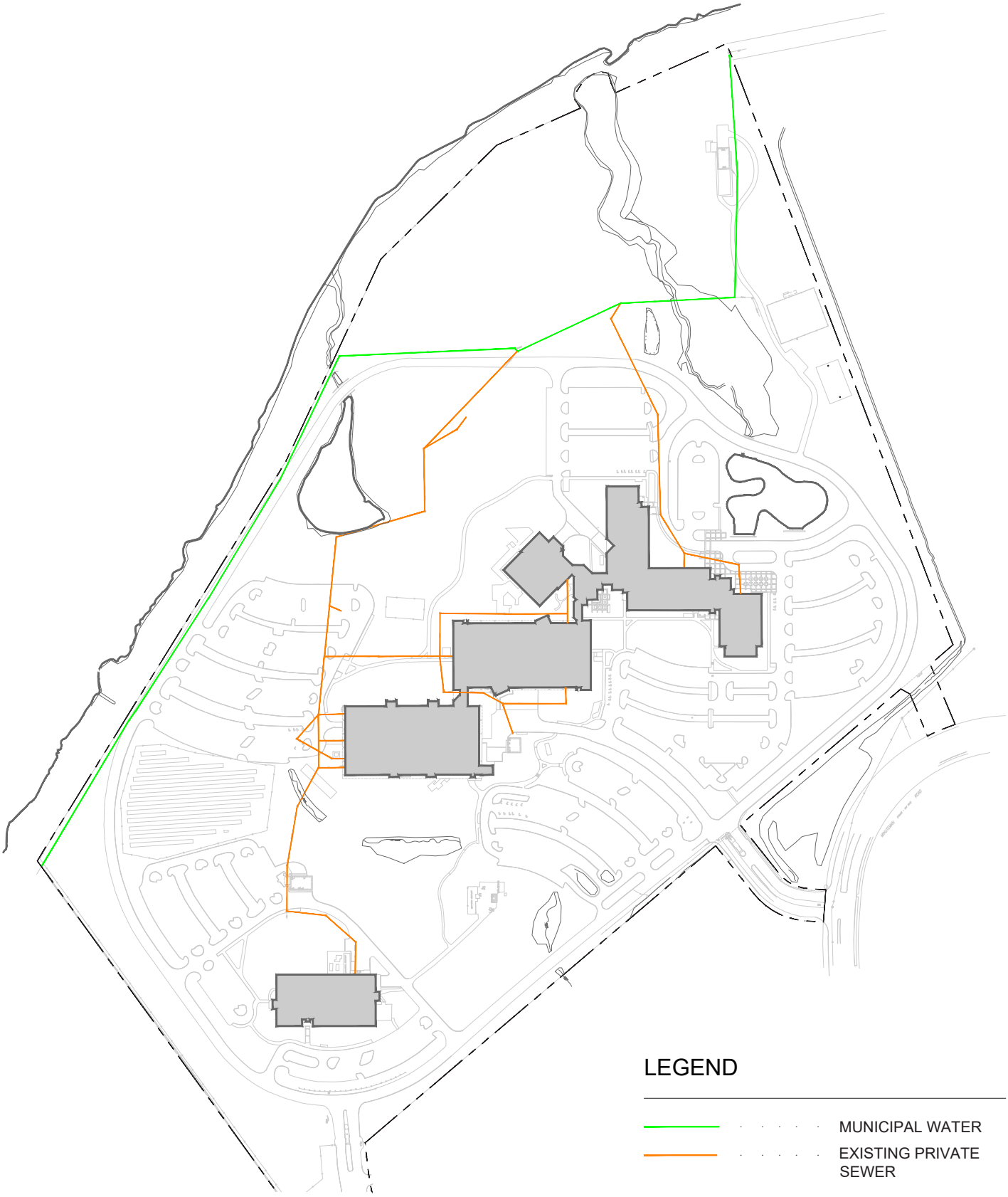


4.2 - Proposed Water System

3000 Minuteman Road, Andover, Massachusetts

ALEXANDRIA

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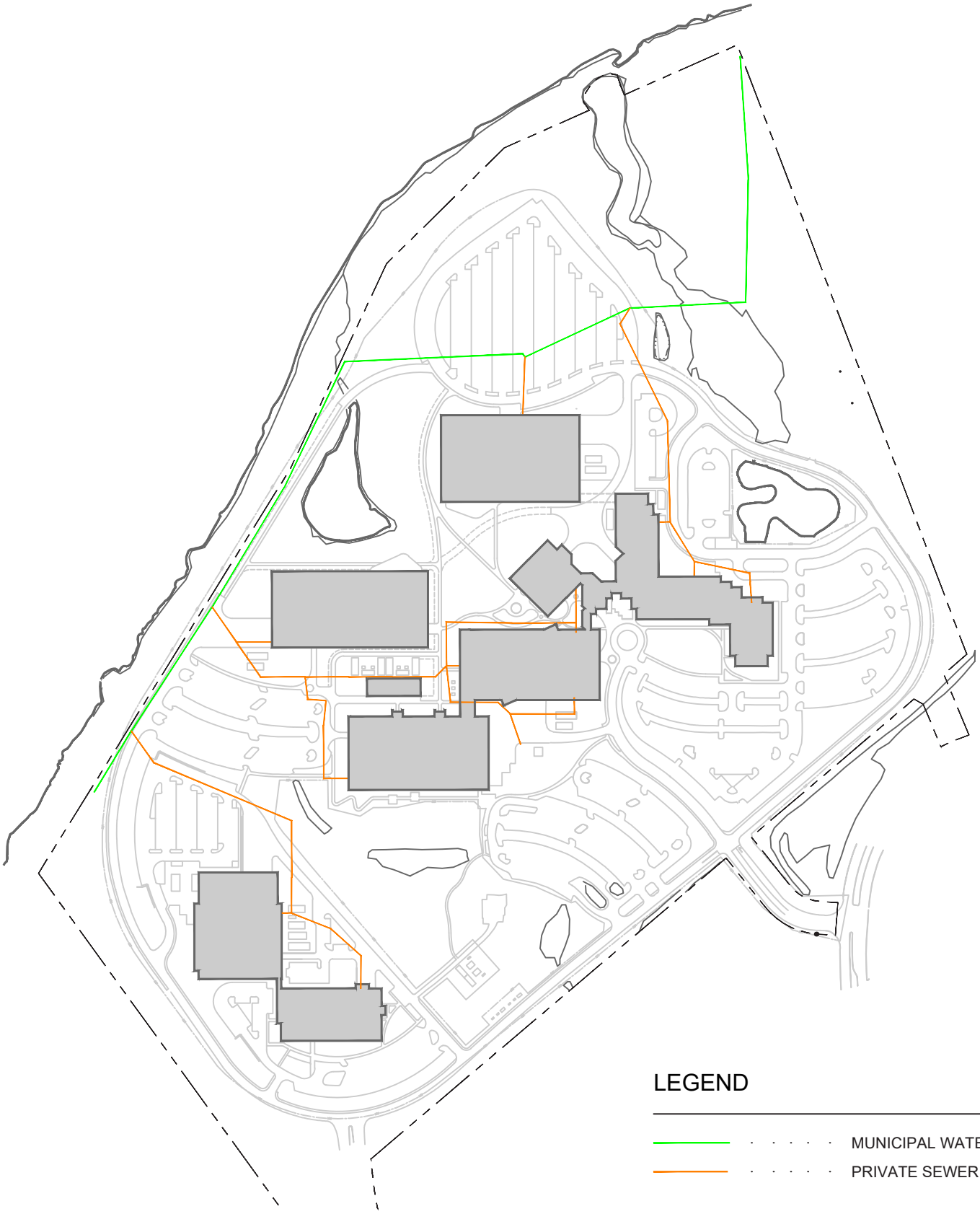


4.3 - Existing Sewer System

3000 Minuteman Road, Andover, Massachusetts

ALEXANDRIA.

SMMA



4.4 - Proposed Sewer System

3000 Minuteman Road, Andover, Massachusetts

ALEXANDRIA

SMMA

Climate Change Adaptation and Resiliency 5

5.1 Regulatory Context
5.2 Greenhouse Gas Emissions Assessment
5.3 Resiliency

Climate Change Adaptation and Resiliency

5.1 Regulatory Context

This section contains a greenhouse gas (GHG) analysis that complies with the MEPA Greenhouse Gas Emissions Policy and Protocol (GHG Policy) of May 2010. This section addresses predicted GHG emissions to be generated by the new Building 1 (Addition), Building 5 and Building 6 operational energy use and associated new traffic. The section demonstrates the proposed building design energy performance measures, transportation analysis, and their impact on reducing predicted GHG emissions in accordance with the MEPA GHG Policy.

5.1.1 MEPA Greenhouse Gas Emissions Policy and Protocol

The GHG Policy requires a GHG emissions analysis demonstrating strategies to avoid, minimize, or mitigate such emissions for projects undergoing MEPA review. The analysis quantifies the proposed energy performance strategies in terms of energy savings and GHG emissions reductions and follows the process and criteria outlined in the Massachusetts GHG Policy.

The analysis provided herein focuses on emissions of carbon dioxide (CO2). As noted in the Massachusetts GHG Policy, although there are other GHGs, CO2 is the predominant contributor to global warming. Furthermore, CO2 is the predominant GHG emitted from the types of sources related to this Project, and CO2 emissions can be calculated for these source types with available data.

GHG emissions sources are categorized into stationary sources and mobiles sources. The GHG Policy requires the Project's GHG emissions analysis calculates and compares the Massachusetts Energy Code Baseline and the proposed design for stationary sources and two cases for mobile source/transportation.

Stationary Sources

Emissions related to activities that are stationary on the site, such as the building operational energy use. Stationary sources are calculated into direct sources and indirect sources:

a. Direct sources: GHG emissions from fuel combustion.

b. Indirect sources: 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 stationary sources base case is the baseline from which energy use reductions and GHG emissions reduction are measured. Per the GHG Policy, the baseline is the applicable state building code (Code) in effect at the time the ENF is filed. The Code at the time of this filing is the 9th Edition, amended to incorporate the building energy provisions of International MA Energy Conservation Code (IECC) 2018 (with MA amendments). The energy modeling analysis protocol follow the ASHRAE 90.1 Appendix G, with the MA Amendments to IECC 2018. It defines the baseline for the new ARE Building 1, Building 5 and Building 6 facilities GHG emissions analysis.

The proposed design case includes the GHG emissions reduction measures (mitigation) anticipated to be included as part of the project design.

Mobile Sources

Emissions related to transportation.

5.1.2 Project Sustainability Goals and Massachusetts Energy Code

Sustainable design and carbon reduction goals are an integral part of the Alexandria Real Estate (ARE) corporate commitments and mandate across their real estate portfolio. The Project is located in Andover which is a Stretch Code Community.

The project design will strive to achieve ARE's sustainable design and carbon requirements as follows:

New Buildings 1, 5 and 6

ARE intends to pursue:

- LEEDv4 Certification (Core and Shell) with a goal of LEED Silver or better where feasible
- Fitwel Certification
- Project Energy Performance in compliance with IECC 2021 with MA Amendments, including compliance with the 2023 MA Stretch Code.** [Please note that new buildings may be designed and permitted under the current MA Energy Code (IECC 2018)]
- 25% electrification of space heating [demand] capacity
- 20% operational carbon reduction goal

Existing Buildings 2, 3 and 4

- ARE intends to pursue LEEDv4 Certification (Core and Shell) with a goal of LEED Silver where feasible.
- Fitwel Certification
- Project Energy Performance in compliance with IECC 2018 with MA Amendments, including compliance with the MA Stretch Code which requires 10% better than IECC 2018 with MA Amendments.
- 10% operational carbon reduction goal

Although MEPA review is not required for renovations of the existing buildings, the renovations projects are incorporating systems with optimal energy efficiency performance within the limitations of the Core/Shell scope and existing conditions.

** Note that the new Buildings 1, 5 and 6 are planned to be designed in 2023-24, likely under the upcoming 2023 Massachusetts Energy Code and Stretch Code update [IECC 2021 with MA Amendments].

Energy Performance related to the Massachusetts Energy Code and Stretch Code

A preliminary energy analysis was conducted for the new ARE Building 1, Building 5, and Building 6 proposed design to support the EENF GHG Emissions Analysis. The preliminary energy analysis estimates the preliminary Energy Performance and demonstrates energy savings and energy cost savings relative to MA IECC 2018 Energy Code with MA Amendments. The energy modeling analysis

follows the C401.2b ASHRAE 90.1-2013 Appendix G, as modified by Massachusetts amended Sections C401.2, C402.1.5, C402.3, 405.3, 405.4, 405.9 and C406, with three C406 options:

1. C406.2-10% HVAC Efficiency
2. C402.8 Enhanced Building Insulation
3. C402.9-Air Infiltration Reduction.

The estimated preliminary energy savings results listed in Table 1 demonstrate the 3 facilities' compliance with the Massachusetts Stretch Code requiring a minimum of 10% over the MA Code baseline. Please note that the energy costs savings may vary pending average utility costs at the completion of construction documents.

Table 1 summarizes the preliminary design predicted energy savings relative to the current MA energy (IECC 2018 with MA Amendments) baseline.

Table 1 – Preliminary Design Predicted Energy Savings Relative to the Massachusetts Energy Code

	Building 1/1A	Building 5	Building 6
Estimated Energy Savings (%)	35%	19%	16%
Energy Costs savings[1]	22%	10%	10%
Predicted EUI	251	236	277
Baseline EUI [IECC 2018 with MA Amendments]	394	291	332

Notes: EIA 2022 energy costs, based on $0.18/kWh and $1.40/therm

Table 2 shows the The ARE Andover Masterplan proposed facility design includes high efficiency systems and energy conservations measures.

Table 2 – Preliminary Design Predicted Energy Savings

Description	New Building 1, 5 and 6	Existing Building Retrofits – Building 2, 3 and 4
Lab/Office program ratios	25% office 25% Labs 25% cGMP 25% warehouse	Buildings 2 and 3: 25% office 25% Labs 25% cGMP 25% warehouse Building 4: 40% offices 60% labs Core space amenities
Building Area	Building 1/1A: New Building 1 - 83,911 SF Existing Building 1A (complete retrofit) - 100,000 SF Building 5: 150,000 SF Building 6: 150,000 SF	Building 2: 159,800 SF Building 3: 158,821 SF Building 4: 275,786 SF

Description	New Building 1, 5 and 6	Existing Building Retrofits – Building 2, 3 and 4
Building Enclosure	High Performance enclosure compliant with IECC 2021: • R-50 roof • R-32 walls • Triple glazing systems]	Existing roof and windows upgraded to a code compliant high performance enclosure: • R-50 roof • R-32 walls • Building 3 glazing replacement with triple glazing system Existing structure and precast concrete exterior finish to remain.
	WWR = 30%	WWR: Existing – varies 20%-25%
Electrical Systems	Tenant guidelines will require Office and lab LPD reductions and applicable controls in alignment with the Core/Shell criteria. High Efficiency LED Lighting Systems, with Light Power Density reduction Equipment Power Density reduction through Energy Star rated equipment and applicable controls	Tenant guidelines will require Office and lab LPD reductions and applicable controls in alignment with the Core/Shell criteria. High Efficiency LED Lighting Systems, with Light Power Density reduction Equipment Power Density reduction through Energy Star rated equipment and applicable controls
HVAC Systems	Heating Offices: DOAS/VRF (ASHP) all-electric Heating Labs: 95% efficient _ Natural Gas Condensing Boilers Cooling Water Cooled Chillers Ventilation AHU with Konvecta Type Heat Recovery System (80%+ efficiency)	Heating 95% efficient _ Natural Gas Condensing Boilers Cooling Water Cooled Chillers Ventilation AHU with Konvecta Type Heat Recovery System (80%+ efficiency)
DHW Heaters	95% thermal efficiency	95% thermal efficiency

Table 3 –Baseline, Proposed Design Energy Model Inputs relative to the Massachusetts Energy Code [ASHRAE 90.1-2013 Baseline as modified per IECC 2018 MA amendments]

Table 3 – Code Baseline and Proposed Design Energy Model Inputs

Description	MA Code Baseline IECC 2018 with MA Amendments	Proposed Design	Comments
Building Enclosure*	Wall assembly U-factor=0.055 Btu/h·ft²·°F (R-18) (C406)	Wall assembly U-factor=0.03125 Btu/h·ft²·°F (R-32)	
	Roof assembly U-factor=0.029 Btu/h·ft²·°F (R-34.5) (C406) Roof reflectance=0.7	Roof assembly U-factor=0.02 Btu/h·ft²·°F (R-50) Roof Reflectance=0.7	
	WWR all facades = 40%	WWR all facades = 30%	
	Slab: R-10 – 4' down foundation wall + R-10 4' perimeter	Slab: R-15 – 4' down foundation wall + R-15 4' perimeter	
Glazing Systems*	Curtain wall/ribbon assembly U-factor=0.38 Btu/h·ft²·°F (C406)	Curtain wall/ribbon assembly U-factor=0.23 Btu/h·ft²·°F or better (triple glazing)	
	SHGC=0.38	SHGC=0.33 or better	
	Spandrel Glass Units - U-factor=0.055 Btu/h·ft²·°F (R-18) (C406)	Spandrel Glass units + Insulation behind spandrel to achieve R-28 goal	
Air Infiltration Reduction	0.25 cfm/SF (75 Pa) - cfm/SF @ 0.3 in. of water (75 Pa) (C406)	0.25 cfm/SF (75 Pa) - cfm/SF @ 0.3 in. of water (75 Pa)	
Lighting Power Density	0.64 W/SF - Office 1.33 w/SF - Labs 0.82 W/SF - cGMP 0.45 W/SF - Warehouse	0.64 W/SF - Office 1.33 w/SF - Labs 0.82 W/SF - cGMP 0.45 W/SF - Warehouse	Core & Shell bldgs.; no lighting savings claimed. Assumes high performance LED lighting systems in compliance with Stretch Code
Exterior Lighting	2.0 kW load (existing)	2.0 kW load (existing)	No exterior lighting savings claimed
Lighting Controls	Occupancy and daylight per Code in Core spaces	Occupancy and daylight per Code in Core spaces	Tenant guidelines for Code Compliance
Equipment Power Density	1.0 W/SF (Office) 4.0 W/SF (Labs) 25.0 W/SF (cGMP) 2x - 15 HP Elevators	1.0 W/SF (Office) 4.0 W/SF (Labs) 25.0 W/SF (cGMP) 2x - 15 HP Elevators	
HVAC System	ASHRAE App G - System 7	ERUs on roof as part of Core Shell/capped connections to tenants.	

Description	MA Code Baseline IECC 2018 with MA Amendments	Proposed Design	Comments
Ventilation	0.3 cfm/SF - 100% OA (Offices) 1.5 cfm/SF - 100% OA (Labs) + 10 ACH 8.0 cfm/SF – 100% OA (cGMP) + 30 ACH	0.3 cfm/SF - 100% OA (Offices) 1.5 cfm/SF - 100% OA (Labs) + 10 ACH 8.0 cfm/SF – 100% OA (cGMP) + 30 ACH	
Heating*	(2) Two Natural Gas Hot Water Boilers – 82% efficiency	High Performance Natural Gas Hot Water Boilers – 95% efficiency Office heating: VRF/ASHP COP 3.2	C406: 10% eff. Over base IEC 2021 = 2 pts
Heat Recovery	50% Eff Heat Pipe	High Efficiency 85% - (Konvecta type)	
Cooling	Water-Cooled Chilled Water System – kw/ton 10% better than IECC (C406)	Water cooled chillers – 0.49 kW/ton	
DHW Heaters	Natural Gas Domestic Hot Water Heater with 80% thermal efficiency	Natural Gas Domestic Hot Water Heater with 95% thermal efficiency	

5.2 Greenhouse Gas Emissions Assessment

GHG Emissions Analysis Summary

The stationary sources GHG emissions reduction results in a 21.7% reduction for the proposed Buildings 1, 5 and 6 design when compared to the baseline (Massachusetts Code (IECC 2018 with MA Amendments). The Build scenario Mobile Sources GHG emissions reduction analysis resulted in a 3% increase and a 1% reduction for the Mitigation Build scenario when compared to the Baseline-2029 No Build.

Refer to Section 5.2.1 for the stationary GHG emission analysis & section 5.2.2 for the mobile sources GHG emissions analysis.

Table 1 - GHG Emissions Analysis Summary: Stationary and Mobile Sources

GHG Emissions	MA Energy Code Baseline (tons/year)	Proposed Design (tons/year)	Difference (%)	GHG Reduction/Increase (tons/year)
	IECC 2018 with MA Amendments			
Stationary Sources	12,304	9,632	-21.7%	-2,672
	2029-No Build			
Mobile Sources (Build))	7,193	7,404	3%	211
Mobile Sources (Mitigated Build)	7,193	7,315	-1%	-89

1 2021 ISO New England Electric Generator Air Emissions Report: 611lbs/MWh

2 EIA Fuel Emissions Factors, Carbon Dioxide Emissions Coefficients by Fuel, 2021:, 117 lbs/MMBtu

5.2.1 Stationary Source GHG Emissions

GHG Emissions Reduction Measures

The new Buildings 1, Building 5 and Building 6 will use a combination of energy efficiency measures for the building enclosure, mechanical, electrical and lighting systems that result in a comprehensive building energy use reduction and partial electrification of the peak space heating capacity. The following GHG emissions reduction measures are included in the project, as provided in the NPC/DEIR.

- High performance building enclosure insulated beyond Code
  - R-50 Roof
  - R-32 Walls
  - U-0.23 Glazing System (SHGC 0.27) -Triple Glazing Systems
  - Window to Wall Ratio- 25-30% goal
  - Light colored Reflective Roof
- High performance lighting systems and controls (Tenant spaces – Stretch Code compliant)
  - Light Power Density Reduction (LPD)
  - Vacancy and Daylight controls
  - Advanced Digital network Controls, as applicable, to office areas
  - All LED Exterior Lighting (Existing)
- High Efficiency transformers.
- Energy Star rated Appliances and Equipment.
- High efficiency mechanical HVAC system including:
  - Office area:
    - DOAS ventilation/VRF (ASHP) heating and cooling for the office areas.
    - Temperature setback during unoccupied hours
    - Heat Recovery (75% efficiency)

  - Lab/cGMP area:
    - High Performance Water Cooled Chiller for Cooling system
    - Heat recovery (75%-80% efficiency)
    - High performance condensing natural gas boilers (95% efficiency)
    - Variable frequency Drives VFDs on pumps, as applicable
  - Demand control ventilation for the office areas, as applicable.
  - High performance natural gas condensing boilers for Domestic Hot Water (95% efficiency)
  - Energy Management System (EMS) and Controls
- Enhanced Commissioning for Mechanical, Electrical, Plumbing and Building Enclosure systems.
- High performance Elevators.
- Code compliant Solar Photovoltaic and Electric Vehicles Charging Station readiness
- MassSave utility incentives programs to optimize cost effective energy performance.

GHG Emissions Reduction Analysis

A preliminary energy analysis was conducted estimating the preliminary energy performance of the new Buildings 1, 5 and 6 relative to the Massachusetts Energy Code to support the calculation of the GHG emissions reduction analysis. Refer to Section 5.1.2 for detailed energy analysis criteria and results.

Based on the preliminary energy analysis, the new ARE Andover Building 1, Building 5, and Building 6 Facilities are predicted to decrease GHG emissions by 21.7% relative to the IECC 2018 Energy Code with MA Amendments. The combined 3 buildings predicted GHG emissions reductions total approximately 2,672 tons/year. The combination of energy efficient systems and partial electrification of heating demonstrate predicted GHG emissions reduction that meet ARE's goal for 20% GHG reduction for the facilities.

The GHG emissions reduction analysis for stationary sources is summarized in Tables 2 through 8.

Table 2A and 2B demonstrated the total GHG emissions reduction for the 3 buildings relative to the current MA energy Code (IECC 2018) baseline, as well as a breakdown of the GHG emissions reduction per building.

Table 2A – Total GHG Emissions Reduction for the Building 1, Building 5 and Building 6 combined

Stationary Sources		**Total Building 1, 5 and 6**	
		MA Code-IECC 2018	**Proposed Design**
		Tons/yr.	**Tons/yr.**
Direct	Natural Gas	4,795	2,607
Indirect	Electricity	7,509	7,024
	Total	12,304	9,632
Diff. (tons/yr)			**-2,672**
Diff. (%)			**-21.7%**

Notes: CO2 Emissions Factors

1. *Electricity: 611 lbs./MWh – 2022 ISO New England Electric Generator Air Emissions Report*
2. *Natural Gas: 117 lbs./MMBtu – EIA Fuel Emissions Factors, Weighted National Average*

Table 2B – Total GHG Emissions Reduction – Breakdown by Building

Stationary Sources	Building 1/1A		Building 5		Building 6	
	MA Code-IECC 2018	Proposed Design	MA Code-IECC 2018	Proposed Design	MA Code-IECC 2018	Proposed Design
	Tons/yr	Tons/yr	Tons/yr.	Tons/yr.	Tons/yr.	Tons/yr.
Direct Natural Gas	2,511	1,121	964	546	1,321	940
Indirect Electricity	2,639	2,412	2,438	2,328	2,433	2,284
Total	5,149	3,532	3,402	2,875	3,753	3,225
Diff. (tons/yr)		**-1,617**		**-527**		**-529**
Diff. (%)		**-31.4%**		**-15.5%**		**14.1%**

Notes: CO2 Emissions Factors

1. *Electricity: 611 lbs./MWh – 2022 ISO New England Electric Generator Air Emissions Report*
2. *Natural Gas: 117 lbs./MMBtu – EIA Fuel Emissions Factors, Weighted National Average*

Table 3A, 3B and 3C demonstrated the projects GHG emissions reduction calculations by end uses, for each new facility, relative to the current MA energy Code (IECC 2018) baseline.

Table 3A – GHG Emissions Reduction by End Uses

ARE Andover GHG Emissions by End use Building 1/1A		
End Use	**MA Energy Code [IECC 2018 with MA Amendments]**	**Proposed Design**
Direct (Natural Gas)	**MMBtu/yr.**	**MMBtu/yr.**
Space Heating	41	17
Domestic Hot Water	2	2
Total	**43**	**19**
Indirect (Electricity)	**MWh/yr.**	
Space Heating	-	151
Space Cooling	580	413
Domestic Hot Water	-	
Ventilation Fans	1,505	840
Pumps & Aux.	182	128
Heat Rejection	26	17
Lighting	520	520
Misc. Equipment	5,818	5,818
Ext. usage	7	7
Total	**8,637**	**7,894**

ARE Andover GHG Emissions by End use Building 1/1A		
End Use	**MA Energy Code [IECC 2018 with MA Amendments]**	**Proposed Design**
Predicted Energy Use Intensity (pEUI)		
	kBtu/SF/yr	
pEUI	394	251
Difference (%)		36%
Project SF (modeled)	183,600	
Project SF (designed)	183,600	
Factor	1	

Notes: CO2 Emissions Factors

1. *Electricity: 611 lbs./MWh – 2021 ISO New England Electric Generator Air Emissions Report*
2. *Natural Gas: 117 lbs./MMBtu – EIA Fuel Emissions Factors, Weighted National Average*

Table 3B – GHG Emissions Reduction by End Uses

ARE Andover GHG Emissions by End use Building 5		
End Use	**MA Energy Code [IECC 2018 with MA Amendments]**	**Proposed Design**
Direct (Natural Gas)	**MMBtu/yr.**	**Mmbtu/yr**
Space Heating	16	9
Domestic Hot Water	0.2	0.2
Total	16	9
Indirect (Electricity	**MWh/yr.**	**MWh/yr.**
Space Heating	-	566
Space Cooling	804	587
Domestic Hot Water	-	-
Ventilation Fans	1,026	893
Pumps & Aux.	1,291	724
Heat Rejection	63	57
Lighting	322	322
Misc. Equipment	4,466	4,466
Ext. usage	7	7
Total	**7,979**	**7,622**
Predicted Energy Use Intensity (pEUI)		
	kBtu/SF/yr	**kBtu/SF/yr**
pEUI	291	236
Difference (%)		19%

ARE Andover GHG Emissions by End use Building 5		
End Use	**MA Energy Code [IECC 2018 with MA Amendments]**	**Proposed Design**
Project SF (modeled)	150,000	
Project SF (designed)	150,000	
Factor	1	

Notes: CO2 Emissions Factors

1. *Electricity: 611 lbs./MWh – 2021 ISO New England Electric Generator Air Emissions Report*
2. *Natural Gas: 117 lbs./MMBtu – EIA Fuel Emissions Factors, Weighted National Average*

Table 3C – GHG Emissions Reduction by End Uses

ARE Andover GHG Emissions by End use Building 6		
End Use	**MA Energy Code [IECC 2018 with MA Amendments]**	**Proposed Design**
Direct (Natural Gas)	**MMBtu/yr.**	**Mmbtu/yr**
Space Heating	23	16
Domestic Hot Water	0.2	0.2
Total	**23**	**16**
Indirect (Electricity	**MWh/yr.**	**MWh/yr.**
Space Heating	-	271
Space Cooling	747	662
Domestic Hot Water	-	-
Ventilation Fans	1,499	1,020
Pumps & Aux.	899	726
Heat Rejection	66	48
Lighting	369	369
Misc. Equipment	4,376	4,376
Ext. usage	7	7
Total	**7,962**	**7,478**
Predicted Energy Use Intensity (pEUI)		
	kBtu/SF/yr	**kBtu/SF/yr**
pEUI	332	277
Difference (%)		16%
Project SF (modeled)	150,000	
Project SF (designed)	150,000	
Factor	1	

Notes: CO2 Emissions Factors

1. *Electricity: 611 lbs./MWh – 2021 ISO New England Electric Generator Air Emissions Report*
2. *Natural Gas: 117 lbs./MMBtu – EIA Fuel Emissions Factors, Weighted National Average*

5.2.2 Mobile Source GHG Emissions

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

Traffic GHG Analysis

In accordance with the MEPA GHG Policy, GHG emissions were estimated for mobile sources within the transportation study area (see Chapter 3 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 (CO2e) 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 Section 3.

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 Section 3 form the basis of the mesoscale GHG study. Approximately 17 roadway links and 7 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.

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.

Appendix D presents the intersection emissions calculations, and the Project-specific link data input into the MOVES3 program.

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

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

Traffic GHG Analysis Results

Table 4-A 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. However, the increase in vehicle miles traveled (VMT) expected in the no build condition results in a 34 percent increase in GHG emissions.

Table 4-A - Regional Traffic GHG Emissions Analysis Summary (No-Build)

Pollutant	CO_2e (lbs/day)	CO_2e (tons/yr)
2022 Existing	29,395	5,365
2029 No-Build	39,415	7,193
Difference	10,020	1,829
Difference (%)	29,395	5,365

Table 4-B 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 3 percent increase of CO2e 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. As mentioned previously, the Build condition analysis accounts for the Proponent's extensive TDM program which is intended to decrease single occupancy vehicle use and increase alternative modes of transportation (i.e., transit, bicycling, walking), which in turn reduce GHG emissions. However, the GHG emission reduction from the TDM program cannot be quantified because of the methodology used for the Build condition transportation analysis.

Table 4-B - Regional Traffic GHG Emissions Analysis Summary (Build)

Pollutant	CO_2e (lbs/day)	CO_2e (tons/yr)
2029 No-Build	39,415	7,193
2029 Unmitigated Build	40,572	7,404
Difference	1,157	211
Difference (%)	3%	3%

Mitigation is proposed in the form of signal timing improvements at four intersections. Signal timings will be adjusted at the intersection of Shattuck Road and River Road; I-93 SB Ramps and River Road; 1-93 NB Ramps and River Road; and Federal Street/Old River Road and River Road.

Traffic mitigation is conducted to improve traffic flow and/or safety and may not result in air quality improvements. Any benefit to air quality is coincidental.

Table 4-C presents a comparison of the 2029 Mitigated Build case to the 2029 Build Case. The adjustments in signal timing result in an 89 TPY decrease in GHG. The adjusted signal timing results in improved traffic flow and decreased idling time decreasing idling emissions.

Table 4-C - Regional Traffic GHG Emissions Analysis Summary (Mitigated Build)

Pollutant	CO_2e (lbs/day)	CO_2e (tons/yr)
2029 Unmitigated Build	40,572	7,404
2029 Mitigated Build	40,082	7,315
Difference	-490	-89
Difference (%)	-1%	-1%

Summary

Table 4-D 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-D - Regional Traffic GHG Emissions Analysis Summary

	Units	2022 Existing	2029 No-Build	2029 Build	2029 Mitigated Build
Daily VMT	veh-miles/day	30,033	46,213	47,678	47,678
Net VMT Change	veh-miles/day	-	16,181	1,464	0
Net Delay	veh-hrs/day	135	259	295	216
Net Delay Change	veh-hrs/day	-	123	36	-79
Roadway CO_2e	tpy	5,187	6,901	7,071	7,071
Intersection CO_2e	tpy	177	293	334	244
Net CO_2e Emissions	tpy	5,365	7,193	7,404	7,315
Net CO_2e Change	tpy	-	1,829	211	-89

GHG emissions between the No-Build and Build conditions are compared to determine the mobile source GHG emissions related to the Project. Table 4-E shows the Project-related mobile source GHG emissions.

Mitigation results in a 42% decrease of overall traffic related GHG generated by the project when compared to the unmitigated build case.

Table 4-E - Project Traffic GHG Emissions Analysis Summary

	Units	2029 Build Minus 2029 No-Build	2029 Mitigated Build minus 2029 Unmitigated Build
Daily VMT	veh-miles/day	1464.4	1464.4
Net Change	veh-miles/day	-	0.0
Net Delay	veh-hrs/day	36.3	-42.7
Roadway CO_2e	tpy	170	170
Intersection CO_2e	tpy	41	-48
Total CO_2e Emissions	tpy	211	122
Net CO_2e Change	tpy	-	-89
Percent Change	%	-	-42%

5.3 Resiliency

As outlined in the ENF form the design team is incorporating best practices from the RMAT Climate Resilience Design Guidelines. The form outlines several of the design strategies that are being implemented into the design, including:

- Stormwater Management strategy for new and redeveloped areas of the Project.
- Site Design elements including selection of paving materials and landscape design.
- Selection of HVAC systems
- Design of electrical and lighting systems
- Design of new and renovated building envelopes.

The Project has completed the RMAT Climate Resilience Design Standards Tool Project Report which is attached as Appendix I.

Construction 6

6.1 Introduction
6.2 Construction Management Plan

Construction

6.1 Introduction

Suffolk Construction is the construction manager (CM) and will manage the Project to ensure consistent execution of the work in accordance with permits, approvals, LEED protocols, and environmental best practices.

6.2 Construction Management Plan

6.2.1 Site Preparation and Construction Staging

Safety

All personnel entering the construction site are required to attend a site-specific safety orientation. Upon completion of orientation the attendees shall receive a site-specific hard hat sticker to display their certification. A scheduled daily or pre-shift safety meeting involving all Trade Partner's (subcontractors) on-site personnel, which is conducted before any activities or work commences. A safety huddle is dedicated to developing, reviewing, and coordinating Pre-Task Plans, focusing on key safety topics or concerns, and for discussing the day or shift's planned activities with the intention of identifying and controlling risks or other issues that could lead to injuries.

Security and Access Control

Suffolk will use existing card access entryways for building access. For areas not contained within the existing buildings, Suffolk will designate the perimeter of exterior site areas with a lockable chain link fence and scrim netting as needed.

Staging

Prior to any hoisting or staging operation, Trade-Partners will be responsible for providing a detailed Logistics plan to Suffolk and ARE for approval.

Deliveries

Deliveries of any materials or supplies shall follow the Construction Management Plan and be coordinated with Suffolk. When required, a flagger used to control vehicle traffic shall be trained and certified for the task and equipped with proper traffic direction and retro-reflective high-visibility protection. Smaller deliveries are sent to designated staging areas or Connex box storage areas. For larger equipment/ Material deliveries must be coordinated with the Superintendent, ARE Supervisor or stored off-site until needed.

6.2.2 Dust and Air Quality

Construction activities generate fugitive dust that will result in localized increases in airborne particulate levels. To reduce emissions of fugitive dust and minimize impacts on the local environment, strictly enforced mitigation measures will be employed, including.

- Wetting agents will be used regularly to control and suppress dust that may come from construction activities.
- Trucks used for the transportation of construction debris will be covered before exiting the project site.
- Streets and sidewalks will be cleaned regularly to minimize accumulations.
- Trucks tires shall be hosed down prior to entering public streets.

Adequate ventilation methods (at least 4 air exchanges per hour) shall be provided and maintained in any partially or fully enclosed work area in which work activities or equipment create or have the potential to create noxious, toxic, or otherwise hazardous fumes, mists, respirable dusts or gases. Additional respiratory protection shall be supplied to and continuously worn by affected employees when natural or mechanical ventilation is not adequate to safely control the hazard

6.2.3 Construction Traffic

Suffolk Construction will work to ensure the staging areas minimize impact to pedestrian and vehicular flow. Secure fencing and barricades will be used to isolate construction areas from pedestrian traffic around the site. In addition, sidewalk areas and walkways near construction activities will be well marked to protect pedestrians and ensure their safety. Proper signage as required by local authorities will be installed and regularly updated as site conditions change during the construction process.

Trucks coming to and from the site are required to use major arterial roadways or highways and not local streets. The selection of proposed truck routes is based on the following criteria:

- Minimizing truck activity in the residential neighborhoods.
- Designating specific roads where trucks are permitted.
- Providing access to and from interstate roadways (e.g., Interstate I-93, I-495).

6.2.4 Construction Noise

A significant effort will be made to minimize the noise impact of the Project's construction activities. Mitigation measures to be undertaken could include:

- Using mufflers on equipment and ongoing maintenance of intake and exhaust mufflers.
- Use of low sulfur fuels.
- Using less noisy specific construction operations and techniques where feasible (e.g., mixing concrete off-site instead of on-site.).
- Scheduling equipment operations to keep average levels low, to synchronize noisiest operations with times of highest ambient levels, and to maintain relatively uniform noise levels.
- Turning off idling equipment.
- Utilize saw-cutting methods in lieu of jack hammering where feasible.

6.2.5 Construction Hazardous Materials and Solid Waste

Waste Management

Suffolk Construction will manage processing construction waste and will have in-place a Construction Waste Management Plan (CWMP) for the project. All construction debris will be taken off site by the site demolition trade-partner, sorted as either recycled debris or waste debris and sent to the proper recycling center or waste facility. Construction debris shall be wetted and covered to minimize air born dust particles.

Dumpsters

Dumpsters will be located within the construction staging area. Dumpsters will be secured with odor and dust control measures and will have proper Fire Department permits. Dumpster pick-ups to be done during normal construction hours and will avoid peak traffic periods.

Loading and unloading of the dumpsters will take place with-in the proposed fence areas

Hazardous Materials

Suffolk Construction will develop and implement a plan for management of hazardous materials with all subcontractors to address:

- Safety data sheets (SDS).
- Storage protocol for materials stored or used at the project site.
- Spills or other environmental incidents.
- Storage and management of combustible or flammable materials such as fuel, paint and cleaning materials.
- On-site refueling.

Environmental Justice 7

7.1 Existing Environmental Justice Population
7.2 Outreach Performed To-Date
7.3 Enhanced Environmental Justice Analysis
7.4 Project Impacts to Environmental Justice Population

Environmental Justice

This Chapter describes the Project's past and planned efforts to reach out to potentially affected Environmental Justice (EJ) communities. It then provides an enhanced analysis of impacts to demonstrate that the Project and its impacts, together with historical or existing sources of environmental pollution, will not have a disproportionate impact on EJ populations.

Since the filing the ENF, the MEPA Office has issued two new protocols related to EJ: 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 have an effective date of January 1, 2022. This section addresses the new guidance and follows the applicable sections of the new protocols even though the ENF for the Project pre-dated January 1, 2022.

7.1 Existing Environmental Justice Population

Per the Massachusetts Executive Office of Energy and Environmental Affairs (EEA), EJ is based on the principle that all people have a right to be protected from environmental pollution, and to live in and enjoy a clean and healthful environment. The EEA has established an EJ Policy (updated June 2021) to "help address the disproportionate share of environmental burdens experienced by lower-income people and communities of color" and "ensure their protection from environmental pollution as well as promote community involvement in planning and environmental decision-making."

7.1.1 Designated Geographic Area

MEPA has classified areas of Massachusetts as to whether it meets the criteria of an Environmental Justice Population by using the United States Census data to determine whether a block group meets one or more of the following criteria:

- The annual median household income is not more than 65% of the statewide annual median household income;
- Minority groups comprise 40% or more of the population;
- 25% or more of households lack English language proficiency;
- 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
- The Secretary has determined that a particular neighborhood should be designated as an Environmental Justice population

The Project is not located within an EJ community but is within one mile of four block groups that meet the criteria as Environmental Justice populations. These four block groups are located within three census tracts and two municipalities. Figure 7.1 shows circles denoting the one-mile, and five-mile radius around the Project site. The one-mile radius establishes the Designated Geographic Area (DGA) used as the basis for analyzing potential Project impacts and for public outreach purposes. The EJ block groups located within the DGA are summarized in Table 7.1. The remainder of this analysis will focus on all identified EJ populations located in whole or in part within the designated geographic area for the project.

Table 7.1 2020 EJ Block Groups within the DGA

Census Tract	Block Group	EJ Designation	Municipality
254402	4	Minority	Andover
252101	1	Minority	Methuen
252102	3	Minority	Methuen
252101	3	Minority	Methuen

7.2 Outreach Performed To-Date

As stated in the ENF, significant efforts were made to reach out to the EJ communities within a mile of the project, and to the broader community including:

- Identification of Community Based Organizations (CBOs) and interested individuals. The Proponent contacted the MEPA Office as well as the Town of Andover for contact lists. The team consulted with the MEPA office and EEA on June 2, 2022, confirmed that the list was appropriate.
- A Notice of Proposed Development was circulated by Epsilon Associates on behalf of the Proponent on July 21, 2022.

7.3 Enhanced Environmental Justice Analysis

This EJ enhanced analysis follows both the scope described in the ENF Certificate and the EJ Analysis Protocol. The EJ Analysis Protocol applies to "any project that is likely to cause damage to the environment and is located within a distance of one mile of an Environmental Justice (EJ) population". The Project does not meet or exceed MEPA review thresholds under 301 CMR 11.03(8)(a)-(b) and will not add 150 or more New average daily trips of diesel vehicle traffic over a duration of one year or more; therefore, the Project is not subject to a 5-mile radius.

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)

7.3.1 Assessment of Existing Environmental Burden

Under the EJ Analysis Protocol a 4-step process has been developed for assessing whether Environmental Justice Populations have experienced existing unfair or inequitable environmental burdens within the DGA. As part of this approach a series of mapping tools have been developed that focus on, (1) the rates of four vulnerable health criteria as it relates to statewide averages, (2) existing past and current polluting activities, and (3) a review of the RMAT Climate Resilience Output Tool. Each of these steps are described in detail below along with an assessment of the specific results for the environmental justice populations within the designated geographic area.

7.3.2 Vulnerable Health Criteria

The vulnerable health EJ criteria are four environmentally related health indicators used 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. Two rate types are used: crude rate and age-adjusted rate. The crude rate is the rate calculated as number of individuals with a condition divided by the entire population. The age-adjusted rate is statistically modified to consider how different age groups have different rates of prevalence, as in the case of heart attack rate. Rates are also classified as stable or unstable. Unstable rates occur when there are too few cases in a community for a rate to be considered reliable such that the addition or deletion of small number of cases would lead to a large change in the rate. Stable rates are the opposite; there are enough cases in a population so that the rate will not fluctuate dramatically. A confidence interval refers to the minimum and maximum value such that the actual rate has a 95% chance of occurring between the calculated range. In other words, the specified rate has a high likelihood to be included in the range of values. The confidence interval is helpful to determine if a rate for a community is much higher than the statewide rate and not due to chance. A *casecount* refers to the number of surveyed individuals that had the condition of interest. For example, if out of 40 children screened for blood lead levels, 1 child had elevated levels, the *casecount* would be equal to 1.

As described above the first step of existing whether EJ populations within the designated geographic area 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 5-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, focusing on Revere in the text and showing all in summary tables.

7.3.2.1 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 5-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 on a community basis.

Heart Attack Vulnerable Health Criteria for the Project

As described above, heart attack data is available at the community level. This indicator was analyzed for the City of Methuen and the Town of Andover. It was found that the heart attack rate for Methuen is 30.6 per 10,000 individuals. This is greater than 110% of the statewide heart attack rate of 29.1 per 10,000 meaning that Methuen meets the Vulnerable Health Criteria for heart attack. The heart attack rate for Andover is and 22.2 per 10,000 individuals, which does not meet the VHC for heart attack. Community level data for communities in the DGA are summarized in Table 7-2 below along with the statewide prevalence data for comparison.

7.3.2.2 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.

Childhood Blood Lead Levels Vulnerable Health Criteria for the Project

The childhood blood lead level indicator is available for individual census tracts as well as at the community level. The statewide average for childhood blood lead level between 2015–2019 was 16.1 cases. At the community level, neither Andover's blood lead level rate of 3.9 cases per 1,000 or Methuen's blood lead level rate of 9.2 case per 1,000 exceed the statewide rate of 16.1 cases per 1,000. Neither community meets the Vulnerable Health Criteria for blood lead levels.

This indicator was further examined for the census tracts within the designated geographic area, but data was not available at this level for the census tracts in the DGA.

Community level data are summarized in Table 7.2 below along with the statewide prevalence data for comparison.

7.3.2.3 Low Birth Weight

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.

Low Birth Weight Vulnerable Health Criteria for the Project

As described above the low-birth-weight indicator is available on a community and census level basis. The statewide LBW rate was 216.8 per 10,000 between 2011-2015. Andover's community-level LBW rate was 172.7 per 10,000 and Methuen's LBW rate was 166 per 10,000, both of which are below the statewide average. Neither Andover nor Methuen meet the Vulnerable Health Criteria for low birth weight.

This indicator was further examined at a census tract level for the EJ block groups within the designated geographic area. All three census tracts' rates are considered unstable due to the small number of raw, case count numbers. In addition, all census tract rates are not statistically significantly different than the statewide average or not reported. Census tract 254402 reported 217 cases per 10,000 which is greater than the statewide rate but less than 110% of that value.

Based on this, none of the EJ populations within the designated geographic area meet the vulnerable health criteria for low birth weight. Community and census level data are summarized in Table 7.2 below along with the statewide rate data for comparison.

7.3.2.4 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.

Childhood Asthma Vulnerable Health Criteria for the Project

As described above the childhood asthma indicator is available on a community basis. This indicator was examined for the EJ populations within the designated geographic area. In Massachusetts, the statewide childhood asthma rate was 83.1 per 10,000 between 2013-2017. The Andover community level rate for the same period was 18.9 per 10,000, and the community rate for Methuen was 80.1 per 10,000. Neither community's rate is for this greater than 110% of the statewide average of 91.4 per 10,000. Based on this, the EJ populations within the designated geographic area do not meet the vulnerable health criteria for childhood asthma. Community level data are summarized in Table 7.2 below along with the statewide rate data for comparison.

7.3.2.5 Vulnerable Health Criteria Summary

Based on the information described above, Methuen meets the vulnerable health criteria for heart attack and Andover does not meet the vulnerable heath criteria for any of the measures.

The data for the other municipalities and census tracts within the DGA are listed in Table 7.2 with criteria that exceed 110% of the statewide rate noted in bold text. Based on the descriptions provided above, some of the EJ communities in the designated geographic area are considered vulnerable and are subject to existing environmental burdens.

7.3.3 Potential Sources of Pollution

As described in the MEPA Interim Protocol for Analysis of Projects Impacts on Environmental Justice Populations the next step of the existing environmental burden analysis focuses on other potential sources of pollution within the boundaries of the EJ population. Specifically, the MEPA Protocol specifies consultation of the data layers in the MA DPH EJ tool to review other potential sources of pollution near the EJ populations.

Layers from the DPH EJ Tool were downloaded into ArcGIS and a one-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 was searched in the Energy & Environmental Affairs Data Portal (EEA portal). Below is a narrative discussion of the information gleaned using the mapping layers listed above in the MA DPH EJ Tool.

Figure 7.2 depicts these hazards along with the one-mile buffer.

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[1]. There is one facility with solid waste land disposal areas in the EJ populations within the DGA. This facility is the Andover landfill located on Ledge Road; this landfill is no longer operational. Additionally, there is one toxics release inventory site located at 400 Federal Street, this facility is operated by Vicor Corporation.

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 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 is 10 21E site identified in EJ areas within the DGA. They are shown in the table below:

Facility Name	Address	TIER
MAARNG Methuen Armory	679 Lowell Road	TIER II
Charm Sciences, Andover	1 Riverside Dr.	TIER II
3M Touch Systems	501 Griffin Brook Park Drive	TIER II
MKS Instruments, Inc., Methuen	651 Lowell Street	TIER II
National Grid-West Andover 8	24 Webster Street	TIER II
VICOR CORPORATION	400 Federal Street	TIER II
ULVAC Technologies Inc.	401 Griffin Brook Drive	TIER II
TEXACO STATION	21 HAVERHILL ST	TIER II
Schneider Electric Boston One Campus	800 Federal Street	TIER II
Sarepta Therapeutics	100 Federal St	TIER II

[1] https://www.mass.gov/info-details/massgis-data-massdep-major-facilities

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 no facilities with AULs located in the EJ block groups 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 six locations which have USTs located in EJ areas within the DGA. The facilities where these tanks are located are listed below

Facility Name	Address
EXXONMOBIL Oil Corp	214 Haverhill Street
Shell 137796	138 Haverhill Street
Daves Service Center	1105 Riverside Drive
Methuen Operating Corp	21 Haverhill Street
Haffners Service Stations Inc.	224 Lowell Street
Methuen Gulf	460 Lowell Street

7.3.4 Climate Adaptation (RMAT)

The RMAT Tool provides the proposed Project with information about sea level rise/storm surge, heat, and extreme precipitation impacts.

The RMAT tool denotes the proposed Project is at risk for:

- Extreme Precipitation – Urban Flooding
- Extreme Precipitation – Riverine Flooding
- Extreme Heat

7.4 Project Impacts to Environmental Justice Population

7.4.1 Impacts to EJ and Non-EJ Populations

The Proponent has taken steps to minimize and mitigate Project impact overall but to the extent that impacts do exist, the Project's location within an EJ community means that EJ communities will be affected. However, these main impacts, transportation, air quality as an effect of transportation, and climate, are diffuse and would be present regardless of the Project's location. Additionally, the beneficial aspects of the Project are expected to outweigh the mitigated impacts.

7.4.2 Transportation Impacts to EJ Population

The Project is expected to generate approximately 7,268 automobile trips on an average weekday, or 3,634 vehicles entering and 3,634 exiting, which will be dispersed over a 24-hour period and include 822 vehicle trips during the weekday morning peak-hour (656 vehicles entering and 166 vehicles exiting) and 933 vehicle trips during the weekday evening peak-hour (227 vehicles entering and 706 vehicles exiting). The Project will not result in a significant impact (increase) on motorist delays or vehicle queuing over

Existing or anticipated future conditions without the Project. The Project also included Transportation Demand Management (TDM) Measures which will be implemented to encourage the use of alternative modes of transportation. These TDM measures are discussed in Section 3.

The Project is not expected to result in a significant increase in truck traffic or diesel-powered vehicles. The Project proponent will seek to engage and retain service providers for trash, recycling and other services from providers that are currently serving the area so as to not increase the overall number of trucks in the area or that travel through the EJ community.

7.4.2.1 Air Quality Impacts to EJ Population

The Project's effect on air quality come in form of vehicle emissions. The products of these emissions are greenhouse gas (GHG) emissions from Project trips and particulate matter. GHG emissions were modeled to determine mobile source emissions associated with those vehicles. From this analysis, emissions are expected to display an increase of 3 percent, or 205 tons CO_2e per year when compared to the expected emissions if the Project were not built. The mobile source analysis can be found in Section 5 – Climate Change Adaptation and Resiliency.

This minimal rise in CO2 emissions can also be extrapolated to determine that other particulate matter, PM from onroad vehicles related to the Project will also be minimal

7.4.3 Climate Impacts to EJ Population

Future climate conditions are expected to produce conditions which will require adaptation and resiliency from existing facilities. Through the design team's efforts, the Project has been designed to use 10-20% less energy than expected by code and building systems will operate exclusively with electricity as the power source which is expected to reduce fossil fuel emissions over time as renewable energy is continually added into the state's electricity production. The Project is not expected to produce any disparate impacts to EJ populations in this regard.

7.4.4 Stormwater and Flooding Impacts to EJ Population

The Project will create approximately 10 acres of new impervious area; however, the Site has been designed to mitigate any impacts that are created as a result of the new impervious areas.

Stormwater mitigation measures are included in the project and described in Section 2.

Table 7.2 Vulnerable Health Criteria

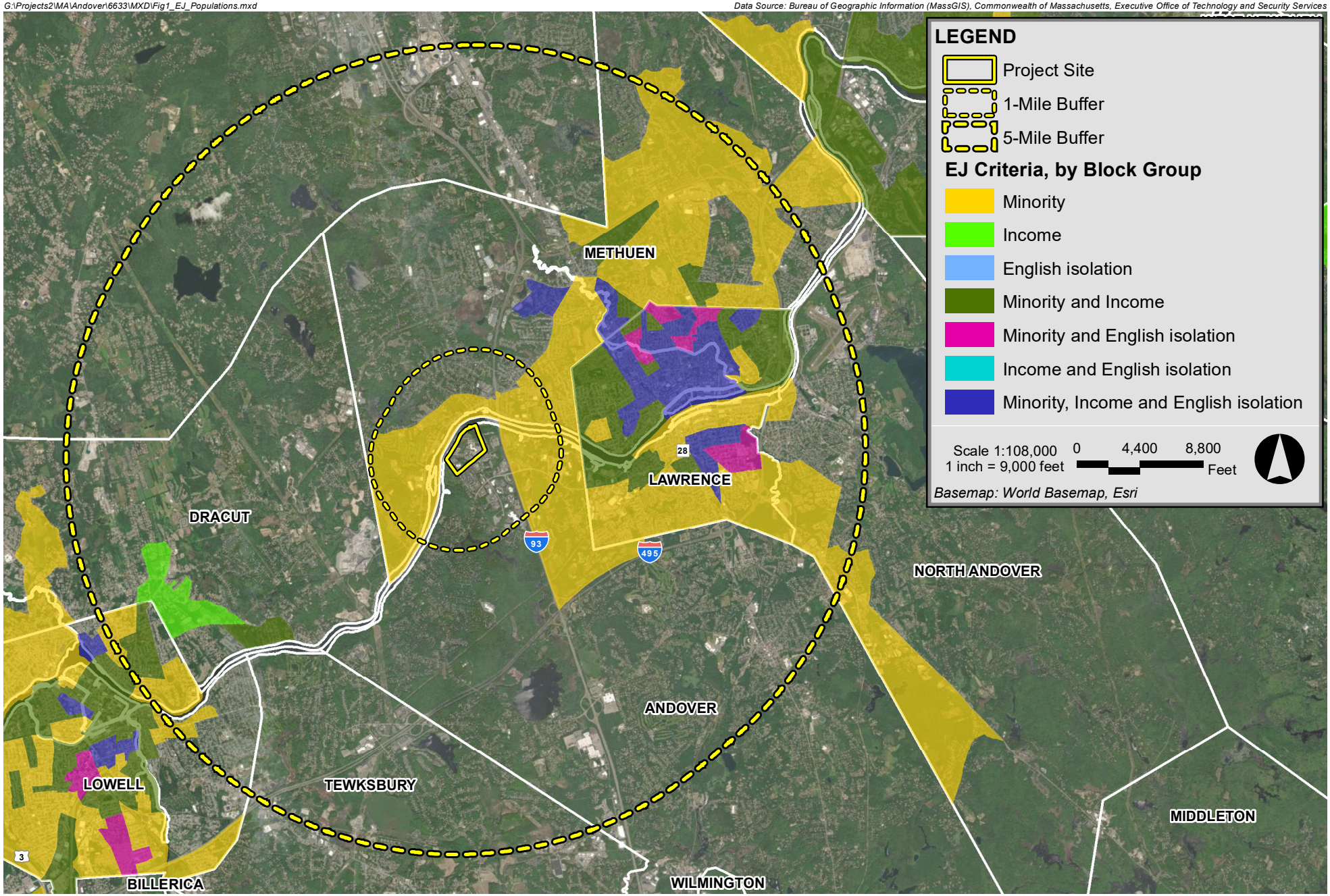
Vulnerable Health Criteria	Geography Type	Community Rate	Community Rate Confidence Interval	Statistical Significance	Stability	Statewide Rate	Statewide Rate Confidence Interval	110% Statewide Rate	>110% of Statewide Rate?
Heart Attack	Andover	22.2	19.5-25	SSL	Stable	26.42	26.2, 26.6	29.06	No
Heart Attack	**Methuen**	**30.6**	**27.9-33.3**	**SSH**	**Stable**	**26.42**	**26.2, 26.6**	**29.06**	**Yes**
Lead Poisoning	Andover	3.9	1.8-5.9	SSL	Stable	14.98	14.72, 5.24	16.48	No
Lead Poisoning	Methuen	9.2	6.8-11.7	SSL	Stable	14.98	14.72, 5.24	16.48	No
Low Birth Weight	Andover	172.7	95.1-250.4	NSSD	Unstable	216.8	277.7,221.93	238.5	No
Low Birth Weight	Methuen	166	115.8-216.2	NSSD	Unstable	216.8	277.7,221.93	238.5	No
Childhood Asthma	Andover	18.9	13.6-24.1	SSL	Unstable	83.1	82.18, 83.99	91.4	No
Childhood Asthma	Methuen	80.1	70.5-89.7	NSSD	Stable	83.1	82.18, 83.99	91.4	No
Lead Poisoning	254402	-	-	-	-	14.98	14.72, 5.24	16.48	-
Lead Poisoning	252101	-	-	-	-	14.98	14.72, 5.24	16.48	-
Lead Poisoning	252102	-	-	-	-	14.98	14.72, 5.24	16.48	-
Low Birth Weight	251101	-	-	-	-	216.8	277.7,221.93	238.5	No
Low Birth Weight	251102	-	-	-	-	216.8	277.7,221.93	238.5	No
Low Birth Weight	254402	217.4	26.8-407.9	NSSD	Unstable	216.8	277.7,221.93	238.5	No

SSH: Statistically significantly higher
NSSD: Not statistically significantly different
SSL: Statistically significantly lower
NSD: Not statistically different

Figures

G:\Projects2\MA\Andover\6633\MXD\Fig1_EJ_Populations.mxd

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



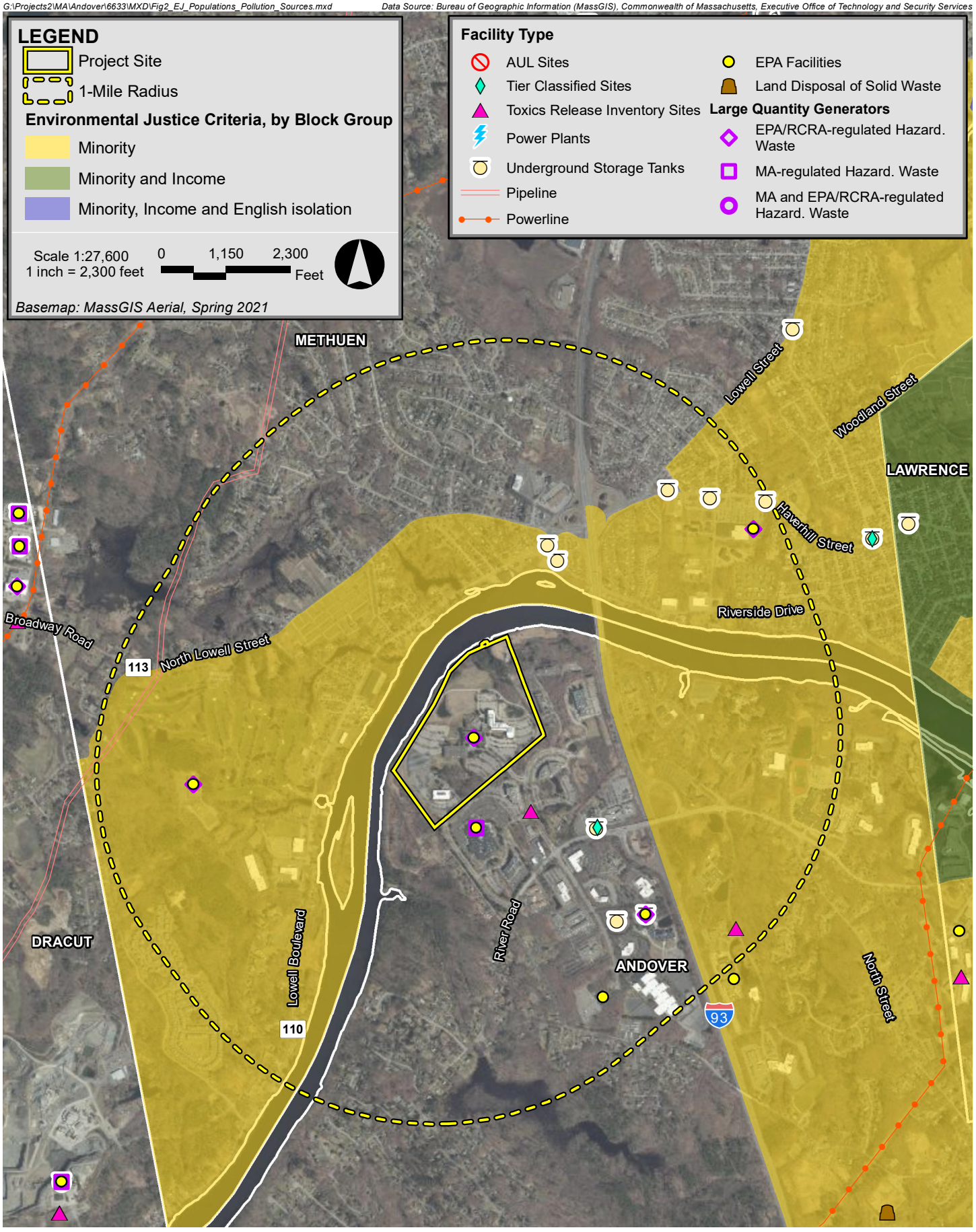
3000 Minuteman Road Andover, Massachusetts

Epsilon Associates Inc.

Figure 7.1

Environmental Justice Populations

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

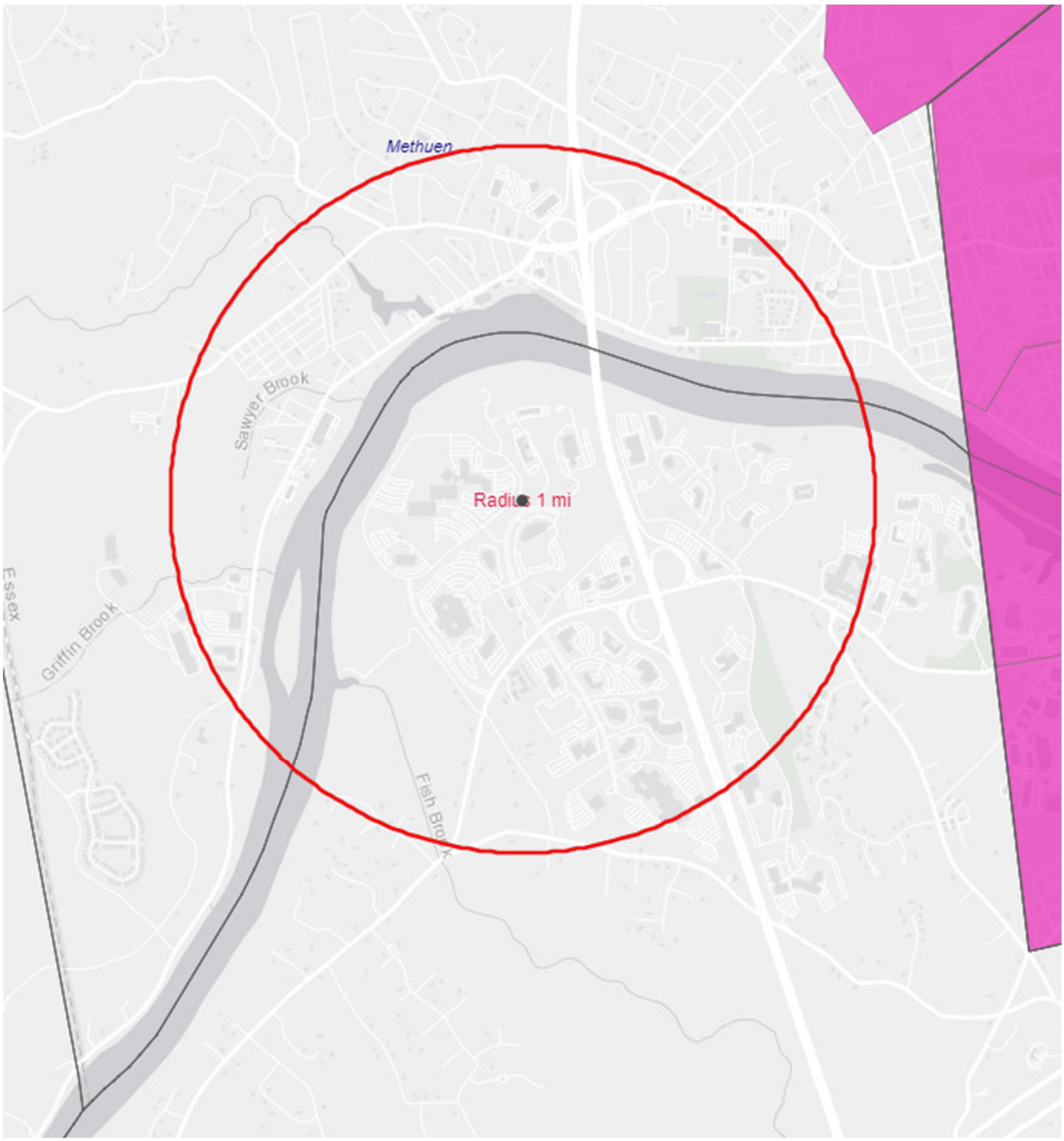


3000 Minuteman Road Andover, Massachusetts

Epsilon Associates Inc.

Figure 7.2

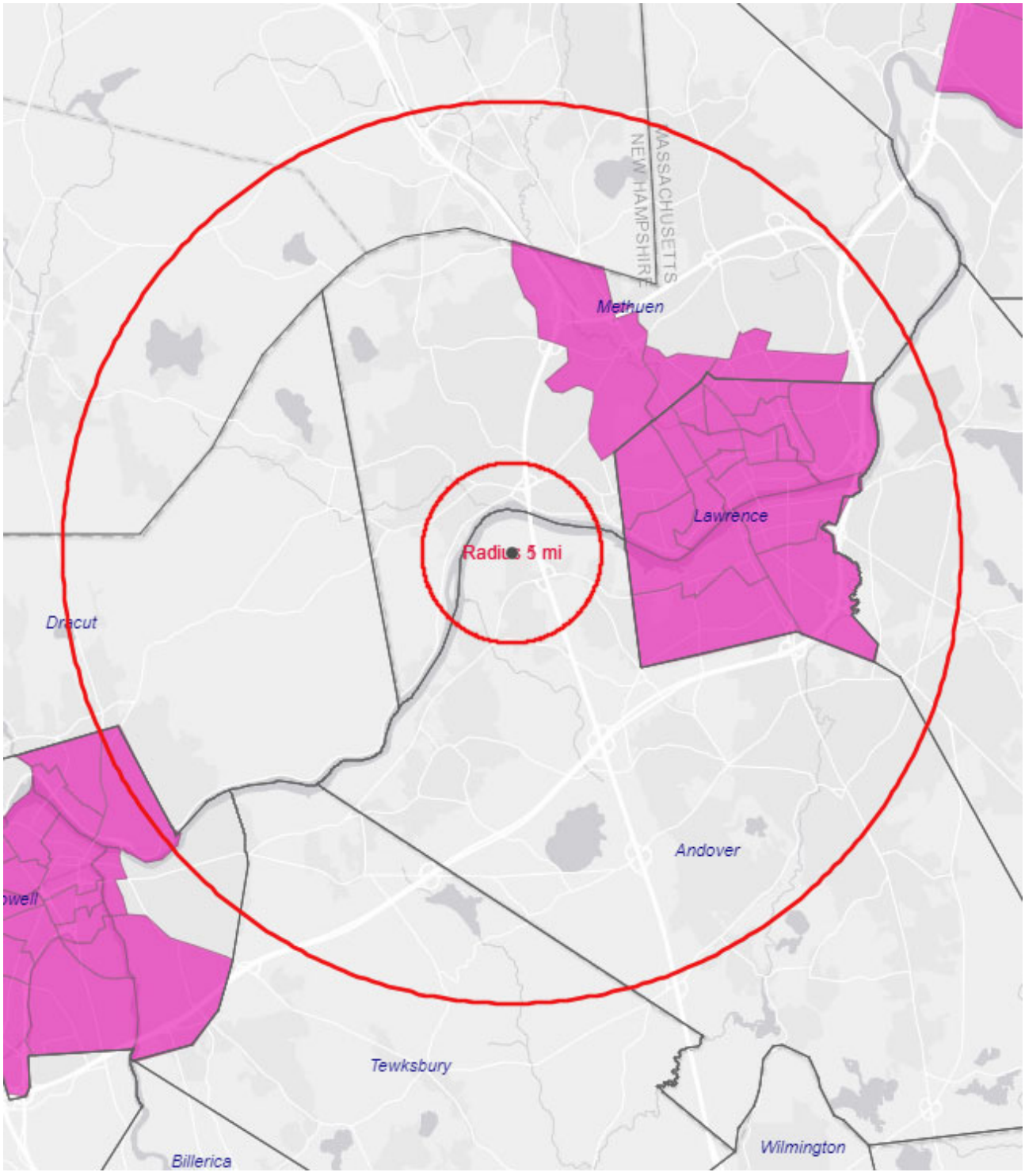
Environmental Justice Areas - Pollution Sources



3000 Minuteman Road Andover, MA

Epsilon ASSOCIATES INC.

Figure 7.3
Location of Languages Spoken within 1 mi



3000 Minuteman Road Andover, MA

Figure 7.4
Location of Languages Spoken-within 5mi.

Mitigation 8

8.1 Summary of Mitigation
8.2 Natural Resources and Water Quality
8.3 Transportation
8.4 Water and Wastewater
8.5 Greenhouse Gas Emissions

Mitigation

8.1 Summary of Mitigation

The primary mitigation strategies being considered for the project are outlined in the sections below. Mitigation is outlined for the following potential impacts:

- Storm water management and increase in impervious cover
- Traffic Generation
- Water use and Wastewater generation
- Energy use and Greenhouse Gas Emissions

8.2 Natural Resources and Water Quality

The proposed stormwater management plan provides treatment, detention, and infiltration of stormwater in accordance with the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Standards and Town of Andover regulations. Best Management Practices (BMPs), including Low Impact Development (LID) BMPs, are designed in accordance with the MassDEP Stormwater Handbook. The stormwater design utilizes two existing siltation ponds described above, as well as proposed BMPs, including three subsurface infiltration systems, three subsurface detention systems, and approximately 7.5 acres of porous pavement.

8.3 Transportation

Access to the Project will continue to be provided by way of the existing driveways that intersect the west side of Minuteman Road approximately 1,450 feet north of River Road and the terminus of 1776 Drive approximately 2,175 feet north of River Road, respectively. The following summarizes the measures that have been incorporated into the design and operation of the shared driveway and internal circulation:

- The driveways serving the Project site should continue to accommodate two-way travel and the turning and maneuvering requirements of service and delivery vehicles, and the largest anticipated responding emergency vehicle as defined by the Andover Fire Department.
- Where perpendicular parking is proposed, the drive aisle behind the parking should be a minimum of 23 feet in order to facilitate parking maneuvers.
- STOP-signs and marked STOP-line should be provided on the individual driveways that intersect the ring-road that circumnavigates the campus, at the intersection of the ring-road with Minuteman Road and on the 1776 Drive approach to River Road (retain existing traffic control at the intersection).
- All signs and pavement markings to be installed within the Project site should conform to the applicable standards of the *Manual on Uniform Traffic Control Devices* (MUTCD).
- Sidewalks and pedestrian paths are provided within the Project site that extend to or provide access to the existing sidewalk along Minuteman Road.
- Americans with Disabilities Act (ADA)-compliant wheelchair ramps will be provided at all pedestrian crossings that are constructed or modified in conjunction with the Project.
- Signs and landscaping to be installed as a part of the Project within intersection sight triangle areas will be designed and maintained so as not to restrict lines of sight.

- Snow accumulations (windrows) within sight triangle areas will be promptly removed where such accumulations would impede sight lines.
- Consideration will be given to providing electric vehicle (EV) charging stations within the Project site.

Off-Site

River Road Traffic Signal System

Independent of the Project, one or more movements at the intersections that comprise the River Road coordinated traffic signal system are currently or are predicted to operate at or over capacity during the peak-hours. In an effort to improve traffic operations and off-set the predicted impact of the Project, the Project proponent will design and implement an optimal traffic signal timing, phasing and coordination plan for the River Road coordinated traffic signal system inclusive of the following intersections:

- River Road/Minuteman Road/Shattuck Road
- River Road/I-93 Southbound Ramps
- River Road/I-93 Northbound Ramps
- River Road/Old River Road/Federal Street

These improvements will be completed prior to the issuance of a Certificate of Occupancy for any new or expanded building within the Project site, subject to receipt of all necessary rights, permits and approvals, and will include the installation, repair and/or upgrade of traffic signal equipment and associated appurtenances required to provide and maintain coordination of the traffic signal system. With the implementation of an optimal traffic signal timing, phasing and coordination plan, overall motorist delays will be reduced such that no movement operates at or over capacity, an improvement over No-Build conditions.

In addition to the traffic signal timing, phasing and coordination improvements, the Project proponent will reconstruct all non-ADA compliant wheelchair ramps at the subject intersections, replace/upgrade non-ADA complaint pushbuttons and install countdown-type pedestrian indications where such indications are not currently installed. These improvements will also be completed prior to the issuance of a Certificate of Occupancy for any new or expanded building within the Project site, subject to receipt of all necessary rights, permits and approvals.

8.4 Water and Wastewater

4.2.3 Water Conservation Measures

Water

To reduce peak water demand at the CUP, the team has selected high-efficiency chillers, best-in-class tower design with drift eliminators, and advanced water filtration to increase condenser water cycles of concentration and reduce blowdown. The CUP has been designed with a water-side economizer to provide free cooling during winter months with low load, allowing the towers to be bypassed and eliminating water use in those periods.

From a programming perspective, the proponent has reduced the basis-of-design GMP clean space air changes per hour (ACH) from 40 to 30 to further reduce cooling demand (and thus water demand) at the CUP. Further tenant limitations have been put in place to reduce the planned lab and office cooling demands, reducing the overall expected CUP size. Demand reductions associated with the above measures are not reflected in the demand calculations presented herein.

Water conservation measures under consideration for the future Buildings 5 and 6 include rainwater harvesting, grey water recycling, AHU condensate collection, and low-flow plumbing fixtures. Potential applications under consideration for condensate and rainwater reuse include boiler feedwater, cooling tower feedwater and irrigation use. Deployment of these water reuse measures are not reflected in the water demand calculations presented herein.

The campus currently uses onsite sources for landscape irrigation and does not use town water. This will continue to be strategy moving forward combined with selection of native and drought tolerant plant materials.

Wastewater

A significant percentage of the water used on site is for evaporative cooling and will not be discharged to sewer. The Proponent is committed to working with tenants as they come of board to utilize low-flow and water re-use for process uses. An example that ARE would like to pursue is the management of RO-reject water to minimize discharge to the sewer.

8.5 Greenhouse Gas Emissions

GHG Emissions Reduction Measures

The new Buildings 1, Building 5 and Building 6 will use a combination of energy efficiency measures for the building enclosure, mechanical, electrical and lighting systems that result in a comprehensive building energy use reduction and partial electrification of the peak space heating capacity. The following GHG emissions reduction measures are included in the project, as provided in the NPC/DEIR.

- High performance building enclosure insulated beyond Code
  - R-50 Roof
  - R-32 Walls
  - U-0.23 Glazing System (SHGC 0.27) -Triple Glazing Systems
  - Window to Wall Ratio- 25-30% goal
  - Light colored Reflective Roof
- High performance lighting systems and controls (Tenant spaces – Stretch Code compliant)
  - Light Power Density Reduction (LPD)
  - Vacancy and Daylight controls
  - Advanced Digital network Controls, as applicable, to office areas
  - All LED Exterior Lighting (Existing)
- High Efficiency transformers.
- Energy Star rated Appliances and Equipment.
- High efficiency mechanical HVAC system including:
  - Office area:
    - DOAS ventilation/VRF (ASHP) heating and cooling for the office areas.
    - Temperature setback during unoccupied hours
    - Heat Recovery (75% efficiency)
  - Lab/cGMP area:
    - High Performance Water Cooled Chiller for Cooling system
    - Heat recovery (75%-80% efficiency)
    - High performance condensing natural gas boilers (95% efficiency)
    - Variable frequency Drives VFDs on pumps, as applicable

  - Demand control ventilation for the office areas, as applicable.
  - High performance natural gas condensing boilers for Domestic Hot Water (95% efficiency)
  - Energy Management System (EMS) and Controls
- Enhanced Commissioning for Mechanical, Electrical, Plumbing and Building Enclosure systems.
- High performance Elevators.
- Code compliant Solar Photovoltaic and Electric Vehicles Charging Station readiness
- MassSave utility incentives programs to optimize cost effective energy performance.

Appendices 9

A EENF Distribution List
B Historical and Archaeological Supporting Documentation
C Stormwater Management Support Documentation
D Transportation Supporting Documentation
E Draft Section 61 Findings
F Draft Section 61 Findings
G Greenhouse Gas Emissions Supporting Documentation
H Environmental Justice Supporting Documentation
I RMAT Climate Resilience Design Standards Tool Project Report
I Previous MEPA Certificates

EENF Distribution List A

SMMA

Expanded ENF Distribution List

In accordance with Section 11.16 of the MEPA regulations (301 CMR 11.00), Alexandria Real Estate Equities, the Proponent, distributed this Expanded Environmental Notification Form (EENF) to the following federal, state, and local agencies/departments for review.

It is anticipated that this EENF will be noticed in the next edition of The Environmental Monitor published on or about August 10, 2022 commencing the 20-day public review period. Therefore, comments on this EENF are due to the MEPA Office no later than August 30, 2022. To request a copy of this document, please contact William Park at (617) 520-9210 or email at wpark@smma.com.

Federal Agencies

U.S. Army Corps of Engineers
New England District
696 Virginia Road
Concord, MA 01742

US Environmental Protection Agency
New England, Region 1
Attention: NPDES Permit Division
5 Post office Square, Suite 100
Boston, MA 02109-3912

State Agencies

Tori Kim, Director (submitted herein)
Executive Office of Energy and Environmental Affairs
Attn: MEPA Office
100 Cambridge Street, Suite 900
Boston, MA 02114

Commissioner's Office
Massachusetts Department of Environmental Protection
One Winter Street
Boston, MA 02108

DEP/Northeast Regional Office
Attn: MEPA Coordinator
205B Lowell Street, Wilmington, MA 01887

Massachusetts Department of Transportation
Public/Private Development Unit
10 Park Plaza, Suite #4150
Boston, MA 02116

MassDOT - District #4
Attn: MEPA Coordinator
519 Appleton Street
Arlington, MA 02476

Massachusetts Historical Commission (hard copy only)
The Massachusetts Archives Building
220 Morrissey Boulevard
Boston, MA 02125

Greater Lawrence Sanitary District
240 Charles Street
North Andover, MA 01845

Department of Energy Resources
Attn: MEPA Coordinator
100 Cambridge Street, Suite 1020
Boston, MA 02114

MEPA Office
Attn: EEA EJ Director
100 Cambridge Street, Suite 900
Boston, MA 02144

Town of Andover

Andrew Flanagan, Town Manager
36 Bartlet Street
Andover, MA 01810

Andover Select Board
36 Bartlet Street
Andover, MA 01810

Andover Planning Board
36 Bartlet Street
Andover, MA 01810

Andover Conservation Commission
36 Bartlet Street
Andover, MA 01810

Andover Board of Health
36 Bartlet Street
Andover, MA 01810

Andover Department of Public Works
Attn: Christopher Cronin, Director of Public Works
5 Campanelli Drive
Andover, MA 01810

Paul Materazzo, Director of Planning & Land Use
Planning & Economic Development
36 Bartlet Street
Andover, MA 01810

Other Interested Parties

Merrimack Valley Planning Commission
160 Main Street
Haverhill, Massachusetts 01830

B Historical and Archaeological Supporting Documentation

SRC NUMBER

MEPA-35

MEPA FILES

8929

MHC comment letter on the ENF 2/5/92

RECEIVED
FEB 10 1992
MEPA

February 5, 1992

Secretary Susan Tierney
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02202

ATTN: MEPA Unit

RE: Hewlett-Packard Company, Andover EOEA # 8198

Dear Secretary Tierney:

Staff of the Massachusetts Historical Commission have reviewed the Environmental Notification Form for the proposed project referenced above. In addition, staff of the MHC have met with representives of Hewlett-Packard to discuss the possible effects which the proposed project may have on archaeological deposits associated with the Shattuck Farm Site (MHC Site #19-ES-196), which contains the remains of prehistoric Indian campsites dating between 7,000 and 500 years ago.

Hewlett-Packard has generously supported archaeological investigations of the Shattuck Farm Site in the past. As a result of these investigations, several specific locations of important archaeological deposits were identified within the open space areas of the Hewlett-Packard property.

Review of the results of the previous archaeological investigations at the Hewlett-Packard property indicates that the proposed Phase I project will not affect any significant archaeological deposits. However, a small area of the proposed Phase II development has not been adequately surveyed for the presence of archaeological resources associated with Locus A of the Shattuck Farm Site. The MHC requests that an intensive (locational) archaeological survey (950 CMR 70) be conducted in this area as early as possible in the planning stages of development, in compliance with Section 106 of the National Historic Preservation Act (36 CFR 800), Massachusetts General Laws, Chapter 9, Sections 26-27C, as amended by Chapter 254 of the Acts of 1988 (950 CMR 71) and MEPA. The goal of the survey should be to locate and identify any important archaeological resources which may be affected by the proposed Phase II development.

The MHC is willing to assist project proponents in developing an appropriate scope for the survey. If you have any questions, please feel free to contact me.

Sincerely,

Brona Simon
State Archaeologist
Deputy State Historic Preservation Officer
Massachusetts Historical Commission

xc: William Sousa, Hewlett-Packard
John G. Crowe Associates

MHC comment letter on the DEIR

JD

RECEIVED
DEC 14 1992
MEPA

December 8, 1992

Secretary Susan Tierney
Executive Office of
Environmental Affairs
100 Cambridge St.
Boston, MA 02202

ATTN: MEPA Unit

RE: Hewlett-Packard, Andover EOEA #8929

Dear Secretary Tierney:

Staff of the Massachusetts Historical Commission have reviewed the Draft EIR for the proposed project referenced above and have consulted with the project proponent to discuss the potential effects of the Phase II project on significant archaeological resources.

The Draft EIR includes a summary of the archaeological investigation of the project area. Three small areas within the property known as Locus B, C and D contain important archaeological resources associated with Native American occupations during the Woodland period (about 2,000 - 500 years ago). These three sites are associated with others within the former Shattuck Farm property and comprise a complex of interrelated sites which possess sufficient integrity and significance to be eligible for listing in the National and State Registers of Historic Places as an archaeological district.

The MHC commends the proponent for stating in the DEIR that attempts will be made to site the proposed recreational facilities in such a manner to avoid impacting the archaeological sites (page 6-4). The MHC recommends that the locations of Loci B, C and D be flagged, surveyed and mapped onto engineering plans for the project by the consulting archaeologists and surveyors, in order to provide an accurate map for project planning.

The MHC looks forward to further consultation with the proponent to determine whether project impacts to the archaeological sites can be avoided, minimized or mitigated.

These comments are offered to assist in compliance with M.G.L. Ch. 9, ss. 26-27C and MEPA. If you have any questions, please feel free to contact me.

Sincerely,

Brona Simon

Brona Simon
State Archaeologist
Deputy State Historic Preservation Officer

xc: William Souza, Hewlett-Packard
John G. Crowe Associates

Stormwater Management Support Documentation

C

ARE Andover - Recharge and Drawdown Calculations
SMMA Job No. 21140
Date: 7/28/2022
Calc by: MF

Required recharge volume is calculated utilizing DEP's "static method."
Hydrologic Soil Group and Rawls Rate based on geotechnical survey of site.

Required Recharge Volume

	Area *ac*	Target Depth Factor *HSG*	*in*	Required Volume *cf*
Existing Impervious	41.2			
Proposed Standard Impervious	45.4			
Proposed Porous Pavement*	7.5			
Net Increase	11.7	A**	0.6	25,483

*Porous pavement considered "impervious" for the sake of recharge calculations
**Target recharge volume conservatively assumes entire site is HSG A

Provided Recharge Volume

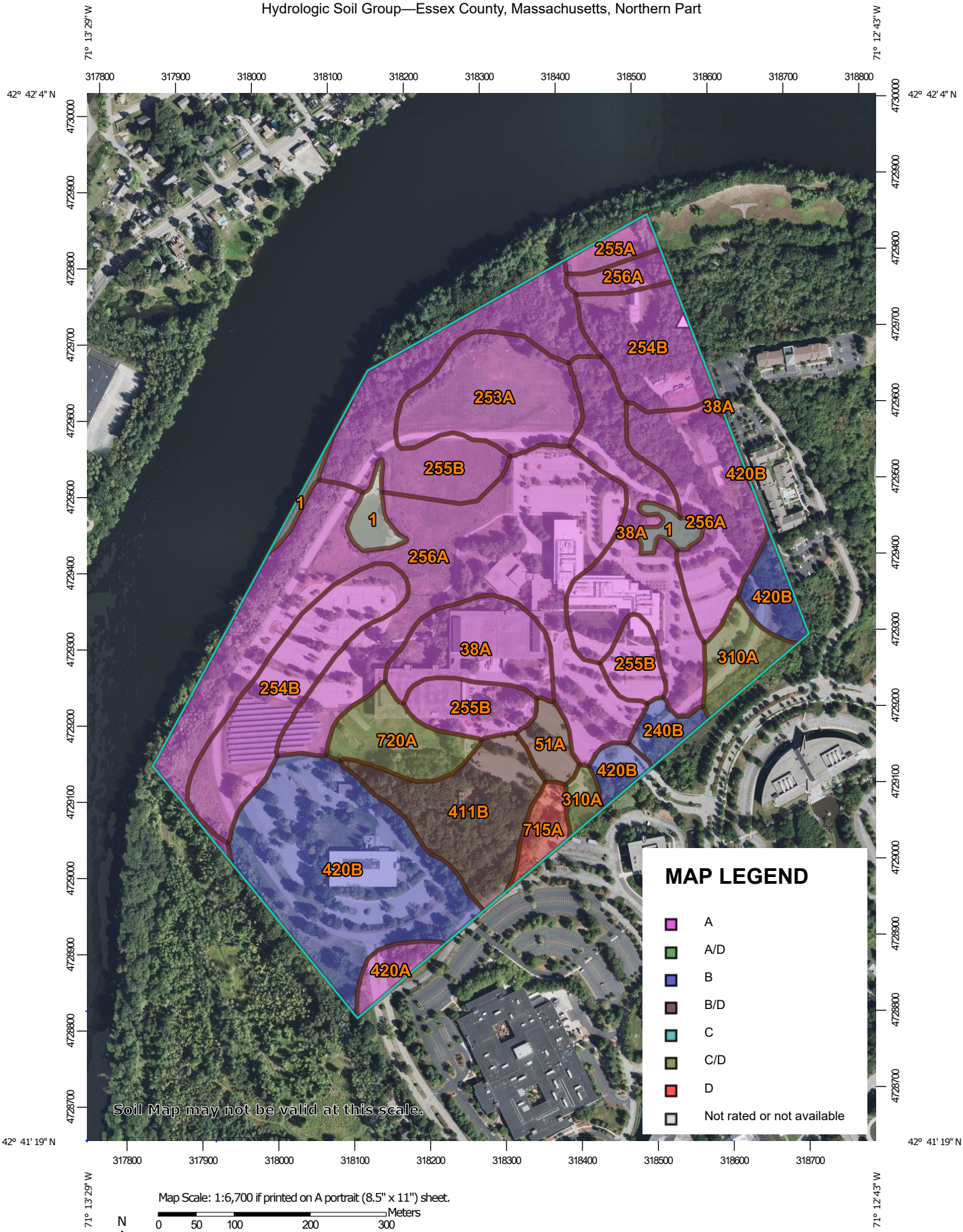
Recharge System	Contributing Impervious Area *ac*	Recharge Volume Provided* *cf*
SRS 1-1	1.7	7,139
SRS 1-2	1.5	2,812
SRS 2-1	2.3	9,346
Porous Pavement**	7.5	49,005
Total	13.0	68,302

*Storage volumes for subsurface systems calculated using HydroCAD, only counting volume below the outlet
**Porous Pavement recharge volume calculated based on 6" minimum reservoir course, with 30% void space

Drawdown Time

	K (Rawls Rate) *in/hr*	Depth *ft*	Time *hr*
Subsurface Recharge System	1.02	1.6	18.8
Porous Pavement	1.02	0.5	5.9

Hydrologic Soil Group—Essex County, Massachusetts, Northern Part



Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Water		2.2	1.8%
38A	Pipestone loamy sand, 0 to 3 percent slopes	A	14.4	11.9%
51A	Swansea muck, 0 to 1 percent slopes	B/D	1.4	1.1%
240B	Elmwood fine sandy loam, 3 to 8 percent slopes	B	1.2	1.0%
253A	Hinckley loamy sand, 0 to 3 percent slopes	A	6.9	5.7%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	12.7	10.5%
255A	Windsor loamy sand, 0 to 3 percent slopes	A	1.1	0.9%
255B	Windsor loamy sand, 3 to 8 percent slopes	A	13.7	11.3%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	A	34.5	28.4%
310A	Woodbridge fine sandy loam, 0 to 3 percent slopes	C/D	3.0	2.5%
411B	Sutton fine sandy loam, 0 to 8 percent slopes, very stony	B/D	6.8	5.6%
420A	Canton fine sandy loam, 0 to 3 percent slopes	A	1.2	1.0%
420B	Canton fine sandy loam, 3 to 8 percent slopes	B	17.4	14.4%
715A	Ridgebury and Leicester fine sandy loams, 0 to 3 percent slopes, extremely stony	D	1.4	1.1%
720A	Whately variant fine sandy loam, 0 to 3 percent slopes	C/D	3.5	2.9%
Totals for Area of Interest			**121.4**	**100.0%**

INSTRUCTIONS:

Version 1, Automated: Mar. 4, 2008

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

Location: Subsurface Recharge System

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Proprietary Treatment Practice	**0.40**	**0.75**	**0.30**	**0.45**
Subsurface Infiltration Structure	**0.80**	**0.45**	**0.36**	**0.09**
	0.00	**0.09**	**0.00**	**0.09**
	0.00	**0.09**	**0.00**	**0.09**

Total TSS Removal = **91%**

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

Project: **ARE Andover**

Prepared By: **SMMA**

Date: **7/28/2022**

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

INSTRUCTIONS:

Version 1, Automated: Mar. 4, 2008

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

Location: Existing Siltation Ponds

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Wet Basin	**0.80**	**0.75**	**0.60**	**0.15**
	0.00	**0.15**	**0.00**	**0.15**
	0.00	**0.15**	**0.00**	**0.15**
	0.00	**0.15**	**0.00**	**0.15**

Total TSS Removal = **85%**

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

Project: **ARE Andover**

Prepared By: **SMMA**

Date: **7/28/2022**

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

INSTRUCTIONS:

Version 1, Automated: Mar. 4, 2008

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

Location: Porous Pavement Areas

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Porous Pavement	0.80	1.00	0.80	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20

Total TSS Removal = 80%

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

Project: ARE Andover
Prepared By: SMMA
Date: 7/28/2022

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

INSTRUCTIONS:

Version 1, Automated: Mar. 4, 2008

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

Location: Water Quality Unit/Inlet Only

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Proprietary Treatment Practice	**0.80**	**1.00**	**0.80**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**

Total TSS Removal = **80%**

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

Project: **ARE Andover**

Prepared By: **SMMA**

Date: **7/28/2022**

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

ARE Andover - Phosphorus Reduction Calculations
SMMA Job No. 21140
Date: 7/28/2022
Calc by: MF
Check by: DCC

Phosphorus Reduction Calculations

Table 1 - Proposed Avg Annual Distinct P Load Export Rates

	P Load Export Rate* (lb/ac/yr)
Impervious (Industrial)	1.78
Pervious (HSG A)	0.03
Pervious (HSG B)	0.12

*Load rates provided by EPA BMP Accounting and Tracking Tool (BATT)

Table 2 - Untreated Proposed Conditions Phosphorus Load by Area

	Proposed Area (ac)*	P Load Export Rate (lb/ac/yr)	Untreated Project P Load (lb/yr)	Target Reduction (%)**	Target Phosphorus Load (lb/yr)
Impervious (Industrial)	45.4	1.78	80.8	50%	40.4
Porous Pavement	7.5	1.78	13.4	50%	6.7
Pervious (HSG A)	32.8	0.03	1.0	0%	1.0
Pervious (HSG B)	15.5	0.12	1.9	0%	1.9
Total	101.2		97.0		49.9

*Proposed area breakdown only includes areas within limit of work
**Andover Town regs require 50% phosphorus reduction from total proposed impervious area.

Table 3 - Phosphorus Reduction Credits for Selected Enhanced Non-Strucutral BMPs
Note: PRF = Phosphorus Reduction Factor from EPA BMP Accounting and Tracking Tool (BATT)

	IA being swept (ac)	PLE (lb/yr)	PRF (lb/ac/yr)	Annual Freq. (%)	Credit (lb/yr)
Street Sweeping	30.9	1.78	0.01	100%	0.55

	IA to CBs (ac)	PLE (lb/yr)	PRF (lb/ac/yr)	Credit (lb/yr)
Catch Basin Cleaning	30.9	1.78	0.02	1.10

	Sweeping (lb/yr)	CB Cleaning (lb/yr)	Total (lb/yr)
Non-Structural P Reduction Credits	0.55	1.10	1.65

Table 4 - Phosphorus Loading to Structural Stormwater BMPs

	Impervious Area (ac)	Pervious Area (ac)	P Load to BMP (lb/yr)
Infiltration System P-1.1	1.7	0.0	3.0
Infiltration System P-1.2	1.6	0.2	2.9
Infiltration System P-2.1	2.3	0.0	4.1
Porous Pavement	7.5	0.0	13.4
Siltation/ Wet Pond P-2*	15.7	21.0	31.6
Siltation/ Wet Pond P-3	12.0	5.0	21.5
Total	40.8	26.2	76.5

*Phosphorus load to Pond P-2 includes phosphorus load from untreated areas and output from porous pavement

Table 5 - Phosphorus Load Reductions per Structural Stormwater BMP

	Infiltration Rate (in/hr)	Design Storm (in)*	Filter/Reservoir Course	P Removal Rate (%)**	P Reduction (lb/yr)
Infiltration System P-1.1	1.02	1.0		96%	2.9
Infiltration System P-1.2	1.02	1.0		96%	2.7
Infiltration System P-2.1	1.02	1.0		96%	3.9
Porous Pavement			18"	70%	9.3
Siltation/ Wet Pond P-2		1.0		53%	16.8
Siltation/ Wet Pond P-3		1.0		53%	11.4
Total					47.1

*Design storm capacities calculated using HydroCAD. See attached HydroCAD report.
**See attached BMP Performance Tables.

Table 6 - P Load Export Proposed Conditions

Untreated Project P Load (lb/yr)	Non-Structural P Reduction (lb/yr)	Structural P Reduction (lb/yr)	Proposed P Export (lb/yr)	Target Phosphorus Load (lb/yr)	Target Met?
97.0	1.65	47.1	48.3	49.9	Yes

Table 3- 7: Infiltration Trench (IR = 1.02 in/hr) BMP Performance Table

Infiltration Trench (IR = 1.02 in/hr) BMP Performance Table: Long-Term Phosphorus Load Reduction								
BMP Capacity: Depth of Runoff Treated from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	26.3%	44.6%	68.2%	81.0%	88.0%	92.1%	96.5%	98.3%
Cumulative Phosphorus Load Reduction	27%	47%	73%	86%	92%	96%	99%	100%

Figure 3- 4: BMP Performance Curve: Infiltration Trench (infiltration rate = 1.02 in/hr)

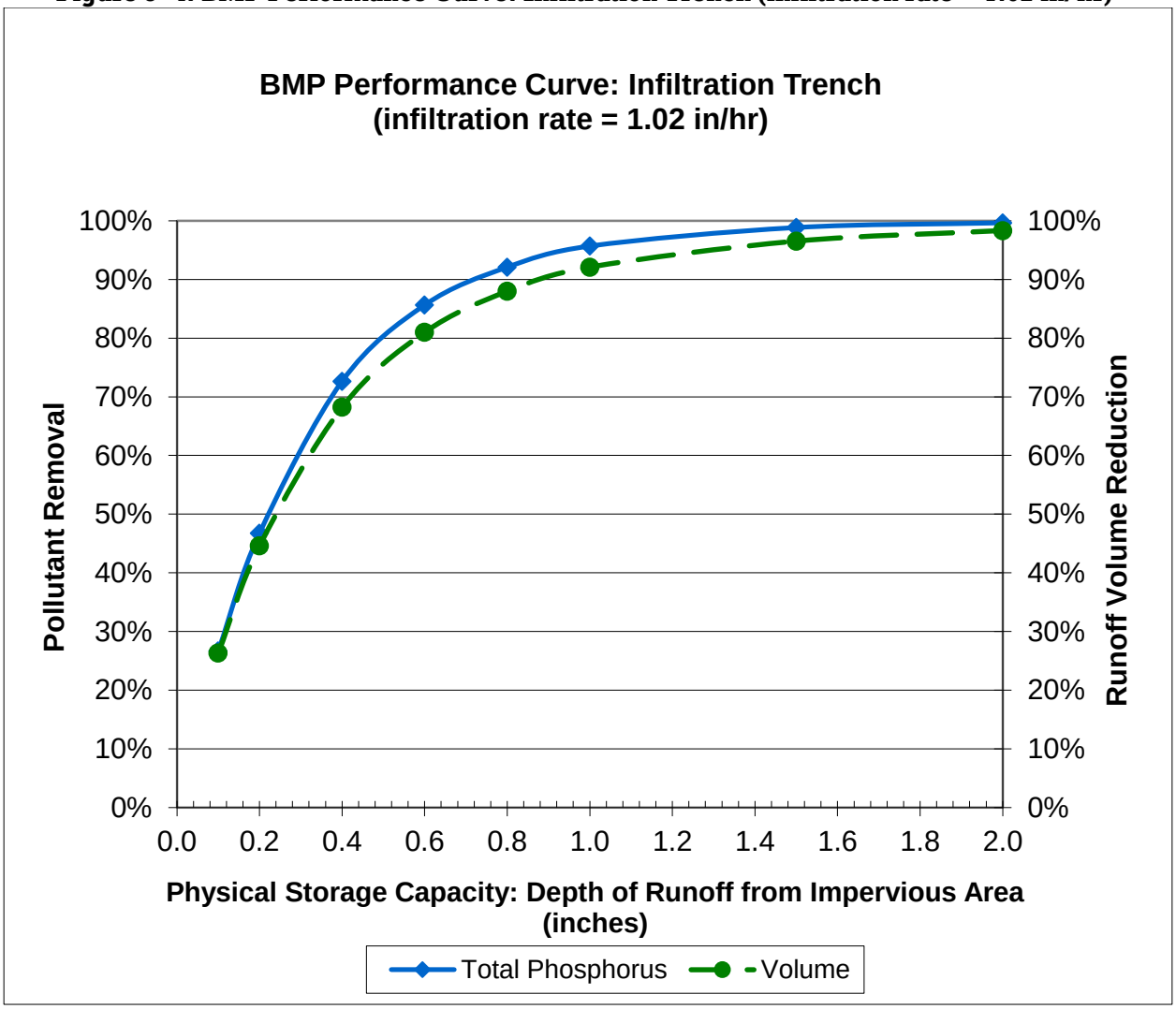


Table 3- 18: Porous Pavement BMP Performance Table

Porous Pavement BMP Performance Table: Long-Term Phosphorus Load Reduction				
BMP Capacity: Depth of Filter Course Area (inches)	12.0	18.0	24.0	32.0
Cumulative Phosphorus Load Reduction	62%	70%	75%	78%

Figure 3- 15: BMP Performance Curve: Porous Pavement

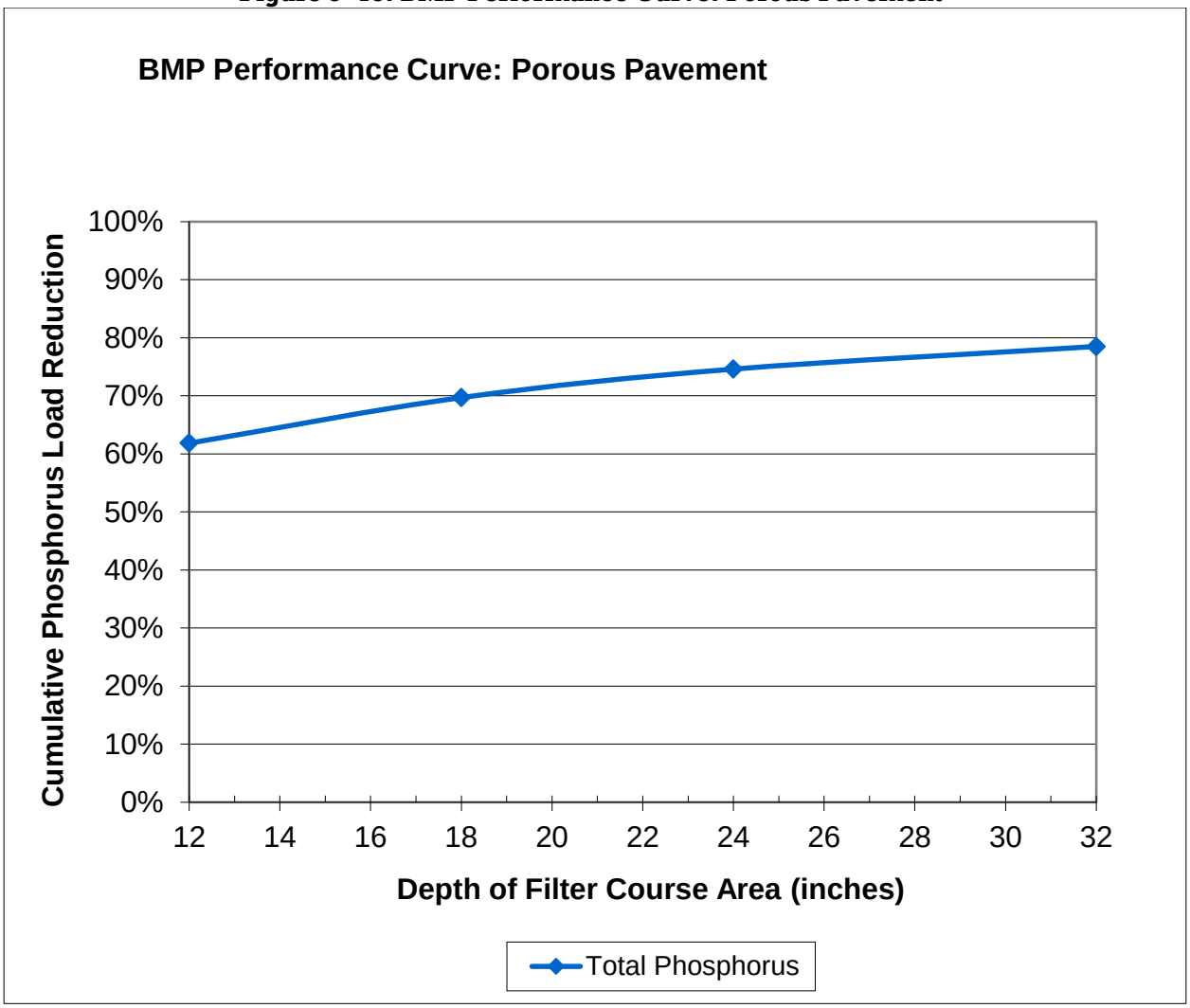


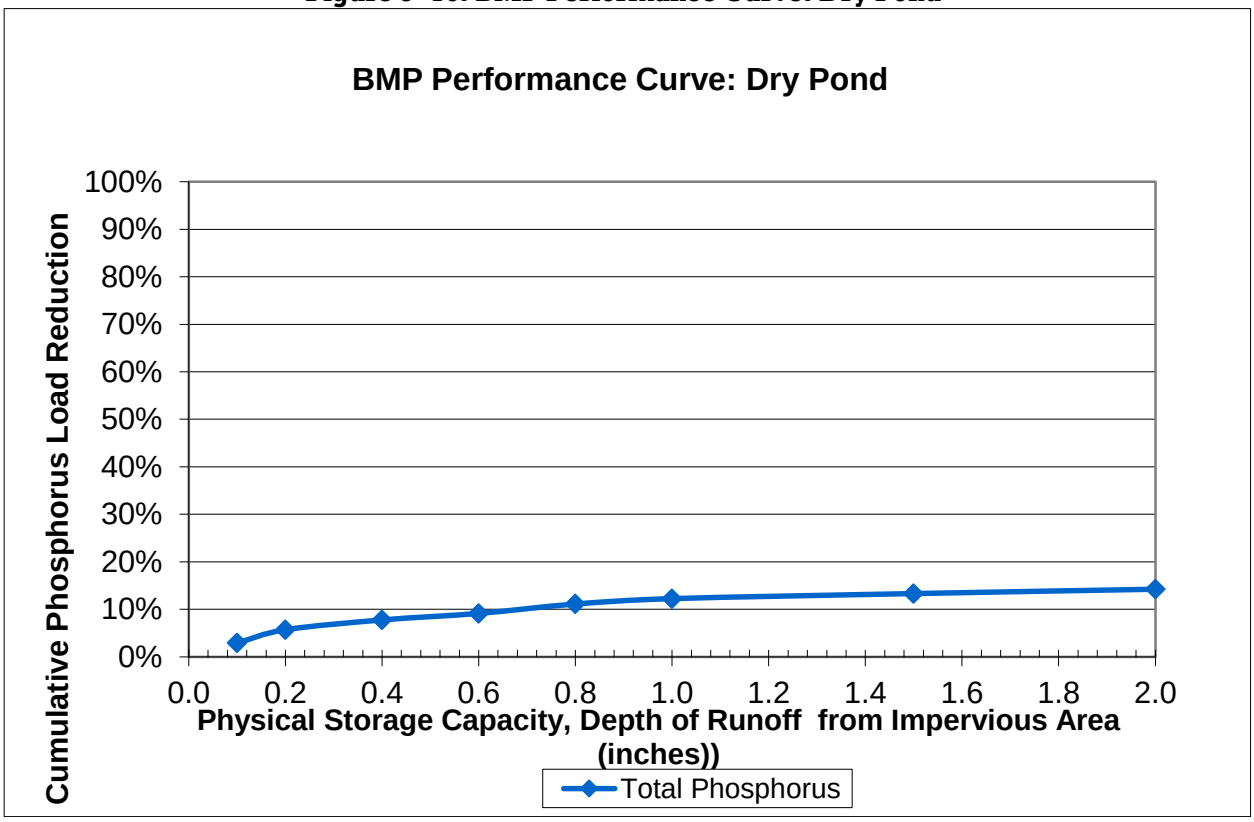
Table 3- 19: Wet Pond BMP Performance Table

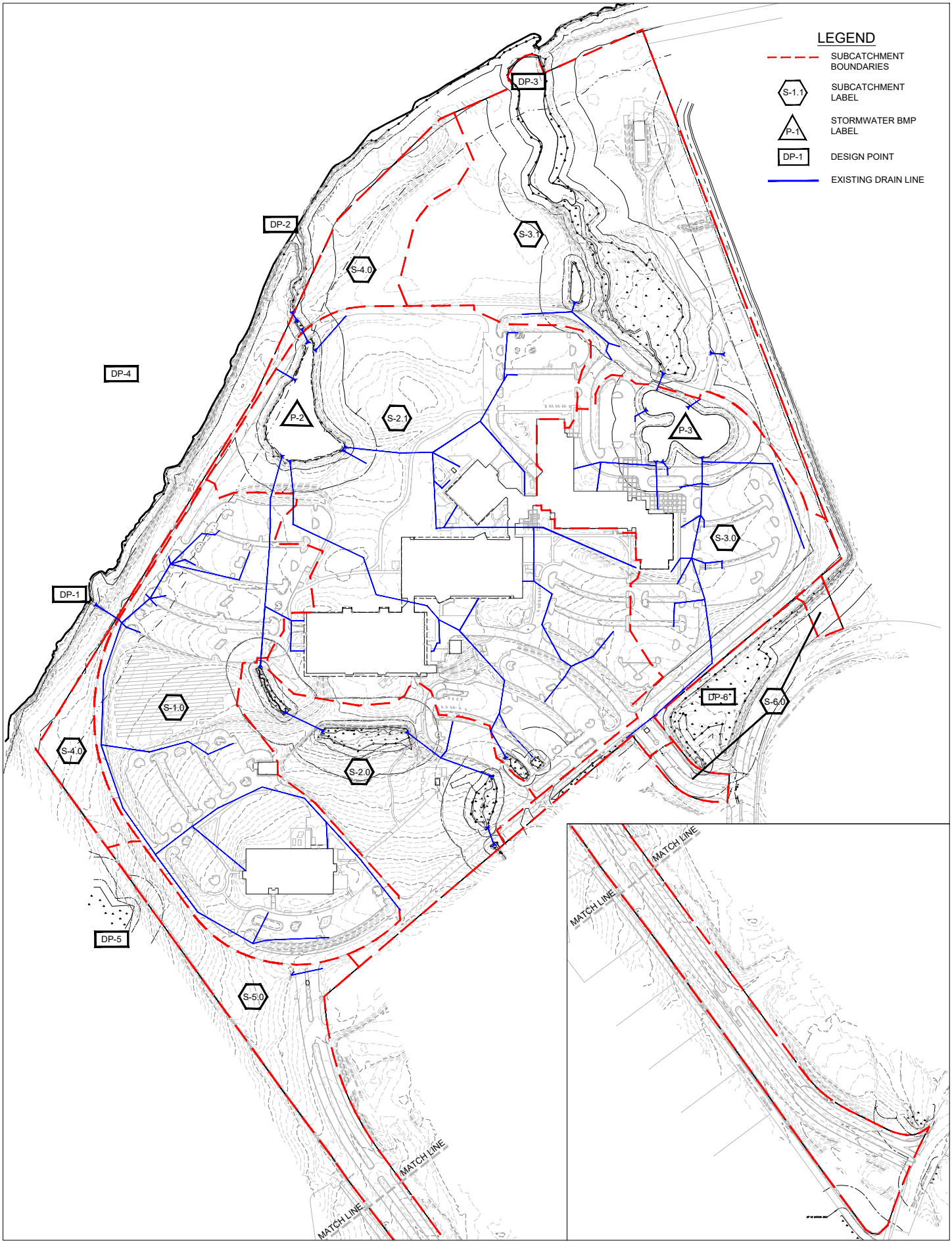
Wet Pond BMP Performance Table: Long-Term Phosphorus Load Reduction								
BMP Capacity: Depth of Runoff Treated from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Cumulative Phosphorus Load Reduction	14%	25%	37%	44%	48%	53%	58%	63%

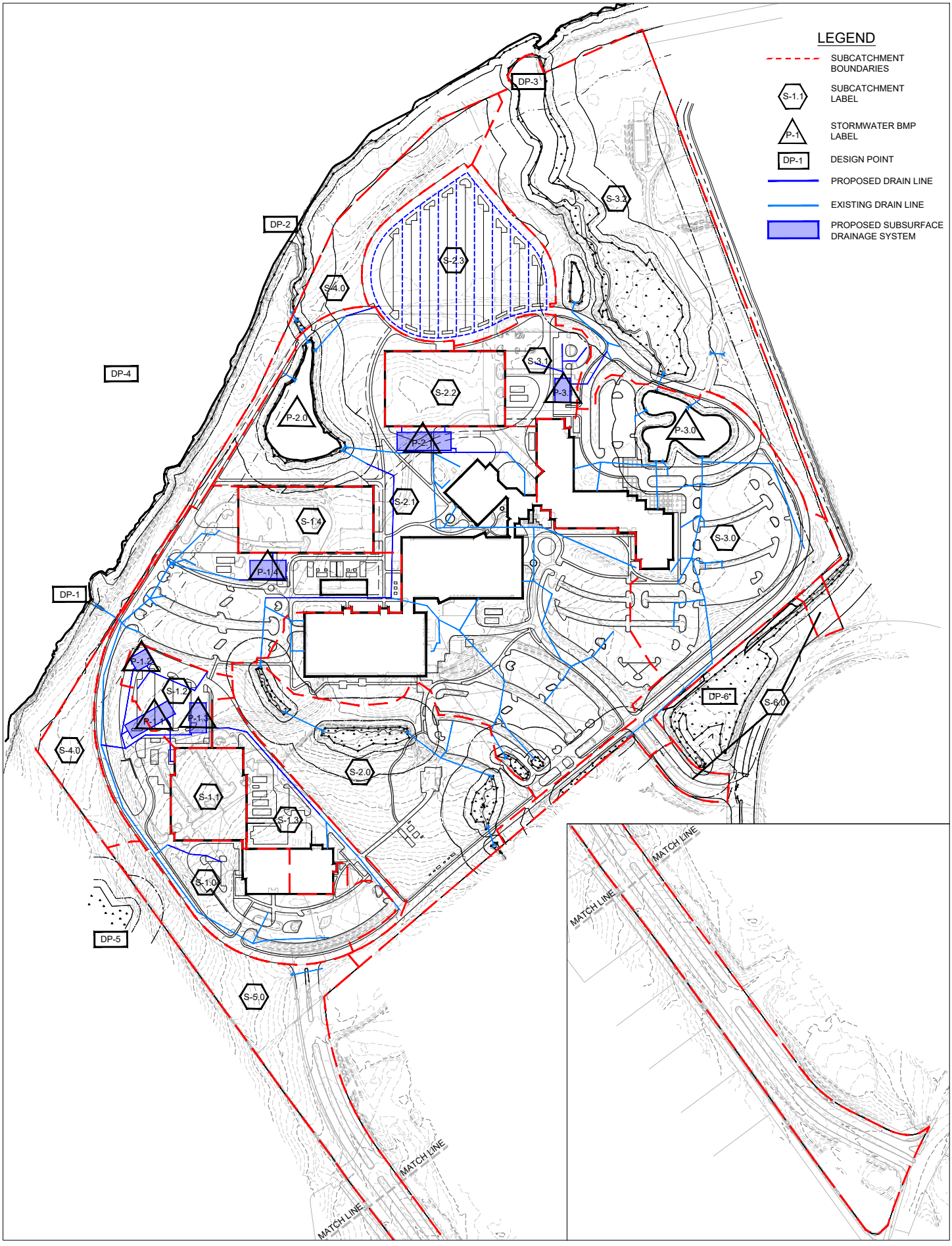
Table 3- 20: Dry Pond BMP Performance Table

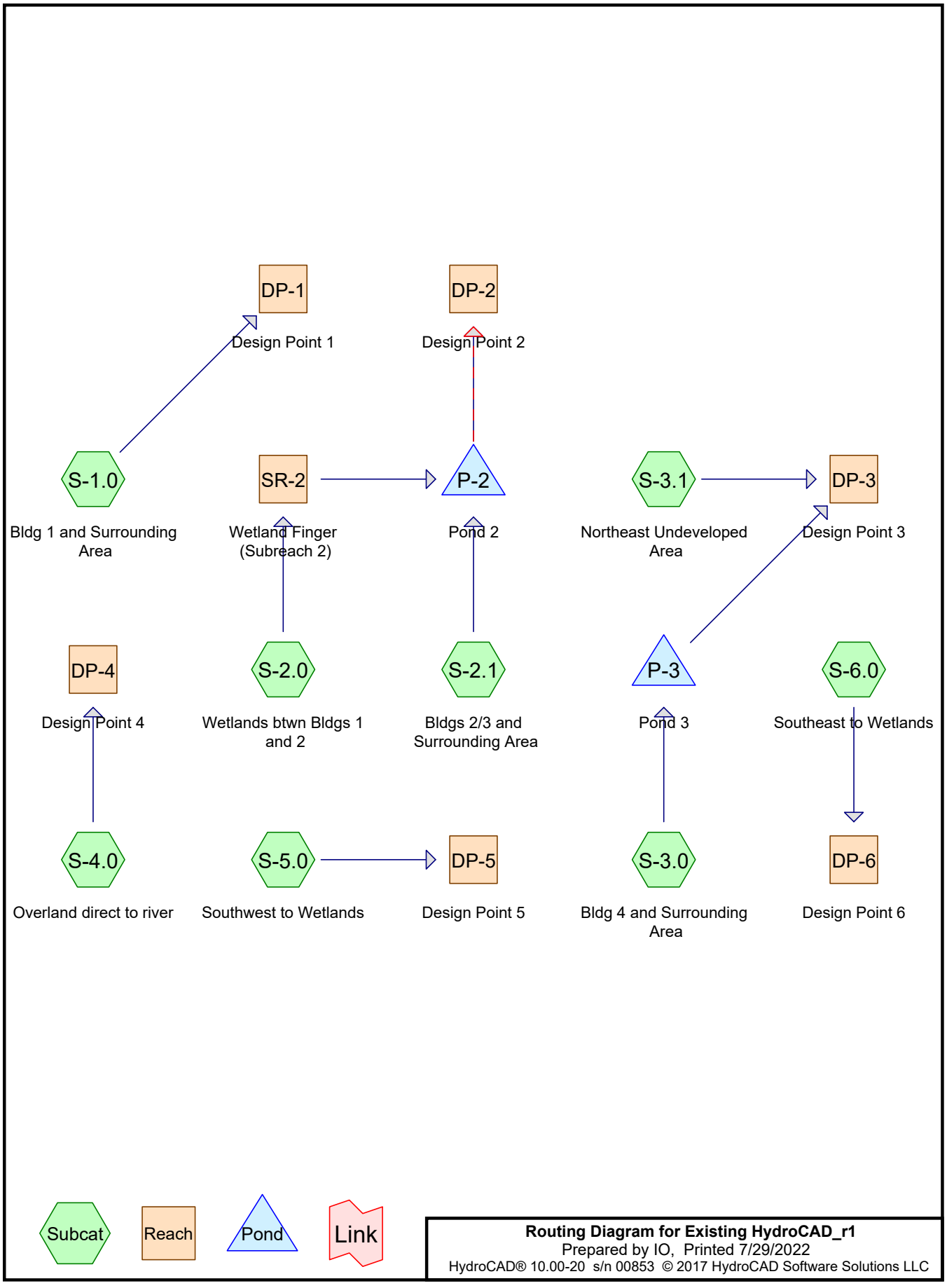
Dry Pond BMP Performance Table: Long-Term Phosphorus Load Reduction								
BMP Capacity: Depth of Runoff Treated from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Cumulative Phosphorus Load Reduction	3%	6%	8%	9%	11%	12%	13%	14%

Figure 3- 16: BMP Performance Curve: Dry Pond




LEGEND
SUBCATCHMENT BOUNDARIES
S-1.1
SUBCATCHMENT LABEL
P-1
STORMWATER BMP LABEL
DP-1
DESIGN POINT
EXISTING DRAIN LINE
DP-1
DP-2
DP-3
DP-4
DP-5
DP-6
S-1.0
S-2.0
S-3.0
S-3.1
S-4.0
S-4.0
S-5.0
S-6.0
P-2
P-3
S-2.1
MATCH LINE
MATCH LINE
MATCH LINE
MATCH LINE
0
420


LEGEND
SUBCATCHMENT BOUNDARIES
SUBCATCHMENT LABEL
STORMWATER BMP LABEL
DESIGN POINT
PROPOSED DRAIN LINE
EXISTING DRAIN LINE
PROPOSED SUBSURFACE DRAINAGE SYSTEM
DP-1
DP-2
DP-3
DP-4
DP-5
DP-6*
S-1.1
S-1.2
S-1.3
S-1.4
S-2.0
S-2.1
S-2.2
S-2.3
S-3.0
S-3.1
S-3.2
S-4.0
S-5.0
S-6.0
P-1.1
P-1.2
P-1.3
P-1.4
P-2.0
P-2.1
P-3.0
P-3.1
MATCH LINE
MATCH LINE
MATCH LINE
MATCH LINE
0
420



Routing Diagram for Existing HydroCAD_r1
Prepared by IO, Printed 7/29/2022
HydroCAD® 10.00-20 s/n 00853 © 2017 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
9.100	61	>75% Grass cover, Good, HSG B (S-1.0)
41.600	98	Impervious (S-1.0, S-2.0, S-2.1, S-3.0, S-3.1, S-5.0, S-6.0)
3.100	98	Water Surface (S-2.1, S-3.0, S-3.1)
8.900	55	Woods, Good, HSG B (S-5.0, S-6.0)
8.600	77	Woods, Good, HSG D (S-2.0)
47.000	32	Woods/grass comb., Good, HSG A (S-2.1, S-3.0, S-3.1, S-4.0)
118.300	**64**	**TOTAL AREA**

Summary for Subcatchment S-1.0: Bldg 1 and Surrounding Area

Runoff = 48.52 cfs @ 11.99 hrs, Volume= 2.343 af, Depth= 1.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.11"

	Area (ac)	CN	Description
*	11.000	98	Impervious
	9.100	61	>75% Grass cover, Good, HSG B
	20.100	81	Weighted Average
	9.100		45.27% Pervious Area
	11.000		54.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0400	1.56		**Sheet Flow, Overland - Road** Smooth surfaces n= 0.011 P2= 3.11"
0.8	190	0.0400	4.06		**Shallow Concentrated Flow, Overland - Road** Paved Kv= 20.3 fps
3.4	918	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
2.3	1,000	0.0100	7.20	22.62	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Corrugated PE, smooth interior
7.0	2,158	Total			

Summary for Subcatchment S-2.0: Wetlands btwn Bldgs 1 and 2

Runoff = 18.70 cfs @ 12.04 hrs, Volume= 1.089 af, Depth= 1.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.11"

	Area (ac)	CN	Description
*	1.200	98	Impervious
	8.600	77	Woods, Good, HSG D
	9.800	80	Weighted Average
	8.600		87.76% Pervious Area
	1.200		12.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0700	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.11"
4.4	350	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.0	400	Total			

Summary for Subcatchment S-2.1: Bldgs 2/3 and Surrounding Area

Runoff = 26.13 cfs @ 12.00 hrs, Volume= 1.463 af, Depth= 0.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.11"

	Area (ac)	CN	Description
*	15.100	98	Impervious
	17.700	32	Woods/grass comb., Good, HSG A
	1.100	98	Water Surface
	33.900	64	Weighted Average
	17.700		52.21% Pervious Area
	16.200		47.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0300	1.39		**Sheet Flow, Overland - Road** Smooth surfaces n= 0.011 P2= 3.11"
1.8	390	0.0300	3.52		**Shallow Concentrated Flow, Overland - Road** Paved Kv= 20.3 fps
4.3	1,167	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
6.7	1,607	Total			

Summary for Subcatchment S-3.0: Bldg 4 and Surrounding Area

Runoff = 30.38 cfs @ 11.98 hrs, Volume= 1.416 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.11"

	Area (ac)	CN	Description
*	9.000	98	Impervious
	4.800	32	Woods/grass comb., Good, HSG A
	1.000	98	Water Surface
	14.800	77	Weighted Average
	4.800		32.43% Pervious Area
	10.000		67.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0400	1.56		**Sheet Flow, Overland - Road** Smooth surfaces n= 0.011 P2= 3.11"
1.9	470	0.0400	4.06		**Shallow Concentrated Flow, Overland - Road** Paved Kv= 20.3 fps
3.1	1,100	0.0100	5.94	10.50	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
5.5	1,620	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S-3.1: Northeast Undeveloped Area

Runoff = 0.02 cfs @ 24.03 hrs, Volume= 0.007 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.11"

	Area (ac)	CN	Description
*	1.900	98	Impervious
	18.400	32	Woods/grass comb., Good, HSG A
	1.000	98	Water Surface
	21.300	41	Weighted Average
	18.400		86.38% Pervious Area
	2.900		13.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	50	0.0040	0.08		**Sheet Flow, Overland - Field** Grass: Short n= 0.150 P2= 3.11"
6.2	370	0.0200	0.99		**Shallow Concentrated Flow, Overland - Field** Short Grass Pasture Kv= 7.0 fps
17.1	420	Total			

Summary for Subcatchment S-4.0: Overland direct to river

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.11"

Area (ac)	CN	Description
6.100	32	Woods/grass comb., Good, HSG A
6.100		100.00% Pervious Area

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

Summary for Subcatchment S-5.0: Southwest to Wetlands

Runoff = 7.04 cfs @ 12.11 hrs, Volume= 0.563 af, Depth= 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.11"

	Area (ac)	CN	Description
*	3.000	98	Impervious
	8.300	55	Woods, Good, HSG B
	11.300	66	Weighted Average
	8.300		73.45% Pervious Area
	3.000		26.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	2,000	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps

Summary for Subcatchment S-6.0: Southeast to Wetlands

Runoff = 1.92 cfs @ 11.90 hrs, Volume= 0.073 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.11"

	Area (ac)	CN	Description
*	0.400	98	Impervious
	0.600	55	Woods, Good, HSG B
	1.000	72	Weighted Average
	0.600		60.00% Pervious Area
	0.400		40.00% Impervious Area

Summary for Reach DP-1: Design Point 1

Inflow Area = 20.100 ac, 54.73% Impervious, Inflow Depth = 1.40" for 2-yr event
Inflow = 48.52 cfs @ 11.99 hrs, Volume= 2.343 af
Outflow = 48.52 cfs @ 11.99 hrs, Volume= 2.343 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: Design Point 2

Inflow Area = 43.700 ac, 39.82% Impervious, Inflow Depth > 0.69" for 2-yr event
Inflow = 4.32 cfs @ 12.83 hrs, Volume= 2.508 af
Outflow = 4.32 cfs @ 12.83 hrs, Volume= 2.508 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-3: Design Point 3

Inflow Area = 36.100 ac, 35.73% Impervious, Inflow Depth > 0.30" for 2-yr event
Inflow = 0.85 cfs @ 15.36 hrs, Volume= 0.889 af
Outflow = 0.85 cfs @ 15.36 hrs, Volume= 0.889 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-4: Design Point 4

Inflow Area = 6.100 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-5: Design Point 5

Inflow Area = 11.300 ac, 26.55% Impervious, Inflow Depth = 0.60" for 2-yr event
Inflow = 7.04 cfs @ 12.11 hrs, Volume= 0.563 af
Outflow = 7.04 cfs @ 12.11 hrs, Volume= 0.563 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-6: Design Point 6

Inflow Area = 1.000 ac, 40.00% Impervious, Inflow Depth = 0.87" for 2-yr event
Inflow = 1.92 cfs @ 11.90 hrs, Volume= 0.073 af
Outflow = 1.92 cfs @ 11.90 hrs, Volume= 0.073 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

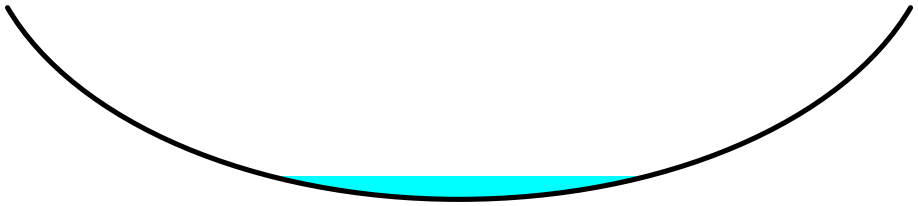
Summary for Reach SR-2: Wetland Finger (Subreach 2)

Inflow Area = 9.800 ac, 12.24% Impervious, Inflow Depth = 1.33" for 2-yr event
Inflow = 18.70 cfs @ 12.04 hrs, Volume= 1.089 af
Outflow = 18.12 cfs @ 12.07 hrs, Volume= 1.089 af, Atten= 3%, Lag= 1.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.14 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 1.70 fps, Avg. Travel Time= 6.7 min

Peak Storage= 2,406 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.61'
Bank-Full Depth= 5.00' Flow Area= 83.3 sf, Capacity= 1,655.51 cfs

25.00' x 5.00' deep Parabolic Channel, n= 0.030 Earth, grassed & winding
Length= 683.0' Slope= 0.0366 '/'
Inlet Invert= 95.00', Outlet Invert= 70.00'



Summary for Pond P-2: Pond 2

Inflow Area = 43.700 ac, 39.82% Impervious, Inflow Depth = 0.70" for 2-yr event
Inflow = 41.42 cfs @ 12.01 hrs, Volume= 2.551 af
Outflow = 4.32 cfs @ 12.83 hrs, Volume= 2.508 af, Atten= 90%, Lag= 48.8 min
Primary = 4.32 cfs @ 12.83 hrs, Volume= 2.508 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= 54.14' @ 12.83 hrs Surf.Area= 49,192 sf Storage= 42,882 cf

Plug-Flow detention time= 267.1 min calculated for 2.508 af (98% of inflow)
Center-of-Mass det. time= 258.0 min (1,138.0 - 880.0)

Volume	Invert	Avail.Storage	Storage Description
#1	53.25'	305,288 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
53.25	47,450	0	0
59.00	58,737	305,288	305,288

Device	Routing	Invert	Outlet Devices
#1	Primary	53.25'	**24.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	58.20'	**50.0' long x 30.0' 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=4.32 cfs @ 12.83 hrs HW=54.14' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 4.32 cfs @ 3.21 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=53.25' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P-3: Pond 3

Inflow Area = 14.800 ac, 67.57% Impervious, Inflow Depth = 1.15" for 2-yr event
Inflow = 30.38 cfs @ 11.98 hrs, Volume= 1.416 af
Outflow = 0.85 cfs @ 15.36 hrs, Volume= 0.883 af, Atten= 97%, Lag= 202.7 min
Primary = 0.85 cfs @ 15.36 hrs, Volume= 0.883 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 61.98' @ 15.36 hrs Surf.Area= 44,897 sf Storage= 38,349 cf

Plug-Flow detention time= 603.3 min calculated for 0.883 af (62% of inflow)
Center-of-Mass det. time= 481.2 min (1,331.8 - 850.6)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	185,617 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
61.10	42,699	0	0
65.00	52,489	185,617	185,617

Device	Routing	Invert	Outlet Devices
#1	Primary	61.60'	**24.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.85 cfs @ 15.36 hrs HW=61.98' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 0.85 cfs @ 2.09 fps)

Summary for Subcatchment S-1.0: Bldg 1 and Surrounding Area

Runoff = 99.29 cfs @ 11.98 hrs, Volume= 4.867 af, Depth= 2.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.91"

	Area (ac)	CN	Description
*	11.000	98	Impervious
	9.100	61	>75% Grass cover, Good, HSG B
	20.100	81	Weighted Average
	9.100		45.27% Pervious Area
	11.000		54.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0400	1.56		**Sheet Flow, Overland - Road** Smooth surfaces n= 0.011 P2= 3.11"
0.8	190	0.0400	4.06		**Shallow Concentrated Flow, Overland - Road** Paved Kv= 20.3 fps
3.4	918	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
2.3	1,000	0.0100	7.20	22.62	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Corrugated PE, smooth interior
7.0	2,158	Total			

Summary for Subcatchment S-2.0: Wetlands btwn Bldgs 1 and 2

Runoff = 39.49 cfs @ 12.04 hrs, Volume= 2.298 af, Depth= 2.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.91"

	Area (ac)	CN	Description
*	1.200	98	Impervious
	8.600	77	Woods, Good, HSG D
	9.800	80	Weighted Average
	8.600		87.76% Pervious Area
	1.200		12.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0700	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.11"
4.4	350	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.0	400	Total			

Summary for Subcatchment S-2.1: Bldgs 2/3 and Surrounding Area

Runoff = 88.63 cfs @ 11.99 hrs, Volume= 4.301 af, Depth= 1.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.91"

	Area (ac)	CN	Description
*	15.100	98	Impervious
	17.700	32	Woods/grass comb., Good, HSG A
	1.100	98	Water Surface
	33.900	64	Weighted Average
	17.700		52.21% Pervious Area
	16.200		47.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0300	1.39		**Sheet Flow, Overland - Road** Smooth surfaces n= 0.011 P2= 3.11"
1.8	390	0.0300	3.52		**Shallow Concentrated Flow, Overland - Road** Paved Kv= 20.3 fps
4.3	1,167	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
6.7	1,607	Total			

Summary for Subcatchment S-3.0: Bldg 4 and Surrounding Area

Runoff = 67.23 cfs @ 11.97 hrs, Volume= 3.142 af, Depth= 2.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.91"

	Area (ac)	CN	Description
*	9.000	98	Impervious
	4.800	32	Woods/grass comb., Good, HSG A
	1.000	98	Water Surface
	14.800	77	Weighted Average
	4.800		32.43% Pervious Area
	10.000		67.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0400	1.56		**Sheet Flow, Overland - Road** Smooth surfaces n= 0.011 P2= 3.11"
1.9	470	0.0400	4.06		**Shallow Concentrated Flow, Overland - Road** Paved Kv= 20.3 fps
3.1	1,100	0.0100	5.94	10.50	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
5.5	1,620	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S-3.1: Northeast Undeveloped Area

Runoff = 1.20 cfs @ 12.26 hrs, Volume= 0.446 af, Depth= 0.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.91"

	Area (ac)	CN	Description
*	1.900	98	Impervious
	18.400	32	Woods/grass comb., Good, HSG A
	1.000	98	Water Surface
	21.300	41	Weighted Average
	18.400		86.38% Pervious Area
	2.900		13.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	50	0.0040	0.08		**Sheet Flow, Overland - Field** Grass: Short n= 0.150 P2= 3.11"
6.2	370	0.0200	0.99		**Shallow Concentrated Flow, Overland - Field** Short Grass Pasture Kv= 7.0 fps
17.1	420	Total			

Summary for Subcatchment S-4.0: Overland direct to river

Runoff = 0.02 cfs @ 24.03 hrs, Volume= 0.010 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.91"

Area (ac)	CN	Description
6.100	32	Woods/grass comb., Good, HSG A
6.100		100.00% Pervious Area

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

Summary for Subcatchment S-5.0: Southwest to Wetlands

Runoff = 23.10 cfs @ 12.09 hrs, Volume= 1.569 af, Depth= 1.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.91"

	Area (ac)	CN	Description
*	3.000	98	Impervious
	8.300	55	Woods, Good, HSG B
	11.300	66	Weighted Average
	8.300		73.45% Pervious Area
	3.000		26.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	2,000	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps

Summary for Subcatchment S-6.0: Southeast to Wetlands

Runoff = 4.71 cfs @ 11.90 hrs, Volume= 0.177 af, Depth= 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.91"

	Area (ac)	CN	Description
*	0.400	98	Impervious
	0.600	55	Woods, Good, HSG B
	1.000	72	Weighted Average
	0.600		60.00% Pervious Area
	0.400		40.00% Impervious Area

Summary for Reach DP-1: Design Point 1

Inflow Area = 20.100 ac, 54.73% Impervious, Inflow Depth = 2.91" for 10-yr event
Inflow = 99.29 cfs @ 11.98 hrs, Volume= 4.867 af
Outflow = 99.29 cfs @ 11.98 hrs, Volume= 4.867 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: Design Point 2

Inflow Area = 43.700 ac, 39.82% Impervious, Inflow Depth > 1.80" for 10-yr event
Inflow = 17.45 cfs @ 12.43 hrs, Volume= 6.555 af
Outflow = 17.45 cfs @ 12.43 hrs, Volume= 6.555 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-3: Design Point 3

Inflow Area = 36.100 ac, 35.73% Impervious, Inflow Depth > 1.02" for 10-yr event
Inflow = 7.05 cfs @ 12.45 hrs, Volume= 3.054 af
Outflow = 7.05 cfs @ 12.45 hrs, Volume= 3.054 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-4: Design Point 4

Inflow Area = 6.100 ac, 0.00% Impervious, Inflow Depth = 0.02" for 10-yr event
Inflow = 0.02 cfs @ 24.03 hrs, Volume= 0.010 af
Outflow = 0.02 cfs @ 24.03 hrs, Volume= 0.010 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-5: Design Point 5

Inflow Area = 11.300 ac, 26.55% Impervious, Inflow Depth = 1.67" for 10-yr event
Inflow = 23.10 cfs @ 12.09 hrs, Volume= 1.569 af
Outflow = 23.10 cfs @ 12.09 hrs, Volume= 1.569 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-6: Design Point 6

Inflow Area = 1.000 ac, 40.00% Impervious, Inflow Depth = 2.13" for 10-yr event
Inflow = 4.71 cfs @ 11.90 hrs, Volume= 0.177 af
Outflow = 4.71 cfs @ 11.90 hrs, Volume= 0.177 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

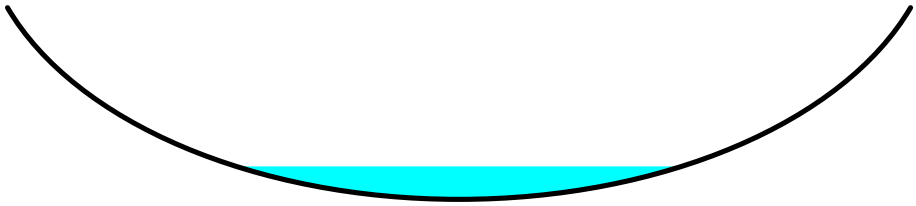
Summary for Reach SR-2: Wetland Finger (Subreach 2)

Inflow Area = 9.800 ac, 12.24% Impervious, Inflow Depth = 2.81" for 10-yr event
Inflow = 39.49 cfs @ 12.04 hrs, Volume= 2.298 af
Outflow = 38.71 cfs @ 12.06 hrs, Volume= 2.298 af, Atten= 2%, Lag= 1.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.48 fps, Min. Travel Time= 1.8 min
Avg. Velocity = 1.97 fps, Avg. Travel Time= 5.8 min

Peak Storage= 4,080 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.86'
Bank-Full Depth= 5.00' Flow Area= 83.3 sf, Capacity= 1,655.51 cfs

25.00' x 5.00' deep Parabolic Channel, n= 0.030 Earth, grassed & winding
Length= 683.0' Slope= 0.0366 '/'
Inlet Invert= 95.00', Outlet Invert= 70.00'



Summary for Pond P-2: Pond 2

Inflow Area = 43.700 ac, 39.82% Impervious, Inflow Depth = 1.81" for 10-yr event
Inflow = 120.84 cfs @ 12.00 hrs, Volume= 6.599 af
Outflow = 17.45 cfs @ 12.43 hrs, Volume= 6.555 af, Atten= 86%, Lag= 25.9 min
Primary = 17.45 cfs @ 12.43 hrs, Volume= 6.555 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= 55.58' @ 12.43 hrs Surf.Area= 52,024 sf Storage= 115,892 cf

Plug-Flow detention time= 168.0 min calculated for 6.555 af (99% of inflow)
Center-of-Mass det. time= 164.1 min (1,014.6 - 850.5)

Volume	Invert	Avail.Storage	Storage Description
#1	53.25'	305,288 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
53.25	47,450	0	0
59.00	58,737	305,288	305,288

Device	Routing	Invert	Outlet Devices
#1	Primary	53.25'	**24.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	58.20'	**50.0' long x 30.0' 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=17.45 cfs @ 12.43 hrs HW=55.58' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 17.45 cfs @ 5.55 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=53.25' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P-3: Pond 3

Inflow Area = 14.800 ac, 67.57% Impervious, Inflow Depth = 2.55" for 10-yr event
Inflow = 67.23 cfs @ 11.97 hrs, Volume= 3.142 af
Outflow = 5.89 cfs @ 12.50 hrs, Volume= 2.608 af, Atten= 91%, Lag= 31.7 min
Primary = 5.89 cfs @ 12.50 hrs, Volume= 2.608 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 62.66' @ 12.50 hrs Surf.Area= 46,606 sf Storage= 69,500 cf

Plug-Flow detention time= 331.5 min calculated for 2.608 af (83% of inflow)
Center-of-Mass det. time= 256.3 min (1,083.7 - 827.4)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	185,617 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
61.10	42,699	0	0
65.00	52,489	185,617	185,617

Device	Routing	Invert	Outlet Devices
#1	Primary	61.60'	**24.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=5.89 cfs @ 12.50 hrs HW=62.66' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 5.89 cfs @ 3.50 fps)

Summary for Subcatchment S-1.0: Bldg 1 and Surrounding Area

Runoff = 131.99 cfs @ 11.98 hrs, Volume= 6.551 af, Depth= 3.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.03"

	Area (ac)	CN	Description
*	11.000	98	Impervious
	9.100	61	>75% Grass cover, Good, HSG B
	20.100	81	Weighted Average
	9.100		45.27% Pervious Area
	11.000		54.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0400	1.56		**Sheet Flow, Overland - Road** Smooth surfaces n= 0.011 P2= 3.11"
0.8	190	0.0400	4.06		**Shallow Concentrated Flow, Overland - Road** Paved Kv= 20.3 fps
3.4	918	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
2.3	1,000	0.0100	7.20	22.62	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Corrugated PE, smooth interior
7.0	2,158	Total			

Summary for Subcatchment S-2.0: Wetlands btwn Bldgs 1 and 2

Runoff = 53.02 cfs @ 12.04 hrs, Volume= 3.110 af, Depth= 3.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.03"

	Area (ac)	CN	Description
*	1.200	98	Impervious
	8.600	77	Woods, Good, HSG D
	9.800	80	Weighted Average
	8.600		87.76% Pervious Area
	1.200		12.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0700	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.11"
4.4	350	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.0	400	Total			

Summary for Subcatchment S-2.1: Bldgs 2/3 and Surrounding Area

Runoff = 134.89 cfs @ 11.99 hrs, Volume= 6.455 af, Depth= 2.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.03"

	Area (ac)	CN	Description
*	15.100	98	Impervious
	17.700	32	Woods/grass comb., Good, HSG A
	1.100	98	Water Surface
	33.900	64	Weighted Average
	17.700		52.21% Pervious Area
	16.200		47.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0300	1.39		**Sheet Flow, Overland - Road** Smooth surfaces n= 0.011 P2= 3.11"
1.8	390	0.0300	3.52		**Shallow Concentrated Flow, Overland - Road** Paved Kv= 20.3 fps
4.3	1,167	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
6.7	1,607	Total			

Summary for Subcatchment S-3.0: Bldg 4 and Surrounding Area

Runoff = 91.60 cfs @ 11.97 hrs, Volume= 4.323 af, Depth= 3.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.03"

	Area (ac)	CN	Description
*	9.000	98	Impervious
	4.800	32	Woods/grass comb., Good, HSG A
	1.000	98	Water Surface
	14.800	77	Weighted Average
	4.800		32.43% Pervious Area
	10.000		67.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0400	1.56		**Sheet Flow, Overland - Road** Smooth surfaces n= 0.011 P2= 3.11"
1.9	470	0.0400	4.06		**Shallow Concentrated Flow, Overland - Road** Paved Kv= 20.3 fps
3.1	1,100	0.0100	5.94	10.50	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
5.5	1,620	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S-3.1: Northeast Undeveloped Area

Runoff = 6.97 cfs @ 12.16 hrs, Volume= 1.005 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 II 24-hr 25-yr Rainfall=6.03"

	Area (ac)	CN	Description
*	1.900	98	Impervious
	18.400	32	Woods/grass comb., Good, HSG A
	1.000	98	Water Surface
	21.300	41	Weighted Average
	18.400		86.38% Pervious Area
	2.900		13.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	50	0.0040	0.08		**Sheet Flow, Overland - Field** Grass: Short n= 0.150 P2= 3.11"
6.2	370	0.0200	0.99		**Shallow Concentrated Flow, Overland - Field** Short Grass Pasture Kv= 7.0 fps
17.1	420	Total			

Summary for Subcatchment S-4.0: Overland direct to river

Runoff = 0.09 cfs @ 13.80 hrs, Volume= 0.070 af, Depth= 0.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.03"

