900 WORCESTER STREET STORMWATER AND TRANSPORTATION STUDY WELLESLEY, MA

JULY 7, 2015

DRAFT

FOR COMMENT

Prepared For:

900 Worcester Street
Wellesley, MA

Gale JN 716890

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900 Worcester Street
Wellesley, MA

STORMWATER AND
TRANSPORTATION STUDY

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STORMWATER AND TRANSPORTATION STUDY

900 Worcester Street
Athletic & Recreation Facility
Wellesley, MA

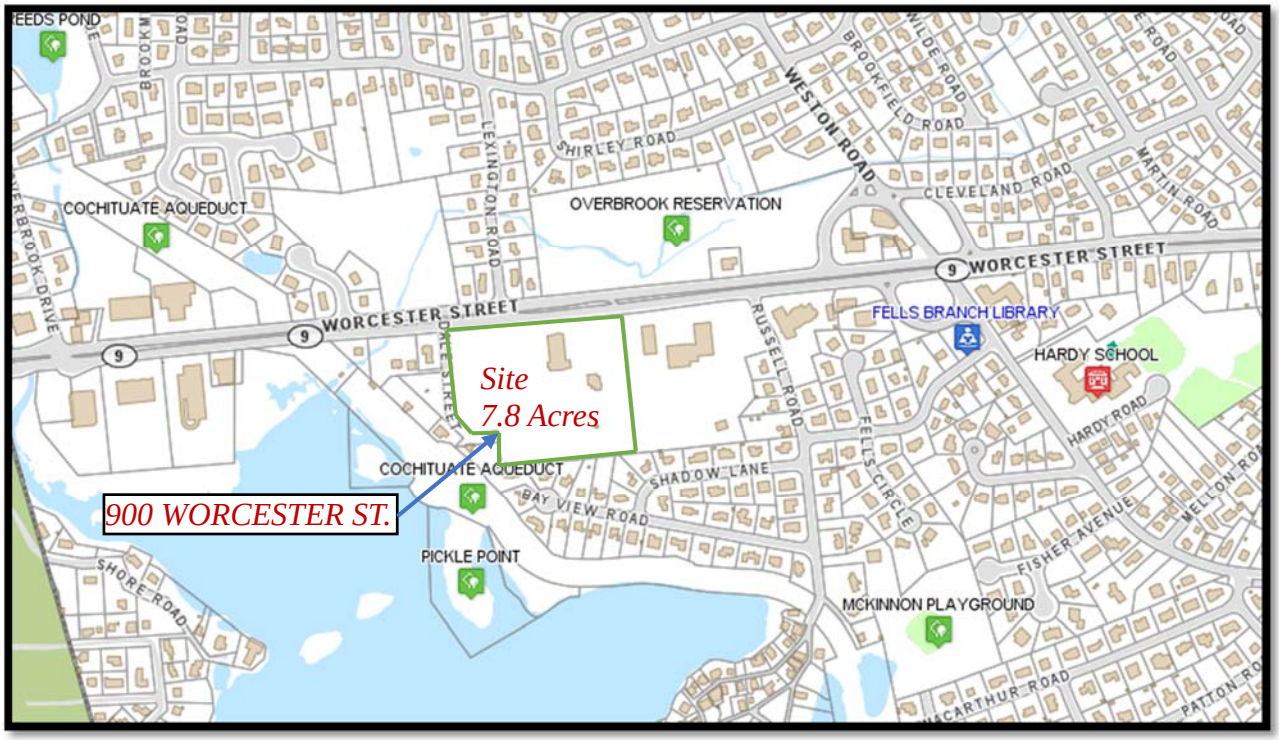
1.0 INTRODUTION

Gale Associates, Inc. (Gale) is pleased to provide the following Stormwater and Transportation Study for a conceptual multi-purpose recreational facility development at 900 Worcester Street in Wellesley, MA. This study provides a summary of possible layouts for a multi-purpose recreation structure (to include an ice rink, natatorium, and fitness center), a multipurpose rectangular field, related parking, and other site amenities. This study evaluates potential stormwater management systems for each layout and also analyzes parking and traffic warrants for each layout.

2.0 EXISTING CONDITIONS

Gale reviewed several studies provided by the Town and visited the site to conduct a visual assessment of the existing conditions. The project site is approximately 7.8 acres of mostly developed land and is bounded by Worcester Street (Route 9) to the north, professional office buildings to the east, Dale Street to the west, and a residential neighborhood to the south. Refer to the locus map below.

Locus Map



The project site is zoned Single Family Residence and is within the Town's Water Supply Protection District. The latter is an overlying district established by the Town in an effort to maintain groundwater recharge to the Town's wells by restricting the uses of a property within the district (see Enclosure 1, Figure 1).

The majority of the project site is paved and predominantly flat with a gradual slope running from the north to south, before transitioning to steeper slopes within the southern portion. Overall, the existing site grades range in elevation from 130' to 135'. There is a natural wooded area in the southern portion of the parcel. According to MassGIS data and the Town's Wetlands Map (see Enclosure 1, Figure 2), a portion of this wooded area is considered an isolated wetland. This is not under the jurisdiction of MassDEP but is under the local jurisdiction of the Natural Resource Commission (NRC). The NRC imposed a 100' jurisdiction buffer and a 25' no disturb zone.

According to the latest FEMA Flood Insurance Rate Map and Wellesley GIS, the northwest portion of the proposed site is located within flood hazard area "Zone A", commonly referred to as the 100-year flood plain. Based on the location of the Zone A and existing topography, it is assumed that the 100-year flood elevation 131' (see Enclosure 1, Figure 2).

According to the latest NHESP Atlas, there are no Priority Habitats of Rare Species, no Estimated Habitats of Rare Wildlife, no Certified Vernal Pools, and no Potential Vernal Pools in the vicinity of the site (see Enclosure 1, Figure 2).

Soils information was taken from the USDA Natural Resources Conservation Service (NRCS) Soil Survey Report as well as record data and recent test pits. The NRCS soils mapping indicates that the majority of the site's soil type is Urban Land (Ur), with 75% or more impervious surface and 0-15% slopes; the southern portion is Hinckley loamy sand (HfD), with 15-35% slopes (see Enclosure 1, Figure 3). Test pits were performed and confirmed that there is a high groundwater table at an elevation of approximately 127' (See Enclosure 2). Soils are generally 2' to 4' of fill with silty sand as native parent material.

The site's utility services (Town water, Town sewer, gas, and electric) originate off of Worcester Street (Route 9). No formal drainage (catch basins, manholes, etc.) was observed within the paved areas on the site. Untreated stormwater runoff is currently allowed to sheet flow in a southerly direction towards the wooded areas and wetlands, and where it either infiltrates or evaporates.

3.0 CONCEPTUAL OPTIONS

Based on various conversations and meetings with the Town, this report proposes three (3) options for a multipurpose recreational facility development. It should be noted that the conceptual designs are merely the basis of what could potentially be constructed at this site. They provide a base line for the subsequent stormwater and transportation study.

Conceptual Option 1 (See Enclosure 3, Option 1)

Conceptual Option 1 proposes an outdoor 210' x 330' synthetic turf field, an enclosed structure with one and a half (1.5) sheets of ice, one (1) pool, and common space. The common space would consist of a reception area, concessions, retail, skate shop, locker rooms, restrooms, and a mechanical room. The proposed multipurpose recreation structure will be 77,000± SF, it will contain approximately 802 spectator seats, and the site will contain approximately 206 parking stalls. (See Enclosure 3, Option 1).

Conceptual Option 2 (See Enclosure 3, Option 2)

Conceptual Option 2 proposes no synthetic turf field, an enclosed structure with two (2) sheets of ice, one (1) pool (larger than option 1), and common space similar to option 1. The proposed multipurpose recreation structure will be 90,000± SF, it will contain approximately 1,437 spectator seats, and the site will contain approximately 244 parking stalls. (See Enclosure 3, Option 2).

Conceptual Option 3 (See Enclosure 3, Option 3)

Conceptual Option 3 proposes a 195' x 315'synthetic turf field, one and a half (1.5) sheets of ice, one (1) pool, common space the proposed multipurpose recreation structure will be 77,000± SF, it will contain approximately 802 seats, and the site will contain approximately 206 parking stalls. (See Enclosure 3, Option 3). This option is identical to Option 1 with the exception of a bubble structure. The bubble will require a full concrete spread footing, vehicular access around all sides, HVAC equipment, and potentially a fire suppression system. The spread footing and vehicular access causes the synthetic turf field to be smaller than option 1, however the dimension still meet minimum high school regulations for all sports other than football.

It is expected that during the winter months, the inflatable bubble will be used to cover the field. In the spring/summer months, the bubble will be taken down and stored. It is reported that the bubble will require a storage are roughly the size of a large tractor trailer.

4.0 APPLICABLE STORMWATER RULES AND REGULATIONS

In order to provide background and context for the subsequent stormwater discussion, we have provided a summary of pertinent rules and regulations governing stormwater and environmental site features. These rules and regulations are summarized as follows:

- **Massachusetts Wetland Protection Act**
    - Regulated area: Bordering Land Subject to Flooding (BLSF) or otherwise referred to as the flood plain area.

    - General performance standards for BLSF (310 CMR 10.57(4)) require that: "compensatory storage be provided for all flood storage volume that will be lost as the result of a proposed project within Bordering Land Subject to Flooding. Compensatory storage shall mean a volume not previously used for flood storage

and shall be incrementally equal to the theoretical volume of flood water at each elevation up to and including the 100-year flood elevation, which would be displaced by the proposed project."

- Based on the FEMA maps, it does not appear that a flood study has been performed to determine that actual limits of the 100 year flood zone. As such, we recommend that a flood study be considered in order to more clearly define the limits of the flood area and associated elevations.

- **Wellesley Wetland Protection By-Laws**
  - Regulated area: Isolated Wetlands greater than 2,500 SF
  - 25' No Disturb Zone is imposed
  - 75' Limited Disturbance Zone is imposed

- **MassDEP Stormwater Standards**

  - MassDEP established a set of ten (10) Stormwater Management Standards encouraging recharge to groundwater and preventing stormwater runoff causing pollution to surface water and groundwater. The standards are listed below:

    1. No New Untreated Discharges
    2. Peak Flow Rate Attenuation
    3. Recharge to Groundwater
    4. Water Quality
    5. Land w/ Higher Potential Pollutant Loads
    6. Critical Areas
    7. Development
    8. Erosion Control
    9. Long Term O&M
    10. Illicit Discharges are Prohibited.

  - This preliminary study focuses mainly on Standards 2, 3, and 4. Detailed descriptions of these are listed below according to the MassDEP Stormwater Handbook.

  - The standards also require that Low Impact Development (LID), such as bioretention areas, permeable surfaces, reduced impervious areas, etc. be considered.

    Standard #2. Peak Flow Rate Attenuation

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

Standard #3. Recharge to Groundwater

- Loss of annual recharge to groundwater shall be minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type.

Standard #4. Water Quality

- Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This is done through a series of pre-treatment and treatment Best Management Practices (BMP's) that must be sized appropriately.

5.0 STORMWATER CONCEPTS AND BEST MANAGEMENT PRACTICES (BMPS)

In order for the conceptual layouts to comply with the above descried rules, regulations and standards, the site will need to implement a series of stormwater Best Management Pracitices (BMPs) to treat, detain, and/or infiltrate stormwater. Although many options for BMPs are available, this evaluation has considered the following as potential BMPs to be used on site: Synthetic Turf Field, Bioretention / Raingardens and Pervious Concrete Pavers. Detailed descriptions of these are listed below:

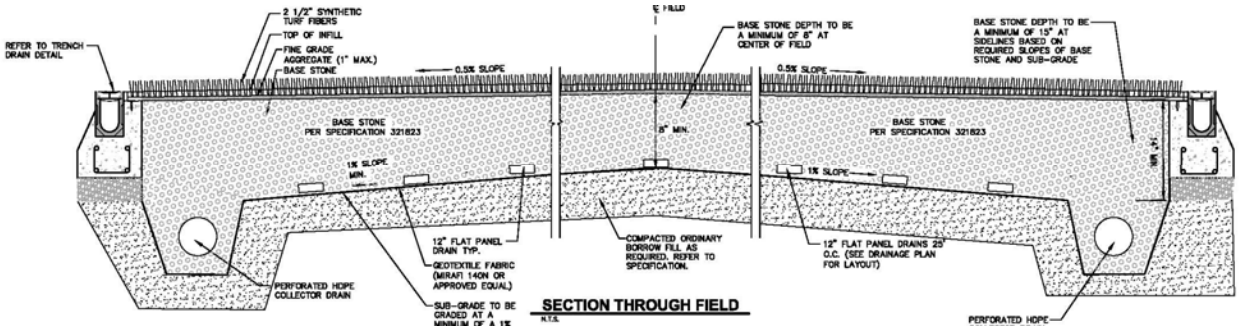
Synthetic Turf Field

- In general, synthetic turf fields drain stormwater runoff vertically. The proposed synthetic turf field is a highly permeable carpet that is designed to be installed on top of an engineered stone base with a 10-inch average depth, and 30% void space for stormwater storage. Stormwater that enters the synthetic turf carpet will drain vertically into the stone base and provide the opportunity to recharge into the existing subsurface soils. The stormwater that does not infiltrate into subsurface soils is drained via flat panel drains, installed within the stone base and drains to a single outlet control structure.

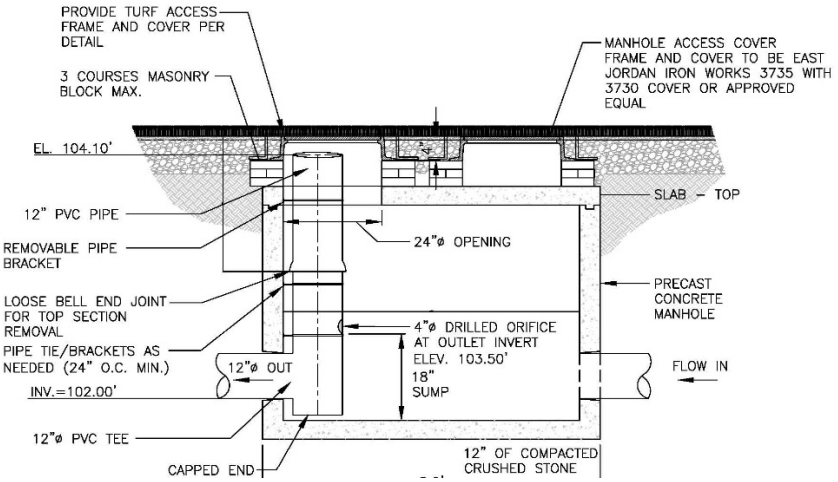
  The outlet control structure is an important part of stormwater management at the site. It is a manhole with a pipe having a horizontal and vertical orifice as the outlet. During large storm events, the outlet control structure will hold back the runoff from the synthetic turf field which in return allows a reduction in runoff.

  In HydroCAD, synthetic turf is modeled with a Curve Number of 98 to artificially represent the direct inflow of precipitation into the stone base. The drainage system has been designed so that post-development peak rates of runoff do not exceed pre-development peak rates for the 2-, 10-, and 100-year storm events.

Synthetic Turf Field – Typical Section through field



Synthetic Turf Field – Outlet Control

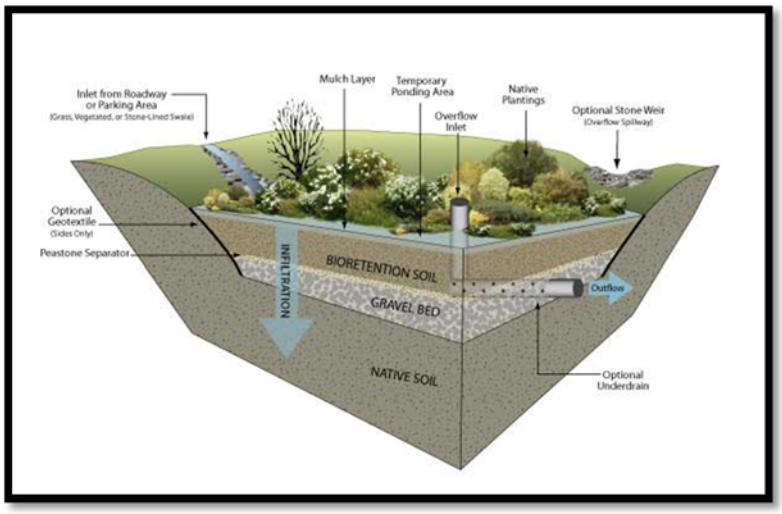


The outlet controls structure is used to restrict water flowing out of the field, hence allowing water to stage up within the stone base and be slowly released or infiltrated into the ground.

Bioretention and Rain Garden

- Bioretention is a technique that uses soils, plants, and microbes to treat stormwater before it is infiltrated and/or discharged. Bioretention cells (also called rain gardens in residential applications) are shallow depressions filled with sandy soil topped with a thick layer of mulch and planted with dense native vegetation. Stormwater runoff is directed into the cell via piped or sheet flow. The runoff percolates through the soil media that acts as a filter and is either infiltrated into the ground or is discharged via an under drain.

Typical Bioretention Area – Section



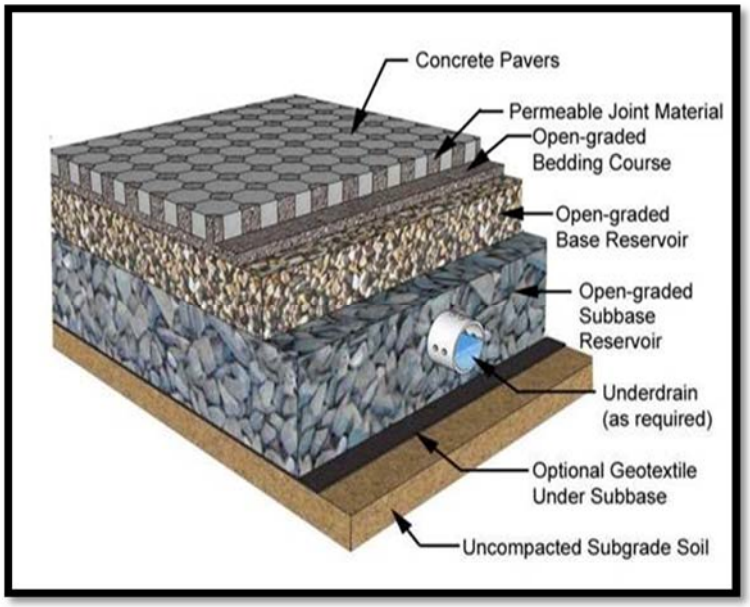
Typical Bioretention Area – in parking island

Pervious Concrete Pavers

- Pervious Concrete Pavers allow water to pass through the joints and infiltrate into the subsoil. This replaces traditional pavement, allowing parking lot runoff to infiltrate directly into the soil and receive water quality treatment. The pavers overlay a stone bed that stores rainwater before it infiltrates into the underlying soil.
- Other permeable paving options include porous asphalt, pervious concrete, paving stones, and manufactured "grass pavers" made of concrete or plastic.
- It should be noted that, in our opinion, the concrete pavers are the most durable option.

Typical concrete pavers in parking application

Typical concrete pavers section



6.0 CONCEPTUAL OPTIONS - STORMWATER

For each conceptual option described under Section 3 above, a schematic level stormwater management plan was produced. A watershed plan was drawn and a hydrologic analysis was derived using HydroCAD. Generally, the stormwater from the site flows and discharges to the isolated wetland pocket that has been designated as the design point. Connecting the proposed conditions into the Route 9 (Worcester Street) drainage system was considered; however, it is not likely that MassDOT would allow this due to previously existing flooding issues within this vicinity of Route 9. A summary of each plan is as follows:

<u>Conceptual Option 1 (See Enclosure 4, Option 1)</u>

- Conceptual Option 1 will use the following BMPs:
    - Synthetic Turf Field with dynamic stone base.
    - Bioretention and Rain Gardens
    - Pervious Concrete Pavers

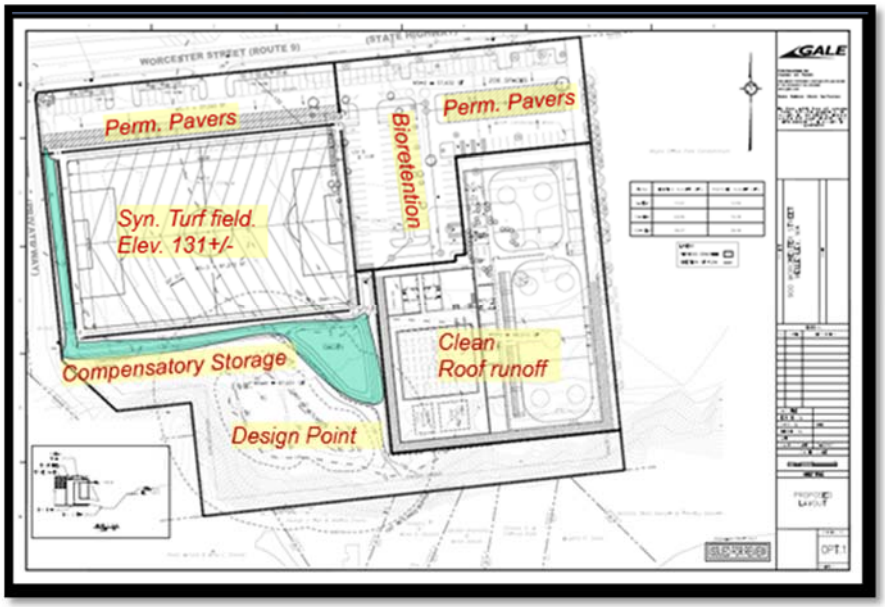
- The elevation of the field needs to be situated high enough so that it can drain into the isolated wetland area (Design Point). For this reason, the field will sit above the current existing floodplain elevation. The construction of the synthetic turf field will require the use of compensatory storage to comply with the general performance standards for BLSF (310 CMR 10.57(4)). A compensatory storage volume will be sited west and south of the synthetic turf field.

- The runoff from the proposed parking areas will be captured by pervious concrete pavers and bioretention and rain gardens. This will help meet water quality standards.

- The runoff from the proposed building, is considered to be "clean" and will not need treatment.

- All stormwater runoff will drain to the isolated wetland designated as the design point.

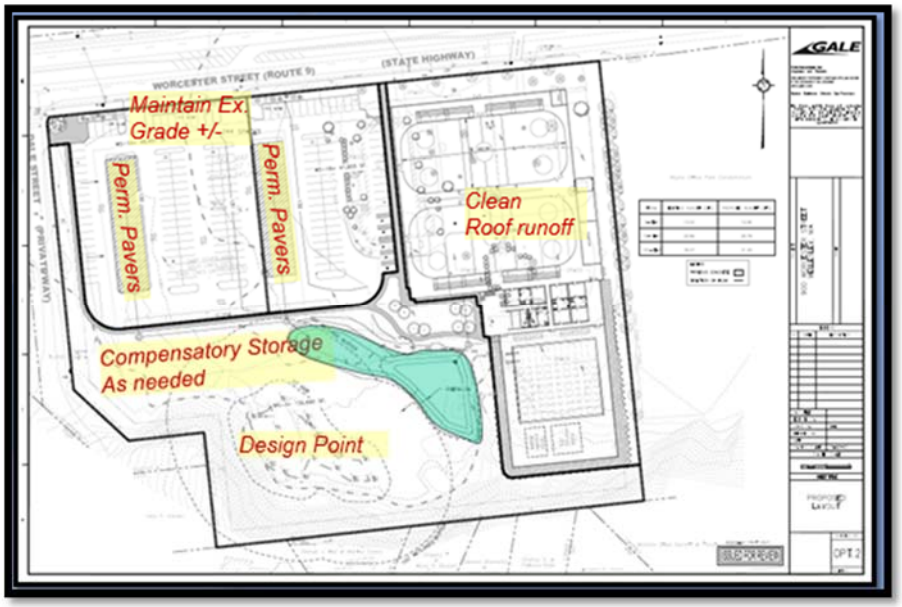
Stormwater Plan for Option #1



<u>Conceptual Option 2 (See Enclosure 4, Option 2)</u>

- Conceptual Option 2 will use the following BMPs:
    - Bioretention and Rain Gardens
    - Pervious Concrete Pavers
- The construction of the new parking will require the use of compensatory storage to comply with the general performance standards for BLSF (310 CMR 10.57(4)). The compensatory storage will be constructed west and south of the proposed parking lot. However, the parking lot can be graded with more flexibility than that of the synthetic turf field in Option #1. Hence, it is possible to maintain the parking lot at closer to existing grade in order to limit the amount of filling and therefor limiting the amount of compensatory storage.
- The runoff from the proposed parking areas will be captured by pervious concrete pavers. This will help meet water quality standards.
- The runoff from the proposed building, is considered to be "clean" and will not need treatment.
- All stormwater runoff will drain to the isolated wetland designated as the design point.

Stormwater Plan for Option #2



<u>Conceptual Option 3 (See Enclosure 4, Option 3)</u>

- Conceptual Option 3 will use the following BMPs:
  - Synthetic Turf Field with dynamic stone base.
  - Bioretention and Rain Gardens
  - Pervious Concrete Pavers

- Although Option #3 proposed to cover the field with a bubble during part of the year, the runoff from the bubble will be directed into the dynamic stone base below.

- The elevation of the field needs to be situated high enough so that it can drain into the isolated wetland area (Design Point). For this reason, the field will sit above the current existing floodplain elevation. The construction of the synthetic turf field will require the use of compensatory storage to comply with the general performance standards for BLSF (310 CMR 10.57(4)). A compensatory storage volume will be sited west and south of the synthetic turf field.

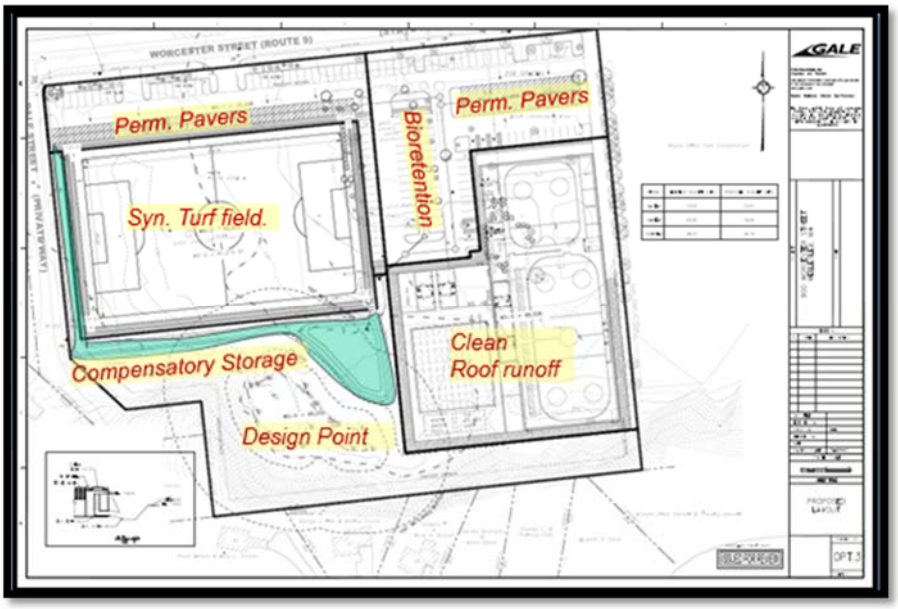
- Option #3 will require a concrete strip footing for the bubble structure. Further investigation into constructing this in the flood plain is recommended.

- The runoff from the proposed parking areas will be captured by pervious concrete pavers and bioretention and rain gardens. This will help meet water quality standards.

- The runoff from the proposed building, is considered to be "clean" and will not need treatment.

- All stormwater runoff will drain to the isolated wetland designated as the design point.

Stormwater Plan for Option #3



7.0 888 WORCESTER STREET DISCUSSION

Gale was requested to evaluate the possibility of connecting the stormwater system from the adjacent site at 888 Worcester Street into the system at 900 Worcester Street. Gale was hired independently by the Owners of 888 Worcester Street to perform an evaluation of their site as it relates to stormwater. In general our conclusions are as follows; we would likely not recommend directly discharging runoff from 888 Worcester Street to 900 Worcester Street. This is due to the fact that all stormwater from 900 Worcester Street flows to the isolated wetland pocket on site. Once it is in the wetland pocket, stormwater either infiltrates or evaporates. Since groundwater is high the potential for infiltration is limited and therefor water tends to stand in the wetland for a period of time. It should also be noted that the site is already within the 100 year flood plain and experiences isolated flooding during large storm events. Although stormwater from 888 Worcester Street can be detained and peak flow rates can be reduced, we would not recommend adding more volume to the 900 Worcester site.

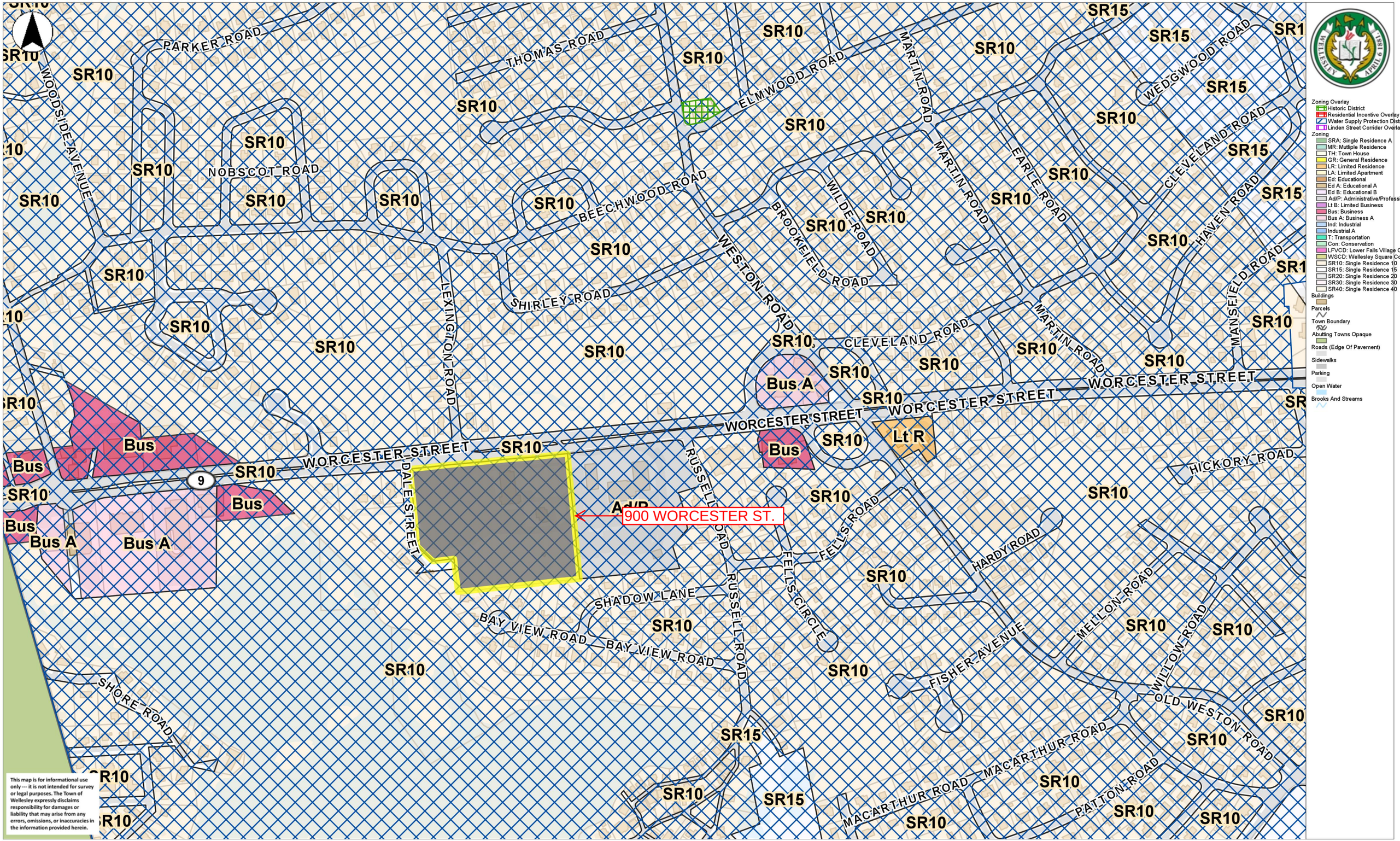
However, based on our study at 888 Worcester Street, we have found that the same BMP techniques discussed earlier in this report, such as bioretention areas or permeable surfaces, could be implemented to improve stormwater on the 888 Worcester Street site. We understand that negotiations may take place between the Town of Wellesley and the owners of 888 Worcester Street to potentially connect the two sites and for the Town to use their parking lot during overflow events. Implementing some on site stormwater improvements on behalf of 888 Worcester Street could be a potential option during this negotiation.

8.0 SUMMARY

Based on our site investigation, schematic designs and preliminary stormwater analysis, it appears that development at the 900 Worcester Street site is feasible. The final design should carefully consider proposed elevations so that site features can drain to the isolated wetland. However; in doing so, the site will likely require compensatory storage to make up for lost flood volume. Each layout considered attempts to keep the occupied structures out of the flood plain to the extent possible. A flood study has not been performed but is recommended prior to final design.

ENCLOSURE 1

FIGURE 1 – Town Zoning and Overlay Districts



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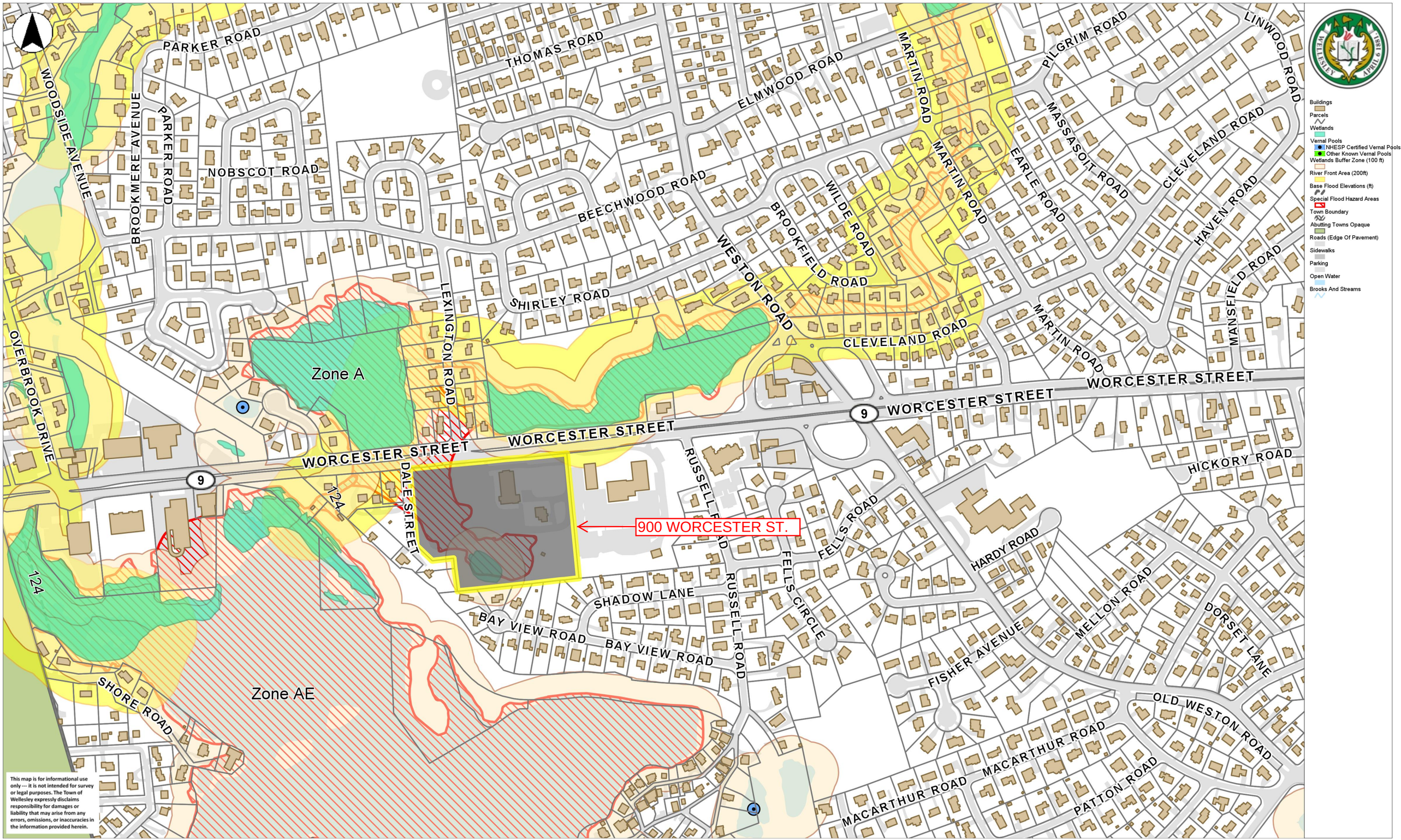
Town of Wellesley, MA

FIGURE 2 – Town Wetlands Map



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Town of Wellesley, MA

FIGURE 3 – NRCS Soils Map

71° 19' 14" W
71° 18' 53" W
42° 18' 20" N
42° 18' 9" N
308730
308780
308830
308880
308930
308980
309030
309080
309130
309180
4686300
4686250
4686200
4686150
4686100
4686050
4686000
Boulder Brook
Worcester St
Driveway
Shadow Ln
5
653
9
602
260B
626B
253D
626B
Map Scale: 1:2,270 if printed on A landscape (11" x 8.5") sheet.
Meters
0
30
60
120
180
Feet
0
100
200
400
600
N
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 10, Sep 19, 2014

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

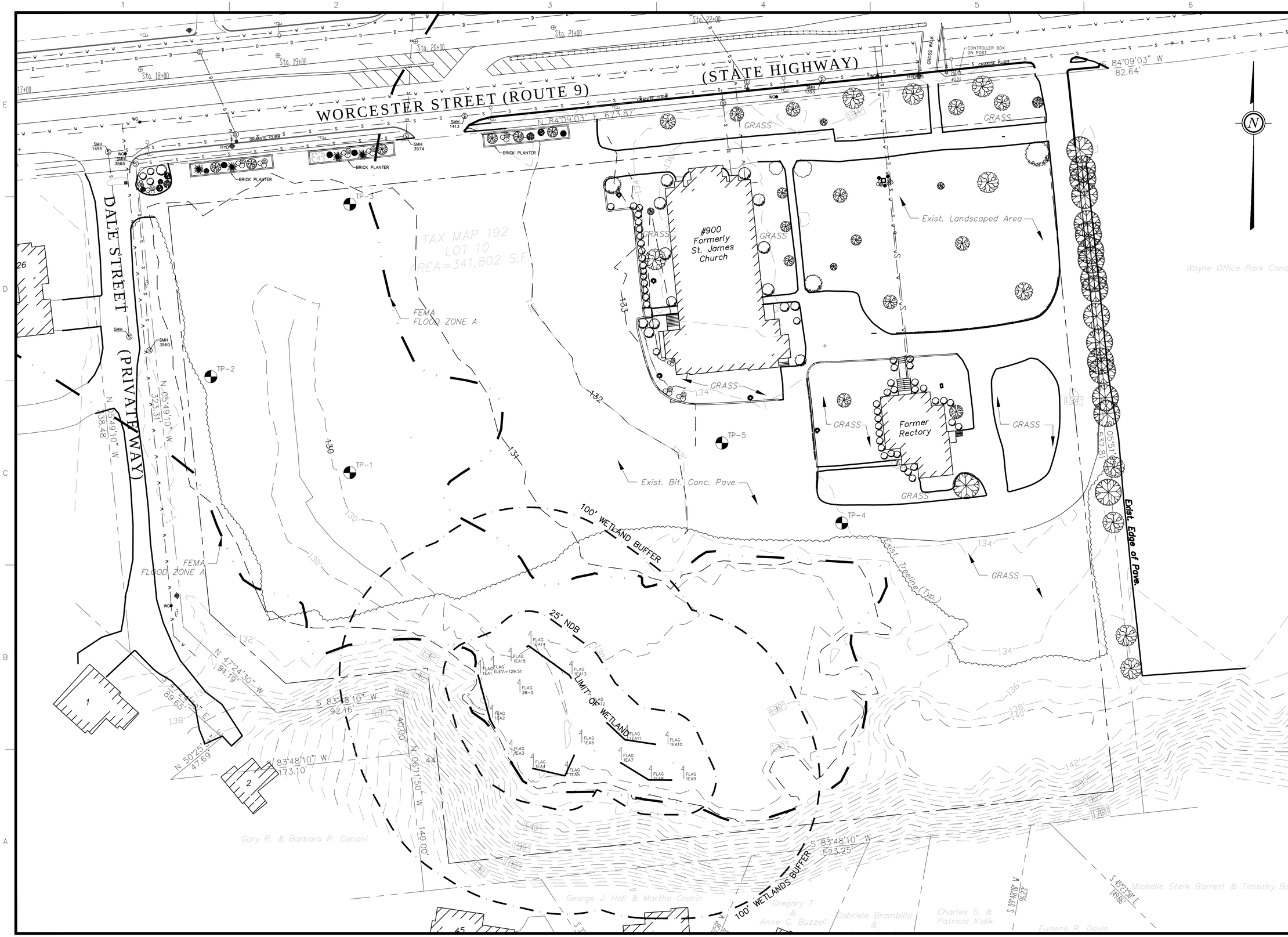
Date(s) aerial images were photographed: Sep 12, 2014—Sep 28, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Norfolk and Suffolk Counties, Massachusetts (MA616)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
5	Saco silt loam, 0 to 3 percent slopes	0.0	0.0%
253D	Hinckley loamy sand, 15 to 35 percent slopes	4.8	23.1%
260B	Sudbury fine sandy loam, 2 to 8 percent slopes	0.4	2.1%
602	Urban land, 0 to 15 percent slopes	14.0	67.5%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	1.5	7.2%
653	Udorthents, sandy	0.0	0.0%
Totals for Area of Interest		**20.7**	**100.0%**

ENCLOSURE 2



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PROJECT
900 WORCHESTER STREET
WELLESLEY, MA

OWNER
TOWN OF WELLESLEY

REVISIONS

NO.	DATE	DESCRIPTION

CADD FILE	
DESIGNED BY	
DRAWN BY	WAH
CHECKED BY	
DATE	
DRAWING SCALE	1"=30'-0"

GRAPHIC SCALE

SHEET TITLE

TEST PIT LOCATIONS

DRAWING NO.
SK-3

PROJECT NO.

SOIL EVALUATOR FORM

Location Address or Lot No. 900 Worcester Street Wellesley, Ma

On-site Review

Deep Hole Number: TP-1 Date: 4-6-15 Time: 9:00 am Weather: Sunny 50 degrees

Location (Identify on site plan): See Map

Land Use: Parking Lot Slope (%): 0-5 Surface Stones: None

Vegetation: N/A

Landform: _____

Position on Landscape (sketch on the back): _____

Distances from:

Open Water Body: _____ feet Drainage way: _____ feet

Possible Wet Area: _____ feet Property Line: _____ feet

Drinking Water Well: _____ feet Other: _____

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-4	Pavement				Pavement
4-16	Fill				Base/Gravel
16-20	Buried Topsoil				
20-66	Silty Sand				Roots, gravel

Notes:

.

Weeping likely from snow melt.

Parent Material (geologic) N/A Depth to Bedrock: None

Depth to Groundwater: 36” Weeping from Pit Face: 24”

Estimated Seasonal High Ground Water: _____

SOIL EVALUATOR FORM

Location Address or Lot No. 900 Worcester Street Wellesley, Ma

On-site Review

Deep Hole Number: TP-2 Date: 4-6-15 Time: 9:00 am Weather: Sunny 50 degrees

Location (Identify on site plan): See Map

Land Use: Parking Lot Slope (%): 0-5 Surface Stones: None

Vegetation: N/A

Landform: _____

Position on Landscape (sketch on the back): _____

Distances from:

Open Water Body: _____ feet Drainage way: _____ feet

Possible Wet Area: _____ feet Property Line: _____ feet

Drinking Water Well: _____ feet Other: _____

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-4	Pavement				
4-16	Fill				Base/Gravel
16-30	Fill				Gravel, stones, some debris
30-34	Buried Topsoil				Buried Topsoil
34-66	Silty Sand				Roots, Gravel

Notes:

.

