370-384 HARVARD STREET

BROOKLINE, MA

Comprehensive Permit Application

Under M.G.L. Chapter 40B, Sections 20-23

Submitted by:

Jewish Community Housing for the Elderly

370-384 HARVARD STREET

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SECTION 1

REQUEST FOR FINDINGS OF FACT

Town of Brookline, Massachusetts

ZONING BOARD OF APPEALS

Premises affected: An 18,323 s.f. parcel of land on 370-384 Harvard Street

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APPLICATION FOR A COMPREHENSIVE PERMIT UNDER GENERAL LAW CHAPTER 40B, SECTIONS 20-23

Jewish Community Housing for the Elderly III, Inc., an affiliate of Jewish Community Housing for the Elderly ("JCHE") hereby applies to the Board of Appeals of the Town of Brookline, Massachusetts, pursuant to General Laws, Chapter 40B, Section 20 through 23, as amended, for the issuance of a Comprehensive Permit authorizing the applicant to construct 62 rental units (of which 58 deed-restricted affordable rental units will serve households at a range of incomes) and less than 5,000 s.f. of retail space on land located at 370-384 Harvard Street to develop a senior living residential program and community space. The applicant and the development are described in the exhibits hereto annexed and submitted simultaneously herewith, all of which are incorporated by reference and constitute documents required to be submitted under the regulations for filing a 40B application by the Massachusetts Department of Housing and Community Development (769 CMR 56.00).

REQUEST FOR FINDINGS OF FACT

The applicant requests that the Board of Appeals make the following findings of fact in connection with the action of the Board on this application:

1. Jewish Community Housing for the Elderly III, Inc. ("JCHE"), a Chapter 180 Non-Profit Corporation, is eligible to receive a subsidy under a state or federal affordable housing program after a Comprehensive Permit has been granted.

2. The applicant has shown evidence of its site control to qualify it as a recipient of a Comprehensive Permit for this site.

3. The Department of Housing and Community Development ("DHCD"), the administrator of the Low Income Housing Tax Credit ("LIHTC") program, will be the subsidizing agency within the meaning of the regulations of 40B (760 CMR 56.00) and within the meaning of the procedural regulations of the Housing Appeals Committee (760 CMR 30.01(C)).

4. The number of low or moderate income housing units in the Town of Brookline constitutes less than 10 percent (10%) as reported in the Subsidized Housing Inventory of the Department of Housing & Community Development as of May 27, 2016.

5. The development as proposed in the application is consistent with local needs within the meaning of General Laws, Chapter 40B, Section 20.

The applicant respectfully requests the Board of Appeals, after complying with the procedural requirements as provided by law, to issue to the applicant a Comprehensive Permit for the development.

Jewish Community Housing for the Elderly III, Inc.

By: _____

Amy Schectman
President & CEO

SECTION 2

PROJECT DATA SUMMARY

SECTION 2
PROJECT DATA SUMMARY

1. Applicant

Jewish Community Housing for the Elderly III, Inc., an affiliate of Jewish Community Housing for the Elderly (the "Applicant") has been organized under the General Laws of the State of Massachusetts. Jewish Community Housing for the Elderly ("JCHE") is a well-established non-profit provider of senior supportive housing in the Greater-Boston area with over 100 full time employees. Formed in 1965, JCHE celebrated its 50th year in 2015. JCHE has developed 1,200 units across 8 properties which we own, manage and provide services to. Ulin House, Leventhal House and Genesis House make up our Brighton Campus, with over 700 units. We have two properties (each comprised of two phases) in Newton, Golda Meir House I and II and Coleman House I and II, which have 199 and 150 units respectively. All of those properties are 100% project based Section 8 and PRAC (with the exception of 25 unrestricted units at Golda), and Leventhal House was syndicated with tax credits in 2007. Shillman House, a 150 unit mixed income project in Framingham, is a tax credit project financed with MassHousing bonds, Section 202 and tax credit equity which was completed in 2010. All developments are fully occupied and generate positive cash flows.

Other than Leventhal, JCHE had not refinanced any of its properties until 2013. In 2013, JCHE marked up to market and refinanced its oldest property, Ulin with a 221(d)(4) loan, which unlocked significant equity for the organization. JCHE also recently closed on the refinancing of Genesis, originally built in the mid-1970s, with a MassHousing tax exempt bond issue and tax credit equity, which will also generate significant equity to the organization. JCHE entities currently hold over $30 million of unrestricted cash. Apart from property level financing, JCHE has no debt.

JCHE is qualified for the express purpose of undertaking the planning, development and operating of "370-384 Harvard Street", an age-restricted apartment development in Coolidge Corner, MA. The Applicant will develop 62 rental units and retail space as required under all laws and regulations of the Commonwealth of Massachusetts.

2. Description of the Development

The 370-384 Harvard Street will be a new construction project comprised of a building with 62 rental units for households at a range of incomes along with supportive services above a ground floor of less than 5,000 gross square feet of retail space. The units will

range in size from 600 sf 1-bedroom units to 852 sf 2-bedroom units. 58 of the 62 units will be available to households qualifying under DHCD and 40B guidelines as low or moderate income. These units will remain affordable in perpetuity.
The bedroom mix will be as follows:

53	1-Bedrooms
9	2-Bedrooms

Preliminary architecture and engineering drawings are attached hereto under separate cover.

SECTION 3

APPLICANT STATUS

SECTION 3

APPLICANT STATUS

The applicant, Jewish Community Housing for the Elderly III, Inc., is a Chapter 180 Non-Profit Corporation and an eligible applicant under 760 CMR 56.04. Pursuant to the Low Income Housing Tax Credit (LIHTC) Program administered by the Department of Housing and Community Development as the subsidizing agency, the applicant intends to enter into an Regulatory Agreement providing for the affordability of the proposed affordable units.

SECTION 4

PROJECT ELIGIBILITY LETTER

Commonwealth of Massachusetts
DEPARTMENT OF HOUSING & COMMUNITY DEVELOPMENT
Charles D. Baker, Governor ◆ Karyn E. Polito, Lt. Governor ◆ Chrystal Kornegay, Undersecretary

September 9, 2016

Ms. Amy Schectman
JCHE
30 Wallingford Road
Brighton, MA 02114

RE: 384 Harvard Street, Brookline, MA 02445– Site Approval Letter

Dear Ms. Schectman:

I am pleased to inform you that your application for project eligibility determination for the proposed 384 Harvard Street project located in Brookline, Massachusetts, has been approved under the Low Income Housing Tax Credit (LIHTC) program. The property is located at 384 Harvard Street, Brookline, Massachusetts. This approval indicates that the proposed plan is for 62 units, 50 of which are affordable (80.6%) at no more than 60% of area median income. The proposed development will consist of 58 one-bedroom units and four two-bedroom units, and the rental structure as described in the application is generally consistent with the standards for affordable housing to be included in the community's Chapter 40B affordable housing stock. This approval does not constitute a guarantee that LIHTC funds will be allocated to the 384 Harvard Street project. It does create a presumption of fundability under 760CMR 56.04, and permits JCHE to apply to the Brookline Zoning Board of Appeals for a comprehensive permit. The sponsor should note that a One Stop submission for funding for this project must conform to all Department of Housing and Community Development (DHCD) program limits and requirements in effect at the time of submission.

As part of the review process, DHCD has made the following findings:

1. The proposed project appears generally eligible under the requirements of the Low Income Housing Tax Credit program.

2. DHCD has performed an on-site inspection of the proposed 384 Harvard Street project and has determined that the proposed site is an appropriate location for the project.

3. The proposed housing design is appropriate for the site.

4. The proposed project appears financially feasible in the context of the Brookline housing market.

5. The initial proforma for the project appears financially feasible and consistent with the requirements for cost examination and limitations on profits on the basis of estimated development

and operating costs. Please note again that a One Stop submission for funding for this project must conform to all DHCD program limits and requirements in effect at the time of submission.

6. The ownership entity will be a single-purpose entity controlled by the Applicant (JCHE) subject to limited dividend requirements, and it meets the general eligibility standards of the Low Income Housing Tax Credit program.

7. The Applicant controls the site.

8. In addition, during the review period, DHCD received the attached comments from the Town of Brookline. We anticipate that JCHE will work closely with the Town boards and officials to resolve the issues identified by the Town. We ask JCHE to update the Department on a regular basis on the discussions with the Town.

The proposed 384 Harvard Street project will have to comply with all state and local codes not specifically exempted by a comprehensive permit. In applying for a comprehensive permit, the project sponsor should identify all aspects of the proposal that will not comply with local requirements.

If a comprehensive permit is granted, construction of this project may not commence without DHCD's issuance of Final Approval pursuant to 760 CMR 56.04 (7) and an award of LIHTC funds. This project eligibility determination letter is not transferable to any other project sponsor or housing program without the express written consent of DHCD.

This letter shall expire two years from this date, or on September 9, 2018, unless a comprehensive permit has been issued.

We congratulate you on your efforts to work with the Town of Brookline to increase its supply of affordable housing.

Sincerely,

Catherine Racer
Associate Director

Cc: Neil Wishinkski, Board of Selectmen
Melvin Kleckner, Town Administrator
Alison Steinfeld, Director, Planning and Community Development Department

TOWN of BROOKLINE
Massachusetts

BOARD OF SELECTMEN

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NANCY A. DALY
BENJAMIN J. FRANCO
NANCY S. HELLER
BERNARD W. GREENE

MELVIN A. KLECKNER
Town Administrator

333 WASHINGTON STREET
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September 8, 2016

Catherine Racer, Associate Director
Department of Housing and Community Development
100 Cambridge Street
Suite 300
Boston, MA 02114

RE: Chapter 40B Comprehensive Permit: 384 Harvard Street, Brookline

Dear Ms. Racer:

Thank you for providing the Town of Brookline with the opportunity to submit its comments on an application for Site Approval submitted by Jewish Community Housing for the Elderly (JCHE) to construct 62 units of elderly housing at 384 Harvard Street in Brookline under G.L. Chapter 40B. We also appreciate your willingness to grant the Town an extension in order to provide the Board of Selectmen time to engage the public by conducting a public hearing on August 16, 2016.

The Town of Brookline supports the creation of affordable housing and is committed to responding to the acute need for elderly housing specifically. The Town has methodically moved to expand the supply of affordable housing while at the same time supporting the improvement of existing subsidized units. The Town has in fact invested significant resources to expand housing opportunities for vulnerable populations. Attached is a summary of recent efforts by the Town to retain, improve and expand the availability of affordable housing, together with a memorandum from Brookline's Housing Advisory Board. The Town has been successful in increasing the supply of affordable housing by supporting well-designed housing that is integrated into its environs, respects the context in which it is located, and is welcoming to the residents who occupy the units. We are pleased to work with JCHE, a mission-based housing

advocacy development entity with a long history of constructing and managing high quality, well-designed affordable housing for the elderly.

Overall, the site plan reflects JCHE's work with the neighborhood to develop a plan that accommodates the needs and concerns of abutters. That said, a number of abutters have expressed concerns about the project. We are confident that JCHE will continue to engage the neighborhood to address several outstanding issues.

While supportive of the project in general, the Board of Selectmen is concerned about the lack of sufficient parking to accommodate the needs of prospective residents, which includes parking not only for the residents themselves but for their caretakers, service providers and visitors. The Board is also very aware that additional effort is warranted to better address the relationship of the proposed development to the residents on Williams Street. The "wall effect" of the proposed building must be mitigated. Unlike Harvard Street, Williams Street is residential and therefore the façade facing existing homes must reflect the character of the neighborhood. Approaches could include, at a minimum, providing additional green space particularly along Williams Street, greater setbacks and improved articulation.

The Board of Selectmen is also concerned about the proposed creation of a drop-off area along Harvard Street. We recommend that the applicant explore approaches to accommodating deliveries within the site itself to avoid impacts on Harvard and/or Williams Streets as well as eliminating public parking spaces.

We also respectfully recommend that DHCD direct the Applicant to submit the following information prior to or as part of a Comprehensive Permit application to the Town's Board of Appeals:

- A 3D model showing the proposed and abutting buildings
- A site plan showing abutting buildings with setbacks of the proposed building to its property lines and to abutting buildings
- A traffic and parking circulation study
- A physical indication on the lot of the building's footprint to illustrate its size and setbacks
- A comprehensive shadow study comparing and contrasting year-round shadows generated by both the existing and proposed development
- A stormwater and drainage report
- A waiver list in tabular form
- A preliminary Building Code analysis with respect to height and area compliance as well as exterior wall rating and openings.

The Board of Selectmen appreciates the willingness of JCHE to engage the neighborhood and strongly encourages it to continue to actively involve the public to identify and address their concerns as well as the specific issues raised herein by the Selectmen.

We look forward to working with JCHE to incorporate modifications into the project to improve its relationship to its environs while expanding the supply of affordable elderly housing.

Thank you for your consideration.

Sincerely,

Neil A. Wishinsky, Chair

Attachments

Town of Brookline
Massachusetts

HOUSING ADVISORY BOARD
Roger F. Blood, Chair
Steven A. Heikin
Michael H. Jacobs
Karen J. Kepler
William Madsen Hardy
Rita McNally
Kathy A. Spiegelman

333 Washington Street
Brookline, MA 02445
(617) 730-2130
FAX (617) 730-2442

To: Brookline Board of Selectmen

From: Roger Blood, Chair
Housing Advisory Board

Re: 384 Harvard Street
40B Proposal by Jewish Community Housing for the Elderly

Date: August 25, 2016

As chair of the Housing Advisory Board, I want to reiterate the board's support of this project, as expressed in our joint letter to Undersecretary Kornegay of June 29th (attached).
This project will provide 100% permanently affordable senior housing – a need that has been consistently identified in Brookline over the past several years. This agency has a very strong history of providing quality housing and services for low- and moderate-income seniors and we look forward to working with JCHE on its successful completion.

Thank you.

TOWN of BROOKLINE
Massachusetts

BOARD OF SELECTMEN

NEIL A. WISHINSKY, Chairman
NANCY A. DALY
BENJAMIN J. FRANCO
NANCY S. HELLER
BERNARD W. GREENE

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Town Administrator

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June 29, 2016

Chrystal Kornegay
Undersecretary
Massachusetts Department of Housing and Community Development
100 Cambridge Street, Suite 300
Boston, MA 02110

Dear Ms. Kornegay,

The Town of Brookline supports the Jewish Community Housing for the Elderly's (JCHE) plan for the new construction of 62 units of affordable rental housing for seniors at 384 Harvard Street in Brookline. The Town has a significant need for additional quality, affordable housing, including affordable rental housing for seniors. JCHE has actively solicited community feedback and input from the surrounding community in developing its plan for the site. The proposed project is right in the heart of Coolidge Corner and in an ideal location for affordable housing, given the site's access to public transportation, retail opportunities and services.

Over the past decade Brookline has experienced a 40% increase in the number of persons aged 55 to 64 years old and a 16% increase in the number of persons aged 65 to 74. Currently 23% of all Brookline households have at least one person aged 65+. With nearly 30% of all Brookline residents facing economic insecurity, according to the Brookline Community Foundation's recent report "Understanding Brookline", the poverty rates for persons 75+ living in Brookline have doubled since 2000 to over 17%.

At the same time, Brookline, like many other communities in Greater Boston over the past several years, has experienced a tremendous increase in housing costs. Currently 18% of <u>all</u> Brookline households pay more than 50% of their incomes towards housing costs. Low and moderate income households (those earning less than 80% of area median income) are affected even more significantly, with over half of those households paying more than 50% of their incomes towards rent.

In 2015, the Town's Housing Division conducted a Housing Needs Assessment for its Consolidated Plan FY2016-FY2020. In reviewing the waiting lists for affordable senior housing serving Town residents, the Division noted the following:

- Senior Public Housing (BHA) has wait lists of 12-18 months for priority cases which include seniors being evicted or facing homelessness or severe rent burdens.
- Center Communities of Brookline (Hebrew Senior Life) has wait lists of 2-4 years for affordable units in their mixed income developments at 100 Centre Street and 1550 Beacon Street. These wait times are lengthening as residents age in place. Wait lists at 112 Centre, which serves very low-income seniors, are even longer at 10+ years.
- JCHE's projects in Brighton, just over the Brookline border, currently have 50+ Brookline households on its wait list. Wait times are 2-3 years and the wait list for Genesis House is closed, as it is greater than 5 years.)

There has also been an increasing need for financial relief among low-income Brookline seniors; as an example, the Brookline Community Foundation's Safety Net program currently provides assistance to Brookline families for rent, utilities and other expenses, of which 30% are senior citizens (age 65 plus).

It is our understanding that as the 384 Harvard Street project moves forward, JCHE will be requesting both local comments in support of a project eligibility letter and funding support from the Town of Brookline. The Town will be happy to consider JCHE's request once a formal application is submitted.

We look forward to working with JCHE and DHCD on this important project.

Sincerely,

Neil Wishinsky, Chair
Brookline Board of Selectmen

Roger Blood, Chair
Brookline Housing Advisory Board

cc. Rebecca Frawley, Massachusetts Department of Housing and Community Development
Amy Schectman, Jewish Community Housing for the Elderly

TOWN OF BROOKLINE

PREVIOUS MUNICIPAL ACTIONS TO MEET AFFORDABLE HOUSING NEEDS

The Department of Housing and Community Development's regulations for Comprehensive Permits under Chapter 40B direct that the Subsidizing Agency "tak[e] into consideration information . . . regarding municipal actions previously taken to meet affordable housing needs such as inclusionary zoning, [and] multi-family districts adopted under M.G.L. Chapter 40A...." Brookline has a robust commitment to multi-family and affordable housing, which is evident in its zoning by-laws and its funding and other support of affordable housing.

A. Multi-Family Housing in Brookline.

Brookline has nineteen (19) zoning districts that permit multi-family housing (more than a two-family structure) covering approximately 18% of the Town's land area. The impact of the Town's zoning is clear—approximately 20,360 units, or 77% of the Town's housing units, are in multi-family buildings. Approximately half of Brookline households rent their homes. Of these renters, approximately 50% pay less than 30% of household income for gross rent. This rate is comparable to that of the entire Boston – Quincy – Cambridge Metropolitan Statistical Area and the state average.

B. Affordable Housing in Brookline.

Brookline has a longstanding commitment to affordable housing and has often been cited by state officials as an exemplar community for creating and preserving opportunities for affordable and multi-family housing that address the goals of Chapter 40B. As of February, 2016, 2,410 of the Town's 26,201 year-round dwelling units (US Census, 2010), or 9.2%, qualified for the Subsidized Housing Inventory,
as well as an additional 73 occupied affordable units serving households with incomes between 80% and 110% of area-median income. The current 40B-eligible units include 923 units owned and operated by the Brookline Housing Authority; 405 rental units owned by private investors; 769 rental units owned or controlled by non-profit organizations; 225 rental units permitted and/or in construction by 40B developers, and 88 owner-occupied homeownership units. Of the Chapter 40B-eligible units, a significant portion contains three or more bedrooms.

The Town has expended substantial municipal resources in support of all of its affordable housing programs and initiatives, facilitating the development and preservation of affordable housing, as more fully discussed below. Since 1992, the Town has spent more than $20 million of Town appropriations, Housing Trust Funds, and Town controlled resources to support affordable housing. This is in addition to the more than $10 million ($9.7 million on operations and $1.1 million on property modernization) expended annually by the Brookline Housing Authority. In 1987, the Town established an Affordable Housing Trust Fund, under the control of the Housing Advisory Board and the Board of Selectmen.

The Town has regularly directed a portion of the Town's Free Cash to the Trust Fund under circumstances where the unreserved Fund balance is less than $5 million, in order to ensure that significant resources are available without need for Town Meeting action whenever opportunities to support affordable housing projects arise. In accordance with this policy, the Town deposited $163,078 into the Trust Fund in FY2015.

In 2005, the Town completed a multi-year comprehensive planning process, which reaffirmed affordable housing as one of the Town's most important long-affordability, consistent with Chapter 40B, and an annual goal of 25 new affordable units per year through conversion or new construction. The Town has adhered to its commitment in both the creation of new affordable housing and the preservation of affordability in "expiring use buildings." Since 2002, the Town has added 257 new affordable units.

C. Brookline's Affordable Housing Policies, Programs and Initiatives.
Under the direction of the Town's Housing Advisory Board, which provides advice and recommendations on the Town's affordable housing policies and initiatives, and the Housing Division of the Town's Department of Planning and Community Development, staffed by two (2) housing professionals who are responsible for implementing housing policy, the Town has employed a multi-faceted approach to increasing and preserving the Town's affordable housing stock. As discussed below, the Town uses virtually all possible opportunities and strategies to accomplish its goals, including regulatory incentives such as inclusionary zoning policies; financial and technical assistance to non- and for-profit property owners and developers to preserve existing affordable units and create additional affordable units through conversion and new construction; tax incentives; the utilization of Chapter 40B in Town-supported affordable housing developments; and technical and financial assistance to those seeking to purchase, rent and rehabilitate affordable homes in Brookline.

1. Inclusionary Zoning.
The Town has significantly increased the number of affordable housing units in mixed-income developments through the Town's inclusionary zoning provisions set forth in Section 4.08 of the Town's zoning by-law. Adopted in 1987 and revised several times since then, these provisions require developers of residential projects with 6 or more units to offer at least 15% of the units to households with incomes under 100% of area median income. At least two-thirds of these units must meet Chapter 40B requirements, that is, serve households with incomes under 80% of area median income. In lieu of providing on-site units, developers of projects with 15 or fewer units may choose to make a cash payment to the Town's Housing Trust in accordance with a specific schedule. This cash payment is based upon a percent of the sales price of each unit minus $125,000 (the imputed price of an affordable unit). The percent charged ranges from 3%

for a 6-unit project to 9.75% for a 15-unit project, encouraging developers at the higher end to provide on-site units.

Between 1996 and the present, these inclusionary zoning provisions have directly produced 104 affordable rental and condominium units (the majority of which serve households with incomes under 80% AMI) in 22 properties. In addition, the zoning by-law has resulted in $6.4 million in contributions to the Town's Housing Trust Fund. This source, along with $4.1 million in Town appropriations and $1.4 million in investment income, has resulted in total revenues of over $12 million to the Housing Trust since its inception in 1987. Housing Trust allocations have already leveraged much greater amounts of State, federal and private funding for Brookline projects.

Examples of projects developed under the Town's inclusionary zoning program include:

Goddard House, a 115-unit development, providing 17 below-market, assisted-living units to low- and moderate-income seniors;

Longwood Towers, the addition of 26 units to an existing rental complex, resulting in 2 new on-site affordable units and 4 affordable units in an existing building off-site;

Kendall Crescent, a 35-unit development combining preservation of a former public school and new construction, and providing 5 affordable condominium units, including one fully accessible unit;

Cypress Lofts, a newly constructed 45-unit condominium in which the Applicant retained 5 units for low-income renters.

Park Place Condominium, a newly constructed 9-unit condominium with 2 affordable units;

The Hammondswood, a newly constructed 59-unit condominium, providing 9 affordable units; and

The Parkway, a newly constructed 16-unit condominium, with 2 affordable units.

2. New Affordable Housing Development.

Brookline has provided financial support and assistance to developers of new affordable housing, including projects on private properties, as well as Town and other publicly-owned properties. These Town-funded

developments went through an extensive planning process, resulting in designs compatible with the surrounding neighborhoods as more particularly described below.

The Olmsted Hill project, completed in 2012, is located on a 4.8 acre former Town-owned reservoir site in the single-family neighborhood of Fisher Hill. After several years of community planning and developer selection, the Town partnered with New Atlantic Development Corporation, which dismantled and filled two underground reservoirs, created a subdivision, sold 10 market-rate, single-family lots, and developed an affordable condominium complex. This project contains 24 affordable two and three bedroom units in three buildings, including 12 units that will serve families with incomes up to 80% of AMI and 12 units that will serve families with incomes up to 100% of AMI. The 2 ½ -story and 3-story multi-family buildings are designed to harmonize with the surrounding single family neighborhood by resembling a large estate home and carriage house. Permanent subsidy provided by the Town for the affordable units includes $1,273,982 in HOME funds, as well as $820,605 from Brookline's Housing Trust, $2,326,600 in revenue from the sale of the lots and a discount to the developer by the Town on the value of the land. All 24 units were sold with long-term deed restrictions.

In 1999, the Town began working with the Archdiocese of Boston Planning Office for Urban Affairs (POUA) to develop St. Aidan's Church as a "friendly 40B" development. POUA submitted an application to the Board of Appeals that conformed to development principles and guidelines established by community process. The 59-unit development was completed in 2009, and includes 36 affordable units (20 low-income rental and 16 homeownership units); preservation of the church building through adaptive reuse; and conservation of open space and specimen trees. The 3-to 5-story buildings are organized around common green space designed for passive and active recreation. The Town's contribution of $6.1 million in Housing Trust, HOME and CDBG monies leveraged $5 million in gap funding from the state and $4.5 million from private investors under the federal Low Income Housing Tax Credit program. This project was identified by Housing and Community Development Undersecretary Aaron Gornstein during his introductory remarks at the September 28, 2012 conference on Chapter 40B, co-sponsored by DHCD and CHAPA, among others.

Most recently, the Town supported the Brookline Housing Authority in its first venture as a developer of privately owned affordable housing. The Town provided $4.3 million towards the development of a 32-unit Low Income Housing Tax Credit project, constructed on an existing under-utilized parking lot serving the BHA's Trustman Apartments. The project was completed in December of 2015 and is now fully occupied.

3. Renovation of Existing Affordable Housing Units

The Town supports the preservation of existing affordable housing by providing funding for capital improvements. The Town regularly funds improvements at Brookline Housing Authority developments, to which it has contributed over $2.3 million. It also has assisted various residences serving individuals with special needs, including a total of $363,000 to Humanity House, a home for 10 developmentally disabled individuals, and $614,000 to a Pine Street Inn project in Brookline, a lodging house at 1043-1045 Beacon Street which serves 28 low-income individuals. Federal AARA dollars were allocated by the Town for energy-saving improvements to several properties controlled by nonprofits, including properties under the umbrella of Specialized Housing, Inc., which serves disabled adults at several locations in Brookline. The Town and the BHA have proven their commitment to modernizing and improving the Town's existing affordable housing stock.

4. Redevelopment of Existing Market Rate Housing.

Brookline has provided extensive financial and technical assistance to property owners and for-profit and non-profit entities proposing to redevelop existing market rate housing into affordable housing units.

Currently the Town is working with the Pine Street Inn to rehabilitate two lodging houses at 51-53 and 55-57 Beals Street. These long term lodging houses were managed by Pine Street under a lease with the owners since 2004. Pine Street Inn was able to purchase the property in 2014 with over $1.9 million in Housing Trust, HOME and CDBG funds from the Town. The buildings are being redeveloped into thirty-one "enhanced" single room occupancy (SRO) units including small bathrooms and mini-kitchenettes.

In 2001, the Town financed the purchase of a dilapidated lodging house at 1754 Beacon Street by the non-profit Brookline Improvement Coalition, Inc. (BIC), the Town's Community Housing Development Organization, and assisted BIC in the selection of a non-profit developer to rehabilitate, own and manage the lodging house. Pine Street Inn, the successful applicant, used the Town's investment of over $907,000 in HOME monies to leverage an additional $1.6 million commitment from three state sources for the rehabilitation of this historic building. The 14 rooms and efficiencies, permanently affordable for income-eligible persons, were occupied in the fall of 2003. The project has been both nationally recognized for innovative use of HOME funds and by the Massachusetts Historic Commission as an exemplary preservation project.

During the summer of 2002, the Housing Division staff learned of another deteriorated lodging house on the market at 1876 Beacon Street. After several affordable lodging house operators viewed the property, the Town agreed to support Caritas Communities, Inc., in acquiring the building. At the same time, the developer of Longyear Estates was seeking property to satisfy its off-site affordable housing obligation under the inclusionary provisions of the Town's zoning by-law. By partnering Caritas with Longyear and supporting Caritas in advocating for additional funding from state agencies, the Town was able to assure that Caritas received the $1.1 million in gap funding required to complete the acquisition, rehabilitation and long-term affordability of another 15 S.R.O. units for lower-income individuals.

At the end of 2003, the Town was notified of the sale of a 6-family building at 154-156 Boylston Street. BIC purchased and completed the rehabilitation and occupancy of this building in 2005 with $593,000 in Town-controlled CDBG funds, leveraging about $500,000 in gap funding from the Massachusetts Housing Partnership.

5. Preservation of Affordability in Expiring Use and Other Projects. Brookline also has actively sought to preserve affordability in its existing housing stock. One strategy has been to extend affordability at the Town's "expiring use" properties.

For example, in 2001, the Town assisted the Hebrew Rehabilitation Center for the Aged (Hebrew Rehab) in connection with its acquisition and rehabilitation of the senior housing at 100 and 112 Centre Street and 1550 Beacon Street, three such "expiring use" properties. The Town's commitment of $1 million in Housing Trust funds and an agreement to terminate the projects' 121A tax agreements gave this non-profit the competitive edge needed to purchase the properties. At that time, only about 280 of 516 units were still affordable, with a potential loss of another 160 affordable units when restrictions expired in 10 to 15 years. As a result of the Town's commitment, Hebrew Rehab acquired and modernized the properties, and is operating them under the name of Center Communities of Brookline, with at least 60% (338) units preserved as affordable for an additional 40 years.

In 2004, the Town modified its 121A tax agreement with the owner of the subsidized project at 1371 Beacon Street, resulting in the extension of the affordability of the project's 30 units until 2028. The Town also negotiated with the Board of the 116-unit Brookline Cooperative, preserving 32 units as affordable condominium units, when the Co-op converted upon the expiration of the original HUD mortgage guarantee.

In 2015, Winn Development sought to pre-pay its federally-subsidized mortgage in order to take advantage of HUD's Rental Assistance Demonstration Program, which provides better protection for existing low-income tenants. The Town negotiated with Winn to increase the number of units that will remain affordable for the next thirty years. The Town also hopes to work with the owner to preserve the 116-unit senior building on the property as permanently affordable with additional state and Town-controlled resources.

6. Other Affordable Housing Activities and Funding.

The Town actively supports affordable homeownership in several ways. It operated a first-time homebuyer down payment assistance program from1992 until 2010. With assistance increasing over the years from a maximum of $25,000 to a maximum of $175,000 per buyer, the program provided over $5 million in HOME and CDBG funds, with some of this total reflecting the recycling of loan payoffs upon resale. Since all new units are sold subject to permanent deed restrictions, the Town regularly exercises its right of first refusal by identifying eligible buyers and holding a lottery upon all unit resales.

In short, unlike many communities in the Commonwealth, Brookline's efforts to create, promote and preserve multi-family and affordable housing have been long-standing, committed, comprehensive and effective. Brookline has committed significant Town resources to these efforts and has made measurable progress in creating and preserving affordable housing. Affordable housing that has been created in the Town is subject to permanent affordability restrictions. Through its own efforts and close cooperation with private developers, Brookline has demonstrated that affordable housing does not need to be incompatible with sound planning objectives, environmental concerns or its surrounding community.

SECTION 5

DEVELOPMENT TEAM

370-384 HARVARD STREET
DEVELOPMENT TEAM

Applicant/Developer:	Jewish Community Housing for the Elderly III, Inc. 30 Wallingford Road Brighton, MA 02135 Contact: Zoe Weinrobe Phone: 617-912-8406 Email: zweinrobe@jche.org
Architect:	Prellwitz Chillinski Associates, Inc. 221 Hampshire Street Cambridge, MA 02139 Contact: Steve Allen Phone: 617-547-8120 Email: sallen@prellchil.com
Civil Engineer/ **Landscape Architect:**	Stantec 226 Causeway Street, 6th Floor Boston MA 02114-2155 Contact: Joe Geller Phone: 617-654-6054 Email: joe.geller@stantec.com
Traffic Consultant:	Stantec 226 Causeway Street, 6th Floor Boston MA 02114-2155 Contact: Richard Bryant Phone: 802-864-0223 Email: Richard.Bryant@stantec.com
Legal Counsel – Permitting:	Law Office of Robert L. Allen, Jr. LLP 300 Washington Street Brookline, MA 02445 Contact: Robert Allen Phone: 617-383-6000 Email: ballen@boballenlaw.com
Legal Counsel – Real Estate:	Nixon Peabody LLP 100 Summer Street Boston, MA 02110 Contact: Paul Bouton Phone: 617-345-1240 Email: pbouton@nixonpeabody.com

SECTION 6

SITE CONTROL

DEVELOPMENT AGREEMENT

THIS DEVELOPMENT AGREEMENT (the "Agreement") is made as of the 29th day of March 2016, by and between The Jewish Community Housing for the Elderly, Inc., a Massachusetts non-profit corporation existing under Chapter 180 of the General Laws of the Commonwealth of Massachusetts (the "Developer"), and Congregation Kehillath Israel, a religious corporation existing under Chapter 180 of the General Laws of the Commonwealth of Massachusetts (the "Owner");

RECITALS

A. The Owner issued a request for qualifications (the "RFQ") for the development of a certain portion of the Owner's real property located at 384 Harvard Street (the southwest corner of the intersection of Harvard Street and Williams Street) in Brookline, Massachusetts and including that portion of the Owner's property that includes the Epstein Auditorium, which property is generally described on **Exhibit "A"** (the "Development Parcel") and includes approximately 17,000 square feet. The exact size and location of the Development Parcel shall be determined by the Owner in consultation with the Developer during the Inspection Period as hereinafter defined. The Owner's entire real property is referred to herein as the "Owner's Property". The portion of the Owner's Property other than the Development Parcel is referred to herein as the "Sanctuary Parcel".

B. In response to the RFQ, the Developer submitted a statement of qualifications and a brief description of a proposed development of the Development Parcel (the "Proposal").

C. Based upon the evaluations of all responses submitted to the Owner in response to the RFQ, the Proposal submitted by the Developer was selected by the Owner.

D. Based upon negotiations between the Owner and the Developer and pursuant to the terms hereof, the Owner has agreed to convey a leasehold interest in the Development Parcel to the Developer, and the Developer has agreed to acquire a leasehold interest in the Development Parcel from the Owner for the development of the Project, as hereinafter defined, subject to the terms and conditions of this Agreement, which may differ from the terms of the Proposal.

NOW THEREFORE, in consideration of the covenants and agreements hereafter set forth, and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the parties agree as follows:

1. RECITALS. The Recitals to this Agreement are true and correct and are incorporated herein by reference and made a part hereof.

2. DEFINITIONS. Capitalized terms not specifically defined herein shall have the meaning ascribed to them elsewhere in this Agreement.

"Approved Budget" shall have the meaning ascribed to it in Section 7.4.

"Approved Plans" shall have the meaning ascribed to it in Section 7.2.

"Approved Schematics" shall have the meaning ascribed to it in Section 7.1.

"Budget" shall have the meaning ascribed to it in Section 7.4.

"Closing" shall have the meaning ascribed to it in Section 9.1.

"Closing Date" shall have the meaning ascribed to it in the Project Schedule.

"Collaboration Agreement" shall have the meaning ascribed to it in Section 3.

"Commitment" shall have the meaning ascribed to it in Section 5.1.

"Completion" shall have the meaning ascribed to it in the Project Schedule.

"Completion Date" shall have the meaning ascribed to it in the Project Schedule.

"Connection" shall have the meaning ascribed to it in Section 6.

"Construction Bonds" shall have the meaning ascribed to it in Section 8.1.5.

"Construction Contract" shall have the meaning ascribed to it in Section 7.5.1.

"Controlling Entity" shall have the meaning ascribed to it in Section 14.1.1.

"Cure Period" shall have the meaning ascribed to it in Section 5.2.

"Developer Conditions Precedent" shall have the meaning ascribed to it in Section 8.3.

"Effective Date" shall mean the date this Agreement is last executed by the Developer and the Owner.

"Equity Commitment" shall have the meaning ascribed to it in Section 7.5.2.

"Financial Terms" shall have the meaning ascribed to it in Section 3.

"Ground Lease" shall have the meaning ascribed to it in Section 3.

"Indemnitor" shall have the meaning ascribed to it in Section 13.

"Indemnitee" shall have the meaning ascribed to it in Section 13.

"Inspections" shall have the meaning ascribed to it in Section 4.1

"Inspection Period" shall have the meaning ascribed to it in the Project Schedule.

"Lenders" shall have the meaning ascribed to it in Section 7.5.2.

"Loans" shall have the meaning ascribed to it in Section 7.5.2.

"Loan Commitments" shall have the meaning ascribed to it in Section 7.5.2.

"Owner Conditions Precedent" shall have the meaning ascribed to it in Section 8.1.

"Owner Deliveries" shall have the meaning ascribed to it in Section 4.9.

"Owner's Unavoidable Delays" shall mean delays beyond the Owner's control (other than delays in connection with obtaining licenses, permits, and approvals from governmental authority relating to the Owner's Work described in Section 7.8) including, without limitation, civil commotion, war, invasion, rebellion, hostility, military or usurped power, sabotage, insurrection, strikes or lockouts on an area-wide basis and not specific to the Project, riots, hurricanes, floods, earthquakes, casualties, acts of public enemy, epidemics, quarantines, restrictions, embargos and area-wide governmental restrictions.

"Permitted Exceptions" shall have the meaning ascribed to it in Section 5.1.

"Phase I Report" shall have the meaning ascribed to it in Section 4.3.

"Phase II Report" shall have the meaning ascribed to it in Section 4.3.

"Plans and Specifications" shall have the meaning ascribed to it in Section 7.2.

"Project" shall have the meaning ascribed to it in Section 6.

"Project Schedule" shall have the meaning ascribed to it in Section 3.

"Purchase Price" shall have the meaning ascribed to it in the Financial Terms set for in **Exhibit "C"**.

"Schematic Design Documents" shall mean, at a minimum, the site plan for the Project, proposed building massing and elevations for the Project, an architectural rendering for the Project of sufficient detail to allow for the evaluation of the proposed design by the Owner.

"Survey" shall have the meaning ascribed to it in Section 5.1.

"Unavoidable Delays" shall mean delays beyond the Developer's control (other than delays in connection with obtaining licenses, permits, and approvals from governmental authority relating to the Project) including, without limitation, civil commotion, war, invasion, rebellion, hostility, military or usurped power, sabotage, insurrection, strikes or lockouts on an area-wide basis and not specific to the Project, riots, hurricanes, floods, earthquakes, casualties, acts of public enemy, epidemics, quarantines, restrictions, embargos and area-wide governmental restrictions.

3. PROPERTY. The property interest to be conveyed by the Owner to the Developer pursuant to the terms of this Agreement consists of the leasehold interest in the Development Parcel and all appurtenances belonging thereto, including any and all rights, privileges and easements in any way pertaining thereto, all right, title and interest of the Owner

in and to any adjoining sidewalk and in and to any adjoining street or alley. At Closing, the Owner and the Developer shall enter into a 75-year ground lease (the "Ground Lease") and a related collaboration agreement (the "Collaboration Agreement"). The Developer shall be responsible for causing the ground lease plan to be prepared, such plan being subject to the approval of the Owner. The Ground Lease and the Collaboration Agreement must be acceptable to the Owner and the Developer and shall include, but not be limited to the following provisions: the financial terms, which shall be agreed on during the Inspection Period (the "Financial Terms"); the construction/development benchmarks as set forth in **Exhibit "B"** attached hereto and made a part hereof, subject to extension as provided herein (the "Project Schedule"); the Developer shall deliver to the Owner any third party inspection reports received by the Developer during construction of the Project and such other Project updates as the Owner may reasonably request, as well as notices to the Developer of any issues relating to potential construction delays of greater than 30 days individually or in the aggregate, construction defects that cannot be corrected or that would cost in excess of $50,000 individually or $100,000 in the aggregate (with all other such defects) or budget increases in excess of the available contingency line item; any cross use agreements/licenses agreed to by the Developer and the Owner; a prohibition of any activities at the Project that would be inconsistent with the Owner's then current use of the Sanctuary Parcel, provided, however, that the foregoing shall only apply to changes to the Project since the Closing; the Developer's indemnification of the Owner relating to the Project; the Owner shall not be required to subordinate the Owner's fee simple interest in the Owner's Property; the Developer shall not allow any liens against the Owner's fee simple interest in the Owner's Property; the construction of the Project shall not interfere with the Owner's then current use of the Sanctuary Parcel; the Developer shall comply with the Owner's reasonable requests regarding dust mitigation and protection of the Sanctuary Parcel and the buildings thereon, including but not limited to, stained glass windows; outside of normal business hours on normal business days, the Owner shall have reasonable approval rights of days and hours that the Developer may construct the Project, including prohibitions on construction during certain Jewish Holidays (with said holidays specified in an addendum to this agreement by June 2016); the Developer shall have shared rights in the driveway to the rear of the Epstein Building. The substantially final form of the Ground Lease and the Collaboration Agreement shall be agreed upon by the Owner and the Developer during the Inspection Period. If they cannot agree within such period (unless the parties agree otherwise), this Agreement shall terminate, except for such indemnity provisions as survive termination.

4. INSPECTION PERIOD.

4.1 Inspections. The Developer shall have the right to perform, at the Developer's sole cost and expense, such investigations and inspections of the Development Parcel as the Developer, in the Developer's sole and absolute discretion deems appropriate, including, without limitation, soil tests, zoning investigations, utility availability and environmental matters (collectively the "Inspections") to determine whether the Development Parcel is acceptable to the Developer, in its sole discretion. Prior to the commencement of on-site Inspections, the Developer shall keep the Owner generally informed as to such Inspections, and shall provide advance written notice to the Owner of any on-site Inspections, which written notice shall provide reasonable detail regarding the type and scope of Inspection(s) to be performed and the scheduled date and time for such Inspection(s) and provide the Owner the

opportunity to have a representative from the Owner present at any such Inspection(s). Notice of any invasive or destructive testing shall be given at least three (3) business days in advance and Owner shall have the right to reasonably delay such testing in the event of possible conflict or interference with Owner's interim use of the building. The Developer shall conduct such Inspection(s) in a manner so as to not interfere with the current use of the Owner's Property.