Area (ac)	CN	Description
6.100	32	Woods/grass comb., Good, HSG A
6.100		100.00% Pervious Area

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

Summary for Subcatchment S-5.0: Southwest to Wetlands

Runoff = 34.88 cfs @ 12.09 hrs, Volume= 2.319 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.03"

	Area (ac)	CN	Description
*	3.000	98	Impervious
	8.300	55	Woods, Good, HSG B
	11.300	66	Weighted Average
	8.300		73.45% Pervious Area
	3.000		26.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	2,000	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps

Summary for Subcatchment S-6.0: Southeast to Wetlands

Runoff = 6.61 cfs @ 11.90 hrs, Volume= 0.251 af, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.03"

	Area (ac)	CN	Description
*	0.400	98	Impervious
	0.600	55	Woods, Good, HSG B
	1.000	72	Weighted Average
	0.600		60.00% Pervious Area
	0.400		40.00% Impervious Area

Summary for Reach DP-1: Design Point 1

Inflow Area = 20.100 ac, 54.73% Impervious, Inflow Depth = 3.91" for 25-yr event
Inflow = 131.99 cfs @ 11.98 hrs, Volume= 6.551 af
Outflow = 131.99 cfs @ 11.98 hrs, Volume= 6.551 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: Design Point 2

Inflow Area = 43.700 ac, 39.82% Impervious, Inflow Depth > 2.61" for 25-yr event
Inflow = 23.88 cfs @ 12.44 hrs, Volume= 9.520 af
Outflow = 23.88 cfs @ 12.44 hrs, Volume= 9.520 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-3: Design Point 3

Inflow Area = 36.100 ac, 35.73% Impervious, Inflow Depth > 1.59" for 25-yr event
Inflow = 18.05 cfs @ 12.17 hrs, Volume= 4.794 af
Outflow = 18.05 cfs @ 12.17 hrs, Volume= 4.794 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-4: Design Point 4

Inflow Area = 6.100 ac, 0.00% Impervious, Inflow Depth = 0.14" for 25-yr event
Inflow = 0.09 cfs @ 13.80 hrs, Volume= 0.070 af
Outflow = 0.09 cfs @ 13.80 hrs, Volume= 0.070 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-5: Design Point 5

Inflow Area = 11.300 ac, 26.55% Impervious, Inflow Depth = 2.46" for 25-yr event
Inflow = 34.88 cfs @ 12.09 hrs, Volume= 2.319 af
Outflow = 34.88 cfs @ 12.09 hrs, Volume= 2.319 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-6: Design Point 6

Inflow Area = 1.000 ac, 40.00% Impervious, Inflow Depth = 3.02" for 25-yr event
Inflow = 6.61 cfs @ 11.90 hrs, Volume= 0.251 af
Outflow = 6.61 cfs @ 11.90 hrs, Volume= 0.251 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

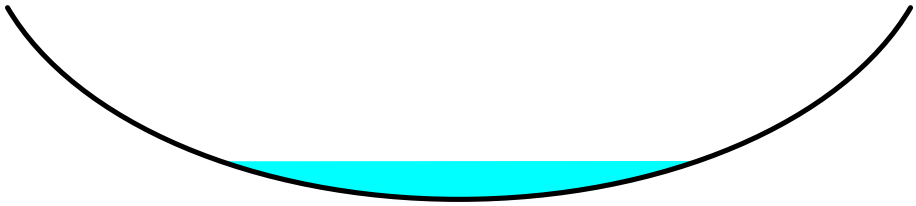
Summary for Reach SR-2: Wetland Finger (Subreach 2)

Inflow Area = 9.800 ac, 12.24% Impervious, Inflow Depth = 3.81" for 25-yr event
Inflow = 53.02 cfs @ 12.04 hrs, Volume= 3.110 af
Outflow = 52.14 cfs @ 12.05 hrs, Volume= 3.110 af, Atten= 2%, Lag= 1.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.09 fps, Min. Travel Time= 1.6 min
Avg. Velocity = 2.11 fps, Avg. Travel Time= 5.4 min

Peak Storage= 5,021 cf @ 12.05 hrs
Average Depth at Peak Storage= 0.99'
Bank-Full Depth= 5.00' Flow Area= 83.3 sf, Capacity= 1,655.51 cfs

25.00' x 5.00' deep Parabolic Channel, n= 0.030 Earth, grassed & winding
Length= 683.0' Slope= 0.0366 '/'
Inlet Invert= 95.00', Outlet Invert= 70.00'



Summary for Pond P-2: Pond 2

Inflow Area = 43.700 ac, 39.82% Impervious, Inflow Depth = 2.63" for 25-yr event
Inflow = 178.47 cfs @ 11.99 hrs, Volume= 9.565 af
Outflow = 23.88 cfs @ 12.44 hrs, Volume= 9.520 af, Atten= 87%, Lag= 26.4 min
Primary = 23.88 cfs @ 12.44 hrs, Volume= 9.520 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= 56.74' @ 12.44 hrs Surf.Area= 54,305 sf Storage= 177,685 cf

Plug-Flow detention time= 152.4 min calculated for 9.520 af (100% of inflow)
Center-of-Mass det. time= 149.5 min (989.5 - 839.9)

Volume	Invert	Avail.Storage	Storage Description
#1	53.25'	305,288 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
53.25	47,450	0	0
59.00	58,737	305,288	305,288

Device	Routing	Invert	Outlet Devices
#1	Primary	53.25'	**24.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	58.20'	**50.0' long x 30.0' 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=23.88 cfs @ 12.44 hrs HW=56.74' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 23.88 cfs @ 7.60 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=53.25' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P-3: Pond 3

Inflow Area = 14.800 ac, 67.57% Impervious, Inflow Depth = 3.51" for 25-yr event
Inflow = 91.60 cfs @ 11.97 hrs, Volume= 4.323 af
Outflow = 11.24 cfs @ 12.29 hrs, Volume= 3.789 af, Atten= 88%, Lag= 18.9 min
Primary = 11.24 cfs @ 12.29 hrs, Volume= 3.789 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 63.17' @ 12.29 hrs Surf.Area= 47,883 sf Storage= 93,538 cf

Plug-Flow detention time= 269.6 min calculated for 3.788 af (88% of inflow)
Center-of-Mass det. time= 209.9 min (1,028.2 - 818.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	185,617 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
61.10	42,699	0	0
65.00	52,489	185,617	185,617

Device	Routing	Invert	Outlet Devices
#1	Primary	61.60'	**24.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=11.24 cfs @ 12.29 hrs HW=63.17' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 11.24 cfs @ 4.26 fps)

Summary for Subcatchment S-1.0: Bldg 1 and Surrounding Area

Runoff = 182.83 cfs @ 11.98 hrs, Volume= 9.240 af, Depth= 5.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.76"

	Area (ac)	CN	Description
*	11.000	98	Impervious
	9.100	61	>75% Grass cover, Good, HSG B
	20.100	81	Weighted Average
	9.100		45.27% Pervious Area
	11.000		54.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0400	1.56		**Sheet Flow, Overland - Road** Smooth surfaces n= 0.011 P2= 3.11"
0.8	190	0.0400	4.06		**Shallow Concentrated Flow, Overland - Road** Paved Kv= 20.3 fps
3.4	918	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
2.3	1,000	0.0100	7.20	22.62	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Corrugated PE, smooth interior
7.0	2,158	Total			

Summary for Subcatchment S-2.0: Wetlands btwn Bldgs 1 and 2

Runoff = 74.16 cfs @ 12.04 hrs, Volume= 4.410 af, Depth= 5.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.76"

	Area (ac)	CN	Description
*	1.200	98	Impervious
	8.600	77	Woods, Good, HSG D
	9.800	80	Weighted Average
	8.600		87.76% Pervious Area
	1.200		12.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0700	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.11"
4.4	350	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.0	400	Total			

Summary for Subcatchment S-2.1: Bldgs 2/3 and Surrounding Area

Runoff = 212.47 cfs @ 11.98 hrs, Volume= 10.144 af, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.76"

	Area (ac)	CN	Description
*	15.100	98	Impervious
	17.700	32	Woods/grass comb., Good, HSG A
	1.100	98	Water Surface
	33.900	64	Weighted Average
	17.700		52.21% Pervious Area
	16.200		47.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0300	1.39		**Sheet Flow, Overland - Road** Smooth surfaces n= 0.011 P2= 3.11"
1.8	390	0.0300	3.52		**Shallow Concentrated Flow, Overland - Road** Paved Kv= 20.3 fps
4.3	1,167	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
6.7	1,607	Total			

Summary for Subcatchment S-3.0: Bldg 4 and Surrounding Area

Runoff = 129.99 cfs @ 11.97 hrs, Volume= 6.234 af, Depth= 5.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.76"

	Area (ac)	CN	Description
*	9.000	98	Impervious
	4.800	32	Woods/grass comb., Good, HSG A
	1.000	98	Water Surface
	14.800	77	Weighted Average
	4.800		32.43% Pervious Area
	10.000		67.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0400	1.56		**Sheet Flow, Overland - Road** Smooth surfaces n= 0.011 P2= 3.11"
1.9	470	0.0400	4.06		**Shallow Concentrated Flow, Overland - Road** Paved Kv= 20.3 fps
3.1	1,100	0.0100	5.94	10.50	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
5.5	1,620	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S-3.1: Northeast Undeveloped Area

Runoff = 23.56 cfs @ 12.13 hrs, Volume= 2.195 af, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.76"

	Area (ac)	CN	Description
*	1.900	98	Impervious
	18.400	32	Woods/grass comb., Good, HSG A
	1.000	98	Water Surface
	21.300	41	Weighted Average
	18.400		86.38% Pervious Area
	2.900		13.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	50	0.0040	0.08		**Sheet Flow, Overland - Field** Grass: Short n= 0.150 P2= 3.11"
6.2	370	0.0200	0.99		**Shallow Concentrated Flow, Overland - Field** Short Grass Pasture Kv= 7.0 fps
17.1	420	Total			

Summary for Subcatchment S-4.0: Overland direct to river

Runoff = 0.95 cfs @ 12.25 hrs, Volume= 0.253 af, Depth= 0.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.76"

Area (ac)	CN	Description
6.100	32	Woods/grass comb., Good, HSG A
6.100		100.00% Pervious Area

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

Summary for Subcatchment S-5.0: Southwest to Wetlands

Runoff = 54.51 cfs @ 12.08 hrs, Volume= 3.589 af, Depth= 3.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.76"

	Area (ac)	CN	Description
*	3.000	98	Impervious
	8.300	55	Woods, Good, HSG B
	11.300	66	Weighted Average
	8.300		73.45% Pervious Area
	3.000		26.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	2,000	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps

Summary for Subcatchment S-6.0: Southeast to Wetlands

Runoff = 9.65 cfs @ 11.90 hrs, Volume= 0.374 af, Depth= 4.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.76"

	Area (ac)	CN	Description
*	0.400	98	Impervious
	0.600	55	Woods, Good, HSG B
	1.000	72	Weighted Average
	0.600		60.00% Pervious Area
	0.400		40.00% Impervious Area

Summary for Reach DP-1: Design Point 1

Inflow Area = 20.100 ac, 54.73% Impervious, Inflow Depth = 5.52" for 100-yr event
Inflow = 182.83 cfs @ 11.98 hrs, Volume= 9.240 af
Outflow = 182.83 cfs @ 11.98 hrs, Volume= 9.240 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: Design Point 2

Inflow Area = 43.700 ac, 39.82% Impervious, Inflow Depth > 3.98" for 100-yr event
Inflow = 51.05 cfs @ 12.28 hrs, Volume= 14.509 af
Outflow = 51.05 cfs @ 12.28 hrs, Volume= 14.509 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-3: Design Point 3

Inflow Area = 36.100 ac, 35.73% Impervious, Inflow Depth > 2.62" for 100-yr event
Inflow = 41.56 cfs @ 12.14 hrs, Volume= 7.894 af
Outflow = 41.56 cfs @ 12.14 hrs, Volume= 7.894 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-4: Design Point 4

Inflow Area = 6.100 ac, 0.00% Impervious, Inflow Depth = 0.50" for 100-yr event
Inflow = 0.95 cfs @ 12.25 hrs, Volume= 0.253 af
Outflow = 0.95 cfs @ 12.25 hrs, Volume= 0.253 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-5: Design Point 5

Inflow Area = 11.300 ac, 26.55% Impervious, Inflow Depth = 3.81" for 100-yr event
Inflow = 54.51 cfs @ 12.08 hrs, Volume= 3.589 af
Outflow = 54.51 cfs @ 12.08 hrs, Volume= 3.589 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-6: Design Point 6

Inflow Area = 1.000 ac, 40.00% Impervious, Inflow Depth = 4.48" for 100-yr event
Inflow = 9.65 cfs @ 11.90 hrs, Volume= 0.374 af
Outflow = 9.65 cfs @ 11.90 hrs, Volume= 0.374 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

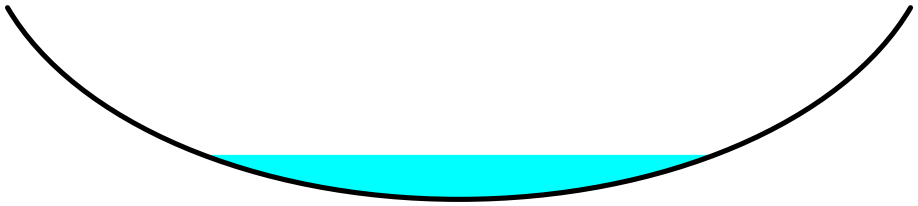
Summary for Reach SR-2: Wetland Finger (Subreach 2)

Inflow Area = 9.800 ac, 12.24% Impervious, Inflow Depth = 5.40" for 100-yr event
Inflow = 74.16 cfs @ 12.04 hrs, Volume= 4.410 af
Outflow = 73.18 cfs @ 12.05 hrs, Volume= 4.410 af, Atten= 1%, Lag= 0.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.86 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 2.28 fps, Avg. Travel Time= 5.0 min

Peak Storage= 6,360 cf @ 12.05 hrs
Average Depth at Peak Storage= 1.16'
Bank-Full Depth= 5.00' Flow Area= 83.3 sf, Capacity= 1,655.51 cfs

25.00' x 5.00' deep Parabolic Channel, n= 0.030 Earth, grassed & winding
Length= 683.0' Slope= 0.0366 '/'
Inlet Invert= 95.00', Outlet Invert= 70.00'



Summary for Pond P-2: Pond 2

Inflow Area = 43.700 ac, 39.82% Impervious, Inflow Depth = 4.00" for 100-yr event
Inflow = 273.99 cfs @ 11.99 hrs, Volume= 14.554 af
Outflow = 51.05 cfs @ 12.28 hrs, Volume= 14.509 af, Atten= 81%, Lag= 17.0 min
Primary = 31.11 cfs @ 12.28 hrs, Volume= 13.975 af
Secondary = 19.94 cfs @ 12.28 hrs, Volume= 0.534 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 58.48' @ 12.28 hrs Surf.Area= 57,717 sf Storage= 275,025 cf

Plug-Flow detention time= 142.3 min calculated for 14.507 af (100% of inflow)
Center-of-Mass det. time= 140.7 min (969.0 - 828.3)

Volume	Invert	Avail.Storage	Storage Description
#1	53.25'	305,288 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
53.25	47,450	0	0
59.00	58,737	305,288	305,288

Device	Routing	Invert	Outlet Devices
#1	Primary	53.25'	**24.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	58.20'	**50.0' long x 30.0' 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=31.11 cfs @ 12.28 hrs HW=58.48' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 31.11 cfs @ 9.90 fps)

Secondary OutFlow Max=19.93 cfs @ 12.28 hrs HW=58.48' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 19.93 cfs @ 1.42 fps)

Summary for Pond P-3: Pond 3

Inflow Area = 14.800 ac, 67.57% Impervious, Inflow Depth = 5.05" for 100-yr event
Inflow = 129.99 cfs @ 11.97 hrs, Volume= 6.234 af
Outflow = 18.08 cfs @ 12.21 hrs, Volume= 5.699 af, Atten= 86%, Lag= 14.5 min
Primary = 18.08 cfs @ 12.21 hrs, Volume= 5.699 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 64.03' @ 12.21 hrs Surf.Area= 50,051 sf Storage= 135,822 cf

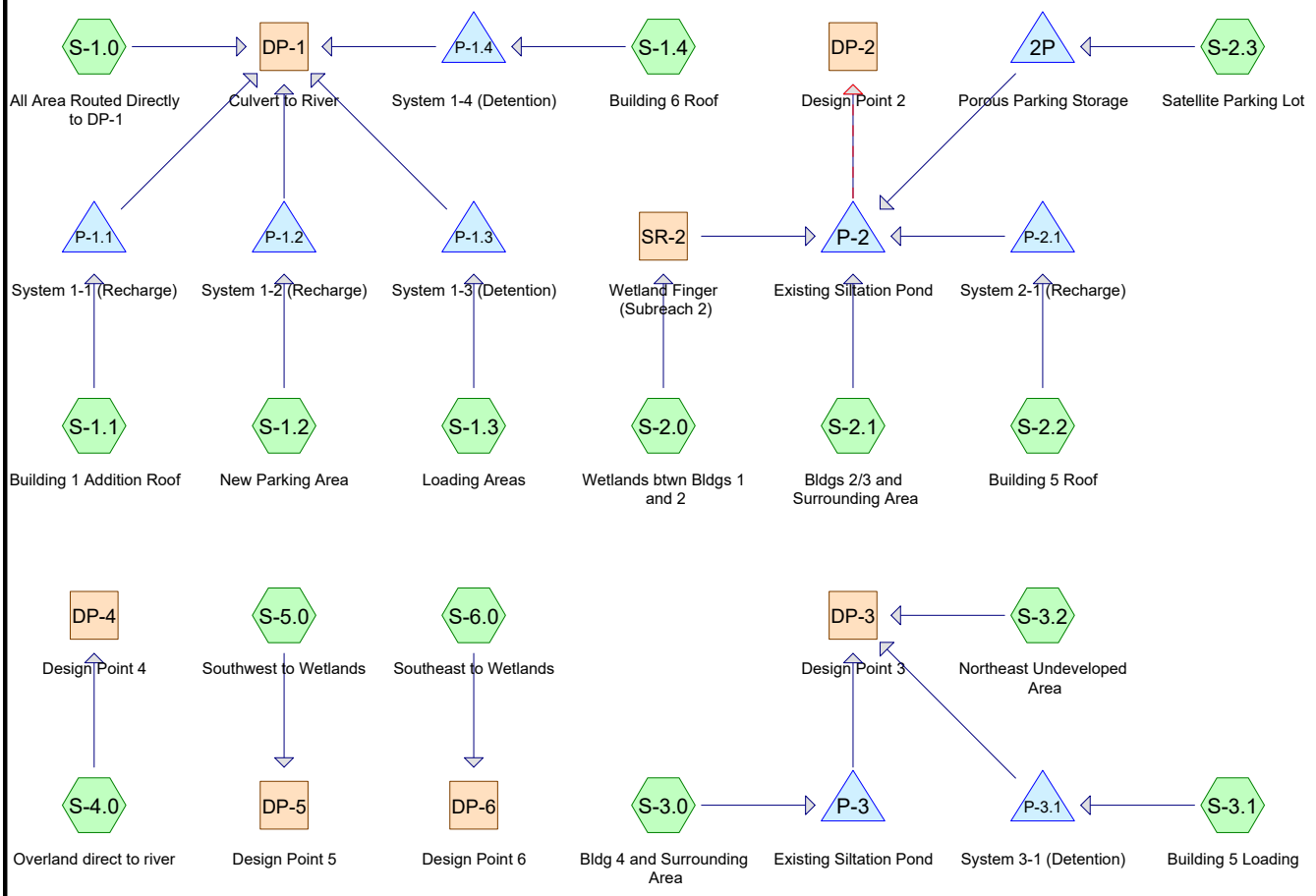
Plug-Flow detention time= 221.9 min calculated for 5.699 af (91% of inflow)
Center-of-Mass det. time= 176.6 min (984.5 - 807.9)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	185,617 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
61.10	42,699	0	0
65.00	52,489	185,617	185,617

Device	Routing	Invert	Outlet Devices
#1	Primary	61.60'	**24.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=18.08 cfs @ 12.21 hrs HW=64.03' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 18.08 cfs @ 5.76 fps)



Subcat Reach Pond Link

Routing Diagram for Proposed HydroCAD_r1
Prepared by IO, Printed 7/29/2022
HydroCAD® 10.00-20 s/n 00853 © 2017 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.400	39	>75% Grass cover, Good, HSG A (S-2.3)
6.800	61	>75% Grass cover, Good, HSG B (S-1.0, S-1.2, S-1.3)
45.400	98	Impervious (S-1.0, S-1.1, S-1.2, S-1.3, S-1.4, S-2.0, S-2.1, S-2.2, S-3.0, S-3.1, S-3.2, S-5.0, S-6.0)
5.700	98	Porous Pavement Parking (S-2.3)
1.800	50	Porous Plaza/Walkway (S-1.0, S-1.2, S-1.3, S-2.1, S-3.1)
3.100	98	Water Surface (S-2.1, S-3.0, S-3.2)
14.000	30	Woods, Good, HSG A (S-3.2)
8.900	55	Woods, Good, HSG B (S-5.0, S-6.0)
8.400	77	Woods, Good, HSG D (S-2.0)
23.800	32	Woods/grass comb., Good, HSG A (S-2.1, S-3.0, S-3.1, S-4.0)
118.300	**69**	**TOTAL AREA**

Summary for Subcatchment S-1.0: All Area Routed Directly to DP-1

Runoff = 30.44 cfs @ 11.99 hrs, Volume= 1.471 af, Depth= 1.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.11"

	Area (ac)	CN	Description
*	7.100	98	Impervious
	5.800	61	>75% Grass cover, Good, HSG B
*	1.000	50	Porous Plaza/Walkway
	13.900	79	Weighted Average
	6.800		48.92% Pervious Area
	7.100		51.08% Impervious Area

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

Summary for Subcatchment S-1.1: Building 1 Addition Roof

Runoff = 7.47 cfs @ 11.97 hrs, Volume= 0.408 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.11"

	Area (ac)	CN	Description
*	1.700	98	Impervious
	1.700		100.00% Impervious Area

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

Summary for Subcatchment S-1.2: New Parking Area

Runoff = 6.70 cfs @ 11.97 hrs, Volume= 0.326 af, Depth= 2.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.11"

	Area (ac)	CN	Description
*	1.500	98	Impervious
	0.200	61	>75% Grass cover, Good, HSG B
*	0.100	50	Porous Plaza/Walkway
	1.800	91	Weighted Average
	0.300		16.67% Pervious Area
	1.500		83.33% Impervious Area

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

Summary for Subcatchment S-1.3: Loading Areas

Runoff = 8.93 cfs @ 11.98 hrs, Volume= 0.434 af, Depth= 1.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.11"

	Area (ac)	CN	Description
*	2.100	98	Impervious
	0.800	61	>75% Grass cover, Good, HSG B
*	0.200	50	Porous Plaza/Walkway
	3.100	85	Weighted Average
	1.000		32.26% Pervious Area
	2.100		67.74% Impervious Area

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

Summary for Subcatchment S-1.4: Building 6 Roof

Runoff = 10.10 cfs @ 11.97 hrs, Volume= 0.552 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.11"

	Area (ac)	CN	Description
*	2.300	98	Impervious
	2.300		100.00% Impervious Area

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

Summary for Subcatchment S-2.0: Wetlands btwn Bldgs 1 and 2

Runoff = 18.90 cfs @ 12.04 hrs, Volume= 1.100 af, Depth= 1.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.11"

	Area (ac)	CN	Description
*	1.500	98	Impervious
	8.400	77	Woods, Good, HSG D
	9.900	80	Weighted Average
	8.400		84.85% Pervious Area
	1.500		15.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0700	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.11"
4.4	350	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.0	400	Total			

Summary for Subcatchment S-2.1: Bldgs 2/3 and Surrounding Area

Runoff = 23.97 cfs @ 12.00 hrs, Volume= 1.276 af, Depth= 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.11"

	Area (ac)	CN	Description
*	11.900	98	Impervious
	12.200	32	Woods/grass comb., Good, HSG A
	1.100	98	Water Surface
*	0.400	50	Porous Plaza/Walkway
	25.600	66	Weighted Average
	12.600		49.22% Pervious Area
	13.000		50.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0300	1.39		**Sheet Flow, Overland - Road** Smooth surfaces n= 0.011 P2= 3.11"
1.8	390	0.0300	3.52		**Shallow Concentrated Flow, Overland - Road** Paved Kv= 20.3 fps
4.3	1,167	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
6.7	1,607	Total			

Summary for Subcatchment S-2.2: Building 5 Roof

Runoff = 12.03 cfs @ 11.90 hrs, Volume= 0.552 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.11"

	Area (ac)	CN	Description
*	2.300	98	Impervious
	2.300		100.00% Impervious Area

Summary for Subcatchment S-2.3: Satellite Parking Lot

Runoff = 29.71 cfs @ 11.90 hrs, Volume= 1.249 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.11"

	Area (ac)	CN	Description
*	5.700	98	Porous Pavement Parking
	0.400	39	>75% Grass cover, Good, HSG A
	6.100	94	Weighted Average
	0.400		6.56% Pervious Area
	5.700		93.44% Impervious Area

Summary for Subcatchment S-3.0: Bldg 4 and Surrounding Area

Runoff = 28.77 cfs @ 11.98 hrs, Volume= 1.344 af, Depth= 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.11"

	Area (ac)	CN	Description
*	8.900	98	Impervious
	4.900	32	Woods/grass comb., Good, HSG A
	1.000	98	Water Surface
	14.800	76	Weighted Average
	4.900		33.11% Pervious Area
	9.900		66.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0400	1.56		**Sheet Flow, Overland - Road** Smooth surfaces n= 0.011 P2= 3.11"
1.9	470	0.0400	4.06		**Shallow Concentrated Flow, Overland - Road** Paved Kv= 20.3 fps
3.1	1,100	0.0100	5.94	10.50	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
5.5	1,620	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S-3.1: Building 5 Loading

Runoff = 2.16 cfs @ 11.90 hrs, Volume= 0.091 af, Depth= 0.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.11"

	Area (ac)	CN	Description
*	1.000	98	Impervious
	1.000	32	Woods/grass comb., Good, HSG A
*	0.100	50	Porous Plaza/Walkway
	2.100	64	Weighted Average
	1.100		52.38% Pervious Area
	1.000		47.62% Impervious Area

Summary for Subcatchment S-3.2: Northeast Undeveloped Area

Runoff = 0.02 cfs @ 24.03 hrs, Volume= 0.005 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.11"

	Area (ac)	CN	Description
*	1.800	98	Impervious
	14.000	30	Woods, Good, HSG A
	1.000	98	Water Surface
	16.800	41	Weighted Average
	14.000		83.33% Pervious Area
	2.800		16.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	50	0.0040	0.08		**Sheet Flow, Overland - Field** Grass: Short n= 0.150 P2= 3.11"
6.2	370	0.0200	0.99		**Shallow Concentrated Flow, Overland - Field** Short Grass Pasture Kv= 7.0 fps
17.1	420	Total			

Summary for Subcatchment S-4.0: Overland direct to river

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.11"

Area (ac)	CN	Description
5.700	32	Woods/grass comb., Good, HSG A
5.700		100.00% Pervious Area

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

Summary for Subcatchment S-5.0: Southwest to Wetlands

Runoff = 7.04 cfs @ 12.11 hrs, Volume= 0.563 af, Depth= 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.11"

	Area (ac)	CN	Description
*	3.000	98	Impervious
	8.300	55	Woods, Good, HSG B
	11.300	66	Weighted Average
	8.300		73.45% Pervious Area
	3.000		26.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	2,000	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps

Summary for Subcatchment S-6.0: Southeast to Wetlands

Runoff = 1.41 cfs @ 11.90 hrs, Volume= 0.055 af, Depth= 0.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.11"

	Area (ac)	CN	Description
*	0.300	98	Impervious
	0.600	55	Woods, Good, HSG B
	0.900	69	Weighted Average
	0.600		66.67% Pervious Area
	0.300		33.33% Impervious Area

Summary for Reach DP-1: Culvert to River

Inflow Area = 22.800 ac, 64.47% Impervious, Inflow Depth = 1.38" for 2-yr event
Inflow = 42.49 cfs @ 12.00 hrs, Volume= 2.626 af
Outflow = 42.49 cfs @ 12.00 hrs, Volume= 2.626 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: Design Point 2

Inflow Area = 43.900 ac, 51.25% Impervious, Inflow Depth > 0.66" for 2-yr event
Inflow = 4.27 cfs @ 12.85 hrs, Volume= 2.399 af
Outflow = 4.27 cfs @ 12.85 hrs, Volume= 2.399 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-3: Design Point 3

Inflow Area = 33.700 ac, 40.65% Impervious, Inflow Depth > 0.32" for 2-yr event
Inflow = 0.83 cfs @ 15.48 hrs, Volume= 0.891 af
Outflow = 0.83 cfs @ 15.48 hrs, Volume= 0.891 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-4: Design Point 4

Inflow Area = 5.700 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-5: Design Point 5

Inflow Area = 11.300 ac, 26.55% Impervious, Inflow Depth = 0.60" for 2-yr event
Inflow = 7.04 cfs @ 12.11 hrs, Volume= 0.563 af
Outflow = 7.04 cfs @ 12.11 hrs, Volume= 0.563 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-6: Design Point 6

Inflow Area = 0.900 ac, 33.33% Impervious, Inflow Depth = 0.73" for 2-yr event
Inflow = 1.41 cfs @ 11.90 hrs, Volume= 0.055 af
Outflow = 1.41 cfs @ 11.90 hrs, Volume= 0.055 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

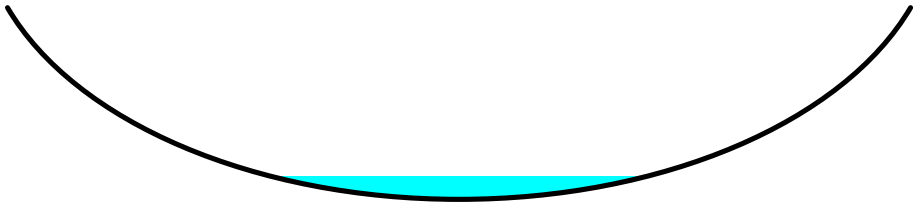
Summary for Reach SR-2: Wetland Finger (Subreach 2)

Inflow Area = 9.900 ac, 15.15% Impervious, Inflow Depth = 1.33" for 2-yr event
Inflow = 18.90 cfs @ 12.04 hrs, Volume= 1.100 af
Outflow = 18.31 cfs @ 12.07 hrs, Volume= 1.100 af, Atten= 3%, Lag= 1.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.16 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 1.70 fps, Avg. Travel Time= 6.7 min

Peak Storage= 2,424 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.61'
Bank-Full Depth= 5.00' Flow Area= 83.3 sf, Capacity= 1,655.51 cfs

25.00' x 5.00' deep Parabolic Channel, n= 0.030 Earth, grassed & winding
Length= 683.0' Slope= 0.0366 '/'
Inlet Invert= 95.00', Outlet Invert= 70.00'



Summary for Pond 2P: Porous Parking Storage

Inflow Area = 6.100 ac, 93.44% Impervious, Inflow Depth = 2.46" for 2-yr event
Inflow = 29.71 cfs @ 11.90 hrs, Volume= 1.249 af
Outflow = 5.86 cfs @ 11.74 hrs, Volume= 1.250 af, Atten= 80%, Lag= 0.0 min
Discarded = 5.86 cfs @ 11.74 hrs, Volume= 1.250 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= 62.68' @ 11.99 hrs Surf.Area= 5.700 ac Storage= 0.309 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 10.2 min (789.4 - 779.2)

Volume	Invert	Avail.Storage	Storage Description
#1	62.50'	2.562 af	**Custom Stage Data (Prismatic)** Listed below (Recalc) 8.550 af Overall - 0.010 af Embedded = 8.540 af x 30.0% Voids
#2	63.00'	0.010 af	**4.0" Round Pipe Storage** Inside #1 L= 5,000.0'
		2.572 af	Total Available Storage

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
62.50	5.700	0.000	0.000
64.00	5.700	8.550	8.550

Device	Routing	Invert	Outlet Devices
#1	Discarded	62.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	63.00'	**4.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=5.86 cfs @ 11.74 hrs HW=62.52' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 5.86 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=62.50' TW=53.25' (Dynamic Tailwater)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond P-1.1: System 1-1 (Recharge)

Inflow Area = 1.700 ac,100.00% Impervious, Inflow Depth = 2.88" for 2-yr event
Inflow = 7.47 cfs @ 11.97 hrs, Volume= 0.408 af
Outflow = 0.44 cfs @ 12.67 hrs, Volume= 0.408 af, Atten= 94%, Lag= 42.3 min
Discarded = 0.19 cfs @ 10.78 hrs, Volume= 0.371 af
Primary = 0.25 cfs @ 12.67 hrs, Volume= 0.037 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 71.80' @ 12.67 hrs Surf.Area= 8,250 sf Storage= 8,339 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 309.6 min (1,062.7 - 753.1)

Volume	Invert	Avail.Storage	Storage Description
#1	70.00'	7,468 cf	**50.00'W x 165.00'L x 4.00'H Prismatoid** 33,000 cf Overall - 11,663 cf Embedded = 21,337 cf x 35.0% Voids
#2	70.50'	11,663 cf	**36.0" Round Pipe Storage (10 rows by 165lf)** Inside #1 L= 1,650.0'
		19,131 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	71.60'	**24.0" Vert. Orifice/Grate** C= 0.600
#2	Discarded	70.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.19 cfs @ 10.78 hrs HW=70.04' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.25 cfs @ 12.67 hrs HW=71.80' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 0.25 cfs @ 1.52 fps)

Summary for Pond P-1.2: System 1-2 (Recharge)

Inflow Area = 1.800 ac, 83.33% Impervious, Inflow Depth = 2.17" for 2-yr event
Inflow = 6.70 cfs @ 11.97 hrs, Volume= 0.326 af
Outflow = 4.29 cfs @ 12.04 hrs, Volume= 0.326 af, Atten= 36%, Lag= 4.3 min
Discarded = 0.08 cfs @ 10.26 hrs, Volume= 0.165 af
Primary = 4.21 cfs @ 12.04 hrs, Volume= 0.162 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 68.98' @ 12.04 hrs Surf.Area= 3,250 sf Storage= 4,901 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 215.0 min (1,015.4 - 800.4)

Volume	Invert	Avail.Storage	Storage Description
#1	66.50'	2,942 cf	**50.00'W x 65.00'L x 4.00'H Prismatoid** 13,000 cf Overall - 4,595 cf Embedded = 8,405 cf x 35.0% Voids
#2	67.00'	4,595 cf	**36.0" Round Pipe Storage (10 rows by 65lf)** Inside #1 L= 650.0'
		7,536 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	68.10'	**24.0" Vert. Orifice/Grate** C= 0.600
#2	Discarded	66.50'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.08 cfs @ 10.26 hrs HW=66.54' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=4.21 cfs @ 12.04 hrs HW=68.97' TW=0.00' (Dynamic Tailwater)
└**1=Orifice/Grate** (Orifice Controls 4.21 cfs @ 3.18 fps)

Summary for Pond P-1.3: System 1-3 (Detention)

Inflow Area = 3.100 ac, 67.74% Impervious, Inflow Depth = 1.68" for 2-yr event
Inflow = 8.93 cfs @ 11.98 hrs, Volume= 0.434 af
Outflow = 3.66 cfs @ 12.09 hrs, Volume= 0.434 af, Atten= 59%, Lag= 6.6 min
Primary = 3.66 cfs @ 12.09 hrs, Volume= 0.434 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 68.44' @ 12.09 hrs Surf.Area= 5,500 sf Storage= 5,413 cf

Plug-Flow detention time= 37.8 min calculated for 0.434 af (100% of inflow)
Center-of-Mass det. time= 37.9 min (863.1 - 825.2)

Volume	Invert	Avail.Storage	Storage Description
#1	67.00'	4,264 cf	**100.00'W x 55.00'L x 4.50'H Prismatoid** 24,750 cf Overall - 12,566 cf Embedded = 12,184 cf x 35.0% Voids
#2	67.00'	12,566 cf	**48.0" Round Pipe Storage (10 rows x 100lf)** Inside #1 L= 1,000.0'
		16,831 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	67.00'	**12.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	70.00'	**3.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=3.66 cfs @ 12.09 hrs HW=68.44' TW=0.00' (Dynamic Tailwater)
├**1=Orifice/Grate** (Orifice Controls 3.66 cfs @ 4.66 fps)
└**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P-1.4: System 1-4 (Detention)

Inflow Area = 2.300 ac,100.00% Impervious, Inflow Depth = 2.88" for 2-yr event
Inflow = 10.10 cfs @ 11.97 hrs, Volume= 0.552 af
Outflow = 6.01 cfs @ 12.04 hrs, Volume= 0.522 af, Atten= 41%, Lag= 4.6 min
Primary = 6.01 cfs @ 12.04 hrs, Volume= 0.522 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 71.75' @ 12.04 hrs Surf.Area= 7,200 sf Storage= 7,037 cf

Plug-Flow detention time= 94.6 min calculated for 0.522 af (95% of inflow)
Center-of-Mass det. time= 63.4 min (816.5 - 753.1)

Volume	Invert	Avail.Storage	Storage Description
#1	70.00'	6,517 cf	**60.00'W x 120.00'L x 4.00'H Prismatoid** 28,800 cf Overall - 10,179 cf Embedded = 18,621 cf x 35.0% Voids
#2	70.50'	10,179 cf	**36.0" Round Pipe Storage (12 rows by 120lf)** Inside #1 L= 1,440.0'
		16,696 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	70.50'	**18.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=6.01 cfs @ 12.04 hrs HW=71.75' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 6.01 cfs @ 3.81 fps)

Summary for Pond P-2: Existing Siltation Pond

Inflow Area = 43.900 ac, 51.25% Impervious, Inflow Depth = 0.67" for 2-yr event
Inflow = 39.49 cfs @ 12.01 hrs, Volume= 2.442 af
Outflow = 4.27 cfs @ 12.85 hrs, Volume= 2.399 af, Atten= 89%, Lag= 50.4 min
Primary = 4.27 cfs @ 12.85 hrs, Volume= 2.399 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= 54.13' @ 12.85 hrs Surf.Area= 49,182 sf Storage= 42,632 cf

Plug-Flow detention time= 271.6 min calculated for 2.399 af (98% of inflow)
Center-of-Mass det. time= 262.0 min (1,132.8 - 870.7)

Volume	Invert	Avail.Storage	Storage Description
#1	53.25'	305,288 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
53.25	47,450	0	0
59.00	58,737	305,288	305,288

Device	Routing	Invert	Outlet Devices
#1	Primary	53.25'	**24.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	58.20'	**50.0' long x 30.0' 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=4.27 cfs @ 12.85 hrs HW=54.13' TW=0.00' (Dynamic Tailwater)
└**1=Orifice/Grate** (Orifice Controls 4.27 cfs @ 3.20 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=53.25' TW=0.00' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Summary for Pond P-2.1: System 2-1 (Recharge)

Inflow Area = 2.300 ac,100.00% Impervious, Inflow Depth = 2.88" for 2-yr event
Inflow = 12.03 cfs @ 11.90 hrs, Volume= 0.552 af
Outflow = 0.73 cfs @ 12.44 hrs, Volume= 0.552 af, Atten= 94%, Lag= 32.3 min
Discarded = 0.25 cfs @ 10.64 hrs, Volume= 0.486 af
Primary = 0.47 cfs @ 12.44 hrs, Volume= 0.066 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 71.81' @ 12.44 hrs Surf.Area= 10,800 sf Storage= 11,027 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 295.1 min (1,042.7 - 747.6)

Volume	Invert	Avail.Storage	Storage Description
#1	70.00'	9,776 cf	**60.00'W x 180.00'L x 4.00'H Prismatoid**
			43,200 cf Overall - 15,268 cf Embedded = 27,932 cf x 35.0% Voids
#2	70.50'	15,268 cf	**36.0" Round Pipe Storage (12 rows by 180lf)**Inside #1
			L= 2,160.0'
		25,044 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	71.60'	**18.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	73.40'	**36.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#3	Discarded	70.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.25 cfs @ 10.64 hrs HW=70.04' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.25 cfs)

Primary OutFlow Max=0.47 cfs @ 12.44 hrs HW=71.81' TW=54.10' (Dynamic Tailwater)
├**1=Orifice/Grate** (Orifice Controls 0.47 cfs @ 1.48 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond P-3: Existing Siltation Pond

Inflow Area = 14.800 ac, 66.89% Impervious, Inflow Depth = 1.09" for 2-yr event
Inflow = 28.77 cfs @ 11.98 hrs, Volume= 1.344 af
Outflow = 0.75 cfs @ 15.75 hrs, Volume= 0.811 af, Atten= 97%, Lag= 226.5 min
Primary = 0.75 cfs @ 15.75 hrs, Volume= 0.811 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 61.95' @ 15.75 hrs Surf.Area= 44,836 sf Storage= 37,261 cf

Plug-Flow detention time= 632.4 min calculated for 0.811 af (60% of inflow)
Center-of-Mass det. time= 506.0 min (1,359.9 - 853.9)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	185,617 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
61.10	42,699	0	0
65.00	52,489	185,617	185,617

Device	Routing	Invert	Outlet Devices
#1	Primary	61.60'	**24.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.75 cfs @ 15.75 hrs HW=61.95' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 0.75 cfs @ 2.02 fps)

Summary for Pond P-3.1: System 3-1 (Detention)

Inflow Area = 2.100 ac, 47.62% Impervious, Inflow Depth = 0.52" for 2-yr event
Inflow = 2.16 cfs @ 11.90 hrs, Volume= 0.091 af
Outflow = 0.16 cfs @ 12.78 hrs, Volume= 0.074 af, Atten= 93%, Lag= 52.8 min
Primary = 0.16 cfs @ 12.78 hrs, Volume= 0.074 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 67.30' @ 12.78 hrs Surf.Area= 4,000 sf Storage= 1,303 cf

Plug-Flow detention time= 209.4 min calculated for 0.074 af (82% of inflow)
Center-of-Mass det. time= 127.8 min (1,023.1 - 895.3)

Volume	Invert	Avail.Storage	Storage Description
#1	66.50'	4,185 cf	**80.00'W x 50.00'L x 5.00'H Prismatoid** 20,000 cf Overall - 8,042 cf Embedded = 11,958 cf x 35.0% Voids
#2	67.00'	8,042 cf	**48.0" Round Pipe Storage (8 rows x 80lf)** Inside #1 L= 640.0'
		12,228 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	67.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	70.00'	**3.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.16 cfs @ 12.78 hrs HW=67.30' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 0.16 cfs @ 1.87 fps)
└—**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Subcatchment S-1.0: All Area Routed Directly to DP-1

Runoff = 64.77 cfs @ 11.98 hrs, Volume= 3.156 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.91"

	Area (ac)	CN	Description
*	7.100	98	Impervious
	5.800	61	>75% Grass cover, Good, HSG B
*	1.000	50	Porous Plaza/Walkway
	13.900	79	Weighted Average
	6.800		48.92% Pervious Area
	7.100		51.08% Impervious Area

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

Summary for Subcatchment S-1.1: Building 1 Addition Roof

Runoff = 11.88 cfs @ 11.97 hrs, Volume= 0.662 af, Depth= 4.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.91"

	Area (ac)	CN	Description
*	1.700	98	Impervious
	1.700		100.00% Impervious Area

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

Summary for Subcatchment S-1.2: New Parking Area

Runoff = 11.58 cfs @ 11.97 hrs, Volume= 0.584 af, Depth= 3.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.91"

	Area (ac)	CN	Description
*	1.500	98	Impervious
	0.200	61	>75% Grass cover, Good, HSG B
*	0.100	50	Porous Plaza/Walkway
	1.800	91	Weighted Average
	0.300		16.67% Pervious Area
	1.500		83.33% Impervious Area

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

Summary for Subcatchment S-1.3: Loading Areas

Runoff = 17.01 cfs @ 11.98 hrs, Volume= 0.849 af, Depth= 3.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.91"

	Area (ac)	CN	Description
*	2.100	98	Impervious
	0.800	61	>75% Grass cover, Good, HSG B
*	0.200	50	Porous Plaza/Walkway
	3.100	85	Weighted Average
	1.000		32.26% Pervious Area
	2.100		67.74% Impervious Area

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

Summary for Subcatchment S-1.4: Building 6 Roof

Runoff = 16.07 cfs @ 11.97 hrs, Volume= 0.896 af, Depth= 4.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.91"

	Area (ac)	CN	Description
*	2.300	98	Impervious
	2.300		100.00% Impervious Area

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

Summary for Subcatchment S-2.0: Wetlands btwn Bldgs 1 and 2

Runoff = 39.89 cfs @ 12.04 hrs, Volume= 2.322 af, Depth= 2.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.91"

	Area (ac)	CN	Description
*	1.500	98	Impervious
	8.400	77	Woods, Good, HSG D
	9.900	80	Weighted Average
	8.400		84.85% Pervious Area
	1.500		15.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0700	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.11"
4.4	350	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.0	400	Total			

Summary for Subcatchment S-2.1: Bldgs 2/3 and Surrounding Area

Runoff = 73.84 cfs @ 11.99 hrs, Volume= 3.556 af, Depth= 1.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.91"

	Area (ac)	CN	Description
*	11.900	98	Impervious
	12.200	32	Woods/grass comb., Good, HSG A
	1.100	98	Water Surface
*	0.400	50	Porous Plaza/Walkway
	25.600	66	Weighted Average
	12.600		49.22% Pervious Area
	13.000		50.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0300	1.39		**Sheet Flow, Overland - Road** Smooth surfaces n= 0.011 P2= 3.11"
1.8	390	0.0300	3.52		**Shallow Concentrated Flow, Overland - Road** Paved Kv= 20.3 fps
4.3	1,167	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
6.7	1,607	Total			

Summary for Subcatchment S-2.2: Building 5 Roof

Runoff = 19.12 cfs @ 11.90 hrs, Volume= 0.896 af, Depth= 4.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.91"

	Area (ac)	CN	Description
*	2.300	98	Impervious
	2.300		100.00% Impervious Area

Summary for Subcatchment S-2.3: Satellite Parking Lot

Runoff = 49.02 cfs @ 11.90 hrs, Volume= 2.145 af, Depth= 4.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.91"

	Area (ac)	CN	Description
*	5.700	98	Porous Pavement Parking
	0.400	39	>75% Grass cover, Good, HSG A
	6.100	94	Weighted Average
	0.400		6.56% Pervious Area
	5.700		93.44% Impervious Area

Summary for Subcatchment S-3.0: Bldg 4 and Surrounding Area

Runoff = 65.08 cfs @ 11.97 hrs, Volume= 3.036 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.91"

	Area (ac)	CN	Description
*	8.900	98	Impervious
	4.900	32	Woods/grass comb., Good, HSG A
	1.000	98	Water Surface
	14.800	76	Weighted Average
	4.900		33.11% Pervious Area
	9.900		66.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0400	1.56		**Sheet Flow, Overland - Road** Smooth surfaces n= 0.011 P2= 3.11"
1.9	470	0.0400	4.06		**Shallow Concentrated Flow, Overland - Road** Paved Kv= 20.3 fps
3.1	1,100	0.0100	5.94	10.50	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
5.5	1,620	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S-3.1: Building 5 Loading

Runoff = 7.07 cfs @ 11.90 hrs, Volume= 0.266 af, Depth= 1.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.91"

	Area (ac)	CN	Description
*	1.000	98	Impervious
	1.000	32	Woods/grass comb., Good, HSG A
*	0.100	50	Porous Plaza/Walkway
	2.100	64	Weighted Average
	1.100		52.38% Pervious Area
	1.000		47.62% Impervious Area

Summary for Subcatchment S-3.2: Northeast Undeveloped Area

Runoff = 0.95 cfs @ 12.26 hrs, Volume= 0.352 af, Depth= 0.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.91"

	Area (ac)	CN	Description
*	1.800	98	Impervious
	14.000	30	Woods, Good, HSG A
	1.000	98	Water Surface
	16.800	41	Weighted Average
	14.000		83.33% Pervious Area
	2.800		16.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	50	0.0040	0.08		**Sheet Flow, Overland - Field** Grass: Short n= 0.150 P2= 3.11"
6.2	370	0.0200	0.99		**Shallow Concentrated Flow, Overland - Field** Short Grass Pasture Kv= 7.0 fps
17.1	420	Total			

Summary for Subcatchment S-4.0: Overland direct to river

Runoff = 0.02 cfs @ 24.03 hrs, Volume= 0.009 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.91"

Area (ac)	CN	Description
5.700	32	Woods/grass comb., Good, HSG A
5.700		100.00% Pervious Area

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

Summary for Subcatchment S-5.0: Southwest to Wetlands

Runoff = 23.10 cfs @ 12.09 hrs, Volume= 1.569 af, Depth= 1.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.91"

	Area (ac)	CN	Description
*	3.000	98	Impervious
	8.300	55	Woods, Good, HSG B
	11.300	66	Weighted Average
	8.300		73.45% Pervious Area
	3.000		26.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	2,000	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps

Summary for Subcatchment S-6.0: Southeast to Wetlands

Runoff = 3.78 cfs @ 11.90 hrs, Volume= 0.142 af, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.91"

	Area (ac)	CN	Description
*	0.300	98	Impervious
	0.600	55	Woods, Good, HSG B
	0.900	69	Weighted Average
	0.600		66.67% Pervious Area
	0.300		33.33% Impervious Area

Summary for Reach DP-1: Culvert to River

Inflow Area = 22.800 ac, 64.47% Impervious, Inflow Depth = 2.89" for 10-yr event
Inflow = 89.10 cfs @ 11.99 hrs, Volume= 5.491 af
Outflow = 89.10 cfs @ 11.99 hrs, Volume= 5.491 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: Design Point 2

Inflow Area = 43.900 ac, 51.25% Impervious, Inflow Depth > 1.68" for 10-yr event
Inflow = 16.88 cfs @ 12.45 hrs, Volume= 6.151 af
Outflow = 16.88 cfs @ 12.45 hrs, Volume= 6.151 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-3: Design Point 3

Inflow Area = 33.700 ac, 40.65% Impervious, Inflow Depth > 1.11" for 10-yr event
Inflow = 6.77 cfs @ 12.49 hrs, Volume= 3.104 af
Outflow = 6.77 cfs @ 12.49 hrs, Volume= 3.104 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-4: Design Point 4

Inflow Area = 5.700 ac, 0.00% Impervious, Inflow Depth = 0.02" for 10-yr event
Inflow = 0.02 cfs @ 24.03 hrs, Volume= 0.009 af
Outflow = 0.02 cfs @ 24.03 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-5: Design Point 5

Inflow Area = 11.300 ac, 26.55% Impervious, Inflow Depth = 1.67" for 10-yr event
Inflow = 23.10 cfs @ 12.09 hrs, Volume= 1.569 af
Outflow = 23.10 cfs @ 12.09 hrs, Volume= 1.569 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-6: Design Point 6

Inflow Area = 0.900 ac, 33.33% Impervious, Inflow Depth = 1.89" for 10-yr event
Inflow = 3.78 cfs @ 11.90 hrs, Volume= 0.142 af
Outflow = 3.78 cfs @ 11.90 hrs, Volume= 0.142 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

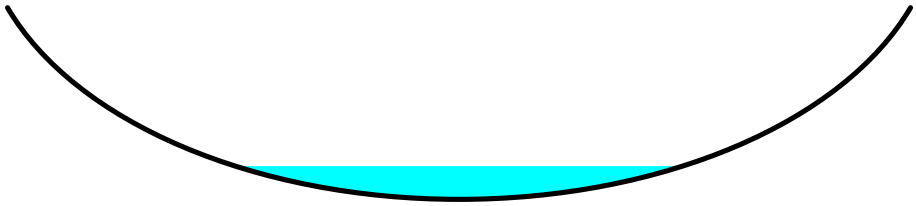
Summary for Reach SR-2: Wetland Finger (Subreach 2)

Inflow Area = 9.900 ac, 15.15% Impervious, Inflow Depth = 2.81" for 10-yr event
Inflow = 39.89 cfs @ 12.04 hrs, Volume= 2.322 af
Outflow = 39.11 cfs @ 12.06 hrs, Volume= 2.322 af, Atten= 2%, Lag= 1.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.50 fps, Min. Travel Time= 1.8 min
Avg. Velocity = 1.98 fps, Avg. Travel Time= 5.8 min

Peak Storage= 4,109 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.87'
Bank-Full Depth= 5.00' Flow Area= 83.3 sf, Capacity= 1,655.51 cfs

25.00' x 5.00' deep Parabolic Channel, n= 0.030 Earth, grassed & winding
Length= 683.0' Slope= 0.0366 '/'
Inlet Invert= 95.00', Outlet Invert= 70.00'



Summary for Pond 2P: Porous Parking Storage

Inflow Area = 6.100 ac, 93.44% Impervious, Inflow Depth = 4.22" for 10-yr event
Inflow = 49.02 cfs @ 11.90 hrs, Volume= 2.145 af
Outflow = 5.86 cfs @ 11.64 hrs, Volume= 2.146 af, Atten= 88%, Lag= 0.0 min
Discarded = 5.86 cfs @ 11.64 hrs, Volume= 2.146 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= 62.88' @ 12.01 hrs Surf.Area= 5.700 ac Storage= 0.657 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 26.6 min (791.6 - 764.9)

Volume	Invert	Avail.Storage	Storage Description
#1	62.50'	2.562 af	**Custom Stage Data (Prismatic)** Listed below (Recalc) 8.550 af Overall - 0.010 af Embedded = 8.540 af x 30.0% Voids
#2	63.00'	0.010 af	**4.0" Round Pipe Storage** Inside #1 L= 5,000.0'
		2.572 af	Total Available Storage

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
62.50	5.700	0.000	0.000
64.00	5.700	8.550	8.550

Device	Routing	Invert	Outlet Devices
#1	Discarded	62.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	63.00'	**4.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=5.86 cfs @ 11.64 hrs HW=62.52' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 5.86 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=62.50' TW=53.25' (Dynamic Tailwater)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond P-1.1: System 1-1 (Recharge)

Inflow Area = 1.700 ac,100.00% Impervious, Inflow Depth = 4.67" for 10-yr event
Inflow = 11.88 cfs @ 11.97 hrs, Volume= 0.662 af
Outflow = 3.65 cfs @ 12.09 hrs, Volume= 0.662 af, Atten= 69%, Lag= 7.4 min
Discarded = 0.19 cfs @ 9.27 hrs, Volume= 0.441 af
Primary = 3.45 cfs @ 12.09 hrs, Volume= 0.221 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 72.39' @ 12.09 hrs Surf.Area= 8,250 sf Storage= 11,903 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 241.5 min (985.7 - 744.2)

Volume	Invert	Avail.Storage	Storage Description
#1	70.00'	7,468 cf	**50.00'W x 165.00'L x 4.00'H Prismatoid** 33,000 cf Overall - 11,663 cf Embedded = 21,337 cf x 35.0% Voids
#2	70.50'	11,663 cf	**36.0" Round Pipe Storage (10 rows by 165lf)** Inside #1 L= 1,650.0'
		19,131 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	71.60'	**24.0" Vert. Orifice/Grate** C= 0.600
#2	Discarded	70.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.19 cfs @ 9.27 hrs HW=70.04' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=3.45 cfs @ 12.09 hrs HW=72.38' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 3.45 cfs @ 3.02 fps)

Summary for Pond P-1.2: System 1-2 (Recharge)

Inflow Area = 1.800 ac, 83.33% Impervious, Inflow Depth = 3.89" for 10-yr event
Inflow = 11.58 cfs @ 11.97 hrs, Volume= 0.584 af
Outflow = 10.10 cfs @ 12.01 hrs, Volume= 0.584 af, Atten= 13%, Lag= 2.4 min
Discarded = 0.08 cfs @ 8.31 hrs, Volume= 0.185 af
Primary = 10.03 cfs @ 12.01 hrs, Volume= 0.399 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 69.55' @ 12.01 hrs Surf.Area= 3,250 sf Storage= 6,180 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 138.0 min (922.1 - 784.2)

Volume	Invert	Avail.Storage	Storage Description
#1	66.50'	2,942 cf	**50.00'W x 65.00'L x 4.00'H Prismatoid** 13,000 cf Overall - 4,595 cf Embedded = 8,405 cf x 35.0% Voids
#2	67.00'	4,595 cf	**36.0" Round Pipe Storage (10 rows by 65lf)** Inside #1 L= 650.0'
		7,536 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	68.10'	**24.0" Vert. Orifice/Grate** C= 0.600
#2	Discarded	66.50'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.08 cfs @ 8.31 hrs HW=66.54' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=10.02 cfs @ 12.01 hrs HW=69.55' TW=0.00' (Dynamic Tailwater)
└**1=Orifice/Grate** (Orifice Controls 10.02 cfs @ 4.10 fps)

Summary for Pond P-1.3: System 1-3 (Detention)

Inflow Area = 3.100 ac, 67.74% Impervious, Inflow Depth = 3.28" for 10-yr event
Inflow = 17.01 cfs @ 11.98 hrs, Volume= 0.849 af
Outflow = 5.66 cfs @ 12.11 hrs, Volume= 0.848 af, Atten= 67%, Lag= 7.7 min
Primary = 5.66 cfs @ 12.11 hrs, Volume= 0.848 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 69.74' @ 12.11 hrs Surf.Area= 5,500 sf Storage= 11,226 cf

Plug-Flow detention time= 34.6 min calculated for 0.848 af (100% of inflow)
Center-of-Mass det. time= 34.4 min (840.5 - 806.1)

Volume	Invert	Avail.Storage	Storage Description
#1	67.00'	4,264 cf	**100.00'W x 55.00'L x 4.50'H Prismatoid** 24,750 cf Overall - 12,566 cf Embedded = 12,184 cf x 35.0% Voids
#2	67.00'	12,566 cf	**48.0" Round Pipe Storage (10 rows x 100lf)** Inside #1 L= 1,000.0'
		16,831 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	67.00'	**12.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	70.00'	**3.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=5.66 cfs @ 12.11 hrs HW=69.74' TW=0.00' (Dynamic Tailwater)
├**1=Orifice/Grate** (Orifice Controls 5.66 cfs @ 7.20 fps)
└**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P-1.4: System 1-4 (Detention)

Inflow Area = 2.300 ac,100.00% Impervious, Inflow Depth = 4.67" for 10-yr event
Inflow = 16.07 cfs @ 11.97 hrs, Volume= 0.896 af
Outflow = 8.85 cfs @ 12.05 hrs, Volume= 0.867 af, Atten= 45%, Lag= 5.0 min
Primary = 8.85 cfs @ 12.05 hrs, Volume= 0.867 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 72.33' @ 12.05 hrs Surf.Area= 7,200 sf Storage= 10,105 cf

Plug-Flow detention time= 71.7 min calculated for 0.867 af (97% of inflow)
Center-of-Mass det. time= 50.8 min (795.1 - 744.2)

Volume	Invert	Avail.Storage	Storage Description
#1	70.00'	6,517 cf	**60.00'W x 120.00'L x 4.00'H Prismatoid** 28,800 cf Overall - 10,179 cf Embedded = 18,621 cf x 35.0% Voids
#2	70.50'	10,179 cf	**36.0" Round Pipe Storage (12 rows by 120lf)** Inside #1 L= 1,440.0'
		16,696 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	70.50'	**18.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=8.85 cfs @ 12.05 hrs HW=72.33' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 8.85 cfs @ 5.01 fps)

Summary for Pond P-2: Existing Siltation Pond

Inflow Area = 43.900 ac, 51.25% Impervious, Inflow Depth = 1.69" for 10-yr event
Inflow = 110.64 cfs @ 12.00 hrs, Volume= 6.195 af
Outflow = 16.88 cfs @ 12.45 hrs, Volume= 6.151 af, Atten= 85%, Lag= 27.3 min
Primary = 16.88 cfs @ 12.45 hrs, Volume= 6.151 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= 55.50' @ 12.45 hrs Surf.Area= 51,857 sf Storage= 111,473 cf

Plug-Flow detention time= 171.1 min calculated for 6.150 af (99% of inflow)
Center-of-Mass det. time= 167.2 min (1,009.0 - 841.8)

Volume	Invert	Avail.Storage	Storage Description
#1	53.25'	305,288 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
53.25	47,450	0	0
59.00	58,737	305,288	305,288

Device	Routing	Invert	Outlet Devices
#1	Primary	53.25'	**24.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	58.20'	**50.0' long x 30.0' 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=16.88 cfs @ 12.45 hrs HW=55.49' TW=0.00' (Dynamic Tailwater)
└**1=Orifice/Grate** (Orifice Controls 16.88 cfs @ 5.37 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=53.25' TW=0.00' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P-2.1: System 2-1 (Recharge)

Inflow Area = 2.300 ac,100.00% Impervious, Inflow Depth = 4.67" for 10-yr event
Inflow = 19.12 cfs @ 11.90 hrs, Volume= 0.896 af
Outflow = 4.54 cfs @ 11.99 hrs, Volume= 0.896 af, Atten= 76%, Lag= 5.4 min
Discarded = 0.25 cfs @ 9.07 hrs, Volume= 0.578 af
Primary = 4.29 cfs @ 11.99 hrs, Volume= 0.317 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 72.53' @ 11.99 hrs Surf.Area= 10,800 sf Storage= 16,676 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 232.3 min (970.9 - 738.7)

Volume	Invert	Avail.Storage	Storage Description
#1	70.00'	9,776 cf	**60.00'W x 180.00'L x 4.00'H Prismatoid**
			43,200 cf Overall - 15,268 cf Embedded = 27,932 cf x 35.0% Voids
#2	70.50'	15,268 cf	**36.0" Round Pipe Storage (12 rows by 180lf)** Inside #1
			L= 2,160.0'
		25,044 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	71.60'	**18.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	73.40'	**36.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#3	Discarded	70.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.25 cfs @ 9.07 hrs HW=70.04' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.25 cfs)

Primary OutFlow Max=4.28 cfs @ 11.99 hrs HW=72.52' TW=54.46' (Dynamic Tailwater)
├**1=Orifice/Grate** (Orifice Controls 4.28 cfs @ 3.09 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond P-3: Existing Siltation Pond

Inflow Area = 14.800 ac, 66.89% Impervious, Inflow Depth = 2.46" for 10-yr event
Inflow = 65.08 cfs @ 11.97 hrs, Volume= 3.036 af
Outflow = 5.38 cfs @ 12.53 hrs, Volume= 2.502 af, Atten= 92%, Lag= 33.6 min
Primary = 5.38 cfs @ 12.53 hrs, Volume= 2.502 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 62.60' @ 12.53 hrs Surf.Area= 46,474 sf Storage= 67,048 cf

Plug-Flow detention time= 340.1 min calculated for 2.502 af (82% of inflow)
Center-of-Mass det. time= 262.5 min (1,092.5 - 830.0)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	185,617 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
61.10	42,699	0	0
65.00	52,489	185,617	185,617

Device	Routing	Invert	Outlet Devices
#1	Primary	61.60'	**24.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=5.38 cfs @ 12.53 hrs HW=62.60' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 5.38 cfs @ 3.41 fps)

Summary for Pond P-3.1: System 3-1 (Detention)

Inflow Area = 2.100 ac, 47.62% Impervious, Inflow Depth = 1.52" for 10-yr event
Inflow = 7.07 cfs @ 11.90 hrs, Volume= 0.266 af
Outflow = 0.49 cfs @ 12.48 hrs, Volume= 0.250 af, Atten= 93%, Lag= 34.9 min
Primary = 0.49 cfs @ 12.48 hrs, Volume= 0.250 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 68.53' @ 12.48 hrs Surf.Area= 4,000 sf Storage= 4,688 cf

Plug-Flow detention time= 145.8 min calculated for 0.250 af (94% of inflow)
Center-of-Mass det. time= 113.4 min (969.3 - 855.9)

Volume	Invert	Avail.Storage	Storage Description
#1	66.50'	4,185 cf	**80.00'W x 50.00'L x 5.00'H Prismatoid** 20,000 cf Overall - 8,042 cf Embedded = 11,958 cf x 35.0% Voids
#2	67.00'	8,042 cf	**48.0" Round Pipe Storage (8 rows x 80lf)** Inside #1 L= 640.0'
		12,228 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	67.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	70.00'	**3.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.49 cfs @ 12.48 hrs HW=68.53' TW=0.00' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 0.49 cfs @ 5.63 fps)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Subcatchment S-1.0: All Area Routed Directly to DP-1

Runoff = 87.18 cfs @ 11.98 hrs, Volume= 4.293 af, Depth= 3.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.03"

	Area (ac)	CN	Description
*	7.100	98	Impervious
	5.800	61	>75% Grass cover, Good, HSG B
*	1.000	50	Porous Plaza/Walkway
	13.900	79	Weighted Average
	6.800		48.92% Pervious Area
	7.100		51.08% Impervious Area

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

Summary for Subcatchment S-1.1: Building 1 Addition Roof

Runoff = 14.61 cfs @ 11.97 hrs, Volume= 0.821 af, Depth= 5.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.03"

	Area (ac)	CN	Description
*	1.700	98	Impervious
	1.700		100.00% Impervious Area

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

Summary for Subcatchment S-1.2: New Parking Area

Runoff = 14.58 cfs @ 11.97 hrs, Volume= 0.748 af, Depth= 4.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.03"

	Area (ac)	CN	Description
*	1.500	98	Impervious
	0.200	61	>75% Grass cover, Good, HSG B
*	0.100	50	Porous Plaza/Walkway
	1.800	91	Weighted Average
	0.300		16.67% Pervious Area
	1.500		83.33% Impervious Area

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

Summary for Subcatchment S-1.3: Loading Areas

Runoff = 22.08 cfs @ 11.98 hrs, Volume= 1.119 af, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.03"

	Area (ac)	CN	Description
*	2.100	98	Impervious
	0.800	61	>75% Grass cover, Good, HSG B
*	0.200	50	Porous Plaza/Walkway
	3.100	85	Weighted Average
	1.000		32.26% Pervious Area
	2.100		67.74% Impervious Area

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

Summary for Subcatchment S-1.4: Building 6 Roof

Runoff = 19.77 cfs @ 11.97 hrs, Volume= 1.110 af, Depth= 5.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.03"

	Area (ac)	CN	Description
*	2.300	98	Impervious
	2.300		100.00% Impervious Area

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

Summary for Subcatchment S-2.0: Wetlands btwn Bldgs 1 and 2

Runoff = 53.56 cfs @ 12.04 hrs, Volume= 3.142 af, Depth= 3.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.03"

	Area (ac)	CN	Description
*	1.500	98	Impervious
	8.400	77	Woods, Good, HSG D
	9.900	80	Weighted Average
	8.400		84.85% Pervious Area
	1.500		15.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0700	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.11"
4.4	350	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.0	400	Total			

Summary for Subcatchment S-2.1: Bldgs 2/3 and Surrounding Area

Runoff = 110.02 cfs @ 11.98 hrs, Volume= 5.253 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.03"

	Area (ac)	CN	Description
*	11.900	98	Impervious
	12.200	32	Woods/grass comb., Good, HSG A
	1.100	98	Water Surface
*	0.400	50	Porous Plaza/Walkway
	25.600	66	Weighted Average
	12.600		49.22% Pervious Area
	13.000		50.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0300	1.39		**Sheet Flow, Overland - Road** Smooth surfaces n= 0.011 P2= 3.11"
1.8	390	0.0300	3.52		**Shallow Concentrated Flow, Overland - Road** Paved Kv= 20.3 fps
4.3	1,167	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
6.7	1,607	Total			

Summary for Subcatchment S-2.2: Building 5 Roof

Runoff = 23.51 cfs @ 11.90 hrs, Volume= 1.110 af, Depth= 5.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.03"

	Area (ac)	CN	Description
*	2.300	98	Impervious
	2.300		100.00% Impervious Area

Summary for Subcatchment S-2.3: Satellite Parking Lot

Runoff = 60.91 cfs @ 11.90 hrs, Volume= 2.708 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 II 24-hr 25-yr Rainfall=6.03"

	Area (ac)	CN	Description
*	5.700	98	Porous Pavement Parking
	0.400	39	>75% Grass cover, Good, HSG A
	6.100	94	Weighted Average
	0.400		6.56% Pervious Area
	5.700		93.44% Impervious Area

Summary for Subcatchment S-3.0: Bldg 4 and Surrounding Area

Runoff = 89.27 cfs @ 11.97 hrs, Volume= 4.201 af, Depth= 3.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.03"

	Area (ac)	CN	Description
*	8.900	98	Impervious
	4.900	32	Woods/grass comb., Good, HSG A
	1.000	98	Water Surface
	14.800	76	Weighted Average
	4.900		33.11% Pervious Area
	9.900		66.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0400	1.56		**Sheet Flow, Overland - Road** Smooth surfaces n= 0.011 P2= 3.11"
1.9	470	0.0400	4.06		**Shallow Concentrated Flow, Overland - Road** Paved Kv= 20.3 fps
3.1	1,100	0.0100	5.94	10.50	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
5.5	1,620	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S-3.1: Building 5 Loading

Runoff = 10.66 cfs @ 11.90 hrs, Volume= 0.400 af, Depth= 2.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.03"

	Area (ac)	CN	Description
*	1.000	98	Impervious
	1.000	32	Woods/grass comb., Good, HSG A
*	0.100	50	Porous Plaza/Walkway
	2.100	64	Weighted Average
	1.100		52.38% Pervious Area
	1.000		47.62% Impervious Area

Summary for Subcatchment S-3.2: Northeast Undeveloped Area

Runoff = 5.50 cfs @ 12.16 hrs, Volume= 0.793 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 II 24-hr 25-yr Rainfall=6.03"

	Area (ac)	CN	Description
*	1.800	98	Impervious
	14.000	30	Woods, Good, HSG A
	1.000	98	Water Surface
	16.800	41	Weighted Average
	14.000		83.33% Pervious Area
	2.800		16.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	50	0.0040	0.08		**Sheet Flow, Overland - Field** Grass: Short n= 0.150 P2= 3.11"
6.2	370	0.0200	0.99		**Shallow Concentrated Flow, Overland - Field** Short Grass Pasture Kv= 7.0 fps
17.1	420	Total			

Summary for Subcatchment S-4.0: Overland direct to river

Runoff = 0.08 cfs @ 13.80 hrs, Volume= 0.065 af, Depth= 0.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.03"

Area (ac)	CN	Description
5.700	32	Woods/grass comb., Good, HSG A
5.700		100.00% Pervious Area

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

Summary for Subcatchment S-5.0: Southwest to Wetlands

Runoff = 34.88 cfs @ 12.09 hrs, Volume= 2.319 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.03"

	Area (ac)	CN	Description
*	3.000	98	Impervious
	8.300	55	Woods, Good, HSG B
	11.300	66	Weighted Average
	8.300		73.45% Pervious Area
	3.000		26.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	2,000	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps

Summary for Subcatchment S-6.0: Southeast to Wetlands

Runoff = 5.43 cfs @ 11.90 hrs, Volume= 0.205 af, Depth= 2.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.03"

	Area (ac)	CN	Description
*	0.300	98	Impervious
	0.600	55	Woods, Good, HSG B
	0.900	69	Weighted Average
	0.600		66.67% Pervious Area
	0.300		33.33% Impervious Area

Summary for Reach DP-1: Culvert to River

Inflow Area = 22.800 ac, 64.47% Impervious, Inflow Depth = 3.89" for 25-yr event
Inflow = 119.61 cfs @ 11.99 hrs, Volume= 7.396 af
Outflow = 119.61 cfs @ 11.99 hrs, Volume= 7.396 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: Design Point 2

Inflow Area = 43.900 ac, 51.25% Impervious, Inflow Depth > 2.42" for 25-yr event
Inflow = 23.01 cfs @ 12.46 hrs, Volume= 8.840 af
Outflow = 23.01 cfs @ 12.46 hrs, Volume= 8.840 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-3: Design Point 3

Inflow Area = 33.700 ac, 40.65% Impervious, Inflow Depth > 1.72" for 25-yr event
Inflow = 16.48 cfs @ 12.18 hrs, Volume= 4.843 af
Outflow = 16.48 cfs @ 12.18 hrs, Volume= 4.843 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-4: Design Point 4

Inflow Area = 5.700 ac, 0.00% Impervious, Inflow Depth = 0.14" for 25-yr event
Inflow = 0.08 cfs @ 13.80 hrs, Volume= 0.065 af
Outflow = 0.08 cfs @ 13.80 hrs, Volume= 0.065 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-5: Design Point 5

Inflow Area = 11.300 ac, 26.55% Impervious, Inflow Depth = 2.46" for 25-yr event
Inflow = 34.88 cfs @ 12.09 hrs, Volume= 2.319 af
Outflow = 34.88 cfs @ 12.09 hrs, Volume= 2.319 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-6: Design Point 6

Inflow Area = 0.900 ac, 33.33% Impervious, Inflow Depth = 2.74" for 25-yr event
Inflow = 5.43 cfs @ 11.90 hrs, Volume= 0.205 af
Outflow = 5.43 cfs @ 11.90 hrs, Volume= 0.205 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

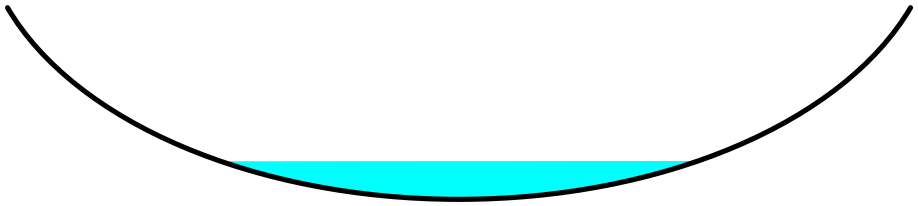
Summary for Reach SR-2: Wetland Finger (Subreach 2)

Inflow Area = 9.900 ac, 15.15% Impervious, Inflow Depth = 3.81" for 25-yr event
Inflow = 53.56 cfs @ 12.04 hrs, Volume= 3.142 af
Outflow = 52.68 cfs @ 12.05 hrs, Volume= 3.142 af, Atten= 2%, Lag= 1.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.11 fps, Min. Travel Time= 1.6 min
Avg. Velocity = 2.11 fps, Avg. Travel Time= 5.4 min

Peak Storage= 5,058 cf @ 12.05 hrs
Average Depth at Peak Storage= 1.00'
Bank-Full Depth= 5.00' Flow Area= 83.3 sf, Capacity= 1,655.51 cfs

25.00' x 5.00' deep Parabolic Channel, n= 0.030 Earth, grassed & winding
Length= 683.0' Slope= 0.0366 '/'
Inlet Invert= 95.00', Outlet Invert= 70.00'



Summary for Pond 2P: Porous Parking Storage

Inflow Area = 6.100 ac, 93.44% Impervious, Inflow Depth = 5.33" for 25-yr event
Inflow = 60.91 cfs @ 11.90 hrs, Volume= 2.708 af
Outflow = 5.86 cfs @ 12.18 hrs, Volume= 2.708 af, Atten= 90%, Lag= 16.6 min
Discarded = 5.86 cfs @ 11.61 hrs, Volume= 2.708 af
Primary = 0.00 cfs @ 12.18 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 63.02' @ 12.18 hrs Surf.Area= 5.700 ac Storage= 0.887 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 38.4 min (797.6 - 759.2)

Volume	Invert	Avail.Storage	Storage Description
#1	62.50'	2.562 af	**Custom Stage Data (Prismatic)** Listed below (Recalc) 8.550 af Overall - 0.010 af Embedded = 8.540 af x 30.0% Voids
#2	63.00'	0.010 af	**4.0" Round Pipe Storage** Inside #1 L= 5,000.0'
		2.572 af	Total Available Storage

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
62.50	5.700	0.000	0.000
64.00	5.700	8.550	8.550

Device	Routing	Invert	Outlet Devices
#1	Discarded	62.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	63.00'	**4.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=5.86 cfs @ 11.61 hrs HW=62.52' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 5.86 cfs)

Primary OutFlow Max=0.00 cfs @ 12.18 hrs HW=63.02' TW=56.34' (Dynamic Tailwater)
↑—**2=Orifice/Grate** (Orifice Controls 0.00 cfs @ 0.47 fps)

Summary for Pond P-1.1: System 1-1 (Recharge)

Inflow Area = 1.700 ac,100.00% Impervious, Inflow Depth = 5.79" for 25-yr event
Inflow = 14.61 cfs @ 11.97 hrs, Volume= 0.821 af
Outflow = 6.78 cfs @ 12.06 hrs, Volume= 0.821 af, Atten= 54%, Lag= 5.7 min
Discarded = 0.19 cfs @ 8.59 hrs, Volume= 0.474 af
Primary = 6.59 cfs @ 12.06 hrs, Volume= 0.347 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 72.73' @ 12.06 hrs Surf.Area= 8,250 sf Storage= 13,905 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 215.3 min (956.2 - 740.9)

Volume	Invert	Avail.Storage	Storage Description
#1	70.00'	7,468 cf	**50.00'W x 165.00'L x 4.00'H Prismatoid** 33,000 cf Overall - 11,663 cf Embedded = 21,337 cf x 35.0% Voids
#2	70.50'	11,663 cf	**36.0" Round Pipe Storage (10 rows by 165lf)** Inside #1 L= 1,650.0'
		19,131 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	71.60'	**24.0" Vert. Orifice/Grate** C= 0.600
#2	Discarded	70.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.19 cfs @ 8.59 hrs HW=70.04' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=6.58 cfs @ 12.06 hrs HW=72.73' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 6.58 cfs @ 3.61 fps)

Summary for Pond P-1.2: System 1-2 (Recharge)

Inflow Area = 1.800 ac, 83.33% Impervious, Inflow Depth = 4.99" for 25-yr event
Inflow = 14.58 cfs @ 11.97 hrs, Volume= 0.748 af
Outflow = 13.03 cfs @ 12.00 hrs, Volume= 0.748 af, Atten= 11%, Lag= 2.1 min
Discarded = 0.08 cfs @ 6.97 hrs, Volume= 0.192 af
Primary = 12.95 cfs @ 12.00 hrs, Volume= 0.556 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 69.83' @ 12.00 hrs Surf.Area= 3,250 sf Storage= 6,710 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 115.0 min (892.5 - 777.5)

Volume	Invert	Avail.Storage	Storage Description
#1	66.50'	2,942 cf	**50.00'W x 65.00'L x 4.00'H Prismatoid** 13,000 cf Overall - 4,595 cf Embedded = 8,405 cf x 35.0% Voids
#2	67.00'	4,595 cf	**36.0" Round Pipe Storage (10 rows by 65lf)** Inside #1 L= 650.0'
		7,536 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	68.10'	**24.0" Vert. Orifice/Grate** C= 0.600
#2	Discarded	66.50'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.08 cfs @ 6.97 hrs HW=66.54' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=12.93 cfs @ 12.00 hrs HW=69.83' TW=0.00' (Dynamic Tailwater)
└**1=Orifice/Grate** (Orifice Controls 12.93 cfs @ 4.48 fps)

Summary for Pond P-1.3: System 1-3 (Detention)

Inflow Area = 3.100 ac, 67.74% Impervious, Inflow Depth = 4.33" for 25-yr event
Inflow = 22.08 cfs @ 11.98 hrs, Volume= 1.119 af
Outflow = 10.19 cfs @ 12.08 hrs, Volume= 1.119 af, Atten= 54%, Lag= 6.1 min
Primary = 10.19 cfs @ 12.08 hrs, Volume= 1.119 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 70.53' @ 12.08 hrs Surf.Area= 5,500 sf Storage= 14,411 cf

Plug-Flow detention time= 33.0 min calculated for 1.119 af (100% of inflow)
Center-of-Mass det. time= 32.9 min (831.1 - 798.3)

Volume	Invert	Avail.Storage	Storage Description
#1	67.00'	4,264 cf	**100.00'W x 55.00'L x 4.50'H Prismatoid** 24,750 cf Overall - 12,566 cf Embedded = 12,184 cf x 35.0% Voids
#2	67.00'	12,566 cf	**48.0" Round Pipe Storage (10 rows x 100lf)** Inside #1 L= 1,000.0'
		16,831 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	67.00'	**12.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	70.00'	**3.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=10.18 cfs @ 12.08 hrs HW=70.52' TW=0.00' (Dynamic Tailwater)
├**1=Orifice/Grate** (Orifice Controls 6.58 cfs @ 8.37 fps)
└**2=Sharp-Crested Rectangular Weir** (Weir Controls 3.60 cfs @ 2.37 fps)

Summary for Pond P-1.4: System 1-4 (Detention)

Inflow Area = 2.300 ac,100.00% Impervious, Inflow Depth = 5.79" for 25-yr event
Inflow = 19.77 cfs @ 11.97 hrs, Volume= 1.110 af
Outflow = 10.36 cfs @ 12.05 hrs, Volume= 1.081 af, Atten= 48%, Lag= 5.2 min
Primary = 10.36 cfs @ 12.05 hrs, Volume= 1.081 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 72.73' @ 12.05 hrs Surf.Area= 7,200 sf Storage= 12,168 cf

Plug-Flow detention time= 63.1 min calculated for 1.081 af (97% of inflow)
Center-of-Mass det. time= 46.2 min (787.1 - 740.9)

Volume	Invert	Avail.Storage	Storage Description
#1	70.00'	6,517 cf	**60.00'W x 120.00'L x 4.00'H Prismatoid** 28,800 cf Overall - 10,179 cf Embedded = 18,621 cf x 35.0% Voids
#2	70.50'	10,179 cf	**36.0" Round Pipe Storage (12 rows by 120lf)** Inside #1 L= 1,440.0'
		16,696 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	70.50'	**18.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=10.36 cfs @ 12.05 hrs HW=72.73' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 10.36 cfs @ 5.86 fps)

Summary for Pond P-2: Existing Siltation Pond

Inflow Area = 43.900 ac, 51.25% Impervious, Inflow Depth = 2.43" for 25-yr event
Inflow = 160.82 cfs @ 12.00 hrs, Volume= 8.884 af
Outflow = 23.01 cfs @ 12.46 hrs, Volume= 8.840 af, Atten= 86%, Lag= 27.7 min
Primary = 23.01 cfs @ 12.46 hrs, Volume= 8.840 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= 56.56' @ 12.46 hrs Surf.Area= 53,955 sf Storage= 168,024 cf

Plug-Flow detention time= 154.6 min calculated for 8.839 af (99% of inflow)
Center-of-Mass det. time= 151.9 min (983.9 - 832.0)

Volume	Invert	Avail.Storage	Storage Description
#1	53.25'	305,288 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
53.25	47,450	0	0
59.00	58,737	305,288	305,288

Device	Routing	Invert	Outlet Devices
#1	Primary	53.25'	**24.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	58.20'	**50.0' long x 30.0' 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=23.01 cfs @ 12.46 hrs HW=56.56' TW=0.00' (Dynamic Tailwater)
└**1=Orifice/Grate** (Orifice Controls 23.01 cfs @ 7.32 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=53.25' TW=0.00' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P-2.1: System 2-1 (Recharge)

Inflow Area = 2.300 ac,100.00% Impervious, Inflow Depth = 5.79" for 25-yr event
Inflow = 23.51 cfs @ 11.90 hrs, Volume= 1.110 af
Outflow = 7.04 cfs @ 11.98 hrs, Volume= 1.110 af, Atten= 70%, Lag= 4.9 min
Discarded = 0.25 cfs @ 8.35 hrs, Volume= 0.621 af
Primary = 6.78 cfs @ 11.98 hrs, Volume= 0.489 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 73.01' @ 11.98 hrs Surf.Area= 10,800 sf Storage= 20,222 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 208.3 min (943.7 - 735.3)

Volume	Invert	Avail.Storage	Storage Description
#1	70.00'	9,776 cf	**60.00'W x 180.00'L x 4.00'H Prismatoid**
			43,200 cf Overall - 15,268 cf Embedded = 27,932 cf x 35.0% Voids
#2	70.50'	15,268 cf	**36.0" Round Pipe Storage (12 rows by 180lf)** Inside #1
			L= 2,160.0'
		25,044 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	71.60'	**18.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	73.40'	**36.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#3	Discarded	70.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.25 cfs @ 8.35 hrs HW=70.04' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.25 cfs)

Primary OutFlow Max=6.78 cfs @ 11.98 hrs HW=73.01' TW=55.09' (Dynamic Tailwater)
├**1=Orifice/Grate** (Orifice Controls 6.78 cfs @ 4.52 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond P-3: Existing Siltation Pond

Inflow Area = 14.800 ac, 66.89% Impervious, Inflow Depth = 3.41" for 25-yr event
Inflow = 89.27 cfs @ 11.97 hrs, Volume= 4.201 af
Outflow = 10.55 cfs @ 12.32 hrs, Volume= 3.666 af, Atten= 88%, Lag= 20.6 min
Primary = 10.55 cfs @ 12.32 hrs, Volume= 3.666 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 63.10' @ 12.32 hrs Surf.Area= 47,723 sf Storage= 90,476 cf

Plug-Flow detention time= 274.8 min calculated for 3.666 af (87% of inflow)
Center-of-Mass det. time= 213.4 min (1,034.1 - 820.7)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	185,617 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
61.10	42,699	0	0
65.00	52,489	185,617	185,617

Device	Routing	Invert	Outlet Devices
#1	Primary	61.60'	**24.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=10.55 cfs @ 12.32 hrs HW=63.10' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 10.55 cfs @ 4.17 fps)

Summary for Pond P-3.1: System 3-1 (Detention)

Inflow Area = 2.100 ac, 47.62% Impervious, Inflow Depth = 2.28" for 25-yr event
Inflow = 10.66 cfs @ 11.90 hrs, Volume= 0.400 af
Outflow = 0.65 cfs @ 12.57 hrs, Volume= 0.384 af, Atten= 94%, Lag= 39.9 min
Primary = 0.65 cfs @ 12.57 hrs, Volume= 0.384 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 69.54' @ 12.57 hrs Surf.Area= 4,000 sf Storage= 7,757 cf

Plug-Flow detention time= 162.1 min calculated for 0.384 af (96% of inflow)
Center-of-Mass det. time= 139.7 min (983.1 - 843.4)

Volume	Invert	Avail.Storage	Storage Description
#1	66.50'	4,185 cf	**80.00'W x 50.00'L x 5.00'H Prismatoid** 20,000 cf Overall - 8,042 cf Embedded = 11,958 cf x 35.0% Voids
#2	67.00'	8,042 cf	**48.0" Round Pipe Storage (8 rows x 80lf)** Inside #1 L= 640.0'
		12,228 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	67.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	70.00'	**3.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.65 cfs @ 12.57 hrs HW=69.54' TW=0.00' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 0.65 cfs @ 7.42 fps)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Subcatchment S-1.0: All Area Routed Directly to DP-1

Runoff = 122.26 cfs @ 11.98 hrs, Volume= 6.122 af, Depth= 5.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.76"

	Area (ac)	CN	Description
*	7.100	98	Impervious
	5.800	61	>75% Grass cover, Good, HSG B
*	1.000	50	Porous Plaza/Walkway
	13.900	79	Weighted Average
	6.800		48.92% Pervious Area
	7.100		51.08% Impervious Area

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

Summary for Subcatchment S-1.1: Building 1 Addition Roof

Runoff = 18.83 cfs @ 11.97 hrs, Volume= 1.065 af, Depth= 7.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.76"

	Area (ac)	CN	Description
*	1.700	98	Impervious
	1.700		100.00% Impervious Area

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

Summary for Subcatchment S-1.2: New Parking Area

Runoff = 19.17 cfs @ 11.97 hrs, Volume= 1.003 af, Depth= 6.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.76"

	Area (ac)	CN	Description
*	1.500	98	Impervious
	0.200	61	>75% Grass cover, Good, HSG B
*	0.100	50	Porous Plaza/Walkway
	1.800	91	Weighted Average
	0.300		16.67% Pervious Area
	1.500		83.33% Impervious Area

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

Summary for Subcatchment S-1.3: Loading Areas

Runoff = 29.91 cfs @ 11.98 hrs, Volume= 1.545 af, Depth= 5.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.76"

	Area (ac)	CN	Description
*	2.100	98	Impervious
	0.800	61	>75% Grass cover, Good, HSG B
*	0.200	50	Porous Plaza/Walkway
	3.100	85	Weighted Average
	1.000		32.26% Pervious Area
	2.100		67.74% Impervious Area

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

Summary for Subcatchment S-1.4: Building 6 Roof

Runoff = 25.48 cfs @ 11.97 hrs, Volume= 1.441 af, Depth= 7.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.76"

	Area (ac)	CN	Description
*	2.300	98	Impervious
	2.300		100.00% Impervious Area

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

Summary for Subcatchment S-2.0: Wetlands btwn Bldgs 1 and 2

Runoff = 74.92 cfs @ 12.04 hrs, Volume= 4.455 af, Depth= 5.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.76"

	Area (ac)	CN	Description
*	1.500	98	Impervious
	8.400	77	Woods, Good, HSG D
	9.900	80	Weighted Average
	8.400		84.85% Pervious Area
	1.500		15.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0700	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.11"
4.4	350	0.0700	1.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.0	400	Total			

Summary for Subcatchment S-2.1: Bldgs 2/3 and Surrounding Area

Runoff = 170.04 cfs @ 11.98 hrs, Volume= 8.132 af, Depth= 3.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.76"

	Area (ac)	CN	Description
*	11.900	98	Impervious
	12.200	32	Woods/grass comb., Good, HSG A
	1.100	98	Water Surface
*	0.400	50	Porous Plaza/Walkway
	25.600	66	Weighted Average
	12.600		49.22% Pervious Area
	13.000		50.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0300	1.39		**Sheet Flow, Overland - Road** Smooth surfaces n= 0.011 P2= 3.11"
1.8	390	0.0300	3.52		**Shallow Concentrated Flow, Overland - Road** Paved Kv= 20.3 fps
4.3	1,167	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
6.7	1,607	Total			

Summary for Subcatchment S-2.2: Building 5 Roof

Runoff = 30.30 cfs @ 11.90 hrs, Volume= 1.441 af, Depth= 7.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.76"

	Area (ac)	CN	Description
*	2.300	98	Impervious
	2.300		100.00% Impervious Area

Summary for Subcatchment S-2.3: Satellite Parking Lot

Runoff = 79.15 cfs @ 11.90 hrs, Volume= 3.580 af, Depth= 7.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.76"

	Area (ac)	CN	Description
*	5.700	98	Porous Pavement Parking
	0.400	39	>75% Grass cover, Good, HSG A
	6.100	94	Weighted Average
	0.400		6.56% Pervious Area
	5.700		93.44% Impervious Area

Summary for Subcatchment S-3.0: Bldg 4 and Surrounding Area

Runoff = 127.52 cfs @ 11.97 hrs, Volume= 6.093 af, Depth= 4.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.76"

	Area (ac)	CN	Description
*	8.900	98	Impervious
	4.900	32	Woods/grass comb., Good, HSG A
	1.000	98	Water Surface
	14.800	76	Weighted Average
	4.900		33.11% Pervious Area
	9.900		66.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0400	1.56		**Sheet Flow, Overland - Road** Smooth surfaces n= 0.011 P2= 3.11"
1.9	470	0.0400	4.06		**Shallow Concentrated Flow, Overland - Road** Paved Kv= 20.3 fps
3.1	1,100	0.0100	5.94	10.50	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
5.5	1,620	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment S-3.1: Building 5 Loading

Runoff = 16.62 cfs @ 11.90 hrs, Volume= 0.628 af, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.76"

	Area (ac)	CN	Description
*	1.000	98	Impervious
	1.000	32	Woods/grass comb., Good, HSG A
*	0.100	50	Porous Plaza/Walkway
	2.100	64	Weighted Average
	1.100		52.38% Pervious Area
	1.000		47.62% Impervious Area

Summary for Subcatchment S-3.2: Northeast Undeveloped Area

Runoff = 18.59 cfs @ 12.13 hrs, Volume= 1.731 af, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.76"

	Area (ac)	CN	Description
*	1.800	98	Impervious
	14.000	30	Woods, Good, HSG A
	1.000	98	Water Surface
	16.800	41	Weighted Average
	14.000		83.33% Pervious Area
	2.800		16.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	50	0.0040	0.08		**Sheet Flow, Overland - Field** Grass: Short n= 0.150 P2= 3.11"
6.2	370	0.0200	0.99		**Shallow Concentrated Flow, Overland - Field** Short Grass Pasture Kv= 7.0 fps
17.1	420	Total			

Summary for Subcatchment S-4.0: Overland direct to river

Runoff = 0.89 cfs @ 12.25 hrs, Volume= 0.236 af, Depth= 0.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.76"

Area (ac)	CN	Description
5.700	32	Woods/grass comb., Good, HSG A
5.700		100.00% Pervious Area

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

Summary for Subcatchment S-5.0: Southwest to Wetlands

Runoff = 54.51 cfs @ 12.08 hrs, Volume= 3.589 af, Depth= 3.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.76"

	Area (ac)	CN	Description
*	3.000	98	Impervious
	8.300	55	Woods, Good, HSG B
	11.300	66	Weighted Average
	8.300		73.45% Pervious Area
	3.000		26.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	2,000	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps

Summary for Subcatchment S-6.0: Southeast to Wetlands

Runoff = 8.11 cfs @ 11.90 hrs, Volume= 0.311 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 II 24-hr 100-yr Rainfall=7.76"

	Area (ac)	CN	Description
*	0.300	98	Impervious
	0.600	55	Woods, Good, HSG B
	0.900	69	Weighted Average
	0.600		66.67% Pervious Area
	0.300		33.33% Impervious Area

Summary for Reach DP-1: Culvert to River

Inflow Area = 22.800 ac, 64.47% Impervious, Inflow Depth = 5.49" for 100-yr event
Inflow = 177.07 cfs @ 12.00 hrs, Volume= 10.439 af
Outflow = 177.07 cfs @ 12.00 hrs, Volume= 10.439 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: Design Point 2

Inflow Area = 43.900 ac, 51.25% Impervious, Inflow Depth > 3.64" for 100-yr event
Inflow = 35.11 cfs @ 12.43 hrs, Volume= 13.328 af
Outflow = 35.11 cfs @ 12.43 hrs, Volume= 13.328 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-3: Design Point 3

Inflow Area = 33.700 ac, 40.65% Impervious, Inflow Depth > 2.81" for 100-yr event
Inflow = 38.62 cfs @ 12.13 hrs, Volume= 7.901 af
Outflow = 38.62 cfs @ 12.13 hrs, Volume= 7.901 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-4: Design Point 4

Inflow Area = 5.700 ac, 0.00% Impervious, Inflow Depth = 0.50" for 100-yr event
Inflow = 0.89 cfs @ 12.25 hrs, Volume= 0.236 af
Outflow = 0.89 cfs @ 12.25 hrs, Volume= 0.236 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-5: Design Point 5

Inflow Area = 11.300 ac, 26.55% Impervious, Inflow Depth = 3.81" for 100-yr event
Inflow = 54.51 cfs @ 12.08 hrs, Volume= 3.589 af
Outflow = 54.51 cfs @ 12.08 hrs, Volume= 3.589 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach DP-6: Design Point 6

Inflow Area = 0.900 ac, 33.33% Impervious, Inflow Depth = 4.15" for 100-yr event
Inflow = 8.11 cfs @ 11.90 hrs, Volume= 0.311 af
Outflow = 8.11 cfs @ 11.90 hrs, Volume= 0.311 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

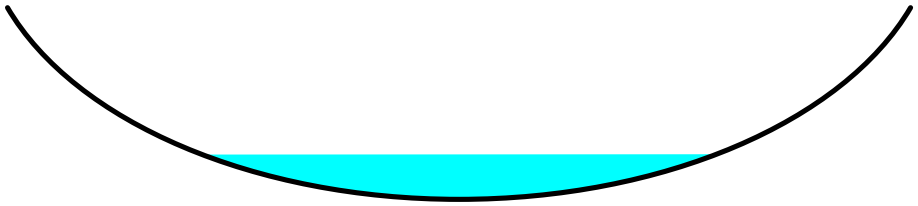
Summary for Reach SR-2: Wetland Finger (Subreach 2)

Inflow Area = 9.900 ac, 15.15% Impervious, Inflow Depth = 5.40" for 100-yr event
Inflow = 74.92 cfs @ 12.04 hrs, Volume= 4.455 af
Outflow = 73.94 cfs @ 12.05 hrs, Volume= 4.455 af, Atten= 1%, Lag= 0.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.88 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 2.29 fps, Avg. Travel Time= 5.0 min

Peak Storage= 6,405 cf @ 12.05 hrs
Average Depth at Peak Storage= 1.17'
Bank-Full Depth= 5.00' Flow Area= 83.3 sf, Capacity= 1,655.51 cfs

25.00' x 5.00' deep Parabolic Channel, n= 0.030 Earth, grassed & winding
Length= 683.0' Slope= 0.0366 '/'
Inlet Invert= 95.00', Outlet Invert= 70.00'



Summary for Pond 2P: Porous Parking Storage

Inflow Area = 6.100 ac, 93.44% Impervious, Inflow Depth = 7.04" for 100-yr event
Inflow = 79.15 cfs @ 11.90 hrs, Volume= 3.580 af
Outflow = 5.97 cfs @ 12.33 hrs, Volume= 3.581 af, Atten= 92%, Lag= 25.7 min
Discarded = 5.86 cfs @ 11.58 hrs, Volume= 3.571 af
Primary = 0.11 cfs @ 12.33 hrs, Volume= 0.010 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 63.24' @ 12.33 hrs Surf.Area= 5.700 ac Storage= 1.264 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 57.9 min (810.6 - 752.7)

Volume	Invert	Avail.Storage	Storage Description
#1	62.50'	2.562 af	**Custom Stage Data (Prismatic)** Listed below (Recalc) 8.550 af Overall - 0.010 af Embedded = 8.540 af x 30.0% Voids
#2	63.00'	0.010 af	**4.0" Round Pipe Storage** Inside #1 L= 5,000.0'
		2.572 af	Total Available Storage

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
62.50	5.700	0.000	0.000
64.00	5.700	8.550	8.550

Device	Routing	Invert	Outlet Devices
#1	Discarded	62.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	63.00'	**4.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=5.86 cfs @ 11.58 hrs HW=62.52' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 5.86 cfs)

Primary OutFlow Max=0.11 cfs @ 12.33 hrs HW=63.24' TW=58.28' (Dynamic Tailwater)
↑—**2=Orifice/Grate** (Orifice Controls 0.11 cfs @ 1.65 fps)

Summary for Pond P-1.1: System 1-1 (Recharge)

Inflow Area = 1.700 ac,100.00% Impervious, Inflow Depth = 7.52" for 100-yr event
Inflow = 18.83 cfs @ 11.97 hrs, Volume= 1.065 af
Outflow = 11.77 cfs @ 12.04 hrs, Volume= 1.065 af, Atten= 37%, Lag= 4.4 min
Discarded = 0.19 cfs @ 6.62 hrs, Volume= 0.509 af
Primary = 11.58 cfs @ 12.04 hrs, Volume= 0.557 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 73.20' @ 12.04 hrs Surf.Area= 8,250 sf Storage= 16,414 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 187.6 min (925.0 - 737.4)

Volume	Invert	Avail.Storage	Storage Description
#1	70.00'	7,468 cf	**50.00'W x 165.00'L x 4.00'H Prismatoid** 33,000 cf Overall - 11,663 cf Embedded = 21,337 cf x 35.0% Voids
#2	70.50'	11,663 cf	**36.0" Round Pipe Storage (10 rows by 165lf)** Inside #1 L= 1,650.0'
		19,131 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	71.60'	**24.0" Vert. Orifice/Grate** C= 0.600
#2	Discarded	70.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.19 cfs @ 6.62 hrs HW=70.04' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=11.57 cfs @ 12.04 hrs HW=73.20' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 11.57 cfs @ 4.30 fps)

Summary for Pond P-1.2: System 1-2 (Recharge)

Inflow Area = 1.800 ac, 83.33% Impervious, Inflow Depth = 6.69" for 100-yr event
Inflow = 19.17 cfs @ 11.97 hrs, Volume= 1.003 af
Outflow = 17.41 cfs @ 12.00 hrs, Volume= 1.003 af, Atten= 9%, Lag= 2.0 min
Discarded = 0.08 cfs @ 5.54 hrs, Volume= 0.200 af
Primary = 17.33 cfs @ 12.00 hrs, Volume= 0.804 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 70.41' @ 12.00 hrs Surf.Area= 3,250 sf Storage= 7,437 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 93.7 min (863.6 - 769.9)

Volume	Invert	Avail.Storage	Storage Description
#1	66.50'	2,942 cf	**50.00'W x 65.00'L x 4.00'H Prismatoid** 13,000 cf Overall - 4,595 cf Embedded = 8,405 cf x 35.0% Voids
#2	67.00'	4,595 cf	**36.0" Round Pipe Storage (10 rows by 65lf)** Inside #1 L= 650.0'
		7,536 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	68.10'	**24.0" Vert. Orifice/Grate** C= 0.600
#2	Discarded	66.50'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.08 cfs @ 5.54 hrs HW=66.54' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=17.32 cfs @ 12.00 hrs HW=70.41' TW=0.00' (Dynamic Tailwater)
└**1=Orifice/Grate** (Orifice Controls 17.32 cfs @ 5.51 fps)

Summary for Pond P-1.3: System 1-3 (Detention)

Inflow Area = 3.100 ac, 67.74% Impervious, Inflow Depth = 5.98" for 100-yr event
Inflow = 29.91 cfs @ 11.98 hrs, Volume= 1.545 af
Outflow = 23.27 cfs @ 12.04 hrs, Volume= 1.545 af, Atten= 22%, Lag= 3.4 min
Primary = 23.27 cfs @ 12.04 hrs, Volume= 1.545 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 71.47' @ 12.04 hrs Surf.Area= 5,500 sf Storage= 16,769 cf

Plug-Flow detention time= 28.8 min calculated for 1.545 af (100% of inflow)
Center-of-Mass det. time= 29.0 min (818.2 - 789.2)

Volume	Invert	Avail.Storage	Storage Description
#1	67.00'	4,264 cf	**100.00'W x 55.00'L x 4.50'H Prismatoid** 24,750 cf Overall - 12,566 cf Embedded = 12,184 cf x 35.0% Voids
#2	67.00'	12,566 cf	**48.0" Round Pipe Storage (10 rows x 100lf)** Inside #1 L= 1,000.0'
		16,831 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	67.00'	**12.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	70.00'	**3.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=23.21 cfs @ 12.04 hrs HW=71.46' TW=0.00' (Dynamic Tailwater)
├**1=Orifice/Grate** (Orifice Controls 7.53 cfs @ 9.59 fps)
└**2=Sharp-Crested Rectangular Weir** (Weir Controls 15.68 cfs @ 3.96 fps)

Summary for Pond P-1.4: System 1-4 (Detention)

Inflow Area = 2.300 ac,100.00% Impervious, Inflow Depth = 7.52" for 100-yr event
Inflow = 25.48 cfs @ 11.97 hrs, Volume= 1.441 af
Outflow = 12.80 cfs @ 12.06 hrs, Volume= 1.412 af, Atten= 50%, Lag= 5.4 min
Primary = 12.80 cfs @ 12.06 hrs, Volume= 1.412 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 73.51' @ 12.06 hrs Surf.Area= 7,200 sf Storage= 15,467 cf

Plug-Flow detention time= 54.8 min calculated for 1.412 af (98% of inflow)
Center-of-Mass det. time= 41.3 min (778.6 - 737.4)

Volume	Invert	Avail.Storage	Storage Description
#1	70.00'	6,517 cf	**60.00'W x 120.00'L x 4.00'H Prismatoid** 28,800 cf Overall - 10,179 cf Embedded = 18,621 cf x 35.0% Voids
#2	70.50'	10,179 cf	**36.0" Round Pipe Storage (12 rows by 120lf)** Inside #1 L= 1,440.0'
		16,696 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	70.50'	**18.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=12.79 cfs @ 12.06 hrs HW=73.51' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 12.79 cfs @ 7.24 fps)

Summary for Pond P-2: Existing Siltation Pond

Inflow Area = 43.900 ac, 51.25% Impervious, Inflow Depth = 3.66" for 100-yr event
Inflow = 245.16 cfs @ 11.99 hrs, Volume= 13.373 af
Outflow = 35.11 cfs @ 12.43 hrs, Volume= 13.328 af, Atten= 86%, Lag= 26.3 min
Primary = 30.47 cfs @ 12.43 hrs, Volume= 13.228 af
Secondary = 4.65 cfs @ 12.43 hrs, Volume= 0.099 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 58.31' @ 12.43 hrs Surf.Area= 57,375 sf Storage= 265,016 cf

Plug-Flow detention time= 148.6 min calculated for 13.328 af (100% of inflow)
Center-of-Mass det. time= 146.4 min (967.7 - 821.2)

Volume	Invert	Avail.Storage	Storage Description
#1	53.25'	305,288 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
53.25	47,450	0	0
59.00	58,737	305,288	305,288

Device	Routing	Invert	Outlet Devices
#1	Primary	53.25'	**24.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	58.20'	**50.0' long x 30.0' 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=30.47 cfs @ 12.43 hrs HW=58.31' TW=0.00' (Dynamic Tailwater)
└**1=Orifice/Grate** (Orifice Controls 30.47 cfs @ 9.70 fps)

Secondary OutFlow Max=4.64 cfs @ 12.43 hrs HW=58.31' TW=0.00' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 4.64 cfs @ 0.87 fps)

Summary for Pond P-2.1: System 2-1 (Recharge)

Inflow Area = 2.300 ac,100.00% Impervious, Inflow Depth = 7.52" for 100-yr event
Inflow = 30.30 cfs @ 11.90 hrs, Volume= 1.441 af
Outflow = 14.22 cfs @ 11.96 hrs, Volume= 1.441 af, Atten= 53%, Lag= 3.8 min
Discarded = 0.25 cfs @ 6.30 hrs, Volume= 0.666 af
Primary = 13.97 cfs @ 11.96 hrs, Volume= 0.776 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 73.99' @ 11.96 hrs Surf.Area= 10,800 sf Storage= 24,993 cf

Plug-Flow detention time= 183.1 min calculated for 1.441 af (100% of inflow)
Center-of-Mass det. time= 183.2 min (915.0 - 731.8)

Volume	Invert	Avail.Storage	Storage Description
#1	70.00'	9,776 cf	**60.00'W x 180.00'L x 4.00'H Prismatoid**
			43,200 cf Overall - 15,268 cf Embedded = 27,932 cf x 35.0% Voids
#2	70.50'	15,268 cf	**36.0" Round Pipe Storage (12 rows by 180lf)** Inside #1
			L= 2,160.0'
		25,044 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	71.60'	**18.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	73.40'	**36.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#3	Discarded	70.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.25 cfs @ 6.30 hrs HW=70.04' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.25 cfs)

Primary OutFlow Max=13.96 cfs @ 11.96 hrs HW=73.99' TW=55.96' (Dynamic Tailwater)
└**1=Orifice/Grate** (Orifice Controls 9.89 cfs @ 6.59 fps)
└**2=Orifice/Grate** (Orifice Controls 4.07 cfs @ 2.71 fps)

Summary for Pond P-3: Existing Siltation Pond

Inflow Area = 14.800 ac, 66.89% Impervious, Inflow Depth = 4.94" for 100-yr event
Inflow = 127.52 cfs @ 11.97 hrs, Volume= 6.093 af
Outflow = 17.58 cfs @ 12.22 hrs, Volume= 5.558 af, Atten= 86%, Lag= 14.8 min
Primary = 17.58 cfs @ 12.22 hrs, Volume= 5.558 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 63.95' @ 12.22 hrs Surf.Area= 49,857 sf Storage= 131,953 cf

Plug-Flow detention time= 223.9 min calculated for 5.558 af (91% of inflow)
Center-of-Mass det. time= 177.8 min (987.9 - 810.1)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	185,617 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
61.10	42,699	0	0
65.00	52,489	185,617	185,617

Device	Routing	Invert	Outlet Devices
#1	Primary	61.60'	**24.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=17.58 cfs @ 12.22 hrs HW=63.95' TW=0.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 17.58 cfs @ 5.60 fps)

Summary for Pond P-3.1: System 3-1 (Detention)

Inflow Area = 2.100 ac, 47.62% Impervious, Inflow Depth = 3.59" for 100-yr event
Inflow = 16.62 cfs @ 11.90 hrs, Volume= 0.628 af
Outflow = 5.98 cfs @ 11.98 hrs, Volume= 0.612 af, Atten= 64%, Lag= 4.6 min
Primary = 5.98 cfs @ 11.98 hrs, Volume= 0.612 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 70.67' @ 11.98 hrs Surf.Area= 4,000 sf Storage= 10,871 cf

Plug-Flow detention time= 145.8 min calculated for 0.612 af (97% of inflow)
Center-of-Mass det. time= 130.7 min (960.9 - 830.2)

Volume	Invert	Avail.Storage	Storage Description
#1	66.50'	4,185 cf	**80.00'W x 50.00'L x 5.00'H Prismatoid** 20,000 cf Overall - 8,042 cf Embedded = 11,958 cf x 35.0% Voids
#2	67.00'	8,042 cf	**48.0" Round Pipe Storage (8 rows x 80lf)** Inside #1 L= 640.0'
		12,228 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	67.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	70.00'	**3.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=5.95 cfs @ 11.98 hrs HW=70.67' TW=0.00' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 0.79 cfs @ 9.01 fps)
2=Sharp-Crested Rectangular Weir (Weir Controls 5.16 cfs @ 2.68 fps)

Transportation Impact Assessment (TIA)

D

Transportation Impact Assessment

Philips Healthcare Campus Redevelopment
3000 Minuteman Road
Andover, Massachusetts

Prepared for:

ALEXANDRIA®
Cambridge, Massachusetts

July 2022

Prepared by:

Vanasse & Associates inc
Transportation Engineers & Planners

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Dear Reviewer:

This letter shall certify that this *Transportation Impact Assessment* has been prepared under my direct supervision and responsible charge. I am a Registered Professional Engineer (P.E.) in the Commonwealth of Massachusetts (Massachusetts P.E. No. 38871, Civil) and hold Certification as a Professional Traffic Operations Engineer (PTOE) from the Transportation Professional Certification Board, Inc. (TPCB), an independent affiliate of the Institute of Transportation Engineers (ITE) (PTOE Certificate No. 993). I am also a Fellow of the Institute of Transportation Engineers (FITE).

Sincerely,

VANASSE & ASSOCIATES, INC.

Jeffrey S. Dirk

Jeffrey S. Dirk, P.E., PTOE, FITE
Managing Partner

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EXECUTIVE SUMMARY

Vanasse & Associates, Inc. (VAI) has conducted a Transportation Impact Assessment (TIA) in order to determine the potential impacts on the transportation infrastructure associated with the renovation and expansion of the former Philips Healthcare campus located at 3000 Minuteman Road in Andover, Massachusetts, to accommodate laboratory/current Good Manufacturing Practice (cGMP) uses (hereafter referred to as the "Project"). This assessment was prepared in consultation with the Town of Andover and the Massachusetts Department of Transportation (MassDOT), and was performed in accordance with MassDOT's *Transportation Impact Assessment (TIA) Guidelines* and the standards of the Traffic Engineering and Transportation Planning professions for the preparation of such reports.

Based on this assessment, we have concluded the following with respect to the Project:

1. Using trip-generation statistics published by the Institute of Transportation Engineers (ITE)[1] for similar functional areas to those that will be associated with the campus redevelopment (research and development (R&D) and manufacturing space for trip-generation purposes), the Project is expected to generate approximately 7,268 vehicle trips on an average weekday (two-way volume over the operational day of the Project), with approximately 822 vehicle trips expected during the weekday morning peak-hour and 933 vehicle trips expected during the weekday evening peak-hour;

2. In comparison to the former Philips Healthcare campus at full occupancy, the Project is expected to generate approximately 77 *additional* vehicle trips during the weekday morning peak-hour and 175 *additional* vehicle trips during the weekday evening peak-hour, with a total of 1,668 *additional* vehicle trips expected over the operational day of the Project;

3. The Project will not result in a significant impact (increase) on motorist delays or vehicle queuing over Existing or anticipated future conditions without the Project (No-Build conditions); however, it was noted that one or more movements at the study intersections are predicted to operate at or over capacity (defined as a level-of-service (LOS) "E" or "F", respectively) independent of the Project. Project-related impacts were generally defined as an increase in average motorist delay that resulted in a corresponding increase in vehicle queuing of up to three (3) vehicles. Specific improvements will be advanced as a part of

[1] *Trip Generation*, 11th Edition; Institute of Transportation Engineers; Washington, DC; 2021.

other development projects in the area or have been recommended as a part of the Project to improve traffic operations;

4. No apparent safety deficiencies were noted with respect to the motor vehicle crash history at the study intersections; and

5. Lines of sight to and from the Project site driveway intersections were found to exceed the recommended minimum distances for the intersections to operate in a safe and efficient manner based on the appropriate approach speed.

In consideration of the above, we have concluded that the Project can be accommodated within the confines of the existing transportation infrastructure in a safe and efficient manner with implementation of the recommendations that follow.

RECOMMENDATIONS

A detailed transportation improvement program has been developed that is designed to provide safe and efficient access to the Project site and address any deficiencies identified at off-site locations evaluated in conjunction with this study. The following improvements have been recommended as a part of this evaluation and, where applicable, will be completed in conjunction with the Project subject to receipt of all necessary rights, permits, and approvals.

Project Access

Access to the Project will continue to be provided by way of the existing driveways that intersect the west side of Minuteman Road approximately 1,450 feet north of River Road and the terminus of 1776 Drive approximately 2,175 feet north of River Road, respectively. The following recommendations are offered with respect to the design and operation of the Project site access and internal circulation, many of which are reflected on the site plans:

- The driveways serving the Project site should continue to accommodate two-way travel and the turning and maneuvering requirements of service and delivery vehicles, and the largest anticipated responding emergency vehicle as defined by the Andover Fire Department.

- Where perpendicular parking is proposed, the drive aisle behind the parking should be a minimum of 23 feet in order to facilitate parking maneuvers.

- STOP-signs and marked STOP-line should be provided on the individual driveways that intersect the ring-road that circumnavigates the campus, at the intersection of the ring-road with Minuteman Road and on the 1776 Drive approach to River Road (retain existing traffic control at the intersection).

- All signs and pavement markings to be installed within the Project site should conform to the applicable standards of the *Manual on Uniform Traffic Control Devices* (MUTCD).[2]

- Sidewalks and pedestrian paths are provided within the Project site that extend to or provide access to the existing sidewalk along Minuteman Road.

[2] *Manual on Uniform Traffic Control Devices (MUTCD)*; Federal Highway Administration; Washington, D.C.; 2009.

- Americans with Disabilities Act (ADA)-compliant wheelchair ramps will be provided at all pedestrian crossings that are constructed or modified in conjunction with the Project.

- Signs and landscaping to be installed as a part of the Project within intersection sight triangle areas will be designed and maintained so as not to restrict lines of sight.

- Snow accumulations (windrows) within sight triangle areas will be promptly removed where such accumulations would impede sight lines.

- Consideration will be given to providing electric vehicle (EV) charging stations within the Project site.

Off Site

River Road Traffic Signal System

Independent of the Project, one or more movements at the intersections that comprise the River Road coordinated traffic signal system are currently or are predicted to operate at or over capacity during the peak-hours. In an effort to improve traffic operations and off-set the predicted impact of the Project, the Project proponent will design and implement an optimal traffic signal timing, phasing and coordination plan for the River Road coordinated traffic signal system inclusive of the following intersections:

- River Road/Minuteman Road/Shattuck Road
- River Road/I-93 Southbound Ramps
- River Road/I-93 Northbound Ramps
- River Road/Old River Road/Federal Street

These improvements will be completed prior to the issuance of a Certificate of Occupancy for any new or expanded building within the Project site, subject to receipt of all necessary rights, permits and approvals, and will include the installation, repair and/or upgrade of traffic signal equipment and associated appurtenances required to provide and maintain coordination of the traffic signal system. With the implementation of an optimal traffic signal timing, phasing and coordination plan, overall motorist delays will be reduced such that no movement operates at or over capacity, an improvement over No-Build conditions.

In addition to the traffic signal timing, phasing and coordination improvements, the Project proponent will reconstruct all non-ADA compliant wheelchair ramps at the subject intersections, replace/upgrade non-ADA complaint pushbuttons and install countdown-type pedestrian indications where such indications are not currently installed. These improvements will also be completed prior to the issuance of a Certificate of Occupancy for any new or expanded building within the Project site, subject to receipt of all necessary rights, permits and approvals.

Transportation Demand Management

The Project site is served by public transportation services that are provided by the Merrimack Valley Regional Transit Authority (MVRTA). The MVRTA operates bus Route 37, *Beacon Street*, which travels along River Road and Minuteman Road, with a stop located at Springhill Suites by Marriot (north of the Project site), and thereafter to the Buckley Transportation Center in Lawrence where connections can be made to other bus lines. From the Buckley Transportation Center, bus service is provided to Lawrence Station on the Haverhill Line of the Massachusetts Bay

Transportation Authority (MBTA) Commuter Rail system with service to North Station in Boston. MVRTA buses operate in a passenger demand service mode and will stop anywhere along the service route where it is safe to pick-up or discharge a passenger.

In an effort to encourage the use of alternative modes of transportation to single-occupant vehicles (SOVs), the following Transportation Demand Management (TDM) measures will be implemented as a part of the Project:

- A transportation coordinator will be assigned for the Project to coordinate the TDM program;
- Information regarding public transportation services, maps, schedules and fare information will be posted in a central location and/or otherwise made available to employees;
- The transportation coordinator will facilitate a rideshare matching program for employees to encourage carpooling;
- A "welcome packet" will be provided to new employees detailing available commuter options and will include the contact information for the transportation coordinator and information to enroll in the employee rideshare program;
- Specific amenities will be provided to discourage off-site trips, including providing a break-room equipped with a microwave and refrigerator; offering direct deposit of paychecks; coordinating with a dry-cleaning service for on-site pick-up and delivery; allowing telecommuting or flexible work schedules; and other such measures to reduce overall traffic volumes and travel during peak traffic volume periods;
- Pedestrian accommodations have been incorporated into the Project site;
- Secure bicycle parking will be provided throughout the Project site and will include exterior bicycle racks and weather protected bicycle parking for each building; and
- A shuttle service will be provided at no ($0) cost to employees of the Project that will provide weekday commuter service between the Project site Andover Station on the Haverhill Line of the MBTA Commuter Rail system. The shuttle service schedule will be coordinate with the arrival and departure of trains from Andover Station, with a minimum of four (4) round trips provided during both the weekday morning and evening peak commuter periods. Off-peak service and service to other commuter hubs will be considered as demand warrants.

With implementation of the aforementioned recommendations, safe and efficient access will be provided to the Project site and the Project can be accommodated within the confines of the existing and improved transportation system.

Traffic Monitoring Program

The Proponent will conduct a post-development traffic monitoring and employee survey program in order to evaluate the success and to refine the elements of the TDM program, and to validate the trip projections and parking demands for the Project. The monitoring program will include:

i) Obtaining traffic-volume information over a continuous seven-day, weeklong period on the driveway serving the Project site along Minuteman Road and 1776 Drive;

ii) Performing manual turning movement and vehicle classification counts at the Project site driveway intersections with Minuteman Road and 1776 Drive, and at the intersections of River Road at Minuteman Road and Shattuck Road and River Road at 1776 Drive during the weekday morning (7:00 to 9:00 AM) and weekday evening (4:00 to 6:00 PM) peak periods; and

iii) Evaluating motor vehicle crash data at the intersections of River Road at Minuteman Road and Shattuck Road and River Road at 1776 Drive.

The monitoring program will commence six (6) months after issuance of the Certificate of Occupancy for the Project and will continue on an annual basis thereafter for a period not to exceed 5-years after completion of the Project. The results of the monitoring program will be summarized in a report to be provided to the Town of Andover and MassDOT within 2-months after the completion of the data collection effort. The report will document: i) traffic volumes associated with the Project; ii) motorist delays, vehicle queuing, crash severity and calculated crash rates at the intersections of River Road at Minuteman Road and Shattuck Road and River Road at 1776 Drive; and iii) the elements of the TDM program that have been implemented and use of alternative modes of transportation to single-occupant vehicles.

INTRODUCTION

Vanasse & Associates, Inc. (VAI) has conducted a Transportation Impact Assessment (TIA) in order to determine the potential impacts on the transportation infrastructure associated with the renovation and expansion of the former Philips Healthcare campus located at 3000 Minuteman Road in Andover, Massachusetts, to accommodate laboratory/current Good Manufacturing Practice (cGMP) uses (hereafter referred to as the "Project"). This study evaluates the following specific areas as they relate to the Project: i) access requirements; ii) potential off-site improvements; and iii) safety considerations; and identifies and analyzes existing traffic conditions and future traffic conditions, both with and without the Project, along River Road, Minuteman Road and 1776 Drive, and at major intersections along these roadways through which Project-related traffic will travel.

PROJECT DESCRIPTION

The Project will entail the renovation and expansion of the former Philips Healthcare campus located at 3000 Minuteman Road in Andover, Massachusetts, to accommodate laboratory/cGMP uses. The campus currently contains four (4) buildings that encompass approximately 726,000± square foot (sf) of office/manufacturing space. The redevelopment plan will transform the former office/manufacturing campus into a life sciences campus consisting of a mix of laboratory, research and development, office, cGMP manufacturing and warehouse space, and will include an expansion of one (1) of the existing buildings (Building 1) and the addition of two (2) new future buildings, to contain approximately 1.126± million sf of space. Specifically, the campus redevelopment will consist of the following elements:

- ***Building 1:*** renovation of the existing 86,000± sf office building to accommodate lab/office (R&D) space and the construction of a 100,000± sf addition that will include cGMP and warehouse space.

- ***Building 2:*** renovation of the existing 164,100± sf building that was formerly used as office (41,025± sf) and associated electronics manufacturing space (123,075± sf) to accommodate a similar amount of laboratory/office and associated cGMP space, respectively.

- ***Building 3:*** renovation of the existing 171,200± sf building that was formerly used as office (42,800± sf) and associated electronics manufacturing space (128,400± sf) to accommodate a similar amount of laboratory/office and associated cGMP space, respectively.

- ***Building 4:*** renovation of the existing 256,700± sf building that was formerly used as office space to accommodate a similar amount of laboratory/office space.

- ***Building 5 (new):*** the construction of a 100,000 sf building that will be devoted to cGMP uses.

- ***Building 6 (new):*** the construction of a 100,000 sf building that will be devoted to cGMP uses.

The existing Link & Amenities Building (48,200± sf) will continue to provide accessory and supporting amenities for the campus, with no change to the existing function of the building.

The Project site is bounded by areas of open and wooded space and the Merrimack River to the north and west, and commercial properties to the south and east. Figure 1 depicts the Project site location in relation to the existing roadway network.

Access to the Project will continue to be provided by way of the existing driveways that intersect the west side of Minuteman Road approximately 1,450 feet north of River Road and the terminus of 1776 Drive approximately 2,175 feet north of River Road, respectively. ***There are no changes proposed to the existing campus roadway network as it relates to 1776 Drive or Minuteman Road that would result in a change in travel patterns or the increased use of 1776 Drive over the historic use of these roadways when Phillips Health Care occupied the campus.***

On-site parking will be provided for 2,704 vehicles, which is below the minimum parking requirements of Section 5.1, *Off-Street Parking and Loading*, of the Town of Andover Zoning By-Law.[3] The Project proponent has applied for and received approvals from the Town of Andover to reduce the parking requirements for the Project in an effort to reduce the amount of impervious area and encourage the use of alternative modes of transportation to single-occupancy vehicles (SOVs) while continuing to meet the parking requirements of prospective tenants.

[3]The Ordinance requires a minimum of 1 space per 300 sf of gross floor area for a laboratory/R&D use (anticipated to be 464,025± sf); and 1 space for each 300 sf of net floor area (anticipated to be 380,400± sf) for an industrial manufacturing use. This would require that a minimum of 2,815 parking spaces be provided to support the Project.

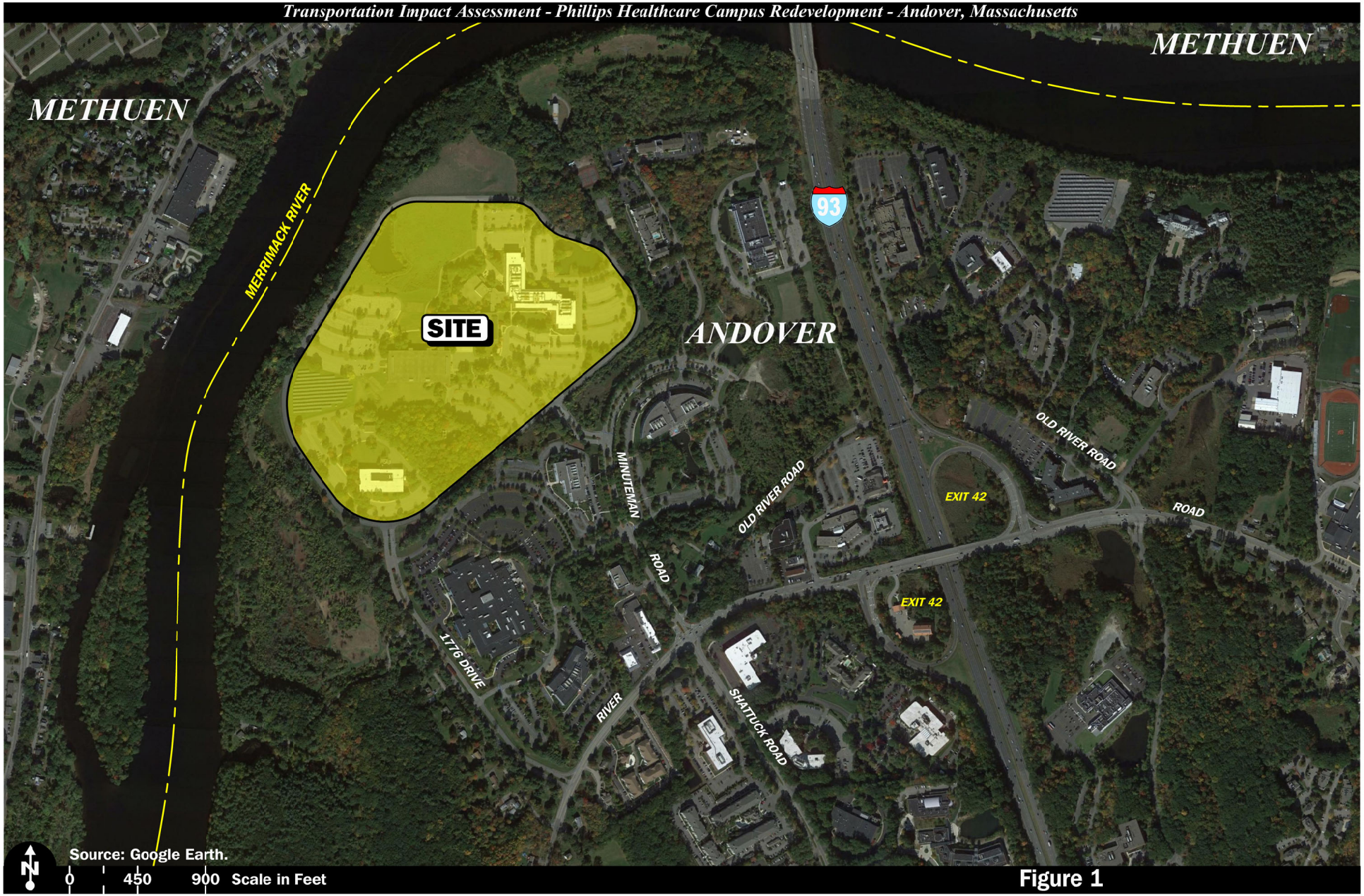


Figure 1

Site Location Map

Vanasse & Associates inc

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STUDY METHODOLOGY

This study was prepared in consultation with the Town of Andover and the Massachusetts Department of Transportation (MassDOT); was performed in accordance with MassDOT's *Transportation Impact Assessment (TIA) Guidelines* and the standards of the Traffic Engineering and Transportation Planning professions for the preparation of such reports; and was conducted in three distinct stages.

The first stage involved an assessment of existing conditions in the study area and included an inventory of roadway geometrics; pedestrian and bicycle facilities; on-street parking; public transportation services; observations of traffic flow; and collection of pedestrian, bicycle and vehicle counts.

In the second stage of the study, future traffic conditions were projected and analyzed. Specific travel demand forecasts for the Project were assessed along with future traffic demands due to expected traffic growth independent of the Project. A seven-year time horizon was selected for analyses consistent with MassDOT's *Transportation Impact Assessment (TIA) Guidelines*. The traffic analysis conducted in stage two identifies existing or projected future roadway capacity, traffic safety, and site access issues.

The third stage of the study presents and evaluates measures to address traffic and safety issues, if any, identified in stage two of the study.

EXISTING CONDITIONS

A comprehensive field inventory of existing conditions within the study area was conducted in May and June 2022. The field investigation consisted of an inventory of existing roadway geometrics; pedestrian and bicycle facilities; public transportation services; traffic volumes; and operating characteristics; as well as posted speed limits and land use information within the study area. The study area that was assessed for the Project consisted of River Road, Minuteman Road and 1776 Drive and the following specific intersections: River Road at 1776 Drive; River Road at Minuteman Road and Shattuck Road; River Road at the Interstate 93 (I-93) southbound ramps; River Road at the I-93 northbound ramps; and River Road at Old River Road and Federal Street.

The following describes the study area roadways and intersections.

ROADWAYS

River Road

- Two to four-lane urban minor arterial roadway under Town jurisdiction, with the exception of the segment of roadway between the I-93 north and southbound ramps, which is under MassDOT jurisdiction;
- Traverses the study area in a general east-west direction;
- Provides four 11 to 12-foot-wide travel lanes separated by a raised median with variable width marked shoulders provided along both sides of the roadway and additional turning lanes provided at major intersections east of Minuteman Road;
- Provides two 11 to 12-foot wide travel lanes separated by a double-yellow centerline with variable width marked shoulders provided along both sides of the roadway and additional turning lanes provided at major intersections west of Minuteman Road;
- Sidewalks are provided along one or both sides of the roadway within the study area;
- Bicycle lanes are provided along both sides of the roadway west of Minuteman Road;
- Illumination is provided by way of streetlights mounted on wood poles;
- The posted speed limit is 35 miles per hour (mph) west of the I-93 northbound ramps and 30 mph to the east;

- Land use within the study area consists of residential and commercial properties and areas of open and wooded space.

Minuteman Road

- Four-lane, private, local access roadway;
- Traverses study area in a general north-south direction for a distance of approximately 2,500-feet north of River Road;
- Provides four 12-foot wide travel lanes that are separated by a raised median with 1 to 2-foot wide shoulders provided along both sides of the roadway and additional turning lanes provided at major intersections;
- The posted speed limit is 25 mph within the study area;
- A sidewalk is provided along the east side of the roadway;
- Illumination is provided by way of streetlights mounted on steel poles;
- Land use within the study area consists of the Project site, commercial properties and areas of open and wooded space.

1776 Drive

- Four-lane, private, local access roadway;
- Traverses study area in a general north-south direction for a distance of approximately 2,200-feet north of River Road;
- Provides four 12-foot wide travel lanes that are separated by a raised median with 1-foot wide shoulders provided along both sides of the roadway;
- A posted speed limit is not provided and, as such, the statutory or "prima facie" speed limit pursuant to M.G.L. c. 90 § 17 is 30 mph;[4]
- Sidewalks are not provided within the study area;
- Illumination is provided by way of streetlights mounted on steel poles;
- Land use within the study area consists of the Project site, commercial properties and areas of open and wooded space.

INTERSECTIONS

Table 1 and Figure 2 summarize existing lane use, traffic control, and pedestrian and bicycle accommodations at the study area intersections as observed in June 2022.

[4]The statutory or "prima facie" speed is defined in M.G.L. Chapter 90, Section 17, as the speed which would be deemed reasonable and proper to operate a motor vehicle.

Table 1
STUDY AREA INTERSECTION DESCRIPTION

Intersection	Traffic Control Type[a]	No. of Travel Lanes Provided	Shoulder Provided? (Yes/No/Width)	Pedestrian Accommodations? (Yes/No/Description)	Bicycle Accommodations? (Yes/No/Description)
River Rd./ 1776 Dr.	S	1 general purpose travel lane along River Rd. eastbound; 1 through lane and 1 channelized right-turn lane on River Rd. westbound; 1 left-turn lane and 1 right-turn lane on 1776 Dr.	Yes; 4 to 5-feet along River Rd.; 1-foot along 1776 Dr.	Yes; sidewalks along both sides of River Rd. east of the intersection and along the south side to the west	Yes; bicycle lanes on River Rd.; shared traveled-way[b] on 1776 Dr.
River Rd./ Minuteman Rd./ Shattuck Rd.	TS	1 left-turn lane, 1 through lane and 1 shared through/right-turn lane along River Rd. eastbound; 2 left-turn lanes, 1 through lane and 1 channelized right-turn lane on River Rd. westbound; 1 left-turn lane, 1 shared left-turn/through lane and 1 channelized right-turn lane on Minuteman Rd.; 1 shared left-turn/through lane and 2 channelized right-turn lanes on Shattuck Rd.	Yes; 1 to 2-feet along River Rd.; 1-foot along Minuteman Rd. and Shattuck Rd.	Yes; sidewalks along both sides of River Rd. west of the intersection and along the north side to the east, along the east side of Minuteman Rd. and along the west side of Shattuck Rd.; crosswalks provided across the River Rd. west leg and Minuteman Rd.; pedestrian traffic signal equipment and phasing (exclusive) provided	Yes; bicycle lanes on River Rd. west of the intersection; shared traveled-way along River Rd. east of the intersection, Minuteman Rd. and Shattuck Rd.
River Rd./ I-93 Southbound Ramps	TS	2 through lanes and 1 channelized right-turn lane on River Rd. eastbound; 2 left-turn lanes and 2 through lanes on River Rd. westbound; 2 left-turn lanes and 1 channelized right-turn lane on the I-93 southbound off-ramp	Yes; 1 to 2-feet along River Rd.; 2-feet along the I-93 southbound ramps	Yes; sidewalks along the north side of River Rd. to the west of the intersection and along the south side to the east; crosswalk provided for crossing the River Rd. east leg; pedestrian traffic signal equipment and phasing (exclusive) provided	Yes; shared traveled-way along River Rd.
River Rd./ I-93 Northbound Ramps	TS	2 left-turn lanes and 2 through lanes on River Rd. eastbound; 2 through lanes and 1 channelized right-turn lane on River Rd. westbound; 2 left-turn lanes and 2 channelized right-turn lanes on the I-93 northbound off-ramp	Yes; 1 to 4-feet along River Rd.; 1 to 3-feet along the I-93 northbound ramps	Yes; sidewalk along the south side of River Rd.	Yes; shared traveled-way along River Rd.

See notes at end of table.

Table 1 (Continued)
STUDY AREA INTERSECTION DESCRIPTION

Intersection	Traffic Control Type[a]	No. of Travel Lanes Provided	Shoulder Provided? (Yes/No/Width)	Pedestrian Accommodations? (Yes/No/Description)	Bicycle Accommodations? (Yes/No/Description)
River Rd./ Old River Rd./ Federal St.	TS	2 left-turn lanes, 2 through lanes and 1 channelized right-turn lane on River Rd. eastbound; 1 left-turn lane, 1 through lane and 1 shared through/right-turn lane along River Rd. westbound; 1 left-turn lane, 1 through lane and 1 channelized right-turn lane on Old River Rd.; 1 shared left-turn/through lane and 1 right-turn lane on Federal St.	Yes; 2 to 6-feet on River Rd.; 1-foot on Federal St.	Yes; sidewalk along the south side of River Rd.; crosswalk provided across the Federal St. leg; pedestrian traffic signal equipment and phasing are not provided	Yes; shared traveled-way along the intersecting roadways

[a]TS = traffic signal control; S = STOP control.
[b]Combined shoulder and travel lane width equal to or exceed 14 feet.

TRAFFIC VOLUMES

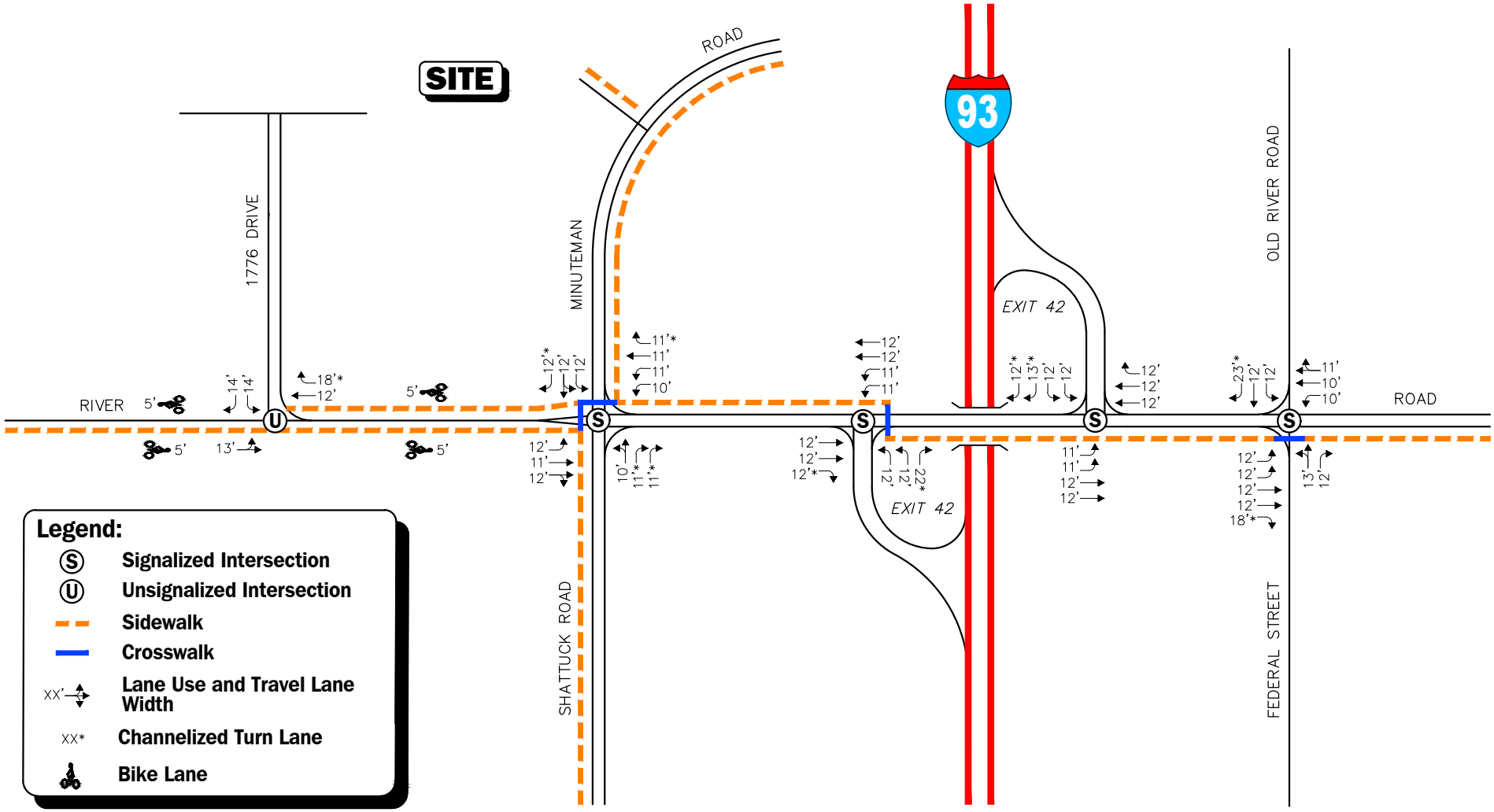
In order to determine existing traffic-volume demands and flow patterns within the study area, automatic traffic recorder (ATR) counts, turning movement counts (TMCs) and vehicle classification counts were completed in May 2022. The ATR counts were conducted on River Road in the vicinity of the Project site on May 11th through 12th, 2022 (Wednesday through Thursday, inclusive) in order to record weekday traffic conditions over an extended period, with peak period TMCs performed at the study intersections during the weekday morning (7:00 to 9:00 AM) and evening (4:00 to 6:00 PM) peak periods on Wednesday, May 11, 2022. These time periods were selected for analysis purposes as they are representative of the peak-traffic-volume hours for both the Project and the adjacent roadway network.

Traffic-Volume Adjustments

In order to evaluate the potential for seasonal fluctuation of traffic volumes within the study area, traffic volume data from MassDOT Continuous Count Station No. 5093 located on I-93, north of Lowell Street, in Methuen were reviewed.[5] Based on a review of this data, it was determined that traffic volumes for the month of May are approximately 0.7 percent above average-month conditions. As such, no adjustment was made to the May traffic volumes as they are representative of average-month conditions.

In order to account for the impact on traffic volumes and trip patterns resulting from the COVID-19 pandemic, traffic volume data collected at MassDOT Continuous Count Station No. 5093 in May 2022 was compared to May 2017 traffic volumes that were collected at the same location. The 2017 traffic volumes were expanded to 2019 by applying the traffic growth procedure detailed

[5]MassDOT Traffic Volumes for the Commonwealth of Massachusetts; 2021.



Not to Scale

Figure 2

Existing Intersection Lane Use, Travel Lane Width, and Pedestrian Facilities

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in the April 2020 "Guidance on Traffic Counting Data" published by MassDOT[6] in order to allow for a comparison of the data. Based on this pre and post COVID-19 traffic-volume comparison, the traffic-volume data that was collected as a part of this assessment was adjusted upward by an additional 2.0 percent in order to account for the reduced traffic volumes resulting from the COVID-19 pandemic.

The 2022 Existing traffic volumes are summarized in Table 2, with the weekday morning and evening peak-hour traffic volumes graphically depicted on Figures 3 and 4, respectively. Note that the peak-hour traffic volumes that are presented in Table 2 were obtained from the aforementioned figures.

Table 2
2022 EXISTING TRAFFIC VOLUMES

Location/Peak Hour	AWT[a]	VPH[b]	K Factor[c]	Directional Distribution[d]
River Road, east of Minuteman Road:	15,050	--	--	--
Weekday Morning (7:15 – 8:15 AM)	--	1,529	10.2	70.3% WB
Weekday Evening (4:30 – 5:30 PM)	--	1,371	9.1	67.6% EB

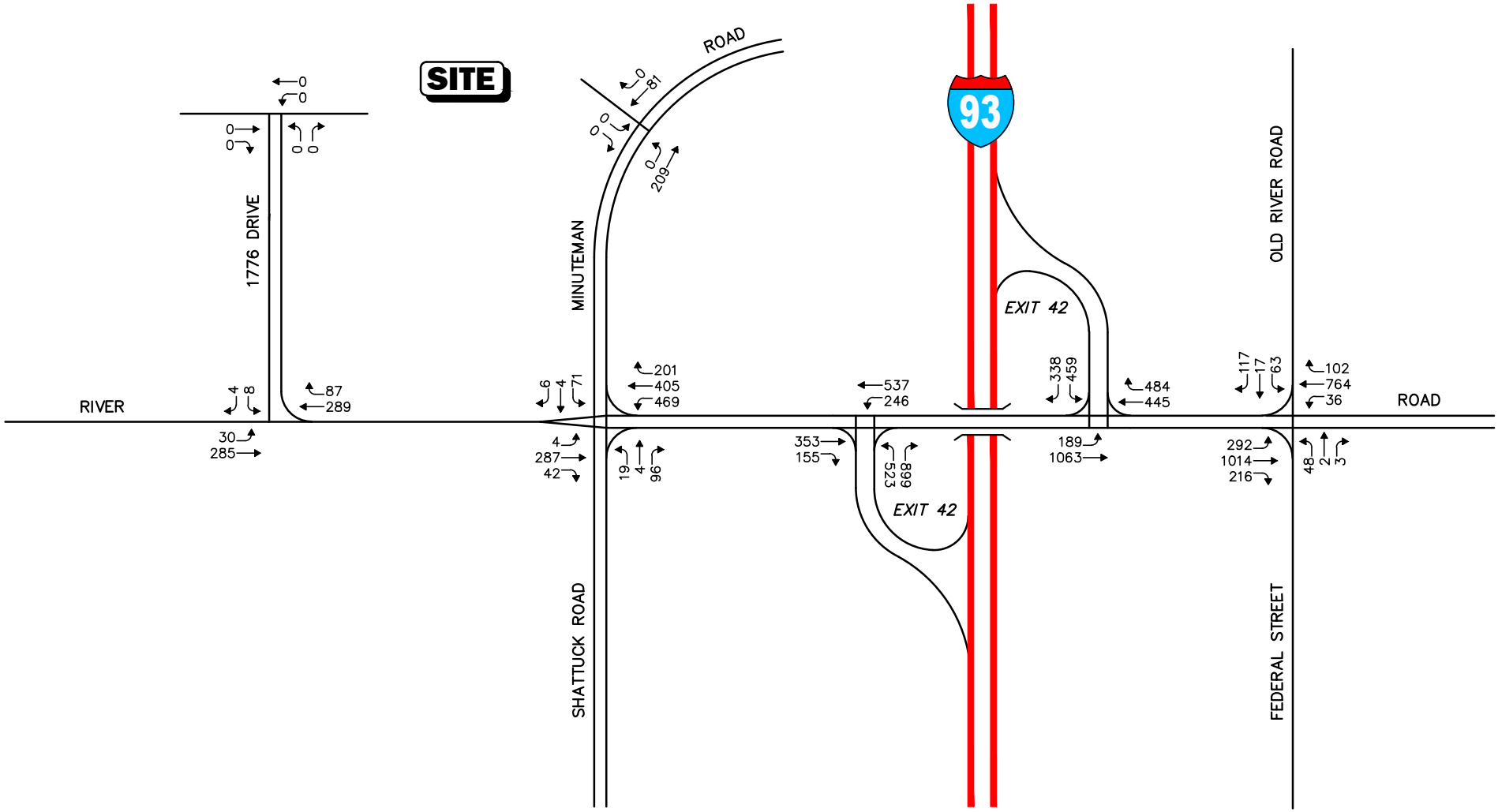
[a]Average weekday traffic in vehicles per day.
[b]Vehicles per hour.
[c]Percent of daily traffic occurring during the peak-hour.
[d]Percent traveling in peak direction.
EB = eastbound; WB = westbound.