Parent Material (geologic) N/A Depth to Bedrock: None

Depth to Groundwater: 42” Weeping from Pit Face: 24”

Estimated Seasonal High Ground Water: _____

SOIL EVALUATOR FORM

Location Address or Lot No. 900 Worcester Street Wellesley, Ma

On-site Review

Deep Hole Number: TP-3 Date: 4-6-15 Time: 9:00 am Weather: Sunny 50 degrees

Location (Identify on site plan): See Map

Land Use: Parking Lot Slope (%): 0-5 Surface Stones: None

Vegetation: N/A

Landform: _____

Position on Landscape (sketch on the back): _____

Distances from:

Open Water Body: _____ feet Drainage way: _____ feet

Possible Wet Area: _____ feet Property Line: _____ feet

Drinking Water Well: _____ feet Other: _____

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-4	Pavement				
4-16	Fill				Base/Gravel
16-36	Fill				Debris, Roots, Brick, and Mud
36-42	Topsoil Buried				Roots
42-66	Silty Sand				

Notes:

.

Parent Material (geologic) N/A Depth to Bedrock: None

Depth to Groundwater: 42" Weeping from Pit Face: 30"

Estimated Seasonal High Ground Water: _____

SOIL EVALUATOR FORM

Location Address or Lot No. 900 Worcester Street Wellesley, Ma

On-site Review

Deep Hole Number: TP-4 Date: 4-6-15 Time: 9:00 am Weather: Sunny 50 degrees

Location (Identify on site plan): See Map

Land Use: Parking Lot Slope (%): 0-5 Surface Stones: None

Vegetation: N/A

Landform: _____

Position on Landscape (sketch on the back): _____

Distances from:

Open Water Body: _____ feet Drainage way: _____ feet

Possible Wet Area: _____ feet Property Line: _____ feet

Drinking Water Well: _____ feet Other: _____

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-6	Pavement				Base/Gravel
6-12	Fill				Loamy Sand, some gravel
12-36	Fill				
36-40	Coarse Sand				
40-72	Loamy Sand				

Notes:

.

Parent Material (geologic) N/A Depth to Bedrock: None

Depth to Groundwater: 66" Weeping from Pit Face: N/A

Estimated Seasonal High Ground Water: 54"

SOIL EVALUATOR FORM

Location Address or Lot No. 900 Worcester Street Wellesley, Ma

On-site Review

Deep Hole Number: TP-5 Date: 4-6-15 Time: 9:00 am Weather: Sunny 50 degrees

Location (Identify on site plan): See Map

Land Use: Parking Lot Slope (%): 0-5 Surface Stones: None

Vegetation: N/A

Landform: _____

Position on Landscape (sketch on the back): _____

Distances from:

Open Water Body: _____ feet Drainage way: _____ feet

Possible Wet Area: _____ feet Property Line: _____ feet

Drinking Water Well: _____ feet Other: _____

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-3	Pavement				
3-14	Fill				Base/Gravel
14-24	Fill				Loamy Sand, gravel, brick, debris
24-36	Topsoil				Topsoil
30-72	Loamy Sand				Large Stones

Notes:

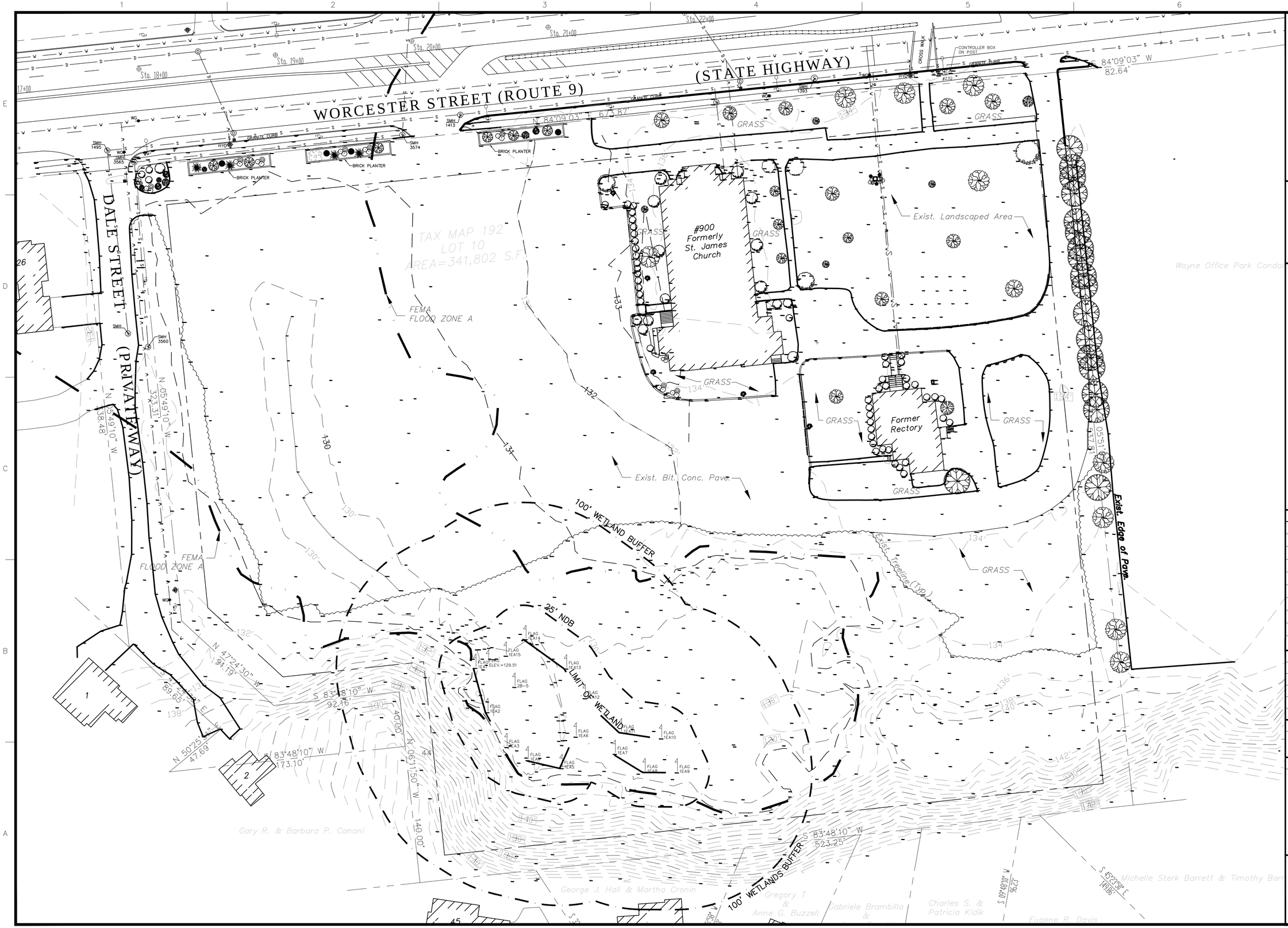
.

Parent Material (geologic) N/A Depth to Bedrock: None

Depth to Groundwater: 66” Weeping from Pit Face: N/A

Estimated Seasonal High Ground Water: 48”

ENCLOSURE 3



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PROJECT
900 WORCHESTER STREET
WELLESLEY, MA

OWNER
TOWN OF WELLESLEY

REVISIONS

NO.	DATE	DESCRIPTION

CADD FILE	
DESIGNED BY	PS
DRAWN BY	KMM
CHECKED BY	
DATE	
DRAWING SCALE	1"=30'-0"

GRAPHIC SCALE

SHEET TITLE

EXISTING CONDITIONS

DRAWING NO.
SK-2

PROJECT NO.

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ASSESSMENT AND PLANNING
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WELLESLEY, MA

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TOWN OF WELLESLEY

REVISIONS

NO.	DATE	DESCRIPTION

CADD FILE	
DESIGNED BY	PS
DRAWN BY	KMM
CHECKED BY	
DATE	9-24-10
DRAWING SCALE	1"=30'-0"

GRAPHIC SCALE

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SHEET TITLE

EXISTING CONDITIONS

DRAWING NO.

SK-1

PROJECT NO.

F:\P01346-900 WORCESTER ST\dwg\Civil\OPTION-1.dwg

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NO.	DATE	DESCRIPTION

CADD FILE	
DESIGNED BY	
DRAWN BY	WAH
CHECKED BY	
DATE	
DRAWING SCALE	1"=30'-0"

GRAPHIC SCALE

0 30' 60'

SHEET TITLE

PROPOSED LAYOUT

DRAWING NO

OPT.1

PROJECT NO.

F:\P01346-900 WORCESTER ST\dwg\Civil\OPTION-2a.dwg

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CADD FILE	
DESIGNED BY	
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CHECKED BY	
DATE	
DRAWING SCALE	1"=30'-0"

GRAPHIC SCALE
0 30' 60'

SHEET TITLE
PROPOSED LAYOUT

DRAWING NO.
OPT.2c

PROJECT NO.

F:\P01346-900 WORCESTER ST\dwg\Civil\OPTION-1.dwg

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DATE	
DRAWING SCALE	1"=30'-0"

GRAPHIC SCALE

0 30' 60'

SHEET TITLE

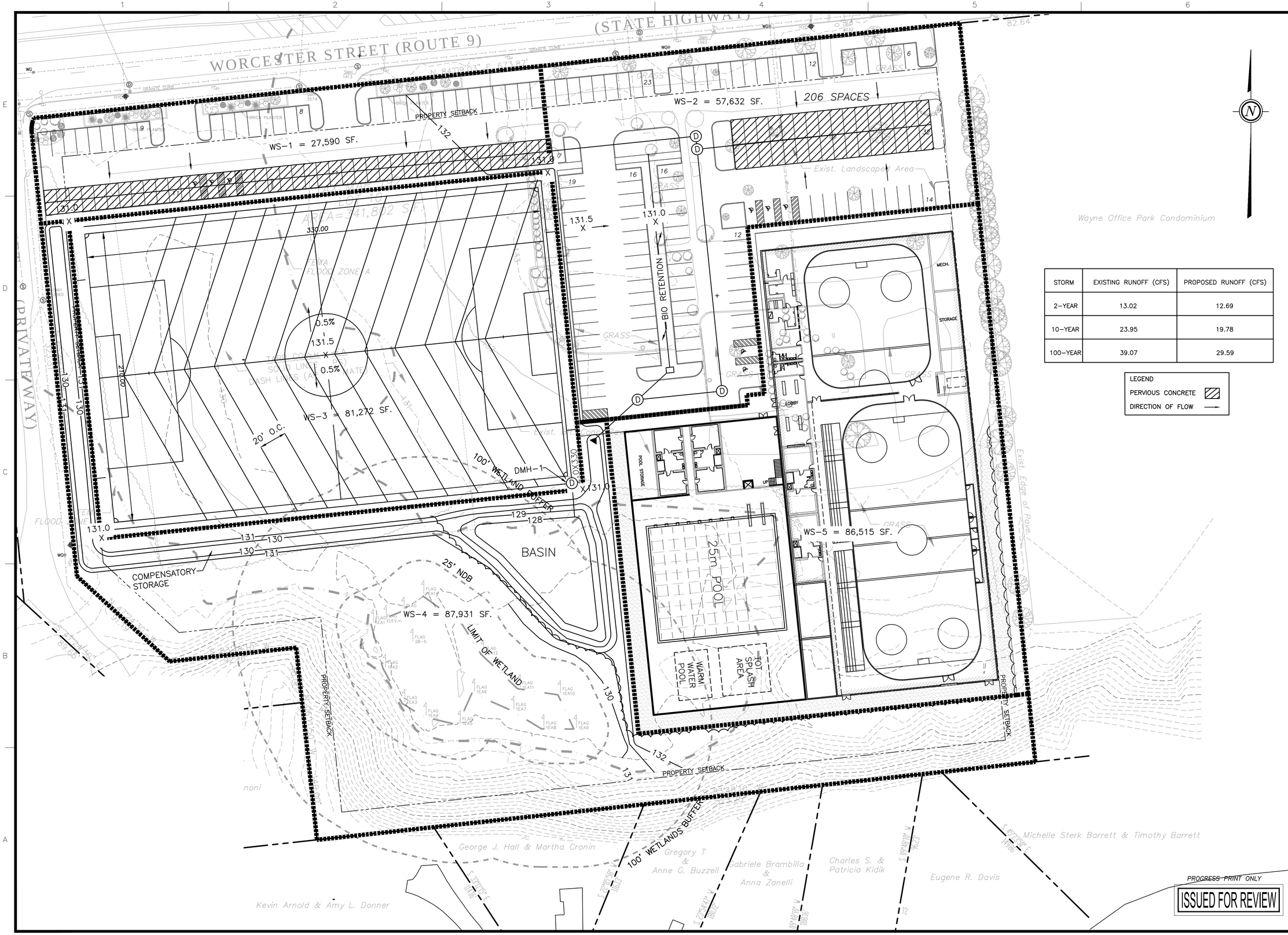
PROPOSED LAYOUT

DRAWING NO

OPT.3

PROJECT NO

ENCLOSURE 4



STORM	EXISTING RUNOFF (CFS)	PROPOSED RUNOFF (CFS)
2-YEAR	13.02	12.69
10-YEAR	23.95	19.78
100-YEAR	39.07	29.59

LEGEND
PERVIOUS CONCRETE
DIRECTION OF FLOW

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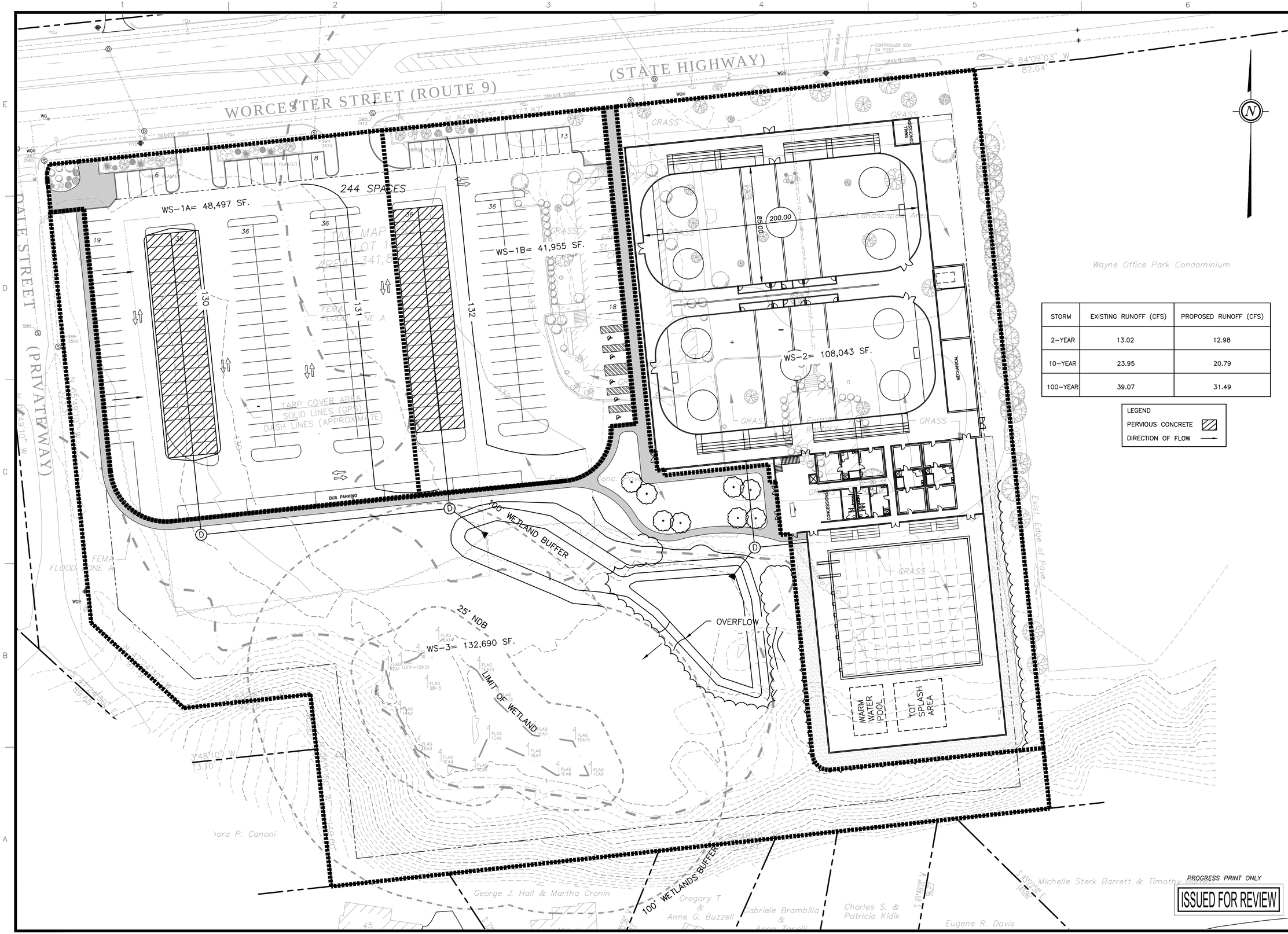
CADD FILE	
DESIGNED BY	
DRAWN BY	WAH
CHECKED BY	
DATE	
DRAWING SCALE	1"=30'-0"

GRAPHIC SCALE
0 30' 60'

SHEET TITLE
PROPOSED LAYOUT

DRAWING NO.
OPT.1

PROJECT NO.



STORM	EXISTING RUNOFF (CFS)	PROPOSED RUNOFF (CFS)
2–YEAR	13.02	12.98
10–YEAR	23.95	20.79
100–YEAR	39.07	31.49

LEGEND

PERVIOUS CONCRETE

DIRECTION OF FLOW

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CHECKED BY	
DATE	
DRAWING SCALE	1"=30'–0"

GRAPHIC SCALE

0 30' 60'

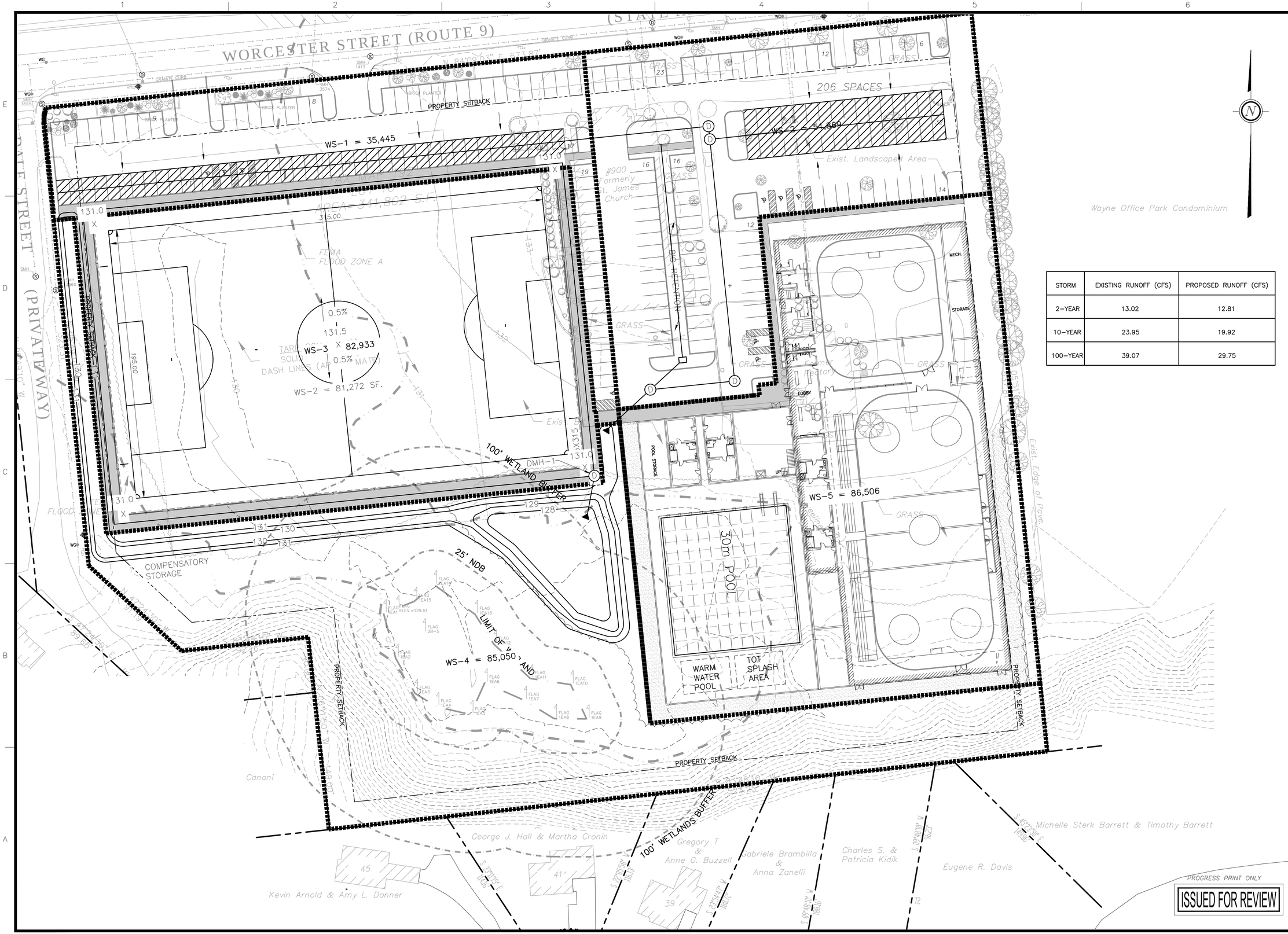
SHEET TITLE

PROPOSED LAYOUT

DRAWING NO.

OPT.2

PROJECT NO.



STORM	EXISTING RUNOFF (CFS)	PROPOSED RUNOFF (CFS)
2-YEAR	13.02	12.81
10-YEAR	23.95	19.92
100-YEAR	39.07	29.75

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REVISIONS

NO.	DATE	DESCRIPTION

CADD FILE	
DESIGNED BY	
DRAWN BY	WAH
CHECKED BY	
DATE	
DRAWING SCALE	1"=30'-0"

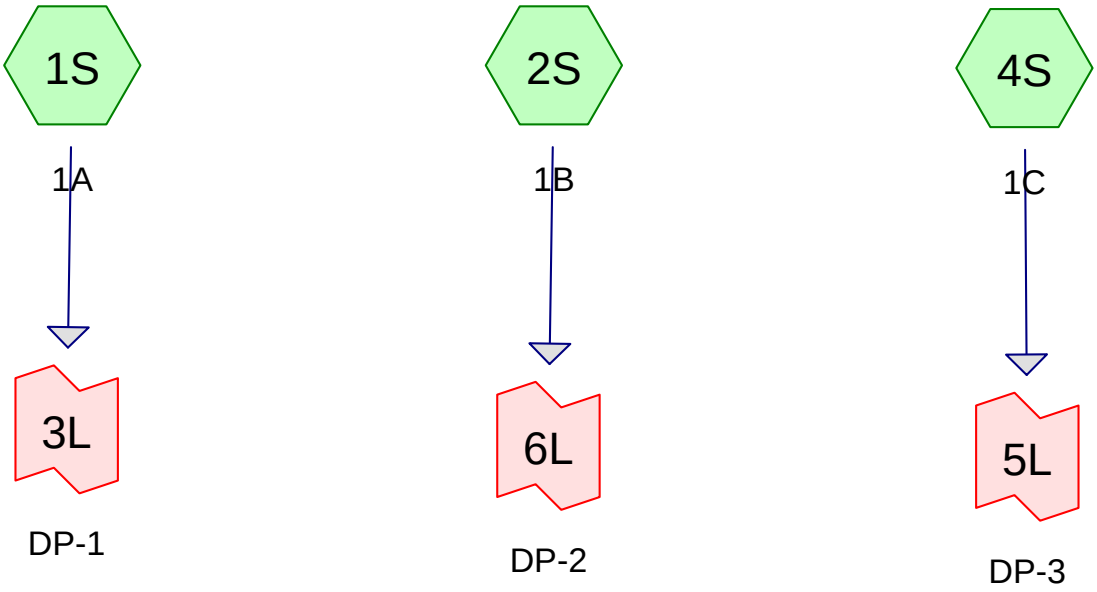
GRAPHIC SCALE
0 30' 60'

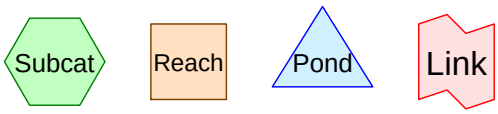
SHEET TITLE
PROPOSED LAYOUT

DRAWING NO.
OPT.3

PROJECT NO.

ENCLOSURE 5





Drainage Diagram for Pre-Development
Prepared by Hewlett-Packard Company, Printed 7/7/2015
HydroCAD® 9.10 s/n 00742 © 2010 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.837	65	Woods/grass comb., Fair, HSG B (1S, 4S)
1.007	69	50-75% Grass cover, Fair, HSG B (1S, 2S, 4S)
3.738	98	Paved parking, HSG B (1S, 2S, 4S)
7.581	82	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
7.581	HSG B	1S, 2S, 4S
0.000	HSG C	
0.000	HSG D	
0.000	Other	
7.581		**TOTAL AREA**

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: 1A Runoff Area=261,430 sf 50.87% Impervious Runoff Depth>4.36"
Flow Length=520' Tc=6.4 min CN=82 Runoff=31.19 cfs 2.181 af

Subcatchment 2S: 1B Runoff Area=18,106 sf 37.70% Impervious Runoff Depth>4.15"
Flow Length=65' Tc=5.2 min CN=80 Runoff=2.13 cfs 0.144 af

Subcatchment 4S: 1C Runoff Area=50,711 sf 45.33% Impervious Runoff Depth>4.25"
Flow Length=305' Tc=7.1 min CN=81 Runoff=5.81 cfs 0.413 af

Link 3L: DP-1 Inflow=31.19 cfs 2.181 af
Primary=31.19 cfs 2.181 af

Link 5L: DP-3 Inflow=5.81 cfs 0.413 af
Primary=5.81 cfs 0.413 af

Link 6L: DP-2 Inflow=2.13 cfs 0.144 af
Primary=2.13 cfs 0.144 af

Total Runoff Area = 7.581 ac Runoff Volume = 2.738 af Average Runoff Depth = 4.33"
50.70% Pervious = 3.844 ac 49.30% Impervious = 3.738 ac

Summary for Subcatchment 1S: 1A

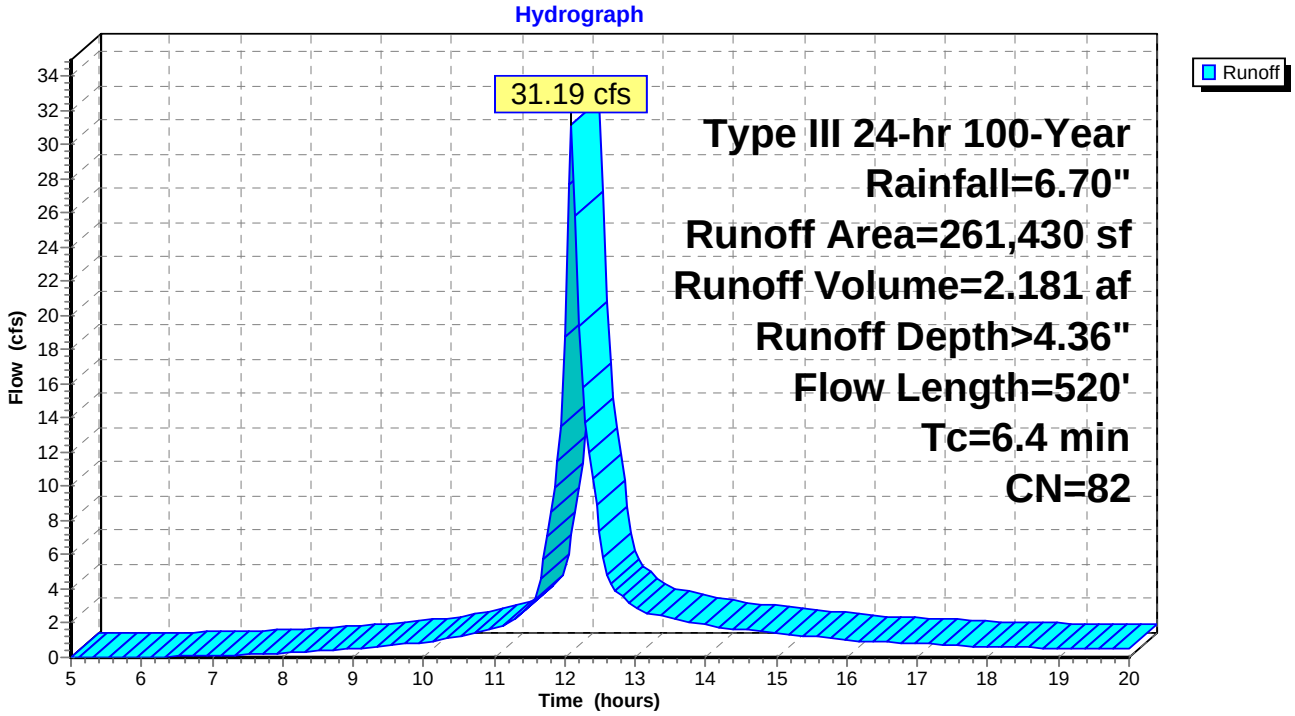
Runoff = 31.19 cfs @ 12.09 hrs, Volume= 2.181 af, Depth> 4.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
16,215	69	50-75% Grass cover, Fair, HSG B
112,215	65	Woods/grass comb., Fair, HSG B
133,000	98	Paved parking, HSG B
261,430	82	Weighted Average
128,430		49.13% Pervious Area
133,000		50.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0100	0.91		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.20"
5.5	470	0.0050	1.44		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
6.4	520	Total			

Subcatchment 1S: 1A



Summary for Subcatchment 2S: 1B

[49] Hint: Tc<2dt may require smaller dt

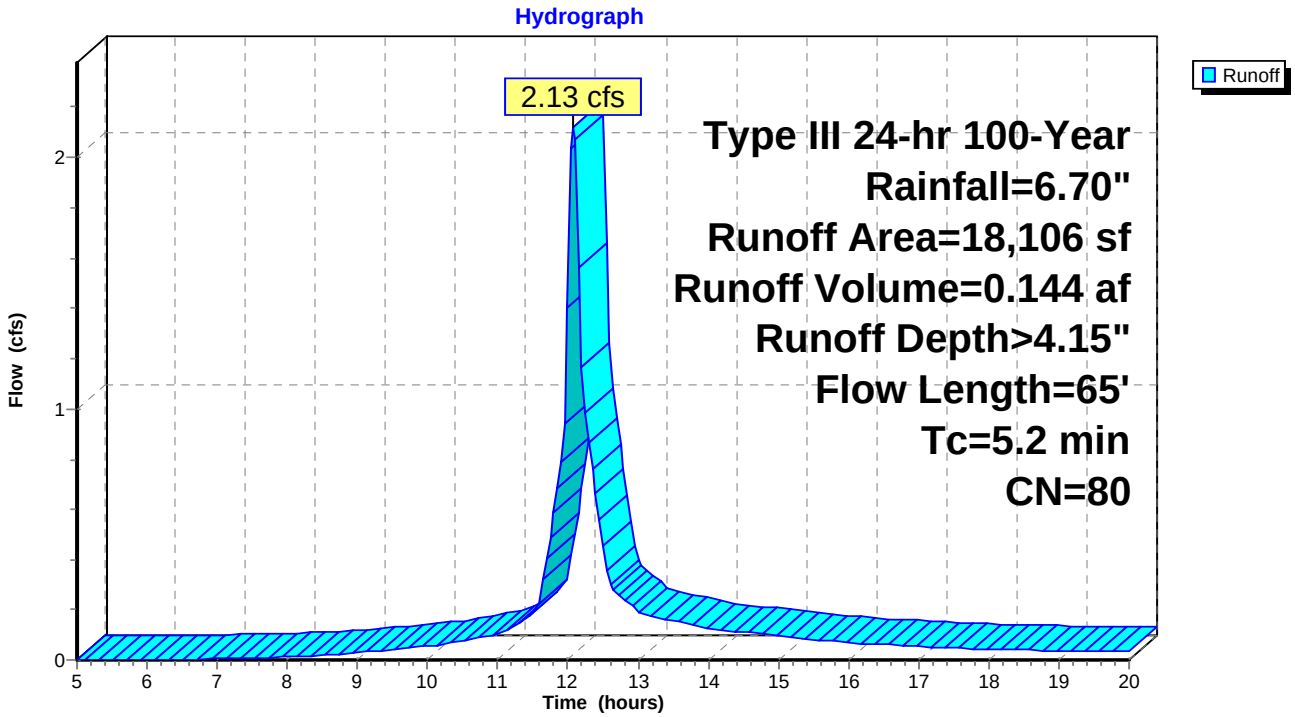
Runoff = 2.13 cfs @ 12.08 hrs, Volume= 0.144 af, Depth> 4.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
11,280	69	50-75% Grass cover, Fair, HSG B
6,826	98	Paved parking, HSG B
18,106	80	Weighted Average
11,280		62.30% Pervious Area
6,826		37.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	50	0.0270	0.17		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
0.2	15	0.0330	1.27		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
5.2	65	Total			

Subcatchment 2S: 1B



Summary for Subcatchment 4S: 1C

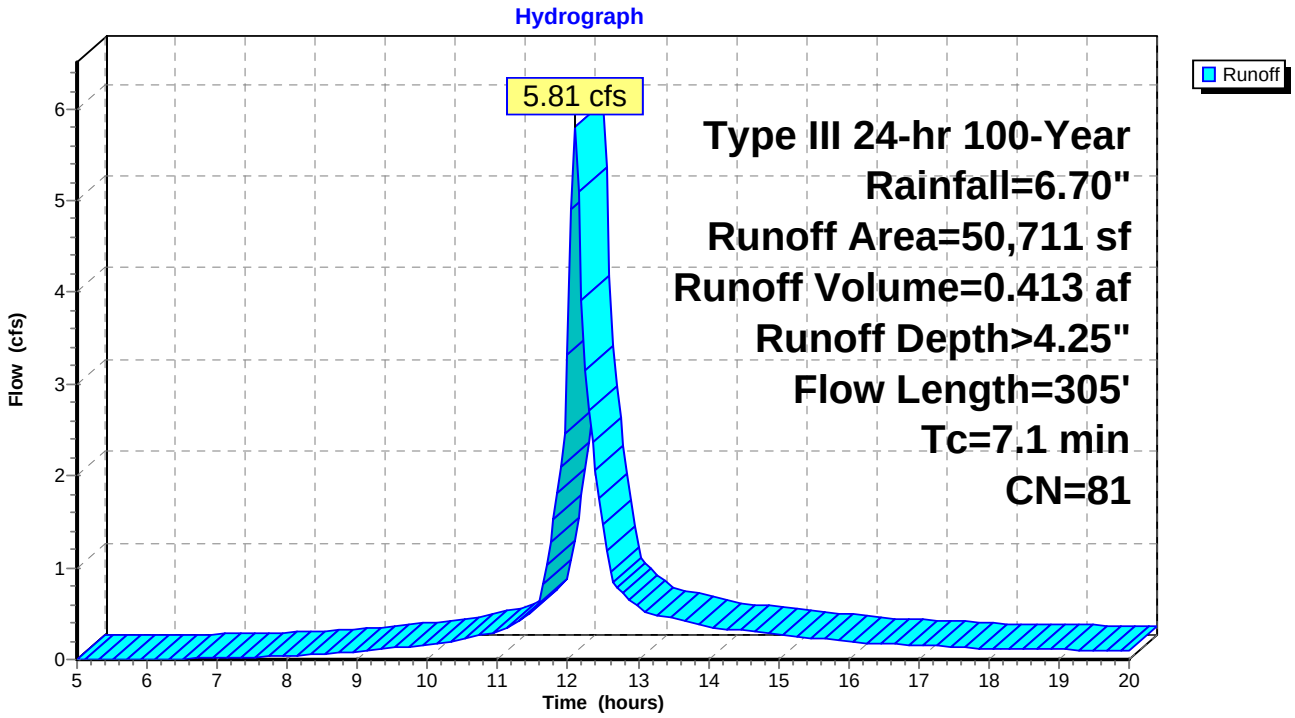
Runoff = 5.81 cfs @ 12.10 hrs, Volume= 0.413 af, Depth> 4.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
16,372	69	50-75% Grass cover, Fair, HSG B
11,350	65	Woods/grass comb., Fair, HSG B
22,989	98	Paved parking, HSG B
50,711	81	Weighted Average
27,722		54.67% Pervious Area
22,989		45.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0460	1.67		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.20"
2.9	55	0.0020	0.31		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
3.7	200	0.0020	0.91		**Shallow Concentrated Flow, C-D** Paved Kv= 20.3 fps
7.1	305	Total			

Subcatchment 4S: 1C

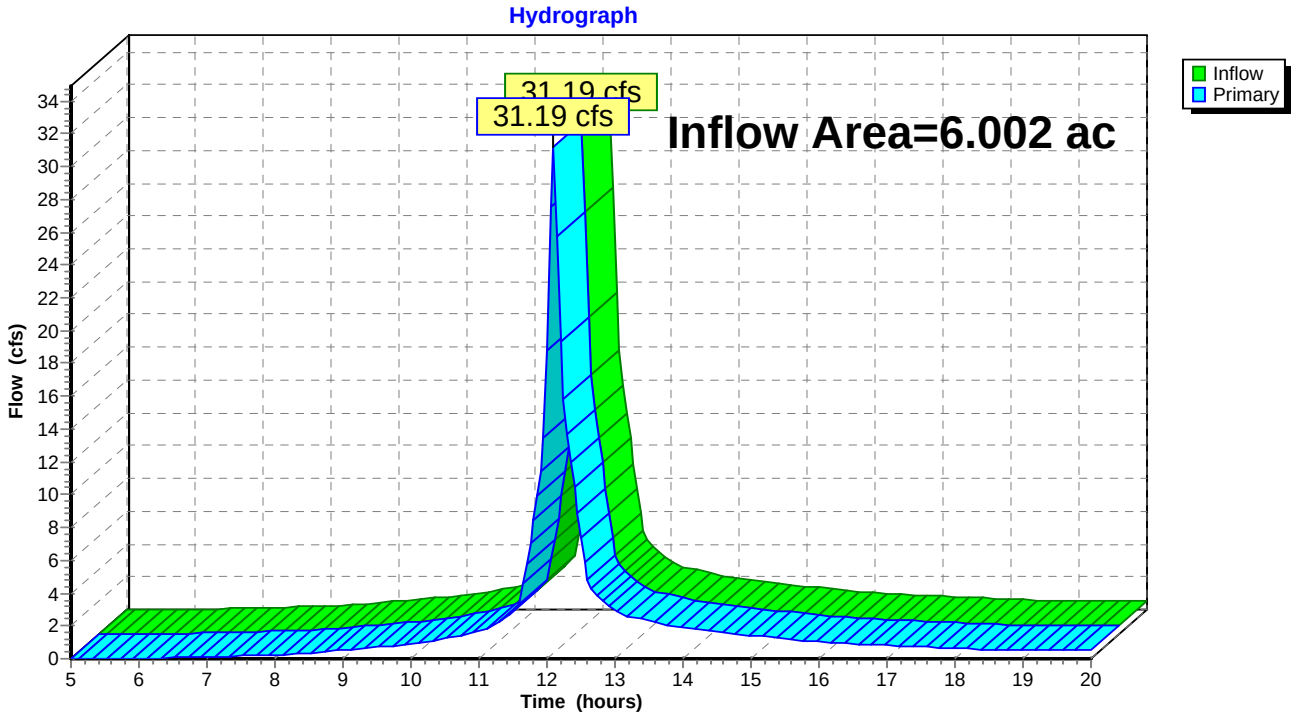


Summary for Link 3L: DP-1

Inflow Area = 6.002 ac, 50.87% Impervious, Inflow Depth > 4.36" for 100-Year event
Inflow = 31.19 cfs @ 12.09 hrs, Volume= 2.181 af
Primary = 31.19 cfs @ 12.09 hrs, Volume= 2.181 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 3L: DP-1

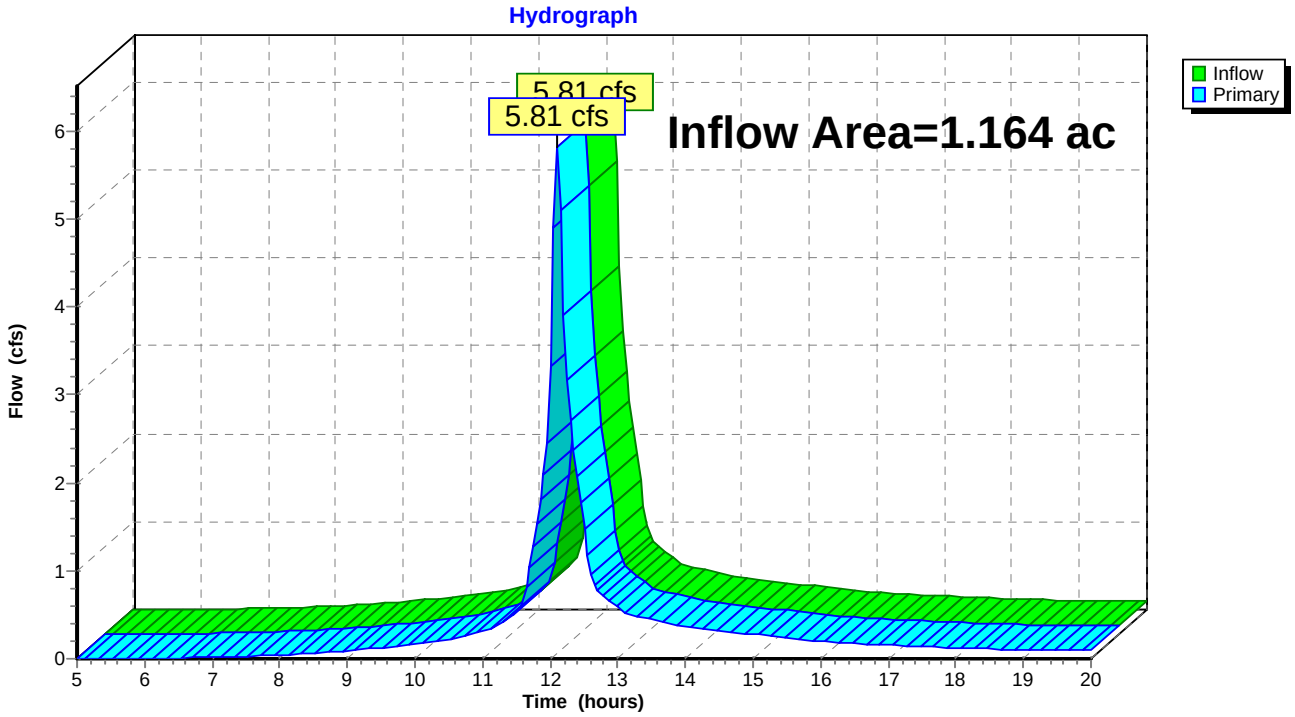


Summary for Link 5L: DP-3

Inflow Area = 1.164 ac, 45.33% Impervious, Inflow Depth > 4.25" for 100-Year event
Inflow = 5.81 cfs @ 12.10 hrs, Volume= 0.413 af
Primary = 5.81 cfs @ 12.10 hrs, Volume= 0.413 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 5L: DP-3