4.2 Restoration. Following any such Inspections, the Developer shall promptly restore the Owner's Property to the condition existing immediately prior to such Inspections to the extent reasonably practicable. If the Owner's Property cannot be fully restored, the Developer shall make such repairs as may be determined by the Owner and shall indemnify the Owner from any loss of value of the Owner's Property arising from any damage caused by the inspections that cannot be restored. The Inspections shall be conducted in accordance with all applicable laws and by licensed and insured professionals and the Developer shall cause its inspectors to obtain, at the Developer's sole cost and expense, any and all licenses and permits required to conduct the Inspections, as applicable.

4.3 Environmental Audit. Should the Developer conduct a Phase I environmental audit ("Phase I Report") and such audit reflects a recommendation for further environmental audits (a "Phase II Report"), the Owner acknowledges that the Developer shall, after the Owner's prior written approval, be authorized, at the Developer's sole cost and expense, to obtain the Phase II Report during the Inspection Period.

4.4 Disclosure. The Developer agrees that in the event the Developer is obligated to notify, under applicable laws, any federal, state or local public agencies of any conditions at the Development Parcel as a result of the Inspections performed by the Developer, its agents, employees, contractors and/or representatives, the Developer shall promptly notify the Owner and, upon the Owner's request, provide the Owner with any pertinent reports, written material or other evidence of the condition requiring such disclosure, if any. Any required disclosures or notifications shall be made directly by the Owner, if deemed necessary thereby, and not the Developer, to any such public agencies, unless the Developer is required to make such disclosures by applicable law, and the Owner fails to timely make such disclosures.

4.5 Indemnification. The Developer shall assume all risks associated with the Inspections and agrees to indemnify and hold harmless the Owner of, from and against any and all costs, losses, claims, damages, liabilities, expenses and other obligations (including, without limitation reasonable attorney's fees and court costs) arising from, out of or in connection with or otherwise relating to the Inspections, including, without limitation, the entry by any one or more of the Developer's agents, employees, contractors and other representatives in or upon the Development Parcel for the purpose of the Inspections. The foregoing indemnification obligations of the Developer shall survive the expiration or termination of this Agreement.

4.6 Insurance. The Developer shall, prior to entering the Development Parcel and performing any Inspections, provide to the Owner evidence of insurance by the Developer and its contractors, as applicable, as specified on **Exhibit "D"** attached hereto, insuring against any liability by any one or more of the Developer, its agents, employees, contractors or other representatives arising from, out of or in connection with or otherwise relating to the entry by

any one or more of the Developer, its agents, employees, contractors or other representatives in or upon the Development Parcel for the purpose of the Inspections. The Developer shall provide the Owner with a certificate of insurance evidencing such insurance coverage, naming the Owner as additional insured thereon and which insurance coverage shall be kept in force until (a) the expiration or early termination of this Agreement or; (b) until completion of construction of the Project.

4.7 Acceptance of Development Parcel. If for any reason whatsoever the Developer, in its sole discretion, determines during the Inspection Period that it does not wish to proceed with the transaction contemplated by this Agreement, the Developer shall have the absolute right to terminate this Agreement by giving written notice of such termination to the Owner in the manner hereinafter provided to give notices prior to the expiration of the Inspection Period. Upon the Owner's receipt of such notice prior to the end of the Inspection Period, this Agreement shall be deemed terminated and of no further force and effect and the parties shall be released and relieved from any liability or obligations hereunder, except for those obligations which expressly survive termination. If the Developer does not terminate this Agreement prior to the expiration of the Inspection Period, then it shall be presumed conclusively that the Developer has had adequate opportunity to review and inspect all portions of the Development Parcel, including, without limitation, the environmental condition of the Development Parcel and the Developer has determined that the condition of all portions of the Development Parcel are satisfactory to the Developer and the Developer has accepted every portion of the Development Parcel in its "AS IS, WHERE IS, WITH ALL FAULTS" condition.

4.8 No Lien. The Developer shall not create or permit to be created any mechanic's liens upon the Owner's Property, or any part thereof, as a result of the Inspections. If any lien shall at any time be filed against the Owner's Property, or any part thereof in connection with the Inspections, the Developer shall cause same to be discharged or transferred to bond in accordance with applicable laws within thirty (30) days after the Developer first becomes aware that such lien has been recorded against the Owner's Property. This provision shall survive the expiration or termination of this Agreement.

4.9 Owner Deliveries. Prior to the date of this Agreement, the Owner has provided to the Developer copies of all surveys and other materials which the Owner has been able to locate with respect to the Development Parcel (collectively the "Owner Deliveries"). Any reliance upon the Owner Deliveries is at the sole risk of the Developer and the Owner makes no representations or warranties, express or implied, with respect to the accuracy or completeness of the Owner Deliveries, and any reliance upon same is at the sole risk of the Developer.

4.10 Disclaimer of Representations by the Developer. The Developer hereby expressly acknowledges and agrees that, except as specifically provided in this Agreement:

4.10.1 The Owner makes and has made no warranty or representation whatsoever as to the condition or suitability of the Development Parcel for the Project, as hereinafter defined.

4.10.2 The Owner makes and has made no warranty, express or implied, with regard to the accuracy or completeness of any information furnished to the Developer, and the Owner shall not be bound by any statement of any broker, employee, agent or other representative of the Owner.

4.10.3 The Owner has made no representations, warranties or promises to the Developer not explicitly set forth in this Agreement. The representations, warranties and agreements of the Owner set forth in this Agreement shall not survive the closing.

4.10.4 The Owner has made no representations or warranties, express or implied, with regard to the neighborhood surrounding the Development Parcel, or as to the precise type or quality of improvements that may be constructed within such neighborhood or the timing thereof.

4.10.5 The Owner makes and has made no representation or warranty, express or implied, concerning any portion of the Development Parcel, its condition or other things or matters directly or indirectly relating thereto or hereto, including, without limitation, no warranty as to merchantability or fitness for any particular purpose or relating to the absence of latent or other defects.

4.11 Copies of Reports. The Developer shall provide the Owner with copies of all third party reports relating to the Inspections upon request within 10 days, and upon any termination of this Agreement, so long as the third party providers permit the distribution of such reports.

5. TITLE AND SURVEY.

5.1.1 The Developer shall obtain a title insurance commitment (the "Commitment") and a survey (the "Survey") of the Development Parcel, at the Developer's sole cost and expense. The Commitment and the Survey shall show the Owner to be vested in fee simple title to the Development Parcel, subject to each of the following (the "Permitted Exceptions"):

5.1.2 Ad valorem real estate taxes and assessments for the year of Closing and subsequent years.

5.1.3 All applicable laws, ordinances and governmental regulations, including, but not limited to, all applicable building, zoning, land use and environmental ordinances and regulations.

5.1.4 Any matters arising by, through, or under the Developer.

5.2 Title Review. The Developer shall have until the end of the Inspection Period to obtain and examine the Commitment and the Survey. The Developer shall promptly provide the Owner with a copy of the Commitment and the Survey upon the Developer's receipt of same. The Survey shall be certified to the Developer and the Owner. If the Commitment and Survey reflect defects in the title to the Development Parcel, the Developer shall, no later than

the expiration of the Inspection Period, notify the Owner in writing of the defect(s). If the Developer fails to give the Owner written notice of the defect(s) prior to the end of the Inspection Period, the defect(s) shown in the Commitment and the Survey shall be deemed to be waived as title objections and same shall be deemed to constitute Permitted Exceptions for all purposes under this Agreement. If the Developer has given the Owner written notice of defect(s), other than the Permitted Exceptions, prior to the end of the Inspection Period, the Owner shall elect within ten (10) days after receipt of written notice of the title defect(s) whether the Owner will elect to attempt to cure the title defect(s); provided, however, that the Owner shall discharge any lien(s), judgment(s) or other matters affecting title to the Development Parcel that are in a liquidated amount, provided that as to liens, judgments or other matters not voluntarily entered into by the Owner, the Owner shall not be required to expend more than $50,000 discharging such liens, judgments or other matters. If the Owner does not elect to cure the title defect(s), the Developer shall have the option, to be exercised within ten (10) days after the Developer receives written notice from the Owner that the Owner has elected not to cure the title defect(s), of either (i) waiving the defect(s), in which event the defect(s) shall be deemed to constitute a Permitted Exception under this Agreement, or (ii) terminating this Agreement, in which event the parties shall be released from any further obligations under this Agreement, except for those obligations that expressly survive the termination of this Agreement. If the Owner elects to attempt to cure the title defect(s), the Owner shall have sixty (60) days from receipt of the written notice of defect(s) to use commercially reasonable efforts to cure same (the "Cure Period"). The Owner shall not be required to commence litigation to resolve any matters. In the event the Owner attempts to cure the title defects and the Owner is not able to cure the defect(s) prior to the end of the Cure Period, the Developer shall have the option, to be exercised within ten (10) days after the end of the Cure Period, of either (i) waiving the defect(s), in which event the defect(s) shall be deemed to constitute a Permitted Exception under this Agreement, or (ii) terminating this Agreement, whereupon the parties shall be released from any further obligations under this Agreement, except for those obligations that expressly survive the termination of this Agreement.

5.3 In the event of any new title defect(s) arising from and after the effective date of the Commitment and prior to the Closing Date, the Owner shall use commercially reasonable efforts to cure such title defect(s) within ten (10) days, if practicable, and in any event prior to the Closing Date. The Owner shall discharge any lien(s), judgment(s) or other matters affecting title to the leasehold interest in the Development Parcel that are in a liquidated amount, provided that as to liens, judgments or other matters not voluntarily entered into by the Owner, the Owner shall not be required to expend more than $50,000 discharging such liens, judgments or other matters. The Owner shall not be required to bring any lawsuit(s) to cure any title defect(s) or expend any funds to cure any title defect(s) that is not in a liquidated amount. In the event that the Owner is unable to cure the title defect(s) prior to the Closing Date after using commercially reasonable efforts, the Developer shall have the option on the Closing Date of: (i) waiving the title defect(s) and accepting title "as is" whereupon the title defect(s) will be deemed to constitute a Permitted Exception under this Agreement; or (ii) terminating this Agreement, whereupon the parties shall be released from all further obligations under this Agreement, except for those obligations that expressly survive the termination of this Agreement.

6. PROJECT DESCRIPTION. The "Project" shall consist of a number of residential units for the elderly of a size, scale and quality reasonably acceptable to the Owner, and in a sufficient amount to make the Project economically viable, as determined by the Developer. The Project will have a sufficient number of parking spaces to comply with applicable law, and will also include commercial space, which shall be used only in a manner compatible with the Owner's then-current use of the Sanctuary Parcel and of a compatible size and quality, all determined in the Owner's sole but reasonable discretion but not unreasonably delayed. Developer is suggesting the following commercial uses: kosher café/restaurant with beer/wine incidental to the café/restaurant; bakery; gallery; exercise studio, toy, clothing, book, art or jewelry retail; bank (ATM only) or other uses reasonably acceptable to the Owner. Developer will work with Owner to make the commercial space a successful and integral component of the total campus. Some of the parking spaces in the Project shall be available for the use of the Owner and its invitees. The Owner has requested six (6) spaces reserved for Owner; the Developer has offered no spaces; the parties will negotiate in good faith to resolve this matter prior to the end of the Inspection Period. The Project shall also have a number of amenities, some of which may be shared with the Owner. All of this will be agreed upon as soon as possible during the Inspection Period. The Collaboration Agreement will provide further details regarding the Project amenities. The Project shall be constructed on the Development Parcel and is currently intended to be partially financed by federal low income housing tax credits. The Owner and the Developer currently anticipate that the Project shall be connected to the Owner's current improvements on the Sanctuary Parcel by one or more internal walkways (collectively, the "Connection") in a manner, size and quality satisfactory to the Owner in its reasonable discretion.

7. PROJECT DEVELOPMENT.

7.1 Approval of Schematic Design Documents by the Owner. Developer intends to work in an iterative fashion with the Owner on plans. During the design period, the project architects will confer, advise and otherwise comment on design progress of the complementary project. In sum, within sixty (60) days from the Effective Date, the Developer shall submit to the Owner for review and approval the height, massing, size, footprint, all exterior finishes, design, connections and landscaping elements (collectively, "Major Elements") of the Schematic Design Documents. Design shall be limited to exterior design, interior if visible to the outside, and design of the Connection. The Developer agrees to modify the Schematic Design Documents as necessary to address the reasonable requirements of the Owner. The Developer understands and agrees that the Owner has a strong vested interest in the total campus and in the design, construction and operation of the Project and its close proximity to Congregation Kehillath Israel, which is of primary importance to the Owner. Owner's reasonableness in approving or disapproving matters under this Section 7 shall be judged in light of such special considerations. The Developer shall provide the Owner such additional back-up information as the Owner may reasonably request to enable the Owner to analyze all relevant aspects of the Project as reflected in the Schematic Design Documents. The Owner shall use reasonable efforts to approve or disapprove same within twenty-one (21) days from the receipt of the Schematic Design Documents. In the event of disapproval, the Owner shall specify the reasons for such disapproval. In the event of disapproval, the Developer shall modify the Schematic Design Documents, as appropriate, to address the comments and concerns of the

Owner. Any resubmission shall be subject to reasonable approval by the Owner in accordance with the procedure outlined above for the original submission until same is reasonably approved by the Owner. The Owner and the Developer shall proceed in good faith to attempt to resolve any disputes regarding the Schematic Design Documents. The Schematic Design Documents approved by the Owner shall be referred to as the "Approved Schematics". The Approved Schematics will be the basis of the submittal to the Brookline Zoning Board of Appeal ("ZBA") for a comprehensive permit. To the extent the Approved Schematics are modified, as part of the 40B process, in a manner that changes the Major Elements, of the Project or impacts the Connection, such modified Schematic Design Documents shall be subject to the reasonable approval of the Owner. The Owner shall use reasonable efforts to approve or disapprove changes within ten (10) days from the receipt of the modified Schematic Design Documents. In the event of disapproval, the Owner shall specify the reasons for such disapproval. In the event of disapproval, the Developer shall modify the Schematic Design Documents, as appropriate, to address the comments and concerns of the Owner, understanding that such modifications will likely require the approval of the ZBA. Any resubmission shall be subject to reasonable approval by the Owner in accordance with the procedure outlined above for the original submission until same is reasonably approved by the Owner. The Owner and the Developer shall proceed in good faith to attempt to resolve any disputes regarding the Schematic Design Documents.

7.2 Construction Documents. As soon as practicable after issuance of a comprehensive permit by the ZBA, the Developer shall submit to the Owner for its review and reasonable approval the plans and specifications for the construction of the Project, which shall be of sufficient detail to allow the Developer to apply for a building permit for the Project ("Plans and Specifications"). The Plans and Specifications shall be subject to the reasonable approval of the Owner, which approval shall not be unreasonably withheld, and such approval shall be given if the Owner determines the Plans and Specifications are consistent with the Approved Schematics and where substantive material changes to the Major Elements have been made, the Developer agrees to make modifications to the Plans and Specifications to satisfy the reasonable requests of the Owner. The Developer shall provide to the Owner such additional back-up information as the Owner may reasonably request to enable the Owner to analyze the Plans and Specifications. The Plans and Specifications approved by the Owner shall be referred to as the "Approved Plans".

7.3 Construction. The Developer shall cause the Project to be constructed substantially in accordance with the Approved Plans. All proposed changes to the Approved Plans shall be promptly submitted to the Owner. The Owner shall have approval rights with respect to the changes to the Approved Plans to the extent such changes to the Approved Plans materially change the Major Elements or materially impact the Connection. The materiality of a change or impact shall be determined by the Owner its sole but reasonable discretion. Any such approval of the Owner shall not be unreasonably withheld, delayed or conditioned. The Owner shall use reasonable efforts to approve or disapprove same within ten (10) days from the receipt of any proposed changes to the Approved Plans.

7.4 Project Budget. Prior to the Closing, the Developer shall submit to the Owner for review and approval, which approvals shall not be unreasonably withheld, conditioned or delayed, a detailed line item budget reflecting all hard and soft costs anticipated to

be incurred by the Developer in connection with the Project and containing all of the applicable Financial Terms (the "Budget"). The Developer shall provide to the Owner such additional back-up information as the Owner may reasonably request to enable the Owner to analyze all aspects of the Budget. The Owner shall use reasonable efforts to approve or disapprove same within fifteen (15) business days after receipt of the Budget. The Budget, if approved by the Owner, shall be deemed the "Approved Budget". The Owner acknowledges that as is typical in the real estate development context, the Approved Budget will likely change over time, and the Owner shall not have approval rights over such changes except to the extent (i) there are not sufficient sources of dedicated funds to pay for the Project or (ii) such changes would materially affect the viability or quality of the Project, including changes that require changes to the Major Elements or impact the Connection.

7.5 Development of Project. As soon as available, the Developer shall submit to the Owner for review and approval, which approval shall not be unreasonably withheld, conditioned or delayed, the following:

7.5.1 Construction Contract. The construction contract for the Project (the "Construction Contract"), together with the "schedule of values" for the Project. The Construction Contract shall be with a quality construction contractor reasonably acceptable to the Owner. Any change in the general contractor or the architect must be reasonably approved in writing by the Owner. The current architect is Prellwitz Chilinski Associates, Inc.

7.5.2 Loan and Equity Commitments. A loan commitment for a construction loan (the "Construction Loan") from a financial institution (the "Construction Lender"), loan commitments for subordinate loans (the "Subordinate Loans") from nonprofit entities or governmental agencies (the "Subordinate Lenders"), a loan commitment for a permanent loan (the "Permanent Loan") from a financial institution (the "Permanent Lender"), collectively evidencing all construction and permanent financing for the development of the Project (collectively, the "Loan Commitments") and an equity commitment (the "Equity Commitment") for an equity investment in the entity that will own and develop the Project. The Construction Loan, the Subordinate Loans and the Permanent Loan are collectively referred to as the "Loans". The Construction Lender, the Subordinate Lenders and the Permanent Lender are collectively referred to as the "Lenders". The Loan Commitments and the Equity Commitment shall demonstrate to the reasonable satisfactory of the Owner that the Developer has sufficient funding available to complete the Project in accordance with the Approved Plans and the Approved Budget.

7.6 Owner Approval. The Owner shall use reasonable efforts to approve or disapprove same after receipt of each of the items required in Sections 7.1 through 7.5. In the event of disapproval of any such item, the Owner shall specify the reasons for such disapproval. In such event, the Developer shall address the comments and concerns of the Owner to amicably resolve any disputes. The Owner shall approve the Budget and the items set forth in Section 7.5 as long as such items show, in the Owner's reasonable discretion, the Project's financial feasibility and sustainability.

7.7 Project Schedule. Subject to Unavoidable Delay, the Developer shall meet each of the timing requirements set forth in the Project Schedule.

7.8 Owner's Work. The Owner shall use reasonable efforts to substantially complete the renovation and new construction on the Sanctuary Parcel and vacate the Development Parcel by October 1, 2017, subject to Owner's Unavoidable Delays or Abandonment (as defined below). As of the date hereof, the Owner expects to begin construction on the Sanctuary Parcel in the second quarter of 2016, subject to receipt of financing and permitting. Owner shall keep Developer fully informed regarding Owner's efforts and progress in this regard. If the Owner has not commenced construction by September 1, 2016, as it may be extended ("Abandonment"), either party hereto may terminate this Agreement. The parties acknowledge that for purposes of determining "Abandonment", the Owner's commencement of exterior masonry and roof repairs shall not be deemed commencement of the renovation and new construction on the Sanctuary Parcel, but rather only the commencement of substantial interior renovations and new construction will count as commencement for purposes of determining "Abandonment". Notwithstanding the foregoing, if Owner provides notice to Developer by June 30, 2016 that Owner will not be able to achieve the date set forth in the first sentence of this Section 7.8, then such date (as well as the date set forth in the fourth sentence of this Section 7.8 regarding commencement of construction and the dates set forth in the Project Schedule) shall be extended for a time period of not less than six months or more than 12 months, as is set forth in such notice from Owner to Developer. Further, if Owner does not complete the renovations by October 1, 2017 (as extended pursuant to the prior sentence) then the dates set forth in the Project Schedule shall be extended for a time period equal to the amount of time after October 1, 2017 (as extended pursuant to the prior sentence) until the renovation and new construction are completed and the Development Parcel vacated.

7.9 Meetings. Representatives of the Owner and the Developer shall meet at least once per month (or more frequent if needed), either by phone or in person, to keep each other informed regarding the Project and each parties' obligations under this Agreement, including without limitation the Developer's predevelopment activities and the Owner's obligations under Section 7.8. The initial representatives of the Owner and the Developer shall be James Koningisor and Rhonda Spector, respectively. Either party may change its representative at any time by notice to the other, subject to the reasonable approval of the other. The Developer hereby approves Marc Plonskier as a successor representative of the Owner, and the Owner hereby approves Lizbeth Heyer as a successor representative of the Developer. The Owner and the Developer agree that the development of this Project, commencing with the production of the Schematic Design Documents and the Plans and Specifications (which will include the building, the Connection and open spaces) will be an iterative and transparent process, with the goal that when the Developer provides the draft of the Schematic Design Documents and of the Plans and Specifications (and drafts of any other required deliverables) to the Owner, there will be no surprises.

8. CONDITIONS PRECEDENT.

8.1 The obligation of the Owner to close the transaction contemplated by this Agreement is subject to the satisfaction or waiver of the following conditions precedent (the "Owner Conditions Precedent"):

8.1.1 Pursuant to the terms of this Agreement, the Owner shall have approved the Budget, the Plans and Specifications, the Construction Contract, the Collaboration Agreement, the Ground Lease, the Loan Commitments and the Equity Commitment.

8.1.2 The Owner shall have completed the renovation and new construction on the Sanctuary Parcel to the level necessary to allow the Owner to vacate the Development Parcel, and Owner shall have vacated the Development Parcel.

8.1.3 The Construction Lender and the Subordinate Lenders are prepared to close the Construction Loan and the Subordinate Loans, respectively, in accordance with terms of the Loan Commitments and such Loans shall close simultaneously with the Closing.

8.1.4 The equity investor(s) is prepared to close the equity investment in accordance with the terms of the Equity Commitment, which closing shall happen simultaneously with the Closing.

8.1.5 The Developer shall have provided to the Owner payment, performance and lien bonds in form and substance reasonably satisfactory to the Owner in an amount equal to one hundred percent (100%) of the construction costs for the Project, which shall be issued by a surety having a credit rating of "A" or higher with a financial strength of X or higher (the "Construction Bonds"). The Construction Bonds shall insure lien-free completion of the Project.

8.1.6 The Developer shall have obtained a building permit to enable the Developer to construct the Project in accordance with the Approved Plans or provided the Owner with evidence that the building permit for construction of the Project, in accordance with the Approved Plans, is ready to be issued only upon payment of the building permit fee and impact fees

8.1.7 The Developer shall have complied with the deadlines set forth in the Project Schedule, including a Closing on or before December 31, 2018, subject to extension as is set forth in this Agreement.

8.2 In the event the Owner Conditions Precedent are not satisfied or waived by the Owner on or before the Closing Date, then the Owner may either (i) terminate this Agreement in which event the parties shall be released from all further obligations under this Agreement except for the obligations under this Agreement which expressly survive the termination of this Agreement, or (ii) waive the condition and proceed in accordance with this Agreement. Notwithstanding the foregoing, except in the case of Abandonment, the Owner shall not be entitled to terminate this Agreement on account of its failure timely to complete the renovation and new construction on the Sanctuary Parcel, the Owner's sole remedy in such event being an extension of the Closing Date to allow for such construction to be completed.

8.3 The obligation of the Developer to close the transaction contemplated by this Agreement is subject to the satisfaction or waiver of the following conditions precedent (the "Developer Conditions Precedent"):

8.3.1 The Owner shall have substantially completed the renovation and new construction on the Sanctuary Parcel to a degree sufficient to allow the Owner to vacate the Development Parcel, and Owner shall have vacated the Development Parcel.

8.3.2 The Construction Lender and the Subordinate Lenders are prepared to close the Construction Loan and the Subordinate Loans, respectively, in accordance with terms of the Loan Commitments and such Loans shall close simultaneously with the Closing.

8.3.3 The equity investor(s) is prepared to close the equity investment in accordance with the terms of the Equity Commitment, which closing shall happen simultaneously with the Closing.

8.3.4 The Developer shall have obtained all permits and approvals it deems necessary to enable the Developer to construct the Project in accordance with the Approved Plans, except that with respect to the building permit, this condition shall be satisfied if the building permit is ready to be issued only upon payment of the building permit fee and impact fees.

8.4 In the event the Developer Conditions Precedent are not satisfied or waived by the Developer on or before the Closing Date, then the Developer may either (i) terminate this Agreement in which event the parties shall be released from all further obligations under this Agreement except for the obligations under this Agreement which expressly survive the termination of this Agreement, or (ii) waive the condition and proceed in accordance with this Agreement.

9. CLOSING DATE.

9.1 Closing. The closing of the transaction contemplated by this Agreement (the "Closing") shall occur on the Closing Date pursuant to the terms of the Project Schedule, time being of the essence. If the Closing has not occurred on or before the outside date set forth in the Project Schedule, this Agreement will terminate and be of no further force or effect unless the parties agree, in their sole and absolute discretion, to extend such outside date for Closing. On the Closing Date the following shall occur provided all of the Conditions Precedent have been satisfied or waived:

9.1.1 The Owner shall deliver to the Developer at Closing:

9.1.1.1 The Collaboration Agreement, the Ground Lease and a related Memorandum of Ground Lease.

9.1.1.2 Evidence of authority to close the transaction and execute and deliver the appropriate closing documents.

9.1.1.3 A no lien, gap and possession affidavit.

9.1.1.4 Such other documents as the title company may reasonably request.

9.2 The Developer shall deliver to the Owner or cause to be delivered to the Owner at Closing:

9.2.1 The Purchase Price.

9.2.2 Evidence of authority to close the transaction and execute and deliver the appropriate closing documents.

9.2.3 The Collaboration Agreement, the Ground Lease and a related Memorandum of Ground Lease.

9.2.4 The Construction Bonds.

9.2.5 Such other documents as the title company may reasonably request.

9.3 The documentary stamp tax and surtax, if any, to be affixed to the Memorandum of Ground Lease shall be paid by the Owner. The cost for recording the Memorandum of Ground Lease shall be paid by the Developer. Each party shall bear the cost of the fees of their own respective attorneys and other professionals and the cost of their own respective performance under this Agreement.

10. REPRESENTATIONS OF OWNER. The Owner makes the following representations to the Developer:

10.1 The Owner is duly organized and validly existing under the laws of the Commonwealth of Massachusetts and has full power and capacity to own its properties, to carry on its business as presently conducted by the Owner, and to perform its obligations under this Agreement.

10.2 The Owner's execution, delivery and performance of this Agreement have been duly authorized by all necessary legal actions and do not and shall not conflict with or constitute a default under any indenture, agreement or instrument to which the Owner is a party or by which the Owner or the Owner's Property may be bound or affected, except for such approvals required by this Agreement.

10.3 This Agreement constitutes the valid and binding obligation of the Owner, enforceable against the Owner, and its successors and assigns, in accordance with its terms, subject to bankruptcy, insolvency and other similar laws affecting the rights of creditors generally.

10.4 There is no action, proceeding or investigation now pending before any court or any governmental department or agency nor any basis therefor, known or believed to exist which: (i) questions the validity of this Agreement or any action or act taken or to be taken by the Owner pursuant to this Agreement, or (ii) is likely to result in a material adverse change in the authority, property, assets, liabilities or condition of the Owner which will materially and substantially impair its ability to perform pursuant to the terms of this Agreement.

11. DEVELOPER'S REPRESENTATIONS. The Developer makes the following representations to the Owner as follows:

11.1 The Developer is duly organized and validly existing under the laws of the Commonwealth of Massachusetts duly qualified to transact business in the Commonwealth of Massachusetts, and has full power and capacity to lease the Development Parcel, to carry on its business as presently conducted, and to enter into the transactions contemplated by this Agreement.

11.2 The Developer has the legal and financial capacity to assume responsibility for compliance with all applicable laws, regulations, rules, programs and agreements and to enter into this Agreement and to perform all of the undertakings set forth herein.

11.3 The Developer's execution, delivery and performance of this Agreement have been duly authorized by all necessary legal actions and do not and shall not conflict with or constitute a default under any indenture, agreement or instrument to which the Developer is a party or by which the Developer or the Developer's property may be bound or affected, except for such approvals required by this Agreement.

11.4 This Agreement constitutes the valid and binding obligation of the Developer, enforceable against the Developer, and its successors and assigns, in accordance with its terms, subject to bankruptcy, insolvency and other similar laws affecting the rights of creditors generally.

11.5 There is no action, proceeding or investigation now pending before any court or any governmental department or agency nor any basis therefor, known or believed to exist which: (i) questions the validity of this Agreement or any action or act taken or to be taken by the Developer pursuant to this Agreement, or (ii) is likely to result in a material adverse change in the authority, property, assets, liabilities or condition of the Developer which will materially and substantially impair its ability to perform pursuant to the terms of this Agreement.

11.6 The Developer has the necessary prior experience in developing projects similar to the Project.

12. DEFAULT.

12.1 Developer Failure to Perform. In the event the Developer fails to meet the dates set forth in the Project Schedule or defaults under this Agreement, which default is not cured within thirty (30) days of written notice from the Owner or such longer period of time not

to exceed sixty (60) days if the default by its nature cannot be cured within thirty (30) days provided the Developer commences the curative action within the thirty (30) day period and diligently pursues the cure, without any default on the part of the Owner, the Owner, as its sole and exclusive remedy, shall be entitled to terminate this Agreement and to collect from the Developer liquidated damages in the amount of $100,000. If the Developer does not pay such liquidate damages within thirty (30) days after receipt of notice from the Owner that such liquidated damages are due, the Owner shall also be entitled to collect its attorneys fees and costs incurred in collecting such liquidated damages plus interest at the rate of eight percent (8%) per annum from the date of Owner's notice until such amount is paid in full.

12.2 Owner Failure to Perform. In the event the Owner defaults under this Agreement, which default is not cured within thirty (30) days of written notice from the Developer or such longer period of time reasonably required, not to exceed sixty (60) days (or 120 days if the default relates to the Owner's completion of construction and vacation of the Development Parcel) if the default by its nature cannot be cured within thirty (30) days provided the Owner commences the curative action within thirty (30) days and diligently pursues the cure, without any default on the part of the Developer, the Developer, as its sole and exclusive remedy, shall be entitled either (i) to terminate this Agreement in which event the parties shall be released from all further obligations under this Agreement except for the obligations that expressly survive the termination or (ii) to sue for specific performance to enforce the terms of this Agreement. The Developer waives any other remedies it may have against the Owner at law or in equity as a result of a breach of this Agreement by the Owner, including without limitation the right to seek damages against the Owner.

13. BROKERS. The parties each represent and warrant to the other that there are no real estate broker(s), salesman (salesmen) or finder(s) involved in this transaction. If a claim for commissions in connection with this transaction is made by any broker, salesman or finder claiming to have dealt through or on behalf of one of the parties hereto ("Indemnitor"), Indemnitor shall indemnify, defend and hold harmless the other party hereunder ("Indemnitee"), and Indemnitee's officers, directors, agents and representatives, from and against all liabilities, damages, claims, costs, fees and expenses whatsoever (including reasonable attorney's fees and court costs at trial and all appellate levels) with respect to said claim for commissions.

14. ASSIGNABILITY.

14.1 This Agreement may not be assigned, directly or indirectly, in whole or in part, without the prior written approval of the Owner, which approval may be granted or withheld by the Owner in its sole and absolute discretion. Notwithstanding the foregoing, the Developer shall form a single purpose entity to enter into the Ground Lease and Collaboration Agreement. The Developer shall not need the Owner approval of this, so long as the sole or controlling general partner or managing member of such entity is owned and controlled by the Developer. The Developer shall provide the Owner with certified copies of such entity's organizational documents.

14.2 Upon approval of the assignment of this Agreement by the Owner in accordance with Section 14.1 and the assumption of all of the duties and obligations under this

Agreement from and after the date of such assignment by the assignee, the Owner may release the Developer from any further obligations under this Agreement arising from and after the date of such assignment.

15. NOTICES. Any notices required or permitted to be given under this Agreement shall be in writing and shall be deemed to have been given if delivered by hand, sent by recognized overnight courier (such as Federal Express), or mailed by certified or registered mail, return receipt requested, in a postage prepaid envelope, and addressed as follows:

If to the Developer:

Jewish Community Housing for the Elderly
30 Wallingford Road
Brighton, MA 02135
Attention: Amy Schectman, President and CEO

With a copy to:

Nixon Peabody LLP
100 Summer Street
Boston, MA 02110
Attention: Paul E. Bouton, P.C.

If to the Owner:

Congregation Kehillath Israel
384 Harvard Street
Brookline, MA 02446
Attention: Rabbi and President of Board of Trustees

With a copies to:

The Gatehouse Group
120 Forbes Blvd., Suite 180
Mansfield, MA 02048
Attention: Marc S. Plonskier

Nolan Sheehan Patten LLP
101 Federal Street, 18th Floor
Boston, MA 02110
Attention: Stephen M. Nolan

Koningisor, Luciano & Associates, Inc.
24 Lakeview Road
Framingham, MA 01701
Attention: James E. Koningisor

Notices personally delivered shall be deemed given on the date of delivery and notices mailed in accordance with the foregoing shall be deemed given upon receipt or the date delivery is refused.

16. MISCELLANEOUS.

16.1 This Agreement shall be construed and governed in accordance with the laws of the Commonwealth of Massachusetts. The parties to this Agreement have participated fully in the negotiation and preparation hereof, and, accordingly, this Agreement shall not be more strictly construed against either of the parties hereto.

16.2 In the event any term or provision of this Agreement is determined by appropriate judicial authority to be illegal or otherwise invalid, such provision shall be given its nearest legal meaning or be construed as deleted as such authority determines, and the remainder of this Agreement shall be construed to be in full force and effect.

16.3 This Agreement may be executed in any number of counterparts, each of which shall be deemed an original of this Agreement and all of which together shall constitute one and the same instrument.

16.4 In the event of any litigation between the parties under this Agreement, the prevailing party shall be entitled to reasonable attorney's fees and court costs at all trial and appellate levels.

16.5 In construing this Agreement, the singular shall be held to include the plural, the plural shall be held to include the singular, the use of any gender shall be held to include every other and all genders, and captions and paragraph headings shall be disregarded.

16.6 All of the exhibits attached to this Agreement are incorporated in, and made a part of, this Agreement.

16.7 Time shall be of the essence for each and every provision of this Agreement.

16.8 This Agreement may not be recorded in the public records.

16.9 In the event the Developer does not terminate this Agreement during the Inspection Period, from and after the preliminary approval of the Schematic Design Documents by the Owner and prior to the submission of an application to the ZBA for a comprehensive permit, the Owner shall use reasonable efforts to execute any documents and/or applications reasonably requested by the Developer which are required to be executed by the record owner of the Development Parcel in connection with any zoning or land use approval or permit applications required to be obtained by the Developer for the Project to enable to the Project to be developed in accordance with the terms of the Schematic Design Documents, provided such documents and applications do not impose any financial obligations or liability upon the Owner.

16.10 Except as otherwise provided herein, this Agreement shall terminate upon the Closing. Any representations, warranties and covenants that are intended to survive the Closing shall be set forth in the Ground Lease or the Collaboration Agreement.

16.11 It is expressly agreed and understood between the Owner and the Developer that the Developer, in entering into this Agreement and carrying out its obligations hereunder, is an independent contractor working for itself and is not, shall not be deemed to be and shall not hold itself out as an agent, joint venturer, legal representative or employee of the Owner. The Developer is not granted any right or authority to assume or to create any obligation, liability or responsibility, express or implied, on behalf of or in the name of the Owner, to bind the Owner in any manner to any contractual or other undertaking whatsoever or to accept payment from any party of any obligation owing to the Owner. The Developer shall be responsible for all costs it incurs in performing its obligations under this Agreement and the Owner shall not have any liability for any debts or other obligations that the Developer may incur in rendering such performance. Similarly, unless otherwise provided herein, the Owner shall be responsible for all costs it incurs in performing its obligations under this Agreement and the Developer shall not have any liability for any debts or other obligations which the Owner may incur in rendering such performance.

17. ENTIRE AGREEMENT. This Agreement constitutes the entire agreement and understanding between the parties with respect to the subject matter hereof and there are no other agreements, representations or warranties other than as set forth herein. This Agreement may not be changed, altered or modified except by an instrument in writing signed by the party against whom enforcement of such change would be sought. This Agreement shall be binding upon the parties hereto and their respective successors and permitted assigns.

[SIGNATURE PAGES TO FOLLOW]

IN WITNESS hereof the parties have executed this Agreement as of the date first above written.

DEVELOPER:

The Jewish Community Housing for the Elderly, Inc., a Massachusetts non-profit corporation

By: _____
Name: Amy Schectman
Title: President + CEO

OWNER:

Congregation Kehillath Israel, a religious corporation existing under Chapter 180 of the General Laws of the Commonwealth of Massachusetts

By: _____
Name: _____
Title: _____

IN WITNESS hereof the parties have executed this Agreement as of the date first above written.

DEVELOPER:

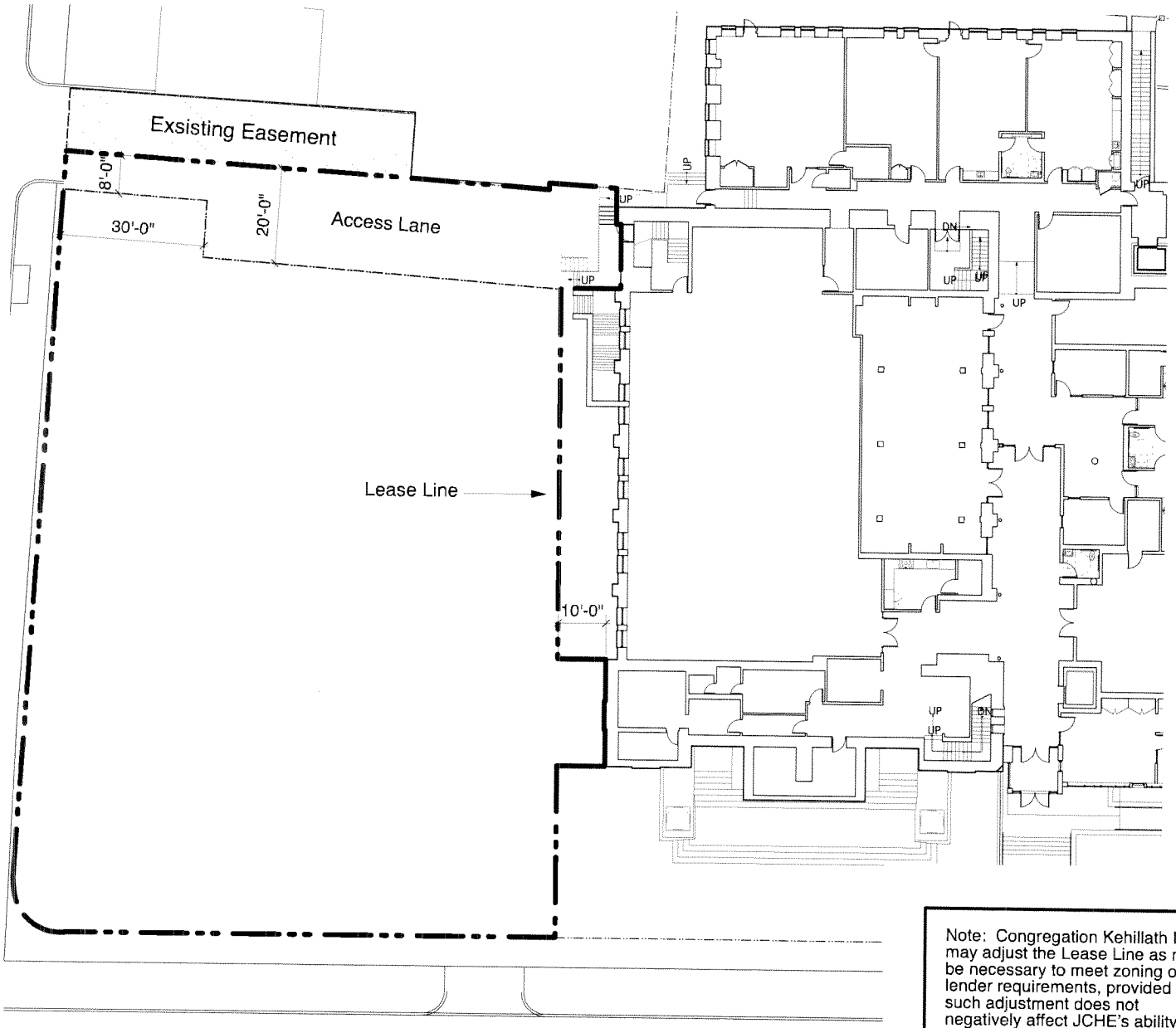
The Jewish Community Housing for the Elderly, Inc., a Massachusetts non-profit corporation

By:_____
Name:_____
Title:_____

OWNER:

Congregation Kehillath Israel, a religious corporation existing under Chapter 180 of the General Laws of the Commonwealth of Massachusetts

By: David E. Williams
Name: David E Williams
Title: President



Note: Congregation Kehillath Israel may adjust the Lease Line as may be necessary to meet zoning or lender requirements, provided that such adjustment does not negatively affect JCHE's ability to obtain necessary zoning approvals to construct its desired number of housing units on the leased parcel

KEHILLATH ISRAEL
ADDITIONS & RENOVATIONS

Brookline, MA

General Notes:

Handlin, Garrahan & Associates
104 Mt. Auburn Street
Cambridge, MA 02138
(617) 576-1496 tel.
(617) 576-1346 FAX

Revised: Date:

Job: 1101
Scale: 1/16" = 1'-0"
Drawn: HM Chkd.:
Date: March 28, 2016

Main Floor Plan

Proposed Lease Line

EXHIBIT "A"

LEGAL DESCRIPTION

See attached sketch plan.