As can be seen in Table 2, River Road in the vicinity of the Project site, was found to accommodate approximately 15,050 vehicles on an average weekday (two-way, 24-hour volume), with approximately 1,529 vehicles per hour (vph) during the weekday morning peak-hour and 1,371 vph during the weekday evening peak-hour.

PEDESTRIAN AND BICYCLE FACILITIES

A comprehensive field inventory of pedestrian and bicycle facilities within the study area was undertaken in June 2022. The field inventory consisted of a review of the location of sidewalks and pedestrian crossing locations along the study roadways and at the study area intersections. As detailed on Figure 2, sidewalks are generally provided along one or both sides of the study area roadways, with marked crosswalks provided for crossing one or more legs of the River Road/Minuteman Road/Shattuck Road, River Road/I-93 southbound ramps and the River Road/Old River Road/Federal Street intersections, with pedestrian traffic signal equipment and phasing provided as a part of the traffic signal systems at the River Road/ Minuteman Road/Shattuck Road and River Road/I-93 southbound ramps intersections.

[6]*Guidance on Traffic Count Data*; MassDOT; revised April 2020. Note, MassDOT considers 2019 to be representative of "existing" traffic volumes.



Note: **Imbalances exist due to numerous curb cuts and side streets that are not shown.**

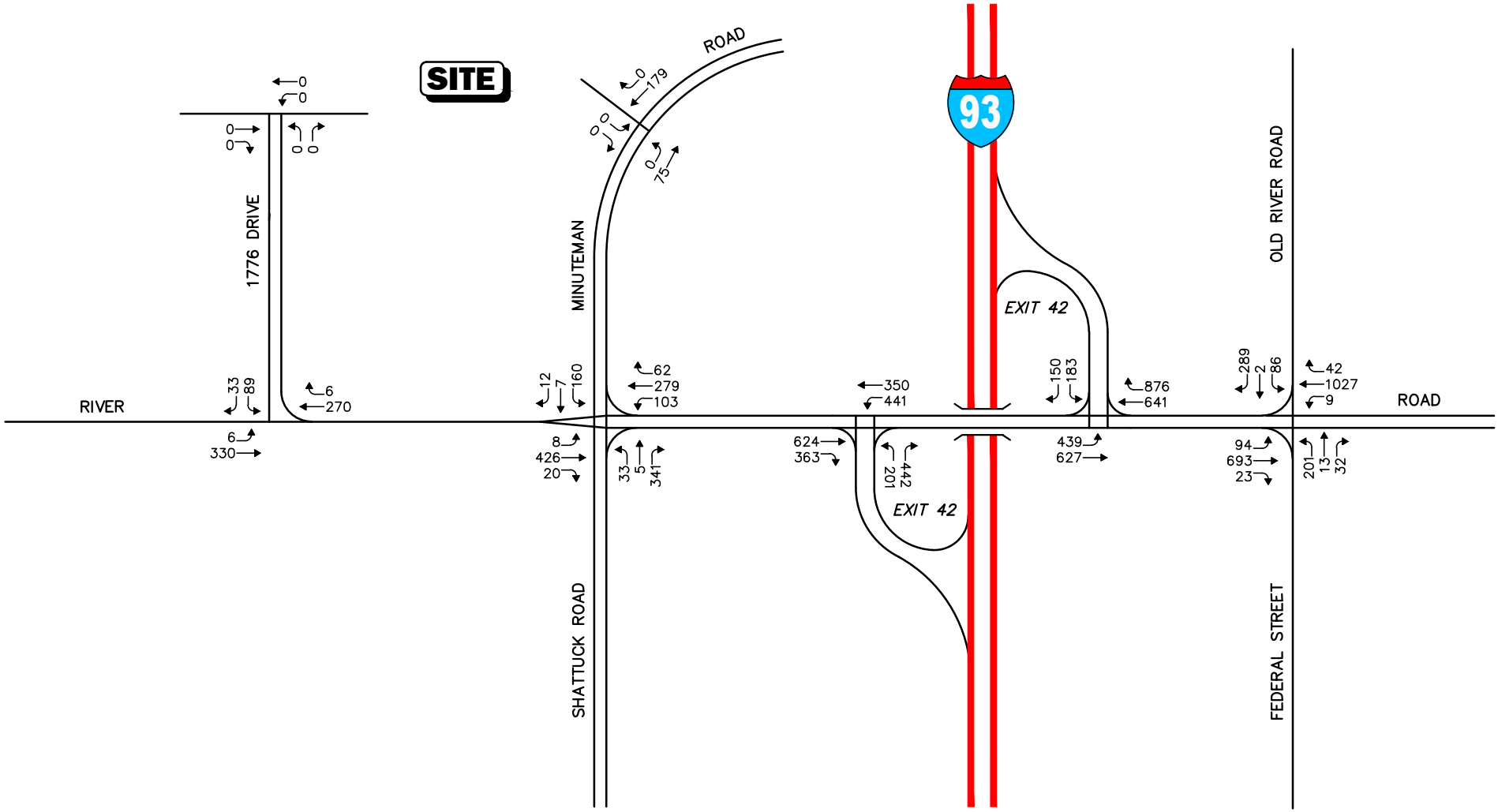
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Figure 3

2022 Existing
Weekday Morning
Peak-Hour Traffic Volumes

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Note: **Imbalances exist due to numerous curb cuts and side streets that are not shown.**

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Figure 4

2022 Existing
Weekday Evening
Peak-Hour Traffic Volumes

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Bike lanes are provided along River Road west of Minuteman Road, with River Road east of Minuteman Road and the remaining study area roadways found to provide sufficient width (combined travel lane and paved shoulder) to support bicycle travel in a shared traveled-way configuration.[7]

PUBLIC TRANSPORTATION

The Project site is served by public transportation services that are provided by the Merrimack Valley Regional Transit Authority (MVRTA). The MVRTA operates bus Route 37, *Beacon Street*, which travels along River Road and Minuteman Road, with a stop located at Springhill Suites by Marriot (north of the Project site), and thereafter to the Buckley Transportation Center in Lawrence where connections can be made to other bus lines. From the Buckley Transportation Center, bus service is provided to Lawrence Station on the Haverhill Line of the Massachusetts Bay Transportation Authority (MBTA) Commuter Rail system with service to North Station in Boston. MVRTA buses operate in a passenger demand service mode and will stop anywhere along the service route where it is safe to pick-up or discharge a passenger.

The public transportation schedules and fare information are provided in the Appendix.

SPOT SPEED MEASUREMENTS

Vehicle travel speed measurements were performed on River Road in the vicinity of the Project site in conjunction with the ATR counts. Table 3 summarizes the vehicle travel speed measurements.

Table 3
VEHICLE TRAVEL SPEED MEASUREMENTS

	River Road	
	Eastbound	Westbound
Mean Travel Speed (mph)	34	36
85th Percentile Speed (mph)	38	41
Posted Speed Limit (mph)	35	35

mph = miles per hour.

As can be seen in Table 3, the mean vehicle travel speed along River Road in the vicinity of the Project site was found to be 34 mph in the eastbound direction and 36 mph westbound. The measured 85th percentile vehicle travel speed, or the speed at which 85 percent of the observed vehicles traveled at or below, was found to be 38 mph eastbound and 41 mph westbound, which is 3 to 6 mph above the posted speed limit (35 mph). The 85th percentile speed is used as the basis of engineering design and in the evaluation of sight distances, and is often used in establishing posted speed limits.

[7]A minimum combined travel lane and paved shoulder width of 14-feet is required to support bicycle travel in a shared traveled-way condition.

MOTOR VEHICLE CRASH DATA

Motor vehicle crash information for the study area intersections was provided by the MassDOT Highway Division Safety Management/Traffic Operations Unit for the most recent five-year period available (2015 through 2019, inclusive) in order to examine motor vehicle crash trends occurring within the study area. The data is summarized by intersection, type, severity, roadway and weather conditions, and day of occurrence, and presented in Table 4.

As can be seen in Table 4, the study intersections experienced an average of 6.4 or fewer reported motor vehicle crashes per year over the five-year review period and were found to have motor vehicle crash rates *below* both the MassDOT statewide and District averages for similar intersections for the MassDOT Highway Division District in which the intersections are located (District 4). The majority of the crashes were reported to have occurred on a weekday; during daylight; under clear weather conditions; and involved rear-end type collisions that resulted in property damage only.

A review of the MassDOT statewide High Crash Location List indicated that there were no locations within the study area that were included on MassDOT's Highway Safety Improvement Program (HSIP) listing as a high crash location. The detailed MassDOT Crash Rate Worksheets and High Crash Location mapping are provided in the Appendix.

Table 4
MOTOR VEHICLE CRASH DATA SUMMARY[a]

	River Rd./ 1776 Dr.	River Rd./ Minuteman Rd./ Shattuck Rd.	River Rd./ I-93 Southbound Ramps	River Rd./ I-93 Northbound Ramps	River Rd./ Old River Rd./ Federal St.
Traffic Control Type:[b]	S	TS	TS	TS	TS
Year:					
2015	1	0	10	3	4
2016	0	3	4	4	7
2017	2	1	9	5	9
2018	2	0	8	10	4
2019	3	0	1	2	3
Total	8	4	32	24	27
Average	1.6	0.8	6.4	4.8	5.4
Rate[c]	0.54	0.14	0.65	0.41	0.53
MassDOT Crash Rate:[d]	0.57/0.57	0.73/0.78	0.73/0.78	0.73/0.78	0.73/0.78
Significant?[e]	No	No	No	No	No
Type:					
Angle	1	0	0	4	5
Rear-End	4	4	26	18	18
Head-On	0	0	1	0	0
Sideswipe	2	0	5	1	2
Fixed Object	1	0	0	1	2
Pedestrian/Bicycle	0	0	0	0	0
Unknown/Other	0	0	0	0	0
Total	8	4	32	24	27
Conditions:					
Clear	3	3	23	15	17
Cloudy	2	0	8	3	7
Rain	1	0	1	4	3
Snow/Ice	2	1	0	2	0
Total	8	4	32	24	27
Lighting:					
Daylight	6	3	24	15	20
Dawn/Dusk	0	0	3	3	4
Dark (Road Lit)	2	1	5	6	2
Dark (Road Unlit)	0	0	0	0	1
Total	8	4	32	24	27
Day of Week:					
Monday through Friday	7	3	28	21	25
Saturday	1	1	2	2	2
Sunday	0	0	2	1	0
Total	8	4	32	24	27
Severity:					
Property Damage Only	7	4	25	18	24
Personal Injury	1	0	7	5	3
Fatality	0	0	0	0	0
Unknown	0	0	0	1	0
Total	8	4	32	24	27

[a]Source: MassDOT Safety Management/Traffic Operations Unit records, 2015 through 2019.
[b]Traffic Control Type: TS = traffic signal control; S = stop control.
[c]Crash rate per million vehicles entering the intersection.
[d]Statewide/District crash rate.
[e]The intersection crash rate is significant if it is found to exceed the MassDOT crash rate for the MassDOT Highway Division District in which the Project is located (District 4).

FUTURE CONDITIONS

Traffic volumes in the study area were projected to the year 2029, which reflects a seven-year planning horizon consistent with MassDOT's *Transportation Impact Assessment (TIA) Guidelines*. Independent of the Project, traffic volumes on the roadway network in the year 2029 under No-Build conditions include all existing traffic and new traffic resulting from background traffic growth. Anticipated Project-generated traffic volumes superimposed upon the 2029 No-Build traffic volumes reflect 2029 Build traffic-volume conditions with the Project.

FUTURE TRAFFIC GROWTH

Future traffic growth is a function of the expected land development in the immediate area and the surrounding region. Several methods can be used to estimate this growth. A procedure frequently employed estimates an annual percentage increase in traffic growth and applies that percentage to all traffic volumes under study. The drawback to such a procedure is that some turning volumes may actually grow at either a higher or a lower rate at particular intersections.

An alternative procedure identifies the location and type of planned development, estimates the traffic to be generated, and assigns it to the area roadway network. This procedure produces a more realistic estimate of growth for local traffic; however, potential population growth and development external to the study area would not be accounted for in the resulting traffic projections.

To provide a conservative analysis framework, both procedures were used, the salient components of which are described below.

Specific Developments by Others

The Town of Andover Planning Department was consulted in order to determine if there were any projects planned within the study area that would have an impact on future traffic volumes at the study intersections. Based on this consultation, the following projects were identified for review in conjunction with this assessment:

- ***Proposed cGMP Facility, 300 Minuteman Road, Andover, Massachusetts.*** This project entails the construction of a 224,500± sf cGMP facility to be located at 300 Minuteman Road, east of the Project site. Traffic volumes associated with this project

within the study area were obtained from the traffic study[8] prepared for the project and were included in the future condition traffic volumes.

- ***Proposed Research and Development Facility, One Corporate Drive, Andover, Massachusetts.*** This proposed project consists of the repurposing and expansion of the existing general office building located at One Corporate Drive, south of the Project site. Traffic volumes associated with this project within the study area were obtained from the traffic study[9] prepared for the project and were included in the future condition traffic volumes.

In addition to the aforementioned projects, traffic volumes associated with the reoccupancy of the Philips Healthcare campus were estimated using trip-generation statistics published by the Institute of Transportation Engineers (ITE)[10] for similar land uses and were added to the future condition traffic volumes. No other developments were identified at this time that are expected to result in an increase in traffic within the study area beyond the general background traffic growth rate.

General Background Traffic Growth

Traffic-volume data compiled by MassDOT from permanent count stations located in Andover, Dracut and Methuen were reviewed in order to determine general traffic growth trends in the area. This data indicates that traffic volumes have fluctuated over the 10-year period between 2009 and 2019, with an average traffic growth rate of 1.14 percent per year. In order to provide a prudent planning condition for the Project, a slightly higher 1.5 percent per year compounded annual background traffic growth rate was used in order to account for future traffic growth and presently unforeseen development within the study area.

Roadway Improvement Projects

The Town of Andover and MassDOT were contacted in order to determine if there were any planned future roadway improvement projects expected to be complete by 2029 within the study area. Based on these discussions, the following roadway improvement project was identified:

- **River Road/Minuteman Road/Shattuck Road Intersection Improvements.** In conjunction with the construction of the cGMP facility to be located at 300 Minuteman Road, the following improvements will be completed at the River Road/ Minuteman Road/Shattuck Road intersection:

    - Replace the existing inductive loop vehicle detection system with video detection (four (4) video cameras required)
    - Replace the existing pedestrian signal indications (two (2)) with countdown-type indications
    - Replace the existing pedestrian pushbuttons with ADA compliant audible devices

No other roadway improvement projects aside from routine maintenance activities were identified to be planned within the study area at this time.

[8] *Transportation Impact Assessment*; Proposed Medical/Pharmaceutical Manufacturing Facility, Andover, Massachusetts; VAI; 2021.

[9] *Transportation Impact Assessment*; Proposed Research and Development Facility, Andover, Massachusetts; VAI; 2022.

[10] Ibid 1.

No-Build Traffic Volumes

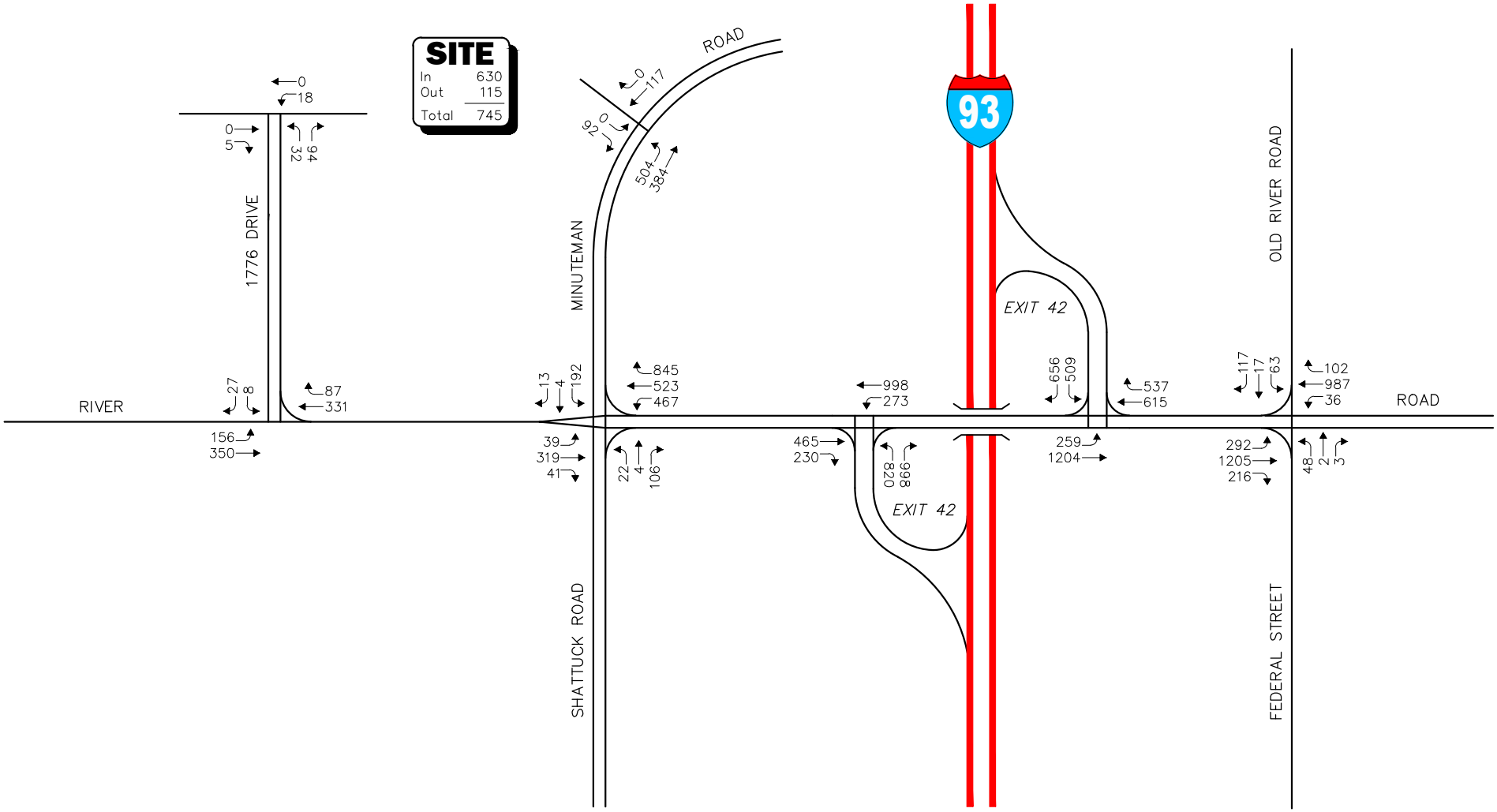
The 2029 No-Build condition peak-hour traffic-volumes were developed by: i) applying the 1.5 percent per year compounded annual background traffic growth rate to the 2022 Existing peak-hour traffic volumes; ii) adding the peak-hour volumes associated with the identified specific development projects by others; and iii) adding the peak-hour volumes associated with the reoccupancy of the existing buildings that are associated with the Philips Healthcare campus. The resulting 2029 No-Build weekday morning and evening peak-hour traffic volumes are shown on Figures 5 and 6, respectively.

PROJECT-GENERATED TRAFFIC

Design year (2029 Build) traffic volumes for the study area roadways were determined by estimating Project-generated traffic volumes and assigning those volumes on the study roadways. The following sections describe the methodology used to develop the anticipated traffic characteristics of the Project.

As proposed, the Project will entail the renovation and expansion of the former Philips Healthcare campus to accommodate laboratory/cGMP uses (functionally classified as research and development (R&D) and manufacturing for trip-generation purposes). In order to develop the traffic characteristics of the Project, trip-generation statistics published by the ITE[11] for similar land uses as those proposed were used. ITE Land Use Codes (LUCs) 140, *Manufacturing*, and 760, *Research and Development Center*, were used to establish the trip-generation calculations for the Project, the results of which are summarized in Table 5. Note that the Link & Amenities Building (48,200± sf) is not included in the trip-generation calculations as this building is supportive of the other uses that will be located within the campus and will not produce additional traffic beyond that attributable to the other buildings and shown in Table 5.

[11]Ibid 1.



Note: **Imbalances exist due to numerous curb cuts and side streets that are not shown.**

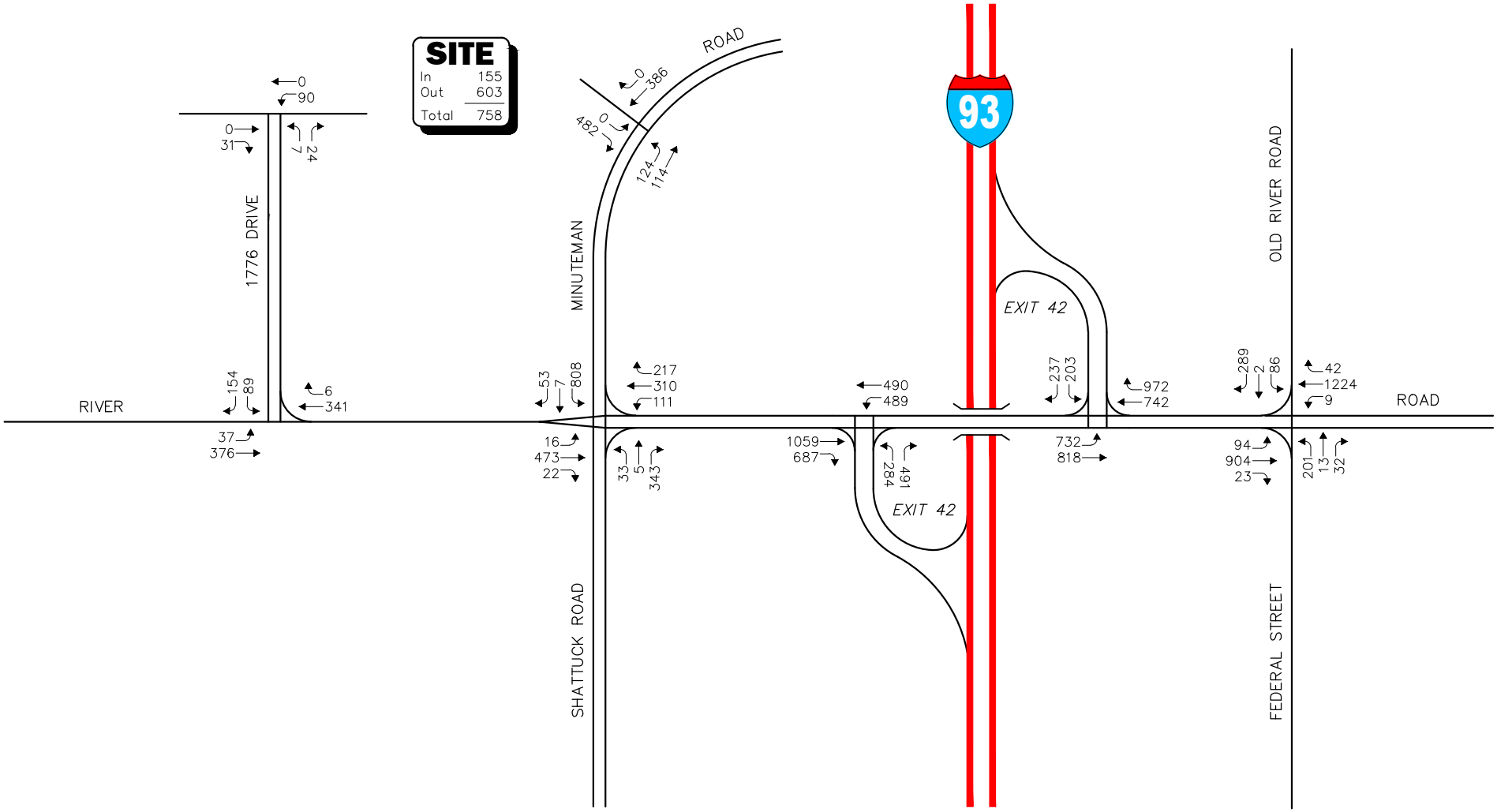
Not to Scale

Figure 5

2029 No-Build
Weekday Morning
Peak-Hour Traffic Volumes

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Note: **Imbalances exist due to numerous curb cuts and side streets that are not shown.**

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Figure 6

2029 No-Build
Weekday Evening
Peak-Hour Traffic Volumes

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Table 5
TRIP GENERATION SUMMARY[a]

Time Period/Direction	Vehicle Trips (A) Lab/Office/R&D Space (464,025 sf)[a]	(B) Manufacturing/ Warehouse Space (cGMP) (613,975 sf)[b]	(A+B) Total Trips
Average Weekday Daily:			
Entering	2,375	1,259	3,634
Exiting	2,375	1,259	3,634
Total	4,750	2,518	7,268
Weekday Morning Peak Hour:			
Entering	364	292	656
Exiting	74	92	166
Total	438	384	822
Weekday Evening Peak Hour:			
Entering	66	161	227
Exiting	349	357	706
Total	415	518	933

[a]Based on ITE LUC 760, *Research and Development Center.*
[b]Based on ITE LUC 140, *Manufacturing.*

Project-Generated Traffic-Volume Summary

As can be seen in Table 5, the Project is expected to generate approximately 7,268 vehicle trips on an average weekday (two-way volume over the operational day of the Project, or 3,634 vehicles entering and 3,634 exiting), with approximately 822 vehicle trips (656 vehicles entering and 166 exiting) expected during the weekday morning peak-hour and 933 vehicle trips (227 vehicles entering and 706 exiting) expected during the weekday evening peak-hour.

As mentioned previously, the Project site is occupied by the former Philips Healthcare campus. Table 6 provides a comparison of the traffic volumes of the Project to those of the former Philips Healthcare campus at full occupancy. The detailed trip-generation calculations for the existing campus are provided in the Appendix.

Table 6
TRAFFIC VOLUME COMPARISON

Time Period/Direction	Vehicle Trips (A) Proposed cGMP Campus[a]	(B) Former Campus[b]	(A-B) Difference
Average Weekday Daily:	7,268	5,600	+1,668
Weekday Morning Peak-Hour:	822	745	+77
Weekday Evening Peak-Hour:	933	758	+175

[a]See Table 5.
[b]Based on ITE LUCs 140, *Manufacturing;* 710, *General Office Building;* and 760, *Research and Development Center.*

Traffic Volume Comparison

As can be seen in Table 6, in comparison to the former Philips Healthcare campus, the Project is expected to generate approximately 1,668 additional vehicle trips on an average weekday, with 77 additional vehicle trips expected during the weekday morning peak-hour and 175 additional vehicle trips expected during the weekday evening peak-hour.

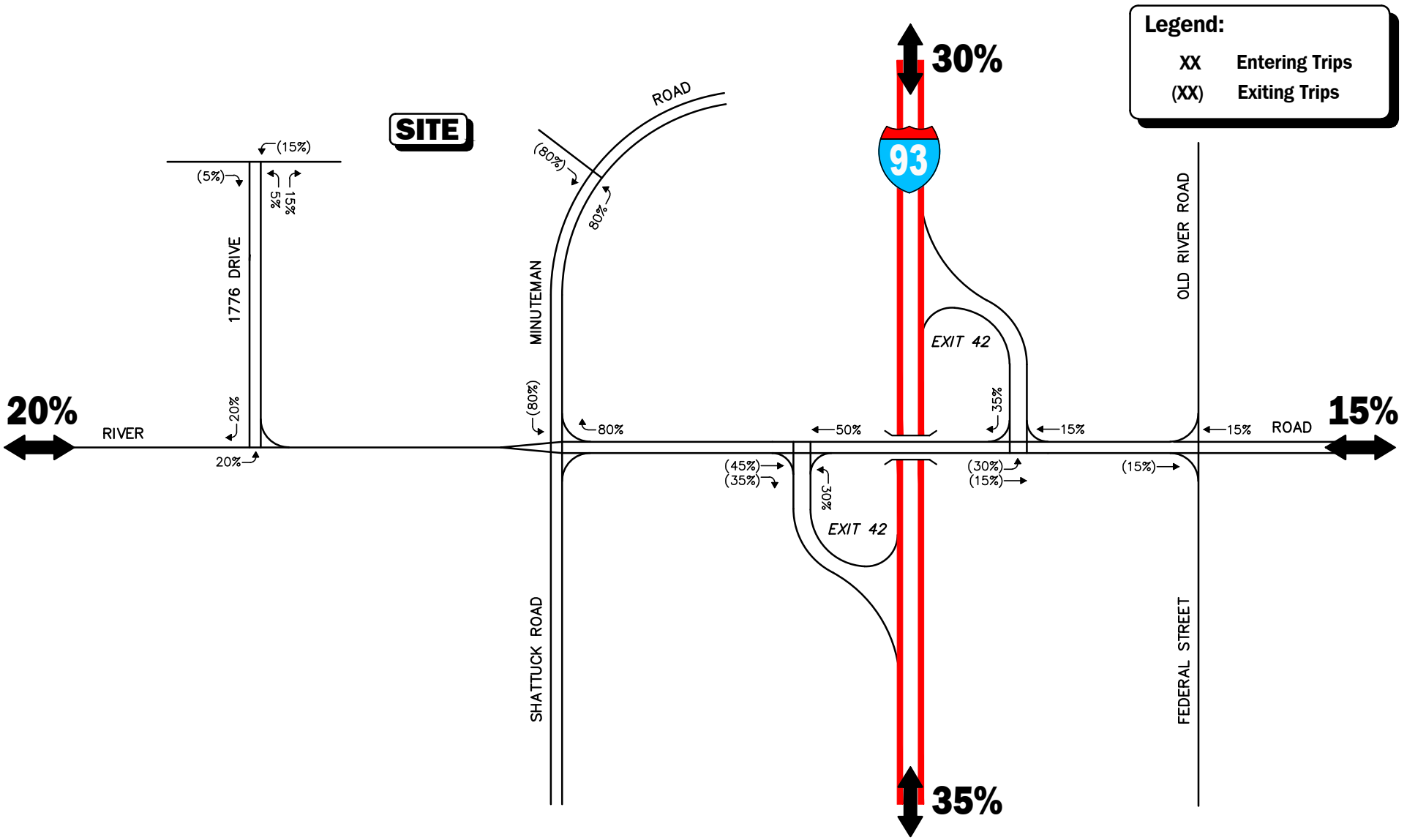
TRIP DISTRIBUTION AND ASSIGNMENT

The directional distribution of generated trips to and from the Project site was determined based on a review of U.S. Census Journey-to-Work data for the Town of Andover and then refined based on a review of existing traffic patterns within the study area. The general trip distribution for the Project is graphically depicted on Figure 7. The additional traffic expected to be generated by the Project was assigned on the study area roadway network as shown on Figures 8 and 9 for the weekday morning and evening peak hours, respectively.

FUTURE TRAFFIC VOLUMES - BUILD CONDITION

The 2029 Build condition traffic volumes consist of the 2029 No-Build traffic volumes with: i) the removal of the traffic associated with the reoccupancy of the Philips Healthcare campus; and ii) the addition of the traffic expected to be generated by the Project. The 2029 Build weekday morning and evening peak-hour traffic volumes are graphically depicted on Figures 10 and 11, respectively.

A summary of peak-hour projected traffic-volume changes outside of the study area that is the subject of this assessment is shown in Table 7. These changes are a result of the construction of the Project.



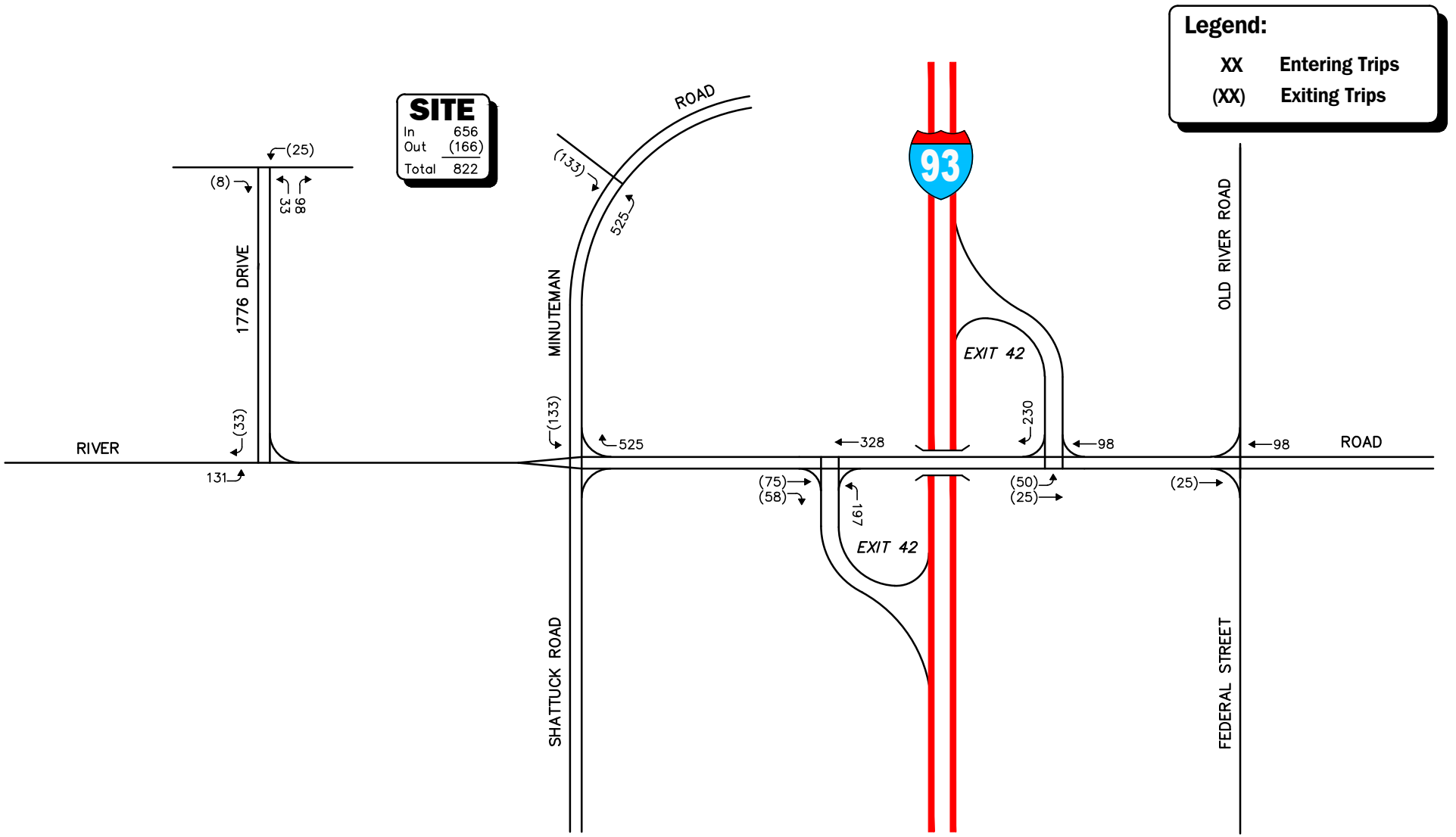
Not to Scale

Figure 7

Trip Distribution Map

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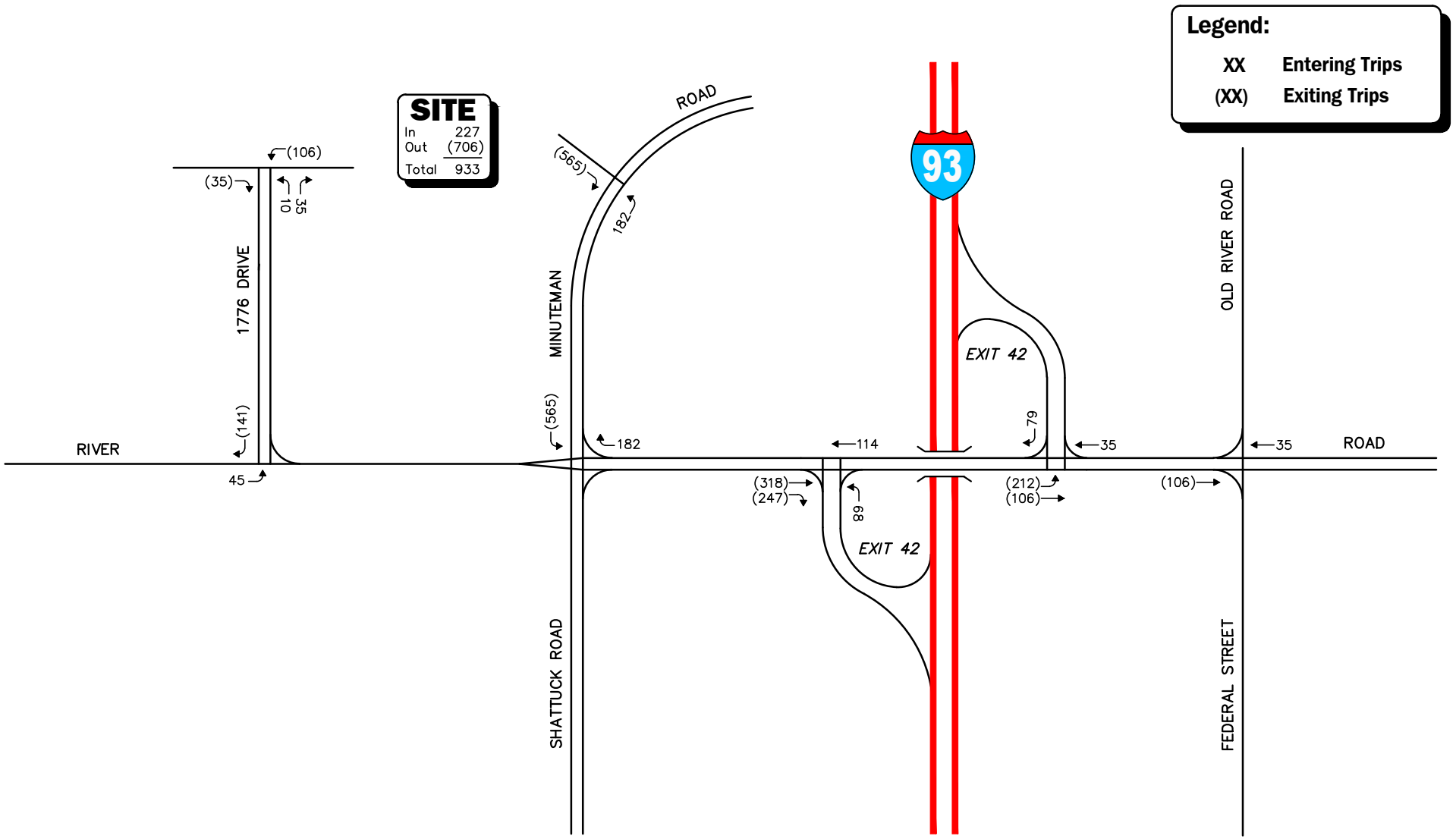
Not to Scale

Figure 8

Project Generated
Weekday Morning
Peak-Hour Traffic Volumes

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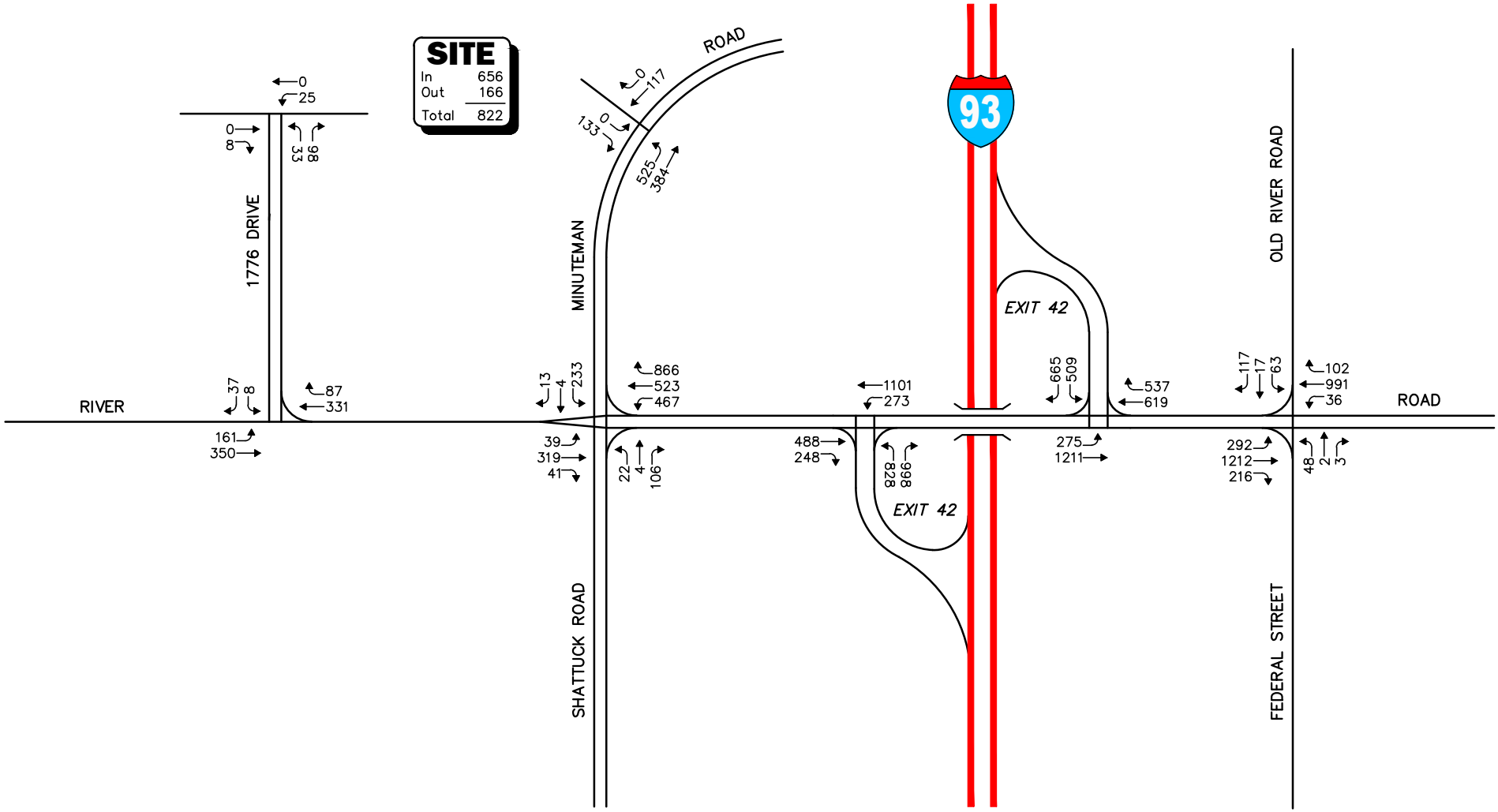
Not to Scale

Figure 9

Project Generated
Weekday Evening
Peak-Hour Traffic Volumes

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Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

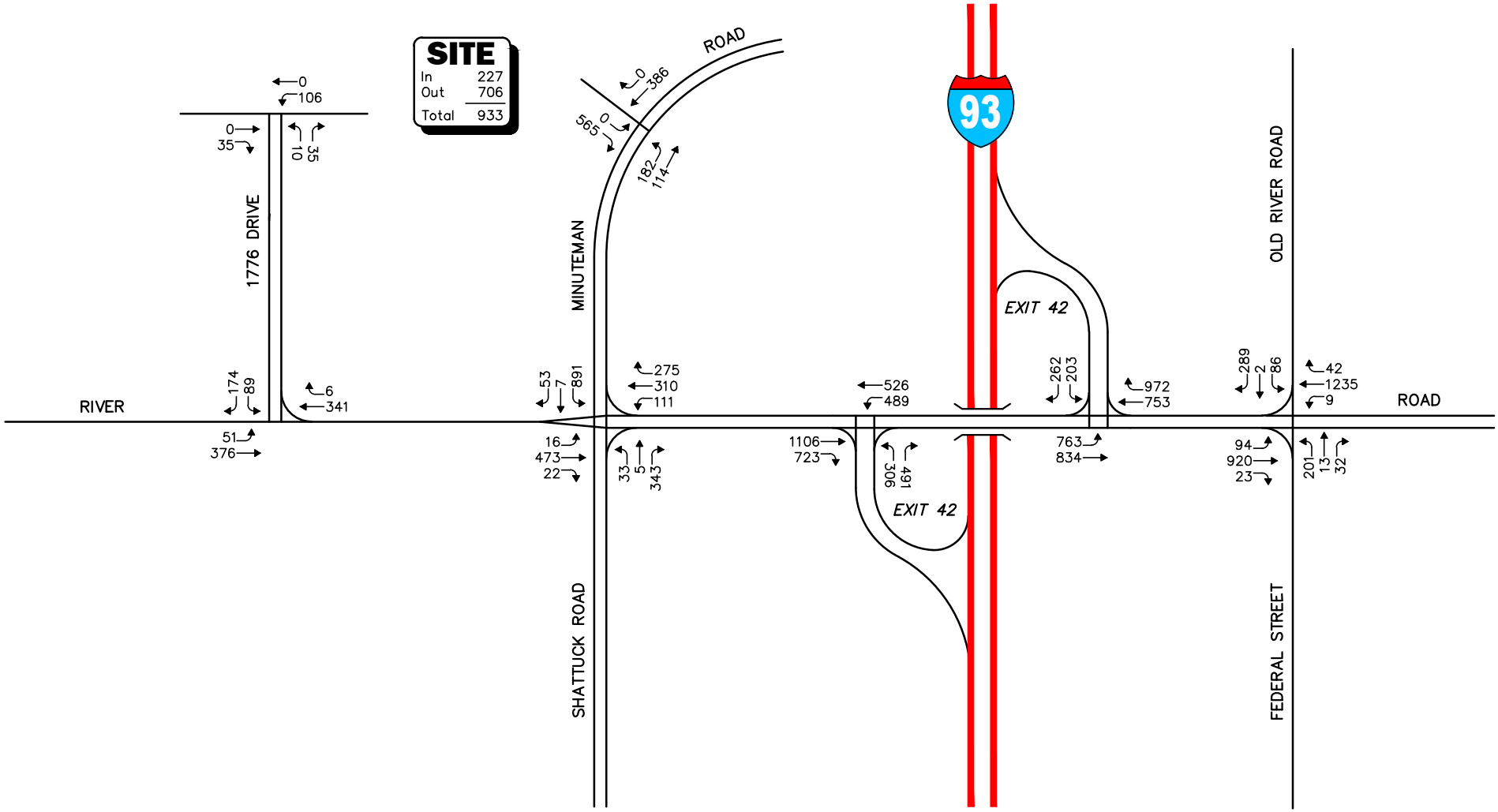
Not to Scale

Figure 10

2029 Build
Weekday Morning
Peak-Hour Traffic Volumes

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Note: **Imbalances exist due to numerous curb cuts and side streets that are not shown.**

Not to Scale

Figure 11

2029 Build
Weekday Evening
Peak-Hour Traffic Volumes

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Table 7
PEAK-HOUR TRAFFIC-VOLUME INCREASES

Location/Peak Hour	2022 Existing	2029 No-Build	2029 Build	Traffic-Volume Increase Over No-Build	Percent Increase Over No-Build
River Road, west of 1776 Drive:					
Weekday Morning	608	864	879	15	1.7
Weekday Evening	639	908	942	34	3.7
River Road, east of Old River Road:					
Weekday Morning	1,982	2,396	2,407	11	0.5
Weekday Evening	1,889	2,297	2,324	27	1.2
I-93 northbound on-ramp:					
Weekday Morning	673	796	812	16	2.0
Weekday Evening	1,315	1,704	1,735	31	1.8
I-93 northbound off-ramp:					
Weekday Morning	797	1,165	1,174	9	0.8
Weekday Evening	333	440	465	25	5.7
I-93 southbound on-ramp:					
Weekday Morning	401	503	521	18	3.6
Weekday Evening	804	1,176	1,212	36	3.1
I-93, southbound off-ramp:					
Weekday Morning	1,422	1,818	1,826	8	0.4
Weekday Evening	643	775	797	22	2.8

As shown in Table 7, Project-related traffic-volume increases outside of the study area that is the subject of this assessment relative to 2029 No-Build conditions are anticipated to range from 0.4 to 5.7 percent during the peak periods, with vehicle increases shown to range from 8 to 36 vehicles. ***When distributed over the peak-hour, the predicted traffic-volume increases would not result in a significant impact (increase) on motorist delays or vehicle queuing outside of the immediate study area that is the subject of this assessment.***

TRAFFIC OPERATIONS ANALYSIS

Measuring existing and future traffic volumes quantifies traffic flow within the study area. To assess quality of flow, roadway capacity and vehicle queue analyses were conducted under Existing, No-Build, and Build traffic-volume conditions. Capacity analyses provide an indication of how well the roadway facilities serve the traffic demands placed upon them, with vehicle queue analyses providing a secondary measure of the operational characteristics of an intersection or section of roadway under study.

METHODOLOGY

Levels of Service

A primary result of capacity analyses is the assignment of level of service to traffic facilities under various traffic-flow conditions.[12] The concept of level of service is defined as a qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers. A level-of-service definition provides an index to quality of traffic flow in terms of such factors as speed, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety.

Six levels of service are defined for each type of facility. They are given letter designations from A to F, with level-of-service (LOS) A representing the best operating conditions and LOS F representing congested or constrained operating conditions.

Since the level of service of a traffic facility is a function of the traffic flows placed upon it, such a facility may operate at a wide range of levels of service, depending on the time of day, day of week, or period of year.

[12]The capacity analysis methodology is based on the concepts and procedures presented in the *Highway Capacity Manual;* Transportation Research Board; Washington, DC; 2010.

Signalized Intersections

The six levels of service for signalized intersections may be described as follows:

- *LOS A* describes operations with very low control delay; most vehicles do not stop at all.
- *LOS B* describes operations with relatively low control delay. However, more vehicles stop than LOS A.
- *LOS C* describes operations with higher control delays. Individual cycle failures may begin to appear. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.
- *LOS D* describes operations with control delay in the range where the influence of congestion becomes more noticeable. Many vehicles stop and individual cycle failures are noticeable.
- *LOS E* describes operations with high control delay values. Individual cycle failures are frequent occurrences.
- *LOS F* describes operations with high control delay values that often occur with oversaturation. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

Levels of service for signalized intersections are calculated using the operational analysis methodology of the 2000 *Highway Capacity Manual*[13] and implemented as a part of the Synchro® 11 software. This method assesses the effects of signal type, timing, phasing, and progression; vehicle mix; and geometrics on delay. Level-of-service designations are based on the criterion of control or signal delay per vehicle. Control or signal delay is a measure of driver discomfort, frustration, and fuel consumption, and includes initial deceleration delay approaching the traffic signal, queue move-up time, stopped delay and final acceleration delay. Table 8 summarizes the relationship between level of service and control delay. The tabulated control delay criterion may be applied in assigning level-of-service designations to individual lane groups, to individual intersection approaches, or to entire intersections.

[13] *Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2000.

Table 8
LEVEL-OF-SERVICE CRITERIA
FOR SIGNALIZED INTERSECTIONS[a]

Level of Service	Control (Signal) Delay Per Vehicle (Seconds)
A	≤10.0
B	10.1 to 20.0
C	20.1 to 35.0
D	35.1 to 55.0
E	55.1 to 80.0
F	>80.0

[a]Source: *Highway Capacity Manual*, Transportation Research Board; Washington, DC; 2000; page 16-2.

Unsignalized Intersections

The six levels of service for unsignalized intersections may be described as follows:

- *LOS A* represents a condition with little or no control delay to minor street traffic.
- *LOS B* represents a condition with short control delays to minor street traffic.
- *LOS C* represents a condition with average control delays to minor street traffic.
- *LOS D* represents a condition with long control delays to minor street traffic.
- *LOS E* represents operating conditions at or near capacity level, with very long control delays to minor street traffic.
- *LOS F* represents a condition where minor street demand volume exceeds capacity of an approach lane, with extreme control delays resulting.

The levels of service of unsignalized intersections are determined by application of a procedure described in the 2000 *Highway Capacity Manual.*[14] Level of service is measured in terms of average control delay. Mathematically, control delay is a function of the capacity and degree of saturation of the lane group and/or approach under study and is a quantification of motorist delay associated with traffic control devices such as traffic signals and STOP signs. Control delay includes the effects of initial deceleration delay approaching a STOP sign, stopped delay, queue move-up time, and final acceleration delay from a stopped condition. Definitions for level of service at unsignalized intersections are also given in the 2000 *Highway Capacity Manual*. Table 9 summarizes the relationship between level of service and average control delay for two-way stop controlled and all-way stop controlled intersections.

[14]*Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2010.

Table 9
LEVEL-OF-SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS[a]

Level of Service	Control (Signal) Delay Per Vehicle (Seconds)
A	≤10.0
B	10.1 to 15.0
C	15.1 to 25.0
D	25.1 to 35.0
E	35.1 to 50.0
F	>50.0

[a]Source: *Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2000; page 17-2.

Vehicle Queue Analysis

Vehicle queue analyses are a direct measurement of an intersection's ability to process vehicles under various traffic control and volume scenarios and lane use arrangements. The vehicle queue analysis was performed using the Synchro® intersection capacity analysis software which is based upon the methodology and procedures presented in the 2000 *Highway Capacity Manual*. The Synchro® vehicle queue analysis methodology is a simulation based model which reports the number of vehicles that experience a delay of six seconds or more at an intersection. For signalized intersections, Synchro® reports both the average (50th percentile) the 95th percentile vehicle queue. For unsignalized intersections, Synchro® reports the 95th percentile vehicle queue. Vehicle queue lengths are a function of the capacity of the movement under study and the volume of traffic being processed by the intersection during the analysis period. The 95th percentile vehicle queue is the vehicle queue length that will be exceeded only 5 percent of the time, or approximately three minutes out of sixty minutes during the peak one hour of the day (during the remaining fifty-seven minutes, the vehicle queue length will be less than the 95th percentile queue length).

ANALYSIS RESULTS

Level-of-service and vehicle queue analyses were conducted for 2022 Existing, 2029 No-Build, and 2029 Build conditions for the intersections within the study area. The results of the intersection capacity and vehicle queue analyses are summarized in Tables 10 and 11, with the detailed analysis results presented in the Appendix.

The following is a summary of the level-of-service and vehicle queue analyses for the intersections within the study area. For context, we note that an LOS of "D" or better is generally defined as "acceptable" operating conditions.

Table 10
SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Signalized Intersection/Peak Hour/Movement	2022 Existing V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	2029 No-Build V/C	Delay	LOS	Queue 50th/95th	2029 Build V/C	Delay	LOS	Queue 50th/95th
River Road at Minuteman Road and Shattuck Road												
Weekday Morning:												
River Road EB LT	0.08	38.5	D	0/1	0.31	36.3	D	1/2	0.31	36.3	D	1/2
River Road EB TH/RT	0.27	17.6	B	3/5	0.31	19.1	B	3/5	0.33	20.3	C	3/5
River Road WB LT	0.67	41.8	D	6/8	0.66	32.7	C	6/8	0.66	33.3	C	6/8
River Road WB TH	0.43	10.6	B	3/7	0.63	16.2	B	8/14	0.66	17.9	B	8/14
River Road WB RT	0.15	17.0	B	0/2	0.61	43.2	D	5/7	0.63	49.1	D	5/7
Shattuck Road NB LT/TH	0.18	34.1	C	1/2	0.20	34.0	C	1/2	0.20	34.0	C	1/2
Shattuck Road NB RT	0.12	16.8	B	1/2	0.13	16.8	B	1/2	0.13	16.8	B	1/2
Minuteman Road SB LT	0.26	34.8	C	1/2	0.57	37.9	D	2/4	0.59	37.1	D	3/5
Minuteman Road SB LT/TH	0.25	34.7	C	1/2	0.57	37.8	D	2/4	0.58	36.9	D	3/5
Minuteman Road SB RT	0.00	0.0	A	0/0	0.01	0.0	A	0/0	0.01	0.0	A	0/0
Overall	**--**	**23.8**	**C**	**--**	**--**	**30.5**	**C**	**--**	**--**	**33.2**	**C**	**--**
Weekday Evening:												
River Road EB LT	0.17	39.3	D	0/1	0.33	41.6	D	1/1	0.33	41.6	D	1/1
River Road EB TH/RT	0.45	23.6	C	4/8	0.80	40.2	D	6/9	0.80	40.2	D	6/9
River Road WB LT	0.32	47.9	D	2/2	0.40	42.0	D	2/2	0.40	42.4	D	2/2
River Road WB TH	0.46	12.4	B	2/10	0.77	32.4	C	3/14	0.77	34.3	C	3/14
River Road WB RT	0.05	15.4	B	0/0	0.17	30.3	C	0/2	0.21	36.5	D	0/3
Shattuck Road NB LT/TH	0.14	24.3	C	1/2	0.16	26.0	C	1/2	0.16	26.0	C	1/2
Shattuck Road NB RT	0.48	18.9	B	4/5	0.54	21.7	C	5/5	0.54	21.7	C	5/5
Minuteman Road SB LT	0.45	32.6	C	2/3	1.06	>80.0	F	13/15	1.17	>80.0	F	15/18
Minuteman Road SB LT/TH	0.45	32.6	C	2/3	1.07	>80.0	F	13/16	1.18	>80.0	F	16/18
Minuteman Road SB RT	0.01	0.0	A	0/0	0.04	0.1	A	0/0	0.04	0.1	A	0/0
Overall	**--**	**22.6**	**C**	**--**	**--**	**50.7**	**D**	**--**	**--**	**67.0**	**E**	**--**

See notes at end of table.

Table 10 (Continued)
SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Signalized Intersection/Peak Hour/Movement	2022 Existing				2029 No-Build				2029 Build			
	V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	V/C	Delay	LOS	Queue 50th/95th	V/C	Delay	LOS	Queue 50th/95th
River Road at the I-93 Southbound Ramps												
Weekday Morning:												
River Road EB TH	0.25	12.3	B	2/3	0.40	22.4	C	4/4	0.42	23.6	C	5/5
River Road EB RT	0.11	0.1	A	0/0	0.16	0.2	A	0/0	0.18	0.2	A	0/0
River Road WB LT	0.53	30.3	C	3/4	0.55	30.3	C	3/4	0.55	30.3	C	3/4
River Road WB TH	0.27	10.5	B	4/6	0.55	13.9	B	9/11	0.56	14.1	B	9/11
I-93 SB Off-Ramp NB LT	0.69	29.6	C	6/7	0.85	31.9	C	9/13	0.86	32.5	C	9/13
I-93 SB Off-Ramp NB RT	0.64	2.0	A	0/0	0.71	2.7	A	0/0	0.71	2.7	A	0/0
Overall	**--**	**12.8**	**B**	**--**	**--**	**16.3**	**B**	**--**	**--**	**16.6**	**B**	**--**
Weekday Evening:												
River Road EB TH	0.46	13.4	B	6/6	0.86	29.5	C	13/16	0.91	32.6	C	13/16
River Road EB RT	0.30	0.4	A	0/0	0.57	0.8	A	0/0	0.59	0.8	A	0/0
River Road WB LT	0.66	20.7	C	4/7	0.67	20.8	B	3/3	0.67	20.8	B	3/3
River Road WB TH	0.14	3.4	A	1/2	0.20	3.4	A	1/1	0.22	3.4	A	1/1
I-93 SB Off-Ramp NB LT	0.43	32.2	C	2/3	0.51	32.2	C	3/4	0.53	32.2	C	3/5
I-93 SB Off-Ramp NB RT	0.29	0.5	A	0/0	0.32	0.5	A	0/0	0.32	0.5	A	0/0
Overall	**--**	**10.4**	**B**	**--**	**--**	**14.9**	**B**	**--**	**--**	**16.0**	**B**	**--**
River Road at the I-93 Northbound Ramps												
Weekday Morning:												
River Road EB LT	0.42	34.5	C	2/4	0.45	33.0	C	3/4	0.47	33.0	C	3/5
River Road EB TH	0.51	6.3	A	4/7	0.60	8.5	A	5/9	0.61	8.7	A	5/9
River Road WB TH	0.35	23.0	C	6/7	0.57	29.9	C	9/10	0.58	30.4	C	9/10
River Road WB RT	0.39	0.7	A	0/2	0.44	0.8	A	0/2	0.44	0.8	A	0/2
I-93 NB Off-Ramp SB LT	0.67	29.5	C	5/7	0.67	28.3	C	6/7	0.67	28.3	C	6/7
I-93 NB Off-Ramp SB RT	0.28	14.6	B	2/3	0.55	14.3	B	6/6	0.55	14.3	B	6/6
Overall	**--**	**14.3**	**B**	**--**	**--**	**16.3**	**B**	**--**	**--**	**16.5**	**B**	**--**
Weekday Evening:												
River Road EB LT	0.61	43.7	D	5/7	0.69	43.7	D	9/10	0.69	43.7	D	9/10
River Road EB TH	0.25	1.1	A	1/1	0.32	1.8	A	1/2	0.33	1.8	A	1/2
River Road WB TH	0.40	13.5	B	6/8	0.59	20.8	C	8/11	0.61	21.8	C	8/11
River Road WB RT	0.60	1.4	A	2/4	0.66	1.7	A	3/6	0.66	1.7	A	3/6
I-93 NB Off-Ramp SB LT	0.49	33.3	C	2/3	0.53	33.6	C	3/4	0.53	33.6	C	3/4
I-93 NB Off-Ramp SB RT	0.13	15.3	B	1/2	0.18	15.3	B	2/2	0.20	15.3	B	2/2
Overall	**--**	**13.2**	**B**	**--**	**--**	**15.6**	**B**	**--**	**--**	**15.8**	**B**	**--**

See notes at end of table.

Table 10 (Continued)
SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Signalized Intersection/Peak Hour/Movement	2022 Existing				2029 No-Build				2029 Build			
	V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	V/C	Delay	LOS	Queue 50th/95th	V/C	Delay	LOS	Queue 50th/95th
River Road at Old River Road and Federal Street												
Weekday Morning:												
River Road EB LT	0.53	26.4	C	3/4	0.53	27.4	C	3/4	0.53	27.4	C	3/4
River Road EB TH	0.46	8.9	A	3/12	0.55	9.5	A	3/15	0.59	12.4	B	3/16
River Road EB RT	0.14	0.2	A	0/0	0.14	0.1	A	0/0	0.14	0.1	A	0/0
River Road WB LT	0.26	35.1	D	1/2	0.26	35.0	C	1/2	0.18	35.0	C	1/2
River Road WB TH/RT	0.50	11.2	B	6/9	0.63	12.8	B	9/12	0.63	12.8	B	9/12
Federal Street NB LT/TH	0.43	35.1	D	1/3	0.45	35.8	D	1/3	0.45	35.8	D	1/3
Federal Street NB RT	0.00	31.5	C	0/0	0.00	31.9	C	0/0	0.00	31.9	C	0/0
Old River Road SB LT	0.60	41.7	D	2/3	0.63	45.0	D	2/3	0.63	45.0	D	2/3
Old River Road SB TH	0.10	32.1	C	1/1	0.10	32.4	C	1/1	0.10	32.4	C	1/1
Old River Road SB RT	0.09	0.1	A	0/0	0.09	0.1	A	0/0	0.09	0.1	A	0/0
Overall	**--**	**12.4**	**B**	**--**	**--**	**13.1**	**B**	**--**	**--**	**14.1**	**B**	**--**
Weekday Evening:												
River Road EB LT	0.35	36.4	D	1/2	0.35	44.5	D	1/2	0.35	45.2	D	1/2
River Road EB TH	0.36	5.4	A	4/5	0.45	3.1	A	4/5	0.46	3.1	A	4/5
River Road EB RT	0.01	0.0	A	0/0	0.01	0.0	A	0/0	0.01	0.0	A	0/0
River Road WB LT	0.21	40.0	D	0/1	0.21	40.0	D	0/1	0.21	40.0	D	0/1
River Road WB TH/RT	0.64	14.6	B	10/11	0.73	15.9	B	11/14	0.74	15.9	B	11/14
Federal Street NB LT/TH	0.73	36.5	D	4/9	0.78	42.5	D	5/10	0.78	42.7	D	5/10
Federal Street NB RT	0.02	23.9	C	0/0	0.02	24.9	C	0/1	0.02	25.0	C	0/1
Old River Road SB LT	0.78	49.6	C	3/4	0.89	72.6	E	3/4	0.90	76.4	E	3/4
Old River Road SB TH	0.01	23.8	C	0/1	0.01	24.9	C	0/1	0.01	24.9	C	0/1
Old River Road SB RT	0.29	0.5	A	0/0	0.29	0.5	A	0/0	0.29	0.5	A	0/0
Overall	**--**	**14.3**	**B**	**--**	**--**	**15.2**	**B**	--	**--**	**15.3**	**B**	**--**

[a]Volume-to-capacity ratio.
[b]Control (signal) delay per vehicle in seconds.
[c]Level-of-Service.
[d]Queue length in vehicles based on 25-feet per vehicle.
NB = northbound; SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

Table 11
UNSIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

	2022 Existing				2029 No-Build				2029 Build			
Unsignalized Intersection/Peak-hour/Movement	Demand[a]	Delay[b]	LOS[c]	Queue[d] 95th	Demand	Delay	LOS	Queue 95th	Demand	Delay	LOS	Queue 95th
River Road at 1776 Drive												
Weekday Morning:												
River Road EB LT/TH	315	0.8	A	0	506	2.6	A	1	511	2.7	A	1
River Road WB TH/RT	376	0.0	A	0	418	0.0	A	0	418	0.0	A	0
1776 Drive SB LT	8	14.9	B	0	8	25.8	D	0	8	26.1	D	0
1776 Drive SB RT	4	10.1	B	0	27	10.6	B	0	37	10.8	B	0
Weekday Evening:												0
River Road EB LT/TH	336	0.1	A	0	413	0.7	A	0	427	1.0	A	0
River Road WB TH/RT	276	0.0	A	0	347	0.0	A	0	347	0.0	A	0
1776 Drive SB LT	89	17.4	C	2	89	24.8	C	2	89	26.8	D	2
1776 Drive SB RT	33	10.3	B	0	154	13.3	B	2	174	13.9	B	2
Minuteman Road at the Project Site Driveway												
Weekday Morning:												
Project Site Driveway EB LT/RT	--	--	--	--	92	9.0	A	1	133	9.3	A	1
Minuteman Road NB LT	--	--	--	--	504	8.9	A	2	525	9.0	A	2
Minuteman Road NB TH	--	--	--	--	384	0.0	A	0	384	0.0	A	0
Minuteman Road SB TH/RT	--	--	--	--	117	0.0	A	0	117	0.0	A	0
Weekday Evening:												
Project Site Driveway EB LT/RT	--	--	--	--	482	20.7	C	6	565	28.7	D	9
Minuteman Road NB LT	--	--	--	--	124	8.9	A	1	182	9.2	A	1
Minuteman Road NB TH	--	--	--	--	114	0.0	A	0	114	0.0	A	0
Minuteman Road SB TH/RT	--	--	--	--	386	0.0	A	0	386	0.0	A	0
1776 Drive at the Project Site Driveway												
Weekday Morning:												
Project Site Driveway EB TH/RT	--	--	--	--	5	0.0	A	0	8	0.0	A	0
Project Site Driveway WB LT/TH	--	--	--	--	18	7.3	A	0	25	7.3	A	0
1776 Drive NB LT	--	--	--	--	32	8.9	A	0	33	9.0	A	0
1776 Drive NB RT	--	--	--	--	94	8.7	A	1	98	8.7	A	1
Weekday Evening:												
Project Site Driveway EB TH/RT	--	--	--	--	31	0.0	A	0	35	0.0	A	0
Project Site Driveway WB LT/TH	--	--	--	--	90	7.4	A	0	106	7.5	A	0
1776 Drive NB LT	--	--	--	--	7	10.0	A	0	10	10.3	B	0
1776 Drive NB RT	--	--	--	--	24	8.5	A	0	35	8.5	A	0

[a]Demand in vehicles per hour.
[b]Average control delay per vehicle (in seconds).
[c]Level-of-Service.
[d]Queue length in vehicles.
NB = northbound; SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

Signalized Intersections

Project-related impacts at the signalized study area intersection are shown on Table 10 and are described as follows:

River Road at Minuteman Road and Shattuck Road - Overall operating conditions were shown to degrade from LOS D to a LOS E during the weekday evening peak-hour as a result of a predicted increase in overall average motorist delay of 16.3 seconds with the addition of Project-related traffic. Vehicle queues at the intersection were shown to increase by up to three (3) vehicles with the addition of Project-related traffic. Focusing on individual movements, through/right-turn movements from the River Road eastbound approach were shown to degrade from LOS B to LOS C during the weekday morning peak-hour (1.2 second increase in average motorist delay) as a result of the addition of Project-related traffic and right-turn movements from the River Road westbound approach were shown to degrade from LOS C to LOS D (6.2 second increase in average motorist delay) during the weekday evening peak-hour. Independent of the Project, left-turn and through movements from Minuteman Road are predicted to operate over capacity (i.e., LOS "F") during the weekday evening peak-hour under 2029 No-Build conditions.

River Road at the I-93 southbound ramps – No-change in level of service is predicted to occur for any movement over No-Build conditions, with Project-related impacts defined as a general increase in average motorist delay that resulted in vehicle queuing of one (1) vehicle.

River Road at the I-93 northbound ramps - No-change in level of service is predicted to occur for any movement over No-Build conditions, with Project-related impacts defined as a general increase in average motorist delay that resulted in vehicle queuing of one (1) vehicle.

River Road at Old River Road and Federal Street - No-change in overall level of service is predicted to occur over No Build conditions; however, the addition of Project-related traffic was shown to result in an increase in average motorist delay that caused a degradation in level-of-service for through movements from the River Road eastbound approach during the weekday morning peak-hour from LOS A to LOS B (2.9 second increase in average motorist delay). Vehicle queues at the intersection were shown to increase by one (1) vehicle with the addition of Project-related traffic.. Independent of the Project, left-turn movements from the Old River Road approach are predicted to operate at capacity (i.e., LOS "E") during the weekday evening peak-hour under 2029 No-Build conditions.

Unsignalized Intersections

Project-related impacts at the unsignalized study area intersections are shown on Table 11 and are described as follows:

River Road at 1776 Drive – The addition of Project-related traffic was shown to result in an increase in average motorist delay for left-turning movements along 1776 Drive during the weekday evening peak-hour that caused a degradation in level-of-service from LOS C to LOS D (2.0 second increase in average motorist delay) with no resulting increase in vehicle queuing.

Minuteman Road at the Project Site Driveway - All movements exiting the Project site driveway to Minuteman Road were shown to operate at LOS A during the weekday morning peak-hour and at LOS D during the weekday evening peak-hour, with vehicle queues of up to nine (9) vehicles, which can be contained within the Project site without inhibiting access or circulation, or the movement of vehicles, pedestrians or bicyclists along Minuteman Road. All movements along

Minuteman Road approaching the driveway were shown to operate at LOS A during the peak-hours, with minor (up to two (2) vehicles) vehicle queuing predicted.

1776 Drive at the Project Site Driveway - All movements exiting the Project site driveway to 1776 Drive were shown to operate at LOS A during the peak hours with negligible vehicle queuing. Entering movements from 1776 Drive were shown to operate at LOS A during the weekday morning peak-hour and at LOS B during the weekday evening peak-hour, with vehicle queues of up to one (1) vehicle.

SIGHT DISTANCE EVALUATION

Sight distance measurements were performed at the Project site driveway intersections with Minuteman Road and 1776 Drive, and at the River Road/1776 Drive and River Road/ Minuteman Road/Shattuck Road intersections in accordance with MassDOT and American Association of State Highway and Transportation Officials (AASHTO)[15] requirements. Both stopping sight distance (SSD) and intersection sight distance (ISD) measurements were performed. In brief, SSD is the distance required by a vehicle traveling at the design speed of a roadway, on wet pavement, to stop prior to striking an object in its travel path. ISD or corner sight distance (CSD) is the sight distance required by a driver entering or crossing an intersecting roadway to perceive an on-coming vehicle and safely complete a turning or crossing maneuver with on-coming traffic. In accordance with AASHTO standards, if the measured ISD is at least equal to the required SSD value for the appropriate design speed, the intersection can operate in a safe manner. Table 12 presents the measured SSD and ISD at the subject intersections.

[15] *A Policy on Geometric Design of Highway and Streets,* 7th Edition; American Association of State Highway and Transportation Officials (AASHTO); Washington D.C.; 2018.

Table 12
SIGHT DISTANCE MEASUREMENTS[a]

Intersection/Sight Distance Measurement	Feet		
	Required Minimum (SSD)	Desirable (ISD)[b]	Measured
Minuteman Road at the Project Site Driveway			
Stopping Sight Distance:			
Minuteman Road approaching from the north	200	--	335+
Minuteman Road approaching from the south	200	--	450+
Intersection Sight Distance:			
Looking to the north from the Project Site Driveway	200	290	350+
Looking to the south from the Project Site Driveway	200	335	500+
1776 Drive at the Project Site Driveway			
Stopping Sight Distance:			
Project Site Driveway approaching from the east	200	--	315+
Project Site Driveway approaching from the west	200	--	330+
Intersection Sight Distance:			
Looking to the east from 1776 Drive	200	290	415+
Looking to the west from 1776 Drive	200	335	350+
River Road at 1776 Drive			
Stopping Sight Distance:			
River Road approaching from the east	360	--	500+
River Road approaching from the west	360	--	500+
Intersection Sight Distance:			
Looking to the east from 1776 Drive	360	430	500+
Looking to the west from 1776 Drive	360	500	500+
River Road at Minuteman Road/Shattuck Road			
Stopping Sight Distance:			
River Road approaching from the east	360	--	500+
River Road approaching from the west	360	--	500+
Intersection Sight Distance:			
Looking to the east from Minuteman Road	360	430	500+
Looking to the west from Minuteman Road	360	500	500+

[a]Recommended minimum values obtained from *A Policy on Geometric Design of Highways and Streets,* 7th Edition; American Association of State Highway and Transportation Officials (AASHTO); 2018; and based on a 45 mph approach speed on River Road and a 30 mph approach speed on Minuteman Road and 1776 Drive.

[b]Values shown are the intersection sight distance for a vehicle turning right or left exiting a roadway under STOP control such that motorists approaching the intersection on the major street should not need to adjust their travel speed to less than 70 percent of their initial approach speed.

As can be seen in Table 12, the available lines of sight at the Project site driveway intersections with Minuteman Road and 1776 Drive, and at the River Road/1776 Drive and River Road/ Minuteman Road/Shattuck Road intersections exceed the recommended minimum sight distances to function in a safe (SSD) and efficient (ISD) manner based on the appropriate approach speed.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

VAI has conducted a TIA in order to determine the potential impacts on the transportation infrastructure associated with the renovation and expansion of the former Philips Healthcare campus located at 3000 Minuteman Road in Andover, Massachusetts. The following specific areas have been evaluated as they relate to the Project: i) access requirements; ii) potential off-site improvements; and iii) safety considerations; under existing and future conditions, both with and without the Project. Based on this assessment, we have concluded the following with respect to the Project:

1. Using trip-generation statistics published by the ITE[16] for similar functional areas to those that will be associated with the campus redevelopment (research and development (R&D) and manufacturing space for trip-generation purposes), the Project is expected to generate approximately 7,268 vehicle trips on an average weekday (two-way volume over the operational day of the Project), with approximately 822 vehicle trips expected during the weekday morning peak-hour and 933 vehicle trips expected during the weekday evening peak-hour;

2. In comparison to the former Philips Healthcare campus at full occupancy, the Project is expected to generate approximately 77 *additional* vehicle trips during the weekday morning peak-hour and 175 *additional* vehicle trips during the weekday evening peak-hour, with a total of 1,668 *additional* vehicle trips expected over the operational day of the Project;

3. The Project will not result in a significant impact (increase) on motorist delays or vehicle queuing over Existing or anticipated future conditions without the Project (No-Build conditions); however, it was noted that one or more movements at the study intersections are predicted to operate at or over capacity (defined as LOS "E" or "F", respectively) independent of the Project. Project-related impacts were generally defined as an increase in average motorist delay that resulted in a corresponding increase in vehicle queuing of up to three (3) vehicles. Specific improvements will be advanced as a part of other

[16]Ibid 1.

development projects in the area or have been recommended as a part of the Project to improve traffic operations;

4. No apparent safety deficiencies were noted with respect to the motor vehicle crash history at the study intersections; and

5. Lines of sight to and from the Project site driveway intersections were found to exceed the recommended minimum distances for the intersections to operate in a safe and efficient manner based on the appropriate approach speed.

In consideration of the above, we have concluded that the Project can be accommodated within the confines of the existing transportation infrastructure in a safe and efficient manner with implementation of the recommendations that follow.

RECOMMENDATIONS

A detailed transportation improvement program has been developed that is designed to provide safe and efficient access to the Project site and address any deficiencies identified at off-site locations evaluated in conjunction with this study. The following improvements have been recommended as a part of this evaluation and, where applicable, will be completed in conjunction with the Project subject to receipt of all necessary rights, permits, and approvals.

Project Access

Access to the Project will continue to be provided by way of the existing driveways that intersect the west side of Minuteman Road approximately 1,450 feet north of River Road and the terminus of 1776 Drive approximately 2,175 feet north of River Road, respectively. The following recommendations are offered with respect to the design and operation of the Project site access and internal circulation, many of which are reflected on the site plans:

- The driveways serving the Project site should continue to accommodate two-way travel and the turning and maneuvering requirements of service and delivery vehicles, and the largest anticipated responding emergency vehicle as defined by the Andover Fire Department.

- Where perpendicular parking is proposed, the drive aisle behind the parking should be a minimum of 23 feet in order to facilitate parking maneuvers.

- STOP-signs and marked STOP-line should be provided on the individual driveways that intersect the ring-road that circumnavigates the campus, at the intersection of the ring-road with Minuteman Road and on the 1776 Drive approach to River Road (retain existing traffic control at the intersection).

- All signs and pavement markings to be installed within the Project site should conform to the applicable standards of the *Manual on Uniform Traffic Control Devices* (MUTCD).[17]

- Sidewalks and pedestrian paths are provided within the Project site that extend to or provide access to the existing sidewalk along Minuteman Road.

[17]Ibid 2.

- Americans with Disabilities Act (ADA)-compliant wheelchair ramps will be provided at all pedestrian crossings that are constructed or modified in conjunction with the Project.

- Signs and landscaping to be installed as a part of the Project within intersection sight triangle areas will be designed and maintained so as not to restrict lines of sight.

- Snow accumulations (windrows) within sight triangle areas will be promptly removed where such accumulations would impede sight lines.

- Consideration will be given to providing electric vehicle (EV) charging stations within the Project site.

Off Site

River Road Traffic Signal System

Independent of the Project, one or more movements at the intersections that comprise the River Road coordinated traffic signal system are currently or are predicted to operate at or over capacity during the peak-hours. In an effort to improve traffic operations and off-set the predicted impact of the Project, the Project proponent will design and implement an optimal traffic signal timing, phasing and coordination plan for the River Road coordinated traffic signal system inclusive of the following intersections:

- River Road/Minuteman Road/Shattuck Road
- River Road/I-93 Southbound Ramps
- River Road/I-93 Northbound Ramps
- River Road/Old River Road/Federal Street

These improvements will be completed prior to the issuance of a Certificate of Occupancy for any new or expanded building within the Project site, subject to receipt of all necessary rights, permits and approvals, and will include the installation, repair and/or upgrade of traffic signal equipment and associated appurtenances required to provide and maintain coordination of the traffic signal system. As can be seen in Table 13, with the implementation of an optimal traffic signal timing, phasing and coordination plan, overall motorist delays will be reduced such that no movement operates at or over capacity, an improvement over No-Build conditions.

In addition to the traffic signal timing, phasing and coordination improvements, the Project proponent will reconstruct all non-ADA compliant wheelchair ramps at the subject intersections, replace/upgrade non-ADA complaint pushbuttons and install countdown-type pedestrian indications where such indications are not currently installed. These improvements will also be completed prior to the issuance of a Certificate of Occupancy for any new or expanded building within the Project site, subject to receipt of all necessary rights, permits and approvals.

Table 13
MITIGATED SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Signalized Intersection/Peak Hour/Movement	2029 No-Build				2029 Build				2029 Build with Mitigation			
	V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	V/C	Delay	LOS	Queue 50th/95th	V/C	Delay	LOS	Queue 50th/95th
River Road at Minuteman Road and Shattuck Road												
Weekday Morning:												
River Road EB LT	0.31	36.3	D	1/2	0.31	36.3	D	1/2	0.48	40.9	D	1/2
River Road EB TH/RT	0.31	19.1	B	3/5	0.33	20.3	C	3/5	0.29	17.8	B	3/5
River Road WB LT	0.66	32.7	C	6/8	0.66	33.3	C	6/8	0.72	29.2	C	6/7
River Road WB TH	0.63	16.2	B	8/14	0.66	17.9	B	8/14	0.60	14.9	B	7/13
River Road WB RT	0.61	43.2	D	5/7	0.63	49.1	D	5/7	0.65	28.4	C	4/9
Shattuck Road NB LT/TH	0.20	34.0	C	1/2	0.20	34.0	C	1/2	0.28	36.7	D	1/2
Shattuck Road NB RT	0.13	16.8	B	1/2	0.13	16.8	B	1/2	0.14	19.2	B	1/2
Minuteman Road SB LT	0.57	37.9	D	2/4	0.59	37.1	D	3/5	0.57	36.3	D	3/5
Minuteman Road SB LT/TH	0.57	37.8	D	2/4	0.58	36.9	D	3/5	0.57	35.9	D	3/5
Minuteman Road SB RT	0.01	0.0	A	0/0	0.01	0.0	A	0/0	0.01	0.0	A	0/0
Overall	**--**	**30.5**	**C**	**--**	**--**	**33.2**	**C**	**--**	**--**	**24.8**	**C**	**--**
Weekday Evening:												
River Road EB LT	0.33	41.6	D	1/1	0.33	41.6	D	1/1	0.27	39.6	D	1/1
River Road EB TH/RT	0.80	40.2	D	6/9	0.80	40.2	D	6/9	0.76	37.4	D	6/8
River Road WB LT	0.40	42.0	D	2/2	0.40	42.4	D	2/2	0.33	41.6	D	2/3
River Road WB TH	0.77	32.4	C	3/14	0.77	34.3	C	3/14	0.70	34.8	C	5/11
River Road WB RT	0.17	30.3	C	0/2	0.21	36.5	D	0/3	0.21	49.0	D	1/3
Shattuck Road NB LT/TH	0.16	26.0	C	1/2	0.16	26.0	C	1/2	0.38	36.1	D	1/2
Shattuck Road NB RT	0.54	21.7	C	5/5	0.54	21.7	C	5/5	0.77	33.8	C	6/6
Minuteman Road SB LT	1.06	>80.0	F	13/15	1.17	>80.0	F	15/18	0.89	36.9	D	12/13
Minuteman Road SB LT/TH	1.07	>80.0	F	13/16	1.18	>80.0	F	16/18	0.90	38.4	D	12/13
Minuteman Road SB RT	0.04	0.1	A	0/0	0.04	0.1	A	0/0	0.04	0.1	A	0/0
Overall	**--**	**50.7**	**D**	**--**	**--**	**67.0**	**E**	**--**	**--**	**37.1**	**D**	**--**

See notes at end of table.

Table 13 (Continued)
MITIGATED SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Signalized Intersection/Peak Hour/Movement	2029 No-Build				2029 Build				2029 Build with Mitigation			
	V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	V/C	Delay	LOS	Queue 50th/95th	V/C	Delay	LOS	Queue 50th/95th
River Road at the I-93 Southbound Ramps												
Weekday Morning:												
River Road EB TH	0.40	22.4	C	4/4	0.42	23.6	C	5/5	0.44	16.2	B	4/6
River Road EB RT	0.16	0.2	A	0/0	0.18	0.2	A	0/0	0.18	0.2	A	0/0
River Road WB LT	0.55	30.3	C	3/4	0.55	30.3	C	3/4	0.60	30.7	C	3/4
River Road WB TH	0.55	13.9	B	9/11	0.56	14.1	B	9/11	0.59	9.9	A	6/11
I-93 SB Off-Ramp NB LT	0.85	31.9	C	9/13	0.86	32.5	C	9/13	0.77	26.2	C	9/10
I-93 SB Off-Ramp NB RT	0.71	2.7	A	0/0	0.71	2.7	A	0/0	0.71	2.7	A	0/0
Overall	**--**	**16.3**	**B**	**--**	**--**	**16.6**	**B**	**--**	**--**	**13.2**	**B**	**--**
Weekday Evening:												
River Road EB TH	0.86	29.5	C	13/16	0.91	32.6	C	13/16	0.78	13.7	B	8/9
River Road EB RT	0.57	0.8	A	0/0	0.59	0.8	A	0/0	0.59	1.0	A	0/0
River Road WB LT	0.67	20.8	B	3/3	0.67	20.8	B	3/3	0.79	42.7	D	6/8
River Road WB TH	0.20	3.4	A	1/1	0.22	3.4	A	1/1	0.21	1.9	A	1/2
I-93 SB Off-Ramp NB LT	0.51	32.2	C	3/4	0.53	32.2	C	3/5	0.71	38.6	D	3/5
I-93 SB Off-Ramp NB RT	0.32	0.5	A	0/0	0.32	0.5	A	0/0	0.32	0.5	A	0/0
Overall	**--**	**14.9**	**B**	**--**	**--**	**16.0**	**B**	**--**	**--**	**13.2**	**B**	**--**
River Road at the I-93 Northbound Ramps												
Weekday Morning:												
River Road EB LT	0.45	33.0	C	3/4	0.47	33.0	C	3/5	0.53	35.6	D	3/5
River Road EB TH	0.60	8.5	A	5/9	0.61	8.7	A	5/9	0.61	6.4	A	5/6
River Road WB TH	0.57	29.9	C	9/10	0.58	30.4	C	9/10	0.55	14.0	B	3/5
River Road WB RT	0.44	0.8	A	0/2	0.44	0.8	A	0/2	0.44	0.8	A	0/0
I-93 NB Off-Ramp SB LT	0.67	28.3	C	6/7	0.67	28.3	C	6/7	0.66	27.9	C	6/7
I-93 NB Off-Ramp SB RT	0.55	14.3	B	6/6	0.55	14.3	B	6/6	0.54	14.9	B	5/6
Overall	**--**	**16.3**	**B**	**--**	**--**	**16.5**	**B**	**--**	**--**	**13.3**	**B**	**--**
Weekday Evening:												
River Road EB LT	0.69	43.7	D	9/10	0.69	43.7	D	9/10	0.74	14.0	B	5/7
River Road EB TH	0.32	1.8	A	1/2	0.33	1.8	A	1/2	0.33	4.0	A	3/5
River Road WB TH	0.59	20.8	C	8/11	0.61	21.8	C	8/11	0.57	12.7	B	5/7
River Road WB RT	0.66	1.7	A	3/6	0.66	1.7	A	3/6	0.66	1.7	A	3/7
I-93 NB Off-Ramp SB LT	0.53	33.6	C	3/4	0.53	33.6	C	3/4	0.54	34.0	C	3/4
I-93 NB Off-Ramp SB RT	0.18	15.3	B	2/2	0.20	15.3	B	2/2	0.18	11.3	B	1/2
Overall	**--**	**15.6**	**B**	**--**	**--**	**15.8**	**B**	**--**	**--**	**9.4**	**A**	**--**

See notes at end of table.

Table 13 (Continued)
MITIGATED SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Signalized Intersection/Peak Hour/Movement	2029 No-Build				2029 Build				2029 Build with Mitigation			
	V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	V/C	Delay	LOS	Queue 50th/95th	V/C	Delay	LOS	Queue 50th/95th
River Road at Old River Road and Federal Street												
Weekday Morning:												
River Road EB LT	0.53	27.4	C	3/4	0.53	27.4	C	3/4	0.59	33.2	C	3/5
River Road EB TH	0.55	9.5	A	3/15	0.59	12.4	B	3/16	0.54	6.1	A	5/7
River Road EB RT	0.14	0.1	A	0/0	0.14	0.1	A	0/0	0.14	0.1	A	0/0
River Road WB LT	0.26	35.0	C	1/2	0.18	35.0	C	1/2	0.31	36.6	D	1/2
River Road WB TH/RT	0.63	12.8	B	9/12	0.63	12.8	B	9/12	0.62	12.1	B	9/11
Federal Street NB LT/TH	0.45	35.8	D	1/3	0.45	35.8	D	1/3	0.42	34.8	C	1/3
Federal Street NB RT	0.00	31.9	C	0/0	0.00	31.9	C	0/0	0.00	31.3	C	0/0
Old River Road SB LT	0.63	45.0	D	2/3	0.63	45.0	D	2/3	0.58	40.7	D	2/3
Old River Road SB TH	0.10	32.4	C	1/1	0.10	32.4	C	1/1	0.10	31.9	C	1/1
Old River Road SB RT	0.09	0.1	A	0/0	0.09	0.1	A	0/0	0.09	0.1	A	0/0
Overall	**--**	**13.1**	**B**	**--**	**--**	**14.1**	**B**	**--**	**--**	**12.0**	**B**	**--**
Weekday Evening:												
River Road EB LT	0.35	44.5	D	1/2	0.35	45.2	D	1/2	0.40	49.4	D	1/2
River Road EB TH	0.45	3.1	A	4/5	0.46	3.1	A	4/5	0.47	2.3	A	1/1
River Road EB RT	0.01	0.0	A	0/0	0.01	0.0	A	0/0	0.01	0.0	A	0/0
River Road WB LT	0.21	40.0	D	0/1	0.21	40.0	D	0/1	0.25	41.5	D	0/1
River Road WB TH/RT	0.73	15.9	B	11/14	0.74	15.9	B	11/14	0.75	16.8	B	12/16
Federal Street NB LT/TH	0.78	42.5	D	5/10	0.78	42.7	D	5/10	0.72	36.2	D	4/7
Federal Street NB RT	0.02	24.9	C	0/1	0.02	25.0	C	0/1	0.02	23.9	C	0/0
Old River Road SB LT	0.89	72.6	E	3/4	0.90	76.4	E	3/4	0.77	48.2	D	3/3
Old River Road SB TH	0.01	24.9	C	0/1	0.01	24.9	C	0/1	0.01	23.8	C	0/0
Old River Road SB RT	0.29	0.5	A	0/0	0.29	0.5	A	0/0	0.29	0.5	A	0/0
Overall	**--**	**15.2**	**B**	--	**--**	**15.3**	**B**	**--**	**--**	**14.0**	**B**	**--**

[a]Volume-to-capacity ratio.
[b]Control (signal) delay per vehicle in seconds.
[c]Level-of-Service.
[d]Queue length in vehicles based on 25-feet per vehicle.
NB = northbound; SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

Transportation Demand Management

The Project site is served by public transportation services that are provided by the MVRTA. The MVRTA operates bus Route 37, *Beacon Street*, which travels along River Road and Minuteman Road, with a stop located at Springhill Suites by Marriot (north of the Project site), and thereafter to the Buckley Transportation Center in Lawrence where connections can be made to other bus lines. From the Buckley Transportation Center, bus service is provided to Lawrence Station on the Haverhill Line of the MBTA Commuter Rail system with service to North Station in Boston. MVRTA buses operate in a passenger demand service mode and will stop anywhere along the service route where it is safe to pick-up or discharge a passenger.

In an effort to encourage the use of alternative modes of transportation to single-occupant vehicles (SOVs), the following Transportation Demand Management (TDM) measures will be implemented as a part of the Project:

- A transportation coordinator will be assigned for the Project to coordinate the TDM program;
- Information regarding public transportation services, maps, schedules and fare information will be posted in a central location and/or otherwise made available to employees;
- The transportation coordinator will facilitate a rideshare matching program for employees to encourage carpooling;
- A "welcome packet" will be provided to new employees detailing available commuter options and will include the contact information for the transportation coordinator and information to enroll in the employee rideshare program;
- Specific amenities will be provided to discourage off-site trips, including providing a break-room equipped with a microwave and refrigerator; offering direct deposit of paychecks; coordinating with a dry-cleaning service for on-site pick-up and delivery; allowing telecommuting or flexible work schedules; and other such measures to reduce overall traffic volumes and travel during peak traffic volume periods;
- Pedestrian accommodations have been incorporated into the Project site;
- Secure bicycle parking will be provided throughout the Project site and will include exterior bicycle racks and weather protected bicycle parking for each building; and
- A shuttle service will be provided at no ($0) cost to employees of the Project that will provide weekday commuter service between the Project site Andover Station on the Haverhill Line of the MBTA Commuter Rail system. The shuttle service schedule will be coordinate with the arrival and departure of trains from Andover Station, with a minimum of four (4) round trips provided during both the weekday morning and evening peak commuter periods. Off-peak service and service to other commuter hubs will be considered as demand warrants.

With implementation of the aforementioned recommendations, safe and efficient access will be provided to the Project site and the Project can be accommodated within the confines of the existing and improved transportation system.

Traffic Monitoring Program

The Proponent will conduct a post-development traffic monitoring and employee survey program in order to evaluate the success and to refine the elements of the TDM program, and to validate the trip projections and parking demands for the Project. The monitoring program will include:

i) Obtaining traffic-volume information over a continuous seven-day, weeklong period on the driveway serving the Project site along Minuteman Road and 1776 Drive;

ii) Performing manual turning movement and vehicle classification counts at the Project site driveway intersections with Minuteman Road and 1776 Drive, and at the intersections of River Road at Minuteman Road and Shattuck Road and River Road at 1776 Drive during the weekday morning (7:00 to 9:00 AM) and weekday evening (4:00 to 6:00 PM) peak periods; and

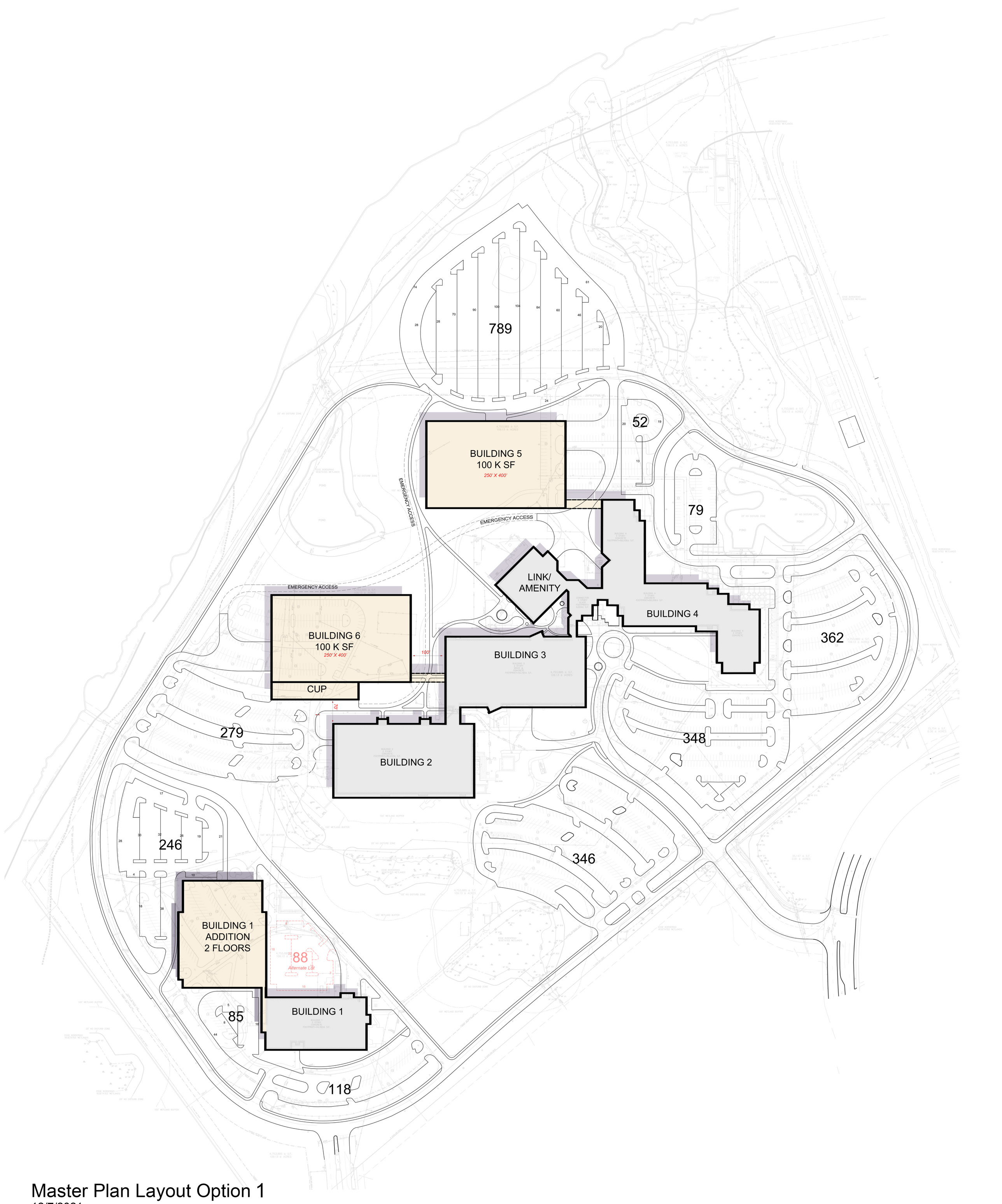
iii) Evaluating motor vehicle crash data at the intersections of River Road at Minuteman Road and Shattuck Road and River Road at 1776 Drive.

The monitoring program will commence six (6) months after issuance of the Certificate of Occupancy for the Project and will continue on an annual basis thereafter for a period not to exceed 5-years after completion of the Project. The results of the monitoring program will be summarized in a report to be provided to the Town of Andover and MassDOT within 2-months after the completion of the data collection effort. The report will document: i) traffic volumes associated with the Project; ii) motorist delays, vehicle queuing, crash severity and calculated crash rates at the intersections of River Road at Minuteman Road and Shattuck Road and River Road at 1776 Drive; and iii) the elements of the TDM program that have been implemented and use of alternative modes of transportation to single-occupant vehicles.

APPENDIX

PROJECT SITE PLAN
AUTOMATIC TRAFFIC RECORDER COUNT DATA
MANUAL TURNING MOVEMENT COUNT DATA
SEASONAL ADJUSTMENT DATA
COVID-19 ADJUSTMENT DATA
VEHICLE TRAVEL SPEED DATA
MASSDOT CRASH RATE WORKSHEETS AND HIGH CRASH LOCATION MAPPING
GENERAL BACKGROUND TRAFFIC GROWTH
BACKGROUND DEVELOPMENT TRAFFIC-VOLUME NETWORKS
PROPOSED TRIP-GENERATION CALCULATIONS
EXISTING TRIP-GENERATION CALCULATIONS
CAPACITY ANALYSIS WORKSHEETS

PROJECT SITE PLAN



Master Plan Layout Option 1

12/7/2021

Scale: 1”=80’

2704 TOTAL PARKING

2815 REQUIRED

SMMA

AUTOMATIC TRAFFIC RECORDER COUNT DATA

Location : River Road WB 91410WB1
Location : East of Shattuck Road
City/State: Andover, MA

	5/11/2022	WB,		Hour Totals	
Time	Wednesday	Morning	Afternoon	Morning	Afternon
12:00		18	92		
12:15		9	74		
12:30		5	119		
12:45		3	94	35	379
1:00		4	96		
1:15		5	83		
1:30		5	85		
1:45		4	86	18	350
2:00		4	84		
2:15		8	102		
2:30		2	137		
2:45		4	129	18	452
3:00		12	130		
3:15		5	119		
3:30		3	114		
3:45		5	92	25	455
4:00		8	80		
4:15		9	97		
4:30		17	99		
4:45		41	89	75	365
5:00		19	124		
5:15		34	124		
5:30		42	84		
5:45		83	105	178	437
6:00		48	94		
6:15		80	79		
6:30		94	86		
6:45		155	88	377	347
7:00		132	72		
7:15		159	68		
7:30		226	76		
7:45		270	60	787	276
8:00		256	69		
8:15		242	53		
8:30		201	61		
8:45		217	56	916	239
9:00		172	51		
9:15		123	32		
9:30		99	32		
9:45		92	33	486	148
10:00		90	28		
10:15		73	29		
10:30		68	24		
10:45		60	18	291	99
11:00		64	24		
11:15		72	11		
11:30		73	29		
11:45		104	32	313	96
Total		3519	3643		
Percent		49.1%	50.9%		

Location : River Road WB 91410WB1
Location : East of Shattuck Road
City/State: Andover, MA

	5/12/2022	WB,		Hour Totals	
Time	Thursday	Morning	Afternoon	Morning	Afternon
12:00		16	96		
12:15		12	102		
12:30		9	91		
12:45		9	108	46	397
1:00		1	79		
1:15		3	82		
1:30		10	74		
1:45		5	103	19	338
2:00		6	88		
2:15		13	107		
2:30		1	123		
2:45		4	146	24	464
3:00		14	109		
3:15		5	130		
3:30		5	108		
3:45		9	90	33	437
4:00		10	103		
4:15		8	102		
4:30		18	123		
4:45		41	155	77	483
5:00		23	130		
5:15		38	116		
5:30		42	103		
5:45		79	99	182	448
6:00		49	75		
6:15		61	77		
6:30		87	69		
6:45		153	89	350	310
7:00		113	73		
7:15		161	77		
7:30		205	65		
7:45		248	63	727	278
8:00		247	80		
8:15		231	63		
8:30		178	53		
8:45		244	58	900	254
9:00		177	52		
9:15		121	42		
9:30		101	34		
9:45		75	26	474	154
10:00		83	27		
10:15		69	23		
10:30		65	27		
10:45		62	27	279	104
11:00		61	24		
11:15		80	18		
11:30		69	32		
11:45		96	36	306	110
Total		3417	3777		
Percent		47.5%	52.5%		
Grand Total		6936	7420		
Percent		48.3%	51.7%		
ADT		ADT: 7,178		AADT: 7,178	

Location : River Road WB 91410WB1
Location : East of Shattuck Road
City/State: Andover, MA

5/9/2022	5/9/22	5/10/22	5/11/2022	5/12/2022	5/13/2022	5/14/2022	5/15/2022	Average	
Time	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon - Fri	Mon - Sun
12:00 AM	*	*	35	46	*	*	*	40	40
1:00	*	*	18	19	*	*	*	18	18
2:00	*	*	18	24	*	*	*	21	21
3:00	*	*	25	33	*	*	*	29	29
4:00	*	*	75	77	*	*	*	76	76
5:00	*	*	178	182	*	*	*	180	180
6:00	*	*	377	350	*	*	*	364	364
7:00	*	*	787	727	*	*	*	757	757
8:00	*	*	916	900	*	*	*	908	908
9:00	*	*	486	474	*	*	*	480	480
10:00	*	*	291	279	*	*	*	285	285
11:00	*	*	313	306	*	*	*	310	310
12:00 PM	*	*	379	397	*	*	*	388	388
1:00	*	*	350	338	*	*	*	344	344
2:00	*	*	452	464	*	*	*	458	458
3:00	*	*	455	437	*	*	*	446	446
4:00	*	*	365	483	*	*	*	424	424
5:00	*	*	437	448	*	*	*	442	442
6:00	*	*	347	310	*	*	*	328	328
7:00	*	*	276	278	*	*	*	277	277
8:00	*	*	239	254	*	*	*	246	246
9:00	*	*	148	154	*	*	*	151	151
10:00	*	*	99	104	*	*	*	102	102
11:00	*	*	96	110	*	*	*	103	103
Total	0	0	7162	7194	0	0	0	7177	7177
Percent	0.0%	0.0%	49.9%	50.1%	0.0%	0.0%	0.0%		
AM Peak			8:00	8:00				8:00	8:00
Volume			916	900				908	908
PM Peak			3:00	4:00				2:00	2:00
Volume			455	483				458	458

MANUAL TURNING MOVEMENT COUNT DATA

Accurate Counts

978-664-2565

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022
Page No : 1

Groups Printed- Cars - Trucks

	1776 Dr From North		River Rd From East		River Rd From West		
Start Time	Left	Right	Thru	Right	Left	Thru	Int. Total
07:00 AM	1	1	61	10	1	47	121
07:15 AM	1	0	49	17	4	59	130
07:30 AM	3	1	84	21	7	77	193
07:45 AM	1	0	57	27	8	64	157
Total	6	2	251	75	20	247	601
08:00 AM	3	1	68	14	4	70	160
08:15 AM	1	2	74	23	10	68	178
08:30 AM	0	0	55	10	2	73	140
08:45 AM	4	0	58	20	9	93	184
Total	8	3	255	67	25	304	662
Grand Total	14	5	506	142	45	551	1263
Apprch %	73.7	26.3	78.1	21.9	7.6	92.4	
Total %	1.1	0.4	40.1	11.2	3.6	43.6	
Cars	13	5	484	141	45	528	1216
% Cars	92.9	100	95.7	99.3	100	95.8	96.3
Trucks	1	0	22	1	0	23	47
% Trucks	7.1	0	4.3	0.7	0	4.2	3.7

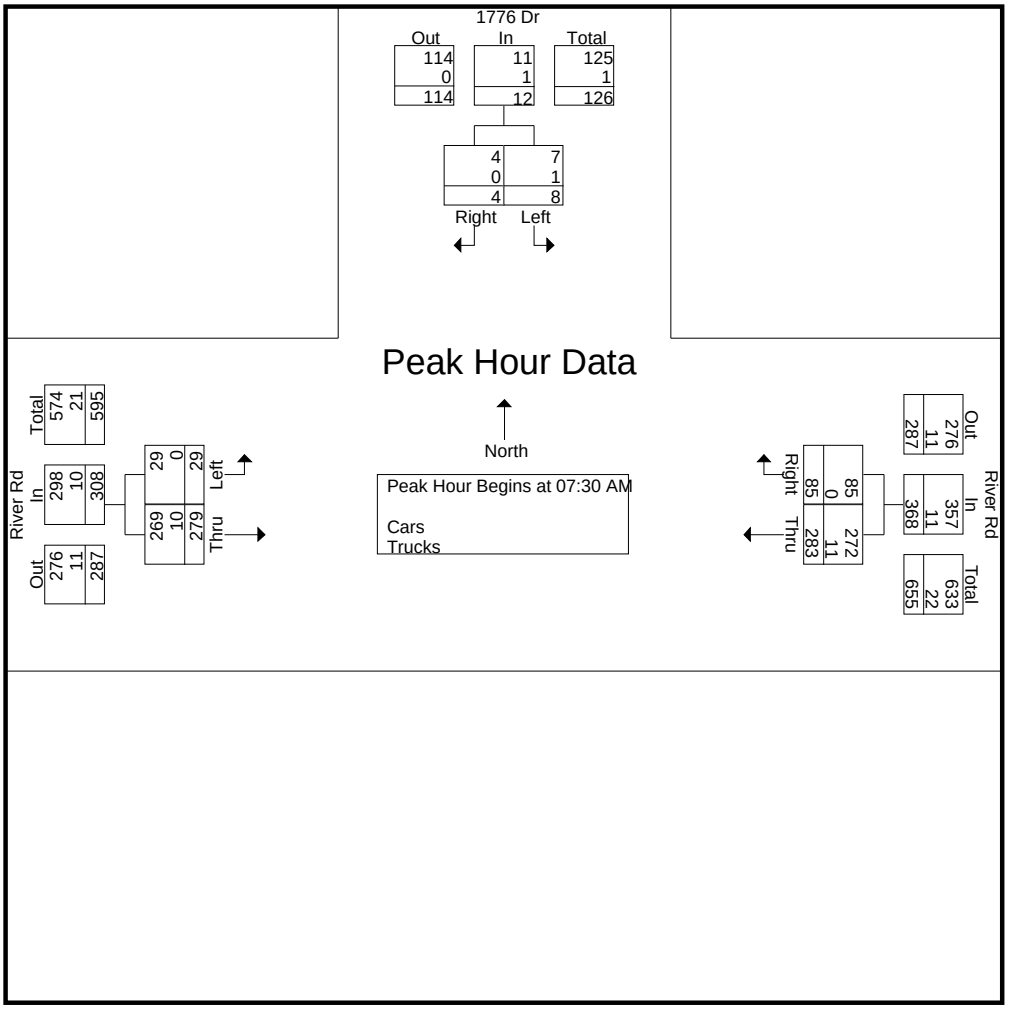
	1776 Dr From North			River Rd From East			River Rd From West			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:30 AM										
07:30 AM	**3**	1	**4**	**84**	21	**105**	7	**77**	**84**	**193**
07:45 AM	1	0	1	57	**27**	84	8	64	72	157
08:00 AM	3	1	4	68	14	82	4	70	74	160
08:15 AM	1	**2**	3	74	23	97	**10**	68	78	178
Total Volume	8	4	12	283	85	368	29	279	308	688
% App. Total	66.7	33.3		76.9	23.1		9.4	90.6		
PHF	.667	.500	.750	.842	.787	.876	.725	.906	.917	.891
Cars	7	4	11	272	85	357	29	269	298	666
% Cars	87.5	100	91.7	96.1	100	97.0	100	96.4	96.8	96.8
Trucks	1	0	1	11	0	11	0	10	10	22
% Trucks	12.5	0	8.3	3.9	0	3.0	0	3.6	3.2	3.2

Accurate Counts

978-664-2565

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022
Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

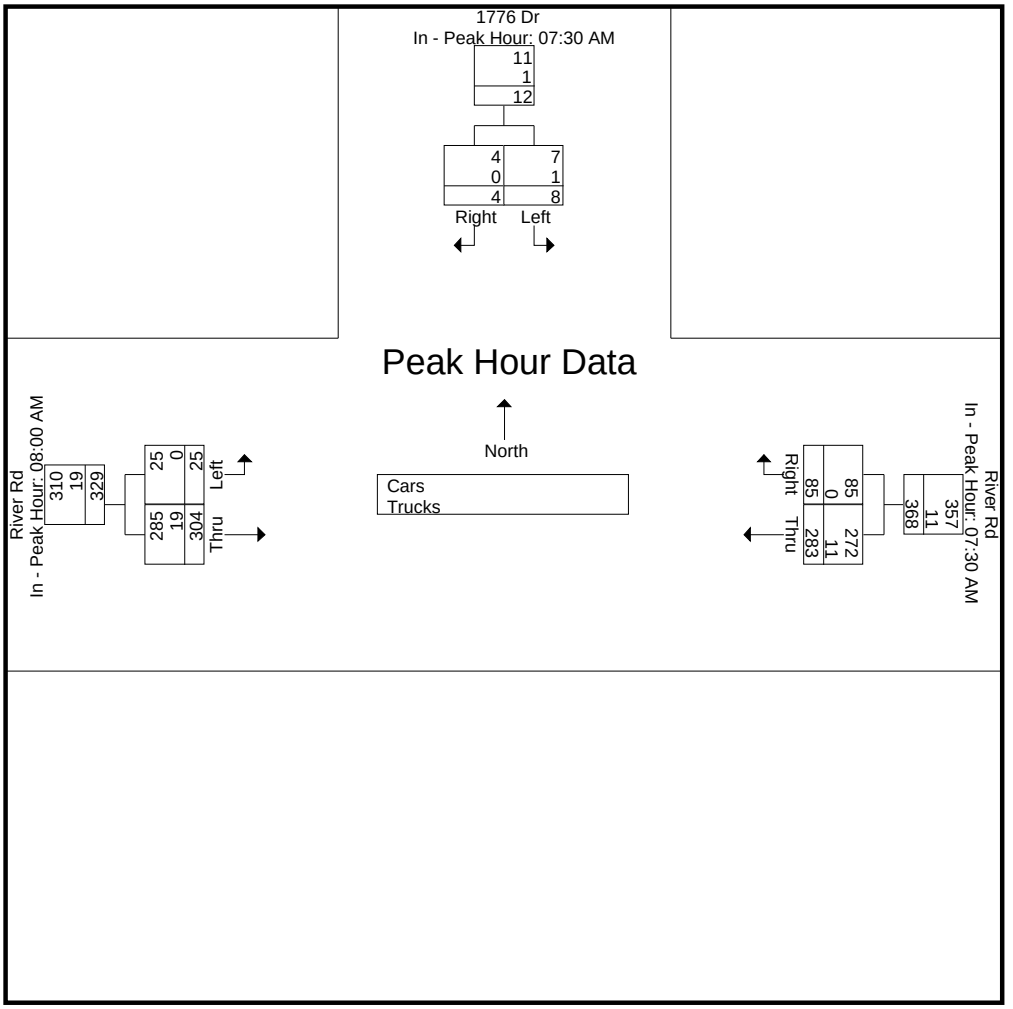
	07:30 AM			07:30 AM			08:00 AM		
+0 mins.	**3**	1	**4**	**84**	21	**105**	4	70	74
+15 mins.	1	0	1	57	**27**	84	**10**	68	78
+30 mins.	3	1	4	68	14	82	2	73	75
+45 mins.	1	**2**	3	74	23	97	9	**93**	**102**
Total Volume	8	4	12	283	85	368	25	304	329
% App. Total	66.7	33.3		76.9	23.1		7.6	92.4	
PHF	.667	.500	.750	.842	.787	.876	.625	.817	.806
Cars	7	4	11	272	85	357	25	285	310
% Cars	87.5	100	91.7	96.1	100	97	100	93.8	94.2
Trucks	1	0	1	11	0	11	0	19	19
% Trucks	12.5	0	8.3	3.9	0	3	0	6.2	5.8

Accurate Counts

978-664-2565

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022
Page No : 3



Accurate Counts

978-664-2565

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022

Groups Printed- Cars

	1776 Dr From North		River Rd From East		River Rd From West		
Start Time	Left	Right	Thru	Right	Left	Thru	Int. Total
07:00 AM	1	1	60	10	1	47	120
07:15 AM	1	0	45	16	4	57	123
07:30 AM	3	1	79	21	7	75	186
07:45 AM	1	0	55	27	8	64	155
Total	6	2	239	74	20	243	584
08:00 AM	2	1	67	14	4	68	156
08:15 AM	1	2	71	23	10	62	169
08:30 AM	0	0	50	10	2	70	132
08:45 AM	4	0	57	20	9	85	175
Total	7	3	245	67	25	285	632
Grand Total	13	5	484	141	45	528	1216
Apprch %	72.2	27.8	77.4	22.6	7.9	92.1	
Total %	1.1	0.4	39.8	11.6	3.7	43.4	

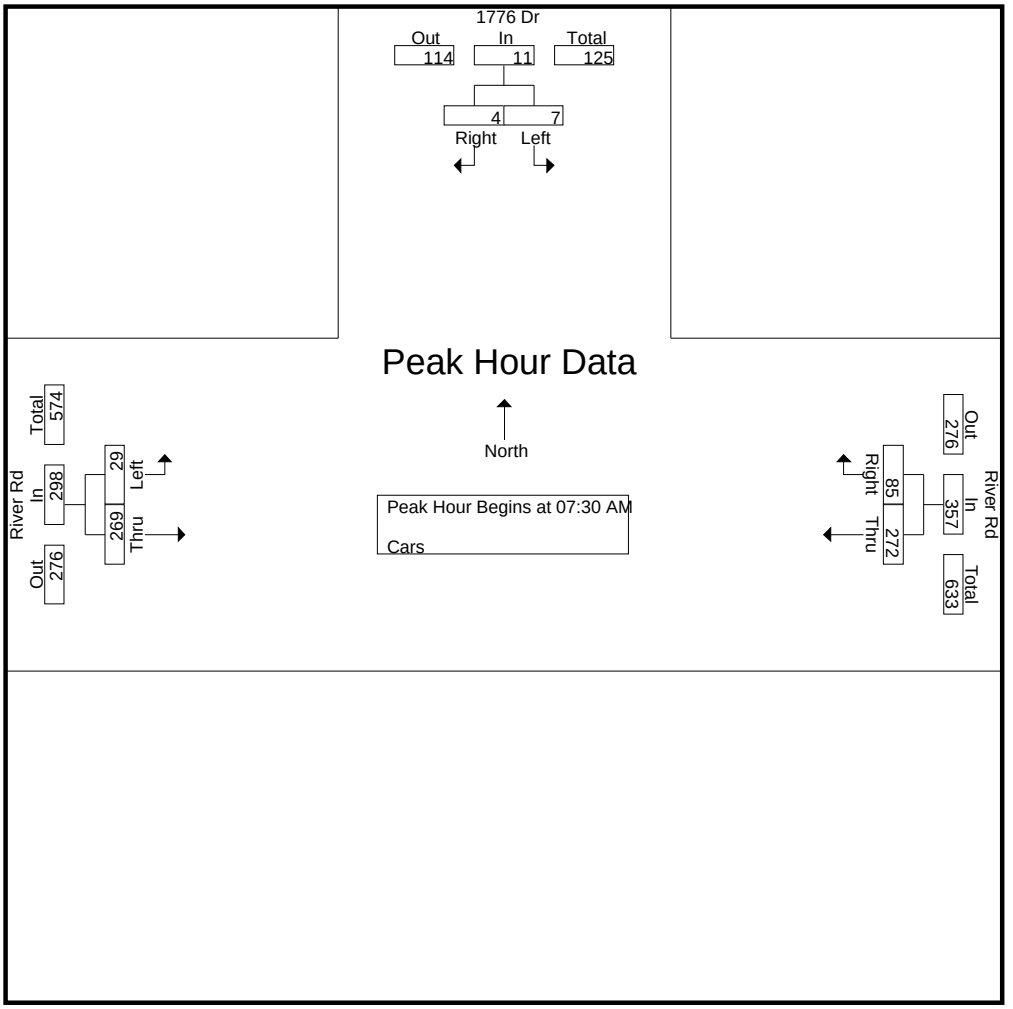
	1776 Dr From North			River Rd From East			River Rd From West			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:30 AM										
07:30 AM	**3**	1	**4**	**79**	21	**100**	7	**75**	**82**	**186**
07:45 AM	1	0	1	55	**27**	82	8	64	72	155
08:00 AM	2	1	3	67	14	81	4	68	72	156
08:15 AM	1	**2**	3	71	23	94	**10**	62	72	169
Total Volume	7	4	11	272	85	357	29	269	298	666
% App. Total	63.6	36.4		76.2	23.8		9.7	90.3		
PHF	.583	.500	.688	.861	.787	.893	.725	.897	.909	.895

Accurate Counts

978-664-2565

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022
Page No : 5



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

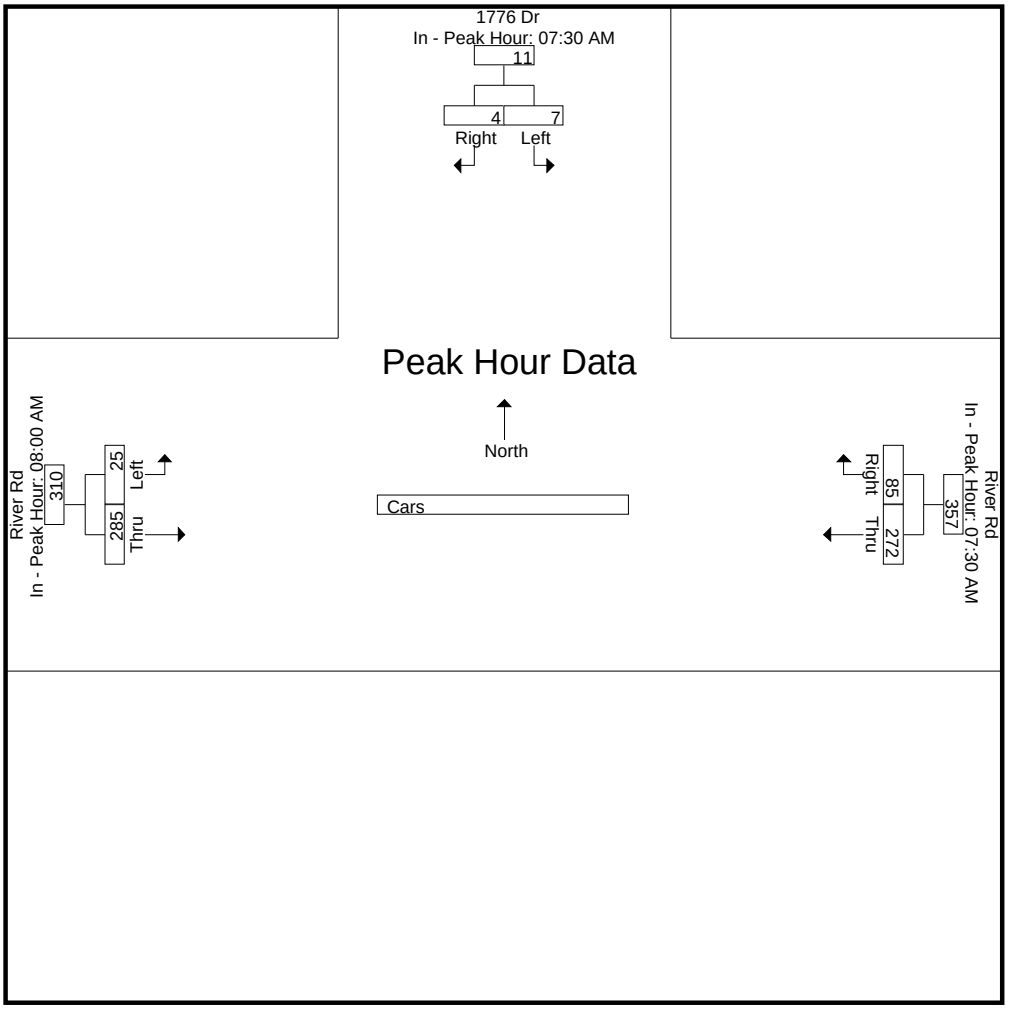
	07:30 AM			07:30 AM			08:00 AM		
+0 mins.	**3**	1	**4**	**79**	21	**100**	4	68	72
+15 mins.	1	0	1	55	**27**	82	**10**	62	72
+30 mins.	2	1	3	67	14	81	2	70	72
+45 mins.	1	**2**	3	71	23	94	9	**85**	**94**
Total Volume	7	4	11	272	85	357	25	285	310
% App. Total	63.6	36.4		76.2	23.8		8.1	91.9	
PHF	.583	.500	.688	.861	.787	.893	.625	.838	.824

Accurate Counts

978-664-2565

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022
Page No : 6



Accurate Counts

978-664-2565

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022
Page No : 7

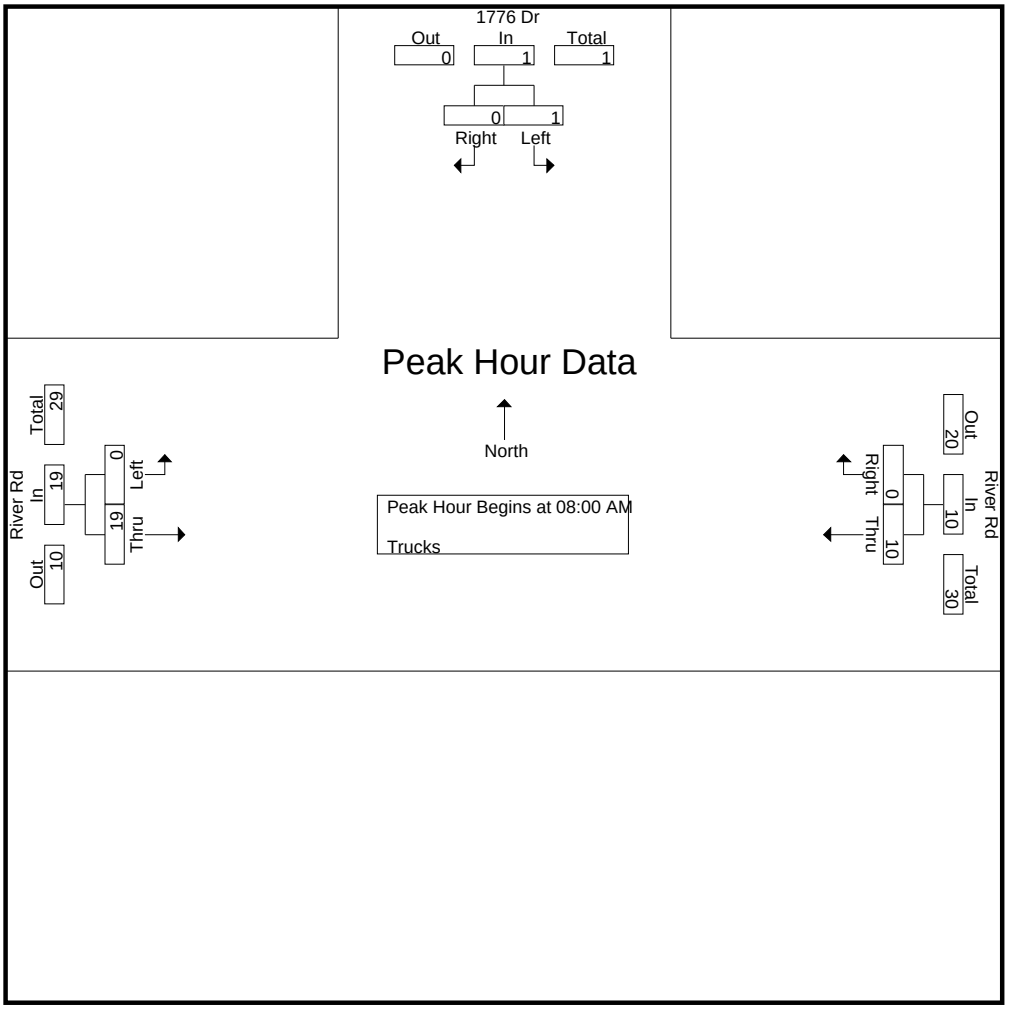
Groups Printed- Trucks

	1776 Dr From North		River Rd From East		River Rd From West		
Start Time	Left	Right	Thru	Right	Left	Thru	Int. Total
07:00 AM	0	0	1	0	0	0	1
07:15 AM	0	0	4	1	0	2	7
07:30 AM	0	0	5	0	0	2	7
07:45 AM	0	0	2	0	0	0	2
Total	0	0	12	1	0	4	17
08:00 AM	1	0	1	0	0	2	4
08:15 AM	0	0	3	0	0	6	9
08:30 AM	0	0	5	0	0	3	8
08:45 AM	0	0	1	0	0	8	9
Total	1	0	10	0	0	19	30
Grand Total	1	0	22	1	0	23	47
Apprch %	100	0	95.7	4.3	0	100	
Total %	2.1	0	46.8	2.1	0	48.9	

	1776 Dr From North			River Rd From East			River Rd From West			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 08:00 AM										
08:00 AM	**1**	0	**1**	1	0	1	0	2	2	4
08:15 AM	0	0	0	3	0	3	0	6	6	**9**
08:30 AM	0	0	0	**5**	0	**5**	0	3	3	8
08:45 AM	0	0	0	1	0	1	0	**8**	**8**	9
Total Volume	1	0	1	10	0	10	0	19	19	30
% App. Total	100	0		100	0		0	100		
PHF	.250	.000	.250	.500	.000	.500	.000	.594	.594	.833

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022
Page No : 8



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

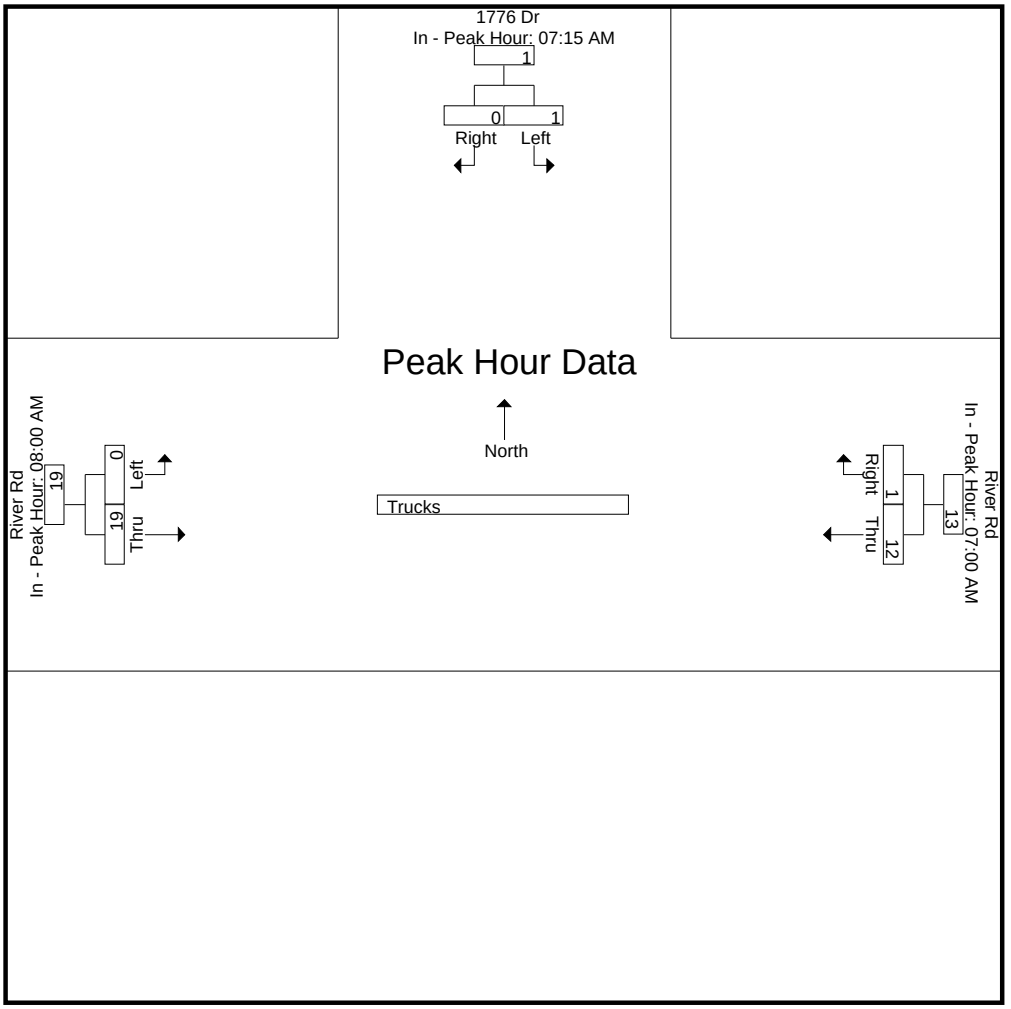
	07:15 AM			07:00 AM			08:00 AM		
+0 mins.	0	0	0	1	0	1	0	2	2
+15 mins.	0	0	0	4	**1**	**5**	0	6	6
+30 mins.	0	0	0	**5**	0	5	0	3	3
+45 mins.	**1**	0	**1**	2	0	2	0	**8**	**8**
Total Volume	1	0	1	12	1	13	0	19	19
% App. Total	100	0		92.3	7.7		0	100	
PHF	.250	.000	.250	.600	.250	.650	.000	.594	.594

Accurate Counts

978-664-2565

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022
Page No : 9



Accurate Counts

978-664-2565

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022

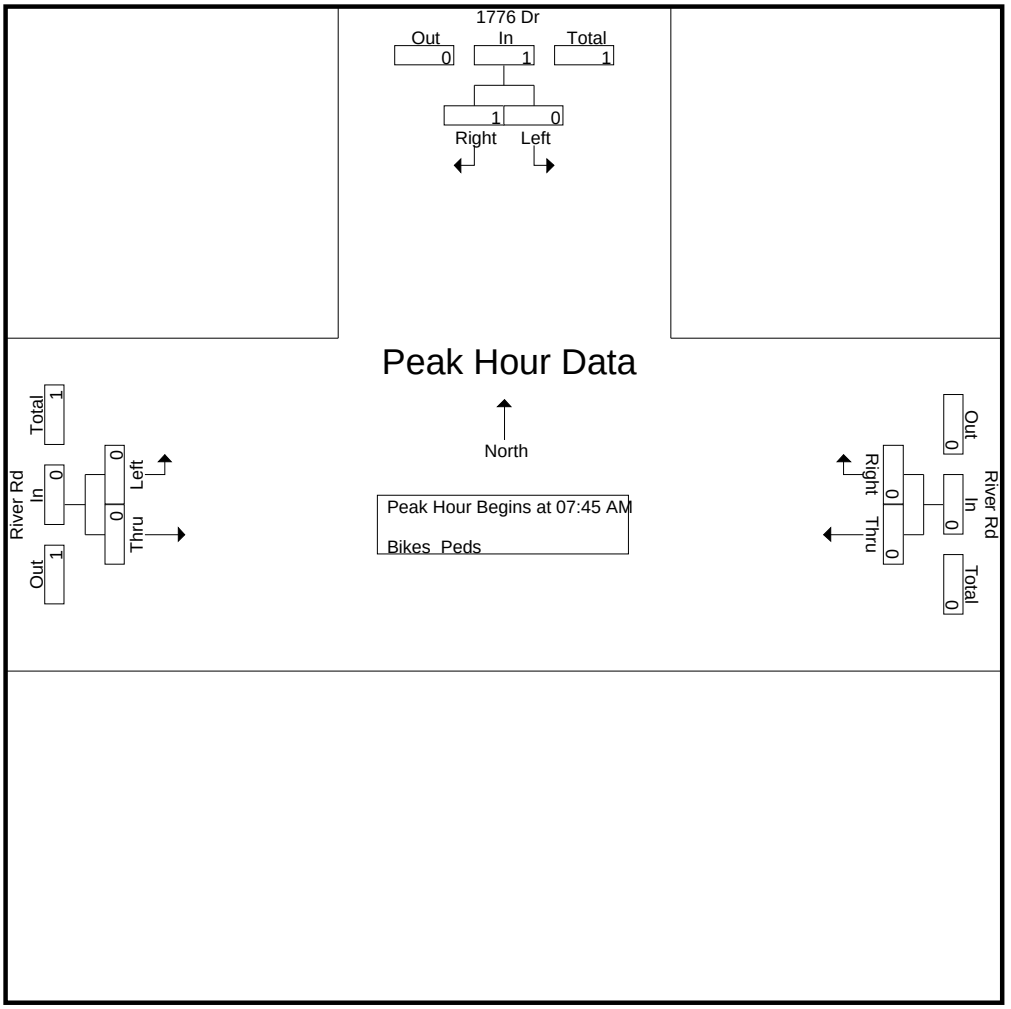
Groups Printed- Bikes Peds

	1776 Dr From North			River Rd From East			River Rd From West					
Start Time	Left	Right	Peds	Thru	Right	Peds	Left	Thru	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	1	0	0	0	0	0	0	0	0	1	1
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	1	0	0	0	0	0	0	0	0	1	1
Grand Total	0	1	0	0	0	0	0	0	0	0	1	1
Apprch %	0	100		0	0		0	0				
Total %	0	100		0	0		0	0		0	100	

	1776 Dr From North			River Rd From East			River Rd From West			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:45 AM										
07:45 AM	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	**1**	**1**	0	0	0	0	0	0	**1**
Total Volume	0	1	1	0	0	0	0	0	0	1
% App. Total	0	100		0	0		0	0		
PHF	.000	.250	.250	.000	.000	.000	.000	.000	.000	.250

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022
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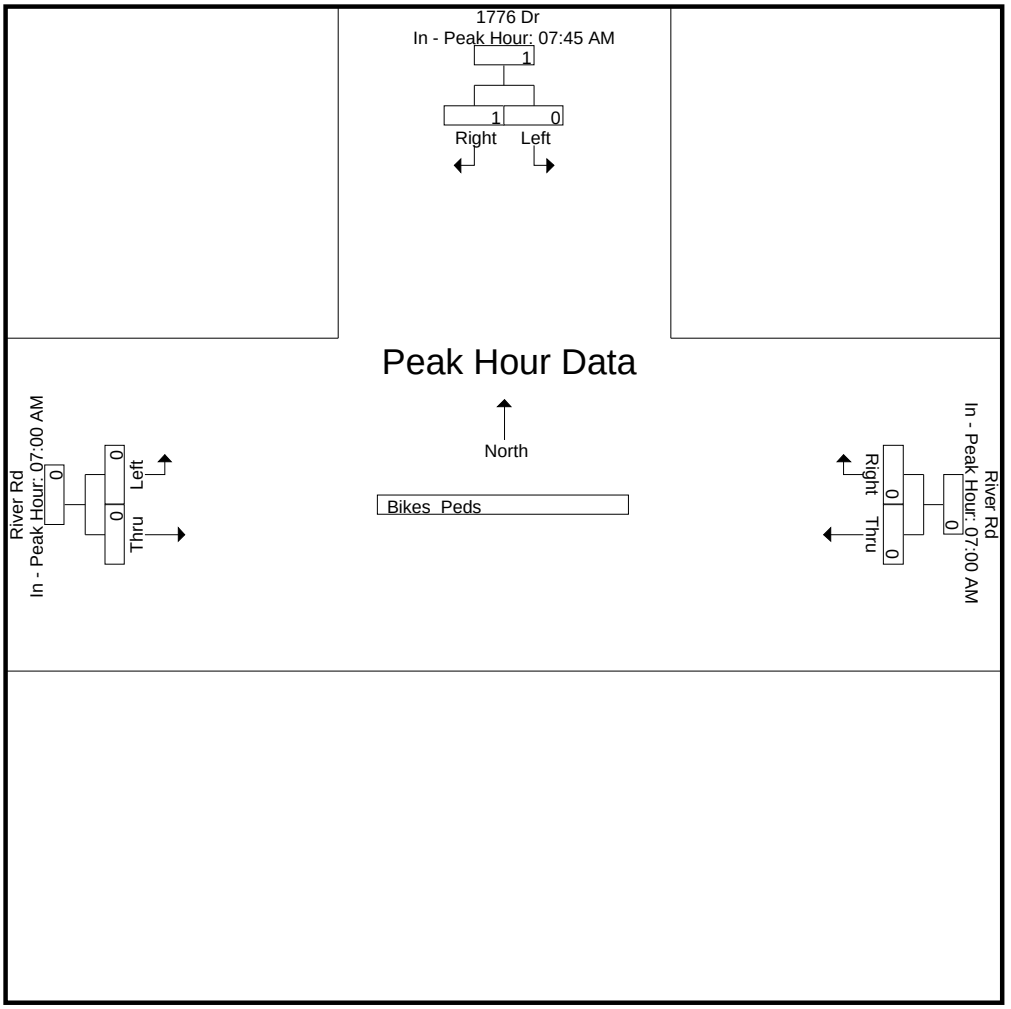


Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:45 AM			07:00 AM			07:00 AM		
+0 mins.	0	0	0	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	0	0	0	0
+30 mins.	0	0	0	0	0	0	0	0	0
+45 mins.	0	**1**	**1**	0	0	0	0	0	0
Total Volume	0	1	1	0	0	0	0	0	0
% App. Total	0	100		0	0		0	0	
PHF	.000	.250	.250	.000	.000	.000	.000	.000	.000

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022
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Accurate Counts

978-664-2565

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022
Page No : 1

Groups Printed- Cars - Trucks

	1776 Dr From North		River Rd From East		River Rd From West		
Start Time	Left	Right	Thru	Right	Left	Thru	Int. Total
04:00 PM	19	9	53	2	0	99	182
04:15 PM	12	5	72	2	2	76	169
04:30 PM	27	9	56	3	1	85	181
04:45 PM	15	9	57	0	3	76	160
Total	73	32	238	7	6	336	692
05:00 PM	33	9	80	1	0	87	210
05:15 PM	9	1	84	1	0	74	169
05:30 PM	13	3	59	1	0	72	148
05:45 PM	8	5	55	4	2	79	153
Total	63	18	278	7	2	312	680
Grand Total	136	50	516	14	8	648	1372
Apprch %	73.1	26.9	97.4	2.6	1.2	98.8	
Total %	9.9	3.6	37.6	1	0.6	47.2	
Cars	134	50	515	12	8	639	1358
% Cars	98.5	100	99.8	85.7	100	98.6	99
Trucks	2	0	1	2	0	9	14
% Trucks	1.5	0	0.2	14.3	0	1.4	1

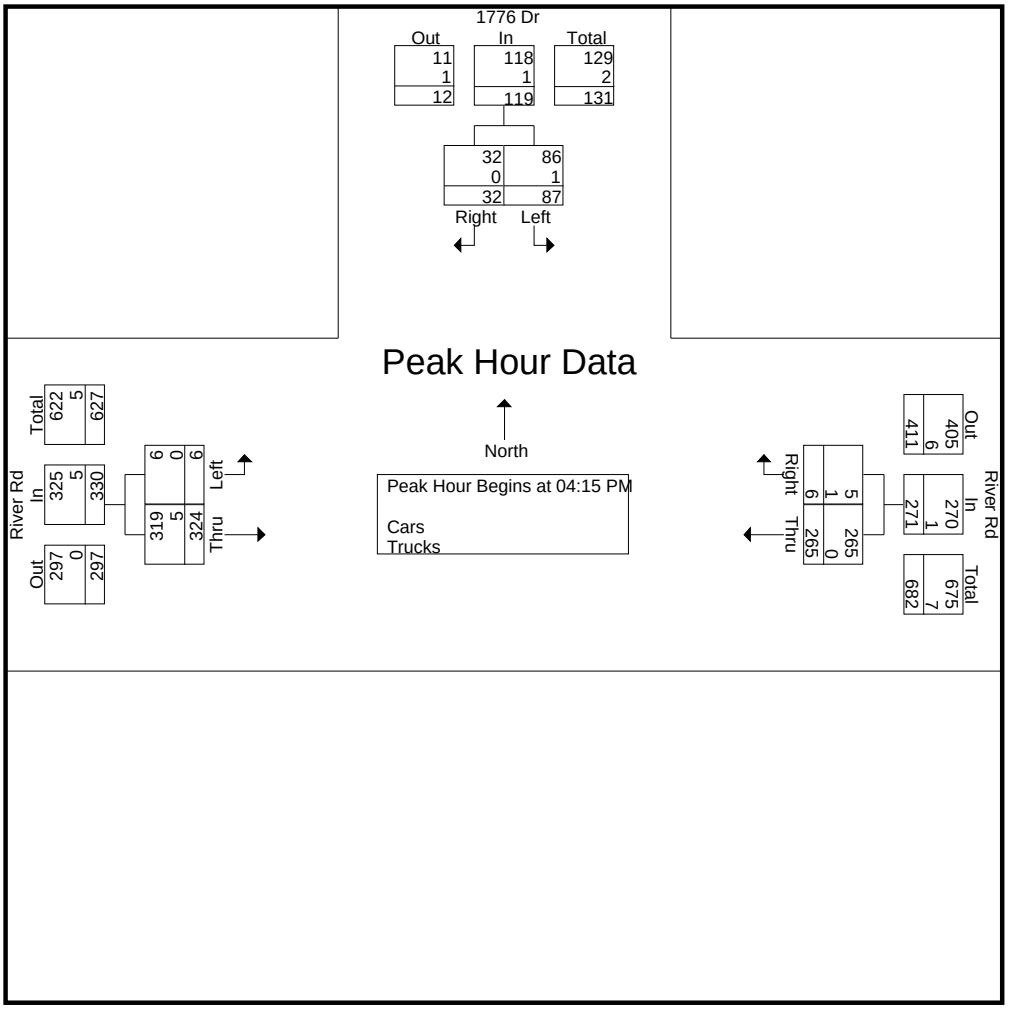
	1776 Dr From North			River Rd From East			River Rd From West			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:15 PM										
04:15 PM	12	5	17	72	2	74	2	76	78	169
04:30 PM	27	**9**	36	56	**3**	59	1	85	86	181
04:45 PM	15	9	24	57	0	57	**3**	76	79	160
05:00 PM	**33**	9	**42**	**80**	1	**81**	0	**87**	**87**	**210**
Total Volume	87	32	119	265	6	271	6	324	330	720
% App. Total	73.1	26.9		97.8	2.2		1.8	98.2		
PHF	.659	.889	.708	.828	.500	.836	.500	.931	.948	.857
Cars	86	32	118	265	5	270	6	319	325	713
% Cars	98.9	100	99.2	100	83.3	99.6	100	98.5	98.5	99.0
Trucks	1	0	1	0	1	1	0	5	5	7
% Trucks	1.1	0	0.8	0	16.7	0.4	0	1.5	1.5	1.0