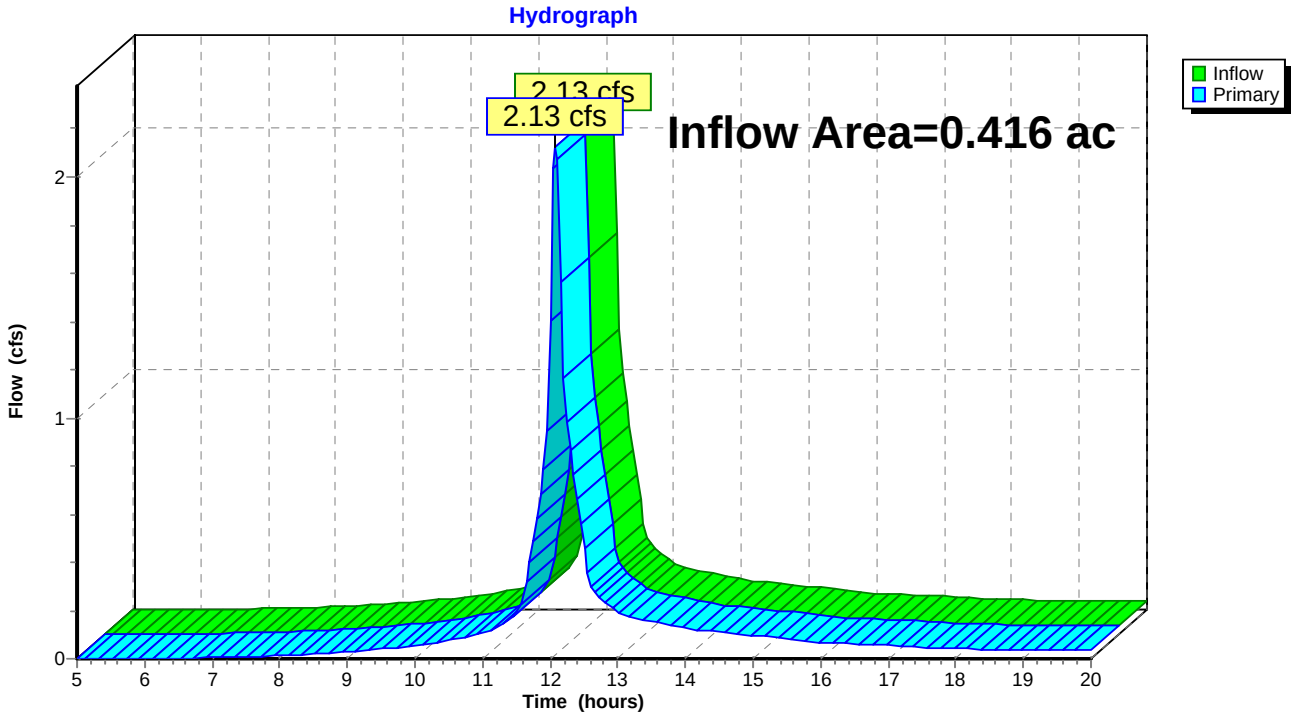


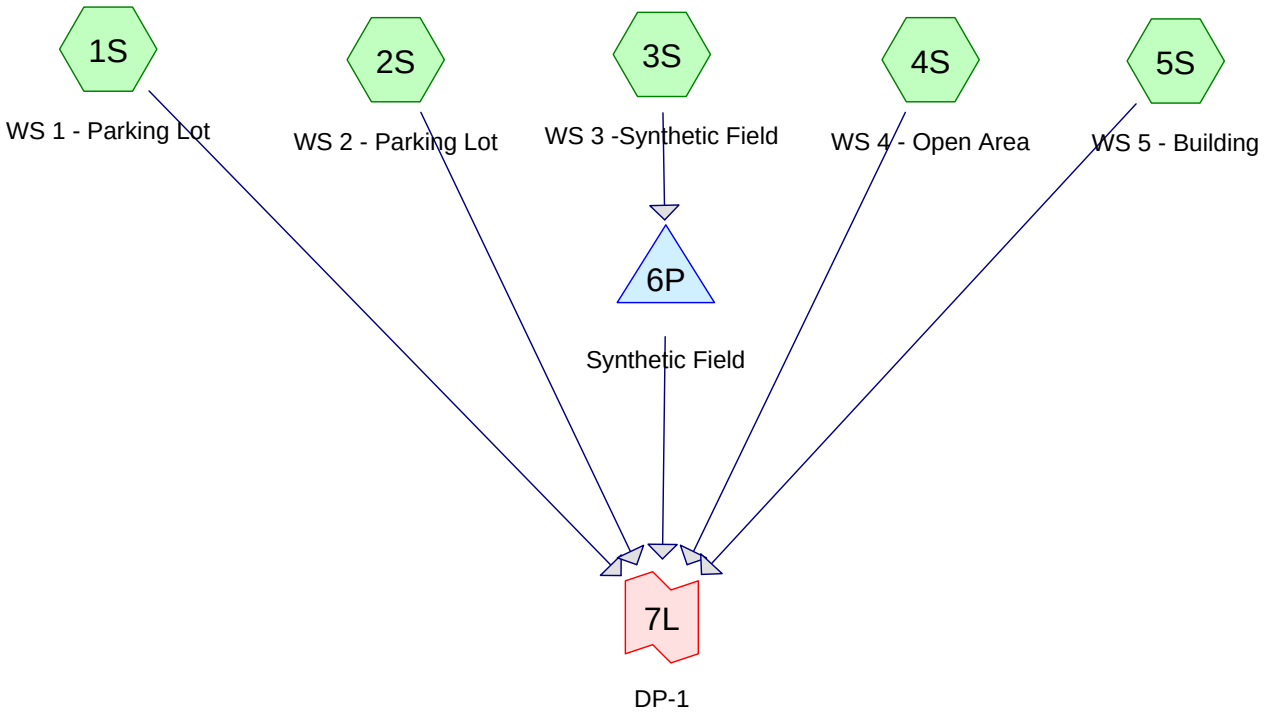
Summary for Link 6L: DP-2

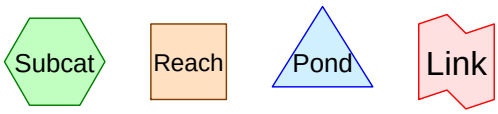
Inflow Area = 0.416 ac, 37.70% Impervious, Inflow Depth > 4.15" for 100-Year event
Inflow = 2.13 cfs @ 12.08 hrs, Volume= 0.144 af
Primary = 2.13 cfs @ 12.08 hrs, Volume= 0.144 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 6L: DP-2







Drainage Diagram for Post-Development_Option 1
Prepared by Hewlett-Packard Company, Printed 7/7/2015
HydroCAD® 9.10 s/n 00742 © 2010 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.866	61	>75% Grass cover, Good, HSG B (3S)
2.019	69	50-75% Grass cover, Fair, HSG B (4S)
1.956	98	Paved parking, HSG B (1S, 2S)
1.986	98	Unconnected roofs, HSG B (5S)
7.827	82	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
7.827	HSG B	1S, 2S, 3S, 4S, 5S
0.000	HSG C	
0.000	HSG D	
0.000	Other	
7.827		**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Fill (inches)
1	6P	128.20	128.00	20.0	0.0100	0.013	12.0	0.0	0.0

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: WS 1 - Parking Lot Runoff Area=27,590 sf 100.00% Impervious Runoff Depth>5.97"
Tc=6.0 min CN=98 Runoff=4.06 cfs 0.315 af

Subcatchment 2S: WS 2 - Parking Lot Runoff Area=57,632 sf 100.00% Impervious Runoff Depth>5.97"
Tc=6.0 min CN=98 Runoff=8.49 cfs 0.658 af

Subcatchment 3S: WS 3 -Synthetic Field Runoff Area=81,272 sf 0.00% Impervious Runoff Depth>2.28"
Tc=6.0 min CN=61 Runoff=5.19 cfs 0.355 af

Subcatchment 4S: WS 4 - Open Area Runoff Area=87,931 sf 0.00% Impervious Runoff Depth>3.02"
Flow Length=450' Tc=13.9 min CN=69 Runoff=5.96 cfs 0.509 af

Subcatchment 5S: WS 5 - Building Runoff Area=86,515 sf 100.00% Impervious Runoff Depth>5.97"
Tc=6.0 min CN=98 Runoff=12.74 cfs 0.987 af

Pond 6P: Synthetic Field Peak Elev=130.64' Storage=0.355 af Inflow=5.19 cfs 0.355 af
Outflow=0.00 cfs 0.000 af

Link 7L: DP-1 Inflow=29.59 cfs 2.469 af
Primary=29.59 cfs 2.469 af

Total Runoff Area = 7.827 ac Runoff Volume = 2.823 af Average Runoff Depth = 4.33"
49.63% Pervious = 3.884 ac 50.37% Impervious = 3.943 ac

Summary for Subcatchment 1S: WS 1 - Parking Lot

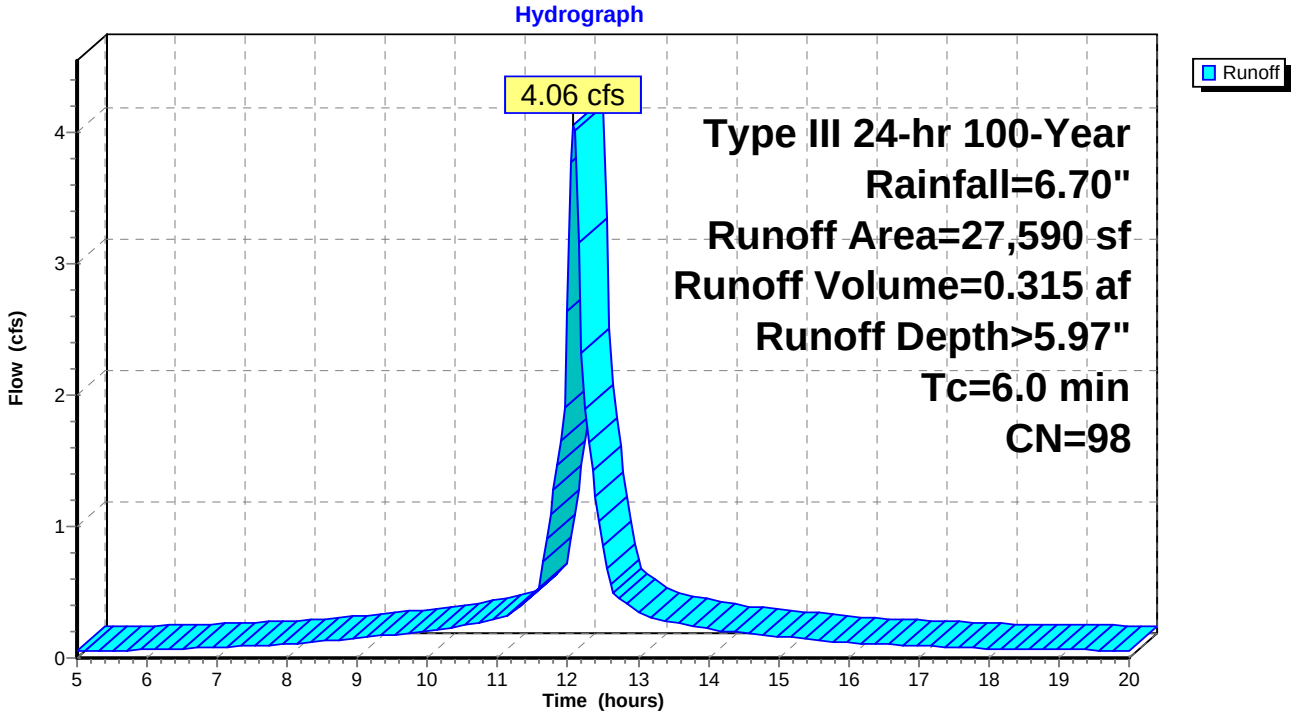
Runoff = 4.06 cfs @ 12.09 hrs, Volume= 0.315 af, Depth> 5.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
27,590	98	Paved parking, HSG B
27,590		100.00% Impervious Area

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

Subcatchment 1S: WS 1 - Parking Lot



Summary for Subcatchment 2S: WS 2 - Parking Lot

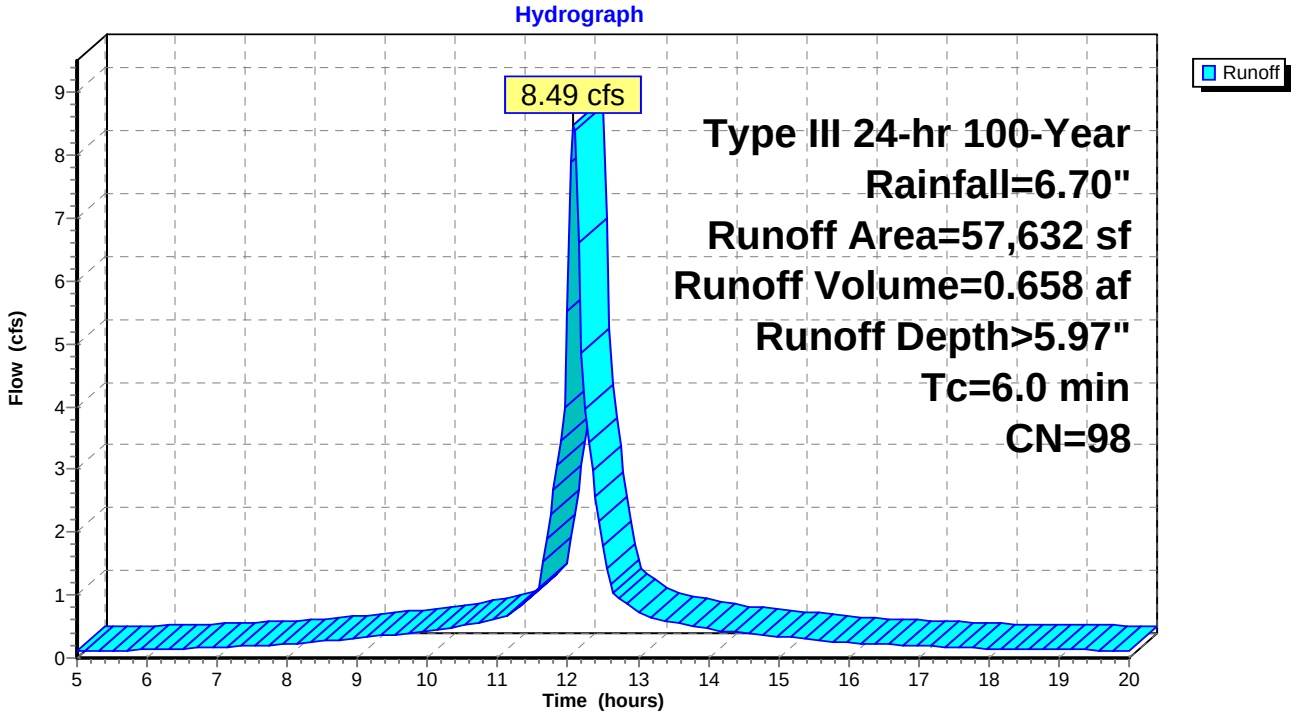
Runoff = 8.49 cfs @ 12.09 hrs, Volume= 0.658 af, Depth> 5.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
57,632	98	Paved parking, HSG B
57,632		100.00% Impervious Area

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

Subcatchment 2S: WS 2 - Parking Lot



Summary for Subcatchment 3S: WS 3 -Synthetic Field

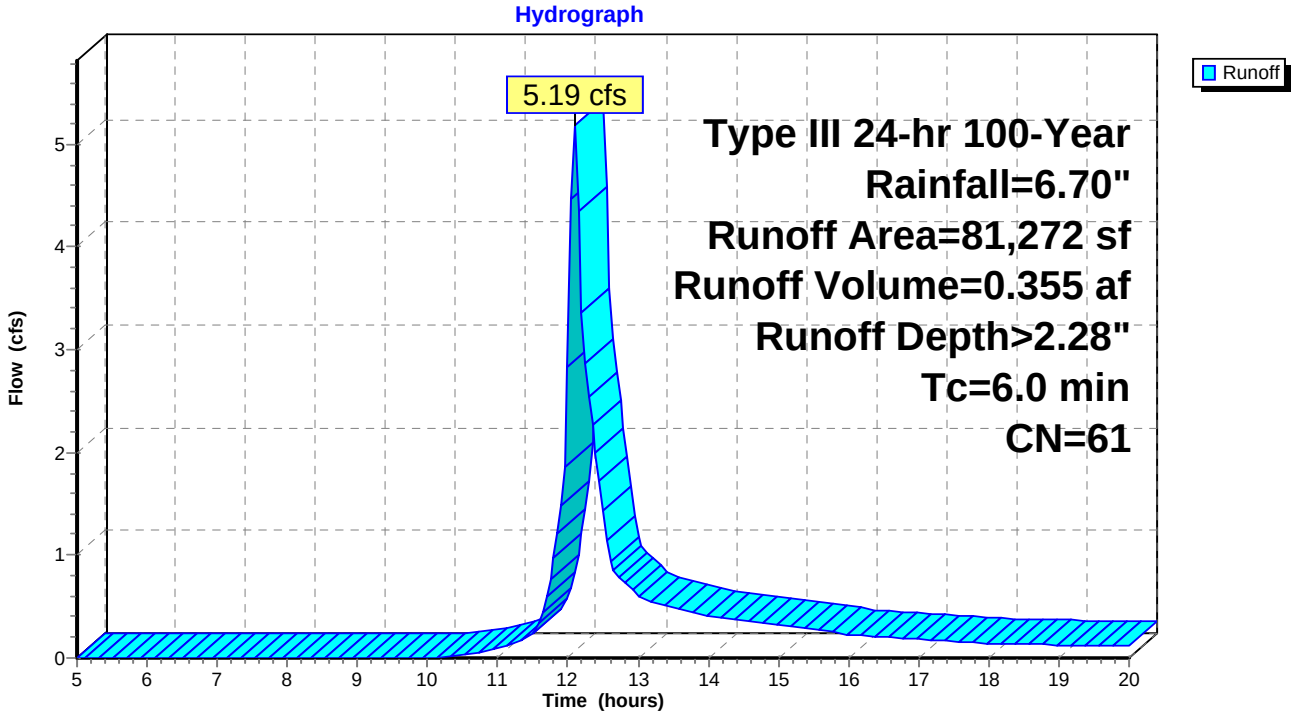
Runoff = 5.19 cfs @ 12.10 hrs, Volume= 0.355 af, Depth> 2.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
81,272	61	>75% Grass cover, Good, HSG B
81,272		100.00% Pervious Area

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

Subcatchment 3S: WS 3 -Synthetic Field



Summary for Subcatchment 4S: WS 4 - Open Area

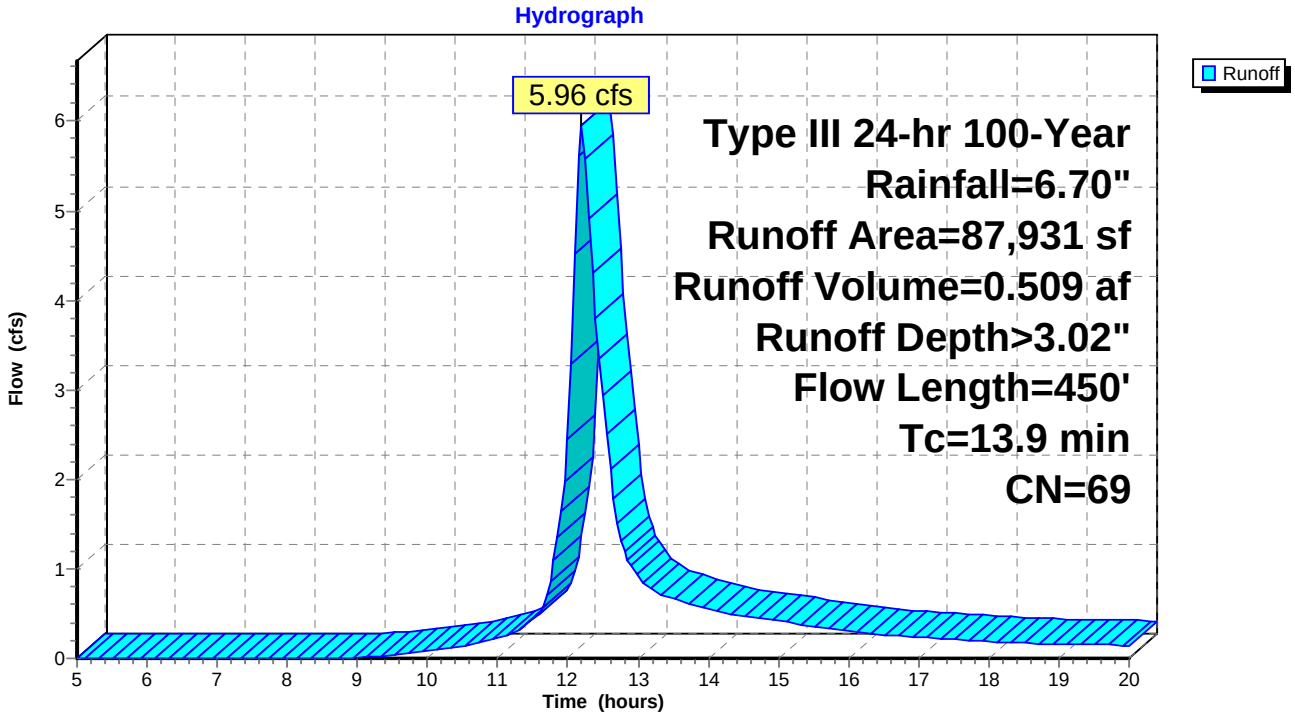
Runoff = 5.96 cfs @ 12.20 hrs, Volume= 0.509 af, Depth> 3.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
87,931	69	50-75% Grass cover, Fair, HSG B
87,931		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0100	0.11		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
6.5	400	0.0040	1.02		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
13.9	450	Total			

Subcatchment 4S: WS 4 - Open Area



Summary for Subcatchment 5S: WS 5 - Building

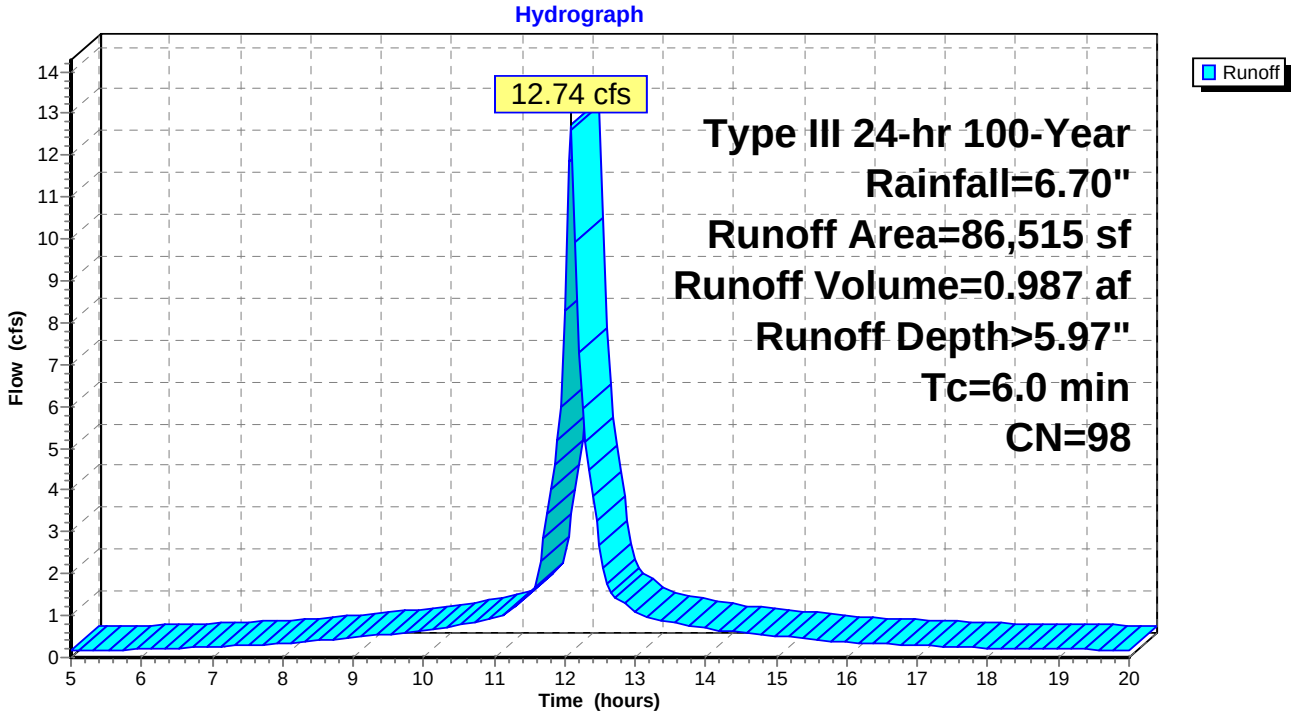
Runoff = 12.74 cfs @ 12.09 hrs, Volume= 0.987 af, Depth> 5.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
86,515	98	Unconnected roofs, HSG B
86,515		100.00% Impervious Area
86,515		100.00% Unconnected

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

Subcatchment 5S: WS 5 - Building



Summary for Pond 6P: Synthetic Field

Inflow Area = 1.866 ac, 0.00% Impervious, Inflow Depth > 2.28" for 100-Year event
Inflow = 5.19 cfs @ 12.10 hrs, Volume= 0.355 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 130.64' @ 20.00 hrs Surf.Area= 1.848 ac Storage= 0.355 af

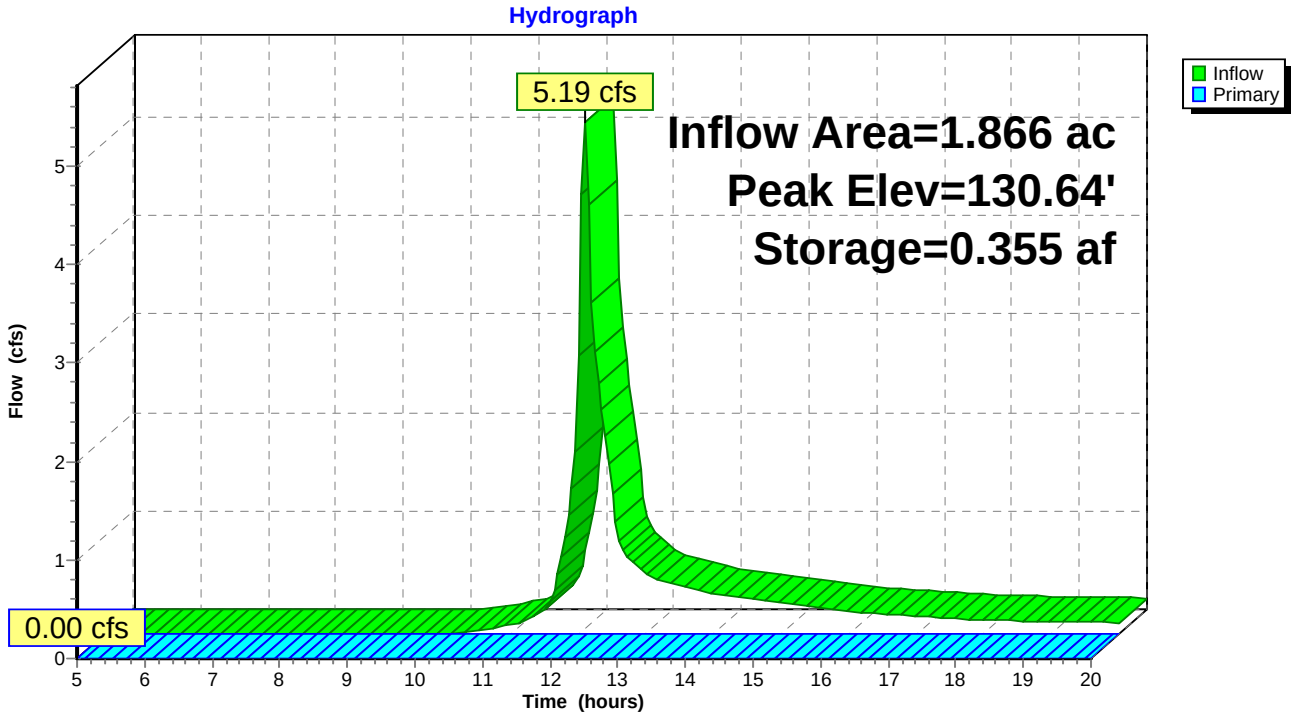
Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	130.00'	0.554 af	**230.00'W x 350.00'L x 1.00'H Prismatoid** 1.848 af Overall x 30.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	128.20'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 128.20' / 128.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior
#2	Device 1	130.80'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 2	128.20'	**2.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=130.00' (Free Discharge)
└─**1=Culvert** (Passes 0.00 cfs of 3.40 cfs potential flow)
  └─**2=Orifice/Grate** (Controls 0.00 cfs)
    └─**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 6P: Synthetic Field

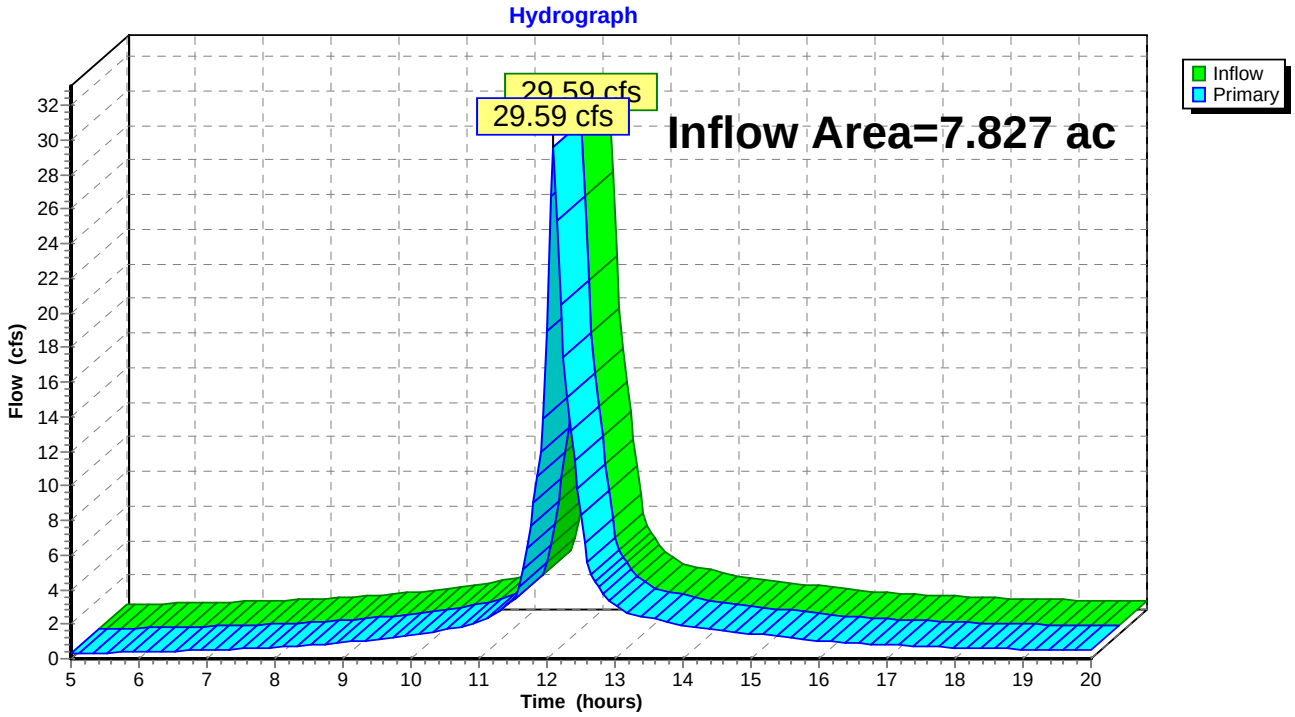


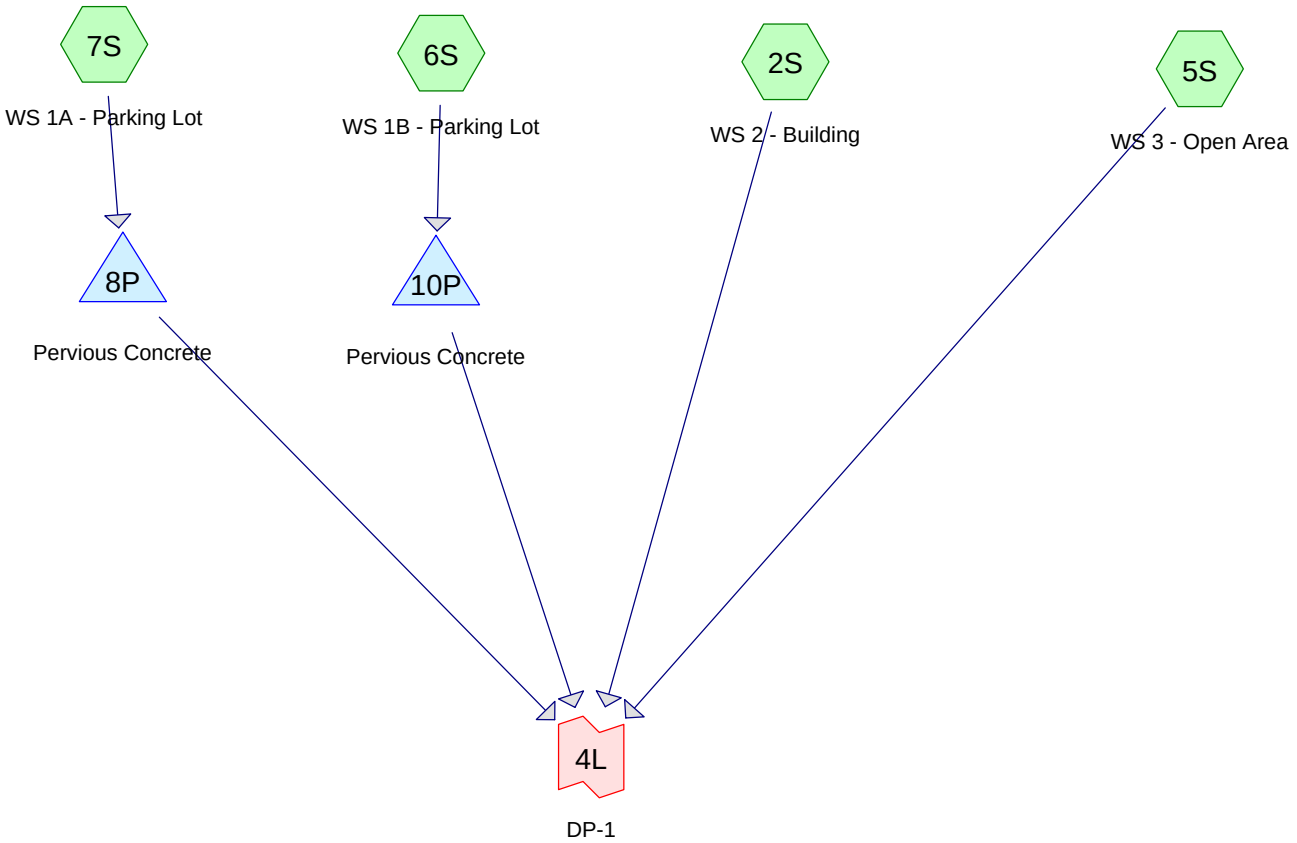
Summary for Link 7L: DP-1

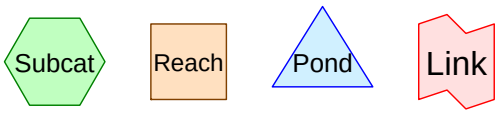
Inflow Area = 7.827 ac, 50.37% Impervious, Inflow Depth > 3.78" for 100-Year event
Inflow = 29.59 cfs @ 12.09 hrs, Volume= 2.469 af
Primary = 29.59 cfs @ 12.09 hrs, Volume= 2.469 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 7L: DP-1







Drainage Diagram for Post-Development_Option 2
Prepared by Hewlett-Packard Company, Printed 7/7/2015
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.868	69	50-75% Grass cover, Fair, HSG B (5S)
2.276	98	Paved parking, HSG B (5S, 6S, 7S)
2.480	98	Unconnected roofs, HSG B (2S)
7.624	87	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
7.624	HSG B	2S, 5S, 6S, 7S
0.000	HSG C	
0.000	HSG D	
0.000	Other	
7.624		**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Fill (inches)
1	8P	128.17	127.97	20.0	0.0100	0.013	12.0	0.0	0.0
2	10P	128.50	128.30	20.0	0.0100	0.013	12.0	0.0	0.0

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 2S: WS 2 - Building Runoff Area=108,043 sf 100.00% Impervious Runoff Depth>6.46"
Tc=0.0 min CN=98 Runoff=18.65 cfs 1.335 af

Subcatchment 5S: WS 3 - Open Area Runoff Area=133,612 sf 6.49% Impervious Runoff Depth>3.47"
Tc=6.0 min CN=71 Runoff=12.24 cfs 0.887 af

Subcatchment 6S: WS 1B - Parking Lot Runoff Area=41,955 sf 100.00% Impervious Runoff Depth>6.46"
Tc=6.0 min CN=98 Runoff=6.18 cfs 0.518 af

Subcatchment 7S: WS 1A - Parking Lot Runoff Area=48,497 sf 100.00% Impervious Runoff Depth>6.46"
Tc=6.0 min CN=98 Runoff=7.14 cfs 0.599 af

Pond 8P: Pervious Concrete Peak Elev=130.26' Storage=4,125 cf Inflow=7.14 cfs 0.599 af
12.0" Round Culvert n=0.013 L=20.0' S=0.0100 '/' Outflow=3.76 cfs 0.593 af

Pond 10P: Pervious Concrete Peak Elev=130.42' Storage=2,203 cf Inflow=6.18 cfs 0.518 af
12.0" Round Culvert n=0.013 L=20.0' S=0.0100 '/' Outflow=3.56 cfs 0.518 af

Link 4L: DP-1 Inflow=31.49 cfs 3.333 af
Primary=31.49 cfs 3.333 af

Total Runoff Area = 7.624 ac Runoff Volume = 3.340 af Average Runoff Depth = 5.26"
37.62% Pervious = 2.868 ac 62.38% Impervious = 4.756 ac

Summary for Subcatchment 2S: WS 2 - Building

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

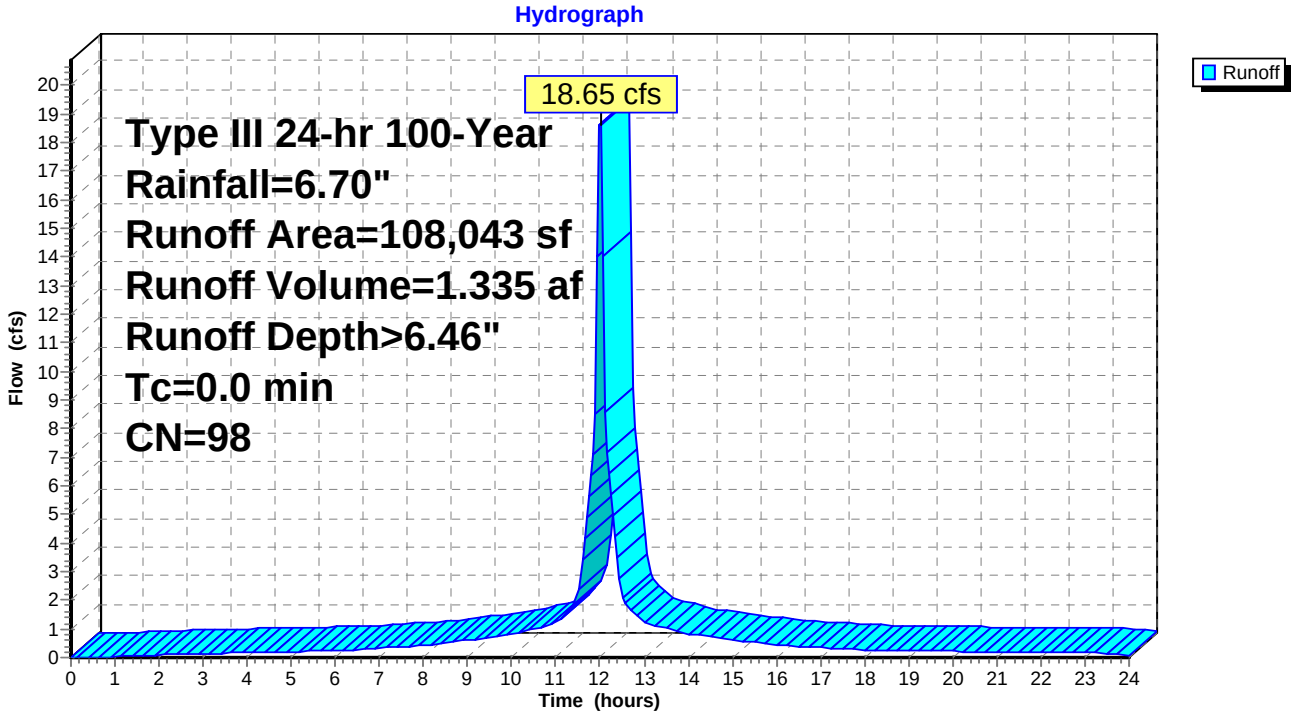
Runoff = 18.65 cfs @ 12.00 hrs, Volume= 1.335 af, Depth> 6.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
108,043	98	Unconnected roofs, HSG B
108,043		100.00% Impervious Area
108,043		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, 6**

Subcatchment 2S: WS 2 - Building



Summary for Subcatchment 5S: WS 3 - Open Area

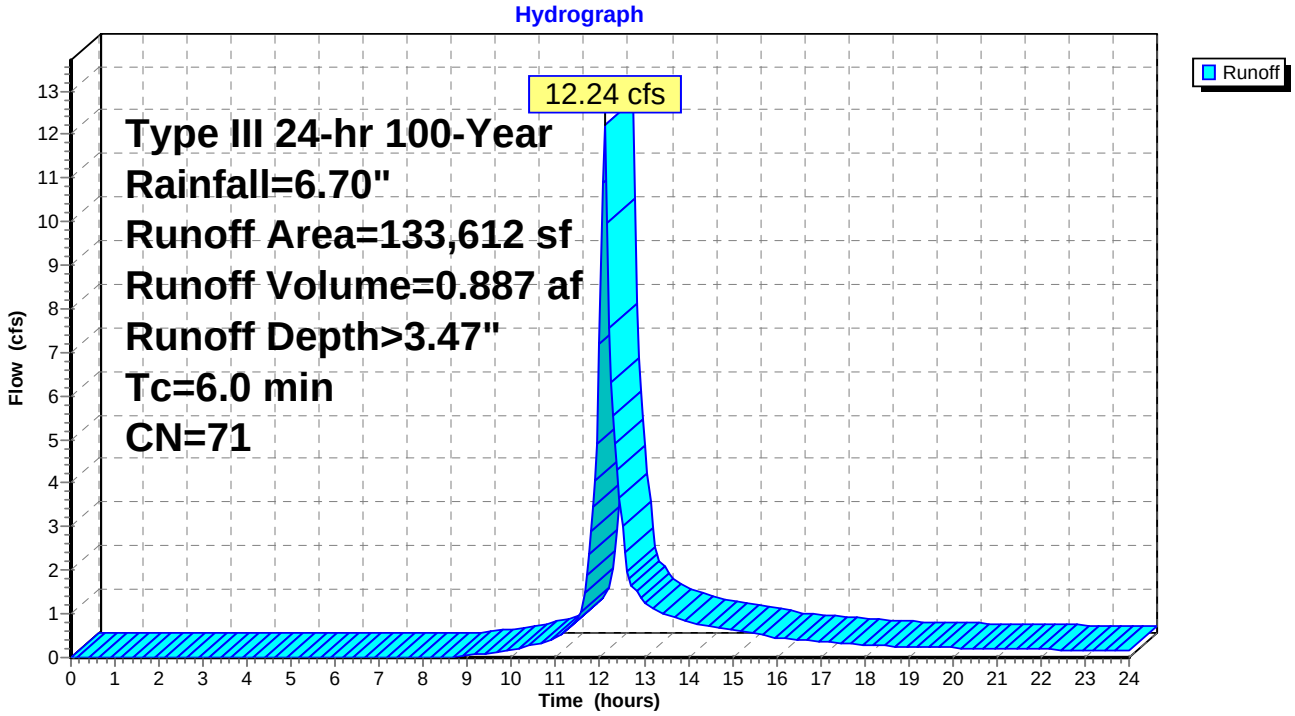
Runoff = 12.24 cfs @ 12.09 hrs, Volume= 0.887 af, Depth> 3.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
8,676	98	Paved parking, HSG B
124,936	69	50-75% Grass cover, Fair, HSG B
133,612	71	Weighted Average
124,936		93.51% Pervious Area
8,676		6.49% Impervious Area