EXHIBIT "B"

PROJECT SCHEDULE

ACTIVITY	DEADLINE
40B Eligibility Letter Submission	July 1, 2016
Inspection Period	120 days from the Effective Date of the Agreement
Comprehensive Permit Application	Sixty days after receipt of 40B Eligibility Letter
Funding Secured	September 30, 2018
Closing Date	A date which shall be ten (10) days after all the Conditions Precedent have been either satisfied or waived by the Owner and the Developer in accordance with Section 8.1 and 8.3 of the Agreement but not earlier than October 1, 2018 and not later than February 28, 2019
Construction Commences	Within 30 days of the Closing Date
Construction Completion*	Within twenty four (24) months from the Closing Date, as same may be extended as a result of Unavoidable Delays (the "Completion Date"), time being of the essence.

* The term "Completion" shall mean that the Project has been completed in material accordance with the Approved Plans and a certificate of occupancy has been issued by the appropriate governmental agency for the Project.

EXHIBIT "C"

FINANCIAL TERMS

The Owner expects certain payments will be due from the Developer, as described below. The Developer agrees to use diligent good faith efforts to obtain funding in amounts sufficient to make such payments in the maximum amounts below. The parties both acknowledge and agree that (i) it is difficult to predict such funding availability or exact amounts due to the vagaries of number and size of units permitted and the proportion of units deemed permanently affordable and to what income group, and (ii) this is expected to be a long-term positive relationship where both sides benefit from improvements made by Developer as provided herein and from the synergistic nature of both operations. In the event the Developer, despite diligent and good faith efforts, is unable to obtain funding in the maximum amounts described below, the Owner and Developer agree to negotiate in good faith to reduce such payments to amounts reasonably satisfactory to both parties, but not less than the minimums described below.

The following expected payments will be due from the Developer to the Owner:

At Closing, the Developer shall pay a lump sum ground rent payment of a minimum of Two Million Two Hundred Thousand Dollars ($2,200,000) and a maximum of Two Million Five Hundred Thousand Dollars ($2,500,000).

Annually commencing on the 1st anniversary of the Ground Lease and throughout the term, the Developer shall pay ground rent equal to a minimum of $5,000 and a maximum of $7,000, increasing annually at the Consumer Price Index or other mutually agreed-upon index.

On the occurrence of a sale or refinancing subsequent to the initial development of the Project (a "Capital Event"), the entity owning the Project at the time of the Capital Event (the "Project Owner") shall pay to the Owner 50% of the net proceeds (the "Net Proceeds") from such Capital Event, as described below.

There are three categories of Capital Events, those being a refinancing, a related party sale (sometimes referred to as a re-syndication) and a third party sale. A related party sale is a sale where the Developer (or an affiliate thereof) is a partner/member of the new owner.

Net Proceeds from a refinancing shall mean the gross loan proceeds from the refinancing less (a) all customary and reasonable expenses in connection therewith, including third party financing and broker fees, transfer taxes and fees and legal and accounting fees, (b) repayment of all mortgage debt and other liabilities of the Project Owner, (c) all soft and hard costs related to improvements or repairs to the Project required by the lender or investors or to other improvements or repairs reasonably determined by the Project Owner (or reserves therefor) and reserves for future operations or escrowed funds required by such lenders or investors, provided that if any reserves or escrowed funds that would otherwise have constituted refinancing proceeds are subsequently released by the lenders or investors they shall be shared equally by the Owner and the then Project Owner; and (d) a customary construction supervision fee and overhead reimbursement for its work with respect to the capital improvements; (e) reserves for capital needs of the Project deemed necessary by Project Owner and (f) reserves for future programs related to the Project. It is the intent of the Developer and Owner that Developer shall

be able to use refinancing proceeds, including reserves, to directly benefit the project and its tenants so that Developer can carry out its unique mission to provide aging in the community for the tenants in the Project.

Net Proceeds from a related party sale shall mean the amount actually paid to the Project Owner from the related party buyer, less (a) all customary and reasonable expenses incurred by the Project Owner in connection therewith, including third party financing fees, transfer taxes and fees and legal and accounting fees, (b) repayment of all mortgage debt and other liabilities of the Project Owner (including "exit fees" or other payments to any investor limited partner), and (c) a sales fee to Developer or its affiliates, in an amount customary and comparable to amounts paid in similar transactions, but not exceeding 3% of the total purchase price. If there is a deferred purchase price, including any purchase money financing, payments of that deferred purchase price shall be considered Net Proceeds as and when received by the Project Owner.

Net Proceeds from a third party sale shall mean the amount actually paid to the Project Owner from the third party buyer, less (a) all customary and reasonable expenses incurred by the Project Owner in connection therewith, including third party broker fees, transfer taxes and fees and legal and accounting fees, (b) repayment of all mortgage debt and other liabilities of the Project Owner (including "exit fees" or other payments to any investor limited partner), and (c) a sales fee to Developer or its affiliates, in an amount customary and comparable to amounts paid in similar transactions, but not exceeding 3% of the total purchase price. If there is a deferred purchase price, including any purchase money financing, payments of that deferred purchase price shall be considered Net Proceeds as and when received by the Project Owner. The payment of Net Proceeds to the Owner shall continue so long as the Developer or any affiliate of the Developer has an ownership interest in the Project, but shall terminate at such time as the Project shall be sold or transferred by the Project Owner to a third party buyer, with no residual or carried interest held by the Developer or any affiliate of the Developer.

The Developer, at its expense, shall be responsible for the costs of maintenance and operation of the Project and the Connection, including without limitation, all taxes and assessments;

The Approved Budget shall include a minimum of $10,000 and maximum of $20,000 line item to be utilized solely to pay third parties retained by the Owner to assist in monitoring compliance with the terms of this Agreement and oversee construction of Project on behalf of the Owner.

EXHIBIT "D"

INSURANCE REQUIREMENTS

I. Commercial General Liability (Primary & Non Contributory)

A. Limits of Liability

Bodily Injury and Property Damage Liability	
Each Occurrence	$1,000,000
General Aggregate Limit	$ 2,000,000
Products/Completed Operations	$ 1,000,000
Personal and Advertising Injury	$1,000,000

B. Endorsements Required

Congregation Kehillath Israel as an Additional Insured (CG 2010 11/85 or its equivalent)
Contingent Liability & Contractual Liability
Premises & Operations Liability
Explosion, Collapse and Underground Hazard
Completed Operations Coverage

II. Business Automobile Liability

A. Limits of Liability

Bodily Injury and Property Damage Liability	
Combined Single Limit	
Any Auto/Owned Autos/Scheduled	
Including Hired, Borrowed or Non-Owned Autos	
Loading and Unloading	
Any One Accident	$ 1,000,000

B. Endorsements Required

Congregation Kehillath Israel listed as an additional insured

III. Worker's Compensation

Limits of Liability
Statutory-Commonwealth of Massachusetts
Waiver of subrogation

Employer's Liability
A. Limits of Liability
$1,000,000 for bodily injury caused by an accident, each accident.
$1,000,000 for bodily injury caused by disease, each employee
$1,000,000 for bodily injury caused by disease, policy limit

IV. Umbrella Policy/Excess Liability (Excess Follow Form)

A. Limits of Liability

Bodily Injury and Property Damage Liability	
Each Occurrence	$3,000,000
Aggregate	$3,000,000

B. Endorsements Required

Congregation Kehillath Israel listed as an additional insured

V. [Intentionally deleted]

VI. Builders' Risk

Causes of Loss: All Risk-Specific Coverage Project Location
Valuation: Replacement Cost
Deductible: up to $25,000

Congregation Kehillath Israel listed as an Additional Insured

Limit/Value at Location or Site 100% of replacement cost

The above policies shall provide Congregation Kehillath Israel with written notice of cancellation or material change from the insurer not less than (30) days prior to any such cancellation or material change, or in accordance to policy provisions.

Companies authorized to do business in the Commonwealth of Massachusetts, with the following qualifications, shall issue all insurance policies required above:

The company must be rated no less than "A" as to management, and no less than "Class V" as to Financial Strength, by the latest edition of Best's Insurance Guide, published by A.M. Best Company, Oldwick, New Jersey, or its equivalent. All policies and /or certificates of insurance are subject to review and verification by Congregation Kehillath Israel prior to insurance approval.

SECTION 7

DHCD SUBSIDIZED HOUSING INVENTORY

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT CH40B SUBSIDIZED HOUSING INVENTORY

Brookline

DHCD ID #	Project Name	Address	Type	Total SHI Units	Affordability Expires	Built w/ Comp. Permit?	Subsidizing Agency
474	Arthur O'Shea House	61 Park St.	Rental	100	Perp	No	*HUD*
475	Kickham Apartments	190 Harvard St.	Rental	39	Perp	No	*HUD*
476	Sussman House	50 Pleasant St.	Rental	100	Perp	No	*HUD*
477	Theresa J. Morse Apts	90 Longwood. Ave.	Rental	99	Perp	No	*HUD*
478	Walnut Street Apts	22 High St./ 16 Walnut	Rental	100	Perp	No	*HUD*
479	Egmont St. Veterans	338-348 St. Paul/51-85 Egmont/209-221 Pleasant	Rental	114	Perp	No	*DHCD*
480	Egmont St. Veterans	44-79 Egmont Street	Rental	6	Perp	Yes	*DHCD*
481	High St. Veterans	176-224 High/6-30 New Terrace/186-218 Chestnut	Rental	177	Perp	No	*DHCD*
482	High St. Veterans	New Terrace Road and High Street	Rental	9	Perp	Yes	*DHCD*
483	Col. Floyd	32-40 Marion/19-36 Foster St	Rental	60	Perp	No	*DHCD*
484	Condos	Browne & St.Paul Streets	Rental	2	Perp	No	*DHCD*
485	McCormack House	151-153 Kent St.	Rental	10	Perp	No	*DHCD*
486	Benjamin Trustman	337-347 St. Paul/144-156 Armory/7-33 Egmont	Rental	86	Perp	No	*DHCD*
487	100 Center Plaza	Centre & Williams	Rental	211	2042	No	*MassHousing*
488	1027 Beacon St	1027 Beacon St	Rental	9	2030	No	*FHLBB* *DHCD*
489	1045 Beacon St	1043-1045 Beacon St.	Rental	28	2015*	No	*HUD* *DHCD*

This data is derived from information provided to the Department of Housing and Community Development (DHCD) by individual communities and is subject to change as new information is obtained and use restrictions expire.

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT CH40B SUBSIDIZED HOUSING INVENTORY

Brookline

DHCD ID #	Project Name	Address	Type	Total SHI Units	Affordability Expires	Built w/ Comp. Permit?	Subsidizing Agency
489	1045 Beacon St	1043-1045 Beacon St.	Rental	28	2015*	No	*HUD*
490	120 Centre Court	120 Centre Court	Rental	125	2042	No	*HUD* *MassHousing*
491	1550 Beacon Plaza	1550 Beacon St.	Rental	180	2042	No	*MassHousing*
492	Beacon Park	1371 Beacon Street	Rental	80	12/31/2028	No	*MassHousing*
493	10 Juniper St	10 Juniper St	Ownership	32	perp	No	*DHCD*
494	Village at Brookline	55 Village Way/72 Pearl St	Rental	307	09/15/2028	No	*DHCD* *DHCD* *MassHousing*
495	Kilgallon House	11 Harris Street	Rental	8	Perp	No	*DHCD*
496	Sara Wallace House	1017 Beacon Street	Rental	16	2016	No	*HUD* *HUD*
497	Connelly House	1057 Beacon Street	Rental	13	Perp	No	*DHCD*
498	Goddard House	165 Chestnut Street	Rental	13	perp	No	*DHCD*
499	1162-1164 Boylston Street	1162-1164 Boylston Street	Ownership	6	perp	No	*DHCD*
500	1470 Beacon Street	1470 Beacon Street	Rental	4	perp	No	*DHCD*
501	Kendall Crescent	243, 245, 275 Cypress Street	Ownership	4	perp	No	*DHCD*
502	The Lofts at Brookline Village	77 Linden Street Unit, 74 Kent Street	Rental	2	perp	No	*DHCD*
3751	1754 Beacon St	1754 Beacon St	Rental	14	10/17/2032	No	*DHCD*

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DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT CH40B SUBSIDIZED HOUSING INVENTORY

Brookline

DHCD ID #	Project Name	Address	Type	Total SHI Units	Affordability Expires	Built w/ Comp. Permit?	Subsidizing Agency
3751	1754 Beacon St	1754 Beacon St	Rental	14	10/17/2032	No	*DHCD* *DHCD*
3752	1876 Beacon St	1876 Beacon St	Rental	15	2023	No	*MassHousing* *MHP*
3753	77 Marion St/ 1405 Beacon St	77 Marion St/ 1405 Beacon St	Rental	4	perp	No	*DHCD*
3951	St. Aidan's	Crowninshield, Pleasant & Freeman Streets	Mix	35	Perp	Yes	*DHCD* *DHCD*
4228	DDS Group Homes	Confidential	Rental	37	N/A	No	*DDS*
4549	DMH Group Homes	Confidential	Rental	49	N/A	No	*DMH*
7126	St. Paul Crossing	St. Paul Street	Ownership	3	perp	No	*DHCD*
7127	Cypress Lofts	110 Cypress Street	Rental	5	Perp	No	*DHCD*
8154	154-156 Bolyston St	154-156 Bolyston St	Rental	6	2035	NO	*HUD* *MHP*
9050	Scattered Sites	Park Street, Boylston Street	Ownership	6	Perp	NO	*DHCD*
9068	1600 Beacon Street	1600 Beacon Street	Ownership	6	Perp	NO	*HUD*
9740	Hammond Pond Place	321 Hammond Pond Parkway	Ownership	3	Perp	NO	*DHCD*
9741	Englewood Residences	20 Englewood Avenue	Rental	2	Perp	NO	*DHCD*
9742	109 Sewall Avenue	109 Sewall Avenue	Ownership	2	Perp	NO	*DHCD*

This data is derived from information provided to the Department of Housing and Community Development (DHCD) by individual communities and is subject to change as new information is obtained and use restrictions expire.

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT CH40B SUBSIDIZED HOUSING INVENTORY

Brookline

DHCD ID #	Project Name	Address	Type	Total SHI Units	Affordability Expires	Built w/ Comp. Permit?	Subsidizing Agency
9832	The Residences of South Brookline	Independence Drive	Rental	161	Perp	YES	*MassDevelopment*
9868	86 Dummer Street	86 Dummer Street	Rental	32	Perpetuity	NO	*HUD* *DHCD*
9869	51-57 Beals Street	51-57 Beals Street	Rental	31	Perpetuity	NO	*DHCD* *HUD*
9870	45 Marion Street	45 Marion Street	Rental	64	2045	YES	*MassHousing*
9871	Olmsted Hill	2-8 Olmsted Road	Ownership	12	Perpetuity	NO	*DHCD* *DHCD*
9924	21 Crown	0-21 Crowninshield Road	Rental	8	Perp	YES	*MassHousing*
	Brookline Totals			2,435	**Census 2010 Year Round Housing Units**		26,201
					Percent Subsidized		9.29%

This data is derived from information provided to the Department of Housing and Community Development (DHCD) by individual communities and is subject to change as new information is obtained and use restrictions expire.

SECTION 8

SAMPLE REGULATORY AGREEMENT

Perpetuity
[For Ground Leased Projects]

TAX CREDIT REGULATORY AGREEMENT AND DECLARATION OF RESTRICTIVE COVENANTS

THIS TAX CREDIT REGULATORY AGREEMENT AND DECLARATION OF RESTRICTIVE COVENANTS (this "AGREEMENT") is granted as of____, 20____ by ____, and its successors and assigns (the "Owner") and the undersigned ____ ("Ground Lessor", and together with the Owner, the "Grantors") to the Commonwealth of Massachusetts, acting by and through the Department of Housing and Community Development ("DHCD", also referred to herein as the "Grantee"). The Ground Lessor joins in this Agreement for the purposes set forth in Section 11 below.

WITNESSETH:

WHEREAS, DHCD, as successor to the former Executive Office of Communities and Development ("EOCD"), is authorized by Executive Order 291 signed by the Governor of the Commonwealth of Massachusetts to administer the State Housing Credit Ceiling as defined in Section 42 of the United States Internal Revenue Code of 1986 as amended, (the "Code") in connection with the allocation and administration of low-income housing tax credits (the "Low-Income Tax Credit"); and

WHEREAS, DHCD has adopted a 200____ Low-Income Housing Tax Credit Allocation Plan (the "Allocation Plan") and certain Low-Income Housing Tax Credit Guidelines (the "Guidelines"), which govern the process and standards for allocation of the Low-Income Tax Credit; and

WHEREAS, the Owner is the owner of a ____ residential rental unit housing development known as or to be known as ____, located on lands in the City/Town of ____, County of ____, Massachusetts more particularly described in Exhibit A hereto, leased by the Owner from the Ground Lessor pursuant to the Ground Lease (the "Project"); and

WHEREAS, the Owner has applied to DHCD for an allocation of Low-Income Tax Credits to the Project; and

WHEREAS, the Owner has represented to DHCD in Owner's Low-Income Housing Credit Application (the "Application") that a certain percentage of the units in the Project shall be both rent restricted and occupied by individuals or families whose income is a certain percentage or less of the area median gross income as determined in accordance with Section 42 of the Code, and that the Owner will maintain other restrictions on the use and occupancy of the Project, as set forth herein; and

WHEREAS, DHCD has determined that, as of the date hereof, the Project would support a Low-Income Tax Credit allocation, as set forth herein, provided that the units in the Project are placed in service in accordance with Section 42 of the Code and any other applicable requirements; and

WHEREAS, the Code requires as a condition precedent to the allocation of the Low-Income Tax Credit that the Owner execute, deliver and record in the official land deed records of the county in which the Project is located this Agreement in order to create certain covenants running with the land for the purpose of enforcing the requirements of Section 42 of the Code and other applicable requirements by regulating and restricting the use and occupancy and transfer of the Project as set forth herein; and

WHEREAS, the Owner, under this Agreement, intends, declares and covenants that the regulatory and restrictive covenants set forth herein governing the use, occupancy and transfer of the Project shall be and are covenants running with the Project Land (as defined herein in Section 1) for the term stated herein and binding upon all subsequent owners of the Project Land for such term, and are not merely personal covenants of the Owner;

NOW, THEREFORE, in consideration of the promises and covenants hereinafter set forth, and of other valuable consideration, the receipt and sufficiency of which is hereby acknowledged, DHCD and the Owner do hereby agree as follows:

SECTION 1 - DEFINITIONS

(a) Unless otherwise expressly provided herein or unless the context clearly requires otherwise, the following terms shall have the respective meanings set forth below for all purposes of this Agreement:

"Agreement" means this Tax Credit Regulatory Agreement and Declaration of Restrictive Covenants, as it may from time to time be amended.

"Applicable Fraction" means the smaller of the "unit fraction" or the "floor space fraction," as these terms are defined in section 42(c)(1) of the Code, which has been determined for the purposes of this Agreement to be _____%.

<"Capital Source(s)," where a Comprehensive Permit has been issued to the Project, means the investing financial entity(ies), as lender(s) to or partner(s) of, the Owner, providing all or substantially all of the capital necessary to construct the Project. The initial Capital Source(s) shall be _____.>

"Code" means the Internal Revenue Code of 1986 as amended and all regulations applicable thereto.

<"Comprehensive Permit" means the permit issued to the Project by the Zoning Board of Appeals of _____, Massachusetts pursuant to Massachusetts General Laws Chapter 40B, Sections 20 through 23, as said permit may be amended from time to time, which provides for the construction of the Project.>

"DHCD" means the Massachusetts Department of Housing and Community Development, its successors and assigns.

"Gross Rent" means the total amount received from a Low-Income Tenant as a rental payment, excluding any payment under Section 8 of the United States Housing Act of 1937 or any comparable rental assistance (with respect to such unit or occupants thereof) and including any utility allowance under Section 8 of the aforementioned act.

"Ground Lease" means the Ground Lease of the Premises from the Ground Lessor, as landlord and fee owner, to the Owner, as tenant of the Premises, dated _____, 200_____, Notice of which is recorded with the _____ County Registry of Deeds in Book _____, Page _____.

"Income Certification" means a certification as to income executed by a Low-Income Tenant of the Project.

<"Limited Dividend Organization" means a corporation, partnership, or other organization, other than a public agency, which by its governing articles of organization or partnership agreement prohibits distribution with respect to any one year of operation of more than 10% on said entity's equity in the Project. Equity in the Project shall be the difference between the amount provided by the Capital Source(s) to the Project and the total cost of the Project, including, where applicable, a Builder's and Sponsor's Risk Allowance (BSPRA) equal to twenty percent (20%) of the total Project cost net of land, BSPRA, and syndication costs.>

"Low-Income Tenant" means the occupant(s) of a housing unit in the Project whose income on admission to the Project, as computed in accordance with the rules and regulations governing the Low-Income Tax Credit, does not exceed _____ percent of the area median gross income, adjusted for family size.

"Low-Income Tenant Rental Period" means the period beginning on the first day of the Compliance period under Section 42 of the Code and extending for ninety-nine (99) years. If the Project consists of more than one building, this shall be determined for each building.

"Low-Income Units" means those units in the Project set aside for occupancy by Low-Income Tenants which shall consist of _____ units.

"Owner" means _____, all its successors and assigns. Where reference is made herein to Owner's Low-Income Housing Credit Application (the "Application"), this term shall also mean any previous sponsor connected with the Project.

"Project" means the multi-family rental housing development known as _____ located in _____, Massachusetts, developed on the site described in Exhibit A to this Agreement (the "Project Land"). For Owner's title and a legal

description of the site, see the Notice of Ground Lease recorded with the _____ County Registry of Deeds at Book _____, Page _____.

"Rent Restricted" means the gross rent to be charged for a Low-Income Unit which does not exceed thirty percent (30%) of the income limitation applicable to such unit, adjusted for unit size (assuming that a unit which does not have a separate bedroom is occupied by one individual and that a unit which has one or more separate bedrooms is occupied by 1.5 individuals for each separate bedroom).

"State" means the Commonwealth of Massachusetts.

(b) Any term not defined in this Agreement shall have the same meaning as terms defined in Section 42 of the Code and the Treasury regulations promulgated thereunder.

SECTION 2 - RECORDING AND FILING; COVENANTS TO RUN WITH THE LAND

(a) Upon execution, the Owner shall cause this Agreement and all amendments hereto to be recorded and filed in the _____ County Registry of Deeds and shall pay all fees and charges incurred in connection therewith. Upon recording, the Owner shall immediately transmit to DHCD evidence of the recording including the date and instrument number or deed book and page numbers. The Owner agrees that DHCD will not issue the Internal Revenue Service Form 8609 constituting final allocation of the Low-Income Tax Credit unless and until DHCD has received a certified copy of the recorded Agreement.

(b) The Owner intends, declares and covenants, on behalf of itself and all future owners and operators of the Project Land during the term of this Agreement, that this Agreement and the covenants and restrictions set forth in this Agreement regulating and restricting the use, occupancy and transfer of the Project Land and the Project (i) shall be and are covenants running with the Project Land, encumbering the Project Land for the term of this Agreement, binding upon the Owner's successors in title and all subsequent owners and operators of the Project Land, (ii) are not merely personal covenants of the Owner, and (iii) shall bind the Owner (and the benefits shall inure to DHCD and any past, present or prospective tenant of the Project) and its respective successors and assigns during the term of this Agreement. The restrictions contained herein are intended to be construed as an affordable housing restriction as that term is defined in Section 31 of Chapter 184 of the Massachusetts General Laws, and which has the benefit of Section 32 of said Chapter 184, such that the restrictions contained herein shall not be limited in duration by any rule or operation of law but rather shall run for the full term hereof. The Owner hereby agrees that any and all requirements of the laws of the Commonwealth of Massachusetts to be satisfied in order for the provisions of this Agreement to constitute deed restrictions and covenants running with the land shall be deemed to be satisfied in full, and that any requirements of privity of estate are intended to be satisfied, or in the alternate, that an equitable servitude has

been created to insure that these restrictions run with the land. For the longer of the period the Low-Income Tax Credit is claimed or the term of this Agreement, each and every contract, deed or other instrument hereafter executed conveying the Project or portion thereof shall expressly provide that such conveyance is subject to this Agreement, provided, however, that the covenants contained herein shall survive and be effective regardless of whether such contract, deed or other instrument hereafter executed conveying the Project or portion thereof provides that such conveyance is subject to this Agreement.

(c) The Owner covenants to obtain the consent of any prior recorded lienholder on the Project to this Agreement and such consent shall be a condition precedent to the issuance of Internal Revenue Service Form 8609 constituting final allocation of the Low-Income Tax Credit.

SECTION 3 - REPRESENTATIONS, COVENANTS AND WARRANTIES OF THE OWNER

The Owner hereby represents, covenants and warrants as follows:

(a) The Owner (i) is a _____ and is qualified to transact business under the laws of this State, (ii) has the power and authority to own its properties and assets and to carry on its business as now being conducted, and (iii) has the full legal right, power and authority to execute and deliver this Agreement.

(b) The execution and performance of this Agreement by the Owner (i) will not violate or, as applicable, have not violated any provision of law, rule or regulation, or any order of any court or other agency or governmental body, and (ii) will not violate or, as applicable, have not violated any provision of any indenture, agreement, mortgage, mortgage note, or other instrument to which the Owner is a party or by which it or the Project is bound, and (iii) will not result in the creation or imposition of any prohibited encumbrance of any nature.

(c) The Owner will, at the time of execution and delivery of this Agreement, have good and marketable title to the Premises constituting the Project free and clear of any lien or encumbrance (subject to encumbrances created pursuant to this Agreement, any loan documents relating to the Project the general terms of which are approved by DHCD, or other permitted encumbrances).

(d) There is no action, suit or proceeding at law or in equity or by or before any governmental instrumentality or other agency now pending, or, to the knowledge of the Owner, threatened against or affecting it, or any of its properties or rights, which, if adversely determined, would materially impair its right to carry on business substantially as now conducted (and as now contemplated by this Agreement) or would materially adversely affect its financial condition.

(e) The Project constitutes or will constitute a qualified low-income building or qualified project, as applicable, as defined in Section 42 of the Code and applicable regulations.

(f) Each unit in the Project contains complete facilities for living, sleeping, eating, cooking and sanitation (unless the Project qualifies as a single-room occupancy project or transitional housing for the homeless) which are to be used on other than a transient basis.

(g) During the term of this Agreement, all Units subject to the Low-Income Tax Credit shall be leased and rented or made available to members of the general public who qualify as Low-Income Tenants (or otherwise qualify for occupancy of the Low-Income Units as set forth in Section 4(e) hereof) under the applicable election specified in Section 42(g) of the Code and as set forth in Section 4 (a) of this Agreement.

(h) The Owner shall insure that all units occupied by Low-Income Tenants shall be of comparable quality to other units in the Project or if not comparable, the excess cost of the other units shall not exceed the percentage set forth in Section 42(d)(3) of the Code and the Owner will file the election provided for therein. The Low-Income Units shall be, to the extent possible, dispersed evenly throughout the Project.

(i) During the term of this Agreement, the Owner covenants, agrees and warrants that each Low-Income Unit is and will remain suitable for occupancy and in compliance with all local health, safety and building codes.

(j) The Owner shall not discriminate on the basis of race, creed, color, sex, age, disability, marital status, national origin, sexual orientation or any other basis prohibited by law in the lease, use and occupancy of the Project or in connection with the employment or application for employment of persons for the operation and management of the Project. Without limiting the foregoing, the Owner is expressly prohibited from refusing to lease to a holder of a voucher or certificate of eligibility under Section 8 of the United States Housing Act of 1937 because of the status of the prospective tenant as such a holder.

(k) Prior to occupancy of any unit in the Project, the Owner shall adopt and implement (i) an affirmative fair marketing plan for all units and (ii) a tenant selection plan for the Low-Income Units, in both cases consistent with any standards and guidelines adopted by DHCD as then in effect and all applicable laws. Both the affirmative fair marketing and tenant selection plans shall be subject to review by DHCD, at DHCD's request from time to time during the term of this Agreement. If the Project is located in a predominantly white neighborhood of Boston, according to a list maintained at DHCD, the affirmative fair marketing plan shall have the percentage goals determined pursuant to section 10(g) below of this Agreement.

(l) The Owner shall enter into a lease with each tenant of a Low-Income Unit (other than units which qualify as single-room occupancy units or transitional housing for

the homeless) which shall be for a minimum period of one (1) year and which shall provide that no tenant of a Low-Income Unit shall be evicted during the Low-Income Tenant Rental Period for any reason other than a substantial breach of a material provision of such lease. Without limiting the foregoing, the lease shall comply in all respects with applicable state, local, and federal law and the terms and conditions of this Agreement.

(m) During the Low-Income Tenant Rental Period, the annual rental for a unit leased to a Low-Income Tenant (unless such Low-Income Tenant fails to continue to qualify as such pursuant to Section 42 of the Code) including the provision for heat, electricity and hot water shall not exceed that permitted for a Low-Income Unit. Such rental, other than at turnover, shall not be increased more often than once a year and no notice of change in rent to be charged for Low-Income Units shall be given prior to providing the affected tenants with a thirty (30) day opportunity to comment on the increase.

(n) The Owner shall provide, on a form and in a manner acceptable to DHCD, an annual notification to each Low-Income Tenant indicating the manner in which the Gross Rents for Low-Income Units are determined.

(o) The Owner may not sell, transfer or exchange less than all of the Project during the term of this Agreement. Subject to the requirements of Section 42 of the Code and this Agreement, the Owner may sell, transfer or exchange the entire Project at any time, but the Owner shall (i) notify DHCD in writing of any sale, transfer or exchange of the Project; and (ii) notify in writing and obtain the agreement of any buyer or successor or other person acquiring the Project that such acquisition is subject to the requirements of this Agreement and to the requirements of Section 42 of the Code and applicable regulations. This provision shall not act to waive any other restriction on sale, transfer or exchange of the Project. The Owner agrees that DHCD may void any sale, transfer or exchange of the Project if the buyer or successor or other person fails to assume in writing the requirements of this Agreement and the requirements of Section 42 of the Code.

(p) The Owner shall not demolish any part of the Project or substantially subtract from any real or personal property of the Project or permit the use of any residential rental unit for any purpose other than rental housing during the term of this Agreement unless required by law.

(q) The Owner represents, warrants and agrees that if the Project, or any part thereof, shall be damaged or destroyed or shall be condemned or acquired for public use, the Owner (subject to the approval of the lender(s) which has provided the financing) will use its best efforts to repair and restore the Project to substantially the same condition as existed prior to the event causing such damage or destruction, or to relieve the condemnation, and thereafter to operate the Project in accordance with the terms of this Agreement.

(r) The Owner warrants that it has not and will not execute any other agreement with provisions contradictory to, or in opposition to, the provisions hereof, and that in

any event, the requirements of this Agreement are paramount and controlling as to the rights and obligations herein set forth and supersede any other requirements in conflict herewith.

(s) The Owner represents, warrants and agrees that the applicable fraction (as defined in section 42(c)(1) of the Code), for each taxable year during the term of this Agreement, will not be less than the applicable fraction specified in Section 1 of this Agreement.

(t) During the Low-Income Tenant Rental Period, the Owner shall not evict or terminate the tenancy of an existing tenant of any Low-Income Unit other than for good cause and shall not increase the Gross Rent above the maximum allowed under the Code with respect to such Low-Income Unit.

(u) The Owner represents and warrants that it has obtained the consent of all current holders of existing mortgages on the Project to this Agreement in the form attached hereto as Exhibit B.

(v) The Owner represents, warrants and agrees that it is and will be a Limited Dividend Organization for the entire duration of the Low-Income Tenant Rental Period. If the Project has received a Comprehensive Permit, the Owner's articles of organization or partnership agreement shall require the Owner to be a Limited Dividend Organization for the entire duration of the Low-Income Tenant Rental Period. Distributions of return on equity not made in any one year may be deferred and made in subsequent years. Proceeds of any refinancing, or insurance or condemnation proceeds, or from the sale of any of Owner's assets shall be excluded from the determination of the annual distribution. Any funds available in excess of that permitted to be distributed shall be used, as determined by DHCD, to either increase the number of Low-Income Units or to further reduce rents on the Low-Income Units.>

(w) The Owner represents, warrants and agrees that if the project has received a Low-Income Tax Credit allocation as a special needs project, the Owner will maintain special needs services throughout the term of this Agreement as represented in the Owner’s EOCD or DHCD approved service plan which is incorporated herein.

SECTION 4 - OCCUPANCY RESTRICTIONS

(a) The Owner represents, warrants and covenants throughout the term of this Agreement and in order to satisfy the requirements of Section 42 of the Code, other applicable requirements and the representations made in the Application that no less than _____ percent of the residential units in the Project shall be both rent-restricted and occupied by individuals or families whose income is _____ percent or less of the area median gross income (Low-Income Tenants). Initially, Low-Income Tenants shall occupy _____ units (Low-Income Units); _____ of which _____ shall be four bedroom units; _____ of which shall be three bedroom units;

_____ of which shall be two bedroom units; _____ of which shall be one bedroom units; and _____ of which shall be studio or single room occupancy units. If applicable, as further represented in Owner's Application, no less than _____% of the Low-Income Units shall be occupied by Low-Income Tenants whose income is 30% or less of the area's median gross income.

(b) If applicable, the residential units in the Project are considered exclusive of any unit(s) occupied by a full-time resident manager(s) (_____ unit(s)). DHCD and the Owner acknowledge that such unit(s) has not been included in determining the Applicable Fraction set forth in Section 1 of this Agreement.

(c) As a condition to occupancy, each person who is intended to be a Low-Income Tenant shall be required to sign and deliver to the Owner an Income Certification using a form, acceptable to DHCD, adopted for such use by the Owner which meets the requirements of the Code and the Treasury regulations promulgated thereunder.

(d) The determination of whether a tenant meets the Low Income requirement shall be made by the Owner at least annually on the basis of the current income of such Low-Income Tenant.

(e) Any Unit occupied by an individual or family who is a Low-Income Tenant at the commencement of occupancy shall continue to be treated as if occupied by a Low-Income Tenant provided that (i) such unit continues to be rent-restricted and (ii) should such Low-Income Tenant's income subsequently exceed 140% of the applicable income limit set forth in Section 4 (a) above, such tenant shall no longer be a Low-Income Tenant if any unit of comparable or smaller size is rented to a tenant who is not a Low-Income Tenant.

SECTION 5 - CONVERSION RESTRICTIONS

The following conversion restrictions are applicable to the Project:

(a) No tenant in the Project shall be evicted due to conversion to condominium or cooperative form of ownership unless and until said tenant has received the rights and benefits as set forth in Chapter 527 of the Acts of the Commonwealth of Massachusetts of 1983, as amended, or any successor act, as then currently in effect (the "Conversion Act") (notwithstanding any exemption provided in the third paragraph of Section 2 of the Conversion Act to the city or town in which the Project is located) and any applicable local laws and ordinances;

(b) No tenant of a Low-Income Unit shall be evicted due to conversion to condominium or cooperative form of ownership nor shall a Low-Income Unit be converted to conventional rental housing (which shall mean housing having an annual rental greater than that permitted for Low-Income Units under the

Low-Income Tax Credit rules and regulations) unless and until the following restrictions have been met and completed with respect to such unit:

(i) the tenant of a Low-Income Unit so affected shall be given prior written notice of intent to convert to condominium or cooperative form of ownership or to convert to conventional rental housing (the "Notice Period") of at least four (4) years, such Notice Period beginning on a date no sooner that four years prior to the expiration of the Low-Income Tenant Rental Period. Once such notice of intent to convert is provided to a tenant, in the event such tenant later vacates the unit, the new tenant is entitled to receive notice under this subsection for a period equal to the remaining time pursuant to the original notice of intent to convert. The notice of intent shall include notice of the tenant's rights and notice of the right of first refusal provided in paragraph (iv) of this Section 5(b); the notice of intent shall also inform tenants that DHCD should be notified if the Owner is not fulfilling its obligations under this Agreement; only tenants occupying Low-Income Units within the Project shall be entitled to receive the additional rights enumerated in this paragraph; DHCD shall be provided with a copy of the notice for review and approval before such notice is sent to the Low-Income Tenant;

(ii) the Owner shall give DHCD six months notice of its intent to convert a Project to condominiums or cooperatives; at the end of the conversion of the market rate units in a development to condominiums or cooperatives, the Owner shall certify to DHCD its compliance with the conversion terms of this Agreement;

(iii) every Low-Income Tenant given, or entitled to be given the notice of intent shall receive an extension of their lease or rental agreement, with substantially the same terms, subject to permissible rental increases, during the Notice Period;

(iv) <subject to such restrictions as are imposed on the Owner by the terms of the Comprehensive Permit> in the event the Owner intends to convert the Project to a condominium or cooperative form of ownership, not later than two (2) years prior to the expiration of the Notice Period, an affected Low-Income Tenant shall receive a right of first refusal for purchase of the Unit which right shall last for a period of not less than six (6) months; such right of first refusal shall be accompanied by a copy of the purchase and sale agreement for the Unit; during this period, the Unit shall be offered to the tenant at a discount of at least ten percent (10%) from the offering price for the Unit; if the tenant of an affected unit chooses not to purchase the Unit, the Unit shall be offered for purchase to DHCD or its designee for an additional period of at least ninety (90) days at the same price the Unit was offered to the tenant;

(v) all tenants given, or entitled to be given the notice of intent who are unable or choose not to exercise their right to purchase or to remain and to pay the

conventional rental shall be entitled to relocation benefits in accordance with the Conversion Act.

SECTION 6 - TERM OF AGREEMENT

(a) This Agreement and the restrictions set forth herein shall commence with the first day of the Compliance period under Section 42 of the Code and shall end on the date which is ninety-nine (99) years after the commencement (the Low-Income Tenant Rental Period). This term will be determined in accordance with the Code for each building in the Project. Except as hereinafter provided, this Agreement and the restrictions set forth herein shall not terminate or expire any earlier than the end of the Low-Income Tenant Rental Period.

(b) Notwithstanding subsection (a) above and except as provided in subsection (c) below, this Agreement and the restrictions set forth herein shall terminate on the date the Project is acquired by foreclosure or instrument in lieu of foreclosure unless the Secretary of the United States Treasury or his or her designee determines that such acquisition is part of an arrangement with the Owner, a purpose of which is to terminate this Agreement and the restrictions set forth herein. DHCD hereby agrees to execute any and all documents necessary to evidence the foregoing termination.

(c) The tenant protections set forth in Section 3(t) above shall survive for a period of three (3) years following a termination pursuant to subsection (b) above and for such three-year period such tenant protections shall be binding upon any holder of a mortgage on the Project, or any successor or assign of such holder, who succeeds to all or any part of the Owner's interest in, or otherwise acquires title to, the Project.

(d) Notwithstanding subsections (a) and (b) above, this Agreement shall not terminate and shall remain in full force and effect to enable DHCD, and any other person with the right to enforce this Agreement pursuant to Section 8 (f) of this Agreement, to enforce and/or monitor under Section 8 of this Agreement any remaining obligations under subsection (c) above, and the Conversion Restrictions set forth in Section 5 above provided, however, in the event this Agreement has terminated pursuant to subsection (b) above, it shall be assumed for purpose of giving notice pursuant to Section 5 that the Low-Income Rental Period has ended.

SECTION 7 - CERTIFICATIONS

On the date of execution and delivery of this Agreement, the Owner shall deliver to DHCD the following certifications or documents:

(a) Evidence of transfer of ownership of the Project to the Owner;

(b) For projects requiring a waiver of the ten year holding requirement in order to obtain a credit for the acquisition of an existing building, a copy of the waiver obtained from the Internal Revenue Service;

(c) Opinion of Owner's Counsel as to Owner's organization, execution, delivery and enforceability of Agreement; and organizational documents for the Owner and Owner's general partner, if any, as follows:

(i) if a limited partnership, a copy of the partnership agreement; and two separate long form certificates of legal existence (identifying general partners and any amendments) from the Massachusetts Secretary of State;

(ii) if a corporation, a clerk's certificate with vote, certified articles of incorporation and by-laws; and certificate of legal existence from the state of incorporation;

(iii) if a trust, a copy of the Declaration of Trust, a Trustee's Certificate and Direction of Beneficiaries;

(iv) if a limited liability company, a copy of the operating agreement; and a certificate of good standing from the Massachusetts Secretary of State; and

(v) any additional organizational documents as DHCD deems appropriate.

(d) Audited certification of costs, an audited schedule of sources (including rental and/or operating subsidies) and uses (including reserves), and an audited schedule of low income housing tax credit eligible basis as well as any supplementary schedules required by DHCD in the format provided by DHCD;

(e) Original certification from the Owner as to the actual date the Project is "placed in service" as that term is defined in the regulations or notices promulgated under Section 42 of the Code;

(f) Certificate(s) of occupancy from the municipality or other governmental authority having jurisdiction;

(g) Original certification from the Owner of the full extent of all federal, State and local subsidies which apply (or which the Owner expects to apply) with respect to the Project;

(h) Original certification from the Project's Architect that the Project is in compliance with all applicable federal and state statutes and regulations in regard to the operation of adaptable and accessible housing for the disabled;

(i) Letter of compliance from a certified inspector that all lead-based paint hazards have been removed from all units in the Project such that, upon occupancy, the Project will be in compliance with all applicable federal, state and local laws, codes and regulations including the Massachusetts Lead Poisoning Prevention and

Control Laws, M.G.L. Chapter 111, Sections 190-199A and the regulations thereunder at 105 CMR 460.000 et seq.

(j) Original Release and Indemnification Agreement agreeing to release and indemnify DHCD from any claim, loss, demand or judgment as a result of the allocation of Low-Income Tax Credits to the Project or the recapture of Low-Income Tax Credits by the Internal Revenue Service;

(k) Original certification from the Owner pursuant to Massachusetts General Laws Chapter 62C Section 49A that the Owner has complied with all laws of the Commonwealth related to taxes; and

(l) Any and all other documents required by Section 42 of the Code or the applicable Treasury Regulations and any documents that DHCD may require.