Accurate Counts

978-664-2565

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022
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Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

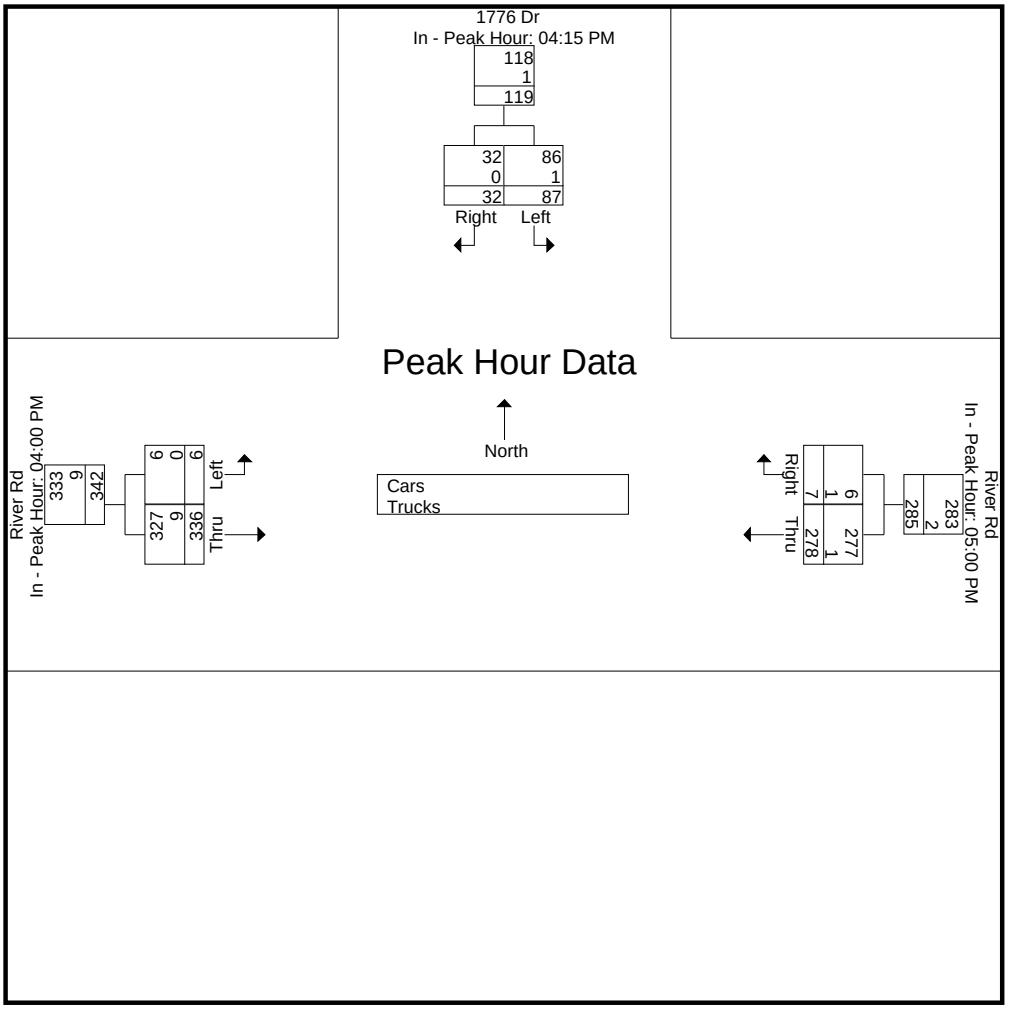
Peak Hour for Each Approach Begins at:

	04:15 PM			05:00 PM			04:00 PM		
+0 mins.	12	5	17	80	1	81	0	**99**	**99**
+15 mins.	27	**9**	36	**84**	1	**85**	2	76	78
+30 mins.	15	9	24	59	1	60	1	85	86
+45 mins.	**33**	9	**42**	55	**4**	59	**3**	76	79
Total Volume	87	32	119	278	7	285	6	336	342
% App. Total	73.1	26.9		97.5	2.5		1.8	98.2	
PHF	.659	.889	.708	.827	.438	.838	.500	.848	.864
Cars	86	32	118	277	6	283	6	327	333
% Cars	98.9	100	99.2	99.6	85.7	99.3	100	97.3	97.4
Trucks	1	0	1	1	1	2	0	9	9
% Trucks	1.1	0	0.8	0.4	14.3	0.7	0	2.7	2.6

Accurate Counts
978-664-2565

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022
Page No : 3



Accurate Counts

978-664-2565

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022

Groups Printed- Cars

	1776 Dr From North		River Rd From East		River Rd From West		
Start Time	Left	Right	Thru	Right	Left	Thru	Int. Total
04:00 PM	18	9	53	1	0	95	176
04:15 PM	12	5	72	2	2	72	165
04:30 PM	27	9	56	3	1	85	181
04:45 PM	15	9	57	0	3	75	159
Total	72	32	238	6	6	327	681
05:00 PM	32	9	80	0	0	87	208
05:15 PM	9	1	84	1	0	74	169
05:30 PM	13	3	59	1	0	72	148
05:45 PM	8	5	54	4	2	79	152
Total	62	18	277	6	2	312	677
Grand Total	134	50	515	12	8	639	1358
Apprch %	72.8	27.2	97.7	2.3	1.2	98.8	
Total %	9.9	3.7	37.9	0.9	0.6	47.1	

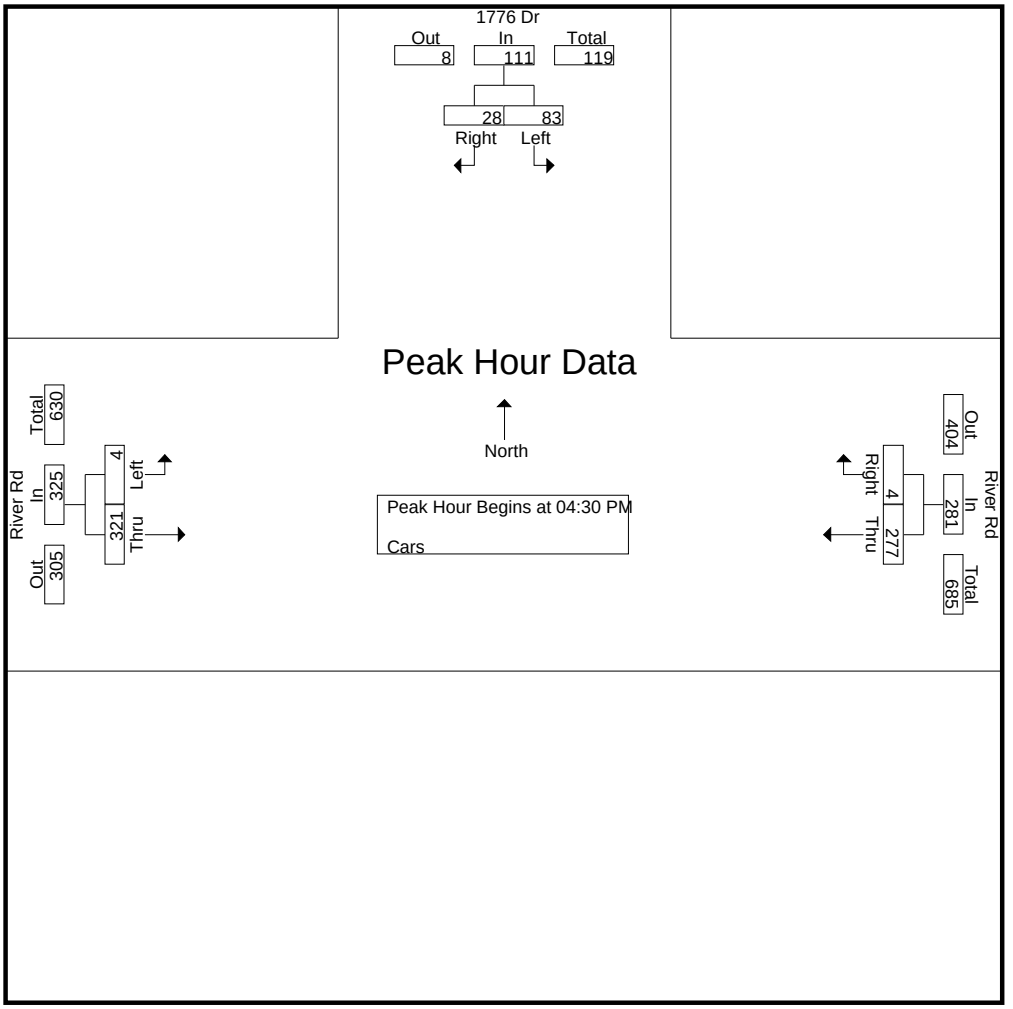
	1776 Dr From North			River Rd From East			River Rd From West			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:30 PM										
04:30 PM	27	**9**	36	56	**3**	59	1	85	86	181
04:45 PM	15	9	24	57	0	57	**3**	75	78	159
05:00 PM	**32**	9	**41**	80	0	80	0	**87**	**87**	**208**
05:15 PM	9	1	10	**84**	1	**85**	0	74	74	169
Total Volume	83	28	111	277	4	281	4	321	325	717
% App. Total	74.8	25.2		98.6	1.4		1.2	98.8		
PHF	.648	.778	.677	.824	.333	.826	.333	.922	.934	.862

Accurate Counts

978-664-2565

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022
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Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

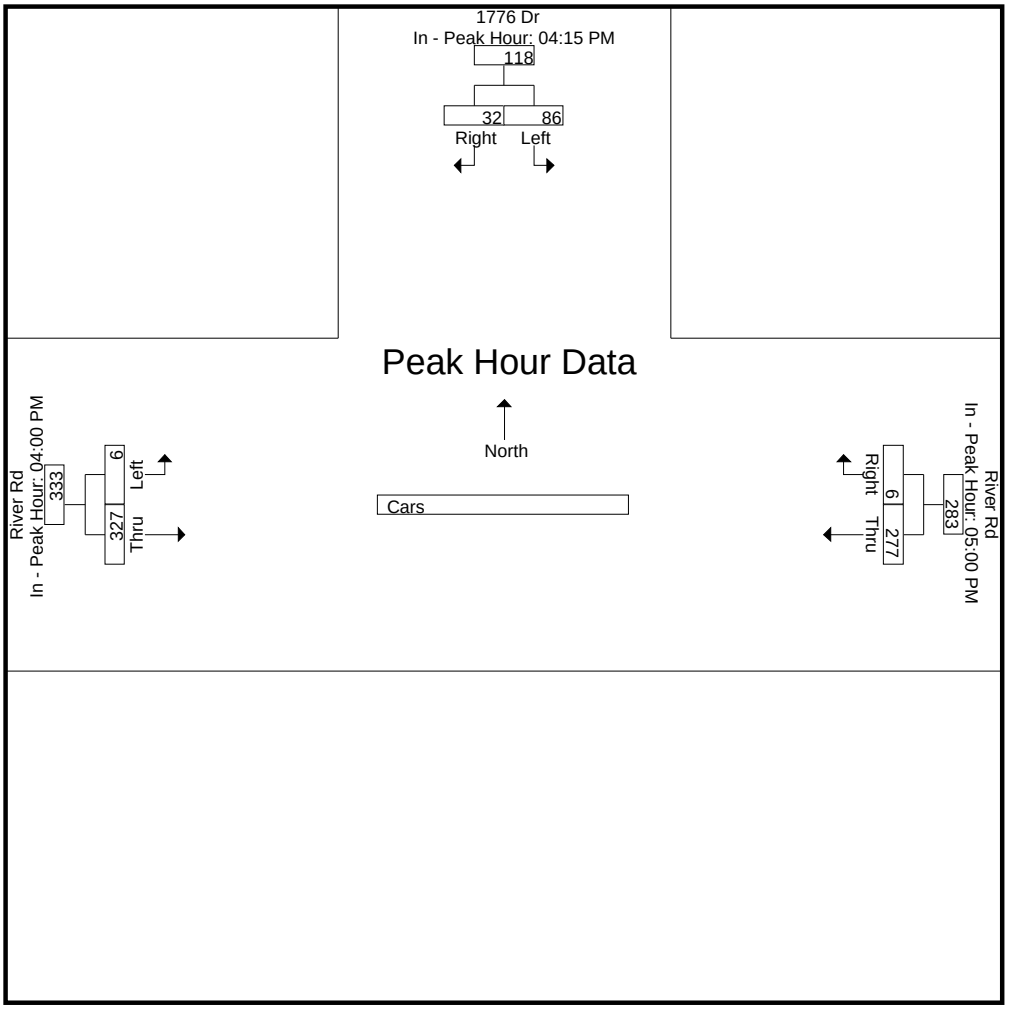
Peak Hour for Each Approach Begins at:

	04:15 PM			05:00 PM			04:00 PM		
+0 mins.	12	5	17	80	0	80	0	**95**	**95**
+15 mins.	27	**9**	36	**84**	1	**85**	2	72	74
+30 mins.	15	9	24	59	1	60	1	85	86
+45 mins.	**32**	9	**41**	54	**4**	58	**3**	75	78
Total Volume	86	32	118	277	6	283	6	327	333
% App. Total	72.9	27.1		97.9	2.1		1.8	98.2	
PHF	.672	.889	.720	.824	.375	.832	.500	.861	.876

Accurate Counts
978-664-2565

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022
Page No : 6



Accurate Counts

978-664-2565

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022
Page No : 7

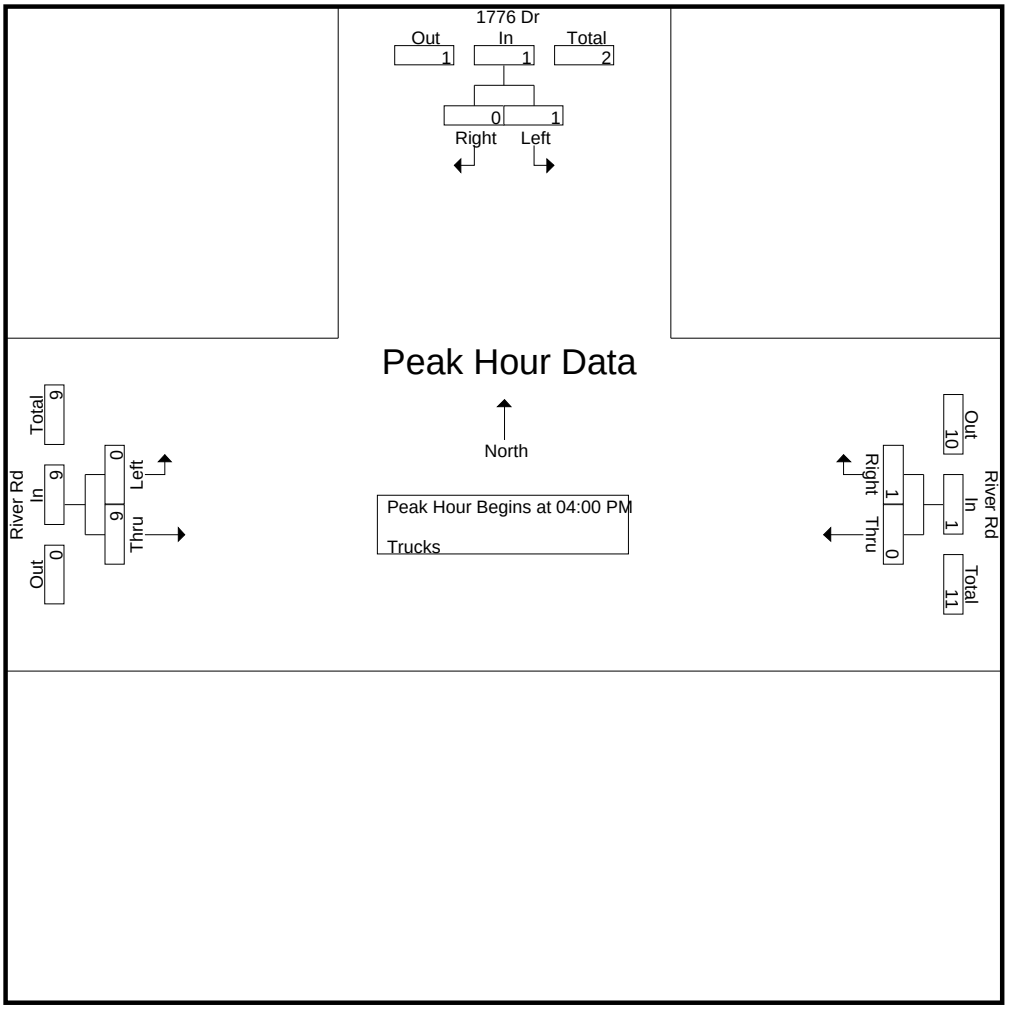
Groups Printed- Trucks

	1776 Dr From North		River Rd From East		River Rd From West		
Start Time	Left	Right	Thru	Right	Left	Thru	Int. Total
04:00 PM	1	0	0	1	0	4	6
04:15 PM	0	0	0	0	0	4	4
04:30 PM	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	1	1
Total	1	0	0	1	0	9	11
05:00 PM	1	0	0	1	0	0	2
05:15 PM	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0
05:45 PM	0	0	1	0	0	0	1
Total	1	0	1	1	0	0	3
Grand Total	2	0	1	2	0	9	14
Apprch %	100	0	33.3	66.7	0	100	
Total %	14.3	0	7.1	14.3	0	64.3	

	1776 Dr From North			River Rd From East			River Rd From West			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:00 PM										
04:00 PM	**1**	0	**1**	0	**1**	**1**	0	**4**	**4**	**6**
04:15 PM	0	0	0	0	0	0	0	4	4	4
04:30 PM	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	1	1	1
Total Volume	1	0	1	0	1	1	0	9	9	11
% App. Total	100	0		0	100		0	100		
PHF	.250	.000	.250	.000	.250	.250	.000	.563	.563	.458

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022
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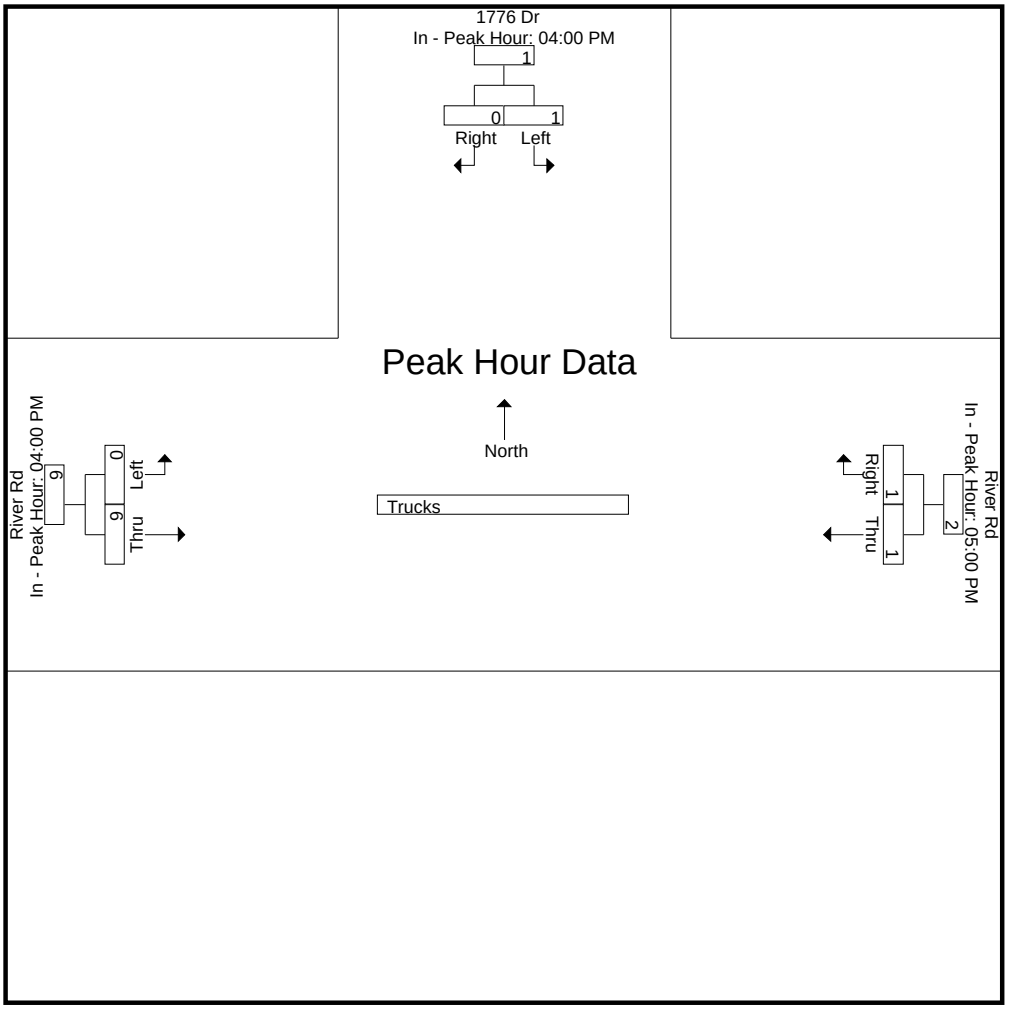
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:00 PM			05:00 PM			04:00 PM		
+0 mins.	**1**	0	**1**	0	**1**	**1**	0	**4**	**4**
+15 mins.	0	0	0	0	0	0	0	4	4
+30 mins.	0	0	0	0	0	0	0	0	0
+45 mins.	0	0	0	**1**	0	1	0	1	1
Total Volume	1	0	1	1	1	2	0	9	9
% App. Total	100	0		50	50		0	100	
PHF	.250	.000	.250	.250	.250	.500	.000	.563	.563

Accurate Counts
978-664-2565

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022
Page No : 9



Accurate Counts

978-664-2565

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022

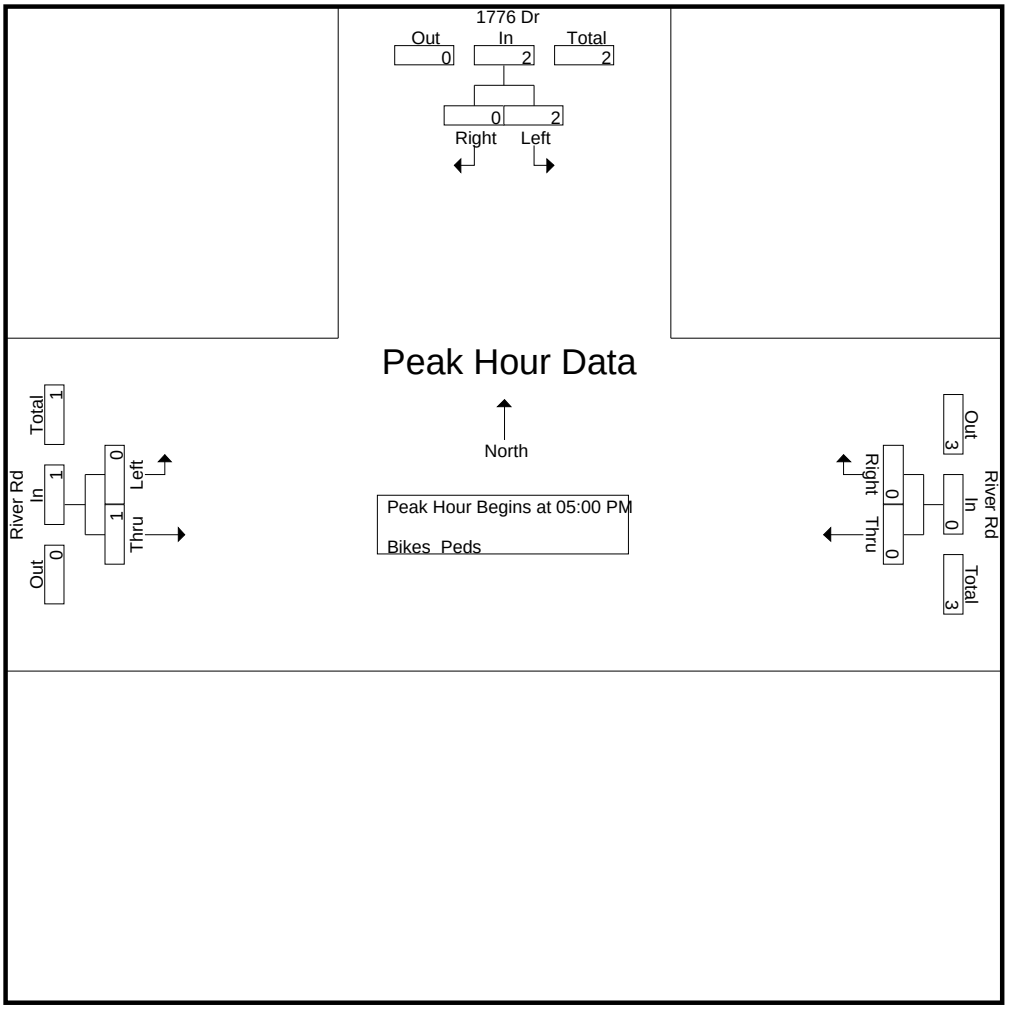
Groups Printed- Bikes Peds

	1776 Dr From North			River Rd From East			River Rd From West					
Start Time	Left	Right	Peds	Thru	Right	Peds	Left	Thru	Peds	Exclu. Total	Inclu. Total	Int. Total
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	1	0	0	0	0	0	0	1	1
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	1	0	0	0	0	0	0	1	1
05:00 PM	0	0	1	0	0	0	0	0	0	1	0	1
05:15 PM	0	0	0	0	0	0	0	0	1	1	0	1
05:30 PM	1	0	0	0	0	0	0	0	0	0	1	1
05:45 PM	1	0	2	0	0	1	0	1	0	3	2	5
Total	2	0	3	0	0	1	0	1	1	5	3	8
Grand Total	2	0	3	1	0	1	0	1	1	5	4	9
Apprch %	100	0		100	0		0	100				
Total %	50	0		25	0		0	25		55.6	44.4	

	1776 Dr From North			River Rd From East			River Rd From West			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 05:00 PM										
05:00 PM	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0
05:30 PM	**1**	0	**1**	0	0	0	0	0	0	1
05:45 PM	1	0	1	0	0	0	0	**1**	**1**	**2**
Total Volume	2	0	2	0	0	0	0	1	1	3
% App. Total	100	0		0	0		0	100		
PHF	.500	.000	.500	.000	.000	.000	.000	.250	.250	.375

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022
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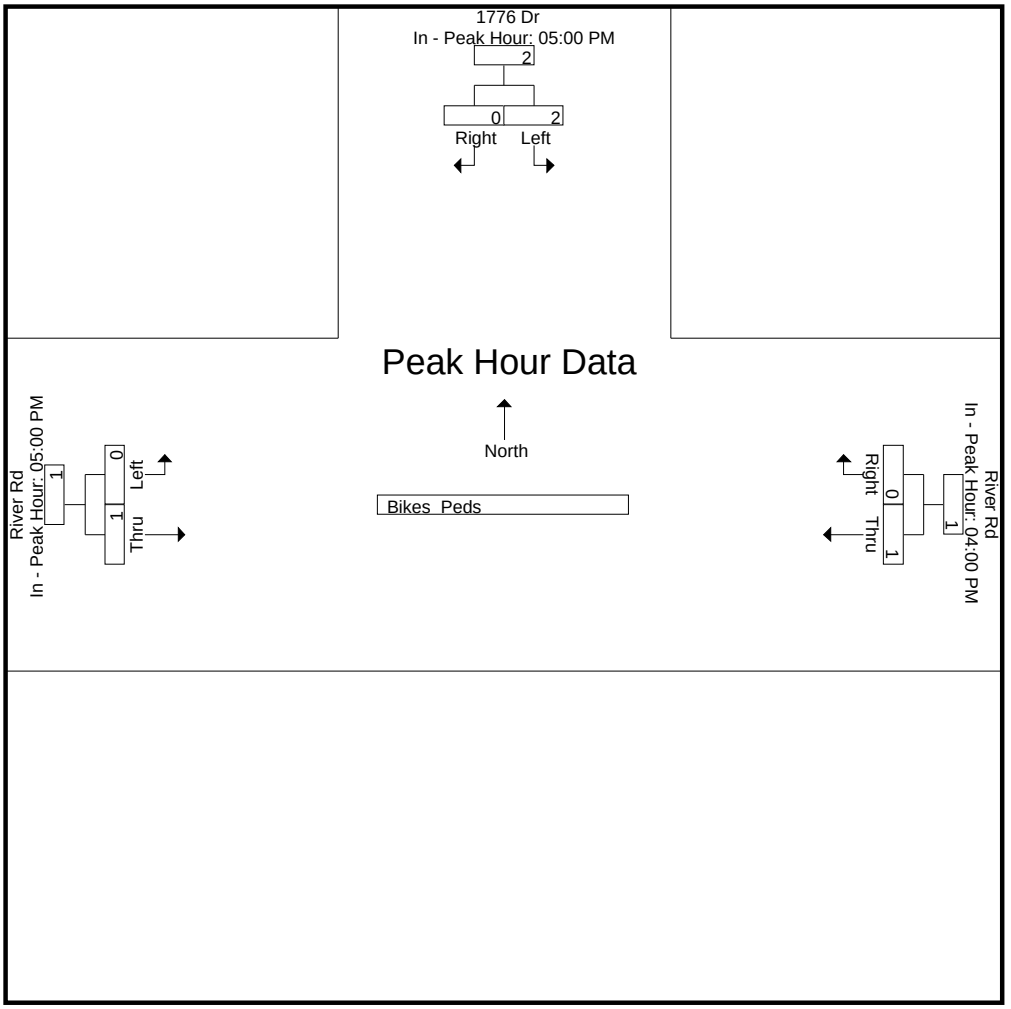


Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	05:00 PM			04:00 PM			05:00 PM		
+0 mins.	0	0	0	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	0	0	0	0
+30 mins.	**1**	0	**1**	**1**	0	**1**	0	0	0
+45 mins.	1	0	1	0	0	0	0	**1**	**1**
Total Volume	2	0	2	1	0	1	0	1	1
% App. Total	100	0		100	0		0	100	
PHF	.500	.000	.500	.250	.000	.250	.000	.250	.250

N/S Street : 1776 Drive
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410001
Site Code : 91410001
Start Date : 5/11/2022
Page No : 12



Accurate Counts

978-664-2565

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022
Page No : 1

Groups Printed- Cars - Trucks

	Minuteman Rd From North			River Rd From East			Shattuck Rd From South			River Rd From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
07:00 AM	21	0	0	73	54	14	22	0	69	0	49	2	304
07:15 AM	10	1	1	59	68	32	2	0	17	1	67	7	265
07:30 AM	18	2	1	84	113	30	4	0	19	1	74	12	358
07:45 AM	19	2	0	143	97	57	4	2	27	1	61	12	425
Total	68	5	2	359	332	133	32	2	132	3	251	33	1352
08:00 AM	17	0	4	136	90	44	5	1	28	0	68	7	400
08:15 AM	16	0	1	97	97	66	6	1	20	2	78	10	394
08:30 AM	12	2	1	100	69	44	3	0	31	0	71	9	342
08:45 AM	13	0	3	113	72	48	9	0	37	1	94	7	397
Total	58	2	9	446	328	202	23	2	116	3	311	33	1533
Grand Total	126	7	11	805	660	335	55	4	248	6	562	66	2885
Apprch %	87.5	4.9	7.6	44.7	36.7	18.6	17.9	1.3	80.8	0.9	88.6	10.4	
Total %	4.4	0.2	0.4	27.9	22.9	11.6	1.9	0.1	8.6	0.2	19.5	2.3	
Cars	122	7	11	796	639	330	54	4	240	6	539	66	2814
% Cars	96.8	100	100	98.9	96.8	98.5	98.2	100	96.8	100	95.9	100	97.5
Trucks	4	0	0	9	21	5	1	0	8	0	23	0	71
% Trucks	3.2	0	0	1.1	3.2	1.5	1.8	0	3.2	0	4.1	0	2.5

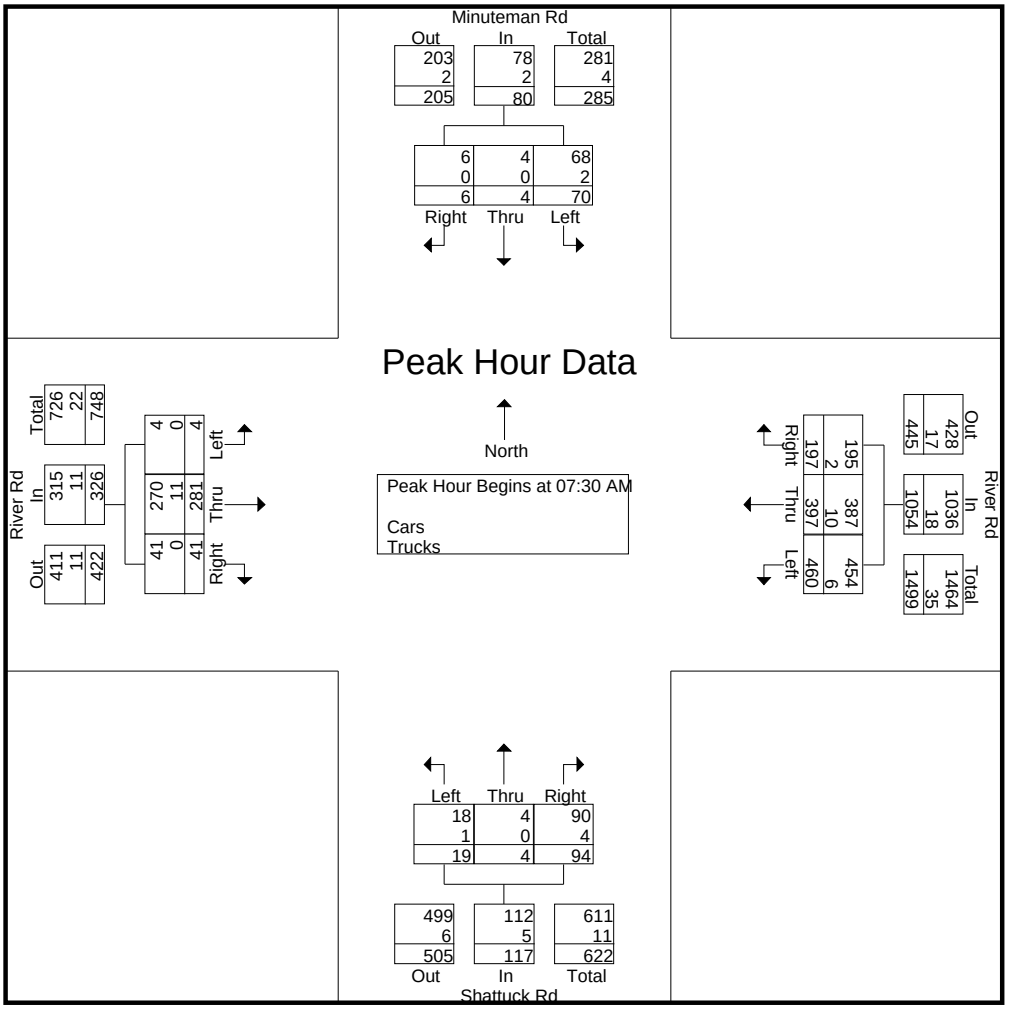
	Minuteman Rd From North				River Rd From East				Shattuck Rd From South				River Rd From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30 AM																	
07:30 AM	18	**2**	1	**21**	84	**113**	30	227	4	0	19	23	1	74	**12**	87	358
07:45 AM	**19**	2	0	21	**143**	97	57	**297**	4	**2**	27	33	1	61	12	74	**425**
08:00 AM	17	0	**4**	21	136	90	44	270	5	1	**28**	**34**	0	68	7	75	400
08:15 AM	16	0	1	17	97	97	**66**	260	**6**	1	20	27	**2**	**78**	10	**90**	394
Total Volume	70	4	6	80	460	397	197	1054	19	4	94	117	4	281	41	326	1577
% App. Total	87.5	5	7.5		43.6	37.7	18.7		16.2	3.4	80.3		1.2	86.2	12.6		
PHF	.921	.500	.375	.952	.804	.878	.746	.887	.792	.500	.839	.860	.500	.901	.854	.906	.928
Cars	68	4	6	78	454	387	195	1036	18	4	90	112	4	270	41	315	1541
% Cars	97.1	100	100	97.5	98.7	97.5	99.0	98.3	94.7	100	95.7	95.7	100	96.1	100	96.6	97.7
Trucks	2	0	0	2	6	10	2	18	1	0	4	5	0	11	0	11	36
% Trucks	2.9	0	0	2.5	1.3	2.5	1.0	1.7	5.3	0	4.3	4.3	0	3.9	0	3.4	2.3

Accurate Counts

978-664-2565

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022
Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

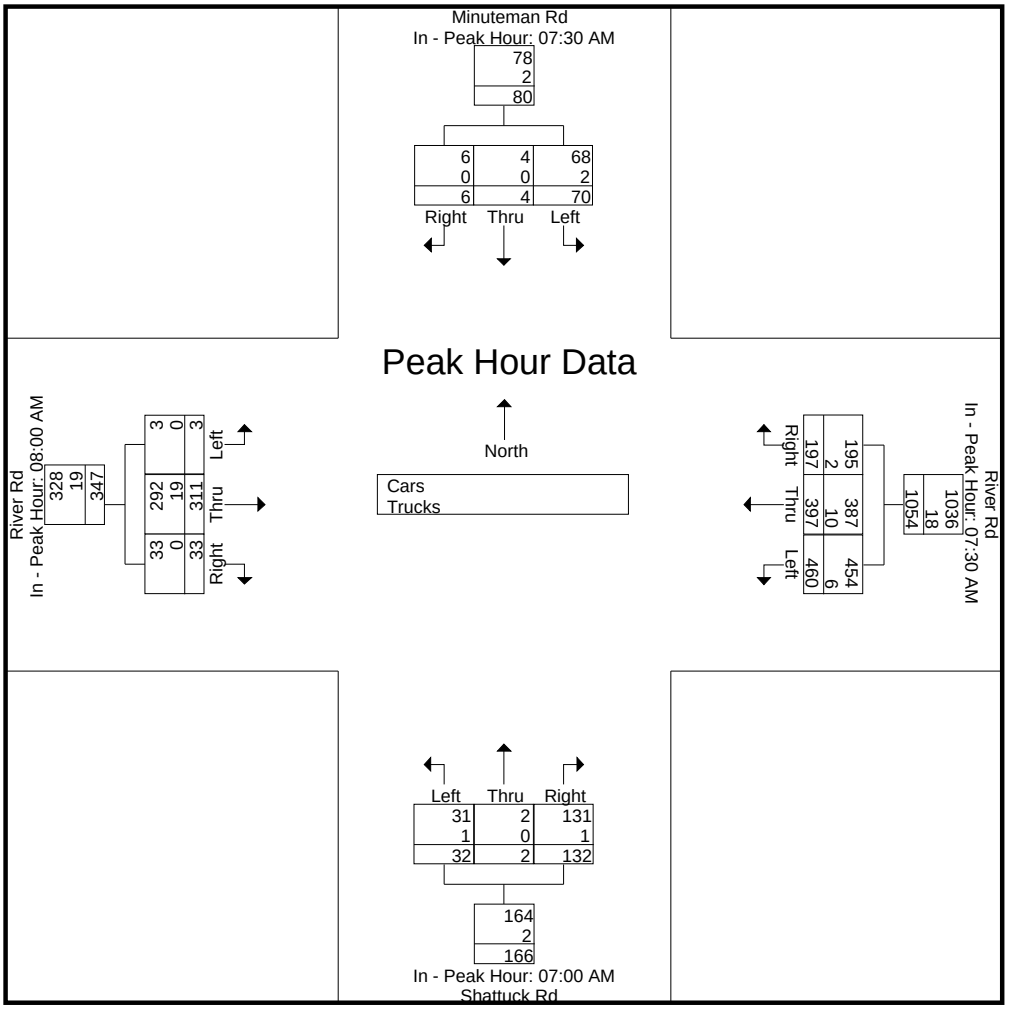
	07:30 AM				07:30 AM				07:00 AM				08:00 AM			
+0 mins.	18	**2**	1	**21**	84	**113**	30	227	**22**	0	**69**	**91**	0	68	7	75
+15 mins.	**19**	2	0	21	**143**	97	57	**297**	2	0	17	19	**2**	78	**10**	90
+30 mins.	17	0	**4**	21	136	90	44	270	4	0	19	23	0	71	9	80
+45 mins.	16	0	1	17	97	97	**66**	260	4	**2**	27	33	1	**94**	7	**102**
Total Volume	70	4	6	80	460	397	197	1054	32	2	132	166	3	311	33	347
% App. Total	87.5	5	7.5		43.6	37.7	18.7		19.3	1.2	79.5		0.9	89.6	9.5	
PHF	.921	.500	.375	.952	.804	.878	.746	.887	.364	.250	.478	.456	.375	.827	.825	.850
Cars	68	4	6	78	454	387	195	1036	31	2	131	164	3	292	33	328
% Cars	97.1	100	100	97.5	98.7	97.5	99	98.3	96.9	100	99.2	98.8	100	93.9	100	94.5
Trucks	2	0	0	2	6	10	2	18	1	0	1	2	0	19	0	19
% Trucks	2.9	0	0	2.5	1.3	2.5	1	1.7	3.1	0	0.8	1.2	0	6.1	0	5.5

Accurate Counts

978-664-2565

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022
Page No : 3



Accurate Counts

978-664-2565

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022

Groups Printed- Cars

	Minuteman Rd From North			River Rd From East			Shattuck Rd From South			River Rd From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
07:00 AM	21	0	0	73	53	14	22	0	69	0	49	2	303
07:15 AM	9	1	1	58	64	31	2	0	16	1	65	7	255
07:30 AM	18	2	1	82	108	30	4	0	19	1	72	12	349
07:45 AM	18	2	0	142	96	56	3	2	27	1	61	12	420
Total	66	5	2	355	321	131	31	2	131	3	247	33	1327
08:00 AM	17	0	4	133	89	44	5	1	24	0	65	7	389
08:15 AM	15	0	1	97	94	65	6	1	20	2	72	10	383
08:30 AM	12	2	1	99	65	43	3	0	31	0	70	9	335
08:45 AM	12	0	3	112	70	47	9	0	34	1	85	7	380
Total	56	2	9	441	318	199	23	2	109	3	292	33	1487
Grand Total	122	7	11	796	639	330	54	4	240	6	539	66	2814
Apprch %	87.1	5	7.9	45.1	36.2	18.7	18.1	1.3	80.5	1	88.2	10.8	
Total %	4.3	0.2	0.4	28.3	22.7	11.7	1.9	0.1	8.5	0.2	19.2	2.3	

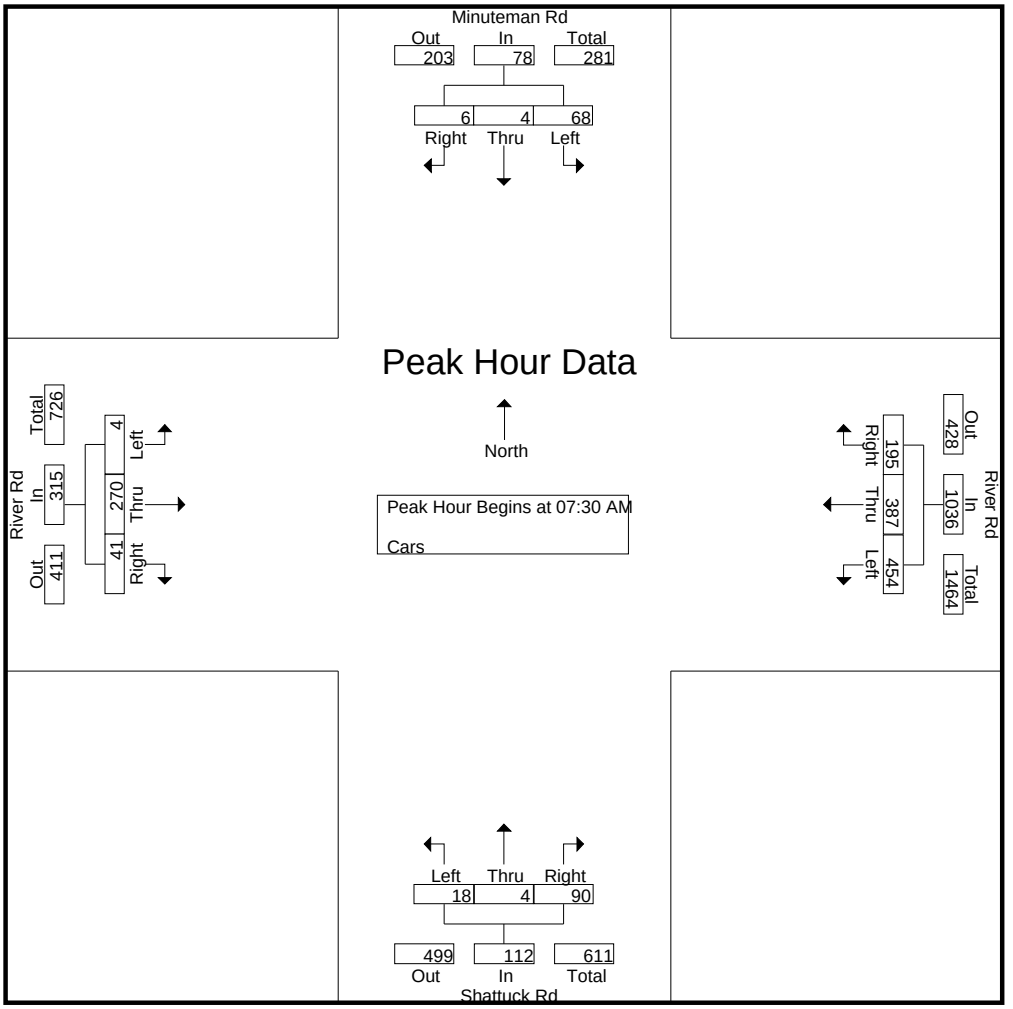
	Minuteman Rd From North				River Rd From East				Shattuck Rd From South				River Rd From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30 AM																	
07:30 AM	**18**	**2**	1	**21**	82	**108**	30	220	4	0	19	23	1	**72**	**12**	**85**	349
07:45 AM	18	2	0	20	**142**	96	56	**294**	3	**2**	**27**	**32**	1	61	12	74	**420**
08:00 AM	17	0	**4**	21	133	89	44	266	5	1	24	30	0	65	7	72	389
08:15 AM	15	0	1	16	97	94	**65**	256	**6**	1	20	27	**2**	72	10	84	383
Total Volume	68	4	6	78	454	387	195	1036	18	4	90	112	4	270	41	315	1541
% App. Total	87.2	5.1	7.7		43.8	37.4	18.8		16.1	3.6	80.4		1.3	85.7	13		
PHF	.944	.500	.375	.929	.799	.896	.750	.881	.750	.500	.833	.875	.500	.938	.854	.926	.917

Accurate Counts

978-664-2565

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022
Page No : 5



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

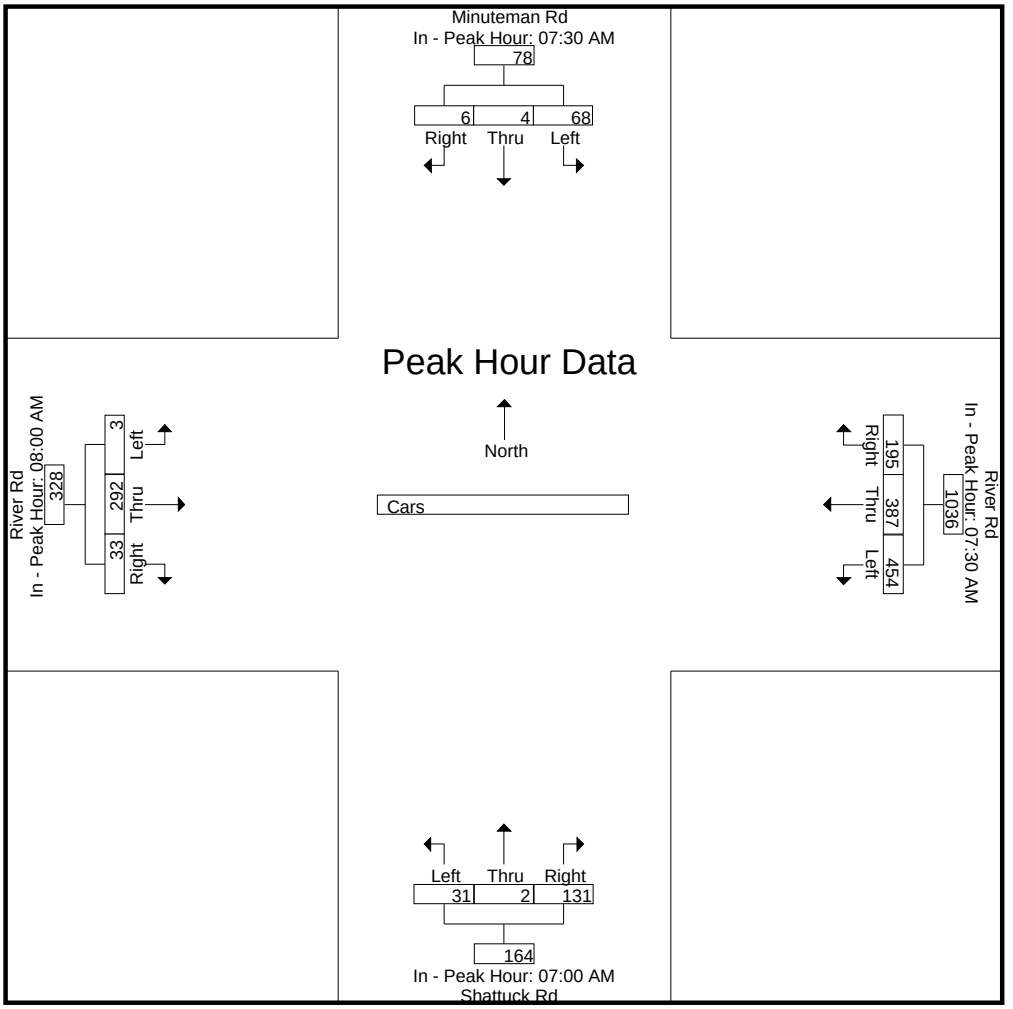
	07:30 AM				07:30 AM				07:00 AM				08:00 AM			
+0 mins.	**18**	**2**	1	**21**	82	**108**	30	220	**22**	0	**69**	**91**	0	65	7	72
+15 mins.	18	2	0	20	**142**	96	56	**294**	2	0	16	18	**2**	72	**10**	84
+30 mins.	17	0	**4**	21	133	89	44	266	4	0	19	23	0	70	9	79
+45 mins.	15	0	1	16	97	94	**65**	256	3	**2**	27	32	1	**85**	7	**93**
Total Volume	68	4	6	78	454	387	195	1036	31	2	131	164	3	292	33	328
% App. Total	87.2	5.1	7.7		43.8	37.4	18.8		18.9	1.2	79.9		0.9	89	10.1	
PHF	.944	.500	.375	.929	.799	.896	.750	.881	.352	.250	.475	.451	.375	.859	.825	.882

Accurate Counts

978-664-2565

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022
Page No : 6



Accurate Counts

978-664-2565

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022

Groups Printed- Trucks

	Minuteman Rd From North			River Rd From East			Shattuck Rd From South			River Rd From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
07:00 AM	0	0	0	0	1	0	0	0	0	0	0	0	1
07:15 AM	1	0	0	1	4	1	0	0	1	0	2	0	10
07:30 AM	0	0	0	2	5	0	0	0	0	0	2	0	9
07:45 AM	1	0	0	1	1	1	1	0	0	0	0	0	5
Total	2	0	0	4	11	2	1	0	1	0	4	0	25
08:00 AM	0	0	0	3	1	0	0	0	4	0	3	0	11
08:15 AM	1	0	0	0	3	1	0	0	0	0	6	0	11
08:30 AM	0	0	0	1	4	1	0	0	0	0	1	0	7
08:45 AM	1	0	0	1	2	1	0	0	3	0	9	0	17
Total	2	0	0	5	10	3	0	0	7	0	19	0	46
Grand Total	4	0	0	9	21	5	1	0	8	0	23	0	71
Apprch %	100	0	0	25.7	60	14.3	11.1	0	88.9	0	100	0	
Total %	5.6	0	0	12.7	29.6	7	1.4	0	11.3	0	32.4	0	

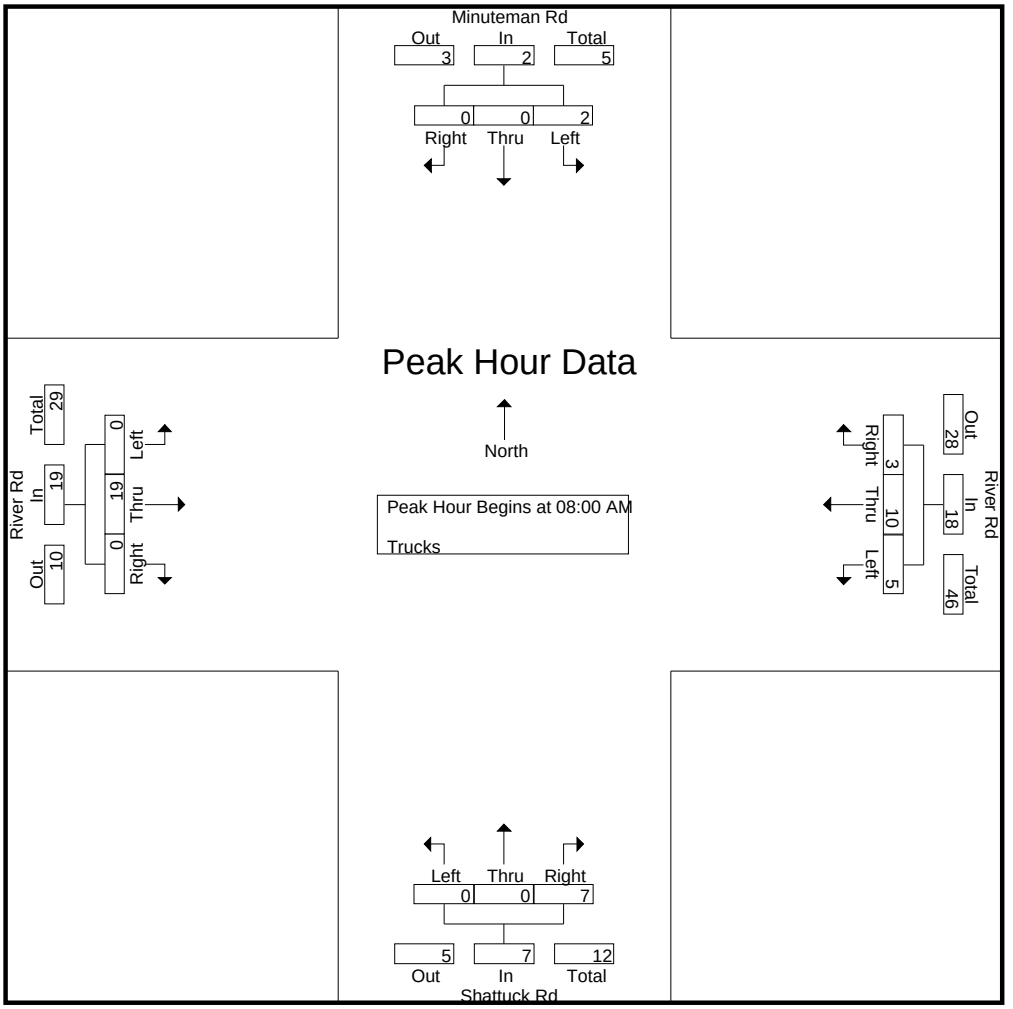
	Minuteman Rd From North				River Rd From East				Shattuck Rd From South				River Rd From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	0	0	0	0	**3**	1	0	4	0	0	**4**	**4**	0	3	0	3	11
08:15 AM	**1**	0	0	**1**	0	3	**1**	4	0	0	0	0	0	6	0	6	11
08:30 AM	0	0	0	0	1	**4**	1	**6**	0	0	0	0	0	1	0	1	7
08:45 AM	1	0	0	1	1	2	1	4	0	0	3	3	0	**9**	0	**9**	**17**
Total Volume	2	0	0	2	5	10	3	18	0	0	7	7	0	19	0	19	46
% App. Total	100	0	0		27.8	55.6	16.7		0	0	100		0	100	0		
PHF	.500	.000	.000	.500	.417	.625	.750	.750	.000	.000	.438	.438	.000	.528	.000	.528	.676

Accurate Counts

978-664-2565

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022
Page No : 8



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

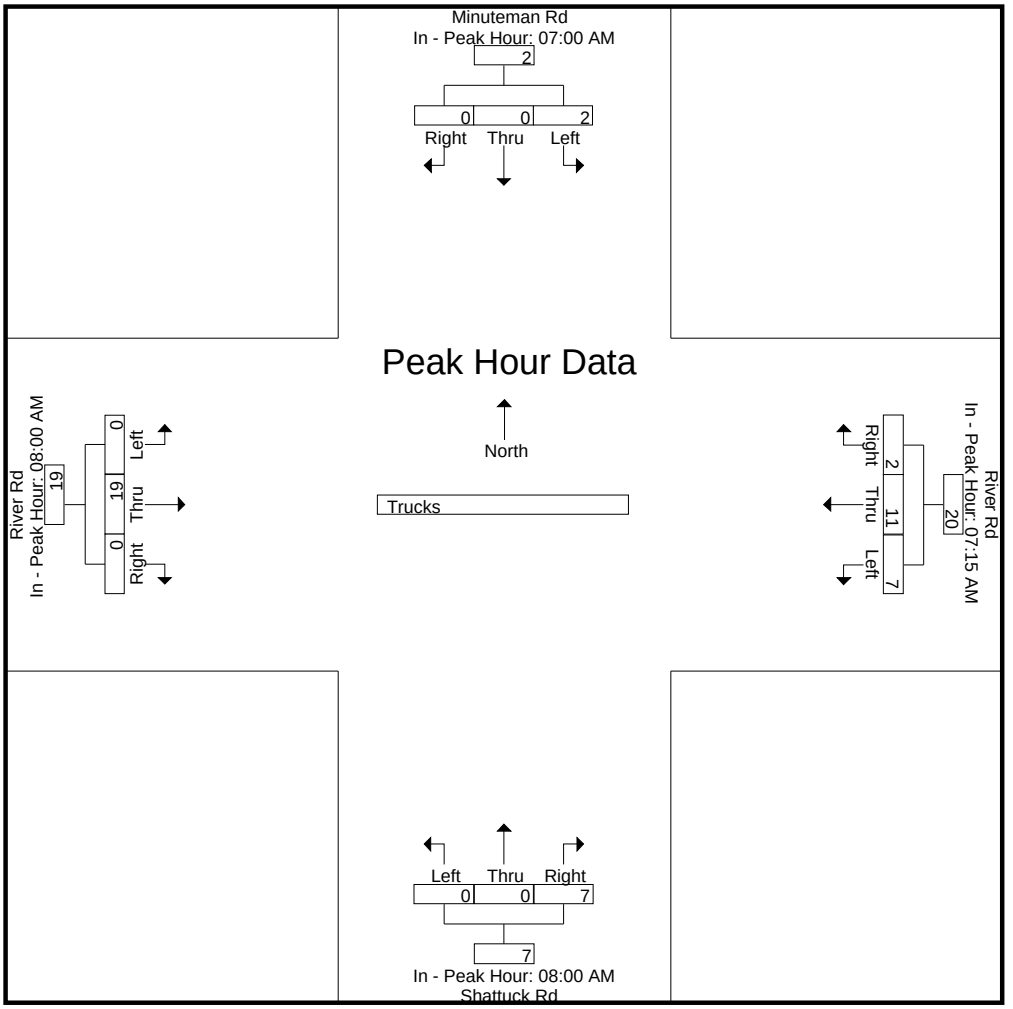
	07:00 AM				07:15 AM				08:00 AM				08:00 AM			
+0 mins.	0	0	0	0	1	4	**1**	6	0	0	**4**	**4**	0	3	0	3
+15 mins.	**1**	0	0	**1**	2	**5**	0	**7**	0	0	0	0	0	6	0	6
+30 mins.	0	0	0	0	1	1	1	3	0	0	0	0	0	1	0	1
+45 mins.	1	0	0	1	**3**	1	0	4	0	0	3	3	0	**9**	0	**9**
Total Volume	2	0	0	2	7	11	2	20	0	0	7	7	0	19	0	19
% App. Total	100	0	0		35	55	10		0	0	100		0	100	0	
PHF	.500	.000	.000	.500	.583	.550	.500	.714	.000	.000	.438	.438	.000	.528	.000	.528

Accurate Counts

978-664-2565

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022
Page No : 9



Accurate Counts

978-664-2565

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022

Groups Printed- Bikes Peds

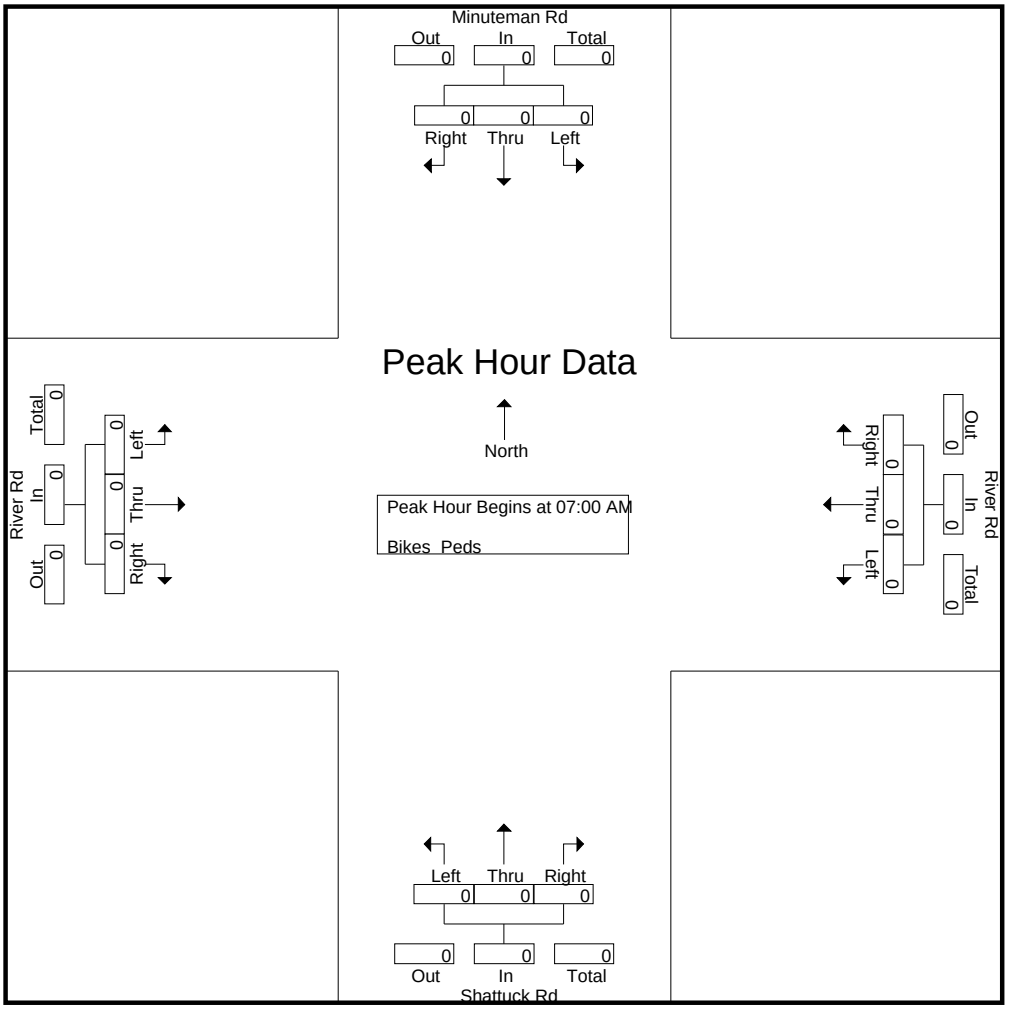
	Minuteman Rd From North				River Rd From East				Shattuck Rd From South				River Rd From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	2	0	2
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	3	0	3
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	4	0	4
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	2	5	0	5
Grand Total	0	0	0	2	0	0	0	2	0	0	0	1	0	0	0	3	8	0	8
Apprch %	0	0	0		0	0	0		0	0	0		0	0	0				
Total %																	100	0	

	Minuteman Rd From North				River Rd From East				Shattuck Rd From South				River Rd From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0		0	0	0		0	0	0		0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

Accurate Counts
978-664-2565

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

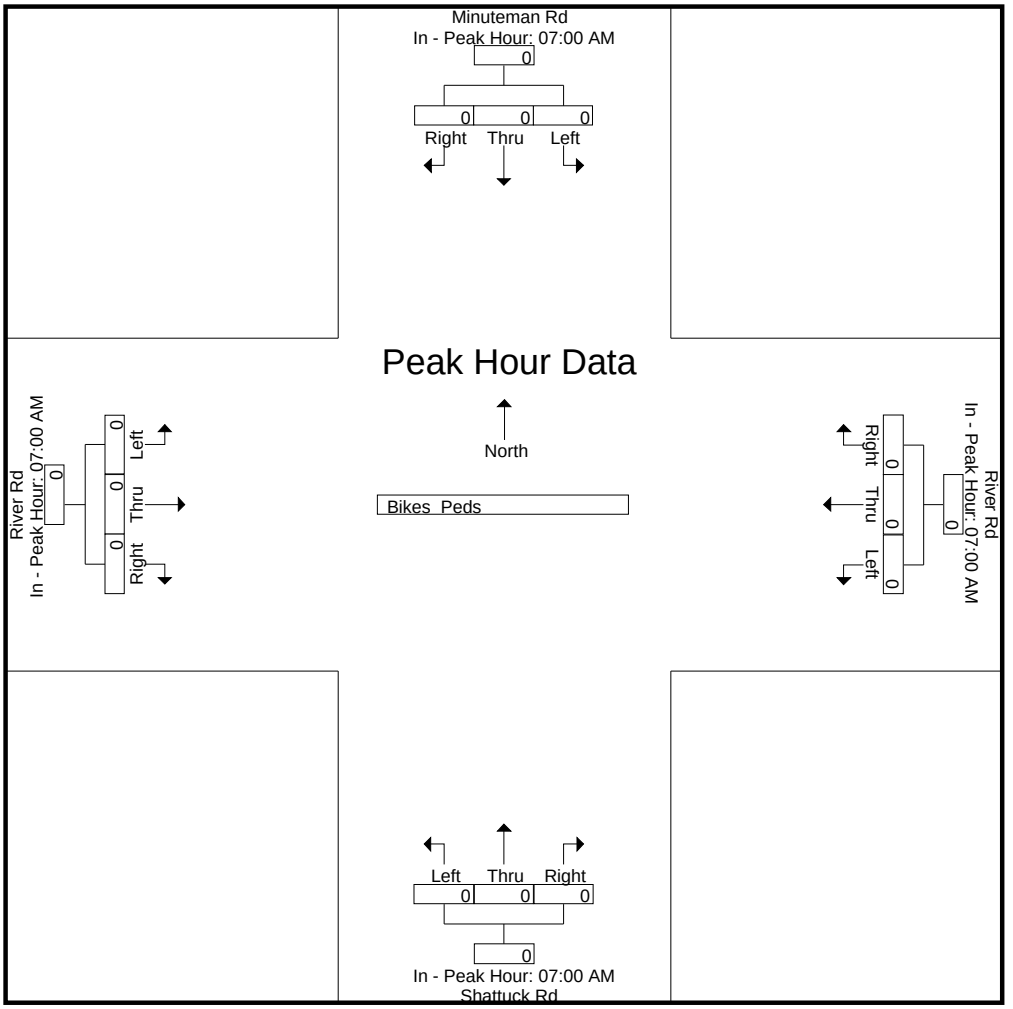
	07:00 AM				07:00 AM				07:00 AM				07:00 AM			
+0 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+30 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+45 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0		0	0	0		0	0	0		0	0	0	
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

Accurate Counts

978-664-2565

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022
Page No : 12



Accurate Counts

978-664-2565

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022
Page No : 1

Groups Printed- Cars - Trucks

	Minuteman Rd From North			River Rd From East			Shattuck Rd From South			River Rd From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
04:00 PM	36	1	0	19	57	5	8	0	73	0	134	7	340
04:15 PM	22	0	1	16	73	10	6	0	43	0	104	2	277
04:30 PM	36	2	3	29	50	15	6	2	72	0	118	3	336
04:45 PM	35	1	5	20	53	15	6	0	62	1	93	4	295
Total	129	4	9	84	233	45	26	2	250	1	449	16	1248
05:00 PM	56	1	2	26	82	17	10	2	127	3	111	8	445
05:15 PM	30	3	2	26	89	14	10	1	74	4	96	5	354
05:30 PM	41	0	3	21	51	15	4	0	44	3	104	2	288
05:45 PM	31	1	6	20	65	24	5	0	40	1	99	4	296
Total	158	5	13	93	287	70	29	3	285	11	410	19	1383
Grand Total	287	9	22	177	520	115	55	5	535	12	859	35	2631
Apprch %	90.3	2.8	6.9	21.8	64	14.2	9.2	0.8	89.9	1.3	94.8	3.9	
Total %	10.9	0.3	0.8	6.7	19.8	4.4	2.1	0.2	20.3	0.5	32.6	1.3	
Cars	281	9	22	175	518	111	55	5	532	12	848	35	2603
% Cars	97.9	100	100	98.9	99.6	96.5	100	100	99.4	100	98.7	100	98.9
Trucks	6	0	0	2	2	4	0	0	3	0	11	0	28
% Trucks	2.1	0	0	1.1	0.4	3.5	0	0	0.6	0	1.3	0	1.1

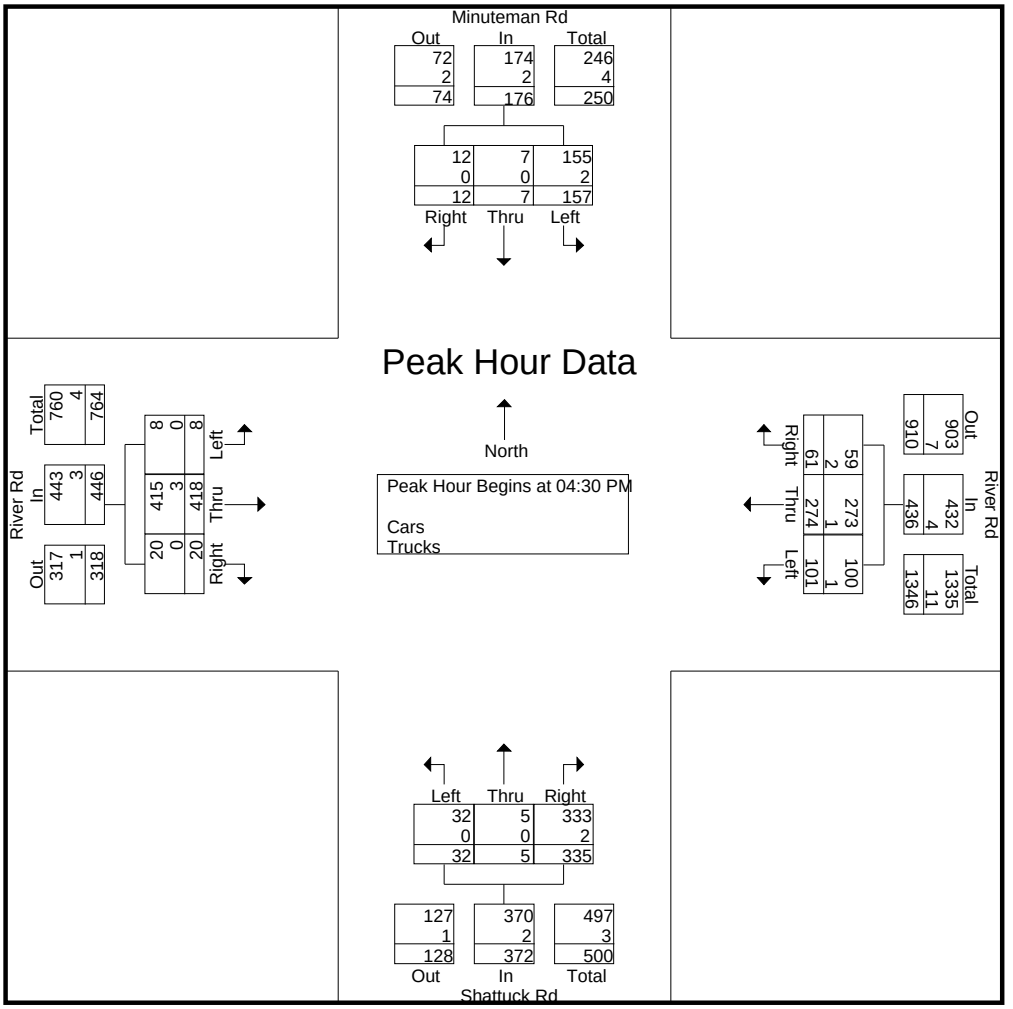
	Minuteman Rd From North				River Rd From East				Shattuck Rd From South				River Rd From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:30 PM																	
04:30 PM	36	2	3	41	**29**	50	15	94	6	**2**	72	80	0	**118**	3	121	336
04:45 PM	35	1	**5**	41	20	53	15	88	6	0	62	68	1	93	4	98	295
05:00 PM	**56**	1	2	**59**	26	82	**17**	125	**10**	2	**127**	**139**	3	111	**8**	**122**	**445**
05:15 PM	30	**3**	2	35	26	**89**	14	**129**	10	1	74	85	**4**	96	5	105	354
Total Volume	157	7	12	176	101	274	61	436	32	5	335	372	8	418	20	446	1430
% App. Total	89.2	4	6.8		23.2	62.8	14		8.6	1.3	90.1		1.8	93.7	4.5		
PHF	.701	.583	.600	.746	.871	.770	.897	.845	.800	.625	.659	.669	.500	.886	.625	.914	.803
Cars	155	7	12	174	100	273	59	432	32	5	333	370	8	415	20	443	1419
% Cars	98.7	100	100	98.9	99.0	99.6	96.7	99.1	100	100	99.4	99.5	100	99.3	100	99.3	99.2
Trucks	2	0	0	2	1	1	2	4	0	0	2	2	0	3	0	3	11
% Trucks	1.3	0	0	1.1	1.0	0.4	3.3	0.9	0	0	0.6	0.5	0	0.7	0	0.7	0.8

Accurate Counts

978-664-2565

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022
Page No : 2



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

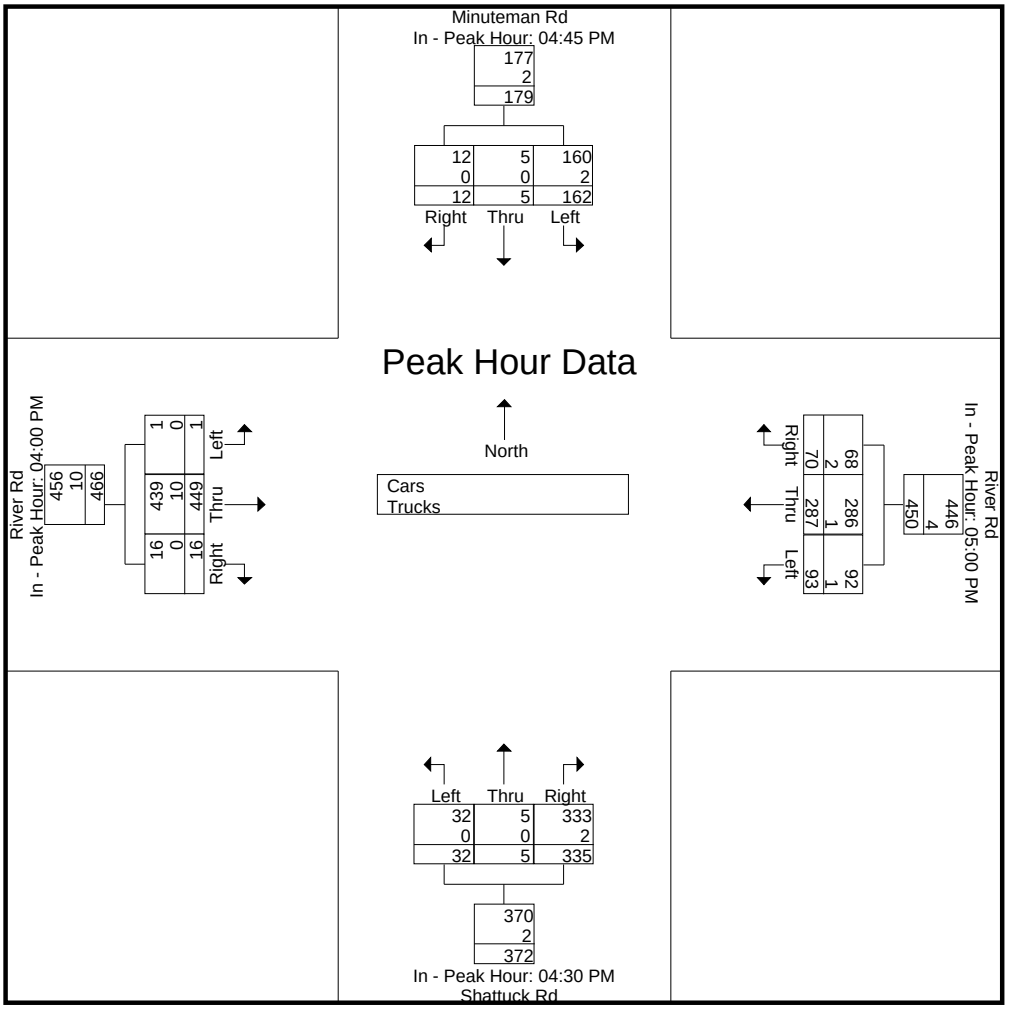
	04:45 PM				05:00 PM				04:30 PM				04:00 PM			
+0 mins.	35	1	**5**	41	**26**	82	17	125	6	**2**	72	80	0	**134**	**7**	**141**
+15 mins.	**56**	1	2	**59**	26	**89**	14	**129**	6	0	62	68	0	104	2	106
+30 mins.	30	**3**	2	35	21	51	15	87	**10**	2	**127**	**139**	0	118	3	121
+45 mins.	41	0	3	44	20	65	**24**	109	10	1	74	85	**1**	93	4	98
Total Volume	162	5	12	179	93	287	70	450	32	5	335	372	1	449	16	466
% App. Total	90.5	2.8	6.7		20.7	63.8	15.6		8.6	1.3	90.1		0.2	96.4	3.4	
PHF	.723	.417	.600	.758	.894	.806	.729	.872	.800	.625	.659	.669	.250	.838	.571	.826
Cars	160	5	12	177	92	286	68	446	32	5	333	370	1	439	16	456
% Cars	98.8	100	100	98.9	98.9	99.7	97.1	99.1	100	100	99.4	99.5	100	97.8	100	97.9
Trucks	2	0	0	2	1	1	2	4	0	0	2	2	0	10	0	10
% Trucks	1.2	0	0	1.1	1.1	0.3	2.9	0.9	0	0	0.6	0.5	0	2.2	0	2.1

Accurate Counts

978-664-2565

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022
Page No : 3



Accurate Counts

978-664-2565

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022
Page No : 4

Groups Printed- Cars

	Minuteman Rd From North			River Rd From East			Shattuck Rd From South			River Rd From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
04:00 PM	34	1	0	19	56	5	8	0	73	0	130	7	333
04:15 PM	21	0	1	16	73	9	6	0	43	0	100	2	271
04:30 PM	36	2	3	28	50	15	6	2	71	0	117	3	333
04:45 PM	34	1	5	20	53	14	6	0	61	1	92	4	291
Total	125	4	9	83	232	43	26	2	248	1	439	16	1228
05:00 PM	56	1	2	26	81	17	10	2	127	3	110	8	443
05:15 PM	29	3	2	26	89	13	10	1	74	4	96	5	352
05:30 PM	41	0	3	20	51	15	4	0	44	3	104	2	287
05:45 PM	30	1	6	20	65	23	5	0	39	1	99	4	293
Total	156	5	13	92	286	68	29	3	284	11	409	19	1375
Grand Total	281	9	22	175	518	111	55	5	532	12	848	35	2603
Apprch %	90.1	2.9	7.1	21.8	64.4	13.8	9.3	0.8	89.9	1.3	94.7	3.9	
Total %	10.8	0.3	0.8	6.7	19.9	4.3	2.1	0.2	20.4	0.5	32.6	1.3	

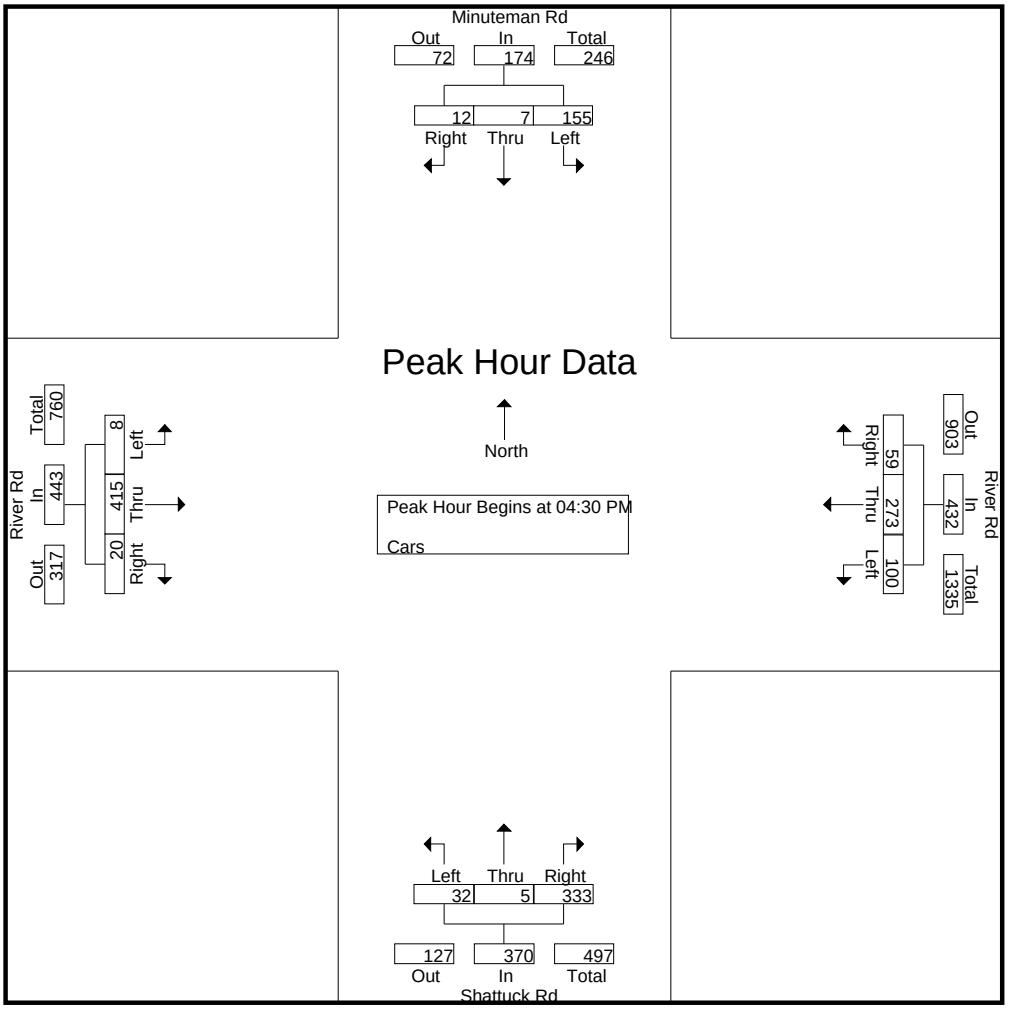
	Minuteman Rd From North				River Rd From East				Shattuck Rd From South				River Rd From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:30 PM																	
04:30 PM	36	2	3	41	**28**	50	15	93	6	**2**	71	79	0	**117**	3	120	333
04:45 PM	34	1	**5**	40	20	53	14	87	6	0	61	67	1	92	4	97	291
05:00 PM	**56**	1	2	**59**	26	81	**17**	124	**10**	2	**127**	**139**	3	110	**8**	**121**	**443**
05:15 PM	29	**3**	2	34	26	**89**	13	**128**	10	1	74	85	**4**	96	5	105	352
Total Volume	155	7	12	174	100	273	59	432	32	5	333	370	8	415	20	443	1419
% App. Total	89.1	4	6.9		23.1	63.2	13.7		8.6	1.4	90		1.8	93.7	4.5		
PHF	.692	.583	.600	.737	.893	.767	.868	.844	.800	.625	.656	.665	.500	.887	.625	.915	.801

Accurate Counts

978-664-2565

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022
Page No : 5



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

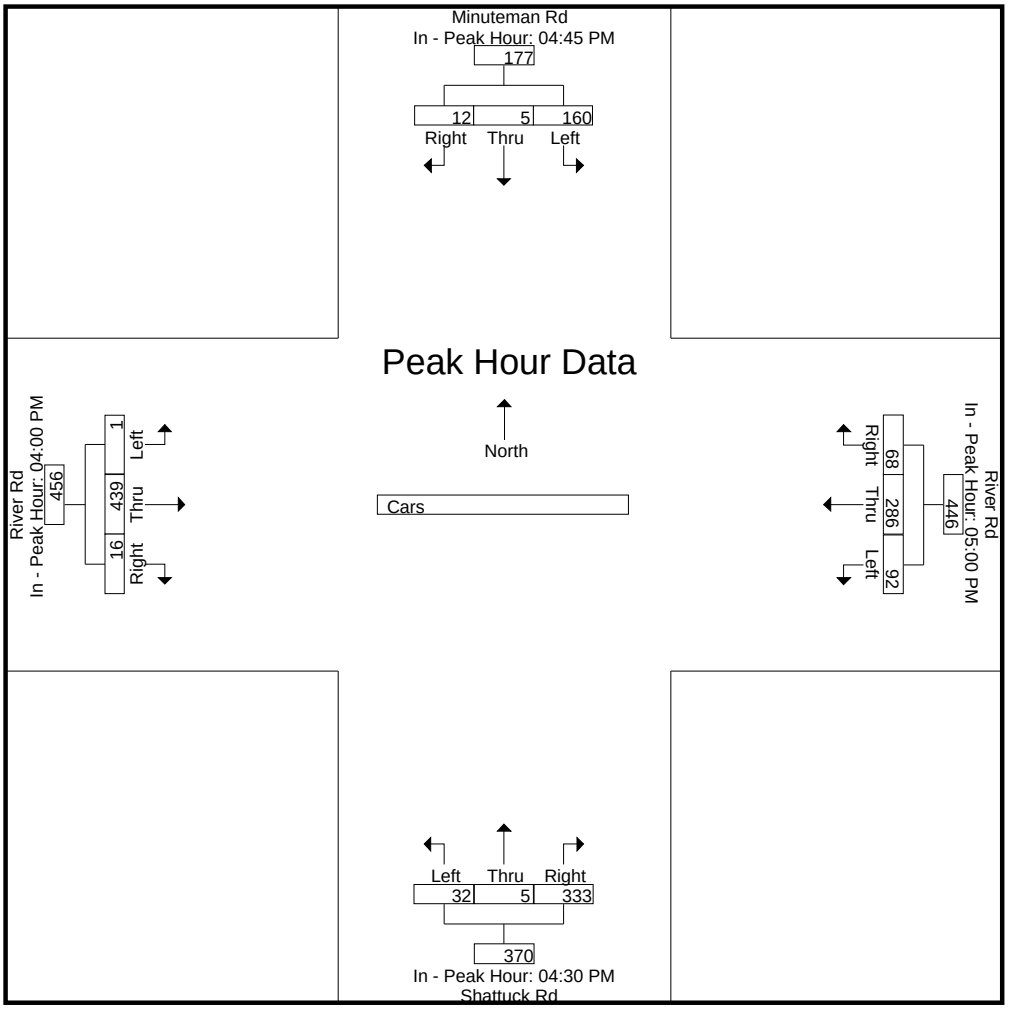
	04:45 PM				05:00 PM				04:30 PM				04:00 PM			
+0 mins.	34	1	**5**	40	**26**	81	17	124	6	**2**	71	79	0	**130**	**7**	**137**
+15 mins.	**56**	1	2	**59**	26	**89**	13	**128**	6	0	61	67	0	100	2	102
+30 mins.	29	**3**	2	34	20	51	15	86	**10**	2	**127**	**139**	0	117	3	120
+45 mins.	41	0	3	44	20	65	**23**	108	10	1	74	85	**1**	92	4	97
Total Volume	160	5	12	177	92	286	68	446	32	5	333	370	1	439	16	456
% App. Total	90.4	2.8	6.8		20.6	64.1	15.2		8.6	1.4	90		0.2	96.3	3.5	
PHF	.714	.417	.600	.750	.885	.803	.739	.871	.800	.625	.656	.665	.250	.844	.571	.832

Accurate Counts

978-664-2565

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022
Page No : 6



Accurate Counts

978-664-2565

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022
Page No : 7

Groups Printed- Trucks

	Minuteman Rd From North			River Rd From East			Shattuck Rd From South			River Rd From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
04:00 PM	2	0	0	0	1	0	0	0	0	0	4	0	7
04:15 PM	1	0	0	0	0	1	0	0	0	0	4	0	6
04:30 PM	0	0	0	1	0	0	0	0	1	0	1	0	3
04:45 PM	1	0	0	0	0	1	0	0	1	0	1	0	4
Total	4	0	0	1	1	2	0	0	2	0	10	0	20
05:00 PM	0	0	0	0	1	0	0	0	0	0	1	0	2
05:15 PM	1	0	0	0	0	1	0	0	0	0	0	0	2
05:30 PM	0	0	0	1	0	0	0	0	0	0	0	0	1
05:45 PM	1	0	0	0	0	1	0	0	1	0	0	0	3
Total	2	0	0	1	1	2	0	0	1	0	1	0	8
Grand Total	6	0	0	2	2	4	0	0	3	0	11	0	28
Apprch %	100	0	0	25	25	50	0	0	100	0	100	0	
Total %	21.4	0	0	7.1	7.1	14.3	0	0	10.7	0	39.3	0	

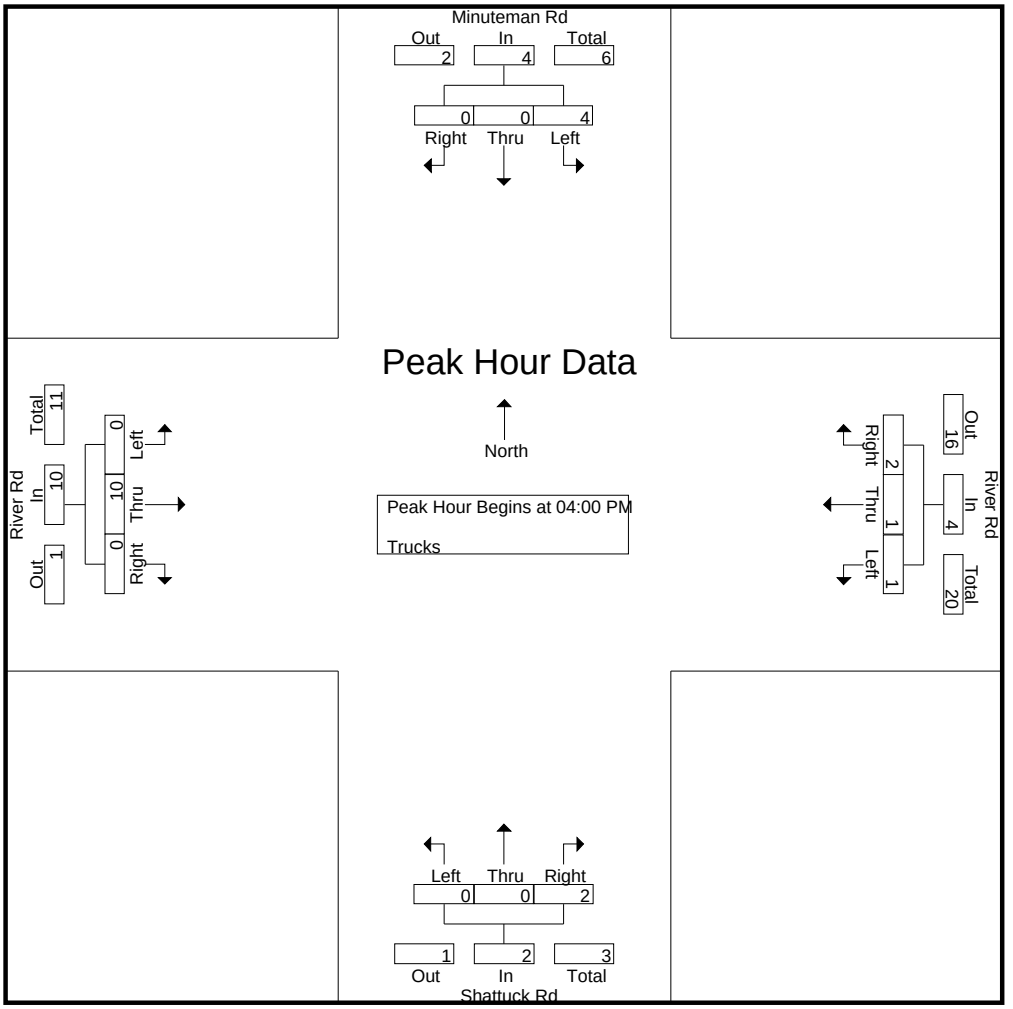
	Minuteman Rd From North				River Rd From East				Shattuck Rd From South				River Rd From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	**2**	0	0	**2**	0	**1**	0	**1**	0	0	0	0	0	**4**	0	**4**	**7**
04:15 PM	1	0	0	1	0	0	**1**	1	0	0	0	0	0	4	0	4	6
04:30 PM	0	0	0	0	**1**	0	0	1	0	0	**1**	**1**	0	1	0	1	3
04:45 PM	1	0	0	1	0	0	1	1	0	0	1	1	0	1	0	1	4
Total Volume	4	0	0	4	1	1	2	4	0	0	2	2	0	10	0	10	20
% App. Total	100	0	0		25	25	50		0	0	100		0	100	0		
PHF	.500	.000	.000	.500	.250	.250	.500	1.00	.000	.000	.500	.500	.000	.625	.000	.625	.714

Accurate Counts

978-664-2565

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022
Page No : 8



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

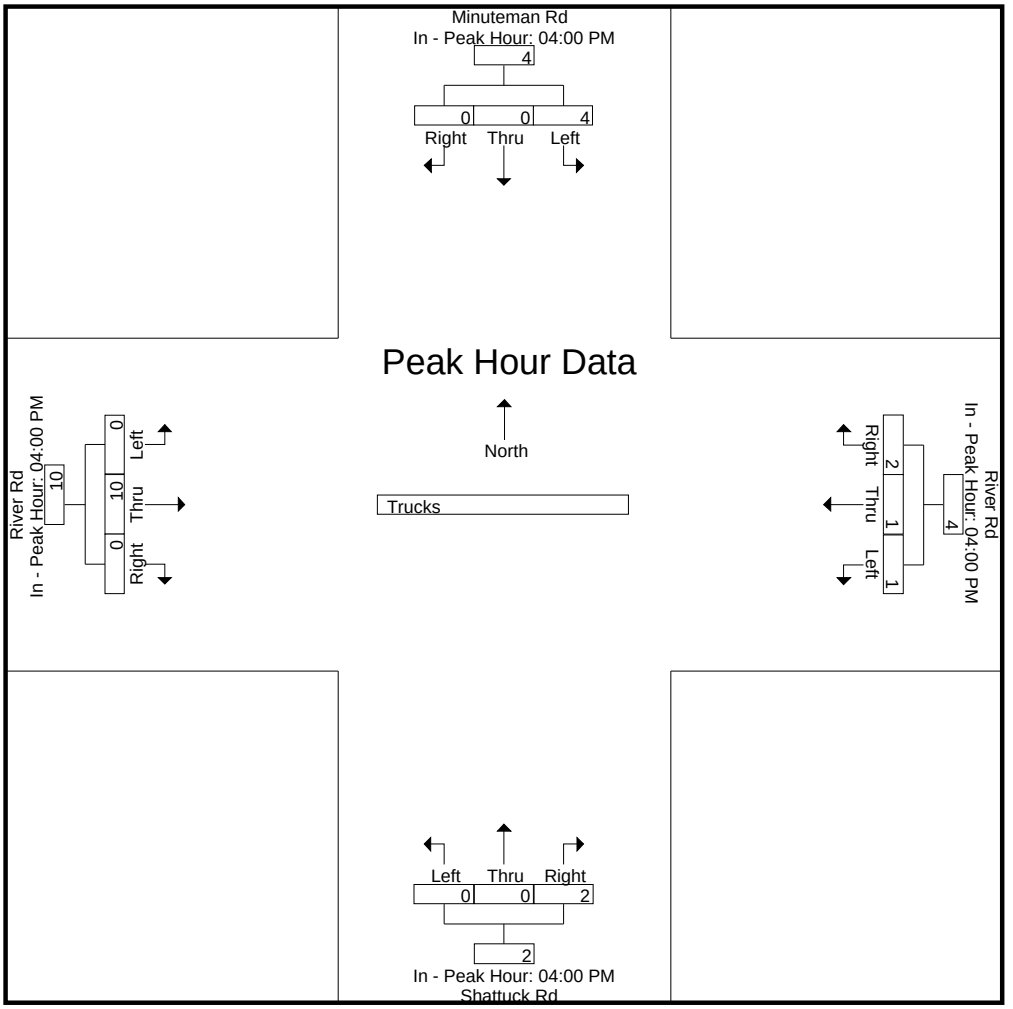
	04:00 PM				04:00 PM				04:00 PM				04:00 PM			
+0 mins.	**2**	0	0	**2**	0	**1**	0	**1**	0	0	0	0	0	**4**	0	**4**
+15 mins.	1	0	0	1	0	0	**1**	1	0	0	0	0	0	4	0	4
+30 mins.	0	0	0	0	**1**	0	0	1	0	0	**1**	**1**	0	1	0	1
+45 mins.	1	0	0	1	0	0	1	1	0	0	1	1	0	1	0	1
Total Volume	4	0	0	4	1	1	2	4	0	0	2	2	0	10	0	10
% App. Total	100	0	0		25	25	50		0	0	100		0	100	0	
PHF	.500	.000	.000	.500	.250	.250	.500	1.000	.000	.000	.500	.500	.000	.625	.000	.625

Accurate Counts

978-664-2565

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022
Page No : 9



Accurate Counts

978-664-2565

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022
Page No : 10

Groups Printed- Bikes Peds

	Minuteman Rd From North				River Rd From East				Shattuck Rd From South				River Rd From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
04:00 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	3
04:30 PM	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1
04:45 PM	0	0	0	3	0	0	0	1	0	0	0	0	0	0	0	4	8	0	8
Total	0	0	0	4	0	1	0	1	0	0	0	0	0	0	0	7	12	1	13
05:00 PM	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	4	6	1	7
05:15 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	2	0	2
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
05:45 PM	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	1	3	1	4
Total	0	0	0	5	0	0	0	0	0	0	1	0	0	2	0	6	11	3	14
Grand Total	0	0	0	9	0	1	0	1	0	0	1	0	0	2	0	13	23	4	27
Apprch %	0	0	0		0	100	0		0	0	100		0	100	0				
Total %	0	0	0		0	25	0		0	0	25		0	50	0		85.2	14.8	

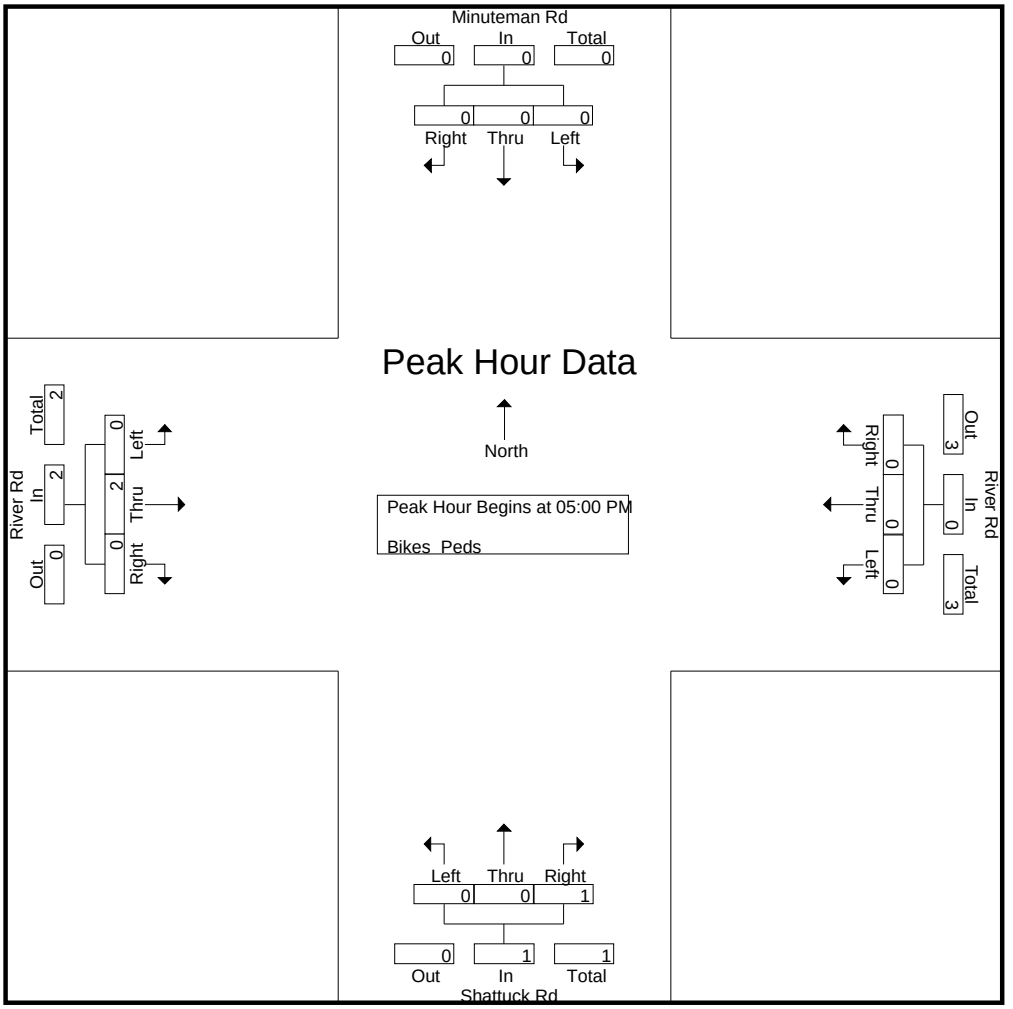
	Minuteman Rd From North				River Rd From East				Shattuck Rd From South				River Rd From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	0	0	0	0	0	0	0	0	0	0	**1**	**1**	0	0	0	0	**1**
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	**1**	1
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
Total Volume	0	0	0	0	0	0	0	0	0	0	1	1	0	2	0	2	3
% App. Total	0	0	0		0	0	0		0	0	100		0	100	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.250	.250	.000	.500	.000	.500	.750

Accurate Counts

978-664-2565

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022
Page No : 11

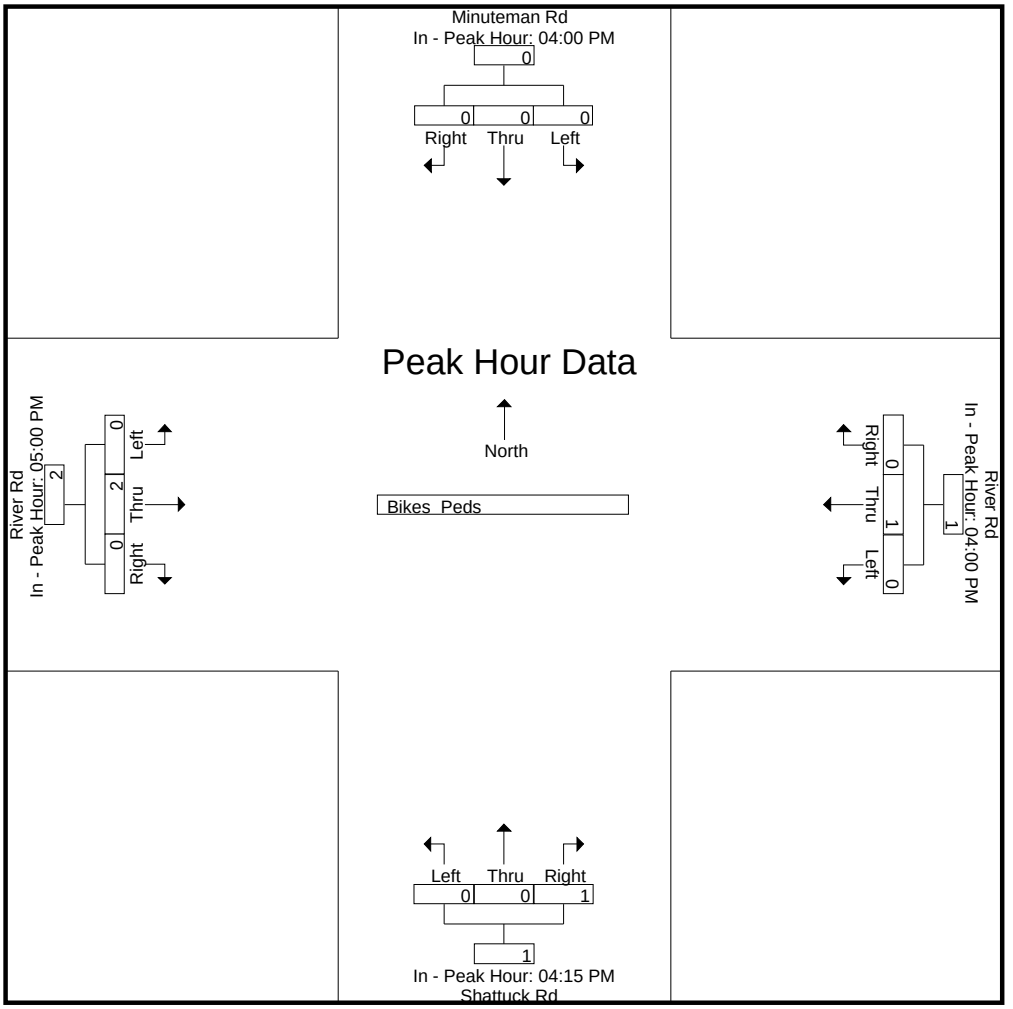


Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:00 PM				04:00 PM				04:15 PM				05:00 PM			
+0 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+30 mins.	0	0	0	0	0	**1**	0	**1**	0	0	0	0	0	**1**	0	**1**
+45 mins.	0	0	0	0	0	0	0	0	0	0	**1**	**1**	0	1	0	1
Total Volume	0	0	0	0	0	1	0	1	0	0	1	1	0	2	0	2
% App. Total	0	0	0		0	100	0		0	0	100		0	100	0	
PHF	.000	.000	.000	.000	.000	.250	.000	.250	.000	.000	.250	.250	.000	.500	.000	.500

N/S Street : Minuteman Rd / Shattuck Rd
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410002
Site Code : 91410002
Start Date : 5/11/2022
Page No : 12



Accurate Counts

978-664-2565

N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410003
Site Code : 91410003
Start Date : 5/11/2022
Page No : 1

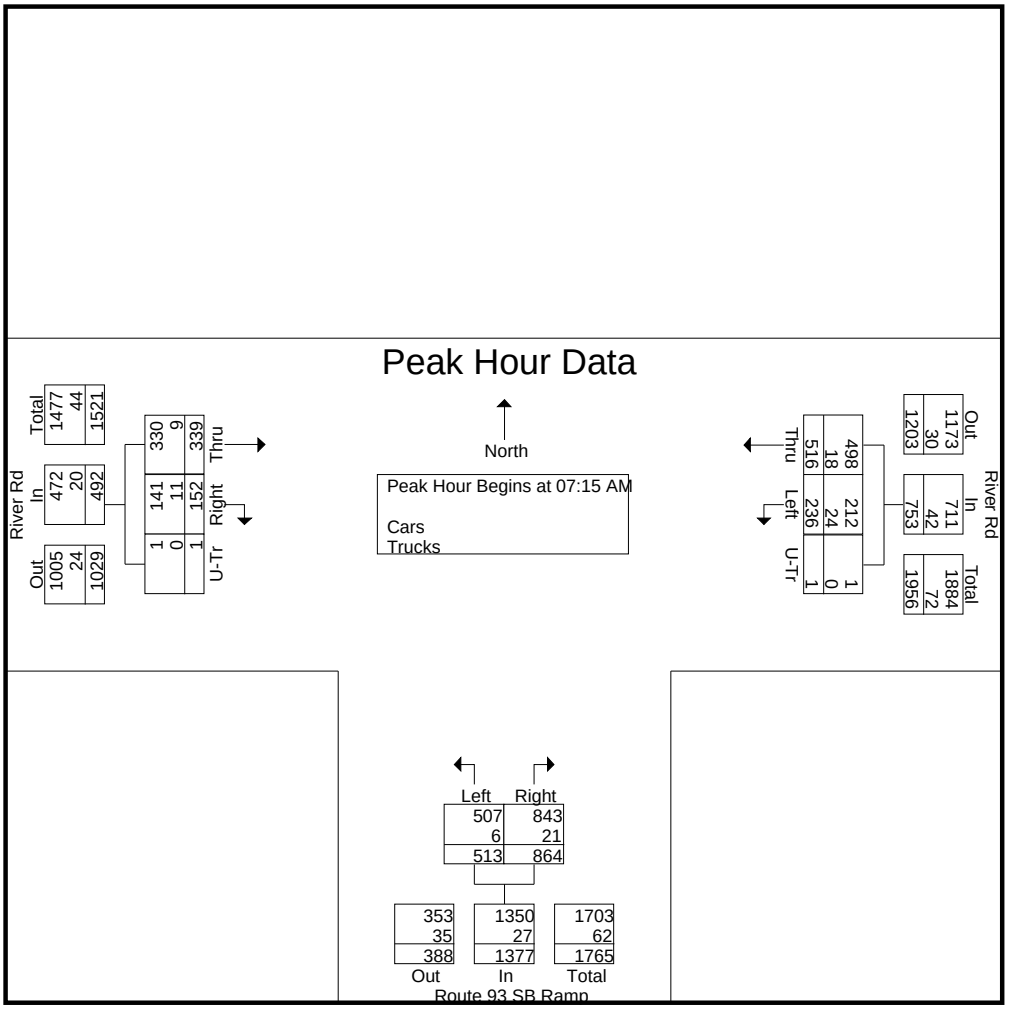
Groups Printed- Cars - Trucks

	River Rd From East			Route 93 SB Ramp From South		River Rd From West			
Start Time	Left	Thru	U-Tr	Left	Right	Thru	Right	U-Tr	Int. Total
07:00 AM	51	79	0	73	192	119	43	0	557
07:15 AM	48	98	1	78	247	82	27	0	581
07:30 AM	75	122	0	134	224	80	37	1	673
07:45 AM	57	158	0	159	229	93	40	0	736
Total	231	457	1	444	892	374	147	1	2547
08:00 AM	56	138	0	142	164	84	48	0	632
08:15 AM	47	159	2	112	134	84	39	0	577
08:30 AM	49	135	1	94	107	91	35	0	512
08:45 AM	38	142	0	116	109	109	51	0	565
Total	190	574	3	464	514	368	173	0	2286
Grand Total	421	1031	4	908	1406	742	320	1	4833
Apprch %	28.9	70.8	0.3	39.2	60.8	69.8	30.1	0.1	
Total %	8.7	21.3	0.1	18.8	29.1	15.4	6.6	0	
Cars	376	994	4	900	1357	712	308	1	4652
% Cars	89.3	96.4	100	99.1	96.5	96	96.2	100	96.3
Trucks	45	37	0	8	49	30	12	0	181
% Trucks	10.7	3.6	0	0.9	3.5	4	3.8	0	3.7

	River Rd From East				Route 93 SB Ramp From South			River Rd From West				
Start Time	Left	Thru	U-Tr	App. Total	Left	Right	App. Total	Thru	Right	U-Tr	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 07:15 AM												
07:15 AM	48	98	**1**	147	78	**247**	325	82	27	0	109	581
07:30 AM	**75**	122	0	197	134	224	358	80	37	**1**	118	673
07:45 AM	57	**158**	0	**215**	**159**	229	**388**	**93**	40	0	**133**	**736**
08:00 AM	56	138	0	194	142	164	306	84	**48**	0	132	632
Total Volume	236	516	1	753	513	864	1377	339	152	1	492	2622
% App. Total	31.3	68.5	0.1		37.3	62.7		68.9	30.9	0.2		
PHF	.787	.816	.250	.876	.807	.874	.887	.911	.792	.250	.925	.891
Cars	212	498	1	711	507	843	1350	330	141	1	472	2533
% Cars	89.8	96.5	100	94.4	98.8	97.6	98.0	97.3	92.8	100	95.9	96.6
Trucks	24	18	0	42	6	21	27	9	11	0	20	89
% Trucks	10.2	3.5	0	5.6	1.2	2.4	2.0	2.7	7.2	0	4.1	3.4

N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410003
Site Code : 91410003
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Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

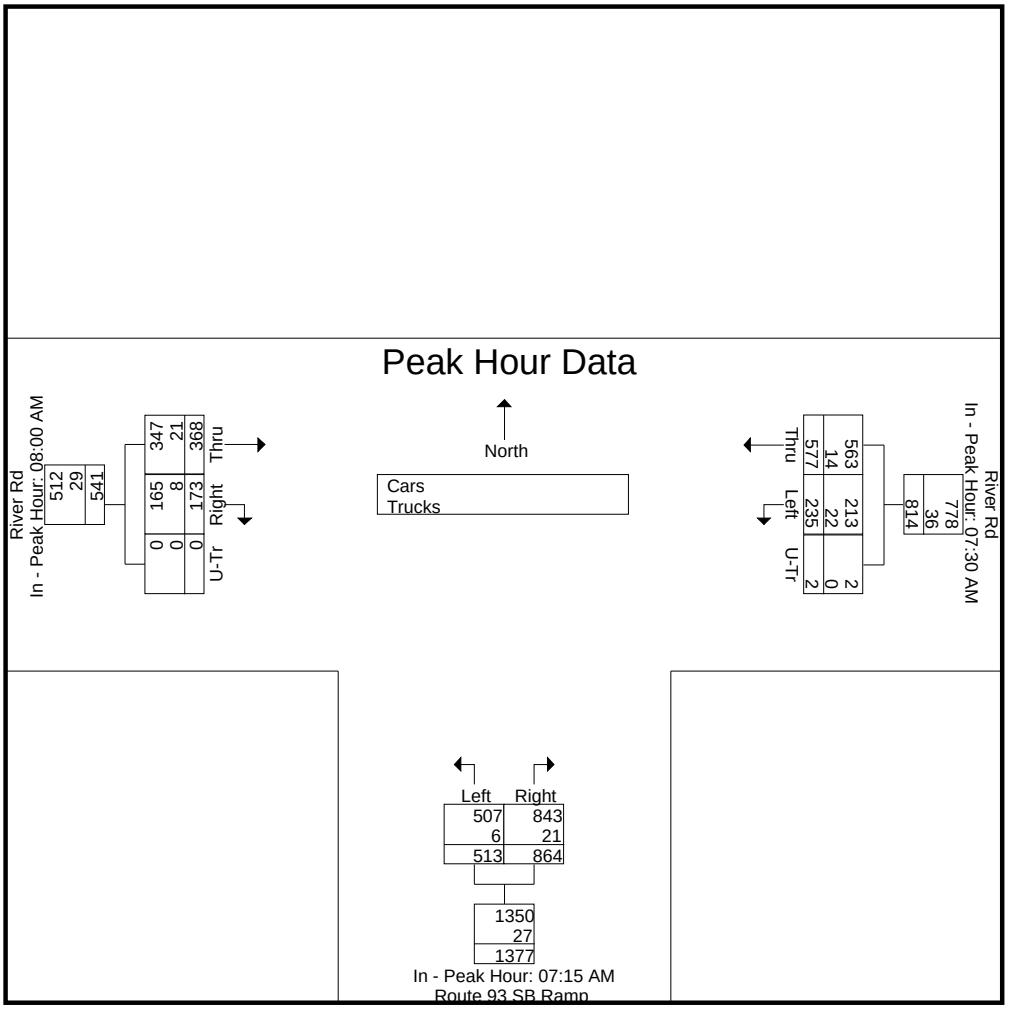
	07:30 AM				07:15 AM			08:00 AM			
+0 mins.	**75**	122	0	197	78	**247**	325	84	48	0	132
+15 mins.	57	158	0	**215**	134	224	358	84	39	0	123
+30 mins.	56	138	0	194	**159**	229	**388**	91	35	0	126
+45 mins.	47	**159**	**2**	208	142	164	306	**109**	**51**	0	**160**
Total Volume	235	577	2	814	513	864	1377	368	173	0	541
% App. Total	28.9	70.9	0.2		37.3	62.7		68	32	0	
PHF	.783	.907	.250	.947	.807	.874	.887	.844	.848	.000	.845
Cars	213	563	2	778	507	843	1350	347	165	0	512
% Cars	90.6	97.6	100	95.6	98.8	97.6	98	94.3	95.4	0	94.6
Trucks	22	14	0	36	6	21	27	21	8	0	29
% Trucks	9.4	2.4	0	4.4	1.2	2.4	2	5.7	4.6	0	5.4

Accurate Counts

978-664-2565

N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410003
Site Code : 91410003
Start Date : 5/11/2022
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Accurate Counts

978-664-2565

N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410003
Site Code : 91410003
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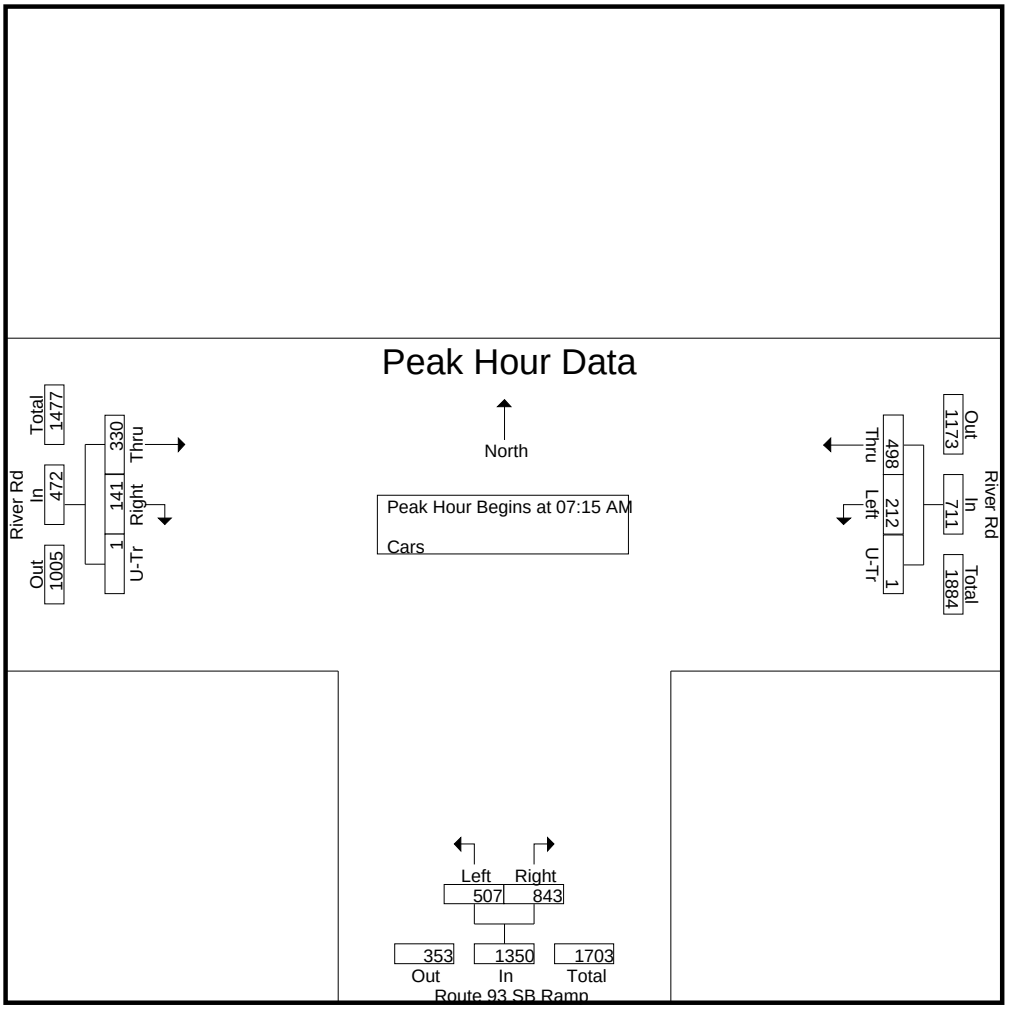
Groups Printed- Cars

	River Rd From East			Route 93 SB Ramp From South		River Rd From West			
Start Time	Left	Thru	U-Tr	Left	Right	Thru	Right	U-Tr	Int. Total
07:00 AM	45	75	0	73	179	118	42	0	532
07:15 AM	40	91	1	76	241	78	27	0	554
07:30 AM	69	117	0	132	223	77	36	1	655
07:45 AM	52	154	0	158	221	92	38	0	715
Total	206	437	1	439	864	365	143	1	2456
08:00 AM	51	136	0	141	158	83	40	0	609
08:15 AM	41	156	2	112	127	77	39	0	554
08:30 AM	46	126	1	93	104	91	35	0	496
08:45 AM	32	139	0	115	104	96	51	0	537
Total	170	557	3	461	493	347	165	0	2196
Grand Total	376	994	4	900	1357	712	308	1	4652
Apprch %	27.4	72.3	0.3	39.9	60.1	69.7	30.2	0.1	
Total %	8.1	21.4	0.1	19.3	29.2	15.3	6.6	0	

	River Rd From East				Route 93 SB Ramp From South			River Rd From West				
Start Time	Left	Thru	U-Tr	App. Total	Left	Right	App. Total	Thru	Right	U-Tr	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 07:15 AM												
07:15 AM	40	91	**1**	132	76	**241**	317	78	27	0	105	554
07:30 AM	**69**	117	0	186	132	223	355	77	36	**1**	114	655
07:45 AM	52	**154**	0	**206**	**158**	221	**379**	**92**	38	0	**130**	**715**
08:00 AM	51	136	0	187	141	158	299	83	**40**	0	123	609
Total Volume	212	498	1	711	507	843	1350	330	141	1	472	2533
% App. Total	29.8	70	0.1		37.6	62.4		69.9	29.9	0.2		
PHF	.768	.808	.250	.863	.802	.874	.891	.897	.881	.250	.908	.886

N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410003
Site Code : 91410003
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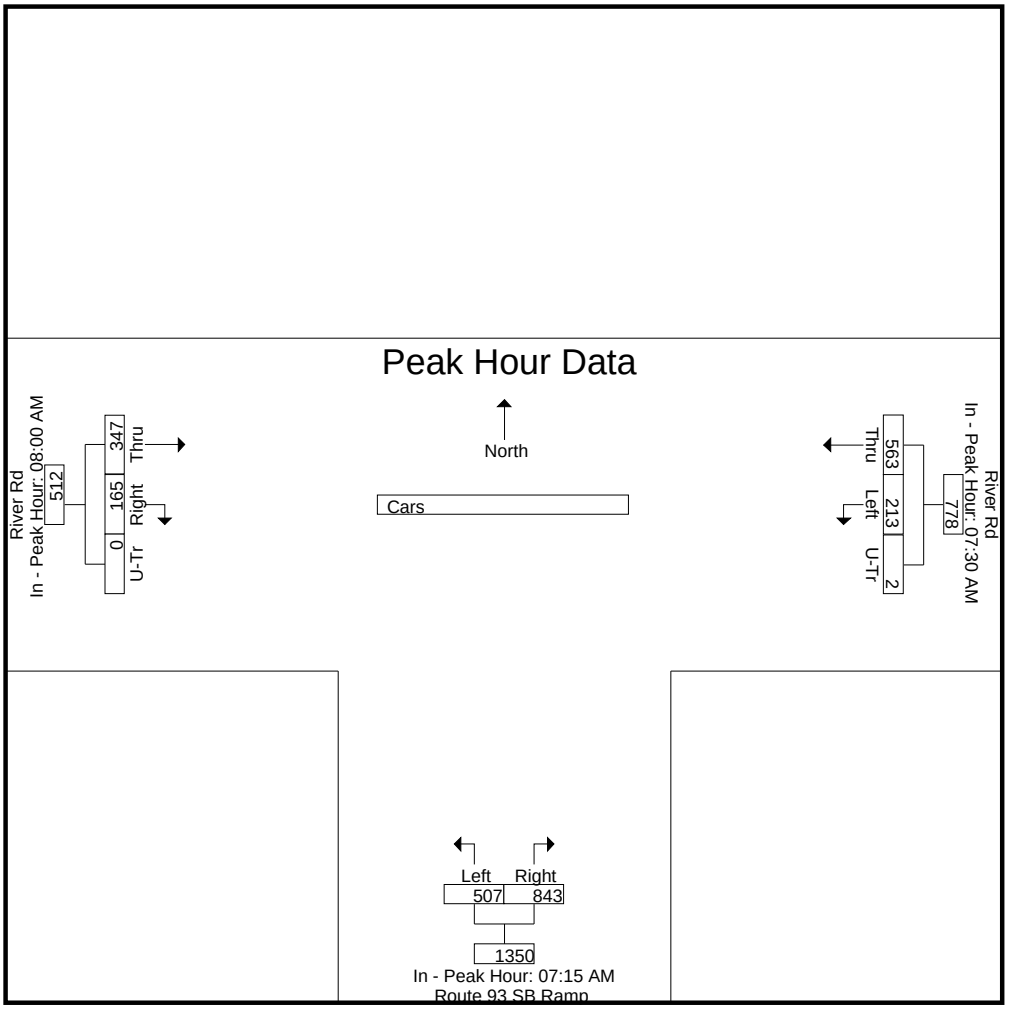
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:30 AM				07:15 AM			08:00 AM			
+0 mins.	**69**	117	0	186	76	**241**	317	83	40	0	123
+15 mins.	52	154	0	**206**	132	223	355	77	39	0	116
+30 mins.	51	136	0	187	**158**	221	**379**	91	35	0	126
+45 mins.	41	**156**	**2**	199	141	158	299	**96**	**51**	0	**147**
Total Volume	213	563	2	778	507	843	1350	347	165	0	512
% App. Total	27.4	72.4	0.3		37.6	62.4		67.8	32.2	0	
PHF	.772	.902	.250	.944	.802	.874	.891	.904	.809	.000	.871

Accurate Counts
978-664-2565

N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410003
Site Code : 91410003
Start Date : 5/11/2022
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Accurate Counts

978-664-2565

N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410003
Site Code : 91410003
Start Date : 5/11/2022
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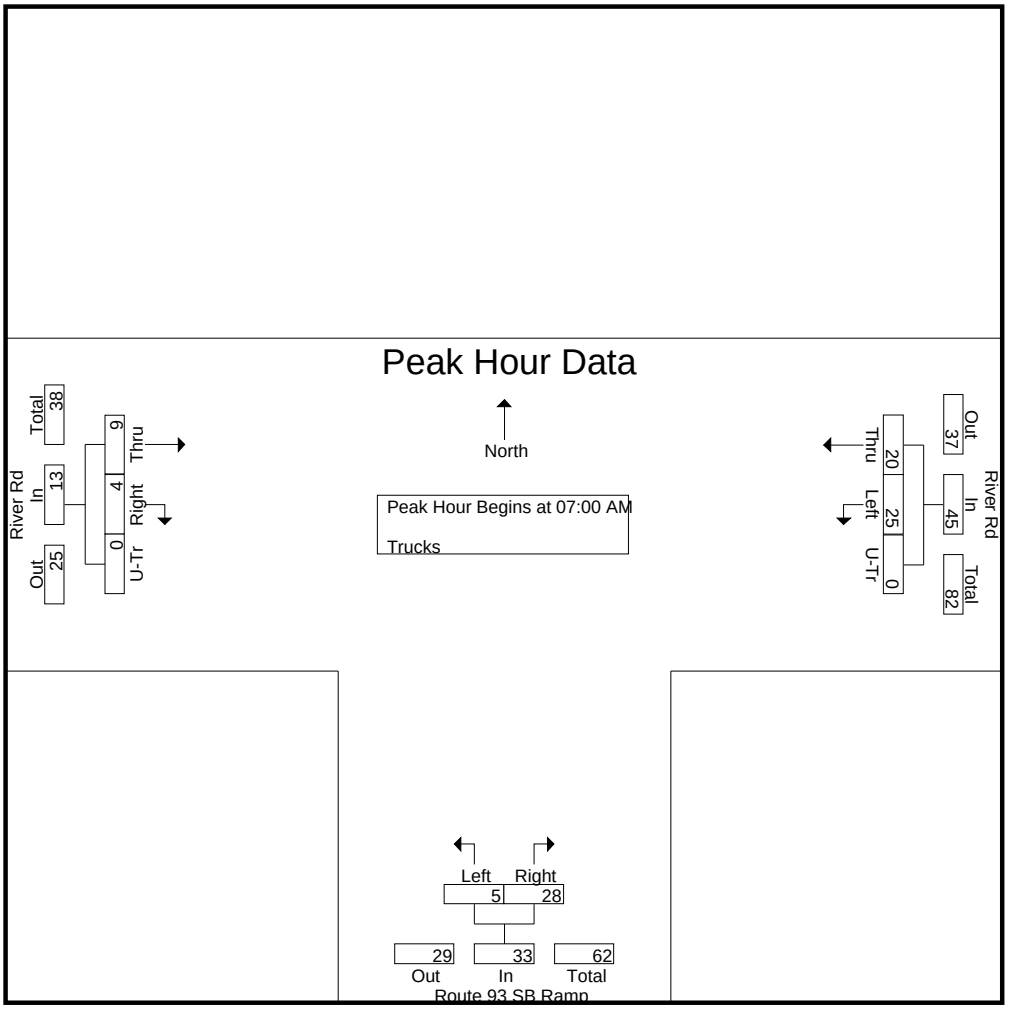
Groups Printed- Trucks

	River Rd From East			Route 93 SB Ramp From South		River Rd From West			
Start Time	Left	Thru	U-Tr	Left	Right	Thru	Right	U-Tr	Int. Total
07:00 AM	6	4	0	0	13	1	1	0	25
07:15 AM	8	7	0	2	6	4	0	0	27
07:30 AM	6	5	0	2	1	3	1	0	18
07:45 AM	5	4	0	1	8	1	2	0	21
Total	25	20	0	5	28	9	4	0	91
08:00 AM	5	2	0	1	6	1	8	0	23
08:15 AM	6	3	0	0	7	7	0	0	23
08:30 AM	3	9	0	1	3	0	0	0	16
08:45 AM	6	3	0	1	5	13	0	0	28
Total	20	17	0	3	21	21	8	0	90
Grand Total	45	37	0	8	49	30	12	0	181
Apprch %	54.9	45.1	0	14	86	71.4	28.6	0	
Total %	24.9	20.4	0	4.4	27.1	16.6	6.6	0	

	River Rd From East				Route 93 SB Ramp From South			River Rd From West				
Start Time	Left	Thru	U-Tr	App. Total	Left	Right	App. Total	Thru	Right	U-Tr	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 07:00 AM												
07:00 AM	6	4	0	10	0	**13**	**13**	1	1	0	2	25
07:15 AM	**8**	**7**	0	**15**	**2**	6	8	**4**	0	0	**4**	**27**
07:30 AM	6	5	0	11	2	1	3	3	1	0	4	18
07:45 AM	5	4	0	9	1	8	9	1	**2**	0	3	21
Total Volume	25	20	0	45	5	28	33	9	4	0	13	91
% App. Total	55.6	44.4	0		15.2	84.8		69.2	30.8	0		
PHF	.781	.714	.000	.750	.625	.538	.635	.563	.500	.000	.813	.843

N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410003
Site Code : 91410003
Start Date : 5/11/2022
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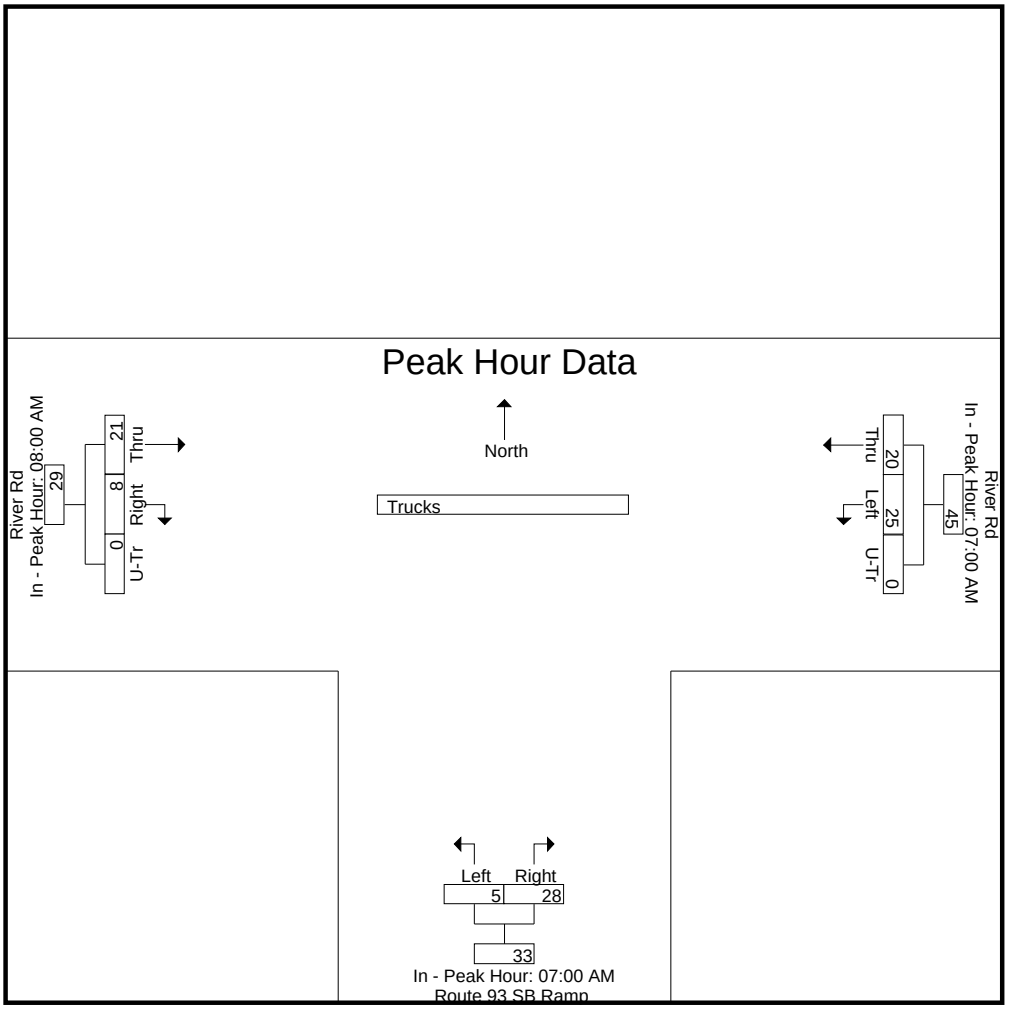
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00 AM				07:00 AM			08:00 AM			
+0 mins.	6	4	0	10	0	**13**	**13**	1	**8**	0	9
+15 mins.	**8**	**7**	0	**15**	**2**	6	8	7	0	0	7
+30 mins.	6	5	0	11	2	1	3	0	0	0	0
+45 mins.	5	4	0	9	1	8	9	**13**	0	0	**13**
Total Volume	25	20	0	45	5	28	33	21	8	0	29
% App. Total	55.6	44.4	0		15.2	84.8		72.4	27.6	0	
PHF	.781	.714	.000	.750	.625	.538	.635	.404	.250	.000	.558

Accurate Counts
978-664-2565

N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410003
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Accurate Counts

978-664-2565

N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410003
Site Code : 91410003
Start Date : 5/11/2022

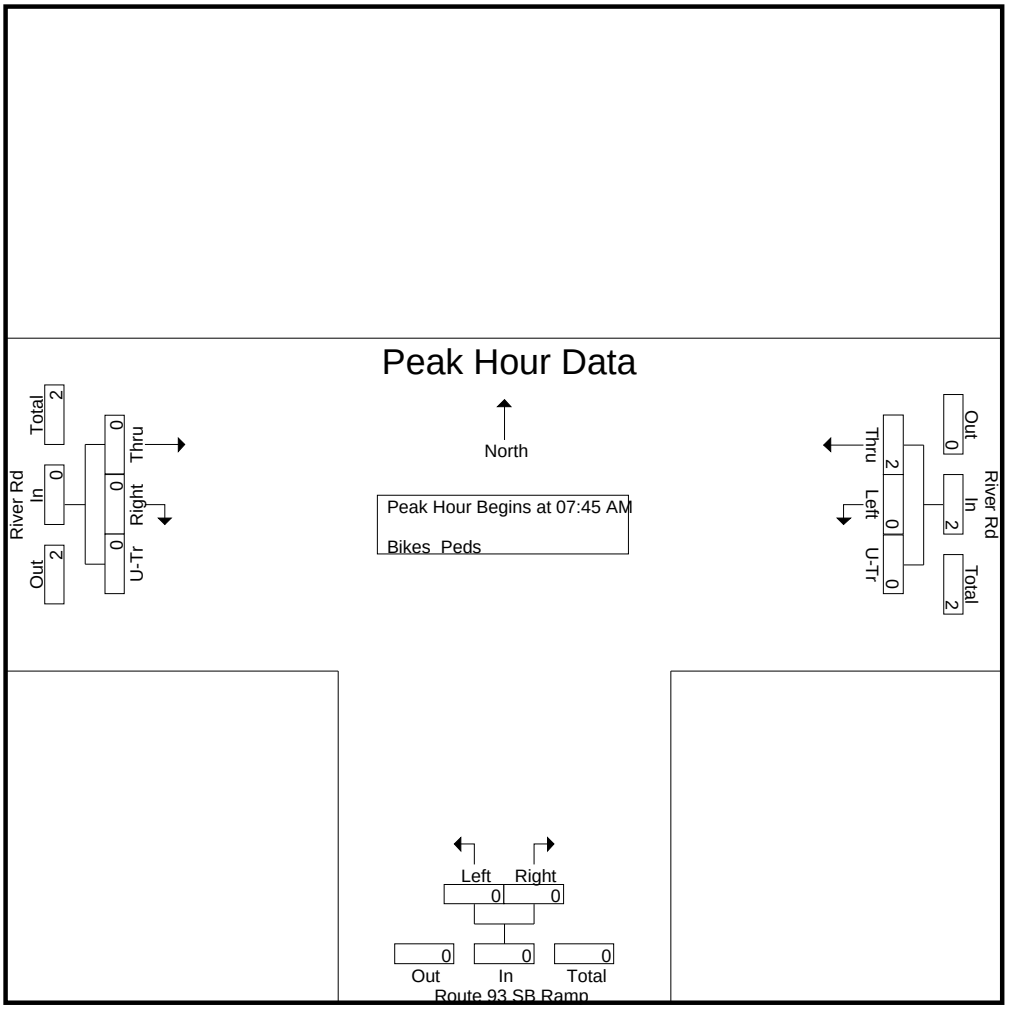
Groups Printed- Bikes Peds

	River Rd From East			Route 93 SB Ramp From South			River Rd From West					
Start Time	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	1	0	0	0	0	0	0	0	0	1	1
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	1	0	0	0	0	0	0	0	0	1	1
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	2	0	0	0	0	0	0	0	0	2	2
Grand Total	0	2	0	0	0	0	0	0	0	0	2	2
Apprch %	0	100	0	0	0		0	0	0			
Total %	0	100	0	0	0		0	0	0	0	100	

	River Rd From East				Route 93 SB Ramp From South			River Rd From West				
Start Time	Left	Thru	Peds	App. Total	Left	Right	App. Total	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 07:45 AM												
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	**1**	0	**1**	0	0	0	0	0	0	0	**1**
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	1	0	1	0	0	0	0	0	0	0	1
Total Volume	0	2	0	2	0	0	0	0	0	0	0	2
% App. Total	0	100	0		0	0		0	0	0		
PHF	.000	.500	.000	.500	.000	.000	.000	.000	.000	.000	.000	.500

N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410003
Site Code : 91410003
Start Date : 5/11/2022



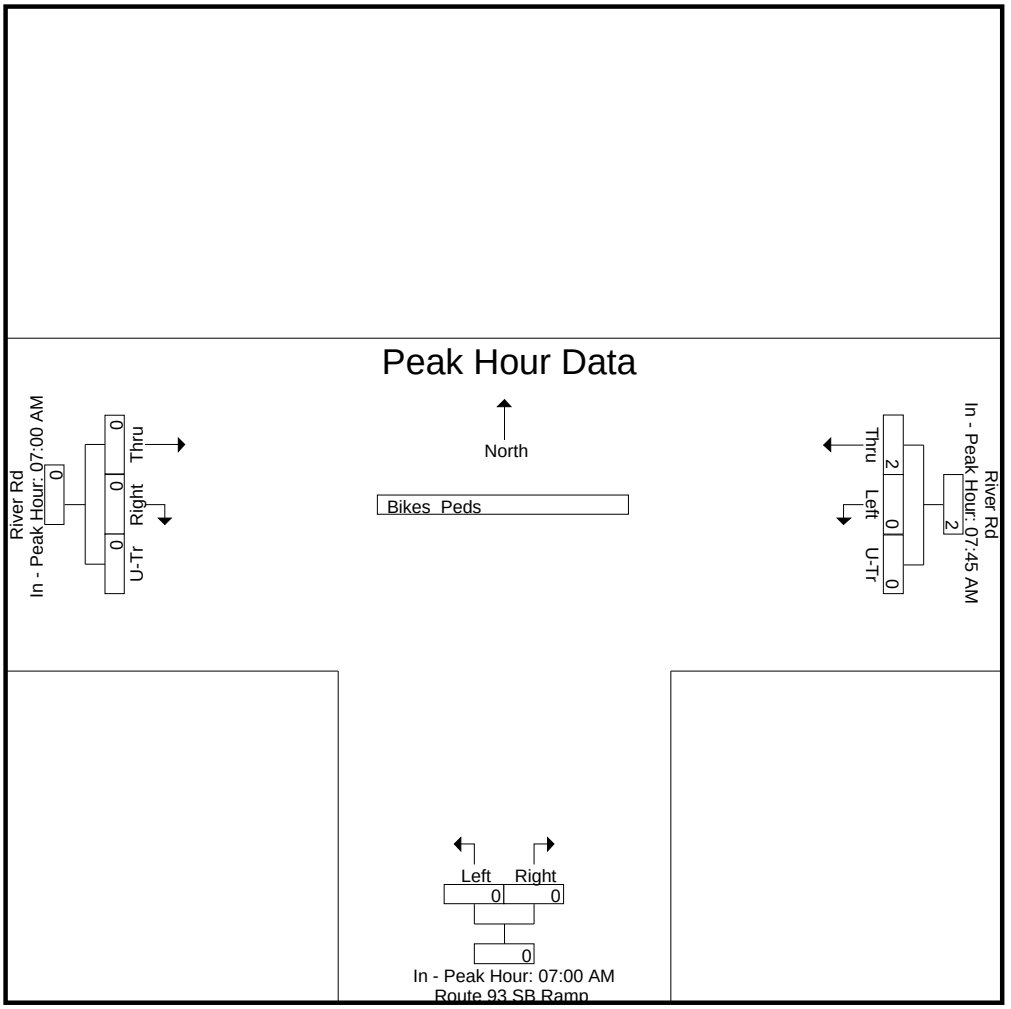
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:45 AM				07:00 AM			07:00 AM			
+0 mins.	0	0	0	0	0	0	0	0	0	0	0
+15 mins.	0	**1**	0	**1**	0	0	0	0	0	0	0
+30 mins.	0	0	0	0	0	0	0	0	0	0	0
+45 mins.	0	1	0	1	0	0	0	0	0	0	0
Total Volume	0	2	0	2	0	0	0	0	0	0	0
% App. Total	0	100	0		0	0		0	0	0	
PHF	.000	.500	.000	.500	.000	.000	.000	.000	.000	.000	.000