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

Subcatchment 5S: WS 3 - Open Area



Summary for Subcatchment 6S: WS 1B - Parking Lot

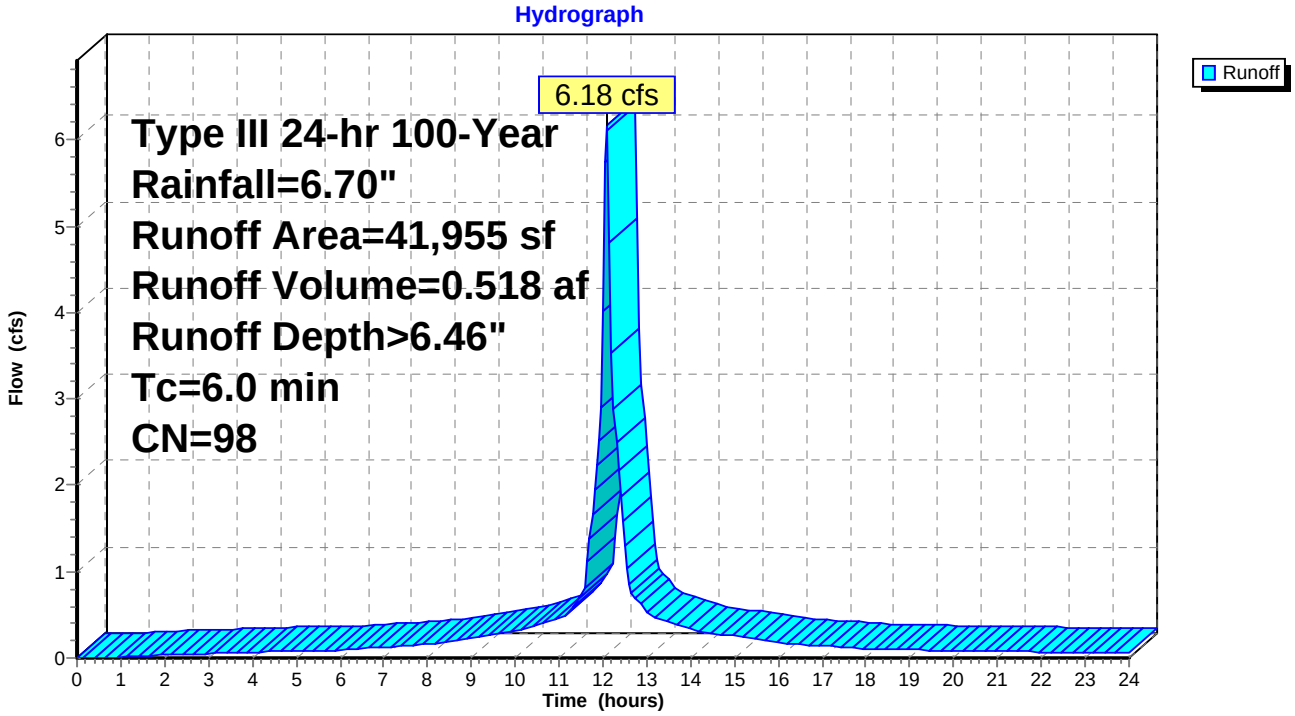
Runoff = 6.18 cfs @ 12.09 hrs, Volume= 0.518 af, Depth> 6.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
41,955	98	Paved parking, HSG B
41,955		100.00% Impervious Area

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

Subcatchment 6S: WS 1B - Parking Lot



Summary for Subcatchment 7S: WS 1A - Parking Lot

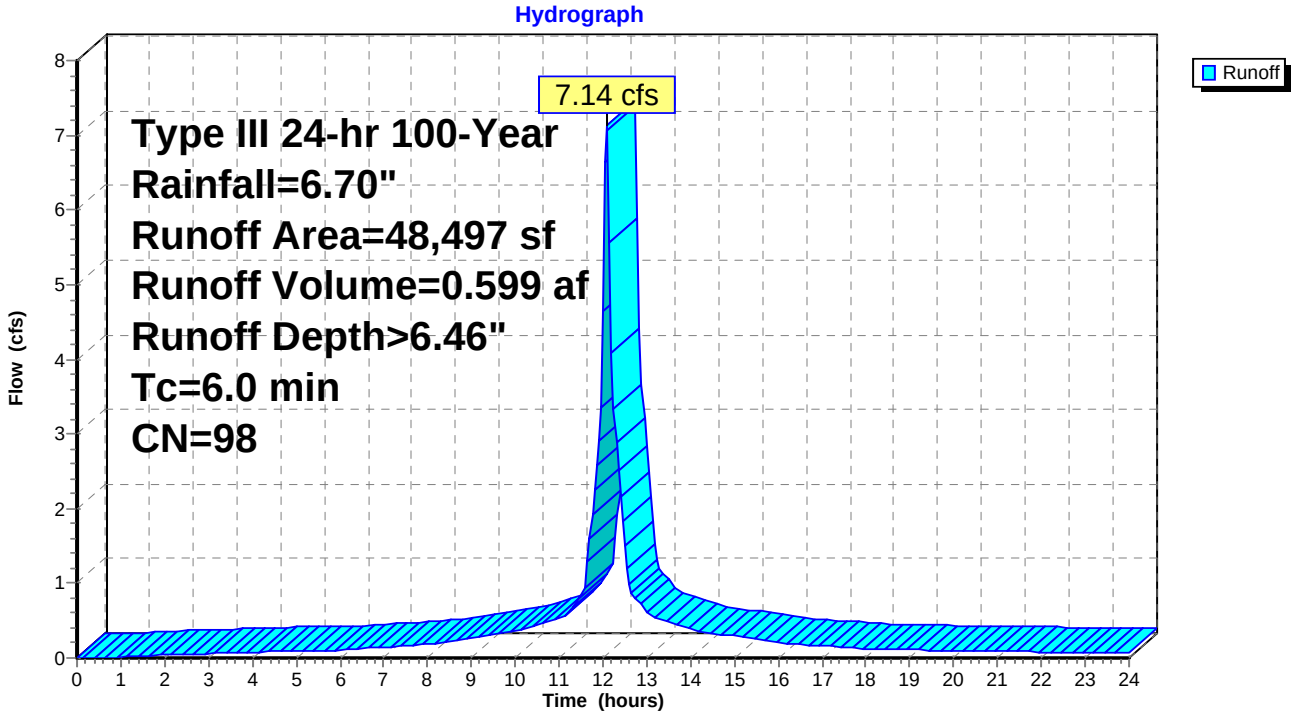
Runoff = 7.14 cfs @ 12.09 hrs, Volume= 0.599 af, Depth> 6.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
48,497	98	Paved parking, HSG B
48,497		100.00% Impervious Area

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

Subcatchment 7S: WS 1A - Parking Lot



Summary for Pond 8P: Pervious Concrete

Inflow Area = 1.113 ac,100.00% Impervious, Inflow Depth > 6.46" for 100-Year event
Inflow = 7.14 cfs @ 12.09 hrs, Volume= 0.599 af
Outflow = 3.76 cfs @ 12.22 hrs, Volume= 0.593 af, Atten= 47%, Lag= 8.2 min
Primary = 3.76 cfs @ 12.22 hrs, Volume= 0.593 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 130.26' @ 12.22 hrs Surf.Area= 8,899 sf Storage= 4,125 cf

Plug-Flow detention time= 27.4 min calculated for 0.593 af (99% of inflow)
Center-of-Mass det. time= 20.5 min (763.7 - 743.1)

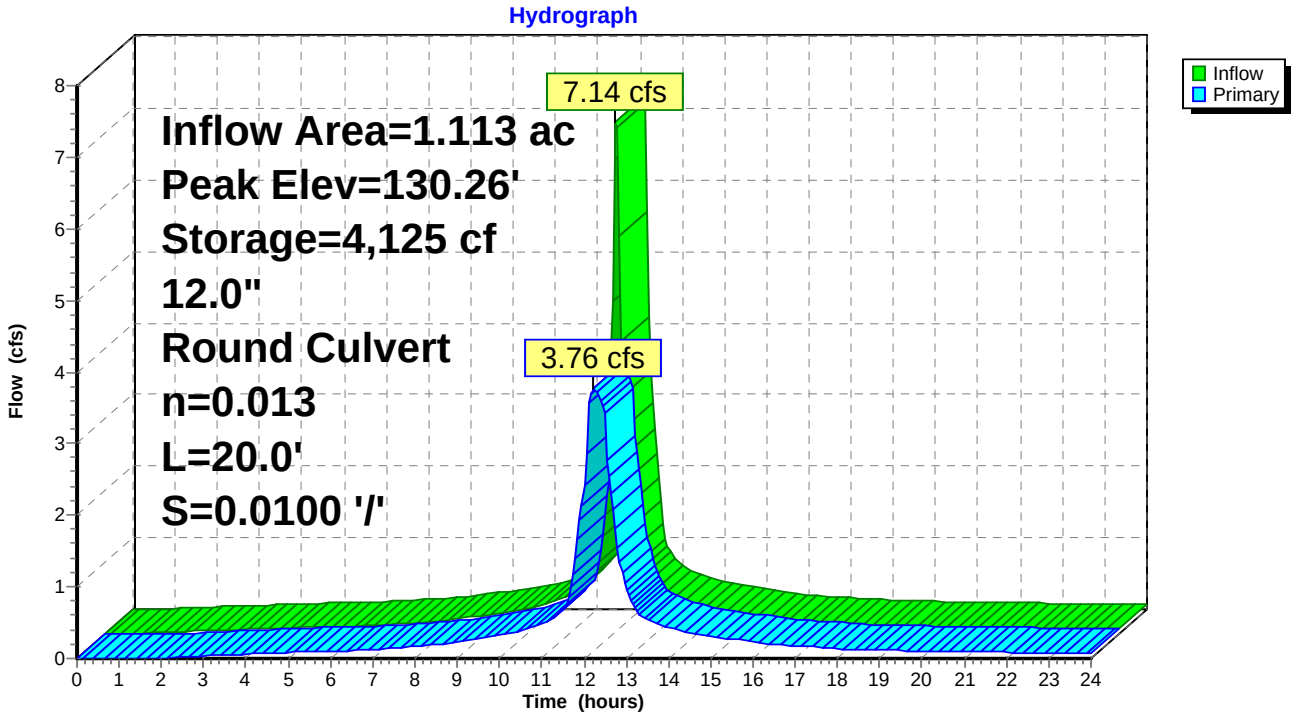
Volume	Invert	Avail.Storage	Storage Description
#1	130.00'	3,528 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	128.17'	2,835 cf	**35.00'W x 135.00'L x 1.50'H Prismatoid**
			7,088 cf Overall x 40.0% Voids
#3	129.03'	127 cf	**12.0" D x 162.0'L Pipe**
		6,490 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
130.00	4,860	0	0
131.00	2,196	3,528	3,528

Device	Routing	Invert	Outlet Devices
#1	Primary	128.17'	**12.0" Round Culvert**
			L= 20.0' CPP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 128.17' / 127.97' S= 0.0100 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=3.75 cfs @ 12.22 hrs HW=130.25' (Free Discharge)
└**1=Culvert** (Inlet Controls 3.75 cfs @ 4.78 fps)

Pond 8P: Pervious Concrete



Summary for Pond 10P: Pervious Concrete

Inflow Area = 0.963 ac,100.00% Impervious, Inflow Depth > 6.46" for 100-Year event
Inflow = 6.18 cfs @ 12.09 hrs, Volume= 0.518 af
Outflow = 3.56 cfs @ 12.21 hrs, Volume= 0.518 af, Atten= 42%, Lag= 7.3 min
Primary = 3.56 cfs @ 12.21 hrs, Volume= 0.518 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 130.42' @ 12.21 hrs Surf.Area= 5,939 sf Storage= 2,203 cf

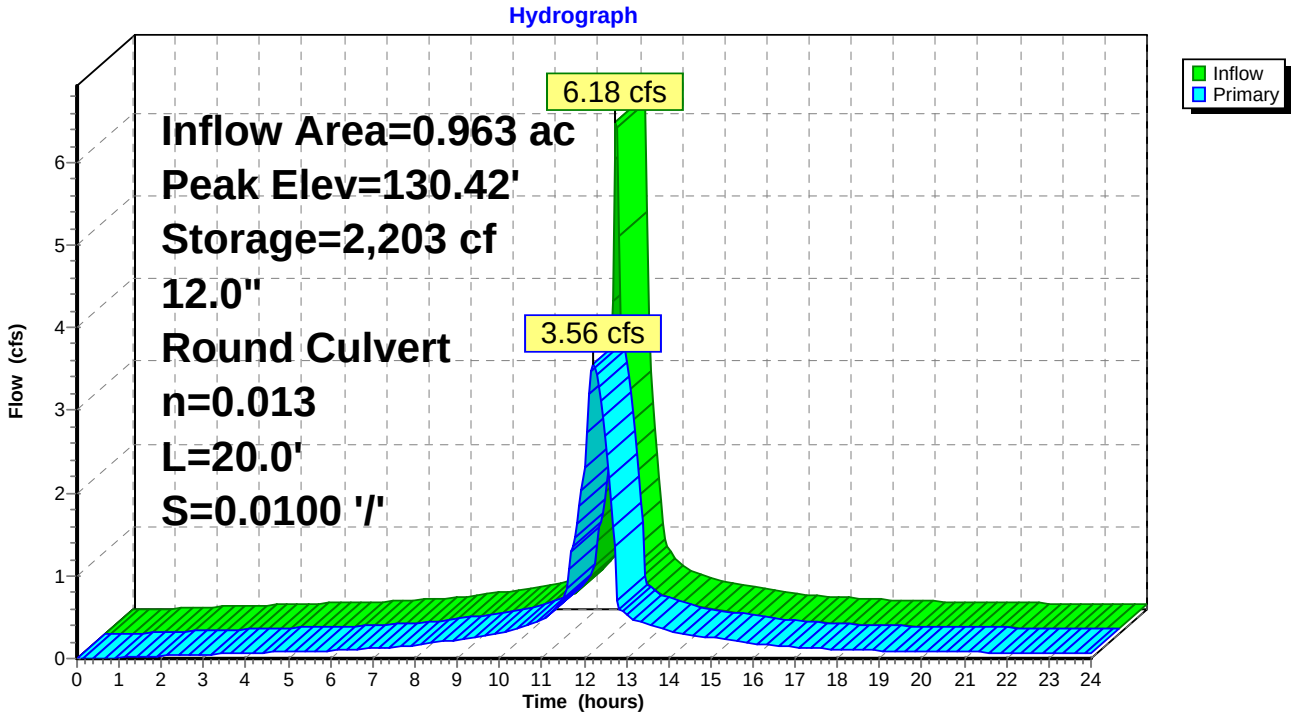
Plug-Flow detention time= 3.1 min calculated for 0.518 af (100% of inflow)
Center-of-Mass det. time= 3.1 min (746.2 - 743.1)

Volume	Invert	Avail.Storage	Storage Description
#1	129.17'	2,624 cf	**36.00'W x 162.00'L x 1.50'H Prismatoid** 8,748 cf Overall x 30.0% Voids
#2	130.30'	127 cf	**12.0" D x 162.0'L Pipe Storage**
		2,752 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	128.50'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 128.50' / 128.30' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=3.55 cfs @ 12.21 hrs HW=130.42' (Free Discharge)
└**1=Culvert** (Inlet Controls 3.55 cfs @ 4.53 fps)

Pond 10P: Pervious Concrete

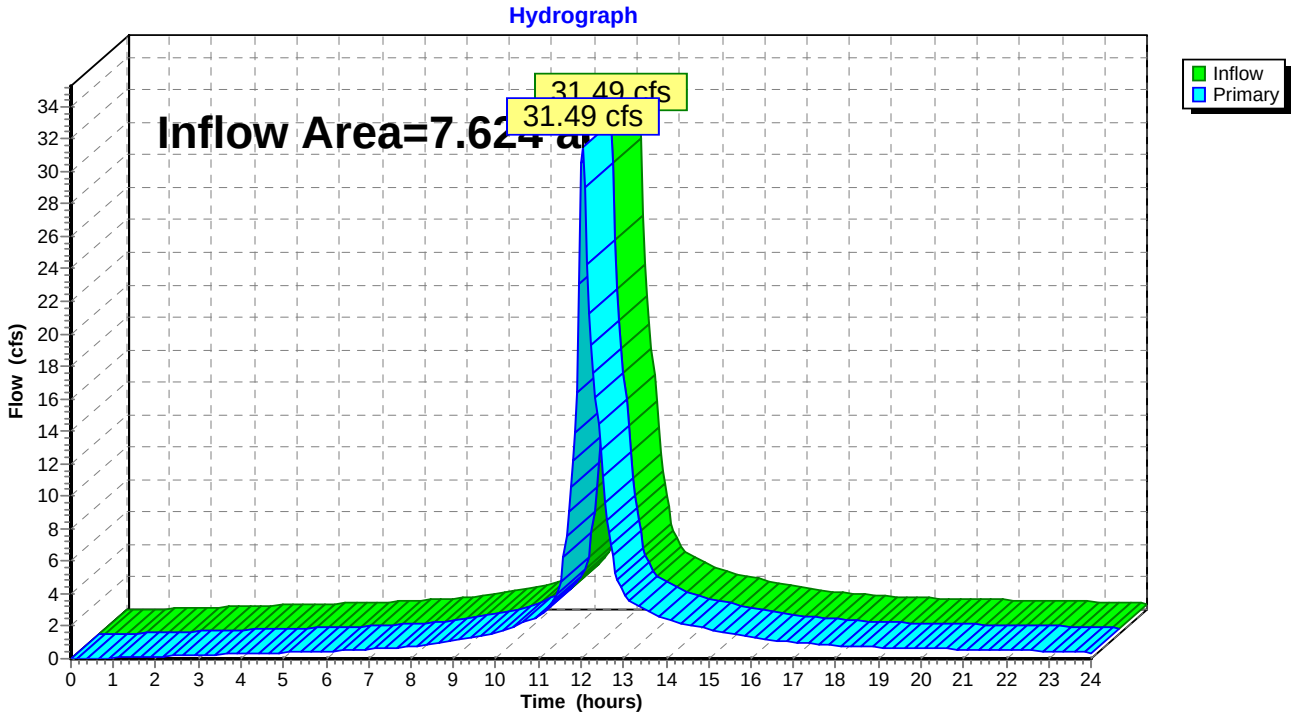


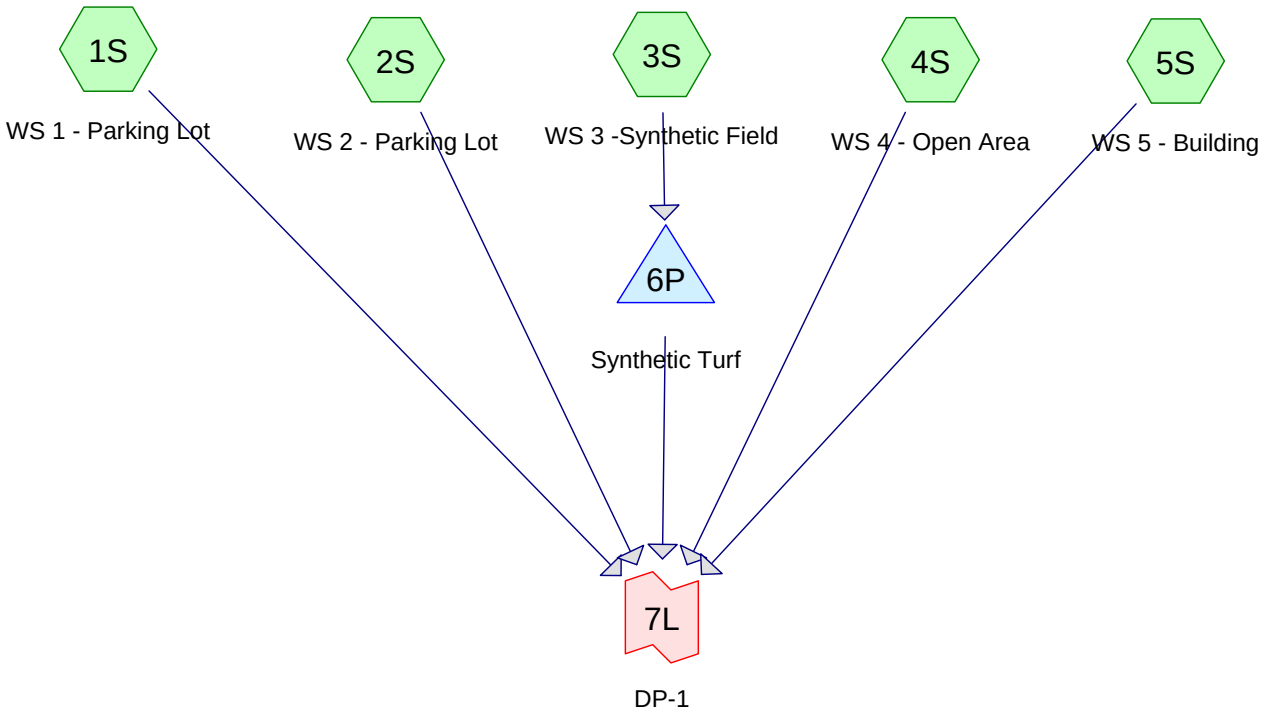
Summary for Link 4L: DP-1

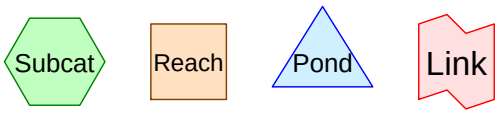
Inflow Area = 7.624 ac, 62.38% Impervious, Inflow Depth > 5.25" for 100-Year event
Inflow = 31.49 cfs @ 12.02 hrs, Volume= 3.333 af
Primary = 31.49 cfs @ 12.02 hrs, Volume= 3.333 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 4L: DP-1







Drainage Diagram for Post-Development_Option 3
Prepared by Hewlett-Packard Company, Printed 7/7/2015
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.904	61	>75% Grass cover, Good, HSG B (3S)
1.952	69	50-75% Grass cover, Fair, HSG B (4S)
2.004	98	Paved parking, HSG B (1S, 2S)
1.986	98	Unconnected roofs, HSG B (5S)
7.847	82	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
7.847	HSG B	1S, 2S, 3S, 4S, 5S
0.000	HSG C	
0.000	HSG D	
0.000	Other	
7.847		**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Fill (inches)
1	6P	128.20	128.00	20.0	0.0100	0.013	12.0	0.0	0.0

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: WS 1 - Parking Lot Runoff Area=35,445 sf 100.00% Impervious Runoff Depth>5.97"
Tc=6.0 min CN=98 Runoff=5.22 cfs 0.404 af

Subcatchment 2S: WS 2 - Parking Lot Runoff Area=51,869 sf 100.00% Impervious Runoff Depth>5.97"
Tc=6.0 min CN=98 Runoff=7.64 cfs 0.592 af

Subcatchment 3S: WS 3 -Synthetic Field Runoff Area=82,933 sf 0.00% Impervious Runoff Depth>2.28"
Tc=6.0 min CN=61 Runoff=5.30 cfs 0.362 af

Subcatchment 4S: WS 4 - Open Area Runoff Area=85,050 sf 0.00% Impervious Runoff Depth>3.02"
Flow Length=450' Tc=13.9 min CN=69 Runoff=5.76 cfs 0.492 af

Subcatchment 5S: WS 5 - Building Runoff Area=86,506 sf 100.00% Impervious Runoff Depth>5.97"
Tc=6.0 min CN=98 Runoff=12.74 cfs 0.987 af

Pond 6P: Synthetic Turf Peak Elev=130.73' Storage=0.362 af Inflow=5.30 cfs 0.362 af
Outflow=0.00 cfs 0.000 af

Link 7L: DP-1 Inflow=29.75 cfs 2.476 af
Primary=29.75 cfs 2.476 af

Total Runoff Area = 7.847 ac Runoff Volume = 2.838 af Average Runoff Depth = 4.34"
49.15% Pervious = 3.856 ac 50.85% Impervious = 3.990 ac

Summary for Subcatchment 1S: WS 1 - Parking Lot

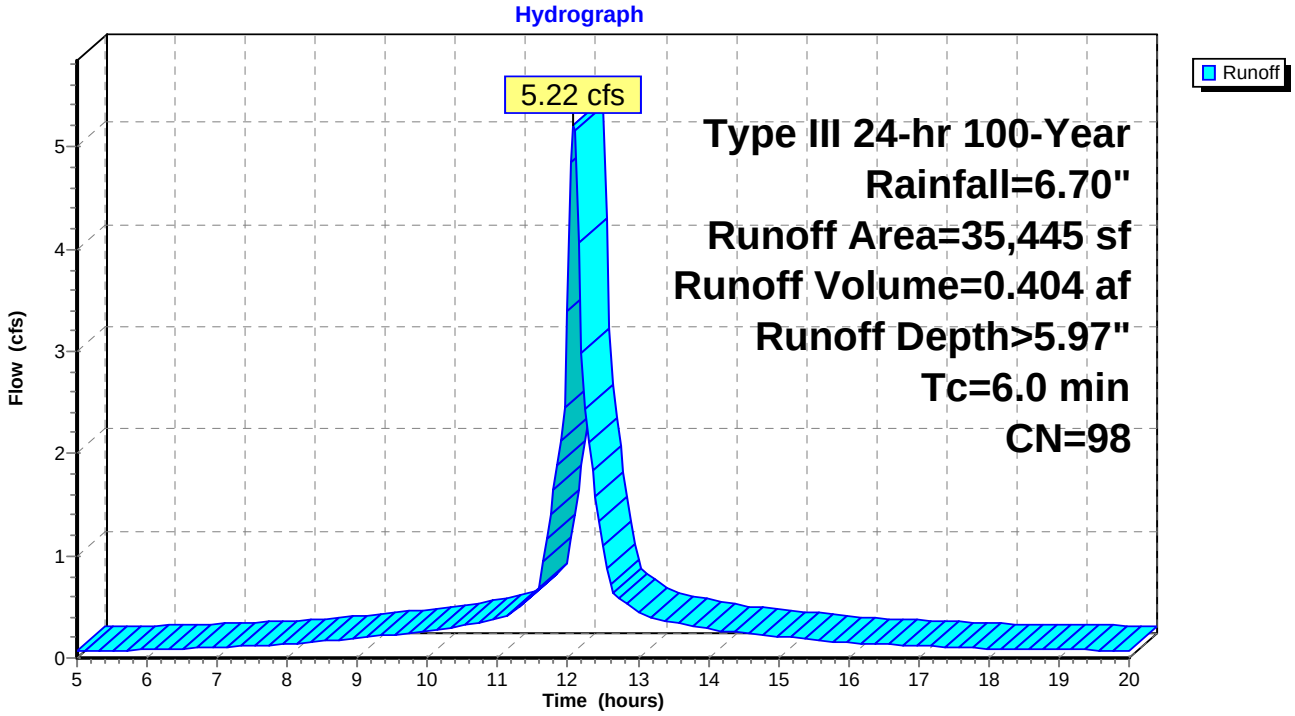
Runoff = 5.22 cfs @ 12.09 hrs, Volume= 0.404 af, Depth> 5.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
35,445	98	Paved parking, HSG B
35,445		100.00% Impervious Area

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

Subcatchment 1S: WS 1 - Parking Lot



Summary for Subcatchment 2S: WS 2 - Parking Lot

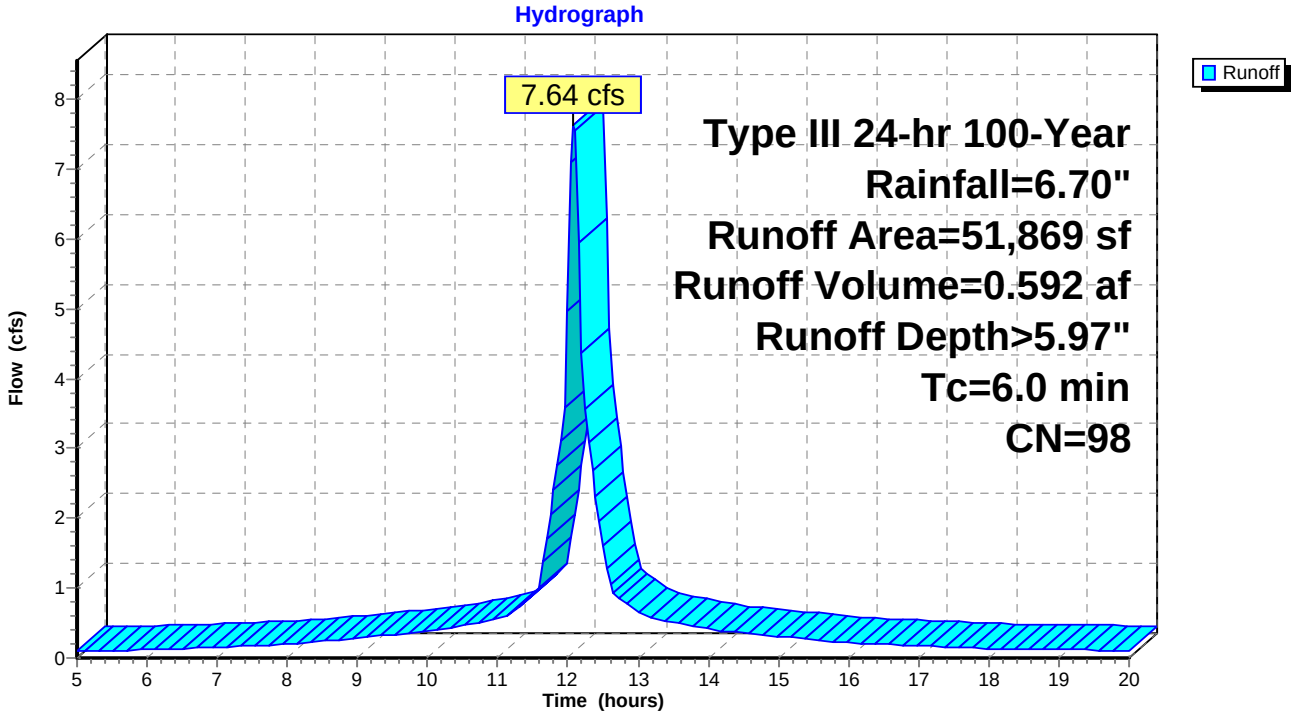
Runoff = 7.64 cfs @ 12.09 hrs, Volume= 0.592 af, Depth> 5.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
51,869	98	Paved parking, HSG B
51,869		100.00% Impervious Area

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

Subcatchment 2S: WS 2 - Parking Lot



Summary for Subcatchment 3S: WS 3 -Synthetic Field

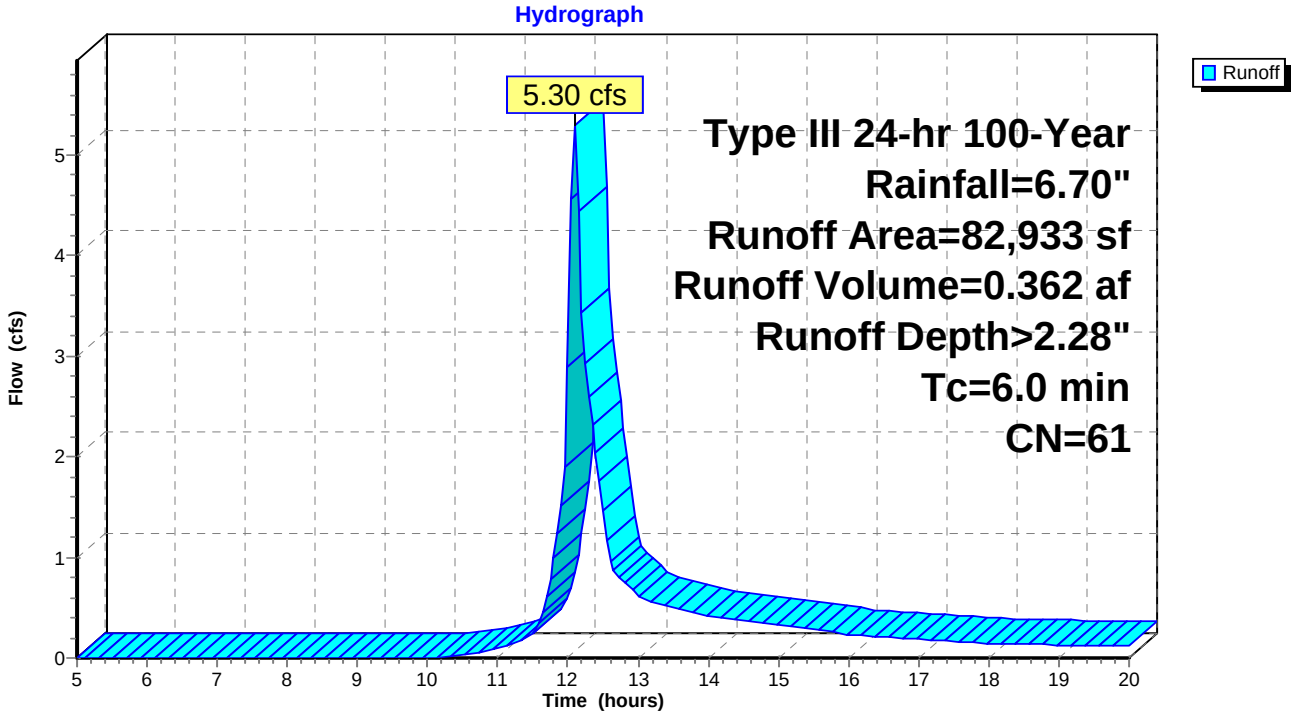
Runoff = 5.30 cfs @ 12.10 hrs, Volume= 0.362 af, Depth> 2.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
82,933	61	>75% Grass cover, Good, HSG B
82,933		100.00% Pervious Area

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

Subcatchment 3S: WS 3 -Synthetic Field



Summary for Subcatchment 4S: WS 4 - Open Area

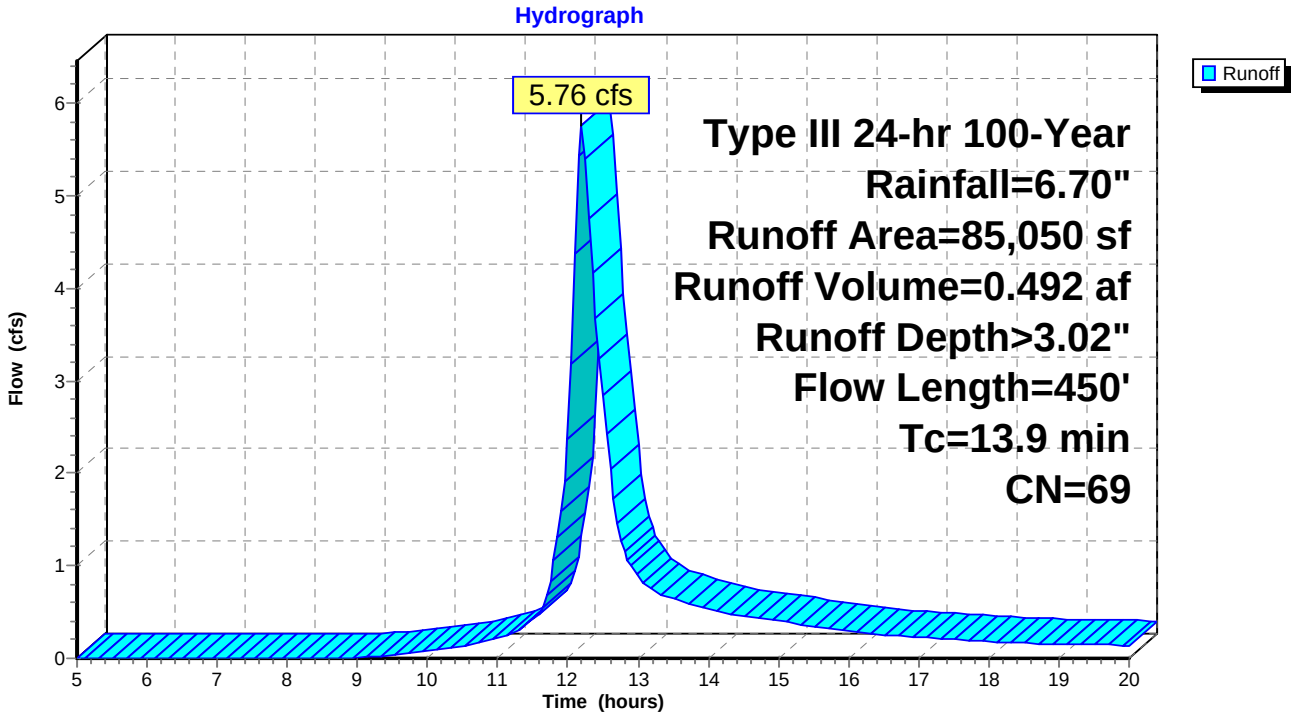
Runoff = 5.76 cfs @ 12.20 hrs, Volume= 0.492 af, Depth> 3.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
85,050	69	50-75% Grass cover, Fair, HSG B
85,050		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0100	0.11		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
6.5	400	0.0040	1.02		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
13.9	450	Total			

Subcatchment 4S: WS 4 - Open Area



Summary for Subcatchment 5S: WS 5 - Building

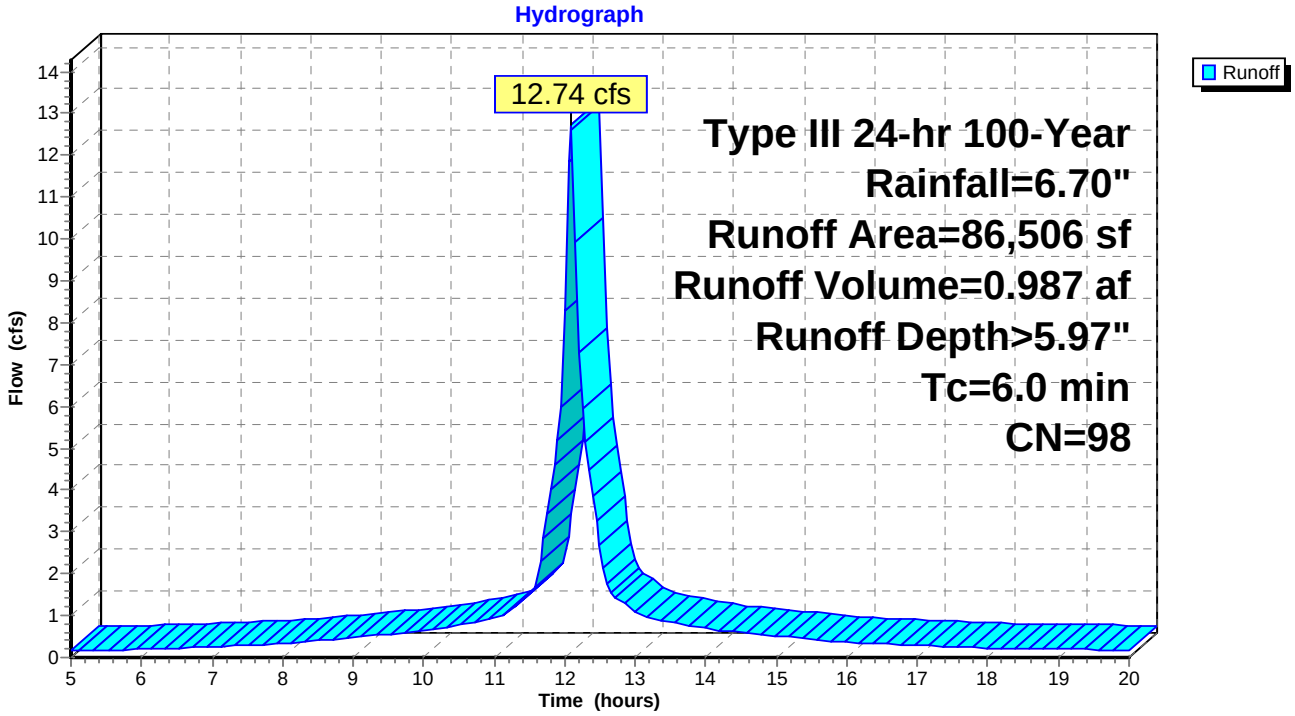
Runoff = 12.74 cfs @ 12.09 hrs, Volume= 0.987 af, Depth> 5.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
86,506	98	Unconnected roofs, HSG B
86,506		100.00% Impervious Area
86,506		100.00% Unconnected

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

Subcatchment 5S: WS 5 - Building



Summary for Pond 6P: Synthetic Turf

Inflow Area = 1.904 ac, 0.00% Impervious, Inflow Depth > 2.28" for 100-Year event
Inflow = 5.30 cfs @ 12.10 hrs, Volume= 0.362 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 130.73' @ 20.00 hrs Surf.Area= 1.653 ac Storage= 0.362 af

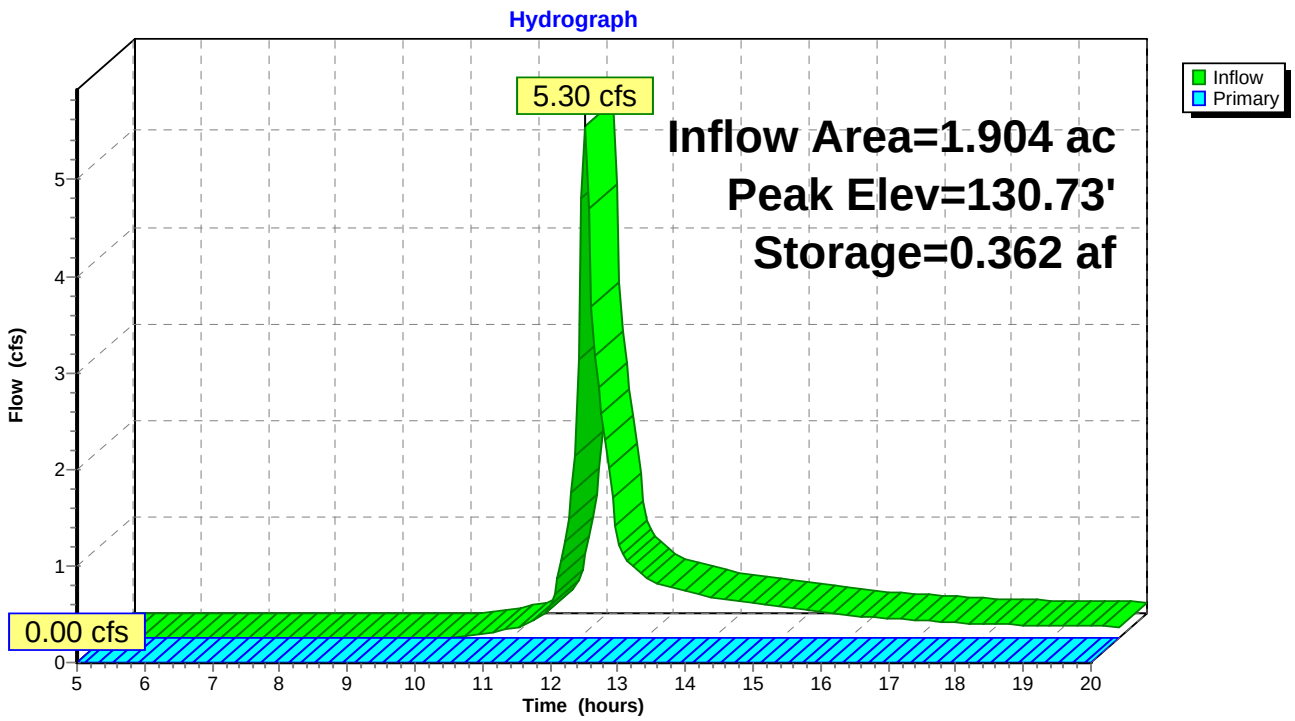
Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	130.00'	0.496 af	**215.00'W x 335.00'L x 1.00'H Prismatoid** 1.653 af Overall x 30.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	128.20'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 128.20' / 128.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior
#2	Device 1	130.80'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 2	128.20'	**2.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=130.00' (Free Discharge)
└─**1=Culvert** (Passes 0.00 cfs of 3.40 cfs potential flow)
  └─**2=Orifice/Grate** (Controls 0.00 cfs)
    └─**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 6P: Synthetic Turf

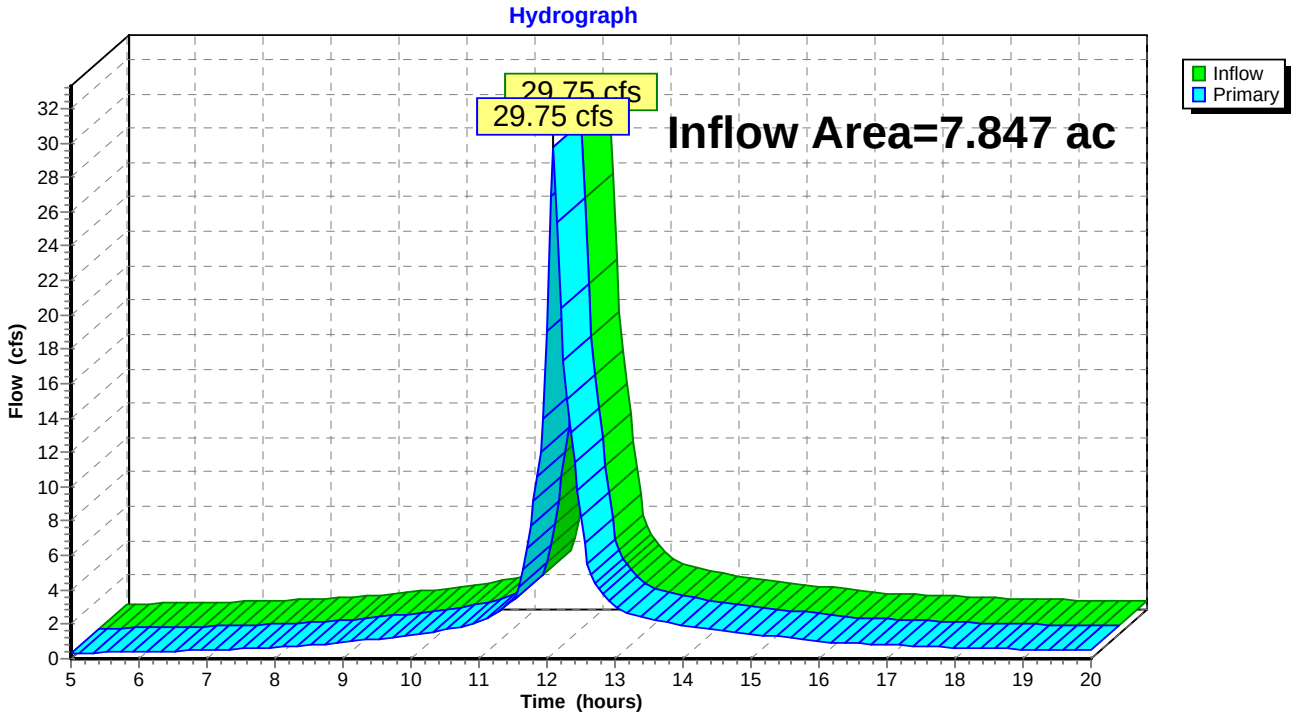


Summary for Link 7L: DP-1

Inflow Area = 7.847 ac, 50.85% Impervious, Inflow Depth > 3.79" for 100-Year event
Inflow = 29.75 cfs @ 12.09 hrs, Volume= 2.476 af
Primary = 29.75 cfs @ 12.09 hrs, Volume= 2.476 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 7L: DP-1



ENCLOSURE 6

MEMORANDUM

TO:	Mr. John M. Perry, P.E. Project Manager Gale Associates, Inc. 163 Libbey Parkway Weymouth, MA 02189	**FROM:**	Mr. Jeffrey S. Dirk, P.E., PTOE, FITE *and* Ms. Lori A. Shattuck, EIT Vanasse & Associates, Inc. 35 New England Business Center Drive Suite 140 Andover, MA 01810-1066 (978) 474-8800 www.rdva.com
DATE:	June 11, 2015	**RE:**	6448

SUBJECT: Preliminary Transportation Impact Assessment
Proposed Athletic Facility - 900 Worcester Street (Route 9)
Wellesley, Massachusetts

Vanasse & Associates, Inc. (VAI) has prepared a Preliminary Transportation Impact Assessment (PTIA) in support of the proposed construction of an athletic facility to be located at 900 Worcester Street (Route 9) in Wellesley, Massachusetts (hereafter referred to as the "Project"). The purpose of this preliminary assessment is to evaluate design considerations with respect to access, parking and on-site circulation consistent with the redevelopment of the subject property as a multipurpose athletic facility. This assessment evaluates the following specific areas as they relate to the Project site: i) existing traffic volumes and vehicle travel speeds along Route 9 proximate to the Project site; ii) projected traffic characteristics for three (3) potential redevelopment options; iii) access and safety considerations with respect to the design and operation of the Project site and the associated driveway intersections with Route 9; and iv) parking requirements.