SECTION 8 - MONITORING AND ENFORCEMENT

(a) The Owner agrees to comply with any monitoring plan, guidelines, procedures, or requirements as may be adopted or amended from time to time by DHCD in accordance with requirements of the Code or regulations promulgated thereunder by the U.S. Department of the Treasury, Internal Revenue Service ("applicable regulations") or in order to monitor compliance with the provisions of this Agreement.

(b) The Owner covenants that it will not knowingly take or permit any action that would result in a violation of the requirements of Section 42 of the Code and applicable regulations or this Agreement. Moreover, Owner covenants to take any lawful action (including amendment of this Agreement as may be necessary, in the opinion of DHCD) to comply fully with the Code and with all applicable regulations, rules, rulings, policies, procedures, or other official statements promulgated or proposed by the United States Department of the Treasury, Internal Revenue Service, from time to time pertaining to Owner's obligations under Section 42 of the Code and affecting the Project.

(c) The Owner will permit, during normal business hours and upon reasonable notice, any duly authorized representative of DHCD (or its Authorized Delegate) to inspect any books and records of the Owner regarding the Project that pertain to compliance with the Code, applicable regulations, and this Agreement. The Owner further agrees to cooperate with any on-site inspection of the Project by DHCD (or its Authorized Delegate) during normal business hours and upon reasonable notice.

(d) The Owner will take any and all actions reasonably necessary and required by DHCD to substantiate the Owner's compliance under the Code, applicable regulations, and this Agreement. The Owner shall at least annually (or more frequently as required by DHCD) submit to DHCD a Certification concerning program compliance in such form, including such documentation, and within such timeframe, as may be required by DHCD pursuant to any monitoring plan,

guidelines, or procedure adopted or amended by DHCD. At DHCD's request, the Owner will submit any other information, documents, forms or certifications which DHCD deems reasonably necessary to substantiate the Owner's continuing compliance with the Code, applicable regulations, and this Agreement.

(e) The Owner covenants and agrees to inform DHCD by written notice of any violation of the Owner's obligations hereunder within seven (7) business days of first discovering such violation. In accordance with the provisions of any monitoring plan, guidelines, or procedures as then may be in effect, DHCD covenants and agrees to inform the Owner by written notice of any violation of the Owner's obligations hereunder and to provide the Owner a period of time in which to correct such violation. If any violation is not corrected to the satisfaction of DHCD within the period of time specified by DHCD in a notice, or within such further time as DHCD determines is necessary to correct the violation, but not to exceed any time limitation set by applicable regulations, then without further notice, DHCD may declare a default under this Agreement effective on the date of such declaration of default, and DHCD may apply to any court, state or federal, for specific performance of this Agreement, or any other remedies at law or in equity, or take any other action as may be necessary or desirable to correct noncompliance with this Agreement. The foregoing is not intended to limit in any way DHCD's obligation to notify the Internal Revenue Service, pursuant to applicable regulations, of a noncompliance on the part of the Owner.

(f) The Owner acknowledges that the primary purpose for requiring compliance by the Owner with the restrictions provided in this Agreement is to assure compliance of the Project and the Owner with Section 42 of the Code and the applicable regulations, and by reason thereof, the Owner in consideration for receiving Low-Income Housing Tax Credits for this Project hereby agrees and consents that DHCD and any individual who meets the income limitation applicable under Section 42 of the Code (whether a prospective, present or former occupant) shall be entitled, for any breach of the provisions hereof, and in addition to all other remedies provided by law or in equity, to enforce specific performance by the Owner of its obligations under this Agreement in a court of competent jurisdiction. The Owner hereby further specifically acknowledges that the beneficiaries of the Owner's obligations hereunder cannot be adequately compensated by monetary damages in the event of any default hereunder. In the event of a breach of this Agreement, the Owner shall reimburse DHCD for all costs and attorneys' fees incurred associated with such breach.

(g) The Owner hereby agrees that the representations and covenants set forth herein may be relied upon by DHCD and all persons interested in Project compliance under Section 42 and the applicable regulations.

(h) Notwithstanding anything in this Agreement to the contrary, in the event that the Owner fails to comply fully with the covenants and agreements contained herein or with the Code, all applicable regulations, rules, rulings, policies, procedures, or other official statements promulgated by the Department of the Treasury, the Internal Revenue Service or DHCD from time to time pertaining to the obligations

of the Owner as set forth therein or herein, DHCD may, in addition to all of the remedies provided by law or in equity, report such noncompliance to the Internal Revenue Service which could result in penalties and/or re-capture of tax credits.

(i) The Owner agrees to pay an annual monitoring fee in such amount and by such method as may be selected by DHCD pursuant to the applicable provisions set forth in the Commonwealth of Massachusetts Allocation Plan for the Low-Income Housing Tax Credit, as such provisions may be amended or superseded in a subsequent year's Allocation Plan. DHCD reserves the right to charge a reasonable monitoring fee to perform compliance monitoring functions after the completion of the tax credit compliance period (as defined in Section 42 of the Code) for the remainder of the term of this Agreement.

(j) DHCD expressly reserves the right to continue monitoring, during the term of this Agreement, for compliance with the provisions of this Agreement beyond any timeframe provided for monitoring in the Code or applicable regulations.

(k) During the tax credit compliance period (as defined in Section 42 of the Code), the Owner will retain records in accordance with the requirements of the applicable regulations, DHCD monitoring plan and/or guidelines. After the end of the compliance period, the Owner will retain records adequate to demonstrate compliance with the terms and conditions of this Agreement, including, but not necessarily limited to, income and rent records pertaining to tenants.

Section 9 ANNUAL DATA COLLECTION

A. Annual Report. Annually, no later than September 30, the Owner shall submit to DHCD, via the web-based annual reporting system, an annual report consisting of the following in a form approved by DHCD and containing such supporting documentation as DHCD shall reasonably require:

(i) Annual adjusted income of each Family occupying a Restricted unit.

(ii) Monthly gross rents (rents plus utility allowances, if applicable) for all Restricted Units, such rents to be consistent with the schedule of maximum rents published annually by DHCD.

(iii) Data required by DHCD regulations at 760 CMR 61.00, promulgated pursuant to Chapter 334 of the Acts of 2006, and all applicable DHCD directives, guidelines and forms as may be amended from time to time. The Owner shall collect said data for the express purpose of reporting to DHCD, and the collection and reporting of said data shall comply with said regulations, directives, guidelines and forms.

(iv) Rental assistance data on all existing Residents of Restricted Units.

B. Confidentiality. DHCD and the Owner shall treat as confidential any of the foregoing information relating to a specific resident or unit in compliance with all

applicable state and federal statutes and regulations, including M.G.L. c. 66A, and shall implement adequate systems and procedures for maintaining the confidentiality of such information (but DHCD and the Owner may release general statistical and other information about the Property, so long as the privacy rights and interests of the individual Residents are protected). DHCD and the Owner shall not use any of the foregoing information in Paragraph A.(iii) for any purpose described in Section 603(d)(1) of the federal Fair Credit Reporting Act (15 U.S.C. § 1681a(d)(1)) or in any manner that would cause DHCD or the Owner to be considered a "consumer reporting agency" under Section 603(f) of the federal Fair Credit Reporting Act (15 U.S.C. § 1681a(f)).

C. Additional Reports. The Owner shall prepare and submit to DHCD such additional reports as DHCD may deem necessary to ensure compliance with the requirements of this Restriction and of the Programs.

D. Records. The Owner shall maintain as part of its records (i) copies of all leases of Restricted Units; (ii) all initial and annual income certifications by Residents of Restricted Units and (iii) such additional records as DHCD may deem necessary to ensure compliance with the requirements of this Restriction and of the Programs.

SECTION 10 - TAX CREDIT ALLOCATION

(a) DHCD has determined that as of the date of this Agreement written above, the Project will support a Low-Income Housing Tax Credit Allocation in the amount of _____ (or insert “not applicable”).

(b) DHCD and the Owner agree that if the Tax Credit Allocation is not specified in Section 9(a) above, the Owner shall deliver to DHCD an audited certification of costs, an audited schedule of sources (including rental and/or operating subsidies) and uses (including reserves), and an audited schedule of low income housing tax credit eligible basis as well as any supplementary schedules required by DHCD in the format provided by DHCD as required by Section 7(d) of this Agreement no later some future date mutually agreeable to the parties. DHCD will thereafter notify the Owner of DHCD’s final determination of the Low-Income Housing Tax Credit Allocation for the Project. Such final allocation will be specified in a written Addendum to this Agreement, to be executed by both parties and recorded in the appropriate registry of deed or land court registry district by the Owner.

SECTION 11 - MISCELLANEOUS

(a) Severability. The invalidity of any clause, part or provision of this Agreement shall not affect the validity of the remaining portions thereof.

(b) Notices. All notices to be given pursuant to this Agreement shall be in writing and shall be deemed given when delivered by hand or when mailed by certified or registered mail, postage prepaid, return receipt requested, to the parties hereto at the addresses set forth below, or to such other place as a party may from time to time designate in writing.

DHCD: Department of Housing and Community Development
100 Cambridge Street, Suite 300
Boston, MA 02114
ATTENTION: Tax Credit Program Director

With a Copy to: Department of Housing and Community Development
100 Cambridge Street, Suite 300
Boston, MA 02114
ATTENTION: Chief Counsel

To the Owner: _____
_____
_____
_____
_____
_____

ATTENTION: _____

DHCD and the Owner, may, by notice given hereunder, designate any further or different addresses to which subsequent notices, certificates or other communications shall be sent.

(c) Amendment. This Agreement may not be amended without the express written consent of DHCD and the Owner. The Owner agrees that it will take all actions necessary to effect amendment of this Agreement as may be necessary to comply with the Code and all applicable rules, regulations, policies, procedures, rulings or other official statements pertaining to the Low-Income Tax Credit.

(d) Governing Law. This Agreement shall be governed by the laws of the Commonwealth of Massachusetts and, where applicable, the laws of the United States of America.

(e) Survival of Obligations. The obligations of the Owner as set forth herein shall survive the allocation of the Low-Income Tax Credit and shall not be deemed to terminate or merge with the awarding of the allocation.

(f) Metrolist Listing. If the Project is located in the Boston Standard Metropolitan Statistical Area, prior to initial tenant selection for tax credit-assisted units, and thereafter whenever there is a vacancy in a tax credit-assisted unit, the Owner shall list such unit(s) with the City of Boston's Metrolist (Metropolitan Housing Opportunity Clearing Center), which is located at Boston City Hall, Room 966A, P.O. Box 5996, Boston, MA 02114-5996.

(g) City of Boston - Occupancy Goals. If the Project is located in a neighborhood which is predominantly white in the City of Boston, according to a list maintained at DHCD, the affirmative fair marketing plan referenced in section 2(k) above of this Agreement shall have the percentage goals for occupancy of the Low-Income Units of the Project which reflect the racial composition of the City of Boston as determined in the most recent U.S. Census. As of the date of execution of this Agreement, these percentages are as follows:

49.5%	White	14.4%	Hispanic	7.5%	Asian/Pacific Island
23.8%	Black	0.3%	Native American	4.5%	Other

DHCD may, from time to time during the term of this Agreement, provide the Owner with written notification of changes in the above percentage goals. The Owner agrees that upon receipt of such notification, it will amend the affirmative fair marketing plan for the Project to reflect such changed goals.

SECTION 11 – GROUND LEASE

(a) The Owner is the tenant under the Ground Lease of the land upon which the Project is located, from the Ground Lessor as landlord and fee owner. For valuable consideration received, the receipt and sufficiency of which hereby are acknowledged, the Ground Lessor hereby joins in the grant of this Tax Credit Regulatory Agreement and Declaration of Restrictive Covenants and agrees, for itself and its successors and assigns, to be bound by all of the terms and conditions hereof for the term of this Agreement, whether or not said Ground Lease is terminated for any reason, to the same extent as if the Ground Lessor were the named Owner hereunder.

(b) On the date of execution and delivery of this Agreement, the Owner shall deliver to DHCD a true and complete copy of the Ground Lease and the Notice of Ground Lease, together with all amendments thereto, and any other documents relating thereto as DHCD shall deem appropriate.

(c) Upon the recording of this Agreement in accordance with Section 2 above, the Owner shall cause a marginal reference to the recording of this Agreement to be noted on the Deed to the Ground Lessor, and shall provide written evidence thereof to DHCD.

(d) All notices to the Ground Lessor hereunder shall be given in the manner set forth in Section 10(b) above and shall be sent to the following address, or to such other address as the Ground Lessor may from time to time designate in writing:

_____

_____

_____

_____

_____

ATTENTION: _____

IN WITNESS WHEREOF, the parties have caused this Agreement to be signed by their duly authorized representatives as a sealed instrument, as of the day and year first written above.

GROUND LESSOR: _____

By: _____

Type Name: _____

Title: _____

OWNER: _____

By: _____, _____

its Manager/General Partner (strike one)

By: _____

Type Name: _____

Title: _____

DHCD: DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT

By: _____

Type Name: _____

Title: _____

COMMONWEALTH OF MASSACHUSETTS

COUNTY OF _____

On this ____ day of _____ 200__, before me, the undersigned notary public, personally appeared _____, _____ of _____, proved to me through satisfactory evidence of identification, which was (a current driver's license) (a current U.S. passport) (my personal knowledge of the identity of the principal), to be the person whose name is signed on the preceding or attached document, and acknowledged that he or she executed the foregoing instrument voluntarily for its stated purpose and that the foregoing instrument is his or her free act and deed and the free act and deed of _____.

_____
Notary Public
My commission expires:

COMMONWEALTH OF MASSACHUSETTS

COUNTY OF_____

On this ____ day of _____ 200__, before me, the undersigned notary public, personally appeared _____, _____ of _____, proved to me through satisfactory evidence of identification, which was (a current driver's license) (a current U.S. passport) (my personal knowledge of the identity of the principal), to be the person whose name is signed on the preceding or attached document, and acknowledged that he or she executed the foregoing instrument voluntarily for its stated purpose and that the foregoing instrument is his or her free act and deed and the free act and deed of _____.

_____
Notary Public
My commission expires:

COMMONWEALTH OF MASSACHUSETTS

COUNTY OF SUFFOLK

On this ____ day of _____ 200__, before me, the undersigned notary public, personally appeared _____, _____ of the Massachusetts Department of Housing and Community Development, proved to me through satisfactory evidence of identification, which was my personal knowledge of the identity of the principal, to be the person whose name is signed on the preceding or attached document, and acknowledged that he or she executed the foregoing instrument voluntarily for its stated purpose and that the foregoing instrument is his or her free act and deed and the free act and deed of _____.

_____
Notary Public
My commission expires:

Exhibit A
Description of Property

_____

SECTION 9

LIST OF EXCEPTIONS TO THE ZONING BYLAWS AND OTHER LOCAL LAND USE REQUIREMENTS

370-384 HARVARD STREET
PROPOSED WAIVER LIST

M-1.0 Zoning District

BROOKLINE ZONING BY-LAW

By-Law Section	Requirement	Requested Waivers	Details of Proposal Requiring Waiver	Waiver Number
§4.07 – Table of Use Regulations	Multi-family Uses	Use property as a multi-family dwelling without a special permit.	The Development is a multi-family dwelling with 62 rental units (of which 58 will be affordable deed-restricted units) and a retail component of less than 5,000 s.f. Approval of a Comprehensive Permit by the Zoning Board of Appeals under M.G.L. c. 40B §20-23 allows proposed use.	A
§4.07 – Table of Use Regulations	Retail Store of less than 5,000 s.f. (Use #29)	Waiver from the restriction on retail stores in M Zoning Districts.	The Development has a retail store of less than 5,000 s.f. on the first floor facing Harvard Street.	B
§4.08	Affordable Housing Requirements	Use property for affordable housing without a special permit and without complying with specific requirements.	The Development is a multi-family dwelling under M.G.L. c. 40B and all affordable housing requirements are governed by the Comprehensive Permit.	C
Table §5.01	Minimum Lot Size	Waiver from minimum lot size requirement of 64,000 s.f. (3,000 s.f. for first dwelling unit and 1,000 s.f. for each additional dwelling unit).	The Development has 18,323 s.f. of lot area for 62 units.	D
Table §5.01	Maximum Floor Area	Waiver from 1.0 maximum ratio of gross floor area to lot area.	With 62,196 s.f. in gross floor area on a lot of 18,323 s.f., the Development will have a floor area ratio of approximately 3.4.	E
Table §5.01	Maximum Height of Buildings	Waiver from 40’ maximum building height restriction.	The building height will be no greater than 70’ 1”.	F
Table §5.01	Minimum Front Yard	Waiver from the 15’ Front Yard Setback requirement.	The front yard setback of the Development will be 0’ along Harvard Street and 0’ along Williams Street.	G

By-Law Section	Requirement	Requested Waivers	Details of Proposal Requiring Waiver	Waiver Number
Table §5.01	Minimum Side Yard	Waiver from the Side Yard Setback requirement (10' + L/10').	The setbacks of the Development will be 0' from the Kehillah Israel synagogue ground lease line and 0' along the Centre-Williams Condo Association property line.	H
Table §5.01	Minimum Rear Yard	Waiver from the Rear Yard Setback requirement (30'). Since the property is a corner lot with two side lot lines, the owner has the privilege of choosing which interior lot line will be considered the rear.	The setbacks of the Development will be 0' from the Kehillah Israel synagogue ground lease line and 0' along the Centre-Williams Condo Association property line.	I
Table §5.01	Minimum Landscaped Open Space	There is a requirement for landscaped open space equaling 10% of gross floor area, or 6,220 s.f. for this Development.	The Development will have 1,517 s.f. in open space, 2.4% of the development's gross floor area.	J
Table §5.01	Minimum Usable Open Space	There is a requirement for usable open space equaling 20% of gross floor area, or 12,439 s.f. for this Development.	The Development will have no usable open space on site.	K
Table §5.01	Minimum Side Yard (Kehillath Israel)	Waiver from the Side Yard Setback requirement (20' + L/10') for the KI Building at 384 Harvard Street.	The KI Building will have a 0' setback along a new ground lease lot line.	L
Table §5.01	Minimum Rear Yard (Kehillath Israel)	Waiver from the Rear Yard Setback requirement (40') for the KI Building at 384 Harvard Street.	The KI Building's new rear entrance will be reconfigured due to a new ground lease lot line and the JCHE development. The rear entrance stairs, ramps, and walls will have a 0' rear yard setback.	M
§5.09	Design Review	Project design approval without Design Review and a special permit under §5.09.	Design elements included in the Comprehensive Permit application to be reviewed by the Zoning Board of Appeals in accordance with M.G.L. c. 40B, §20-23.	N

By-Law Section	Requirement	Requested Waivers	Details of Proposal Requiring Waiver	Waiver Number
§5.45	Traffic Visibility Across Corners	Waiver from the requirement that no structure be maintained between a plane of 2.5' and 7' above curb level within 25' of the street intersection.	The Development has a 0' front yard setback along Harvard Street and a 0' front yard setback along William Street and the building will be located within this area.	O
§5.51	Projections into Front Yards	Waiver from the requirements restricting building projections.	Projections such as bays will extend more than 2.5' into the front yard setback.	P
§5.52	Fences and Terraces in Front Yards	Waiver from the requirements restricting decks in the front yard.	Wooden decking at the ground level will extend to the front property line along Williams Street, and a roof deck will extend to the front property line along Harvard Street.	Q
§5.62	Fences and Terraces in Side Yards (Kehillath Israel)	Waiver from the requirements restricting steps, decks and walls in the side yard.	The KI Building's new rear entrance will be reconfigured due to a new ground lease lot line and the JCHE development. The rear entrance stairs, ramps, and walls will have a 0' side yard setback.	R
§5.74	Fences and Terraces in Rear Yards (Kehillath Israel)	Waiver from the requirements restricting steps, decks and walls in the rear yard.	The KI Building's new rear entrance will be reconfigured due to a new ground lease lot line and the JCHE development. The rear entrance stairs, ramps, and walls will have a 0' rear yard setback.	S
§6.02, Paragraph 1, Table of Off-Street Parking Space Requirements	Off-Street Parking Spaces	Waiver from parking space requirement of 2.0 per dwelling unit and 1 space per 200 s.f. for retail component of project.	The project will have a total of 14 parking spaces.	T
Article VI	Vehicular Service Uses Requirements	Waiver from all dimensional and design requirements for off-street parking, including but not limited to minimum aisle width, maximum driveway width; number of accessible	Off-street parking design and dimensions per Comprehensive Permit plans.	U

By-Law Section	Requirement	Requested Waivers	Details of Proposal Requiring Waiver	Waiver Number
		parking spaces and driveway location distance from a street corner.		
§6.06	Off-Street Loading Spaces	Waiver from the one required loading space for the project's retail component.	Loading for 370-384 Harvard Street will take place in the proposed pick-up/drop off area on Harvard Street.	V
§6.07	Design and Layout of Off-Street Loading Facilities	Waiver from design and layout requirements for loading facilities.	Design and layout of loading facilities per Comprehensive Permit plans.	W

BROOKLINE TOWN BY-LAWS

Bylaw Section	Requirement	Requested Waiver(s)	Details of Proposal Requiring Waiver	Waiver Number
§3.17	Department of Public Works – Tree Removal Permit Process*	Waiver from the Department of Public Works.	Comprehensive Permit, as may be granted by Zoning Board of Appeals shall provide all local permits per M.G.L. c. 40B § 20-23.	X
§3.17	Department of Public Works – Transportation**	Waiver from the Transportation Board review process to remove on-street parking and establish a drop-off/pick-up zone on Harvard Street.	Comprehensive Permit, as may be granted by Zoning Board of Appeals, shall provide all local permits per M.G.L. c.40B § 20-23.	Y
§5.3	Demolition Delay By-law	Waiver from the Preservation Commission requirements to demolish buildings in Brookline.	Comprehensive Permit, as may be granted by Zoning Board of Appeals shall provide all local permits per M.G.L. c. 40B § 20-23.	Z

*Refer to M.G.L. ch. 87 regarding removal of Public Shade Trees.

**Refer to M.G.L. ch. 317 of the Acts of 1974 regarding the Transportation Board's authority in the Town of Brookline.

SECTION 10

TRAFFIC IMPACT ASSESSMENT

Stantec Consulting Services Inc.
226 Causeway Street 6th Floor
Boston MA US 02114-2155

October 28, 2016
File: 210801364

Attention: Ms. Rhonda Spector
Director of Real Estate Development
Jewish Community Housing for the Elderly
30 Wallingford Road
Brighton, MA 02135-4753

Dear Ms. Spector,

Reference: Congregation Kehillath Israel Senior Living Community, Brookline, MA

Per your request, we conducted an investigation of potential traffic impacts associated with the above referenced project. Based on this investigation we conclude that the project will have a negligible impact on area traffic operations. Furthermore, the roadway system operates at a high level of service under existing conditions and has adequate capacity to accommodate the project related traffic increases at the same high level of service. Proposed changes at the site, a new driveway on Williams Street and a pick-up/drop-off area on Harvard Street, will allow for safe site access for employees and emergency vehicles.

PROJECT DESCRIPTION

Congregation Kehillath Israel is entering into a long term lease agreement with Jewish Community Housing for the Elderly to redevelop a portion of their property at the Harvard Street and Williams Street intersection in Brookline as an independent senior living community. The existing Epstein Auditorium building on the property would be removed and replaced with 62 senior living units, including 53 one-bedroom units and nine two-bedroom units. Less than 5000 square feet of retail space is also proposed fronting Harvard Street to serve resident and neighborhood needs. Parking on the site would be increased by 14 spaces. Three of these spaces will be designated for use by the existing temple and the balance, including at least one car-share space, will support the new facility. Access to the parking would be by way of a new driveway at Williams Street. The proposed driveway will be approximately 20 feet wide.

EXISTING CONDITIONS

Roadways

The project site is located in the southwest quadrant of the signalized Williams Street/Stedman Street/Harvard Street intersection. Harvard Street is a two-lane, two-way minor arterial adjacent to the project site with on-street parking and bike lanes. Sidewalks are also provided on both sides of the street. Stedman Street enters Harvard Street from the north and Williams Street exits Harvard Street to the south. (Both are one-way southbound streets.) Williams Street is located just west of Stedman Street creating an off-set intersection. At this intersection Harvard Street includes a westbound left-turn lane approximately 90 feet in length. Stedman Street includes separate right and left turn lanes. The signal provides a protected

phase for left turns from Harvard Street to Williams Street. An exclusive pedestrian phase is also provided. A school, the Edward Devotion School, is located in the northeast quadrant of the intersection and generates significant pedestrian traffic during morning arrivals and afternoon dismissal. A police detail is present to help manage traffic at these times.

Traffic Volumes

Peak hour traffic volume data for the above intersection was obtained from another recent traffic study and new field counts. A Transportation Study prepared by VHB for the *Edward Devotion School Project* date April 25, 2015 was referenced to obtain AM peak hour traffic volumes. Since this study considered traffic impacts during school peak activity periods it did not include counts during the afternoon commuter peak traffic period. New counts were contracted by Stantec for the PM peak period in April 2016. The weekday AM and PM peak hour volumes are reported in Table 1. As shown, during the AM commuter peak hour the highest volume flow, 425 vehicles per hour, is westbound on Harvard Street towards Allston. During the PM peak hour Harvard Street volumes are fairly balanced with a westbound through volume of 495 vehicles and an eastbound through volume, headed toward Brookline Village, of 485 vehicles. The side street volumes range from 75 to 125 vehicles per hour. The AM peak hour occurs 7:15 to 8:15 AM and the PM peak hour is from 5:00 to 6:00 PM.

Direction/Movement	AM Peak Hour	PM Peak Hour
Southbound (Stedman St.)		
Left	30	15
Through	25	30
Right	55	30
Eastbound (Harvard Ave.)		
Through	350	485
Right	30	25
Westbound (Harvard Ave.)		
Left	70	100
Through	425	495
TOTAL	985	1180

Table 1 Existing Peak Hour Traffic Volumes – Williams Street/Stedman Street/Harvard Street Intersection

Reference: Congregation Kehillath Israel Senior Living Community, Brookline, MA

Operations

Existing intersection peak hour operating levels of service were calculated for the Williams Street/Stedman Street/Harvard Street intersection following procedures described in the latest edition of the *Highway Capacity Manual*. Operating level of service (LOS) is a term used to describe the quality of traffic flow on a roadway. It is an aggregate measure of travel delay, travel speed, congestion, driver discomfort, convenience, and safety based on a comparison of roadway capacity to travel demand. Operating levels of service are reported on a scale of A to F with LOS A representing the best operating conditions (little or no delay to motorists) and LOS F representing the worst operating conditions (long delays and with traffic demands sometimes exceeding roadway capacity.) As reported in *Edward Devotion School Project Transportation Study* the subject intersection presently operates at LOS B during the AM peak hour and LOS B during the school dismissal hour. Stantec's analysis of PM commuter peak hour operations, attached, indicates that it operates at LOS B during this hour.

FUTURE CONDITIONS

Traffic volume conditions on the area roadway system were developed for a "Build" scenario. The "Build" scenario assumes that traffic generated by the proposed development is combined with existing traffic volumes. Existing and Build traffic conditions at the subject intersection were then compared to quantify the impact of project traffic on volumes and operations.

Site Traffic

Traffic forecasts for the proposed development project were based on the application of standard Institute of Transportation Engineers (ITE) trip rates. Based on the ITE trip rates for Land Use Code 252-Senior Adult Housing – Attached, a 62-unit senior living facility will generate only 12 AM peak hour vehicle trips and 15 PM peak hour trips as noted in Table 2. Up to 214 vehicle trips on a daily basis are expected based on the ITE data. Vehicle trip generation for the retail space is expected to be nominal as the retail space will serve residents of the project and the neighborhood. The retail space will be sustained primarily by walk-in traffic.

Time Period	Direction	Trip Rate (Trips / Dwelling Unit)	Vehicle Trips
AM Peak Hour	Entering	0.07	4
	Exiting	0.13	8
	Total	0.20	12
PM Peak Hour	Entering	0.13	8
	Exiting	0.12	7
	Total	0.25	15

Reference: Congregation Kehillath Israel Senior Living Community, Brookline, MA

Time Period	Direction	Trip Rate (Trips / Dwelling Unit)	Vehicle Trips
Daily	Entering	1.72	107
	Exiting	1.72	107
	Total	3.44	214

Table 2 Project Traffic Generation

The above trip estimates are considered very conservative for two reasons. First, residents of the proposed facility will not be allowed to own vehicles. (Two parking stalls will be reserved for car-share vehicles and transportation services will be offered to residents for local trips.) Consequently, trip generation at this site will be limited primarily to employee trips. Since the ITE trip rates include both employee and resident trips, the trip estimates are conservative. Second, not all employees will drive to the site. The ITE trip rates are based on data collected primarily at suburban sites where virtually all trips to and from the sites monitored are made by automobile. In Brookline, only 40 percent of residents drive alone to work based on 2010 US Census data. Older Census data (2000) indicate that only 65 percent of people working in Brookline commute by private automobile. Consequently, at the Brookline location trip generation associated with employees will likely be 35 percent lower than the ITE estimate.

Another component of the project traffic generation relates to home care workers. Residents may choose to hire part-time home care workers (non-JCHE employees) who will make visits to the site throughout the day. These trips are already accounted for in the ITE trip rates to the extent that residents in the sites surveyed also employ home care workers. Here again the analysis is conservative in that all project generated trips are assumed to be generated at the site. In discussions with the sponsor (JCHE), they report that many home care workers will likely walk or use public transportation. The few vehicle trips that they generate will be dispersed among nearby municipal parking lots and available on-street parking.

Future Traffic Volumes

Anticipated site generated vehicle trips were assigned to the area roadway network assuming that a driveway serving the project-related parking would be located on Williams Street. It was also assumed that all of the entering trips would pass through the Williams Street/Stedman Street/Harvard Street intersection with approximately one-half approaching from the east and one-half approaching from the west. Due to the one-way nature of Williams Street traffic exiting the site will not likely pass through the subject intersection. However, to be conservative, it was assumed that all of the exiting trips would access Harvard Street by way of Fuller Street (located west of the site). Half of these exiting trips would then turn right from Fuller Street and pass through the subject intersection in the eastbound direction. The project trip assignments are documented in Table 3.

Reference: Congregation Kehillath Israel Senior Living Community, Brookline, MA

Direction/Movement	AM Peak Hour			PM Peak Hour		
	Existing Volumes	Project Traffic	Build Volumes	Existing Volumes	Project Traffic	Build Volumes
Southbound (Stedman St.)						
Left	30	0	30	15	0	15
Through	25	0	25	30	0	30
Right	55	0	55	30	0	30
Eastbound (Harvard Ave.)						
Through	350	4	354	485	4	489
Right	30	2	32	25	4	29
Westbound (Harvard Ave.)						
Left	70	2	72	100	4	104
Through	425	0	425	495	0	495
TOTAL	**985**	**8**	**993**	**1180**	**12**	**1192**

Table 3 Future Peak Hour Traffic Volumes – Williams Street/Stedman Street/Harvard Street Intersection

The combined project traffic and existing traffic volumes represent the Build condition traffic volumes which are also shown in Table 3. As noted, based on the assumptions described above, the project will add 12 or less peak hour vehicles to the subject intersection. This represents a one percent or less increase in volumes over existing conditions.

Future Traffic Operations

The traffic operations analyses completed above for existing traffic conditions were repeated for Build conditions for the Williams Street/Stedman Street/Harvard Street intersection. The results for both conditions are presented in Table 4. Also provided are calculated 95th percentile vehicle queues for the westbound left-turn lane on Harvard Street. As shown, the added project traffic will not have a noticeable impact on intersection operations. The calculated level of service is unchanged between existing and Build conditions. The overall vehicle delay is expected to increase by less than one second as a result of the proposed development project. Calculated 95th percentile vehicle queues in the 90-feet long westbound left-turn lane on Harvard Street are 50 feet or less under Build conditions. Capacity analysis worksheets for all analysis conditions are attached.

Reference: Congregation Kehillath Israel Senior Living Community, Brookline, MA

	Existing Conditions				Build Conditions			
Peak Hour	LOS[1]	Delay[2]	V/C[3]	Queue[4]	LOS	Delay	V/C	Queue[4]
AM	B	15.6	0.41	36	B	15.7	0.41	37
PM	B	16.4	0.53	49	B	16.6	0.54	50

[1] LOS= Level of Service
[2] Delay = Average delay expressed in seconds per vehicle
[3] V/C = Volume-to-capacity ratio for critical movements
[4] 95th Percentile vehicle queue measured in feet in the westbound left-turn lane on Harvard Street

Table 4 Williams Street/Stedman Street/Harvard Street Intersection Operations

Emergency Response

A concern often cited with respect to senior housing is the frequency with which ambulances may arrive at such a facility. Data for the number of ambulance calls for four Jewish Community Housing for the Elderly facilities was provided to Stantec. The data is summarized below in Table 5.

Facility	# Units	Calls per Week	Weekly Calls per Unit	Annual Calls per Unit
Shillman House	150	2	0.013	0.693
Coleman House	146	3	0.021	1.068
Golda Meir House	199	3	0.015	0.784
Brighton Campus	702	9	0.013	0.667
Average	299	4.25	0.014	0.739

Table 5 Fire/EMS calls at JCHE Facilities

As shown in Table 5, the average annual EMS/Fire call rate at these existing facilities is 0.74 calls per unit. Applying this call rate to the proposed 62-unit residential development indicates 46 EMS calls per year at this facility or 0.88 EMS calls per week. Permission will be sought from the Town to remove several parking spaces along Harvard Street adjacent to the site so that these spaces could be repurposed as a pick-up/drop-off zone for residents and visitors. The pick-up/drop-off zone would also serve emergency vehicles. Ambulances arriving from Coolidge Corner will have adequate space to make a U-turn to enter the pick-up/drop-off area, if desired. (The minimum turning radius for an ambulance is 42 feet and Harvard Street is 42 feet wide at this location excluding the parking lane on the north side of the street.)

CONCLUSIONS AND RECOMMENDATIONS

As explained above, the proposed development will not have a significant impact on traffic operations at the Williams Street/Stedman Street/Harvard Street intersection. Likewise, it will not generate a significant

Reference: Congregation Kehillath Israel Senior Living Community, Brookline, MA

number of EMS calls. Consequently, no recommendations are proposed to mitigate project related traffic impacts.

Thank you for the opportunity in assisting you with this project. Please do not hesitate to call if you have questions regarding the above.

Regards,

Stantec Consulting Services Inc.

Richard S. Bryant
Associate
Phone:802 864 0223
Fax:802 864 0165
Richard.Bryant@stantec.com

Attachments: Traffic Counts, Capacity Analysis Worksheets

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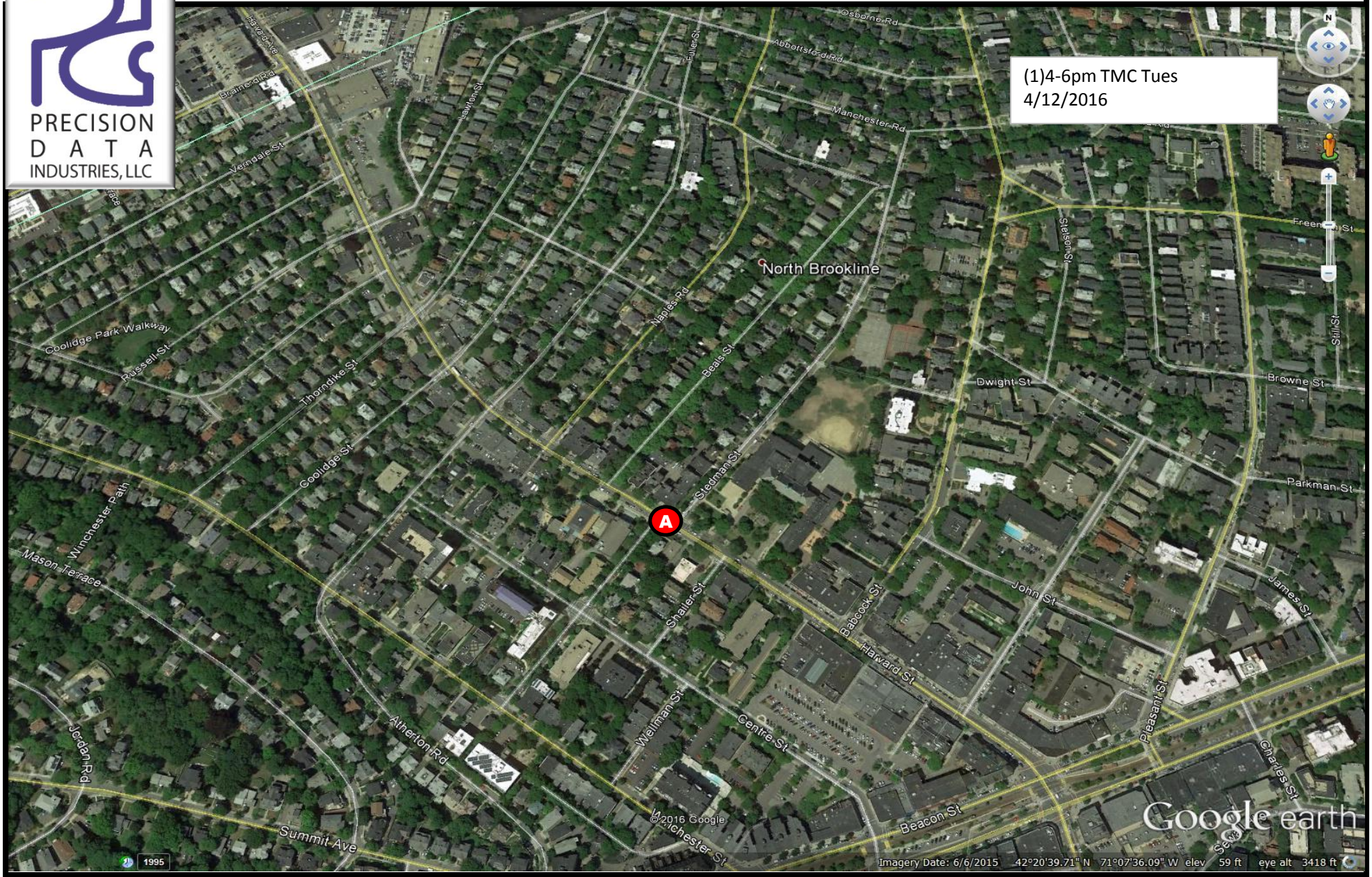
Location Map: 165044 Brookline, MA



Client:	Engineer:	Site Code:	Date:	PDI Job #	City, State:
Stantec	R. Bryant	TBA	Tuesday 4/12/2016	165044	Brookline, MA

N/S: Stedman Street/ Williams Street
E/W: Harvard Street
City, State: Brookline, MA
Client: Stantec/ R. Bryant

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File Name : 165044 A
Site Code : TBA
Start Date : 4/12/2016
Page No : 1

Groups Printed- Cars - Heavy Vehicles

	Stedman Street From North				Harvard Street From East				Williams Street From South				Harvard Street From West				
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Int. Total
04:00 PM	5	5	16	0	0	95	27	1	0	0	0	0	8	94	0	0	251
04:15 PM	4	6	5	0	0	118	21	0	0	0	0	0	9	121	0	0	284
04:30 PM	4	4	4	0	0	118	24	0	0	0	0	0	10	115	0	0	279
04:45 PM	2	3	6	0	0	107	26	1	0	0	0	0	8	113	0	0	266
Total	15	18	31	0	0	438	98	2	0	0	0	0	35	443	0	0	1080
05:00 PM	9	7	5	0	0	118	18	0	0	0	0	0	2	113	0	0	272
05:15 PM	7	8	4	0	0	119	24	0	0	0	0	0	9	120	0	0	291
05:30 PM	10	8	5	0	0	121	27	0	0	0	0	0	4	130	0	0	305
05:45 PM	4	7	2	0	0	137	30	0	0	0	0	0	12	122	0	0	314
Total	30	30	16	0	0	495	99	0	0	0	0	0	27	485	0	0	1182
Grand Total	45	48	47	0	0	933	197	2	0	0	0	0	62	928	0	0	2262
Apprch %	32.1	34.3	33.6	0	0	82.4	17.4	0.2	0	0	0	0	6.3	93.7	0	0	
Total %	2	2.1	2.1	0	0	41.2	8.7	0.1	0	0	0	0	2.7	41	0	0	
Cars	45	48	47	0	0	895	194	2	0	0	0	0	62	897	0	0	2190
% Cars	100	100	100	0	0	95.9	98.5	100	0	0	0	0	100	96.7	0	0	96.8
Heavy Vehicles	0	0	0	0	0	38	3	0	0	0	0	0	0	31	0	0	72
% Heavy Vehicles	0	0	0	0	0	4.1	1.5	0	0	0	0	0	0	3.3	0	0	3.2

	Stedman Street From North					Harvard Street From East					Williams Street From South					Harvard Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	9	7	**5**	**0**	**21**	**0**	**118**	**18**	**0**	**136**	**0**	**0**	**0**	**0**	**0**	**2**	**113**	**0**	**0**	**115**	**272**
05:15 PM	**7**	**8**	4	0	19	0	119	24	0	143	0	0	0	0	0	9	120	0	0	129	291
05:30 PM	**10**				**23**	0	121	27	0	148	0	0	0	0	0	4	**130**			**134**	
05:45 PM	**4**	**7**	**2**	**0**	**13**	**0**	**137**	**30**	0	**167**	**0**	**0**	**0**	**0**	**0**	**12**	122	0	0	134	**314**
Total Volume	30	30	16	0	76	0	495	99	0	594	0	0	0	0	0	27	485	0	0	512	1182
% App. Total	39.5	39.5	21.1	0		0	83.3	16.7	0		0	0	0	0		5.3	94.7	0	0		
PHF	.750	.938	.800	.000	.826	.000	.903	.825	.000	.889	.000	.000	.000	.000	.000	.563	.933	.000	.000	.955	.941
Cars	30	30	16	0	76	0	476	98	0	574	0	0	0	0	0	27	473	0	0	500	1150
% Cars	100	100	100	0	100	0	96.2	99.0	0	96.6	0	0	0	0	0	100	97.5	0	0	97.7	97.3
Heavy Vehicles	0	0	0	0	0	0	19	1	0	20	0	0	0	0	0	0	12	0	0	12	32
% Heavy Vehicles	0	0	0	0	0	0	3.8	1.0	0	3.4	0	0	0	0	0	0	2.5	0	0	2.3	2.7