Accurate Counts
978-664-2565

N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410003
Site Code : 91410003
Start Date : 5/11/2022
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Accurate Counts

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N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410003
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Groups Printed- Cars - Trucks

	River Rd From East			Route 93 SB Ramp From South		River Rd From West			
Start Time	Left	Thru	U-Tr	Left	Right	Thru	Right	U-Tr	Int. Total
04:00 PM	94	59	0	51	96	177	86	0	563
04:15 PM	73	65	2	54	105	126	59	0	484
04:30 PM	117	65	2	52	109	149	91	0	585
04:45 PM	89	75	2	44	109	128	68	0	515
Total	373	264	6	201	419	580	304	0	2147
05:00 PM	115	90	0	55	102	196	123	0	681
05:15 PM	102	105	1	46	113	139	74	0	580
05:30 PM	89	71	0	59	101	126	82	0	528
05:45 PM	84	68	0	49	111	127	55	0	494
Total	390	334	1	209	427	588	334	0	2283
Grand Total	763	598	7	410	846	1168	638	0	4430
Apprch %	55.8	43.7	0.5	32.6	67.4	64.7	35.3	0	
Total %	17.2	13.5	0.2	9.3	19.1	26.4	14.4	0	
Cars	744	586	7	407	828	1152	630	0	4354
% Cars	97.5	98	100	99.3	97.9	98.6	98.7	0	98.3
Trucks	19	12	0	3	18	16	8	0	76
% Trucks	2.5	2	0	0.7	2.1	1.4	1.3	0	1.7

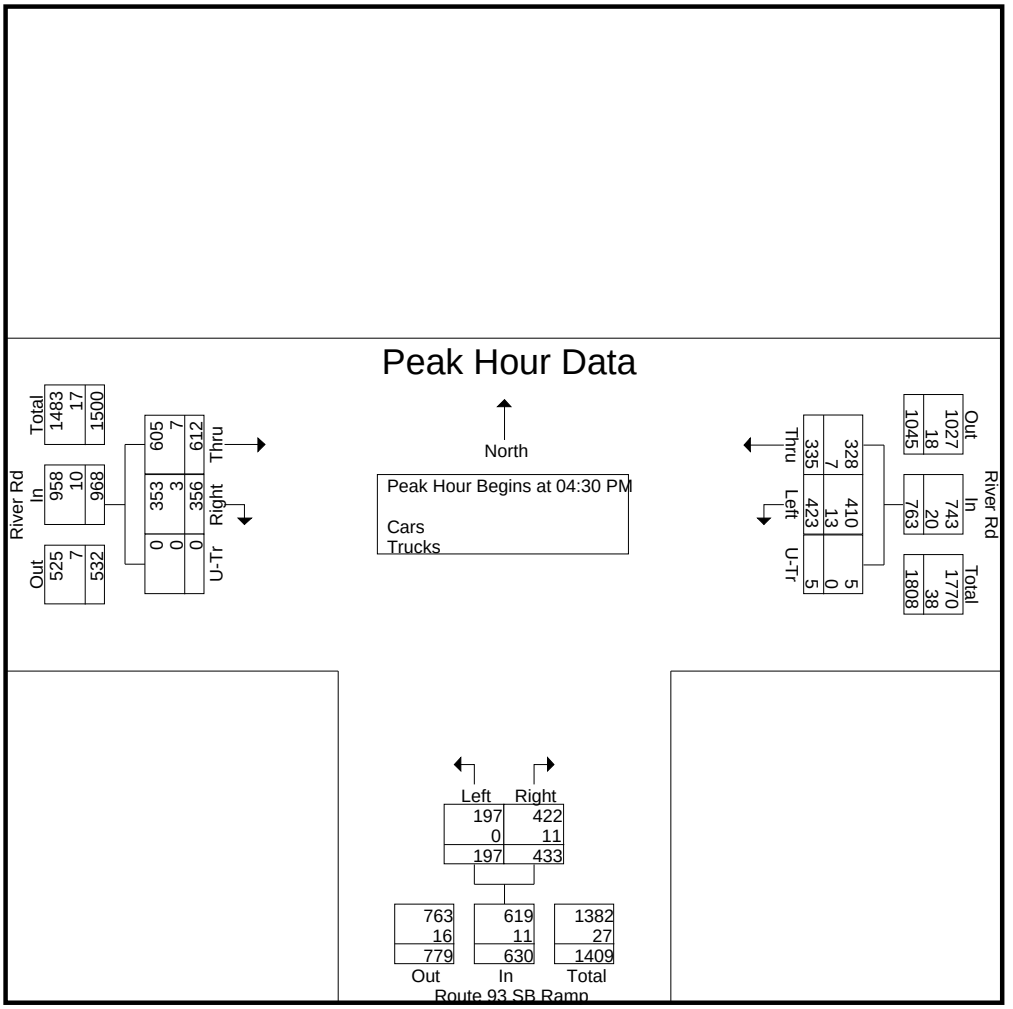
	River Rd From East				Route 93 SB Ramp From South			River Rd From West				
Start Time	Left	Thru	U-Tr	App. Total	Left	Right	App. Total	Thru	Right	U-Tr	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 04:30 PM												
04:30 PM	**117**	65	**2**	184	52	109	**161**	149	91	0	240	585
04:45 PM	89	75	2	166	44	109	153	128	68	0	196	515
05:00 PM	115	90	0	205	**55**	102	157	**196**	**123**	0	**319**	**681**
05:15 PM	102	**105**	1	**208**	46	**113**	159	139	74	0	213	580
Total Volume	423	335	5	763	197	433	630	612	356	0	968	2361
% App. Total	55.4	43.9	0.7		31.3	68.7		63.2	36.8	0		
PHF	.904	.798	.625	.917	.895	.958	.978	.781	.724	.000	.759	.867
Cars	410	328	5	743	197	422	619	605	353	0	958	2320
% Cars	96.9	97.9	100	97.4	100	97.5	98.3	98.9	99.2	0	99.0	98.3
Trucks	13	7	0	20	0	11	11	7	3	0	10	41
% Trucks	3.1	2.1	0	2.6	0	2.5	1.7	1.1	0.8	0	1.0	1.7

Accurate Counts

978-664-2565

N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410003
Site Code : 91410003
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Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

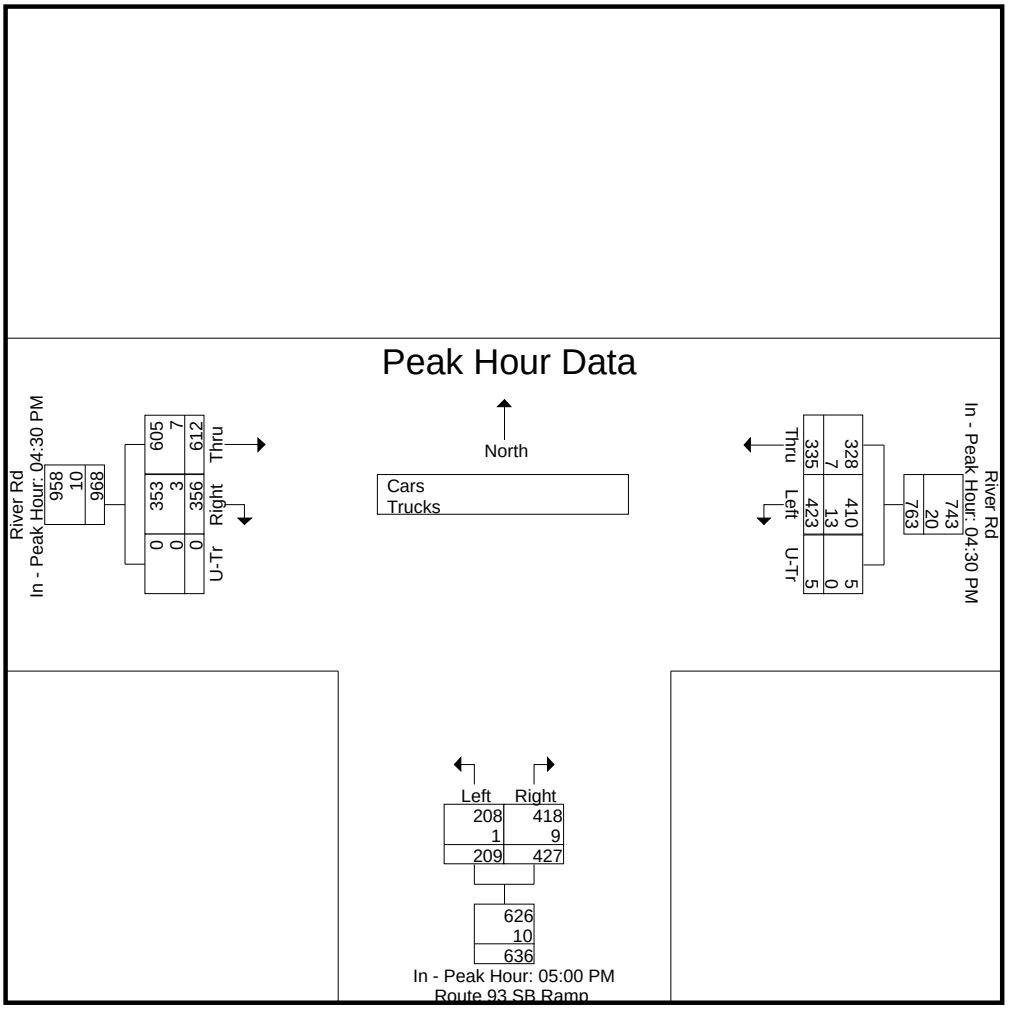
	04:30 PM				05:00 PM			04:30 PM			
+0 mins.	**117**	65	**2**	184	55	102	157	149	91	0	240
+15 mins.	89	75	2	166	46	**113**	159	128	68	0	196
+30 mins.	115	90	0	205	**59**	101	**160**	**196**	**123**	0	**319**
+45 mins.	102	**105**	1	**208**	49	111	160	139	74	0	213
Total Volume	423	335	5	763	209	427	636	612	356	0	968
% App. Total	55.4	43.9	0.7		32.9	67.1		63.2	36.8	0	
PHF	.904	.798	.625	.917	.886	.945	.994	.781	.724	.000	.759
Cars	410	328	5	743	208	418	626	605	353	0	958
% Cars	96.9	97.9	100	97.4	99.5	97.9	98.4	98.9	99.2	0	99
Trucks	13	7	0	20	1	9	10	7	3	0	10
% Trucks	3.1	2.1	0	2.6	0.5	2.1	1.6	1.1	0.8	0	1

Accurate Counts

978-664-2565

N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410003
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Accurate Counts

978-664-2565

N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
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File Name : 91410003
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Start Date : 5/11/2022
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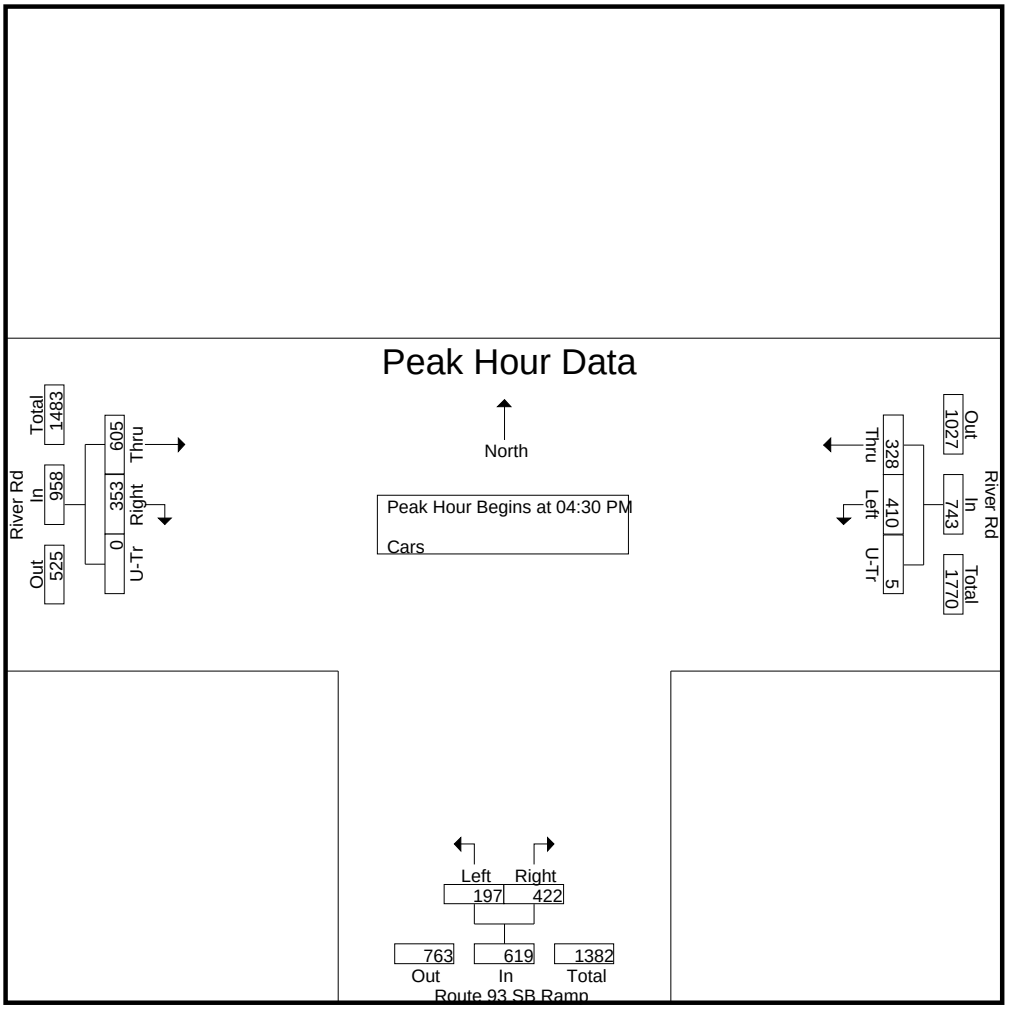
Groups Printed- Cars

	River Rd From East			Route 93 SB Ramp From South		River Rd From West			
Start Time	Left	Thru	U-Tr	Left	Right	Thru	Right	U-Tr	Int. Total
04:00 PM	93	57	0	50	95	172	86	0	553
04:15 PM	71	63	2	53	103	123	56	0	471
04:30 PM	115	64	2	52	108	147	90	0	578
04:45 PM	88	74	2	44	104	126	68	0	506
Total	367	258	6	199	410	568	300	0	2108
05:00 PM	108	88	0	55	99	194	122	0	666
05:15 PM	99	102	1	46	111	138	73	0	570
05:30 PM	87	71	0	58	99	126	81	0	522
05:45 PM	83	67	0	49	109	126	54	0	488
Total	377	328	1	208	418	584	330	0	2246
Grand Total	744	586	7	407	828	1152	630	0	4354
Apprch %	55.6	43.8	0.5	33	67	64.6	35.4	0	
Total %	17.1	13.5	0.2	9.3	19	26.5	14.5	0	

	River Rd From East				Route 93 SB Ramp From South			River Rd From West				
Start Time	Left	Thru	U-Tr	App. Total	Left	Right	App. Total	Thru	Right	U-Tr	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 04:30 PM												
04:30 PM	**115**	64	**2**	181	52	108	**160**	147	90	0	237	578
04:45 PM	88	74	2	164	44	104	148	126	68	0	194	506
05:00 PM	108	88	0	196	**55**	99	154	**194**	**122**	0	**316**	**666**
05:15 PM	99	**102**	1	**202**	46	**111**	157	138	73	0	211	570
Total Volume	410	328	5	743	197	422	619	605	353	0	958	2320
% App. Total	55.2	44.1	0.7		31.8	68.2		63.2	36.8	0		
PHF	.891	.804	.625	.920	.895	.950	.967	.780	.723	.000	.758	.871

N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410003
Site Code : 91410003
Start Date : 5/11/2022



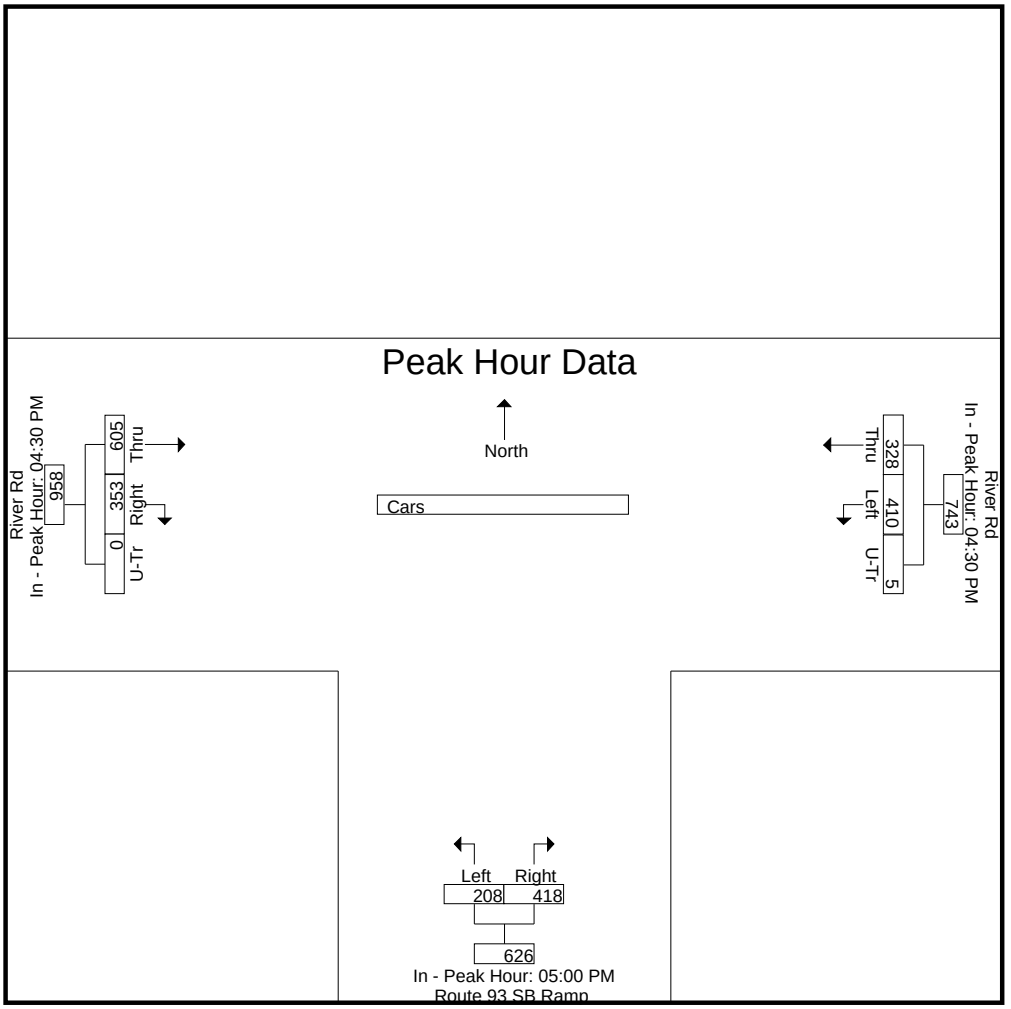
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:30 PM				05:00 PM			04:30 PM			
+0 mins.	**115**	64	**2**	181	55	99	154	147	90	0	237
+15 mins.	88	74	2	164	46	**111**	157	126	68	0	194
+30 mins.	108	88	0	196	**58**	99	157	**194**	**122**	0	**316**
+45 mins.	99	**102**	1	**202**	49	109	**158**	138	73	0	211
Total Volume	410	328	5	743	208	418	626	605	353	0	958
% App. Total	55.2	44.1	0.7		33.2	66.8		63.2	36.8	0	
PHF	.891	.804	.625	.920	.897	.941	.991	.780	.723	.000	.758

Accurate Counts
978-664-2565

N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410003
Site Code : 91410003
Start Date : 5/11/2022
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Accurate Counts

978-664-2565

N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410003
Site Code : 91410003
Start Date : 5/11/2022
Page No : 1

Groups Printed- Trucks

	River Rd From East			Route 93 SB Ramp From South		River Rd From West			
Start Time	Left	Thru	U-Tr	Left	Right	Thru	Right	U-Tr	Int. Total
04:00 PM	1	2	0	1	1	5	0	0	10
04:15 PM	2	2	0	1	2	3	3	0	13
04:30 PM	2	1	0	0	1	2	1	0	7
04:45 PM	1	1	0	0	5	2	0	0	9
Total	6	6	0	2	9	12	4	0	39
05:00 PM	7	2	0	0	3	2	1	0	15
05:15 PM	3	3	0	0	2	1	1	0	10
05:30 PM	2	0	0	1	2	0	1	0	6
05:45 PM	1	1	0	0	2	1	1	0	6
Total	13	6	0	1	9	4	4	0	37
Grand Total	19	12	0	3	18	16	8	0	76
Apprch %	61.3	38.7	0	14.3	85.7	66.7	33.3	0	
Total %	25	15.8	0	3.9	23.7	21.1	10.5	0	

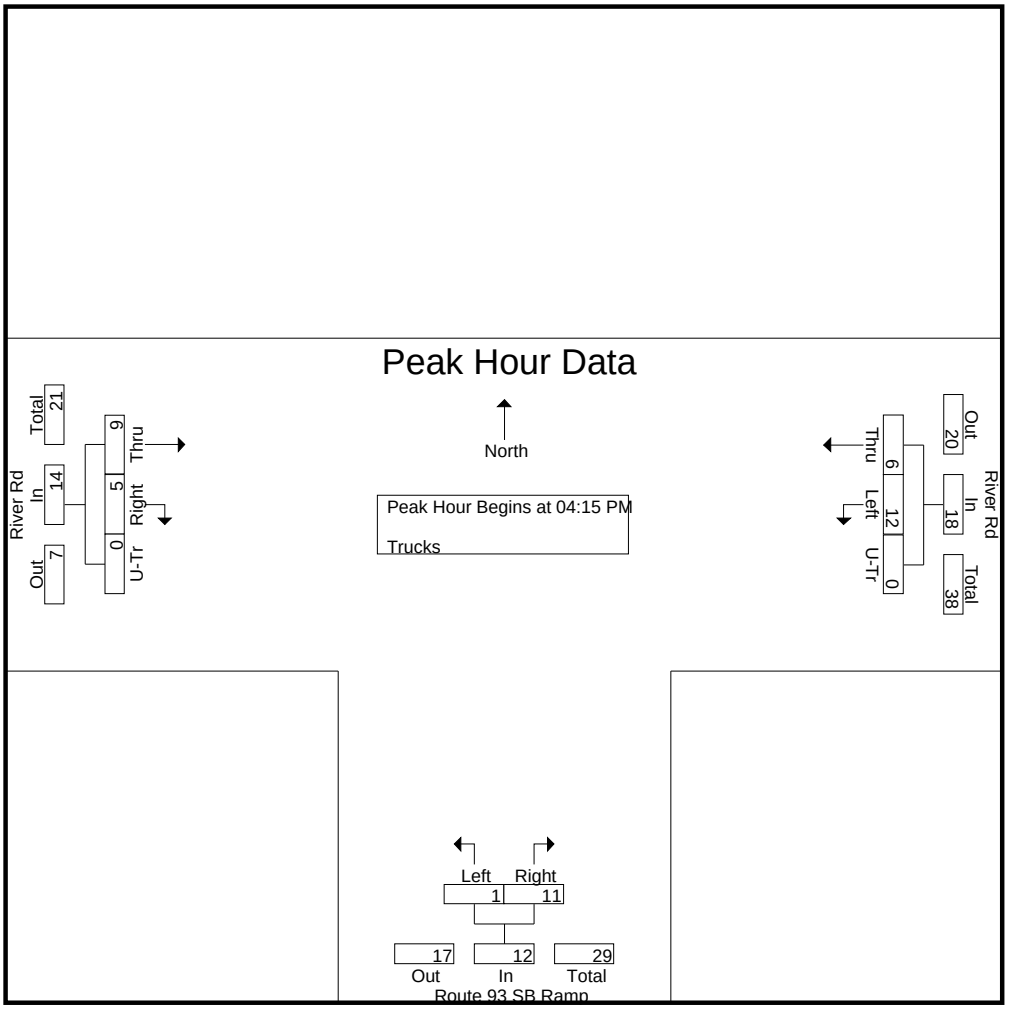
	River Rd From East				Route 93 SB Ramp From South			River Rd From West				
Start Time	Left	Thru	U-Tr	App. Total	Left	Right	App. Total	Thru	Right	U-Tr	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 04:15 PM												
04:15 PM	2	**2**	0	4	**1**	2	3	**3**	**3**	0	**6**	13
04:30 PM	2	1	0	3	0	1	1	2	1	0	3	7
04:45 PM	1	1	0	2	0	**5**	**5**	2	0	0	2	9
05:00 PM	**7**	2	0	**9**	0	3	3	2	1	0	3	**15**
Total Volume	12	6	0	18	1	11	12	9	5	0	14	44
% App. Total	66.7	33.3	0		8.3	91.7		64.3	35.7	0		
PHF	.429	.750	.000	.500	.250	.550	.600	.750	.417	.000	.583	.733

Accurate Counts

978-664-2565

N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410003
Site Code : 91410003
Start Date : 5/11/2022
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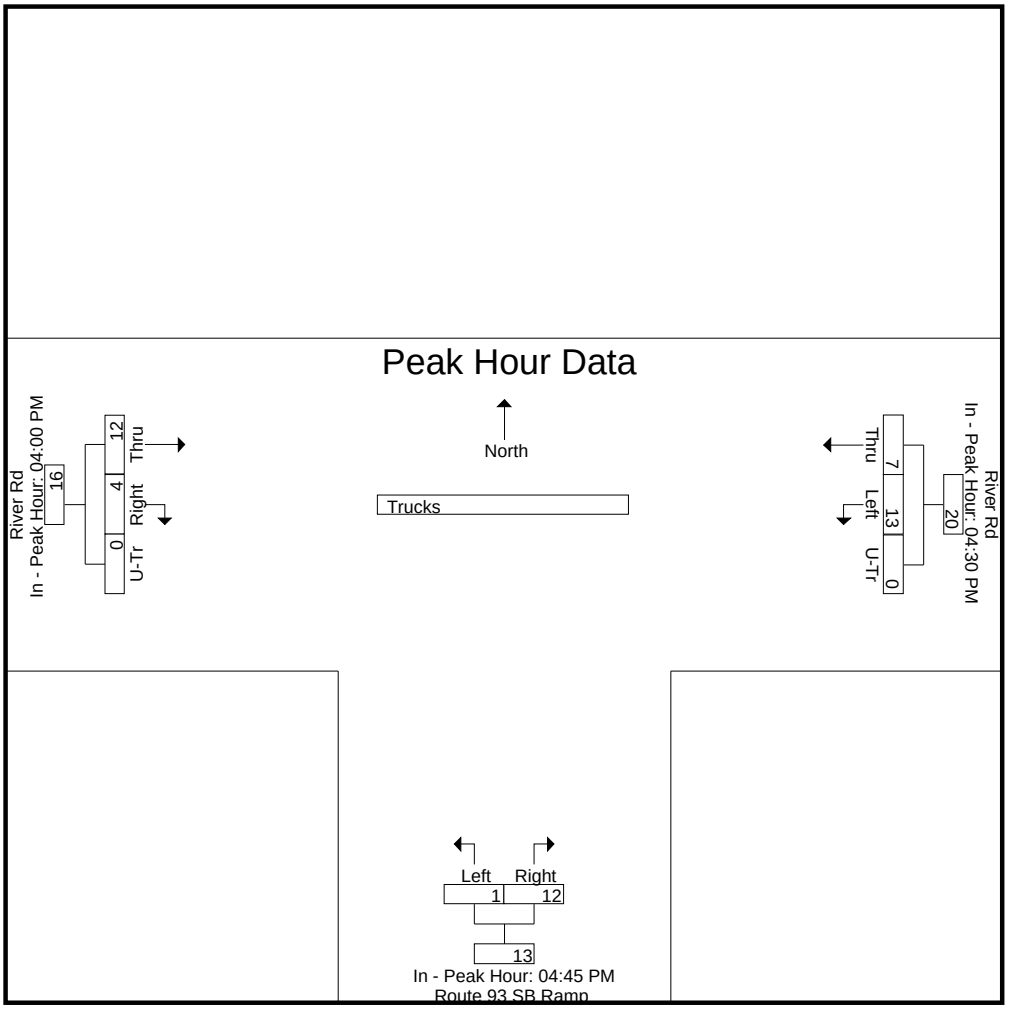


Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:30 PM				04:45 PM			04:00 PM			
+0 mins.	2	1	0	3	0	**5**	**5**	**5**	0	0	5
+15 mins.	1	1	0	2	0	3	3	3	**3**	0	**6**
+30 mins.	**7**	2	0	**9**	0	2	2	2	1	0	3
+45 mins.	3	**3**	0	6	**1**	2	3	2	0	0	2
Total Volume	13	7	0	20	1	12	13	12	4	0	16
% App. Total	65	35	0		7.7	92.3		75	25	0	
PHF	.464	.583	.000	.556	.250	.600	.650	.600	.333	.000	.667

N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410003
Site Code : 91410003
Start Date : 5/11/2022
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Accurate Counts

978-664-2565

N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410003
Site Code : 91410003
Start Date : 5/11/2022

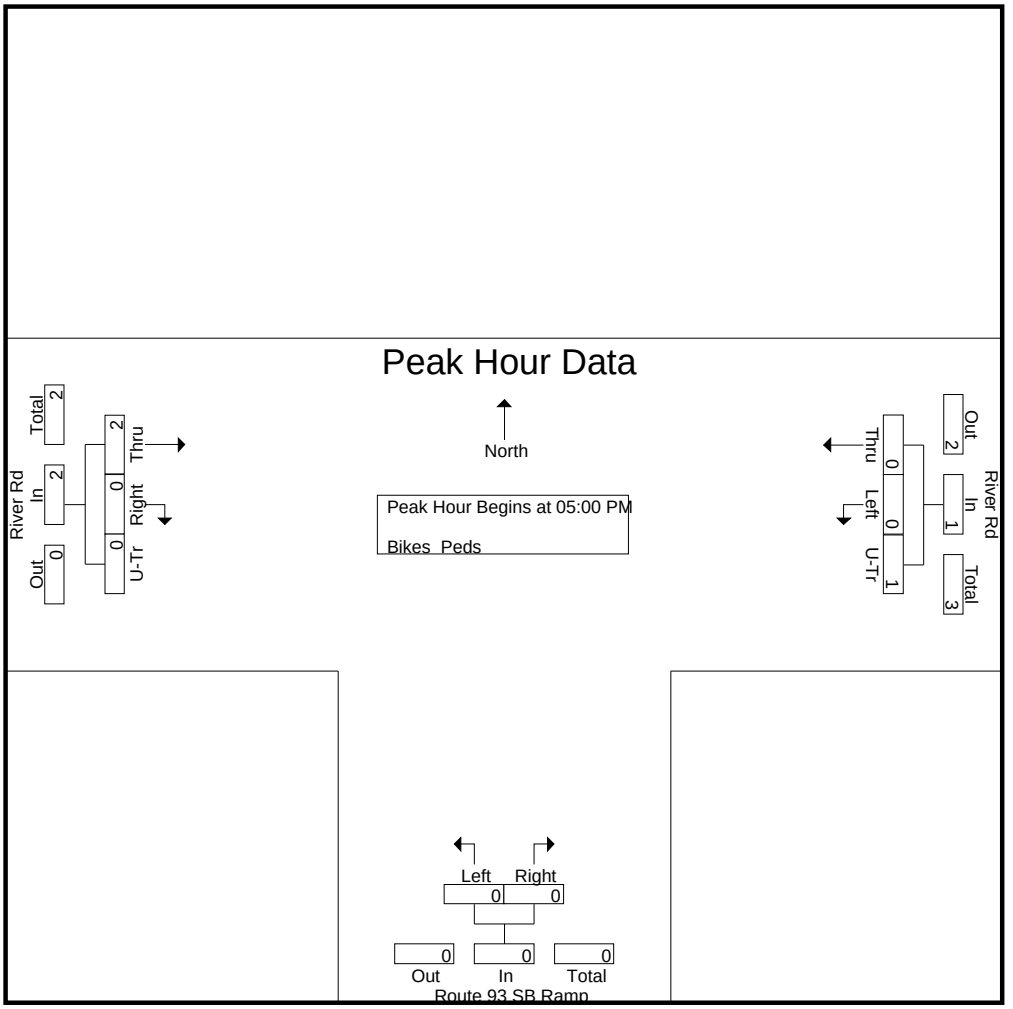
Groups Printed- Bikes Peds

	River Rd From East			Route 93 SB Ramp From South			River Rd From West					
Start Time	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
04:00 PM	0	0	1	0	0	0	0	0	0	0	1	1
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	1	0	0	0	0	0	0	0	0	1	1
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	1	1	0	0	0	0	0	0	0	2	2
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	1	0	0	0	0	0	0	0	1	1
05:45 PM	0	0	0	0	0	0	2	0	0	0	2	2
Total	0	0	1	0	0	0	2	0	0	0	3	3
Grand Total	0	1	2	0	0	0	2	0	0	0	5	5
Apprch %	0	33.3	66.7	0	0		100	0	0			
Total %	0	20	40	0	0		40	0	0	0	100	

	River Rd From East				Route 93 SB Ramp From South			River Rd From West				
Start Time	Left	Thru	Peds	App. Total	Left	Right	App. Total	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 05:00 PM												
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	**1**	**1**	0	0	0	0	0	0	0	1
05:45 PM	0	0	0	0	0	0	0	**2**	0	0	**2**	**2**
Total Volume	0	0	1	1	0	0	0	2	0	0	2	3
% App. Total	0	0	100		0	0		100	0	0		
PHF	.000	.000	.250	.250	.000	.000	.000	.250	.000	.000	.250	.375

N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410003
Site Code : 91410003
Start Date : 5/11/2022
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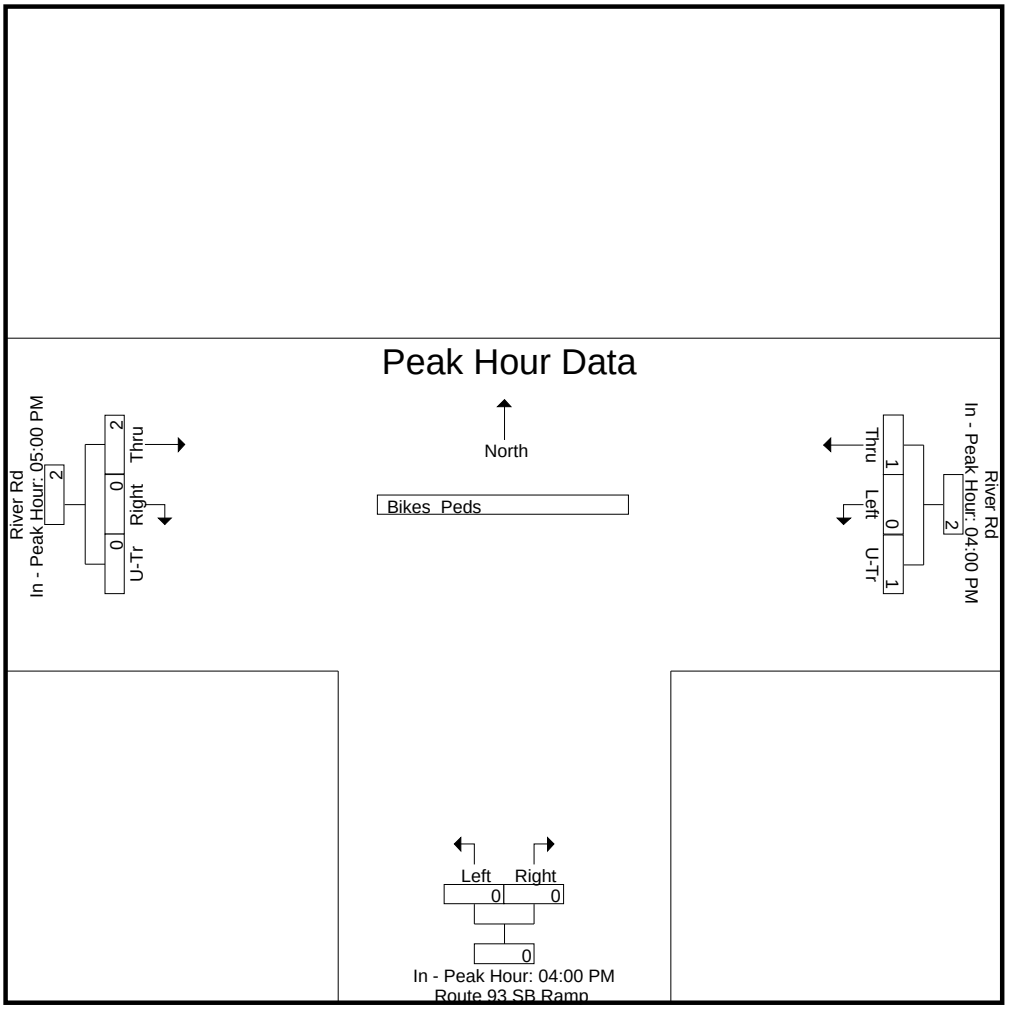
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:00 PM				04:00 PM			05:00 PM			
+0 mins.	0	0	**1**	**1**	0	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	0	0	0	0	0	0
+30 mins.	0	**1**	0	1	0	0	0	0	0	0	0
+45 mins.	0	0	0	0	0	0	0	**2**	0	0	**2**
Total Volume	0	1	1	2	0	0	0	2	0	0	2
% App. Total	0	50	50		0	0		100	0	0	
PHF	.000	.250	.250	.500	.000	.000	.000	.250	.000	.000	.250

Accurate Counts
978-664-2565

N/S Street : Route 93 SB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410003
Site Code : 91410003
Start Date : 5/11/2022
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Accurate Counts

978-664-2565

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022

Groups Printed- Cars - Trucks

	Route 93 NB Ramp From North		River Rd From East			River Rd From West			
Start Time	Left	Right	Thru	Right	U-Tr	Left	Thru	U-Tr	Int. Total
07:00 AM	102	48	86	96	0	66	231	0	629
07:15 AM	106	60	91	103	0	48	290	0	698
07:30 AM	99	75	131	149	0	41	282	0	777
07:45 AM	109	97	116	123	1	53	266	0	765
Total	416	280	424	471	1	208	1069	0	2869
08:00 AM	133	99	98	100	0	43	198	0	671
08:15 AM	131	115	96	99	0	42	192	1	676
08:30 AM	92	84	100	75	0	43	163	0	557
08:45 AM	106	109	78	95	0	69	149	0	606
Total	462	407	372	369	0	197	702	1	2510
Grand Total	878	687	796	840	1	405	1771	1	5379
Apprch %	56.1	43.9	48.6	51.3	0.1	18.6	81.4	0	
Total %	16.3	12.8	14.8	15.6	0	7.5	32.9	0	
Cars	843	673	730	790	1	396	1704	1	5138
% Cars	96	98	91.7	94	100	97.8	96.2	100	95.5
Trucks	35	14	66	50	0	9	67	0	241
% Trucks	4	2	8.3	6	0	2.2	3.8	0	4.5

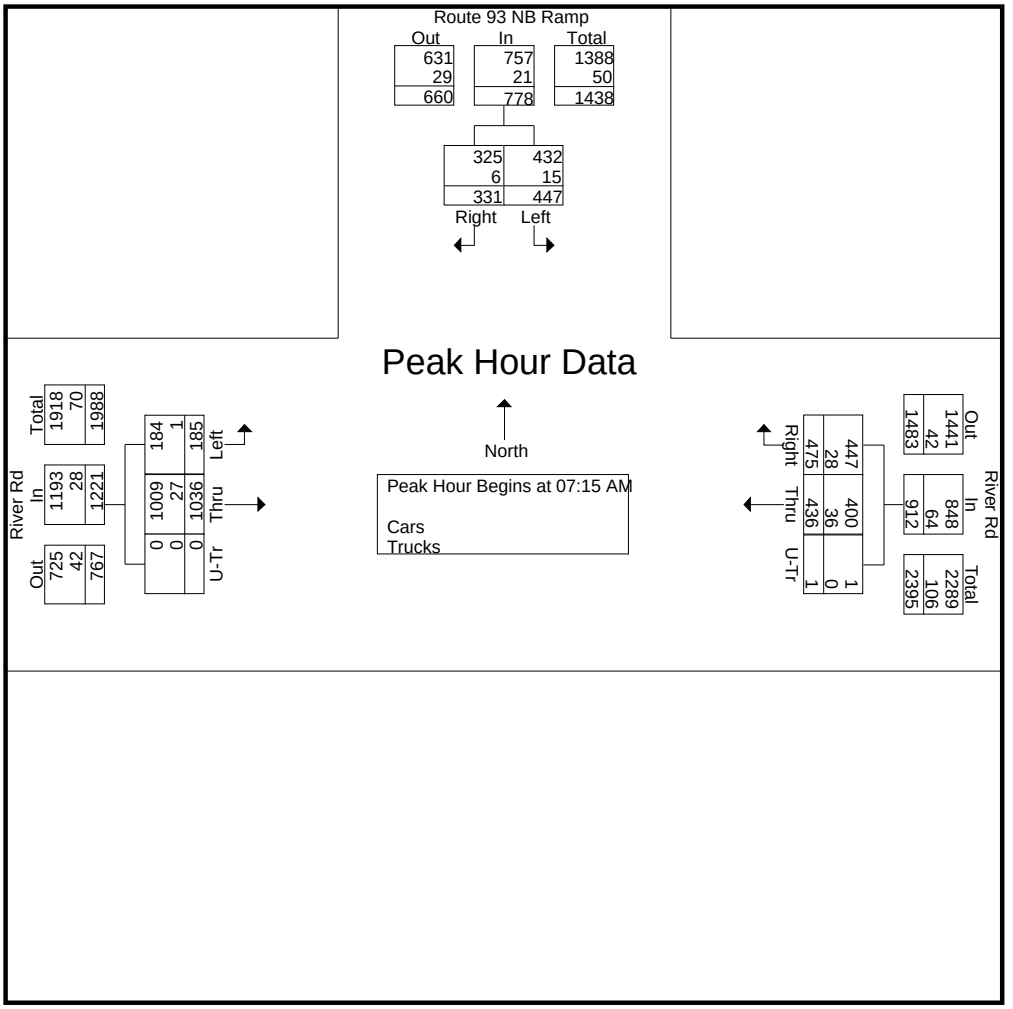
	Route 93 NB Ramp From North			River Rd From East				River Rd From West				
Start Time	Left	Right	App. Total	Thru	Right	U-Tr	App. Total	Left	Thru	U-Tr	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 07:15 AM												
07:15 AM	106	60	166	91	103	0	194	48	**290**	0	**338**	698
07:30 AM	99	75	174	**131**	**149**	0	**280**	41	282	0	323	**777**
07:45 AM	109	97	206	116	123	**1**	240	**53**	266	0	319	765
08:00 AM	**133**	**99**	**232**	98	100	0	198	43	198	0	241	671
Total Volume	447	331	778	436	475	1	912	185	1036	0	1221	2911
% App. Total	57.5	42.5		47.8	52.1	0.1		15.2	84.8	0		
PHF	.840	.836	.838	.832	.797	.250	.814	.873	.893	.000	.903	.937
Cars	432	325	757	400	447	1	848	184	1009	0	1193	2798
% Cars	96.6	98.2	97.3	91.7	94.1	100	93.0	99.5	97.4	0	97.7	96.1
Trucks	15	6	21	36	28	0	64	1	27	0	28	113
% Trucks	3.4	1.8	2.7	8.3	5.9	0	7.0	0.5	2.6	0	2.3	3.9

Accurate Counts

978-664-2565

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022
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Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

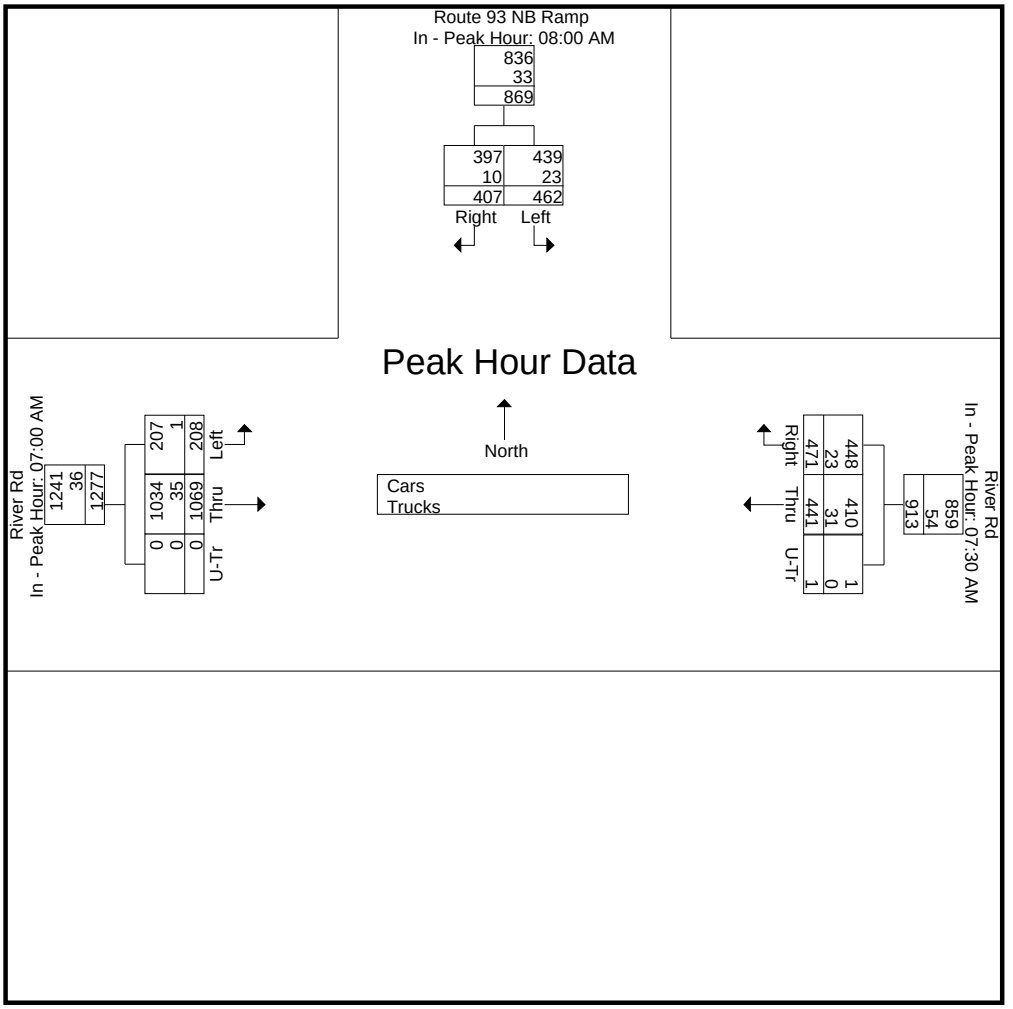
	08:00 AM			07:30 AM				07:00 AM			
+0 mins.	**133**	99	232	**131**	**149**	0	**280**	**66**	231	0	297
+15 mins.	131	**115**	**246**	116	123	**1**	240	48	**290**	0	**338**
+30 mins.	92	84	176	98	100	0	198	41	282	0	323
+45 mins.	106	109	215	96	99	0	195	53	266	0	319
Total Volume	462	407	869	441	471	1	913	208	1069	0	1277
% App. Total	53.2	46.8		48.3	51.6	0.1		16.3	83.7	0	
PHF	.868	.885	.883	.842	.790	.250	.815	.788	.922	.000	.945
Cars	439	397	836	410	448	1	859	207	1034	0	1241
% Cars	95	97.5	96.2	93	95.1	100	94.1	99.5	96.7	0	97.2
Trucks	23	10	33	31	23	0	54	1	35	0	36
% Trucks	5	2.5	3.8	7	4.9	0	5.9	0.5	3.3	0	2.8

Accurate Counts

978-664-2565

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022
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Accurate Counts

978-664-2565

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022

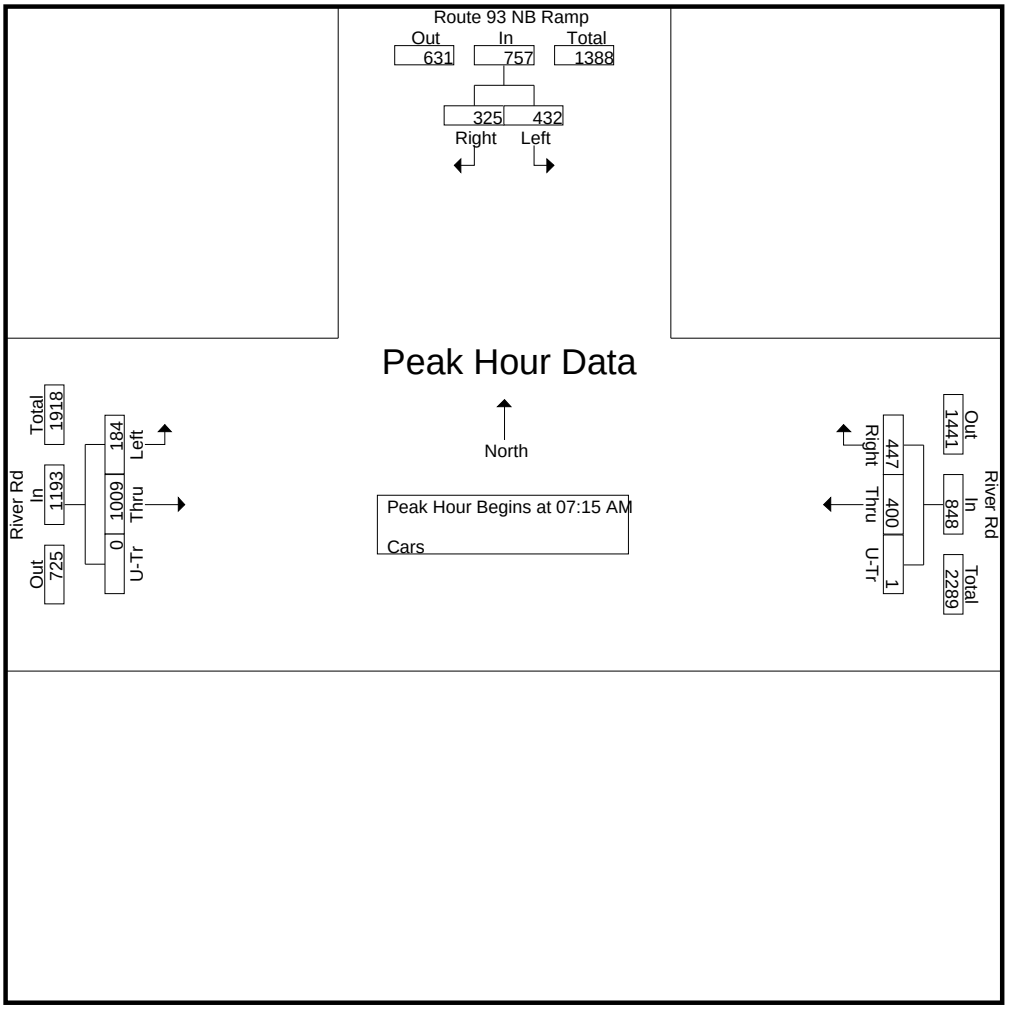
Groups Printed- Cars

	Route 93 NB Ramp From North		River Rd From East			River Rd From West			
Start Time	Left	Right	Thru	Right	U-Tr	Left	Thru	U-Tr	Int. Total
07:00 AM	99	48	77	92	0	66	216	0	598
07:15 AM	104	58	79	94	0	48	280	0	663
07:30 AM	94	74	121	145	0	40	280	0	754
07:45 AM	107	96	107	115	1	53	258	0	737
Total	404	276	384	446	1	207	1034	0	2752
08:00 AM	127	97	93	93	0	43	191	0	644
08:15 AM	124	115	89	95	0	42	177	1	643
08:30 AM	89	79	92	73	0	43	161	0	537
08:45 AM	99	106	72	83	0	61	141	0	562
Total	439	397	346	344	0	189	670	1	2386
Grand Total	843	673	730	790	1	396	1704	1	5138
Apprch %	55.6	44.4	48	51.9	0.1	18.8	81.1	0	
Total %	16.4	13.1	14.2	15.4	0	7.7	33.2	0	

	Route 93 NB Ramp From North			River Rd From East				River Rd From West				
Start Time	Left	Right	App. Total	Thru	Right	U-Tr	App. Total	Left	Thru	U-Tr	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 07:15 AM												
07:15 AM	104	58	162	79	94	0	173	48	**280**	0	**328**	663
07:30 AM	94	74	168	**121**	**145**	0	**266**	40	280	0	320	**754**
07:45 AM	107	96	203	107	115	**1**	223	**53**	258	0	311	737
08:00 AM	**127**	**97**	**224**	93	93	0	186	43	191	0	234	644
Total Volume	432	325	757	400	447	1	848	184	1009	0	1193	2798
% App. Total	57.1	42.9		47.2	52.7	0.1		15.4	84.6	0		
PHF	.850	.838	.845	.826	.771	.250	.797	.868	.901	.000	.909	.928

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022
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Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

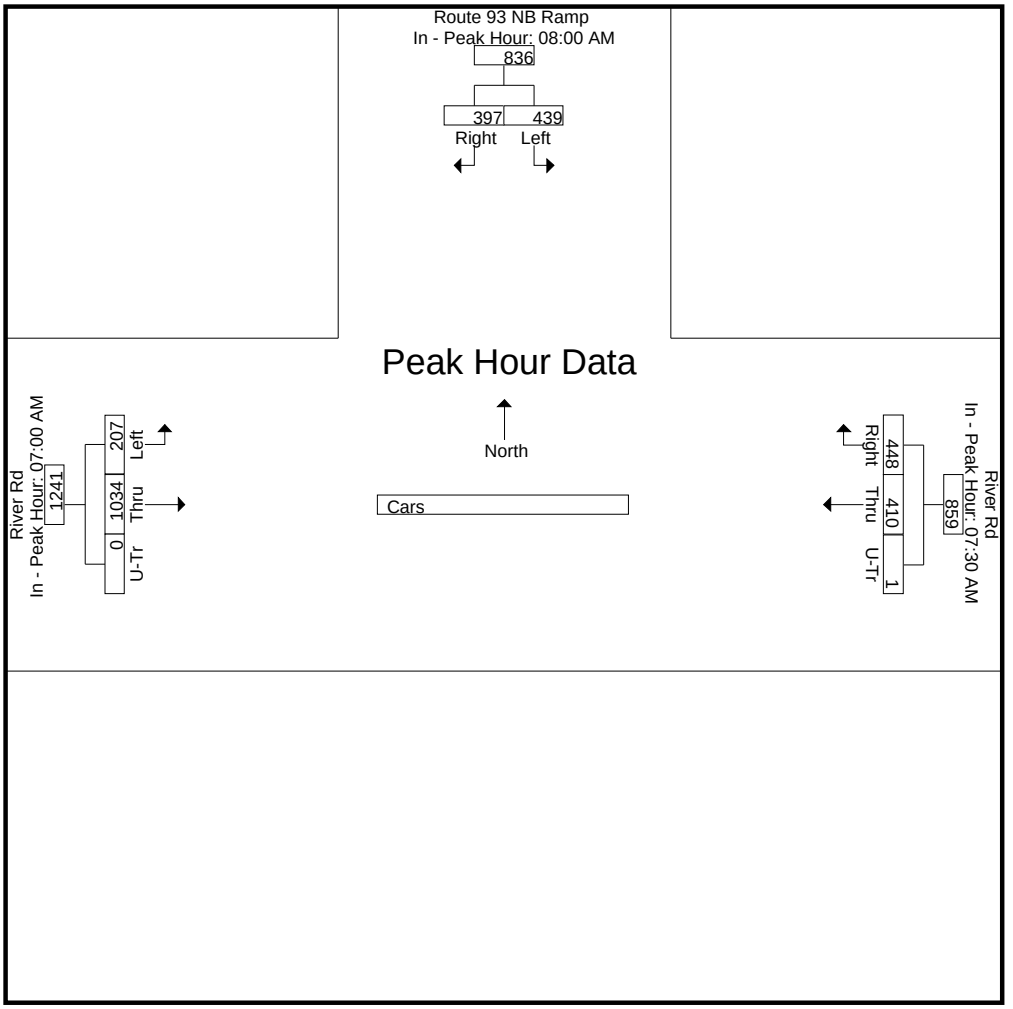
	08:00 AM			07:30 AM				07:00 AM			
+0 mins.	**127**	97	224	**121**	**145**	0	**266**	**66**	216	0	282
+15 mins.	124	**115**	**239**	107	115	**1**	223	48	**280**	0	**328**
+30 mins.	89	79	168	93	93	0	186	40	280	0	320
+45 mins.	99	106	205	89	95	0	184	53	258	0	311
Total Volume	439	397	836	410	448	1	859	207	1034	0	1241
% App. Total	52.5	47.5		47.7	52.2	0.1		16.7	83.3	0	
PHF	.864	.863	.874	.847	.772	.250	.807	.784	.923	.000	.946

Accurate Counts

978-664-2565

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022
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Accurate Counts

978-664-2565

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022

Groups Printed- Trucks

	Route 93 NB Ramp From North		River Rd From East			River Rd From West			
Start Time	Left	Right	Thru	Right	U-Tr	Left	Thru	U-Tr	Int. Total
07:00 AM	3	0	9	4	0	0	15	0	31
07:15 AM	2	2	12	9	0	0	10	0	35
07:30 AM	5	1	10	4	0	1	2	0	23
07:45 AM	2	1	9	8	0	0	8	0	28
Total	12	4	40	25	0	1	35	0	117
08:00 AM	6	2	5	7	0	0	7	0	27
08:15 AM	7	0	7	4	0	0	15	0	33
08:30 AM	3	5	8	2	0	0	2	0	20
08:45 AM	7	3	6	12	0	8	8	0	44
Total	23	10	26	25	0	8	32	0	124
Grand Total	35	14	66	50	0	9	67	0	241
Apprch %	71.4	28.6	56.9	43.1	0	11.8	88.2	0	
Total %	14.5	5.8	27.4	20.7	0	3.7	27.8	0	

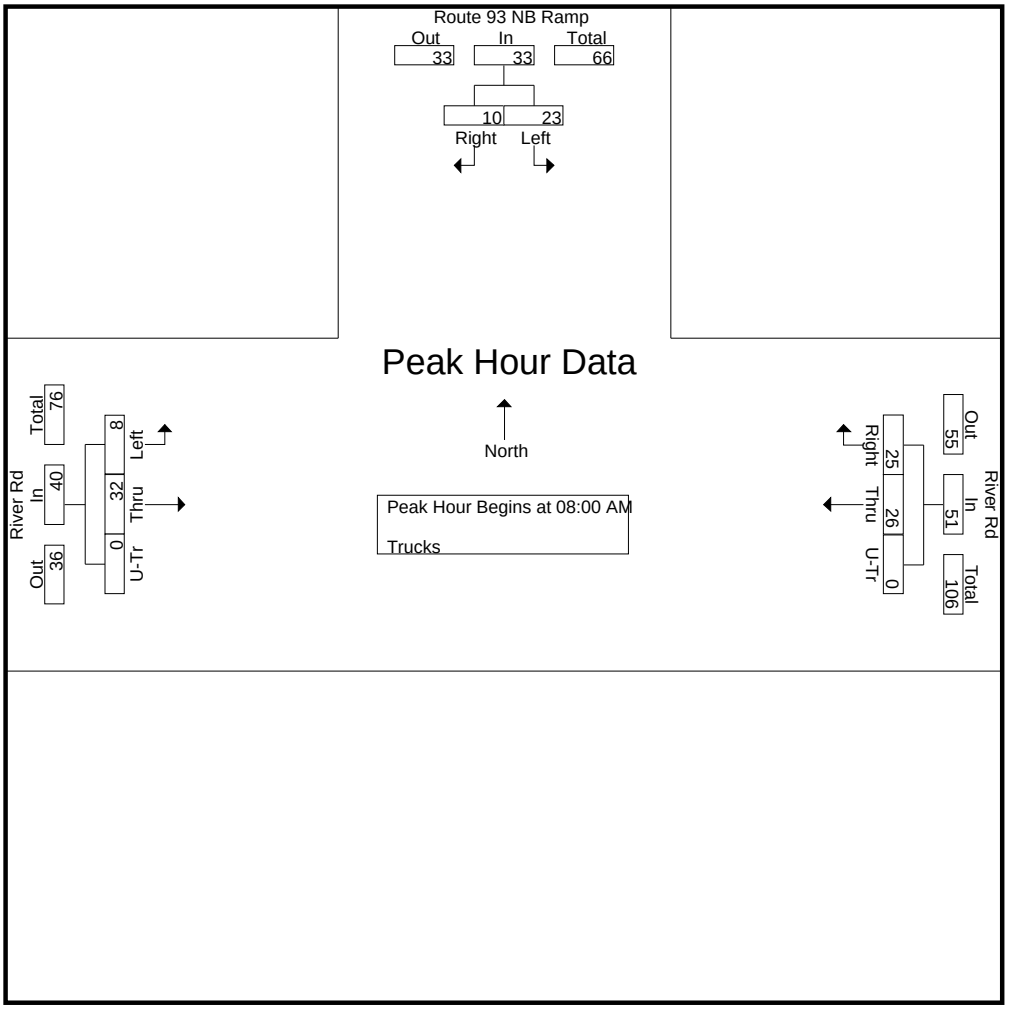
	Route 93 NB Ramp From North			River Rd From East				River Rd From West				
Start Time	Left	Right	App. Total	Thru	Right	U-Tr	App. Total	Left	Thru	U-Tr	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 08:00 AM												
08:00 AM	6	2	8	5	7	0	12	0	7	0	7	27
08:15 AM	**7**	0	7	7	4	0	11	0	**15**	0	15	33
08:30 AM	3	**5**	8	**8**	2	0	10	0	2	0	2	20
08:45 AM	7	3	**10**	6	**12**	0	**18**	**8**	8	0	**16**	**44**
Total Volume	23	10	33	26	25	0	51	8	32	0	40	124
% App. Total	69.7	30.3		51	49	0		20	80	0		
PHF	.821	.500	.825	.813	.521	.000	.708	.250	.533	.000	.625	.705

Accurate Counts

978-664-2565

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022
Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

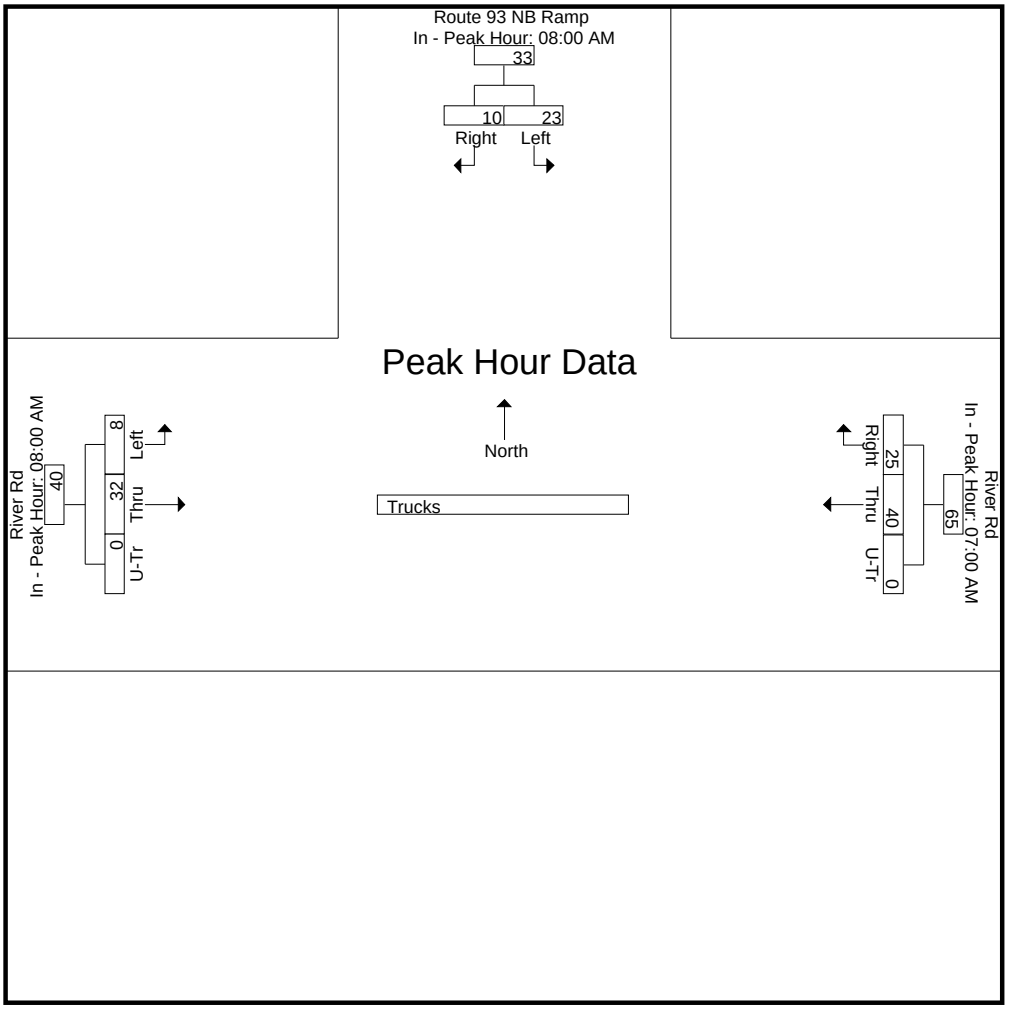
	08:00 AM			07:00 AM				08:00 AM			
+0 mins.	6	2	8	9	4	0	13	0	7	0	7
+15 mins.	**7**	0	7	**12**	**9**	0	**21**	0	**15**	0	15
+30 mins.	3	**5**	8	10	4	0	14	0	2	0	2
+45 mins.	7	3	**10**	9	8	0	17	**8**	8	0	**16**
Total Volume	23	10	33	40	25	0	65	8	32	0	40
% App. Total	69.7	30.3		61.5	38.5	0		20	80	0	
PHF	.821	.500	.825	.833	.694	.000	.774	.250	.533	.000	.625

Accurate Counts

978-664-2565

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022
Page No : 3



Accurate Counts

978-664-2565

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022
Page No : 1

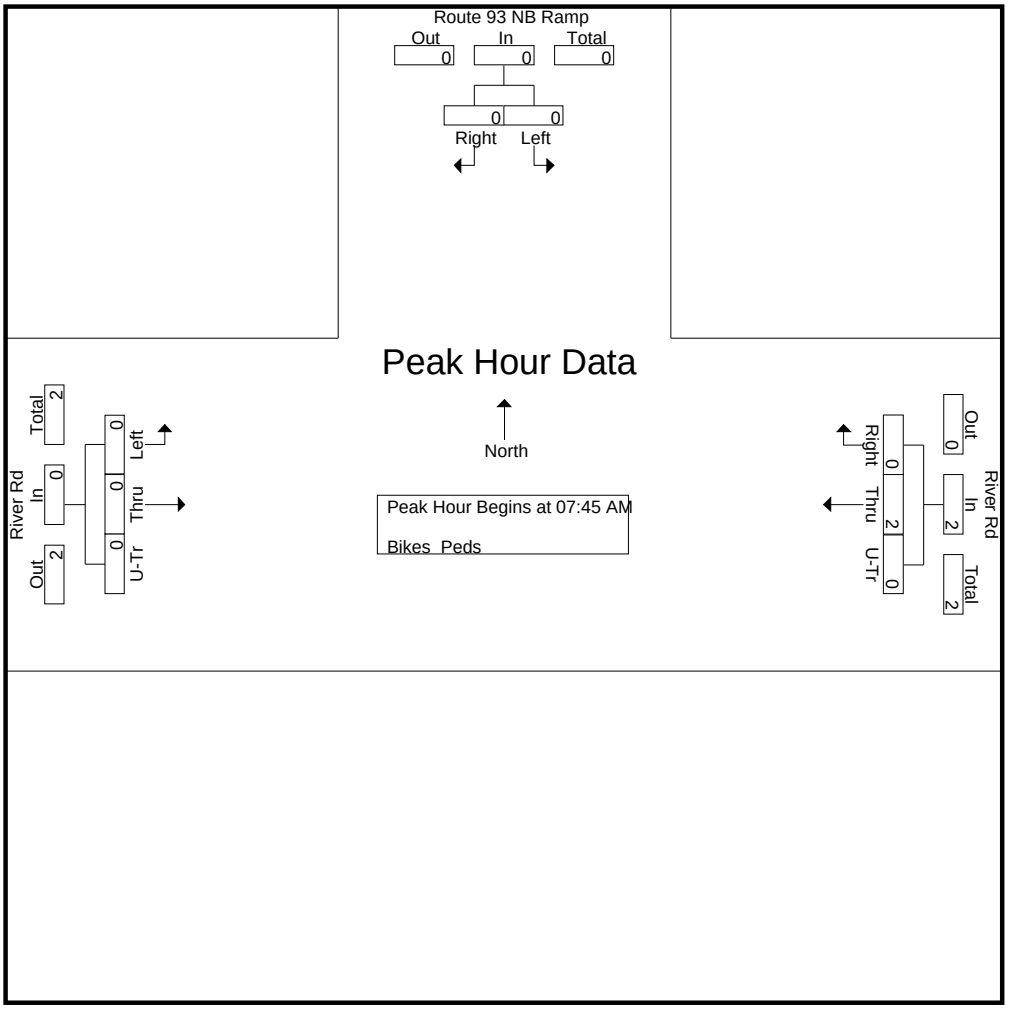
Groups Printed- Bikes Peds

	Route 93 NB Ramp From North			River Rd From East			River Rd From West					
Start Time	Left	Right	Peds	Thru	Right	Peds	Left	Thru	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	1	0	0	0	0	0	0	1	1
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	1	0	0	0	0	0	0	1	1
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	2	0	0	0	0	0	0	2	2
Grand Total	0	0	0	2	0	0	0	0	0	0	2	2
Apprch %	0	0		100	0	0	0	0	0			
Total %	0	0		100	0	0	0	0	0	0	100	

	Route 93 NB Ramp From North			River Rd From East				River Rd From West				
Start Time	Left	Right	App. Total	Thru	Right	Peds	App. Total	Left	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 07:45 AM												
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	**1**	0	0	**1**	0	0	0	0	**1**
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	1	0	0	1	0	0	0	0	1
Total Volume	0	0	0	2	0	0	2	0	0	0	0	2
% App. Total	0	0		100	0	0		0	0	0		
PHF	.000	.000	.000	.500	.000	.000	.500	.000	.000	.000	.000	.500

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022
Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

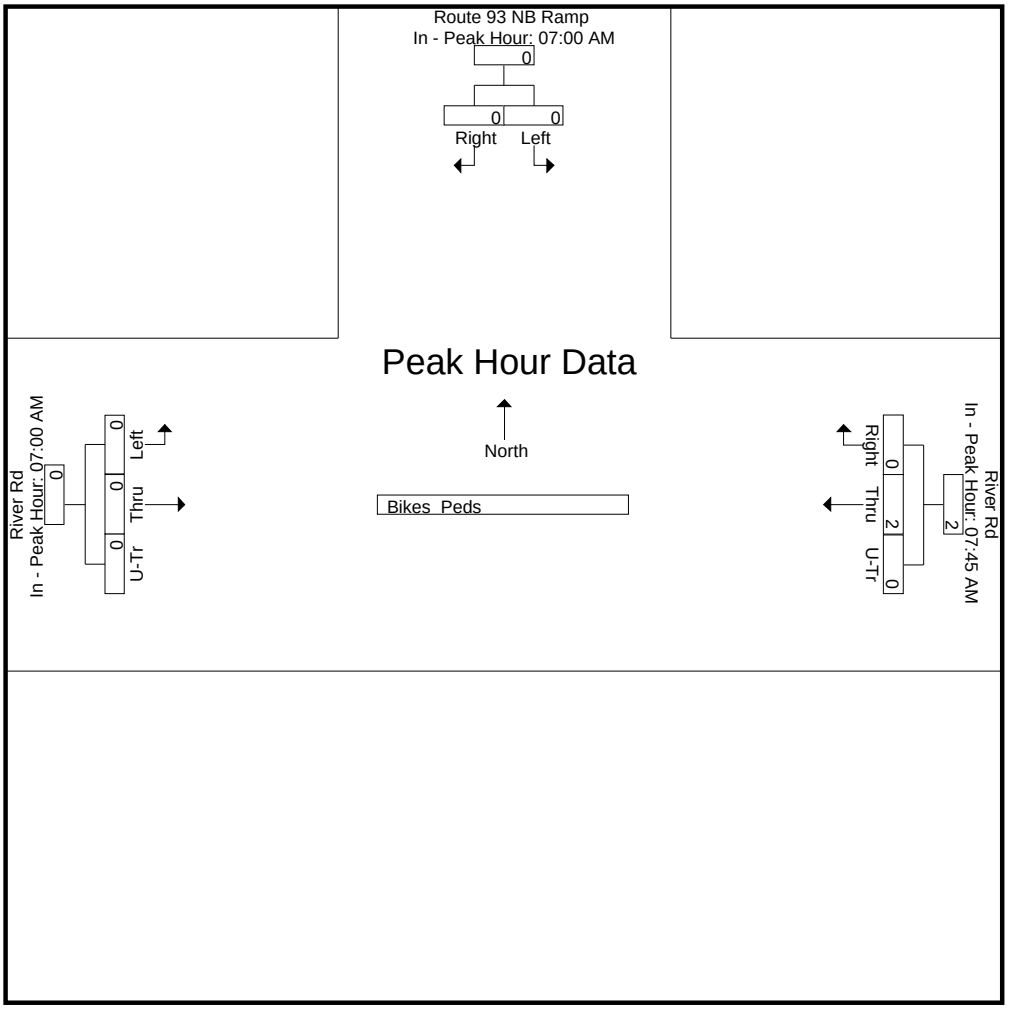
	07:00 AM			07:45 AM				07:00 AM			
+0 mins.	0	0	0	0	0	0	0	0	0	0	0
+15 mins.	0	0	0	**1**	0	0	**1**	0	0	0	0
+30 mins.	0	0	0	0	0	0	0	0	0	0	0
+45 mins.	0	0	0	1	0	0	1	0	0	0	0
Total Volume	0	0	0	2	0	0	2	0	0	0	0
% App. Total	0	0		100	0	0		0	0	0	
PHF	.000	.000	.000	.500	.000	.000	.500	.000	.000	.000	.000

Accurate Counts

978-664-2565

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022
Page No : 3



Accurate Counts

978-664-2565

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022
Page No : 1

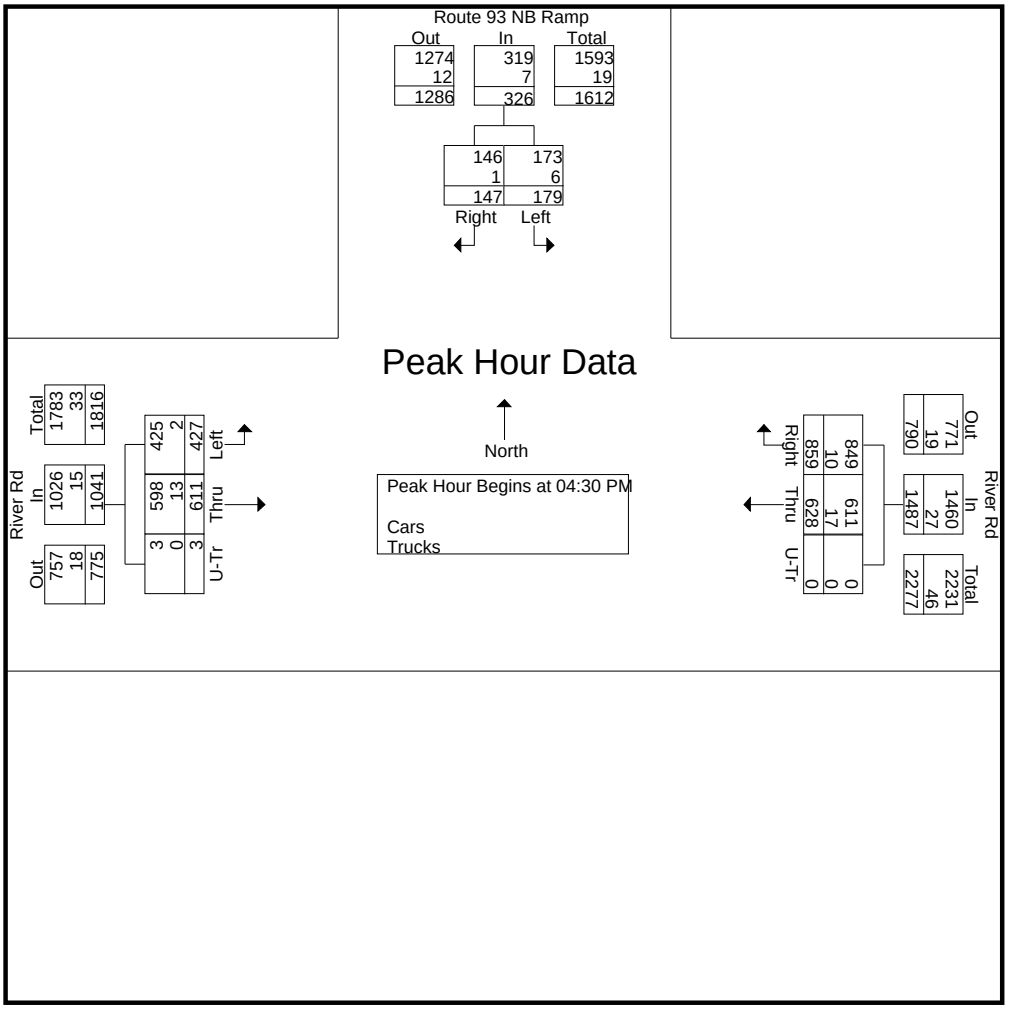
Groups Printed- Cars - Trucks

	Route 93 NB Ramp From North		River Rd From East			River Rd From West			
Start Time	Left	Right	Thru	Right	U-Tr	Left	Thru	U-Tr	Int. Total
04:00 PM	41	30	122	199	1	113	145	1	652
04:15 PM	28	31	111	169	0	93	152	0	584
04:30 PM	38	29	160	243	0	109	153	0	732
04:45 PM	41	31	140	206	0	90	143	0	651
Total	148	121	533	817	1	405	593	1	2619
05:00 PM	56	39	176	226	0	123	147	1	768
05:15 PM	44	48	152	184	0	105	168	2	703
05:30 PM	47	33	128	168	0	95	130	2	603
05:45 PM	35	29	129	137	0	84	159	0	573
Total	182	149	585	715	0	407	604	5	2647
Grand Total	330	270	1118	1532	1	812	1197	6	5266
Apprch %	55	45	42.2	57.8	0	40.3	59.4	0.3	
Total %	6.3	5.1	21.2	29.1	0	15.4	22.7	0.1	
Cars	319	266	1094	1506	1	805	1171	6	5168
% Cars	96.7	98.5	97.9	98.3	100	99.1	97.8	100	98.1
Trucks	11	4	24	26	0	7	26	0	98
% Trucks	3.3	1.5	2.1	1.7	0	0.9	2.2	0	1.9

	Route 93 NB Ramp From North			River Rd From East				River Rd From West				
Start Time	Left	Right	App. Total	Thru	Right	U-Tr	App. Total	Left	Thru	U-Tr	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 04:30 PM												
04:30 PM	38	29	67	160	**243**	0	**403**	109	153	0	262	732
04:45 PM	41	31	72	140	206	0	346	90	143	0	233	651
05:00 PM	**56**	39	**95**	**176**	226	0	402	**123**	147	1	271	**768**
05:15 PM	44	**48**	92	152	184	0	336	105	**168**	**2**	**275**	703
Total Volume	179	147	326	628	859	0	1487	427	611	3	1041	2854
% App. Total	54.9	45.1		42.2	57.8	0		41	58.7	0.3		
PHF	.799	.766	.858	.892	.884	.000	.922	.868	.909	.375	.946	.929
Cars	173	146	319	611	849	0	1460	425	598	3	1026	2805
% Cars	96.6	99.3	97.9	97.3	98.8	0	98.2	99.5	97.9	100	98.6	98.3
Trucks	6	1	7	17	10	0	27	2	13	0	15	49
% Trucks	3.4	0.7	2.1	2.7	1.2	0	1.8	0.5	2.1	0	1.4	1.7

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022
Page No : 2



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

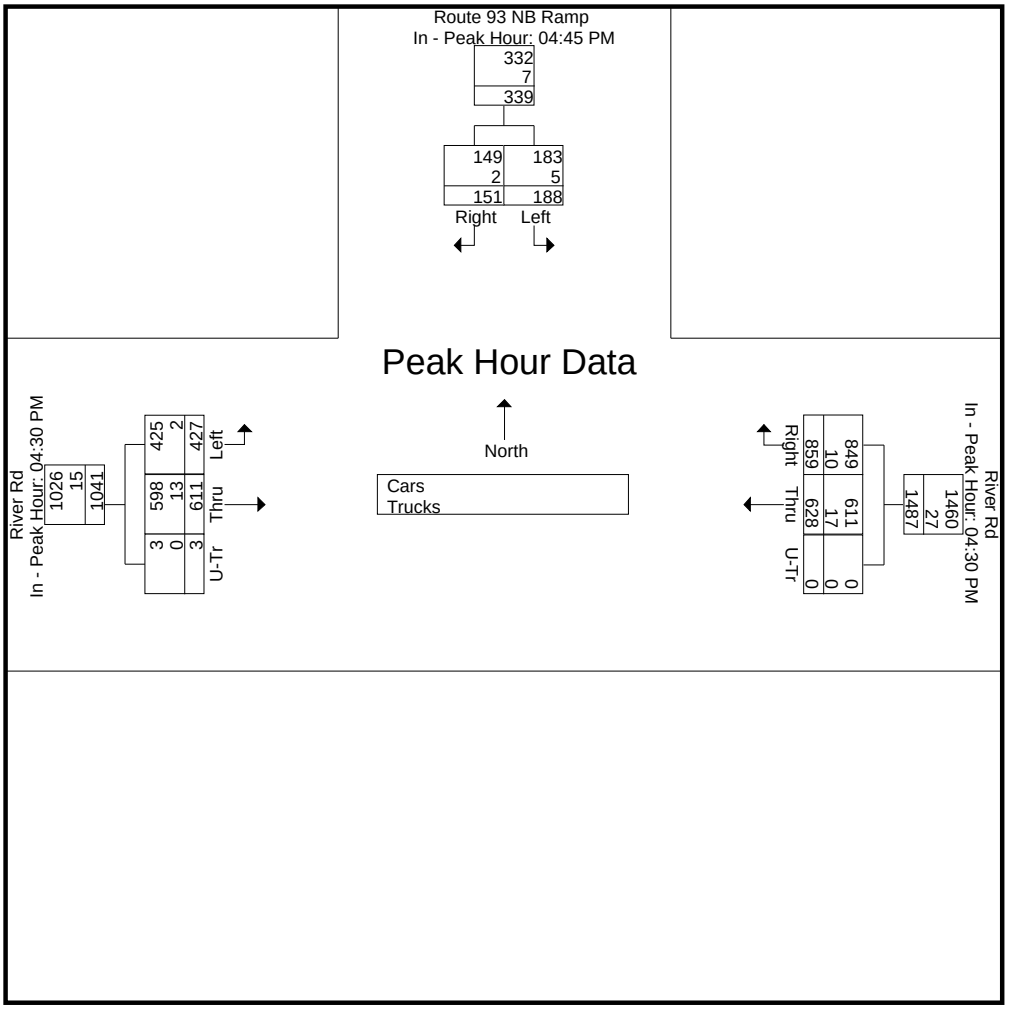
	04:45 PM			04:30 PM				04:30 PM			
+0 mins.	41	31	72	160	**243**	0	**403**	109	153	0	262
+15 mins.	**56**	39	**95**	140	206	0	346	90	143	0	233
+30 mins.	44	**48**	92	**176**	226	0	402	**123**	147	1	271
+45 mins.	47	33	80	152	184	0	336	105	**168**	**2**	**275**
Total Volume	188	151	339	628	859	0	1487	427	611	3	1041
% App. Total	55.5	44.5		42.2	57.8	0		41	58.7	0.3	
PHF	.839	.786	.892	.892	.884	.000	.922	.868	.909	.375	.946
Cars	183	149	332	611	849	0	1460	425	598	3	1026
% Cars	97.3	98.7	97.9	97.3	98.8	0	98.2	99.5	97.9	100	98.6
Trucks	5	2	7	17	10	0	27	2	13	0	15
% Trucks	2.7	1.3	2.1	2.7	1.2	0	1.8	0.5	2.1	0	1.4

Accurate Counts

978-664-2565

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022
Page No : 3



Accurate Counts

978-664-2565

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022
Page No : 1

Groups Printed- Cars

	Route 93 NB Ramp From North		River Rd From East			River Rd From West			
Start Time	Left	Right	Thru	Right	U-Tr	Left	Thru	U-Tr	Int. Total
04:00 PM	39	29	121	195	1	108	143	1	637
04:15 PM	26	30	108	162	0	93	147	0	566
04:30 PM	37	29	157	240	0	108	151	0	722
04:45 PM	39	31	137	202	0	89	138	0	636
Total	141	119	523	799	1	398	579	1	2561
05:00 PM	53	38	170	225	0	123	144	1	754
05:15 PM	44	48	147	182	0	105	165	2	693
05:30 PM	47	32	126	164	0	95	128	2	594
05:45 PM	34	29	128	136	0	84	155	0	566
Total	178	147	571	707	0	407	592	5	2607
Grand Total	319	266	1094	1506	1	805	1171	6	5168
Apprch %	54.5	45.5	42.1	57.9	0	40.6	59.1	0.3	
Total %	6.2	5.1	21.2	29.1	0	15.6	22.7	0.1	

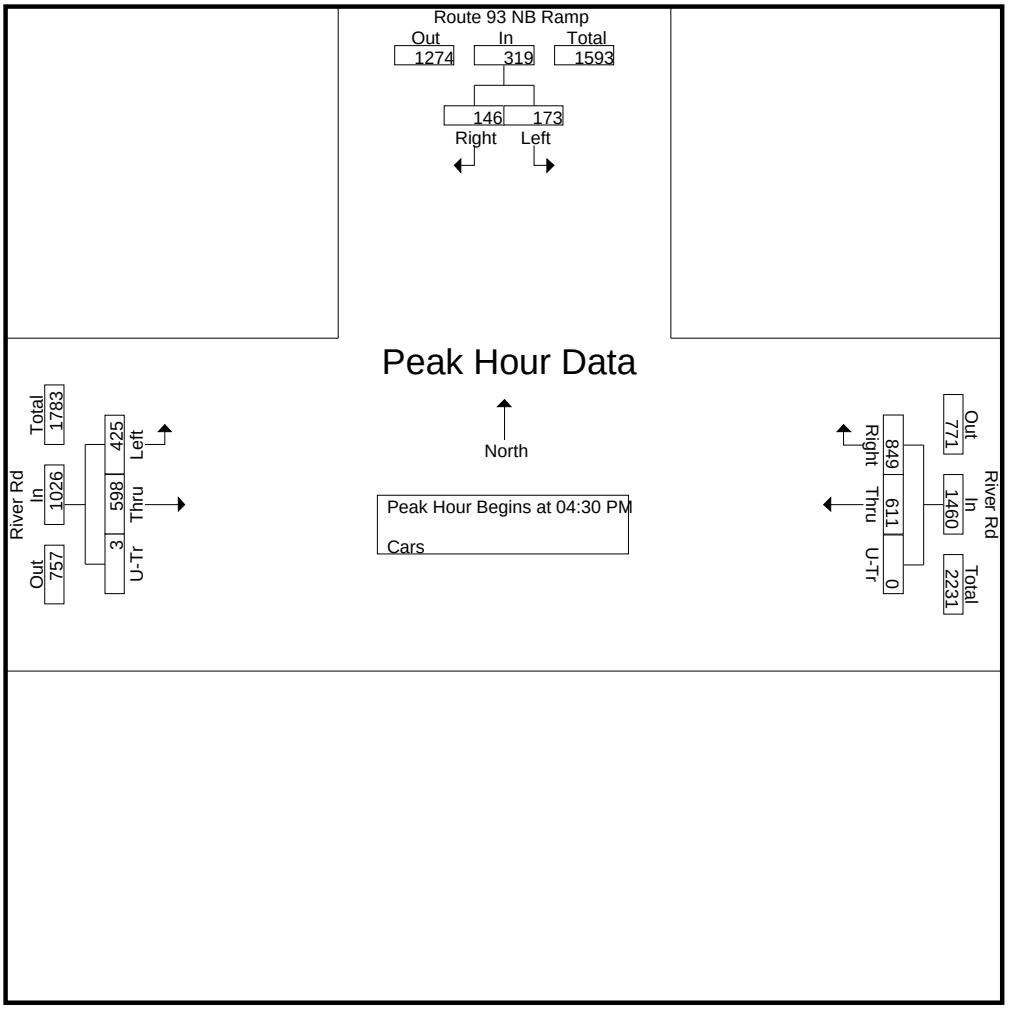
	Route 93 NB Ramp From North			River Rd From East				River Rd From West				
Start Time	Left	Right	App. Total	Thru	Right	U-Tr	App. Total	Left	Thru	U-Tr	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 04:30 PM												
04:30 PM	37	29	66	157	**240**	0	**397**	108	151	0	259	722
04:45 PM	39	31	70	137	202	0	339	89	138	0	227	636
05:00 PM	**53**	38	91	**170**	225	0	395	**123**	144	1	268	**754**
05:15 PM	44	**48**	**92**	147	182	0	329	105	**165**	**2**	**272**	693
Total Volume	173	146	319	611	849	0	1460	425	598	3	1026	2805
% App. Total	54.2	45.8		41.8	58.2	0		41.4	58.3	0.3		
PHF	.816	.760	.867	.899	.884	.000	.919	.864	.906	.375	.943	.930

Accurate Counts

978-664-2565

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022
Page No : 2



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

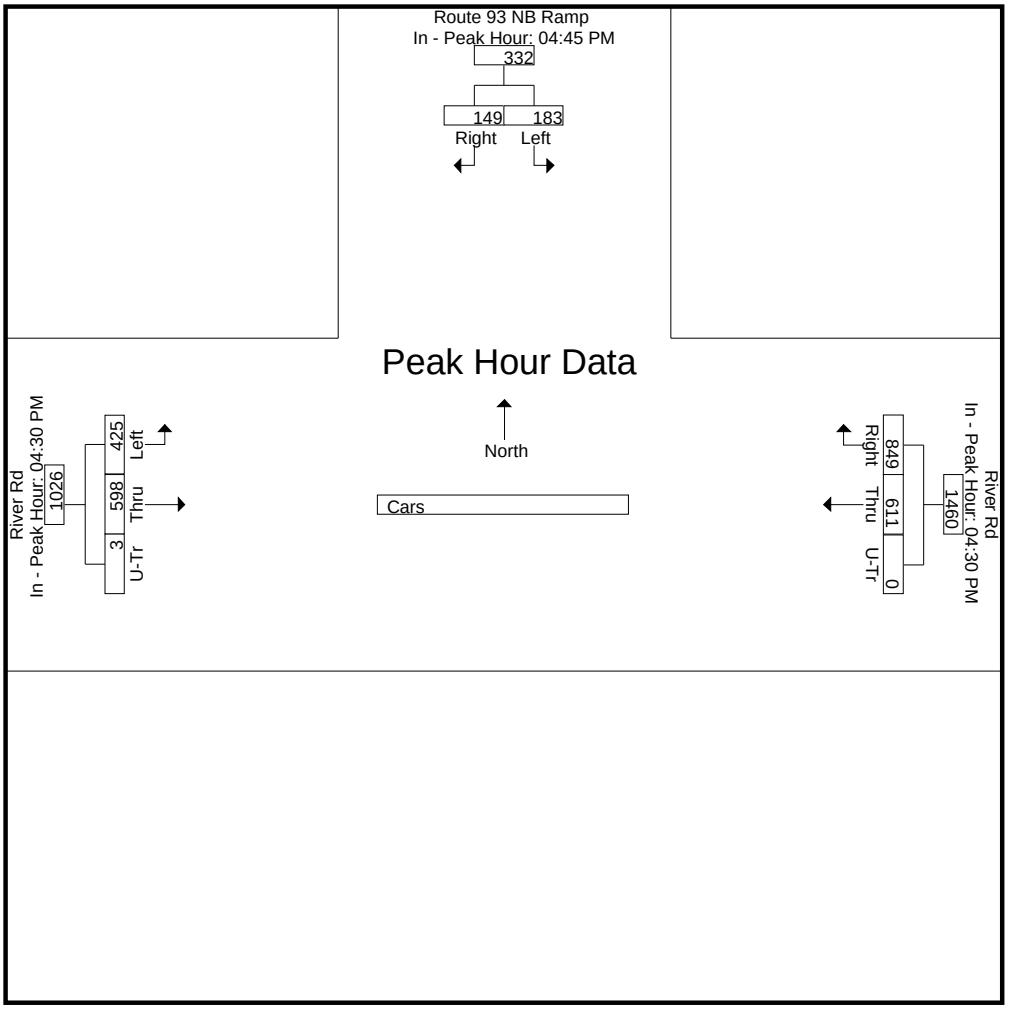
	04:45 PM			04:30 PM				04:30 PM			
+0 mins.	39	31	70	157	**240**	0	**397**	108	151	0	259
+15 mins.	**53**	38	91	137	202	0	339	89	138	0	227
+30 mins.	44	**48**	**92**	**170**	225	0	395	**123**	144	1	268
+45 mins.	47	32	79	147	182	0	329	105	**165**	**2**	**272**
Total Volume	183	149	332	611	849	0	1460	425	598	3	1026
% App. Total	55.1	44.9		41.8	58.2	0		41.4	58.3	0.3	
PHF	.863	.776	.902	.899	.884	.000	.919	.864	.906	.375	.943

Accurate Counts

978-664-2565

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022
Page No : 3



Accurate Counts

978-664-2565

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022

Groups Printed- Trucks

	Route 93 NB Ramp From North		River Rd From East			River Rd From West			
Start Time	Left	Right	Thru	Right	U-Tr	Left	Thru	U-Tr	Int. Total
04:00 PM	2	1	1	4	0	5	2	0	15
04:15 PM	2	1	3	7	0	0	5	0	18
04:30 PM	1	0	3	3	0	1	2	0	10
04:45 PM	2	0	3	4	0	1	5	0	15
Total	7	2	10	18	0	7	14	0	58
05:00 PM	3	1	6	1	0	0	3	0	14
05:15 PM	0	0	5	2	0	0	3	0	10
05:30 PM	0	1	2	4	0	0	2	0	9
05:45 PM	1	0	1	1	0	0	4	0	7
Total	4	2	14	8	0	0	12	0	40
Grand Total	11	4	24	26	0	7	26	0	98
Apprch %	73.3	26.7	48	52	0	21.2	78.8	0	
Total %	11.2	4.1	24.5	26.5	0	7.1	26.5	0	

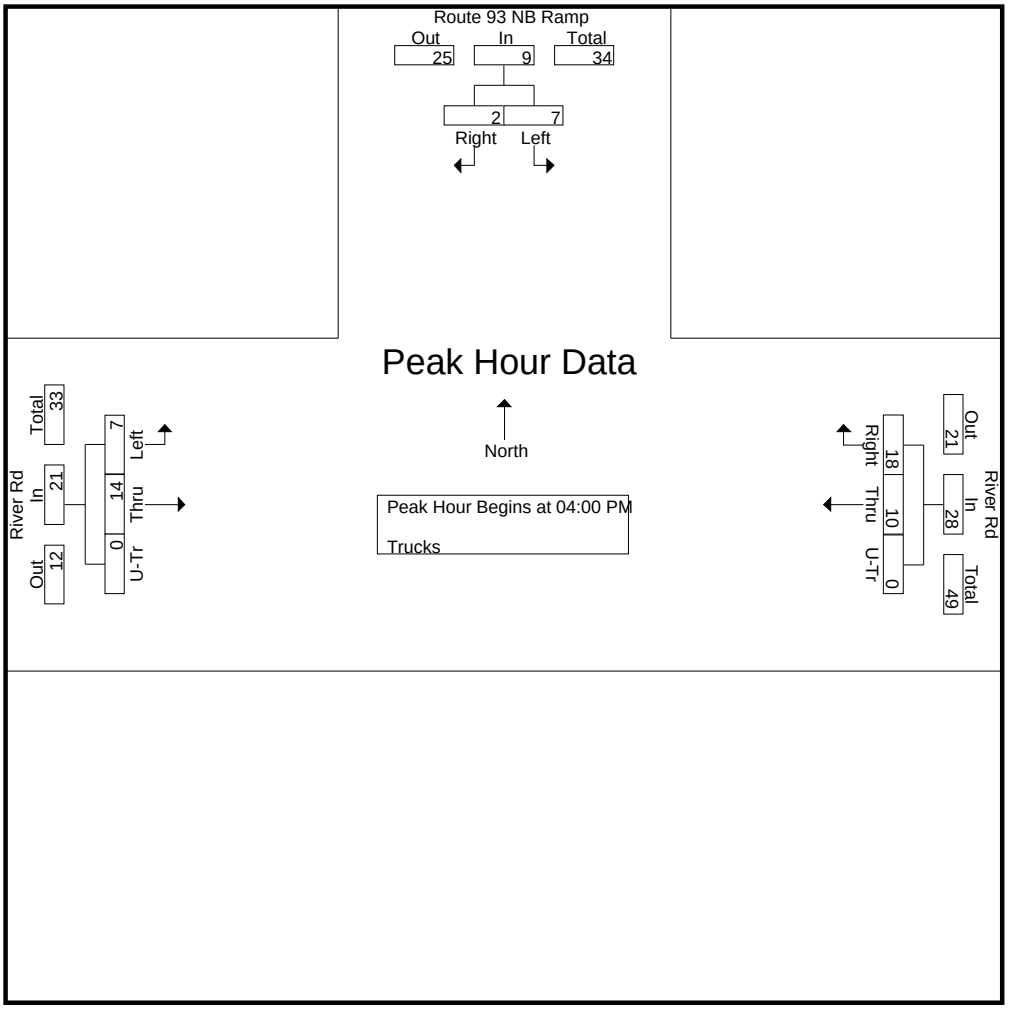
	Route 93 NB Ramp From North			River Rd From East				River Rd From West				
Start Time	Left	Right	App. Total	Thru	Right	U-Tr	App. Total	Left	Thru	U-Tr	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 04:00 PM												
04:00 PM	**2**	**1**	**3**	1	4	0	5	**5**	2	0	**7**	15
04:15 PM	2	1	3	**3**	**7**	0	**10**	0	**5**	0	5	**18**
04:30 PM	1	0	1	3	3	0	6	1	2	0	3	10
04:45 PM	2	0	2	3	4	0	7	1	5	0	6	15
Total Volume	7	2	9	10	18	0	28	7	14	0	21	58
% App. Total	77.8	22.2		35.7	64.3	0		33.3	66.7	0		
PHF	.875	.500	.750	.833	.643	.000	.700	.350	.700	.000	.750	.806

Accurate Counts

978-664-2565

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022
Page No : 2



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

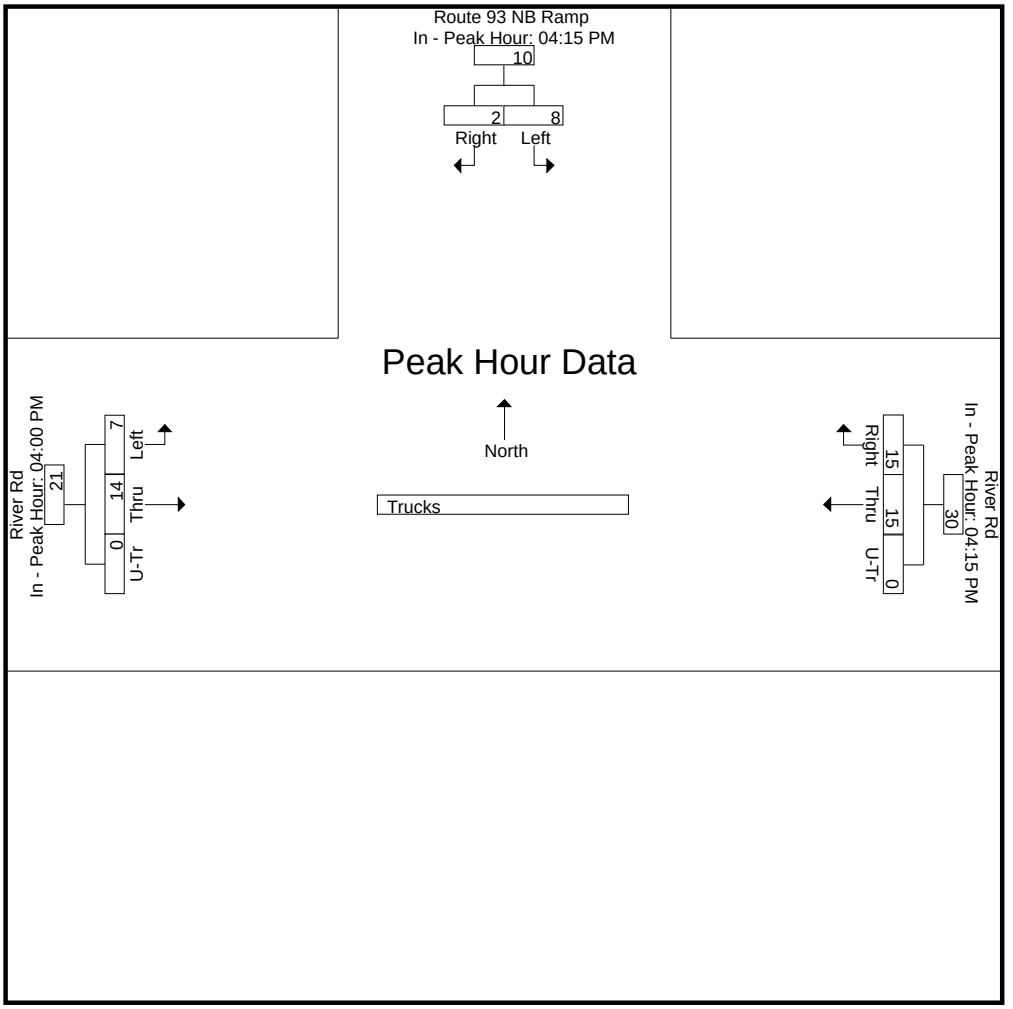
	04:15 PM			04:15 PM				04:00 PM			
+0 mins.	2	**1**	3	3	**7**	0	**10**	**5**	2	0	**7**
+15 mins.	1	0	1	3	3	0	6	0	**5**	0	5
+30 mins.	2	0	2	3	4	0	7	1	2	0	3
+45 mins.	**3**	1	**4**	**6**	1	0	7	1	5	0	6
Total Volume	8	2	10	15	15	0	30	7	14	0	21
% App. Total	80	20		50	50	0		33.3	66.7	0	
PHF	.667	.500	.625	.625	.536	.000	.750	.350	.700	.000	.750

Accurate Counts

978-664-2565

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022
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Accurate Counts

978-664-2565

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022

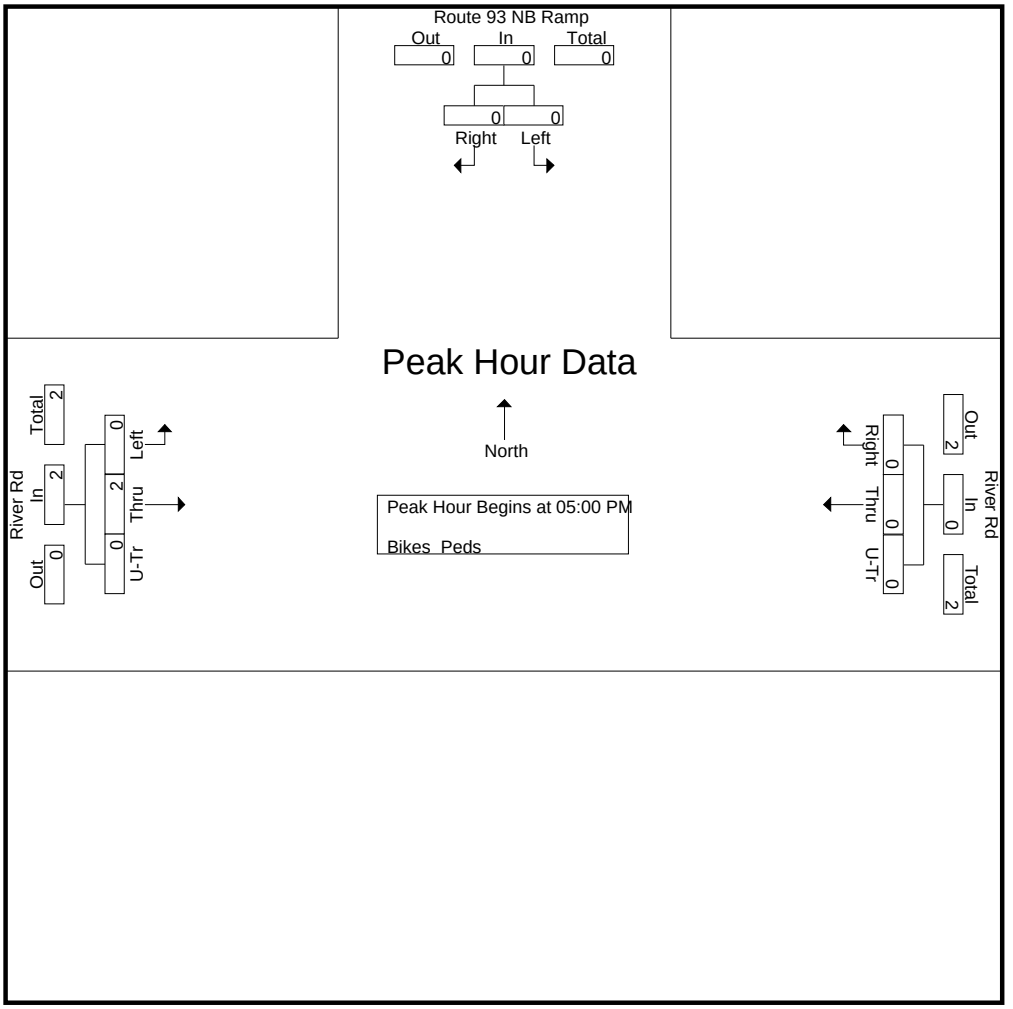
Groups Printed- Bikes Peds

	Route 93 NB Ramp From North			River Rd From East			River Rd From West					
Start Time	Left	Right	Peds	Thru	Right	Peds	Left	Thru	Peds	Exclu. Total	Inclu. Total	Int. Total
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	1	0	0	0	0	0	0	1	1
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	1	0	0	0	0	0	0	1	1
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	2	0	0	2	2
Total	0	0	0	0	0	0	0	2	0	0	2	2
Grand Total	0	0	0	1	0	0	0	2	0	0	3	3
Apprch %	0	0		100	0	0	0	100	0			
Total %	0	0		33.3	0	0	0	66.7	0	0	100	

	Route 93 NB Ramp From North			River Rd From East				River Rd From West				
Start Time	Left	Right	App. Total	Thru	Right	Peds	App. Total	Left	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 05:00 PM												
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	**2**	0	**2**	**2**
Total Volume	0	0	0	0	0	0	0	0	2	0	2	2
% App. Total	0	0		0	0	0		0	100	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.250	.000	.250	.250

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022
Page No : 2



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

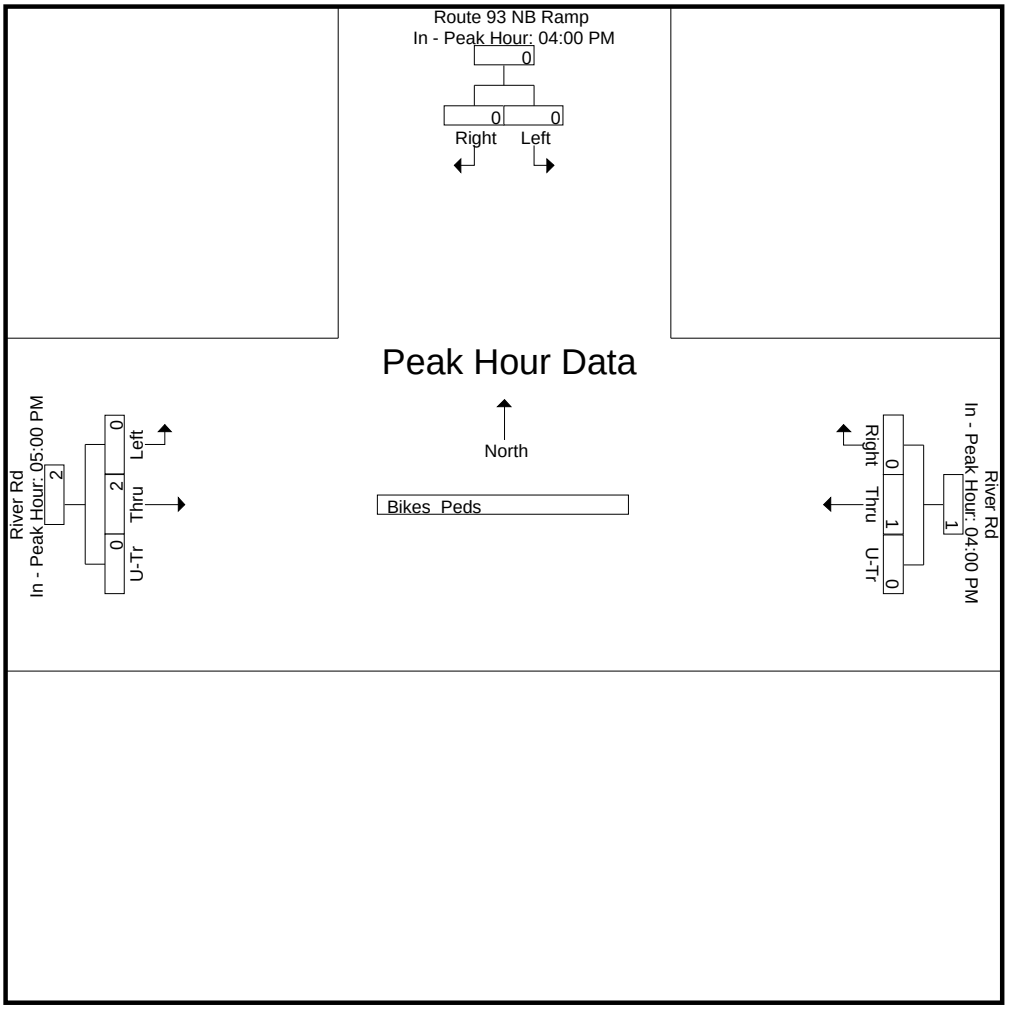
	04:00 PM			04:00 PM				05:00 PM			
+0 mins.	0	0	0	0	0	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	0	0	0	0	0	0
+30 mins.	0	0	0	**1**	0	0	**1**	0	0	0	0
+45 mins.	0	0	0	0	0	0	0	0	**2**	0	**2**
Total Volume	0	0	0	1	0	0	1	0	2	0	2
% App. Total	0	0		100	0	0		0	100	0	
PHF	.000	.000	.000	.250	.000	.000	.250	.000	.250	.000	.250

Accurate Counts

978-664-2565

N/S Street : Route 93 NB Ramp
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410004
Site Code : 91410004
Start Date : 5/11/2022
Page No : 3



Accurate Counts

978-664-2565

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022
Page No : 1

Groups Printed- Cars - Trucks

	Old River Rd From North			River Rd From East				Federal St From South			River Rd From West				
Start Time	Left	Thru	Right	Left	Thru	Right	U-Tr	Left	Thru	Right	Left	Thru	Right	U-Tr	Int. Total
07:00 AM	7	1	16	6	163	8	0	6	0	2	34	269	40	0	552
07:15 AM	14	7	13	3	161	6	0	14	0	1	37	301	48	0	605
07:30 AM	11	3	43	6	223	17	1	15	1	1	54	282	47	0	704
07:45 AM	19	2	38	9	188	28	2	13	0	1	89	231	65	0	685
Total	51	13	110	24	735	59	3	48	1	5	214	1083	200	0	2546
08:00 AM	18	5	20	17	173	49	0	7	1	0	106	180	52	0	628
08:15 AM	9	2	29	9	158	22	0	4	1	5	68	194	61	0	562
08:30 AM	8	5	28	7	135	16	1	8	0	4	52	150	49	0	463
08:45 AM	14	4	22	5	149	23	0	3	0	2	54	167	41	1	485
Total	49	16	99	38	615	110	1	22	2	11	280	691	203	1	2138
Grand Total	100	29	209	62	1350	169	4	70	3	16	494	1774	403	1	4684
Apprch %	29.6	8.6	61.8	3.9	85.2	10.7	0.3	78.7	3.4	18	18.5	66.4	15.1	0	
Total %	2.1	0.6	4.5	1.3	28.8	3.6	0.1	1.5	0.1	0.3	10.5	37.9	8.6	0	
Cars	94	29	199	61	1246	168	4	65	3	14	486	1684	398	1	4452
% Cars	94	100	95.2	98.4	92.3	99.4	100	92.9	100	87.5	98.4	94.9	98.8	100	95
Trucks	6	0	10	1	104	1	0	5	0	2	8	90	5	0	232
% Trucks	6	0	4.8	1.6	7.7	0.6	0	7.1	0	12.5	1.6	5.1	1.2	0	5

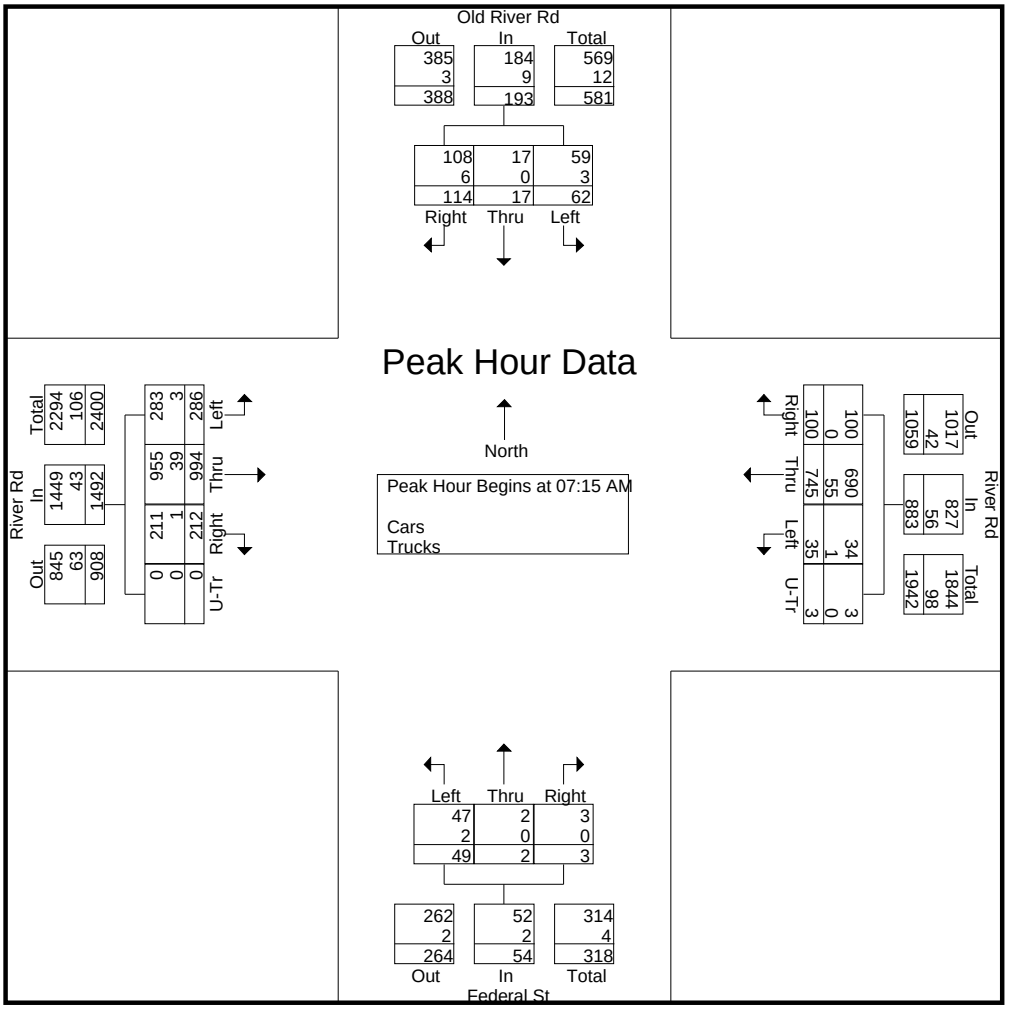
	Old River Rd From North				River Rd From East					Federal St From South				River Rd From West					
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	U-Tr	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	U-Tr	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																			
Peak Hour for Entire Intersection Begins at 07:15 AM																			
07:15 AM	14	**7**	13	34	3	161	6	0	170	14	0	**1**	15	37	**301**	48	0	**386**	605
07:30 AM	11	3	**43**	57	6	**223**	17	1	**247**	**15**	**1**	1	**17**	54	282	47	0	383	**704**
07:45 AM	**19**	2	38	**59**	9	188	28	**2**	227	13	0	1	14	89	231	**65**	0	385	685
08:00 AM	18	5	20	43	**17**	173	**49**	0	239	7	1	0	8	**106**	180	52	0	338	628
Total Volume	62	17	114	193	35	745	100	3	883	49	2	3	54	286	994	212	0	1492	2622
% App. Total	32.1	8.8	59.1		4	84.4	11.3	0.3		90.7	3.7	5.6		19.2	66.6	14.2	0		
PHF	.816	.607	.663	.818	.515	.835	.510	.375	.894	.817	.500	.750	.794	.675	.826	.815	.000	.966	.931
Cars	59	17	108	184	34	690	100	3	827	47	2	3	52	283	955	211	0	1449	2512
% Cars	95.2	100	94.7	95.3	97.1	92.6	100	100	93.7	95.9	100	100	96.3	99.0	96.1	99.5	0	97.1	95.8
Trucks	3	0	6	9	1	55	0	0	56	2	0	0	2	3	39	1	0	43	110
% Trucks	4.8	0	5.3	4.7	2.9	7.4	0	0	6.3	4.1	0	0	3.7	1.0	3.9	0.5	0	2.9	4.2

Accurate Counts

978-664-2565

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022
Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

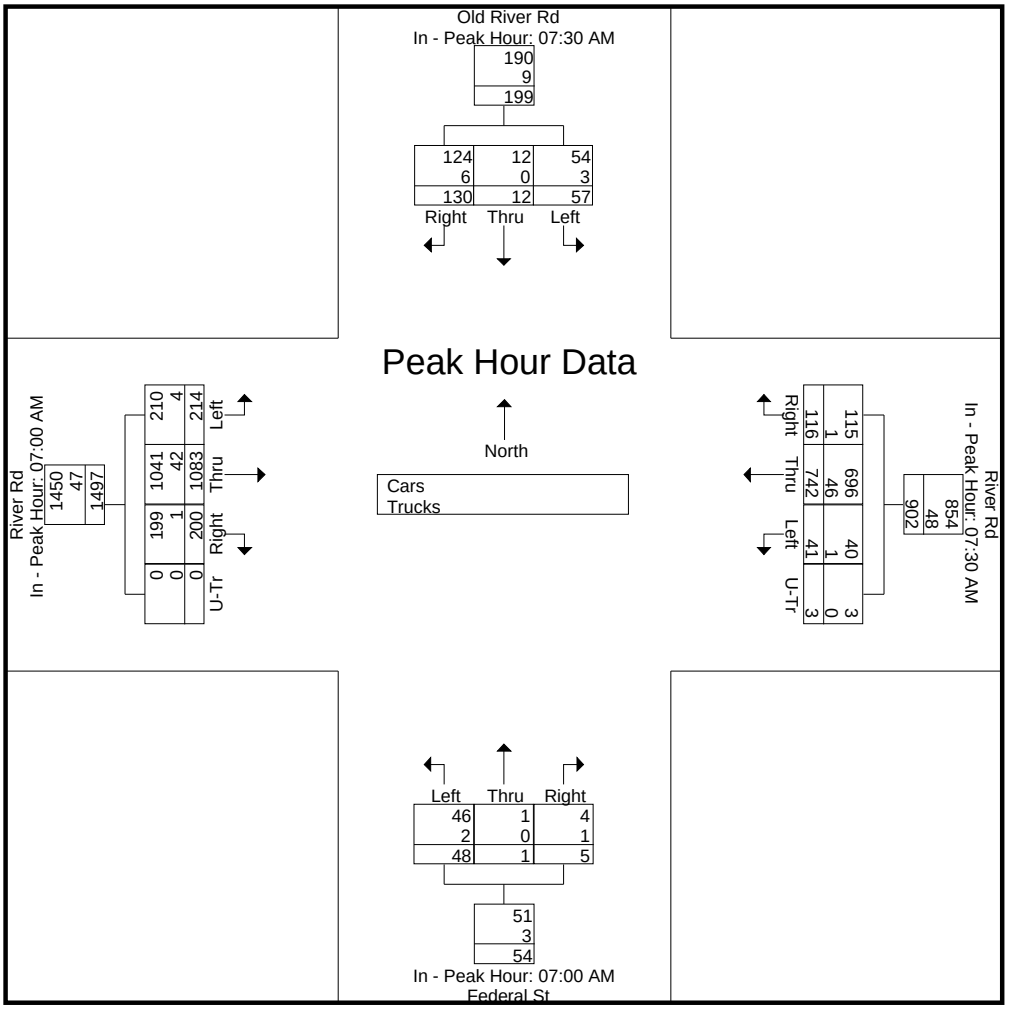
	07:30 AM				07:30 AM					07:00 AM				07:00 AM				
+0 mins.	11	3	**43**	57	6	**223**	17	1	**247**	6	0	**2**	8	34	269	40	0	343
+15 mins.	**19**	2	38	**59**	9	188	28	**2**	227	14	0	1	15	37	**301**	48	0	**386**
+30 mins.	18	**5**	20	43	**17**	173	**49**	0	239	**15**	**1**	1	**17**	54	282	47	0	383
+45 mins.	9	2	29	40	9	158	22	0	189	13	0	1	14	**89**	231	**65**	0	385
Total Volume	57	12	130	199	41	742	116	3	902	48	1	5	54	214	1083	200	0	1497
% App. Total	28.6	6	65.3		4.5	82.3	12.9	0.3		88.9	1.9	9.3		14.3	72.3	13.4	0	
PHF	.750	.600	.756	.843	.603	.832	.592	.375	.913	.800	.250	.625	.794	.601	.900	.769	.000	.970
Cars	54	12	124	190	40	696	115	3	854	46	1	4	51	210	1041	199	0	1450
% Cars	94.7	100	95.4	95.5	97.6	93.8	99.1	100	94.7	95.8	100	80	94.4	98.1	96.1	99.5	0	96.9
Trucks	3	0	6	9	1	46	1	0	48	2	0	1	3	4	42	1	0	47
% Trucks	5.3	0	4.6	4.5	2.4	6.2	0.9	0	5.3	4.2	0	20	5.6	1.9	3.9	0.5	0	3.1

Accurate Counts

978-664-2565

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022
Page No : 3



Accurate Counts

978-664-2565

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022
Page No : 1

Groups Printed- Cars

	Old River Rd From North			River Rd From East				Federal St From South			River Rd From West				
Start Time	Left	Thru	Right	Left	Thru	Right	U-Tr	Left	Thru	Right	Left	Thru	Right	U-Tr	Int. Total
07:00 AM	6	1	16	6	150	8	0	6	0	1	32	253	40	0	519
07:15 AM	13	7	12	3	143	6	0	12	0	1	36	291	48	0	572
07:30 AM	10	3	40	6	213	17	1	15	1	1	53	275	47	0	682
07:45 AM	19	2	37	9	171	28	2	13	0	1	89	222	64	0	657
Total	48	13	105	24	677	59	3	46	1	4	210	1041	199	0	2430
08:00 AM	17	5	19	16	163	49	0	7	1	0	105	167	52	0	601
08:15 AM	8	2	28	9	149	21	0	3	1	5	66	175	60	0	527
08:30 AM	8	5	26	7	127	16	1	7	0	3	52	146	48	0	446
08:45 AM	13	4	21	5	130	23	0	2	0	2	53	155	39	1	448
Total	46	16	94	37	569	109	1	19	2	10	276	643	199	1	2022
Grand Total	94	29	199	61	1246	168	4	65	3	14	486	1684	398	1	4452
Apprch %	29.2	9	61.8	4.1	84.2	11.4	0.3	79.3	3.7	17.1	18.9	65.6	15.5	0	
Total %	2.1	0.7	4.5	1.4	28	3.8	0.1	1.5	0.1	0.3	10.9	37.8	8.9	0	

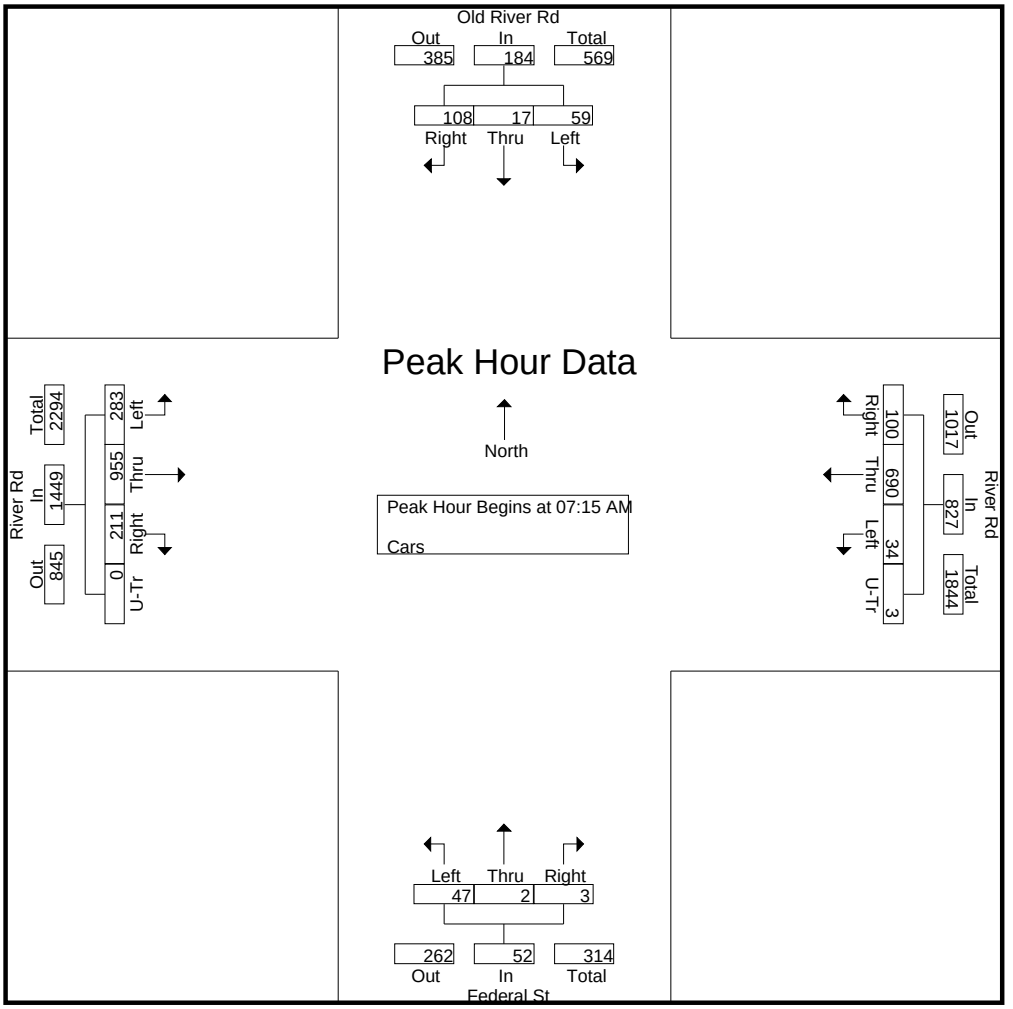
	Old River Rd From North				River Rd From East					Federal St From South				River Rd From West					
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	U-Tr	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	U-Tr	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																			
Peak Hour for Entire Intersection Begins at 07:15 AM																			
07:15 AM	13	**7**	12	32	3	143	6	0	152	12	0	**1**	13	36	**291**	48	0	**375**	572
07:30 AM	10	3	**40**	53	6	**213**	17	1	**237**	**15**	**1**	1	**17**	53	275	47	0	375	**682**
07:45 AM	**19**	2	37	**58**	9	171	28	**2**	210	13	0	1	14	89	222	**64**	0	375	657
08:00 AM	17	5	19	41	**16**	163	**49**	0	228	7	1	0	8	**105**	167	52	0	324	601
Total Volume	59	17	108	184	34	690	100	3	827	47	2	3	52	283	955	211	0	1449	2512
% App. Total	32.1	9.2	58.7		4.1	83.4	12.1	0.4		90.4	3.8	5.8		19.5	65.9	14.6	0		
PHF	.776	.607	.675	.793	.531	.810	.510	.375	.872	.783	.500	.750	.765	.674	.820	.824	.000	.966	.921

Accurate Counts

978-664-2565

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022
Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

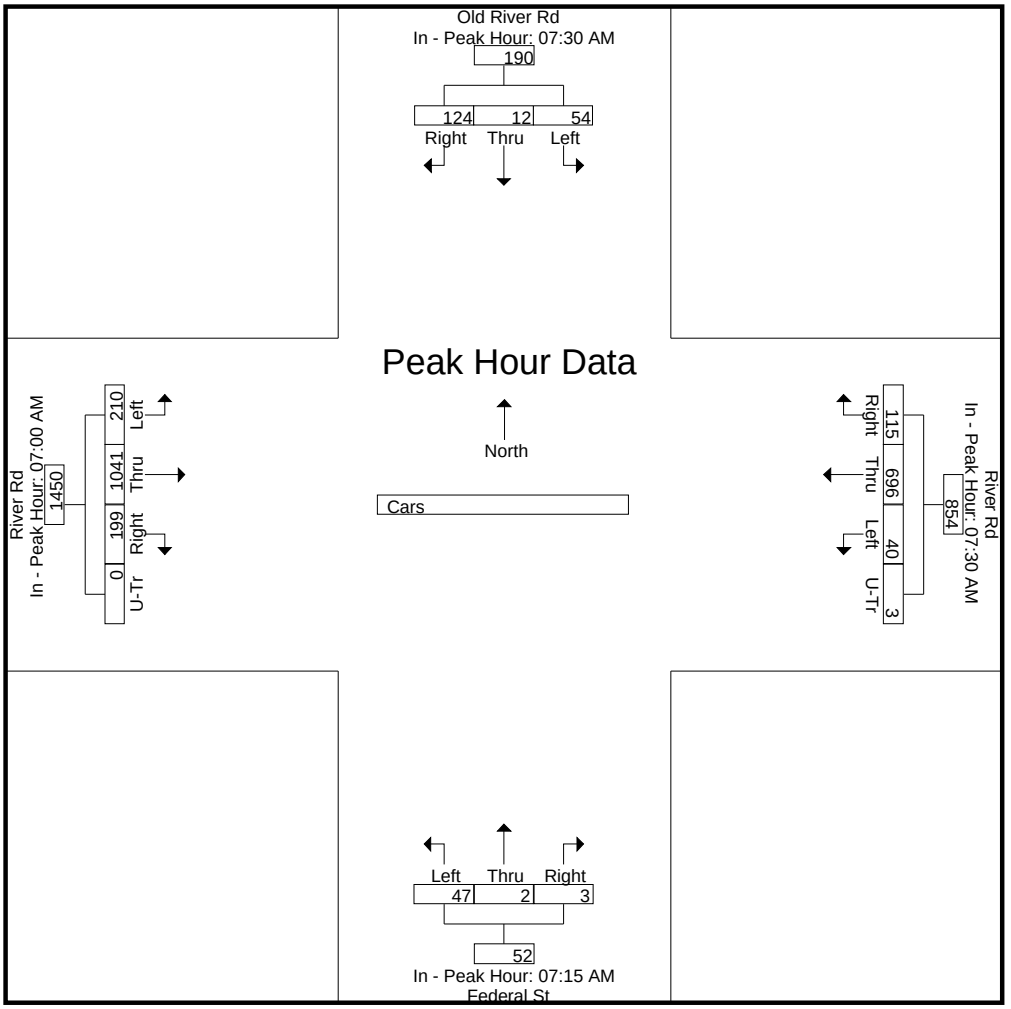
	07:30 AM				07:30 AM					07:15 AM				07:00 AM				
+0 mins.	10	3	**40**	53	6	**213**	17	1	**237**	12	0	**1**	13	32	253	40	0	325
+15 mins.	**19**	2	37	**58**	9	171	28	**2**	210	**15**	**1**	1	**17**	36	**291**	48	0	**375**
+30 mins.	17	**5**	19	41	**16**	163	**49**	0	228	13	0	1	14	53	275	47	0	375
+45 mins.	8	2	28	38	9	149	21	0	179	7	1	0	8	**89**	222	**64**	0	375
Total Volume	54	12	124	190	40	696	115	3	854	47	2	3	52	210	1041	199	0	1450
% App. Total	28.4	6.3	65.3		4.7	81.5	13.5	0.4		90.4	3.8	5.8		14.5	71.8	13.7	0	
PHF	.711	.600	.775	.819	.625	.817	.587	.375	.901	.783	.500	.750	.765	.590	.894	.777	.000	.967

Accurate Counts

978-664-2565

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022
Page No : 3



Accurate Counts

978-664-2565

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022

Groups Printed- Trucks

	Old River Rd From North			River Rd From East				Federal St From South			River Rd From West				
Start Time	Left	Thru	Right	Left	Thru	Right	U-Tr	Left	Thru	Right	Left	Thru	Right	U-Tr	Int. Total
07:00 AM	1	0	0	0	13	0	0	0	0	1	2	16	0	0	33
07:15 AM	1	0	1	0	18	0	0	2	0	0	1	10	0	0	33
07:30 AM	1	0	3	0	10	0	0	0	0	0	1	7	0	0	22
07:45 AM	0	0	1	0	17	0	0	0	0	0	0	9	1	0	28
Total	3	0	5	0	58	0	0	2	0	1	4	42	1	0	116
08:00 AM	1	0	1	1	10	0	0	0	0	0	1	13	0	0	27
08:15 AM	1	0	1	0	9	1	0	1	0	0	2	19	1	0	35
08:30 AM	0	0	2	0	8	0	0	1	0	1	0	4	1	0	17
08:45 AM	1	0	1	0	19	0	0	1	0	0	1	12	2	0	37
Total	3	0	5	1	46	1	0	3	0	1	4	48	4	0	116
Grand Total	6	0	10	1	104	1	0	5	0	2	8	90	5	0	232
Apprch %	37.5	0	62.5	0.9	98.1	0.9	0	71.4	0	28.6	7.8	87.4	4.9	0	
Total %	2.6	0	4.3	0.4	44.8	0.4	0	2.2	0	0.9	3.4	38.8	2.2	0	

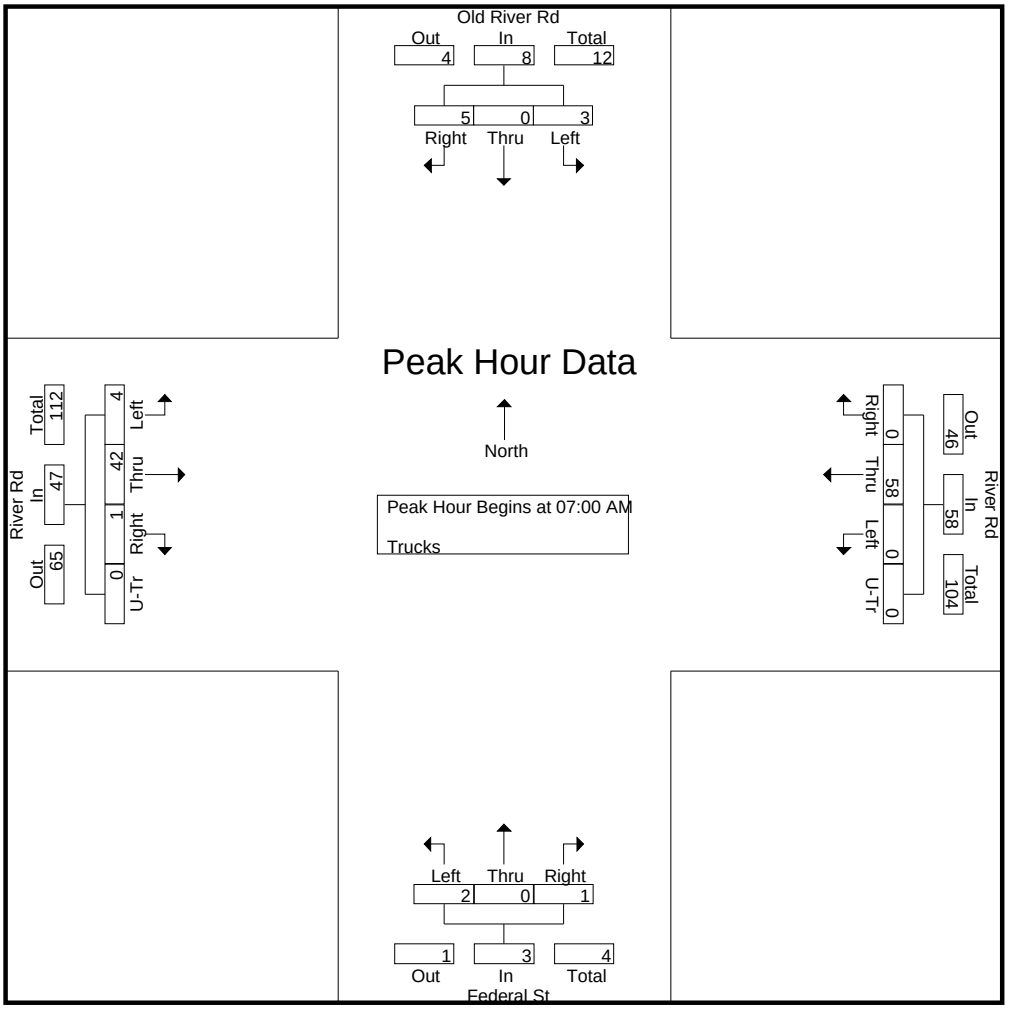
	Old River Rd From North				River Rd From East					Federal St From South				River Rd From West					
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	U-Tr	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	U-Tr	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																			
Peak Hour for Entire Intersection Begins at 07:00 AM																			
07:00 AM	**1**	0	0	1	0	13	0	0	13	0	0	**1**	1	**2**	**16**	0	0	**18**	**33**
07:15 AM	1	0	1	2	0	**18**	0	0	**18**	**2**	0	0	**2**	1	10	0	0	11	33
07:30 AM	1	0	**3**	**4**	0	10	0	0	10	0	0	0	0	1	7	0	0	8	22
07:45 AM	0	0	1	1	0	17	0	0	17	0	0	0	0	0	9	**1**	0	10	28
Total Volume	3	0	5	8	0	58	0	0	58	2	0	1	3	4	42	1	0	47	116
% App. Total	37.5	0	62.5		0	100	0	0		66.7	0	33.3		8.5	89.4	2.1	0		
PHF	.750	.000	.417	.500	.000	.806	.000	.000	.806	.250	.000	.250	.375	.500	.656	.250	.000	.653	.879

Accurate Counts

978-664-2565

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022
Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

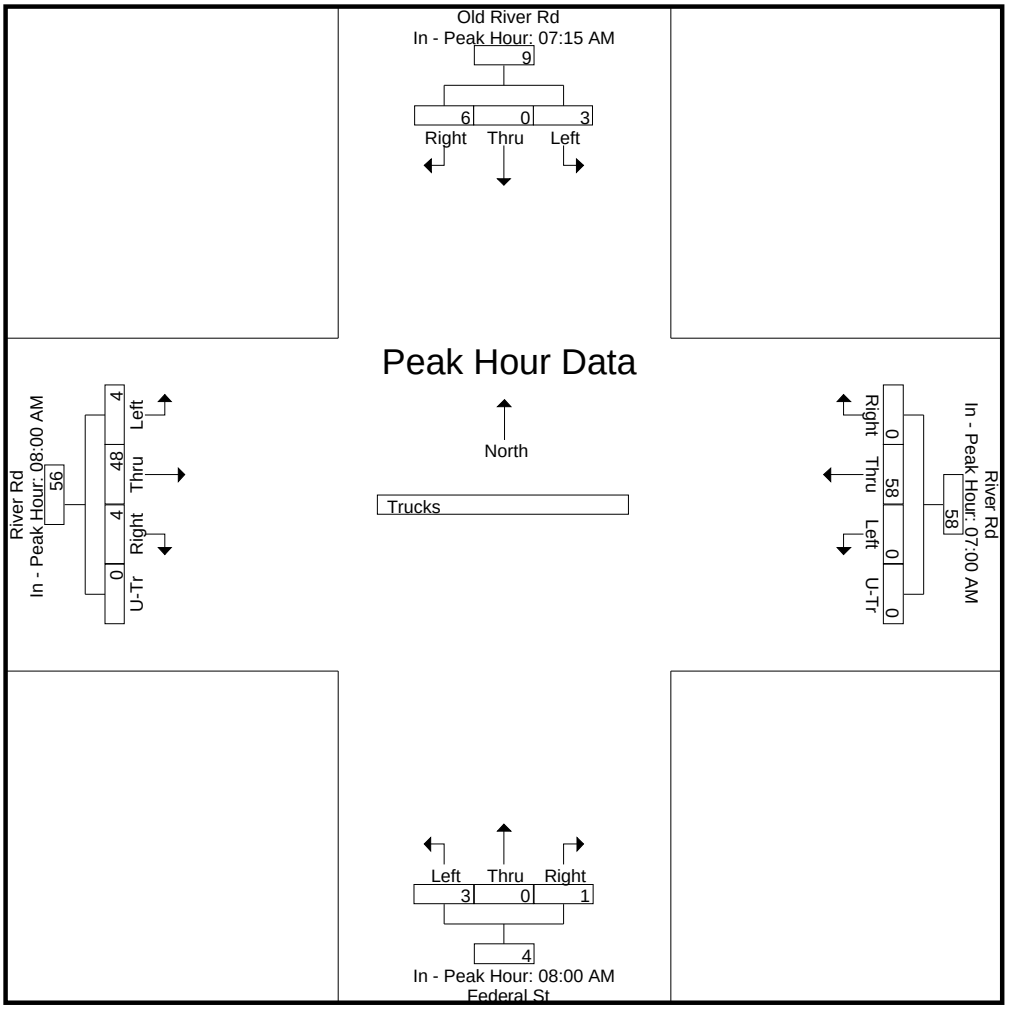
	07:15 AM				07:00 AM					08:00 AM				08:00 AM				
+0 mins.	**1**	0	1	2	0	13	0	0	13	0	0	0	0	1	13	0	0	14
+15 mins.	1	0	**3**	**4**	0	**18**	0	0	**18**	**1**	0	0	1	**2**	**19**	1	0	**22**
+30 mins.	0	0	1	1	0	10	0	0	10	1	0	**1**	**2**	0	4	1	0	5
+45 mins.	1	0	1	2	0	17	0	0	17	1	0	0	1	1	12	**2**	0	15
Total Volume	3	0	6	9	0	58	0	0	58	3	0	1	4	4	48	4	0	56
% App. Total	33.3	0	66.7		0	100	0	0		75	0	25		7.1	85.7	7.1	0	
PHF	.750	.000	.500	.563	.000	.806	.000	.000	.806	.750	.000	.250	.500	.500	.632	.500	.000	.636