PROJECT DESCRIPTION

The Project will entail the construction of a multipurpose athletic facility to be located at 900 Worcester Street (Route 9) in Wellesley, Massachusetts. The Project site consists of 7.8±-acres of land and is bounded by Route 9 to the north; commercial properties to the east; residential properties and areas of open and wooded space to the south; and Dale Street (a private way), residential properties and areas of open and wooded space to the west. At present, the Project site is occupied by the former St. James Church and associated appurtenances which will be removed as a part of the Project. Figure 1 depicts the Project site location in relation to the existing roadway network.

Access to the Project site is currently provided by way of two (2) driveways that intersect the south side of Route 9 and a driveway that intersects the east side of Dale Street (a private way). Breaks are provided in the median along Route 9 that permit vehicles to enter the Project site from Route 9 westbound at the west driveway and to exit to Route 9 westbound from the east driveway under police detail officer control. A gate is provided across the median break at the east Project site driveway to prohibit left-turn exiting movements when a police detail officer is not present. Absent police detail control, exiting traffic from the Project site is restricted to right-turn movements only. In addition, a signalized pedestrian crossing of Route 9 was provided just west of the east Project site driveway; however, the crosswalk, signal indications and pushbuttons have since been removed.

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Figure 1

Site Location Map

Vanasse & Associates, Inc.
Transportation Engineers & Planners

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Redevelopment Options

Three potential redevelopment options have been conceptualized for the Project site and are as follows:

- ***Option 1*** – Redevelopment Option 1 would include a multipurpose athletic field and a 77,092 square foot (sf) building containing a hockey rink with 1.5 sheets of ice and seating for 635 spectators, and a 21,525 sf pool/fitness center with seating for 167 spectators. Access to the athletic facility would be provided by way of the existing driveways that intersect the south side of Route 9; the current access to Dale Street would be removed or converted to allow pedestrian/bicycle/emergency vehicle access. Parking will be provided for 206 vehicles.

- ***Option 2*** – Redevelopment Option 2 would entail the construction of a 90,416 sf building containing a hockey rink with two (2) sheets of ice and seating for 1,270 spectators, and a 24,015 sf pool/fitness center with seating for 167 spectators. Primary access to the athletic facility would be provided by way of a driveway situated at the approximate location of the existing west Project site driveway (opposite Lexington Road), with secondary access for emergency vehicles provided by way of the existing east Project site driveway; the current connection to Dale Street would be converted to pedestrian/bicycle/emergency vehicle access. Parking will be provided for 244 vehicles.

- ***Option 3*** – Redevelopment Option 3 would include a multipurpose athletic field that would be designed to be enclosed (covered) to allow for use during the winter months, and a 77,092 sf building containing a hockey rink with 1.5 sheets of ice and seating for 635 spectators, and a 22,550 sf pool/fitness center with seating for 167 spectators. Access to the athletic facility would be provided by way of the existing driveways that intersect the south side of Route 9; the current access to Dale Street would be removed or converted to allow pedestrian/bicycle/emergency vehicle access. Parking will be provided for 206 vehicles.

EXISTING CONDITIONS CONTEXT

Route 9 is four-lane, principal arterial roadway under the jurisdiction of the Massachusetts Department of Transportation (MassDOT) that traverses the study area in a general east-west direction and provides access to Interstate 95(I-95)/Route 128 to the east of the Project site and to I-90 (a.k.a. the Massachusetts Turnpike) to the west. In the vicinity of the Project site, Route 9 provides four (4) 11 to 13-foot wide travel lanes (two (2) travel lanes per direction) separated by a raised median with guard rail, with 6 to 8-foot wide marked shoulders provided. The posted speed limit along Route 9 is 50 miles per hour (mph). A sidewalk is provided along both sides of Route 9, with the closest pedestrian crossing provided at the signalized intersection of Route 9 at Overbrook Drive, approximately 0.7 miles to the west. Land use in the vicinity of the Project site consists of residential and commercial properties, and areas of open and wooded space.

Bus service is provided within the study area by the Metrowest Regional Transit Authority (MWRTA). MWRTA bus *Route 1* provides bus service between the Central Hub in downtown Framingham and the Woodland Massachusetts Bay Transportation Authority (MBTA) commuter rail station in Newton, with the closest scheduled stop to the Project site located at the Route 9/Overbrook Drive intersection.

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Existing Traffic Volumes

Automatic traffic recorder (ATR) counts were completed on Route 9 in the vicinity of the Project site in March 2015 while public schools were in regular session in order to record weekday and Saturday traffic conditions along this roadway over an extended period. The March traffic volumes were found to be representative of an average-month condition and, therefore, did not require a seasonal adjustment. The following summarizes existing traffic volumes along Route 9 in the vicinity of the Project site:

Route 9:

Average Weekday: 41,435 vehicles[1]
Weekday Morning Peak Hour (8:00 – 9:00 AM): 2,958 vph[2]
Weekday Evening Peak-Hour (5:00 – 6:00 PM): 2,731 vph
Average Saturday: 34,805 vehicles
Saturday Midday Peak-Hour (1:45 – 2:45 PM): 2,450 vph

Spot Speed Measurements

Vehicle travel speed measurements were performed on Route 9 in the vicinity of the Project site over a continuous 72-hour period (Thursday through Saturday) in conjunction with the ATR counts. Table 1 summarizes the vehicle travel speed measurements.

Table 1
VEHICLE TRAVEL SPEED MEASUREMENTS

	Route 9	
	Eastbound	Westbound
Mean Travel Speed (mph)	41	40
85th Percentile Speed (mph)	46	46
Posted Speed Limit (mph)	50	50

mph = miles per hour.

As can be seen in Table 1, the mean (average) vehicle travel speed along Route 9 in the vicinity of the Project site was found to be approximately 41 mph. The average 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 approximately 46 mph, which is 4 mph below the posted speed limit within the study area (50 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.

[1]Two-way, 24-hour volume.
[2]Vehicles per hour (vph).

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TRAFFIC VOLUME PROJECTIONS

The traffic characteristics for each of the conceptualized redevelopment options for the Project site were developed using a potential use schedule for the multipurpose field and trip-generation statistics published by the Institute of Transportation Engineers (ITE)[3] for the hockey rink and pool/fitness center. The ITE provides trip-generation information for various types of land uses developed as a result of scientific studies that have been conducted over the past 50 plus years, the most recent update of which was published in 2012. Based on a review of the ITE database and the known elements of the Project, ITE Land Use Code (LUC) 465, *Ice Skating Rink*, was used to develop the traffic characteristics of the hockey rink component of the Project using the number of spectator seats as the independent variable; a potential field use schedule assuming 18 players and two (2) coaches per team with accompanying spectators for each game scheduled over the course of a weekday and weekend was used to develop the traffic characteristics of the multipurpose field component of the Project; and LUC 495, *Recreational Community Center*, was used to develop the traffic characteristics of the pool/fitness center component of the Project using the gross floor area as the independent variable.

The methodology used to establish the traffic characteristics for each component of the athletic facility allows for the projections to be scaled (increased or decreased) to reflect the development proposal that is ultimately advanced for the Project site. For the purpose of this preliminary analysis, it has been assumed that the operator of the athletic facility would maximize the use scheduling of the hockey rink and multipurpose field. In addition, the traffic volume projections for the pool/fitness center are based on a community based model similar to a YMCA facility.

Table 2 summarizes the traffic volume projections for each of the conceptualized redevelopment options for the Project site using the above methodology, with the detailed trip-generation calculations provided in the technical appendix.

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[3] *Trip Generation*, 9th Edition; Institute of Transportation Engineers; Washington, DC; 2012.

Table 2
900 WORCESTER STREET ATHLETIC FACILITY
REDEVELOPMENT OPTIONS TRIP-GENERATION SUMMARY

	Redevelopment Option 1				Redevelopment Option 2			Redevelopment Option 3			
Time Period/Direction	(A) Hockey Rink (635 Seats)[a]	(B) Multipurpose Field (1 Field)[b]	(C) Pool/ Fitness Center (21,525 sf)[c]	(D = A + B + C) Total	(A) Hockey Rink (1,270 Seats)[a]	(B) Pool/ Fitness Center (24,015 sf)[b]	(C = A + B) Total	(A) Hockey Rink (635 Seats)[a]	(B) Multipurpose Field (1 Field)[b]	(C) Pool/ Fitness Center (22,550 sf)[c]	(D = A + B + C) Total
Average Weekday Daily:											
Entering	400	142	364	906	800	406	1,206	400	142	382	924
Exiting	400	142	364	906	800	406	1,206	400	142	382	924
Total	800	284	728	1,812	1,600	812	2,412	800	284	764	1,848
Weekday Morning Peak Hour:											
Entering	3	2	29	34	7	32	39	3	2	30	35
Exiting	3	1	15	19	6	17	23	3	1	16	20
Total	6	3	44	53	13	49	62	6	3	46	55
Weekday Evening Peak Hour:											
Entering	34	31	29	94	68	32	100	34	31	30	95
Exiting	42	16	30	88	84	34	118	42	16	32	90
Total	76	47	59	182	152	66	218	76	47	62	185
Saturday:											
Entering	659	344	245	1,248	1,317	274	1,591	659	344	257	1,260
Exiting	659	344	245	1,248	1,317	274	1,591	659	344	257	1,260
Total	1,318	688	490	2,496	2,634	548	3,182	1,318	688	514	2,520
Saturday Midday Peak Hour:											
Entering	64	41	37	142	128	42	170	64	41	39	144
Exiting	69	45	32	146	139	35	174	69	45	33	147
Total	133	86	69	288	267	77	344	133	86	72	291

[a]Based on ITE LUC 635, *Hockey Rink*, and LUC 688, *Soccer Complex*.
[b]Based on projected field use schedule. ITE LUC 688, *Soccer Complex*, used for directional distribution.
[c]Based on ITE LUC 695, *Recreational Community Center*.

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Traffic Volume Summary

The following summarizes the traffic volume projections for each of the conceptualized redevelopment options:

Option 1:

Redevelopment Option 1 is projected to generate approximately 1,812 vehicle trips on an average weekday (906 vehicles entering and 906 exiting), with 53 vehicle trips expected during the weekday morning peak-hour (34 vehicles entering and 19 exiting) and 182 vehicle trips expected during the weekday evening peak-hour (94 vehicles entering and 88 exiting). On a Saturday, redevelopment Option 1 is expected to generate approximately 2,496 vehicle trips (1,248 vehicles entering and 1,248 exiting), with 288 vehicle trips expected during the Saturday midday peak-hour (142 vehicles entering and 146 exiting).

Option 2:

Redevelopment Option 2 is expected to generate approximately 2,412 vehicle trips on an average weekday (1,206 vehicles entering and 1,206 exiting), with 62 vehicle trips expected during the weekday morning peak-hour (39 vehicles entering and 23 exiting) and 218 vehicle trips expected during the weekday evening peak-hour (100 vehicles entering and 118 exiting). On a Saturday, redevelopment Option 2 is expected to generate approximately 3,182 vehicle trips (1,591 vehicles entering and 1,591 exiting), with 344 vehicle trips expected during the Saturday midday peak-hour (170 vehicles entering and 174 exiting). It should be noted that redevelopment Option 2 is the highest traffic generator of the three (3) development options under consideration.

Option 3:

Redevelopment Option 3 is expected to generate approximately 1,848 vehicle trips on an average weekday (924 vehicles entering and 924 exiting), with 55 vehicle trips expected during the weekday morning peak-hour (35 vehicles entering and 20 exiting) and 185 vehicle trips expected during the weekday evening peak-hour (95 vehicles entering and 90 exiting). On a Saturday, redevelopment Option 3 is expected to generate approximately 2,520 vehicle trips (1,260 vehicles entering and 1,260 exiting), with 291 vehicle trips expected during the Saturday midday peak-hour (144 vehicles entering and 147 exiting).

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ACCESS ASSESSMENT

As defined previously, each of the three (3) conceptualized redevelopment options afford primary access by way of the existing driveways along Route 9, with the Dale Street access to be converted to pedestrian/bicycle/emergency vehicle access. Redevelopment Option 2 contemplates the elimination of the connection between and the east driveway and the primary parking field in order to accommodate the creation of two (2) full sheets of ice within the athletic building.

Based on a review of the traffic volume projections for the redevelopment options and the access limitations along Route 9 (median divided highway), it is suggested that redevelopment of the Project site continue to afford access by way of a primary driveway ideally located opposite Lexington Road in order to accommodate the installation of a traffic control signal (discussion follows), with a secondary driveway limited to right turns entering and exiting the Project site provided for traffic dispersal and emergency response. The following recommendations are offered with respect to affording safe and efficient access to the Project site:

- ***Primary Access:***
  - 36-feet in width accommodating a single entering lane and separate left and right-turn lanes exiting;
  - Modify the median on Route 9 to allow for left-turns exiting; and
  - Install a fully actuated traffic signal control with pedestrian accommodations subject to meeting the necessary warrants specified in the *Manual on Uniform Traffic Control Devices* (MUTCD).[4]

- ***Secondary Access:***
  - 24-feet in width accommodating a single entering and exiting travel lane with appropriate geometry to channelize traffic consistent with the right-turn only access limitation;
  - Install appropriate signs ("No Left Turn", "Right-Turn Only", etc.) and pavement markings to indicate the regulated flow of traffic at the driveway; and
  - Vehicles exiting the driveway should be placed under STOP-sign control with a marked STOP-line provided.

- The Project site driveways and internal circulating aisles should be designed to accommodate emergency vehicles (as defined by the Town of Wellesley Fire Department) and school buses.

- All signs and pavement markings to be installed within the Project site shall conform to the applicable standards of the MUTCD.

- Marked pedestrian crossings and wheelchair ramps compliant with the Americans with Disabilities Act (ADA) should be provided for crossing the Project site driveways and where crossings of drive aisles are to be provided within the Project site.

- Signs and landscaping internal to the Project site and at the Project site driveway intersections with Route 9 should be designed and maintained so as not to restrict lines of sight.

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

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Traffic Signal Warrants Analysis

In order to determine if the installation of a traffic control signal could be justified at the primary access to the Project site, a Traffic Signal Warrants Analysis (TSWA) was completed for each of the three (3) redevelopment options under 2015 Existing traffic-volume conditions with the addition of Project-related traffic. The MUTCD[5] establishes nine warrants or criteria to evaluate a location for the installation (or retention) of a traffic signal. At least one of the nine warrants must be satisfied in order to justify the installation or retention of a traffic signal; however, satisfaction of a warrant in and of itself does not necessarily indicate that the installation of a traffic signal is the best traffic control solution. An engineering evaluation of the location in question should indicate that the establishment of traffic signal control will improve the overall safety and/or operation of the intersection. The results of the TSWA for the subject intersection are summarized in Table 3.

Table 3
TRAFFIC SIGNAL WARRANTS ANALYSIS
ROUTE 9/PRIMARY PROJECT SITE DRIVEWAY

		Satisfied? (Yes/No)		
Warrant No.	Description	Redevelopment Option 1	Redevelopment Option 2	Redevelopment Option 3
1	Eight-Hour Vehicular Volume	No	**Yes**	No
2	Four-Hour Vehicular Volume	**Yes**	**Yes**	**Yes**
3	Peak Hour	**Yes**	**Yes**	**Yes**
4	Pedestrian Volume	No	No	No
5	School Crossing	No	No	No
6	Coordinated Signal System	No	No	No
7	Crash Experience	No	No	No
8	Roadway Network	No	No	No
9	Intersection Near a Grade Crossing	No	No	No

As can be seen in Table 3, the TSWA indicates that traffic volumes at the primary Project site driveway intersection with Route 9 would meet the necessary warrants to justify the installation of a traffic control signal (Warrant 1 and/or 2) under 2015 Existing traffic volume conditions with the addition of Project-related traffic. Warrant 3 (*Peak-Hour*), while satisfied, is typically applied to intersections that experience pronounced surges in traffic during defined periods where the implementation of traffic signal control would aid in reducing delay and vehicle queuing. Examples of such occurrences would be a factory, manufacturing facility or office complex that have defined shifts or start/stop times for employees. This condition is not applicable to the subject redevelopment options and, therefore, would not apply.

[5]Ibid.

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Sight Distance Evaluation

Sight distance measurements were performed at the Project site driveway intersections with Route 9 in accordance with MassDOT and American Association of State Highway and Transportation Officials (AASHTO)[6] 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 4 presents the measured SSD and ISD at the subject intersections.

Table 4
SIGHT DISTANCE MEASUREMENTS[a]

Intersection/Sight Distance Measurement	Feet		
	Required Minimum	ISD[b]	Measured
Route 9 at the West Project Site Driveway			
Stopping Sight Distance:			
Route 9 approaching from the east	495	--	650+
Route 9 approaching from the west	495	--	650+
Intersection Sight Distance:			
Looking to the east from the Project Site Driveway	495	530/610	650+
Looking to the west from the Project Site Driveway	495	530/610	650+
Route 9 at the East Project Site Driveway			
Stopping Sight Distance:			
Route 9 approaching from the east	495	--	650+
Route 9 approaching from the west	495	--	650+
Intersection Sight Distance:			
Looking to the east from the Project Site Driveway	495	530/610	650+
Looking to the west from the Project Site Driveway	495	530/610	650+

[a]Recommended minimum values obtained from *A Policy on Geometric Design of Highways and Streets*, 6th Edition; American Association of State Highway and Transportation Officials (AASHTO); 2011; and based on a 55 mph approach speed on Route 9.

[b]Values shown are the intersection sight distance for a vehicle turning right/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 6, the available lines of sight at the subject intersections were found to exceed the recommended minimum sight distance requirements to function in a safe (SSD) and efficient (ISD) manner based on a 55 mph approach speed along Route 9, which is 5 mph above the posted speed limit (50 mph) and exceeds the measured 85th percentile vehicle travel speed (46 mph) in the vicinity of the Project site.

[6]*A Policy on Geometric Design of Highways and Streets, 6th Edition*; American Association of State Highway and Transportation Officials (AASHTO); 2011.

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TRAFFIC OPERATIONS ANALYSIS

In order to assess the potential impact of the Project on operating conditions along Route 9 and at the primary Project site driveway, a detailed traffic operations (level-of-service) analysis was completed under 2022 Build (with the Project) conditions, which reflects a seven-year planning horizon consistent with MassDOT's *Transportation Impact Assessment (TIA) Guidelines* and incorporating the following elements:

1. 2015 Existing peak-hour traffic volumes obtained from the March 2015 traffic counts;
2. Background traffic growth – established as 1 percent per year compounded annually;
3. Traffic from other development projects in the area that have not yet been constructed (mixed-use development at 978 Worcester Street); and
4. Peak-hour traffic for redevelopment Option 2 (the highest traffic generator of the three conceptualized redevelopment options).

Project-related traffic was assigned to Route 9 and the Project site based on a review of population densities within the Town of Wellesley and existing travel patterns along Route 9 (as documented as a part of the traffic count program). Based on a review of this information, it is expected that approximately 75 percent of Project-related traffic will be oriented to/from the east of the Project site along Route 9, with the balance (25 percent) oriented to/from the west. It was assumed that all Project traffic would enter and exit the Project site by way of the signalized primary Project driveway in order to present a conservative analysis scenario. The 2022 Build condition traffic-volumes are depicted on Figure 2 and were developed by superimposing the traffic expected to be generated by redevelopment Option 2 onto the projected future traffic volumes using the trip distribution pattern described above.

Methodology

In brief, six levels of service are defined for each type of facility and are correlated to motorist delay. They are given letter designations ranging from A to F, with level-of-service (LOS) A representing the best operating conditions and LOS F representing congested or constrained operations. Since the level-of-service of a traffic facility is a function of the 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 the year. The *Synchro*™ intersection capacity analysis software, which is based on the analysis methodologies and procedures presented in the 2010 *Highway Capacity Manual* (HCM)[7] for signalized intersections, was used to complete the level-of-service analyses for the study intersection. Levels of service for signalized intersections were calculated using the Percentile Delay Method implemented as a part of the *Synchro* 8™ software as suggested by MassDOT in order to compensate for errors found when employing the 2010 *Highway Capacity Manual* methodology as a part of the software.

Analysis Results

Level-of-service analyses were conducted for 2022 Build conditions for redevelopment Option 2 (the highest traffic generator of the three conceptualized redevelopment options) for the Route 9/Primary Project site driveway intersection assuming all Project traffic would enter and exit by way of the signalized primary Project driveway (worst case design condition). The results of the intersection capacity and vehicle queue analyses are summarized in Table 5, with the detailed analysis results attached.

[7] *Highway Capacity Manual*, Transportation Research Board; Washington, DC; 2010.

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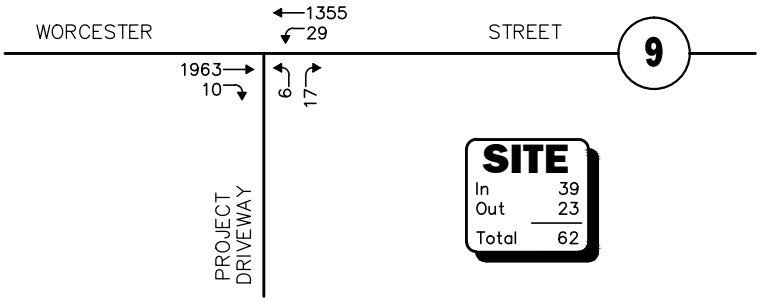
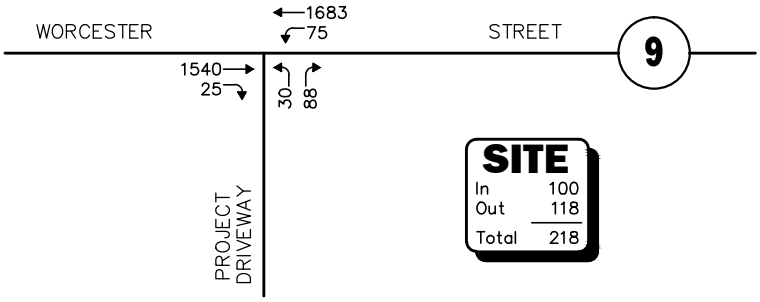
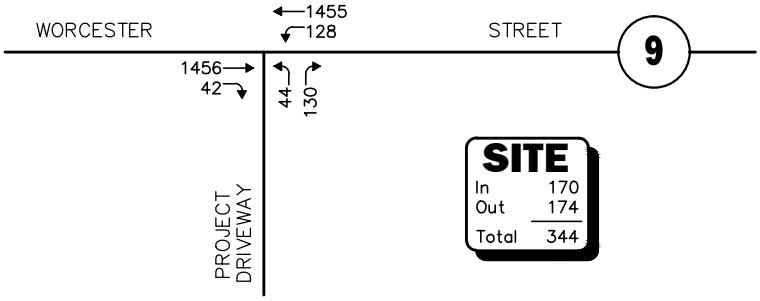
WEEKDAY MORNING PEAK HOUR



WEEKDAY EVENING PEAK HOUR



SATURDAY MIDDAY PEAK HOUR



Not To Scale

Figure 2

Vanasse & Associates, Inc.
Transportation Engineers & Planners

2022 Build
Development Option 2
Peak Hour Traffic Volumes

R:\6448\6448ent1.dwg, 6/11/2015 4:06:20 PM

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Table 5
SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE ANALYSIS SUMMARY

Signalized Intersection/Peak Hour/Movement	2022 Build Redevelopment Option 2 V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th
Route 9 at the Primary Project Site Driveway				
Weekday Morning:				
Route 9 EB TH/RT	0.74	8.6	A	9/29
Route 9 WB LT	0.17	33.5	C	1/2
Route 9 WB TH	0.45	1.3	A	0/5
Primary Project Site Driveway NB LT	0.04	31.5	C	1/1
Primary Project Site Driveway NB RT	0.08	17.0	B	0/1
Overall	--	**5.9**	**A**	--
Weekday Evening:				
Route 9 EB TH/RT	0.73	12.4	B	5/18
Route 9 WB LT	0.31	25.4	C	1/3
Route 9 WB TH	0.60	3.6	A	6/9
Primary Project Site Driveway NB LT	0.12	23.0	C	1/2
Primary Project Site Driveway NB RT	0.25	15.1	B	1/2
Overall	--	**8.6**	**A**	--
Saturday Midday:				
Route 9 EB TH/RT	0.75	14.5	B	11/18
Route 9 WB LT	0.49	29.5	C	2/4
Route 9 WB TH	0.55	3.8	A	5/6
Primary Project Site Driveway NB LT	0.18	24.7	C	1/2
Primary Project Site Driveway NB RT	0.30	14.9	B	1/3
Overall	--	**10.5**	**B**	--

[a]Volume-to-capacity ratio.
[b]Percentile delay per vehicle in seconds.
[c]Level-of-Service.
[d]Queue length in vehicles. The 50th percentile vehicle queue represents the vehicle queue that would be expected 50 percent of the time during the peak-hour; the 95th percentile vehicle queue represents the vehicle queue that would be exceeded only 5 percent of the time during the peak-hour (during the remaining 57 minutes the vehicle queue length would be less than the 95th percentile vehicle queue).
NB = northbound; SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

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As can be seen in Table 5, under 2022 Build conditions with redevelopment Option 2 and the installation of a traffic control signal to facilitate safe and efficient access to the Project site, the Route 9/primary Project site driveway intersection was shown to operate at an overall LOS A during both the weekday morning and evening peak hours and at LOS B during the Saturday midday peak-hour. For context, LOS D is generally defined as the limit of "acceptable" traffic operations.

Vehicle queues at the intersection were shown to range from 0 to 29 vehicles during the peak periods, with the longest vehicle queue projected to occur for the Route 9 eastbound movement during the weekday morning peak-hour.

PARKING DEMAND

A preliminary parking demand analysis was completed in order to evaluate the parking supply required to accommodate the projected parking demands for the conceptualized redevelopment options for the Project site. The projected parking demands were derived from parking demand data obtained from the ITE[8] for similar land uses as those proposed. ITE LUC 488, *Soccer Complex*, was used to develop the parking demands for the hockey rink and field components of the Project, and LUC 495, *Recreational Community Center*, was used to develop the parking demands for the pool/fitness center component of the Project. Table 6 summarizes the parking demand calculations for each of the conceptualized redevelopment options for the Project site using the ITE data.

Parking Demand Summary

As can be seen in Table 6, using the ITE parking demand data, the projected peak parking demand for each of the redevelopment options was determined to exceed the available parking supply on a weekday or weekend, with the absolute peak parking demand identified to occur on a Sunday. ***This conclusion should not be construed to indicate that the parking that is to be provided cannot support the conceptualized redevelopment options; however, the analysis does indicate that careful attention to the scheduling of games and events at the facility will be required in order to manage traffic and parking demands so as to be consistent with the available parking supply.***

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[8] *Parking Generation*, 4th Edition; Institute of Transportation Engineers; Washington, D.C.; 2010.

Table 6
900 WORCESTER STREET ATHLETIC FACILITY
PROJECTED PARKING DEMAND[a]

	No. of Parking Spaces Required										
	Redevelopment Option 1				Redevelopment Option 2			Redevelopment Option 3			
Day of Week	**Hockey Rink (1.5 Sheets of Ice)[b]**	**Field (1 Field)[b]**	**Pool/ Fitness Center (21,525 sf)[c]**	**Total**	**Hockey Rink (2 Sheets of Ice)[b]**	**Pool/ Fitness Center (24,015 sf)[c]**	**Total**	**Hockey Rink (1.5 Sheets of Ice)[b]**	**Field (1 Field)[b]**	**Pool/ Fitness Center (22,550 sf)[c]**	**Total**
Weekday:	91	61	109	261	121	121	242	91	61	114	266
Saturday:	98	66	117	281	131	131	262	98	66	123	287
Sunday:	104	70	124	298	139	139	278	104	70	130	304
Parking Provided:				**206**			**244**				**206**

[a]*Parking Generation*, 4th Edition; Institute of Transportation Engineers; Washington, D.C.; 2010.
[b]Based on LUC 488, *Soccer Complex*. For the hockey rink, a "sheet of ice" was considered to be equivalent to a "field" for parking generation purposes.
[c]Based on LUC 495, *Recreational Community Center*.

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CONCLUSIONS

VAI has completed a Preliminary Transportation Impact Assessment (PTIA) in support of the proposed construction of an athletic complex to be located at 900 Worcester Street (Route 9) in Wellesley, Massachusetts. The purpose of this preliminary assessment was to evaluate design considerations with respect to access, parking and on-site circulation consistent with the redevelopment of the subject property as a multipurpose athletic facility. This assessment has evaluated the following specific areas as they relate to the Project site: i) existing traffic volumes and vehicle travel speeds along Route 9 proximate to the Project site; ii) projected traffic characteristics for three (3) potential redevelopment options; iii) access and safety considerations with respect to the design and operation of the Project site and the associated driveway intersections with Route 9; and iv) parking requirements.

Based on this assessment, the following design considerations were identified that should be advanced as a part of the redevelopment of the Project site:

- A parking and traffic management program should be developed, including accommodations for bus parking.
- The primary Project site driveway should be placed under traffic signal control in order to facilitate vehicle, pedestrian and bicycle access to the Project site;
- Measures to limit the use of Lexington Road and Beechwood Road by cut-through traffic between Route 9 and Weston Road should be evaluated in consideration of access alternatives that would include a driveway aligned opposite Lexington Road, particularly if the driveway is to be placed under traffic signal control;
- A minimum of two access points should be provided to the Project site for traffic dispersal and emergency response;
- Shared use of parking at adjacent office development on weekday evenings and weekends should be considered;
- Pedestrian and bicycle connections to abutting neighborhoods should be explored; and
- Parking layout and circulation patterns should consider passenger drop-off/pick-up.

It is expected that these considerations will be further advanced as the redevelopment plans for the Project site are formalized and the proposal advances through the Town's Project of Significant Impact (PSI) review process with the Planning Board.

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APPENDIX

AUTOMATIC TRAFFIC RECORDER COUNTS
PUBLIC TRANSPORTATION SCHEDULES
VEHICLE TRAVEL SPEED DATA
PEAK-HOUR TRAFFIC VOLUME CALCULATIONS
TRIP-GENERATION CALCULATIONS
TRAFFIC SIGNAL WARRANTS ANALYSIS
CAPACITY ANALYSIS WORKSHEETS
ITE PARKING DEMAND DATA
SAMPLE PARKING AND EVENT MANAGEMENT PLAN

AUTOMATIC TRAFFIC RECORDER COUNTS

Accurate Counts
978-664-2565

Location : Route 9 EB
Location : West of Weston Road
City/State: Wellesley, MA

6448VOLEB

Start Time	26-Mar-15 Thu	EB Morning	EB Afternoon	Hour Totals Morning	Hour Totals Afternoon
12:00		19	298		
12:15		23	317		
12:30		20	321		
12:45		11	320	73	1256
01:00		18	319		
01:15		13	353		
01:30		2	306		
01:45		14	246	47	1224
02:00		16	299		
02:15		10	286		
02:30		7	336		
02:45		9	294	42	1215
03:00		6	333		
03:15		11	276		
03:30		11	267		
03:45		13	296	41	1172
04:00		12	340		
04:15		23	328		
04:30		32	277		
04:45		42	320	109	1265
05:00		60	288		
05:15		74	347		
05:30		126	318		
05:45		166	337	426	1290
06:00		176	374		
06:15		272	333		
06:30		368	361		
06:45		466	341	1282	1409
07:00		426	302		
07:15		467	260		
07:30		453	309		
07:45		464	253	1810	1124
08:00		421	209		
08:15		440	213		
08:30		466	190		
08:45		439	165	1766	777
09:00		426	177		
09:15		351	197		
09:30		326	152		
09:45		344	164	1447	690
10:00		340	138		
10:15		298	233		
10:30		260	251		
10:45		280	229	1178	851
11:00		306	168		
11:15		294	162		
11:30		263	60		
11:45		292	36	1155	426
Total		9376	12699		
Percent		42.5%	57.5%		

Accurate Counts
978-664-2565

Location : Route 9 EB
Location : West of Weston Road
City/State: Wellesley, MA

6448VOLEB

Start Time	27-Mar-15 Fri	EB Morning	EB Afternoon	Hour Totals Morning	Hour Totals Afternoon
12:00		33	287		
12:15		26	273		
12:30		22	294		
12:45		16	269	97	1123
01:00		18	260		
01:15		11	302		
01:30		12	288		
01:45		9	262	50	1112
02:00		8	309		
02:15		12	310		
02:30		6	314		
02:45		6	279	32	1212
03:00		9	336		
03:15		7	324		
03:30		14	309		
03:45		11	332	41	1301
04:00		10	333		
04:15		21	327		
04:30		23	333		
04:45		36	348	90	1341
05:00		51	321		
05:15		59	318		
05:30		86	298		
05:45		112	353	308	1290
06:00		156	299		
06:15		160	371		
06:30		161	338		
06:45		276	313	753	1321
07:00		352	323		
07:15		396	335		
07:30		365	315		
07:45		338	354	1451	1327
08:00		354	310		
08:15		317	244		
08:30		346	281		
08:45		312	239	1329	1074
09:00		292	240		
09:15		332	223		
09:30		302	234		
09:45		318	209	1244	906
10:00		298	191		
10:15		309	235		
10:30		341	362		
10:45		310	294	1258	1082
11:00		328	250		
11:15		255	209		
11:30		299	105		
11:45		340	73	1222	637
Total		7875	13726		
Percent		36.5%	63.5%		

Accurate Counts
978-664-2565

Location : Route 9 EB
Location : West of Weston Road
City/State: Wellesley, MA

6448VOLEB

Start Time	28-Mar-15 Sat	EB Morning	EB Afternoon	Hour Totals Morning	Hour Totals Afternoon
12:00		64	250		
12:15		39	284		
12:30		25	296		
12:45		29	270	157	1100
01:00		30	283		
01:15		21	328		
01:30		27	284		
01:45		17	335	95	1230
02:00		20	291		
02:15		17	275		
02:30		27	328		
02:45		5	293	69	1187
03:00		10	291		
03:15		16	290		
03:30		16	252		
03:45		12	274	54	1107
04:00		8	283		
04:15		13	297		
04:30		13	297		
04:45		18	264	52	1141
05:00		25	273		
05:15		20	260		
05:30		24	297		
05:45		34	296	103	1126
06:00		34	370		
06:15		57	294		
06:30		75	298		
06:45		115	290	281	1252
07:00		141	294		
07:15		124	255		
07:30		155	279		
07:45		154	302	574	1130
08:00		196	281		
08:15		172	295		
08:30		197	253		
08:45		209	231	774	1060
09:00		223	191		
09:15		260	224		
09:30		205	198		
09:45		252	217	940	830
10:00		254	165		
10:15		266	198		
10:30		243	286		
10:45		256	328	1019	977
11:00		249	292		
11:15		252	287		
11:30		260	205		
11:45		278	119	1039	903
Total		5157	13043		
Percent		28.3%	71.7%		
Grand Total		22408	39468		
Percent		36.2%	63.8%		
ADT		ADT 20,693		AADT 20,693	

Accurate Counts
978-664-2565

Location : Route 9 EB
Location : West of Weston Road
City/State: Wellesley, MA

6448VOLEB

Start Time	Mon 23-Mar-15	Tue 24-Mar-15	Wed 25-Mar-15	Thu 26-Mar-15	Fri 27-Mar-15	Average Day	Sat 28-Mar-15	Sun 29-Mar-15	Week Average
12:00 AM	*	*	*	73	97	85	157	*	109
01:00	*	*	*	47	50	48	95	*	64
02:00	*	*	*	42	32	37	69	*	48
03:00	*	*	*	41	41	41	54	*	45
04:00	*	*	*	109	90	100	52	*	84
05:00	*	*	*	426	308	367	103	*	279
06:00	*	*	*	1282	753	1018	281	*	772
07:00	*	*	*	**1810**	**1451**	**1630**	574	*	1278
08:00	*	*	*	1766	1329	1548	774	*	**1290**
09:00	*	*	*	1447	1244	1346	940	*	1210
10:00	*	*	*	1178	1258	1218	1019	*	1152
11:00	*	*	*	1155	1222	1188	**1039**	*	1139
12:00 PM	*	*	*	1256	1123	1190	1100	*	1160
01:00	*	*	*	1224	1112	1168	1230	*	1189
02:00	*	*	*	1215	1212	1214	1187	*	1205
03:00	*	*	*	1172	1301	1236	1107	*	1193
04:00	*	*	*	1265	**1341**	1303	1141	*	1249
05:00	*	*	*	1290	1290	1290	1126	*	1235
06:00	*	*	*	**1409**	1321	**1365**	**1252**	*	**1327**
07:00	*	*	*	1124	1327	1226	1130	*	1194
08:00	*	*	*	777	1074	926	1060	*	970
09:00	*	*	*	690	906	798	830	*	809
10:00	*	*	*	851	1082	966	977	*	970
11:00	*	*	*	426	637	532	903	*	655
Day Total	0	0	0	22075	21601	21840	18200	0	20626
% Avg. WkDay	0.0%	0.0%	0.0%	101.1%	98.9%				
% Avg. Week	0.0%	0.0%	0.0%	107.0%	104.7%	105.9%	88.2%	0.0%	
AM Peak	-	-	-	07:00	07:00	- 07:00	- 11:00	-	- 08:00 - -
Vol.	-	-	-	1810	1451	- 1630	- 1039	-	- 1290 - -
PM Peak	-	-	-	18:00	16:00	- 18:00	- 18:00	-	- 18:00 - -
Vol.	-	-	-	1409	1341	- 1365	- 1252	-	- 1327 - -
Grand Total	0	0	0	22075	21601	21840	18200	0	20626

ADT ADT 20,693 AADT 20,693

Accurate Counts
978-664-2565

Location : Route 9
Location : West of Weston Road
City/State: Wellesley, MA

6448VOLWB

Start Time	26-Mar-15 Thu	WB Morning	WB Afternoon	Hour Totals Morning	Hour Totals Afternoon
12:00		95	285		
12:15		74	293		
12:30		70	239		
12:45		61	294	300	1111
01:00		55	302		
01:15		42	338		
01:30		39	325		
01:45		33	261	169	1226
02:00		35	255		
02:15		43	263		
02:30		27	231		
02:45		18	292	123	1041
03:00		17	265		
03:15		20	311		
03:30		7	302		
03:45		13	296	57	1174
04:00		11	272		
04:15		15	288		
04:30		9	337		
04:45		19	356	54	1253
05:00		37	373		
05:15		52	355		
05:30		49	354		
05:45		90	359	228	1441
06:00		97	288		
06:15		137	357		
06:30		140	357		
06:45		184	196	558	1198
07:00		226	220		
07:15		278	271		
07:30		268	241		
07:45		273	241	1045	973
08:00		290	243		
08:15		283	219		
08:30		280	224		
08:45		339	214	1192	900
09:00		318	167		
09:15		318	199		
09:30		271	159		
09:45		262	155	1169	680
10:00		253	165		
10:15		273	134		
10:30		239	140		
10:45		288	200	1053	639
11:00		241	196		
11:15		241	206		
11:30		275	176		
11:45		305	133	1062	711
Total		7010	12347		
Percent		36.2%	63.8%		