N/S: Stedman Street/ Williams Street
E/W: Harvard Street
City, State: Brookline, MA
Client: Stantec/ R. Bryant

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Groups Printed- Cars

	Stedman Street From North				Harvard Street From East				Williams Street From South				Harvard Street From West				
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Int. Total
04:00 PM	5	5	16	0	0	90	27	1	0	0	0	0	8	92	0	0	244
04:15 PM	4	6	5	0	0	114	19	0	0	0	0	0	9	118	0	0	275
04:30 PM	4	4	4	0	0	110	24	0	0	0	0	0	10	107	0	0	263
04:45 PM	2	3	6	0	0	105	26	1	0	0	0	0	8	107	0	0	258
Total	15	18	31	0	0	419	96	2	0	0	0	0	35	424	0	0	1040
05:00 PM	9	7	5	0	0	111	18	0	0	0	0	0	2	111	0	0	263
05:15 PM	7	8	4	0	0	113	24	0	0	0	0	0	9	116	0	0	281
05:30 PM	10	8	5	0	0	118	27	0	0	0	0	0	4	128	0	0	300
05:45 PM	4	7	2	0	0	134	29	0	0	0	0	0	12	118	0	0	306
Total	30	30	16	0	0	476	98	0	0	0	0	0	27	473	0	0	1150
Grand Total	45	48	47	0	0	895	194	2	0	0	0	0	62	897	0	0	2190
Apprch %	32.1	34.3	33.6	0	0	82	17.8	0.2	0	0	0	0	6.5	93.5	0	0	
Total %	2.1	2.2	2.1	0	0	40.9	8.9	0.1	0	0	0	0	2.8	41	0	0	

	Stedman Street From North					Harvard Street From East					Williams Street From South					Harvard Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	9	7	**5**	**0**	**21**	**0**	**111**	**18**	**0**	**129**	**0**	**0**	**0**	**0**	**0**	**2**	**111**	**0**	**0**	**113**	**263**
05:15 PM	**7**	**8**	4	0	19	0	113	24	0	137	0	0	0	0	0	9	116	0	0	125	281
05:30 PM	**10**				**23**	0	118	27	0	145	0	0	0	0	0	4	**128**			**132**	
05:45 PM	**4**	**7**	**2**	**0**	**13**	**0**	**134**	**29**	0	**163**	**0**	**0**	**0**	**0**	**0**	**12**	118	0	0	130	**306**
Total Volume	30	30	16	0	76	0	476	98	0	574	0	0	0	0	0	27	473	0	0	500	1150
% App. Total	39.5	39.5	21.1	0		0	82.9	17.1	0		0	0	0	0		5.4	94.6	0	0		
PHF	.750	.938	.800	.000	.826	.000	.888	.845	.000	.880	.000	.000	.000	.000	.000	.563	.924	.000	.000	.947	.940

N/S: Stedman Street/ Williams Street
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Page No : 1

Groups Printed- Heavy Vehicles

	Stedman Street From North				Harvard Street From East				Williams Street From South				Harvard Street From West				
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Int. Total
04:00 PM	0	0	0	0	0	5	0	0	0	0	0	0	0	2	0	0	7
04:15 PM	0	0	0	0	0	4	2	0	0	0	0	0	0	3	0	0	9
04:30 PM	0	0	0	0	0	8	0	0	0	0	0	0	0	8	0	0	16
04:45 PM	0	0	0	0	0	2	0	0	0	0	0	0	0	6	0	0	8
Total	0	0	0	0	0	19	2	0	0	0	0	0	0	19	0	0	40
05:00 PM	0	0	0	0	0	7	0	0	0	0	0	0	0	2	0	0	9
05:15 PM	0	0	0	0	0	6	0	0	0	0	0	0	0	4	0	0	10
05:30 PM	0	0	0	0	0	3	0	0	0	0	0	0	0	2	0	0	5
05:45 PM	0	0	0	0	0	3	1	0	0	0	0	0	0	4	0	0	8
Total	0	0	0	0	0	19	1	0	0	0	0	0	0	12	0	0	32
Grand Total	0	0	0	0	0	38	3	0	0	0	0	0	0	31	0	0	72
Apprch %	0	0	0	0	0	92.7	7.3	0	0	0	0	0	0	100	0	0	
Total %	0	0	0	0	0	52.8	4.2	0	0	0	0	0	0	43.1	0	0	

	Stedman Street From North					Harvard Street From East					Williams Street From South					Harvard Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:30 PM																					
04:30 PM	0	0	0	0	0	0	**8**	**0**	**0**	**8**	**0**	**0**	**0**	**0**	**0**	**0**	**8**	**0**	**0**	**8**	**16**
04:45 PM	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**6**	**0**	**0**	**6**	**8**
05:00 PM	**0**	**0**	**0**	**0**	**0**	**0**	**7**	**0**	**0**	**7**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**2**	**9**
05:15 PM	**0**	**0**	**0**	**0**	**0**	**0**	**6**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**4**	**10**
Total Volume	0	0	0	0	0	0	23	0	0	23	0	0	0	0	0	0	20	0	0	20	43
% App. Total	0	0	0	0		0	100	0	0		0	0	0	0		0	100	0	0		
PHF	.000	.000	.000	.000	.000	.000	.719	.000	.000	.719	.000	.000	.000	.000	.000	.000	.625	.000	.000	.625	.672

N/S: Stedman Street/ Williams Street
E/W: Harvard Street
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Client: Stantec/ R. Bryant

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Page No : 1

Groups Printed- Peds and Bicycles

	Stedman Street From North					Harvard Street From East					Williams Street From South					Harvard Street From West					
Start Time	Right	Thru	Left	Peds EB	Peds WB	Right	Thru	Left	Peds SB	Peds NB	Right	Thru	Left	Peds WB	Peds EB	Right	Thru	Left	Peds NB	Peds SB	Int. Total
04:00 PM	0	0	0	11	14	5	0	0	2	4	0	0	0	10	10	0	0	0	0	1	57
04:15 PM	0	0	0	22	19	5	1	0	7	6	0	0	0	16	13	0	3	0	0	0	92
04:30 PM	0	0	0	8	28	2	1	0	10	3	0	0	0	11	12	0	3	0	0	0	78
04:45 PM	0	0	0	21	28	4	0	0	8	8	0	0	0	21	12	0	2	0	0	2	106
Total	0	0	0	62	89	16	2	0	27	21	0	0	0	58	47	0	8	0	0	3	333
05:00 PM	0	0	0	16	41	6	0	0	10	3	0	0	0	14	11	0	5	0	0	0	106
05:15 PM	0	0	0	23	40	12	1	0	3	6	0	0	0	16	19	0	4	0	0	0	124
05:30 PM	0	0	1	13	54	10	0	0	15	0	0	0	0	18	20	0	6	0	0	0	137
05:45 PM	0	0	0	14	59	11	1	0	11	4	0	0	0	23	16	0	14	0	0	0	153
Total	0	0	1	66	194	39	2	0	39	13	0	0	0	71	66	0	29	0	0	0	520
Grand Total	0	0	1	128	283	55	4	0	66	34	0	0	0	129	113	0	37	0	0	3	853
Apprch %	0	0	0.2	31.1	68.7	34.6	2.5	0	41.5	21.4	0	0	0	53.3	46.7	0	92.5	0	0	7.5	
Total %	0	0	0.1	15	33.2	6.4	0.5	0	7.7	4	0	0	0	15.1	13.2	0	4.3	0	0	0.4	

	Stedman Street From North						Harvard Street From East						Williams Street From South						Harvard Street From West						
Start Time	Right	Thru	Left	Peds EB	Peds WB	App. Total	Right	Thru	Left	Peds SB	Peds NB	App. Total	Right	Thru	Left	Peds WB	Peds EB	App. Total	Right	Thru	Left	Peds NB	Peds SB	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																									
Peak Hour for Entire Intersection Begins at 05:00 PM																									
05:00 PM	0	0	0	16	41	57	6	0	0	10	3	19	0	0	0	14	11	25	0	5	0	0	0	5	106
05:15 PM	0	0	0	**23**	40	63	**12**	**1**	0	3	**6**	22	0	0	0	16	19	35	0	4	0	0	0	4	124
05:30 PM	0	0	**1**	13	54	68	10	0	0	**15**	0	25	0	0	0	18	**20**	38	0	6	0	0	0	6	137
05:45 PM	0	0	0	14	**59**	**73**	11	1	0	11	4	**27**	0	0	0	**23**	16	**39**	0	**14**	0	0	0	**14**	**153**
Total Volume	0	0	1	66	194	261	39	2	0	39	13	93	0	0	0	71	66	137	0	29	0	0	0	29	520
% App. Total	0	0	0.4	25.3	74.3		41.9	2.2	0	41.9	14		0	0	0	51.8	48.2		0	100	0	0	0		
PHF	.000	.000	.250	.717	.822	.894	.813	.500	.000	.650	.542	.861	.000	.000	.000	.772	.825	.878	.000	.518	.000	.000	.000	.518	.850

N/S: Stedman Street/ Williams Street
E/W: Harvard Street
City, State: Brookline, MA
Client: Stantec/ R. Bryant

PRECISION DATA INDUSTRIES, LLC
46 Morton Street, Framingham, MA 01752
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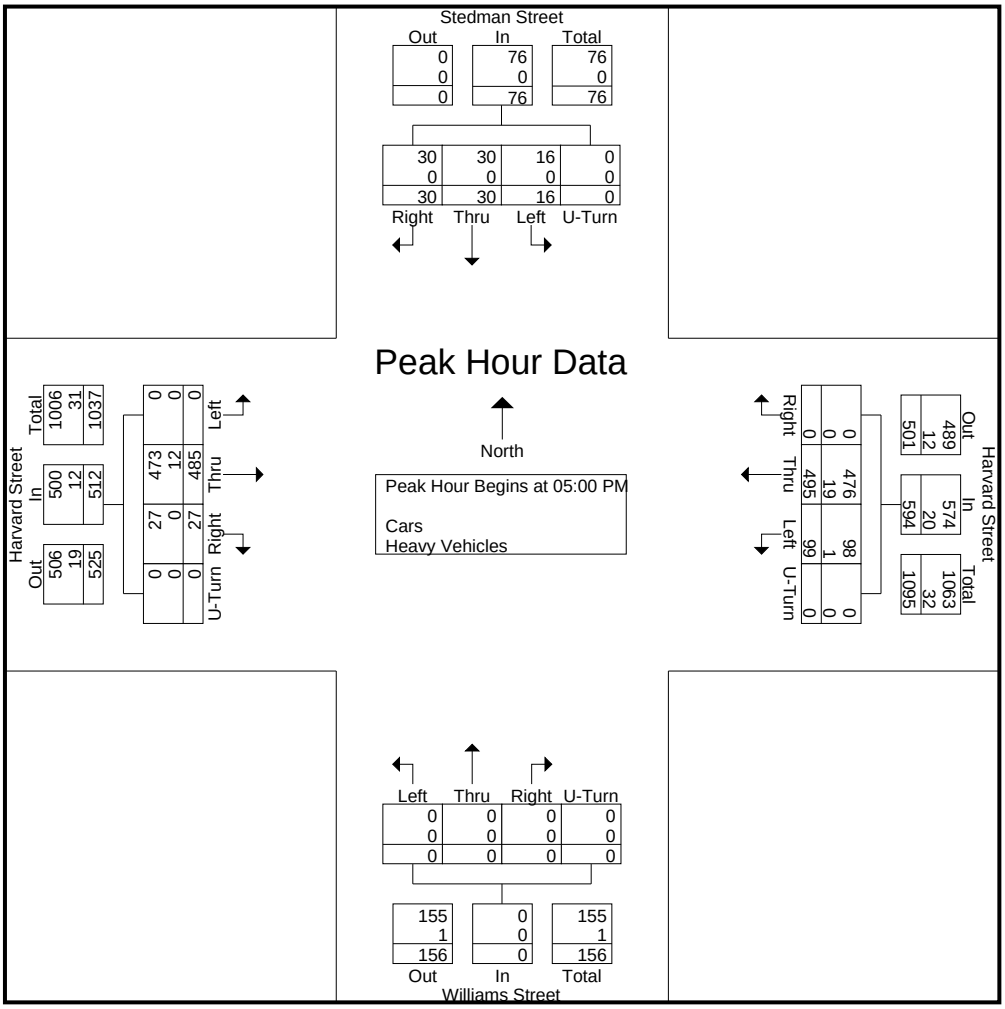
File Name : 165044 A
Site Code : TBA
Start Date : 4/12/2016
Page No : 1

	Stedman Street From North					Harvard Street From East					Williams Street From South					Harvard Street From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	9	7	**5**	**0**	**21**	**0**	**118**	**18**	**0**	**136**	**0**	**0**	**0**	**0**	**0**	**2**	**113**	**0**	**0**	**115**	**272**
05:15 PM	**7**	**8**	4	0	19	0	119	24	0	143	0	0	0	0	0	9	120	0	0	129	291
05:30 PM	**10**				**23**	0	121	27	0	148	0	0	0	0	0	4	**130**			**134**	
05:45 PM	**4**	**7**	**2**	**0**	**13**	**0**	**137**	**30**	0	**167**	**0**	**0**	**0**	**0**	**0**	**12**	122	0	0	134	**314**
Total Volume	30	30	16	0	76	0	495	99	0	594	0	0	0	0	0	27	485	0	0	512	1182
% App. Total	39.5	39.5	21.1	0		0	83.3	16.7	0		0	0	0	0		5.3	94.7	0	0		
PHF	.750	.938	.800	.000	.826	.000	.903	.825	.000	.889	.000	.000	.000	.000	.000	.563	.933	.000	.000	.955	.941
Cars	30	30	16	0	76	0	476	98	0	574	0	0	0	0	0	27	473	0	0	500	1150
% Cars	100	100	100	0	100	0	96.2	99.0	0	96.6	0	0	0	0	0	100	97.5	0	0	97.7	97.3
Heavy Vehicles	0	0	0	0	0	0	19	1	0	20	0	0	0	0	0	0	12	0	0	12	32
% Heavy Vehicles	0	0	0	0	0	0	3.8	1.0	0	3.4	0	0	0	0	0	0	2.5	0	0	2.3	2.7



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	350	30	70	425	0	0	0	0	30	25	55
Future Volume (vph)	0	350	30	70	425	0	0	0	0	30	25	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	15	12	12	15	12	12	12	12	12	12	12
Total Lost time (s)		4.0		4.0	4.0					4.0	4.0	
Lane Util. Factor		1.00		1.00	1.00					1.00	1.00	
Frpb, ped/bikes		1.00		1.00	1.00					1.00	1.00	
Flpb, ped/bikes		1.00		1.00	1.00					1.00	1.00	
Frt		0.99		1.00	1.00					1.00	0.90	
Flt Protected		1.00		0.95	1.00					0.95	1.00	
Satd. Flow (prot)		1721		1736	1758					1579	1491	
Flt Permitted		1.00		0.33	1.00					0.95	1.00	
Satd. Flow (perm)		1721		595	1758					1579	1491	
Peak-hour factor, PHF	0.95	0.95	0.95	0.97	0.97	0.97	0.92	0.92	0.92	0.66	0.66	0.66
Adj. Flow (vph)	0	368	32	72	438	0	0	0	0	45	38	83
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	0	0	77	0
Lane Group Flow (vph)	0	396	0	72	438	0	0	0	0	45	44	0
Confl. Bikes (#/hr)			10			10						
Heavy Vehicles (%)	0%	5%	3%	4%	4%	0%	0%	0%	0%	0%	0%	0%
Parking (#/hr)		5	5		5					5	5	5
Turn Type		NA		pm+pt	NA					Split	NA	
Protected Phases		2		1	6					4	4	
Permitted Phases				6								
Actuated Green, G (s)		23.6		31.0	31.0					4.5	4.5	
Effective Green, g (s)		23.6		31.0	31.0					4.5	4.5	
Actuated g/C Ratio		0.39		0.51	0.51					0.07	0.07	
Clearance Time (s)		4.0		4.0	4.0					4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0					3.0	3.0	
Lane Grp Cap (vph)		672		369	902					117	111	
v/s Ratio Prot		c0.23		0.01	c0.25					0.03	c0.03	
v/s Ratio Perm				0.09								
v/c Ratio		0.59		0.20	0.49					0.38	0.40	
Uniform Delay, d1		14.6		8.5	9.5					26.6	26.7	
Progression Factor		1.00		1.00	1.00					1.00	1.00	
Incremental Delay, d2		1.3		0.3	1.9					2.1	2.3	
Delay (s)		15.9		8.7	11.4					28.7	29.0	
Level of Service		B		A	B					C	C	
Approach Delay (s)		15.9			11.0			0.0			28.9	
Approach LOS		B			B			A			C	

Intersection Summary			
HCM 2000 Control Delay	15.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	60.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	40.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	WBL	WBT	SBL	SBT
Lane Group Flow (vph)	400	72	438	45	121
v/c Ratio	0.53	0.17	0.47	0.27	0.52
Control Delay	25.2	11.8	14.9	29.4	20.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	25.2	11.8	14.9	29.4	20.3
Queue Length 50th (ft)	138	15	118	15	13
Queue Length 95th (ft)	#292	36	200	30	32
Internal Link Dist (ft)	1		180		129
Turn Bay Length (ft)		125			
Base Capacity (vph)	749	429	937	169	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	0.53	0.17	0.47	0.27	0.52

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	485	25	100	495	0	0	0	0	15	30	30
Future Volume (vph)	0	485	25	100	495	0	0	0	0	15	30	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	15	12	12	15	12	12	12	12	12	12	12
Total Lost time (s)		4.0		4.0	4.0					4.0	4.0	
Lane Util. Factor		1.00		1.00	1.00					1.00	1.00	
Frpb, ped/bikes		1.00		1.00	1.00					1.00	1.00	
Flpb, ped/bikes		1.00		1.00	1.00					1.00	1.00	
Frt		0.99		1.00	1.00					1.00	0.92	
Flt Protected		1.00		0.95	1.00					0.95	1.00	
Satd. Flow (prot)		1761		1752	1775					1579	1538	
Flt Permitted		1.00		0.22	1.00					0.95	1.00	
Satd. Flow (perm)		1761		403	1775					1579	1538	
Peak-hour factor, PHF	0.88	0.88	0.88	0.90	0.90	0.90	0.92	0.92	0.92	0.63	0.63	0.63
Adj. Flow (vph)	0	551	28	111	550	0	0	0	0	24	48	48
RTOR Reduction (vph)	0	2	0	0	0	0	0	0	0	0	45	0
Lane Group Flow (vph)	0	577	0	111	550	0	0	0	0	24	51	0
Confl. Bikes (#/hr)			10			10						
Heavy Vehicles (%)	0%	3%	4%	3%	3%	0%	0%	0%	0%	0%	0%	0%
Parking (#/hr)		5	5		5					5	5	5
Turn Type		NA		pm+pt	NA					Split	NA	
Protected Phases		2		1	6					4	4	
Permitted Phases				6								
Actuated Green, G (s)		31.5		40.1	40.1					4.6	4.6	
Effective Green, g (s)		31.5		40.1	40.1					4.6	4.6	
Actuated g/C Ratio		0.45		0.58	0.58					0.07	0.07	
Clearance Time (s)		4.0		4.0	4.0					4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0					3.0	3.0	
Lane Grp Cap (vph)		795		320	1021					104	101	
v/s Ratio Prot		c0.33		0.02	c0.31					0.02	c0.03	
v/s Ratio Perm				0.18								
v/c Ratio		0.73		0.35	0.54					0.23	0.51	
Uniform Delay, d1		15.6		9.4	9.1					30.9	31.5	
Progression Factor		1.00		1.00	1.00					1.00	1.00	
Incremental Delay, d2		3.3		0.7	2.0					1.1	4.0	
Delay (s)		18.9		10.1	11.1					32.0	35.4	
Level of Service		B		B	B					C	D	
Approach Delay (s)		18.9			11.0			0.0			34.7	
Approach LOS		B			B			A			C	

Intersection Summary			
HCM 2000 Control Delay	16.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	69.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	47.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	WBL	WBT	SBL	SBT
Lane Group Flow (vph)	579	111	550	24	96
v/c Ratio	0.68	0.31	0.52	0.17	0.52
Control Delay	26.1	11.8	13.9	32.7	29.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	26.1	11.8	13.9	32.7	29.7
Queue Length 50th (ft)	232	24	161	10	20
Queue Length 95th (ft)	#409	49	258	22	37
Internal Link Dist (ft)	1		180		129
Turn Bay Length (ft)		125			
Base Capacity (vph)	857	358	1065	143	183
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	0.68	0.31	0.52	0.17	0.52

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	354	32	72	425	0	0	0	0	30	25	55
Future Volume (vph)	0	354	32	72	425	0	0	0	0	30	25	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	15	12	12	15	12	12	12	12	12	12	12
Total Lost time (s)		4.0		4.0	4.0					4.0	4.0	
Lane Util. Factor		1.00		1.00	1.00					1.00	1.00	
Frpb, ped/bikes		1.00		1.00	1.00					1.00	1.00	
Flpb, ped/bikes		1.00		1.00	1.00					1.00	1.00	
Frt		0.99		1.00	1.00					1.00	0.90	
Flt Protected		1.00		0.95	1.00					0.95	1.00	
Satd. Flow (prot)		1721		1736	1758					1579	1491	
Flt Permitted		1.00		0.32	1.00					0.95	1.00	
Satd. Flow (perm)		1721		583	1758					1579	1491	
Peak-hour factor, PHF	0.95	0.95	0.95	0.97	0.97	0.97	0.92	0.92	0.92	0.66	0.66	0.66
Adj. Flow (vph)	0	373	34	74	438	0	0	0	0	45	38	83
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	0	0	77	0
Lane Group Flow (vph)	0	403	0	74	438	0	0	0	0	45	44	0
Confl. Bikes (#/hr)			10			10						
Heavy Vehicles (%)	0%	5%	3%	4%	4%	0%	0%	0%	0%	0%	0%	0%
Parking (#/hr)		5	5		5					5	5	5
Turn Type		NA		pm+pt	NA					Split	NA	
Protected Phases		2		1	6					4	4	
Permitted Phases				6								
Actuated Green, G (s)		23.6		31.0	31.0					4.5	4.5	
Effective Green, g (s)		23.6		31.0	31.0					4.5	4.5	
Actuated g/C Ratio		0.39		0.51	0.51					0.07	0.07	
Clearance Time (s)		4.0		4.0	4.0					4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0					3.0	3.0	
Lane Grp Cap (vph)		672		364	902					117	111	
v/s Ratio Prot		c0.23		0.01	c0.25					0.03	c0.03	
v/s Ratio Perm				0.09								
v/c Ratio		0.60		0.20	0.49					0.38	0.40	
Uniform Delay, d1		14.6		8.5	9.5					26.6	26.7	
Progression Factor		1.00		1.00	1.00					1.00	1.00	
Incremental Delay, d2		1.4		0.3	1.9					2.1	2.3	
Delay (s)		16.1		8.8	11.4					28.7	29.0	
Level of Service		B		A	B					C	C	
Approach Delay (s)		16.1			11.0			0.0			28.9	
Approach LOS		B			B			A			C	

Intersection Summary			
HCM 2000 Control Delay	15.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	60.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	40.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	WBL	WBT	SBL	SBT
Lane Group Flow (vph)	407	74	438	45	121
v/c Ratio	0.54	0.17	0.47	0.27	0.52
Control Delay	25.6	11.8	14.9	29.4	20.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	25.6	11.8	14.9	29.4	20.3
Queue Length 50th (ft)	142	16	118	15	13
Queue Length 95th (ft)	#298	37	200	30	32
Internal Link Dist (ft)	1		180		129
Turn Bay Length (ft)		90			
Base Capacity (vph)	749	424	937	169	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	0.54	0.17	0.47	0.27	0.52

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	489	29	104	495	0	0	0	0	15	30	30
Future Volume (vph)	0	489	29	104	495	0	0	0	0	15	30	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	15	12	12	15	12	12	12	12	12	12	12
Total Lost time (s)		4.0		4.0	4.0					4.0	4.0	
Lane Util. Factor		1.00		1.00	1.00					1.00	1.00	
Frpb, ped/bikes		1.00		1.00	1.00					1.00	1.00	
Flpb, ped/bikes		1.00		1.00	1.00					1.00	1.00	
Frt		0.99		1.00	1.00					1.00	0.93	
Flt Protected		1.00		0.95	1.00					0.95	1.00	
Satd. Flow (prot)		1758		1752	1775					1579	1538	
Flt Permitted		1.00		0.21	1.00					0.95	1.00	
Satd. Flow (perm)		1758		389	1775					1579	1538	
Peak-hour factor, PHF	0.88	0.88	0.88	0.90	0.90	0.90	0.92	0.92	0.92	0.63	0.63	0.63
Adj. Flow (vph)	0	556	33	116	550	0	0	0	0	24	48	48
RTOR Reduction (vph)	0	3	0	0	0	0	0	0	0	0	45	0
Lane Group Flow (vph)	0	586	0	116	550	0	0	0	0	24	51	0
Confl. Bikes (#/hr)			10			10						
Heavy Vehicles (%)	0%	3%	4%	3%	3%	0%	0%	0%	0%	0%	0%	0%
Parking (#/hr)		5	5		5					5	5	5
Turn Type		NA		pm+pt	NA					Split	NA	
Protected Phases		2		1	6					4	4	
Permitted Phases				6								
Actuated Green, G (s)		31.5		40.1	40.1					4.6	4.6	
Effective Green, g (s)		31.5		40.1	40.1					4.6	4.6	
Actuated g/C Ratio		0.45		0.58	0.58					0.07	0.07	
Clearance Time (s)		4.0		4.0	4.0					4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0					3.0	3.0	
Lane Grp Cap (vph)		794		313	1021					104	101	
v/s Ratio Prot		c0.33		0.02	c0.31					0.02	c0.03	
v/s Ratio Perm				0.19								
v/c Ratio		0.74		0.37	0.54					0.23	0.51	
Uniform Delay, d1		15.7		9.6	9.1					30.9	31.5	
Progression Factor		1.00		1.00	1.00					1.00	1.00	
Incremental Delay, d2		3.6		0.7	2.0					1.1	4.0	
Delay (s)		19.3		10.4	11.1					32.0	35.4	
Level of Service		B		B	B					C	D	
Approach Delay (s)		19.3			11.0			0.0			34.7	
Approach LOS		B			B			A			C	

Intersection Summary			
HCM 2000 Control Delay	16.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	69.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	48.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	WBL	WBT	SBL	SBT
Lane Group Flow (vph)	589	116	550	24	96
v/c Ratio	0.69	0.33	0.52	0.17	0.52
Control Delay	26.7	12.1	13.9	32.7	29.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	26.7	12.1	13.9	32.7	29.7
Queue Length 50th (ft)	238	25	161	10	20
Queue Length 95th (ft)	#419	50	258	22	37
Internal Link Dist (ft)	1		180		129
Turn Bay Length (ft)		90			
Base Capacity (vph)	855	351	1065	143	183
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	0.69	0.33	0.52	0.17	0.52

Intersection Summary

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

SECTION 11

SITE ENGINEERING AND LANDSCAPING PLANS,
ARCHITECTURAL PLANS,
AND STORMWATER REPORT

384 Harvard Street, Brookline

BROOKLINE, MA

10/28/2016 COMPREHENSIVE PERMIT SUBMISSION

PCA PROJECT #: 14091.00

LOCUS PLAN

DRAWING LIST			
Starred	**Sheet Number**	**Sheet Name**	**Sheet Issue Date**
GEN ERAL			
	A0.00	COVER SHEET	10/28/16
LANDSCAPE			
	L-000	ZONING PLAN	10/28/16
	L-100	SITE PREPARATION AND DEMOLITION	10/28/16
	L-101	LAYOUT AND MATERIALS	10/28/16
	L-201	GRADING	10/28/16
	L-301	UTILITY PLAN	10/28/16
	L-401	PLANTING	10/28/16
	L-501	SITE DETAILS	10/28/16
	L-502	SITE DETAILS	10/28/16
	L-601	UTILITY DETAILS	10/28/16
	L-602	UTILITY DETAILS	10/28/16
	L-701	LIGHTING	10/28/16
ARCHITECTURAL			
	A1.01	FLOOR PLANS	10/28/16
	A1.02	BUILDING ELEVATIONS & SECTION	10/28/16

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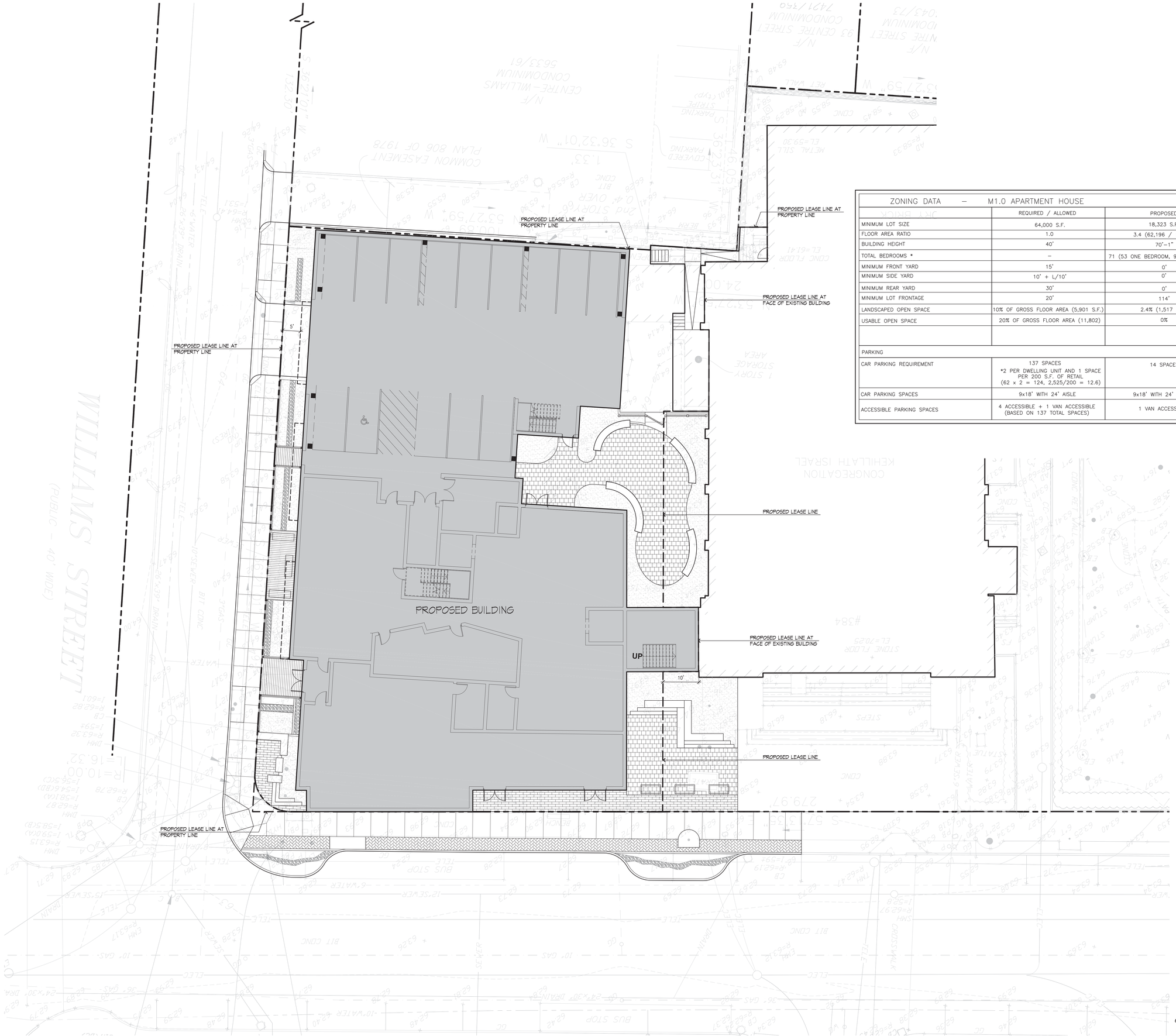

ZONING DATA – M1.0 APARTMENT HOUSE		
	REQUIRED / ALLOWED	PROPOSED
MINIMUM LOT SIZE	64,000 S.F.	18,323 S.F.
FLOOR AREA RATIO	1.0	3.4 (62,196 / 18,323)
BUILDING HEIGHT	40'	70'–1"
TOTAL BEDROOMS *	–	71 (53 ONE BEDROOM, 9 TWO BEDROOM)
MINIMUM FRONT YARD	15'	0'
MINIMUM SIDE YARD	10' + L/10'	0'
MINIMUM REAR YARD	30'	0'
MINIMUM LOT FRONTAGE	20'	114'
LANDSCAPED OPEN SPACE	10% OF GROSS FLOOR AREA (5,901 S.F.)	2.4% (1,517 S.F.)
USABLE OPEN SPACE	20% OF GROSS FLOOR AREA (11,802)	0%
PARKING		
CAR PARKING REQUIREMENT	137 SPACES *2 PER DWELLING UNIT AND 1 SPACE PER 200 S.F. OF RETAIL (62 x 2 = 124, 2,525/200 = 12.6)	14 SPACES
CAR PARKING SPACES	9x18' WITH 24' AISLE	9x18' WITH 24' AISLES
ACCESSIBLE PARKING SPACES	4 ACCESSIBLE + 1 VAN ACCESSIBLE (BASED ON 137 TOTAL SPACES)	1 VAN ACCESSIBLE

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ZONING

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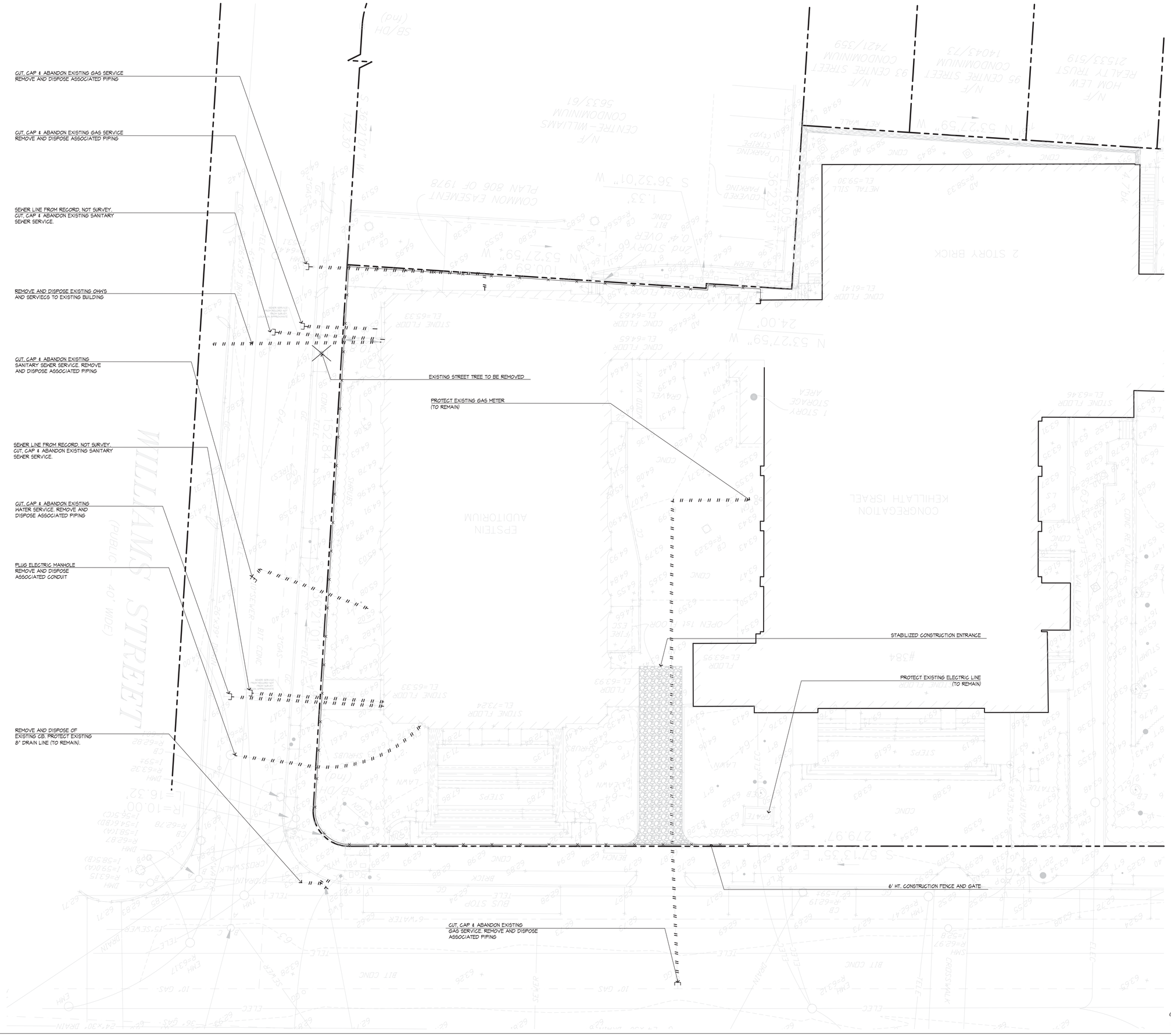

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SITE
PREPARATION
AND
DEMOLITION

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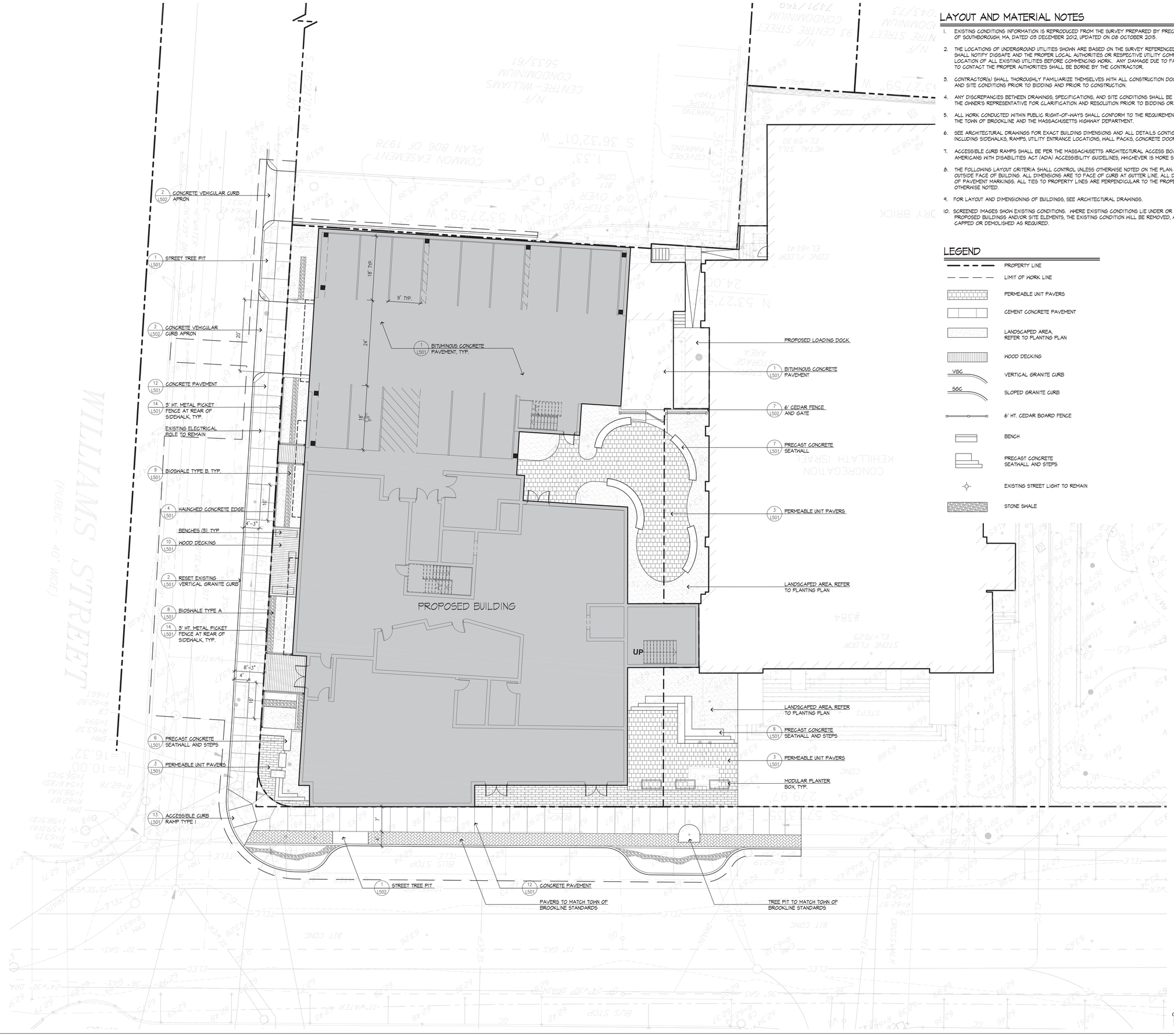

LAYOUT AND MATERIAL NOTES

1. EXISTING CONDITIONS INFORMATION IS REPRODUCED FROM THE SURVEY PREPARED BY PRECISION LAND SURVEYING INC, OF SOUTHBOROUGH, MA, DATED 03 DECEMBER 2012, UPDATED ON 08 OCTOBER 2015.
2. THE LOCATIONS OF UNDERGROUND UTILITIES SHOWN ARE BASED ON THE SURVEY REFERENCED ABOVE. THE CONTRACTOR SHALL NOTIFY DIGSAFE AND THE PROPER LOCAL AUTHORITIES OR RESPECTIVE UTILITY COMPANIES TO CONFIRM THE LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. ANY DAMAGE DUE TO FAILURE OF THE CONTRACTOR TO CONTACT THE PROPER AUTHORITIES SHALL BE BORNE BY THE CONTRACTOR.
3. CONTRACTOR(s) SHALL THOROUGHLY FAMILIARIZE THEMSELVES WITH ALL CONSTRUCTION DOCUMENTS, SPECIFICATIONS, AND SITE CONDITIONS PRIOR TO BIDDING AND PRIOR TO CONSTRUCTION.
4. ANY DISCREPANCIES BETWEEN DRAWINGS, SPECIFICATIONS, AND SITE CONDITIONS SHALL BE REPORTED IMMEDIATELY TO THE OWNER'S REPRESENTATIVE FOR CLARIFICATION AND RESOLUTION PRIOR TO BIDDING OR CONSTRUCTION.
5. ALL WORK CONDUCTED WITHIN PUBLIC RIGHT-OF-WAYS SHALL CONFORM TO THE REQUIREMENTS AND SPECIFICATIONS OF THE TOWN OF BROOKLINE AND THE MASSACHUSETTS HIGHWAY DEPARTMENT.
6. SEE ARCHITECTURAL DRAWINGS FOR EXACT BUILDING DIMENSIONS AND ALL DETAILS CONTIGUOUS TO THE BUILDING, INCLUDING SIDEWALKS, RAMPS, UTILITY ENTRANCE LOCATIONS, WALL PACKS, CONCRETE DOOR PADS, ROOF DRAINS, ETC.
7. ACCESSIBLE CURB RAMPS SHALL BE PER THE MASSACHUSETTS ARCHITECTURAL ACCESS BOARD (AAB) AND THE AMERICANS WITH DISABILITIES ACT (ADA) ACCESSIBILITY GUIDELINES, WHICHEVER IS MORE STRINGENT.
8. THE FOLLOWING LAYOUT CRITERIA SHALL CONTROL UNLESS OTHERWISE NOTED ON THE PLAN. ALL DIMENSIONS ARE TO OUTSIDE FACE OF BUILDING. ALL DIMENSIONS ARE TO FACE OF CURB AT GUTTER LINE. ALL DIMENSIONS ARE TO CENTER OF PAVEMENT MARKINGS. ALL TIES TO PROPERTY LINES ARE PERPENDICULAR TO THE PROPERTY LINE UNLESS OTHERWISE NOTED.
9. FOR LAYOUT AND DIMENSIONING OF BUILDINGS, SEE ARCHITECTURAL DRAWINGS.
10. SCREENED IMAGES SHOW EXISTING CONDITIONS. WHERE EXISTING CONDITIONS LIE UNDER OR ARE IMPINGED UPON BY PROPOSED BUILDINGS AND/OR SITE ELEMENTS, THE EXISTING CONDITION WILL BE REMOVED, ABANDONED AND/OR CAPPED OR DEMOLISHED AS REQUIRED.