Accurate Counts

978-664-2565

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022
Page No : 3



Accurate Counts

978-664-2565

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022
Page No : 1

Groups Printed- Bikes Peds

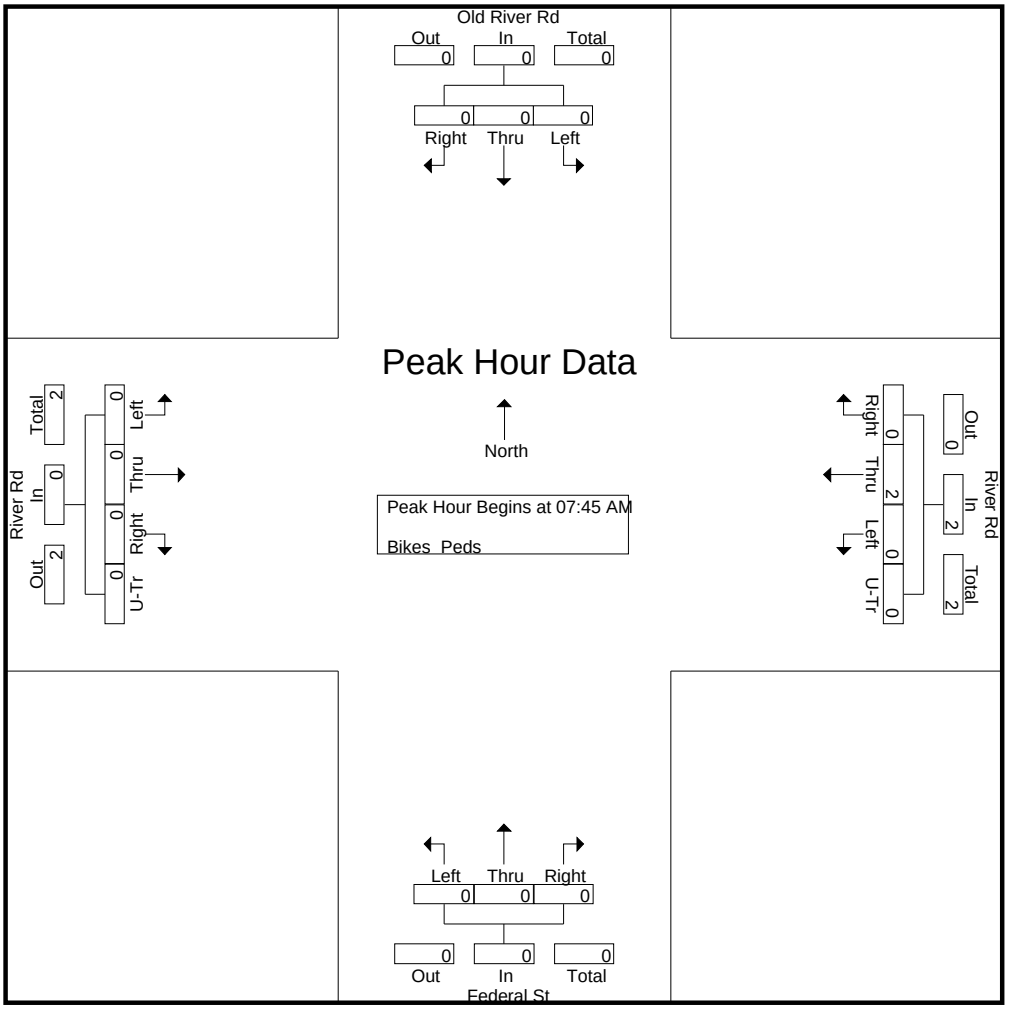
	Old River Rd From North				River Rd From East				Federal St From South				River Rd From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	1	2
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	1	2	3
Grand Total	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	1	2	3
Apprch %	0	0	0		0	100	0	0	0	0	0		0	0	0	0			
Total %	0	0	0		0	100	0	0	0	0	0		0	0	0	0	33.3	66.7	

	Old River Rd From North				River Rd From East					Federal St From South				River Rd From West						
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																			
Peak Hour for Entire Intersection Begins at 07:45 AM																			
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	**1**	0	0	**1**	0	0	0	0	0	0	0	0	0	**1**
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1
Total Volume	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	2
% App. Total	0	0	0		0	100	0	0		0	0	0		0	0	0	0		
PHF	.000	.000	.000	.000	.000	.500	.000	.000	.500	.000	.000	.000	.000	.000	.000	.000	.000	.000	.500

Accurate Counts
978-664-2565

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

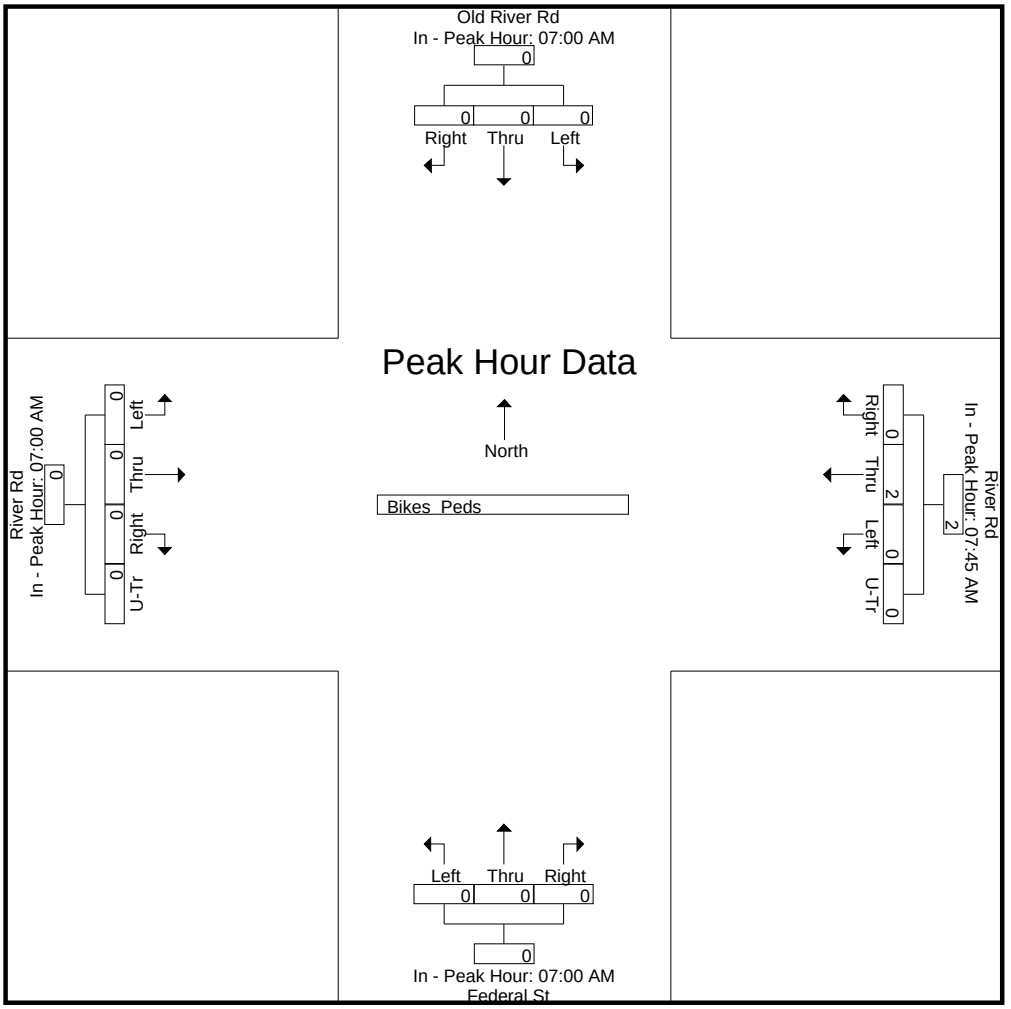
	07:00 AM				07:45 AM					07:00 AM				07:00 AM				
+0 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	**1**	0	0	**1**	0	0	0	0	0	0	0	0	0
+30 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+45 mins.	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0		0	100	0	0		0	0	0		0	0	0	0	
PHF	.000	.000	.000	.000	.000	.500	.000	.000	.500	.000	.000	.000	.000	.000	.000	.000	.000	.000

Accurate Counts

978-664-2565

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022
Page No : 3



Accurate Counts

978-664-2565

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022

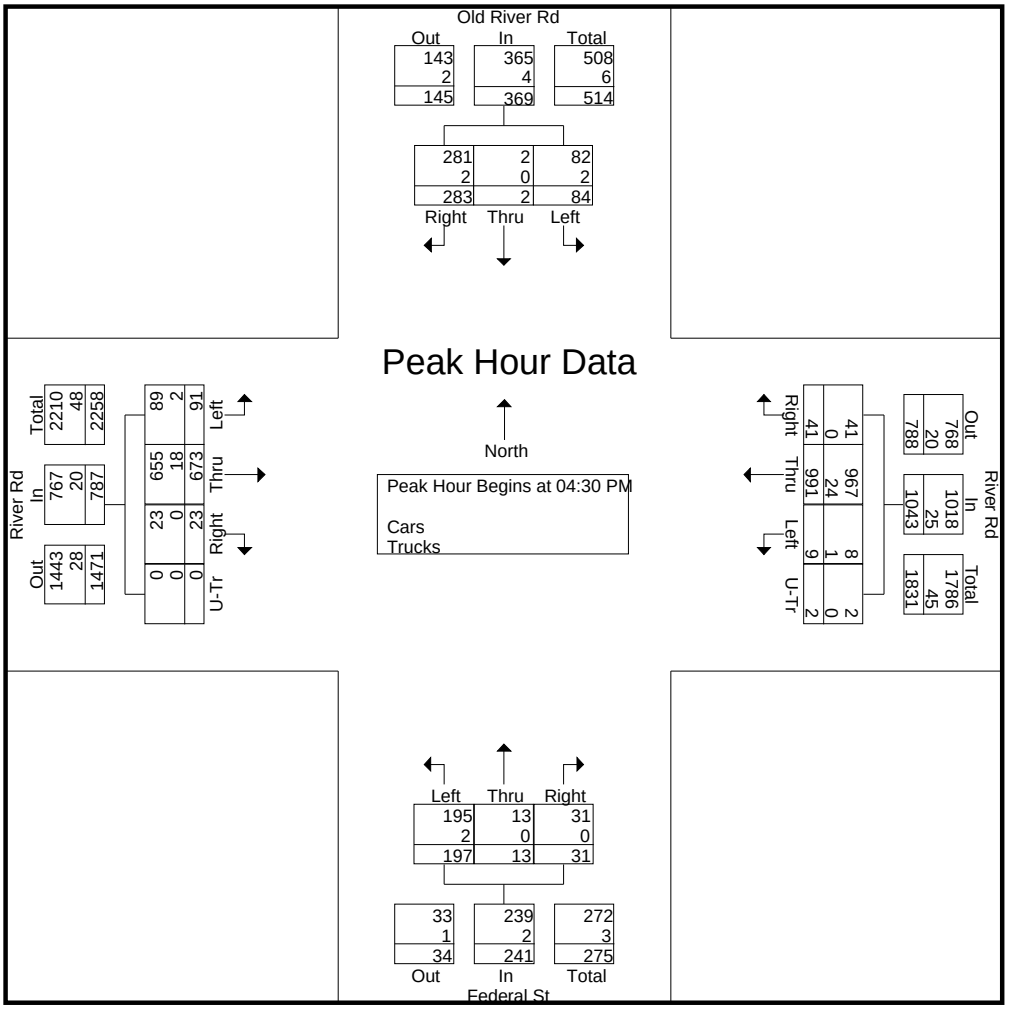
Groups Printed- Cars - Trucks

	Old River Rd From North			River Rd From East				Federal St From South			River Rd From West				
Start Time	Left	Thru	Right	Left	Thru	Right	U-Tr	Left	Thru	Right	Left	Thru	Right	U-Tr	Int. Total
04:00 PM	13	1	47	2	240	12	0	47	0	8	23	156	5	0	554
04:15 PM	7	2	56	4	178	13	2	45	2	7	21	154	6	0	497
04:30 PM	33	1	112	3	238	18	1	46	9	7	22	171	2	0	663
04:45 PM	15	0	39	1	245	14	0	58	1	6	22	153	6	0	560
Total	68	4	254	10	901	57	3	196	12	28	88	634	19	0	2274
05:00 PM	24	0	70	4	288	6	0	52	2	10	25	165	11	0	657
05:15 PM	12	1	62	1	220	3	1	41	1	8	22	184	4	0	560
05:30 PM	16	0	37	3	232	6	0	38	2	8	16	165	2	0	525
05:45 PM	12	0	42	0	175	7	0	32	3	1	14	180	0	2	468
Total	64	1	211	8	915	22	1	163	8	27	77	694	17	2	2210
Grand Total	132	5	465	18	1816	79	4	359	20	55	165	1328	36	2	4484
Apprch %	21.9	0.8	77.2	0.9	94.7	4.1	0.2	82.7	4.6	12.7	10.8	86.7	2.4	0.1	
Total %	2.9	0.1	10.4	0.4	40.5	1.8	0.1	8	0.4	1.2	3.7	29.6	0.8	0	
Cars	128	5	462	17	1770	79	4	357	20	55	157	1300	36	2	4392
% Cars	97	100	99.4	94.4	97.5	100	100	99.4	100	100	95.2	97.9	100	100	97.9
Trucks	4	0	3	1	46	0	0	2	0	0	8	28	0	0	92
% Trucks	3	0	0.6	5.6	2.5	0	0	0.6	0	0	4.8	2.1	0	0	2.1

	Old River Rd From North				River Rd From East					Federal St From South				River Rd From West					
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	U-Tr	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	U-Tr	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																			
Peak Hour for Entire Intersection Begins at 04:30 PM																			
04:30 PM	**33**	**1**	**112**	**146**	3	238	**18**	**1**	260	46	**9**	7	62	22	171	2	0	195	**663**
04:45 PM	15	0	39	54	1	245	14	0	260	**58**	1	6	**65**	22	153	6	0	181	560
05:00 PM	24	0	70	94	**4**	**288**	6	0	**298**	52	2	**10**	64	**25**	165	**11**	0	201	657
05:15 PM	12	1	62	75	1	220	3	1	225	41	1	8	50	22	**184**	4	0	**210**	560
Total Volume	84	2	283	369	9	991	41	2	1043	197	13	31	241	91	673	23	0	787	2440
% App. Total	22.8	0.5	76.7		0.9	95	3.9	0.2		81.7	5.4	12.9		11.6	85.5	2.9	0		
PHF	.636	.500	.632	.632	.563	.860	.569	.500	.875	.849	.361	.775	.927	.910	.914	.523	.000	.937	.920
Cars	82	2	281	365	8	967	41	2	1018	195	13	31	239	89	655	23	0	767	2389
% Cars	97.6	100	99.3	98.9	88.9	97.6	100	100	97.6	99.0	100	100	99.2	97.8	97.3	100	0	97.5	97.9
Trucks	2	0	2	4	1	24	0	0	25	2	0	0	2	2	18	0	0	20	51
% Trucks	2.4	0	0.7	1.1	11.1	2.4	0	0	2.4	1.0	0	0	0.8	2.2	2.7	0	0	2.5	2.1

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022
Page No : 2



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

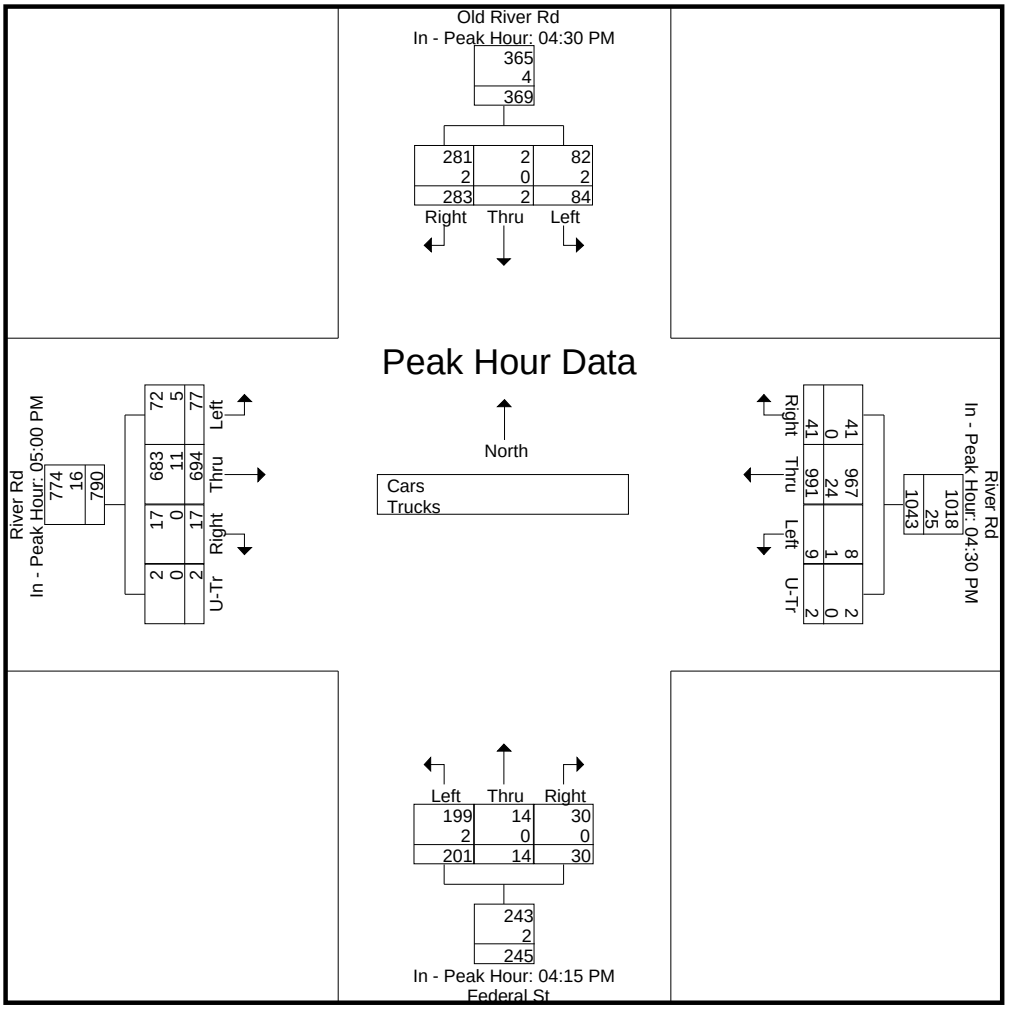
	04:30 PM				04:30 PM					04:15 PM				05:00 PM				
+0 mins.	**33**	**1**	**112**	**146**	3	238	**18**	**1**	260	45	2	7	54	**25**	165	**11**	0	201
+15 mins.	15	0	39	54	1	245	14	0	260	46	**9**	7	62	22	**184**	4	0	**210**
+30 mins.	24	0	70	94	**4**	**288**	6	0	**298**	**58**	1	6	**65**	16	165	2	0	183
+45 mins.	12	1	62	75	1	220	3	1	225	52	2	**10**	64	14	180	0	**2**	196
Total Volume	84	2	283	369	9	991	41	2	1043	201	14	30	245	77	694	17	2	790
% App. Total	22.8	0.5	76.7		0.9	95	3.9	0.2		82	5.7	12.2		9.7	87.8	2.2	0.3	
PHF	.636	.500	.632	.632	.563	.860	.569	.500	.875	.866	.389	.750	.942	.770	.943	.386	.250	.940
Cars	82	2	281	365	8	967	41	2	1018	199	14	30	243	72	683	17	2	774
% Cars	97.6	100	99.3	98.9	88.9	97.6	100	100	97.6	99	100	100	99.2	93.5	98.4	100	100	98
Trucks	2	0	2	4	1	24	0	0	25	2	0	0	2	5	11	0	0	16
% Trucks	2.4	0	0.7	1.1	11.1	2.4	0	0	2.4	1	0	0	0.8	6.5	1.6	0	0	2

Accurate Counts

978-664-2565

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022
Page No : 3



Accurate Counts

978-664-2565

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022
Page No : 1

Groups Printed- Cars

	Old River Rd From North			River Rd From East				Federal St From South			River Rd From West				
Start Time	Left	Thru	Right	Left	Thru	Right	U-Tr	Left	Thru	Right	Left	Thru	Right	U-Tr	Int. Total
04:00 PM	12	1	47	2	233	12	0	47	0	8	22	153	5	0	542
04:15 PM	7	2	55	4	171	13	2	45	2	7	20	150	6	0	484
04:30 PM	32	1	112	2	232	18	1	46	9	7	22	167	2	0	651
04:45 PM	15	0	39	1	238	14	0	57	1	6	21	147	6	0	545
Total	66	4	253	9	874	57	3	195	12	28	85	617	19	0	2222
05:00 PM	23	0	69	4	283	6	0	51	2	10	24	160	11	0	643
05:15 PM	12	1	61	1	214	3	1	41	1	8	22	181	4	0	550
05:30 PM	15	0	37	3	226	6	0	38	2	8	15	164	2	0	516
05:45 PM	12	0	42	0	173	7	0	32	3	1	11	178	0	2	461
Total	62	1	209	8	896	22	1	162	8	27	72	683	17	2	2170
Grand Total	128	5	462	17	1770	79	4	357	20	55	157	1300	36	2	4392
Apprch %	21.5	0.8	77.6	0.9	94.7	4.2	0.2	82.6	4.6	12.7	10.5	87	2.4	0.1	
Total %	2.9	0.1	10.5	0.4	40.3	1.8	0.1	8.1	0.5	1.3	3.6	29.6	0.8	0	

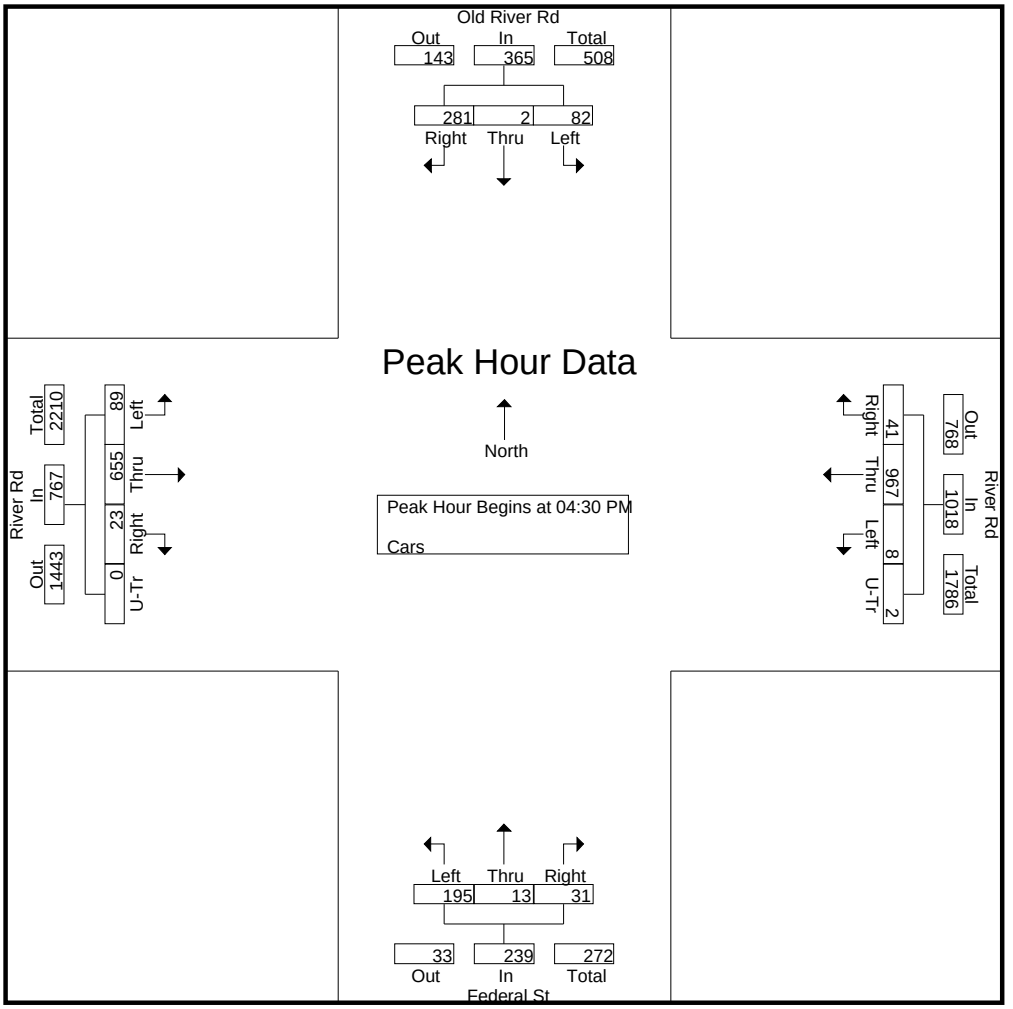
	Old River Rd From North				River Rd From East					Federal St From South				River Rd From West					
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	U-Tr	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	U-Tr	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																			
Peak Hour for Entire Intersection Begins at 04:30 PM																			
04:30 PM	**32**	**1**	**112**	**145**	2	232	**18**	**1**	253	46	**9**	7	62	22	167	2	0	191	**651**
04:45 PM	15	0	39	54	1	238	14	0	253	**57**	1	6	**64**	21	147	6	0	174	545
05:00 PM	23	0	69	92	**4**	**283**	6	0	**293**	51	2	**10**	63	**24**	160	**11**	0	195	643
05:15 PM	12	1	61	74	1	214	3	1	219	41	1	8	50	22	**181**	4	0	**207**	550
Total Volume	82	2	281	365	8	967	41	2	1018	195	13	31	239	89	655	23	0	767	2389
% App. Total	22.5	0.5	77		0.8	95	4	0.2		81.6	5.4	13		11.6	85.4	3	0		
PHF	.641	.500	.627	.629	.500	.854	.569	.500	.869	.855	.361	.775	.934	.927	.905	.523	.000	.926	.917

Accurate Counts

978-664-2565

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022
Page No : 2



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

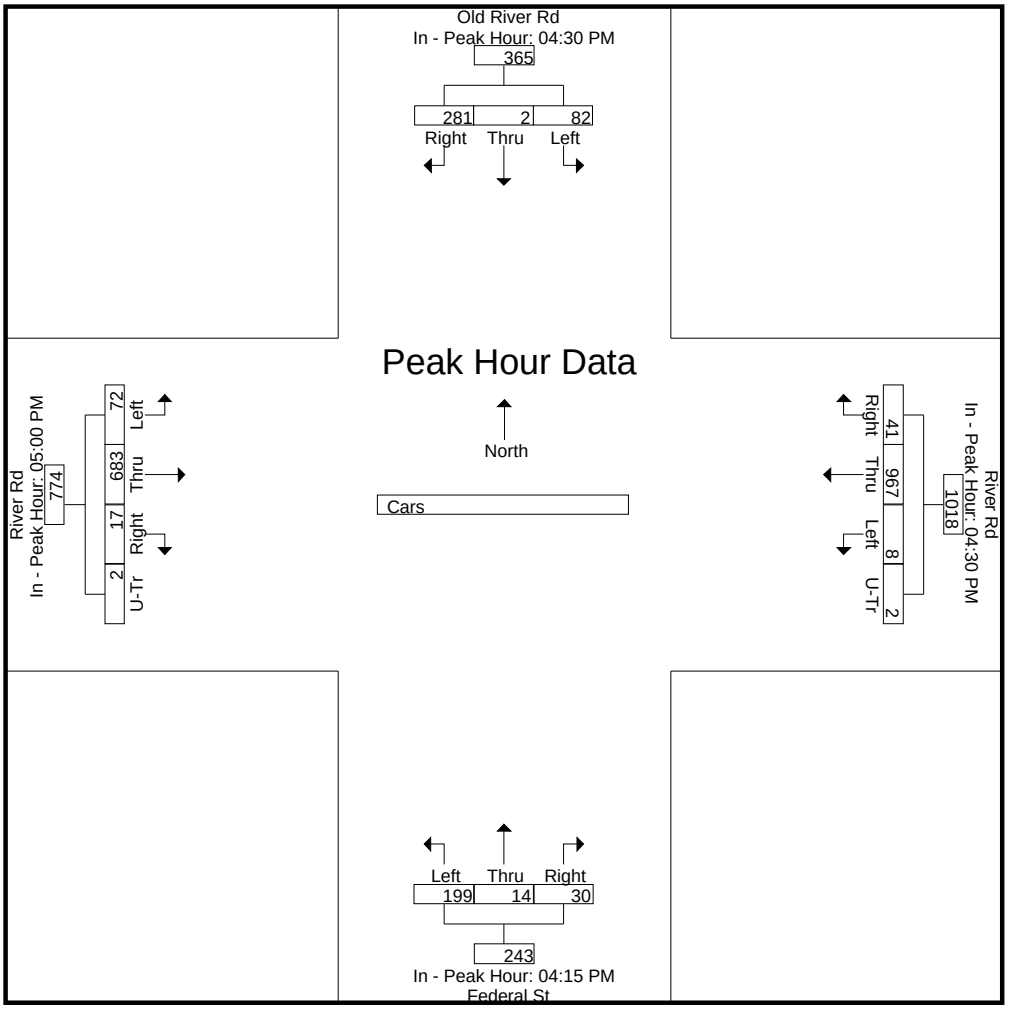
	04:30 PM				04:30 PM					04:15 PM				05:00 PM				
+0 mins.	**32**	**1**	**112**	**145**	2	232	**18**	**1**	253	45	2	7	54	**24**	160	**11**	0	195
+15 mins.	15	0	39	54	1	238	14	0	253	46	**9**	7	62	22	**181**	4	0	**207**
+30 mins.	23	0	69	92	**4**	**283**	6	0	**293**	**57**	1	6	**64**	15	164	2	0	181
+45 mins.	12	1	61	74	1	214	3	1	219	51	2	**10**	63	11	178	0	**2**	191
Total Volume	82	2	281	365	8	967	41	2	1018	199	14	30	243	72	683	17	2	774
% App. Total	22.5	0.5	77		0.8	95	4	0.2		81.9	5.8	12.3		9.3	88.2	2.2	0.3	
PHF	.641	.500	.627	.629	.500	.854	.569	.500	.869	.873	.389	.750	.949	.750	.943	.386	.250	.935

Accurate Counts

978-664-2565

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022
Page No : 3



Accurate Counts

978-664-2565

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022

Groups Printed- Trucks

	Old River Rd From North			River Rd From East				Federal St From South			River Rd From West				
Start Time	Left	Thru	Right	Left	Thru	Right	U-Tr	Left	Thru	Right	Left	Thru	Right	U-Tr	Int. Total
04:00 PM	1	0	0	0	7	0	0	0	0	0	1	3	0	0	12
04:15 PM	0	0	1	0	7	0	0	0	0	0	1	4	0	0	13
04:30 PM	1	0	0	1	6	0	0	0	0	0	0	4	0	0	12
04:45 PM	0	0	0	0	7	0	0	1	0	0	1	6	0	0	15
Total	2	0	1	1	27	0	0	1	0	0	3	17	0	0	52
05:00 PM	1	0	1	0	5	0	0	1	0	0	1	5	0	0	14
05:15 PM	0	0	1	0	6	0	0	0	0	0	0	3	0	0	10
05:30 PM	1	0	0	0	6	0	0	0	0	0	1	1	0	0	9
05:45 PM	0	0	0	0	2	0	0	0	0	0	3	2	0	0	7
Total	2	0	2	0	19	0	0	1	0	0	5	11	0	0	40
Grand Total	4	0	3	1	46	0	0	2	0	0	8	28	0	0	92
Apprch %	57.1	0	42.9	2.1	97.9	0	0	100	0	0	22.2	77.8	0	0	
Total %	4.3	0	3.3	1.1	50	0	0	2.2	0	0	8.7	30.4	0	0	

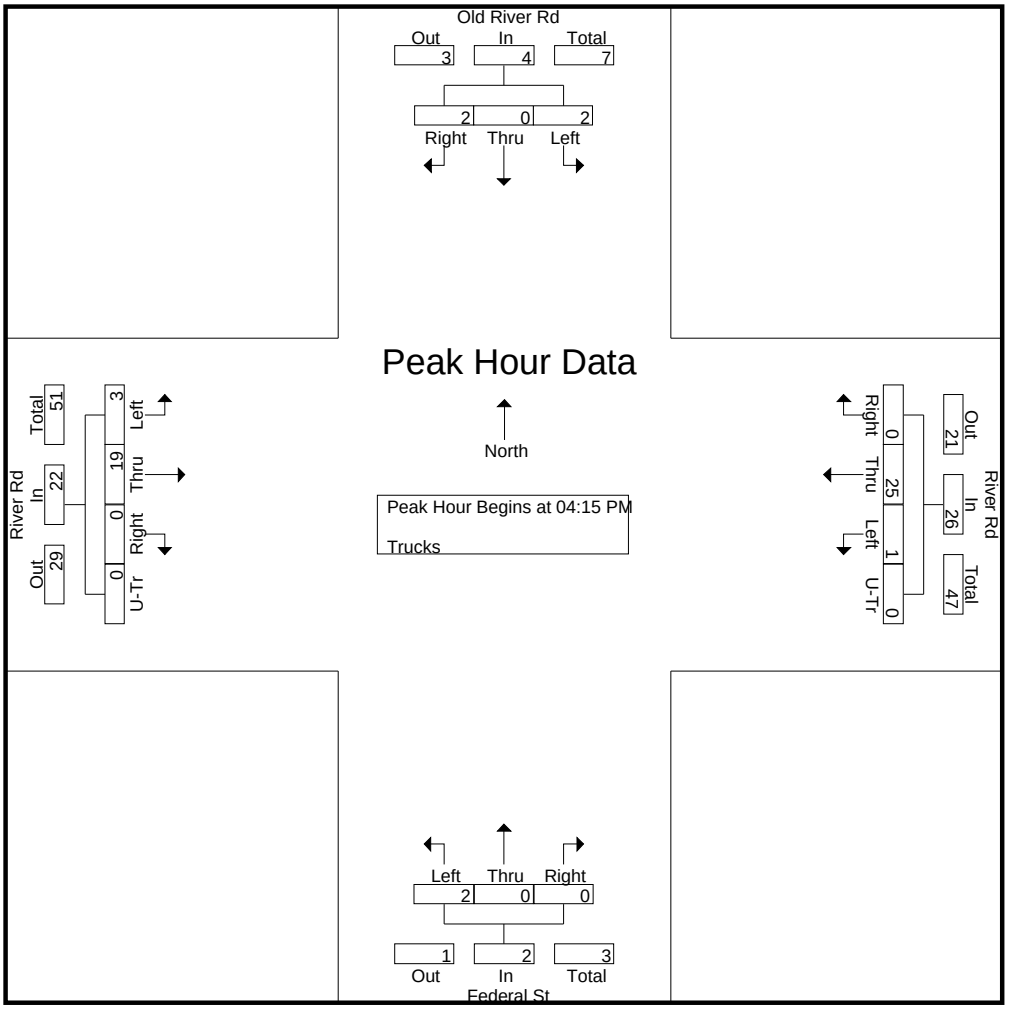
	Old River Rd From North				River Rd From East					Federal St From South				River Rd From West					
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	U-Tr	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	U-Tr	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																			
Peak Hour for Entire Intersection Begins at 04:15 PM																			
04:15 PM	0	0	**1**	1	0	**7**	0	0	**7**	0	0	0	0	**1**	4	0	0	5	13
04:30 PM	**1**	0	0	1	**1**	6	0	0	7	0	0	0	0	0	4	0	0	4	12
04:45 PM	0	0	0	0	0	7	0	0	7	**1**	0	0	**1**	1	**6**	0	0	**7**	**15**
05:00 PM	1	0	1	**2**	0	5	0	0	5	1	0	0	1	1	5	0	0	6	14
Total Volume	2	0	2	4	1	25	0	0	26	2	0	0	2	3	19	0	0	22	54
% App. Total	50	0	50		3.8	96.2	0	0		100	0	0		13.6	86.4	0	0		
PHF	.500	.000	.500	.500	.250	.893	.000	.000	.929	.500	.000	.000	.500	.750	.792	.000	.000	.786	.900

Accurate Counts

978-664-2565

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022
Page No : 2



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

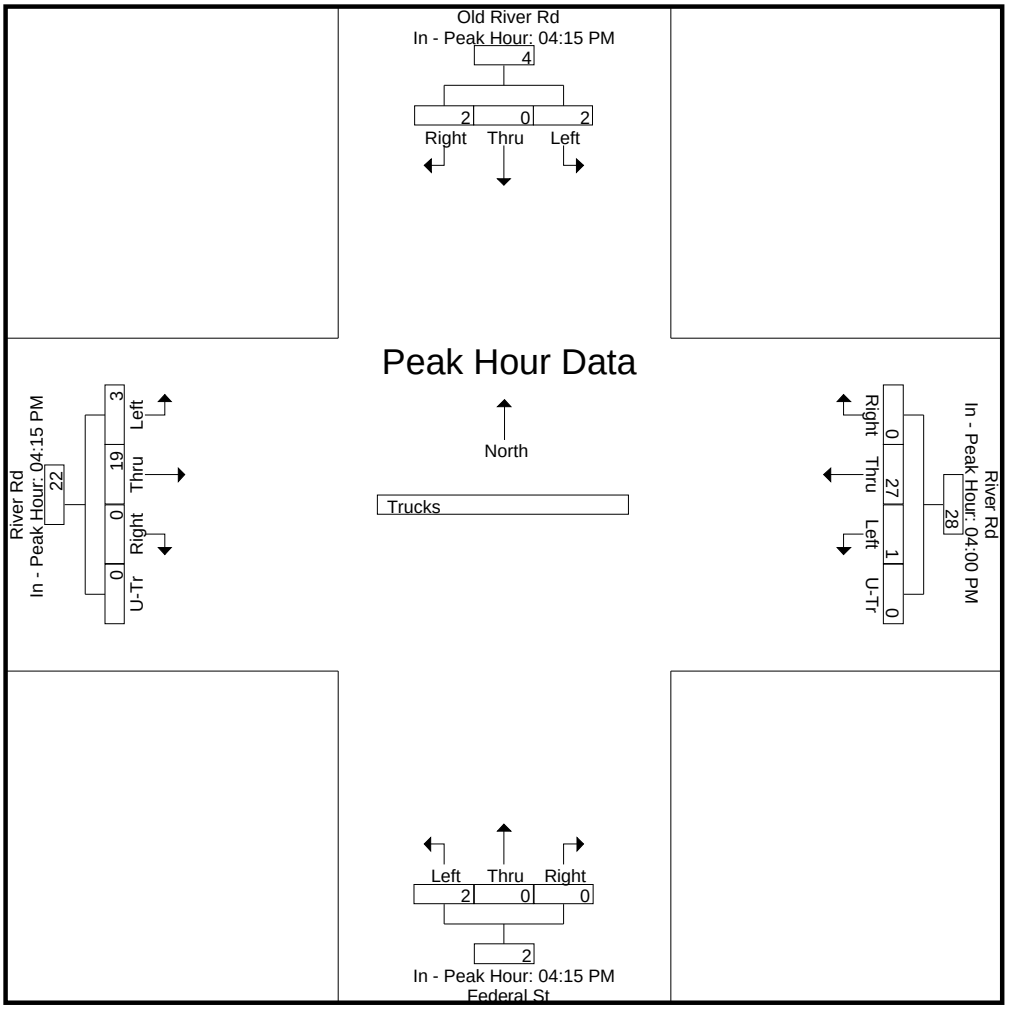
	04:15 PM				04:00 PM					04:15 PM				04:15 PM				
+0 mins.	0	0	**1**	1	0	**7**	0	0	**7**	0	0	0	0	**1**	4	0	0	5
+15 mins.	**1**	0	0	1	0	7	0	0	7	0	0	0	0	0	4	0	0	4
+30 mins.	0	0	0	0	**1**	6	0	0	7	**1**	0	0	**1**	1	**6**	0	0	**7**
+45 mins.	1	0	1	**2**	0	7	0	0	7	1	0	0	1	1	5	0	0	6
Total Volume	2	0	2	4	1	27	0	0	28	2	0	0	2	3	19	0	0	22
% App. Total	50	0	50		3.6	96.4	0	0		100	0	0		13.6	86.4	0	0	
PHF	.500	.000	.500	.500	.250	.964	.000	.000	1.000	.500	.000	.000	.500	.750	.792	.000	.000	.786

Accurate Counts

978-664-2565

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022
Page No : 3



Accurate Counts

978-664-2565

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022
Page No : 1

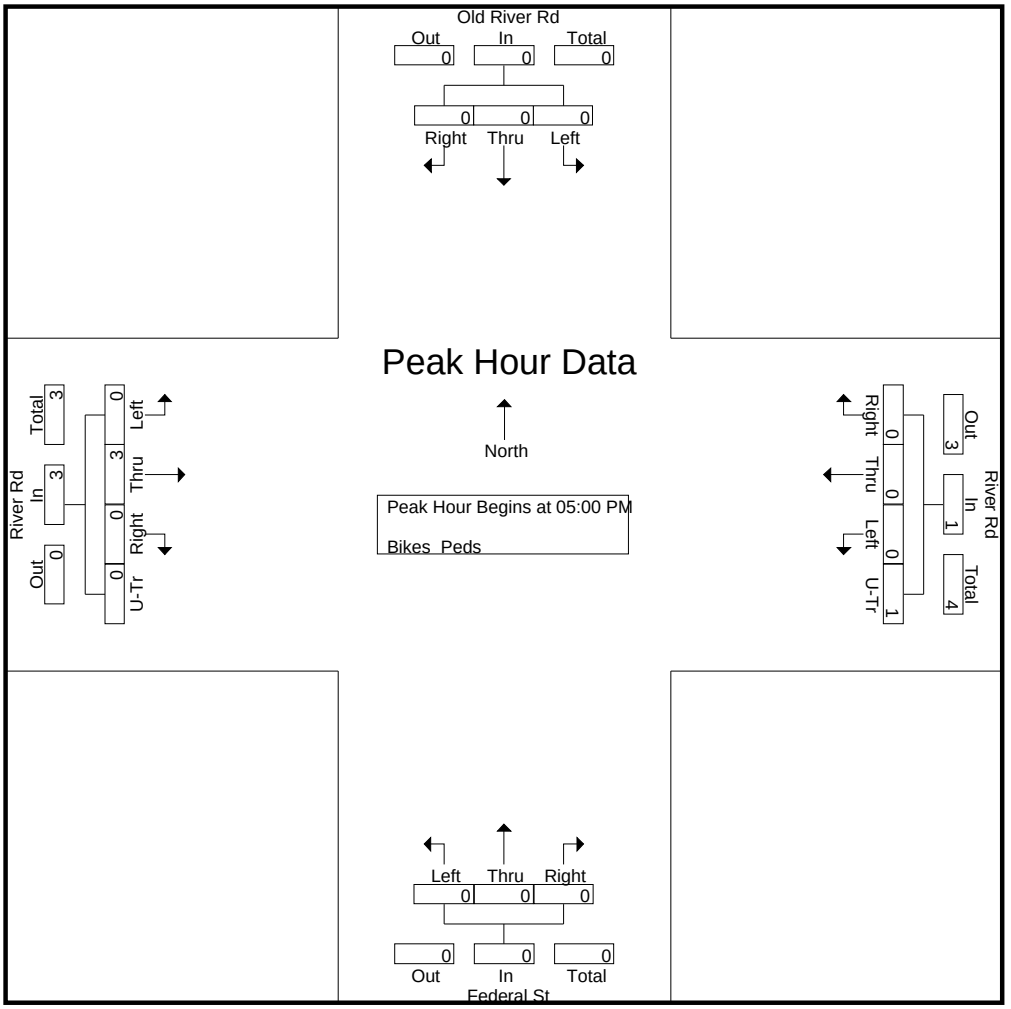
Groups Printed- Bikes Peds

	Old River Rd From North				River Rd From East				Federal St From South				River Rd From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
04:00 PM	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	1	2
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	2	3
05:00 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	3
Total	0	0	0	0	0	0	0	1	0	0	0	0	0	3	0	0	0	4	4
Grand Total	0	0	0	0	0	1	0	2	0	0	0	1	0	3	0	0	1	6	7
Apprch %	0	0	0		0	33.3	0	66.7	0	0	0		0	100	0	0			
Total %	0	0	0		0	16.7	0	33.3	0	0	0		0	50	0	0	14.3	85.7	

	Old River Rd From North				River Rd From East					Federal St From South				River Rd From West						
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																			
Peak Hour for Entire Intersection Begins at 05:00 PM																			
05:00 PM	0	0	0	0	0	0	0	**1**	**1**	0	0	0	0	0	0	0	0	0	1
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**3**	0	0	**3**	**3**
Total Volume	0	0	0	0	0	0	0	1	1	0	0	0	0	0	3	0	0	3	4
% App. Total	0	0	0		0	0	0	100		0	0	0		0	100	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.250	.250	.000	.000	.000	.000	.000	.250	.000	.000	.250	.333

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022
Page No : 2



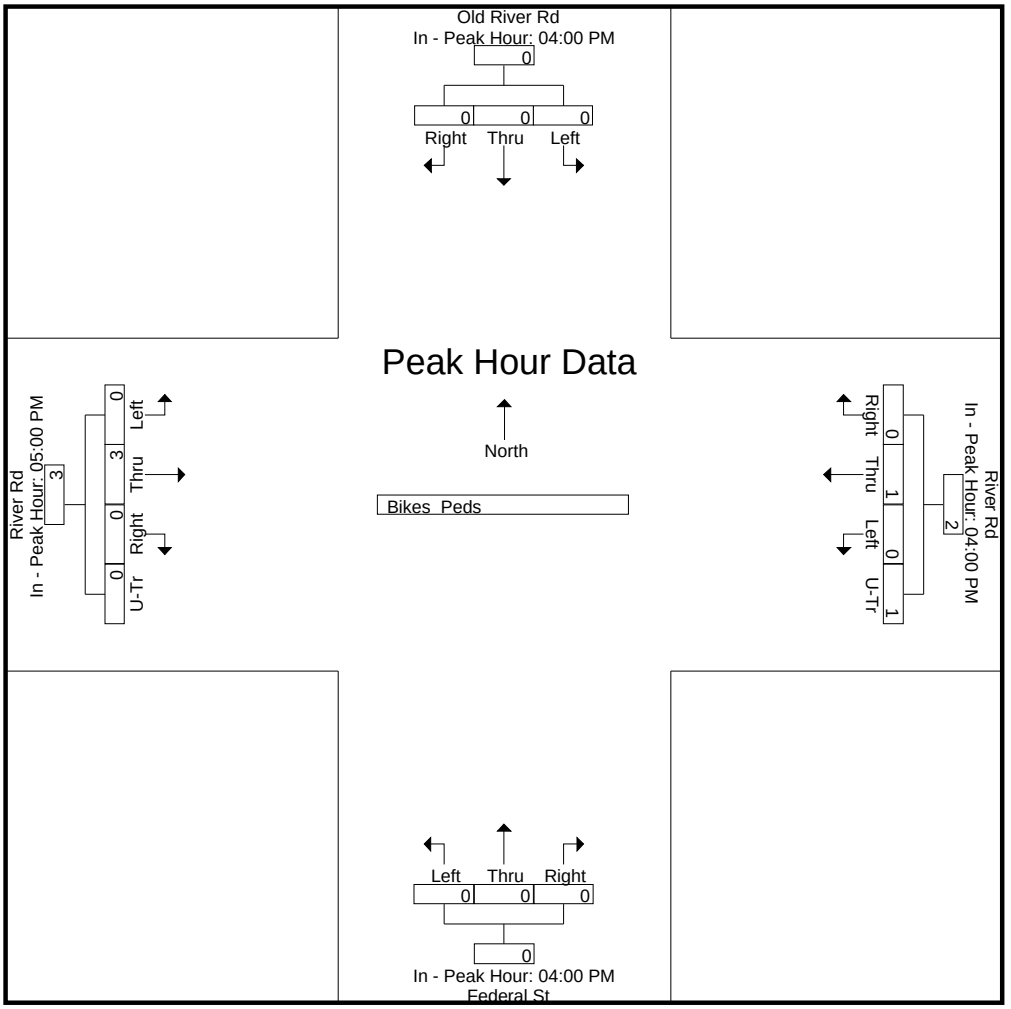
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:00 PM				04:00 PM					04:00 PM				05:00 PM				
+0 mins.	0	0	0	0	0	0	0	**1**	**1**	0	0	0	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+30 mins.	0	0	0	0	0	**1**	0	0	1	0	0	0	0	0	0	0	0	0
+45 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**3**	0	0	**3**
Total Volume	0	0	0	0	0	1	0	1	2	0	0	0	0	0	3	0	0	3
% App. Total	0	0	0		0	50	0	50		0	0	0		0	100	0	0	
PHF	.000	.000	.000	.000	.000	.250	.000	.250	.500	.000	.000	.000	.000	.000	.250	.000	.000	.250

Accurate Counts
978-664-2565

N/S Street : Old River Rd / Federal St
E/W Street : River Road
City/State : Andover, MA
Weather : Clear

File Name : 91410005
Site Code : 91410005
Start Date : 5/11/2022
Page No : 3



SEASONAL ADJUSTMENT DATA

Massachusetts Highway Department

5093: Monthly Hourly Volume for May 2017

Location ID:	**5093**	**Seasonal Factor Group:**	**U1-Essex**
County:	**Essex**	**Daily Factor Group:**	
Functional Class	**1**	**Axle Factor Group:**	**U1-Essex**
Location:	**INTERSTATE 93**	**Growth Factor Group:**	

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	TOTAL	QC Status
1	910	567	463	600	1787	5357	7349	8595	7710	6004	5327	5560	5933	6177	7749	8477	8800	9002	7456	4898	3488	2534	1920	1400	118063	Accepted
2	776	524	537	614	1785	4811	6700	8284	7554	6632	5368	5520	5703	6122	7372	8334	9321	8520	7624	5037	3686	2987	2295	1621	117727	Accepted
3	896	514	476	604	1747	5399	7520	8092	7393	6630	5555	5710	6022	6384	7914	9163	9634	9383	7396	5373	4023	3001	2036	1552	122417	Accepted
4	849	573	500	697	1791	5424	7365	8392	8045	6559	5798	6015	6344	6583	8036	8908	8782	9224	8056	6124	4308	3447	2461	1808	126089	Accepted
5	896	634	531	650	1688	4922	6778	8152	7376	6451	6050	6376	6526	7235	8092	8633	8411	8457	7771	5523	3933	3080	2555	1896	122616	Accepted
6	1160	739	559	462	687	1581	2409	3709	4826	6095	7039	7948	8317	8233	8019	8033	7737	7133	6227	5280	4354	3542	2866	1938	108893	Accepted
7	1198	770	474	371	400	837	1533	2528	3547	5057	6568	7509	8087	8349	8085	8033	7968	7026	6101	4822	3711	2645	1863	1105	98587	Accepted
8	686	457	426	623	1874	5453	7418	8437	7754	6053	5484	5519	5837	6105	7676	8332	8954	9083	7035	4864	3635	2752	1753	1327	117537	Accepted
9	722	489	455	604	1852	5553	7364	8797	7901	6269	5538	5463	5795	6095	7512	8523	9329	9149	7448	5173	3831	2933	1771	1359	119925	Accepted
10	722	486	495	599	1880	5384	7487	8731	8316	6419	5612	5676	6192	6446	8041	8506	9818	9608	7638	5632	4119	3075	2111	1726	124719	Accepted
11																										
12																										
13																										
14																										
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27																										
28																										
29																										
30																										
31																										

May Average	**117657**
2017 AADT	**116829**
Seasonal Adjustment	**0.993**

COVID-19 ADJUSTMENT DATA

2017 Average Count Data – Sta. 5093

May ADT: 117,657

Growth Rate (2017-2018):1.4% [MassDOT Yearly Growth Rates (U1-Essex)]
Growth Rate (2018-2019): 1.1% [MassDOT Yearly Growth Rates (U1-Essex)]

$$117{,}657 \times (1.014) \times (1.011) = 120{,}617$$

2022 Average Count Data – Sta. 5093

May ADT: 118,218

COVID Adjustment

$$\frac{120{,}617}{118{,}218} = 1.020$$

Massachusetts Highway Department
5093: Monthly Hourly Volume for May 2022

Location ID: 5093
County: Essex
Functional Class 1
Location: INTERSTATE 93

Seasonal Factor Group: U1-Essex
Daily Factor Group:
Axle Factor Group: U1-Essex
Growth Factor Group:

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	TOTAL	QC Status
1	1389	862	556	394	501	920	1600	2614	4032	5498	7375	8647	9119	8429	8093	7926	7954	7742	6658	5450	3997	2788	1698	1118	105360	Accepted
2	651	557	455	639	1767	4646	6616	7391	6901	6015	5611	5879	6199	6659	8156	8912	8681	7675	6374	4371	3097	2264	1547	1230	112293	Accepted
3	660	520	432	651	1767	4546	6527	7584	6945	5896	5568	5849	6208	6757	8246	8641	8709	9457	6531	4716	3578	2621	2077	1438	115924	Accepted
4	733	592	408	605	1809	4678	6701	7857	6986	5871	5545	5867	6109	6661	7923	8973	8508	8902	6474	4510	3543	2633	1813	1475	115176	Accepted
5	725	607	456	641	1806	4763	6949	8224	7438	6325	6132	6373	6814	7161	8486	9281	9434	9379	7428	5573	4463	3252	2336	1723	125769	Accepted
6	952	667	509	710	1686	4412	6316	7308	6884	6348	6395	7265	7711	8384	9161	9816	10138	9471	7525	5652	4459	3543	2906	2187	130405	Accepted
7	1226	811	579	505	867	1605	2677	3965	5414	6801	8041	8963	9118	9012	9038	8742	8041	7557	6687	5552	4585	3601	2800	2002	118189	Accepted
8	1156	829	431	360	400	697	1357	2313	3637	5674	7874	8747	9556	8909	8467	8646	8837	8051	6870	5454	4143	2760	1695	1050	107913	Accepted
9	606	469	387	642	1862	4877	6662	7434	6692	5975	5807	5954	6378	6654	7685	9080	8927	8854	6133	4705	3398	2408	1641	1288	114518	Accepted
10	732	510	457	633	1816	4733	6813	7156	7156	6215	5738	6045	6215	6704	7958	9005	9231	9127	6784	4966	3759	2711	1794	1407	117665	Accepted
11	820	506	401	641	1789	4781	6740	7611	7203	6179	6015	6163	6608	7127	8187	9326	9359	9153	6850	5032	4005	2855	2259	1527	121137	Accepted
12	812	553	427	676	1770	4902	6876	8094	7272	6435	6168	6495	6761	7347	8431	9199	9663	8908	7544	5347	4418	3172	2465	1657	125392	Accepted
13																										
14	1327	825	572	516	864	1788	2937	4299	5871	7247	8258	8853	9108	8836	8600	8287	7846	7505	6276	5456	4650	3841	2963	2083	118808	Accepted
15	1233	718	430	368	495	882	1558	2558	3896	5758	7292	8579	8947	8963	8656	8318	7510	6651	6181	5491	3942	2615	1740	1124	103905	Accepted
16	662	505	459	606	1812	4878	6997	7883	6941	6055	5845	6205	6503	6968	8165	8340	8434	8722	6167	4661	3382	2318	1625	1207	115340	Accepted
17	692	462	446	623	1859	5159	6987	7147	7166	6309	6034	6126	6544	6724	8153	9241	9236	9074	6886	5133	4019	2767	1937	1407	120131	Accepted
18	771	522	450	647	1914	5030	6979	7927	7179	6401	5911	6180	6637	7241	8624	9465	9439	9467	6916	5265	4240	3360	2151	1592	124308	Accepted
19	871	526	457	683	1864	5011	6825	7889	7283	6172	6042	6331	6808	7375	8180	8752	9341	9130	7072	5356	4038	2975	2052	1709	122742	Accepted
20	876	654	477	668	1832	4792	6466	7454	7095	6598	6723	7438	8135	8551	9306	9922	9772	9781	8251	6250	4984	3846	2843	2286	135000	Accepted
21	1428	759	567	547	817	1667	2880	4114	5827	7098	8063	8691	9130	8978	8606	8351	7873	7332	6320	5557	4964	3911	3041	2158	118679	Accepted
22	1776	1034	597	444	528	964	1732	2621	4140	5680	7450	8477	8884	8647	8268	7847	7796	7379	6507	5517	4295	2855	1889	1342	106669	Accepted
23	693	567	448	667	1839	5021	7054	7922	7012	6076	6205	6241	6694	7038	8234	9259	9135	8916	6641	4898	3788	2645	1721	1492	120206	Accepted
24	857	537	461	640	1946	5109	7264	8178	7494	6530	6188	6100	6414	7051	7819	8873	9381	8981	7004	5311	4080	2877	1875	1438	122408	Accepted
25	744	496	457	632	1800	5039	7058	8165	7696	6441	6151	6320	6712	7322	8547	9270	9111	9380	7118	5497	4279	2956	2024	1443	124658	Accepted
26	856	543	510	670	1817	5017	7130	8038	7699	6631	6430	6658	7055	7734	8784	9513	8750	9522	7588	6033	4789	3541	2413	1685	129406	Accepted
27	984	674	498	633	1715	4454	6375	7298	6889	6889	7330	8225	8663	8906	9414	9556	9218	9186	7658	6292	4860	3568	2567	2082	133934	Accepted
28	1554	879	596	499	688	1283	2456	3608	5100	6581	8188	8673	8867	8524	8527	7728	7312	6290	5446	4635	3943	3477	2624	1911	109389	Accepted
29	1148	696	500	416	459	905	1748	2646	4058	5812	7759	8429	8834	8237	7815	7217	7187	6902	6819	6135	4958	3544	2514	1819	106557	Accepted
30	1267	598	439	389	538	1019	1687	2410	3375	4973	6644	8105	8286	8072	7639	7296	7028	7069	6832	6596	4862	3402	2076	1201	101803	Accepted
31	676	442	394	588	1881	5049	7251	8231	7813	6441	5968	6468	6850	6718	8503	9204	9155	9297	6886	5084	3837	2831	1918	1381	122866	Accepted
																							May Average		**118218**	

VEHICLE TRAVEL SPEED DATA

Location : River Road EB 91410001
Location : East of Shattuck Road
City/State: Andover, MA
Direction: EB,

5/11/2022 Time	0 - 15 MPH	> 15 - 20 MPH	> 20 - 25 MPH	> 25 - 30 MPH	> 30 - 35 MPH	> 35 - 40 MPH	> 40 - 45 MPH	> 45 - 50 MPH	> 50 - 55 MPH	> 55 - 60 MPH	> 60 - 65 MPH	> 65 - 70 MPH	> 70 MPH	Total
12:00 AM	0	0	3	22	37	11	1	1	0	0	0	0	0	75
1:00	0	0	5	5	11	2	2	0	0	0	0	0	0	25
2:00	0	0	0	4	5	0	0	0	0	0	0	0	0	9
3:00	0	0	1	3	7	6	0	0	0	0	0	0	0	17
4:00	0	0	2	6	22	14	8	0	0	0	0	0	0	52
5:00	0	0	3	22	37	22	22	5	1	0	0	0	0	112
6:00	0	0	6	43	120	79	22	3	1	0	0	0	0	274
7:00	0	0	2	52	232	109	27	3	0	0	0	0	0	425
8:00	0	0	14	101	222	116	19	1	0	0	0	0	0	473
9:00	1	0	15	103	162	87	21	3	0	0	0	0	0	392
10:00	0	0	7	66	143	97	16	0	0	0	0	0	0	329
11:00	0	0	15	90	178	83	25	1	1	0	0	0	0	393
12:00 PM	0	0	5	77	214	94	18	2	1	0	0	0	0	411
1:00	0	1	6	63	191	110	29	5	0	0	0	0	0	405
2:00	0	0	0	88	311	146	33	2	1	0	0	0	0	581
3:00	0	0	5	165	466	196	41	4	1	0	0	0	0	878
4:00	0	0	3	97	386	239	52	10	2	0	0	0	0	789
5:00	0	2	7	126	409	182	66	5	0	0	0	0	0	797
6:00	0	1	5	68	154	136	35	5	0	0	0	0	0	404
7:00	0	2	1	47	113	72	18	4	0	0	0	0	0	257
8:00	0	0	6	42	76	57	16	2	0	0	0	0	0	199
9:00	0	0	1	17	44	37	15	4	0	0	0	0	0	118
10:00	0	0	2	18	29	18	5	1	0	0	0	0	0	73
11:00	0	0	1	10	22	20	6	0	1	0	0	0	0	60
Total	1	6	115	1335	3591	1933	497	61	9	0	0	0	0	7548
			Percentile	15th	50th	85th	95th							
			Speed	29	33	38	41							

Mean Speed (Average)	33.6
10 MPH Pace Speed	30-39
Number in Pace	5512
Percent in Pace	73.0%
Number > 35 MPH	2500
Percent > 35 MPH	33.1%

Location : River Road EB 91410001
Location : East of Shattuck Road
City/State: Andover, MA
Direction: EB,

5/12/2022 Time	0 - 15 MPH	> 15 - 20 MPH	> 20 - 25 MPH	> 25 - 30 MPH	> 30 - 35 MPH	> 35 - 40 MPH	> 40 - 45 MPH	> 45 - 50 MPH	> 50 - 55 MPH	> 55 - 60 MPH	> 60 - 65 MPH	> 65 - 70 MPH	> 70 MPH	Total
12:00 AM	0	0	0	20	45	9	5	0	1	0	0	0	0	80
1:00	0	0	2	2	6	6	2	0	0	0	0	0	0	18
2:00	0	0	1	3	2	6	1	0	0	0	0	0	0	13
3:00	0	0	0	4	4	4	0	2	1	0	0	0	0	15
4:00	0	0	3	14	16	7	10	1	0	0	0	0	0	51
5:00	0	0	1	11	44	44	14	2	1	0	0	0	0	117
6:00	0	1	3	34	108	71	18	4	1	0	0	0	0	240
7:00	0	0	1	64	221	104	28	1	0	0	0	0	0	419
8:00	0	1	3	77	244	102	17	5	1	0	0	0	0	450
9:00	0	1	14	100	189	82	21	3	0	0	0	0	0	410
10:00	0	0	4	63	136	90	20	5	1	0	0	0	0	319
11:00	0	0	4	57	167	111	30	4	1	0	0	0	0	374
12:00 PM	0	0	1	75	168	127	36	1	1	0	0	0	0	409
1:00	0	0	4	59	171	153	38	3	2	0	0	0	0	430
2:00	0	1	0	83	249	194	48	4	1	0	0	0	0	580
3:00	0	0	3	161	467	197	35	0	1	1	0	0	0	865
4:00	0	0	3	98	383	217	58	10	3	0	0	0	0	772
5:00	0	1	2	131	402	225	50	4	2	0	0	0	0	817
6:00	0	0	4	66	211	140	41	9	0	0	0	0	0	471
7:00	0	1	2	52	127	74	18	3	0	0	0	0	0	277
8:00	0	0	2	47	82	58	23	0	0	0	0	0	0	212
9:00	0	0	3	25	46	35	16	1	0	0	0	0	0	126
10:00	0	0	1	23	33	19	6	1	0	0	0	0	0	83
11:00	0	0	1	14	22	16	3	1	2	0	0	0	0	59
Total	0	6	62	1283	3543	2091	538	64	19	1	0	0	0	7607
			Percentile	15th	50th	85th	95th							
			Speed	30	33	38	41							
			Mean Speed (Average)	33.9										
			10 MPH Pace Speed	30-39										
			Number in Pace	5618										
			Percent in Pace	73.9%										
			Number > 35 MPH	2713										
			Percent > 35 MPH	35.7%										
Grand Total	1	12	177	2618	7134	4024	1035	125	28	1	0	0	0	15155
Stats			Percentile	15th	50th	85th	95th							
			Speed	29	33	38	41							
			Mean Speed (Average)	33.7										
			10 MPH Pace Speed	30-39										
			Number in Pace	11130										
			Percent in Pace	73.4%										
			Number > 35 MPH	5213										
			Percent > 35 MPH	34.4%										

Location : River Road EB 91410001
Location : East of Shattuck Road
City/State: Andover, MA

	5/11/2022	EB,		Hour Totals	
Time	Wednesday	Morning	Afternoon	Morning	Afternon
12:00		65	128		
12:15		5	95		
12:30		1	99		
12:45		4	89	75	411
1:00		14	98		
1:15		2	84		
1:30		5	115		
1:45		4	108	25	405
2:00		2	139		
2:15		2	114		
2:30		2	170		
2:45		3	158	9	581
3:00		8	197		
3:15		2	211		
3:30		3	302		
3:45		4	168	17	878
4:00		18	229		
4:15		8	169		
4:30		14	205		
4:45		12	186	52	789
5:00		15	284		
5:15		20	176		
5:30		31	182		
5:45		46	155	112	797
6:00		37	126		
6:15		58	90		
6:30		71	99		
6:45		108	89	274	404
7:00		138	86		
7:15		86	65		
7:30		98	54		
7:45		103	52	425	257
8:00		119	53		
8:15		108	59		
8:30		102	51		
8:45		144	36	473	199
9:00		148	34		
9:15		111	31		
9:30		71	27		
9:45		62	26	392	118
10:00		97	24		
10:15		61	15		
10:30		89	18		
10:45		82	16	329	73
11:00		79	29		
11:15		95	13		
11:30		109	13		
11:45		110	5	393	60
Total		2576	4972		
Percent		34.1%	65.9%		

Location : River Road EB 91410001
Location : East of Shattuck Road
City/State: Andover, MA

	5/12/2022	EB,		Hour Totals	
Time	Thursday	Morning	Afternoon	Morning	Afternon
12:00		59	119		
12:15		8	103		
12:30		9	99		
12:45		4	88	80	409
1:00		12	98		
1:15		2	106		
1:30		2	114		
1:45		2	112	18	430
2:00		3	164		
2:15		6	113		
2:30		1	153		
2:45		3	150	13	580
3:00		5	193		
3:15		2	208		
3:30		3	279		
3:45		5	185	15	865
4:00		10	227		
4:15		9	169		
4:30		19	195		
4:45		13	181	51	772
5:00		14	230		
5:15		14	214		
5:30		34	194		
5:45		55	179	117	817
6:00		30	155		
6:15		47	116		
6:30		72	100		
6:45		91	100	240	471
7:00		135	90		
7:15		102	58		
7:30		84	62		
7:45		98	67	419	277
8:00		112	65		
8:15		102	47		
8:30		106	51		
8:45		130	49	450	212
9:00		136	48		
9:15		90	29		
9:30		104	23		
9:45		80	26	410	126
10:00		102	21		
10:15		75	21		
10:30		75	26		
10:45		67	15	319	83
11:00		84	13		
11:15		86	17		
11:30		90	16		
11:45		114	13	374	59
Total		2506	5101		
Percent		32.9%	67.1%		
Grand Total		5082	10073		
Percent		33.5%	66.5%		
ADT		ADT: 7,578		AADT: 7,578	

Location : River Road EB 91410001
Location : East of Shattuck Road
City/State: Andover, MA

5/9/2022	5/9/22	5/10/22	5/11/2022	5/12/2022	5/13/2022	5/14/2022	5/15/2022	Average	
Time	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon - Fri	Mon - Sun
12:00 AM	*	*	75	80	*	*	*	78	78
1:00	*	*	25	18	*	*	*	22	22
2:00	*	*	9	13	*	*	*	11	11
3:00	*	*	17	15	*	*	*	16	16
4:00	*	*	52	51	*	*	*	52	52
5:00	*	*	112	117	*	*	*	114	114
6:00	*	*	274	240	*	*	*	257	257
7:00	*	*	425	419	*	*	*	422	422
8:00	*	*	473	450	*	*	*	462	462
9:00	*	*	392	410	*	*	*	401	401
10:00	*	*	329	319	*	*	*	324	324
11:00	*	*	393	374	*	*	*	384	384
12:00 PM	*	*	411	409	*	*	*	410	410
1:00	*	*	405	430	*	*	*	418	418
2:00	*	*	581	580	*	*	*	580	580
3:00	*	*	878	865	*	*	*	872	872
4:00	*	*	789	772	*	*	*	780	780
5:00	*	*	797	817	*	*	*	807	807
6:00	*	*	404	471	*	*	*	438	438
7:00	*	*	257	277	*	*	*	267	267
8:00	*	*	199	212	*	*	*	206	206
9:00	*	*	118	126	*	*	*	122	122
10:00	*	*	73	83	*	*	*	78	78
11:00	*	*	60	59	*	*	*	60	60
Total	0	0	7548	7607	0	0	0	7581	7581
Percent	0.0%	0.0%	49.8%	50.2%	0.0%	0.0%	0.0%		
AM Peak			8:00	8:00				8:00	8:00
Volume			473	450				462	462
PM Peak			3:00	3:00				3:00	3:00
Volume			878	865				872	872

Location : River Road WB 91410WB1
Location : East of Shattuck Road
City/State: Andover, MA
Direction: WB,

5/11/2022 Time	0 - 15 MPH	> 15 - 20 MPH	> 20 - 25 MPH	> 25 - 30 MPH	> 30 - 35 MPH	> 35 - 40 MPH	> 40 - 45 MPH	> 45 - 50 MPH	> 50 - 55 MPH	> 55 - 60 MPH	> 60 - 65 MPH	> 65 - 70 MPH	> 70 MPH	Total
12:00 AM	0	0	1	3	3	18	6	3	1	0	0	0	0	35
1:00	1	1	1	4	3	4	3	1	0	0	0	0	0	18
2:00	0	0	0	10	5	2	1	0	0	0	0	0	0	18
3:00	0	0	0	10	12	3	0	0	0	0	0	0	0	25
4:00	0	2	0	8	20	27	11	6	1	0	0	0	0	75
5:00	1	4	7	7	44	61	36	11	6	1	0	0	0	178
6:00	2	8	14	13	94	158	67	19	2	0	0	0	0	377
7:00	2	19	34	25	212	361	116	12	5	1	0	0	0	787
8:00	0	22	41	42	237	383	153	29	8	1	0	0	0	916
9:00	0	13	25	20	116	206	73	27	3	3	0	0	0	486
10:00	0	10	8	12	51	127	65	16	2	0	0	0	0	291
11:00	1	10	14	18	68	125	59	15	2	1	0	0	0	313
12:00 PM	1	18	27	20	74	148	64	21	4	2	0	0	0	379
1:00	0	11	11	14	72	150	71	16	4	1	0	0	0	350
2:00	0	14	20	35	115	182	62	20	4	0	0	0	0	452
3:00	2	15	13	26	112	184	82	18	3	0	0	0	0	455
4:00	0	10	18	20	86	143	65	15	6	2	0	0	0	365
5:00	1	19	18	23	94	177	83	19	2	1	0	0	0	437
6:00	1	3	6	20	69	140	80	23	3	2	0	0	0	347
7:00	1	9	10	19	50	105	69	9	4	0	0	0	0	276
8:00	0	3	9	16	74	97	32	8	0	0	0	0	0	239
9:00	1	6	6	12	48	51	20	4	0	0	0	0	0	148
10:00	0	4	1	15	33	33	11	1	1	0	0	0	0	99
11:00	1	3	4	8	42	26	10	2	0	0	0	0	0	96
Total	15	204	288	400	1734	2911	1239	295	61	15	0	0	0	7162

Percentile	15th	50th	85th	95th
Speed	31	36	41	45

Mean Speed (Average)	36.0
10 MPH Pace Speed	30-39
Number in Pace	4595
Percent in Pace	64.2%
Number > 35 MPH	4521
Percent > 35 MPH	63.1%

Location : River Road WB 91410WB1
Location : East of Shattuck Road
City/State: Andover, MA
Direction: WB,

5/12/2022 Time	0 - 15 MPH	> 15 - 20 MPH	> 20 - 25 MPH	> 25 - 30 MPH	> 30 - 35 MPH	> 35 - 40 MPH	> 40 - 45 MPH	> 45 - 50 MPH	> 50 - 55 MPH	> 55 - 60 MPH	> 60 - 65 MPH	> 65 - 70 MPH	> 70 MPH	Total
12:00 AM	0	1	0	2	13	21	9	0	0	0	0	0	0	46
1:00	0	0	2	1	9	4	2	1	0	0	0	0	0	19
2:00	0	0	1	1	5	14	3	0	0	0	0	0	0	24
3:00	0	0	0	4	13	14	2	0	0	0	0	0	0	33
4:00	0	3	1	7	21	26	16	3	0	0	0	0	0	77
5:00	1	3	4	6	46	67	43	8	3	0	0	1	0	182
6:00	0	9	13	14	95	139	61	16	3	0	0	0	0	350
7:00	0	27	36	39	237	283	86	18	1	0	0	0	0	727
8:00	0	18	27	51	294	373	113	17	6	1	0	0	0	900
9:00	1	19	23	30	121	178	75	20	6	1	0	0	0	474
10:00	1	9	14	8	58	114	56	18	0	1	0	0	0	279
11:00	1	12	14	6	65	128	61	15	4	0	0	0	0	306
12:00 PM	1	18	16	18	77	182	70	12	2	1	0	0	0	397
1:00	1	11	7	24	72	129	79	11	4	0	0	0	0	338
2:00	2	20	32	29	121	182	65	11	2	0	0	0	0	464
3:00	3	13	17	30	140	159	57	15	2	1	0	0	0	437
4:00	0	7	23	31	120	196	90	15	1	0	0	0	0	483
5:00	2	18	19	9	132	181	70	14	2	1	0	0	0	448
6:00	0	8	12	18	67	135	53	15	2	0	0	0	0	310
7:00	2	8	9	15	64	119	50	11	0	0	0	0	0	278
8:00	0	9	8	25	80	88	37	6	1	0	0	0	0	254
9:00	0	5	2	24	58	45	17	3	0	0	0	0	0	154
10:00	0	3	4	10	33	37	13	2	2	0	0	0	0	104
11:00	0	3	2	12	45	35	9	3	1	0	0	0	0	110
Total	15	224	286	414	1986	2849	1137	234	42	6	0	1	0	7194
			Percentile	15th	50th	85th	95th							
			Speed	31	36	41	44							
		Mean Speed (Average)		35.5										
		10 MPH Pace Speed		30-39										
		Number in Pace		4786										
		Percent in Pace		66.5%										
		Number > 35 MPH		4269										
		Percent > 35 MPH		59.3%										
Grand Total	30	428	574	814	3720	5760	2376	529	103	21	0	1	0	14356
Stats			Percentile	15th	50th	85th	95th							
			Speed	31	36	41	45							
		Mean Speed (Average)		35.8										
		10 MPH Pace Speed		30-39										
		Number in Pace		9381										
		Percent in Pace		65.3%										
		Number > 35 MPH		8790										
		Percent > 35 MPH		61.2%										

MASSDOT CRASH RATE WORKSHEETS AND HIGH CRASH LOCATION MAPPING

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Andover | COUNT DATE : May-22

DISTRICT : 4 | UNSIGNALIZED : X | SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : River Road

MINOR STREET(S) : 1776 Drive

INTERSECTION DIAGRAM (Label Approaches)

↑ *North*



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	SB	EB	WB			
PEAK HOURLY VOLUMES (AM/PM) :	122	336	276			**734**

" K " FACTOR :	**0.090**	INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME :			**8,156**
TOTAL # OF CRASHES :	8	# OF YEARS :	5	AVERAGE # OF CRASHES PER YEAR (**A**) :	**1.60**

CRASH RATE CALCULATION : **0.54**

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(V * 365)}$$

Comments : Below MassDOT Statewide and District Average Crash Rates

Project Title & Date: Proposed cGMP Campus

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Andover COUNT DATE : May-22

DISTRICT : 4 UNSIGNALIZED : SIGNALIZED : X

~ INTERSECTION DATA ~

MAJOR STREET : River Road

MINOR STREET(S) : Minuteman Road

Shattuck 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 (AM/PM) :	379	179	454	444		**1,456**

" K " FACTOR : **0.090** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **16,178**

TOTAL # OF CRASHES : 4 # OF YEARS : 5 AVERAGE # OF CRASHES PER YEAR (**A**) : **0.80**

CRASH RATE CALCULATION : **0.14** RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : Below MassDOT Statewide and District Average Crash Rates

Project Title & Date: Proposed cGMP Campus

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Andover | COUNT DATE : May-22

DISTRICT : 4 | UNSIGNALIZED : | SIGNALIZED : X

~ INTERSECTION DATA ~

MAJOR STREET : River Road

MINOR STREET(S) : I-93 Southbound Ramps

INTERSECTION DIAGRAM (Label Approaches)

↑ *North*



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	EB	WB			
PEAK HOURLY VOLUMES (AM/PM) :	643	987	791			**2,421**

" K " FACTOR : **0.090**

INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **26,900**

TOTAL # OF CRASHES : 32

OF YEARS : 5

AVERAGE # OF CRASHES PER YEAR (**A**) : **6.40**

CRASH RATE CALCULATION : **0.65**

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(V * 365)}$$

Comments : Below MassDOT Statewide and District Average Crash Rates

Project Title & Date: Proposed cGMP Campus

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Andover | COUNT DATE : May-22

DISTRICT : 4 | UNSIGNALIZED : | SIGNALIZED : X

~ INTERSECTION DATA ~

MAJOR STREET : River Road

MINOR STREET(S) : I-93 Northbound Ramps

INTERSECTION DIAGRAM (Label Approaches)

↑ *North*



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	SB	EB	WB			
PEAK HOURLY VOLUMES (AM/PM) :	333	1,066	1,517			**2,916**

" K " FACTOR : **0.090** | INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **32,400**

TOTAL # OF CRASHES : 24 | # OF YEARS : 5 | AVERAGE # OF CRASHES PER YEAR (**A**) : **4.80**

CRASH RATE CALCULATION : **0.41**

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(V * 365)}$$

Comments : Below MassDOT Statewide and District Average Crash Rates

Project Title & Date: Proposed cGMP Campus

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Andover | COUNT DATE : May-22

DISTRICT : 4 | UNSIGNALIZED : | SIGNALIZED : X

~ INTERSECTION DATA ~

MAJOR STREET : River Road

MINOR STREET(S) : Old River Road

Federal Street

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 (AM/PM) :	246	377	810	1,078		**2,511**

" K " FACTOR : **0.090** | INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **27,900**

TOTAL # OF CRASHES : 27 | # OF YEARS : 5 | AVERAGE # OF CRASHES PER YEAR (**A**) : **5.40**

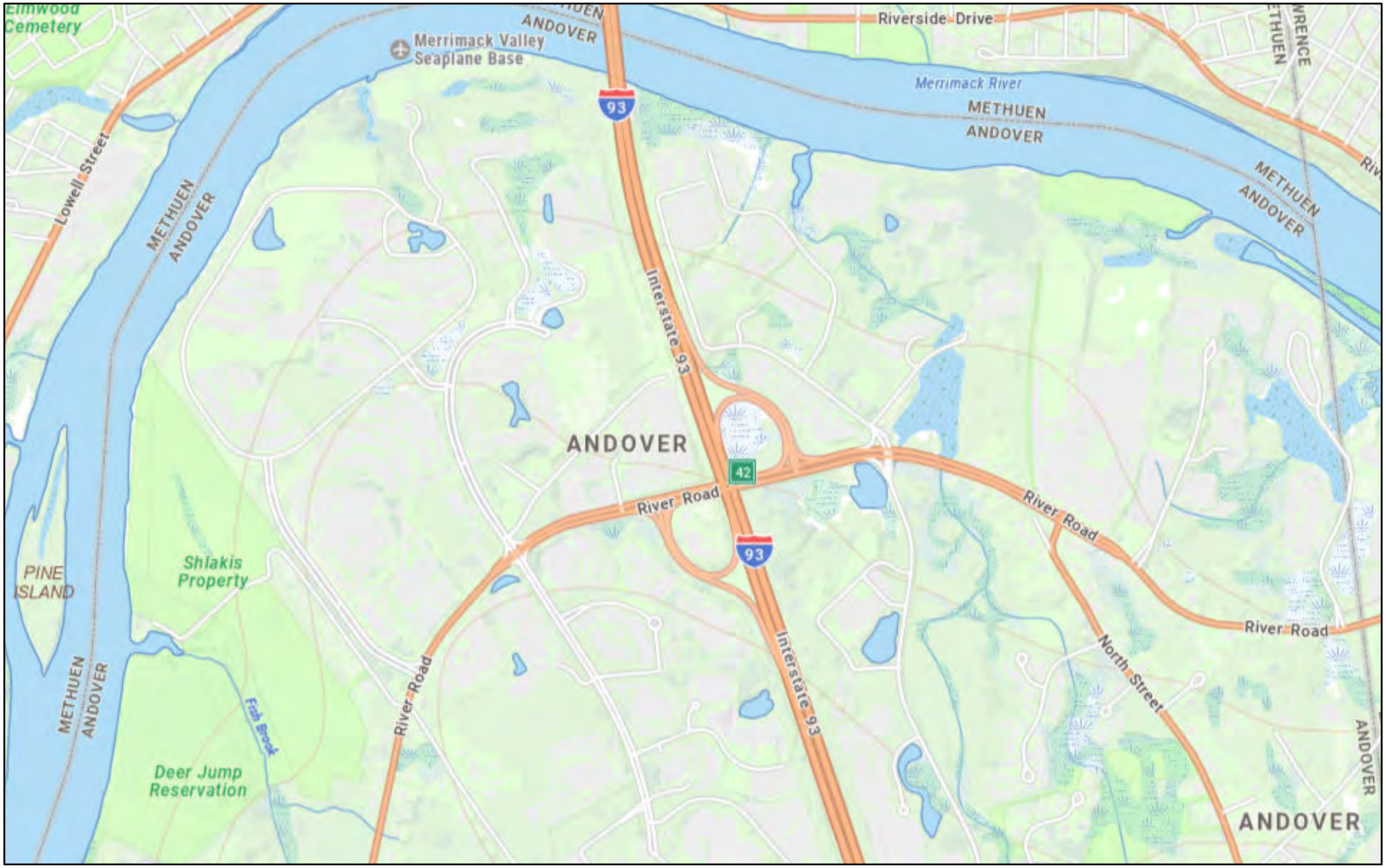
CRASH RATE CALCULATION : **0.53**

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(V * 365)}$$

Comments : Below MassDOT Statewide and District Average Crash Rates

Project Title & Date: Proposed cGMP Campus

MassDOT Top Crash Locations



7/7/2022, 3:32:37 PM

1:18,056

0 0.1 0.2 0.4 mi

0 0.17 0.35 0.7 km

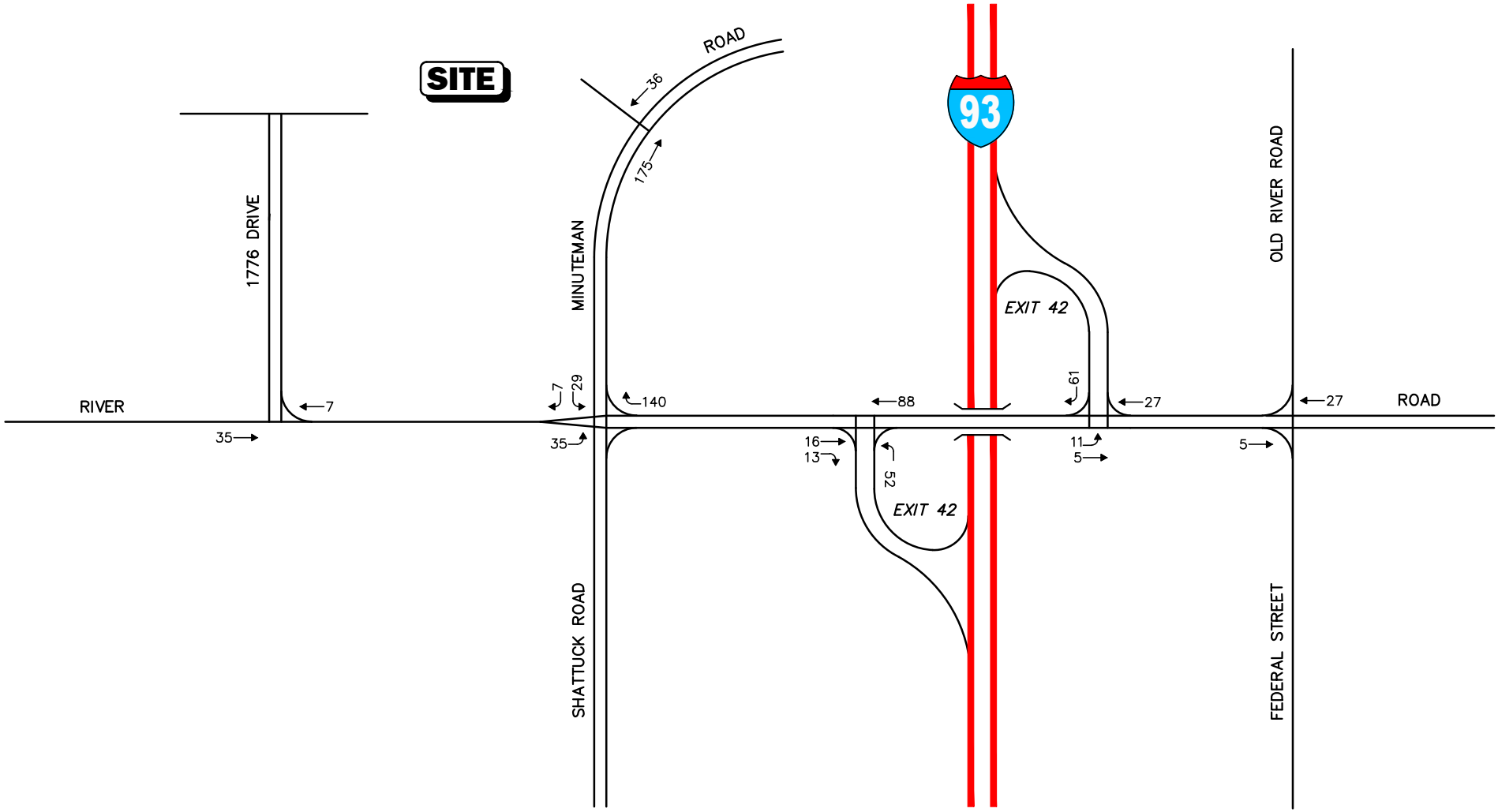
MassDOT

GENERAL BACKGROUND TRAFFIC GROWTH

General Background Traffic Growth - Daily Traffic Volumes

CITY/TOWN	ROUTE/STREET	LOCATION	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Annual Growth Rate
Dracut	Broadway	at the Methuen Town Line							11,937	12,677	12,893	12,932	12,880	**1.78%**
Andover	River Road	West of Shattuck Road						6,600	6,752	7,171	7,293	7,315	7,286	**2.16%**
Methuen	Interstate 93	North of Route 110/113	119,732	114,628	117,713	115,082	111,501	111,072	116,586	118,710	116,829	115,369	116,638	**-0.05%**
Andover	Interstate 93	North of Interstate 495		123,320			122,302	122,026	147,095	131,150	130,905	127,682	129,087	**0.77%**
Andover	Interstate 93	South of Methuen Town Line	123,633	124,488		123,295	121,630	123,614	126,235	129,908	130,817	132,947	134,409	**1.03%**
														1.14%

BACKGROUND DEVELOPMENT TRAFFIC-VOLUME NETWORKS



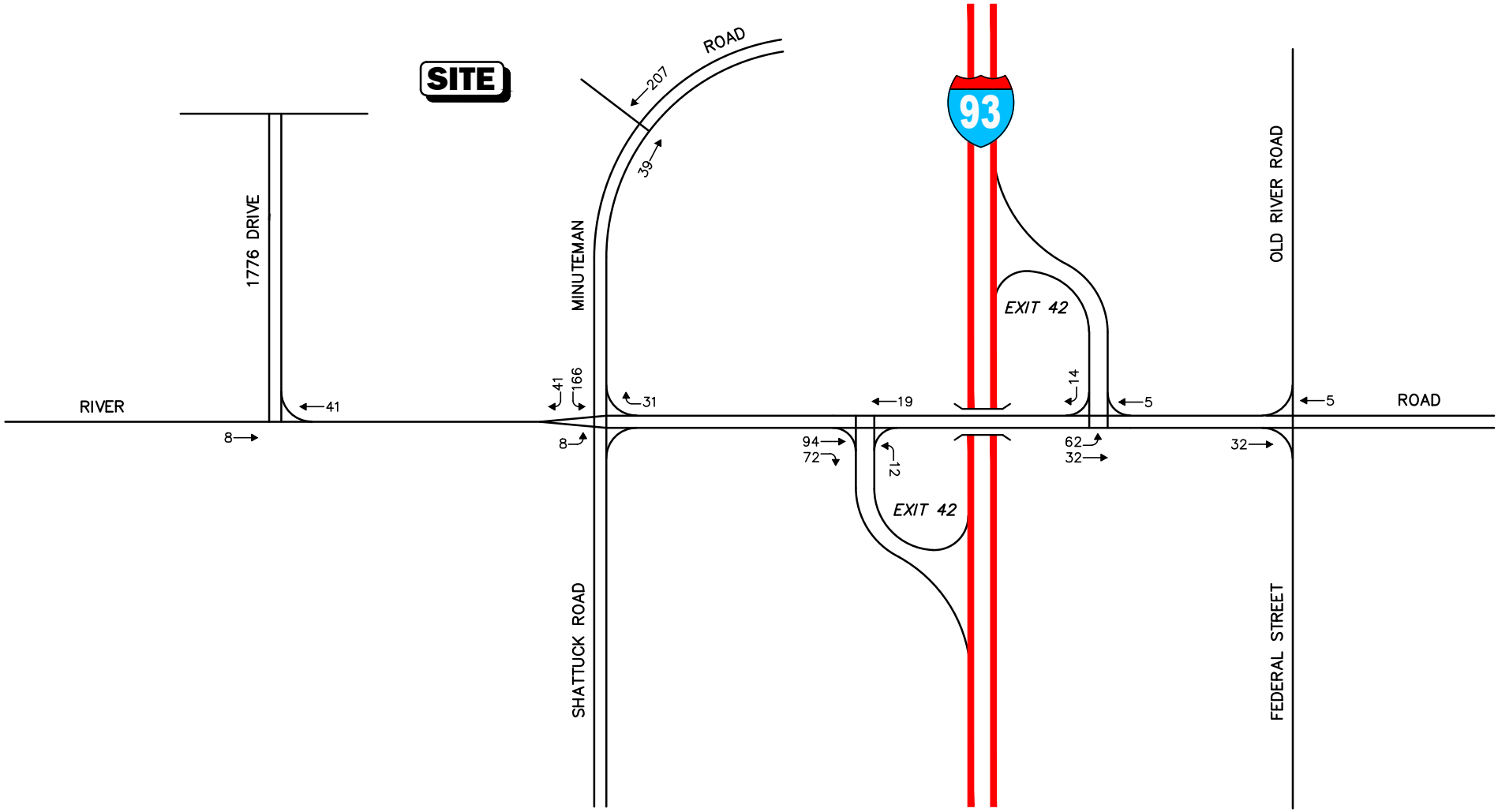
Not to Scale

Figure A1

Proposed cGMP Facility
300 Minuteman Road
Weekday Morning
Peak-Hour Traffic Volumes

Vanasse & Associates inc

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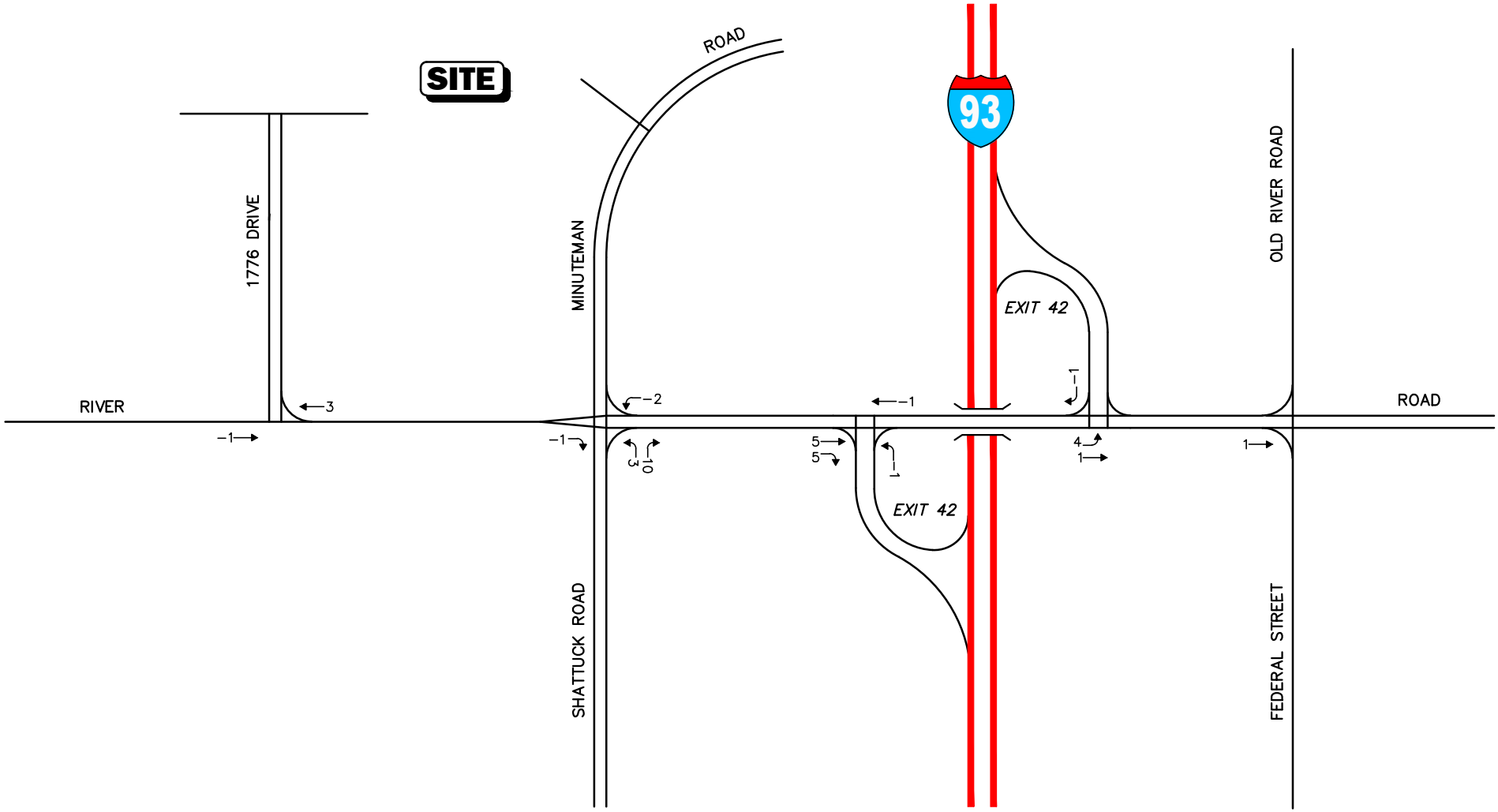
Not to Scale

Figure A2

Proposed cGMP Facility
300 Minuteman Road
Weekday Evening
Peak-Hour Traffic Volumes

Vanasse & Associates inc

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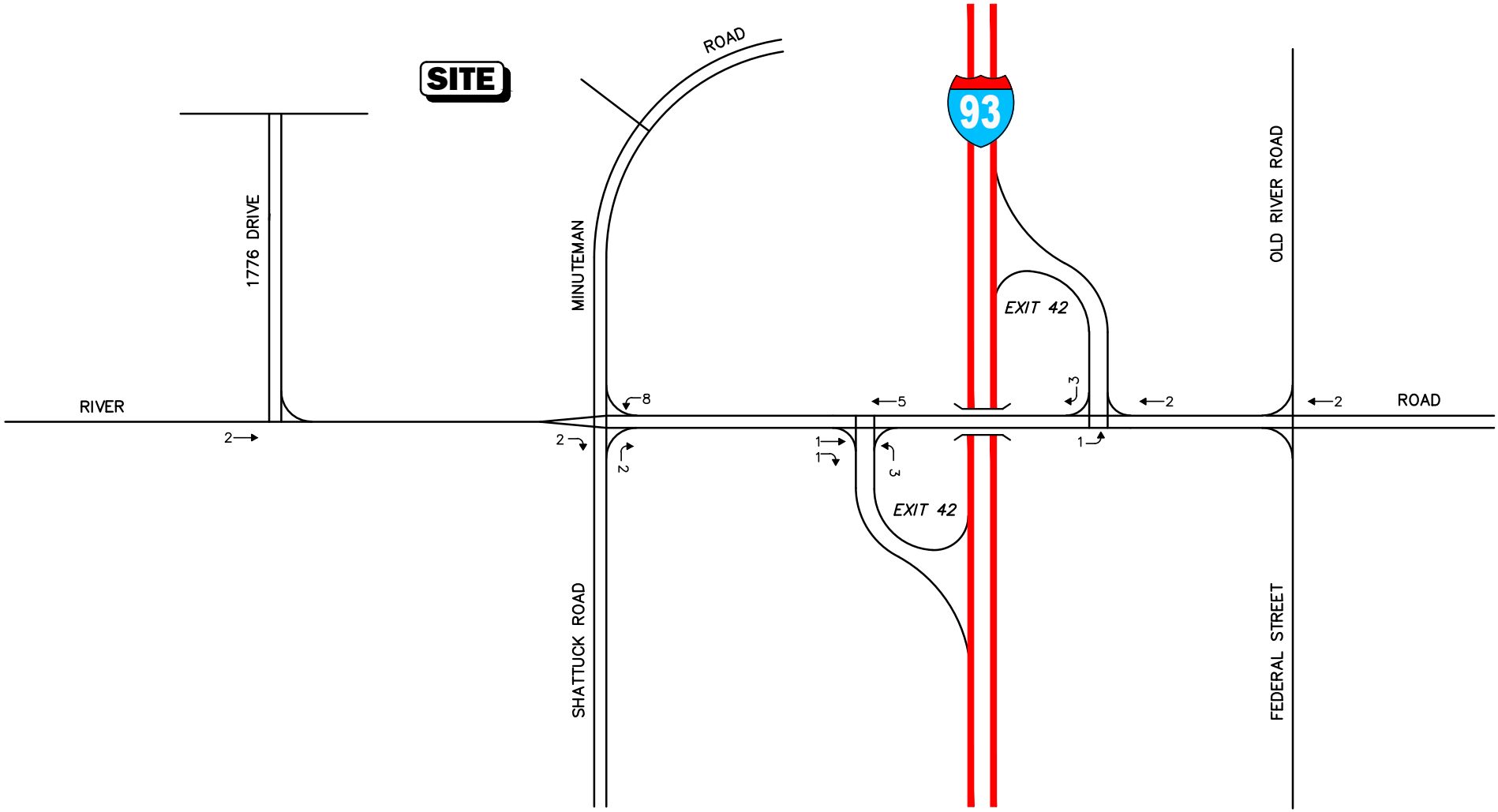
Not to Scale

Figure A3

Proposed Research and Development Facility
One Corporate Drive
Weekday Morning
Peak-Hour Traffic Volumes

Vanasse & Associates inc

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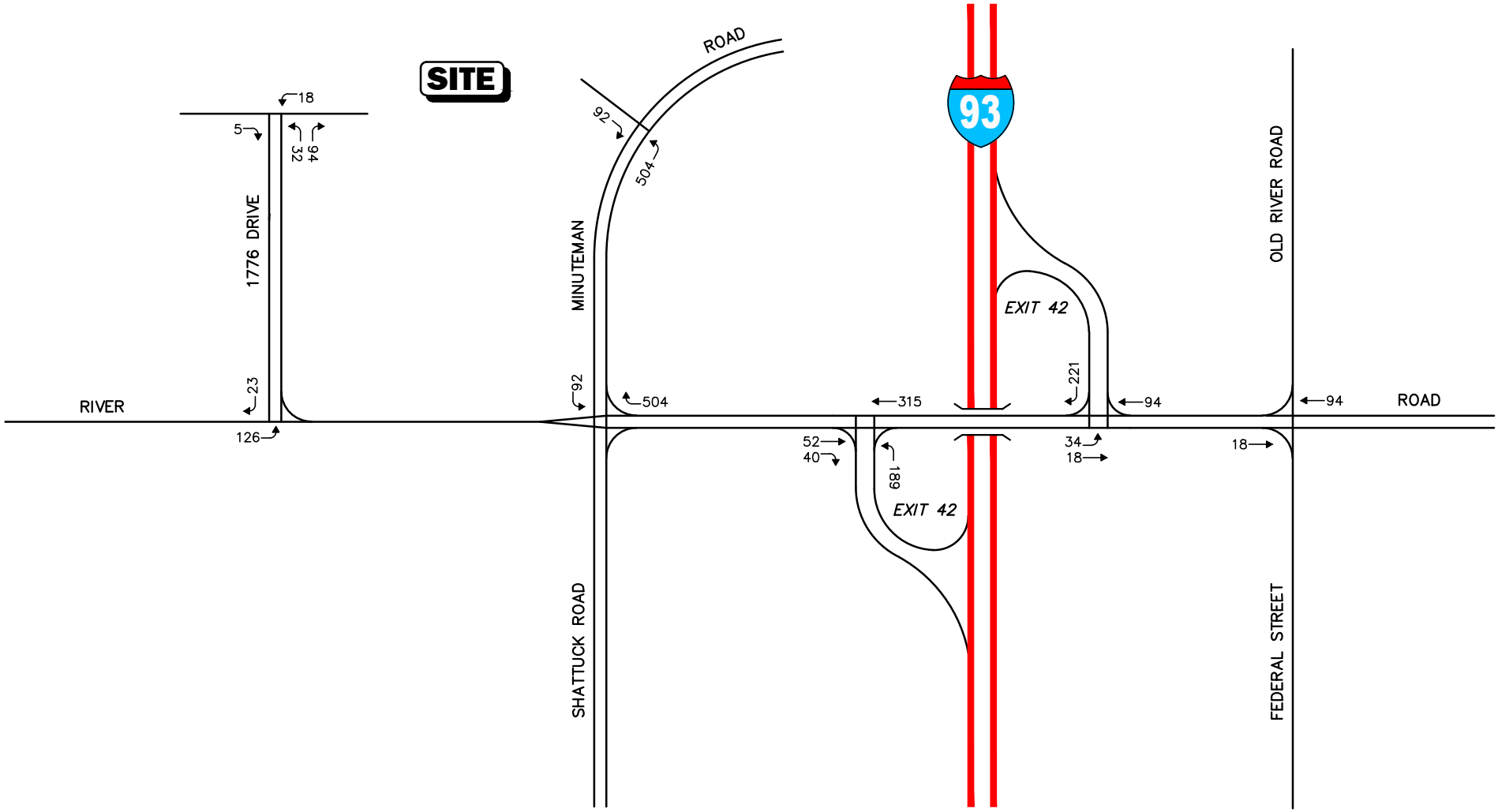
Not to Scale

Figure A4

Proposed Research and Development Facility
One Corporate Drive
Weekday Evening Peak-Hour Traffic Volumes

Vanasse & Associates inc

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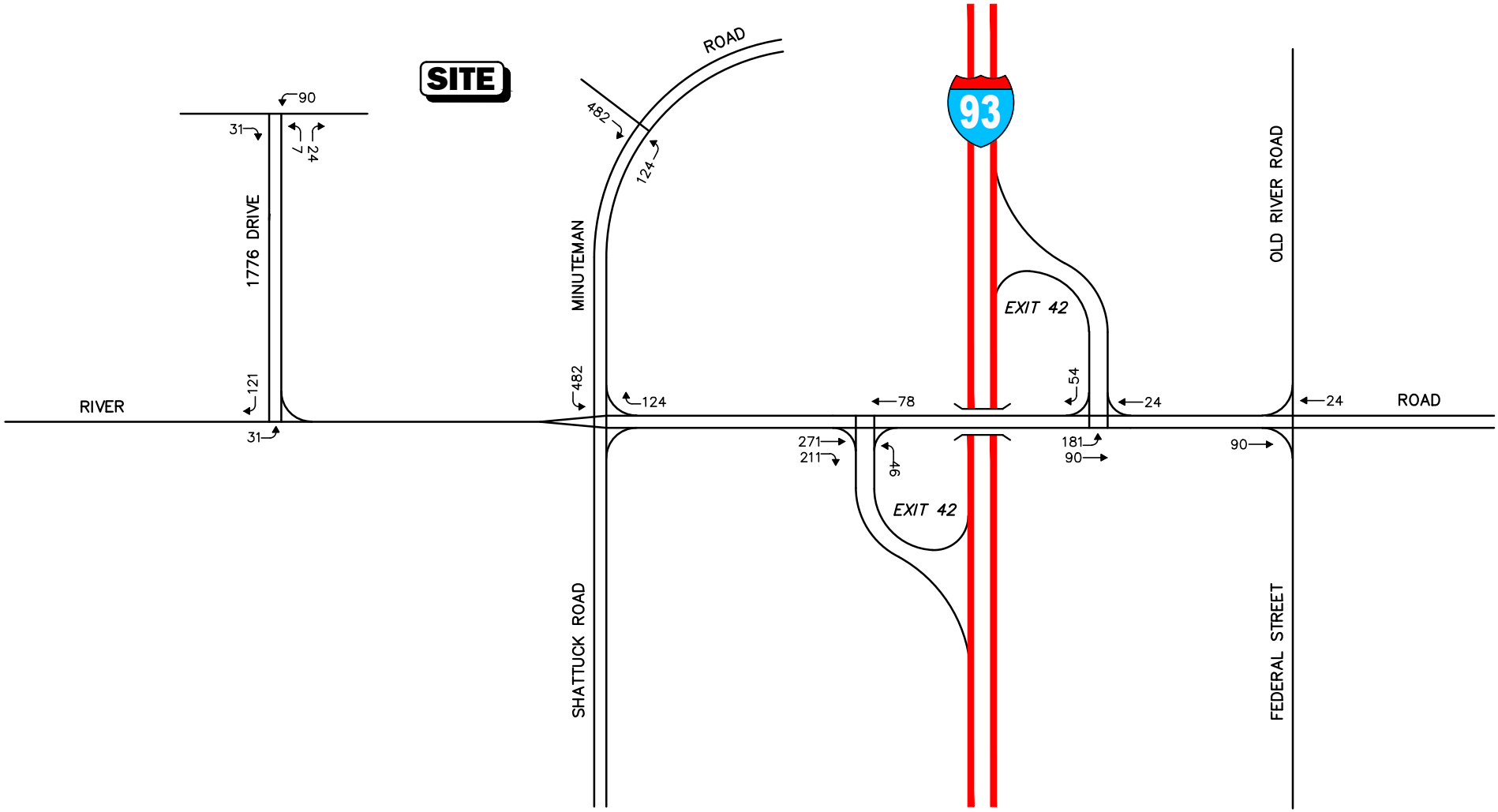
Not to Scale

Figure A5

Existing Site Reoccupancy
Weekday Morning
Peak-Hour Traffic Volumes

Vanasse & Associates inc

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Not to Scale

Figure A6

Existing Site Reoccupancy
Weekday Evening
Peak-Hour Traffic Volumes

Vanasse & Associates inc

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PROPOSED TRIP-GENERATION CALCULATIONS

Research and Development Center
(760)

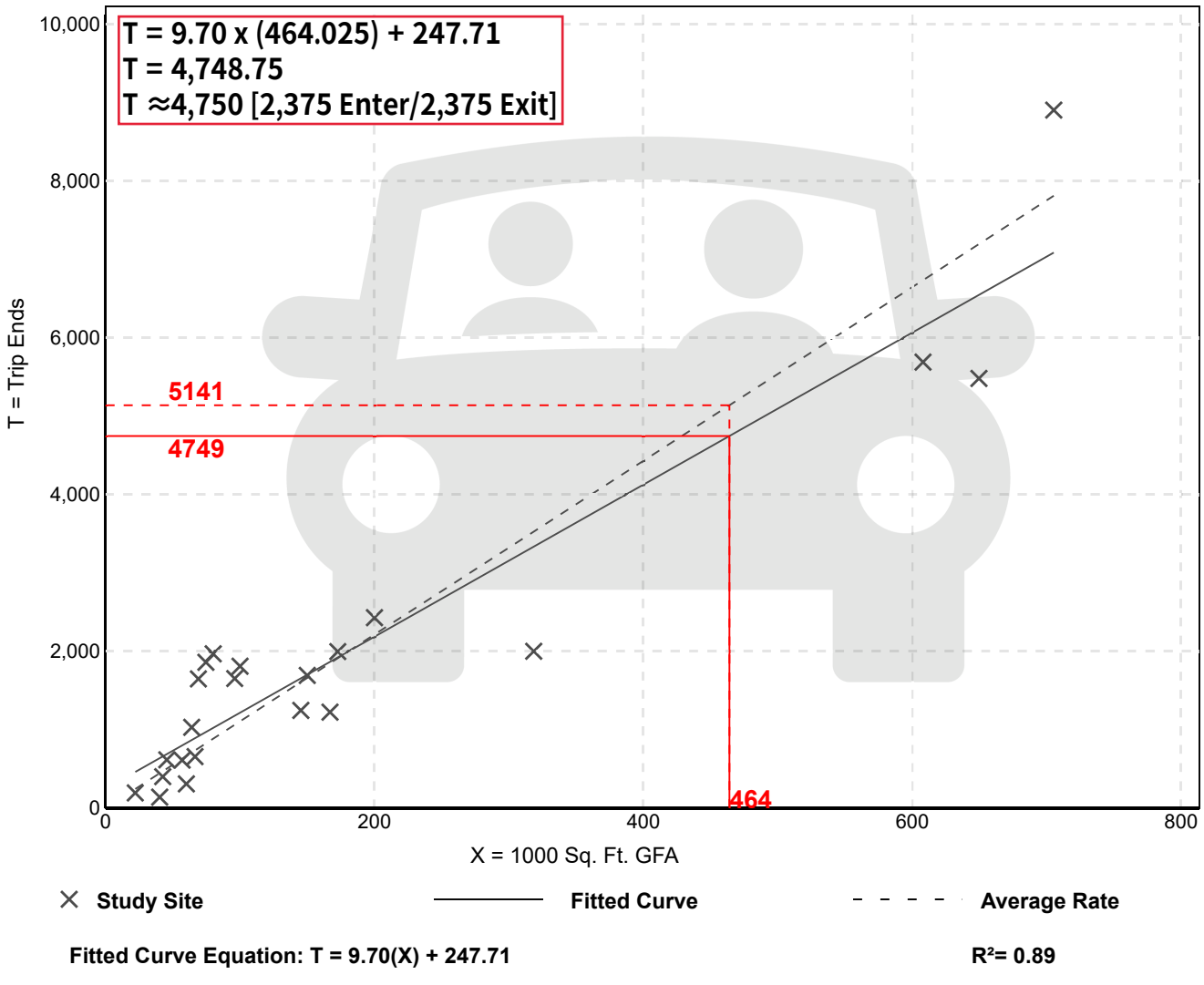
Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 22
Avg. 1000 Sq. Ft. GFA: 179
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
11.08	3.48 - 24.95	4.45

Data Plot and Equation



Fitted Curve Equation: T = 9.70(X) + 247.71

R^2= 0.89

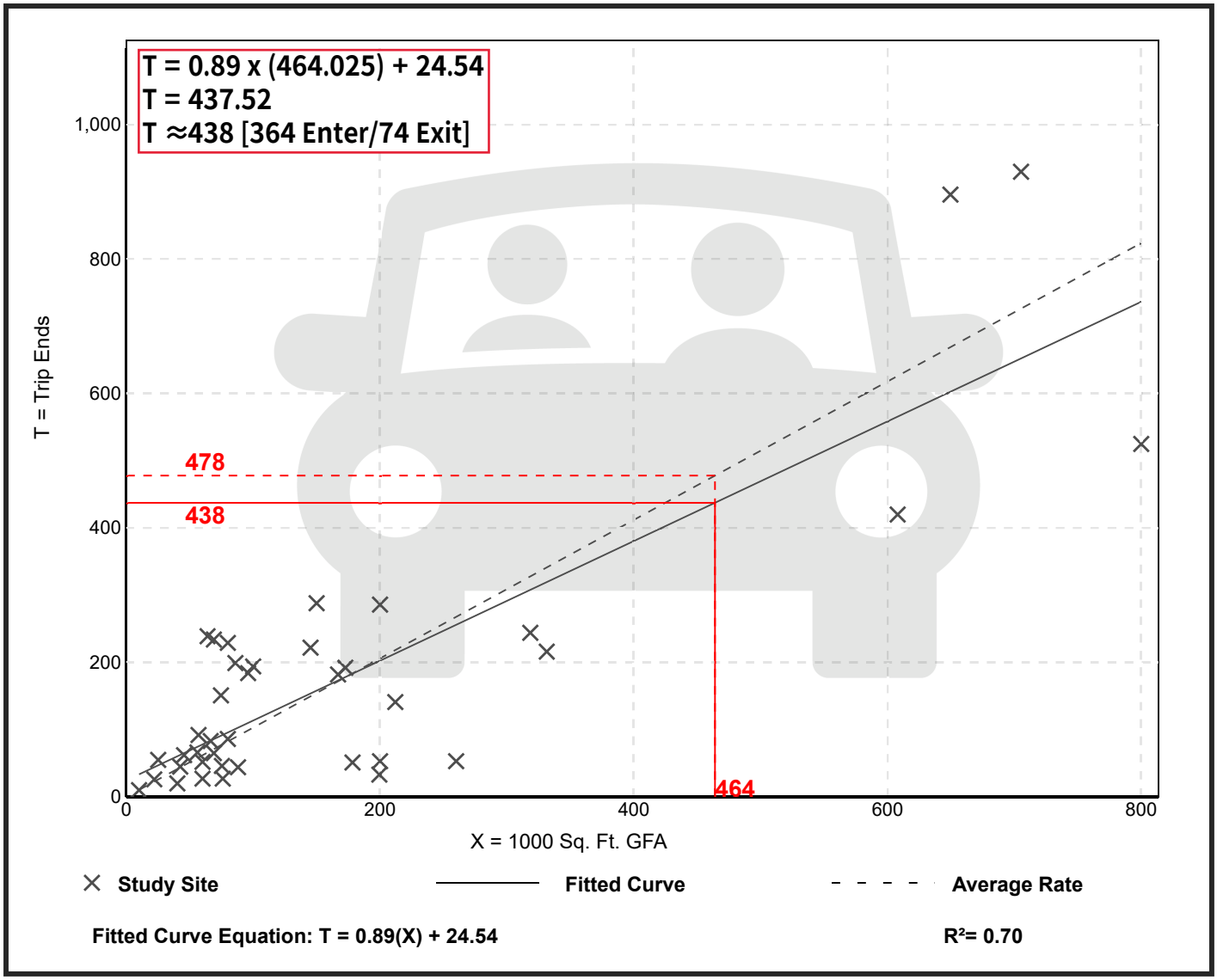
Research and Development Center
(760)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	39
Avg. 1000 Sq. Ft. GFA:	173
Directional Distribution:	82% entering, 18% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.03	0.17 - 3.73	0.65

Data Plot and Equation



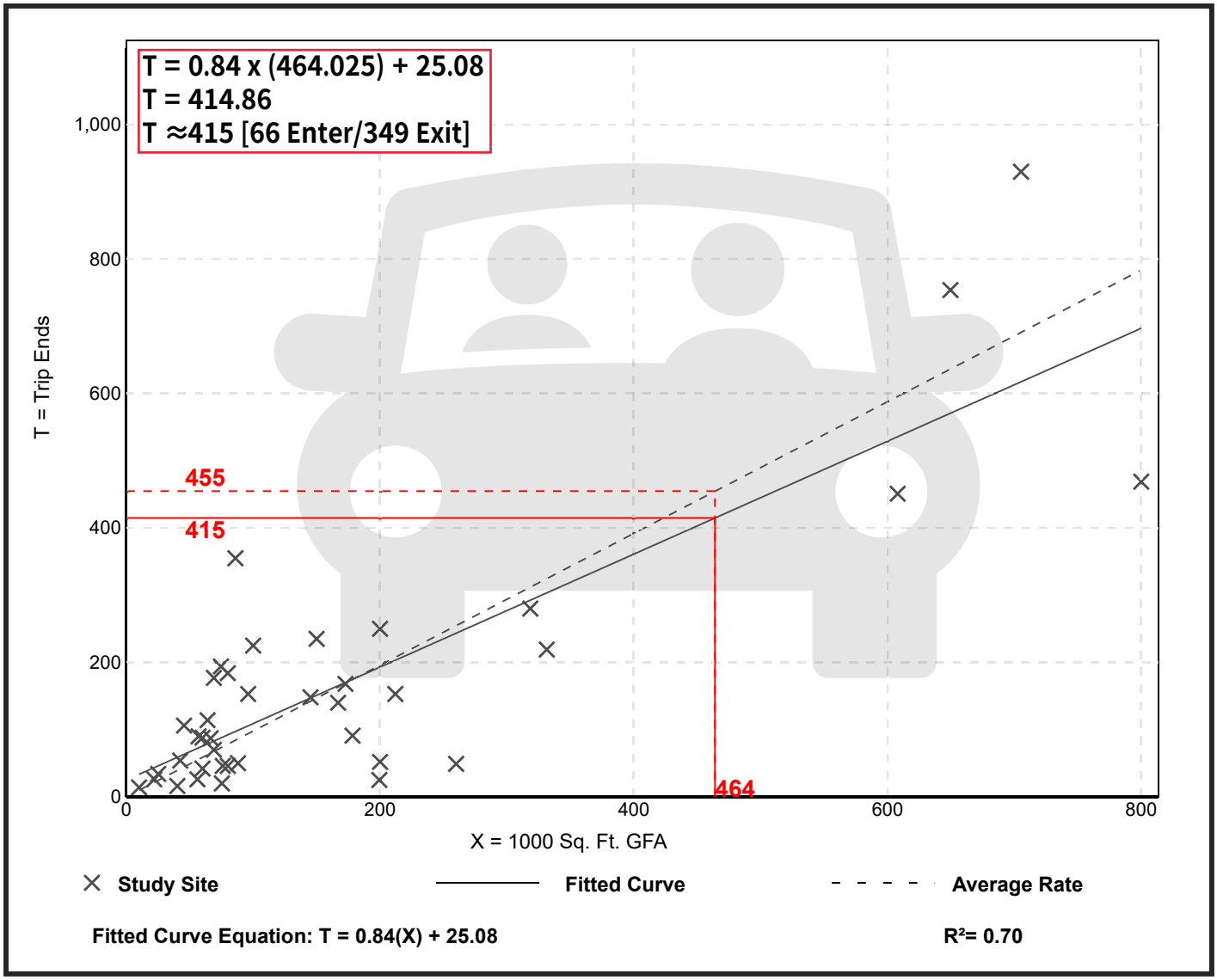
Research and Development Center
(760)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	39
Avg. 1000 Sq. Ft. GFA:	173
Directional Distribution:	16% entering, 84% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
0.98	0.13 - 4.13	0.64

Data Plot and Equation



Manufacturing
(140)

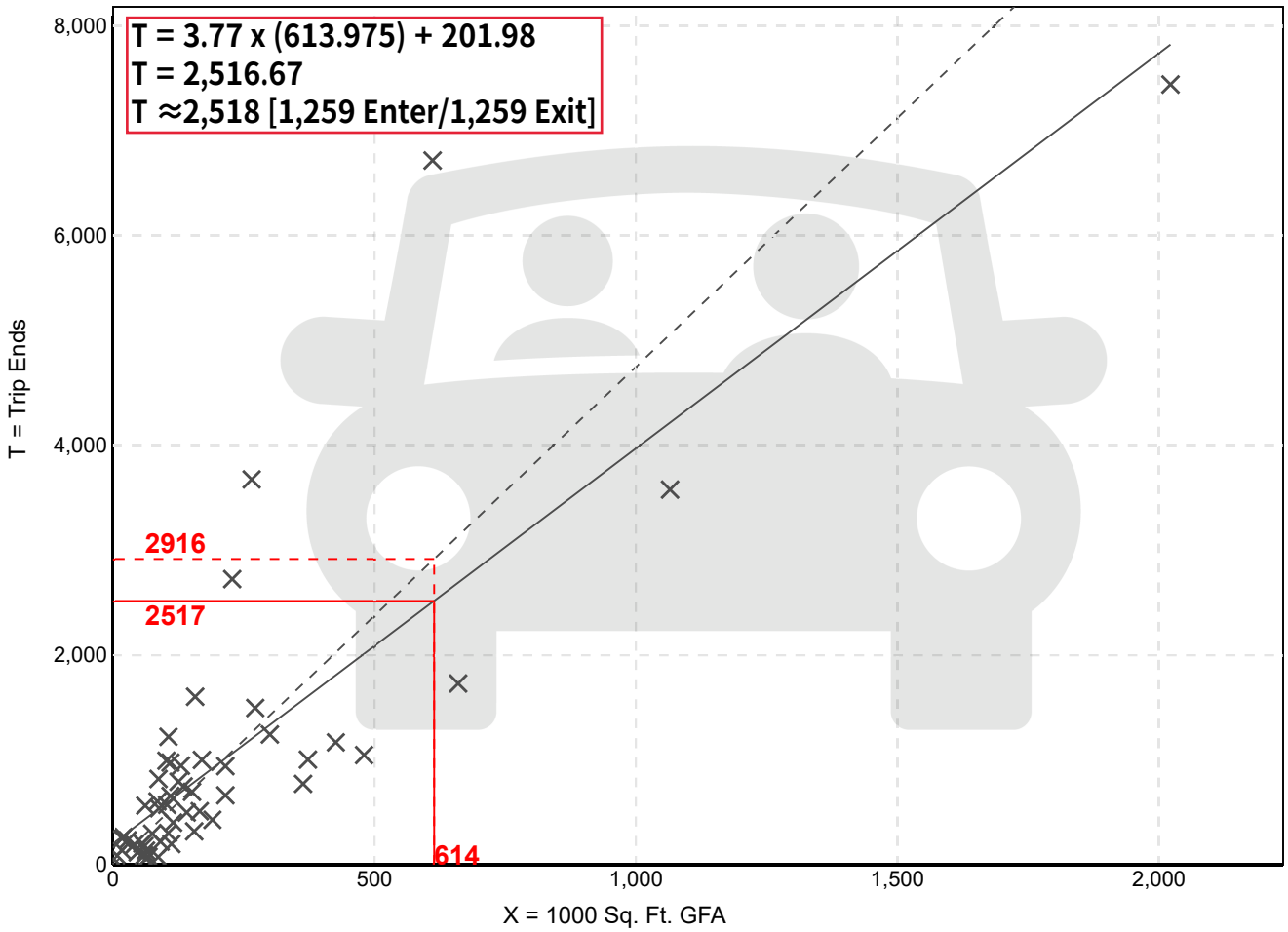
Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 53
Avg. 1000 Sq. Ft. GFA: 208
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
4.75	0.83 - 49.50	3.20

Data Plot and Equation



Fitted Curve Equation: T = 3.77(X) + 201.98

R^2= 0.68

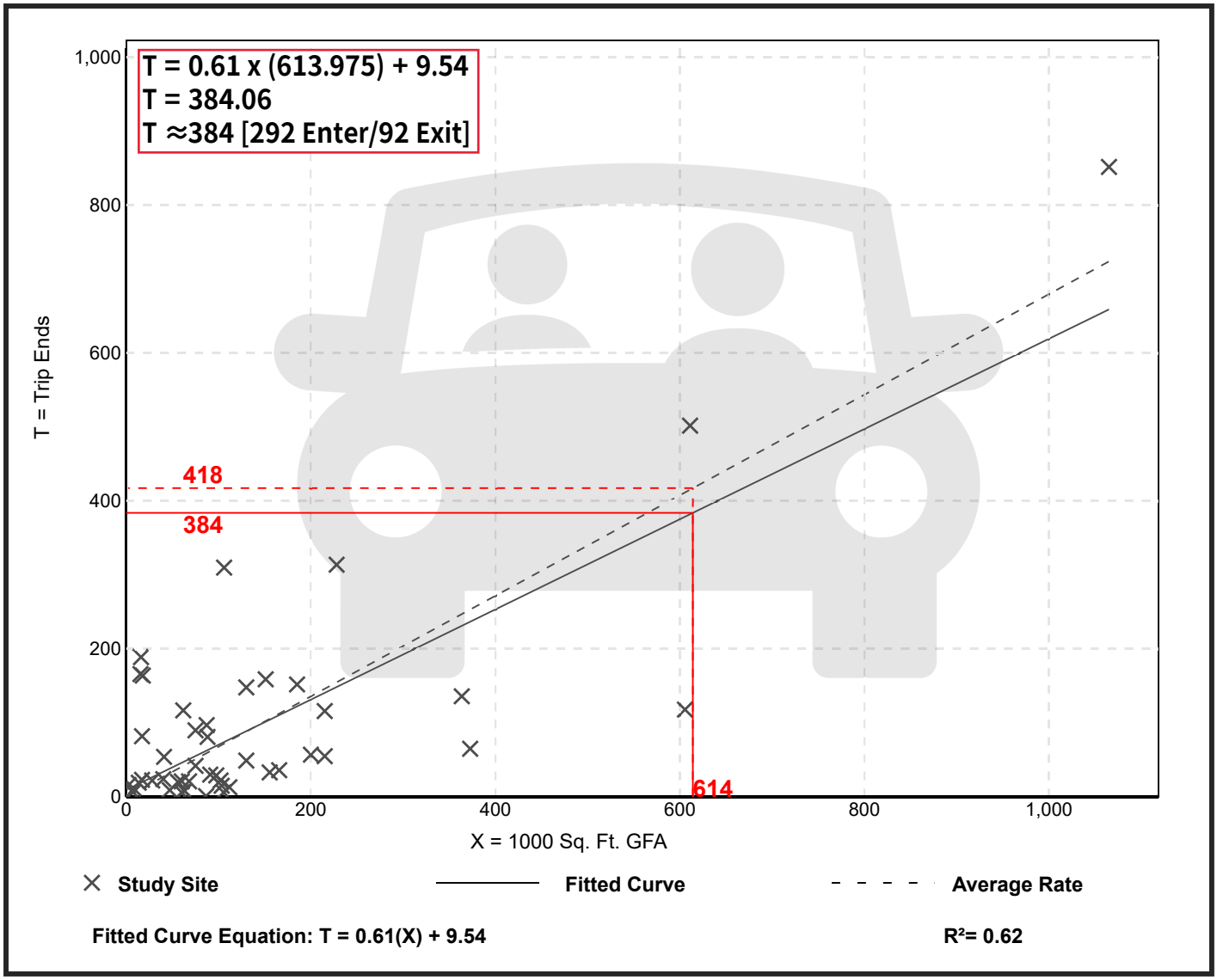
Manufacturing
(140)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	48
Avg. 1000 Sq. Ft. GFA:	138
Directional Distribution:	76% entering, 24% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
0.68	0.01 - 11.93	1.03

Data Plot and Equation



Fitted Curve Equation: T = 0.61(X) + 9.54

R^2= 0.62

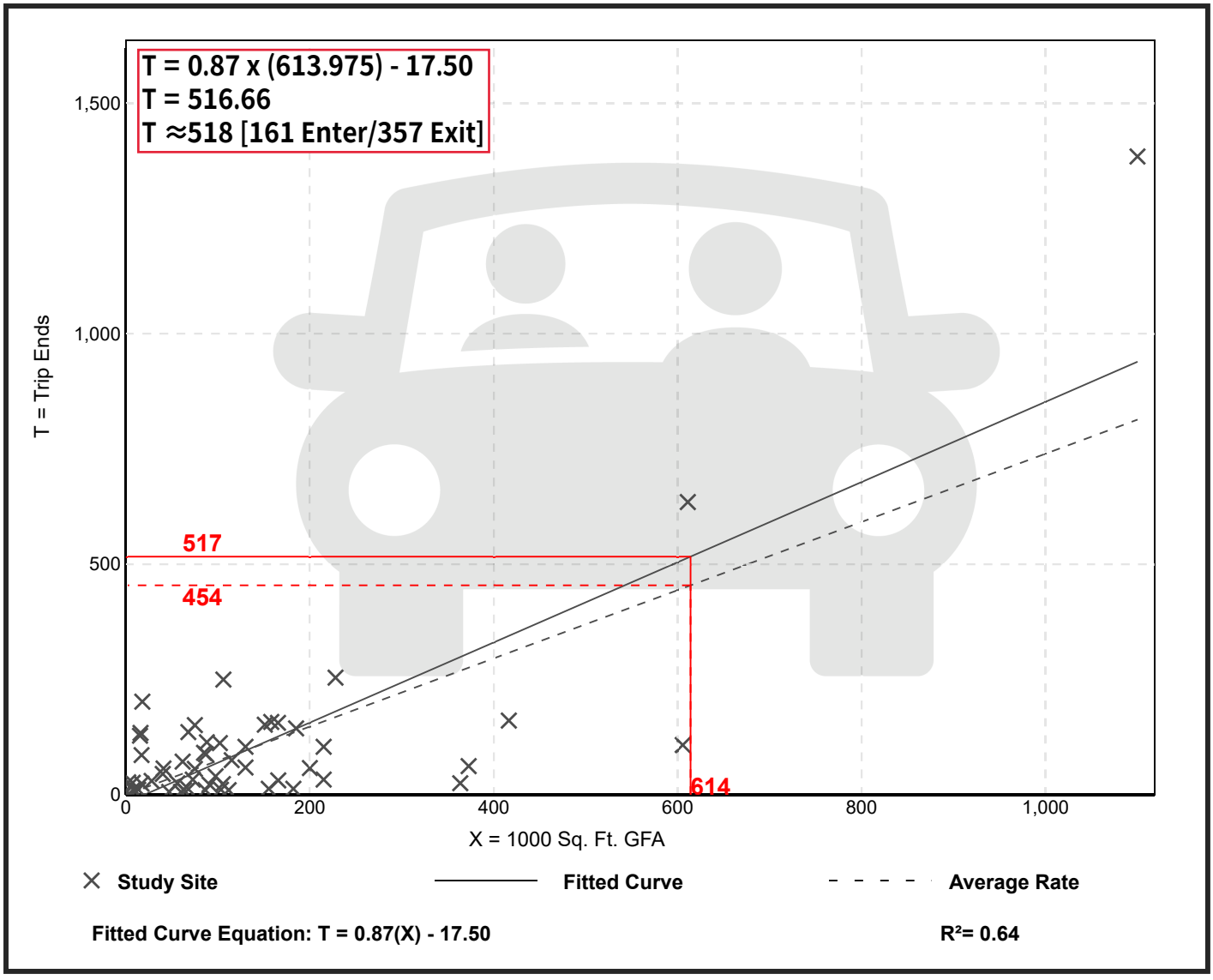
Manufacturing
(140)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	55
Avg. 1000 Sq. Ft. GFA:	142
Directional Distribution:	31% entering, 69% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
0.74	0.07 - 11.37	0.93

Data Plot and Equation



Fitted Curve Equation: T = 0.87(X) - 17.50

R^2= 0.64

EXISTING TRIP-GENERATION CALCULATIONS

Graph Look Up

Query Filter

DATA SOURCE:
Trip Generation Manual, 11th Ed

SEARCH BY LAND USE CODE:
140

LAND USE GROUP:
(100-199) Industrial

LAND USE :
140 - Manufacturing

LAND USE SUBCATEGORY:
All Sites

SETTING/LOCATION:
General Urban/Suburban

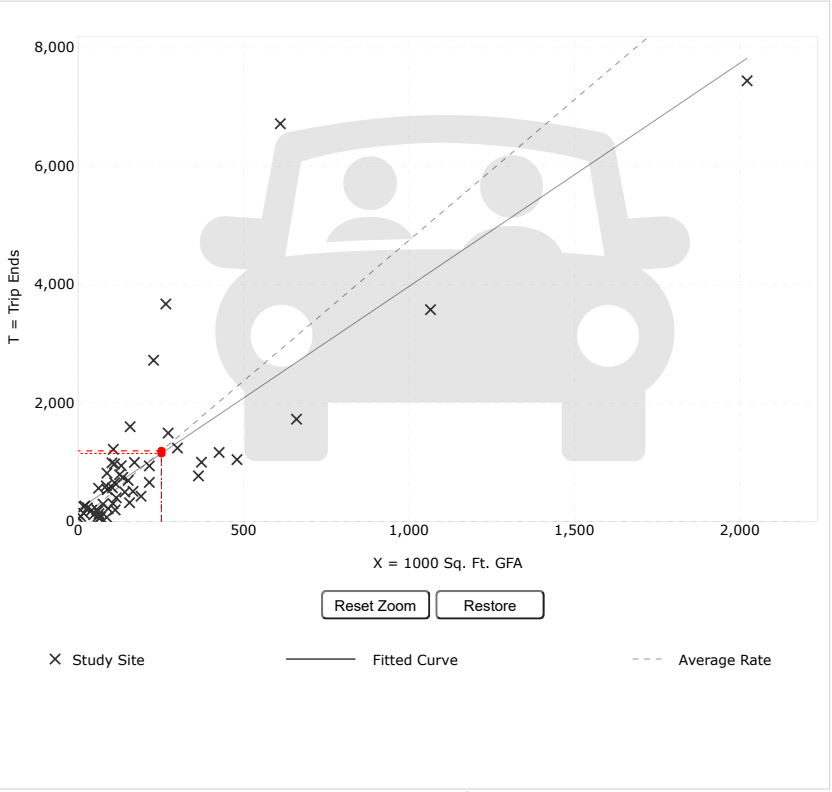
INDEPENDENT VARIABLE (IV):
1000 Sq. Ft. GFA

TIME PERIOD:
Weekday

TRIP TYPE:
Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:
251.48 Calculate

Data Plot and Equation



Use the mouse wheel to Zoom Out or Zoom In.
Hover the mouse pointer on data points to view X and T values.

DATA STATISTICS

Land Use:
Manufacturing (140) Click for Description and Data Plots

Independent Variable:
1000 Sq. Ft. GFA

Time Period:
Weekday

Setting/Location:
General Urban/Suburban

Trip Type:
Vehicle

Number of Studies:
53

Avg. 1000 Sq. Ft. GFA:
208

Average Rate:
4.75

Range of Rates:
0.83 - 49.50

Standard Deviation:
3.20

Fitted Curve Equation:
T = 3.77(X) + 201.98

R^2:
0.68

Directional Distribution:
50% entering, 50% exiting

Calculated Trip Ends:
Average Rate: 1195 (Total), 597 (Entry), 598 (Exit)
Fitted Curve: 1150 (Total), 575 (Entry), 575 (Exit)

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Graph Look Up

Query Filter

DATA SOURCE:
Trip Generation Manual, 11th Ed

SEARCH BY LAND USE CODE:
140

LAND USE GROUP:
(100-199) Industrial

LAND USE :
140 - Manufacturing

LAND USE SUBCATEGORY:
All Sites

SETTING/LOCATION:
General Urban/Suburban

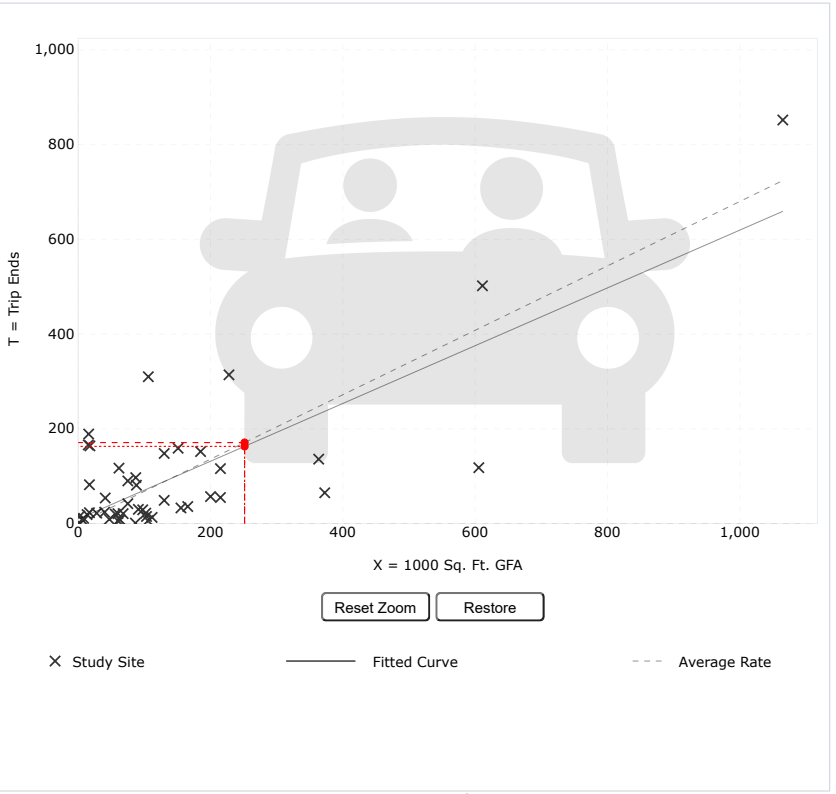
INDEPENDENT VARIABLE (IV):
1000 Sq. Ft. GFA

TIME PERIOD:
Weekday, Peak Hour of Adjacent Street Traffic

TRIP TYPE:
Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:
251.48 Calculate

Data Plot and Equation



Use the mouse wheel to Zoom Out or Zoom In.
Hover the mouse pointer on data points to view X and T values.

DATA STATISTICS

Land Use:
Manufacturing (140) Click for Description and Data Plots

Independent Variable:
1000 Sq. Ft. GFA

Time Period:
Weekday
Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.

Setting/Location:
General Urban/Suburban

Trip Type:
Vehicle

Number of Studies:
48

Avg. 1000 Sq. Ft. GFA:
138

Average Rate:
0.68

Range of Rates:
0.01 - 11.93

Standard Deviation:
1.03

Fitted Curve Equation:
T = 0.61(X) + 9.54

R^2:
0.62

Directional Distribution:
76% entering, 24% exiting

Calculated Trip Ends:
Average Rate: 171 (Total), 130 (Entry), 41 (Exit)
Fitted Curve: 163 (Total), 124 (Entry), 39 (Exit)

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Query | Filter

DATA SOURCE:
Trip Generation Manual, 11th Ed

SEARCH BY LAND USE CODE:
140

LAND USE GROUP:
(100-199) Industrial

LAND USE :
140 - Manufacturing

LAND USE SUBCATEGORY:
All Sites

SETTING/LOCATION:
General Urban/Suburban

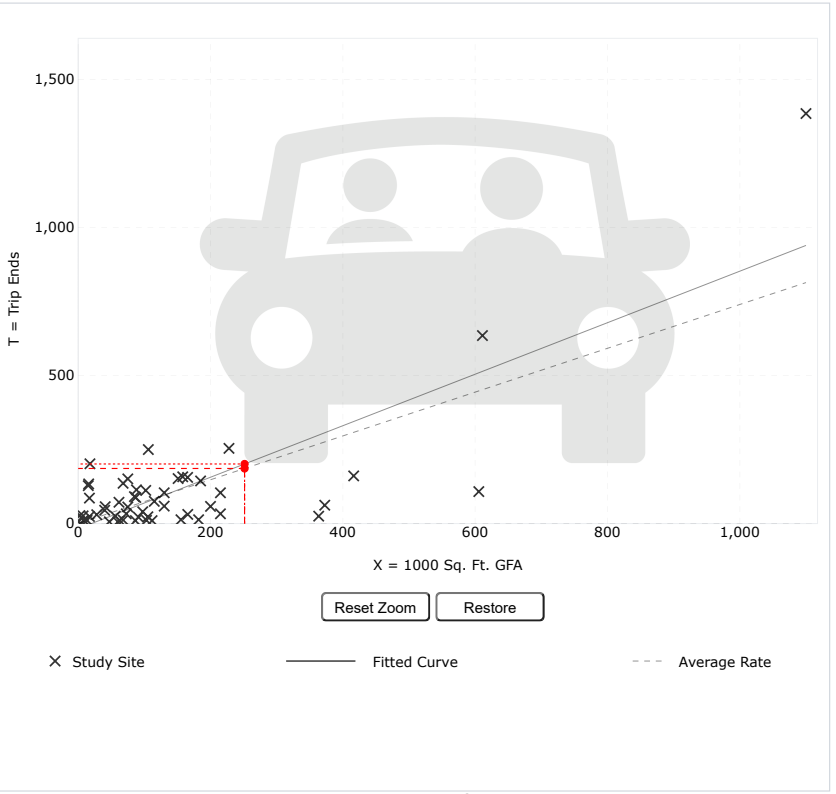
INDEPENDENT VARIABLE (IV):
1000 Sq. Ft. GFA

TIME PERIOD:
Weekday, Peak Hour of Adjacent Street Traffic

TRIP TYPE:
Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:
251.48 Calculate

Data Plot and Equation



Use the mouse wheel to Zoom Out or Zoom In.
Hover the mouse pointer on data points to view X and T values.

DATA STATISTICS

Land Use:
Manufacturing (140) Click for Description and Data Plots

Independent Variable:
1000 Sq. Ft. GFA

Time Period:
Weekday
Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.

Setting/Location:
General Urban/Suburban

Trip Type:
Vehicle

Number of Studies:
55

Avg. 1000 Sq. Ft. GFA:
142

Average Rate:
0.74

Range of Rates:
0.07 - 11.37

Standard Deviation:
0.93

Fitted Curve Equation:
T = 0.87(X) - 17.50

R^2:
0.64

Directional Distribution:
31% entering, 69% exiting

Calculated Trip Ends:
Average Rate: 186 (Total), 58 (Entry), 128 (Exit)
Fitted Curve: 201 (Total), 62 (Entry), 139 (Exit)

Add-ons to do more

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Graph Look Up

Query Filter

DATA SOURCE:
Trip Generation Manual, 11th Ed

SEARCH BY LAND USE CODE:
710

LAND USE GROUP:
(700-799) Office

LAND USE :
710 - General Office Building

LAND USE SUBCATEGORY:
All Sites

SETTING/LOCATION:
General Urban/Suburban

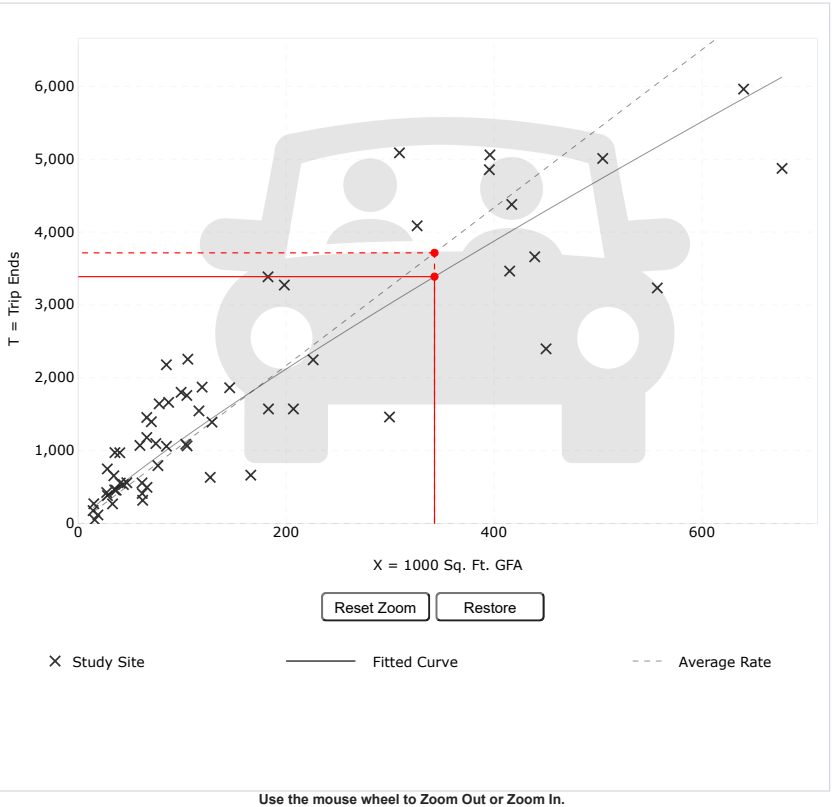
INDEPENDENT VARIABLE (IV):
1000 Sq. Ft. GFA

TIME PERIOD:
Weekday

TRIP TYPE:
Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:
342.7 Calculate

Data Plot and Equation



Use the mouse wheel to Zoom Out or Zoom In.
Hover the mouse pointer on data points to view X and T values.