Accurate Counts
978-664-2565

Location : Route 9
Location : West of Weston Road
City/State: Wellesley, MA

6448VOLWB

Start Time	27-Mar-15 Fri	WB Morning	WB Afternoon	Hour Totals Morning	Hour Totals Afternoon
12:00		137	333		
12:15		126	296		
12:30		106	303		
12:45		107	341	476	1273
01:00		33	323		
01:15		19	262		
01:30		13	340		
01:45		11	330	76	1255
02:00		13	320		
02:15		7	343		
02:30		12	337		
02:45		9	287	41	1287
03:00		14	328		
03:15		8	290		
03:30		7	360		
03:45		7	316	36	1294
04:00		8	311		
04:15		8	315		
04:30		7	341		
04:45		23	350	46	1317
05:00		24	402		
05:15		40	268		
05:30		56	274		
05:45		65	401	185	1345
06:00		93	362		
06:15		109	369		
06:30		141	411		
06:45		150	341	493	1483
07:00		150	343		
07:15		178	279		
07:30		237	307		
07:45		257	326	822	1255
08:00		288	312		
08:15		255	311		
08:30		236	295		
08:45		232	272	1011	1190
09:00		266	244		
09:15		337	253		
09:30		222	211		
09:45		241	221	1066	929
10:00		269	179		
10:15		244	169		
10:30		264	137		
10:45		261	201	1038	686
11:00		192	224		
11:15		227	244		
11:30		212	202		
11:45		287	165	918	835
Total		6208	14149		
Percent		30.5%	69.5%		

Accurate Counts
978-664-2565

Location : Route 9
Location : West of Weston Road
City/State: Wellesley, MA

6448VOLWB

Start Time	28-Mar-15 Sat	WB Morning	WB Afternoon	Hour Totals Morning	Hour Totals Afternoon
12:00		216	328		
12:15		173	254		
12:30		170	249		
12:45		72	274	631	1105
01:00		28	290		
01:15		30	292		
01:30		19	257		
01:45		27	278	104	1117
02:00		23	324		
02:15		27	352		
02:30		30	267		
02:45		18	245	98	1188
03:00		21	284		
03:15		10	282		
03:30		9	270		
03:45		14	288	54	1124
04:00		12	269		
04:15		13	226		
04:30		12	308		
04:45		13	252	50	1055
05:00		14	21		
05:15		17	79		
05:30		17	166		
05:45		22	230	70	496
06:00		36	274		
06:15		57	254		
06:30		51	268		
06:45		80	225	224	1021
07:00		85	252		
07:15		125	236		
07:30		149	251		
07:45		167	226	526	965
08:00		161	243		
08:15		177	208		
08:30		222	149		
08:45		206	170	766	770
09:00		235	175		
09:15		267	171		
09:30		277	123		
09:45		284	125	1063	594
10:00		331	104		
10:15		282	120		
10:30		212	147		
10:45		232	234	1057	605
11:00		285	222		
11:15		247	198		
11:30		252	239		
11:45		249	226	1033	885
Total		5676	10925		
Percent		34.2%	65.8%		
Grand Total		18894	37421		
Percent		33.6%	66.4%		
ADT		ADT 18,772		AADT 18,772	

Accurate Counts
978-664-2565

Location : Route 9
Location : West of Weston Road
City/State: Wellesley, MA

6448VOLWB

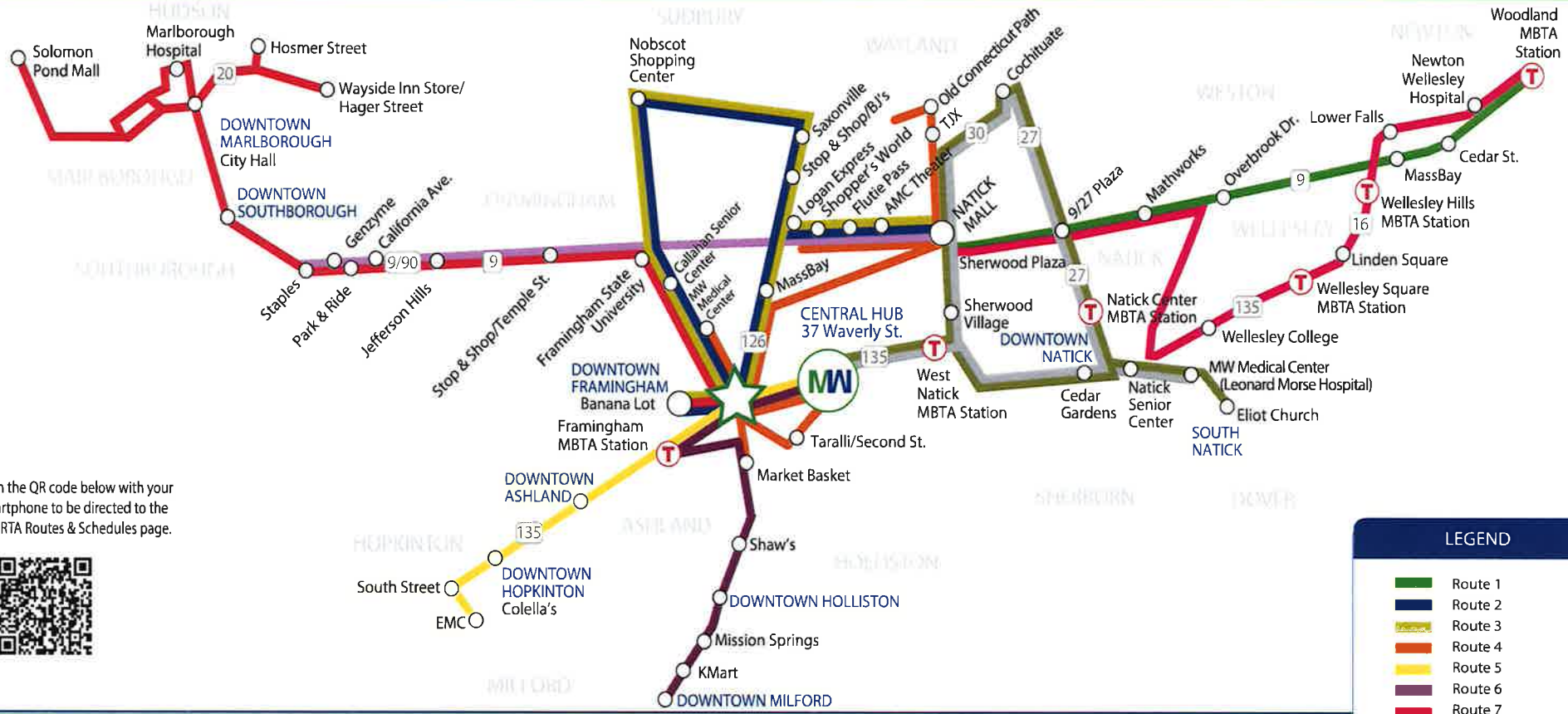
Start Time	Mon 23-Mar-15	Tue 24-Mar-15	Wed 25-Mar-15	Thu 26-Mar-15	Fri 27-Mar-15	Average Day	Sat 28-Mar-15	Sun 29-Mar-15	Week Average
12:00 AM	*	*	*	300	476	388	631	*	469
01:00	*	*	*	169	76	122	104	*	116
02:00	*	*	*	123	41	82	98	*	87
03:00	*	*	*	57	36	46	54	*	49
04:00	*	*	*	54	46	50	50	*	50
05:00	*	*	*	228	185	206	70	*	161
06:00	*	*	*	558	493	526	224	*	425
07:00	*	*	*	1045	822	934	526	*	798
08:00	*	*	*	**1192**	1011	1102	766	*	990
09:00	*	*	*	1169	**1066**	**1118**	**1063**	*	**1099**
10:00	*	*	*	1053	1038	1046	1057	*	1049
11:00	*	*	*	1062	918	990	1033	*	1004
12:00 PM	*	*	*	1111	1273	1192	1105	*	1163
01:00	*	*	*	1226	1255	1240	1117	*	1199
02:00	*	*	*	1041	1287	1164	**1188**	*	1172
03:00	*	*	*	1174	1294	1234	1124	*	1197
04:00	*	*	*	1253	1317	1285	1055	*	1208
05:00	*	*	*	**1441**	1345	**1393**	496	*	1094
06:00	*	*	*	1198	**1483**	1340	1021	*	**1234**
07:00	*	*	*	973	1255	1114	965	*	1064
08:00	*	*	*	900	1190	1045	770	*	953
09:00	*	*	*	680	929	804	594	*	734
10:00	*	*	*	639	686	662	605	*	643
11:00	*	*	*	711	835	773	885	*	810
Day Total	0	0	0	19357	20357	19856	16601	0	18768
% Avg. WkDay	0.0%	0.0%	0.0%	97.5%	102.5%				
% Avg. Week	0.0%	0.0%	0.0%	103.1%	108.5%	105.8%	88.5%	0.0%	
AM Peak	-	-	-	08:00	09:00	- 09:00	- 09:00	-	- 09:00 - -
Vol.	-	-	-	1192	1066	- 1118	- 1063	-	- 1099 - -
PM Peak	-	-	-	17:00	18:00	- 17:00	- 14:00	-	- 18:00 - -
Vol.	-	-	-	1441	1483	- 1393	- 1188	-	- 1234 - -
Grand Total	0	0	0	19357	20357	19856	16601	0	18768

ADT ADT 18,772 AADT 18,772

PUBLIC TRANSPORTATION SCHEDULES

METROWEST REGIONAL TRANSIT AUTHORITY

Public Transportation System



Scan the QR code below with your smartphone to be directed to the MWRTA Routes & Schedules page.

LEGEND

- Route 1
- Route 2
- Route 3
- Route 4
- Route 5
- Route 6
- Route 7
- Route 8
- Route 9
- Route 10
- Route 11
- Scheduled Stop Location
- New MWRTA Hub
- The MWRTA uses the "flag down" system.

MetroWest Regional Transit Authority

From Solomon Pond Mall in Marlborough to Woodland Station in Newton—We've got you covered.

MetroWest Regional Transit Authority (MWTRA) provides public transportation along twelve different bus routes connecting the entire MetroWest community.

We provide access to all major area employers, medical facilities, and shopping locations. MWRTA also connects commuters with the Massachusetts Bay Transportation Authority (MBTA) system. The commuter rail connection can take you eastbound or westbound to Boston or Worcester.

Go Green! Be friendly to our environment and be mindful of your carbon footprint.

Customer Service & Travel Information
Please call 508.935.2222 or visit us online at mwrta.com.

@mwrta

www.mwrta.com 508.935.2222

ROUTE 1 AM

EASTBOUND	Central Hub	5:30 AM	5:55 AM													
	Concord & Howard	5:32 AM	5:57 AM													
	Flutie Pass	5:42 AM	6:05 AM													
	Natick Mall	**5:43 AM**	**6:06 AM**	**6:18 AM**	**6:46 AM**	**6:58 AM**	**7:25 AM**	**7:41 AM**	**8:08 AM**	**8:27 AM**	**8:53 AM**	**9:22 AM**	**9:46 AM**	**10:07 AM**	**10:53 AM**	**11:35 AM**
	MathWorks	5:47 AM	6:10 AM	6:22 AM	6:50 AM	7:02 AM	7:29 AM	7:45 AM	8:12 AM	8:31 AM	8:57 AM	9:26 AM	9:50 AM	10:11 AM	10:57 AM	11:39 AM
	Woodland	**6:00 AM**	**6:25 AM**	**6:35 AM**	**7:03 AM**	**7:19 AM**	**7:47 AM**	**8:04 AM**	**8:31 AM**	**8:52 AM**	**9:16 AM**	**9:42 AM**	**10:09 AM**	**10:27 AM**	**11:12 AM**	**11:54 AM**
WESTBOUND	**Woodland**	**6:00 AM**	**6:28 AM**	**6:40 AM**	**7:08 AM**	**7:24 AM**	**7:52 AM**	**8:09 AM**	**8:35 AM**	**9:02 AM**	**9:26 AM**	**9:47 AM**	**10:14 AM**	**10:32 AM**	**11:17 AM**	**11:59 AM**
	Natick Mall	**6:18 AM**	**6:46 AM**	**6:56 AM**	**7:24 AM**	**7:40 AM**	**8:08 AM**	**8:27 AM**	**8:53 AM**	**9:22 AM**	**9:46 AM**	**10:05 AM**	**10:32 AM**	**10:52 AM**	**11:35 AM**	**12:17 PM**
	Central Hub												10:37 AM			

ROUTE 1 PM

EASTBOUND	Central Hub			1:35 PM			3:35 PM											
	Concord & Howard																	
	Flutie Pass																	
	Natick Mall	**12:18 PM**	**1:00 PM**	**1:50 PM**	**2:35 PM**	**3:20 PM**	**3:50 PM**	**4:05 PM**	**4:35 PM**	**4:50 PM**	**5:20 PM**	**5:35 PM**	**6:05 PM**	**6:20 PM**	**6:50 PM**	**7:05 PM**	**7:35 PM**	**7:50 PM**
	MathWorks	12:22 PM	1:04 PM	1:54 PM	2:39 PM	3:24 PM	3:54 PM	4:09 PM	4:39 PM	4:54 PM	5:24 PM	5:39 PM	6:09 PM	6:24 PM	6:54 PM	7:09 PM	7:39 PM	7:54 PM
	Woodland	**12:37 PM**	**1:19 PM**	**2:09 PM**	**2:54 PM**	**3:39 PM**	**4:09 PM**	**4:24 PM**	**4:54 PM**	**5:12 PM**	**5:39 PM**	**5:54 PM**	**6:24 PM**	**6:39 PM**	**7:09 PM**	**7:24 PM**	**7:54 PM**	**8:09 PM**
WESTBOUND	**Woodland**	**12:42 PM**	**1:22 PM**	**2:14 PM**	**2:59 PM**	**3:44 PM**	**4:14 PM**	**4:29 PM**	**4:59 PM**	**5:17 PM**	**5:44 PM**	**5:59 PM**	**6:29 PM**	**6:44 PM**	**7:14 PM**	**7:29 PM**	**7:59 PM**	**8:14 PM**
	Natick Mall	**1:00 PM**	**1:36 PM**	**2:32 PM**	**3:17 PM**	**4:02 PM**	**4:32 PM**	**4:47 PM**	**5:17 PM**	**5:35 PM**	**6:02 PM**	**6:17 PM**	**6:47 PM**	**7:02 PM**	**7:32 PM**	**7:47 PM**	**8:17 PM**	**8:27 PM**
	Central Hub		1:43 PM														8:23 PM	8:32 PM

Please note:

Shaded areas are approximate arrival times only. The bus may leave these locations prior to the listed time. Riders should be at these time points at least ten minutes prior to the time listed. The bus will not leave the **bolded** locations prior to listed times.

If you have any questions, please contact Customer Service at (508) 935-2222.

VEHICLE TRAVEL SPEED DATA

Accurate Counts
978-664-2565

Location : Route 9 EB
Location : West of Weston Road
City/State: Wellesley, MA
EB

6448SPDEB

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
03/26/15	0	0	0	0	2	19	25	19	7	0	1	0	0	0	73	49	53
01:00	0	0	0	0	1	14	11	13	6	2	0	0	0	0	47	50	54
02:00	0	0	0	0	2	7	22	10	1	0	0	0	0	0	42	47	49
03:00	1	0	0	1	2	10	10	14	3	0	0	0	0	0	41	48	51
04:00	0	0	0	0	3	13	47	39	6	1	0	0	0	0	109	48	51
05:00	0	0	0	0	3	41	184	152	44	2	0	0	0	0	426	49	52
06:00	4	1	2	0	14	244	658	**312**	40	**5**	**2**	0	0	0	1282	47	49
07:00	6	10	4	3	106	**712**	**715**	233	16	4	1	0	0	0	**1810**	44	48
08:00	3	14	**14**	**16**	**147**	585	714	239	32	2	0	0	0	0	1766	45	48
09:00	**9**	**18**	10	1	42	386	650	283	48	0	0	0	0	0	1447	47	49
10:00	5	13	5	3	57	317	502	233	39	4	0	0	0	0	1178	47	49
11:00	4	6	1	3	67	325	461	231	**54**	3	0	0	0	0	1155	47	49
12 PM	2	2	4	2	58	355	**529**	**247**	**55**	1	**1**	0	0	0	1256	47	49
13:00	7	**10**	4	12	115	423	432	184	34	**3**	0	0	0	0	1224	46	49
14:00	6	8	8	2	92	410	480	184	23	1	1	0	0	0	1215	45	49
15:00	18	7	1	12	119	370	458	161	23	3	0	0	0	0	1172	45	48
16:00	6	6	3	6	99	410	504	181	48	2	0	0	0	0	1265	46	49
17:00	11	3	3	**36**	**273**	**547**	328	81	6	1	0	**1**	0	0	1290	43	46
18:00	13	7	**9**	31	144	530	495	150	27	3	0	0	0	0	**1409**	44	48
19:00	16	1	0	11	95	336	454	170	39	2	0	0	0	0	1124	46	49
20:00	12	1	5	26	171	312	200	42	7	1	0	0	0	0	777	43	46
21:00	14	0	4	30	136	273	183	41	8	1	0	0	0	0	690	43	46
22:00	**20**	4	4	31	113	288	291	80	18	2	0	0	0	0	851	44	48
23:00	9	0	0	0	29	142	157	69	19	1	0	0	0	0	426	46	49
Total	166	111	81	226	1890	7069	8510	3368	603	44	6	1	0	0	22075		
Percent	0.8%	0.5%	0.4%	1.0%	8.6%	32.0%	38.6%	15.3%	2.7%	0.2%	0.0%	0.0%	0.0%	0.0%			
AM Peak	09:00	09:00	08:00	08:00	08:00	07:00	07:00	06:00	11:00	06:00	06:00				07:00		
Vol.	9	18	14	16	147	712	715	312	54	5	2				1810		
PM Peak	22:00	13:00	18:00	17:00	17:00	17:00	12:00	12:00	12:00	13:00	12:00	17:00			18:00		
Vol.	20	10	9	36	273	547	529	247	55	3	1	1			1409		

Accurate Counts
978-664-2565

Location : Route 9 EB
Location : West of Weston Road
City/State: Wellesley, MA
EB

6448SPDEB

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
03/27/15	4	0	0	0	4	20	34	27	7	1	0	0	0	0	97	48	52
01:00	0	0	0	0	3	14	23	7	2	0	**1**	0	0	0	50	46	51
02:00	0	0	0	0	3	9	8	10	2	0	0	0	0	0	32	48	50
03:00	0	0	0	2	1	8	19	8	2	1	0	0	0	0	41	48	52
04:00	0	0	0	1	7	20	40	14	8	0	0	0	0	0	90	48	52
05:00	4	0	0	2	8	73	133	74	13	1	0	0	0	0	308	47	49
06:00	21	2	0	1	10	169	340	**177**	**27**	**5**	1	0	0	0	753	47	49
07:00	14	6	3	7	81	**519**	**627**	165	24	5	0	0	0	0	**1451**	44	48
08:00	24	7	4	**10**	**118**	482	505	159	19	1	0	0	0	0	1329	44	48
09:00	**29**	**15**	**13**	6	102	441	486	131	18	3	0	0	0	0	1244	44	48
10:00	24	14	4	8	98	436	489	158	24	3	0	0	0	0	1258	44	48
11:00	8	8	6	3	103	439	477	148	25	5	0	0	0	0	1222	44	48
12 PM	**6**	8	1	3	81	332	469	191	28	2	**1**	**1**	0	0	1123	46	49
13:00	5	10	5	5	77	361	444	170	31	3	1	0	0	0	1112	46	49
14:00	2	**17**	**8**	5	**100**	386	443	201	44	6	0	0	0	0	1212	46	49
15:00	2	14	8	8	55	345	550	263	50	5	1	0	0	0	1301	47	49
16:00	1	8	2	1	57	**427**	551	252	37	4	1	0	0	0	**1341**	46	49
17:00	6	8	2	1	44	322	541	293	64	**9**	0	0	0	0	1290	47	50
18:00	3	4	2	11	45	293	560	313	**81**	9	0	0	0	0	1321	48	51
19:00	1	4	2	7	46	274	**571**	**339**	71	9	**3**	0	0	0	1327	48	51
20:00	5	1	1	3	35	262	473	228	60	5	1	0	0	0	1074	47	51
21:00	1	1	1	12	65	282	389	130	20	5	0	0	0	0	906	45	49
22:00	1	2	2	**13**	90	348	456	135	31	4	0	0	0	0	1082	45	49
23:00	4	3	1	4	45	156	238	140	39	6	1	0	0	0	637	48	51
Total	165	132	65	113	1278	6418	8866	3733	727	92	11	1	0	0	21601		
Percent	0.8%	0.6%	0.3%	0.5%	5.9%	29.7%	41.0%	17.3%	3.4%	0.4%	0.1%	0.0%	0.0%	0.0%			
AM Peak	09:00	09:00	09:00	08:00	08:00	07:00	07:00	06:00	06:00	06:00	01:00				07:00		
Vol.	29	15	13	10	118	519	627	177	27	5	1				1451		
PM Peak	12:00	14:00	14:00	22:00	14:00	16:00	19:00	19:00	18:00	17:00	19:00	12:00			16:00		
Vol.	6	17	8	13	100	427	571	339	81	9	3	1			1341		

Accurate Counts
978-664-2565

Location : Route 9 EB
Location : West of Weston Road
City/State: Wellesley, MA
EB

6448SPDEB

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
03/28/15	0	0	0	1	3	27	62	48	15	1	0	0	0	0	157	49	52
01:00	0	0	0	0	4	28	26	25	11	1	0	0	0	0	95	49	53
02:00	1	2	1	0	4	12	25	16	5	2	**1**	0	0	0	69	49	54
03:00	0	0	0	1	3	9	18	20	2	0	0	**1**	0	0	54	48	50
04:00	0	0	0	0	3	11	19	14	2	3	0	0	0	0	52	49	55
05:00	0	0	0	0	6	17	36	35	7	2	0	0	0	0	103	49	52
06:00	1	0	0	1	3	38	91	110	34	3	0	0	0	0	281	49	53
07:00	0	0	1	0	11	83	242	177	**50**	**9**	1	0	0	0	574	49	53
08:00	2	1	2	3	60	205	306	148	38	9	0	0	0	0	774	47	51
09:00	6	**7**	2	2	38	230	384	**232**	34	5	0	0	0	0	940	47	49
10:00	5	6	**10**	5	75	308	393	189	27	1	0	0	0	0	1019	46	49
11:00	**16**	2	3	**13**	**89**	**348**	**404**	135	25	4	0	0	0	0	**1039**	45	49
12 PM	12	11	0	10	112	356	411	154	**33**	1	0	0	0	0	1100	45	49
13:00	6	6	2	4	108	385	**480**	**205**	30	4	0	0	0	0	1230	46	49
14:00	5	5	4	1	123	429	420	166	30	4	0	0	0	0	1187	45	49
15:00	13	0	3	4	97	396	418	139	31	**5**	1	0	0	0	1107	45	49
16:00	10	7	3	4	87	415	437	145	31	0	**2**	0	0	0	1141	45	49
17:00	**17**	**15**	**12**	19	140	408	385	114	15	1	0	0	0	0	1126	44	48
18:00	16	2	0	34	**212**	**479**	380	112	14	3	0	0	0	0	**1252**	44	47
19:00	16	3	1	12	109	412	426	129	20	2	0	0	0	0	1130	44	48
20:00	10	2	3	**40**	198	413	305	76	11	1	1	0	0	0	1060	43	47
21:00	5	3	5	35	185	378	165	46	8	0	0	0	0	0	830	42	46
22:00	8	2	2	25	164	430	274	56	15	1	0	0	0	0	977	43	47
23:00	8	2	1	8	155	304	299	99	22	3	2	0	0	0	903	44	49
Total	157	76	55	222	1989	6121	6406	2590	510	65	8	1	0	0	18200		
Percent	0.9%	0.4%	0.3%	1.2%	10.9%	33.6%	35.2%	14.2%	2.8%	0.4%	0.0%	0.0%	0.0%	0.0%			
AM Peak	11:00	09:00	10:00	11:00	11:00	11:00	11:00	09:00	07:00	07:00	02:00	03:00			11:00		
Vol.	16	7	10	13	89	348	404	232	50	9	1	1			1039		
PM Peak	17:00	17:00	17:00	20:00	18:00	18:00	13:00	13:00	12:00	15:00	16:00				18:00		
Vol.	17	15	12	40	212	479	480	205	33	5	2				1252		
Grand Total	488	319	201	561	5157	19608	23782	9691	1840	201	25	3	0	0	61876		
Percent	0.8%	0.5%	0.3%	0.9%	8.3%	31.7%	38.4%	15.7%	3.0%	0.3%	0.0%	0.0%	0.0%	0.0%			

15th Percentile :	35 MPH
50th Percentile :	40 MPH
85th Percentile :	46 MPH
95th Percentile :	49 MPH

Statistics

10 MPH Pace Speed :	36-45 MPH
Number in Pace :	43390
Percent in Pace :	70.1%
Number of Vehicles > 40 MPH :	35542
Percent of Vehicles > 40 MPH :	57.4%
Mean Speed(Average) :	41 MPH

Accurate Counts
978-664-2565

Location : Route 9
Location : West of Weston Road
City/State: Wellesley, MA
WB

6448SPDWB

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
03/26/15	8	0	0	0	11	100	117	50	12	0	**2**	0	0	0	300	46	49
01:00	7	0	0	0	4	34	80	34	7	3	0	0	0	0	169	47	51
02:00	2	**2**	1	1	3	26	42	35	9	2	0	0	0	0	123	48	52
03:00	2	0	0	2	7	15	18	7	6	0	0	0	0	0	57	48	52
04:00	0	0	0	0	3	19	19	9	3	1	0	0	0	0	54	47	52
05:00	1	0	0	3	5	50	82	69	15	3	0	0	0	0	228	48	52
06:00	8	0	0	2	10	81	226	163	62	6	0	0	0	0	558	49	53
07:00	**21**	0	2	6	18	167	433	**305**	**83**	**9**	1	0	0	0	1045	48	52
08:00	16	0	2	9	37	268	502	291	64	3	0	0	0	0	**1192**	48	50
09:00	21	0	**4**	7	**50**	297	**504**	247	38	1	0	0	0	0	1169	47	49
10:00	17	0	4	**13**	32	**306**	427	209	40	5	0	0	0	0	1053	47	49
11:00	13	0	1	10	42	290	464	205	32	5	0	0	0	0	1062	47	49
12 PM	20	0	0	5	26	256	511	**246**	**41**	**4**	**2**	0	0	0	1111	47	49
13:00	6	0	1	15	59	338	**542**	232	33	0	0	0	0	0	1226	46	49
14:00	16	0	5	11	68	322	439	149	31	0	0	0	0	0	1041	45	49
15:00	15	0	7	53	116	367	438	157	21	0	0	0	0	0	1174	45	48
16:00	13	9	23	66	256	435	341	104	6	0	0	0	0	0	1253	43	47
17:00	10	11	**64**	**161**	**319**	**572**	270	32	2	0	0	0	0	0	**1441**	41	44
18:00	**109**	**80**	62	92	273	361	185	33	3	0	0	0	0	0	1198	41	44
19:00	98	80	36	26	62	287	306	70	8	0	0	0	0	0	973	43	47
20:00	20	0	0	17	105	296	343	109	10	0	0	0	0	0	900	44	48
21:00	19	0	1	3	57	284	243	67	6	0	0	0	0	0	680	44	47
22:00	15	0	0	4	51	260	223	73	12	1	0	0	0	0	639	44	48
23:00	24	0	1	2	46	237	305	81	12	3	0	0	0	0	711	44	48
Total	481	182	214	508	1660	5668	7060	2977	556	46	5	0	0	0	19357		
Percent	2.5%	0.9%	1.1%	2.6%	8.6%	29.3%	36.5%	15.4%	2.9%	0.2%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	02:00	09:00	10:00	09:00	10:00	09:00	07:00	07:00	07:00	00:00				08:00		
Vol.	21	2	4	13	50	306	504	305	83	9	2				1192		
PM Peak	18:00	18:00	17:00	17:00	17:00	17:00	13:00	12:00	12:00	12:00	12:00				17:00		
Vol.	109	80	64	161	319	572	542	246	41	4	2				1441		

Accurate Counts
978-664-2565

Location : Route 9
Location : West of Weston Road
City/State: Wellesley, MA
WB

6448SPDWB

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
03/27/15	19	0	0	4	17	152	204	65	14	1	0	0	0	0	476	45	49
01:00	3	0	0	1	2	30	22	17	1	0	0	0	0	0	76	46	49
02:00	1	0	1	0	2	12	14	10	1	0	0	0	0	0	41	47	49
03:00	0	0	0	2	7	9	12	4	2	0	0	0	0	0	36	45	50
04:00	0	0	0	0	3	18	14	10	1	0	0	0	0	0	46	47	49
05:00	8	0	1	0	6	47	81	37	4	1	0	0	0	0	185	46	49
06:00	7	0	1	0	21	89	224	105	**41**	**5**	0	0	0	0	493	48	52
07:00	23	0	**4**	1	32	199	359	**160**	41	3	0	0	0	0	822	47	50
08:00	26	0	2	5	46	332	**430**	149	19	1	**1**	0	0	0	1011	45	49
09:00	24	0	3	10	74	346	424	155	27	3	0	0	0	0	**1066**	45	49
10:00	12	0	3	11	**77**	**362**	409	137	26	1	0	0	0	0	1038	45	49
11:00	**30**	0	2	**12**	77	327	345	104	20	1	0	0	0	0	918	44	48
12 PM	12	0	2	7	100	478	514	143	15	2	0	0	0	0	1273	44	48
13:00	18	0	3	12	137	498	453	114	18	2	0	0	0	0	1255	44	48
14:00	8	0	0	15	58	412	577	186	29	2	0	0	0	0	1287	45	49
15:00	11	0	0	25	57	390	558	**210**	**42**	1	0	0	0	0	1294	46	49
16:00	23	0	0	14	95	399	548	208	27	2	**1**	0	0	0	1317	45	49
17:00	**163**	**127**	**127**	**135**	**225**	319	205	36	8	0	0	0	0	0	1345	41	44
18:00	13	0	0	5	62	**562**	**628**	183	30	0	0	0	0	0	**1483**	44	48
19:00	81	59	22	31	107	319	456	161	19	0	0	0	0	0	1255	44	48
20:00	7	0	0	3	25	340	577	202	35	1	0	0	0	0	1190	46	49
21:00	9	0	1	2	40	301	422	130	22	1	1	0	0	0	929	45	49
22:00	5	0	0	4	23	178	314	128	31	2	1	0	0	0	686	47	49
23:00	16	0	1	6	13	226	386	154	29	**4**	0	0	0	0	835	47	49
Total	519	186	173	305	1306	6345	8176	2808	502	33	4	0	0	0	20357		
Percent	2.5%	0.9%	0.8%	1.5%	6.4%	31.2%	40.2%	13.8%	2.5%	0.2%	0.0%	0.0%	0.0%	0.0%			
AM Peak	11:00		07:00	11:00	10:00	10:00	08:00	07:00	06:00	06:00	08:00				09:00		
Vol.	30		4	12	77	362	430	160	41	5	1				1066		
PM Peak	17:00	17:00	17:00	17:00	17:00	18:00	18:00	15:00	15:00	23:00	16:00				18:00		
Vol.	163	127	127	135	225	562	628	210	42	4	1				1483		

Accurate Counts
978-664-2565

Location : Route 9
Location : West of Weston Road
City/State: Wellesley, MA
WB

6448SPDWB

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
03/28/15	6	0	0	6	12	145	292	132	35	2	0	**1**	0	0	631	47	50
01:00	2	**1**	1	0	8	20	48	20	4	0	0	0	0	0	104	47	49
02:00	0	0	0	2	4	29	36	20	7	0	0	0	0	0	98	48	51
03:00	1	0	0	3	2	9	30	8	1	0	0	0	0	0	54	45	48
04:00	1	0	0	2	3	12	15	12	1	3	**1**	0	0	0	50	48	57
05:00	2	0	0	0	3	13	30	14	5	3	0	0	0	0	70	49	54
06:00	2	0	0	0	10	50	85	51	26	0	0	0	0	0	224	49	52
07:00	3	1	0	1	21	118	229	113	37	2	0	1	0	0	526	48	51
08:00	13	0	2	0	23	167	311	175	**59**	**15**	1	0	0	0	766	48	53
09:00	7	1	**4**	4	89	336	413	165	41	3	0	0	0	0	**1063**	46	49
10:00	**20**	0	4	**15**	**93**	**337**	416	148	20	3	1	0	0	0	1057	45	49
11:00	12	0	1	9	57	313	**418**	**188**	33	2	0	0	0	0	1033	46	49
12 PM	21	0	0	3	35	383	464	164	34	1	0	0	0	0	1105	46	49
13:00	20	0	2	12	79	417	425	139	21	2	0	0	0	0	1117	44	48
14:00	18	0	5	**55**	**163**	**435**	356	135	19	2	0	0	0	0	**1188**	44	48
15:00	20	0	3	32	83	313	462	**182**	28	1	0	0	0	0	1124	46	49
16:00	20	3	13	28	99	308	413	140	30	1	0	0	0	0	1055	45	49
17:00	**198**	**77**	**22**	1	13	55	85	37	7	1	0	0	0	0	496	43	47
18:00	15	0	0	1	46	251	**494**	174	**35**	**5**	0	0	0	0	1021	46	49
19:00	13	0	1	9	56	261	411	179	33	2	0	0	0	0	965	46	49
20:00	8	0	1	5	43	216	338	135	20	3	**1**	0	0	0	770	46	49
21:00	14	0	1	6	39	222	223	73	16	0	0	0	0	0	594	44	49
22:00	10	0	3	3	35	227	224	88	11	4	0	0	0	0	605	45	49
23:00	7	0	1	6	39	265	372	160	34	1	0	0	0	0	885	46	49
Total	433	83	64	203	1055	4902	6590	2652	557	56	4	2	0	0	16601		
Percent	2.6%	0.5%	0.4%	1.2%	6.4%	29.5%	39.7%	16.0%	3.4%	0.3%	0.0%	0.0%	0.0%	0.0%			
AM Peak	10:00	01:00	09:00	10:00	10:00	10:00	11:00	11:00	08:00	08:00	04:00	00:00			09:00		
Vol.	20	1	4	15	93	337	418	188	59	15	1	1			1063		
PM Peak	17:00	17:00	17:00	14:00	14:00	14:00	18:00	15:00	18:00	18:00	20:00				14:00		
Vol.	198	77	22	55	163	435	494	182	35	5	1				1188		

Accurate Counts
978-664-2565

Location : Route 9
Location : West of Weston Road
City/State: Wellesley, MA
WB

6448SPDWB

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
03/29/15	5	1	**3**	6	35	132	208	70	14	0	0	0	**2**	0	476	46	49
01:00	2	2	0	2	4	26	58	31	3	0	0	0	0	0	128	47	49
02:00	1	0	0	0	0	19	46	13	5	0	0	0	0	0	84	47	50
03:00	2	1	0	1	2	13	25	15	3	0	0	0	0	0	62	47	49
04:00	0	0	0	2	3	9	12	8	2	0	0	0	0	0	36	47	50
05:00	0	0	0	4	1	10	17	10	1	1	0	0	0	0	44	47	49
06:00	0	0	1	1	8	29	58	28	10	3	0	0	0	0	138	48	53
07:00	0	0	2	0	10	47	139	77	31	4	0	0	0	0	310	49	53
08:00	4	0	0	0	11	104	177	146	46	**5**	0	0	0	0	493	49	52
09:00	10	0	0	2	11	154	288	181	**47**	3	0	0	0	0	696	48	51
10:00	**75**	**35**	3	**36**	**108**	221	247	109	20	1	0	0	0	0	855	45	49
11:00	13	0	0	3	33	**296**	**584**	**205**	31	1	0	0	0	0	**1166**	46	49
12 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
13:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
14:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
15:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
16:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
17:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
18:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
19:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
20:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
21:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
22:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
23:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Total	112	39	9	57	226	1060	1859	893	213	18	0	0	2	0	4488		
Percent	2.5%	0.9%	0.2%	1.3%	5.0%	23.6%	41.4%	19.9%	4.7%	0.4%	0.0%	0.0%	0.0%	0.0%			
AM Peak	10:00	10:00	00:00	10:00	10:00	11:00	11:00	11:00	09:00	08:00			00:00		11:00		
Vol.	75	35	3	36	108	296	584	205	47	5			2		1166		
PM Peak																	
Vol.																	
Grand Total	1545	490	460	1073	4247	17975	23685	9330	1828	153	13	2	2	0	60803		
Percent	2.5%	0.8%	0.8%	1.8%	7.0%	29.6%	39.0%	15.3%	3.0%	0.3%	0.0%	0.0%	0.0%	0.0%			

15th Percentile :	35 MPH
50th Percentile :	40 MPH
85th Percentile :	46 MPH
95th Percentile :	49 MPH

Statistics

10 MPH Pace Speed :	36-45 MPH
Number in Pace :	41660
Percent in Pace :	68.5%
Number of Vehicles > 40 MPH :	35013
Percent of Vehicles > 40 MPH :	57.6%
Mean Speed(Average) :	40 MPH

PEAK-HOUR TRAFFIC VOLUME CALCULATIONS

Peak Hour Traffic Volumes
Route 9 at Project Site

	2015 Existing		1% Growth - 2022		978 Worcester St		2022 No-Build	
	EB	WB	EB	WB	EB	WB	EB	WB
AM	1766	1192	1893	1278	70	77	1963	1355
PM	1290	1441	1383	1545	157	138	1540	1683
Sat	1229	1221	1318	1309	138	146	1456	1455

TRIP-GENERATION CALCULATIONS

Institute of Transportation Engineers (ITE)
Trip Generation, 9 th Edition
Land Use Code (LUC) 465 - Ice Skating Rink

Average Vehicle Trips Ends vs: Seats
Independent Variable (X): 635

AVERAGE WEEKDAY DAILY

T = 1.26 * (X)
T = 1.26 * 635
T = 800.10
T = 800 vehicle trips
with 50% (400 vpd) entering and 50% (400 vpd) exiting.

WEEKDAYMORNING PEAK HOUR

$$\frac{\text{ITE LUC 488 Weekday Morning Trip Rate}}{\text{ITE LUC 488 Weekday Evening Trip Rate}} = \frac{\text{ITE LUC 465 Weekday Morning Trip Rate}}{\text{ITE LUC 465 Weekday Evening Trip Rate}}$$

$$\frac{1.12}{17.70} = \frac{(Y)}{0.12} \qquad Y = 0.01$$

T = Y * 635
T = 6.35
T = 6 vehicle trips
with 57% (3 vpd) entering and 43% (3 vpd) exiting.

WEEKDAY EVENING PEAK HOUR

T = 0.12 * (X)
T = 0.12 * 635
T = 76.20
T = 76 vehicle trips
with 45% (34 vph) entering and 55% (42 vph) exiting.

AVERAGE SATURDAY DAILY

$$\frac{\text{ITE LUC 488 Saturday Daily Trip Rate}}{\text{ITE LUC 488 Weekday Evening Trip Rate}} = \frac{\text{ITE LUC 465 Saturday Daily Trip Rate}}{\text{ITE LUC 465 Weekday Evening Trip Rate}}$$

$$\frac{117.43}{71.33} = \frac{(Y)}{1.26} \qquad Y = 2.074328$$

T = Y * 635
T = 1317.2
T = 1,318 vehicle trips
with 50% (659 vpd) entering and 50% (659 vpd) exiting.

SATURDAY MIDDAY PEAK HOUR

$$\frac{\text{ITE LUC 488 Saturday Midday Trip Rate}}{\text{ITE LUC 488 Weekday Evening Trip Rate}} = \frac{\text{ITE LUC 465 Saturday Midday Trip Rate}}{\text{ITE LUC 465 Weekday Evening Trip Rate}}$$

$$\frac{30.34}{17.70} = \frac{(Y)}{0.12} \qquad Y = 0.21$$

T = Y * 635
T = 133.35
T = 133 vehicle trips
with 48% (64 vpd) entering and 52% (69 vpd) exiting.

Institute of Transportation Engineers (ITE)
***Trip Generation, 9*th Edition**
Land Use Code (LUC) 465 - Ice Skating Rink

Average Vehicle Trips Ends vs: Seats
Independent Variable (X): 1270

AVERAGE WEEKDAY DAILY

T = 1.26 * (X)
T = 1.26 * 1270
T = 1600.20
T = 1,600 vehicle trips
with 50% (800 vpd) entering and 50% (800 vpd) exiting.

WEEKDAYMORNING PEAK HOUR

$$\frac{\text{ITE LUC 488 Weekday Morning Trip Rate}}{\text{ITE LUC 488 Weekday Evening Trip Rate}} = \frac{\text{ITE LUC 465 Weekday Morning Trip Rate}}{\text{ITE LUC 465 Weekday Evening Trip Rate}}$$

$$\frac{1.12}{17.70} = \frac{(Y)}{0.12} \qquad Y = 0.01$$

T = Y * 1,270
T = 12.7
T = 13 vehicle trips
with 57% (7 vpd) entering and 43% (6 vpd) exiting.

WEEKDAY EVENING PEAK HOUR

T = 0.12 * (X)
T = 0.12 * 1270
T = 152.40
T = 152 vehicle trips
with 45% (68 vph) entering and 55% (84 vph) exiting.

AVERAGE SATURDAY DAILY

$$\frac{\text{ITE LUC 488 Saturday Daily Trip Rate}}{\text{ITE LUC 488 Weekday Evening Trip Rate}} = \frac{\text{ITE LUC 465 Saturday Daily Trip Rate}}{\text{ITE LUC 465 Weekday Evening Trip Rate}}$$

$$\frac{117.43}{71.33} = \frac{(Y)}{1.26} \qquad Y = 2.074328$$

T = Y * 1,270
T = 2634.4
T = 2,634 vehicle trips
with 50% (1,317 vpd) entering and 50% (1,317 vpd) exiting.

SATURDAY MIDDAY PEAK HOUR

$$\frac{\text{ITE LUC 488 Saturday Midday Trip Rate}}{\text{ITE LUC 488 Weekday Evening Trip Rate}} = \frac{\text{ITE LUC 465 Saturday Midday Trip Rate}}{\text{ITE LUC 465 Weekday Evening Trip Rate}}$$

$$\frac{30.34}{17.70} = \frac{(Y)}{0.12} \qquad Y = 0.21$$

T = Y * 1,270
T = 266.7
T = 267 vehicle trips
with 48% (128 vpd) entering and 52% (139 vpd) exiting.

Trip Generation Calculations - Town of Wellesley Athletic Complex

Soccer Field

18	players/team (parents)	Wkdy AM Pk Hr: (7:15 - 8:15)		
2	coaches/team	In	2	
20	Total/team	Out	1	
40	Total/game	Total	3	
2	officials/game	Wkdy PM Pk Hr: (5:00 - 6:00)		
1	trainer/game	In	31	
		Out	16	
43	Total/game	Total	47 *	(43 total/game plus 10%)
# of games/field		Sat Mid Pk Hr: (1:15 - 2:15)		
3	Weekday	In	41	
8	Saturday	Out	45	
		Total	86 *	

# of daily trips

258	Weekday	(**5:00**, 7:00, 9:00)
688	Saturday	(6:00, 8:00, 10:00, **12:00, 2:00**, 4:00, 6:00, 8:00)

Public Use (10:00 - 4:00)
Assume 10% of weekday daily trips

26 Weekday Daily Trips

Total Soccer Field

284	Weekday Daily Trips
688	Saturday Trips

*Directional Distribution is based on ITE LUC 488, *Soccer Complex* .