LEGEND

- PROPERTY LINE
- LIMIT OF WORK LINE
- PERMEABLE UNIT PAVERS
- CEMENT CONCRETE PAVEMENT
- LANDSCAPED AREA, REFER TO PLANTING PLAN
- WOOD DECKING
- VGC — VERTICAL GRANITE CURB
- SGC — SLOPED GRANITE CURB
- 6' HT. CEDAR BOARD FENCE
- BENCH
- PRECAST CONCRETE SEATWALL AND STEPS
- EXISTING STREET LIGHT TO REMAIN
- STONE SWALE

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LAYOUT AND MATERIALS

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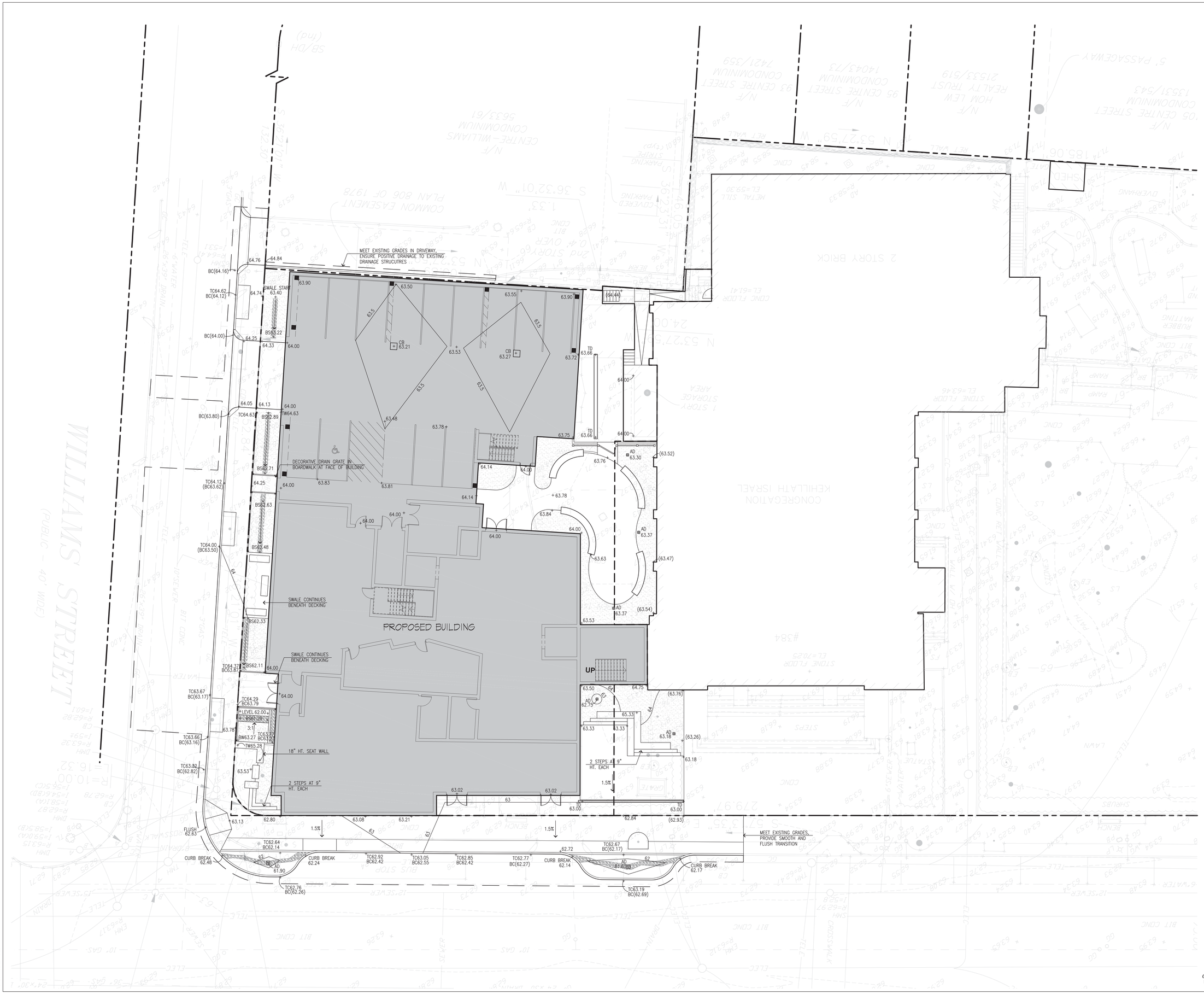

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GRADING

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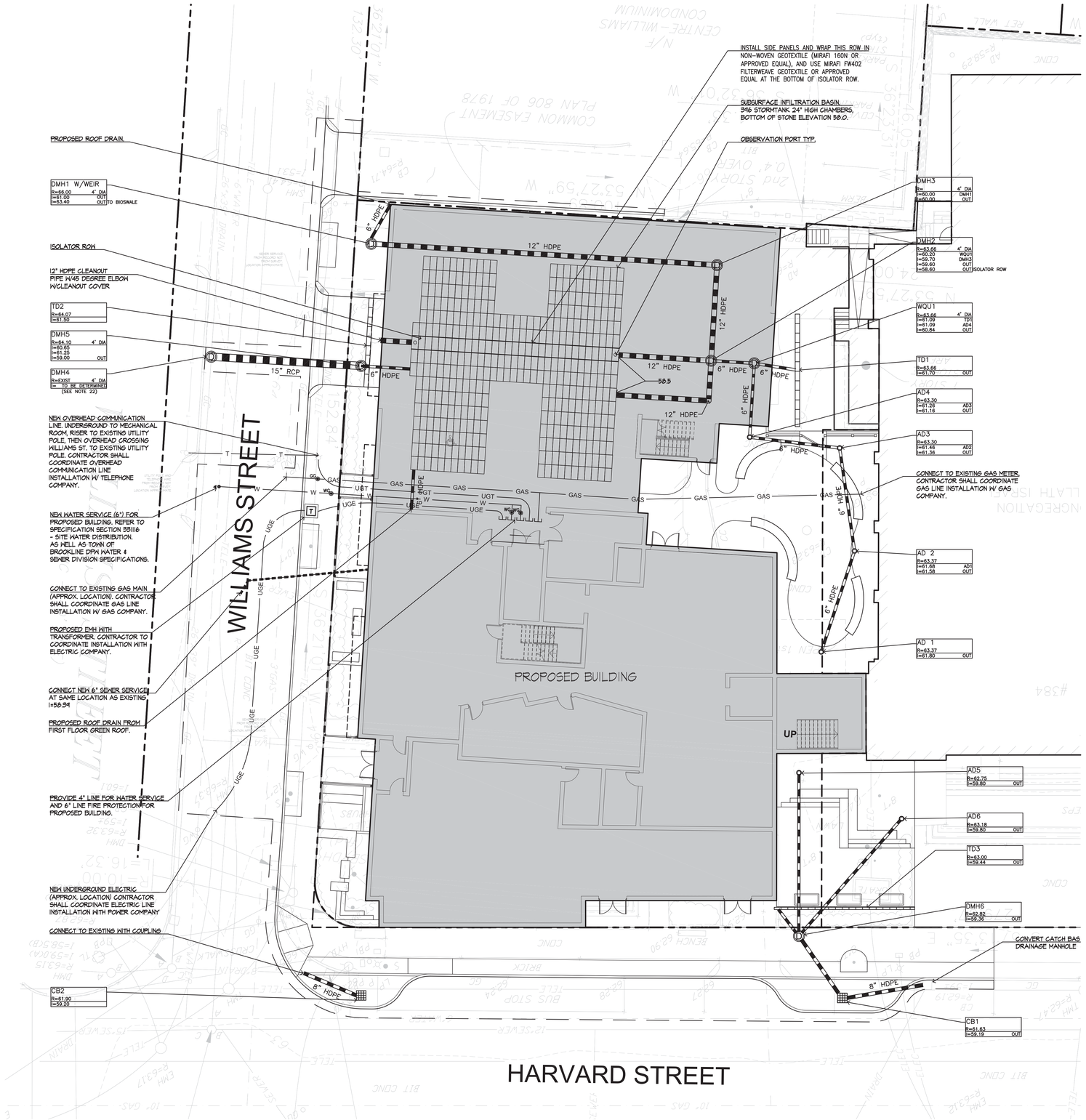

UTILITY NOTES

1. EXISTING CONDITIONS INFORMATION IS REPRODUCED FROM THE SURVEY PREPARED BY PRECISION LAND SURVEYING INC, OF SOUTHBOROUGH, MA, DATED 03 DECEMBER 2012, UPDATED ON 03 OCTOBER 2015.
2. THE LOCATIONS OF UNDERGROUND UTILITIES SHOWN ARE BASED ON THE SURVEY REFERENCED ABOVE (AND RECORD UTILITY INFORMATION WHERE NOTED). THE CONTRACTOR SHALL NOTIFY DIGSAFE AND THE PROPER LOCAL AUTHORITIES OR RESPECTIVE UTILITY COMPANIES TO CONFIRM THE LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. ANY DAMAGE DUE TO FAILURE OF THE CONTRACTOR TO CONTACT THE PROPER AUTHORITIES SHALL BE BORNE BY THE CONTRACTOR. PRIOR TO THE START OF ANY EXCAVATION FOR THE PROJECT, BOTH ON AND OFF THE SITE, THE CONTRACTOR SHALL NOTIFY DIGSAFE AND BE PROVIDED WITH A DIGSAFE NUMBER INDICATING THAT ALL EXISTING UTILITIES HAVE BEEN LOCATED AND MARKED.
3. CONTRACTOR TO ADJUST UTILITY ELEMENTS MEANT TO BE FLUSH WITH GRADE (CLEAN-OUTS,UTILITY MANHOLES, CATCH BASINS, INLETS, ETC.) THAT IS AFFECTED BY SITE WORK OR GRADE CHANGES, WHETHER SPECIFICALLY NOTED ON PLANS OR NOT.
4. ALL WORK TO BE DONE WITHIN PUBLIC RIGHT-OF-WAYS SHALL CONFORM TO THE REQUIREMENTS AND SPECIFICATIONS OF THE TOWN OF BROOKLINE AND THE MASSACHUSETTS DEPARTMENT OF TRANSPORTATION.
5. NEW SEWER AND DRAIN CONNECTIONS MUST BE CORED AND ATTACHED WITH AN INSERT-A-TEE, OR APPROVED EQUAL IF FACTORY WYE IS NOT AVAILABLE OR DAMAGED.
6. THE CONTRACTOR SHALL TV/VIDEO INSPECT THE EXISTING SEWER AND DRAIN SERVICES TO REMAIN.
7. THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTATIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MAY BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ALL UNDERGROUND UTILITIES.
8. WHERE AN EXISTING UTILITY IS FOUND TO CONFLICT WITH THE PROPOSED WORK, THE LOCATION, ELEVATION, AND SIZE OF THE UTILITY SHALL BE ACCURATELY DETERMINED WITHOUT DELAY BY THE CONTRACTOR, AND THE INFORMATION FURNISHED TO THE ENGINEER FOR RESOLUTION OF THE CONFLICT.
9. THE CONTRACTOR SHALL ALTER THE MASONRY OF THE TOP SECTION OF ALL EXISTING DRAINAGE STRUCTURES AS NECESSARY FOR CHANGES IN GRADE, AND RESET ALL WATER AND DRAINAGE FRAMES, GRATES, AND BOXES TO THE PROPOSED FINISH SURFACE GRADE
10. THE CONTRACTOR SHALL MAKE ALL ARRANGEMENTS FOR THE ALTERATION AND ADJUSTMENT OF ALL GAS, ELECTRIC, TELEPHONE, AND ANY OTHER PRIVATE UTILITIES BY THE UTILITY COMPANIES.
11. CONTRACTOR SHALL MAINTAIN, OR ADJUST TO NEW FINISH GRADE, AS NECESSARY ALL UTILITY AND SITE STRUCTURES SUCH AS: LIGHT POLES, SIGN POLES, MANHOLES, CATCH BASINS, HAND HOLES, WATER AND GAS GATES, HYDRANTS, ETC., FROM MAINTAINED UTILITY AND SITE SYSTEMS, UNLESS OTHERWISE NOTED OR DIRECTED BY OWNER'S REPRESENTATIVE.
10. ALL SEWER PIPES SHALL BE PVC PER ASTM D3034, SDR-35 AND ASTM D1784 WITH RUBBER GASKET JOINTS.
13. AREAS OUTSIDE THE LIMITS OF PROPOSED WORK DISTURBED BY THE CONTRACTOR'S OPERATIONS SHALL BE RESTORED BY THE CONTRACTOR TO THEIR ORIGINAL CONDITION, AT THE CONTRACTOR'S EXPENSE.
14. REFER TO ARCHITECTURAL PLANS FOR PROPOSED LOCATION OF UTILITY SERVICE STUBS AT BUILDING. THE LOCATION, SIZE, DEPTH, AND SPECIFICATIONS FOR CONSTRUCTION OF PRIVATE UTILITY SERVICES SHALL BE INSTALLED ACCORDING TO THE REQUIREMENTS PROVIDED BY, AND APPROVED BY, THE RESPECTIVE UTILITY COMPANY (GAS, TELEPHONE, ELECTRICAL, ETC)
15. FINAL DESIGN AND LOCATIONS AT THE BUILDING WILL BE PROVIDED BY THE ARCHITECT. THE CONTRACTOR SHALL COORDINATE THE INSTALLATION OF THE UTILITY CONNECTIONS WITH THE RESPECTIVE COMPANIES PRIOR TO ANY UTILITY CONSTRUCTION.
16. ALL CEMENT LINED DUCTILE IRON JOINTS AT FITTINGS (CLASS 52) VALVES, AND HYDRANT LATERALS SHALL BE MECHANICAL JOINT WITH NEOPRENE GASKETS. JOINTS AT OTHER LOCATIONS SHALL BE PUSH-ON TYPE WITH NEOPRENE OR SYNTHETIC RUBBER GASKETS.
17. ALL WATER GATES SHALL OPEN AS PER TOWN OF BROOKLINE REQUIREMENTS. HYDRANTS AND VALVES SHALL OPEN RIGHT.
18. ALL WATER LINES SHALL HAVE A MINIMUM OF 5.0 FEET OF GROUND COVER AND A MINIMUM OF 10 FOOT SEPARATION FROM THE SEWER SYSTEM. AT WATER AND SEWER CROSSINGS, THE WATER LINE SHALL BE ENCASED IN SIX INCHES OF CONCRETE FOR A DISTANCE OF 10 FEET ON EITHER SIDE OF THE CROSSING PROTECT AND MAINTAIN EXISTING ON-SITE UTILITY STRUCTURES AND PIPES UNLESS OTHERWISE NOTED.
19. CONTRACTOR SHALL PROTECT ALL STORMWATER INFRASTRUCTURE FROM EROSION AND SEDIMENT UNTIL THE PROJECT SITE HAS REACHED PERMANENT STABILIZATION BY THE OWNERS REPRESENTATIVE. IN THE EVENT SEDIMENT DOES ENTER THE STORMWATER SYSTEM THE CONTRACTOR SHALL CLEAN AND REMOVE ALL SEDIMENT.
20. ROOF DRAIN TIE-INS, TRENCH DRAIN TIE-INS, DRAIN LINES, AND SANITARY SEWER LINES WILL BE INSPECTED PRIOR TO BACKFILLING AND PAVING
21. PLANS SHALL COMPLY WITH TOWN OF BROOKLINE MINIMUM REQUIREMENTS.
22. THE CONTRACTOR SHALL FIELD VERIFY ALL INVERTS OF EXISTING UTILITIES TO BE REUSED. THE CONTRACTOR SHALL PROVIDE FIELD VERIFICATION TO THE ENGINEER FOR REVIEW. THE CONTRACTOR SHALL NOT ORDER ANY UTILITY STRUCTURES UNTIL EXISTING INVERTS ARE FIELD VERIFIED AND REVIEWED BY THE ENGINEER. THE CONTRACTOR SHALL CLEAN ALL EXISTING UTILITIES TO BE REUSED, INCLUDING ALL DRAINAGE PIPING AND STRUCTURES.
23. CONTRACTOR SHALL PROVIDE ALL CCTV VIDEOS TO TOWN OF BROOKLINE.

PROPOSED UTILITY LEGEND

PROPERTY LINE	
LIMIT OF WORK LINE	
SEWER LINE	
DRAIN LINE	
FOUNDATION DRAIN	FD
WATER LINE	W
GAS LINE	GAS
UNDERGROUND ELECTRIC	UGE
OVERHEAD COMMUNICATION LINE	T
TRENCH DRAIN	
CATCH BASIN OR LEACHING CATCH BASIN/DRY WELL	
AREA DRAIN	
DRAIN MANHOLE OR WATER QUALITY UNIT	
ELECTRIC MANHOLE AND TRANSFORMER	
WATER GATE	WG
TAPPING SLEEVE AND VALVE	
END CAP/PLUG	
GAS GATE	GG
HDPE	HIGH DENSITY POLYETHYLENE
WQU	WATER QUALITY UNIT

0' 5' 10' 20'

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UTILITY PLAN

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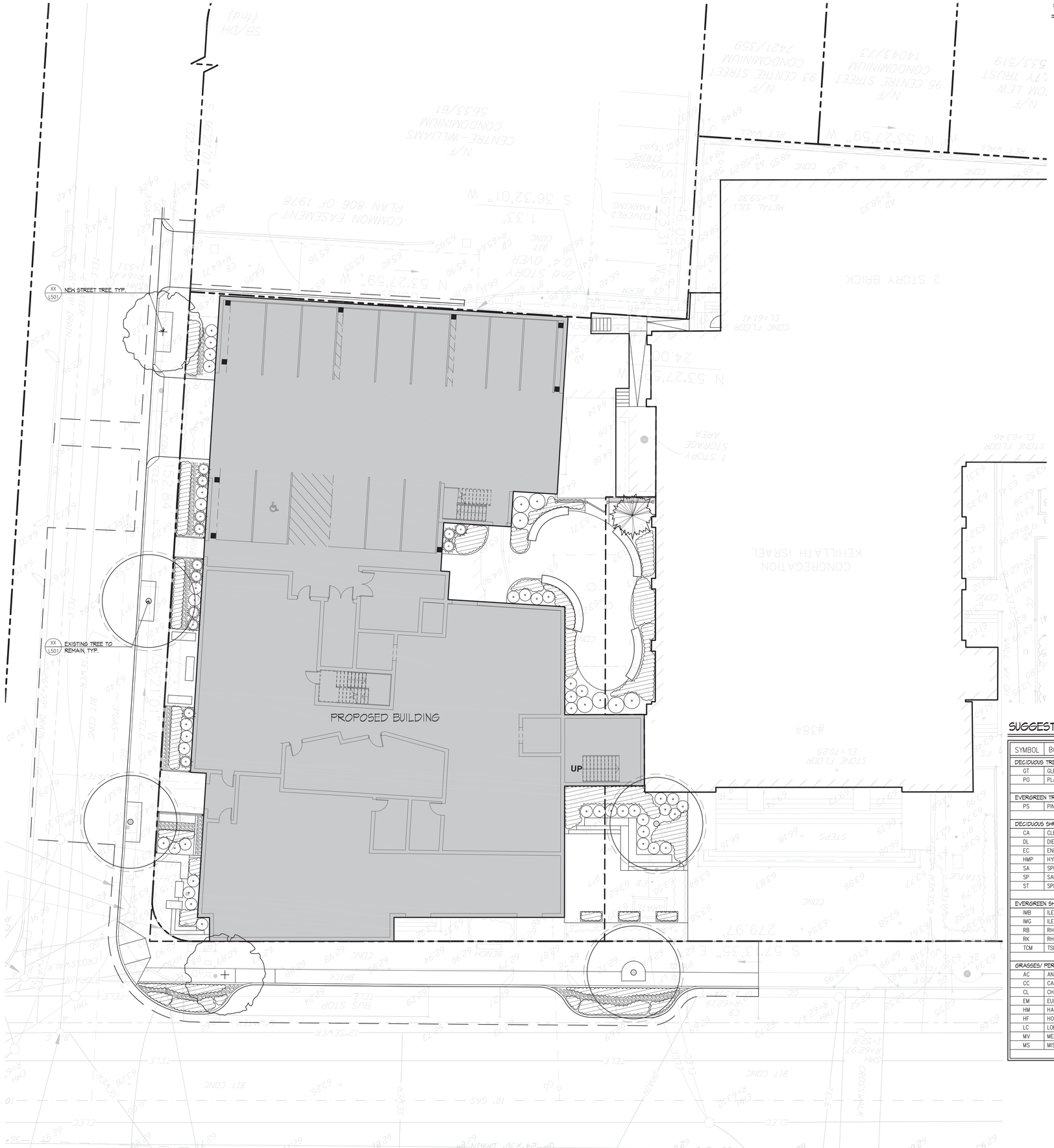

PLANTING NOTES

1. EXISTING CONDITIONS INFORMATION IS REPRODUCED FROM THE SURVEY PREPARED BY PRECISION LAND SURVEYING INC, OF SOUTHBOROUGH, MA, DATED 05 DECEMBER 2012, UPDATED ON 08 OCTOBER 2015.
2. THE LOCATIONS OF UNDERGROUND UTILITIES SHOWN ARE BASED ON THE SURVEY REFERENCED ABOVE. THE CONTRACTOR SHALL CONTACT DIGSAFE AND THE PROPER LOCAL AUTHORITIES OR RESPECTIVE UTILITY COMPANIES TO CONFIRM THE LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. ANY DAMAGE DUE TO FAILURE OF THE CONTRACTOR TO CONTACT THE PROPER AUTHORITIES SHALL BE BORNE BY THE CONTRACTOR.
3. CONTRACTOR SHALL BEGIN MAINTENANCE IMMEDIATELY AFTER PLANTING AND WILL CONTINUE UNTIL FINAL WRITTEN ACCEPTANCE OF PLANT MATERIAL.
4. LANDSCAPE ARCHITECT TO FLAG ALL TREES TO BE TRANSPLANTED PRIOR TO CONSTRUCTION START.
5. CONTRACTOR SHALL VERIFY ALL TREE REMOVALS AND/OR TRANSPLANTS WITH OWNER'S REPRESENTATIVE PRIOR TO CONSTRUCTION START.
6. CONTRACTOR SHALL MAINTAIN POSITIVE DRAINAGE AWAY FROM ALL BUILDING FOUNDATIONS, STRUCTURES, AND PLANTING BEDS.
7. MAXIMUM SLOPE WITHIN DISTURBED AREAS SHALL NOT EXCEED 3:1, UNLESS OTHERWISE NOTED.
8. THE LANDSCAPE CONTRACTOR SHALL SUPPLY ALL PLANT MATERIALS IN QUANTITIES SUFFICIENT TO COMPLETE ALL PLANTINGS SHOWN ON THIS DRAWING.
9. ALL MATERIALS SHALL CONFORM TO THE GUIDELINES ESTABLISHED BY THE AMERICAN NURSERY AND LANDSCAPE ASSOCIATION.
10. ALL PLANTS SHALL BEAR THE SAME RELATIONSHIP TO FINISH GRADE AS TO ORIGINAL GRADES BEFORE DIGGING.
11. ALL PLANTS TO BE BALLED IN BURLAP OR CONTAINERIZED.
12. MULCH FOR PLANTED AREAS TO BE AGED PINE BARK. PARTIALLY DECOMPOSED, DARK BROWN IN COLOR AND FREE OF WOOD CHIPS THICKER THAN 1/4 INCH.
13. PLANTING SOIL MIX: LOAM THOROUGHLY INCORPORATED WITH ROTTED MANURE PROPORTIONED 5 C.Y. TO 1 C.Y. OR EQUIVALENT. FERTILIZER ADDED PER RECOMMENDED RATES OF SOILS ANALYSIS.
14. THE LANDSCAPE CONTRACTOR SHALL GUARANTEE ALL PLANT MATERIALS FOR ONE (1) FULL YEAR FROM DATE OF ACCEPTANCE.
15. ALL PLANT MATERIALS ARE SUBJECT TO THE APPROVAL OF THE LANDSCAPE ARCHITECT, AT THE NURSERY, AND AT THE SITE.
16. ALL AREAS OF THE SITE WHICH HAVE BEEN DISTURBED AND NOT OTHERWISE DEVELOPED SHALL BE LOAMED AND SEEDED WITH A MINIMUM DEPTH OF 6" DEPTH TOPSOIL.
17. PLANT SPECIES AS INDICATED IN THE PLANT LIST ARE SUGGESTIONS ONLY. FINAL SELECTION OF SPECIES SHALL OCCUR AT THE TIME OF PLANT PURCHASE, DEPENDING ON AVAILABILITY. PLANT SIZE AND QUANTITY SHALL NOT CHANGE WITHOUT APPROVAL OF OWNER'S REPRESENTATIVE.
18. ALL AREAS WITHIN PROJECT LIMITS SHALL BE DRIP IRRIGATED WITH WATER CONSERVING HIGH EFFICIENCY SYSTEM.

LEGEND

- EXISTING TREE
- DECIDUOUS TREE
- ORNAMENTAL TREE
- EVERGREEN TREE
- DECIDUOUS SHRUBS
- EVERGREEN SHRUBS
- GROUNDCOVER AND/OR PERENNIAL MASSING
- LIMIT OF WORK
- PROPERTY LINE

SUGGESTED PLANT LIST

SYMBOL	BOTANICAL NAME	COMMON NAME	SIZE	COMMENT
DECIDUOUS TREES				
GT	GLEDITSIA TRIACANTHOS 'INERMIS'	THORNLESS HONEYLOCUST	3 –3 1/2" CAL.	
PO	PLATANUS OCCIDENTALIS	AMERICAN SYCAMORE	3 –3 1/2" CAL.	
EVERGREEN TREES				
PS	PINUS STROBUS 'FASTIGIATA'	FASTIGIATE WHITE PINE	6–8' HT.	
DECIDUOUS SHRUBS				
CA	CLETHRA ALNIFOLIA 'HUMMINGBIRD'	SWEET PEPPERBUSH	2–3' HT.	
DL	DIERVILLA LONICERA	LOW BUSH HONEYSUCKLE	2–3' HT.	
EC	ENKIANTHUS CAMPANULATUS "RED VELVET'	RED VELVET ENKIANTHUS	2–3' HT.	
HMP	HYDRANGEA MACROPHYLLA 'PIA'	PIA HYDRANGEA	2–3" HT.	
SA	SPIRAEA ALBA	MEADOW SWEET	2–3' HT.	
SP	SALIX PURPUREA 'NANA'	BLUE ARTIC WILLOW	2–3' HT.	
ST	SPIRAEA TOMENTOSA	STEEPLEBUSH	2–3' HT.	
EVERGREEN SHRUBS				
IMB	ILEX MESERVEAE 'CHINA BOY'	CHINA BOY HOLLY	2–3' HT.	
IMG	ILEX MESERVEAE 'CHINA GIRL'	CHINA GIRL HOLLY	2–3' HT.	
RB	RHODODENDRON 'BOULE DE NEIGE'	BOULE DE NEIGE RHODODENDRON	2–3' HT.	
RK	RHODODENDRON 'KEN JANEK'	KEN JANEK RHODODENDRON	2–3' HT.	
TCM	TSUGA CANADENSIS 'MINUTA'	DWARF HEMLOCK	2–3' HT.	
GRASSES/ PERENNIALS				
AC	ANEMONE CANADENSIS	WINDFLOWER	#3 POT	12" SPACING
CC	CAREX CRINITA	CATERPILLER SEDGE	#3 POT	18" SPACING
CL	CHASMANTHIUM LATIFOLIUM	NORTHERN SEA OATS	#3 POT	12" SPACING
EM	EUPATORIUM MACULATUM	JOE PYE WEED	#3 POT	18" SPACING
HM	HAKONECHOLA MACRA	GOLDEN JAPANESE FOREST GRASS	#3 POT	18" SPACING
HF	HOSTA FORTUNEI	GOLDEN–EDGED HOSTA	#4 POT	18 SPACING
LC	LOBELIA CARDINALIS	CARDINAL FLOWER	#3 POT	12" SPACING
MV	MERTENSIA VIRGINICA	VIRGINIA BLUEBELLS	#4 POT	12" SPACING
MS	MISCANTHUS SINENSIS 'MORNING LIGHT'	MAIDEN GRASS	#3 POT	2' SPACING

0' 5' 10' 20'

PCA
PRELLWITZ CHILINSKI ASSOCIATES
Architecture Planning Interiors

ARCHITECT:
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LANDSCAPE ARCHITECT:
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PCA PROJECT #: 14091.00

384 Harvard Street, Brookline

Brookline, MA

REVISIONS:

MASSACHUSETTS JOSEPH F. GILLIS NO. 171 REGISTERED LANDSCAPE ARCHITECT

ORIGINAL ISSUE:
COMPREHENSIVE PERMIT SUBMISSION
10/28/16

SCALE: AS NOTED

PLANTING

L-401

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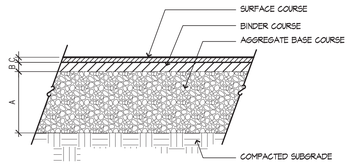
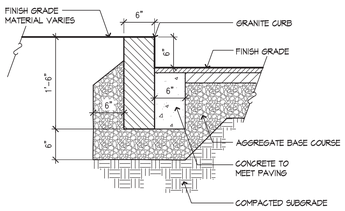
	A	B	C
BIT. CONCRETE WALK	6"	1 1/2"	1"
BIT. CONCRETE DRIVE	12"	2 1/2"	1 1/2"

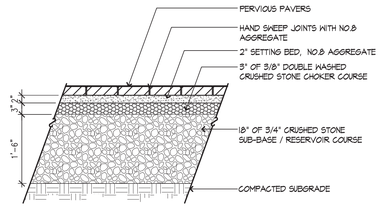
* SUBJECT TO FINAL GEOTECHNICAL APPROVAL.



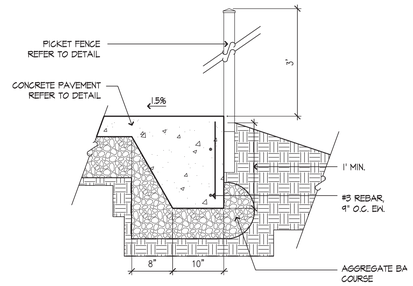
1 BITUMINOUS CONCRETE PAVEMENT
SCALE: NOT TO SCALE



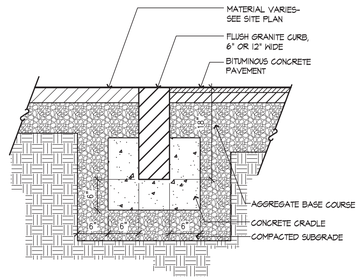
2 VERTICAL GRANITE CURB
SCALE: NOT TO SCALE



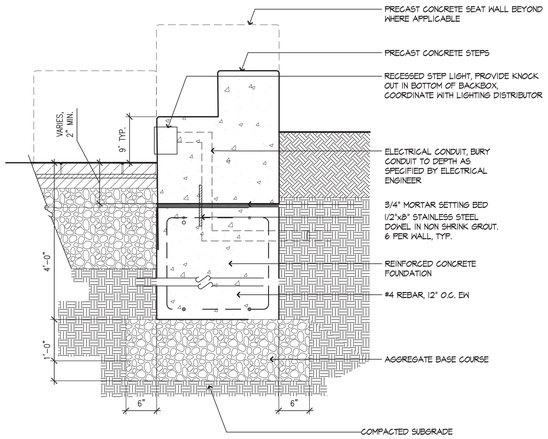
3 PERMEABLE UNIT PAVERS
SCALE: NOT TO SCALE



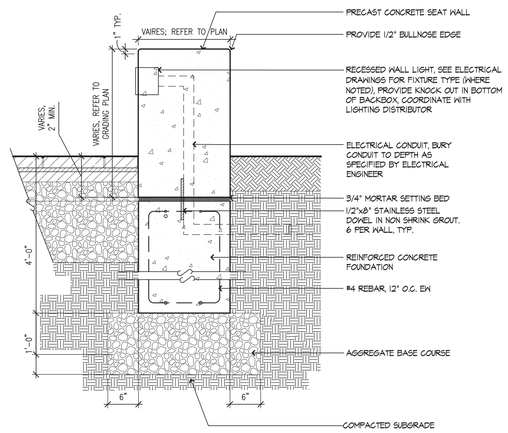
4 HAUNCHED CONCRETE EDGE
SCALE: NOT TO SCALE



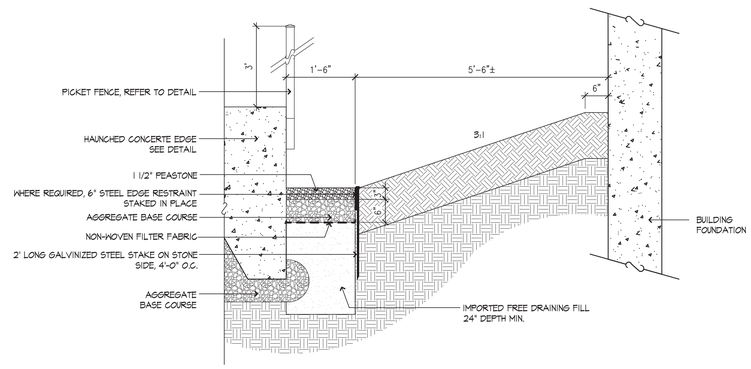
5 FLUSH GRANITE CURB
SCALE: NOT TO SCALE



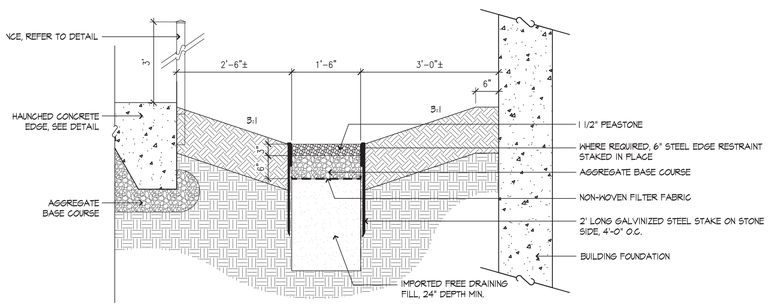
6 PRECAST CONCRETE STEPS
SCALE: NOT TO SCALE



7 PRECAST CONCRETE SEATWALL
SCALE: NOT TO SCALE



8 BIOSWALE TYPE A
SCALE: NOT TO SCALE



9 BIOSWALE TYPE B
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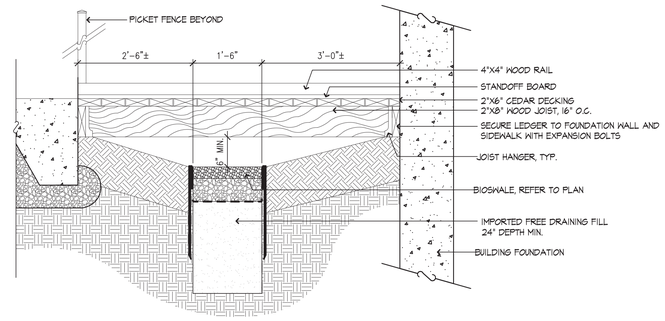
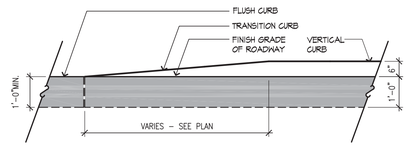


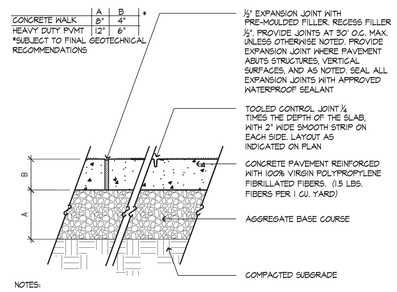
10 WOOD DECKING
SCALE: NOT TO SCALE



11 TRANSITION CURB
SCALE: NOT TO SCALE

	A	B	*
CONCRETE WALK	8"	4"	
HEAVY DUTY PVMT	12"	6"	

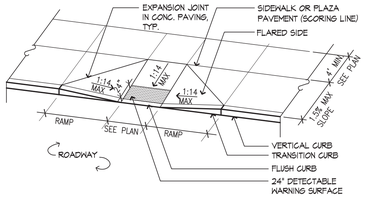
*SUBJECT TO FINAL GEOTECHNICAL RECOMMENDATIONS



NOTES:

PROVIDE LIGHT BROOM FINISH PERPENDICULAR TO THE TRAFFIC FLOW UNLESS OTHERWISE NOTED

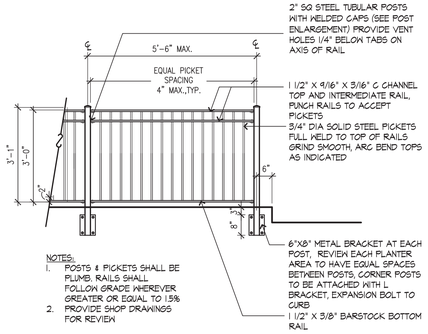
12 CONCRETE PAVEMENT
SCALE: NOT TO SCALE



NOTES:

1. RAMP CROSS SECTION TO BE THE SAME AS ADJACENT SIDEWALK; I.E. DEPTH OF SURFACE AND FOUNDATION.
2. DIMENSIONS ARE SUBJECT TO CHANGE IN FIELD. ALL SLOPES AND DIMENSIONS TO COMPLY WITH A.D.A. AND MAAB REQUIREMENTS.
3. PROVIDE EXPANSION JOINT AT TOPS OF RAMP AND AT BACK OF WALK AT INTERFACE OF CURB.
4. PROVIDE HEAVY BROOM FINISH ON RAMP AND SIDE SLOPES PERPENDICULAR TO FLOW OF TRAFFIC. MINIMUM WALK DIMENSIONS ARE FROM BACK OF CURB.
5. TRANSITION CURB LENGTH AS REQUIRED TO MEET CODE.
6. FIXED OBJECTS (I.e. UTILITY POLES, HYDRANTS ETC.) MUST NOT ENCROACH ON ANY PART OF A WHEELCHAIR RAMP, INCLUDING TRANSITION SLOPES.
7. AT NO TIME IS ANY PART OF THE WHEELCHAIR RAMP, EXCLUDING CURB TRANSITIONS, TO BE LOCATED OUTSIDE OF THE CROSSWALK.