DATA STATISTICS

Land Use:
General Office Building (710) Click for Description and Data Plots

Independent Variable:
1000 Sq. Ft. GFA

Time Period:
Weekday

Setting/Location:
General Urban/Suburban

Trip Type:
Vehicle

Number of Studies:
59

Avg. 1000 Sq. Ft. GFA:
163

Average Rate:
10.84

Range of Rates:
3.27 - 27.56

Standard Deviation:
4.76

Fitted Curve Equation:
Ln(T) = 0.87 Ln(X) + 3.05

R^2:
0.78

Directional Distribution:
50% entering, 50% exiting

Calculated Trip Ends:
Average Rate: 3715 (Total), 1857 (Entry), 1858 (Exit)
Fitted Curve: 3388 (Total), 1694 (Entry), 1694 (Exit)

VERSION: 6.0 (UPDATES) | DATA: 11TH EDITION | TERMS AND CONDITIONS | PRIVACY | ITE MARKETPLACE

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Query Filter

DATA SOURCE:
Trip Generation Manual, 11th Ed

SEARCH BY LAND USE CODE:
710

LAND USE GROUP:
(700-799) Office

LAND USE :
710 - General Office Building

LAND USE SUBCATEGORY:
All Sites

SETTING/LOCATION:
General Urban/Suburban

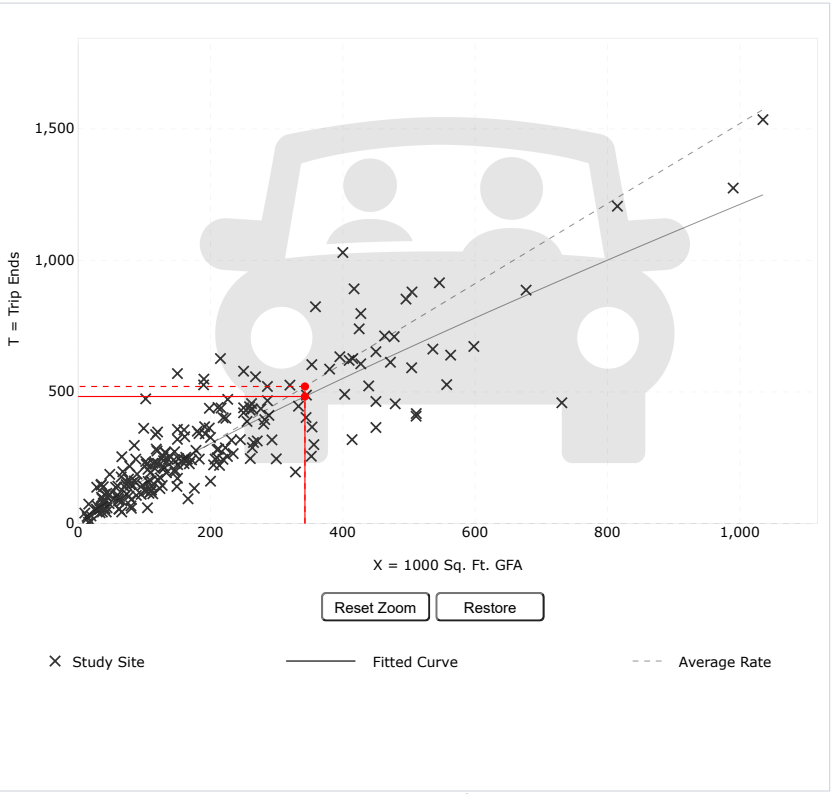
INDEPENDENT VARIABLE (IV):
1000 Sq. Ft. GFA

TIME PERIOD:
Weekday, Peak Hour of Adjacent Street Traffic

TRIP TYPE:
Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:
342.7 Calculate

Data Plot and Equation



Use the mouse wheel to Zoom Out or Zoom In.
Hover the mouse pointer on data points to view X and T values.

DATA STATISTICS

Land Use:
General Office Building (710) Click for Description and Data Plots

Independent Variable:
1000 Sq. Ft. GFA

Time Period:
Weekday
Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.

Setting/Location:
General Urban/Suburban

Trip Type:
Vehicle

Number of Studies:
221

Avg. 1000 Sq. Ft. GFA:
201

Average Rate:
1.52

Range of Rates:
0.32 - 4.93

Standard Deviation:
0.58

Fitted Curve Equation:
Ln(T) = 0.86 Ln(X) + 1.16

R^2:
0.78

Directional Distribution:
88% entering, 12% exiting

Calculated Trip Ends:
Average Rate: 521 (Total), 458 (Entry), 63 (Exit)
Fitted Curve: 483 (Total), 425 (Entry), 58 (Exit)

Add-ons to do more

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Query Filter

DATA SOURCE:
Trip Generation Manual, 11th Ed

SEARCH BY LAND USE CODE:
710

LAND USE GROUP:
(700-799) Office

LAND USE :
710 - General Office Building

LAND USE SUBCATEGORY:
All Sites

SETTING/LOCATION:
General Urban/Suburban

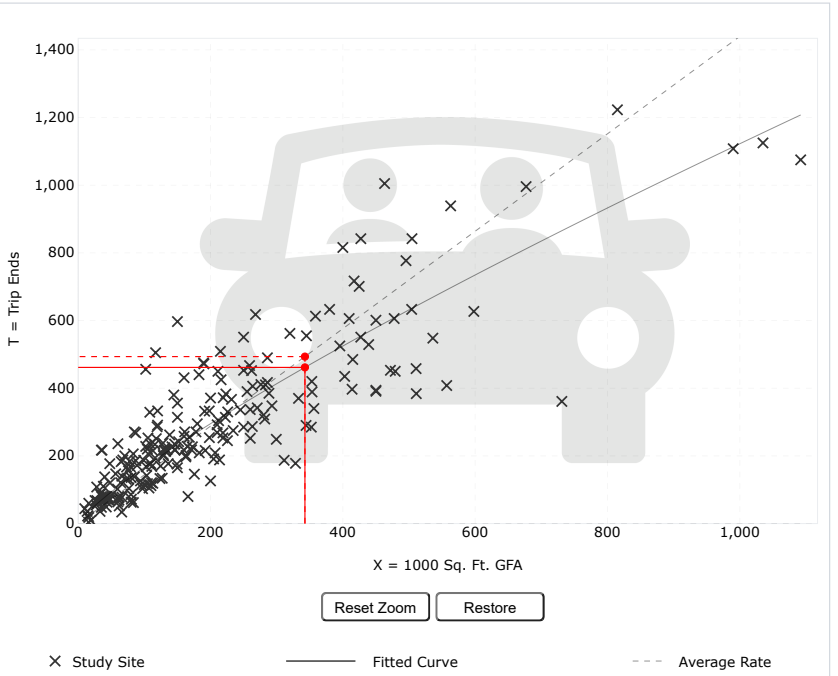
INDEPENDENT VARIABLE (IV):
1000 Sq. Ft. GFA

TIME PERIOD:
Weekday, Peak Hour of Adjacent Street Traffic

TRIP TYPE:
Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:
342.7 Calculate

Data Plot and Equation



Use the mouse wheel to Zoom Out or Zoom In.
Hover the mouse pointer on data points to view X and T values.

DATA STATISTICS

Land Use:
General Office Building (710) Click for Description and Data Plots

Independent Variable:
1000 Sq. Ft. GFA

Time Period:
Weekday
Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.

Setting/Location:
General Urban/Suburban

Trip Type:
Vehicle

Number of Studies:
232

Avg. 1000 Sq. Ft. GFA:
199

Average Rate:
1.44

Range of Rates:
0.26 - 6.20

Standard Deviation:
0.60

Fitted Curve Equation:
Ln(T) = 0.83 Ln(X) + 1.29

R^2:
0.77

Directional Distribution:
17% entering, 83% exiting

Calculated Trip Ends:
Average Rate: 493 (Total), 83 (Entry), 410 (Exit)
Fitted Curve: 462 (Total), 78 (Entry), 384 (Exit)

Add-ons to do more

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Comments

Query Filter

DATA SOURCE:
Trip Generation Manual, 11th Ed

SEARCH BY LAND USE CODE:
760

LAND USE GROUP:
(700-799) Office

LAND USE :
760 - Research and Development Center

LAND USE SUBCATEGORY:
All Sites

SETTING/LOCATION:
General Urban/Suburban

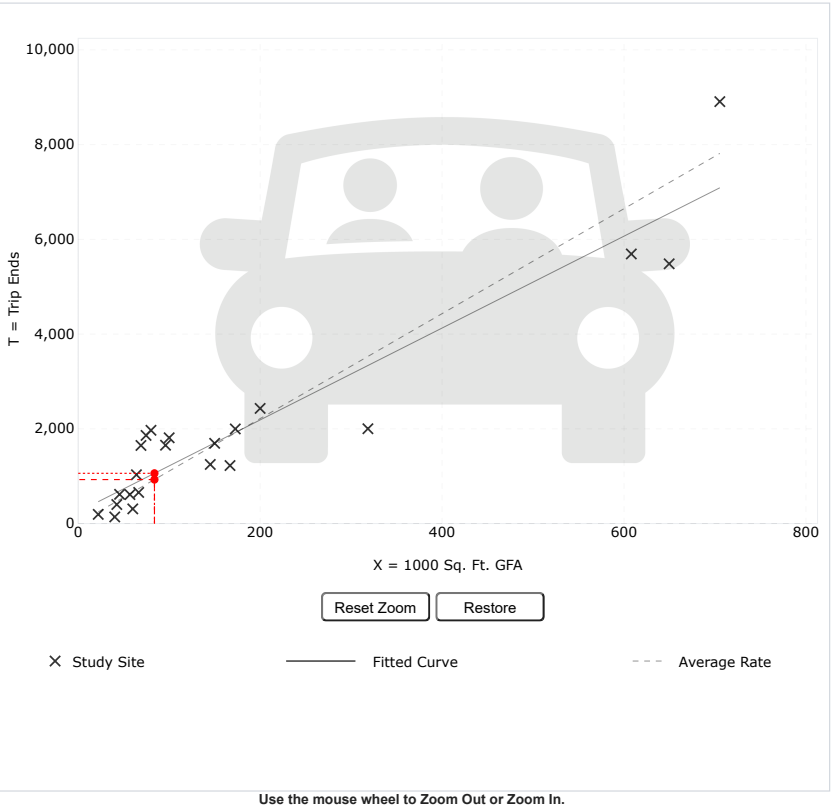
INDEPENDENT VARIABLE (IV):
1000 Sq. Ft. GFA

TIME PERIOD:
Weekday

TRIP TYPE:
Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:
83.83 Calculate

Data Plot and Equation



Use the mouse wheel to Zoom Out or Zoom In.
Hover the mouse pointer on data points to view X and T values.

DATA STATISTICS

Land Use:
Research and Development Center (760) Click for Description and Data Plots

Independent Variable:
1000 Sq. Ft. GFA

Time Period:
Weekday

Setting/Location:
General Urban/Suburban

Trip Type:
Vehicle

Number of Studies:
22

Avg. 1000 Sq. Ft. GFA:
179

Average Rate:
11.08

Range of Rates:
3.48 - 24.95

Standard Deviation:
4.45

Fitted Curve Equation:
T = 9.70(X) + 247.71

R^2:
0.89

Directional Distribution:
50% entering, 50% exiting

Calculated Trip Ends:
Average Rate: 929 (Total), 464 (Entry), 465 (Exit)
Fitted Curve: 1061 (Total), 530 (Entry), 531 (Exit)

Add-ons to do more

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Comments

Query | Filter

DATA SOURCE:
Trip Generation Manual, 11th Ed

SEARCH BY LAND USE CODE:
760

LAND USE GROUP:
(700-799) Office

LAND USE :
760 - Research and Development Center

LAND USE SUBCATEGORY:
All Sites

SETTING/LOCATION:
General Urban/Suburban

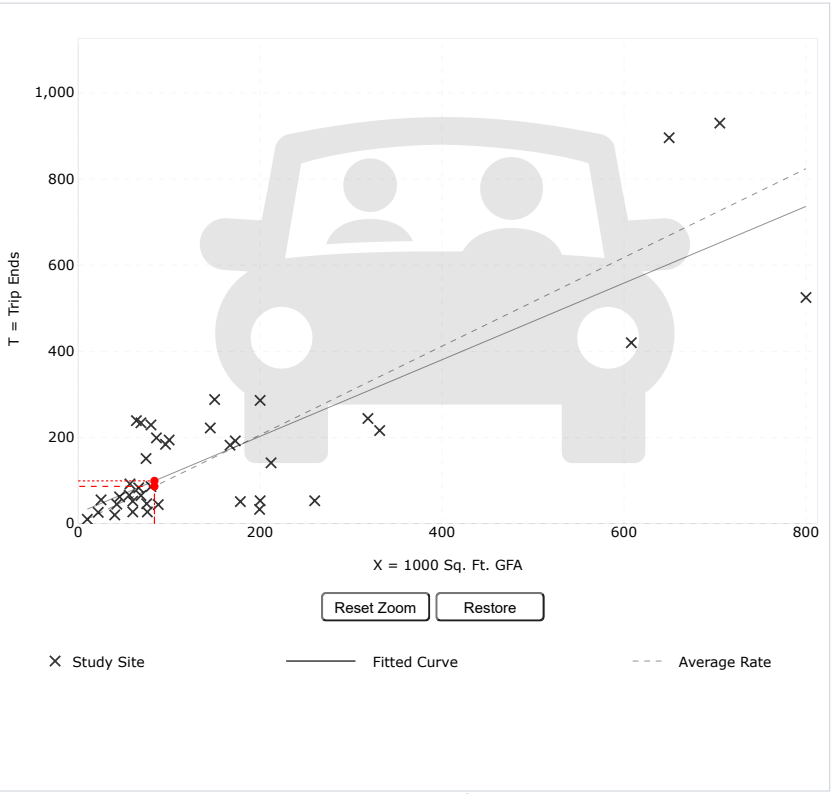
INDEPENDENT VARIABLE (IV):
1000 Sq. Ft. GFA

TIME PERIOD:
Weekday, Peak Hour of Adjacent Street Traffic

TRIP TYPE:
Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:
83.83 Calculate

Data Plot and Equation



Use the mouse wheel to Zoom Out or Zoom In.
Hover the mouse pointer on data points to view X and T values.

DATA STATISTICS

Land Use:
Research and Development Center (760) Click for Description and Data Plots

Independent Variable:
1000 Sq. Ft. GFA

Time Period:
Weekday
Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.

Setting/Location:
General Urban/Suburban

Trip Type:
Vehicle

Number of Studies:
39

Avg. 1000 Sq. Ft. GFA:
173

Average Rate:
1.03

Range of Rates:
0.17 - 3.73

Standard Deviation:
0.65

Fitted Curve Equation:
T = 0.89(X) + 24.54

R^2:
0.70

Directional Distribution:
82% entering, 18% exiting

Calculated Trip Ends:
Average Rate: 86 (Total), 70 (Entry), 16 (Exit)
Fitted Curve: 99 (Total), 81 (Entry), 18 (Exit)

Add-ons to do more

Try OTISS Pro

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Graph Look Up

Query Filter

DATA SOURCE:
Trip Generation Manual, 11th Ed

SEARCH BY LAND USE CODE:
760

LAND USE GROUP:
(700-799) Office

LAND USE :
760 - Research and Development Center

LAND USE SUBCATEGORY:
All Sites

SETTING/LOCATION:
General Urban/Suburban

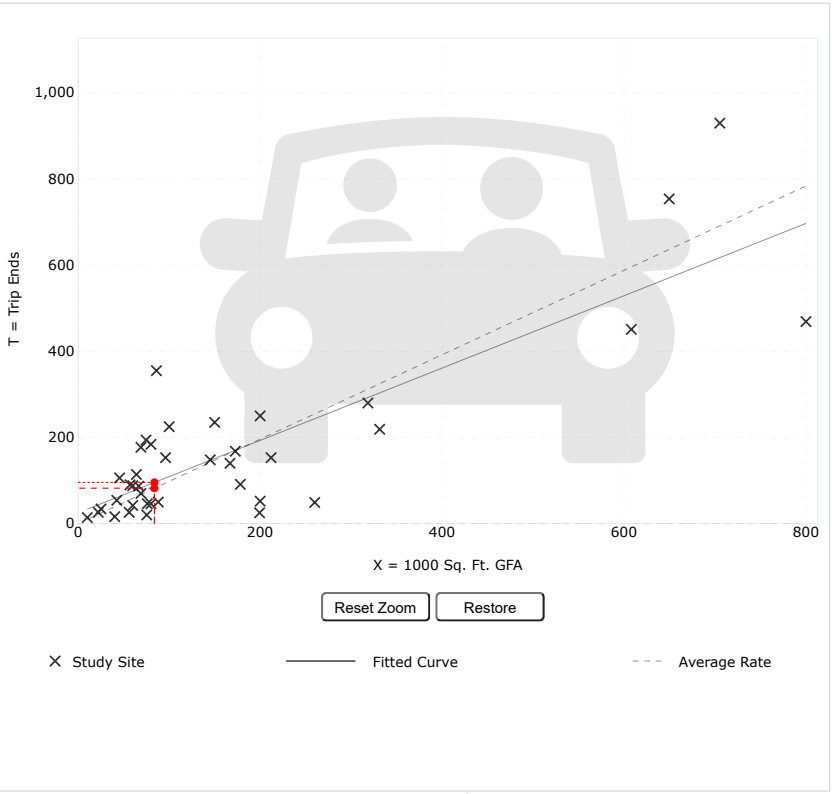
INDEPENDENT VARIABLE (IV):
1000 Sq. Ft. GFA

TIME PERIOD:
Weekday, Peak Hour of Adjacent Street Traffic

TRIP TYPE:
Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:
83.83 Calculate

Data Plot and Equation



Use the mouse wheel to Zoom Out or Zoom In.
Hover the mouse pointer on data points to view X and T values.

DATA STATISTICS

Land Use:
Research and Development Center (760) Click for Description and Data Plots

Independent Variable:
1000 Sq. Ft. GFA

Time Period:
Weekday
Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.

Setting/Location:
General Urban/Suburban

Trip Type:
Vehicle

Number of Studies:
39

Avg. 1000 Sq. Ft. GFA:
173

Average Rate:
0.98

Range of Rates:
0.13 - 4.13

Standard Deviation:
0.64

Fitted Curve Equation:
T = 0.84(X) + 25.08

R^2:
0.70

Directional Distribution:
16% entering, 84% exiting

Calculated Trip Ends:
Average Rate: 82 (Total), 13 (Entry), 69 (Exit)
Fitted Curve: 95 (Total), 15 (Entry), 80 (Exit)

Add-ons to do more

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CAPACITY ANALYSIS WORKSHEETS

River Road at 1776 Drive
River Road at Minuteman Road and Shattuck Road
River Road at the I-93 southbound ramps
River Road at the I-93 northbound ramps
River Road at Old River Road and Federal Street
Minuteman Road at the Project site driveway
1776 Drive at the Project site driveway

River Road at 1776 Drive

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	30	285	289	87	8	4
Future Vol, veh/h	30	285	289	87	8	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	Free	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	88	88	75	75
Heavy Vehicles, %	0	4	4	0	13	0
Mvmt Flow	33	310	328	99	11	5

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	328	0	-	0	704	328
Stage 1	-	-	-	-	328	-
Stage 2	-	-	-	-	376	-
Critical Hdwy	4.1	-	-	-	6.53	6.2
Critical Hdwy Stg 1	-	-	-	-	5.53	-
Critical Hdwy Stg 2	-	-	-	-	5.53	-
Follow-up Hdwy	2.2	-	-	-	3.617	3.3
Pot Cap-1 Maneuver	1243	-	-	0	387	718
Stage 1	-	-	-	0	706	-
Stage 2	-	-	-	0	671	-
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	1243	-	-	-	375	718
Mov Cap-2 Maneuver	-	-	-	-	375	-
Stage 1	-	-	-	-	683	-
Stage 2	-	-	-	-	671	-

Approach	EB	WB	SB
HCM Control Delay, s	0.8	0	13.3
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	SBLn1	SBLn2
Capacity (veh/h)	1243	-	-	375	718
HCM Lane V/C Ratio	0.026	-	-	0.028	0.007
HCM Control Delay (s)	8	0	-	14.9	10.1
HCM Lane LOS	A	A	-	B	B
HCM 95th %tile Q(veh)	0.1	-	-	0.1	0

Intersection	
Int Delay, s/veh	3.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	6	330	270	6	89	33
Future Vol, veh/h	6	330	270	6	89	33
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	Free	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	84	84	71	71
Heavy Vehicles, %	0	2	0	17	1	0
Mvmt Flow	6	347	321	7	125	46

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	321	0	-	0	680	321
Stage 1	-	-	-	-	321	-
Stage 2	-	-	-	-	359	-
Critical Hdwy	4.1	-	-	-	6.41	6.2
Critical Hdwy Stg 1	-	-	-	-	5.41	-
Critical Hdwy Stg 2	-	-	-	-	5.41	-
Follow-up Hdwy	2.2	-	-	-	3.509	3.3
Pot Cap-1 Maneuver	1250	-	-	0	418	724
Stage 1	-	-	-	0	738	-
Stage 2	-	-	-	0	709	-
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	1250	-	-	-	415	724
Mov Cap-2 Maneuver	-	-	-	-	415	-
Stage 1	-	-	-	-	734	-
Stage 2	-	-	-	-	709	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	15.5
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	SBLn1	SBLn2
Capacity (veh/h)	1250	-	-	415	724
HCM Lane V/C Ratio	0.005	-	-	0.302	0.064
HCM Control Delay (s)	7.9	0	-	17.4	10.3
HCM Lane LOS	A	A	-	C	B
HCM 95th %tile Q(veh)	0	-	-	1.3	0.2

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	156	350	331	87	8	27
Future Vol, veh/h	156	350	331	87	8	27
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	Free	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	88	88	75	75
Heavy Vehicles, %	0	4	4	0	13	0
Mvmt Flow	170	380	376	99	11	36

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	376	0	-	0	1096	376
Stage 1	-	-	-	-	376	-
Stage 2	-	-	-	-	720	-
Critical Hdwy	4.1	-	-	-	6.53	6.2
Critical Hdwy Stg 1	-	-	-	-	5.53	-
Critical Hdwy Stg 2	-	-	-	-	5.53	-
Follow-up Hdwy	2.2	-	-	-	3.617	3.3
Pot Cap-1 Maneuver	1194	-	-	0	225	675
Stage 1	-	-	-	0	671	-
Stage 2	-	-	-	0	463	-
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	1194	-	-	-	184	675
Mov Cap-2 Maneuver	-	-	-	-	184	-
Stage 1	-	-	-	-	550	-
Stage 2	-	-	-	-	463	-

Approach	EB	WB	SB
HCM Control Delay, s	2.6	0	14.1
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1194	-	-	-	184	675
HCM Lane V/C Ratio	0.142	-	-	-	0.058	0.053
HCM Control Delay (s)	8.5	0	-	-	25.8	10.6
HCM Lane LOS	A	A	-	-	D	B
HCM 95th %tile Q(veh)	0.5	-	-	-	0.2	0.2

Intersection	
Int Delay, s/veh	5.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	37	376	341	6	89	154
Future Vol, veh/h	37	376	341	6	89	154
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	Free	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	84	84	71	71
Heavy Vehicles, %	0	2	0	17	1	0
Mvmt Flow	39	396	406	7	125	217

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	406	0	-	0	880	406
Stage 1	-	-	-	-	406	-
Stage 2	-	-	-	-	474	-
Critical Hdwy	4.1	-	-	-	6.41	6.2
Critical Hdwy Stg 1	-	-	-	-	5.41	-
Critical Hdwy Stg 2	-	-	-	-	5.41	-
Follow-up Hdwy	2.2	-	-	-	3.509	3.3
Pot Cap-1 Maneuver	1164	-	-	0	319	649
Stage 1	-	-	-	0	675	-
Stage 2	-	-	-	0	628	-
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	1164	-	-	-	305	649
Mov Cap-2 Maneuver	-	-	-	-	305	-
Stage 1	-	-	-	-	646	-
Stage 2	-	-	-	-	628	-

Approach	EB	WB	SB
HCM Control Delay, s	0.7	0	17.5
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	SBLn1	SBLn2
Capacity (veh/h)	1164	-	-	305	649
HCM Lane V/C Ratio	0.033	-	-	0.411	0.334
HCM Control Delay (s)	8.2	0	-	24.8	13.3
HCM Lane LOS	A	A	-	C	B
HCM 95th %tile Q(veh)	0.1	-	-	1.9	1.5

Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	161	350	331	87	8	37
Future Vol, veh/h	161	350	331	87	8	37
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	Free	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	88	88	75	75
Heavy Vehicles, %	0	4	4	0	13	0
Mvmt Flow	175	380	376	99	11	49

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	376	0	-	0	1106	376
Stage 1	-	-	-	-	376	-
Stage 2	-	-	-	-	730	-
Critical Hdwy	4.1	-	-	-	6.53	6.2
Critical Hdwy Stg 1	-	-	-	-	5.53	-
Critical Hdwy Stg 2	-	-	-	-	5.53	-
Follow-up Hdwy	2.2	-	-	-	3.617	3.3
Pot Cap-1 Maneuver	1194	-	-	0	222	675
Stage 1	-	-	-	0	671	-
Stage 2	-	-	-	0	458	-
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	1194	-	-	-	181	675
Mov Cap-2 Maneuver	-	-	-	-	181	-
Stage 1	-	-	-	-	546	-
Stage 2	-	-	-	-	458	-

Approach	EB	WB	SB
HCM Control Delay, s	2.7	0	13.5
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	SBLn1	SBLn2
Capacity (veh/h)	1194	-	-	181	675
HCM Lane V/C Ratio	0.147	-	-	0.059	0.073
HCM Control Delay (s)	8.5	0	-	26.1	10.8
HCM Lane LOS	A	A	-	D	B
HCM 95th %tile Q(veh)	0.5	-	-	0.2	0.2

Intersection	
Int Delay, s/veh	5.9

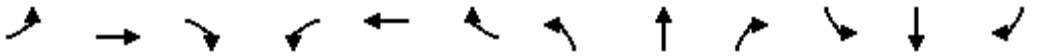
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	51	376	341	6	89	174
Future Vol, veh/h	51	376	341	6	89	174
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	Free	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	84	84	71	71
Heavy Vehicles, %	0	2	0	17	1	0
Mvmt Flow	54	396	406	7	125	245

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	406	0	-	0	910	406
Stage 1	-	-	-	-	406	-
Stage 2	-	-	-	-	504	-
Critical Hdwy	4.1	-	-	-	6.41	6.2
Critical Hdwy Stg 1	-	-	-	-	5.41	-
Critical Hdwy Stg 2	-	-	-	-	5.41	-
Follow-up Hdwy	2.2	-	-	-	3.509	3.3
Pot Cap-1 Maneuver	1164	-	-	0	306	649
Stage 1	-	-	-	0	675	-
Stage 2	-	-	-	0	609	-
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	1164	-	-	-	288	649
Mov Cap-2 Maneuver	-	-	-	-	288	-
Stage 1	-	-	-	-	635	-
Stage 2	-	-	-	-	609	-

Approach	EB	WB	SB
HCM Control Delay, s	1	0	18.3
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	SBLn1	SBLn2
Capacity (veh/h)	1164	-	-	288	649
HCM Lane V/C Ratio	0.046	-	-	0.435	0.378
HCM Control Delay (s)	8.2	0	-	26.8	13.9
HCM Lane LOS	A	A	-	D	B
HCM 95th %tile Q(veh)	0.1	-	-	2.1	1.8

River Road at Minuteman Road and Shattuck Road



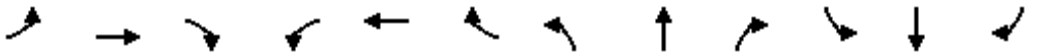
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	287	42	469	405	201	19	4	96	71	4	6
Future Volume (vph)	4	287	42	469	405	201	19	4	96	71	4	6
Lane Util. Factor	1.00	0.95	0.95	0.97	1.00	1.00	1.00	1.00	0.88	0.95	0.95	1.00
Frt		0.981				0.850			0.850			0.850
Flt Protected	0.950			0.950				0.961		0.950	0.957	
Satd. Flow (prot)	1805	3422	0	3351	1783	1546	0	1637	2642	1665	1682	1615
Flt Permitted	0.950			0.950				0.961		0.950	0.957	
Satd. Flow (perm)	1805	3422	0	3351	1783	1546	0	1637	2642	1665	1682	1615
Satd. Flow (RTOR)		19				226						232
Adj. Flow (vph)	4	315	46	527	455	226	22	5	112	75	4	6
Lane Group Flow (vph)	4	361	0	527	455	226	0	27	112	40	39	6
Turn Type	Prot	NA		Prot	NA	Prot	Split	NA	pt+ov	Split	NA	Free
Protected Phases	5	2		1	6	6	8	8	1 8	3	3	
Permitted Phases												Free
Detector Phase	5	2		1	6	6	8	8	1 8	3	3	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Minimum Split (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0		10.0	10.0	
Total Split (s)	25.0	23.0		25.0	23.0	23.0	17.0	17.0		15.0	15.0	
Total Split (%)	31.3%	28.8%		31.3%	28.8%	28.8%	21.3%	21.3%		18.8%	18.8%	
Maximum Green (s)	20.0	18.0		20.0	18.0	18.0	12.0	12.0		10.0	10.0	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0	-1.0		-1.0		-1.0	-1.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	C-Min		None	C-Min	C-Min	None	None		None	None	
v/c Ratio	0.03	0.26		0.67	0.38	0.20		0.15	0.12	0.23	0.22	0.00
Control Delay	33.8	19.2		43.2	10.7	4.4		34.0	15.3	35.3	35.1	0.0
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	33.8	19.2		43.2	10.7	4.4		34.0	15.3	35.3	35.1	0.0
Queue Length 50th (ft)	2	63		146	78	0		12	19	20	18	0
Queue Length 95th (ft)	11	115		192	179	54		34	31	48	47	0
Internal Link Dist (ft)		766			1120			242			1320	
Turn Bay Length (ft)	80			350					190	125		100
Base Capacity (vph)	473	1395		904	1199	1114		266	997	228	231	1615
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	0.01	0.26		0.58	0.38	0.20		0.10	0.11	0.18	0.17	0.00

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 39 (49%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 55

Control Type: Actuated-Coordinated

Splits and Phases: 2: Shattuck Road/Minuteman Road & River Road

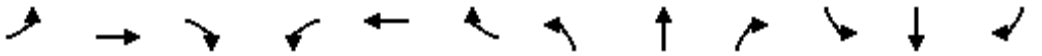




Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	287	42	469	405	201	19	4	96	71	4	6
Future Volume (vph)	4	287	42	469	405	201	19	4	96	71	4	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	11	11	11	10	10	11	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	5.0	4.0	4.0	3.0
Lane Util. Factor	1.00	0.95		0.97	1.00	1.00		1.00	0.88	0.95	0.95	1.00
Frt	1.00	0.98		1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.96	1.00
Satd. Flow (prot)	1805	3422		3351	1783	1546		1637	2642	1665	1682	1615
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.96	1.00
Satd. Flow (perm)	1805	3422		3351	1783	1546		1637	2642	1665	1682	1615
Peak-hour factor, PHF	0.91	0.91	0.91	0.89	0.89	0.89	0.86	0.86	0.86	0.95	0.95	0.95
Adj. Flow (vph)	4	315	46	527	455	226	22	5	112	75	4	6
RTOR Reduction (vph)	0	12	0	0	0	93	0	0	0	0	0	0
Lane Group Flow (vph)	4	349	0	527	455	133	0	27	112	40	39	6
Heavy Vehicles (%)	0%	4%	0%	1%	3%	1%	5%	0%	4%	3%	0%	0%
Turn Type	Prot	NA		Prot	NA	Prot	Split	NA	pt+ov	Split	NA	Free
Protected Phases	5	2		1	6	6	8	8	1 8	3	3	
Permitted Phases												Free
Actuated Green, G (s)	1.3	29.4		17.9	46.0	46.0		6.4	29.3	6.3	6.3	80.0
Effective Green, g (s)	2.3	30.4		18.9	47.0	47.0		7.4	29.3	7.3	7.3	80.0
Actuated g/C Ratio	0.03	0.38		0.24	0.59	0.59		0.09	0.37	0.09	0.09	1.00
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	51	1300		791	1047	908		151	967	151	153	1615
v/s Ratio Prot	0.00	0.10		c0.16	c0.26	0.09		c0.02	0.04	c0.02	0.02	
v/s Ratio Perm												0.00
v/c Ratio	0.08	0.27		0.67	0.43	0.15		0.18	0.12	0.26	0.25	0.00
Uniform Delay, d1	37.8	17.1		27.7	9.1	7.4		33.5	16.8	33.9	33.8	0.0
Progression Factor	1.00	1.00		1.44	1.03	2.24		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.5		2.0	1.2	0.3		0.6	0.1	0.9	0.9	0.0
Delay (s)	38.5	17.6		41.8	10.6	17.0		34.1	16.8	34.8	34.7	0.0
Level of Service	D	B		D	B	B		C	B	C	C	A
Approach Delay (s)		17.9			25.4			20.2			32.3	
Approach LOS		B			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	23.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	44.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



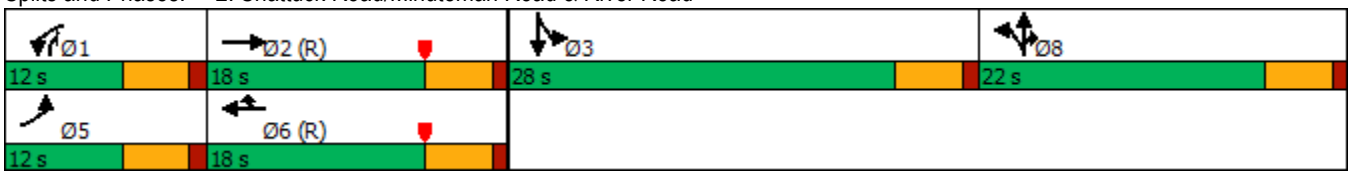
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	426	20	103	279	62	33	5	341	160	7	12
Future Volume (vph)	8	426	20	103	279	62	33	5	341	160	7	12
Lane Util. Factor	1.00	0.95	0.95	0.97	1.00	1.00	1.00	1.00	0.88	0.95	0.95	1.00
Frt		0.993				0.850			0.850			0.850
Flt Protected	0.950			0.950				0.958		0.950	0.956	
Satd. Flow (prot)	1805	3551	0	3351	1837	1516	0	1699	2720	1698	1710	1615
Flt Permitted	0.950			0.950				0.958		0.950	0.956	
Satd. Flow (perm)	1805	3551	0	3351	1837	1516	0	1699	2720	1698	1710	1615
Satd. Flow (RTOR)		5				164						232
Adj. Flow (vph)	9	468	22	121	328	73	49	7	509	213	9	16
Lane Group Flow (vph)	9	490	0	121	328	73	0	56	509	111	111	16
Turn Type	Prot	NA		Prot	NA	Prot	Split	NA	pt+ov	Split	NA	Free
Protected Phases	5	2		1	6	6	8	8	1 8	3	3	
Permitted Phases												Free
Detector Phase	5	2		1	6	6	8	8	1 8	3	3	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Minimum Split (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0		10.0	10.0	
Total Split (s)	12.0	18.0		12.0	18.0	18.0	22.0	22.0		28.0	28.0	
Total Split (%)	15.0%	22.5%		15.0%	22.5%	22.5%	27.5%	27.5%		35.0%	35.0%	
Maximum Green (s)	7.0	13.0		7.0	13.0	13.0	17.0	17.0		23.0	23.0	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0	-1.0		-1.0		-1.0	-1.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	C-Min		None	C-Min	C-Min	None	None		None	None	
v/c Ratio	0.06	0.45		0.32	0.41	0.10		0.14	0.48	0.45	0.45	0.01
Control Delay	34.0	26.3		49.3	15.2	1.3		23.4	19.6	36.4	36.3	0.0
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	34.0	26.3		49.3	15.2	1.3		23.4	19.6	36.4	36.3	0.0
Queue Length 50th (ft)	4	100		34	33	0		22	107	54	54	0
Queue Length 95th (ft)	18	#192		45	#245	2		34	90	80	80	0
Internal Link Dist (ft)		766			1120			242			1320	
Turn Bay Length (ft)	80			350					190	125		100
Base Capacity (vph)	180	1092		384	807	757		423	1024	509	513	1615
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	0.05	0.45		0.32	0.41	0.10		0.13	0.50	0.22	0.22	0.01

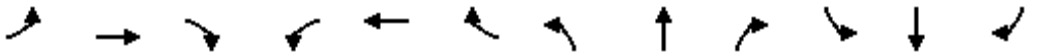
Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 29 (36%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 50

Control Type: Actuated-Coordinated

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: Shattuck Road/Minuteman Road & River Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	426	20	103	279	62	33	5	341	160	7	12
Future Volume (vph)	8	426	20	103	279	62	33	5	341	160	7	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	11	11	11	10	10	11	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	5.0	4.0	4.0	3.0
Lane Util. Factor	1.00	0.95		0.97	1.00	1.00		1.00	0.88	0.95	0.95	1.00
Frt	1.00	0.99		1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.96	1.00
Satd. Flow (prot)	1805	3552		3351	1837	1516		1699	2720	1698	1710	1615
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.96	1.00
Satd. Flow (perm)	1805	3552		3351	1837	1516		1699	2720	1698	1710	1615
Peak-hour factor, PHF	0.91	0.91	0.91	0.85	0.85	0.85	0.67	0.67	0.67	0.75	0.75	0.75
Adj. Flow (vph)	9	468	22	121	328	73	49	7	509	213	9	16
RTOR Reduction (vph)	0	3	0	0	0	45	0	0	0	0	0	0
Lane Group Flow (vph)	9	487	0	121	328	28	0	56	509	111	111	16
Heavy Vehicles (%)	0%	1%	0%	1%	0%	3%	0%	0%	1%	1%	0%	0%
Turn Type	Prot	NA		Prot	NA	Prot	Split	NA	pt+ov	Split	NA	Free
Protected Phases	5	2		1	6	6	8	8	1 8	3	3	
Permitted Phases												Free
Actuated Green, G (s)	1.4	23.5		8.0	30.1	30.1		17.9	30.9	10.6	10.6	80.0
Effective Green, g (s)	2.4	24.5		9.0	31.1	31.1		18.9	30.9	11.6	11.6	80.0
Actuated g/C Ratio	0.03	0.31		0.11	0.39	0.39		0.24	0.39	0.14	0.14	1.00
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	54	1087		376	714	589		401	1050	246	247	1615
v/s Ratio Prot	0.00	0.14		0.04	c0.18	0.02		0.03	c0.19	c0.07	0.06	
v/s Ratio Perm												0.01
v/c Ratio	0.17	0.45		0.32	0.46	0.05		0.14	0.48	0.45	0.45	0.01
Uniform Delay, d1	37.8	22.3		32.7	18.2	15.2		24.1	18.5	31.3	31.3	0.0
Progression Factor	1.00	1.00		1.45	0.57	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.5	1.3		0.5	2.1	0.2		0.2	0.4	1.3	1.3	0.0
Delay (s)	39.3	23.6		47.9	12.4	15.4		24.3	18.9	32.6	32.6	0.0
Level of Service	D	C		D	B	B		C	B	C	C	A
Approach Delay (s)		23.9			21.1			19.4			30.4	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	22.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	40.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	39	319	41	467	523	845	22	4	106	192	4	13
Future Volume (vph)	39	319	41	467	523	845	22	4	106	192	4	13
Lane Util. Factor	1.00	0.95	0.95	0.97	1.00	1.00	1.00	1.00	0.88	0.95	0.95	1.00
Frt		0.983				0.850			0.850			0.850
Flt Protected	0.950			0.950				0.960		0.950	0.954	
Satd. Flow (prot)	1805	3427	0	3351	1783	1546	0	1634	2642	1665	1674	1615
Flt Permitted	0.950			0.950				0.960		0.950	0.954	
Satd. Flow (perm)	1805	3427	0	3351	1783	1546	0	1634	2642	1665	1674	1615
Satd. Flow (RTOR)		16				949						232
Adj. Flow (vph)	43	351	45	525	588	949	26	5	123	202	4	14
Lane Group Flow (vph)	43	396	0	525	588	949	0	31	123	103	103	14
Turn Type	Prot	NA		Prot	NA	Prot	Split	NA	pt+ov	Split	NA	Free
Protected Phases	5	2		1	6	6	8	8	1 8	3	3	
Permitted Phases												Free
Detector Phase	5	2		1	6	6	8	8	1 8	3	3	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Minimum Split (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0		10.0	10.0	
Total Split (s)	25.0	23.0		25.0	23.0	23.0	17.0	17.0		15.0	15.0	
Total Split (%)	31.3%	28.8%		31.3%	28.8%	28.8%	21.3%	21.3%		18.8%	18.8%	
Maximum Green (s)	20.0	18.0		20.0	18.0	18.0	12.0	12.0		10.0	10.0	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0	-1.0		-1.0		-1.0	-1.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	C-Min		None	C-Min	C-Min	None	None		None	None	
v/c Ratio	0.23	0.30		0.66	0.57	0.73		0.17	0.13	0.50	0.50	0.01
Control Delay	35.1	20.8		33.9	19.0	7.8		34.1	15.4	41.1	40.9	0.0
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	35.1	20.8		33.9	19.0	7.8		34.1	15.4	41.1	40.9	0.0
Queue Length 50th (ft)	20	75		143	189	111		14	22	50	50	0
Queue Length 95th (ft)	48	128		m180	m#348	m158		37	33	101	101	0
Internal Link Dist (ft)		766			1120			242			1320	
Turn Bay Length (ft)	80			350					190	125		100
Base Capacity (vph)	473	1330		903	1035	1295		265	996	228	230	1615
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	0.09	0.30		0.58	0.57	0.73		0.12	0.12	0.45	0.45	0.01

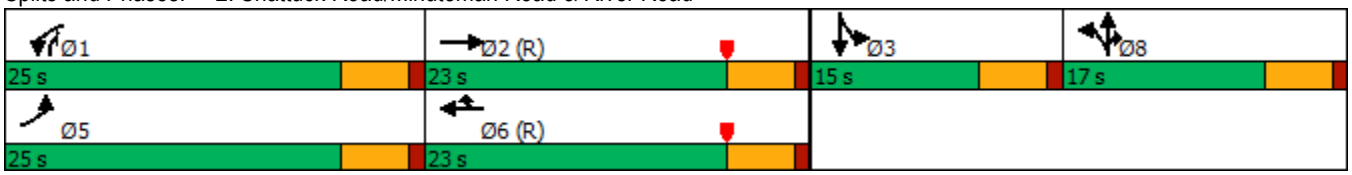
Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 39 (49%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 60

Control Type: Actuated-Coordinated

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Shattuck Road/Minuteman Road & River Road



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	39	319	41	467	523	845	22	4	106	192	4	13
Future Volume (vph)	39	319	41	467	523	845	22	4	106	192	4	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	11	11	11	10	10	11	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	5.0	4.0	4.0	3.0
Lane Util. Factor	1.00	0.95		0.97	1.00	1.00		1.00	0.88	0.95	0.95	1.00
Frt	1.00	0.98		1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.95	1.00
Satd. Flow (prot)	1805	3427		3351	1783	1546		1633	2642	1665	1674	1615
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.95	1.00
Satd. Flow (perm)	1805	3427		3351	1783	1546		1633	2642	1665	1674	1615
Peak-hour factor, PHF	0.91	0.91	0.91	0.89	0.89	0.89	0.86	0.86	0.86	0.95	0.95	0.95
Adj. Flow (vph)	43	351	45	525	588	949	26	5	123	202	4	14
RTOR Reduction (vph)	0	10	0	0	0	456	0	0	0	0	0	0
Lane Group Flow (vph)	43	386	0	525	588	493	0	31	123	103	103	14
Heavy Vehicles (%)	0%	4%	0%	1%	3%	1%	5%	0%	4%	3%	0%	0%
Turn Type	Prot	NA		Prot	NA	Prot	Split	NA	pt+ov	Split	NA	Free
Protected Phases	5	2		1	6	6	8	8	1 8	3	3	
Permitted Phases												Free
Actuated Green, G (s)	5.1	27.8		17.9	40.6	40.6		6.6	29.5	7.7	7.7	80.0
Effective Green, g (s)	6.1	28.8		18.9	41.6	41.6		7.6	29.5	8.7	8.7	80.0
Actuated g/C Ratio	0.08	0.36		0.24	0.52	0.52		0.09	0.37	0.11	0.11	1.00
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	137	1233		791	927	803		155	974	181	182	1615
v/s Ratio Prot	0.02	0.11		c0.16	c0.33	0.32		c0.02	0.05	c0.06	0.06	
v/s Ratio Perm												0.01
v/c Ratio	0.31	0.31		0.66	0.63	0.61		0.20	0.13	0.57	0.57	0.01
Uniform Delay, d1	35.0	18.5		27.7	13.8	13.5		33.4	16.7	33.9	33.9	0.0
Progression Factor	1.00	1.00		1.12	1.00	3.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.3	0.7		1.6	2.4	2.6		0.6	0.1	4.1	4.0	0.0
Delay (s)	36.3	19.1		32.7	16.2	43.2		34.0	16.8	37.9	37.8	0.0
Level of Service	D	B		C	B	D		C	B	D	D	A
Approach Delay (s)		20.8			32.8			20.3			35.5	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	30.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	70.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	16	473	22	111	310	217	33	5	343	808	7	53
Future Volume (vph)	16	473	22	111	310	217	33	5	343	808	7	53
Lane Util. Factor	1.00	0.95	0.95	0.97	1.00	1.00	1.00	1.00	0.88	0.95	0.95	1.00
Frt		0.993				0.850			0.850			0.850
Flt Protected	0.950			0.950				0.958		0.950	0.953	
Satd. Flow (prot)	1805	3551	0	3351	1837	1516	0	1699	2720	1698	1703	1615
Flt Permitted	0.950			0.950				0.958		0.950	0.953	
Satd. Flow (perm)	1805	3551	0	3351	1837	1516	0	1699	2720	1698	1703	1615
Satd. Flow (RTOR)		5				255						232
Adj. Flow (vph)	18	520	24	131	365	255	49	7	512	1077	9	71
Lane Group Flow (vph)	18	544	0	131	365	255	0	56	512	538	548	71
Turn Type	Prot	NA		Prot	NA	Prot	Split	NA	pt+ov	Split	NA	Free
Protected Phases	5	2		1	6	6	8	8	1 8	3	3	
Permitted Phases												Free
Detector Phase	5	2		1	6	6	8	8	1 8	3	3	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Minimum Split (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0		10.0	10.0	
Total Split (s)	12.0	18.0		12.0	18.0	18.0	22.0	22.0		28.0	28.0	
Total Split (%)	15.0%	22.5%		15.0%	22.5%	22.5%	27.5%	27.5%		35.0%	35.0%	
Maximum Green (s)	7.0	13.0		7.0	13.0	13.0	17.0	17.0		23.0	23.0	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0	-1.0		-1.0		-1.0	-1.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	C-Min		None	C-Min	C-Min	None	None		None	None	
v/c Ratio	0.11	0.80		0.39	0.64	0.40		0.16	0.54	1.06	1.07	0.04
Control Delay	34.7	42.0		44.9	28.9	7.1		26.4	23.2	85.8	91.1	0.1
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	34.7	42.0		44.9	28.9	7.1		26.4	23.2	85.8	91.1	0.1
Queue Length 50th (ft)	8	139		27	69	0		23	111	~314	~325	0
Queue Length 95th (ft)	28	#227		52	#341	50		38	111	#380	#388	0
Internal Link Dist (ft)		766			1120			242			1320	
Turn Bay Length (ft)	80			350					190	125		100
Base Capacity (vph)	180	679		339	568	645		382	921	509	510	1615
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	0.10	0.80		0.39	0.64	0.40		0.15	0.56	1.06	1.07	0.04

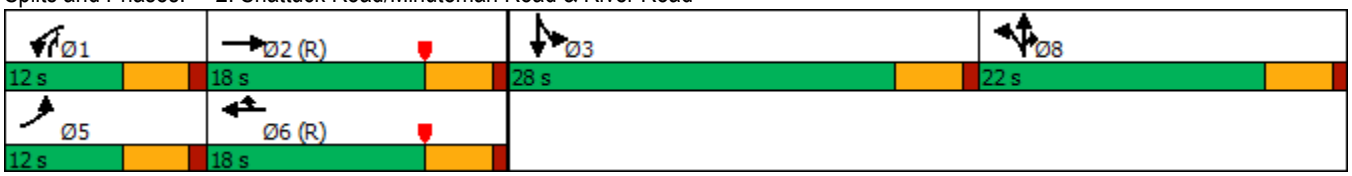
Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 29 (36%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 70

Control Type: Actuated-Coordinated

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: Shattuck Road/Minuteman Road & River Road



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	16	473	22	111	310	217	33	5	343	808	7	53
Future Volume (vph)	16	473	22	111	310	217	33	5	343	808	7	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	11	11	11	10	10	11	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	5.0	4.0	4.0	3.0
Lane Util. Factor	1.00	0.95		0.97	1.00	1.00		1.00	0.88	0.95	0.95	1.00
Frt	1.00	0.99		1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.95	1.00
Satd. Flow (prot)	1805	3552		3351	1837	1516		1699	2720	1698	1704	1615
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.95	1.00
Satd. Flow (perm)	1805	3552		3351	1837	1516		1699	2720	1698	1704	1615
Peak-hour factor, PHF	0.91	0.91	0.91	0.85	0.85	0.85	0.67	0.67	0.67	0.75	0.75	0.75
Adj. Flow (vph)	18	520	24	131	365	255	49	7	512	1077	9	71
RTOR Reduction (vph)	0	4	0	0	0	189	0	0	0	0	0	0
Lane Group Flow (vph)	18	540	0	131	365	66	0	56	512	538	548	71
Heavy Vehicles (%)	0%	1%	0%	1%	0%	3%	0%	0%	1%	1%	0%	0%
Turn Type	Prot	NA		Prot	NA	Prot	Split	NA	pt+ov	Split	NA	Free
Protected Phases	5	2		1	6	6	8	8	1 8	3	3	
Permitted Phases												Free
Actuated Green, G (s)	1.4	14.3		6.9	19.8	19.8		15.8	27.7	23.0	23.0	80.0
Effective Green, g (s)	2.4	15.3		7.9	20.8	20.8		16.8	27.7	24.0	24.0	80.0
Actuated g/C Ratio	0.03	0.19		0.10	0.26	0.26		0.21	0.35	0.30	0.30	1.00
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	54	679		330	477	394		356	941	509	511	1615
v/s Ratio Prot	0.01	0.15		0.04	c0.20	0.04		0.03	c0.19	0.32	c0.32	
v/s Ratio Perm												0.04
v/c Ratio	0.33	0.80		0.40	0.77	0.17		0.16	0.54	1.06	1.07	0.04
Uniform Delay, d1	38.0	30.9		33.8	27.3	22.9		25.8	21.1	28.0	28.0	0.0
Progression Factor	1.00	1.00		1.22	0.78	1.28		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.6	9.3		0.8	11.0	0.9		0.2	0.6	55.8	60.6	0.1
Delay (s)	41.6	40.2		42.0	32.4	30.3		26.0	21.7	83.8	88.6	0.1
Level of Service	D	D		D	C	C		C	C	F	F	A
Approach Delay (s)		40.2			33.3			22.1			80.9	
Approach LOS		D			C			C			F	

Intersection Summary			
HCM 2000 Control Delay	50.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	59.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	39	319	41	467	523	866	22	4	106	233	4	13
Future Volume (vph)	39	319	41	467	523	866	22	4	106	233	4	13
Lane Util. Factor	1.00	0.95	0.95	0.97	1.00	1.00	1.00	1.00	0.88	0.95	0.95	1.00
Frt		0.983				0.850			0.850			0.850
Flt Protected	0.950			0.950				0.960		0.950	0.954	
Satd. Flow (prot)	1805	3427	0	3351	1783	1546	0	1634	2642	1665	1673	1615
Flt Permitted	0.950			0.950				0.960		0.950	0.954	
Satd. Flow (perm)	1805	3427	0	3351	1783	1546	0	1634	2642	1665	1673	1615
Satd. Flow (RTOR)		16				973						232
Adj. Flow (vph)	43	351	45	525	588	973	26	5	123	245	4	14
Lane Group Flow (vph)	43	396	0	525	588	973	0	31	123	125	124	14
Turn Type	Prot	NA		Prot	NA	Prot	Split	NA	pt+ov	Split	NA	Free
Protected Phases	5	2		1	6	6	8	8	1 8	3	3	
Permitted Phases												Free
Detector Phase	5	2		1	6	6	8	8	1 8	3	3	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Minimum Split (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0		10.0	10.0	
Total Split (s)	25.0	23.0		25.0	23.0	23.0	17.0	17.0		15.0	15.0	
Total Split (%)	31.3%	28.8%		31.3%	28.8%	28.8%	21.3%	21.3%		18.8%	18.8%	
Maximum Green (s)	20.0	18.0		20.0	18.0	18.0	12.0	12.0		10.0	10.0	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0	-1.0		-1.0		-1.0	-1.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	C-Min		None	C-Min	C-Min	None	None		None	None	
v/c Ratio	0.23	0.32		0.66	0.61	0.76		0.17	0.13	0.59	0.58	0.01
Control Delay	35.1	21.5		34.5	20.1	8.4		34.1	15.4	44.6	44.1	0.0
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	35.1	21.5		34.5	20.1	8.4		34.1	15.4	44.6	44.1	0.0
Queue Length 50th (ft)	20	75		143	189	113		14	22	62	62	0
Queue Length 95th (ft)	48	128		m179	m#334	m161		37	33	118	117	0
Internal Link Dist (ft)		766			1120			242			1320	
Turn Bay Length (ft)	80			350					190	125		100
Base Capacity (vph)	473	1222		903	961	1281		265	996	228	230	1615
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	0.09	0.32		0.58	0.61	0.76		0.12	0.12	0.55	0.54	0.01

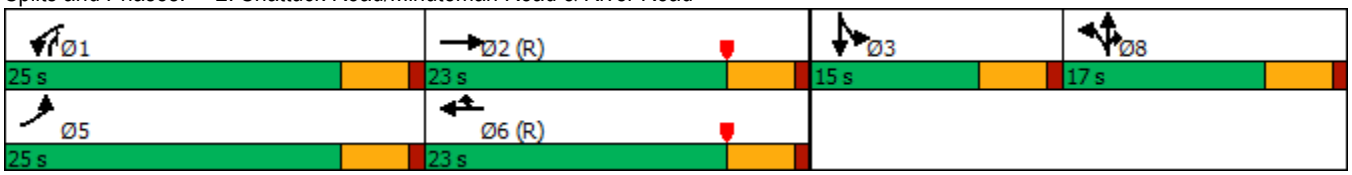
Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 39 (49%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 60

Control Type: Actuated-Coordinated

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Shattuck Road/Minuteman Road & River Road



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	39	319	41	467	523	866	22	4	106	233	4	13
Future Volume (vph)	39	319	41	467	523	866	22	4	106	233	4	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	11	11	11	10	10	11	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	5.0	4.0	4.0	3.0
Lane Util. Factor	1.00	0.95		0.97	1.00	1.00		1.00	0.88	0.95	0.95	1.00
Frt	1.00	0.98		1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.95	1.00
Satd. Flow (prot)	1805	3427		3351	1783	1546		1633	2642	1665	1673	1615
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.95	1.00
Satd. Flow (perm)	1805	3427		3351	1783	1546		1633	2642	1665	1673	1615
Peak-hour factor, PHF	0.91	0.91	0.91	0.89	0.89	0.89	0.86	0.86	0.86	0.95	0.95	0.95
Adj. Flow (vph)	43	351	45	525	588	973	26	5	123	245	4	14
RTOR Reduction (vph)	0	11	0	0	0	485	0	0	0	0	0	0
Lane Group Flow (vph)	43	385	0	525	588	488	0	31	123	125	124	14
Heavy Vehicles (%)	0%	4%	0%	1%	3%	1%	5%	0%	4%	3%	0%	0%
Turn Type	Prot	NA		Prot	NA	Prot	Split	NA	pt+ov	Split	NA	Free
Protected Phases	5	2		1	6	6	8	8	1 8	3	3	
Permitted Phases												Free
Actuated Green, G (s)	5.1	26.3		17.9	39.1	39.1		6.6	29.5	9.2	9.2	80.0
Effective Green, g (s)	6.1	27.3		18.9	40.1	40.1		7.6	29.5	10.2	10.2	80.0
Actuated g/C Ratio	0.08	0.34		0.24	0.50	0.50		0.09	0.37	0.13	0.13	1.00
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	137	1169		791	893	774		155	974	212	213	1615
v/s Ratio Prot	0.02	0.11		c0.16	c0.33	0.32		c0.02	0.05	c0.08	0.07	
v/s Ratio Perm												0.01
v/c Ratio	0.31	0.33		0.66	0.66	0.63		0.20	0.13	0.59	0.58	0.01
Uniform Delay, d1	35.0	19.6		27.7	14.9	14.5		33.4	16.7	32.9	32.9	0.0
Progression Factor	1.00	1.00		1.15	1.02	3.18		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.3	0.8		1.5	2.8	2.8		0.6	0.1	4.2	4.0	0.0
Delay (s)	36.3	20.3		33.3	17.9	49.1		34.0	16.8	37.1	36.9	0.0
Level of Service	D	C		C	B	D		C	B	D	D	A
Approach Delay (s)		21.9			36.3			20.3			35.0	
Approach LOS		C			D			C			D	

Intersection Summary			
HCM 2000 Control Delay	33.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	72.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	16	473	22	111	310	275	33	5	343	891	7	53
Future Volume (vph)	16	473	22	111	310	275	33	5	343	891	7	53
Lane Util. Factor	1.00	0.95	0.95	0.97	1.00	1.00	1.00	1.00	0.88	0.95	0.95	1.00
Frt		0.993				0.850			0.850			0.850
Flt Protected	0.950			0.950				0.958		0.950	0.953	
Satd. Flow (prot)	1805	3551	0	3351	1837	1516	0	1699	2720	1698	1703	1615
Flt Permitted	0.950			0.950				0.958		0.950	0.953	
Satd. Flow (perm)	1805	3551	0	3351	1837	1516	0	1699	2720	1698	1703	1615
Satd. Flow (RTOR)		5				324						232
Adj. Flow (vph)	18	520	24	131	365	324	49	7	512	1188	9	71
Lane Group Flow (vph)	18	544	0	131	365	324	0	56	512	594	603	71
Turn Type	Prot	NA		Prot	NA	Prot	Split	NA	pt+ov	Split	NA	Free
Protected Phases	5	2		1	6	6	8	8	1 8	3	3	
Permitted Phases												Free
Detector Phase	5	2		1	6	6	8	8	1 8	3	3	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Minimum Split (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0		10.0	10.0	
Total Split (s)	12.0	18.0		12.0	18.0	18.0	22.0	22.0		28.0	28.0	
Total Split (%)	15.0%	22.5%		15.0%	22.5%	22.5%	27.5%	27.5%		35.0%	35.0%	
Maximum Green (s)	7.0	13.0		7.0	13.0	13.0	17.0	17.0		23.0	23.0	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0	-1.0		-1.0		-1.0	-1.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	C-Min		None	C-Min	C-Min	None	None		None	None	
v/c Ratio	0.11	0.80		0.39	0.64	0.47		0.16	0.54	1.17	1.18	0.04
Control Delay	34.7	42.0		45.3	30.3	7.9		26.4	23.2	123.5	129.3	0.1
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	34.7	42.0		45.3	30.3	7.9		26.4	23.2	123.5	129.3	0.1
Queue Length 50th (ft)	8	139		28	79	1		23	111	~376	~386	0
Queue Length 95th (ft)	28	#227		52	#348	75		38	111	#435	#445	0
Internal Link Dist (ft)		766			1120			242			1320	
Turn Bay Length (ft)	80			350					190	125		100
Base Capacity (vph)	180	679		339	568	692		382	921	509	510	1615
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	0.10	0.80		0.39	0.64	0.47		0.15	0.56	1.17	1.18	0.04

Intersection Summary

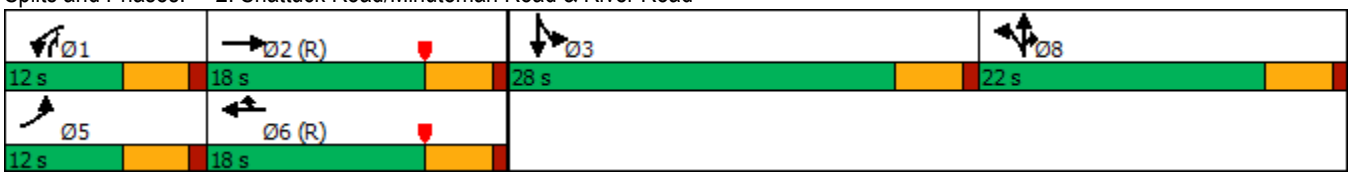
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 29 (36%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 80

Control Type: Actuated-Coordinated

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: Shattuck Road/Minuteman Road & River Road



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	16	473	22	111	310	275	33	5	343	891	7	53
Future Volume (vph)	16	473	22	111	310	275	33	5	343	891	7	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	11	11	11	10	10	11	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	5.0	4.0	4.0	3.0
Lane Util. Factor	1.00	0.95		0.97	1.00	1.00		1.00	0.88	0.95	0.95	1.00
Frt	1.00	0.99		1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.95	1.00
Satd. Flow (prot)	1805	3552		3351	1837	1516		1699	2720	1698	1703	1615
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.95	1.00
Satd. Flow (perm)	1805	3552		3351	1837	1516		1699	2720	1698	1703	1615
Peak-hour factor, PHF	0.91	0.91	0.91	0.85	0.85	0.85	0.67	0.67	0.67	0.75	0.75	0.75
Adj. Flow (vph)	18	520	24	131	365	324	49	7	512	1188	9	71
RTOR Reduction (vph)	0	4	0	0	0	240	0	0	0	0	0	0
Lane Group Flow (vph)	18	540	0	131	365	84	0	56	512	594	603	71
Heavy Vehicles (%)	0%	1%	0%	1%	0%	3%	0%	0%	1%	1%	0%	0%
Turn Type	Prot	NA		Prot	NA	Prot	Split	NA	pt+ov	Split	NA	Free
Protected Phases	5	2		1	6	6	8	8	1 8	3	3	
Permitted Phases												Free
Actuated Green, G (s)	1.4	14.3		6.9	19.8	19.8		15.8	27.7	23.0	23.0	80.0
Effective Green, g (s)	2.4	15.3		7.9	20.8	20.8		16.8	27.7	24.0	24.0	80.0
Actuated g/C Ratio	0.03	0.19		0.10	0.26	0.26		0.21	0.35	0.30	0.30	1.00
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	54	679		330	477	394		356	941	509	510	1615
v/s Ratio Prot	0.01	0.15		0.04	c0.20	0.06		0.03	c0.19	0.35	c0.35	
v/s Ratio Perm												0.04
v/c Ratio	0.33	0.80		0.40	0.77	0.21		0.16	0.54	1.17	1.18	0.04
Uniform Delay, d1	38.0	30.9		33.8	27.3	23.2		25.8	21.1	28.0	28.0	0.0
Progression Factor	1.00	1.00		1.23	0.85	1.52		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.6	9.3		0.8	10.9	1.2		0.2	0.6	94.7	100.7	0.1
Delay (s)	41.6	40.2		42.4	34.3	36.5		26.0	21.7	122.7	128.7	0.1
Level of Service	D	D		D	C	D		C	C	F	F	A
Approach Delay (s)		40.2			36.5			22.1			118.7	
Approach LOS		D			D			C			F	

Intersection Summary			
HCM 2000 Control Delay	67.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	62.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

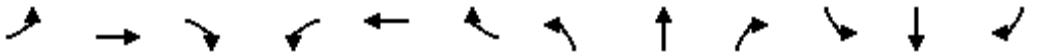
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	39	319	41	467	523	866	22	4	106	233	4	13
Future Volume (vph)	39	319	41	467	523	866	22	4	106	233	4	13
Lane Util. Factor	1.00	0.95	0.95	0.97	1.00	1.00	1.00	1.00	0.88	0.95	0.95	1.00
Frt		0.983				0.850			0.850			0.850
Flt Protected	0.950			0.950				0.960		0.950	0.954	
Satd. Flow (prot)	1805	3427	0	3351	1783	1546	0	1634	2642	1665	1673	1615
Flt Permitted	0.950			0.950				0.960		0.950	0.954	
Satd. Flow (perm)	1805	3427	0	3351	1783	1546	0	1634	2642	1665	1673	1615
Satd. Flow (RTOR)		19				926						300
Adj. Flow (vph)	43	351	45	525	588	973	26	5	123	245	4	14
Lane Group Flow (vph)	43	396	0	525	588	973	0	31	123	125	124	14
Turn Type	Prot	NA		Prot	NA	Prot	Split	NA	pt+ov	Split	NA	Free
Protected Phases	5	2		1	6	6	8	8	1 8	3	3	
Permitted Phases												Free
Detector Phase	5	2		1	6	6	8	8	1 8	3	3	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Minimum Split (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0		10.0	10.0	
Total Split (s)	10.0	32.0		23.0	45.0	45.0	10.0	10.0		15.0	15.0	
Total Split (%)	12.5%	40.0%		28.8%	56.3%	56.3%	12.5%	12.5%		18.8%	18.8%	
Maximum Green (s)	5.0	27.0		18.0	40.0	40.0	5.0	5.0		10.0	10.0	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0	-1.0		-1.0		-1.0	-1.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	C-Min		None	C-Min	C-Min	None	None		None	None	
v/c Ratio	0.30	0.29		0.72	0.56	0.75		0.23	0.15	0.58	0.57	0.01
Control Delay	40.8	17.8		31.3	15.2	6.8		39.1	18.9	43.5	43.1	0.0
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	40.8	17.8		31.3	15.2	6.8		39.1	18.9	43.5	43.1	0.0
Queue Length 50th (ft)	21	72		141	170	82		15	23	61	61	0
Queue Length 95th (ft)	52	106		158	323	209		39	41	118	117	0
Internal Link Dist (ft)		766			1120			242			1320	
Turn Bay Length (ft)	80			350					190	125		100
Base Capacity (vph)	143	1372		795	1054	1292		136	873	233	235	1615
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	0.30	0.29		0.66	0.56	0.75		0.23	0.14	0.54	0.53	0.01

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 79 (99%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 60

Control Type: Actuated-Coordinated

Splits and Phases: 2: Shattuck Road/Minuteman Road & River Road

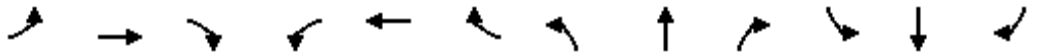




Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	39	319	41	467	523	866	22	4	106	233	4	13
Future Volume (vph)	39	319	41	467	523	866	22	4	106	233	4	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	11	11	11	10	10	11	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	5.0	4.0	4.0	3.0
Lane Util. Factor	1.00	0.95		0.97	1.00	1.00		1.00	0.88	0.95	0.95	1.00
Frt	1.00	0.98		1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.95	1.00
Satd. Flow (prot)	1805	3427		3351	1783	1546		1633	2642	1665	1673	1615
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.95	1.00
Satd. Flow (perm)	1805	3427		3351	1783	1546		1633	2642	1665	1673	1615
Peak-hour factor, PHF	0.91	0.91	0.91	0.89	0.89	0.89	0.86	0.86	0.86	0.95	0.95	0.95
Adj. Flow (vph)	43	351	45	525	588	973	26	5	123	245	4	14
RTOR Reduction (vph)	0	12	0	0	0	417	0	0	0	0	0	0
Lane Group Flow (vph)	43	384	0	525	588	556	0	31	123	125	124	14
Heavy Vehicles (%)	0%	4%	0%	1%	3%	1%	5%	0%	4%	3%	0%	0%
Turn Type	Prot	NA		Prot	NA	Prot	Split	NA	pt+ov	Split	NA	Free
Protected Phases	5	2		1	6	6	8	8	1 8	3	3	
Permitted Phases												Free
Actuated Green, G (s)	3.0	29.5		16.5	43.0	43.0		4.5	26.0	9.5	9.5	80.0
Effective Green, g (s)	4.0	30.5		17.5	44.0	44.0		5.5	26.0	10.5	10.5	80.0
Actuated g/C Ratio	0.05	0.38		0.22	0.55	0.55		0.07	0.32	0.13	0.13	1.00
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	90	1306		733	980	850		112	858	218	219	1615
v/s Ratio Prot	0.02	0.11		c0.16	0.33	c0.36		c0.02	0.05	c0.08	0.07	
v/s Ratio Perm												0.01
v/c Ratio	0.48	0.29		0.72	0.60	0.65		0.28	0.14	0.57	0.57	0.01
Uniform Delay, d1	37.0	17.2		28.9	12.1	12.7		35.4	19.1	32.6	32.6	0.0
Progression Factor	1.00	1.00		0.92	1.05	2.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.0	0.6		2.6	2.1	3.1		1.3	0.1	3.6	3.3	0.0
Delay (s)	40.9	17.8		29.2	14.9	28.4		36.7	19.2	36.3	35.9	0.0
Level of Service	D	B		C	B	C		D	B	D	D	A
Approach Delay (s)		20.1			24.8			22.7			34.2	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	24.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	72.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	16	473	22	111	310	275	33	5	343	891	7	53
Future Volume (vph)	16	473	22	111	310	275	33	5	343	891	7	53
Lane Util. Factor	1.00	0.95	0.95	0.97	1.00	1.00	1.00	1.00	0.88	0.95	0.95	1.00
Frt		0.993				0.850			0.850			0.850
Flt Protected	0.950			0.950				0.958		0.950	0.953	
Satd. Flow (prot)	1805	3551	0	3351	1837	1516	0	1699	2720	1698	1703	1615
Flt Permitted	0.950			0.950				0.958		0.950	0.953	
Satd. Flow (perm)	1805	3551	0	3351	1837	1516	0	1699	2720	1698	1703	1615
Satd. Flow (RTOR)		5				324						232
Adj. Flow (vph)	18	520	24	131	365	324	49	7	512	1188	9	71
Lane Group Flow (vph)	18	544	0	131	365	324	0	56	512	594	603	71
Turn Type	Prot	NA		Prot	NA	Prot	Split	NA	pt+ov	Split	NA	Free
Protected Phases	5	2		1	6	6	8	8	1 8	3	3	
Permitted Phases												Free
Detector Phase	5	2		1	6	6	8	8	1 8	3	3	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Minimum Split (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0		10.0	10.0	
Total Split (s)	10.0	20.0		14.0	24.0	24.0	10.0	10.0		36.0	36.0	
Total Split (%)	12.5%	25.0%		17.5%	30.0%	30.0%	12.5%	12.5%		45.0%	45.0%	
Maximum Green (s)	5.0	15.0		9.0	19.0	19.0	5.0	5.0		31.0	31.0	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0	-1.0		-1.0		-1.0	-1.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	C-Min		None	C-Min	C-Min	None	None		None	None	
v/c Ratio	0.13	0.76		0.33	0.62	0.46		0.38	0.77	0.89	0.90	0.04
Control Delay	37.0	37.8		43.2	32.0	9.4		43.3	37.8	40.7	42.1	0.1
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	37.0	37.8		43.2	32.0	9.4		43.3	37.8	40.7	42.1	0.1
Queue Length 50th (ft)	9	134		32	109	16		27	136	281	286	0
Queue Length 95th (ft)	29	#193		m58	#270	65		46	136	321	327	0
Internal Link Dist (ft)		766			1120			242			1320	
Turn Bay Length (ft)	80			350					190	125		100
Base Capacity (vph)	135	717		418	587	705		148	680	679	681	1615
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	0.13	0.76		0.31	0.62	0.46		0.38	0.75	0.87	0.89	0.04

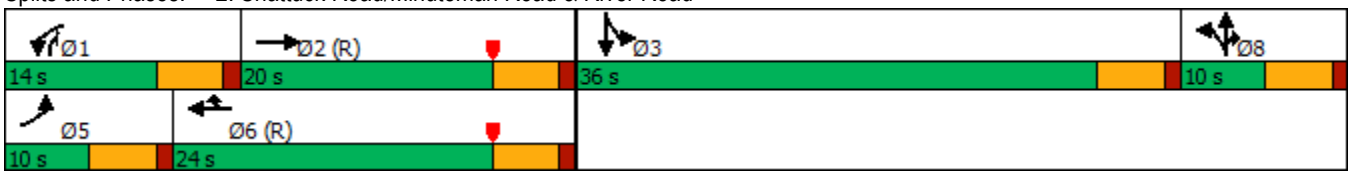
Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 38 (48%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 80

Control Type: Actuated-Coordinated

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Shattuck Road/Minuteman Road & River Road



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	16	473	22	111	310	275	33	5	343	891	7	53
Future Volume (vph)	16	473	22	111	310	275	33	5	343	891	7	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	11	11	11	10	10	11	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	5.0	4.0	4.0	3.0
Lane Util. Factor	1.00	0.95		0.97	1.00	1.00		1.00	0.88	0.95	0.95	1.00
Frt	1.00	0.99		1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.95	1.00
Satd. Flow (prot)	1805	3552		3351	1837	1516		1699	2720	1698	1703	1615
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95	0.95	1.00
Satd. Flow (perm)	1805	3552		3351	1837	1516		1699	2720	1698	1703	1615
Peak-hour factor, PHF	0.91	0.91	0.91	0.85	0.85	0.85	0.67	0.67	0.67	0.75	0.75	0.75
Adj. Flow (vph)	18	520	24	131	365	324	49	7	512	1188	9	71
RTOR Reduction (vph)	0	4	0	0	0	232	0	0	0	0	0	0
Lane Group Flow (vph)	18	540	0	131	365	92	0	56	512	594	603	71
Heavy Vehicles (%)	0%	1%	0%	1%	0%	3%	0%	0%	1%	1%	0%	0%
Turn Type	Prot	NA		Prot	NA	Prot	Split	NA	pt+ov	Split	NA	Free
Protected Phases	5	2		1	6	6	8	8	1 8	3	3	
Permitted Phases												Free
Actuated Green, G (s)	2.0	15.1		8.5	21.6	21.6		6.0	19.5	30.4	30.4	80.0
Effective Green, g (s)	3.0	16.1		9.5	22.6	22.6		7.0	19.5	31.4	31.4	80.0
Actuated g/C Ratio	0.04	0.20		0.12	0.28	0.28		0.09	0.24	0.39	0.39	1.00
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	67	714		397	518	428		148	663	666	668	1615
v/s Ratio Prot	0.01	0.15		0.04	c0.20	0.06		0.03	c0.19	0.35	c0.35	
v/s Ratio Perm												0.04
v/c Ratio	0.27	0.76		0.33	0.70	0.21		0.38	0.77	0.89	0.90	0.04
Uniform Delay, d1	37.4	30.1		32.3	25.7	21.9		34.4	28.2	22.7	22.9	0.0
Progression Factor	1.00	1.00		1.27	1.06	2.18		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.2	7.3		0.5	7.4	1.1		1.6	5.6	14.2	15.5	0.1
Delay (s)	39.6	37.4		41.6	34.8	49.0		36.1	33.8	36.9	38.4	0.1
Level of Service	D	D		D	C	D		D	C	D	D	A
Approach Delay (s)		37.5			41.5			34.0			35.6	
Approach LOS		D			D			C			D	

Intersection Summary			
HCM 2000 Control Delay	37.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	62.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

River Road at the I-93 southbound ramps

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	353	155	246	537	523	899
Future Volume (vph)	353	155	246	537	523	899
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	3505	1509	3183	3505	3467	1583
Flt Permitted			0.950		0.950	
Satd. Flow (perm)	3505	1509	3183	3505	3467	1583
Satd. Flow (RTOR)		167				815
Adj. Flow (vph)	380	167	280	610	588	1010
Lane Group Flow (vph)	380	167	280	610	588	1010
Turn Type	NA	Free	Prot	NA	Prot	Free
Protected Phases	2		1	6	8	
Permitted Phases		Free				Free
Detector Phase	2		1	6	8	
Switch Phase						
Minimum Initial (s)	5.0		5.0	5.0	5.0	
Minimum Split (s)	10.0		10.0	10.0	10.0	
Total Split (s)	24.0		28.0	52.0	28.0	
Total Split (%)	30.0%		35.0%	65.0%	35.0%	
Maximum Green (s)	19.0		23.0	47.0	23.0	
Yellow Time (s)	4.0		4.0	4.0	4.0	
All-Red Time (s)	1.0		1.0	1.0	1.0	
Lost Time Adjust (s)	-1.0		-1.0	-1.0	-1.0	
Total Lost Time (s)	4.0		4.0	4.0	4.0	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Recall Mode	C-Min		None	C-Min	None	
v/c Ratio	0.25	0.11	0.53	0.27	0.68	0.64
Control Delay	13.7	0.1	32.5	11.5	31.2	2.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.7	0.1	32.5	11.5	31.2	2.0
Queue Length 50th (ft)	45	0	72	95	137	0
Queue Length 95th (ft)	64	0	90	140	171	0
Internal Link Dist (ft)	1120			1020	216	
Turn Bay Length (ft)		125	225		280	
Base Capacity (vph)	1526	1509	954	2295	1049	1583
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	0.25	0.11	0.29	0.27	0.56	0.64

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 53 (66%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 40

Control Type: Actuated-Coordinated

Splits and Phases: 3: I-93 SB Ramps & River Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	353	155	246	537	523	899
Future Volume (vph)	353	155	246	537	523	899
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.0	4.0	4.0	4.0	3.0
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3505	1509	3183	3505	3467	1583
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3505	1509	3183	3505	3467	1583
Peak-hour factor, PHF	0.93	0.93	0.88	0.88	0.89	0.89
Adj. Flow (vph)	380	167	280	610	588	1010
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	380	167	280	610	588	1010
Heavy Vehicles (%)	3%	7%	10%	3%	1%	2%
Turn Type	NA	Free	Prot	NA	Prot	Free
Protected Phases	2		1	6	8	
Permitted Phases		Free				Free
Actuated Green, G (s)	33.9	80.0	12.3	51.2	18.8	80.0
Effective Green, g (s)	34.9	80.0	13.3	52.2	19.8	80.0
Actuated g/C Ratio	0.44	1.00	0.17	0.65	0.25	1.00
Clearance Time (s)	5.0		5.0	5.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	1529	1509	529	2287	858	1583
v/s Ratio Prot	0.11		0.09	0.17	0.17	
v/s Ratio Perm		0.11				c0.64
v/c Ratio	0.25	0.11	0.53	0.27	0.69	0.64
Uniform Delay, d1	14.3	0.0	30.5	5.8	27.3	0.0
Progression Factor	0.83	1.00	0.96	1.75	1.00	1.00
Incremental Delay, d2	0.4	0.1	0.9	0.3	2.3	2.0
Delay (s)	12.3	0.1	30.3	10.5	29.6	2.0
Level of Service	B	A	C	B	C	A
Approach Delay (s)	8.6			16.7	12.1	
Approach LOS	A			B	B	

Intersection Summary			
HCM 2000 Control Delay	12.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	41.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	624	363	441	350	201	442
Future Volume (vph)	624	363	441	350	201	442
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	3574	1599	3400	3539	3502	1568
Flt Permitted			0.950		0.950	
Satd. Flow (perm)	3574	1599	3400	3539	3502	1568
Satd. Flow (RTOR)		299				451
Adj. Flow (vph)	821	478	479	380	205	451
Lane Group Flow (vph)	821	478	479	380	205	451
Turn Type	NA	Free	Prot	NA	Prot	Free
Protected Phases	2		1	6	8	
Permitted Phases		Free				Free
Detector Phase	2		1	6	8	
Switch Phase						
Minimum Initial (s)	5.0		5.0	5.0	5.0	
Minimum Split (s)	10.0		10.0	10.0	10.0	
Total Split (s)	32.0		20.0	52.0	28.0	
Total Split (%)	40.0%		25.0%	65.0%	35.0%	
Maximum Green (s)	27.0		15.0	47.0	23.0	
Yellow Time (s)	4.0		4.0	4.0	4.0	
All-Red Time (s)	1.0		1.0	1.0	1.0	
Lost Time Adjust (s)	-1.0		-1.0	-1.0	-1.0	
Total Lost Time (s)	4.0		4.0	4.0	4.0	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Recall Mode	C-Min		None	C-Min	None	
v/c Ratio	0.46	0.30	0.65	0.14	0.43	0.29
Control Delay	14.6	0.5	22.8	3.7	33.9	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.6	0.5	22.8	3.7	33.9	0.5
Queue Length 50th (ft)	139	0	105	14	48	0
Queue Length 95th (ft)	147	0	164	53	77	0
Internal Link Dist (ft)	1120			1020	216	
Turn Bay Length (ft)		125	225		280	
Base Capacity (vph)	1776	1599	760	2697	1050	1568
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	0.46	0.30	0.63	0.14	0.20	0.29

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 32 (40%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 40

Control Type: Actuated-Coordinated

Splits and Phases: 3: I-93 SB Ramps & River Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	624	363	441	350	201	442
Future Volume (vph)	624	363	441	350	201	442
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.0	4.0	4.0	4.0	3.0
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3574	1599	3400	3539	3502	1568
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3574	1599	3400	3539	3502	1568
Peak-hour factor, PHF	0.76	0.76	0.92	0.92	0.98	0.98
Adj. Flow (vph)	821	478	479	380	205	451
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	821	478	479	380	205	451
Heavy Vehicles (%)	1%	1%	3%	2%	0%	3%
Turn Type	NA	Free	Prot	NA	Prot	Free
Protected Phases	2		1	6	8	
Permitted Phases		Free				Free
Actuated Green, G (s)	38.8	80.0	16.2	60.0	10.0	80.0
Effective Green, g (s)	39.8	80.0	17.2	61.0	11.0	80.0
Actuated g/C Ratio	0.50	1.00	0.21	0.76	0.14	1.00
Clearance Time (s)	5.0		5.0	5.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	1778	1599	731	2698	481	1568
v/s Ratio Prot	c0.23		c0.14	0.11	c0.06	
v/s Ratio Perm		0.30				0.29
v/c Ratio	0.46	0.30	0.66	0.14	0.43	0.29
Uniform Delay, d1	13.1	0.0	28.7	2.5	31.6	0.0
Progression Factor	0.96	1.00	0.65	1.31	1.00	1.00
Incremental Delay, d2	0.8	0.4	2.0	0.1	0.6	0.5
Delay (s)	13.4	0.4	20.7	3.4	32.2	0.5
Level of Service	B	A	C	A	C	A
Approach Delay (s)	8.7			13.1	10.4	
Approach LOS	A			B	B	

Intersection Summary			
HCM 2000 Control Delay	10.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	45.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	465	230	273	998	820	998
Future Volume (vph)	465	230	273	998	820	998
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	3505	1509	3183	3505	3467	1583
Flt Permitted			0.950		0.950	
Satd. Flow (perm)	3505	1509	3183	3505	3467	1583
Satd. Flow (RTOR)		247				794
Adj. Flow (vph)	500	247	310	1134	921	1121
Lane Group Flow (vph)	500	247	310	1134	921	1121
Turn Type	NA	Free	Prot	NA	Prot	Free
Protected Phases	2		1	6	8	
Permitted Phases		Free				Free
Detector Phase	2		1	6	8	
Switch Phase						
Minimum Initial (s)	5.0		5.0	5.0	5.0	
Minimum Split (s)	10.0		10.0	10.0	10.0	
Total Split (s)	24.0		28.0	52.0	28.0	
Total Split (%)	30.0%		35.0%	65.0%	35.0%	
Maximum Green (s)	19.0		23.0	47.0	23.0	
Yellow Time (s)	4.0		4.0	4.0	4.0	
All-Red Time (s)	1.0		1.0	1.0	1.0	
Lost Time Adjust (s)	-1.0		-1.0	-1.0	-1.0	
Total Lost Time (s)	4.0		4.0	4.0	4.0	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Recall Mode	C-Min		None	C-Min	None	
v/c Ratio	0.40	0.16	0.55	0.55	0.85	0.71
Control Delay	23.6	0.3	32.4	14.3	34.6	2.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.6	0.3	32.4	14.3	34.6	2.7
Queue Length 50th (ft)	96	0	70	212	208	0
Queue Length 95th (ft)	90	0	98	266	#325	0
Internal Link Dist (ft)	1120			1020	216	
Turn Bay Length (ft)		125	225		280	
Base Capacity (vph)	1261	1509	954	2119	1105	1583
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	0.40	0.16	0.32	0.54	0.83	0.71

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 53 (66%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 40

Control Type: Actuated-Coordinated

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: I-93 SB Ramps & River Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	465	230	273	998	820	998
Future Volume (vph)	465	230	273	998	820	998
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.0	4.0	4.0	4.0	3.0
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3505	1509	3183	3505	3467	1583
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3505	1509	3183	3505	3467	1583
Peak-hour factor, PHF	0.93	0.93	0.88	0.88	0.89	0.89
Adj. Flow (vph)	500	247	310	1134	921	1121
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	500	247	310	1134	921	1121
Heavy Vehicles (%)	3%	7%	10%	3%	1%	2%
Turn Type	NA	Free	Prot	NA	Prot	Free
Protected Phases	2		1	6	8	
Permitted Phases		Free				Free
Actuated Green, G (s)	27.8	80.0	13.1	45.9	24.1	80.0
Effective Green, g (s)	28.8	80.0	14.1	46.9	25.1	80.0
Actuated g/C Ratio	0.36	1.00	0.18	0.59	0.31	1.00
Clearance Time (s)	5.0		5.0	5.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	1261	1509	561	2054	1087	1583
v/s Ratio Prot	0.14		0.10	0.32	c0.27	
v/s Ratio Perm		0.16				c0.71
v/c Ratio	0.40	0.16	0.55	0.55	0.85	0.71
Uniform Delay, d1	19.1	0.0	30.1	10.1	25.7	0.0
Progression Factor	1.13	1.00	0.97	1.28	1.00	1.00
Incremental Delay, d2	0.9	0.2	1.0	0.9	6.3	2.7
Delay (s)	22.4	0.2	30.3	13.9	31.9	2.7
Level of Service	C	A	C	B	C	A
Approach Delay (s)	15.1			17.5	15.9	
Approach LOS	B			B	B	

Intersection Summary			
HCM 2000 Control Delay	16.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	1059	687	489	490	284	491
Future Volume (vph)	1059	687	489	490	284	491
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	3574	1599	3400	3539	3502	1568
Flt Permitted			0.950		0.950	
Satd. Flow (perm)	3574	1599	3400	3539	3502	1568
Satd. Flow (RTOR)		333				501
Adj. Flow (vph)	1393	904	532	533	290	501
Lane Group Flow (vph)	1393	904	532	533	290	501
Turn Type	NA	Free	Prot	NA	Prot	Free
Protected Phases	2		1	6	8	
Permitted Phases		Free				Free
Detector Phase	2		1	6	8	
Switch Phase						
Minimum Initial (s)	5.0		5.0	5.0	5.0	
Minimum Split (s)	10.0		10.0	10.0	10.0	
Total Split (s)	32.0		20.0	52.0	28.0	
Total Split (%)	40.0%		25.0%	65.0%	35.0%	
Maximum Green (s)	27.0		15.0	47.0	23.0	
Yellow Time (s)	4.0		4.0	4.0	4.0	
All-Red Time (s)	1.0		1.0	1.0	1.0	
Lost Time Adjust (s)	-1.0		-1.0	-1.0	-1.0	
Total Lost Time (s)	4.0		4.0	4.0	4.0	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Recall Mode	C-Min		None	C-Min	None	
v/c Ratio	0.86	0.57	0.67	0.20	0.51	0.32
Control Delay	32.0	1.2	20.0	2.3	33.6	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.0	1.2	20.0	2.3	33.6	0.5
Queue Length 50th (ft)	308	0	80	6	69	0
Queue Length 95th (ft)	m#405	m0	57	12	101	0
Internal Link Dist (ft)	1120			1020	216	
Turn Bay Length (ft)		125	225		280	
Base Capacity (vph)	1623	1599	811	2613	1050	1568
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	0.86	0.57	0.66	0.20	0.28	0.32

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 32 (40%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 55

Control Type: Actuated-Coordinated

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: I-93 SB Ramps & River Road





Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	1059	687	489	490	284	491
Future Volume (vph)	1059	687	489	490	284	491
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.0	4.0	4.0	4.0	3.0
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3574	1599	3400	3539	3502	1568
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3574	1599	3400	3539	3502	1568
Peak-hour factor, PHF	0.76	0.76	0.92	0.92	0.98	0.98
Adj. Flow (vph)	1393	904	532	533	290	501
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	1393	904	532	533	290	501
Heavy Vehicles (%)	1%	1%	3%	2%	0%	3%
Turn Type	NA	Free	Prot	NA	Prot	Free
Protected Phases	2		1	6	8	
Permitted Phases		Free				Free
Actuated Green, G (s)	35.4	80.0	17.7	58.1	11.9	80.0
Effective Green, g (s)	36.4	80.0	18.7	59.1	12.9	80.0
Actuated g/C Ratio	0.45	1.00	0.23	0.74	0.16	1.00
Clearance Time (s)	5.0		5.0	5.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	1626	1599	794	2614	564	1568
v/s Ratio Prot	c0.39		0.16	0.15	0.08	
v/s Ratio Perm		c0.57				0.32
v/c Ratio	0.86	0.57	0.67	0.20	0.51	0.32
Uniform Delay, d1	19.5	0.0	27.8	3.2	30.7	0.0
Progression Factor	1.33	1.00	0.58	0.62	1.00	1.00
Incremental Delay, d2	3.6	0.8	2.0	0.2	0.8	0.5
Delay (s)	29.5	0.8	18.3	2.1	31.5	0.5
Level of Service	C	A	B	A	C	A
Approach Delay (s)	18.2			10.2	11.9	
Approach LOS	B			B	B	

Intersection Summary			
HCM 2000 Control Delay	14.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	488	248	273	1011	828	998
Future Volume (vph)	488	248	273	1011	828	998
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	3505	1509	3183	3505	3467	1583
Flt Permitted			0.950		0.950	
Satd. Flow (perm)	3505	1509	3183	3505	3467	1583
Satd. Flow (RTOR)		261				791
Adj. Flow (vph)	525	267	310	1149	930	1121
Lane Group Flow (vph)	525	267	310	1149	930	1121
Turn Type	NA	Free	Prot	NA	Prot	Free
Protected Phases	2		1	6	8	
Permitted Phases		Free				Free
Detector Phase	2		1	6	8	
Switch Phase						
Minimum Initial (s)	5.0		5.0	5.0	5.0	
Minimum Split (s)	10.0		10.0	10.0	10.0	
Total Split (s)	24.0		28.0	52.0	28.0	
Total Split (%)	30.0%		35.0%	65.0%	35.0%	
Maximum Green (s)	19.0		23.0	47.0	23.0	
Yellow Time (s)	4.0		4.0	4.0	4.0	
All-Red Time (s)	1.0		1.0	1.0	1.0	
Lost Time Adjust (s)	-1.0		-1.0	-1.0	-1.0	
Total Lost Time (s)	4.0		4.0	4.0	4.0	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Recall Mode	C-Min		None	C-Min	None	
v/c Ratio	0.42	0.18	0.55	0.56	0.86	0.71
Control Delay	24.7	0.3	32.2	14.4	35.5	2.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.7	0.3	32.2	14.4	35.5	2.7
Queue Length 50th (ft)	114	0	70	214	213	0
Queue Length 95th (ft)	106	0	98	272	#330	0
Internal Link Dist (ft)	1120			1020	216	
Turn Bay Length (ft)		125	225		280	
Base Capacity (vph)	1265	1509	954	2116	1099	1583
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	0.42	0.18	0.32	0.54	0.85	0.71

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 53 (66%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 40

Control Type: Actuated-Coordinated

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: I-93 SB Ramps & River Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	488	248	273	1011	828	998
Future Volume (vph)	488	248	273	1011	828	998
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.0	4.0	4.0	4.0	3.0
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3505	1509	3183	3505	3467	1583
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3505	1509	3183	3505	3467	1583
Peak-hour factor, PHF	0.93	0.93	0.88	0.88	0.89	0.89
Adj. Flow (vph)	525	267	310	1149	930	1121
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	525	267	310	1149	930	1121
Heavy Vehicles (%)	3%	7%	10%	3%	1%	2%
Turn Type	NA	Free	Prot	NA	Prot	Free
Protected Phases	2		1	6	8	
Permitted Phases		Free				Free
Actuated Green, G (s)	27.8	80.0	13.1	45.9	24.1	80.0
Effective Green, g (s)	28.8	80.0	14.1	46.9	25.1	80.0
Actuated g/C Ratio	0.36	1.00	0.18	0.59	0.31	1.00
Clearance Time (s)	5.0		5.0	5.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	1261	1509	561	2054	1087	1583
v/s Ratio Prot	0.15		0.10	0.33	c0.27	
v/s Ratio Perm		0.18				c0.71
v/c Ratio	0.42	0.18	0.55	0.56	0.86	0.71
Uniform Delay, d1	19.3	0.0	30.1	10.2	25.7	0.0
Progression Factor	1.18	1.00	0.97	1.29	1.00	1.00
Incremental Delay, d2	1.0	0.2	1.0	1.0	6.8	2.7
Delay (s)	23.6	0.2	30.1	14.1	32.5	2.7
Level of Service	C	A	C	B	C	A
Approach Delay (s)	15.8			17.5	16.2	
Approach LOS	B			B	B	

Intersection Summary			
HCM 2000 Control Delay	16.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	58.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	1106	723	489	526	306	491
Future Volume (vph)	1106	723	489	526	306	491
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	3574	1599	3400	3539	3502	1568
Flt Permitted			0.950		0.950	
Satd. Flow (perm)	3574	1599	3400	3539	3502	1568
Satd. Flow (RTOR)		335				501
Adj. Flow (vph)	1455	951	532	572	312	501
Lane Group Flow (vph)	1455	951	532	572	312	501
Turn Type	NA	Free	Prot	NA	Prot	Free
Protected Phases	2		1	6	8	
Permitted Phases		Free				Free
Detector Phase	2		1	6	8	
Switch Phase						
Minimum Initial (s)	5.0		5.0	5.0	5.0	
Minimum Split (s)	10.0		10.0	10.0	10.0	
Total Split (s)	32.0		20.0	52.0	28.0	
Total Split (%)	40.0%		25.0%	65.0%	35.0%	
Maximum Green (s)	27.0		15.0	47.0	23.0	
Yellow Time (s)	4.0		4.0	4.0	4.0	
All-Red Time (s)	1.0		1.0	1.0	1.0	
Lost Time Adjust (s)	-1.0		-1.0	-1.0	-1.0	
Total Lost Time (s)	4.0		4.0	4.0	4.0	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Recall Mode	C-Min		None	C-Min	None	
v/c Ratio	0.91	0.59	0.67	0.22	0.53	0.32
Control Delay	34.9	1.6	20.3	2.3	33.5	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.9	1.6	20.3	2.3	33.5	0.5
Queue Length 50th (ft)	327	3	79	6	74	0
Queue Length 95th (ft)	m#405	m0	62	14	107	0
Internal Link Dist (ft)	1120			1020	216	
Turn Bay Length (ft)		125	225		280	
Base Capacity (vph)	1603	1599	809	2592	1050	1568
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	0.91	0.59	0.66	0.22	0.30	0.32

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 32 (40%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 60

Control Type: Actuated-Coordinated

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: I-93 SB Ramps & River Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	1106	723	489	526	306	491
Future Volume (vph)	1106	723	489	526	306	491
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.0	4.0	4.0	4.0	3.0
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3574	1599	3400	3539	3502	1568
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3574	1599	3400	3539	3502	1568
Peak-hour factor, PHF	0.76	0.76	0.92	0.92	0.98	0.98
Adj. Flow (vph)	1455	951	532	572	312	501
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	1455	951	532	572	312	501
Heavy Vehicles (%)	1%	1%	3%	2%	0%	3%
Turn Type	NA	Free	Prot	NA	Prot	Free
Protected Phases	2		1	6	8	
Permitted Phases		Free				Free
Actuated Green, G (s)	34.9	80.0	17.7	57.6	12.4	80.0
Effective Green, g (s)	35.9	80.0	18.7	58.6	13.4	80.0
Actuated g/C Ratio	0.45	1.00	0.23	0.73	0.17	1.00
Clearance Time (s)	5.0		5.0	5.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	1603	1599	794	2592	586	1568
v/s Ratio Prot	c0.41		0.16	0.16	0.09	
v/s Ratio Perm		c0.59				0.32
v/c Ratio	0.91	0.59	0.67	0.22	0.53	0.32
Uniform Delay, d1	20.5	0.0	27.8	3.4	30.4	0.0
Progression Factor	1.37	1.00	0.59	0.58	1.00	1.00
Incremental Delay, d2	4.6	0.8	2.0	0.2	0.9	0.5
Delay (s)	32.6	0.8	18.5	2.1	31.4	0.5
Level of Service	C	A	B	A	C	A
Approach Delay (s)	20.0			10.0	12.4	
Approach LOS	C			B	B	

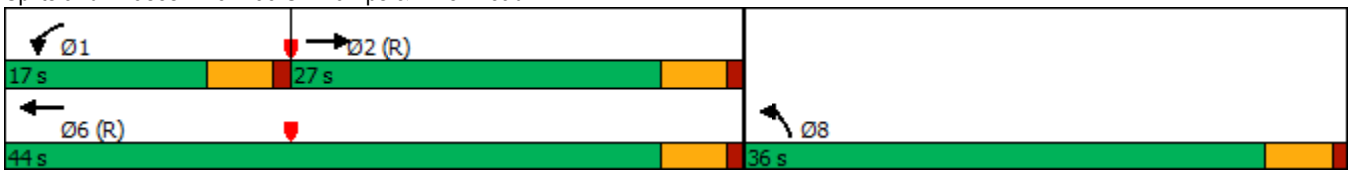
Intersection Summary			
HCM 2000 Control Delay	16.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	63.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	488	248	273	1011	828	998
Future Volume (vph)	488	248	273	1011	828	998
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	3505	1509	3183	3505	3467	1583
Flt Permitted			0.950		0.950	
Satd. Flow (perm)	3505	1509	3183	3505	3467	1583
Satd. Flow (RTOR)		261				754
Adj. Flow (vph)	525	267	310	1149	930	1121
Lane Group Flow (vph)	525	267	310	1149	930	1121
Turn Type	NA	Free	Prot	NA	Prot	Free
Protected Phases	2		1	6	8	
Permitted Phases		Free				Free
Detector Phase	2		1	6	8	
Switch Phase						
Minimum Initial (s)	5.0		5.0	5.0	5.0	
Minimum Split (s)	10.0		10.0	10.0	10.0	
Total Split (s)	27.0		17.0	44.0	36.0	
Total Split (%)	33.8%		21.3%	55.0%	45.0%	
Maximum Green (s)	22.0		12.0	39.0	31.0	
Yellow Time (s)	4.0		4.0	4.0	4.0	
All-Red Time (s)	1.0		1.0	1.0	1.0	
Lost Time Adjust (s)	-1.0		-1.0	-1.0	-1.0	
Total Lost Time (s)	4.0		4.0	4.0	4.0	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Recall Mode	C-Min		None	C-Min	None	
v/c Ratio	0.44	0.18	0.60	0.59	0.77	0.71
Control Delay	17.3	0.3	33.4	10.6	27.6	2.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.3	0.3	33.4	10.6	27.6	2.7
Queue Length 50th (ft)	93	0	62	140	207	0
Queue Length 95th (ft)	136	0	105	267	251	0
Internal Link Dist (ft)	1120			1020	216	
Turn Bay Length (ft)		125	225		280	
Base Capacity (vph)	1199	1509	543	1932	1386	1583
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	0.44	0.18	0.57	0.59	0.67	0.71

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 18 (23%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 40

Control Type: Actuated-Coordinated

Splits and Phases: 3: I-93 SB Ramps & River Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	488	248	273	1011	828	998
Future Volume (vph)	488	248	273	1011	828	998
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.0	4.0	4.0	4.0	3.0
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3505	1509	3183	3505	3467	1583
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3505	1509	3183	3505	3467	1583
Peak-hour factor, PHF	0.93	0.93	0.88	0.88	0.89	0.89
Adj. Flow (vph)	525	267	310	1149	930	1121
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	525	267	310	1149	930	1121
Heavy Vehicles (%)	3%	7%	10%	3%	1%	2%
Turn Type	NA	Free	Prot	NA	Prot	Free
Protected Phases	2		1	6	8	
Permitted Phases		Free				Free
Actuated Green, G (s)	26.1	80.0	12.0	43.1	26.9	80.0
Effective Green, g (s)	27.1	80.0	13.0	44.1	27.9	80.0
Actuated g/C Ratio	0.34	1.00	0.16	0.55	0.35	1.00
Clearance Time (s)	5.0		5.0	5.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	1187	1509	517	1932	1209	1583
v/s Ratio Prot	0.15		0.10	0.33	0.27	
v/s Ratio Perm		0.18				c0.71
v/c Ratio	0.44	0.18	0.60	0.59	0.77	0.71
Uniform Delay, d1	20.6	0.0	31.1	12.0	23.2	0.0
Progression Factor	0.73	1.00	0.94	0.73	1.00	1.00
Incremental Delay, d2	1.2	0.2	1.6	1.1	3.0	2.7
Delay (s)	16.2	0.2	30.7	9.9	26.2	2.7
Level of Service	B	A	C	A	C	A
Approach Delay (s)	10.8			14.3	13.4	
Approach LOS	B			B	B	

Intersection Summary			
HCM 2000 Control Delay	13.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	58.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	1106	723	489	526	306	491
Future Volume (vph)	1106	723	489	526	306	491
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	3574	1599	3400	3539	3502	1568
Flt Permitted			0.950		0.950	
Satd. Flow (perm)	3574	1599	3400	3539	3502	1568
Satd. Flow (RTOR)		335				434
Adj. Flow (vph)	1455	951	532	572	312	501
Lane Group Flow (vph)	1455	951	532	572	312	501
Turn Type	NA	Free	Prot	NA	Prot	Free
Protected Phases	2		1	6	8	
Permitted Phases		Free				Free
Detector Phase	2		1	6	8	
Switch Phase						
Minimum Initial (s)	5.0		5.0	5.0	5.0	
Minimum Split (s)	10.0		10.0	10.0	10.0	
Total Split (s)	45.0		21.0	66.0	14.0	
Total Split (%)	56.3%		26.3%	82.5%	17.5%	
Maximum Green (s)	40.0		16.0	61.0	9.0	
Yellow Time (s)	4.0		4.0	4.0	4.0	
All-Red Time (s)	1.0		1.0	1.0	1.0	
Lost Time Adjust (s)	-1.0		-1.0	-1.0	-1.0	
Total Lost Time (s)	4.0		4.0	4.0	4.0	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Recall Mode	C-Min		None	C-Min	None	
v/c Ratio	0.78	0.59	0.77	0.21	0.71	0.32
Control Delay	14.2	1.0	45.7	1.9	43.4	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.2	1.0	45.7	1.9	43.4	0.5
Queue Length 50th (ft)	207	0	146	20	78	0
Queue Length 95th (ft)	200	0	198	41	#128	0
Internal Link Dist (ft)	1120			1020	216	
Turn Bay Length (ft)		125	225		280	
Base Capacity (vph)	1856	1599	722	2742	442	1568
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	0.78	0.59	0.74	0.21	0.71	0.32

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 61 (76%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 60

Control Type: Actuated-Coordinated

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

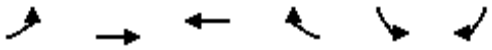
Splits and Phases: 3: I-93 SB Ramps & River Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	1106	723	489	526	306	491
Future Volume (vph)	1106	723	489	526	306	491
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.0	4.0	4.0	4.0	3.0
Lane Util. Factor	0.95	1.00	0.97	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3574	1599	3400	3539	3502	1568
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3574	1599	3400	3539	3502	1568
Peak-hour factor, PHF	0.76	0.76	0.92	0.92	0.98	0.98
Adj. Flow (vph)	1455	951	532	572	312	501
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	1455	951	532	572	312	501
Heavy Vehicles (%)	1%	1%	3%	2%	0%	3%
Turn Type	NA	Free	Prot	NA	Prot	Free
Protected Phases	2		1	6	8	
Permitted Phases		Free				Free
Actuated Green, G (s)	40.5	80.0	15.4	60.9	9.1	80.0
Effective Green, g (s)	41.5	80.0	16.4	61.9	10.1	80.0
Actuated g/C Ratio	0.52	1.00	0.20	0.77	0.13	1.00
Clearance Time (s)	5.0		5.0	5.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	1854	1599	697	2738	442	1568
v/s Ratio Prot	c0.41		c0.16	0.16	0.09	
v/s Ratio Perm		c0.59				0.32
v/c Ratio	0.78	0.59	0.76	0.21	0.71	0.32
Uniform Delay, d1	15.6	0.0	30.0	2.4	33.5	0.0
Progression Factor	0.74	1.00	1.28	0.72	1.00	1.00
Incremental Delay, d2	2.2	1.0	4.5	0.2	5.1	0.5
Delay (s)	13.7	1.0	42.7	1.9	38.6	0.5
Level of Service	B	A	D	A	D	A
Approach Delay (s)	8.7			21.6	15.1	
Approach LOS	A			C	B	

Intersection Summary			
HCM 2000 Control Delay	13.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	63.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

River Road at the I-93 northbound ramps



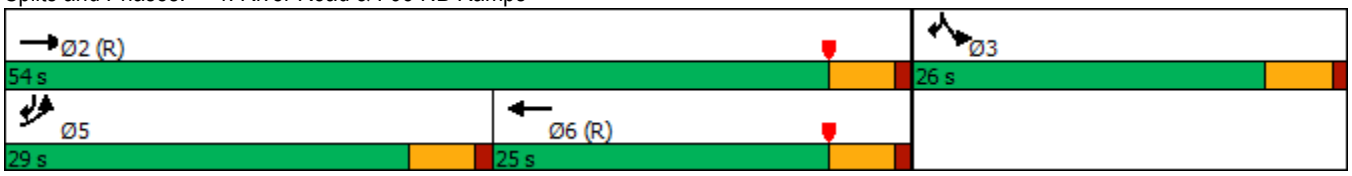
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	189	1063	445	484	459	338
Future Volume (vph)	189	1063	445	484	459	338
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.88
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3502	3505	3343	1524	3400	2787
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3502	3505	3343	1524	3400	2787
Satd. Flow (RTOR)				279		117
Adj. Flow (vph)	210	1181	549	598	546	402
Lane Group Flow (vph)	210	1181	549	598	546	402
Turn Type	Prot	NA	NA	Free	Prot	pt+ov
Protected Phases	5	2	6		3	3 5
Permitted Phases				Free		
Detector Phase	5	2	6		3	3 5
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	
Minimum Split (s)	10.0	10.0	10.0		10.0	
Total Split (s)	29.0	54.0	25.0		26.0	
Total Split (%)	36.3%	67.5%	31.3%		32.5%	
Maximum Green (s)	24.0	49.0	20.0		21.0	
Yellow Time (s)	4.0	4.0	4.0		4.0	
All-Red Time (s)	1.0	1.0	1.0		1.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0		-1.0	
Total Lost Time (s)	4.0	4.0	4.0		4.0	
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Recall Mode	None	C-Min	C-Min		None	
v/c Ratio	0.42	0.51	0.35	0.39	0.67	0.31
Control Delay	35.6	6.8	25.1	1.4	31.4	10.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.6	6.8	25.1	1.4	31.4	10.1
Queue Length 50th (ft)	53	105	131	0	126	48
Queue Length 95th (ft)	m82	156	178	4	156	62
Internal Link Dist (ft)		1020	670		221	
Turn Bay Length (ft)	240			50		155
Base Capacity (vph)	1094	2312	1555	1524	938	1717
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	0.19	0.51	0.35	0.39	0.58	0.23

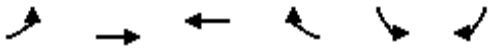
Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow, Master Intersection
Natural Cycle: 40

Control Type: Actuated-Coordinated

m Volume for 95th percentile queue is metered by upstream signal.

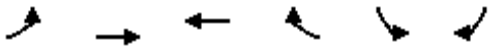
Splits and Phases: 4: River Road & I-93 NB Ramps





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	189	1063	445	484	459	338
Future Volume (vph)	189	1063	445	484	459	338
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	3.0	4.0	4.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3502	3505	3343	1524	3400	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3502	3505	3343	1524	3400	2787
Peak-hour factor, PHF	0.90	0.90	0.81	0.81	0.84	0.84
Adj. Flow (vph)	210	1181	549	598	546	402
RTOR Reduction (vph)	0	0	0	0	0	66
Lane Group Flow (vph)	210	1181	549	598	546	336
Heavy Vehicles (%)	0%	3%	8%	6%	3%	2%
Turn Type	Prot	NA	NA	Free	Prot	pt+ov
Protected Phases	5	2	6		3	3 5
Permitted Phases				Free		
Actuated Green, G (s)	10.5	51.7	36.2	80.0	18.3	33.8
Effective Green, g (s)	11.5	52.7	37.2	80.0	19.3	34.8
Actuated g/C Ratio	0.14	0.66	0.47	1.00	0.24	0.43
Clearance Time (s)	5.0	5.0	5.0		5.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	503	2308	1554	1524	820	1212
v/s Ratio Prot	0.06	c0.34	0.16		c0.16	0.12
v/s Ratio Perm				0.39		
v/c Ratio	0.42	0.51	0.35	0.39	0.67	0.28
Uniform Delay, d1	31.2	7.0	13.7	0.0	27.4	14.5
Progression Factor	1.09	0.80	1.63	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.7	0.6	0.7	2.1	0.1
Delay (s)	34.5	6.3	23.0	0.7	29.5	14.6
Level of Service	C	A	C	A	C	B
Approach Delay (s)		10.6	11.4		23.2	
Approach LOS		B	B		C	

Intersection Summary			
HCM 2000 Control Delay	14.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	49.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

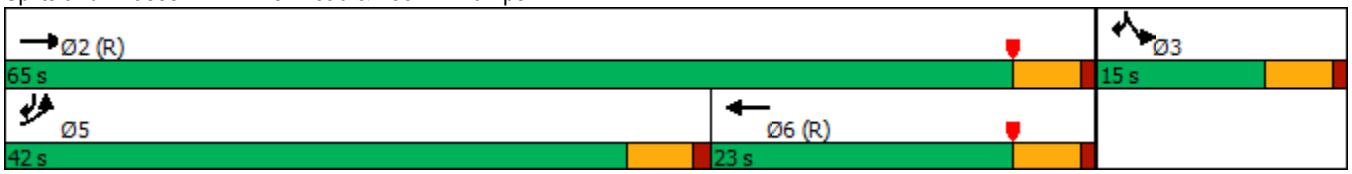


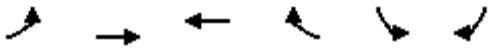
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	439	627	641	876	183	150
Future Volume (vph)	439	627	641	876	183	150
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.88
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3502	3539	3505	1599	3400	2842
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3502	3539	3505	1599	3400	2842
Satd. Flow (RTOR)				350		35
Adj. Flow (vph)	472	674	697	952	213	174
Lane Group Flow (vph)	472	674	697	952	213	174
Turn Type	Prot	NA	NA	Free	Prot	pt+ov
Protected Phases	5	2	6		3	3 5
Permitted Phases				Free		
Detector Phase	5	2	6		3	3 5
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	
Minimum Split (s)	10.0	10.0	10.0		10.0	
Total Split (s)	42.0	65.0	23.0		15.0	
Total Split (%)	52.5%	81.3%	28.8%		18.8%	
Maximum Green (s)	37.0	60.0	18.0		10.0	
Yellow Time (s)	4.0	4.0	4.0		4.0	
All-Red Time (s)	1.0	1.0	1.0		1.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0		-1.0	
Total Lost Time (s)	4.0	4.0	4.0		4.0	
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Recall Mode	None	C-Min	C-Min		None	
v/c Ratio	0.61	0.25	0.40	0.60	0.49	0.15
Control Delay	45.0	1.2	14.5	3.4	36.3	11.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	45.0	1.2	14.5	3.4	36.3	11.4
Queue Length 50th (ft)	127	12	142	55	51	23
Queue Length 95th (ft)	171	22	202	101	80	37
Internal Link Dist (ft)		1020	670		221	
Turn Bay Length (ft)	240			50		155
Base Capacity (vph)	1663	2729	1753	1599	467	1838
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	0.28	0.25	0.40	0.60	0.46	0.09

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow, Master Intersection
Natural Cycle: 40

Control Type: Actuated-Coordinated

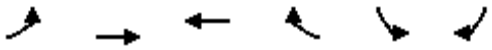
Splits and Phases: 4: River Road & I-93 NB Ramps





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	439	627	641	876	183	150
Future Volume (vph)	439	627	641	876	183	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	3.0	4.0	4.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3502	3539	3505	1599	3400	2842
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3502	3539	3505	1599	3400	2842
Peak-hour factor, PHF	0.93	0.93	0.92	0.92	0.86	0.86
Adj. Flow (vph)	472	674	697	952	213	174
RTOR Reduction (vph)	0	0	0	0	0	21
Lane Group Flow (vph)	472	674	697	952	213	153
Heavy Vehicles (%)	0%	2%	3%	1%	3%	0%
Turn Type	Prot	NA	NA	Free	Prot	pt+ov
Protected Phases	5	2	6		3	3 5
Permitted Phases				Free		
Actuated Green, G (s)	16.7	60.7	39.0	80.0	9.3	31.0
Effective Green, g (s)	17.7	61.7	40.0	80.0	10.3	32.0
Actuated g/C Ratio	0.22	0.77	0.50	1.00	0.13	0.40
Clearance Time (s)	5.0	5.0	5.0		5.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	774	2729	1752	1599	437	1136
v/s Ratio Prot	0.13	0.19	0.20		0.06	0.05
v/s Ratio Perm				c0.60		
v/c Ratio	0.61	0.25	0.40	0.60	0.49	0.13
Uniform Delay, d1	28.0	2.6	12.5	0.0	32.4	15.2
Progression Factor	1.51	0.36	1.03	1.00	1.00	1.00
Incremental Delay, d2	1.3	0.2	0.6	1.4	0.9	0.1
Delay (s)	43.7	1.1	13.5	1.4	33.3	15.3
Level of Service	D	A	B	A	C	B
Approach Delay (s)		18.7	6.5		25.2	
Approach LOS		B	A		C	

Intersection Summary			
HCM 2000 Control Delay	13.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	45.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



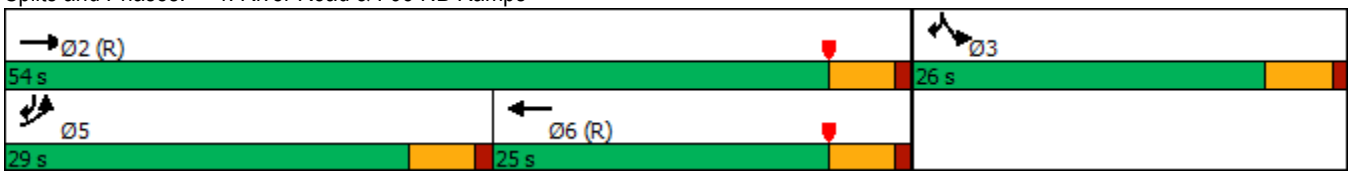
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	259	1204	615	537	509	656
Future Volume (vph)	259	1204	615	537	509	656
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.88
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3502	3505	3343	1524	3400	2787
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3502	3505	3343	1524	3400	2787
Satd. Flow (RTOR)				224		38
Adj. Flow (vph)	288	1338	759	663	606	781
Lane Group Flow (vph)	288	1338	759	663	606	781
Turn Type	Prot	NA	NA	Free	Prot	pt+ov
Protected Phases	5	2	6		3	3 5
Permitted Phases				Free		
Detector Phase	5	2	6		3	3 5
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	
Minimum Split (s)	10.0	10.0	10.0		10.0	
Total Split (s)	29.0	54.0	25.0		26.0	
Total Split (%)	36.3%	67.5%	31.3%		32.5%	
Maximum Green (s)	24.0	49.0	20.0		21.0	
Yellow Time (s)	4.0	4.0	4.0		4.0	
All-Red Time (s)	1.0	1.0	1.0		1.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0		-1.0	
Total Lost Time (s)	4.0	4.0	4.0		4.0	
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Recall Mode	None	C-Min	C-Min		None	
v/c Ratio	0.45	0.60	0.57	0.44	0.67	0.55
Control Delay	33.5	8.9	32.1	1.3	30.3	14.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.5	8.9	32.1	1.3	30.3	14.3
Queue Length 50th (ft)	72	124	211	1	137	134
Queue Length 95th (ft)	m100	224	244	0	175	145
Internal Link Dist (ft)		1020	670		221	
Turn Bay Length (ft)	240			50		155
Base Capacity (vph)	1094	2224	1341	1524	936	1763
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	0.26	0.60	0.57	0.44	0.65	0.44

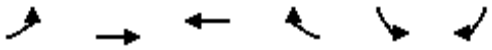
Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow, Master Intersection
Natural Cycle: 40

Control Type: Actuated-Coordinated

m Volume for 95th percentile queue is metered by upstream signal.

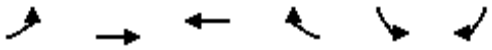
Splits and Phases: 4: River Road & I-93 NB Ramps





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	259	1204	615	537	509	656
Future Volume (vph)	259	1204	615	537	509	656
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	3.0	4.0	4.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3502	3505	3343	1524	3400	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3502	3505	3343	1524	3400	2787
Peak-hour factor, PHF	0.90	0.90	0.81	0.81	0.84	0.84
Adj. Flow (vph)	288	1338	759	663	606	781
RTOR Reduction (vph)	0	0	0	0	0	19
Lane Group Flow (vph)	288	1338	759	663	606	762
Heavy Vehicles (%)	0%	3%	8%	6%	3%	2%
Turn Type	Prot	NA	NA	Free	Prot	pt+ov
Protected Phases	5	2	6		3	3 5
Permitted Phases				Free		
Actuated Green, G (s)	13.7	49.8	31.1	80.0	20.2	38.9
Effective Green, g (s)	14.7	50.8	32.1	80.0	21.2	39.9
Actuated g/C Ratio	0.18	0.63	0.40	1.00	0.26	0.50
Clearance Time (s)	5.0	5.0	5.0		5.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	643	2225	1341	1524	901	1390
v/s Ratio Prot	0.08	c0.38	0.23		c0.18	0.27
v/s Ratio Perm				0.44		
v/c Ratio	0.45	0.60	0.57	0.44	0.67	0.55
Uniform Delay, d1	29.0	8.6	18.6	0.0	26.3	13.8
Progression Factor	1.12	0.88	1.53	1.00	1.00	1.00
Incremental Delay, d2	0.4	1.0	1.5	0.8	2.0	0.4
Delay (s)	33.0	8.5	29.9	0.8	28.3	14.3
Level of Service	C	A	C	A	C	B
Approach Delay (s)		12.9	16.3		20.4	
Approach LOS		B	B		C	

Intersection Summary			
HCM 2000 Control Delay	16.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	54.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



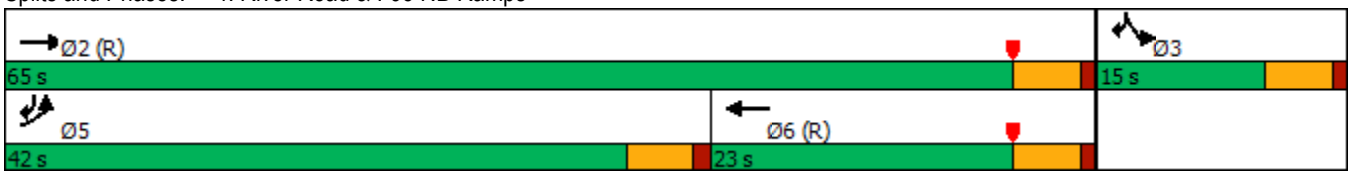
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	732	818	742	972	203	237
Future Volume (vph)	732	818	742	972	203	237
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.88
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3502	3539	3505	1599	3400	2842
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3502	3539	3505	1599	3400	2842
Satd. Flow (RTOR)				336		18
Adj. Flow (vph)	787	880	807	1057	236	276
Lane Group Flow (vph)	787	880	807	1057	236	276
Turn Type	Prot	NA	NA	Free	Prot	pt+ov
Protected Phases	5	2	6		3	3 5
Permitted Phases				Free		
Detector Phase	5	2	6		3	3 5
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	
Minimum Split (s)	10.0	10.0	10.0		10.0	
Total Split (s)	42.0	65.0	23.0		15.0	
Total Split (%)	52.5%	81.3%	28.8%		18.8%	
Maximum Green (s)	37.0	60.0	18.0		10.0	
Yellow Time (s)	4.0	4.0	4.0		4.0	
All-Red Time (s)	1.0	1.0	1.0		1.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0		-1.0	
Total Lost Time (s)	4.0	4.0	4.0		4.0	
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Recall Mode	None	C-Min	C-Min		None	
v/c Ratio	0.69	0.32	0.59	0.66	0.53	0.19
Control Delay	40.8	1.8	22.5	4.6	37.0	9.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.8	1.8	22.5	4.6	37.0	9.4
Queue Length 50th (ft)	213	13	196	69	57	36
Queue Length 95th (ft)	m251	m48	271	154	87	44
Internal Link Dist (ft)		1020	670		221	
Turn Bay Length (ft)	240			50		155
Base Capacity (vph)	1663	2721	1372	1599	467	1832
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	0.47	0.32	0.59	0.66	0.51	0.15

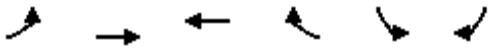
Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow, Master Intersection
Natural Cycle: 50

Control Type: Actuated-Coordinated

m Volume for 95th percentile queue is metered by upstream signal.

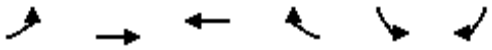
Splits and Phases: 4: River Road & I-93 NB Ramps





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	732	818	742	972	203	237
Future Volume (vph)	732	818	742	972	203	237
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	3.0	4.0	4.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3502	3539	3505	1599	3400	2842
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3502	3539	3505	1599	3400	2842
Peak-hour factor, PHF	0.93	0.93	0.92	0.92	0.86	0.86
Adj. Flow (vph)	787	880	807	1057	236	276
RTOR Reduction (vph)	0	0	0	0	0	9
Lane Group Flow (vph)	787	880	807	1057	236	267
Heavy Vehicles (%)	0%	2%	3%	1%	3%	0%
Turn Type	Prot	NA	NA	Free	Prot	pt+ov
Protected Phases	5	2	6		3	3 5
Permitted Phases				Free		
Actuated Green, G (s)	25.2	60.5	30.3	80.0	9.5	39.7
Effective Green, g (s)	26.2	61.5	31.3	80.0	10.5	40.7
Actuated g/C Ratio	0.33	0.77	0.39	1.00	0.13	0.51
Clearance Time (s)	5.0	5.0	5.0		5.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	1146	2720	1371	1599	446	1445
v/s Ratio Prot	0.22	0.25	0.23		0.07	0.09
v/s Ratio Perm				c0.66		
v/c Ratio	0.69	0.32	0.59	0.66	0.53	0.18
Uniform Delay, d1	23.3	2.8	19.3	0.0	32.4	10.7
Progression Factor	1.69	0.54	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	0.2	1.5	1.7	1.1	0.1
Delay (s)	40.6	1.8	20.8	1.7	33.6	10.7
Level of Service	D	A	C	A	C	B
Approach Delay (s)		20.1	10.0		21.3	
Approach LOS		C	A		C	

Intersection Summary			
HCM 2000 Control Delay	15.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



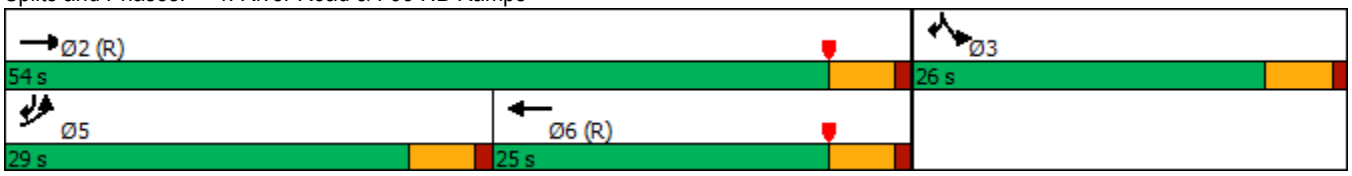
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	275	1211	619	537	509	665
Future Volume (vph)	275	1211	619	537	509	665
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.88
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3502	3505	3343	1524	3400	2787
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3502	3505	3343	1524	3400	2787
Satd. Flow (RTOR)				223		37
Adj. Flow (vph)	306	1346	764	663	606	792
Lane Group Flow (vph)	306	1346	764	663	606	792
Turn Type	Prot	NA	NA	Free	Prot	pt+ov
Protected Phases	5	2	6		3	3 5
Permitted Phases				Free		
Detector Phase	5	2	6		3	3 5
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	
Minimum Split (s)	10.0	10.0	10.0		10.0	
Total Split (s)	29.0	54.0	25.0		26.0	
Total Split (%)	36.3%	67.5%	31.3%		32.5%	
Maximum Green (s)	24.0	49.0	20.0		21.0	
Yellow Time (s)	4.0	4.0	4.0		4.0	
All-Red Time (s)	1.0	1.0	1.0		1.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0		-1.0	
Total Lost Time (s)	4.0	4.0	4.0		4.0	
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Recall Mode	None	C-Min	C-Min		None	
v/c Ratio	0.47	0.61	0.58	0.44	0.67	0.56
Control Delay	33.6	9.0	32.6	1.2	30.3	14.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.6	9.0	32.6	1.2	30.3	14.1
Queue Length 50th (ft)	76	123	213	1	137	135
Queue Length 95th (ft)	m106	229	246	0	175	145
Internal Link Dist (ft)		1020	670		221	
Turn Bay Length (ft)	240			50		155
Base Capacity (vph)	1094	2222	1324	1524	935	1762
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	0.28	0.61	0.58	0.44	0.65	0.45

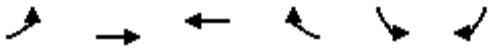
Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow, Master Intersection
Natural Cycle: 40

Control Type: Actuated-Coordinated

m Volume for 95th percentile queue is metered by upstream signal.

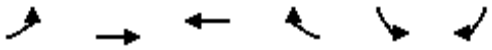
Splits and Phases: 4: River Road & I-93 NB Ramps





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	275	1211	619	537	509	665
Future Volume (vph)	275	1211	619	537	509	665
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	3.0	4.0	4.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3502	3505	3343	1524	3400	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3502	3505	3343	1524	3400	2787
Peak-hour factor, PHF	0.90	0.90	0.81	0.81	0.84	0.84
Adj. Flow (vph)	306	1346	764	663	606	792
RTOR Reduction (vph)	0	0	0	0	0	18
Lane Group Flow (vph)	306	1346	764	663	606	774
Heavy Vehicles (%)	0%	3%	8%	6%	3%	2%
Turn Type	Prot	NA	NA	Free	Prot	pt+ov
Protected Phases	5	2	6		3	3 5
Permitted Phases				Free		
Actuated Green, G (s)	14.0	49.7	30.7	80.0	20.3	39.3
Effective Green, g (s)	15.0	50.7	31.7	80.0	21.3	40.3
Actuated g/C Ratio	0.19	0.63	0.40	1.00	0.27	0.50
Clearance Time (s)	5.0	5.0	5.0		5.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	656	2221	1324	1524	905	1403
v/s Ratio Prot	0.09	c0.38	0.23		c0.18	0.28
v/s Ratio Perm				0.44		
v/c Ratio	0.47	0.61	0.58	0.44	0.67	0.55
Uniform Delay, d1	28.9	8.7	18.9	0.0	26.2	13.6
Progression Factor	1.13	0.88	1.52	1.00	1.00	1.00
Incremental Delay, d2	0.4	1.0	1.6	0.8	1.9	0.5
Delay (s)	33.0	8.7	30.4	0.8	28.1	14.1
Level of Service	C	A	C	A	C	B
Approach Delay (s)		13.2	16.6		20.2	
Approach LOS		B	B		C	

Intersection Summary			
HCM 2000 Control Delay	16.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	54.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	763	834	753	972	203	262
Future Volume (vph)	763	834	753	972	203	262
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.88
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3502	3539	3505	1599	3400	2842
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3502	3539	3505	1599	3400	2842
Satd. Flow (RTOR)				331		17
Adj. Flow (vph)	820	897	818	1057	236	305
Lane Group Flow (vph)	820	897	818	1057	236	305
Turn Type	Prot	NA	NA	Free	Prot	pt+ov
Protected Phases	5	2	6		3	3 5
Permitted Phases				Free		
Detector Phase	5	2	6		3	3 5
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	
Minimum Split (s)	10.0	10.0	10.0		10.0	
Total Split (s)	42.0	65.0	23.0		15.0	
Total Split (%)	52.5%	81.3%	28.8%		18.8%	
Maximum Green (s)	37.0	60.0	18.0		10.0	
Yellow Time (s)	4.0	4.0	4.0		4.0	
All-Red Time (s)	1.0	1.0	1.0		1.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0		-1.0	
Total Lost Time (s)	4.0	4.0	4.0		4.0	
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Recall Mode	None	C-Min	C-Min		None	
v/c Ratio	0.69	0.33	0.62	0.66	0.53	0.20
Control Delay	40.6	1.8	23.7	4.6	36.9	9.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.6	1.8	23.7	4.6	36.9	9.3
Queue Length 50th (ft)	223	16	201	66	57	40
Queue Length 95th (ft)	m251	m47	#279	148	87	48
Internal Link Dist (ft)		1020	670		221	
Turn Bay Length (ft)	240			50		155
Base Capacity (vph)	1663	2718	1329	1599	467	1832
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	0.49	0.33	0.62	0.66	0.51	0.17

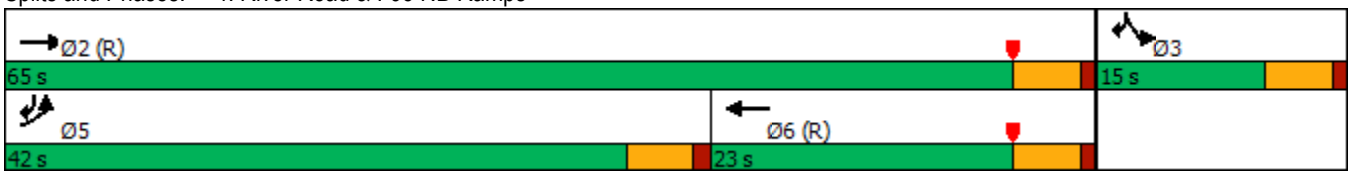
Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow, Master Intersection
Natural Cycle: 50

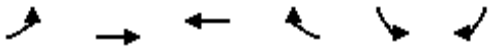
Control Type: Actuated-Coordinated

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

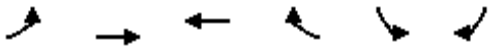
Splits and Phases: 4: River Road & I-93 NB Ramps





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	763	834	753	972	203	262
Future Volume (vph)	763	834	753	972	203	262
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	3.0	4.0	4.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3502	3539	3505	1599	3400	2842
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3502	3539	3505	1599	3400	2842
Peak-hour factor, PHF	0.93	0.93	0.92	0.92	0.86	0.86
Adj. Flow (vph)	820	897	818	1057	236	305
RTOR Reduction (vph)	0	0	0	0	0	8
Lane Group Flow (vph)	820	897	818	1057	236	297
Heavy Vehicles (%)	0%	2%	3%	1%	3%	0%
Turn Type	Prot	NA	NA	Free	Prot	pt+ov
Protected Phases	5	2	6		3	3 5
Permitted Phases				Free		
Actuated Green, G (s)	26.1	60.5	29.4	80.0	9.5	40.6
Effective Green, g (s)	27.1	61.5	30.4	80.0	10.5	41.6
Actuated g/C Ratio	0.34	0.77	0.38	1.00	0.13	0.52
Clearance Time (s)	5.0	5.0	5.0		5.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	1186	2720	1331	1599	446	1477
v/s Ratio Prot	0.23	0.25	0.23		0.07	0.10
v/s Ratio Perm				c0.66		
v/c Ratio	0.69	0.33	0.61	0.66	0.53	0.20
Uniform Delay, d1	22.8	2.9	20.1	0.0	32.4	10.3
Progression Factor	1.72	0.55	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	0.2	1.7	1.7	1.1	0.1
Delay (s)	40.5	1.8	21.8	1.7	33.6	10.4
Level of Service	D	A	C	A	C	B
Approach Delay (s)		20.3	10.4		20.5	
Approach LOS		C	B		C	

Intersection Summary			
HCM 2000 Control Delay	15.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	58.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	275	1211	619	537	509	665
Future Volume (vph)	275	1211	619	537	509	665
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.88
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3502	3505	3343	1524	3400	2787
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3502	3505	3343	1524	3400	2787
Satd. Flow (RTOR)				223		139
Adj. Flow (vph)	306	1346	764	663	606	792
Lane Group Flow (vph)	306	1346	764	663	606	792
Turn Type	Prot	NA	NA	Free	Prot	pt+ov
Protected Phases	5	2	6		3	3 5
Permitted Phases				Free		
Detector Phase	5	2	6		3	3 5
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	
Minimum Split (s)	10.0	10.0	10.0		10.0	
Total Split (s)	18.0	53.0	35.0		27.0	
Total Split (%)	22.5%	66.3%	43.8%		33.8%	
Maximum Green (s)	13.0	48.0	30.0		22.0	
Yellow Time (s)	4.0	4.0	4.0		4.0	
All-Red Time (s)	1.0	1.0	1.0		1.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0		-1.0	
Total Lost Time (s)	4.0	4.0	4.0		4.0	
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Recall Mode	None	C-Min	C-Min		None	
v/c Ratio	0.53	0.61	0.55	0.44	0.66	0.56
Control Delay	37.5	6.8	14.9	1.2	29.7	13.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.5	6.8	14.9	1.2	29.7	13.1
Queue Length 50th (ft)	63	112	76	1	135	111
Queue Length 95th (ft)	m106	142	107	0	172	148
Internal Link Dist (ft)		1020	670		221	
Turn Bay Length (ft)	240			50		155
Base Capacity (vph)	621	2233	1420	1524	996	1420
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	0.49	0.60	0.54	0.44	0.61	0.56

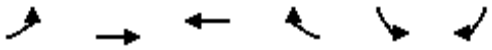
Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow, Master Intersection
Natural Cycle: 40

Control Type: Actuated-Coordinated

m Volume for 95th percentile queue is metered by upstream signal.