Institute of Transportation Engineers (ITE)
***Trip Generation, 9*th Edition**
Land Use Code (LUC) 495 - Recreational Community Center

Average Vehicle Trips Ends vs: 1,000 Sq. Feet Gross Floor Area
Independent Variable (X): 21.525

AVERAGE WEEKDAY DAILY

T = 33.82 * (X)
T = 33.82 * 21.525
T = 727.98
T = 728 vehicle trips
with 50% (364 vph) entering and 50% (364 vph) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 2.05 * (X)
T = 2.05 * 21.525
T = 44.13
T = 44 vehicle trips
with 66% (29 vph) entering and 34% (15 vph) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 2.74 * (X)
T = 2.74 * 21.525
T = 58.98
T = 59 vehicle trips
with 49% (29 vph) entering and 51% (30 vph) exiting.

SATURDAY DAILY

$$\frac{\text{ITE LUC 495 Average Weekday Trip Rate Employee}}{\text{ITE LUC 495 Saturday Daily Trip Rate Employee}} = \frac{\text{ITE LUC 495 Average Weekday Trip Rate GSF}}{\text{ITE LUC 495 Saturday Daily Trip Rate GSF}}$$

$$\frac{27.25}{18.34} = \frac{33.82}{(Y)} \qquad Y = 22.7618$$

T = Y * 21.525
T = 490
T = 490 vehicle trips
with 50% (245 vph) entering and 50% (245 vph) exiting.

SATURDAY MIDDAY PEAK HOUR

$$\frac{\text{ITE LUC 495 Saturday Midday Trip Rate Employee}}{\text{ITE LUC 495 Saturday Daily Trip Rate Employee}} = \frac{\text{ITE LUC 495 Saturday Midday Trip Rate SF}}{\text{ITE LUC 495 Saturday Daily Trip Rate SF}}$$

$$\frac{2.59}{18.34} = \frac{(Y)}{22.76} \qquad Y = 3.21445$$

T = Y * 21.525
T = 69.2
T = 69 vehicle trips
with 54% (37 vph) entering and 46% (32 vph) exiting.

Institute of Transportation Engineers (ITE)
***Trip Generation, 9*th Edition**
Land Use Code (LUC) 495 - Recreational Community Center

Average Vehicle Trips Ends vs: 1,000 Sq. Feet Gross Floor Area
Independent Variable (X): 24.015

AVERAGE WEEKDAY DAILY

T = 33.82 * (X)
T = 33.82 * 24.015
T = 812.19
T = 812 vehicle trips
with 50% (406 vph) entering and 50% (406 vph) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 2.05 * (X)
T = 2.05 * 24.015
T = 49.23
T = 49 vehicle trips
with 66% (32 vph) entering and 34% (17 vph) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 2.74 * (X)
T = 2.74 * 24.015
T = 65.80
T = 66 vehicle trips
with 49% (32 vph) entering and 51% (34 vph) exiting.

SATURDAY DAILY

$$\frac{\text{ITE LUC 495 Average Weekday Trip Rate Employee}}{\text{ITE LUC 495 Saturday Daily Trip Rate Employee}} = \frac{\text{ITE LUC 495 Average Weekday Trip Rate GSF}}{\text{ITE LUC 495 Saturday Daily Trip Rate GSF}}$$

$$\frac{27.25}{18.34} = \frac{33.82}{(Y)} \qquad Y = 22.7618$$

T = Y * 24.015
T = 547
T = 548 vehicle trips
with 50% (274 vph) entering and 50% (274 vph) exiting.

SATURDAY MIDDAY PEAK HOUR

$$\frac{\text{ITE LUC 495 Saturday Midday Trip Rate Employee}}{\text{ITE LUC 495 Saturday Daily Trip Rate Employee}} = \frac{\text{ITE LUC 495 Saturday Midday Trip Rate SF}}{\text{ITE LUC 495 Saturday Daily Trip Rate SF}}$$

$$\frac{2.59}{18.34} = \frac{(Y)}{22.76} \qquad Y = 3.21445$$

T = Y * 24.015
T = 77.2
T = 77 vehicle trips
with 54% (42 vph) entering and 46% (35 vph) exiting.

Institute of Transportation Engineers (ITE)
***Trip Generation, 9*th Edition**
Land Use Code (LUC) 495 - Recreational Community Center

Average Vehicle Trips Ends vs: 1,000 Sq. Feet Gross Floor Area
Independent Variable (X): 22.55

AVERAGE WEEKDAY DAILY

T = 33.82 * (X)
T = 33.82 * 22.55
T = 762.64
T = 764 vehicle trips
with 50% (382 vph) entering and 50% (382 vph) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 2.05 * (X)
T = 2.05 * 22.55
T = 46.23
T = 46 vehicle trips
with 66% (30 vph) entering and 34% (16 vph) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 2.74 * (X)
T = 2.74 * 22.55
T = 61.79
T = 62 vehicle trips
with 49% (30 vph) entering and 51% (32 vph) exiting.

SATURDAY DAILY

$$\frac{\text{ITE LUC 495 Average Weekday Trip Rate Employee}}{\text{ITE LUC 495 Saturday Daily Trip Rate Employee}} = \frac{\text{ITE LUC 495 Average Weekday Trip Rate GSF}}{\text{ITE LUC 495 Saturday Daily Trip Rate GSF}}$$

$$\frac{27.25}{18.34} = \frac{33.82}{(Y)} \qquad Y = 22.7618$$

T = Y * 22.550
T = 513
T = 514 vehicle trips
with 50% (257 vph) entering and 50% (257 vph) exiting.

SATURDAY MIDDAY PEAK HOUR

$$\frac{\text{ITE LUC 495 Saturday Midday Trip Rate Employee}}{\text{ITE LUC 495 Saturday Daily Trip Rate Employee}} = \frac{\text{ITE LUC 495 Saturday Midday Trip Rate SF}}{\text{ITE LUC 495 Saturday Daily Trip Rate SF}}$$

$$\frac{2.59}{18.34} = \frac{(Y)}{22.76} \qquad Y = 3.21445$$

T = Y * 22.550
T = 72.5
T = 72 vehicle trips
with 54% (39 vph) entering and 46% (33 vph) exiting.

Land Use: 465
Ice Skating Rink

Independent Variables with One Observation

The following trip generation data are for independent variables with only one observation. This information is shown in this table only; there are no related plots for these data.

Users are cautioned to use data with care because of the small sample size.

Independent Variable	Trip Generation Rate	Size of Independent Variable	Number of Studies	Directional Distribution
1,000 Square Feet Gross Floor Area				
Weekday P.M. Peak Hour of Adjacent Street Traffic	2.36	70	1	45% entering, 55% exiting
Seats				
Weekday	1.26	300	1	50% entering, 50% exiting
Weekday P.M. Peak Hour of Adjacent Street Traffic	0.12	300	1	Not available

Land Use: 488
Soccer Complex
Independent Variables with One Observation

The following trip generation data are for independent variables with only one observation. This information is shown in this table only; there are no related plots for these data.

Users are cautioned to use data with care because of the small sample size.

Independent Variable	Trip Generation Rate	Size of Independent Variable	Number of Studies	Directional Distribution
Fields				
Saturday	117.43	7	1	50% entering, 50% exiting
Sunday Peak Hour of Generator	28.10	20	1	41% entering, 59% exiting

Soccer Complex
(488)

Average Vehicle Trip Ends vs: Fields
On a: Weekday

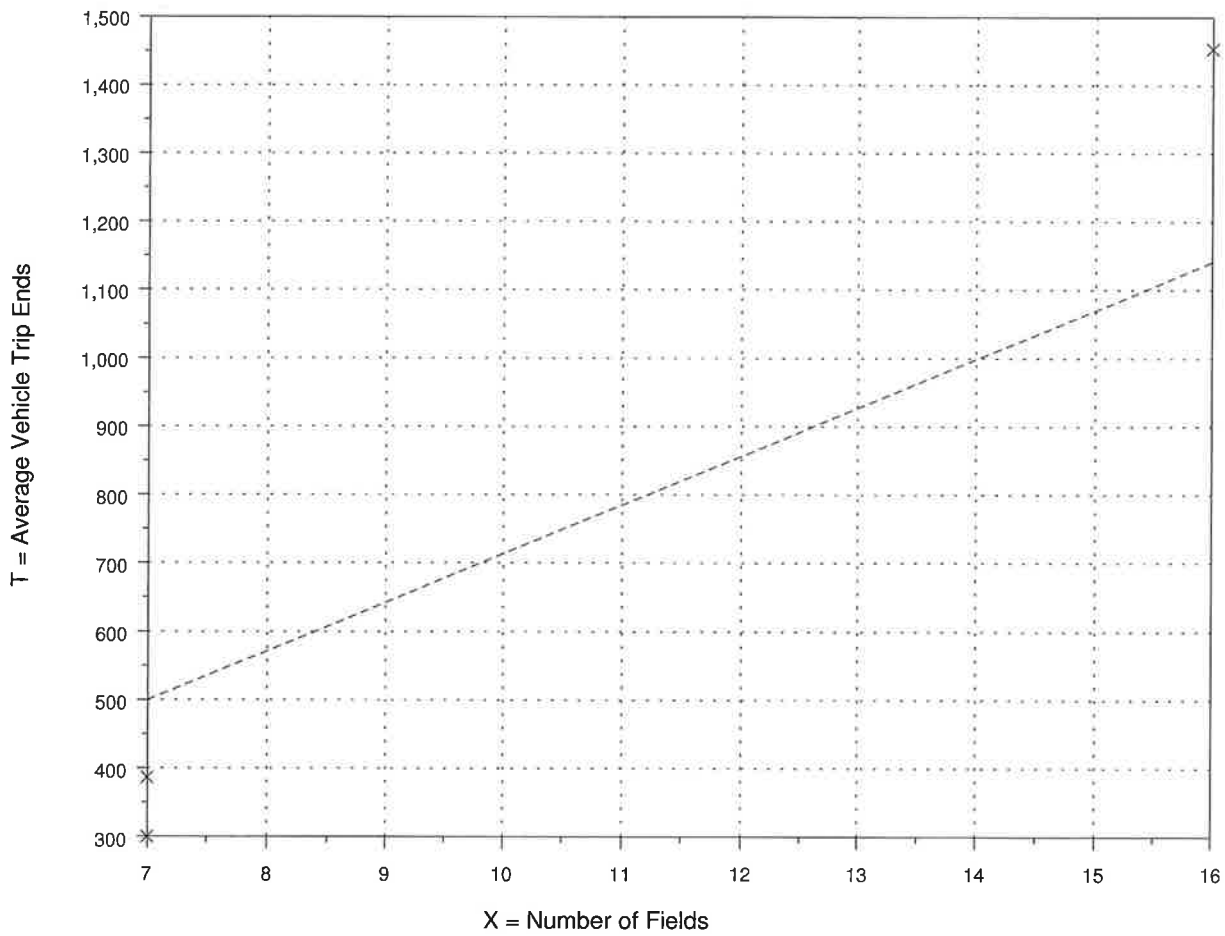
Number of Studies: 3
Average Number of Fields: 10
Directional Distribution: 50% entering, 50% exiting

Trip Generation per Field

Average Rate	Range of Rates	Standard Deviation
71.33	42.86 - 90.81	23.12

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



× **Actual Data Points**

------ **Average Rate**

Fitted Curve Equation: Not given

R^2 = ****

Soccer Complex
(488)

Average Vehicle Trip Ends vs: Fields
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

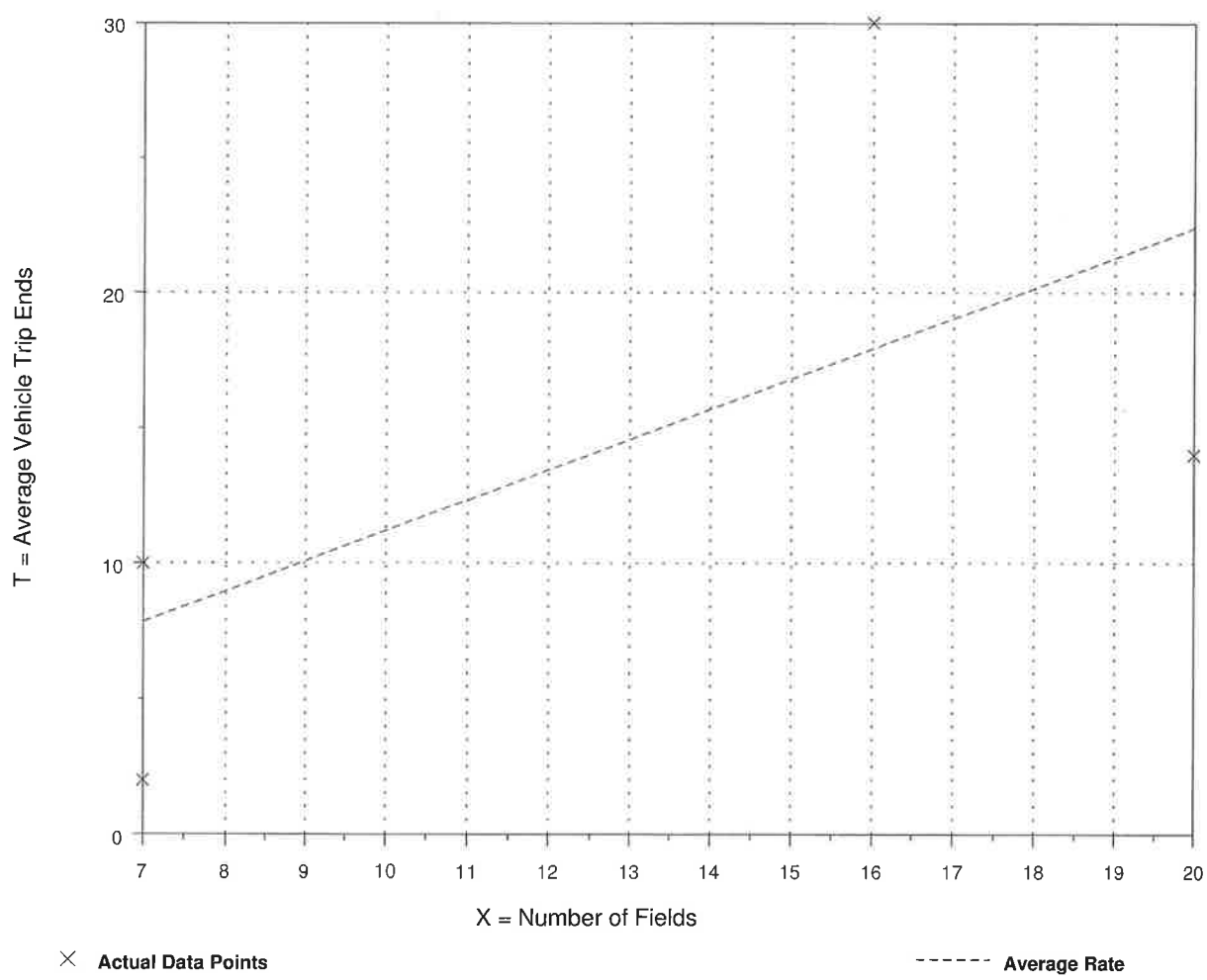
Number of Studies: 4
Average Number of Fields: 13
Directional Distribution: 57% entering, 43% exiting

Trip Generation per Field

Average Rate	Range of Rates	Standard Deviation
1.12	0.29 - 1.88	1.19

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: Not Given

R^2 = ****

Soccer Complex
(488)

Average Vehicle Trip Ends vs: Fields
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

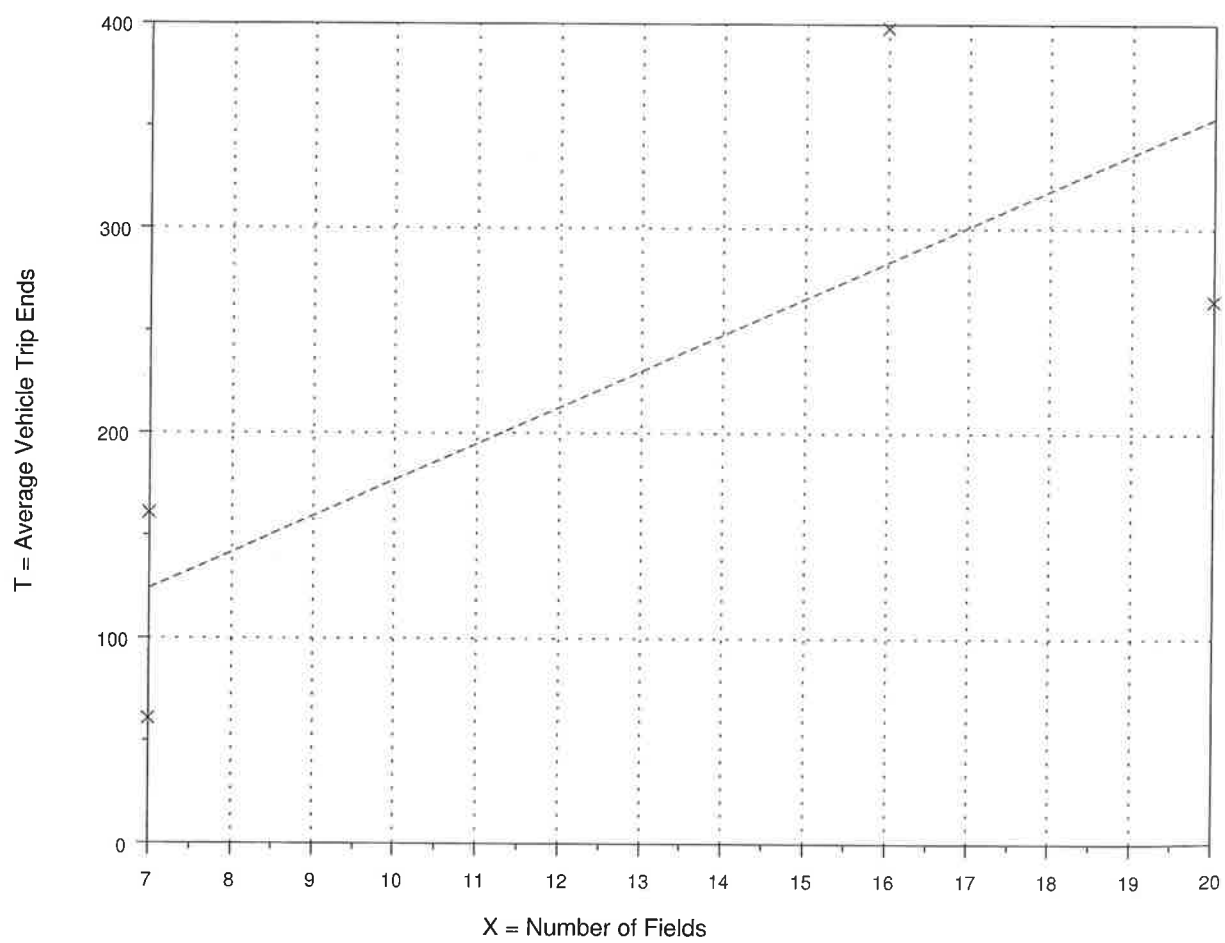
Number of Studies: 4
Average Number of Fields: 13
Directional Distribution: 67% entering, 33% exiting

Trip Generation per Field

Average Rate	Range of Rates	Standard Deviation
17.70	8.71 - 24.88	7.55

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



× **Actual Data Points**

------ **Average Rate**

Fitted Curve Equation: Not Given

R^2 = ****

Soccer Complex
(488)

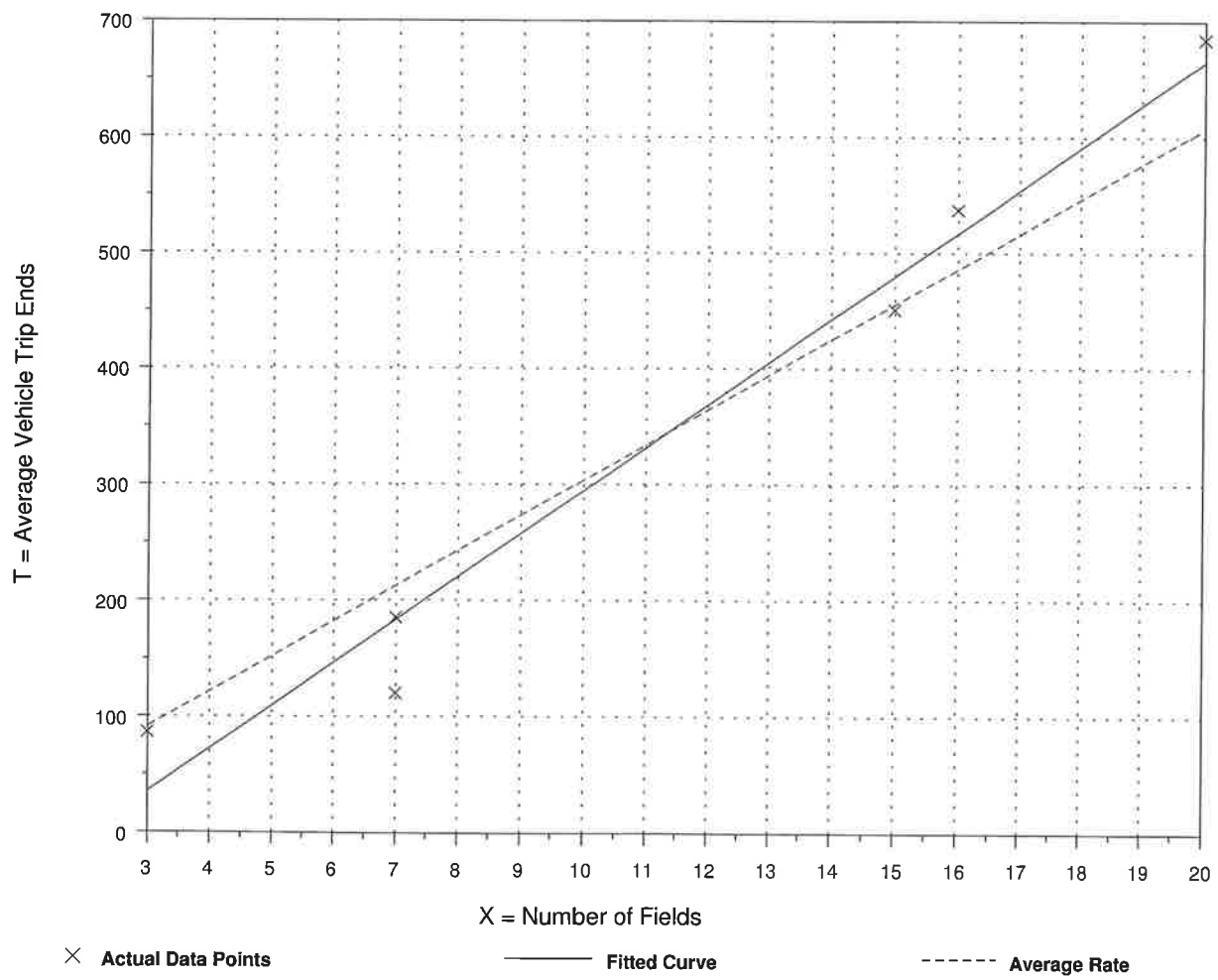
Average Vehicle Trip Ends vs: Fields
On a: Saturday,
Peak Hour of Generator

Number of Studies: 6
Average Number of Fields: 11
Directional Distribution: 48% entering, 52% exiting

Trip Generation per Field

Average Rate	Range of Rates	Standard Deviation
30.34	17.14 - 34.20	7.42

Data Plot and Equation



Fitted Curve Equation: T = 37.04(X) - 75.92

R^2 = 0.97

Recreational Community Center
(495)

Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday

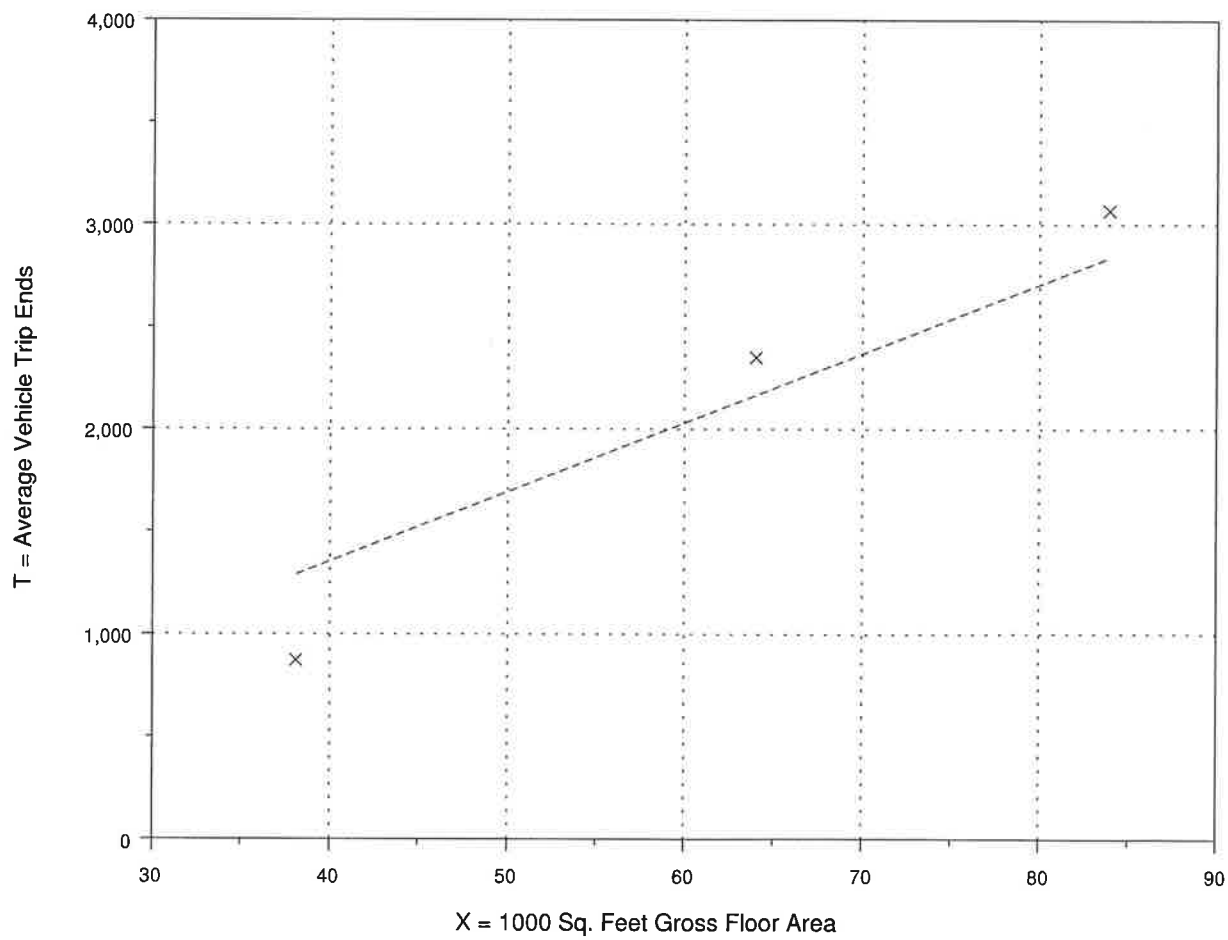
Number of Studies: 3
Average 1000 Sq. Feet GFA: 62
Directional Distribution: 50% entering, 50% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
33.82	22.88 - 36.71	8.03

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



× **Actual Data Points**

------ **Average Rate**

Fitted Curve Equation: Not given

R^2 = ****

Recreational Community Center
(495)

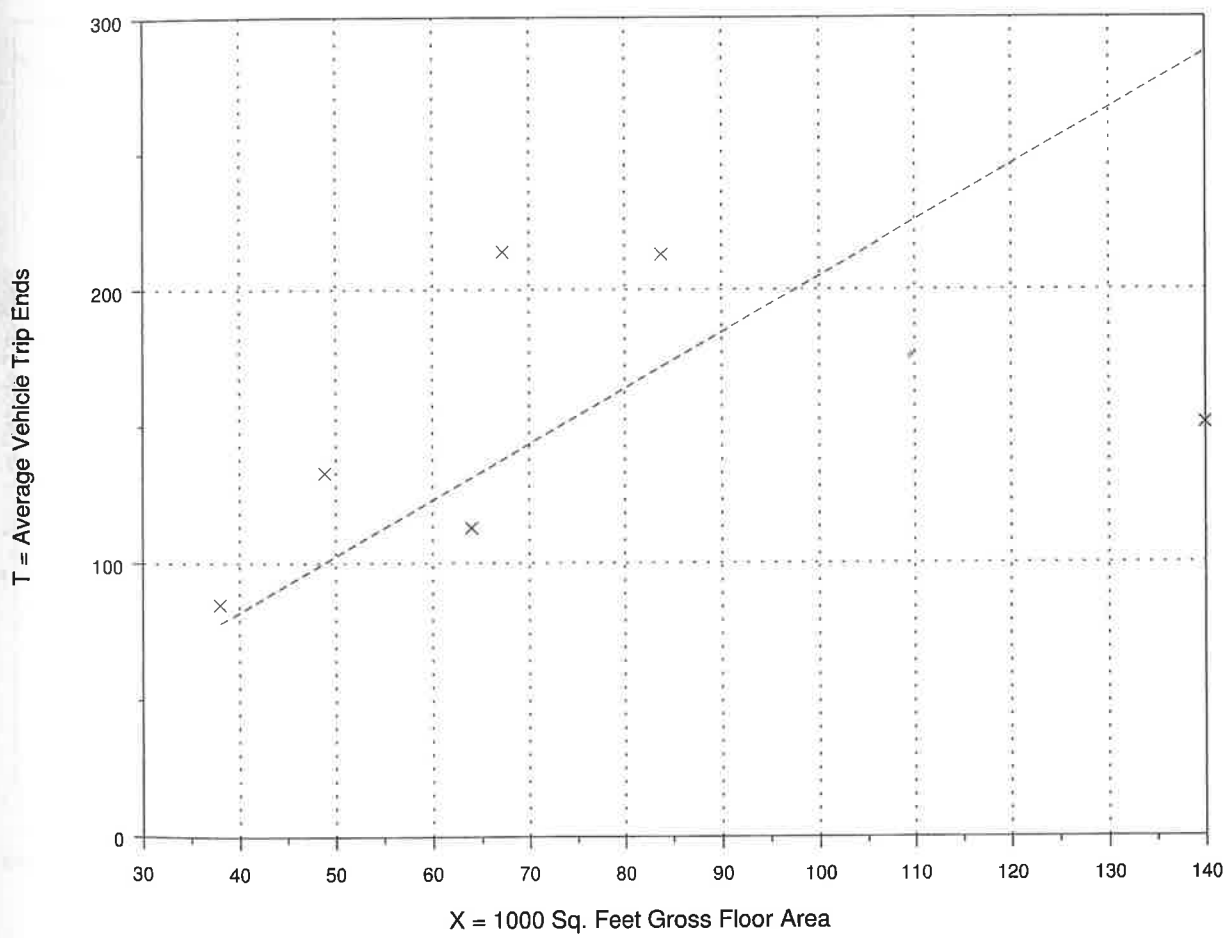
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

Number of Studies: 6
Average 1000 Sq. Feet GFA: 74
Directional Distribution: 66% entering, 34% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
2.05	1.08 - 3.18	1.62

Data Plot and Equation



× **Actual Data Points** ------ **Average Rate**

Fitted Curve Equation: Not given R^2 = ****

Recreational Community Center
(495)

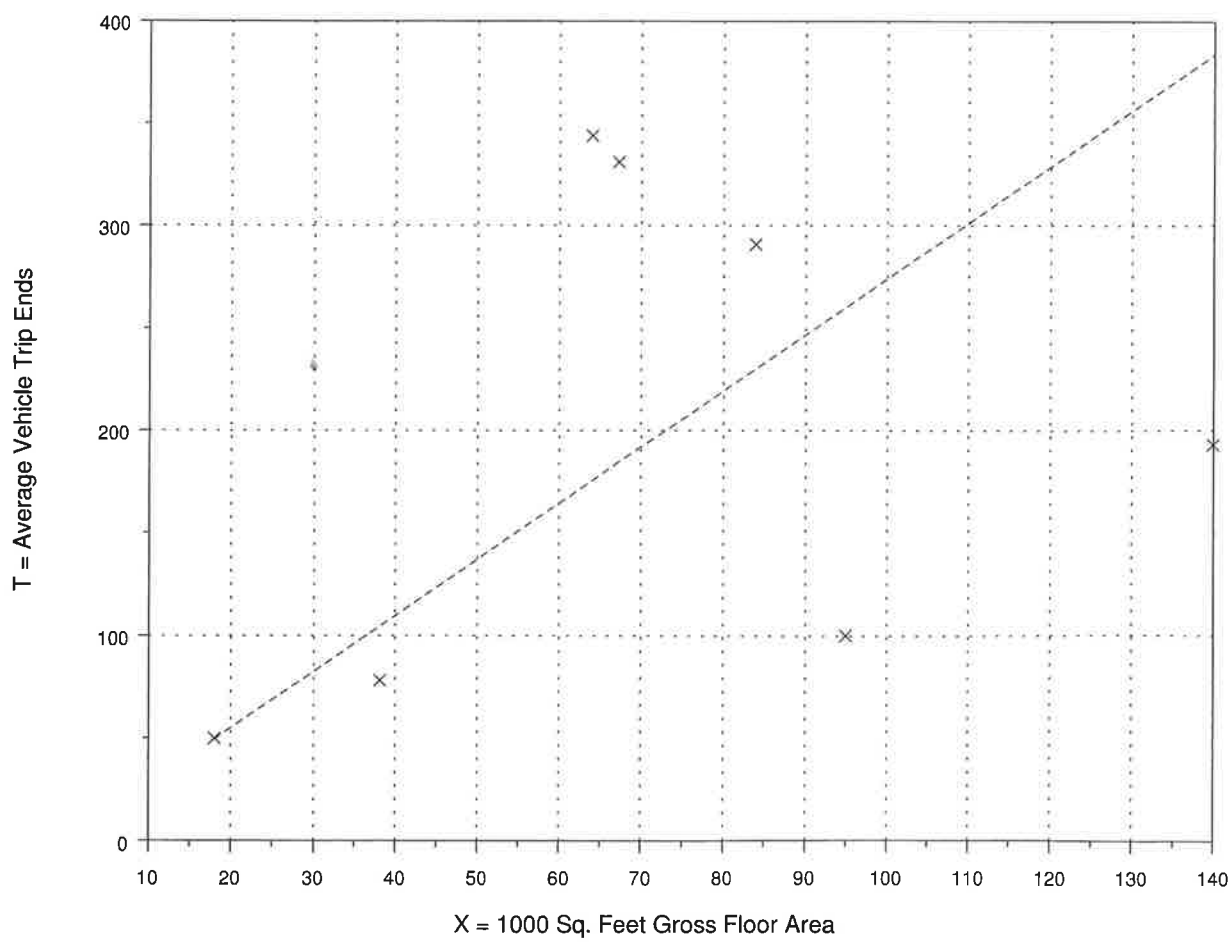
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 7
Average 1000 Sq. Feet GFA: 72
Directional Distribution: 49% entering, 51% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
2.74	1.05 - 5.37	2.32

Data Plot and Equation



× **Actual Data Points** ------ **Average Rate**

Fitted Curve Equation: Not given R^2 = ****

Recreational Community Center
(495)

Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Saturday

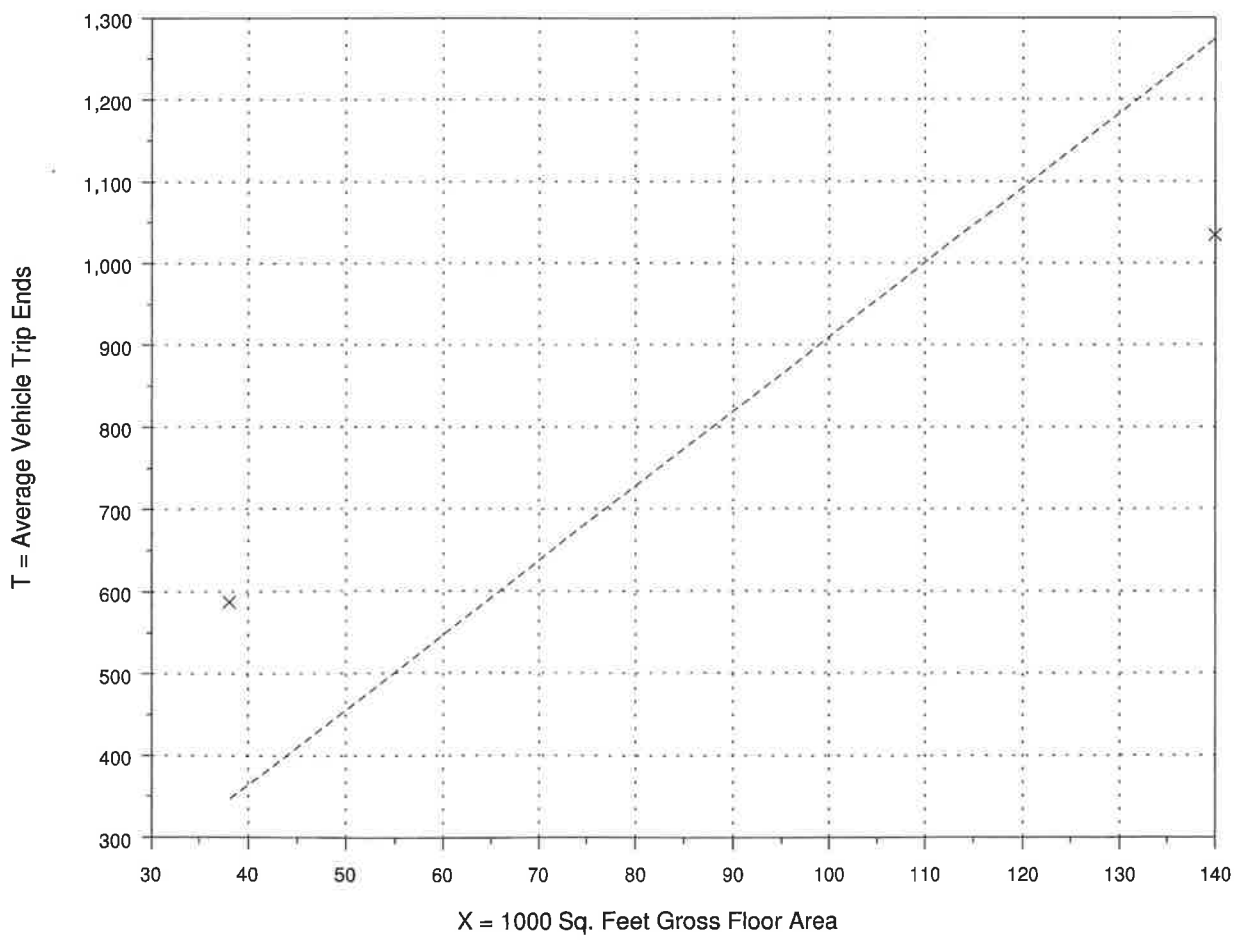
Number of Studies: 2
Average 1000 Sq. Feet GFA: 89
Directional Distribution: 50% entering, 50% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
9.10	7.39 - 15.40	*

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: Not given

R^2 = ****

Recreational Community Center
(495)

Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Saturday,
Peak Hour of Generator

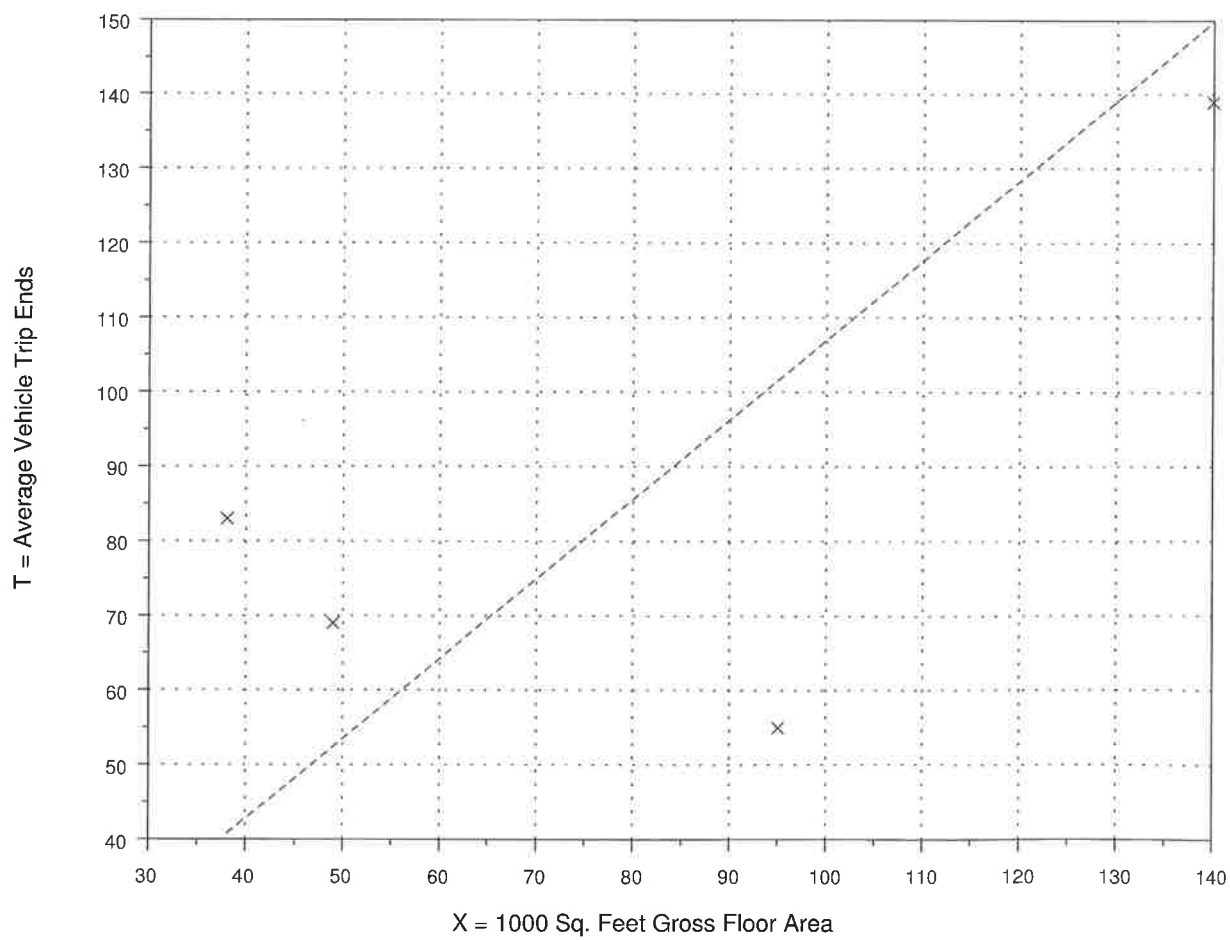
Number of Studies: 4
Average 1000 Sq. Feet GFA: 81
Directional Distribution: 54% entering, 46% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
1.07	0.58 - 2.18	1.14

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



× **Actual Data Points** ------ **Average Rate**

Fitted Curve Equation: Not given R^2 = ****

TRAFFIC SIGNAL WARRANTS ANALYSIS

Traffic Signal Warrant Analysis Summary - Route 9 at the Project Driveway - Option 1
2015 Average-Month Conditions

Time	Route 9 Volume (Major Street)[a]	Project Driveway Volume (Minor Street)[b]	Warrant 1 Condition A[c]	Warrant 1 Condition B[d]	Warrant 2[e]	Warrant 3[f]
7:00	2855	5	No	No	No	No
8:00	2958	19	No	No	No	No
9:00	2616	32	No	No	No	No
10:00	2231	63	No	Yes	Yes	No
11:00	2217	59	No	Yes	No	No
12:00	2367	51	No	No	No	No
1:00	2450	58	No	Yes	No	No
2:00	2256	47	No	No	No	No
3:00	2346	50	No	No	No	No
4:00	2518	75	No	Yes	Yes	No
5:00	2731	88	No	Yes	Yes	No
6:00	2607	118	Yes	Yes	Yes	Yes
7:00	1677	65	No	Yes	Yes	No
8:00	1370	25	No	No	No	No
9:00	1490	20	No	No	No	No
Warrant Satisfied?			No	No	Yes	Yes

[a]Based on weekday ATR counts conducted on Route 9 by VAI in March 2015. Volume includes total of both approaches.
[b]Based on estimated hourly distribution (modified LUC 492 Health/Fitness Club).
[c]Warrant 1 Condition A - Eight Hour Vehicular Volume, Minimum Vehicular Volume - satisfied when major street volume > 420 and minor street volume > 105.
[d]Warrant 1 Condition B - Eight Hour Vehicular Volume, Interruption of Continuous Traffic - satisfied when major street volume > 630 and minor street volume >53.
[e]Warrant 2 - Four Hour Vehicular Volume - see Figure 4C-2 (lower threshold is 60 vph).
[f]Warrant 3 - Peak Hour Vehicular Volume - see Figure 4C-4 (lower threshold is 75 vph).