13 ACCESSIBLE CURB RAMP TYPE 1
SCALE: NOT TO SCALE



NOTES:

1. POSTS & PICKETS SHALL BE PLUMB. RAILS SHALL FOLLOW GRADE WHEREVER GREATER OR EQUAL TO 1.5%
2. PROVIDE SHOP DRAWINGS FOR REVIEW

14 METAL PICKET FENCE
SCALE: NOT TO SCALE

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PCA PROJECT #: 14091.00

384 Harvard Street, Brookline

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REVISIONS:

ORIGINAL ISSUE:
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SUBMISSION
10/28/16

SCALE: AS NOTED

SITE DETAILS

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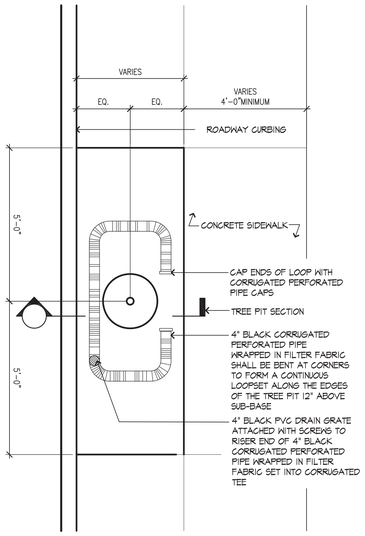
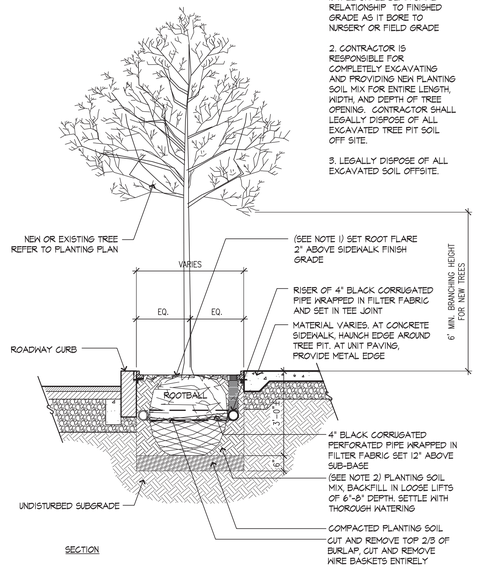


NOTES:

1. TREE SHALL BEAR SAME RELATIONSHIP TO FINISHED GRADE AS IT BORE TO NURSERY OR FIELD GRADE

2. CONTRACTOR IS RESPONSIBLE FOR COMPLETELY EXCAVATING AND PROVIDING NEW PLANTING SOIL MIX FOR ENTIRE LENGTH, WIDTH, AND DEPTH OF TREE OPENING. CONTRACTOR SHALL LEGALLY DISPOSE OF ALL EXCAVATED TREE PIT SOIL OFF SITE.

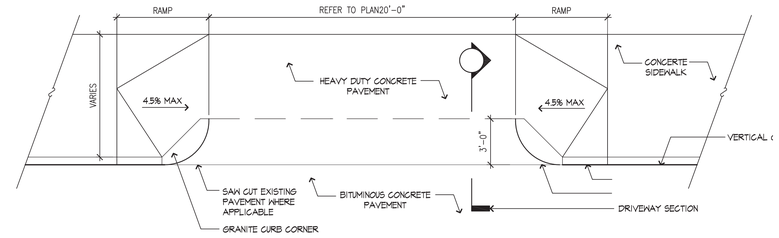
3. LEGALLY DISPOSE OF ALL EXCAVATED SOIL OFFSITE.

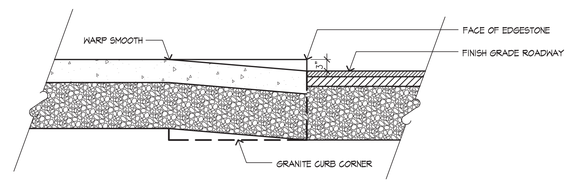


SECTION

1 STREET TREE PIT

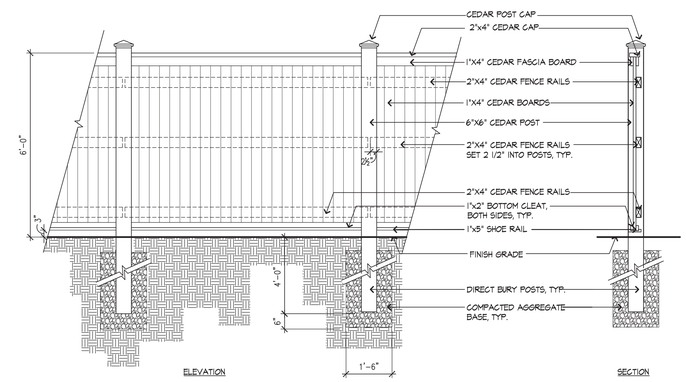
SCALE: NOT TO SCALE





2 CONCRETE VEHICULAR CURB APRON

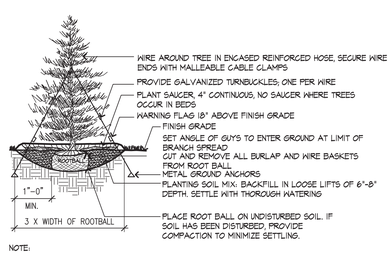
SCALE: NOT TO SCALE



NOTE:
SUBMIT CEDAR POST CAP PRODUCT CUT SHEETS FOR APPROVAL BY LANDSCAPE ARCHITECT

3 CEDAR FENCE

SCALE: NOT TO SCALE



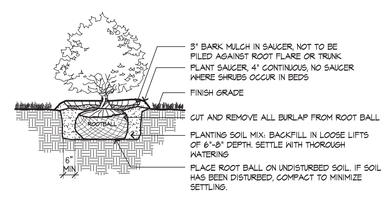
NOTE:

1. TREE SHALL BEAR SAME RELATIONSHIP TO FINISHED GRADE AS IT BORE TO NURSERY OR FIELD GRADE

2. INSTALL THREE GUYS PER TREE; EQUALLY SPACED AROUND BALL. ATTACH GUYS AT 2/3 HEIGHT OF TREE; USE DOUBLE STRAND GALVANIZED STEEL WIRE

4 EVERGREEN TREE PLANTING

SCALE: NOT TO SCALE



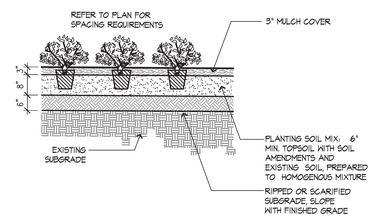
NOTES:

1. SHRUB SHALL BEAR SAME RELATIONSHIP TO FINISHED GRADE AS IT BORE TO NURSERY OR FIELD GRADE

2. WHERE SHRUBS OCCUR IN GROUPINGS IN PLANT BEDS, PROVIDE 2 - FOOT DEEP CONTINUOUS LOAM BED.

5 SHRUB PLANTING

SCALE: NOT TO SCALE



6 GROUNDCOVER PLANTING

SCALE: NOT TO SCALE

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PCA PROJECT #: 14091.00

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Brookline, MA

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MASSACHUSETTS REGISTERED LANDSCAPE ARCHITECT
JOSEPH T. GERARDI
No. 771

ORIGINAL ISSUE:
COMPREHENSIVE PERMIT SUBMISSION
10/28/16

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SITE DETAILS

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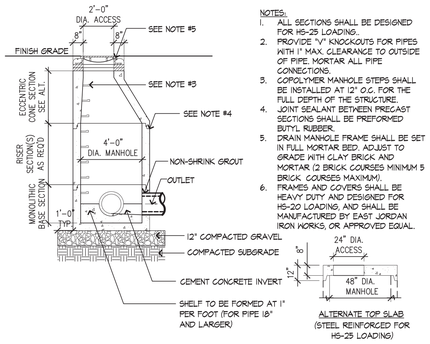
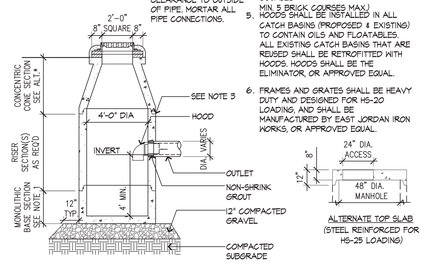


NOTES:
1. ALL SECTIONS SHALL BE DESIGNED FOR HS-25 LOADING.
2. PROVIDE "V" KNOCKOUTS FOR PIPES WITH 1" MAX. CLEARANCE TO OUTSIDE OF PIPE. MORTAR ALL PIPE CONNECTIONS.
3. COPOLYMER MANHOLE STEPS SHALL BE INSTALLED AT 12" O.C. FOR THE FULL DEPTH OF THE STRUCTURE.
4. JOINT SEALANT BETWEEN PRECAST SECTIONS SHALL BE PREFORMED BUTYL RUBBER.
5. DRAIN MANHOLE FRAME SHALL BE SET IN FULL MORTAR BED. ADJUST TO GRADE WITH CLAY BRICK AND MORTAR (2 BRICK COURSES MINIMUM 5 BRICK COURSES MAXIMUM).
6. FRAMES AND COVERS SHALL BE HEAVY DUTY AND DESIGNED FOR HS-20 LOADING, AND SHALL BE MANUFACTURED BY EAST JORDAN IRON WORKS, OR APPROVED EQUAL.

1 DRAIN MANHOLE (TYP.)
NOT TO SCALE

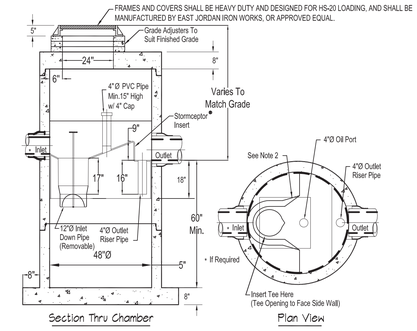


NOTES:
1. ALL SECTIONS SHALL BE DESIGNED FOR HS-25 LOADING.
2. PROVIDE "V" KNOCKOUTS FOR PIPES WITH 1" MAX. CLEARANCE TO OUTSIDE OF PIPE. MORTAR ALL PIPE CONNECTIONS.
3. JOINT SEALANT BETWEEN PRECAST SECTIONS SHALL BE PREFORMED BUTYL RUBBER.
4. CATCH BASIN FRAME SHALL BE SET IN FULL MORTAR BED. ADJUST TO GRADE WITH CLAY BRICK AND MORTAR. (2 BRICK COURSES MIN. 5 BRICK COURSES MAX.)
5. HOODS SHALL BE INSTALLED IN ALL CATCH BASINS (PROPOSED & EXISTING) TO CONTAIN OILS AND FLOATABLES. ALL EXISTING CATCH BASINS THAT ARE REUSED SHALL BE RETROFITTED WITH HOODS. HOODS SHALL BE THE ELIMINATOR, OR APPROVED EQUAL.
6. FRAMES AND GRATES SHALL BE HEAVY DUTY AND DESIGNED FOR HS-20 LOADING, AND SHALL BE MANUFACTURED BY EAST JORDAN IRON WORKS, OR APPROVED EQUAL.

2 NEW/PROPOSED CATCH BASIN
NOT TO SCALE

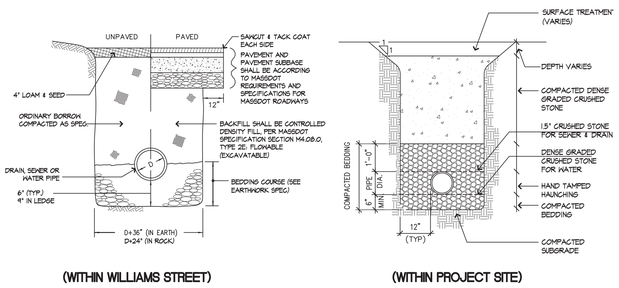
Rinker MATERIALS™ — Concrete Pipe Division

STC 450i Precast Concrete Stormceptor®
(450 U.S. Gallon Capacity)

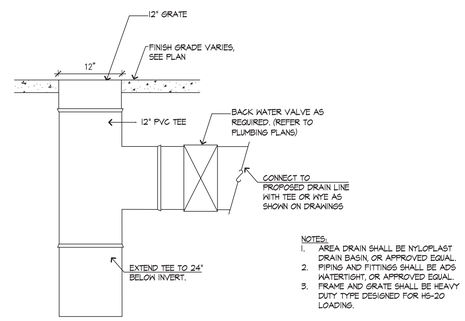


Notes:
1. The Use Of Flexible Connection Is Recommended at The Inlet and Outlet Where Applicable.
2. The Cover Should be Positioned Over The Inlet Drop Pipe and The Oil Port.
3. The Stormceptor System is protected by one or more of the following U.S. Patents: #4485148, #5498331, #5125760, #5753119, #5844181, #6268765, #6371690.
4. Contact a Concrete Pipe Division representative for further details not listed on this drawing.

3 STORMCEPTOR STC-450
SCALE: N.T.S.

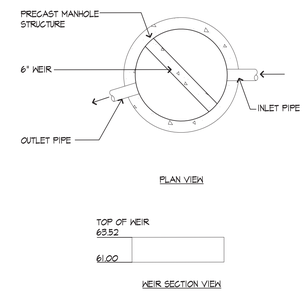


4 UTILITY TRENCH
SCALE: N.T.S.

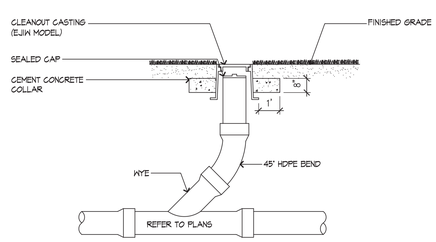


NOTES:
1. AREA DRAIN SHALL BE NYLOPLAST DRAIN BASIN, OR APPROVED EQUAL.
2. PIPING AND FITTINGS SHALL BE ADS WATERTIGHT, OR APPROVED EQUAL.
3. FRAME AND GRATE SHALL BE HEAVY DUTY TYPE DESIGNED FOR HS-20 LOADING.

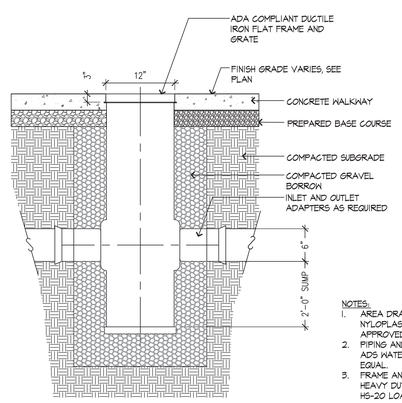
5 AREA DRAIN CONNECTION
SCALE: N.T.S.



6 DMH1 WITH WEIR
SCALE: N.T.S.

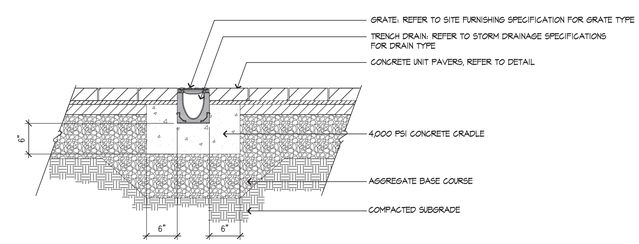


7 DRAINAGE CLEANOUT
SCALE: N.T.S.



NOTES:
1. AREA DRAIN SHALL BE NYLOPLAST DRAIN BASIN, OR APPROVED EQUAL.
2. PIPING AND FITTINGS SHALL BE ADS WATERTIGHT, OR APPROVED EQUAL.
3. FRAME AND GRATE SHALL BE HEAVY DUTY TYPE DESIGNED FOR HS-20 LOADING.

8 AREA DRAIN
SCALE: N.T.S.



1. TRENCH DRAIN SHALL BE HEAVY DUTY TYPE DESIGNED FOR HS-20 LOADING.
2. CONCRETE SHALL BE COMPRESSIVE STRENGTH 4000 PSI, TYPE II CEMENT.
3. TRENCH DRAIN GRATE SHALL MEET AMERICANS WITH DISABILITY (ADA) REGULATIONS.
4. TRENCH DRAINS SHALL BE INSTALLED AT DOORWAY ENTRANCES ALONG BOYLSTON STREET, AND PIPING FROM TRENCH DRAINS SHALL BE CONNECTED TO NEAREST STORMWATER STRUCTURE, AS SHOWN ON THE UTILITY PLAN (SHEET L-301).

9 TRENCH DRAIN
SCALE: N.T.S.

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UTILITY DETAILS

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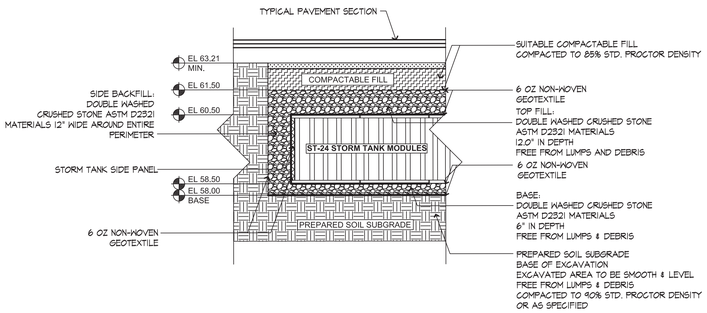
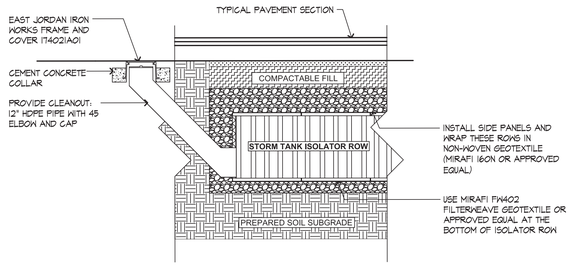


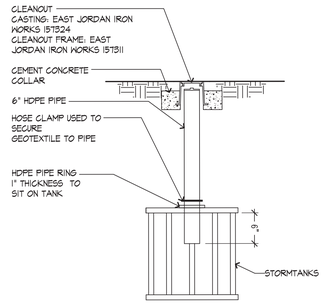
1 SUBSURFACE INFILTRATION BASIN

SCALE: NTS



2 ISOLATOR ROW

SCALE: NTS



3 OBSERVATION PORT

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384 Harvard Street, Brookline

Brookline, MA

PCA PROJECT #: 14091.00

REVISIONS:

COMMONWEALTH OF MASSACHUSETTS
FRANK HOLMES
CIVIL
No. 40053
REGISTERED PROFESSIONAL ENGINEER

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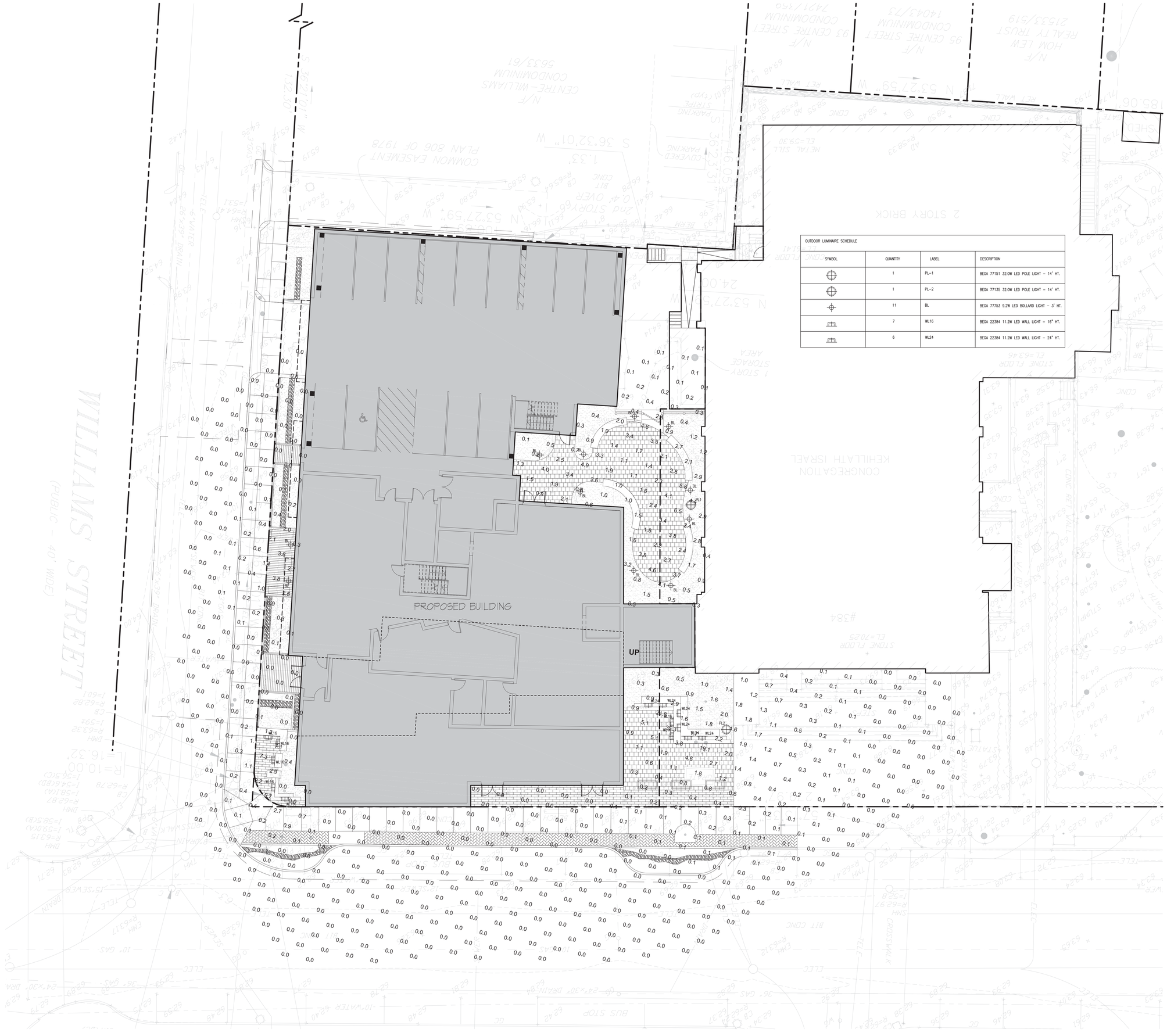

OUTDOOR LUMINAIRE SCHEDULE

SYMBOL	QUANTITY	LABEL	DESCRIPTION
	1	PL-1	BEGA 77151 32.0W LED POLE LIGHT – 14' HT.
	1	PL-2	BEGA 77135 32.0W LED POLE LIGHT – 14' HT.
	11	BL	BEGA 77753 9.2W LED BOLLARD LIGHT – 3' HT.
	7	WL16	BEGA 22384 11.2W LED WALL LIGHT – 16" HT.
	6	WL24	BEGA 22384 11.2W LED WALL LIGHT – 24" HT.

0' 5' 10' 20'

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Brookline, MA

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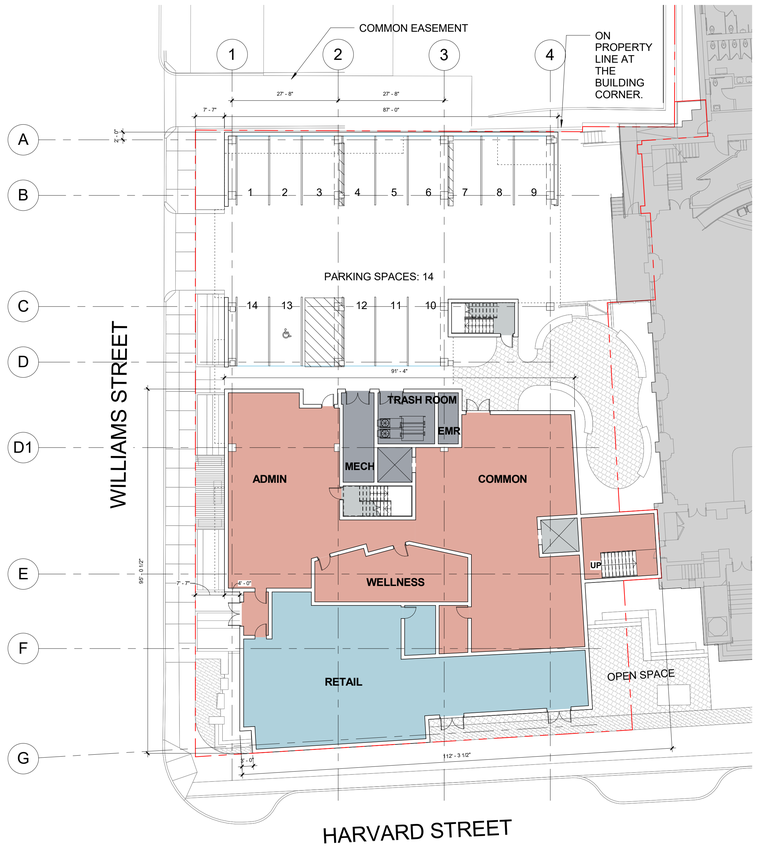
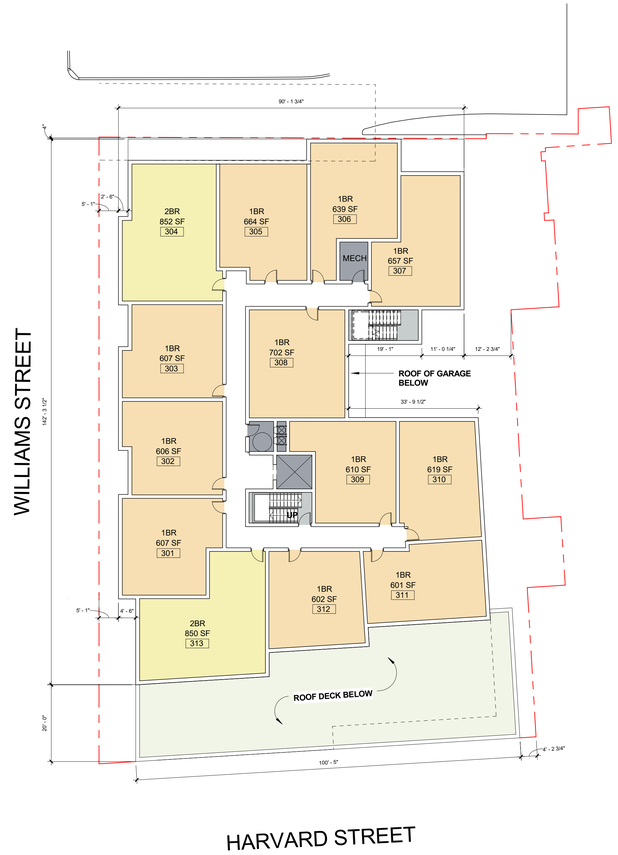


1 LEVEL 1 PLAN
1/16" = 1'-0"



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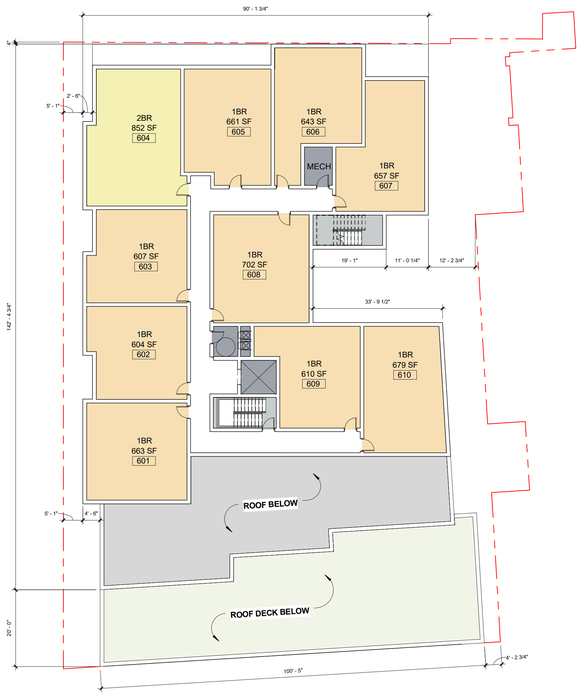

3 LEVEL 6 PLAN
1/16" = 1'-0"

4 ROOF PLAN
1/16" = 1'-0"

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FLOOR PLANS

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NORTH ELEVATION

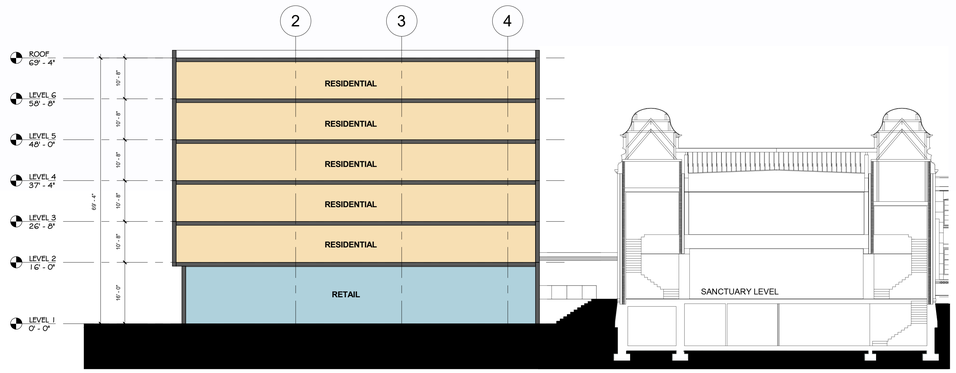
EAST ELEVATION

SOUTH ELEVATION

WEST ELEVATION

EXTERIOR MATERIALS LEGEND

1	NICHIHA VINTAGE WOOD	5	FIBERGLASS WINDOWS
2	NICHIHA RIBBED PANEL	6	GROUND FACE CMU
3	FIBER CEMENT SIDING	7	SWISSPEARL FIBER CEMENT PANEL
4	ALUMINUM CURTAIN WALL	8	COMPOSITE METAL PANEL



1 TYPICAL BUILDING SECTION

1/16" = 1'-0"

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BUILDING ELEVATIONS & SECTION

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STORMWATER REPORT

JCHE at Congregation Kehillath Israel
384 Harvard Street
Brookline, Massachusetts

Prepared for:
Jewish Community Housing for the Elderly
30 Wallingford Road
Brighton, MA 02135

Prepared by:
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October 21, 2016

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I. Executive Summary

Project Description

Jewish Community Housing for the Elderly (JCHE) is proposing a redevelopment of a portion of the Congregation Kehillath Israel property at 384 Harvard Street in Brookline, MA to construct a new building. The 384 Harvard Street project consists of 62 units of affordable rental housing units for seniors in the heart of Brookline's Coolidge Corner neighborhood. The new 6-story building will be located on the former Epstein Auditorium site. The project will serve households at a range of incomes including extremely low-income units at 30% AMI, low-income units at 60% AMI, moderate income units between 60% and 100% AMI, as well as middle-income units between 100% and 120% of AMI. The building's ground floor includes residential program and community space, an indoor connection to the neighboring Congregation Kehillath Israel ("KI"), and community-oriented retail space that will be available to the public. The project will provide ample green space with a landscaped set-back on Williams Street and a pocket park on Harvard Street.

Site Characteristics

The existing site has no treatment features. The existing stormwater systems consist of catch basins, trench drains, roof drains, manholes, and area drains. All of the site's stormwater runoff is directed towards the northeastern portion of the site, and into the Town's closed drainage system along Harvard Street and Williams Street.

Stormwater Management

The proposed project includes the addition of stormwater mitigation and treatment features to the existing site. In the proposed condition, stormwater runoff from the entire site, except for the pocket park on Harvard Street, will be collected in drainage structures and directed to the new underground infiltration system and/or bioswale. In addition, the first floor roof over the retail space of the building is designed as a green roof.

The proposed redevelopment project will result in a slight increase in impervious area (approximately 204 sf) due to the extension of the building to the sidewalk. This increase is offset by the addition of two bump out areas (approximately 312 sf) along Harvard Street in front of the building, which are designed as raingardens. In addition, a portion of the proposed hardscape areas at the pocket park, the courtyard between the two buildings and green space area on Williams Street will be constructed with porous pavers. The project has been designed to incorporate a subsurface infiltration system to recharge runoff and decrease the rate of runoff from the site in the post-development condition. The project will also incorporate best management practices (BMPs) that will promote pretreatment, stormwater recharge and Total Suspend Solids (TSS) removal. The project has been designed to meet all the requirements of the Massachusetts Stormwater Management Standards and Town of Brookline requirements.

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Figure 1 – USGS Topographic Map

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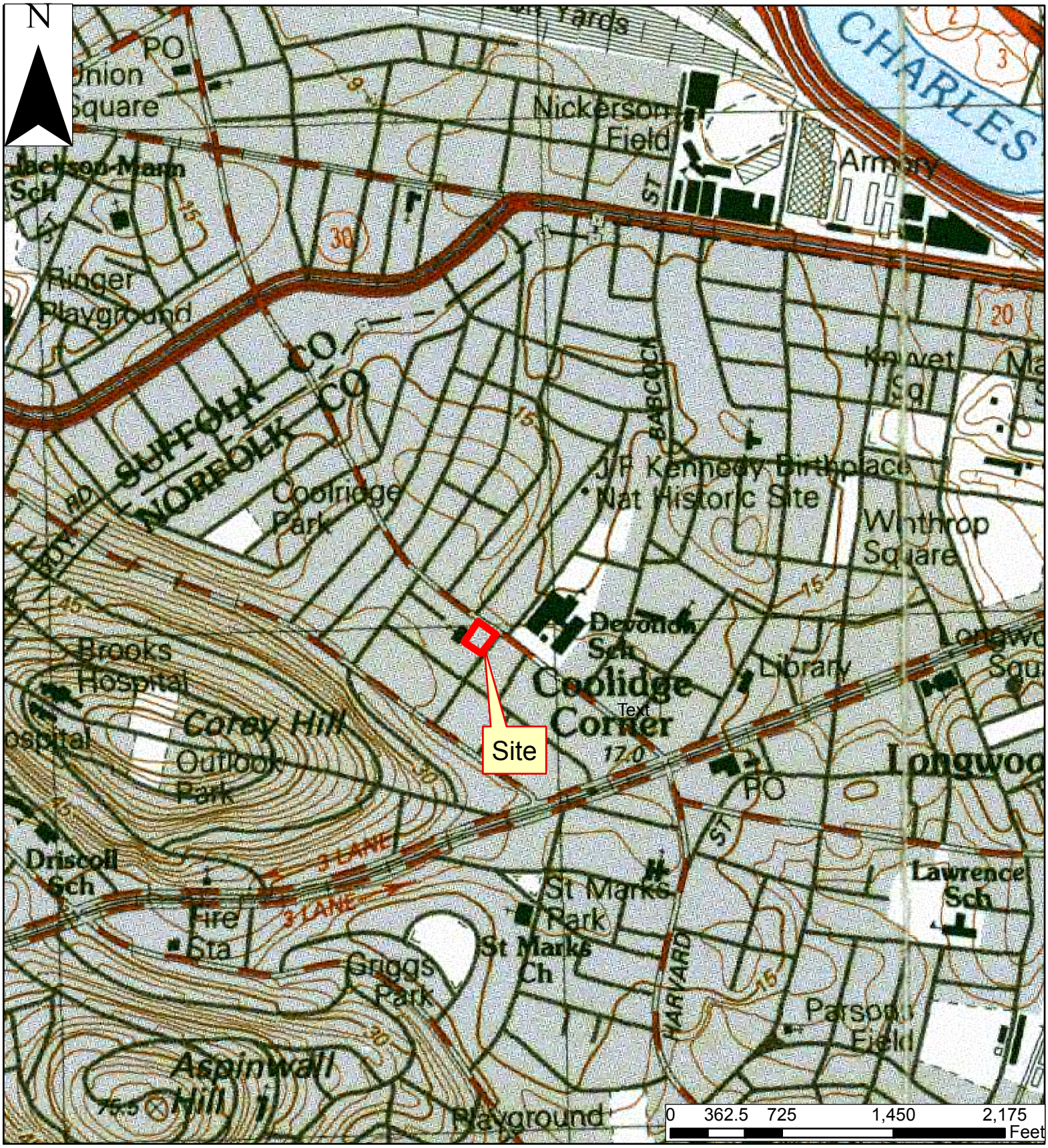

Stantec

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Figure 1 - USGS Topographic Map
JCHE at Kehillath Israel
Boston, MA

10/13/2016

Data Source: "Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, Information Technology Division"

II. Project Type

JCHE is proposing a redevelopment project at their property at 384 Harvard Street. The project consists of 62 units of affordable rental housing units for seniors in the heart of Brookline's Coolidge Corner neighborhood. The new 6-story building will be located on the former Epstein Auditorium site. The project will result in a slight increase in impervious area due to the extension of the building to the sidewalk, and meets all the DEP's Stormwater Standards and Town of Brookline requirements.

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III. LID Measures

Key features of Low Impact Development (LID) stormwater management systems include implementing practices to maintain a site's existing hydrology. This is achieved using decentralized practices to manage stormwater close to the source of generation and maximizing onsite infiltration which reduces runoff. The project will implement low-impact development methods and strategies for treating and mitigating stormwater runoff.

The following LID techniques are Best Management Practices according to MassDEP and are included as part of the proposed project:

- There will be no disturbance to any wetland resources.
- Subsurface infiltration basin.
- Bioswale.
- Green roof.
- Stormceptor water quality unit.

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1.0 Standard 1: No New Untreated Discharges

Stormwater Management Standard 1 states:

> *"No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth."*

The project does not have direct discharge of stormwater to waters or wetlands. Standard 1 is therefore met.

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2.0 Standard 2: Peak Rate Attenuation

Stormwater Management Standard 2 states:

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

2.1 SUMMARY

Per the requirement of the Massachusetts Stormwater Handbook, Standard 2, the pre-development (existing condition) and post-development (proposed condition) peak discharge rates for the 2-, 10-, 25- and 100-year storm events were evaluated. The peak discharge rates were calculated at one (1) discharge/design point, which represents the Harvard Street/Williams Street existing closed drainage system. Below are the results from the analysis.

Table 2.1 –Peak Discharge Rates

Discharge Point	2-Year Storm		10-Year Storm		25-Year Storm	
	Pre–Dev. Peak Discharge Rate(cfs)	Post–Dev. Peak Discharge Rate(cfs)	Pre–Dev. Peak Discharge Rate(cfs)	Post–Dev. Peak Discharge Rate(cfs)	Pre–Dev. Peak Discharge Rate(cfs)	Post–Dev. Peak Discharge Rate(cfs)
DP-1 (Boylston Drain)	1.15	0.08	1.82	0.13	2.25	0.16

Discharge Point	100-Year Storm	
	Pre–Dev. Peak Discharge Rate(cfs)	Post–Dev. Peak Discharge Rate(cfs)
DP-1 (Boylston Drain)	2.76	0.20

The post-development peak discharge rates do not exceed pre-development peak discharge rates at the analyzed design point. Therefore, Stormwater Management Standard 2 is met. All runoff collected at the site will be retained and infiltrated up to the 100-year storm event, with the exception of the 1,433 square foot pocket park area at the northwestern portion of the site, which cannot be directed to the proposed subsurface infiltration system or bioswale.

Piping on-site has been analyzed and designed to handle at least the 25-year storm event. Pipe design calculations are provided in Appendix E of this report.

The following section describes the pre- and post-development conditions and outlines the procedure for determining the peak discharge rates.

2.2 ANALYSIS

2.2.1 Soil Conditions

The Natural Resources Conservation Service (NRCS) was analyzed to determine the soils within and adjacent to the project site (see Appendix B of this report), but no data was available near the project site. Table 2.2 summarizes the NRCS hydrologic soil group classifications.

Table 2.2 –NRCS Soil Classification

Map Unit Symbol	Map Unit Name	Description	Hydrologic Soil Group
602	Urban Land	0-15 percent slopes	NR/NA

Supporting documentation can be found in Appendix B. According to the NRCS soil maps, there are Hydrologic Group A soils to the north of the site and Hydrologic Group B soils to the south of the site. In order to determine the soil group for the project site, the geotechnical report prepared for the adjacent Congregation Kehillath Israel addition project on the western portion of the project site was analyzed. Given its proximity to the project site, it is a reasonable assumption that the soil information and findings in this report can be applied to the proposed project. These assumptions will be field verified during construction, and any adjustments that may be required will be made at that time.

Subsurface explorations were performed by McPhail Associates, LLC in September 2015 and the results are documented in the "Foundation Engineering Report – Proposed Addition to the Congregation Kehillath Israel in Brookline, Massachusetts", dated September 28, 2015. This report has been included in Appendix B. The geotechnical evaluation included borings, test pits and laboratory investigations to determine locations and elevations of bedrock and groundwater and the hydrologic soils groups around the site. Based on the geotechnical report, ledge was observed at two of the borings at a depth of approximately 11-ft to 15.5-ft below the existing ground surface. Groundwater was not encountered in either the groundwater monitoring well or any of the borings.

Design assumptions related to soils on site, and utilized in the design of the stormwater management system, are summarized below:

<u>Hydrologic Soil Group and Soil Infiltration Rates</u>

The assumption for the hydrologic soil group was based on a combination of information from the NRCS soil maps and from the geotechnical report. As previously mentioned, the NRCS soil maps show both hydrologic group A and hydrologic group B soils in nearby areas. Permeability tests were performed in Boring B-4 and B-5. Boring B-4 had a permeability of 3.2 ft/day, or approximately 1.6 in/hr, which lies between a hydrologic group A and B soil according to the Massachusetts Stormwater Handbook Rawls Rates. Boring B-5 had a permeability of 8.5 ft/day, or approximately 4.3 in/hr, which would fall within a hydrologic group A soil. The borings indicate

the presence of a dense sand and gravel with some cobbles, which would qualify the soils as group A or B.

Since neither the NRCS soil maps nor soil testing can definitively determine the hydrologic soil group, the more conservative value has been applied for each calculation. For infiltration, the lesser of the two field measured infiltration rates was applied (1.6 in/hr) for a conservative value. For required recharge, it was assumed that the soils were hydrologic group A and that the total recharge requirement was 0.6 inches over the increase in impervious area.

Seasonal High Groundwater

Indication of seasonal high groundwater was not found in the field during the borings and soil testing. For the purposes of this analysis, it is assumed that the existing groundwater elevation is below the depths of the borings. Therefore, the separation from the bottom of the proposed subsurface system to the seasonal high groundwater elevation is greater than 4-ft, and no mounding analysis is required.