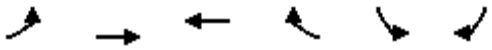
Splits and Phases: 4: River Road & I-93 NB Ramps





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	275	1211	619	537	509	665
Future Volume (vph)	275	1211	619	537	509	665
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	3.0	4.0	4.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3502	3505	3343	1524	3400	2787
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3502	3505	3343	1524	3400	2787
Peak-hour factor, PHF	0.90	0.90	0.81	0.81	0.84	0.84
Adj. Flow (vph)	306	1346	764	663	606	792
RTOR Reduction (vph)	0	0	0	0	0	72
Lane Group Flow (vph)	306	1346	764	663	606	720
Heavy Vehicles (%)	0%	3%	8%	6%	3%	2%
Turn Type	Prot	NA	NA	Free	Prot	pt+ov
Protected Phases	5	2	6		3	3 5
Permitted Phases				Free		
Actuated Green, G (s)	12.1	49.5	32.4	80.0	20.5	37.6
Effective Green, g (s)	13.1	50.5	33.4	80.0	21.5	38.6
Actuated g/C Ratio	0.16	0.63	0.42	1.00	0.27	0.48
Clearance Time (s)	5.0	5.0	5.0		5.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	573	2212	1395	1524	913	1344
v/s Ratio Prot	0.09	c0.38	0.23		c0.18	0.26
v/s Ratio Perm				0.44		
v/c Ratio	0.53	0.61	0.55	0.44	0.66	0.54
Uniform Delay, d1	30.7	8.8	17.6	0.0	26.0	14.4
Progression Factor	1.14	0.61	0.72	1.00	1.00	1.00
Incremental Delay, d2	0.8	1.0	1.4	0.8	1.8	0.4
Delay (s)	35.6	6.4	14.0	0.8	27.9	14.9
Level of Service	D	A	B	A	C	B
Approach Delay (s)		11.8	7.9		20.5	
Approach LOS		B	A		C	

Intersection Summary			
HCM 2000 Control Delay	13.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	54.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

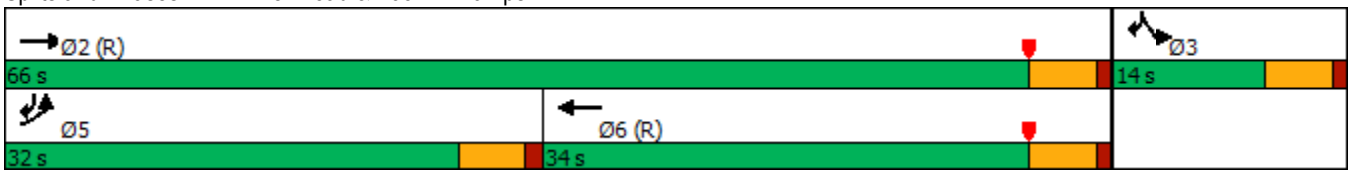


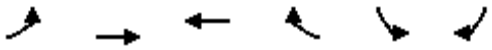
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	763	834	753	972	203	262
Future Volume (vph)	763	834	753	972	203	262
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.88
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3502	3539	3505	1599	3400	2842
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3502	3539	3505	1599	3400	2842
Satd. Flow (RTOR)				331		104
Adj. Flow (vph)	820	897	818	1057	236	305
Lane Group Flow (vph)	820	897	818	1057	236	305
Turn Type	Prot	NA	NA	Free	Prot	pt+ov
Protected Phases	5	2	6		3	3 5
Permitted Phases				Free		
Detector Phase	5	2	6		3	3 5
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	
Minimum Split (s)	10.0	10.0	10.0		10.0	
Total Split (s)	32.0	66.0	34.0		14.0	
Total Split (%)	40.0%	82.5%	42.5%		17.5%	
Maximum Green (s)	27.0	61.0	29.0		9.0	
Yellow Time (s)	4.0	4.0	4.0		4.0	
All-Red Time (s)	1.0	1.0	1.0		1.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0		-1.0	
Total Lost Time (s)	4.0	4.0	4.0		4.0	
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Recall Mode	None	C-Min	C-Min		None	
v/c Ratio	0.74	0.33	0.57	0.66	0.54	0.21
Control Delay	15.3	4.1	13.4	4.8	37.5	7.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.3	4.1	13.4	4.8	37.5	7.2
Queue Length 50th (ft)	126	79	107	80	56	27
Queue Length 95th (ft)	165	120	162	165	89	46
Internal Link Dist (ft)		1020	670		221	
Turn Bay Length (ft)	240			50		155
Base Capacity (vph)	1225	2753	1428	1599	449	1533
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	0.67	0.33	0.57	0.66	0.53	0.20

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow, Master Intersection
Natural Cycle: 50

Control Type: Actuated-Coordinated

Splits and Phases: 4: River Road & I-93 NB Ramps

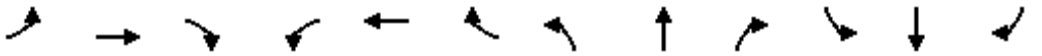




Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	763	834	753	972	203	262
Future Volume (vph)	763	834	753	972	203	262
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	3.0	4.0	4.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.88
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3502	3539	3505	1599	3400	2842
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3502	3539	3505	1599	3400	2842
Peak-hour factor, PHF	0.93	0.93	0.92	0.92	0.86	0.86
Adj. Flow (vph)	820	897	818	1057	236	305
RTOR Reduction (vph)	0	0	0	0	0	53
Lane Group Flow (vph)	820	897	818	1057	236	252
Heavy Vehicles (%)	0%	2%	3%	1%	3%	0%
Turn Type	Prot	NA	NA	Free	Prot	pt+ov
Protected Phases	5	2	6		3	3 5
Permitted Phases				Free		
Actuated Green, G (s)	24.2	60.7	31.5	80.0	9.3	38.5
Effective Green, g (s)	25.2	61.7	32.5	80.0	10.3	39.5
Actuated g/C Ratio	0.31	0.77	0.41	1.00	0.13	0.49
Clearance Time (s)	5.0	5.0	5.0		5.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	1103	2729	1423	1599	437	1403
v/s Ratio Prot	0.23	0.25	0.23		0.07	0.09
v/s Ratio Perm				c0.66		
v/c Ratio	0.74	0.33	0.57	0.66	0.54	0.18
Uniform Delay, d1	24.5	2.8	18.4	0.0	32.6	11.3
Progression Factor	0.49	1.34	0.62	1.00	1.00	1.00
Incremental Delay, d2	2.0	0.2	1.3	1.7	1.4	0.1
Delay (s)	14.0	4.0	12.7	1.7	34.0	11.3
Level of Service	B	A	B	A	C	B
Approach Delay (s)		8.8	6.5		21.2	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	9.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	58.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

River Road at Old River Road and Federal Street

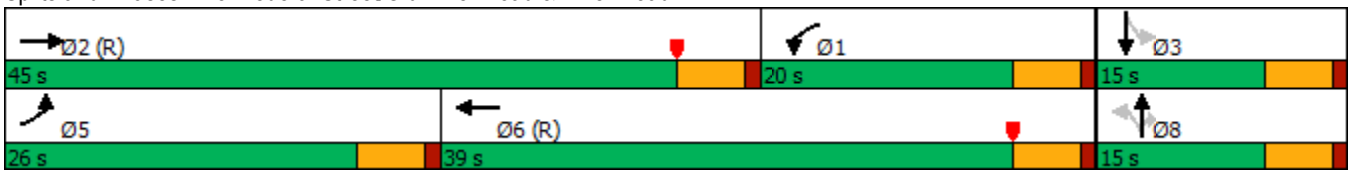


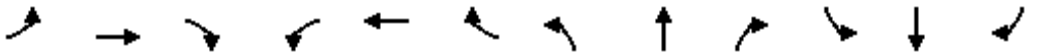
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	292	1014	216	36	764	102	48	2	3	63	17	117
Future Volume (vph)	292	1014	216	36	764	102	48	2	3	63	17	117
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.982				0.850			0.850
Flt Protected	0.950			0.950				0.955		0.950		
Satd. Flow (prot)	3467	3471	1599	1752	3339	0	0	1748	1615	1719	1900	1538
Flt Permitted	0.950			0.950				0.721		0.715		
Satd. Flow (perm)	3467	3471	1599	1752	3339	0	0	1320	1615	1294	1900	1538
Satd. Flow (RTOR)			232		23				164			232
Adj. Flow (vph)	301	1045	223	40	858	115	61	3	4	77	21	143
Lane Group Flow (vph)	301	1045	223	40	973	0	0	64	4	77	21	143
Turn Type	Prot	NA	Free	Prot	NA		Perm	NA	Perm	Perm	NA	Free
Protected Phases	5	2		1	6			8			3	
Permitted Phases			Free				8		8	3		Free
Detector Phase	5	2		1	6		8	8	8	3	3	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Total Split (s)	26.0	45.0		20.0	39.0		15.0	15.0	15.0	15.0	15.0	
Total Split (%)	32.5%	56.3%		25.0%	48.8%		18.8%	18.8%	18.8%	18.8%	18.8%	
Maximum Green (s)	21.0	40.0		15.0	34.0		10.0	10.0	10.0	10.0	10.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0			-1.0	-1.0	0.0	-1.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0	4.0	5.0	4.0	
Lead/Lag	Lead	Lead		Lag	Lag							
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	C-Min		None	C-Min		None	None	None	None	None	
v/c Ratio	0.53	0.42	0.14	0.17	0.50			0.38	0.01	0.52	0.09	0.09
Control Delay	28.3	10.5	0.2	30.4	12.1			38.4	0.0	45.8	30.7	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0
Total Delay	28.3	10.5	0.2	30.4	12.1			38.4	0.0	45.8	30.7	0.1
Queue Length 50th (ft)	62	68	0	19	147			29	0	36	9	0
Queue Length 95th (ft)	90	298	0	42	216			58	0	71	27	0
Internal Link Dist (ft)		670			220			220			220	
Turn Bay Length (ft)	225		50	170					160			
Base Capacity (vph)	953	2479	1599	350	1960			188	370	168	270	1538
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	0.32	0.42	0.14	0.11	0.50			0.34	0.01	0.46	0.08	0.09

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 9 (11%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 45

Control Type: Actuated-Coordinated

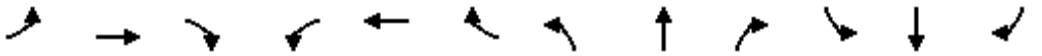
Splits and Phases: 5: Federal Street/Old River Road & River Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	292	1014	216	36	764	102	48	2	3	63	17	117
Future Volume (vph)	292	1014	216	36	764	102	48	2	3	63	17	117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	3.0	4.0	4.0			4.0	4.0	5.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95			1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3467	3471	1599	1752	3340			1747	1615	1719	1900	1538
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.72	1.00	0.72	1.00	1.00
Satd. Flow (perm)	3467	3471	1599	1752	3340			1319	1615	1294	1900	1538
Peak-hour factor, PHF	0.97	0.97	0.97	0.89	0.89	0.89	0.79	0.79	0.79	0.82	0.82	0.82
Adj. Flow (vph)	301	1045	223	40	858	115	61	3	4	77	21	143
RTOR Reduction (vph)	0	0	0	0	10	0	0	0	4	0	0	0
Lane Group Flow (vph)	301	1045	223	40	963	0	0	64	0	77	21	143
Heavy Vehicles (%)	1%	4%	1%	3%	7%	0%	4%	0%	0%	5%	0%	5%
Turn Type	Prot	NA	Free	Prot	NA		Perm	NA	Perm	Perm	NA	Free
Protected Phases	5	2		1	6			8			3	
Permitted Phases			Free				8		8	3		Free
Actuated Green, G (s)	12.2	51.1	80.0	5.9	44.8			8.0	8.0	8.0	8.0	80.0
Effective Green, g (s)	13.2	52.1	80.0	6.9	45.8			9.0	9.0	8.0	9.0	80.0
Actuated g/C Ratio	0.16	0.65	1.00	0.09	0.57			0.11	0.11	0.10	0.11	1.00
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	572	2260	1599	151	1912			148	181	129	213	1538
v/s Ratio Prot	c0.09	0.30		0.02	c0.29						0.01	
v/s Ratio Perm			0.14					0.05	0.00	c0.06		0.09
v/c Ratio	0.53	0.46	0.14	0.26	0.50			0.43	0.00	0.60	0.10	0.09
Uniform Delay, d1	30.5	7.0	0.0	34.2	10.3			33.1	31.5	34.5	31.9	0.0
Progression Factor	0.84	1.20	1.00	1.00	1.00			1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.6	0.2	0.9	1.0			2.0	0.0	7.2	0.2	0.1
Delay (s)	26.4	8.9	0.2	35.1	11.2			35.1	31.5	41.7	32.1	0.1
Level of Service	C	A	A	D	B			D	C	D	C	A
Approach Delay (s)		11.0			12.2			34.9			16.2	
Approach LOS		B			B			C			B	

Intersection Summary			
HCM 2000 Control Delay	12.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	52.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	94	693	23	9	1027	42	201	13	32	86	2	289
Future Volume (vph)	94	693	23	9	1027	42	201	13	32	86	2	289
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.994				0.850			0.850
Flt Protected	0.950			0.950				0.955		0.950		
Satd. Flow (prot)	3433	3505	1615	1626	3521	0	0	1798	1615	1770	1900	1599
Flt Permitted	0.950			0.950				0.737		0.436		
Satd. Flow (perm)	3433	3505	1615	1626	3521	0	0	1387	1615	812	1900	1599
Satd. Flow (RTOR)			164		8				95			228
Adj. Flow (vph)	100	737	24	10	1167	48	216	14	34	137	3	459
Lane Group Flow (vph)	100	737	24	10	1215	0	0	230	34	137	3	459
Turn Type	Prot	NA	Free	Prot	NA		Perm	NA	Perm	Perm	NA	Free
Protected Phases	5	2		1	6			8			3	
Permitted Phases			Free				8		8	3		Free
Detector Phase	5	2		1	6		8	8	8	3	3	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Total Split (s)	12.0	47.0		12.0	47.0		21.0	21.0	21.0	21.0	21.0	
Total Split (%)	15.0%	58.8%		15.0%	58.8%		26.3%	26.3%	26.3%	26.3%	26.3%	
Maximum Green (s)	7.0	42.0		7.0	42.0		16.0	16.0	16.0	16.0	16.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0			-1.0	-1.0	0.0	-1.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0	4.0	5.0	4.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	C-Min		None	C-Min		None	None	None	None	None	
v/c Ratio	0.30	0.33	0.01	0.07	0.62			0.73	0.08	0.78	0.01	0.29
Control Delay	36.9	4.7	0.0	34.2	14.9			44.0	0.3	61.5	24.5	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0
Total Delay	36.9	4.7	0.0	34.2	14.9			44.0	0.3	61.5	24.5	0.5
Queue Length 50th (ft)	23	87	0	5	235			102	0	62	1	0
Queue Length 95th (ft)	44	115	m0	19	264			#221	0	#92	6	0
Internal Link Dist (ft)		670			220			220			220	
Turn Bay Length (ft)	225		50	170					160			
Base Capacity (vph)	343	2246	1615	162	2021			325	451	180	445	1599
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	0.29	0.33	0.01	0.06	0.60			0.71	0.08	0.76	0.01	0.29

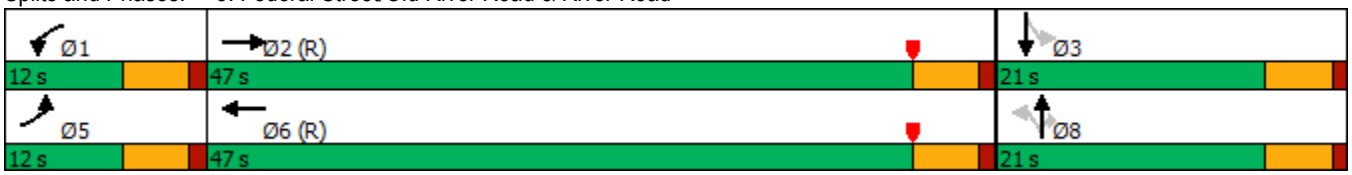
Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 42 (53%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 60

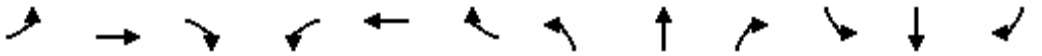
Control Type: Actuated-Coordinated

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Federal Street/Old River Road & River Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	94	693	23	9	1027	42	201	13	32	86	2	289
Future Volume (vph)	94	693	23	9	1027	42	201	13	32	86	2	289
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	3.0	4.0	4.0			4.0	4.0	5.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95			1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3505	1615	1626	3521			1798	1615	1770	1900	1599
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.74	1.00	0.44	1.00	1.00
Satd. Flow (perm)	3433	3505	1615	1626	3521			1388	1615	812	1900	1599
Peak-hour factor, PHF	0.94	0.94	0.94	0.88	0.88	0.88	0.93	0.93	0.93	0.63	0.63	0.63
Adj. Flow (vph)	100	737	24	10	1167	48	216	14	34	137	3	459
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	26	0	0	0
Lane Group Flow (vph)	100	737	24	10	1211	0	0	230	8	137	3	459
Heavy Vehicles (%)	2%	3%	0%	11%	2%	0%	1%	0%	0%	2%	0%	1%
Turn Type	Prot	NA	Free	Prot	NA		Perm	NA	Perm	Perm	NA	Free
Protected Phases	5	2		1	6			8			3	
Permitted Phases			Free				8		8	3		Free
Actuated Green, G (s)	5.6	46.3	80.0	1.4	42.1			17.3	17.3	17.3	17.3	80.0
Effective Green, g (s)	6.6	47.3	80.0	2.4	43.1			18.3	18.3	17.3	18.3	80.0
Actuated g/C Ratio	0.08	0.59	1.00	0.03	0.54			0.23	0.23	0.22	0.23	1.00
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	283	2072	1615	48	1896			317	369	175	434	1599
v/s Ratio Prot	0.03	0.21		0.01	c0.34						0.00	
v/s Ratio Perm			0.01					0.17	0.00	c0.17		c0.29
v/c Ratio	0.35	0.36	0.01	0.21	0.64			0.73	0.02	0.78	0.01	0.29
Uniform Delay, d1	34.7	8.5	0.0	37.9	13.0			28.5	23.9	29.6	23.8	0.0
Progression Factor	1.03	0.59	1.00	1.00	1.00			1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.5	0.0	2.2	1.7			8.0	0.0	20.1	0.0	0.5
Delay (s)	36.4	5.4	0.0	40.0	14.6			36.5	23.9	49.6	23.8	0.5
Level of Service	D	A	A	D	B			D	C	D	C	A
Approach Delay (s)		8.9			14.8			34.9			11.8	
Approach LOS		A			B			C			B	

Intersection Summary			
HCM 2000 Control Delay	14.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	62.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

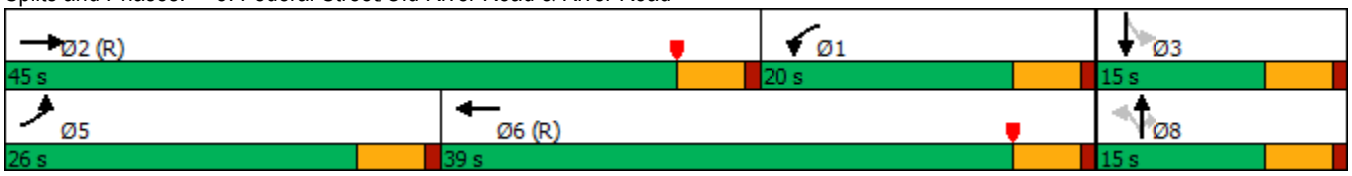
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	292	1205	216	36	987	102	48	2	3	63	17	117
Future Volume (vph)	292	1205	216	36	987	102	48	2	3	63	17	117
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.986				0.850			0.850
Flt Protected	0.950			0.950				0.955		0.950		
Satd. Flow (prot)	3467	3471	1599	1752	3347	0	0	1748	1615	1719	1900	1538
Flt Permitted	0.950			0.950				0.721		0.715		
Satd. Flow (perm)	3467	3471	1599	1752	3347	0	0	1320	1615	1294	1900	1538
Satd. Flow (RTOR)			232		17				164			232
Adj. Flow (vph)	301	1242	223	40	1109	115	61	3	4	77	21	143
Lane Group Flow (vph)	301	1242	223	40	1224	0	0	64	4	77	21	143
Turn Type	Prot	NA	Free	Prot	NA		Perm	NA	Perm	Perm	NA	Free
Protected Phases	5	2		1	6			8			3	
Permitted Phases			Free				8		8	3		Free
Detector Phase	5	2		1	6		8	8	8	3	3	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Total Split (s)	26.0	45.0		20.0	39.0		15.0	15.0	15.0	15.0	15.0	
Total Split (%)	32.5%	56.3%		25.0%	48.8%		18.8%	18.8%	18.8%	18.8%	18.8%	
Maximum Green (s)	21.0	40.0		15.0	34.0		10.0	10.0	10.0	10.0	10.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0			-1.0	-1.0	0.0	-1.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0	4.0	5.0	4.0	
Lead/Lag	Lead	Lead		Lag	Lag							
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	C-Min		None	C-Min		None	None	None	None	None	
v/c Ratio	0.53	0.50	0.14	0.17	0.62			0.40	0.01	0.55	0.09	0.09
Control Delay	29.1	11.1	0.1	30.2	13.8			39.6	0.0	48.1	31.3	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0
Total Delay	29.1	11.1	0.1	30.2	13.8			39.6	0.0	48.1	31.3	0.1
Queue Length 50th (ft)	61	49	0	19	209			29	0	36	9	0
Queue Length 95th (ft)	91	379	m0	42	303			58	0	71	27	0
Internal Link Dist (ft)		670			220			220			220	
Turn Bay Length (ft)	225		50	170					160			
Base Capacity (vph)	953	2479	1599	350	1979			181	363	161	261	1538
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	0.32	0.50	0.14	0.11	0.62			0.35	0.01	0.48	0.08	0.09

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 9 (11%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 55

Control Type: Actuated-Coordinated

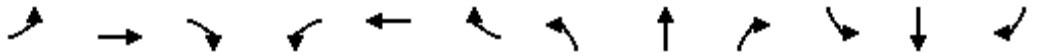
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Federal Street/Old River Road & River Road



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	292	1205	216	36	987	102	48	2	3	63	17	117
Future Volume (vph)	292	1205	216	36	987	102	48	2	3	63	17	117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	3.0	4.0	4.0			4.0	4.0	5.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95			1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3467	3471	1599	1752	3347			1747	1615	1719	1900	1538
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.72	1.00	0.72	1.00	1.00
Satd. Flow (perm)	3467	3471	1599	1752	3347			1319	1615	1294	1900	1538
Peak-hour factor, PHF	0.97	0.97	0.97	0.89	0.89	0.89	0.79	0.79	0.79	0.82	0.82	0.82
Adj. Flow (vph)	301	1242	223	40	1109	115	61	3	4	77	21	143
RTOR Reduction (vph)	0	0	0	0	7	0	0	0	4	0	0	0
Lane Group Flow (vph)	301	1242	223	40	1217	0	0	64	0	77	21	143
Heavy Vehicles (%)	1%	4%	1%	3%	7%	0%	4%	0%	0%	5%	0%	5%
Turn Type	Prot	NA	Free	Prot	NA		Perm	NA	Perm	Perm	NA	Free
Protected Phases	5	2		1	6			8			3	
Permitted Phases			Free				8		8	3		Free
Actuated Green, G (s)	12.2	51.4	80.0	6.0	45.2			7.6	7.6	7.6	7.6	80.0
Effective Green, g (s)	13.2	52.4	80.0	7.0	46.2			8.6	8.6	7.6	8.6	80.0
Actuated g/C Ratio	0.16	0.65	1.00	0.09	0.58			0.11	0.11	0.09	0.11	1.00
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	572	2273	1599	153	1932			141	173	122	204	1538
v/s Ratio Prot	0.09	c0.36		0.02	c0.36						0.01	
v/s Ratio Perm			0.14					0.05	0.00	c0.06		0.09
v/c Ratio	0.53	0.55	0.14	0.26	0.63			0.45	0.00	0.63	0.10	0.09
Uniform Delay, d1	30.5	7.4	0.0	34.1	11.2			33.5	31.9	34.9	32.2	0.0
Progression Factor	0.87	1.19	1.00	1.00	1.00			1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.7	0.1	0.9	1.6			2.3	0.0	10.2	0.2	0.1
Delay (s)	27.4	9.5	0.1	35.0	12.8			35.8	31.9	45.0	32.4	0.1
Level of Service	C	A	A	C	B			D	C	D	C	A
Approach Delay (s)		11.4			13.5			35.6			17.3	
Approach LOS		B			B			D			B	

Intersection Summary			
HCM 2000 Control Delay	13.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	59.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	94	904	23	9	1224	42	201	13	32	86	2	289
Future Volume (vph)	94	904	23	9	1224	42	201	13	32	86	2	289
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.995				0.850			0.850
Flt Protected	0.950			0.950				0.955		0.950		
Satd. Flow (prot)	3433	3505	1615	1626	3524	0	0	1798	1615	1770	1900	1599
Flt Permitted	0.950			0.950				0.737		0.414		
Satd. Flow (perm)	3433	3505	1615	1626	3524	0	0	1387	1615	771	1900	1599
Satd. Flow (RTOR)			164		7				95			210
Adj. Flow (vph)	100	962	24	10	1391	48	216	14	34	137	3	459
Lane Group Flow (vph)	100	962	24	10	1439	0	0	230	34	137	3	459
Turn Type	Prot	NA	Free	Prot	NA		Perm	NA	Perm	Perm	NA	Free
Protected Phases	5	2		1	6			8			3	
Permitted Phases			Free				8		8	3		Free
Detector Phase	5	2		1	6		8	8	8	3	3	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Total Split (s)	12.0	47.0		12.0	47.0		21.0	21.0	21.0	21.0	21.0	
Total Split (%)	15.0%	58.8%		15.0%	58.8%		26.3%	26.3%	26.3%	26.3%	26.3%	
Maximum Green (s)	7.0	42.0		7.0	42.0		16.0	16.0	16.0	16.0	16.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0			-1.0	-1.0	0.0	-1.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0	4.0	5.0	4.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	C-Min		None	C-Min		None	None	None	None	None	
v/c Ratio	0.30	0.42	0.01	0.07	0.72			0.78	0.08	0.89	0.01	0.29
Control Delay	44.8	2.7	0.0	34.2	16.1			49.9	0.4	83.0	25.0	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0
Total Delay	44.8	2.7	0.0	34.2	16.1			49.9	0.4	83.0	25.0	0.5
Queue Length 50th (ft)	22	14	0	5	274			109	0	67	1	0
Queue Length 95th (ft)	50	81	m0	19	343			#221	0	#96	6	0
Internal Link Dist (ft)		670			220			220			220	
Turn Bay Length (ft)	225		50	170					160			
Base Capacity (vph)	343	2302	1615	162	2022			302	427	159	414	1599
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	0.29	0.42	0.01	0.06	0.71			0.76	0.08	0.86	0.01	0.29

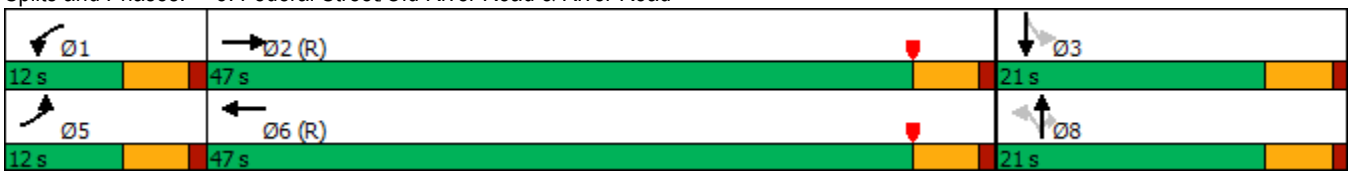
Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 42 (53%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 60

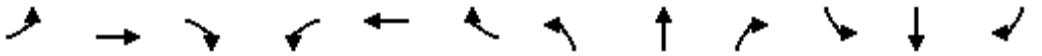
Control Type: Actuated-Coordinated

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Federal Street/Old River Road & River Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	94	904	23	9	1224	42	201	13	32	86	2	289
Future Volume (vph)	94	904	23	9	1224	42	201	13	32	86	2	289
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	3.0	4.0	4.0			4.0	4.0	5.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95			1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3505	1615	1626	3524			1798	1615	1770	1900	1599
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.74	1.00	0.41	1.00	1.00
Satd. Flow (perm)	3433	3505	1615	1626	3524			1388	1615	771	1900	1599
Peak-hour factor, PHF	0.94	0.94	0.94	0.88	0.88	0.88	0.93	0.93	0.93	0.63	0.63	0.63
Adj. Flow (vph)	100	962	24	10	1391	48	216	14	34	137	3	459
RTOR Reduction (vph)	0	0	0	0	3	0	0	0	27	0	0	0
Lane Group Flow (vph)	100	962	24	10	1436	0	0	230	7	137	3	459
Heavy Vehicles (%)	2%	3%	0%	11%	2%	0%	1%	0%	0%	2%	0%	1%
Turn Type	Prot	NA	Free	Prot	NA		Perm	NA	Perm	Perm	NA	Free
Protected Phases	5	2		1	6			8			3	
Permitted Phases			Free				8		8	3		Free
Actuated Green, G (s)	5.6	47.6	80.0	1.4	43.4			16.0	16.0	16.0	16.0	80.0
Effective Green, g (s)	6.6	48.6	80.0	2.4	44.4			17.0	17.0	16.0	17.0	80.0
Actuated g/C Ratio	0.08	0.61	1.00	0.03	0.55			0.21	0.21	0.20	0.21	1.00
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	283	2129	1615	48	1955			294	343	154	403	1599
v/s Ratio Prot	0.03	0.27		0.01	c0.41						0.00	
v/s Ratio Perm			0.01					0.17	0.00	c0.18		c0.29
v/c Ratio	0.35	0.45	0.01	0.21	0.73			0.78	0.02	0.89	0.01	0.29
Uniform Delay, d1	34.7	8.5	0.0	37.9	13.4			29.8	24.9	31.1	24.8	0.0
Progression Factor	1.26	0.29	1.00	1.00	1.00			1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.7	0.0	2.2	2.5			12.7	0.0	41.5	0.0	0.5
Delay (s)	44.5	3.1	0.0	40.0	15.9			42.5	24.9	72.6	24.9	0.5
Level of Service	D	A	A	D	B			D	C	E	C	A
Approach Delay (s)		6.9			16.0			40.2			17.1	
Approach LOS		A			B			D			B	

Intersection Summary			
HCM 2000 Control Delay	15.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

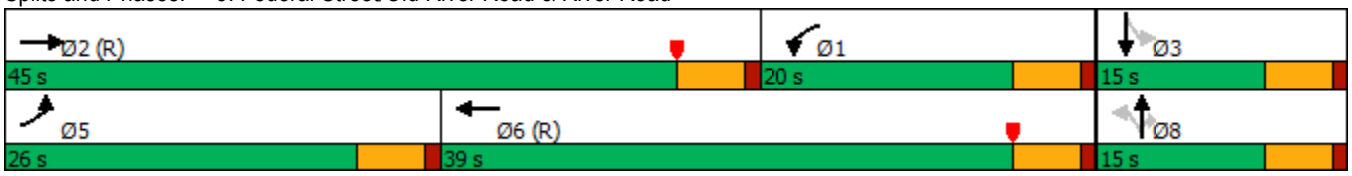
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	292	1212	216	36	991	102	48	2	3	63	17	117
Future Volume (vph)	292	1212	216	36	991	102	48	2	3	63	17	117
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.986				0.850			0.850
Flt Protected	0.950			0.950				0.955		0.950		
Satd. Flow (prot)	3467	3471	1599	1752	3347	0	0	1748	1615	1719	1900	1538
Flt Permitted	0.950			0.950				0.721		0.715		
Satd. Flow (perm)	3467	3471	1599	1752	3347	0	0	1320	1615	1294	1900	1538
Satd. Flow (RTOR)			232		17				164			232
Adj. Flow (vph)	301	1249	223	40	1113	115	61	3	4	77	21	143
Lane Group Flow (vph)	301	1249	223	40	1228	0	0	64	4	77	21	143
Turn Type	Prot	NA	Free	Prot	NA		Perm	NA	Perm	Perm	NA	Free
Protected Phases	5	2		1	6			8			3	
Permitted Phases			Free				8		8	3		Free
Detector Phase	5	2		1	6		8	8	8	3	3	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Total Split (s)	26.0	45.0		20.0	39.0		15.0	15.0	15.0	15.0	15.0	
Total Split (%)	32.5%	56.3%		25.0%	48.8%		18.8%	18.8%	18.8%	18.8%	18.8%	
Maximum Green (s)	21.0	40.0		15.0	34.0		10.0	10.0	10.0	10.0	10.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0			-1.0	-1.0	0.0	-1.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0	4.0	5.0	4.0	
Lead/Lag	Lead	Lead		Lag	Lag							
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	C-Min		None	C-Min		None	None	None	None	None	
v/c Ratio	0.53	0.54	0.14	0.15	0.62			0.40	0.01	0.55	0.09	0.09
Control Delay	29.0	14.8	0.1	28.2	13.8			39.6	0.0	48.1	31.3	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0
Total Delay	29.0	14.8	0.1	28.2	13.8			39.6	0.0	48.1	31.3	0.1
Queue Length 50th (ft)	62	293	0	16	210			29	0	36	9	0
Queue Length 95th (ft)	91	382	m0	42	305			58	0	71	27	0
Internal Link Dist (ft)		670			220			220			220	
Turn Bay Length (ft)	225		50	170					160			
Base Capacity (vph)	953	2306	1599	355	1979			181	363	161	261	1538
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	0.32	0.54	0.14	0.11	0.62			0.35	0.01	0.48	0.08	0.09

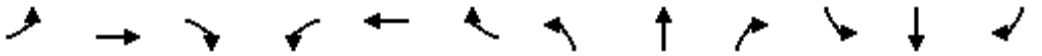
Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 9 (11%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 55

Control Type: Actuated-Coordinated

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Federal Street/Old River Road & River Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	292	1212	216	36	991	102	48	2	3	63	17	117
Future Volume (vph)	292	1212	216	36	991	102	48	2	3	63	17	117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	3.0	4.0	4.0			4.0	4.0	5.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95			1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3467	3471	1599	1752	3347			1747	1615	1719	1900	1538
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.72	1.00	0.72	1.00	1.00
Satd. Flow (perm)	3467	3471	1599	1752	3347			1319	1615	1294	1900	1538
Peak-hour factor, PHF	0.97	0.97	0.97	0.89	0.89	0.89	0.79	0.79	0.79	0.82	0.82	0.82
Adj. Flow (vph)	301	1249	223	40	1113	115	61	3	4	77	21	143
RTOR Reduction (vph)	0	0	0	0	7	0	0	0	4	0	0	0
Lane Group Flow (vph)	301	1249	223	40	1221	0	0	64	0	77	21	143
Heavy Vehicles (%)	1%	4%	1%	3%	7%	0%	4%	0%	0%	5%	0%	5%
Turn Type	Prot	NA	Free	Prot	NA		Perm	NA	Perm	Perm	NA	Free
Protected Phases	5	2		1	6			8			3	
Permitted Phases			Free				8		8	3		Free
Actuated Green, G (s)	12.2	48.2	80.0	9.2	45.2			7.6	7.6	7.6	7.6	80.0
Effective Green, g (s)	13.2	49.2	80.0	10.2	46.2			8.6	8.6	7.6	8.6	80.0
Actuated g/C Ratio	0.16	0.62	1.00	0.13	0.58			0.11	0.11	0.09	0.11	1.00
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	572	2134	1599	223	1932			141	173	122	204	1538
v/s Ratio Prot	0.09	c0.36		0.02	c0.36						0.01	
v/s Ratio Perm			0.14					0.05	0.00	c0.06		0.09
v/c Ratio	0.53	0.59	0.14	0.18	0.63			0.45	0.00	0.63	0.10	0.09
Uniform Delay, d1	30.5	9.3	0.0	31.2	11.2			33.5	31.9	34.9	32.2	0.0
Progression Factor	0.87	1.24	1.00	1.00	1.00			1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.9	0.1	0.4	1.6			2.3	0.0	10.2	0.2	0.1
Delay (s)	27.3	12.4	0.1	31.6	12.8			35.8	31.9	45.0	32.4	0.1
Level of Service	C	B	A	C	B			D	C	D	C	A
Approach Delay (s)		13.4			13.4			35.6			17.3	
Approach LOS		B			B			D			B	

Intersection Summary			
HCM 2000 Control Delay	14.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	59.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	94	920	23	9	1235	42	201	13	32	86	2	289
Future Volume (vph)	94	920	23	9	1235	42	201	13	32	86	2	289
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.995				0.850			0.850
Flt Protected	0.950			0.950				0.955		0.950		
Satd. Flow (prot)	3433	3505	1615	1626	3524	0	0	1798	1615	1770	1900	1599
Flt Permitted	0.950			0.950				0.737		0.412		
Satd. Flow (perm)	3433	3505	1615	1626	3524	0	0	1387	1615	767	1900	1599
Satd. Flow (RTOR)			164		7				95			210
Adj. Flow (vph)	100	979	24	10	1403	48	216	14	34	137	3	459
Lane Group Flow (vph)	100	979	24	10	1451	0	0	230	34	137	3	459
Turn Type	Prot	NA	Free	Prot	NA		Perm	NA	Perm	Perm	NA	Free
Protected Phases	5	2		1	6			8			3	
Permitted Phases			Free				8		8	3		Free
Detector Phase	5	2		1	6		8	8	8	3	3	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Total Split (s)	12.0	47.0		12.0	47.0		21.0	21.0	21.0	21.0	21.0	
Total Split (%)	15.0%	58.8%		15.0%	58.8%		26.3%	26.3%	26.3%	26.3%	26.3%	
Maximum Green (s)	7.0	42.0		7.0	42.0		16.0	16.0	16.0	16.0	16.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0			-1.0	-1.0	0.0	-1.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0	4.0	5.0	4.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	C-Min		None	C-Min		None	None	None	None	None	
v/c Ratio	0.30	0.42	0.01	0.07	0.72			0.79	0.08	0.90	0.01	0.29
Control Delay	45.5	2.6	0.0	34.2	16.1			50.9	0.4	86.7	25.0	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0
Total Delay	45.5	2.6	0.0	34.2	16.1			50.9	0.4	86.7	25.0	0.5
Queue Length 50th (ft)	22	14	0	5	278			109	0	67	1	0
Queue Length 95th (ft)	50	77	m0	19	348			#221	0	#96	6	0
Internal Link Dist (ft)		670			220			220			220	
Turn Bay Length (ft)	225		50	170					160			
Base Capacity (vph)	343	2310	1615	162	2022			299	424	156	410	1599
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	0.29	0.42	0.01	0.06	0.72			0.77	0.08	0.88	0.01	0.29

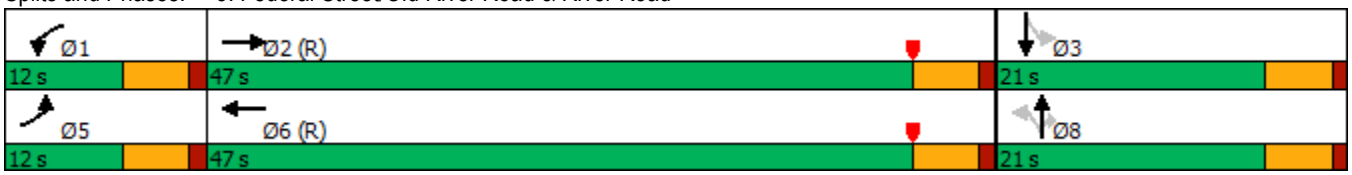
Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 42 (53%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 60

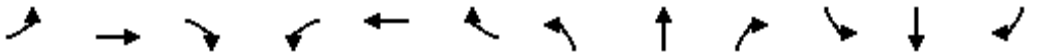
Control Type: Actuated-Coordinated

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

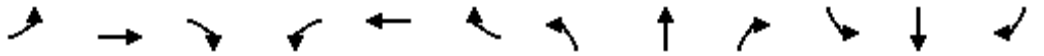
Splits and Phases: 5: Federal Street/Old River Road & River Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	94	920	23	9	1235	42	201	13	32	86	2	289
Future Volume (vph)	94	920	23	9	1235	42	201	13	32	86	2	289
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	3.0	4.0	4.0			4.0	4.0	5.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95			1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3505	1615	1626	3524			1798	1615	1770	1900	1599
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.74	1.00	0.41	1.00	1.00
Satd. Flow (perm)	3433	3505	1615	1626	3524			1388	1615	768	1900	1599
Peak-hour factor, PHF	0.94	0.94	0.94	0.88	0.88	0.88	0.93	0.93	0.93	0.63	0.63	0.63
Adj. Flow (vph)	100	979	24	10	1403	48	216	14	34	137	3	459
RTOR Reduction (vph)	0	0	0	0	3	0	0	0	27	0	0	0
Lane Group Flow (vph)	100	979	24	10	1448	0	0	230	7	137	3	459
Heavy Vehicles (%)	2%	3%	0%	11%	2%	0%	1%	0%	0%	2%	0%	1%
Turn Type	Prot	NA	Free	Prot	NA		Perm	NA	Perm	Perm	NA	Free
Protected Phases	5	2		1	6			8			3	
Permitted Phases			Free				8		8	3		Free
Actuated Green, G (s)	5.6	47.7	80.0	1.4	43.5			15.9	15.9	15.9	15.9	80.0
Effective Green, g (s)	6.6	48.7	80.0	2.4	44.5			16.9	16.9	15.9	16.9	80.0
Actuated g/C Ratio	0.08	0.61	1.00	0.03	0.56			0.21	0.21	0.20	0.21	1.00
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	283	2133	1615	48	1960			293	341	152	401	1599
v/s Ratio Prot	0.03	0.28		0.01	c0.41						0.00	
v/s Ratio Perm			0.01					0.17	0.00	c0.18		c0.29
v/c Ratio	0.35	0.46	0.01	0.21	0.74			0.78	0.02	0.90	0.01	0.29
Uniform Delay, d1	34.7	8.5	0.0	37.9	13.4			29.8	25.0	31.3	24.9	0.0
Progression Factor	1.28	0.28	1.00	1.00	1.00			1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.7	0.0	2.2	2.5			12.9	0.0	45.1	0.0	0.5
Delay (s)	45.2	3.1	0.0	40.0	15.9			42.7	25.0	76.4	24.9	0.5
Level of Service	D	A	A	D	B			D	C	E	C	A
Approach Delay (s)		6.8			16.1			40.5			17.9	
Approach LOS		A			B			D			B	

Intersection Summary			
HCM 2000 Control Delay	15.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



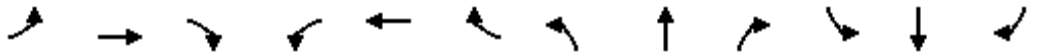
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	292	1212	216	36	991	102	48	2	3	63	17	117
Future Volume (vph)	292	1212	216	36	991	102	48	2	3	63	17	117
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.986				0.850			0.850
Flt Protected	0.950			0.950				0.955		0.950		
Satd. Flow (prot)	3467	3471	1599	1752	3347	0	0	1748	1615	1719	1900	1538
Flt Permitted	0.950			0.950				0.721		0.715		
Satd. Flow (perm)	3467	3471	1599	1752	3347	0	0	1320	1615	1294	1900	1538
Satd. Flow (RTOR)			232		22				164			232
Adj. Flow (vph)	301	1249	223	40	1113	115	61	3	4	77	21	143
Lane Group Flow (vph)	301	1249	223	40	1228	0	0	64	4	77	21	143
Turn Type	Prot	NA	Free	Prot	NA		Perm	NA	Perm	Perm	NA	Free
Protected Phases	5	2		1	6			8			3	
Permitted Phases			Free				8		8	3		Free
Detector Phase	5	2		1	6		8	8	8	3	3	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Total Split (s)	16.0	54.0		10.0	48.0		16.0	16.0	16.0	16.0	16.0	
Total Split (%)	20.0%	67.5%		12.5%	60.0%		20.0%	20.0%	20.0%	20.0%	20.0%	
Maximum Green (s)	11.0	49.0		5.0	43.0		11.0	11.0	11.0	11.0	11.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0			-1.0	-1.0	0.0	-1.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0	4.0	5.0	4.0	
Lead/Lag	Lead	Lead		Lag	Lag							
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	C-Min		None	C-Min		None	None	None	None	None	
v/c Ratio	0.59	0.51	0.14	0.22	0.61			0.38	0.01	0.51	0.09	0.09
Control Delay	35.8	6.7	0.1	36.3	12.7			37.7	0.0	44.9	30.3	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0
Total Delay	35.8	6.7	0.1	36.3	12.7			37.7	0.0	44.9	30.3	0.1
Queue Length 50th (ft)	62	112	0	18	208			29	0	36	9	0
Queue Length 95th (ft)	107	175	0	48	271			57	0	70	26	0
Internal Link Dist (ft)		670			220			220			220	
Turn Bay Length (ft)	225		50	170					160			
Base Capacity (vph)	529	2540	1599	178	2026			201	384	180	289	1538
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	0.57	0.49	0.14	0.22	0.61			0.32	0.01	0.43	0.07	0.09

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 73 (91%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 55

Control Type: Actuated-Coordinated

Splits and Phases: 5: Federal Street/Old River Road & River Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	292	1212	216	36	991	102	48	2	3	63	17	117
Future Volume (vph)	292	1212	216	36	991	102	48	2	3	63	17	117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	3.0	4.0	4.0			4.0	4.0	5.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95			1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3467	3471	1599	1752	3347			1747	1615	1719	1900	1538
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.72	1.00	0.72	1.00	1.00
Satd. Flow (perm)	3467	3471	1599	1752	3347			1319	1615	1294	1900	1538
Peak-hour factor, PHF	0.97	0.97	0.97	0.89	0.89	0.89	0.79	0.79	0.79	0.82	0.82	0.82
Adj. Flow (vph)	301	1249	223	40	1113	115	61	3	4	77	21	143
RTOR Reduction (vph)	0	0	0	0	9	0	0	0	4	0	0	0
Lane Group Flow (vph)	301	1249	223	40	1219	0	0	64	0	77	21	143
Heavy Vehicles (%)	1%	4%	1%	3%	7%	0%	4%	0%	0%	5%	0%	5%
Turn Type	Prot	NA	Free	Prot	NA		Perm	NA	Perm	Perm	NA	Free
Protected Phases	5	2		1	6			8			3	
Permitted Phases			Free				8		8	3		Free
Actuated Green, G (s)	10.7	52.0	80.0	4.8	46.1			8.2	8.2	8.2	8.2	80.0
Effective Green, g (s)	11.7	53.0	80.0	5.8	47.1			9.2	9.2	8.2	9.2	80.0
Actuated g/C Ratio	0.15	0.66	1.00	0.07	0.59			0.11	0.11	0.10	0.11	1.00
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	507	2299	1599	127	1970			151	185	132	218	1538
v/s Ratio Prot	0.09	c0.36		0.02	c0.36						0.01	
v/s Ratio Perm			0.14					0.05	0.00	c0.06		0.09
v/c Ratio	0.59	0.54	0.14	0.31	0.62			0.42	0.00	0.58	0.10	0.09
Uniform Delay, d1	31.9	7.1	0.0	35.2	10.6			32.9	31.3	34.3	31.7	0.0
Progression Factor	0.99	0.76	1.00	1.00	1.00			1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.5	0.7	0.1	1.4	1.5			1.9	0.0	6.4	0.2	0.1
Delay (s)	33.2	6.1	0.1	36.6	12.1			34.8	31.3	40.7	31.9	0.1
Level of Service	C	A	A	D	B			C	C	D	C	A
Approach Delay (s)		10.0			12.9			34.6			15.8	
Approach LOS		A			B			C			B	

Intersection Summary			
HCM 2000 Control Delay	12.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	59.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

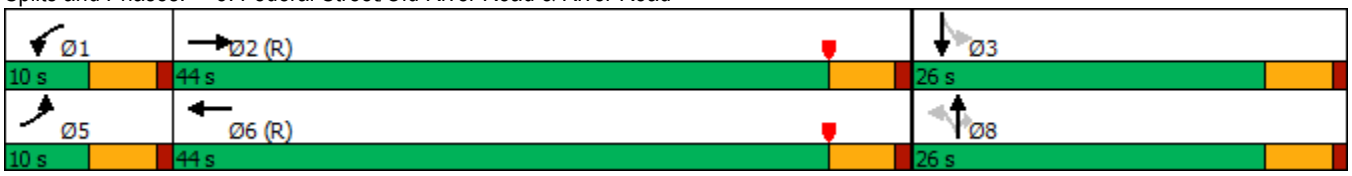
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	94	920	23	9	1235	42	201	13	32	86	2	289
Future Volume (vph)	94	920	23	9	1235	42	201	13	32	86	2	289
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.995				0.850			0.850
Flt Protected	0.950			0.950				0.955		0.950		
Satd. Flow (prot)	3433	3505	1615	1626	3524	0	0	1798	1615	1770	1900	1599
Flt Permitted	0.950			0.950				0.737		0.438		
Satd. Flow (perm)	3433	3505	1615	1626	3524	0	0	1387	1615	816	1900	1599
Satd. Flow (RTOR)			164		6				95			226
Adj. Flow (vph)	100	979	24	10	1403	48	216	14	34	137	3	459
Lane Group Flow (vph)	100	979	24	10	1451	0	0	230	34	137	3	459
Turn Type	Prot	NA	Free	Prot	NA		Perm	NA	Perm	Perm	NA	Free
Protected Phases	5	2		1	6			8			3	
Permitted Phases			Free				8		8	3		Free
Detector Phase	5	2		1	6		8	8	8	3	3	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Total Split (s)	10.0	44.0		10.0	44.0		26.0	26.0	26.0	26.0	26.0	
Total Split (%)	12.5%	55.0%		12.5%	55.0%		32.5%	32.5%	32.5%	32.5%	32.5%	
Maximum Green (s)	5.0	39.0		5.0	39.0		21.0	21.0	21.0	21.0	21.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0			-1.0	-1.0	0.0	-1.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0	4.0	5.0	4.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	C-Min		None	C-Min		None	None	None	None	None	
v/c Ratio	0.33	0.43	0.01	0.08	0.74			0.72	0.08	0.77	0.01	0.29
Control Delay	50.5	2.1	0.0	35.9	17.7			41.4	0.3	57.6	21.5	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0
Total Delay	50.5	2.1	0.0	35.9	17.7			41.4	0.3	57.6	21.5	0.5
Queue Length 50th (ft)	25	16	0	5	305			105	0	64	1	0
Queue Length 95th (ft)	53	30	m0	19	382			174	0	78	5	0
Internal Link Dist (ft)		670			220			220			220	
Turn Bay Length (ft)	225		50	170					160			
Base Capacity (vph)	303	2262	1615	129	1972			381	513	214	522	1599
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	0.33	0.43	0.01	0.08	0.74			0.60	0.07	0.64	0.01	0.29

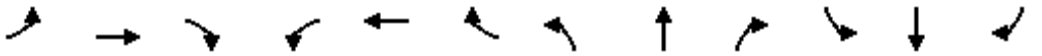
Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 63 (79%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 60

Control Type: Actuated-Coordinated

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Federal Street/Old River Road & River Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	94	920	23	9	1235	42	201	13	32	86	2	289
Future Volume (vph)	94	920	23	9	1235	42	201	13	32	86	2	289
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	3.0	4.0	4.0			4.0	4.0	5.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95			1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3505	1615	1626	3524			1798	1615	1770	1900	1599
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.74	1.00	0.44	1.00	1.00
Satd. Flow (perm)	3433	3505	1615	1626	3524			1388	1615	815	1900	1599
Peak-hour factor, PHF	0.94	0.94	0.94	0.88	0.88	0.88	0.93	0.93	0.93	0.63	0.63	0.63
Adj. Flow (vph)	100	979	24	10	1403	48	216	14	34	137	3	459
RTOR Reduction (vph)	0	0	0	0	3	0	0	0	26	0	0	0
Lane Group Flow (vph)	100	979	24	10	1448	0	0	230	8	137	3	459
Heavy Vehicles (%)	2%	3%	0%	11%	2%	0%	1%	0%	0%	2%	0%	1%
Turn Type	Prot	NA	Free	Prot	NA		Perm	NA	Perm	Perm	NA	Free
Protected Phases	5	2		1	6			8			3	
Permitted Phases			Free				8		8	3		Free
Actuated Green, G (s)	4.9	46.6	80.0	1.0	42.7			17.4	17.4	17.4	17.4	80.0
Effective Green, g (s)	5.9	47.6	80.0	2.0	43.7			18.4	18.4	17.4	18.4	80.0
Actuated g/C Ratio	0.07	0.60	1.00	0.02	0.55			0.23	0.23	0.22	0.23	1.00
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	253	2085	1615	40	1924			319	371	177	437	1599
v/s Ratio Prot	0.03	0.28		0.01	c0.41						0.00	
v/s Ratio Perm			0.01					0.17	0.00	c0.17		c0.29
v/c Ratio	0.40	0.47	0.01	0.25	0.75			0.72	0.02	0.77	0.01	0.29
Uniform Delay, d1	35.3	9.1	0.0	38.3	14.0			28.4	23.8	29.5	23.8	0.0
Progression Factor	1.37	0.18	1.00	1.00	1.00			1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.0	0.7	0.0	3.3	2.8			7.8	0.0	18.8	0.0	0.5
Delay (s)	49.4	2.3	0.0	41.5	16.8			36.2	23.9	48.2	23.8	0.5
Level of Service	D	A	A	D	B			D	C	D	C	A
Approach Delay (s)		6.5			16.9			34.6			11.5	
Approach LOS		A			B			C			B	

Intersection Summary			
HCM 2000 Control Delay	14.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Minuteman Road at the Project site driveway

Intersection	
Int Delay, s/veh	4.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	92	504	384	117	0
Future Vol, veh/h	0	92	504	384	117	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	100	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	89	95	92
Heavy Vehicles, %	2	2	2	1	3	2
Mvmt Flow	0	100	548	431	123	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1435	62	123	0	-	0
Stage 1	123	-	-	-	-	-
Stage 2	1312	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.14	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.22	-	-	-
Pot Cap-1 Maneuver	125	990	1462	-	-	-
Stage 1	889	-	-	-	-	-
Stage 2	216	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	78	990	1462	-	-	-
Mov Cap-2 Maneuver	78	-	-	-	-	-
Stage 1	556	-	-	-	-	-
Stage 2	216	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9	5	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1462	-	990	-	-
HCM Lane V/C Ratio	0.375	-	0.101	-	-
HCM Control Delay (s)	8.9	-	9	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	1.8	-	0.3	-	-

Intersection	
Int Delay, s/veh	9.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	482	124	114	386	0
Future Vol, veh/h	0	482	124	114	386	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	100	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	84	75	92
Heavy Vehicles, %	2	2	2	3	1	2
Mvmt Flow	0	524	135	136	515	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	853	258	515	0	-	0
Stage 1	515	-	-	-	-	-
Stage 2	338	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.14	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.22	-	-	-
Pot Cap-1 Maneuver	298	741	1047	-	-	-
Stage 1	565	-	-	-	-	-
Stage 2	694	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	260	741	1047	-	-	-
Mov Cap-2 Maneuver	260	-	-	-	-	-
Stage 1	492	-	-	-	-	-
Stage 2	694	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	20.7	4.5	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1047	-	741	-	-
HCM Lane V/C Ratio	0.129	-	0.707	-	-
HCM Control Delay (s)	8.9	-	20.7	-	-
HCM Lane LOS	A	-	C	-	-
HCM 95th %tile Q(veh)	0.4	-	5.9	-	-

Intersection	
Int Delay, s/veh	5.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	133	525	384	117	0
Future Vol, veh/h	0	133	525	384	117	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	100	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	89	95	92
Heavy Vehicles, %	2	2	2	1	3	2
Mvmt Flow	0	145	571	431	123	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1481	62	123	0	-	0
Stage 1	123	-	-	-	-	-
Stage 2	1358	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.14	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.22	-	-	-
Pot Cap-1 Maneuver	116	990	1462	-	-	-
Stage 1	889	-	-	-	-	-
Stage 2	204	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	71	990	1462	-	-	-
Mov Cap-2 Maneuver	71	-	-	-	-	-
Stage 1	541	-	-	-	-	-
Stage 2	204	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.3	5.1	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1462	-	990	-	-
HCM Lane V/C Ratio	0.39	-	0.146	-	-
HCM Control Delay (s)	9	-	9.3	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	1.9	-	0.5	-	-

Intersection	
Int Delay, s/veh	13.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	565	182	114	386	0
Future Vol, veh/h	0	565	182	114	386	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	100	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	84	75	92
Heavy Vehicles, %	2	2	2	3	1	2
Mvmt Flow	0	614	198	136	515	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	979	258	515	0	-	0
Stage 1	515	-	-	-	-	-
Stage 2	464	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.14	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.22	-	-	-
Pot Cap-1 Maneuver	247	741	1047	-	-	-
Stage 1	565	-	-	-	-	-
Stage 2	599	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	200	741	1047	-	-	-
Mov Cap-2 Maneuver	200	-	-	-	-	-
Stage 1	458	-	-	-	-	-
Stage 2	599	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	28.7	5.5	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1047	-	741	-	-
HCM Lane V/C Ratio	0.189	-	0.829	-	-
HCM Control Delay (s)	9.2	-	28.7	-	-
HCM Lane LOS	A	-	D	-	-
HCM 95th %tile Q(veh)	0.7	-	9.2	-	-

1776 Drive at the Project site driveway

Intersection	
Int Delay, s/veh	8.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	0	5	18	0	32	94
Future Vol, veh/h	0	5	18	0	32	94
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	5	20	0	35	102

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	5	0	43	3
Stage 1	-	-	-	-	3	-
Stage 2	-	-	-	-	40	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1616	-	968	1081
Stage 1	-	-	-	-	1020	-
Stage 2	-	-	-	-	982	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1616	-	956	1081
Mov Cap-2 Maneuver	-	-	-	-	956	-
Stage 1	-	-	-	-	1020	-
Stage 2	-	-	-	-	970	-

Approach	EB	WB	NB
HCM Control Delay, s	0	7.3	8.8
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	956	1081	-	-	1616	-
HCM Lane V/C Ratio	0.036	0.095	-	-	0.012	-
HCM Control Delay (s)	8.9	8.7	-	-	7.3	0
HCM Lane LOS	A	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	0.3	-	-	0	-

Intersection	
Int Delay, s/veh	6.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	0	31	90	0	7	24
Future Vol, veh/h	0	31	90	0	7	24
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	34	98	0	8	26

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	34	0	213	17
Stage 1	-	-	-	-	17	-
Stage 2	-	-	-	-	196	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1578	-	775	1062
Stage 1	-	-	-	-	1006	-
Stage 2	-	-	-	-	837	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1578	-	727	1062
Mov Cap-2 Maneuver	-	-	-	-	727	-
Stage 1	-	-	-	-	1006	-
Stage 2	-	-	-	-	785	-

Approach	EB	WB	NB
HCM Control Delay, s	0	7.4	8.8
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	727	1062	-	-	1578	-
HCM Lane V/C Ratio	0.01	0.025	-	-	0.062	-
HCM Control Delay (s)	10	8.5	-	-	7.4	0
HCM Lane LOS	B	A	-	-	A	A
HCM 95th %tile Q(veh)	0	0.1	-	-	0.2	-

Intersection	
Int Delay, s/veh	8.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	0	8	25	0	33	98
Future Vol, veh/h	0	8	25	0	33	98
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	9	27	0	36	107

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	9	0	59	5
Stage 1	-	-	-	-	5	-
Stage 2	-	-	-	-	54	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1611	-	948	1078
Stage 1	-	-	-	-	1018	-
Stage 2	-	-	-	-	969	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1611	-	932	1078
Mov Cap-2 Maneuver	-	-	-	-	932	-
Stage 1	-	-	-	-	1018	-
Stage 2	-	-	-	-	953	-

Approach	EB	WB	NB
HCM Control Delay, s	0	7.3	8.8
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	932	1078	-	-	1611	-
HCM Lane V/C Ratio	0.038	0.099	-	-	0.017	-
HCM Control Delay (s)	9	8.7	-	-	7.3	0
HCM Lane LOS	A	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	0.3	-	-	0.1	-

Intersection	
Int Delay, s/veh	6.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	0	35	106	0	10	35
Future Vol, veh/h	0	35	106	0	10	35
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	38	115	0	11	38

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	38	0	249	19
Stage 1	-	-	-	-	19	-
Stage 2	-	-	-	-	230	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1572	-	739	1059
Stage 1	-	-	-	-	1004	-
Stage 2	-	-	-	-	808	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1572	-	685	1059
Mov Cap-2 Maneuver	-	-	-	-	685	-
Stage 1	-	-	-	-	1004	-
Stage 2	-	-	-	-	749	-

Approach	EB	WB	NB
HCM Control Delay, s	0	7.5	8.9
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	685	1059	-	-	1572	-
HCM Lane V/C Ratio	0.016	0.036	-	-	0.073	-
HCM Control Delay (s)	10.3	8.5	-	-	7.5	0
HCM Lane LOS	B	A	-	-	A	A
HCM 95th %tile Q(veh)	0	0.1	-	-	0.2	-

Draft Section 61 Findings

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Vanasse & Associates inc
Transportation Engineers & Planners

35 New England Business Center Drive
Suite 140
Andover, MA 01810

Ref: 9141

_____ __, 2022

Mr. Lionel J. Lucien, P.E.
Manager, Public/Private Development Unit
MassDOT Highway Division
Office of Transportation Planning
10 Park Plaza, Room 4150
Boston MA 02116

Re: Philips Health Care Campus Redevelopment (EEA No. _____)
3000 Minuteman Road
Andover, Massachusetts

Dear Mr. Lucien:

In order to assist you in the preparation of the Section 61 Finding for the proposed renovation and expansion of the former Philips Healthcare campus located at 3000 Minuteman Road in Andover, Massachusetts, to accommodate laboratory/current Good Manufacturing Practice (cGMP) uses (EEA No. _____, and hereafter referred to as the "Project"), Vanasse & Associates, Inc. (VAI), on behalf of Alexandria Real Estate Equities, Inc. (the "Proponent"), has prepared a summary of the proposed mitigation commitments, the anticipated schedule for implementation, and the responsible party. Listed below is a brief description of the Project, the Massachusetts Environmental Policy Act (MEPA) history, and the elements of the proposed mitigation program, which were also defined in the _____ __, 2022 Single Environmental Impact Report (the "Single EIR") and the subsequent _____ __, 2022 Certificate of the Secretary of Energy and Environmental Affairs issued on the Final EIR, a copy of which is attached.

I. Project Description

The Project will entail the renovation and expansion of the former Philips Healthcare campus located at 3000 Minuteman Road in Andover, Massachusetts, to accommodate laboratory/cGMP uses. The campus currently contains four (4) buildings that encompass approximately 726,000± square foot (sf) of office/manufacturing space. The redevelopment plan will transform the former office/manufacturing campus into a life sciences campus consisting of a mix of laboratory, research and development, office, cGMP manufacturing and warehouse space, and will include an expansion of one (1) of the existing buildings (Building 1) and the addition of two (2) new future buildings, to contain approximately 1.126± million sf of space. Specifically, the campus redevelopment will consist of the following elements:

- ***Building 1:*** renovation of the existing 86,000± sf office building to accommodate lab/office (R&D) space and the construction of a 100,000± sf addition that will include cGMP and warehouse space.

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- ***Building 2:*** renovation of the existing 164,100± sf building that was formerly used as office (41,025± sf) and associated electronics manufacturing space (123,075± sf) to accommodate a similar amount of laboratory/office and associated cGMP space, respectively.

- ***Building 3:*** renovation of the existing 171,200± sf building that was formerly used as office (42,800± sf) and associated electronics manufacturing space (128,400± sf) to accommodate a similar amount of laboratory/office and associated cGMP space, respectively.

- ***Building 4:*** renovation of the existing 256,700± sf building that was formerly used as office space to accommodate a similar amount of laboratory/office space.

- ***Building 5 (new):*** the construction of a 100,000 sf building that will be devoted to cGMP uses.

- ***Building 6 (new):*** the construction of a 100,000 sf building that will be devoted to cGMP uses.

The existing Link & Amenities Building (48,200± sf) will continue to provide accessory and supporting amenities for the campus, with no change to the existing function of the building.

The Project site is bounded by areas of open and wooded space and the Merrimack River to the north and west, and commercial properties to the south and east. Access to the Project will continue to be provided by way of the existing driveways that intersect the west side of Minuteman Road approximately 1,450 feet north of River Road and the terminus of 1776 Drive approximately 2,175 feet north of River Road, respectively. ***There are no changes proposed to the existing campus roadway network as it relates to 1776 Drive or Minuteman Road that would result in a change in travel patterns or the increased use of 1776 Drive over the historic use of these roadways when Phillips Health Care occupied the campus.***

On-site parking will be provided for 2,704 vehicles, which is below the minimum parking requirements of Section 5.1, *Off-Street Parking and Loading*, of the Town of Andover Zoning By-Law.[1] The Project proponent has applied for and received approvals from the Town of Andover to reduce the parking requirements for the Project in an effort to reduce the amount of impervious area and encourage the use of alternative modes of transportation to single-occupancy vehicles (SOVs) while continuing to meet the parking requirements of prospective tenants.

II. MEPA History

The Proponent prepared and submitted, pursuant to M.G.L. c. 30, § 61 and 62A-H of MEPA and its implementing regulations (301 CMR 11.00), an Environmental Notification Form (_____ ___, 2022)[2] and a Single EIR (_____ __, 2022). On _____ __, 2022, the Secretary of Energy and Environmental Affairs issued a Certificate stating that the Single EIR adequately and properly complied with MEPA and its implementing regulations, and that the preparation of an EIR was not required.

[1]The Ordinance requires a minimum of 1 space per 300 sf of gross floor area for a laboratory/R&D use (anticipated to be 464,025± sf); and 1 space for each 300 sf of net floor area (anticipated to be 380,400± sf) for an industrial manufacturing use. This would require that a minimum of 2,815 parking spaces be provided to support the Project.

[2]Dates in parentheses refer to when notice of availability for public review was published in The Environmental Monitor for the respective environmental disclosure document.

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III. Traffic Characteristics

Using trip-generation statistics published by the Institute of Transportation Engineers (ITE)[3] for similar functional areas to those that will be associated with the campus redevelopment (research and development (R&D) and manufacturing space for trip-generation purposes), the Project is expected to generate approximately 7,268 vehicle trips on an average weekday (two-way volume over the operational day of the Project), with approximately 822 vehicle trips expected during the weekday morning peak-hour and 933 vehicle trips expected during the weekday evening peak-hour.

In comparison to the former Philips Healthcare campus at full occupancy, the Project is expected to generate approximately 77 *additional* vehicle trips during the weekday morning peak-hour and 175 *additional* vehicle trips during the weekday evening peak-hour, with a total of 1,668 *additional* vehicle trips expected over the operational day of the Project.

IV. Specific Project Mitigation Measures

The Proponent is committed to the implementation of a comprehensive transportation improvement program that is designed to reduce the impact of the planned development on the transportation infrastructure. The major elements of the improvement program can be separated into four primary categories: i) Project site access accommodations; ii) Transportation Demand Management (TDM) measures; iii) Traffic and Construction Management; and iv) Traffic Monitoring. The elements of the planned transportation improvement program are discussed in detail in the following sections.

Project Site Access

Access to the Project will continue to be provided by way of the existing driveways that intersect the west side of Minuteman Road approximately 1,450 feet north of River Road and the terminus of 1776 Drive approximately 2,175 feet north of River Road, respectively. The following elements have been incorporated into the design and operation of the Project site access and internal circulation:

- The driveways serving the Project site will continue to accommodate two-way travel and the turning and maneuvering requirements of service and delivery vehicles, and the largest anticipated responding emergency vehicle as defined by the Andover Fire Department.
- Where perpendicular parking is proposed, the drive aisle behind the parking will be a minimum of 23 feet in order to facilitate parking maneuvers.
- STOP-signs and marked STOP-line will be provided on the individual driveways that intersect the ring-road that circumnavigates the campus, at the intersection of the ring-road with Minuteman Road and on the 1776 Drive approach to River Road (retain existing traffic control at the intersection).
- All signs and pavement markings to be installed within the Project site will conform to the applicable standards of the *Manual on Uniform Traffic Control Devices* (MUTCD).[4]

[3] *Trip Generation*, 11th Edition; Institute of Transportation Engineers; Washington, DC; 2021.
[4] *Manual on Uniform Traffic Control Devices (MUTCD)*; Federal Highway Administration; Washington, D.C.; 2009.

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- Sidewalks and pedestrian paths are provided within the Project site will extend to or provide access to the existing sidewalk along Minuteman Road.

- Americans with Disabilities Act (ADA)-compliant wheelchair ramps will be provided at all pedestrian crossings that are constructed or modified in conjunction with the Project.

- Signs and landscaping to be installed as a part of the Project within intersection sight triangle areas will be designed and maintained so as not to restrict lines of sight.

- Snow accumulations (windrows) within sight triangle areas will be promptly removed where such accumulations would impede sight lines.

- Consideration will be given to providing electric vehicle (EV) charging stations within the Project site.

The cost to implement the defined site access measures is included in the overall development cost for the Project.

Off-Site

River Road Traffic Signal System

Independent of the Project, one or more movements at the intersections that comprise the River Road coordinated traffic signal system are currently or are predicted to operate at or over capacity during the peak-hours. In an effort to improve traffic operations and off-set the predicted impact of the Project, the Proponent will design and implement an optimal traffic signal timing, phasing and coordination plan for the River Road coordinated traffic signal system inclusive of the following intersections:

- River Road/Minuteman Road/Shattuck Road
- River Road/I-93 Southbound Ramps
- River Road/I-93 Northbound Ramps
- River Road/Old River Road/Federal Street

These improvements will be completed prior to the issuance of a Certificate of Occupancy for any new or expanded building within the Project site, subject to receipt of all necessary rights, permits and approvals, and will include the installation, repair and/or upgrade of traffic signal equipment and associated appurtenances required to provide and maintain coordination of the traffic signal system. With the implementation of an optimal traffic signal timing, phasing and coordination plan, overall motorist delays will be reduced such that no movement operates at or over capacity, an improvement over No-Build conditions.

In addition to the traffic signal timing, phasing and coordination improvements, the Proponent will reconstruct all non-ADA compliant wheelchair ramps at the subject intersections, replace/upgrade non-ADA complaint pushbuttons and install countdown-type pedestrian indications where such indications are not currently installed. These improvements will also be completed prior to the issuance of a Certificate of Occupancy for any new or expanded building within the Project site, subject to receipt of all necessary rights, permits and approvals.

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Transportation Demand Management Program

The Project site is served by public transportation services that are provided by the Merrimack Valley Regional Transit Authority (MVRTA). The MVRTA operates bus Route 37, *Beacon Street*, which travels along River Road and Minuteman Road, with a stop located at Springhill Suites by Marriot (north of the Project site), and thereafter to the Buckley Transportation Center in Lawrence where connections can be made to other bus lines. From the Buckley Transportation Center, bus service is provided to Lawrence Station on the Haverhill Line of the Massachusetts Bay Transportation Authority (MBTA) Commuter Rail system with service to North Station in Boston. MVRTA buses operate in a passenger demand service mode and will stop anywhere along the service route where it is safe to pick-up or discharge a passenger.

In an effort to encourage the use of alternative modes of transportation to single-occupant vehicles (SOVs), the following Transportation Demand Management (TDM) measures will be implemented as a part of the Project:

- A transportation coordinator will be assigned for the Project to coordinate the TDM program;
- Information regarding public transportation services, maps, schedules and fare information will be posted in a central location and/or otherwise made available to employees;
- The transportation coordinator will facilitate a rideshare matching program for employees to encourage carpooling;
- A "welcome packet" will be provided to new employees detailing available commuter options and will include the contact information for the transportation coordinator and information to enroll in the employee rideshare program;
- Specific amenities will be provided to discourage off-site trips, including providing a break-room equipped with a microwave and refrigerator; offering direct deposit of paychecks; coordinating with a dry-cleaning service for on-site pick-up and delivery; allowing telecommuting or flexible work schedules; and other such measures to reduce overall traffic volumes and travel during peak traffic volume periods;
- Pedestrian accommodations have been incorporated into the Project site;
- Secure bicycle parking will be provided throughout the Project site and will include exterior bicycle racks and weather protected bicycle parking for each building; and
- A shuttle service will be provided at no ($0) cost to employees of the Project that will provide weekday commuter service between the Project site Andover Station on the Haverhill Line of the MBTA Commuter Rail system. The shuttle service schedule will be coordinate with the arrival and departure of trains from Andover Station, with a minimum of four (4) round trips provided during both the weekday morning and evening peak commuter periods. Off-peak service and service to other commuter hubs will be considered as demand warrants.

The costs associated with the TDM program are included in the overall development cost of the Project or will be a part of annual operating costs.

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Traffic Monitoring Program

The Proponent will conduct a post-development traffic monitoring and employee survey program in order to evaluate the success and to refine the elements of the TDM program, and to validate the trip projections and parking demands for the Project. The monitoring program will include:

i) Obtaining traffic-volume information over a continuous seven-day, weeklong period on the driveway serving the Project site along Minuteman Road and 1776 Drive;

ii) Performing manual turning movement and vehicle classification counts at the Project site driveway intersections with Minuteman Road and 1776 Drive, and at the intersections of River Road at Minuteman Road and Shattuck Road and River Road at 1776 Drive during the weekday morning (7:00 to 9:00 AM) and weekday evening (4:00 to 6:00 PM) peak periods; and

iii) Evaluating motor vehicle crash data at the intersections of River Road at Minuteman Road and Shattuck Road and River Road at 1776 Drive.

The monitoring program will commence six (6) months after issuance of the Certificate of Occupancy for the Project and will continue on an annual basis thereafter for a period not to exceed 5-years after completion of the Project. The results of the monitoring program will be summarized in a report to be provided to the Town of Andover and MassDOT within 2-months after the completion of the data collection effort. The report will document: i) traffic volumes associated with the Project; ii) motorist delays, vehicle queuing, crash severity and calculated crash rates at the intersections of River Road at Minuteman Road and Shattuck Road and River Road at 1776 Drive; and iii) the elements of the TDM program that have been implemented and use of alternative modes of transportation to single-occupant vehicles.

Greenhouse Gas Emissions Reduction Self-Certification

The Proponent will provide a certification to the MEPA Office signed by an appropriate professional (e.g., engineer, architect, transportation planner, general contractor) indicating that the greenhouse gas (GHG) emissions reduction measures adopted by the Proponent have been incorporated into the Project. Should alternative GHG emissions reduction measures be implemented that differ from those outlined in the _____ __, 2022 Final EIR, the Proponent shall certify that the collective measures achieve an equivalent percentage reduction in GHG emissions based on the same modeling assumptions. For those measures that are operational in nature (i.e. TDM, recycling), the Proponent shall provide an updated plan and/or narrative identifying the measures, the schedule for implementation and how progress towards achieving the measures will be obtained. Said certification shall be provided following the completion of each phase of the Project (to the extent that the Project is phased) and shall be supported by plans that clearly illustrate where GHG mitigation measures have been incorporated.

DRAFT

We trust that this information is of assistance. If you have any questions or require additional information in order to issue a Section 61 Finding for the Project, please feel free to contact me.

Sincerely,

VANASSE & ASSOCIATES, INC.

Jeffrey S. Dirk, P.E., PTOE, FITE
Managing Partner

Professional Engineer in CT, MA, ME, NH, RI and VA

JSD/jsd

Attachments

DRAFT

Water & Wastewater F
Supporting Documentation

ARE Master Plan - Sewer System Capacity Calculations
SMMA Job No. 21140
Last Updated: 7/22/2022
Calc By: DCC

Existing Sewer System Velocities and Capacities

	Length (ft)	Req. Cap. Qd (cfs)	Size (in)	Start Inv. (ft)	End Inv. (ft)	Slope (ft/ft)	Flow Full Qf (cfs)	Vel. Full Vf (fps)	Design Vel. Vd (fps)	Material	Q/Qf
Municipal Main Only											
MM	427	2.53	24	51.2	51.1	0.02%	4.1	1.3	1.2	PVC	62%
MM	400	2.53	24	51.1	50.9	0.05%	6.0	1.9	1.6	PVC	42%
MM	913	2.53	24	50.9	49.6	0.14%	10.1	3.2	2.3	PVC	25%
Campus Private Sewer											
B1	95	0.04	6	93.3	91.1	2.3%	0.8	4.3	1.9	VC	5%
B1	117	0.04	6	91.1	86.8	3.7%	1.1	5.5	2.2	VC	4%
B1	114	0.04	6	86.8	81.4	4.7%	1.2	6.2	2.4	VC	3%
B1	135	0.04	6	81.4	77.3	3.0%	1.0	5.0	2.1	VC	4%
B1	175	0.04	6	77.3	63.4	7.9%	1.6	8.0	2.9	VC	3%
B1	128	0.04	6	63.4	58.1	4.1%	1.1	5.8	2.3	VC	4%
B1, B2	156	0.10	12	58.1	56.0	1.3%	4.1	5.3	1.9	VC	2%
B1, B2	172	0.10	12	56.0	54.4	0.9%	3.4	4.4	1.7	VC	3%
B1, B2, B3	150	0.17	12	54.4	53.1	0.9%	3.3	4.2	1.9	VC	5%
B1, B2, B3	202	0.17	12	53.1	52.8	0.1%	1.3	1.7	1.0	VC	13%
B1, B2, B3	270	0.17	15	52.8	51.0	0.7%	5.4	4.4	1.7	VC	3%
B1, B2, B3	583	0.17	18	51.0	49.6	0.2%	5.1	2.9	1.1	VC	3%
MM, B1, B2, B3	335	2.70	18	49.6	48.9	0.2%	4.8	2.7	2.4	VC	56%
MM, Campus	333	2.96	18	48.9	44.7	1.3%	11.8	6.7	4.7	VC	25%
MM, Campus	718	2.96	18	44.7	42.5	0.3%	5.8	3.3	2.8	VC	51%

Proposed Sewer System Velocities and Capacities

	Length (ft)	Req. Cap. Qd (cfs)	Size (in)	Start Inv. (ft)	End Inv. (ft)	Slope (ft/ft)	Flow Full Qf (cfs)	Vel. Full Vf (fps)	Design Vel. Vd (fps)	Material	Q/Qf
B1	95	0.09	6	93.3	91.1	2.3%	0.8	4.3	2.4	VC	11%
B1	117	0.09	6	91.1	86.8	3.7%	1.1	5.5	2.8	VC	9%
B1	114	0.09	6	86.8	81.4	4.7%	1.2	6.2	3.1	VC	8%
B1, B1A	135	0.12	6	81.4	78.4	2.2%	1.0	5.0	2.8	PVC	12%
B1, B1A	265	0.12	6	78.4	75.4	1.1%	0.7	3.6	2.2	PVC	17%
B1, B1A	325	0.12	6	75.4	68.0	2.3%	1.0	5.1	2.9	PVC	12%
B1, B1A	70	0.12	6	68.0	65.0	4.3%	1.4	7.0	3.6	PVC	8%
MM, B1, B1A	427	2.65	24	51.2	51.1	0.02%	4.1	1.3	1.2	PVC	65%
MM, B1, B1A, B2, B3, B6, CUP	400	3.40	24	51.1	50.9	0.05%	6.0	1.9	1.7	PVC	57%
MM, B1, B1A, B2, B3, B6, CUP	913	3.40	24	50.9	49.6	0.14%	10.1	3.2	2.5	PVC	34%
MM, B1, B1A, B2, B3, B5, B6, CUP	335	3.53	18	49.6	48.9	0.2%	4.8	2.7	2.6	VC	73%
MM, Campus	333	3.85	18	48.9	44.7	1.3%	11.8	6.7	5.1	VC	33%
MM, Campus	718	3.85	18	44.7	42.5	0.31%	5.8	3.3	3.1	VC	66%

Municipal Main, pre- and post-development

				Vd (fps)		Q/Qf	
Leg	Length (ft)	Size (in)	Slope	Existing	Proposed	Existing	Proposed
1	427	24	0.02%	1.2	1.2	62%	65%
2	400	24	0.05%	1.6	1.7	42%	57%
3	913	24	0.14%	2.3	2.5	25%	34%
4	335	18	0.2%	2.4	2.6	56%	73%
5	333	18	1.3%	4.7	5.1	25%	33%
6	718	18	0.3%	2.8	3.1	51%	66%

Note: Legs 3 and 6 have intermediary manholes with unknown inverts.

1000 MASSACHUSETTS AVENUE
CAMBRIDGE, MASSACHUSETTS 02138
T: 617.547.5400

ARE Andover - Hydraulic Modeling
SMMA Job No. 21140
Date: 7/27/2022
Calc by: DCC

Software used:

WaterCAD [10.03.05.05]

Bentley Systems, Inc., Haestad Methods Solution Center

76 Watertown Road, Suite 2D, Thomaston, CT 06787 (1-203-755-1666)

Hydraulic model results, sorted by descending demand:

ID	Elev. (ft)	Demand (gpm)	Hyd. Grade (ft)	Pressure (psi)
CUP	66	903	292.88	98
BLDG 4	68	183	300.95	101
BLDG 6	64	110	294.3	100
BLDG 2	68	103	310.35	105
BLDG 1A	100	94	298.52	86
BLDG 3	68	92	312.63	106
BLDG 1	100	82	298.54	86
BLDG 5	64	81	297.33	101
1	112	0	320.58	90
2	100	0	320.58	95
3	90	0	320.58	100
4	84	0	310.59	98
5	80	0	312.7	101
6	68	0	312.78	106
7	68	0	309.97	105
8	68	0	304.79	102
9	68	0	301.03	101
10	68	0	299.17	100
11	68	0	297.34	99
12	100	0	298.55	86
13	90	0	298.59	90
14	90	0	298.93	90
15	68	0	296.16	99
16	68	0	331.27	114
17	68	0	331.36	114
18	68	0	331.32	114
19	68	0	331.14	114
20	86	0	307.13	96
21	80	0	305.85	98
22	80	0	299.04	95
23	68	0	331.17	114

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ID	Elev. (ft)	Demand (gpm)	Hyd. Grade (ft)	Pressure (psi)
24	68	0	331.1	114
25	80	0	330.94	109
26	80	0	330.7	108
27	86	0	330.66	106
28	80	0	330.77	108
29	80	0	330.89	109
30	68	0	333.15	115
31	68	0	335.58	116
32	68	0	340.25	118
33	68	0	341.06	118
34	68	0	340.4	118
35	68	0	339.63	118
36	68	0	339.32	117
37	68	0	339.32	117
38	90	0	330.94	104
39	100	0	330.94	100
40	68	0	332.22	114
41	65	0	294.98	100
42	68	0	341.52	118
43	90	0	320.58	100
44	84	0	330.55	107
45	82	0	323.1	104
46	75	0	315.16	104
47	75	0	323.1	107
48	75	0	330.89	111
49	68	0	331.48	114
50	68	0	333.58	115
51	68	0	334.66	115
52	68	0	336.68	116
53	68	0	338.78	117
54	68	0	338.78	117
55	68	0	293.87	98
56	68	0	295.05	98
57	68	0	295.6	98
58	68	0	296.95	99
59	68	0	339.63	118
60	68	0	339.63	118
61	77	0	331.27	110
62	75	0	330.94	111
63	82	0	330.94	108
64	90	0	330.94	104
65	82	0	330.94	108

1000 MASSACHUSETTS AVENUE
CAMBRIDGE, MASSACHUSETTS 02138
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ID	Elev. (ft)	Demand (gpm)	Hyd. Grade (ft)	Pressure (psi)
66	90	0	330.94	104
67	68	0	294.31	98
68	66.5	0	293.47	98

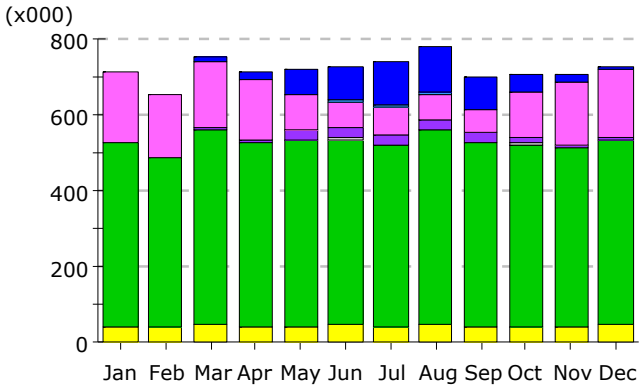
WaterCAD Model Diagram



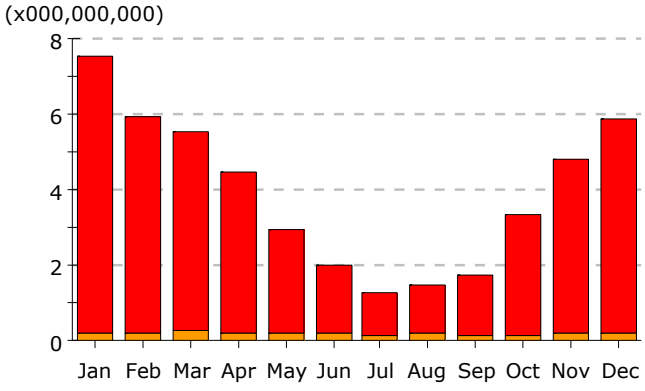
Greenhouse Gas Emissions Supporting Documentation

G

Electric Consumption (kWh)



Gas Consumption (Btu)





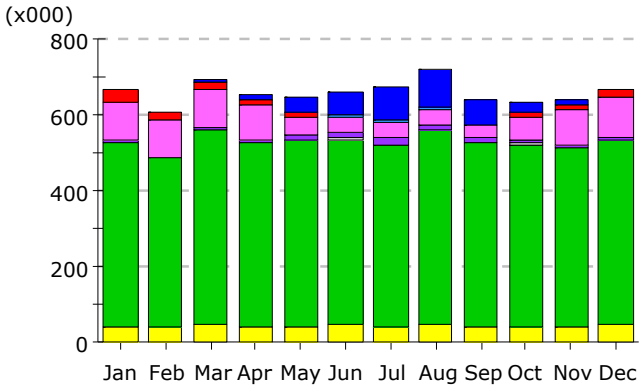
Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	1.7	-	11.0	20.7	68.7	89.3	113.9	120.5	83.8	46.8	19.8	3.9	580.1
Heat Reject.	0.0	-	0.1	0.3	1.1	4.0	8.1	8.5	2.4	0.7	0.2	0.0	25.5
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	185.9	166.8	175.3	157.0	91.7	72.3	69.2	66.4	60.8	118.1	161.3	179.9	1,504.8
Pumps & Aux.	2.6	1.2	5.3	10.2	25.5	27.1	25.8	27.2	25.5	19.1	9.0	3.5	182.1
Ext. Usage	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	6.9
Misc. Equip.	480.8	443.7	511.3	482.5	490.6	492.2	480.6	511.2	481.8	480.8	471.5	491.1	5,818.1
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	42.8	39.7	46.9	43.1	42.9	44.4	41.3	46.4	43.1	42.1	42.2	44.7	519.6
Total	714.4	651.9	750.5	714.5	721.0	729.8	739.6	780.8	697.9	708.2	704.7	723.8	8,637.0

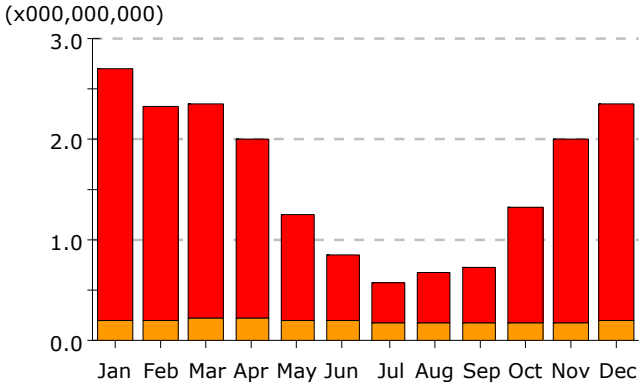
Gas Consumption (Btu x000,000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	7.34	5.77	5.32	4.23	2.71	1.80	1.09	1.30	1.59	3.18	4.65	5.66	44.63
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.20	0.20	0.24	0.21	0.20	0.19	0.17	0.18	0.16	0.16	0.17	0.20	2.28
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	7.54	5.96	5.55	4.44	2.91	1.99	1.25	1.48	1.76	3.35	4.82	5.85	46.90

Electric Consumption (kWh)



Gas Consumption (Btu)



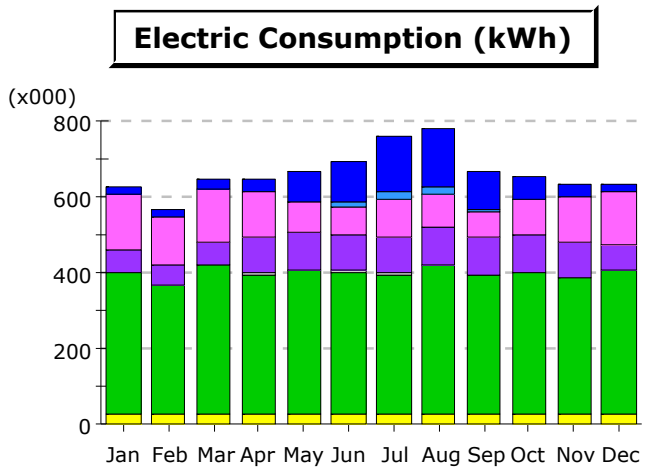


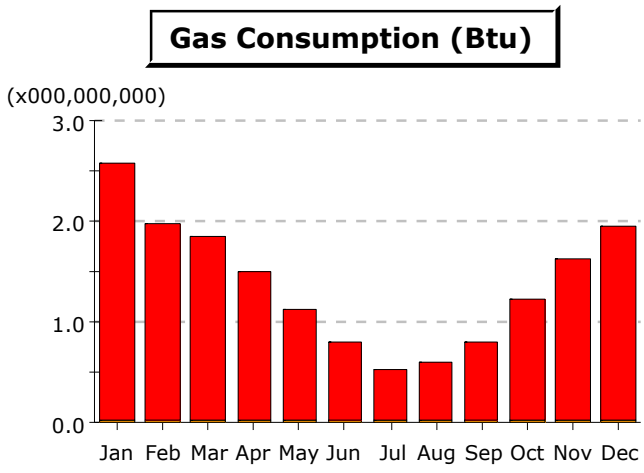
Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	0.8	-	6.4	12.6	42.1	63.2	89.0	97.6	60.7	27.4	10.8	2.1	412.6
Heat Reject.	0.0	-	0.1	0.2	0.7	2.5	5.3	5.8	1.6	0.4	0.1	0.0	16.7
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	29.2	24.0	21.1	14.8	7.3	3.4	1.2	1.4	1.7	8.9	15.5	22.4	150.9
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	105.3	94.3	98.6	90.0	48.7	39.7	39.1	38.3	32.8	61.7	89.5	101.9	839.8
Pumps & Aux.	6.0	5.2	7.1	8.5	13.5	14.8	15.6	16.9	14.7	11.1	8.2	6.4	128.0
Ext. Usage	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	6.9
Misc. Equip.	480.8	443.7	511.3	482.5	490.6	492.2	480.6	511.2	481.8	480.8	471.5	491.1	5,818.1
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	42.9	39.8	47.0	43.2	43.0	44.4	41.4	46.5	43.1	42.2	42.2	44.8	520.6
Total	665.5	607.6	692.1	652.4	646.5	660.8	672.8	718.1	637.0	633.2	638.4	669.4	7,893.8

Gas Consumption (Btu x000,000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	2.51	2.13	2.11	1.79	1.05	0.67	0.42	0.50	0.57	1.15	1.81	2.16	16.88
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.20	0.20	0.24	0.21	0.20	0.19	0.17	0.18	0.16	0.16	0.17	0.20	2.28
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	2.71	2.33	2.35	2.00	1.25	0.86	0.59	0.68	0.73	1.32	1.99	2.36	19.16





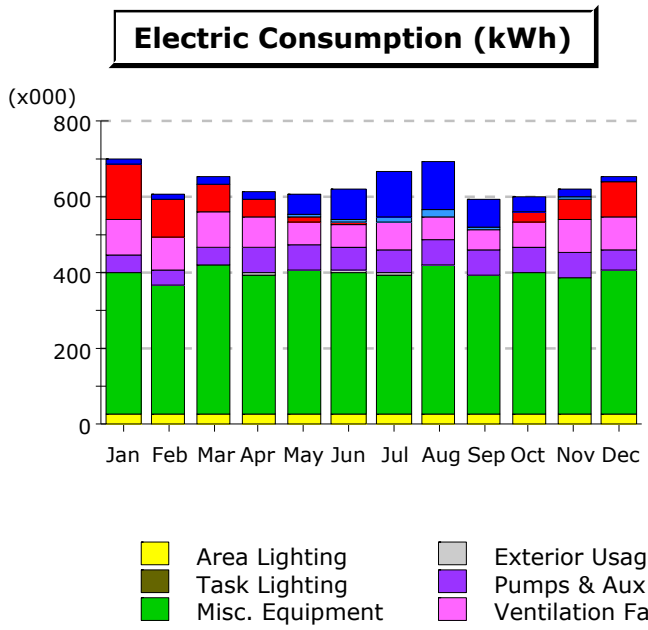


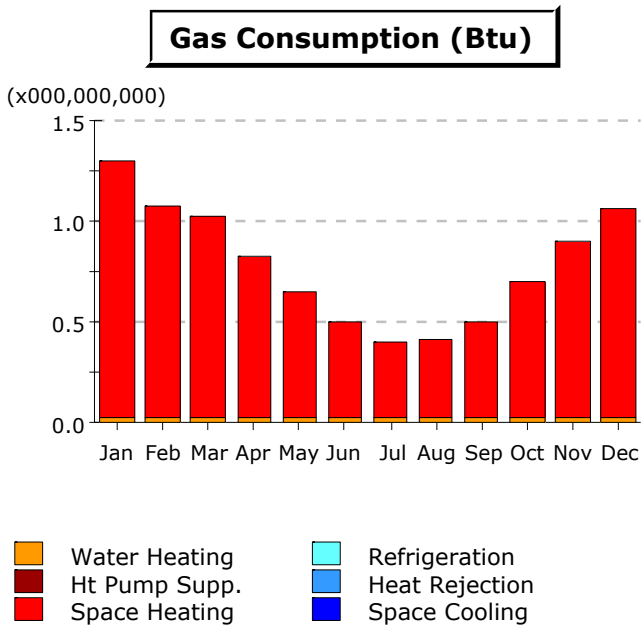
Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	21.9	18.9	26.4	35.0	78.9	104.9	145.3	154.0	103.0	59.5	32.8	23.2	803.7
Heat Reject.	0.0	-	0.2	1.1	4.1	9.3	18.4	20.0	7.1	2.5	0.7	0.1	63.7
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	143.3	129.4	134.8	120.1	81.7	76.9	97.0	85.6	65.5	96.6	121.9	137.7	1,290.7
Pumps & Aux.	65.1	54.4	63.4	95.8	99.0	95.8	99.0	99.3	95.8	99.0	89.7	69.7	1,026.1
Ext. Usage	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	6.9
Misc. Equip.	370.9	341.0	390.0	369.6	377.2	375.7	370.8	389.8	369.3	371.0	363.0	377.3	4,465.7
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	26.5	24.6	29.1	26.8	26.7	27.5	25.7	28.8	26.7	26.1	26.1	27.7	322.2
Total	628.3	568.9	644.5	648.9	668.3	690.8	756.8	778.0	668.0	655.2	634.9	636.3	7,979.0

Gas Consumption (Btu x000,000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	2.54	1.96	1.82	1.47	1.09	0.78	0.50	0.57	0.77	1.19	1.59	1.92	16.20
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.28
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	2.56	1.98	1.85	1.49	1.12	0.80	0.52	0.59	0.79	1.21	1.61	1.94	16.48







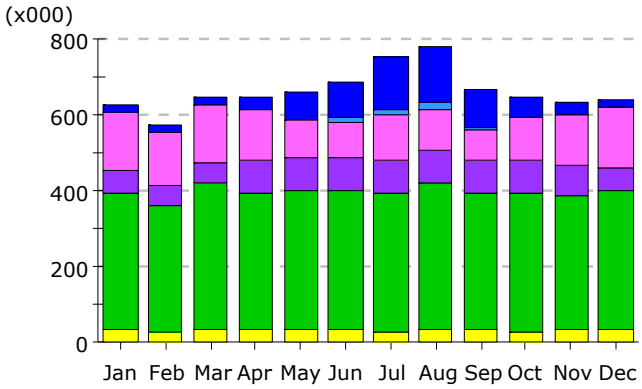
Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	13.0	11.2	16.1	22.1	52.4	78.5	119.8	127.3	74.0	38.3	20.2	13.8	586.7
Heat Reject.	0.0	-	0.2	0.8	3.3	8.2	16.9	19.4	5.9	2.0	0.5	0.1	57.1
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	142.4	100.4	77.8	44.5	15.5	6.8	1.3	1.4	3.9	23.3	59.3	89.9	566.3
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	94.4	83.9	88.1	81.7	62.5	58.7	67.5	61.1	51.8	70.5	82.2	90.4	892.8
Pumps & Aux.	49.9	42.7	48.9	68.6	66.8	63.8	66.2	66.6	63.7	68.5	65.1	53.2	724.0
Ext. Usage	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	6.9
Misc. Equip.	370.9	341.0	390.0	369.6	377.2	375.7	370.8	389.8	369.3	371.0	363.0	377.3	4,465.7
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	26.5	24.6	29.1	26.8	26.7	27.5	25.7	28.8	26.7	26.1	26.1	27.7	322.2
Total	697.7	604.4	650.7	614.6	604.9	619.8	668.7	694.9	595.9	600.2	617.1	653.0	7,621.8

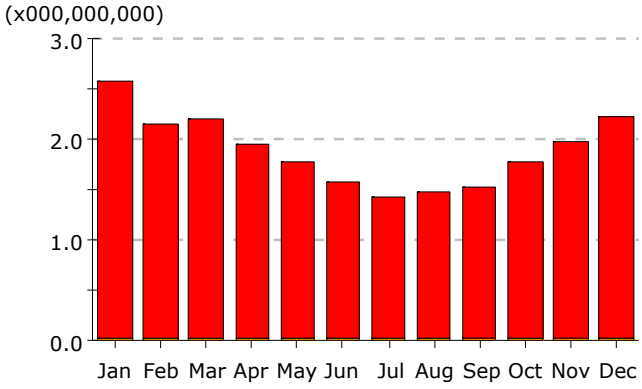
Gas Consumption (Btu x000,000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	1.27	1.05	0.99	0.80	0.63	0.48	0.38	0.39	0.48	0.69	0.88	1.04	9.07
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.28
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1.30	1.07	1.02	0.83	0.65	0.50	0.40	0.41	0.50	0.71	0.90	1.07	9.34

Electric Consumption (kWh)



Gas Consumption (Btu)



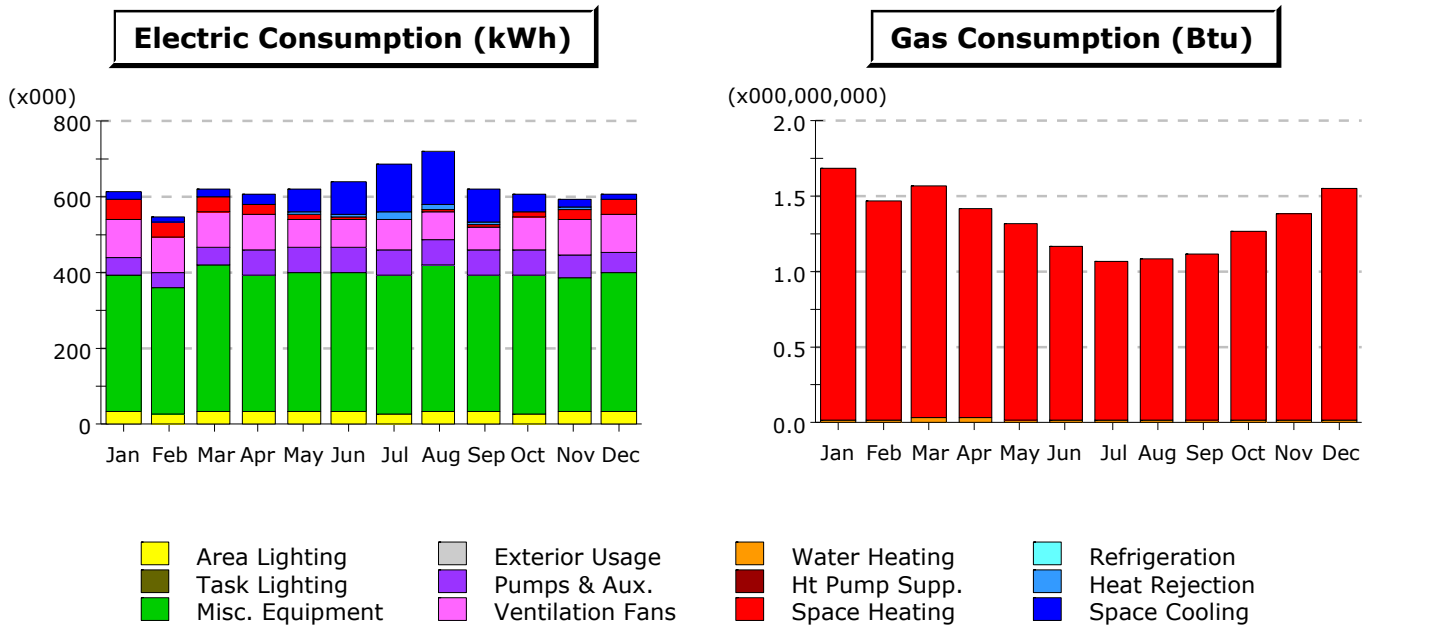


Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	19.3	16.5	23.4	31.5	73.3	98.1	137.2	148.0	95.2	54.8	29.6	20.5	747.2
Heat Reject.	0.0	-	0.2	1.0	4.1	9.6	19.2	21.5	7.1	2.5	0.6	0.1	65.9
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	157.8	143.5	150.9	136.0	98.8	96.5	118.6	107.2	83.9	113.4	138.1	154.2	1,498.8
Pumps & Aux.	57.5	47.5	55.5	83.7	86.6	83.9	87.0	87.2	83.9	86.6	78.4	61.0	898.8
Ext. Usage	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	6.9
Misc. Equip.	361.9	333.8	384.3	362.9	369.1	370.0	361.7	384.2	362.3	361.9	354.8	369.4	4,376.2
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	30.4	28.2	33.2	30.6	30.4	31.4	29.3	32.8	30.5	29.9	30.0	31.8	368.6
Total	627.5	570.1	648.1	646.2	662.8	690.0	753.5	781.5	663.5	649.6	632.1	637.5	7,962.4

Gas Consumption (Btu x000,000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	2.56	2.12	2.16	1.92	1.76	1.55	1.40	1.45	1.50	1.75	1.95	2.19	22.30
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.28
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	2.58	2.14	2.19	1.95	1.78	1.57	1.42	1.47	1.52	1.77	1.97	2.22	22.58



Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	15.2	13.2	18.9	25.2	61.0	88.2	131.2	140.2	84.3	44.8	23.3	16.2	661.7
Heat Reject.	0.0	-	0.2	0.7	3.0	6.8	13.6	15.4	5.3	1.9	0.5	0.1	47.6
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	54.4	42.1	36.0	24.4	12.8	7.0	3.0	3.2	5.2	16.0	28.2	39.4	271.7
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	101.7	92.2	98.6	92.4	73.7	70.6	79.6	73.5	62.9	81.6	92.4	100.5	1,019.6
Pumps & Aux.	47.0	39.5	45.9	68.1	69.2	66.8	69.1	69.3	66.7	69.7	64.0	50.3	725.5
Ext. Usage	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	6.9
Misc. Equip.	361.9	333.8	384.3	362.9	369.1	370.0	361.7	384.2	362.3	361.9	354.8	369.4	4,376.2
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	30.4	28.2	33.2	30.6	30.4	31.4	29.3	32.8	30.5	29.9	30.0	31.8	368.6
Total	611.2	549.5	617.7	604.9	619.9	641.3	688.1	719.2	617.9	606.3	593.7	608.3	7,477.9

Gas Consumption (Btu x000,000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	1.65	1.45	1.53	1.39	1.29	1.15	1.04	1.07	1.09	1.25	1.37	1.52	15.80
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.28
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1.68	1.47	1.56	1.41	1.31	1.17	1.06	1.09	1.11	1.27	1.39	1.54	16.07

Environmental Justice Supporting Documentation

H

From: David Hewett
Sent: Wednesday, June 15, 2022 5:01 PM
To: 'MEPA-EJ (EEA)'; 'danielledolan@massriversalliance.org'; 'juliablatt@massriversalliance.org'; 'Andrea@n2nma.org'; 'elvis@n2nma.org'; 'ben@environmentmassachusetts.org'; 'claire@uumassaction.org'; 'cluppi@cleanwater.org'; 'deb.pasternak@sierraclub.org'; 'hclish@outdoors.org'; 'hricci@massaudubon.org'; 'kelly.boling@tpl.org'; 'kerry@msaadapartners.com'; 'lorel@thetrustees.org'; 'ngoodman@environmentalleague.org'; 'pstanton@e4thefuture.org'; 'rob@oceanriver.org'; 'robb@massland.org'; 'sarah@massclimateaction.net'; 'srubin@clf.org'; 'sylvia@communityactionworks.org'; 'wvaughan@hcwh.org'; 'tribalcouncil@chappaquiddick-wampanoag.org'; 'crwritings@aol.com'; 'john.peters@mass.gov'; 'acw1213@verizon.net'; 'melissa@herringpondtribe.org'; 'rockerpatriciad@verizon.net'; 'rhalsey@naicob.org'; 'Coradot@yahooe.com'; 'Solomon.Elizabeth.e@gmail.om'; 'Solomon.Elizabeth.e@gmail.om'; 'thpo@wampanoagtribe-nsn.gov'; 'bonney.hartley@mohican-nsn.gov'; 'Brian.Weeden@mwtribe-nsn.gov'
Cc: Lawlor, Brian; RICKIE GOLDEN (rgolden@are.com); Mark B. Johnson
Subject: Advance Notification of Proposed Project in Andover, MA
Attachments: EJ screening form.pdf

On behalf of the Proponent, Alexandria Real Estate, I am pleased to send you this advance notification of a proposed project at 3000 Minuteman Road in Andover that will undergoing Massachusetts Environmental Policy Act (MEPA)review.

The proposed Project consists of the redevelopment of the former HP/Philips Medical campus in Andover to an office, life science, therapeutic drug development, and CGMP compliant manufacturing uses. The Project includes the rehabilitation of existing buildings and will add approximately 448,200 square feet of new building as well as a 15,000 square-foot central utility plant.

The Proponent plans to submit an Environmental Notification Form (ENF) with the MEPA Office to initiate state environmental review of the project, no sooner than August 1, 2022.

If you are interested in learning more about the project or would like to receive a paper copy of the attached notice, please feel free to contact me at DHewett@epsilonassociates.com.

Community-based organizations and tribal organizations are receiving this notification in accordance with the MEPA Public Involvement Protocol for Environmental Justice Populations, which took effect on January 1, 2022. More information is available on the MEPA website.

Thank you for your interest in this project.

David Hewett
Principal

Epsilon Associates, Inc.
3 Mill & Main Place, Suite 250
Maynard, Massachusetts 01754
978.897.7100 | 978.461.6215 (direct) | (617) 699-9463 mobile
dhewett@epsilonassociates.com | www.epsilonassociates.com

Environmental Justice Screening Form

Project Name	**3000 Minuteman Road**
Anticipated Date of MEPA Filing	**August 1, 2022**
Proponent Name	**Alexandria Real Estate**
Contact Information (e.g., consultant)	**David Hewett** **Epsilon Associates, Inc.** **3 Mill & Main, Suite 250** **Maynard, MA 01754** **Phone: 978-897-7100** **Email: dhewett@epsilonassociates.com**
Public website for project or other physical location where project materials can be obtained (if available)	**The Proponent will provide information to the Andover Public Library as it becomes available.**
Municipality and Zip Code for Project (if known)	**Andover MA 01810**
Project Type* (list all that apply)	**Lab/office**
Is the project site within a mapped 100-year FEMA flood plain? Y/N/ unknown	**No**
Estimated GHG emissions of conditioned spaces (click **here** for GHG Estimation tool)	**7,325 tons per year CO_2**

Project Description

1. Provide a brief project description, including overall size of the project site and square footage of proposed buildings and structures if known.

The proposed Project consists of the redevelopment of the former HP/Philips Medical campus in Andover to an office, life science, therapeutic drug development, and CGMP compliant manufacturing uses. The Project includes the rehabilitation of existing buildings and will add approximately 448,200 square feet of new building as well as a 15,000 square-foot central utility plant.

2. List anticipated MEPA review thresholds (301 CMR 11.03) (if known)

- **301 CMR 11.03(1)(b)(2) - Creation of five or more acres of impervious area**
- **301 CMR 11.03(6)(b)(xv) - Construction of 300 or more New parking spaces at a single location**

3. List all anticipated state, local and federal permits needed for the project (if known)

Andover

- **Planning Board – Site Plan Review**
- **Conservation Commission – Order of Conditions**

State

- **MassDOT Indirect Access Permit**

Federal

- **EPA NPDES General Permit for Construction**

4. Identify EJ populations and characteristics (Minority, Income, English Isolation) within 5 miles of project site (can attach map identifying 5-mile radius from EJ Maps Viewer in lieu of narrative)

The Proponent identified numerous Environmental Justice (EJ) Populations within 5 miles of the Project site. They are as follows:

Block Group	Census Tract	County	Town	Criteria	Households with language isolation	Median Household Income
3	2521.02	Essex	Methuen	Minority	1%	$85,114 (99% of the MA median)
3	2521.01	Essex	Methuen	Minority	3%	$56,488 (66% of the MA median)
1	2521.01	Essex	Methuen	Minority	6%	$65,652 (76% of the MA median)
2	2521.01	Essex	Methuen	Minority	0%	$62,976 (73% of the MA median)
4	2544.02	Essex	Andover	Minority	5%	$176,645 (206% of the MA median)
1	3103	Middlesex	Lowell	Minority	21%	$57,273 (67% of the MA median)
5	3201	Middlesex	Lowell	Minority; Income	6%	49,507 (58% of the MA median)
4	3102	Middlesex	Lowell	Minority; Income	0%	$40,559 (47% of the MA median)
2	3102	Middlesex	Lowell	Minority	0%	$95,409 (111% of the MA median)
3	3102	Middlesex	Lowell	Minority	24%	$69,79 (81% of the MA median)
5	3102	Middlesex	Lowell	Minority; Income	6%	$49,507 (58% of the MA median)
3	3125.01	Middlesex	Lowell	Minority	12%	$72,813 (85% of the MA median)
5	3143.01	Middlesex	Dracut	Income	4%	$41,720 (49% of the MA median)
2	3143.01	Middlesex	Dracut	Minority; Income	0%	$37,447 (44% of the MA median)
4	2514	Essex	Lawrence	Minority	0%	$57,250 (67% of the MA median)
1	2502	Essex	Lawrence	Minority; Income	23%	$53,079 (62% of the MA median)
2	2502	Essex	Lawrence	Minority; Income	15%	$39,485 (46% of the MA median)
3	2502	Essex	Lawrence	Minority; Income	8%	$48,563 (57% of the MA median)
4	2502	Essex	Lawrence	Minority; Income	3%	$44,583 (52% of the MA median)
3	2514	Essex	Lawrence	Minority; Income	19%	$50,242 (59% of the MA media)

5	2515	Essex	Lawrence	Minority; Income	17%	$50,125 (58% of the MA median)	
4	2515	Essex	Lawrence	Minority; Income	0%	$52,500 (61% of the MA median)	
1	2514	Essex	Lawrence	Minority; Income; English isolation	37%	$53,173 (62% of the MA median)	
2	2514	Essex	Lawrence	Minority; Income	23%	$39,653 (46% of the MA median)	
3	2514	Essex	Lawrence	Minority; Income	18%	$43,631 (51% of the MA median)	
1	2515	Essex	Lawrence	Minority	22%	$70,547 (82% of the MA median)	
2	2515	Essex	Lawrence	Minority	23%	$0 (0% of the MA median)	
3	2515	Essex	Lawrence	Minority	10%	$35,500 (41% of the MA median)	
1	2518	Essex	Lawrence	Minority	2%	$82,266 (96% of the MA median)	
2	2518	Essex	Lawrence	Minority	0%	$63,070 (73% of the MA median)	
3	2518	Essex	Lawrence	Minority	18%	$68,182 (79% of the MA median)	
4	2518	Essex	Lawrence	Minority	20%	$0 (0% of the MA median)	
1	2513	Essex	Lawrence	Minority; Income; English isolation	51%	$18,882 (22% of the MA median)	
2	2513	Essex	Lawrence	Minority; Income	24%	$37,468 (44% of the MA median)	
3	2513	Essex	Lawrence	Minority; Income	18%	$43,631 (51% of the MA median)	
2	2523	Essex	Methuen	Minority	19%	$92,333 (108% of the MA median)	
3	2523	Essex	Methuen	Minority	0%	$69,858 (81% of the MA median)	
4	2523	Essex	Methuen	Minority	4%	$0 (0% of the MA median)	
5	2523	Essex	Methuen	Minority; Income; English isolation	26%	$27,692 (32% of the MA median)	
1	2503	Essex	Lawrence	Minority; Income; English isolation	30%	$44,103 (51% of the MA median)	
1	2517	Essex	Lawrence	Minority; English isolation	44%	$60,739 (71% of the MA median)	
2	2517	Essex	Lawrence	Minority	6%	$97,941 ($114% of the MA	

						median)	
3	2517	Essex	Lawrence	Minority; English isolation	31%	$0 (0% of the MA median)	
4	2517	Essex	Lawrence	Minority; Income; English isolation	29%	$53,021 (62% of the MA median)	
1	2516	Essex	Lawrence	Minority	8%	$65,579 (76% of the MA median)	
2	2516	Essex	Lawrence	Minority; Income; English isolation	26%	$54,063 (63% of the MA median)	
3	2516	Essex	Lawrence	Minority; Income; English isolation	33%	$35,882 (42% of the MA median)	
4	2516	Essex	Lawrence	Minority	16%	$67,950 (79% of the MA median)	
1	2501	Essex	Lawrence	Minority; Income; English isolation	47%	$22,682 (26% of the MA median)	
1	2508	Essex	Lawrence	Minority; Income	13%	$44,028 (51% of the MA median)	
2	2508	Essex	Lawrence	Minority	18%	$57,632 (67% of the MA median)	
3	2508	Essex	Lawrence	Minority; Income	13%	$34,623 (40% of the MA median)	
4	2508	Essex	Lawrence	Minority; Income	5%	$52,847 (62% of the MA median)	
5	2508	Essex	Lawrence	Minority; Income; English isolation	36%	$53,430 (62% of the MA median)	
1	2507	Essex	Lawrence	Minority; Income; English isolation	35%	$45,637 (53% of the MA median)	
2	2507	Essex	Lawrence	Minority; Income; English isolation	42%	$52,222 (61% of the MA median)	
3	2507	Essex	Lawrence	Minority; English isolation	54%	$66,607 (78% of the MA median)	
1	2509	Essex	Lawrence	Minority; Income; English isolation	35%	$42,500 (50% of the MA median)	
1	2524	Essex	Methuen	Minority	13%	$66,288 (77% of the MA median)	

2	2524	Essex	Methuen	Minority; Income	13%	$48,528 (57% of the MA median)	
3	2524	Essex	Methuen	Minority; Income; English isolation	36%	$26,111 (30% of the MA median)	
1	2510	Essex	Lawrence	Minority; Income; English isolation	34%	$52,434 (61% of the MA median)	
1	2511	Essex	Lawrence	Minority; Income; English isolation	35%	$15,481 (18% of the MA median)	
2	2511	Essex	Lawrence	Minority; Income	24%	$28,125 (33% of the MA median)	
3	2511	Essex	Lawrence	Minority; English isolation	60%	$76,047 (89% of the MA median)	
1	2512	Essex	Lawrence	Minority; Income; English isolation	46%	$24,773 (29% of the MA median)	
1	2504	Essex	Lawrence	Minority; Income	23%	$35,625 (42% of the MA median)	
2	2504	Essex	Lawrence	Minority; Income; English isolation	43%	$40,809 (48% of the MA median)	
3	2504	Essex	Lawrence	Minority; English isolation	60%	$0 (0% of the MA median)	
3	2532.02	Essex	North Andover	Minority	0%	$0 (0% of the MA median)	
4	2532.02	Essex	North Andover	Minority	7%	$86,739 (101% of the MA median)	
2	2532.02	Essex	North Andover	Minority	4%	$100,673 ($117% of the MA median)	
1	2505	Essex	Minority; Income	Minority; Income	20%	$40,867 (48% of the MA median)	
2	2505	Essex	Lawrence	Minority; Income; English isolation	67%	$41,316 (48% of the MA median)	
3	2505	Essex	Lawrence	Minority; Income; English isolation	31%	$51,176 (60% of the MA median)	
1	2526.02	Essex	Methuen	Minority	6%	$69,926 (81% of the MA median)	
1	2526.03	Essex	Methuen	Minority	5%	$95,110 (111% of the MA median)	

3	2526.02	Essex	Methuen	Minority	5%	$143,417 (167% of the MA median)	
3	2526.01	Essex	Methuen	Minority	6%	$89,688 (104% of the MA median)	
1	2506	Essex	Lawrence	Minority; English isolation	31%	$61,027 (71% of the MA median)	
2	2506	Essex	Lawrence	Minority; Income; English isolation	36%	$47,917 (56% of the MA median)	
3	2506	Essex	Lawrence	Minority; Income; English isolation	38%	$36,964 (43% of the MA median)	
4	2506	Essex	Lawrence	Minority; English isolation	36%	$70,085 (82% of the MA median)	
1	2525.01	Essex	Methuen	Minority	4%	$66,378 (77% of the MA median)	
2	2525.01	Essex	Methuen	Minority; Income	2%	$48,793 (57% of the MA median)	
3	2525.01	Essex	Methuen	Minority	6%	$80,906 (94% of the MA median)	
1	2525.02	Essex	Methuen	Minority	0%	$79,211 (92% of the MA median)	
3	2525.02	Essex	Methuen	Minority	2%	$107,031 (125% of the MA median)	
4	2525.02	Essex	Methuen	Minority; Income	6%	$53,167 (62% of the MA median)	
5	2531	Essex	North Andover	Minority	0%	$81,486 (95% of the MA median)	

Using the EJ Maps Viewer that identifies "Languages Spoken in Massachusetts," the Proponent found that there are 23 groups with 5% or more of the population who do not speak English very well within five miles of the Project site. The languages are as follows:

- **Spanish or Spanish Creole**
- **MonKhmer/Cambodian**

Note that there are none that are within one mile.

5. Identify any municipality or census tract meeting the definition of "vulnerable health EJ criteria" in the DPH EJ Tool located in whole or in part within a 1 mile radius of the project site.

The Massachusetts Department of Public Health (MassDPH) EJ Tool's Vulnerable Health by Community layer indicates the existing vulnerabilities of the surrounding EJ Population near the Project site. The Proponent identified two towns within one mile of the Project site: Andover and Methuen. Andover does not meet the Vulnerable Health EJ criterion. Methuen meets the criterion for heart attack.

6. Identify potential short-term and long-term environmental and public health impacts that may affect EJ Populations and any anticipated mitigation

- **Increased vehicle emissions from project associated traffic**
- **Temporary impacts to air quality/noise during construction**
- **Increased noise levels during construction and from ongoing operations at the site**

All impacts will be reviewed through MEPA and the various permitting programs and will be appropriately mitigated in accordance with applicable regulations.

7. Identify project benefits, including "Environmental Benefits" as defined in 301 CMR 11.02, that may improve environmental conditions or public health of the EJ population

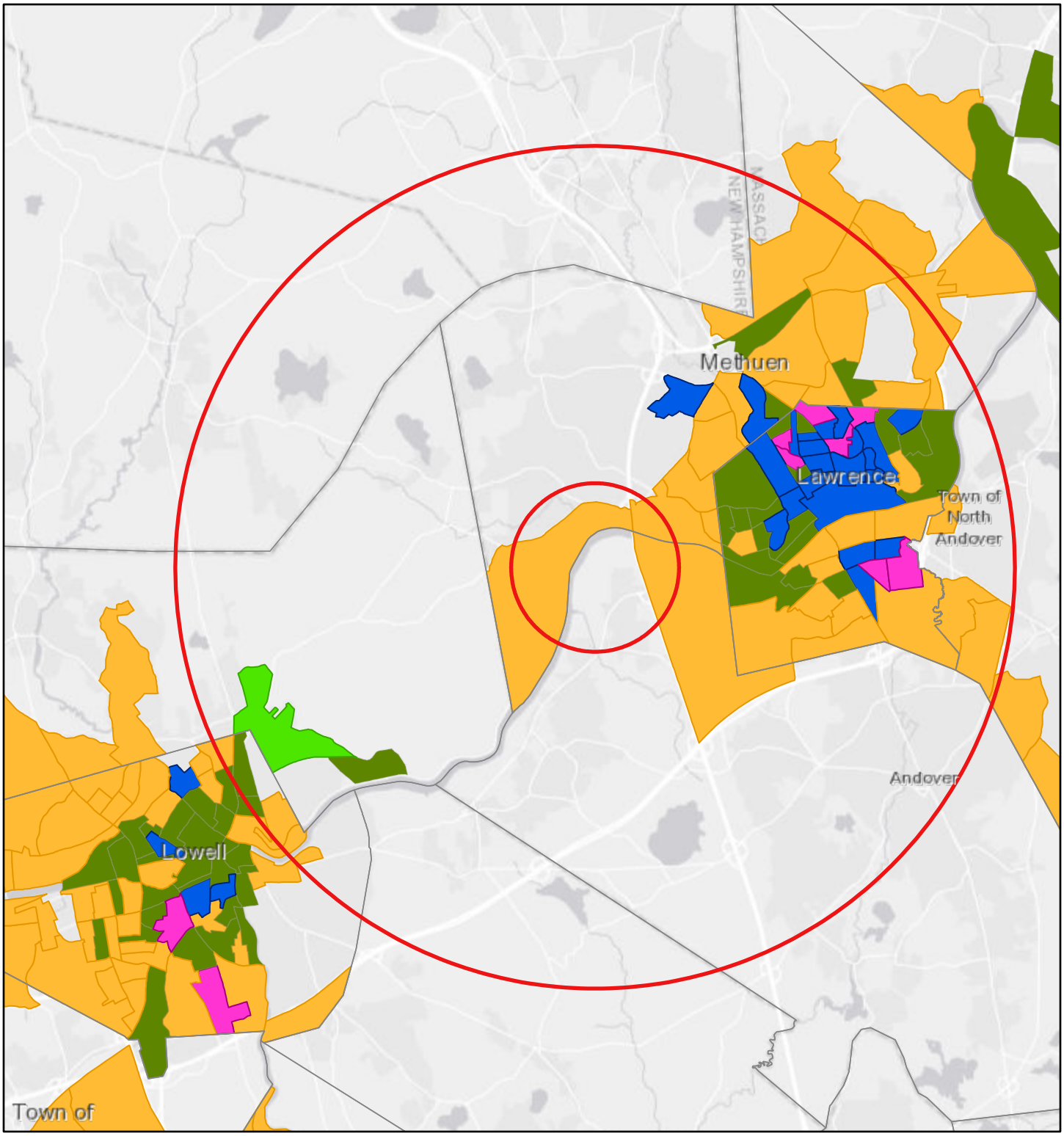
The proposed Project will provide economic benefits to the surrounding town and community through the form of an increase in employment opportunities and new taxes.

8. Describe how the community can request a meeting to discuss the project, and how the community can request oral language interpretation services at the meeting. Specify how to request other accommodations, including meetings after business hours and at locations near public transportation.

The Project Proponent is willing to meet with community members at times and locations that are convenient to the public. To request a meeting and any needed accommodations, contact David Hewett at Epsilon Associates, the environmental consultant firm assisting the developer through the permitting process.

David Hewett
Phone: 978-897-7100
Email: dhewett@epsilonassociates.com

2020 Environmental Justice Populations



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0 1.25 2.5 5 km

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Formulario de evaluación de justicia ambiental

Nombre del proyecto	**3000 Minuteman Road**
Fecha prevista de presentación ante MEPA	**1.º de agosto de 2022**
Nombre del proponente	**Alexandria Real Estate**
Información de contacto (p. ej., consultor)	**David Hewett** **Epsilon Associates, Inc.** **3 Mill & Main, Suite 250** **Maynard, MA 01754** **Teléfono: 978-897-7100** **Correo electrónico: dhewett@epsilonassociates.com**
Sitio web público para el proyecto u otra ubicación física donde se pueden obtener materiales del proyecto (si está disponible)	**El proponente proporcionará información a la Biblioteca Pública de Andover a medida que esté disponible.**
Municipio y código postal del proyecto (si se conoce)	**Andover MA 01810**
Tipo de proyecto* (indique todos los que correspondan)	**Laboratorio/oficina**
¿Se encuentra el sitio del proyecto dentro de un terreno inundable dentro de 100 años mapeado por la FEMA? S/N/Se desconoce	**No**
Emisiones estimadas de GEI de los espacios acondicionados (haga clic **aquí** para acceder a la herramienta de estimación de GEI)	**7,325 toneladas anuales de CO_2**

Descripción del proyecto

1. Proporcione una breve descripción del proyecto, incluido el tamaño total del sitio del proyecto y los pies cuadrados de los edificios y estructuras propuestos, si se conocen. **El proyecto propuesto consiste en la remodelación del antiguo campus de HP/Philips Medical en Andover para convertirlo en una oficina, ciencias de la vida, desarrollo de fármacos terapéuticos y usos de fabricación que cumplan con las prácticas recomendadas de fabricación vigentes (Current Good Manufacturing Practices, CGMP). El proyecto incluye la rehabilitación de edificios existentes y agregará aproximadamente 448,200 pies cuadrados de edificio nuevo, así como una planta central de servicios públicos de 15,000 pies cuadrados.**
2. Indique los niveles de revisión anticipada de MEPA (301 CMR 11.03) (si se conocen). • **301 CMR 11.03(1)(b)(2): creación de cinco o más acres de área impermeable** • **301 CMR 11.03(6)(b)(xv): construcción de 300 o más nuevos espacios de estacionamiento en una sola ubicación**

3. Enumere todos los permisos estatales, locales y federales previstos necesarios para el proyecto (si se conocen).

Andover

- **Tablero de planificación: revisión del plano del sitio**
- **Comisión de conservación: orden de condiciones**

Estado

- **Permiso de acceso indirecto a MassDOT**

Federal

- **Permiso general de construcción del Sistema Nacional de Eliminación de Descargas Contaminantes (National Pollutant Discharge Elimination System, NPDES) de la Agencia de Protección del Medio Ambiente (Environmental Protection Agency, EPA)**

4. Identifique las poblaciones y características de justicia ambiental (EJ) (minoría, ingresos, aislamiento inglés) dentro de las 5 millas del sitio del proyecto (puede adjuntar un mapa que identifique un radio de 5 millas desde la opción Visor de mapas de EJ en lugar de texto)

El proponente identificó numerosas poblaciones de justicia ambiental (Enviromental Justice, EJ) dentro de las 5 millas del sitio del proyecto. Son las siguientes:

Grupo de bloque	Área censal	País	Ciudad	Criterios	Hogares con aislamiento lingüístico	Ingreso familiar medio
3	2521.02	Essex	Methuen	Minoría	1%	$85,114 (99 % de la media de MA)
3	2521.01	Essex	Methuen	Minoría	3%	$56,488 (66 % de la media de MA)
1	2521.01	Essex	Methuen	Minoría	6%	$65,652 (76 % de la media de MA)
2	2521.01	Essex	Methuen	Minoría	0%	$62,976 (73 % de la media de MA)
4	2544.02	Essex	Andover	Minoría	5%	$176,645 (206 % de la media de MA)
1	3103	Middlesex	Lowell	Minoría	21%	$57,273 (67 % de la media de MA)
5	3201	Middlesex	Lowell	Minoría; Ingresos	6%	49,507 (58 % de la media de MA)
4	3102	Middlesex	Lowell	Minoría; Ingresos	0%	$40,559 (47 % de la media de MA)
2	3102	Middlesex	Lowell	Minoría	0%	$95,409 (111 % de la media de MA)
3	3102	Middlesex	Lowell	Minoría	24%	$69,79 (81 % de la media de MA)
5	3102	Middlesex	Lowell	Minoría; Ingresos	6%	$49,507 (58 % de la media de MA)
3	3125.01	Middlesex	Lowell	Minoría	12%	$72,813 (85 % de la media de MA)
5	3143.01	Middlesex	Dracut	Ingresos	4%	$41,720 (49 % de la media de MA)

2	3143.01	Middlesex	Dracut	Minoría; Ingresos	0%	$37,447 (44 % de la media de MA)	
4	2514	Essex	Lawrence	Minoría	0%	$57,250 (67 % de la media de MA)	
1	2502	Essex	Lawrence	Minoría; Ingresos	23%	$53,079 (62 % de la media de MA)	
2	2502	Essex	Lawrence	Minoría; Ingresos	15%	$39,485 (46 % de la media de MA)	
3	2502	Essex	Lawrence	Minoría; Ingresos	8%	$48,563 (57 % de la media de MA)	
4	2502	Essex	Lawrence	Minoría; Ingresos	3%	$44,583 (52 % de la media de MA)	
3	2514	Essex	Lawrence	Minoría; Ingresos	19%	$50,242 (59 % de la media de MA)	
5	2515	Essex	Lawrence	Minoría; Ingresos	17%	$50,125 (58 % de la media de MA)	
4	2515	Essex	Lawrence	Minoría; Ingresos	0%	$52,500 (61 % de la media de MA)	
1	2514	Essex	Lawrence	Minoría; Ingresos; Aislamiento del inglés	37%	$53,173 (62 % de la media de MA)	
2	2514	Essex	Lawrence	Minoría; Ingresos	23%	$39,653 (46 % de la media de MA)	
3	2514	Essex	Lawrence	Minoría; Ingresos	18%	$43,631 (51 % de la media de MA)	
1	2515	Essex	Lawrence	Minoría	22%	$70,547 (82 % de la media de MA)	
2	2515	Essex	Lawrence	Minoría	23%	$0 (0 % de la media de MA)	
3	2515	Essex	Lawrence	Minoría	10%	$35,500 (41 % de la media de MA)	
1	2518	Essex	Lawrence	Minoría	2%	$82,266 (96 % de la media de MA)	
2	2518	Essex	Lawrence	Minoría	0%	$63,070 (73 % de la media de MA)	
3	2518	Essex	Lawrence	Minoría	18%	$68,182 (79 % de la media de MA)	
4	2518	Essex	Lawrence	Minoría	20%	$0 (0 % de la media de MA)	
1	2513	Essex	Lawrence	Minoría; Ingresos; Aislamiento del inglés	51%	$18,882 (22 % de la media de MA)	
2	2513	Essex	Lawrence	Minoría; Ingresos	24%	$37,468 (44 % de la media de MA)	
3	2513	Essex	Lawrence	Minoría; Ingresos	18%	$43,631 (51 % de la media de MA)	
2	2523	Essex	Methuen	Minoría	19%	$92,333 (108 % de la media de MA)	
3	2523	Essex	Methuen	Minoría	0%	$69,858 (81 % de la media de MA)	

4	2523	Essex	Methuen	Minoría	4%	$0 (0 % de la media de MA)	
5	2523	Essex	Methuen	Minoría; Ingresos; Aislamiento del inglés	26%	$27,692 (32 % de la media de MA)	
1	2503	Essex	Lawrence	Minoría; Ingresos; Aislamiento del inglés	30%	$44,103 (51 % de la media de MA)	
1	2517	Essex	Lawrence	Minoría; Aislamiento del inglés	44%	$60,739 (71 % de la media de MA)	
2	2517	Essex	Lawrence	Minoría	6%	$97,941 ($114 % de la media de MA)	
3	2517	Essex	Lawrence	Minoría; Aislamiento del inglés	31%	$0 (0 % de la media de MA)	
4	2517	Essex	Lawrence	Minoría; Ingresos; Aislamiento del inglés	29%	$53,021 (62 % de la media de MA)	
1	2516	Essex	Lawrence	Minoría	8%	$65,579 (76 % de la media de MA)	
2	2516	Essex	Lawrence	Minoría; Ingresos; Aislamiento del inglés	26%	$54,063 (63 % de la media de MA)	
3	2516	Essex	Lawrence	Minoría; Ingresos; Aislamiento del inglés	33%	$35,882 (42 % de la media de MA)	
4	2516	Essex	Lawrence	Minoría	16%	$67,950 (79 % de la media de MA)	
1	2501	Essex	Lawrence	Minoría; Ingresos; Aislamiento del inglés	47%	$22,682 (26 % de la media de MA)	
1	2508	Essex	Lawrence	Minoría; Ingresos	13%	$44,028 (51 % de la media de MA)	
2	2508	Essex	Lawrence	Minoría	18%	$57,632 (67 % de la media de MA)	
3	2508	Essex	Lawrence	Minoría; Ingresos	13%	$34,623 (40 % de la media de MA)	
4	2508	Essex	Lawrence	Minoría; Ingresos	5%	$52,847 (62 % de la media de MA)	
5	2508	Essex	Lawrence	Minoría; Ingresos; Aislamiento del inglés	36%	$53,430 (62 % de la media de MA)	
1	2507	Essex	Lawrence	Minoría; Ingresos;	35%	$45,637 (53 % de la media de MA)	

				Aislamiento del inglés			
2	2507	Essex	Lawrence	Minoría; Ingresos; Aislamiento del inglés	42%	$52,222 (61 % de la media de MA)	
3	2507	Essex	Lawrence	Minoría; Aislamiento del inglés	54%	$66,607 (78 % de la media de MA)	
1	2509	Essex	Lawrence	Minoría; Ingresos; Aislamiento del inglés	35%	$42,500 (50 % de la media de MA)	
1	2524	Essex	Methuen	Minoría	13%	$66,288 (77 % de la media de MA)	
2	2524	Essex	Methuen	Minoría; Ingresos	13%	$48,528 (57 % de la media de MA)	
3	2524	Essex	Methuen	Minoría; Ingresos; Aislamiento del inglés	36%	$26,111 (30 % de la media de MA)	
1	2510	Essex	Lawrence	Minoría; Ingresos; Aislamiento del inglés	34%	$52,434 (61 % de la media de MA)	
1	2511	Essex	Lawrence	Minoría; Ingresos; Aislamiento del inglés	35%	$15,481 (18 % de la media de MA)	
2	2511	Essex	Lawrence	Minoría; Ingresos	24%	$28,125 (33 % de la media de MA)	
3	2511	Essex	Lawrence	Minoría; Aislamiento del inglés	60%	$76,047 (89 % de la media de MA)	
1	2512	Essex	Lawrence	Minoría; Ingresos; Aislamiento del inglés	46%	$24,773 (29 % de la media de MA)	
1	2504	Essex	Lawrence	Minoría; Ingresos	23%	$35,625 (42 % de la media de MA)	
2	2504	Essex	Lawrence	Minoría; Ingresos; Aislamiento del inglés	43%	$40,809 (48 % de la media de MA)	
3	2504	Essex	Lawrence	Minoría; Aislamiento del inglés	60%	$0 (0 % de la media de MA)	
3	2532.02	Essex	Norte de Andover	Minoría	0%	$0 (0 % de la media de MA)	
4	2532.02	Essex	Norte de Andover	Minoría	7%	$86,739 (101 % de la media de MA)	
2	2532.02	Essex	Norte de	Minoría	4%	$100,673 ($117 %	

			Andover			de la media de MA)	
1	2505	Essex	Minoría; Ingresos	Minoría; Ingresos	20%	$40,867 (48 % de la media de MA)	
2	2505	Essex	Lawrence	Minoría; Ingresos; Aislamiento del inglés	67%	$41,316 (48 % de la media de MA)	
3	2505	Essex	Lawrence	Minoría; Ingresos; Aislamiento del inglés	31%	$51,176 (60 % de la media de MA)	
1	2526.02	Essex	Methuen	Minoría	6%	$69,926 (81 % de la media de MA)	
1	2526.03	Essex	Methuen	Minoría	5%	$95,110 (111 % de la media de MA)	
3	2526.02	Essex	Methuen	Minoría	5%	$143,417 (167 % de la media de MA)	
3	2526.01	Essex	Methuen	Minoría	6%	$89,688 (104 % de la media de MA)	
1	2506	Essex	Lawrence	Minoría; Aislamiento del inglés	31%	$61,027 (71 % de la media de MA)	
2	2506	Essex	Lawrence	Minoría; Ingresos; Aislamiento del inglés	36%	$47,917 (56 % de la media de MA)	
3	2506	Essex	Lawrence	Minoría; Ingresos; Aislamiento del inglés	38%	$36,964 (43 % de la media de MA)	
4	2506	Essex	Lawrence	Minoría; Aislamiento del inglés	36%	$70,085 (82 % de la media de MA)	
1	2525.01	Essex	Methuen	Minoría	4%	$66,378 (77 % de la media de MA)	
2	2525.01	Essex	Methuen	Minoría; Ingresos	2%	$48,793 (57 % de la media de MA)	
3	2525.01	Essex	Methuen	Minoría	6%	$80,906 (94 % de la media de MA)	
1	2525.02	Essex	Methuen	Minoría	0%	$79,211 (92 % de la media de MA)	
3	2525.02	Essex	Methuen	Minoría	2%	$107,031 (125 % de la media de MA)	
4	2525.02	Essex	Methuen	Minoría; Ingresos	6%	$53,167 (62 % de la media de MA)	
5	2531	Essex	Norte de Andover	Minoría	0%	$81,486 (95 % de la media de MA)	

Con el visor de mapas de EJ que identifica los "idiomas que se hablan en Massachusetts", el proponente descubrió que hay 23 grupos con el 5 % o más de la población que no hablan inglés muy bien dentro de las cinco millas del sitio del proyecto. Los idiomas son los siguientes:

- **Español o español criollo**
- **Mon-Khmer/camboyano**

Tenga en cuenta que no hay ninguno dentro de una milla.

5. Identifique cualquier municipio o sección censal que cumpla con la definición de "criterios de población de EJ con salud vulnerable" en la Herramienta de EJ del Departamento de Salud Pública (DPH) ubicado en su totalidad o en parte dentro de un radio de 1 milla del sitio del proyecto.

El nivel de salud vulnerable por comunidad de la herramienta de justicia ambiental del Departamento de Salud Pública de Massachusetts (Massachusetts Department of Public Health, MassDPH) indica las vulnerabilidades existentes de la población EJ circundante cerca del sitio del proyecto. El proponente identificó dos ciudades en un radio de una milla del sitio del proyecto: Andover y Methuen. Andover no cumple el criterio de salud vulnerable EJ. Methuen cumple el criterio de ataque cardíaco.

6. Identifique los potenciales impactos a corto y largo plazo sobre el ambiente y la salud pública que pueden afectar a las poblaciones de EJ y cualquier mitigación prevista.

- **Aumento de las emisiones de los vehículos por el tráfico asociado al proyecto**
- **Impactos temporales en la calidad del aire/ruido durante la construcción**
- **Aumento de los niveles de ruido durante la construcción y las operaciones en curso en el sitio**

Todos los impactos serán revisados a través del Ministerio de Protección Ambiental y Agricultura (Ministry of Enviromental Protection and Agriculture, MEPA) y los diversos programas de permisos, y serán mitigados apropiadamente de acuerdo con las regulaciones aplicables.

7. Identifique los beneficios del proyecto, incluidos los "beneficios ambientales", tal como se definen en 301 CMR 11.02, que pueden mejorar las condiciones ambientales o la salud pública de la población de EJ.

El proyecto propuesto proporcionará beneficios económicos a la ciudad y la comunidad circundantes mediante un aumento de las oportunidades de empleo y nuevos impuestos.

8. Describa cómo la comunidad puede solicitar una reunión para analizar el proyecto y cómo la comunidad puede solicitar servicios de interpretación de lenguaje oral en la reunión. Especifique cómo solicitar otras adaptaciones, incluidas reuniones fuera del horario laboral y en lugares cercanos al transporte público.

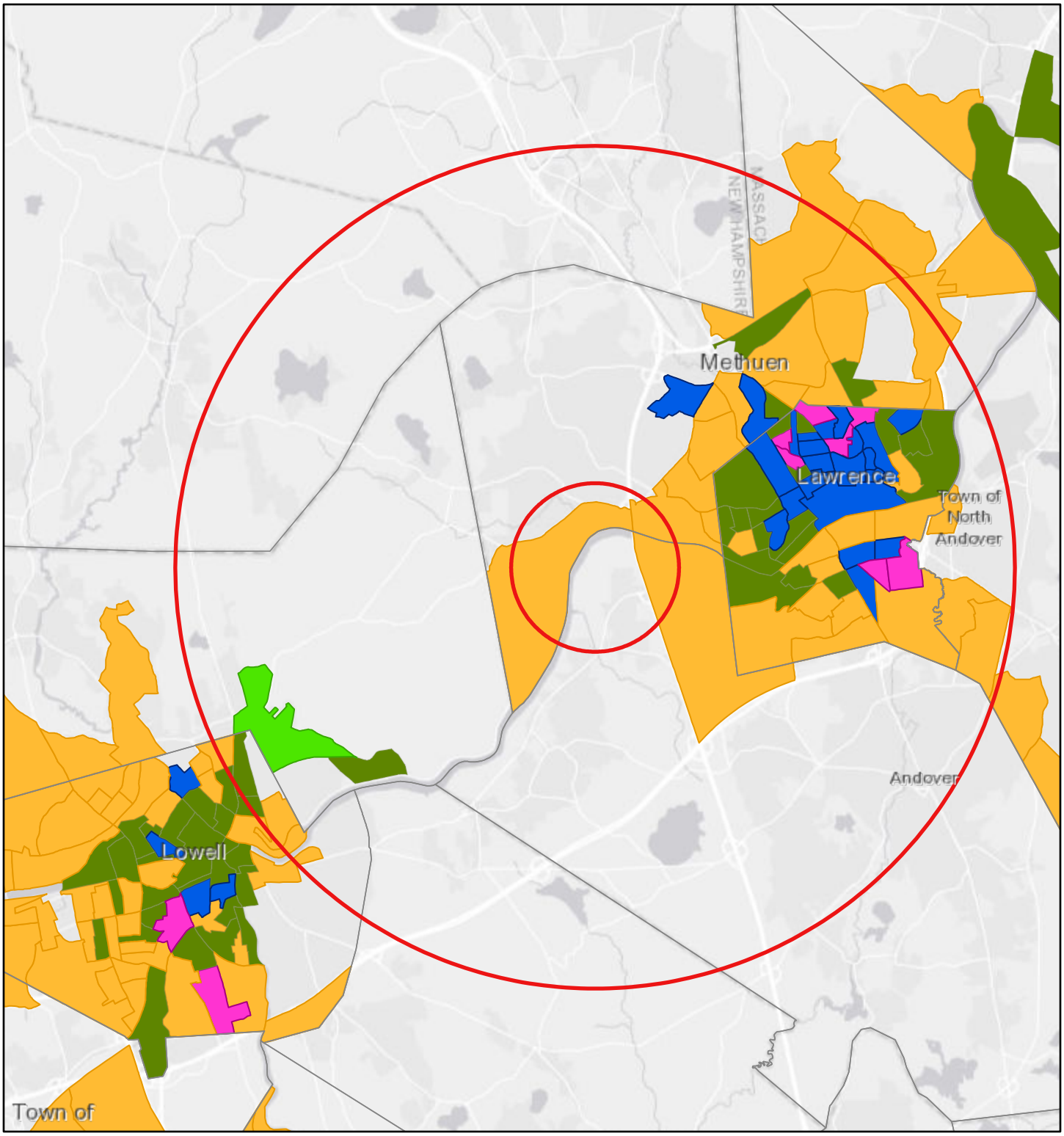
El proponente del proyecto está dispuesto a reunirse con los miembros de la comunidad en momentos y lugares que sean convenientes para el público. Para solicitar una reunión y cualquier adaptación necesaria, póngase en contacto con David Hewett en Epsilon Associates, la firma de consultoría ambiental que ayuda al desarrollador a través del proceso de concesión de permisos.

David Hewett
Teléfono: 978-897-7100
Correo electrónico: dhewett@epsilonassociates.com

**Tipos de proyectos de MEPA [Nota: esta lista se puede omitir al distribuir este formulario].*

Artículo 97	Marihuana
Agricultura	Marina industrial
Aeropuerto	Plan maestro: desarrollo
Acuicultura/Mariscos	Plan maestro: plan de renovación urbana
Relleno de costas/playas	Otro (especifique)
Infraestructura costera	Recreación
Comercial: oficina/laboratorio/I+D	Regulaciones
Comercial: hotel	Remediación
Comercial: depósito	Residencial
Comercial: minorista	Resiliencia
Eliminación de represas	Residuos sólidos
Reparación/reemplazo de represas	Transporte: carreteras/tránsito
Dragado	Transporte: senderos
Restauración ecológica	Aguas residuales: tratamiento/transporte
Generación de energía	Aguas residuales: Plan integral de manejo de aguas residuales (CWMP)
Almacenamiento de energía	Suministro de agua: nueva fuente
Transporte de energía	Abastecimiento de agua: tratamiento/transporte
Industrial	
Institucional: educativo	

2020 Environmental Justice Populations



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RMAT Climate Resilience Design Standards Tool Project Report

RMAT Climate Resilience Design Standards Tool Project Report

3000 Minuteman Road
Date Created: 7/29/2022 4:30:43 PM Created By: blawlor [Download]

Project Summary

Link to Project

Estimated Construction Cost: $10000000.00
End of Life Year: 2048
Project within mapped Environmental Justice neighborhood: No

Ecosystem Benefits	Scores
Project Score	High
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
Addition to Building 1 and new Buildings 5 and 6	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					
Addition to Building 1 and new Buildings 5 and 6					
Extreme Precipitation					
Addition to Building 1 and new Buildings 5 and 6	2050			10-yr (10%)	Tier 2
Extreme Heat					
Addition to Building 1 and new Buildings 5 and 6	2050		50th		Tier 2

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 100ft of a 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:

- 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%
- 10 to 30 day increase in days over 90 deg. F within project's useful life
- Located within 100 ft of existing water body

Scoring Rationale - Asset Risk Scoring

Asset - Addition to Building 1 and new Buildings 5 and 6
Primary asset criticality factors influencing risk ratings for this asset:

- Asset may inaccessible/inoperable during natural hazard event, but must be accessible/operable within one day after natural hazard event
- Loss/inoperability of the asset would have impacts limited to the site only
- Inoperability of the asset would not be expected to result in injuries
- Cost to replace is between $10 million and $30 million
- Spills and/or releases of hazardous materials would be relatively easy to clean up

Project Design Standards Output

Asset: Addition to Building 1 and new Buildings 5 and 6 — 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: 2050
Return Period: 10-yr (10%)

Applicable Design Criteria

Tiered Methodology: Tier 2

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
Addition to Building 1 and new Buildings 5 and 6	2050	10-Year (10%)	6.2	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: 2050
Percentile: 50th Percentile

Applicable Design Criteria

Tiered Methodology: Tier 2

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:	3000 Minuteman Road
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)?	2048
Location of Project:	Andover
Estimated Capital Cost:	$10,000,000
Who is the Submitting Entity?	Private Other Alexandra Real Estate Equities, Inc Rickie Golden (rgolden@are.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?	Permitting
Is climate resiliency a core objective of this project?	Yes
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:	Renovation of 726,000sf of existing microelectronic manufacturing, R&D and office space to reposition for life science uses plus addition of approximately 400,000sf of new construction also focused on life science uses.
Project Submission Comments:	

Project Ecosystem Benefits

Factors Influencing Output

- ✓ Project reduces storm damage
- ✓ Project protects public water supply
- ✓ Project promotes decarbonization
- ✓ Project recharges groundwater
- ✓ Project filters stormwater using green infrastructure
- ✓ Project improves water quality
- ✓ Project protects fisheries, wildlife, and plant habitat
- ✓ Project remediates existing sources of pollution
- ✓ Project provides recreation
- ✓ Project improves air quality
- ✓ Project prevents pollution

Factors to Improve Output

- ✓ Incorporate nature-based solutions that may provide flood protection
- ✓ Incorporate vegetation that provides pollinator habitat
- ✓ 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	Maybe
Reduces storm damage	Yes

Recharges groundwater	Yes
Protects public water supply	Yes
Filters stormwater using green infrastructure	Yes
Improves water quality	Yes
Promotes decarbonization	Yes
Enables carbon sequestration	No
Provides oxygen production	No
Improves air quality	Yes
Prevents pollution	Yes
Remediates existing sources of pollution	Yes
Protects fisheries, wildlife, and plant habitat	Yes
Protects land containing shellfish	No
Provides pollinator habitat	Maybe
Provides recreation	Yes
Provides cultural resources/education	Maybe

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: Addition to Building 1 and new Buildings 5 and 6
Asset Type: Typically Occupied
Asset Sub-Type: Non-residential building (office, commercial, retail)
Construction Type: New Construction
Construction Year: 2023
Useful Life: 25

Identify the length of time the asset can be inaccessible/inoperable without significant consequences.
Building may be inaccessible/inoperable during natural hazard event, but must be accessible/operable within one day after natural hazard event

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 100 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?
Spills and/or releases of hazardous materials would be relatively easy to clean up

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?
Between $10 million and $30 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

Previous MEPA Certificates

J

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
100 Cambridge Street, Boston, 02202

WILLIAM F. WELD
GOVERNOR

ARGEO PAUL CELLUCCI
LIEUTENANT GOVERNOR

SUSAN F. TIERNEY
SECRETARY

(617) 727-9800

December 16, 1992

FILE COPY
12/21/92

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
DRAFT ENVIRONMENTAL IMPACT REPORT

PROJECT NAME	: Hewlett-Packard
PROJECT LOCATION	: Andover
EOEA NUMBER	: 8929
PROJECT PROPONENT	: Hewlett-Packard
DATE NOTICED IN MONITOR	: November 9, 1992

The Secretary of Environmental Affairs herein issues a statement that the Draft Environmental Impact Report submitted on the above project adequately and properly complies with the Massachusetts Environmental Policy Act (G. L., c. 30, s. 61-62H) and with its implementing regulations (301 CMR 11.00).

The Draft EIR for this project was clear, thorough and well presented. I found the organization and presentation of material, data and conclusions to be among the best I have reviewed in a long time. The Draft EIR appears to have addressed successfully the environmental issues and has demonstrated that the project's impacts will be mitigated. Further, the DEIR has demonstrated that the traffic impacts are consistent with the impacts anticipated in the River Road - Andover Street EIR (EOEA #6036). I therefore propose to notice and review the Draft EIR as a Final EIR in the next issue of the Environmental Monitor.

The only outstanding issue appears to be final resolution of the archaeological concerns. Three areas within the property contain important resources. The DEIR reports that Phase II development may impact resource areas, but it appears that development plans are not yet finalized. The proponent should site facilities in a manner that would avoid impacting archaeological sites. The proponent should continue to work with the Massachusetts Historical Commission and follow the recommendations of the MHC in order that impacts to these sites can be avoided, minimized or mitigated. Any changes in the site design that might result in damage to these sites require that

the MEPA Unit be notified pursuant to 301 CMR 11.17 - Project Change.

The DEIR identified a number of interim traffic mitigation measures in a section of the DEIR transportation analysis called "1994 Phase I Build Interim Mitigation." The analysis indicates that these interim measures will be needed regardless of the status of the Hewlett-Packard project if the River Road - Andover Street Project is not completed. I appreciate the identification of this interim mitigation, and hope that the corridor project is not unduly delayed.

Finally, the proponent is to be commended for the good work with respect to transportation demand management strategies identified in the DEIR. The proponent has been working with Caravan, the Town of Andover and other business in the area to establish a River Road Transportation Management Association. In addition, Hewlett-Packard will subsidize a vanpool program for employees, encourage carpooling at this facility and offer a flexible work schedule to employees.

December 16, 1992
DATE

Thomas P. McShane
Susan F. Tierney, Secretary

Comments received :
Caravan
MHC

SFT/JMD/jmd

P:HPDEIR

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
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March 3, 1993

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
FINAL ENVIRONMENTAL IMPACT REPORT

PROJECT NAME	: Hewlett-Packard
PROJECT LOCATION	: Andover
EOEA NUMBER	: 8929
PROJECT PROPONENT	: Hewlett-Packard
DATE NOTICED IN MONITOR	: January 25, 1993

The Secretary of Environmental Affairs herein issues a statement that the Final Environmental Impact Report submitted on the above project adequately and properly complies with the Massachusetts Environmental Policy Act (G. L., c. 30, s. 61-62H) and with its implementing regulations (301 CMR 11.00).

The Draft Environmental Impact Report for this project was noticed in the Environmental Monitor as the Final Environmental Impact Report (FEIR). No additional comments were received during the FEIR comment period.

I take this opportunity to remind the proponent that the development of Phase II, for which plans have not yet been finalized, should be designed in a manner that avoids impacting archaeological resources. The proponent should continue the good work already started with the Massachusetts Historical Commission (MHC) and follow the recommendations of the MHC so that impacts can be avoided, minimized or mitigated. Any changes in the site design that might result in damage to archaeological resources requires that the MEPA Unit be notified pursuant to 301 CMR 11.17 - Project Change.

March 3, 1993
Date

Susan F. Tierney, Secretary

SFT/JMD/jmd
P:HPFEIR

100% RECYCLED PAPER

SMMA

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