Hourly Distribution Option 1

	LUC 492 Health/Fitness Club									
	Parking Demand			Exiting Distribution (Percent)			Exiting Distribution (Trips)			
start time	Percent of Peak Period	Adjusted		Hockey Rink	Soccer Field	Pool/Fitness Ctr	Hockey Rink	Soccer Field	Pool/Fitness Ctr	Total
12:00 AM	0		0							
1:00 AM	0		0							
2:00 AM	0		0							
3:00 AM	0		0							
4:00 AM	0		0							
5:00 AM	0		0							
6:00 AM	20	2	0.00270636	0.00270636	0.00270636	0.00270636	1	0	1	2
7:00 AM	20	4	0.00541272	0.00541272	0.00541272	0.00541272	2	1	2	5
8:00 AM	20	20	0.027063599	0.00645	0.009084507	0.041208791	3	1	15	19
9:00 AM	26	26	0.035182679	0.035182679	0.035182679	0.035182679	14	5	13	32
10:00 AM	51	51	0.069012179	0.069012179	0.069012179	0.069012179	28	10	25	63
11:00 AM	48	48	0.064952639	0.064952639	0.064952639	0.064952639	26	9	24	59
12:00 PM	42	42	0.056833559	0.056833559	0.056833559	0.056833559	23	8	21	51
1:00 PM	47	47	0.063599459	0.063599459	0.063599459	0.063599459	25	9	23	58
2:00 PM	38	38	0.051420839	0.051420839	0.051420839	0.051420839	21	7	19	47
3:00 PM	41	41	0.055480379	0.055480379	0.055480379	0.055480379	22	8	20	50
4:00 PM	61	61	0.082543978	0.082543978	0.082543978	0.082543978	33	12	30	75
5:00 PM	84	84	0.113667118	0.105	0.112676056	0.082417582	42	16	30	88
6:00 PM	91	91	0.123139378	0.132828633	0.129416774	0.12879936	53	18	47	118
7:00 PM	100	100	0.135317997	0.145965531	0.142216235	0.141537759	58	20	52	130
8:00 PM	50	50	0.067658999	0.072982765	0.071108118	0.070768879	29	10	26	65
9:00 PM	0	19	0.025710419	0.027733451	0.027021085	0.026892174	11	4	10	25
10:00 PM	0	15	0.0202977	0.02189483	0.021332435	0.021230664	9	3	8	20
11:00 PM	0	0	0	0	0	0	0	0	0	0
TOTAL	**739**	**739**	**1**	**1**	**1**	**1**	**400**	**142**	**364**	**906**
Adjustments				0.029280717	0.018970154	0.017104344				
				0.372124493	0.372124493	0.372124493				
		Daily Exiting Trips		400	142	364				

Traffic Signal Warrant Analysis Summary - Route 9 at the Project Driveway - Option 2
2015 Average-Month Conditions

Time	Route 9 Volume (Major Street)[a]	Project Driveway Volume (Minor Street)[b]	Warrant 1 Condition A[c]	Warrant 1 Condition B[d]	Warrant 2[e]	Warrant 3[f]
7:00	2855	7	No	No	No	No
8:00	2958	13	No	No	No	No
9:00	2616	42	No	No	No	No
10:00	2231	83	No	Yes	Yes	Yes
11:00	2217	78	No	Yes	Yes	Yes
12:00	2367	69	No	Yes	Yes	No
1:00	2450	77	No	Yes	Yes	Yes
2:00	2256	62	No	Yes	Yes	No
3:00	2346	67	No	Yes	Yes	No
4:00	2518	100	No	Yes	Yes	Yes
5:00	2731	123	Yes	Yes	Yes	Yes
6:00	2607	160	Yes	Yes	Yes	Yes
7:00	1677	88	No	Yes	Yes	Yes
8:00	1370	33	No	No	No	No
9:00	1490	26	No	No	No	No
Warrant Satisfied?			No	Yes	Yes	Yes

[a]Based on weekday ATR counts conducted on Route 9 by VAI in March 2015. Volume includes total of both approaches.
[b]Based on estimated hourly distribution (modified LUC 492 Health/Fitness Club).
[c]Warrant 1 Condition A - Eight Hour Vehicular Volume, Minimum Vehicular Volume - satisfied when major street volume > 420 and minor street volume > 105.
[d]Warrant 1 Condition B - Eight Hour Vehicular Volume, Interruption of Continuous Traffic - satisfied when major street volume > 630 and minor street volume >53.
[e]Warrant 2 - Four Hour Vehicular Volume - see Figure 4C-2 (lower threshold is 60 vph).
[f]Warrant 3 - Peak Hour Vehicular Volume - see Figure 4C-4 (lower threshold is 75 vph).

Hourly Distribution Option 2

	LUC 492 Health/Fitness Club									
	Parking Demand			Exiting Distribution (Percent)			Exiting Distribution (Trips)			
start time	Percent of Peak Period	Adjusted		Hockey Rink	Soccer Field	Pool/Fitness Ctr	Hockey Rink	Soccer Field	Pool/Fitness Ctr	Total
12:00 AM	0		0							
1:00 AM	0		0							
2:00 AM	0		0							
3:00 AM	0		0							
4:00 AM	0		0							
5:00 AM	0		0							
6:00 AM	20	2	0.00270636	0.00270636	0.00270636	0.00270636	2	0	1	3
7:00 AM	20	4	0.00541272	0.00541272	0.00541272	0.00541272	4	0	2	7
8:00 AM	20	20	0.027063599	0.0069875	0.041871921	0.018731343	6	0	8	13
9:00 AM	26	26	0.035182679	0.035182679	0.035182679	0.035182679	28	0	14	42
10:00 AM	51	51	0.069012179	0.069012179	0.069012179	0.069012179	55	0	28	83
11:00 AM	48	48	0.064952639	0.064952639	0.064952639	0.064952639	52	0	26	78
12:00 PM	42	42	0.056833559	0.056833559	0.056833559	0.056833559	45	0	23	69
1:00 PM	47	47	0.063599459	0.063599459	0.063599459	0.063599459	51	0	26	77
2:00 PM	38	38	0.051420839	0.051420839	0.051420839	0.051420839	41	0	21	62
3:00 PM	41	41	0.055480379	0.055480379	0.055480379	0.055480379	44	0	23	67
4:00 PM	61	61	0.082543978	0.082543978	0.082543978	0.082543978	66	0	34	100
5:00 PM	84	84	0.113667118	0.1045	0.083743842	0.097512438	84	0	40	123
6:00 PM	91	91	0.123139378	0.132816224	0.128141053	0.131242327	106	0	53	160
7:00 PM	100	100	0.135317997	0.145951894	0.140814344	0.144222338	117	0	59	175
8:00 PM	50	50	0.067658999	0.072975947	0.070407172	0.072111169	58	0	29	88
9:00 PM	0	19	0.025710419	0.02773086	0.026754725	0.027402244	22	0	11	33
10:00 PM	0	15	0.0202977	0.021892784	0.021122152	0.021633351	18	0	9	26
11:00 PM	0	0	0	0	0	0	0	0	0	0
TOTAL	**739**	**739**	**1**	**1**	**1**	**1**	**800**	**0**	**406**	**1206**
Adjustments				0.029243217	0.015114954	0.024486936				
				0.372124493	0.372124493	0.372124493				
		Daily Exiting Trips		800	0	406				

Traffic Signal Warrant Analysis Summary - Route 9 at the Project Driveway - Option 3
2015 Average-Month Conditions

Time	Route 9 Volume (Major Street)[a]	Project Driveway Volume (Minor Street)[b]	Warrant 1 Condition A[c]	Warrant 1 Condition B[d]	Warrant 2[e]	Warrant 3[f]
7:00	2855	5	No	No	No	No
8:00	2958	20	No	No	No	No
9:00	2616	33	No	No	No	No
10:00	2231	64	No	Yes	Yes	No
11:00	2217	60	No	Yes	Yes	No
12:00	2367	53	No	No	No	No
1:00	2450	59	No	Yes	No	No
2:00	2256	48	No	No	No	No
3:00	2346	51	No	No	No	No
4:00	2518	76	No	Yes	Yes	Yes
5:00	2731	90	No	Yes	Yes	Yes
6:00	2607	120	Yes	Yes	Yes	Yes
7:00	1677	66	No	Yes	Yes	No
8:00	1370	25	No	No	No	No
9:00	1490	20	No	No	No	No
Warrant Satisfied?			No	No	Yes	Yes

[a]Based on weekday ATR counts conducted on Route 9 by VAI in March 2015. Volume includes total of both approaches.
[b]Based on estimated hourly distribution (modified LUC 492 Health/Fitness Club).
[c]Warrant 1 Condition A - Eight Hour Vehicular Volume, Minimum Vehicular Volume - satisfied when major street volume > 420 and minor street volume > 105.
[d]Warrant 1 Condition B - Eight Hour Vehicular Volume, Interruption of Continuous Traffic - satisfied when major street volume > 630 and minor street volume >53.
[e]Warrant 2 - Four Hour Vehicular Volume - see Figure 4C-2 (lower threshold is 60 vph).
[f]Warrant 3 - Peak Hour Vehicular Volume - see Figure 4C-4 (lower threshold is 75 vph).

Hourly Distribution Option 3

	LUC 492 Health/Fitness Club									
	Parking Demand			Exiting Distribution (Percent)			Exiting Distribution (Trips)			
start time	Percent of Peak Period	Adjusted		Hockey Rink	Soccer Field	Pool/Fitness Ctr	Hockey Rink	Soccer Field	Pool/Fitness Ctr	Total
12:00 AM	0		0							
1:00 AM	0		0							
2:00 AM	0		0							
3:00 AM	0		0							
4:00 AM	0		0							
5:00 AM	0		0							
6:00 AM	20	2	0.00270636	0.00270636	0.00270636	0.00270636	1	0	1	3
7:00 AM	20	4	0.00541272	0.00541272	0.00541272	0.00541272	2	1	2	5
8:00 AM	20	20	0.027063599	0.00645	0.009084507	0.041884817	3	1	16	20
9:00 AM	26	26	0.035182679	0.035182679	0.035182679	0.035182679	14	5	13	33
10:00 AM	51	51	0.069012179	0.069012179	0.069012179	0.069012179	28	10	26	64
11:00 AM	48	48	0.064952639	0.064952639	0.064952639	0.064952639	26	9	25	60
12:00 PM	42	42	0.056833559	0.056833559	0.056833559	0.056833559	23	8	22	53
1:00 PM	47	47	0.063599459	0.063599459	0.063599459	0.063599459	25	9	24	59
2:00 PM	38	38	0.051420839	0.051420839	0.051420839	0.051420839	21	7	20	48
3:00 PM	41	41	0.055480379	0.055480379	0.055480379	0.055480379	22	8	21	51
4:00 PM	61	61	0.082543978	0.082543978	0.082543978	0.082543978	33	12	32	76
5:00 PM	84	84	0.113667118	0.105	0.112676056	0.083769634	42	16	32	90
6:00 PM	91	91	0.123139378	0.132828633	0.129416774	0.128128251	53	18	49	120
7:00 PM	100	100	0.135317997	0.145965531	0.142216235	0.140800276	58	20	54	132
8:00 PM	50	50	0.067658999	0.072982765	0.071108118	0.070400138	29	10	27	66
9:00 PM	0	19	0.025710419	0.027733451	0.027021085	0.026752052	11	4	10	25
10:00 PM	0	15	0.0202977	0.02189483	0.021332435	0.021120041	9	3	8	20
11:00 PM	0	0	0	0	0	0	0	0	0	0
TOTAL	**739**	**739**	**1**	**1**	**1**	**1**	**400**	**142**	**382**	**924**
Adjustments				0.029280717	0.018970154	0.015076267				
				0.372124493	0.372124493	0.372124493				
		Daily Exiting Trips		400	142	382				

CAPACITY ANALYSIS WORKSHEETS

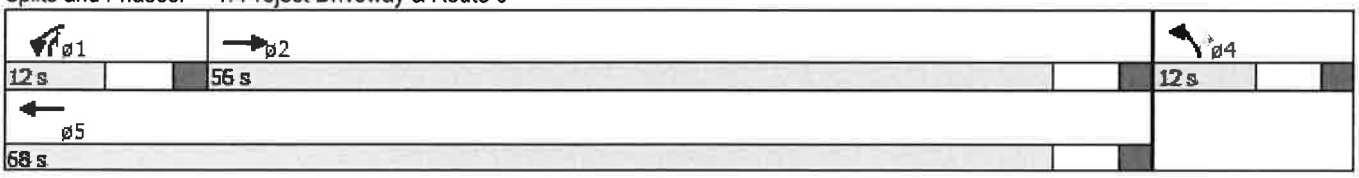
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1963	10	29	1355	6	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	12	12
Lane Util. Factor	0.95	0.95	1.00	0.95	1.00	1.00
Frt	0.999					0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	3418	0	1711	3421	1770	1583
Flt Permitted			0.950		0.950	
Satd. Flow (perm)	3418	0	1711	3421	1770	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	1					12
Link Speed (mph)	30			30	30	
Link Distance (ft)	340			348	252	
Travel Time (s)	7.7			7.9	5.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2134	11	32	1473	7	18
Shared Lane Traffic (%)						
Lane Group Flow (vph)	2145	0	32	1473	7	18
Turn Type	NA		Prot	NA	Prot	pm+ov
Protected Phases	2		1	5	4	1
Permitted Phases						4
Detector Phase	2		1	5	4	1
Switch Phase						
Minimum Initial (s)	20.0		6.0	20.0	6.0	6.0
Minimum Split (s)	26.0		12.0	26.0	12.0	12.0
Total Split (s)	56.0		12.0	68.0	12.0	12.0
Total Split (%)	70.0%		15.0%	85.0%	15.0%	15.0%
Maximum Green (s)	50.0		6.0	62.0	6.0	6.0
Yellow Time (s)	4.0		4.0	4.0	4.0	4.0
All-Red Time (s)	2.0		2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0		-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0		4.0	4.0	4.0	4.0
Lead/Lag	Lag		Lead			Lead
Lead-Lag Optimize?	Yes		Yes			Yes
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Recall Mode	Min		None	Min	None	None
Act Effct Green (s)	61.6		8.1	70.0	8.1	10.3
Actuated g/C Ratio	0.84		0.11	0.96	0.11	0.14
v/c Ratio	0.74		0.17	0.45	0.04	0.08
Control Delay	8.6		33.6	1.3	31.5	17.0
Queue Delay	0.0		0.0	0.0	0.0	0.0
Total Delay	8.6		33.6	1.3	31.5	17.0
LOS	A		C	A	C	B
Approach Delay	8.6			2.0	21.1	
Approach LOS	A			A	C	
Queue Length 50th (ft)	212		16	0	3	3
Queue Length 95th (ft)	#713		41	125	15	18
Internal Link Dist (ft)	260			268	172	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Turn Bay Length (ft)						
Base Capacity (vph)	2886		189	3284	196	233
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	0	0
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.74		0.17	0.45	0.04	0.08

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 72.9
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.74
Intersection Signal Delay: 6.0 — Intersection LOS: A
Intersection Capacity Utilization 66.2% — ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Project Driveway & Route 9



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1540	25	75	1683	30	88
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	12	12
Lane Util. Factor	0.95	0.95	1.00	0.95	1.00	1.00
Frt	0.998					0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	3414	0	1711	3421	1770	1583
Flt Permitted			0.950		0.950	
Satd. Flow (perm)	3414	0	1711	3421	1770	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	4					15
Link Speed (mph)	30			30	30	
Link Distance (ft)	340			348	252	
Travel Time (s)	7.7			7.9	5.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1674	27	82	1829	33	96
Shared Lane Traffic (%)						
Lane Group Flow (vph)	1701	0	82	1829	33	96
Turn Type	NA		Prot	NA	Prot	pm+ov
Protected Phases	2		1	5	4	1
Permitted Phases						4
Detector Phase	2		1	5	4	1
Switch Phase						
Minimum Initial (s)	20.0		6.0	20.0	6.0	6.0
Minimum Split (s)	26.0		12.0	26.0	12.0	12.0
Total Split (s)	36.0		12.0	48.0	12.0	12.0
Total Split (%)	60.0%		20.0%	80.0%	20.0%	20.0%
Maximum Green (s)	30.0		6.0	42.0	6.0	6.0
Yellow Time (s)	4.0		4.0	4.0	4.0	4.0
All-Red Time (s)	2.0		2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0		-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0		4.0	4.0	4.0	4.0
Lead/Lag	Lag		Lead			Lead
Lead-Lag Optimize?	Yes		Yes			Yes
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Recall Mode	Min		None	Min	None	None
Act Effct Green (s)	35.3		8.1	46.4	8.1	12.3
Actuated g/C Ratio	0.68		0.16	0.89	0.16	0.24
v/c Ratio	0.73		0.31	0.60	0.12	0.25
Control Delay	12.4		25.4	3.6	23.0	15.1
Queue Delay	0.0		0.0	0.0	0.0	0.0
Total Delay	12.4		25.4	3.6	23.0	15.1
LOS	B		C	A	C	B
Approach Delay	12.4			4.5	17.1	
Approach LOS	B			A	B	
Queue Length 50th (ft)	124		20	0	8	20
Queue Length 95th (ft)	#450		63	208	32	49
Internal Link Dist (ft)	260			268	172	

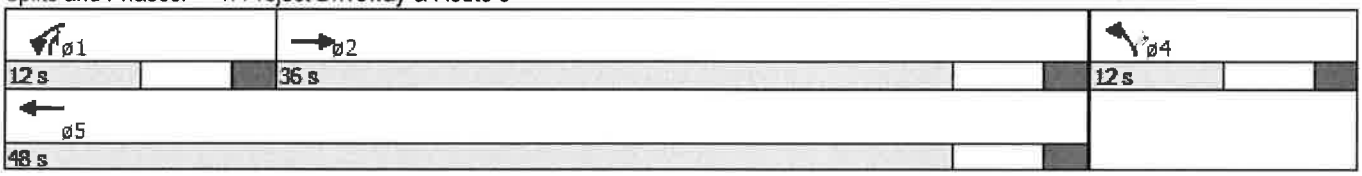
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Turn Bay Length (ft)						
Base Capacity (vph)	2322		268	3056	278	386
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	0	0
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.73		0.31	0.60	0.12	0.25

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 51.9
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.73
Intersection Signal Delay: 8.6 — Intersection LOS: A
Intersection Capacity Utilization 63.4% — ICU Level of Service B
Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Project Driveway & Route 9



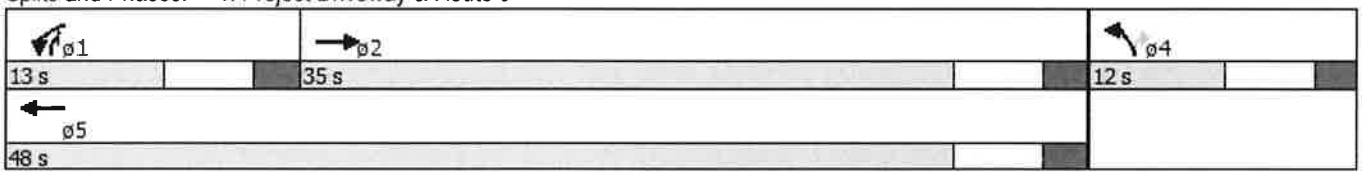
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1456	42	128	1455	44	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	12	12
Lane Util. Factor	0.95	0.95	1.00	0.95	1.00	1.00
Frt	0.996					0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	3408	0	1711	3421	1770	1583
Flt Permitted			0.950		0.950	
Satd. Flow (perm)	3408	0	1711	3421	1770	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	7					17
Link Speed (mph)	30			30	30	
Link Distance (ft)	340			348	252	
Travel Time (s)	7.7			7.9	5.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1583	46	139	1582	48	141
Shared Lane Traffic (%)						
Lane Group Flow (vph)	1629	0	139	1582	48	141
Turn Type	NA		Prot	NA	Prot	pm+ov
Protected Phases	2		1	5	4	1
Permitted Phases						4
Detector Phase	2		1	5	4	1
Switch Phase						
Minimum Initial (s)	20.0		6.0	20.0	6.0	6.0
Minimum Split (s)	26.0		12.0	26.0	12.0	12.0
Total Split (s)	35.0		13.0	48.0	12.0	13.0
Total Split (%)	58.3%		21.7%	80.0%	20.0%	21.7%
Maximum Green (s)	29.0		7.0	42.0	6.0	7.0
Yellow Time (s)	4.0		4.0	4.0	4.0	4.0
All-Red Time (s)	2.0		2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0		-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0		4.0	4.0	4.0	4.0
Lead/Lag	Lag		Lead			Lead
Lead-Lag Optimize?	Yes		Yes			Yes
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Recall Mode	Min		None	Min	None	None
Act Effct Green (s)	34.5		9.0	45.3	8.2	15.4
Actuated g/C Ratio	0.64		0.17	0.84	0.15	0.29
v/c Ratio	0.75		0.49	0.55	0.18	0.30
Control Delay	14.5		29.5	3.8	24.7	14.9
Queue Delay	0.0		0.0	0.0	0.0	0.0
Total Delay	14.5		29.5	3.8	24.7	14.9
LOS	B		C	A	C	B
Approach Delay	14.5			5.9	17.4	
Approach LOS	B			A	B	
Queue Length 50th (ft)	261		47	107	16	31
Queue Length 95th (ft)	#430		#97	153	42	67
Internal Link Dist (ft)	260			268	172	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Turn Bay Length (ft)						
Base Capacity (vph)	2181		292	2873	269	472
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	0	0
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.75		0.48	0.55	0.18	0.30

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 53.9
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.75
Intersection Signal Delay: 10.5 — Intersection LOS: B
Intersection Capacity Utilization 63.7% — ICU Level of Service B
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Project Driveway & Route 9



ITE PARKING DEMAND DATA

Wellesley Athletic Complex
Max Parking Demand

	Hockey Rink	Soccer Field	Pool	Total
Option 1	1.5 sheets	1 Field	21,525 sf	
Weekday	60.5*1.5 = 91	60.5*1 = 61	5.03*21.525 = 109	**261**
Saturday	65.2*1.5 = 98	65.2* 1 = 66	5.42*21.525 = 117	**281**
Sunday	69.3*1.5 = 104	69.3*1 = 70	5.76*21.525 = 124	**298**
Provided				**206**

Option 2	2 sheets	0 Fields	24,015 sf	
Weekday	60.5*2 = 121	0	5.03*24.015 = 121	**242**
Saturday	65.2* 2 = 131	0	5.42*24.015 = 131	**262**
Sunday	69.3*2 = 139	0	5.76*24.015 = 139	**278**
Provided				**244**

Option 3	1.5 sheets	1 Field	22,550 sf	
Weekday	60.5*1.5 = 91	60.5*1 = 61	5.03*22.55 = 114	**266**
Saturday	65.2*1.5 = 98	65.2* 1 = 66	5.42*22.55 = 123	**287**
Sunday	69.3*1.5 = 104	69.3*1 = 70	5.76*22.55 = 130	**304**
Provided				**206**

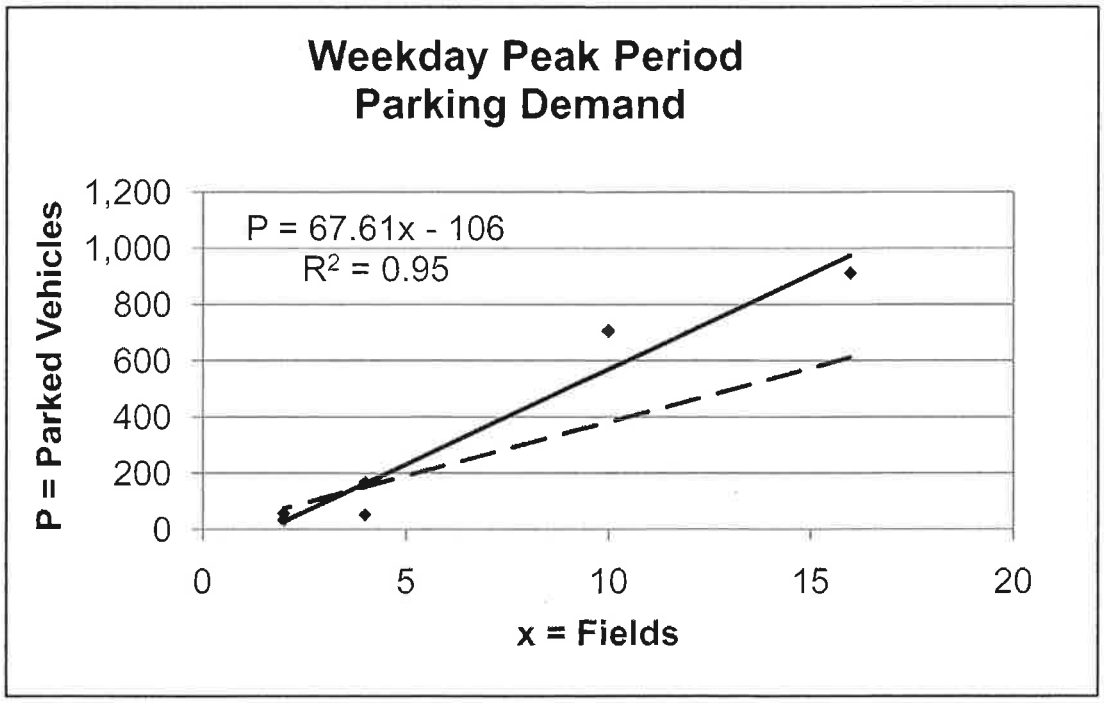
*Hockey and Soccer based on ITE Parking Generation, LUC 488, Soccer Complex.
**Pool based on ITE Parking Generation, LUC 495, Recreational Community Center (Saturday based on ratio of weekday to Saturday for LUC 488).

Land Use: 488
Soccer Complex

Average Peak Period Parking Demand vs. Fields
On a: Weekday

Statistic	Peak Period Demand
Peak Period	Varies*
Number of Study Sites	6
Average Size of Study Sites	6 fields
Average Peak Period Parking Demand	38.30 vehicles per field
Standard Deviation	22.67
Coefficient of Variation	59%
Range	13.30–70.80 vehicles per field
85th Percentile	60.50 vehicles per field
33rd Percentile	25.00 vehicles per field

**** Caution—refer to "Database Description" section for discussion on limitations of data regarding the peak period.***

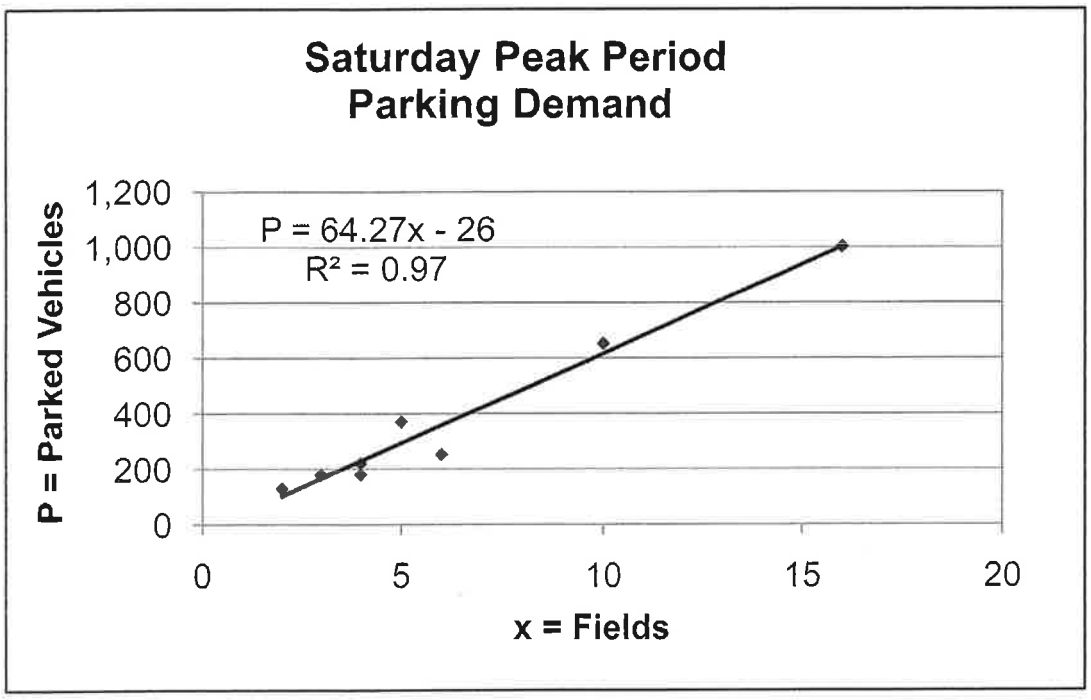


◆ Actual Data Points ——— Fitted Curve - - - - Average Rate

Land Use: 488
Soccer Complex

Average Peak Period Parking Demand vs. Fields
On a: Saturday

Statistic	Peak Period Demand
Peak Period	12:00–1:00 p.m.; 3:00–5:00 p.m.; 6:00–7:00 p.m.
Number of Study Sites	9
Average Size of Study Sites	6 fields
Average Peak Period Parking Demand	58.80 vehicles per field
Standard Deviation	10.10
Coefficient of Variation	17%
Range	42.00–74.00 vehicles per field
85th Percentile	65.20 vehicles per field
33rd Percentile	58.30 vehicles per field

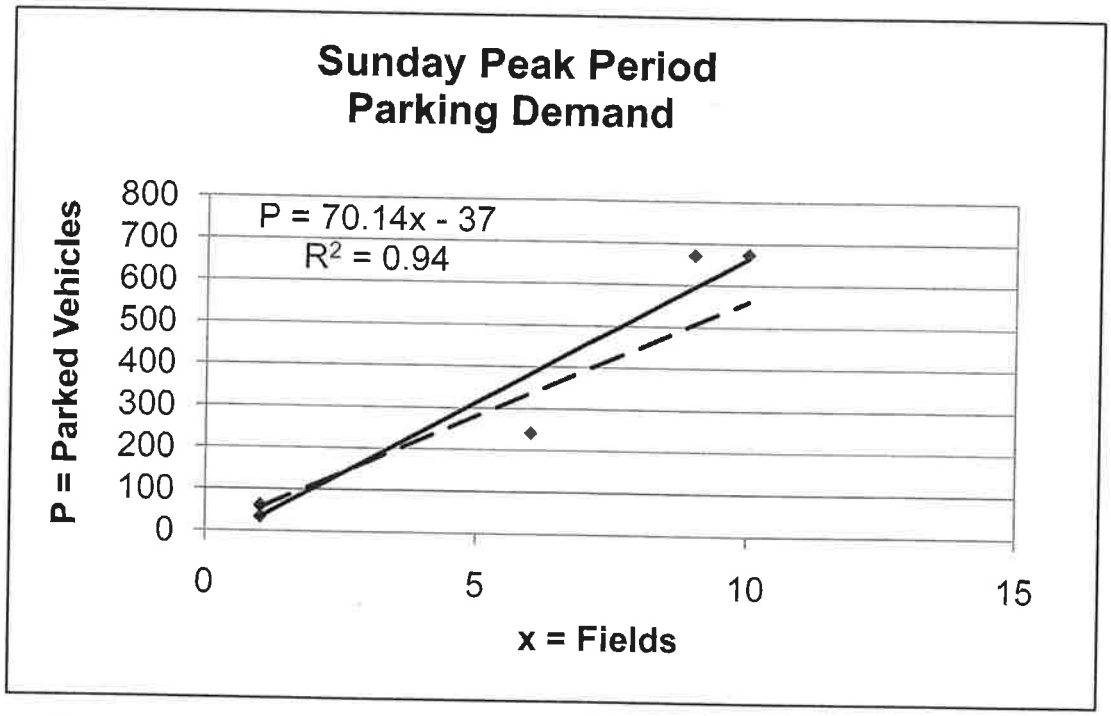


◆ Actual Data Points ——— Fitted Curve/Average Rate

Land Use: 488
Soccer Complex

Average Peak Period Parking Demand vs. Fields
On a: Sunday

Statistic	Peak Period Demand
Peak Period	11:00 a.m.–12:00 p.m.; 1:00–2:00 p.m.
Number of Study Sites	6
Average Size of Study Sites	5 fields
Average Peak Period Parking Demand	56.30 vehicles per field
Standard Deviation	15.80
Coefficient of Variation	28%
Range	34.00–74.70 vehicles per field
85th Percentile	69.30 vehicles per field
33rd Percentile	52.50 vehicles per field

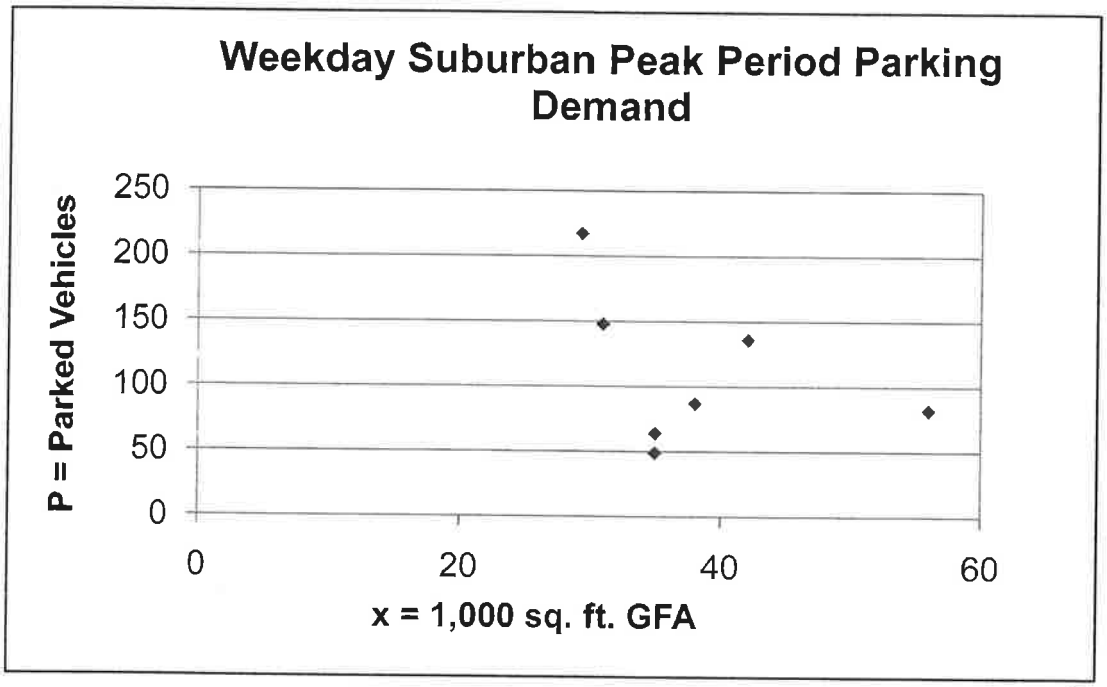


◆ Actual Data Points ——— Fitted Curve - - - - Average Rate

Land Use: 495
Recreational Community Center

Average Peak Period Parking Demand vs. 1,000 sq. ft. GFA
On a: Weekday
Location: Suburban

Statistic	Peak Period Demand
Peak Period	6:00–8:00 p.m.
Number of Study Sites	7
Average Size of Study Sites	38,000 sq. ft. GFA
Average Peak Period Parking Demand	3.20 vehicles per 1,000 sq. ft. GFA
Standard Deviation	2.20
Coefficient of Variation	69%
Range	1.40–7.38 vehicles per 1,000 sq. ft. GFA
85th Percentile	5.03 vehicles per 1,000 sq. ft. GFA
33rd Percentile	1.82 vehicles per 1,000 sq. ft. GFA



◆ Actual Data Points

SAMPLE PARKING AND EVENT MANAGEMENT PLAN

900 WORCESTER STREET ATHLETIC FACILITY
PARKING AND EVENT MANAGEMENT PLAN

In order to manage traffic and parking demands for the athletic facility, the following parking and event management measures will be implemented:

- A transportation coordinator will be assigned who will be responsible for coordinating and implementing the elements of the Parking and Event Management Plan.
- Special events will be scheduled to occur on a Saturday, Sunday, or after 4 PM on a weekday in order to minimize traffic impacts during peak travel periods.
- The start times for sequential games will be scheduled to minimize coincidental arrival and departure of players and spectators. This includes coordination of games scheduled at the hockey rink and multipurpose field.
- Parking management staff will be positioned within the parking lot for event conditions in order to manage traffic flow, pedestrians and parking operations within the Project site.
- Off-site parking accommodations (such as a park-and-ride lot, school or similar facility) with shuttle bus transport to the facility will be used for event conditions.
- In order to maximize available parking within the site, buses and shuttle vans will be used for team and spectator transport, and staged at off-site locations once passengers have been discharged.
- Coordinate with the Town of Wellesley Police Department prior to the scheduling of events in order to determine if police details should be retained to manage the flow of vehicles and pedestrians. The need for police details shall be at the discretion of the Police Chief.

Implementation of the elements of the parking and event management plan will be managed by the transportation coordinator in consultation with the Wellesley Police Department. The transportation coordinator will meet with the Police Chief or their designee prior to the scheduling of an event or as may be necessary to coordinate activities and event scheduling, and to review the effectiveness of the parking and event management plan. Any and all costs associated with the implementation of the parking and event management plan will be the sole responsibility of the facility management and may be assessed to the users of the facility.

ENCLOSURE 7

Questions for Gale and Vanasse:

Overview:

1. The information was excellent. It has made us much smarter.
2. David Perry informed us the rink requirement is for 500 seats not 635. Also in scenario two assume the second rink only has seating for 100.

Hydrology:

1. Please be sure to highlight the maintenance obligation with the various types of porous pavement, bricks, bioretention pools.
2. Please note the void space in the tuft field section is around 30% (or whatever it is).
3. Please discuss the 100 year storm implications since that is what is used by planning
4. Please produce a summary slide for the 3 scenarios (very useful for BoS and Town Meeting) and more credible when from you.
5. Please highlight that the site can manage the storm water on site but may not have enough capacity to support 888 Worcester St needs. "Keep Haynes and St James hydrology separate.

Traffic:

1. Does the traffic assume all uses are used all year round?

   Yes, as it is likely that there will be overlap in the use of both the hockey rink and the multi-purpose field during some portion (or all) of the year; the pool/fitness center was assumed to be open year-round. This assumption also reflects maximum programming for use of the athletic facility, a condition which prospective development partners will likely evaluate for the site.

2. Please discuss the importance of the programming more than the sf or seating.

   The number of seats and the relative size of the facilities defines the theoretical person capacity of the specific uses which can then be translated into traffic and parking demand projections; however, it is the programming and use scheduling of the specific uses that establishes the interaction and potential for simultaneous arrival and departure of users that will define the peak traffic and parking demands of the facility.

3. What would be the traffic produced by a 3 hour swim meeting with 150 swimmers?

   The traffic and parking projections would be based on the seating capacity of the pool for spectators and the use of buses/vans to transport swimmers. If it were assumed that 4 to 6 buses would be used to transport the swimmers and coaches (team swim meet), 75 to 80 spectator vehicles, and 10 miscellaneous vehicles for trainers, coaches, judges, etc., it could reasonably be assumed that the resulting traffic would be on the order of 80 to 100 vehicles (one-way). Such an event would likely require the implementation of a parking and traffic management plan that would include schedule coordination with other uses within the facility.

4. Can you provide an estimate of the traffic (in/out) generated by 888 Worcester to add to 900 W for consideration for the street light?

   The existing office buildings (assuming 80,000 ± sf total and full occupancy) would add

approximately 80 to 100 additional trips to the potential signalized intersection during the peak traffic volume periods. Note that the proposed athletic facility as currently envisioned would itself generate sufficient traffic volumes to warrant the installation of a traffic signal.

5. What hours of operation were assumed? What were the peak hours?

   The peak hours were generally identified to occur within a range between 4 to 6 PM on a weekday and between 11 AM and 2 PM on a Saturday. Within these ranges, the peak traffic and parking demands of the athletic facility would occur and would be coincidental with the peak traffic demand along Route 9. Again, management of use scheduling will be important to off-set simultaneous peaking of uses coincidental with the peak traffic volume period along Route 9.

6. Please explain the importance of the "traffic signal warrants", especially #1-3 vs. 4-10.

   Warrants 1 and 2 are considered the "primary" warrants when considering if the installation of a traffic control signal is an appropriate measure to improve traffic operations and safety at an intersection. Warrants 3 through 9 relate to specific conditions or circumstances that may exist that would benefit from the installation of a traffic control signal, none of which would be applicable to the subject site or the proposed use.

7. Would you expect the addition of a traffic light to be a necessity for permitting? What would be the impact of the traffic light on Rt 9 in reducing Weston Rd and Overbrook Rd, etc. traffic? If not can you estimate impact on Weston Rd and those cut thru streets.

   Based on our preliminary analysis, we have determined that the installation of a traffic control signal at the primary access to the site will be necessary in order to facilitate safe and efficient access to the site for all users (motor vehicles, pedestrians and bicyclists). The installation of the traffic control signal would reduce the volume of project-related traffic using the Weston Road interchange and the Route 9/Overbrook Road intersection to reverse direction on Route 9 to enter or exit the site. The approximate volume of traffic associated with these maneuvers would be in the range of approximately 100 vehicles during the peak hours.

8. Is there a slide somewhere that would show the neighboring streets and expected increased traffic due to the facility with some type of volume impact.

   An assessment of potential impacts on neighboring streets will be completed as a part of the formal transportation impact assessment that will be required as a part of the Town's PSI process.

9. Would "special traffic management be required" when a "big event" (swim meet or WHS hockey game) occurred or would you expect the light be sufficient – explain please.

   A parking and event management plan would be required for large events at the athletic facility, a framework of which has been included as a part of the preliminary transportation assessment.

Parking:

1. Please highlight the benefits of event coordination. How much less parking is required with good time management and coordination.

   Coordinating the scheduling of events will be important in managing the traffic and parking

demands of the athletic facility, particularly given the finite amount of parking that is available. Parking and traffic demand reductions of 10 to 15 percent could reasonably be achieved with an effective management plan.

2. How much parking is required if the pool has seating for 150 available for “meets”.

   Assuming a reasonable vehicle occupancy ratio of 2 persons and use of buses to transport participants and coaches, it would be reasonable to assume a potential parking demand of approximately 50 to 60 vehicles.

3. Please provide specific comparable facilities and parking/traffic data for the rink and pool facility. We have often looked at Falmouth and Westboro as comps for the potential rink and Beede Pool or a YMCA for the pool.

   The parking and traffic projections for the pool/fitness center are based on a YMCA model with a pool, and does not include a hockey rink (for which traffic and parking demands were estimated separately).

4. If a new scenario only had one sheet of ice would the expected parking needs be 60 cars (half of option 2 and 2/3 of option 1).

   Yes, the projected parking demand is approximately 60 spaces per sheet of ice.

5. When were the peak parking hours?

   The peak parking demand period on a weekday is expected to occur between 5 and 6 PM, with the peak demand on a weekend predicted to occur between 12 noon and 1 PM.