2.2.2 Discharge Points

The project site was divided into one (1) subcatchment area for the pre-development condition, and nine (9) subcatchment areas for the post-development conditions as shown on Figures 2 and 3. The peak discharge rate for the pre-and post-development conditions were analyzed for the following discharge/design point:

- DP1 – Harvard Street/Williams Street Existing Closed Drainage System

Results of the analysis are found in Table 2.1.

2.2.3 Pre-Development Conditions

For the existing conditions, one (1) subcatchment area was analyzed. A summary of the subcatchment is summarized below:

Subcatchment EX1

Subcatchment EX1 includes runoff from the entire northeastern portion of the site to be redeveloped. Included is the existing building, courtyard area between the two buildings, and the grassed areas abutting the building along Harvard Street and Williams Street. All the runoff from this area reaches the existing closed drainage system along Harvard Street/Williams Street.

Subcatchment Area Summary

Table 2.3 summarizes the pre-development conditions drainage area and includes information

used for the hydraulic analysis (Appendix C, Existing Conditions HydroCAD Calculations).

Table 2.3 – Pre-Development Conditions Drainage Area Summary

Drainage Area	Area (sf)	Curve Number	Time of Concentration (min.)
EX-1	19,264	90	5

2.2.4 Post-Development Conditions

For the proposed conditions, nine (9) subcatchment areas were analyzed, and these areas are summarized below:

Subcatchment PR1

Subcatchment PR1 includes runoff from the roof of the first floor of the building. This roof is designed as a green roof. Runoff from this area is directed to the underground infiltration system, represented as pond P1 in the HydroCAD model, through roof drains.

Subcatchment PR1A

Subcatchment PR1A includes runoff from the roof of the first floor of the building near the back of the parking lot. Runoff from this area is directed to the underground infiltration system, represented as pond P1 in the HydroCAD model, through roof drains.

Subcatchment PR1B

Subcatchment PR1B includes runoff from the roof of the first floor of the building near the courtyard. Runoff from this area is directed to the underground infiltration system, represented as pond P1 in the HydroCAD model, through roof drains.

Subcatchment PR2

Subcatchment PR2 includes runoff from the roof of the second floor of the building. Runoff from this area is directed to the underground infiltration system through roof drains.

Subcatchment PR3

Subcatchment PR3 includes runoff from the roof of the sixth floor of the building. Runoff from this area is directed to a flow control structure, represented as pond P2 in the HydroCAD model, via a roof drain. Low flow runoff volumes from this area are directed through an orifice to the bioswale adjacent to the building along Williams Street, with higher runoff volumes directed via to the underground infiltration system.

Subcatchment PR4

Subcatchment PR4 includes runoff from the courtyard area between the two buildings. The runoff is collected in area drainas and directed to the underground infiltration system.

Subcatchment PR5

Subcatchment PR5 includes runoff from the pocket park on Harvard Street. The runoff is collected in a trench drain and directed to the existing closed drainage system on Harvard Street.

Subcatchment PR6

Subcatchment PR6 includes runoff from the green space area along Williams Street. The runoff will infiltrate in the bioswale, represented as pond P3 in the HydroCAD model. The bioswale has been designed so that any potential overflow would flow back to the underground infiltration system. Curbing at the end of the bioswale has been designed as a secondary overflow that would allow sheet flow towards Harvard Street/Williams Street.

Subcatchment PR7

Subcatchment PR7 includes runoff in between the two buildings in front of the loading dock. The runoff is collected in a trench drain and directed to a Stormceptor unit prior to being directed to the underground infiltration system.

Table 2.4– Post-Development Conditions Drainage Area Summary

Drainage Area	Area (sf)	Curve Number	Time of Concentration (min.)
PR1	2,143	61	5
PR1A	396	98	5
PR1B	416	98	5
PR2	2,135	98	5
PR3	9,029	98	5
PR4	1,951	83	5
PR5	1,433	88	5
PR6	1,106	74	5
PR7	655	98	5

2.3 METHODOLOGY AND DESIGN CRITERIA

2.3.1 Hydrologic Modeling

The peak discharge rates and stormwater runoff volumes were calculated using the Soil Conservation Service (SCS) TR-55 and TR-20 methodologies and the computer program HydroCAD 10.0 by HydroCAD Software Solutions, LLC.

Pipe design flows were calculated for the 25-year storm recurrence interval using the Rational Method (see Appendix E, Pipe Design Calculations).

2.3.2 Design Storms

The analysis was performed on the 2-, 10-, 25- and 100-year frequency rainfall events. The events were based on the 24-hour, type-III duration storm (See Appendix F, Massachusetts Rainfall Data).

2.3.3 Time of Concentration

A time of concentration (T_C) of 5.0 minutes was used for all hydrologic design calculations (HydroCAD and pipe calculations). The majority of the site was modeled as either paved surfaces or roofs; therefore a minimum Tc of 5.0 minutes was used.

2.3.4 Curve Numbers

Although there are some grass areas within the project site, the majority of the area consists of paved surfaces or roof with a Curve Number of 98. The curve numbers were based on the SCS TR-55 methodology and are included in the HydroCAD input and output found in Appendix C and Appendix D.

2.3.5 Rainfall Depth

Rainfall depths were acquired from Technical Paper 40, "The Rainfall Frequency Atlas of the United States". Rainfall events for the 2-, 10-, 25- and 100-year storms were analyzed.

The following rainfall depths were used in the calculations:

Storm Event	Rainfall Depth
2-Year	3.20 inches
10-Year	4.60 inches
25-Year	5.50 inches
100-Year	6.60 inches

Figure 2 – Existing Watershed Plan

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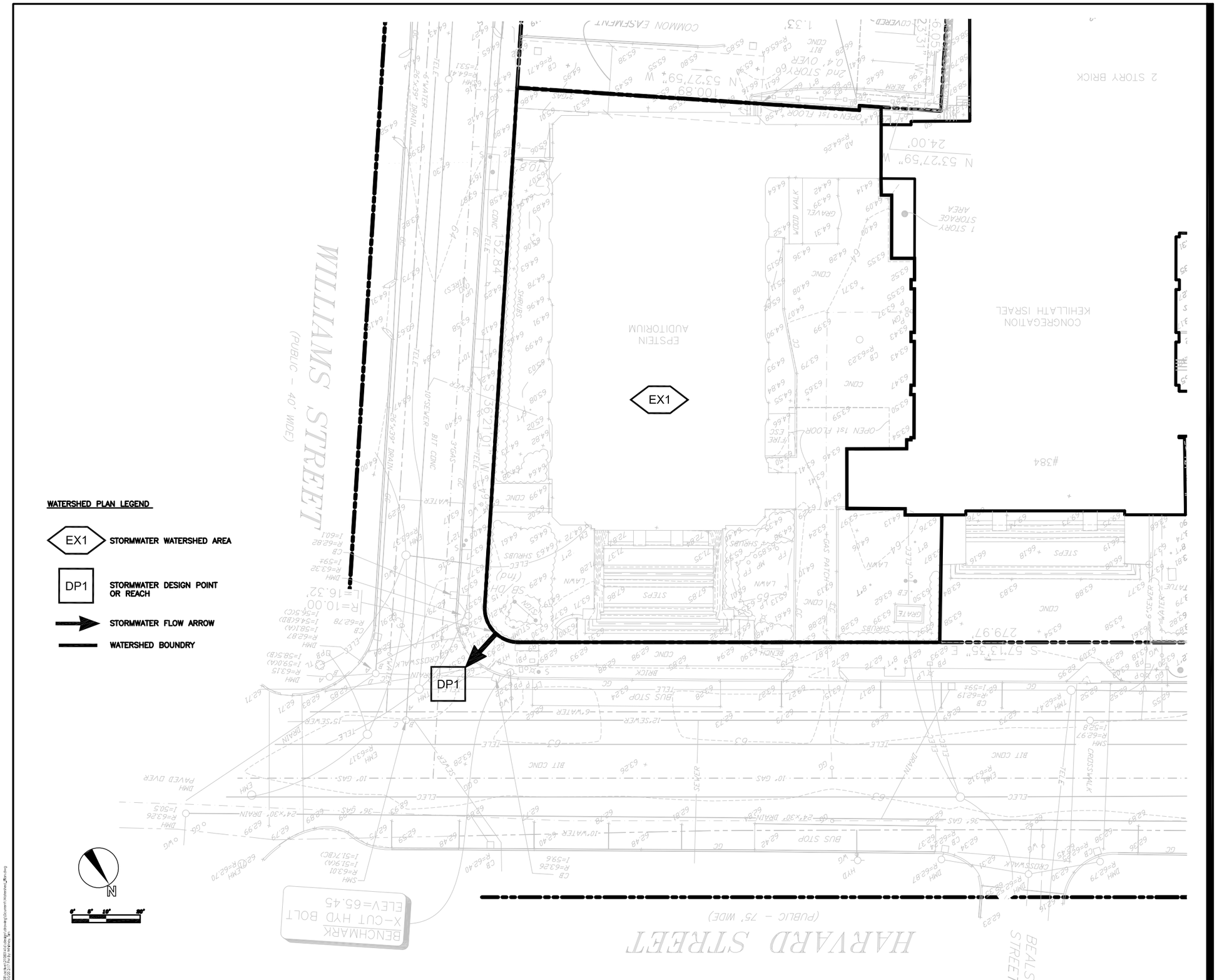

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Legend

Notes

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Client/Project

JEWISH COMMUNITY HOUSING FOR THE ELDERLY

CONGREGATION KEHILLATH ISREAL

BROOKLINE, MA

Title

EXISTING WATERSHED PLAN

Project No. 210801416

Scale

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FIGURE -2

Figure 3 – Proposed Watershed Plan

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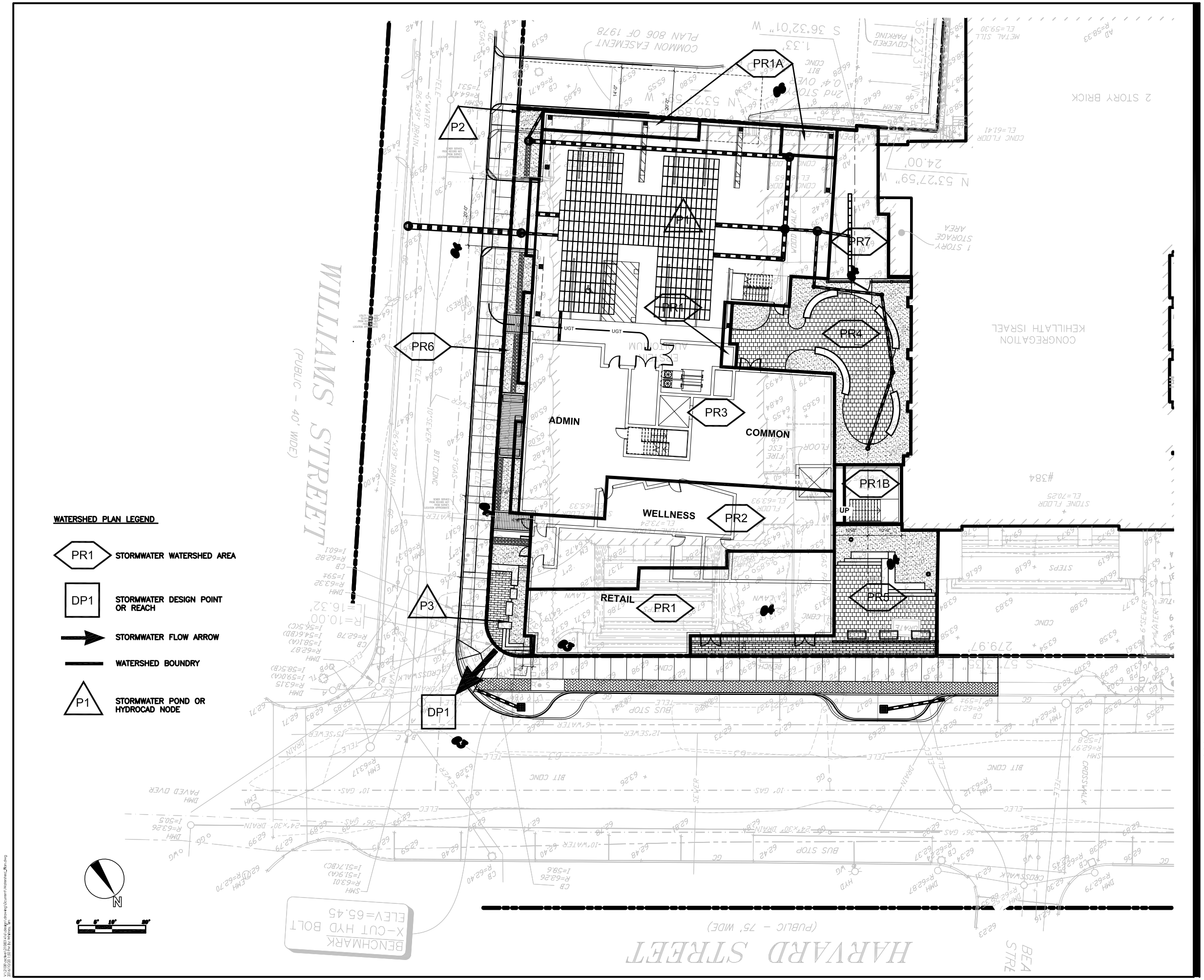

WATERSHED PLAN LEGEND

- PR1 — STORMWATER WATERSHED AREA
- DP1 — STORMWATER DESIGN POINT OR REACH
- STORMWATER FLOW ARROW
- WATERSHED BOUNDRY
- P1 — STORMWATER POND OR HYDROCAD NODE

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BROOKLINE, MA

Title

PROPOSED WATERSHED PLAN

Project No. 210801416

Scale

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FIGURE -3

3.0 Standard 3: Recharge

Stormwater Management Standard 3 states:

> *"The annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type."*
>
> *"Infiltration BMP's must be able to drain fully within 72 hours."*
>
> *"There must be at least a two-foot separation between the bottom of the infiltration BMP and the seasonal high groundwater."*

For the project,

- The annual recharge from the post-development condition can approximate the annual recharge from the pre-development conditions based on assumed soil type.
- Based on the assumptions described, the subsurface infiltration system can drain fully within 72 hours.
- There is estimated to be greater than a four-foot of separation between the bottom of the subsurface infiltration system and the seasonal high groundwater.

Stormwater Management Standard 3 is met.

This section describes the procedures for determining compliance with Stormwater Management Standard 3.

3.1 RECHARGE REQUIREMENT

3.1.1 Summary

The project is required to infiltrate the required recharge volume. See Appendix G, Recharge Volume Calculations, and Sections 3.1.2 and 3.1.3 for supporting calculations and analysis.

3.1.2 Determining the Recharge Requirement

The project is required to provide recharge to groundwater.

<u>Underlying Soil Types</u>

The project site is mapped by NRCS as Urban Land, and no hydrologic soil group has been assigned to this soil. However, soils adjacent to the site are in hydrologic soil groups "A" and "B". In addition, as described in Section2.2.1, soil testing was performed for the adjacent building renovations and revealed the presence of a dense sand and gravel with some cobbles, which

would qualify the soils as group A or B. For conservatively designing the infiltration systems, we have classified the soils as hydrologic soil group "B".

Per the Handbook, the required recharge volume for a Hydrologic Soil Group equals the recharge volume which is shown in Handbook multiplied by the total area within that NRCS Hydrologic Group that is impervious. For purposes of these recharge volume calculations, the entire site was conservatively considered to be hydrologic soil group "A".

Infiltration Rates

The project site includes a subsurface infiltration system to provide the required groundwater recharge. For purposes of these calculations, a conservative infiltration rate of 1.6 in/hr has been used. This rate is based on soil testing as described in Section 2.2.1.

The subsurface infiltration system was designed to provide the required recharge, assuming the site is comprised of hydrologic soil group "A" soils. Currently, under the pre-development conditions, there is no recharge provided on-site. Therefore, the post-development design is considered an improvement of pre-development conditions.

For hydrologic soil group "A," the required recharge volume equals 0.60 inches of runoff multiplied by the total impervious area at the post development condition. This result is an initial required recharge volume. (Appendix G, Recharge Volume Calculations). This is summarized in Table 3.1 below.

Table 3.1 – Required Recharge Volume

Hydrologic Soil Group	Impervious Area (sf)	Target Depth*	Volume Required (cf)
A (entire site)	15,192 (paved)	0.60	317
		Initial Required Recharge Volume:	***317***

*The Target depth is from the Massachusetts Stormwater Handbook

During post-development conditions, approximately 93 percent of the project area's impervious cover is routed through the subsurface infiltration system. A capture area adjustment of 1.07 is required to be applied to the initial required recharge volume, and therefore, the total ***required recharge volume is 340 cf.*** The total recharge provided for this project is ***3,975 cf.***

3.1.3 Sizing the Subsurface Infiltration System

In order to accommodate the required recharge volume, a subsurface infiltration system is proposed as part of the stormwater management system. The subsurface infiltration system was designed and sized using the "Static" method as described in the Massachusetts Stormwater Handbook, Volume 3, Chapter 1. The "Static" method was used to produce a larger storage volume, resulting in a conservative approach. Hydrologic modeling (HydroCAD 10.00) was used to determine the size of the subsurface infiltration system. See Appendix D, node P1. When designing the subsurface infiltration system, the following was taken into consideration:

The subsurface infiltration system is designed to accommodate the site's assumed characteristics of the ground surface, underlying soil types, and subsurface conditions (seasonal high groundwater table, depth to bedrock, hydrologic conductivity rate and type of receiving soil layers). See Section 2.2.1. Additionally, the subsurface infiltration system is sized to provide a recharge volume of 3,975 cubic feet.

Table 3.2 summarizes the recharge provided for the project.

Table 3.2 – Recharge Summary

Subsurface Infiltration Item	Recharge Volume Provided (cf)
Subsurface Infiltration System	3,975
Total Volume	**3,975**

3.2 DRAWDOWN WITHIN 72 HOURS

The required drawdown time for the proposed recharge volumes shall be less than or equal to 72 hours. The drawdown time is calculated by dividing the storage volume by the permeability rate times the bottom area of the subsurface infiltration system.

Exhibit 3.1 – Drawdown Equation

$$Time_{drawdown} = \frac{Rv}{(K)(Bottom\ Area)}$$

Where:

Rv = Storage Volume

K = Saturated Hydraulic Conductivity for "Static" and "Simple Dynamic" Methods, use Rawls Rate (Table 2.3.3, Massachusetts Stormwater Handbook). For "Dynamic Field" Method, use 50% of the in-situ saturated hydraulic conductivity.

Bottom Area = Bottom Area of Recharge Structure

The Storage Volume (Rv) and Bottom Area for the subsurface infiltration system was derived from the Proposed Conditions HydroCAD model (Appendix D). The Rawls Rate (K) used for the analysis was 1.02 in/hr (sandy loam). For information on how this rate was determined, refer to Section 2.2.1. This is the Rawls rate corresponding to sandy loam in Hydrologic Soil Group "B," thus providing a conservative approach. Supporting calculations are included in Appendix H. Table 3.3 summarizes the drawdown time for the subsurface basin.

Table3.3 – Summary of Drawdown Time

Infiltration BMP	Maximum Drawdown Time (hours)	Drawdown Time Provided (hours)
Subsurface Infiltration System	72	23.86
Bioswale	72	63.90

The drawdown time for the BMP is less than the required drawdown time of 72 hours from Standard 3.

3.3 SEPARATION FROM SEASONAL HIGH GROUNDWATER

The Massachusetts Stormwater Handbook requires at least a two-foot separation between the bottom of the infiltration BMP and the seasonal high groundwater table. Indication of seasonal high groundwater was not found in the field during the borings and soil testing. For the purposes of this analysis, it is assumed that the existing groundwater elevation is below the depths of the borings. Therefore, the separation from the bottom of the proposed subsurface system to the seasonal high groundwater elevation is greater than 4-ft.

The bottom of the subsurface infiltration system provides the seasonal high groundwater separation required from Standard 3.

4.0 Standard 4: Water Quality

Stormwater Management Standard 4 states:

> *"Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This standard is met when:*
>
> *a. Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;*
>
> *b. Stormwater BMP's are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and*
>
> *c. Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*

For the project,

- Pollution prevention is identified and a long-term pollution prevention plan is proposed to be implemented and maintained.
- The structural stormwater best management practices are sized to capture the required water quality volume as determined in accordance with the Massachusetts Stormwater Handbook, to the maximum extent practicable.
- Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

Stormwater Management Standard 4 has been met.

This section describes the procedures for determining compliancy with Stormwater Management Standard 4.

4.1 LONG – TERM POLLUTION PREVENTION PLAN

The long-term pollution prevention plan for the project site is included as part of the Operation and Maintenance Plan (Section 9.2). A long term pollution prevention plan that fully meets the requirements of Standard 4 will be implemented.

- The pollution prevention plan includes; salt, sand and other deicing chemicals; proper management of fertilizers, herbicides, and pesticides; and stabilization of stockpile areas and any existing eroding surfaces.
- The redevelopment design results in a slight increase in impervious area. With the exception of the pocket park located along Harvard Street, the design provides

treatment for runoff from all the remaining impervious surfaces within the project area to achieve 80% TSS removal. In addition, two small raingardens on Harvard Street in front of the building have been incorporated into the design.

- The following pollution prevention measures have been considered:
    - Deicing materials will only be used to the extent needed to make the drive aisle and walkways safe.
    - Fertilizers, herbicides, and pesticides will only be used to the extent needed to maintain healthy plant materials and landscaped areas.
    - Landscaping that reduces the need for fertilizer, herbicides, and pesticides.
    - All catch basins and area drains will be inspected at least two times per year and cleaned a minimum of at least once per year. Sediment and/or floatable pollutants will be pumped from the catch basin. During colder periods, the catch basin grates will be kept free of snow and ice. During warmer periods, catch basin grates will be kept free of leaves, litter, sand, and debris.
- There are no discharges to impaired waters.

4.2 WATER QUALITY TREATMENT VOLUME

A water quality depth of 0.5-inch was utilized to compute the required water quality treatment. Water quality calculations are included in Appendix H. The subsurface infiltration system was sized based on 0.5 in. of runoff times the total contributing impervious area at the post development site. The required water quality volume based on a 0.5-inch depth and 15,192 square feet of impervious area is 633 cubic feet. The subsurface infiltration system provides 3,975 of storage, and therefore exceeds the required water quality treatment volume.

4.3 TSS REMOVAL COMPUTATIONS

Standard 4 requires that a minimum of 80% Total Suspended Solids (TSS) removal rate be achieved in the proposed condition. TSS calculations are included in Appendix I.

The following BMPs are proposed:

<u>Subsurface Infiltration Basin</u>
One subsurface infiltration system (StormTank units) is proposed to detain and infiltrate stormwater runoff. Stormwater will be pretreated prior to entering the system through an isolator row or Stormceptor unit.

<u>Bioswale</u>
A bioswale is proposed along Williams Street to detain and infiltrate low runoff volumes from the roof area,

Stormceptor Unit

A Stormceptor unit is proposed to treat runoff from the loading dock and courtyard area prior to entering the underground infiltration system.

The proposed stormwater management system is designed to meet the required 80 percent removal of TSS from the stormwater runoff from impervious areas. The best management practices (BMP) implemented for the project consist of a subsurface infiltration system with isolator row, bioswale, Stormceptor unit and raingardens.

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5.0 Standard 5: Land Uses with Higher Potential Pollutant Loads

Stormwater Management Standard 5 states:

> *"For land uses with higher potential pollutant loads (LUHPPL), source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable."*
>
> *"Stormwater discharges from LUHPPLs requires the use of a treatment train that provides 80% TSS removal prior to discharge and at least 44% TSS removal prior to discharge to the infiltration BMP."*
>
> *"The infiltration BMP shall be designed to treat 1.0 in. of runoff times the total impervious area at the post development site."*

The project is not considered to be within Land use with Higher Potential Pollutant Loads area. Therefore, Stormwater Management Standard 5 is not applicable.

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6.0 Standard 6: Critical Areas

Stormwater Management Standard 6 states:

> *"Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook."*
>
> *"Stormwater discharges to an Outstanding Resource Water or Special Resource Water requires the use of a treatment train that provides 80% TSS removal prior to discharge and at least 44% TSS removal prior to discharge to the infiltration BMP."*
>
> *"The infiltration BMP shall be designed to treat 1.0 in. of runoff times the total impervious area at the post development site."*

The project is not considered to be within a critical area. Therefore, Stormwater Management Standard 6 is not applicable.

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7.0 Standard 7: Redevelopment

Stormwater Management Standard 7 states:

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

Full compliance with the Stormwater Management Standards is required for this project, as the project proposes a slight increase in impervious area.

For this project, all Stormwater Management Standards are met. Stormwater Management Standard 7 is therefore met.

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

Construction period pollution prevention and erosion and sedimentation control measures will be implemented at the project site to control construction related impacts during construction and land disturbance activities. The general contractor for the project will be responsible for implementation of the construction period controls.

8.1 EROSION AND SEDIMENT CONTROL MEASURES

The project will not disturb more than one acre of land during the construction process and therefore, will not require a NPDES Construction General Permit issued by the Environmental Protection Agency. As a result, a stormwater pollution prevention plan (SWPPP) will not be required. The Site Preparation and Erosion Control Plan (L-001) addresses erosion and sedimentation control for this project.

Without proper erosion and sediment control measures, grading, filling and installation of piping structures may cause erosion and sedimentation, resulting in temporarily increased turbidity and suspended solid loads. Runoff from construction sites may also transport sediment to downstream stormwater systems and watercourses, where sediment deposition and accumulation will occur as flow velocities decrease.

Erosion and sedimentation controls will be employed to prevent the erosion and transport of sediment into adjacent areas and drainage systems during the earthwork and construction phases of the project. Erosion and sedimentation control measures will be installed prior to site excavation or disturbance and will be maintained throughout the construction period.

Below is a description of some of the erosion and sediment control measures that will be employed at the project and that will be included in the SWPPP.

Hay Bale and Silt Fence Barriers

Prior to any ground disturbance, a professional engineer or land surveyor will certify that a barrier of staked hay bales and silt fence is in place at the down gradient limit of work in accordance with the plan filed with the design plans. The barrier will be placed to trap sediment transported by runoff before it reaches the drainage system or leaves the construction site. The silt fence is a semi-permeable barrier made of a synthetic porous fabric which provides additional protection when used with hay bale barriers. When necessary, additional hay bale and silt fence barriers will be installed immediately down gradient of erosion-prone areas, such as the base of steep exposed slopes and around the base of stockpiles, throughout the construction phase of the project. The barriers will be entrenched into the substrate to prevent underflow.

The erosion control barriers will be inspected weekly and after every storm event. Any sediment that collects behind the barriers will be removed and will be either reused at the site or disposed

of at a suitable offsite location. Any damaged sections of silt fence or hay bales will be repaired or replaced. The underside of hay bales will be kept in close contact with the earth and reset as necessary. Hay bale barriers and silt fences will be maintained and cleaned until slopes have healthy stands of grass.

Catch Basin Inlet Protection

The inlets of proposed and existing catch basins will be protected from sediment inflow during the work period through the installation of Siltsacks™, or approved equal. A layer of filter fabric will be installed beneath the grates of the catch basins. The inlets of existing catch basins will be protected by Siltsacks™, or approved equal. These protection measures will be inspected after every storm event and will be routinely maintained until the drainage area tributary to each inlet has been stabilized with vegetation and/or covered by pavement. Any sediment that collects behind the barrier or in the sacks will be removed and will be either reused onsite or disposed of at a suitable off-site location.

Dust Control

Fugitive dust from large areas of unstabilized soil can be a problem during construction. On dry and windy days when dust generation is a concern, a water truck will traverse the site and spray water as necessary to prevent dust from forming. Calcium chloride may also be applied to the ground in granular form to attract atmospheric moisture, dampening the ground and preventing fugitive dust.

Slope Stabilization

A temporary vegetative cover will be established on areas of exposed soils (including stockpiles) that remain inactive and unstabilized for a period of more than 30 days for slopes, and weather permitting. The seeded surfaces will be covered with a layer of straw mulch or hydro mulch as described above.

Upon completion of final grading, any areas not covered by pavement, other forms of stabilization, or other methods of landscaping will be seeded with an erosion control seed mix. On slopes 4:1 and greater, loamed and seeded areas will be mulched with hay to prevent erosion prior to germination of the seed. After disturbed areas have been stabilized, the temporary erosion control measures will be removed and accumulated sediment will be removed and disposed of in an appropriate location.

Stabilized Construction Entrance

A temporary stabilized construction entrance will be installed at the site. The purpose of the construction entrance is to remove sediment attached to vehicle tires and to minimize sediment transport and deposition onto public road surfaces. The construction entrance will be composed of beds of crushed stone which will be replenished as necessary to maintain their proper function. The stone will be placed over a layer of non-woven filter fabric. The stabilized

construction entrance will remain in place until the excavation and grading phases of the construction are complete.

8.2 MATERIAL MANAGEMENT PRACTICES

The following material management practices will be used to reduce the risk of spills or other accidental exposure of materials and substances to stormwater runoff. These include good housekeeping practices and guidelines for the handling of hazardous products. The following good housekeeping practices will be followed on-site during the construction period.

- An effort will be made to store only enough products required to do the job.
- All materials stored on-site will be stored in a neat, orderly manner in their appropriate containers, and (if possible) under a roof or other enclosure.
- Products will be kept in their original containers with the original manufacturer's label.
- Substances will not be mixed with one another unless recommended by the manufacturer.
- Whenever possible, all of a product will be used before disposing of the container.
- Manufacturer's recommendations for proper use and disposal will be followed.
- The site superintendent will observe the storage area daily to ensure proper use and disposal of materials on-site.

The following practices will reduce the risks associated with hazardous materials (e.g., petroleum products, solvents):

- A copy of all Material Safety Data Sheets (MSDS) for materials or products used during construction will be kept on site.
- Products will be kept in original containers unless they are not re-sealable.
- Original labels and material safety data (MSD sheets) will be retained since they contain important product information.
- If surplus product must be disposed, manufacturer's or local- and state-recommended methods for proper disposal will be followed.

8.3 PRODUCT SPECIFIC PRACTICES

The following product-specific practices will be followed on-site. Recommendations are provided for petroleum products, fertilizers, solvents, paints, and other hazardous substances.

Petroleum Products

All on-site construction vehicles will be monitored for leaks and will receive regular preventive maintenance to reduce the chance of leakage. No vehicle maintenance or handling of petroleum products will occur on within 100 feet of a waterway. Petroleum products will be stored in tightly sealed containers that are clearly labeled. Any asphalt substances used on-site

will be applied according to manufacturer's recommendations. No petroleum-based or asphalt substances will be stored within 100 feet of a waterway.

Fertilizers

Fertilizers will be applied only in the minimum amounts recommended by the manufacturer. Once applied, the fertilizer will be worked into the soil to limit exposure to stormwater. Storage will be either covered, or in a covered area; and the contents of any partially used bags will be transferred to a sealable, plastic bin to avoid spills.

Solvents, Paints, and other Hazardous Substances

All containers will be tightly sealed and stored when not required for use. Excess materials will not be discharged to the storm sewer system, but will be properly disposed according to manufacturer's instructions or state and local regulations.

Concrete Trucks

Concrete trucks will not be allowed to wash out or discharge surplus concrete or drum wash water into catch basins or drainage systems.

8.4 SPILL CONTROL/NOTIFICATION PRACTICES

In addition to the good housekeeping and material management practices discussed above, the following practices will be followed for spill control, notification and cleanup.

- Manufacturer's recommended methods for spill cleanup will be clearly posted and site personnel will be informed of the procedures and the location of the information and cleanup supplies.
- Materials and equipment necessary for spill cleanup will be kept in the material storage area on-site. Equipment and materials will include, but will not be limited to, spill kits, shovels, wheel barrows, brooms, dust pans, mops, rags, gloves, goggles, kitty litter or Speedi-Dry, sand, sawdust, and plastic and metal trash containers specifically designated for this purpose.
- All spills will be cleaned up immediately after discovery.
- The spill area will be kept well ventilated and personnel will wear protective clothing to prevent injury from contact with a hazardous substance.
- Spills of toxic or hazardous material in excess of reportable quantities, as established in the Massachusetts Contingency Plan (MCP), will be reported to the Massachusetts Department of Environmental Protection Division of Hazardous Waste [(617) 292-5500 or (978) 694-3200].
- The construction superintendent responsible for the daily operations will be the spill prevention and cleanup coordinator. He will designate at least three other site personnel to receive spill prevention and cleanup training. These individuals will each become responsible

for a particular phase of prevention and cleanup. The names of the responsible spill personnel will be posted in the material storage area and in the on-site office trailer or office building.

8.5 MAINTENANCE PROGRAM PRACTICES: PRIOR OR DURING CONSTRUCTION

In addition to the maintenance described for each stormwater control, the following practices should be followed:

- Prior to construction, install erosion and sediment control measures as shown on the plan and details.
- The site contractor shall inspect all sediment and erosion control structures after each rainfall event and at the end of the working day.
- All measures shall be maintained in good working order. If repair is necessary, it shall be initiated within 1 business day of inspection.
- Silt shall be removed from the filter bags if depths reach 6-inches or greater and as-needed.
- Sediment shall be contained within the construction site and away from drainage structures.
- The underside of hay bales shall be kept in close contact with the ground and reset as necessary.
- Damaged or deteriorated erosion control measures will be repaired immediately after identification.
- The contractor's site superintendent will be responsible for inspection, maintenance and repair activities.

Erosion control measures shall remain in place until all construction is completed and all disturbed earth is stabilized.

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9.0 Standard 9: Operation and Maintenance Plan

The goal of the operation and maintenance plan is not only to protect resources on-site or nearby, but also to protect resources in the region that may be affected by the activities at the site. Water quality treatment measures and the implementation of Best Management Practices (BMP's) for structural controls will result in the treatment of site stormwater and the removal of a minimum of 80 percent of the total suspended solids (TSS) load in runoff prior to discharge from the site, consistent with Massachusetts DEP's TSS removal standard.

The Stormwater Management System Owners will be owners of the property (JCHE). The responsible party for operation and maintenance shall also be JCHE.

An Operation and Maintenance Log has been prepared for this project and is included in this report as Appendix K. This log shall be filled out by the party responsible for operation and maintenance. JCHE will be responsible for overseeing the performance of the inspections and maintenance as outlined in the Operations and Maintenance Plan with their own personnel.

Non-structural pollutant controls include encouraging the use of salt substitutes for maintenance of paved parking and access areas, as well sweeping of paved parking and access areas on a regular basis.

9.1 STRUCTURAL POLLUTANT CONTROLS

The proposed stormwater management system is designed to protect runoff water quality through the removal of sediment and pollutants. Operation and maintenance for structural pollutant controls used to separate and capture stormwater pollutants is described below. In addition, operation and maintenance for existing site features such as pavement, roofs and gutters is described below. Refer to Appendix L for Operation and Maintenance Logs required under this section.

Subsurface Infiltration System

The subsurface infiltration system at the project site will be constructed with StormTank chambers. The system requires maintenance to remain functional. Well maintained pretreatment BMPs will reduce the need for maintenance of the subsurface system. An isolator row, consisting of one row of StormTank chambers is provided and includes a 12" HDPE pipe with a cleanout for ease of access for operation and maintenance.

Proprietary Structural BMPs (Stormceptor Water Quality Units)

Proprietary structural BMPs are underground structures that provide total suspended solids removal and serve as a gas and oil trap to improve water quality. The units are proprietary products that consist of precast concrete structures, each of which contain a fiberglass weir, drop tee, and insert that captures oil.

The proper removal of sediments, debris, and associated pollutants occurs only when proprietary structural BMPs are cleaned out regularly. The more frequent the cleaning, the less likely sediments will be re-suspended and subsequently discharged. In addition, frequent cleaning also results in more volume available for future deposition and enhances overall performance. Regular maintenance and cleaning will assure adequate performance of these structures.

The proprietary structural BMP used at the project site consists of one (1) Stormceptor unit (water quality unit), which will be used for pretreatment prior to discharging to the subsurface infiltration system. Well maintained pretreatment BMPs will reduce the need for maintenance of the subsurface infiltration system.

The proprietary structural BMP (Stormceptor unit) will be inspected and cleaned in strict accordance with the manufacturer's recommendations and requirements. Inspections will occur post-construction, prior to putting the water quality unit into service, routinely during the first year of operation to assess sediment accumulation, and frequently (at least twice) in subsequent years based on the maintenance plan developed in the first year. Inspections will also be performed after an oil, fuel, or other chemical spill. The unit will be cleaned once the sediment depth reaches 15% of the unit's total storage capacity, approximately once annually. The unit will be cleaned after an oil, fuel, or chemical spill.

See Appendix J for StormTank and Stormceptor unit maintenance guidelines for additional information.

Bioswale

Bioretention areas require regular maintenance. Bioretention areas should be inspected regularly for sediment buildup, structural damage, and standing water. Inspect soil and repair eroded areas monthly. Re-mulch void areas as needed. Remove litter and debris monthly. Treat diseased vegetation as needed. Remove and replace dead vegetation twice per year (spring and fall). Replace mulch every two years, in the early spring. The entire soil media and all vegetation shall be replaced as needed when the capacity of the media decreases to prevent contaminants from entering the groundwater.

Green Roof

Extensive green roofs require regular watering during the establishment period of approximately 3 to 12 months depending on the installation season. Once established, ongoing maintenance includes monthly inspections to ensure the vegetation free zones and roof drains are not clogged and functioning properly, as well as to remove any trash, debris or tree seedlings that may have become established.

Trench Drain

The trench drains shall be inspected twice per year and at the end of foliage and snow-removal seasons. Cleaning shall be performed with a vactor truck to prevent damage to the trench drains. Any structural damage or other indication of malfunction will be repaired as necessary. During colder periods, the grates will be kept free of snow and ice. During warmer periods, grates will be kept free of leaves, litter, sand, and debris. Regular maintenance and cleaning of the trench drains will assure adequate performance of these structures.

Roof Drain Leaders

Roof runoff from the building will be collected and conveyed to the underground infiltration system. Routine roof inspections will be performed two times per year. Roofs will be kept clean and free of debris, and the roof drainage systems will be kept clear. The roof systems will be cleaned at least twice per year, or more frequently as necessary.

Catch Basins

All catch basins will be inspected at least two times per year and cleaned when the sump is half full of sediment. Sediment and/or floatable pollutants will be pumped from the catch basin and disposed of at an approved off project area facility in accordance with all applicable regulations. Any structural damage or other indication of malfunction will be reported to the project area manager and repaired as necessary. During colder periods, catch basin grates will be kept free of snow and ice. During warmer periods, catch basin grates will be kept free of leaves, litter, sand, and debris. Regular maintenance and cleaning of catch basins will assure adequate performance of these structures. Well maintained pretreatment BMP's (i.e. Catch Basins and isolator row) will reduce the need for maintenance of the subsurface stormwater infiltration system.

Vegetated Areas Maintenance

Although not a structural component of the drainage system, the maintenance of vegetated areas may affect the functioning of stormwater management practices. This includes the health/density of vegetative cover and activities such as the application and disposal of lawn and garden care products, disposal of leaves and yard trimmings.

Initial Post-Construction Inspection

During the initial period of vegetation establishment in disturbed areas pruning and weeding are required twice in first year by contractor or owner. Any dead vegetation/plantings found after the first year will be replaced. Proper mulching is mandatory and regular watering may be required initially to ensure proper establishment of new vegetation.

Long-Term Maintenance

Weeds and invasive plant species will be removed by hand. Leaf litter and other detritus shall be removed twice per year. If needed to maintain aesthetic appearance, perennial plantings may be trimmed at the end of the growing season. Trees and shrubs will be inspected twice per year to evaluate health and attended to as necessary. Seeded ground cover or grass areas shall not receive mulching. PH tests of the soils in the planting bed will occur annually. If the pH is below 5.2, limestone will be applied to increase it. If the pH is above 8.0, iron sulfate plus sulfur will be added accordingly.

9.2 LONG TERM POLLUTION PREVENTION PLAN

The following measures will be employed to control potential sources of contamination and prevent pollution at the project site:

Deicing

To prevent increased pollutant concentrations in stormwater discharges, the amount of road salt applied will be controlled. The amount of deicing materials used will be monitored with the goal of using only enough to make the drive aisle and walkways safe.

Fertilizer/Pesticide/Herbicide Application

Landscaping maintenance will limit the amount of fertilizer, pesticides and herbicides to only what is needed to maintain healthy plant materials and landscaped areas.

No pesticides or herbicides are to be used unless a single spot treatment is required for a specific control application.

Fertilizer usage will be avoided. If deemed necessary, slow release fertilizer will be used, and applied only in the minimum amounts recommended by the manufacturer. Once applied, the fertilizer will be worked into the soil to limit exposure to stormwater. Storage will be in a covered area; and the contents of any partially used bags will be transferred to a sealable, plastic bin to avoid spills.

Fertilizer will be used to begin the establishment of vegetation in bare or damaged areas, but will not be applied on a regular basis unless necessary.

Records of soil management, application dates, planting dates, preventive measures, treatments and other appropriate information should be kept. This information will be used as a reference when fertilizer/pesticide/herbicide management decisions in the future.

Materials Management/Housekeeping Practices

The following product-specific practices will be followed on-site. Recommendations are provided for petroleum products, fertilizers, solvents, paints, and other hazardous substances, and concrete.

Petroleum Products - No vehicle maintenance or handling of petroleum products will occur on site, unless performed in a compliant area (i.e. maintenance building). Petroleum products will be stored in tightly sealed containers that are clearly labeled. Any asphalt substances used on-site will be applied according to manufacturer's recommendations.

Solvents, Paints, and other Hazardous Substances - All containers will be tightly sealed and stored indoors when not required for use. Excess materials will not be discharged to the storm sewer system, but will be properly disposed according to manufacturer's instructions or state and local regulations. Any storage on-site shall be in compliance with all local, state and federal regulations.

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10.0 Standard 10: Prohibition of Illicit Discharges

Standard 10 of the Massachusetts Stormwater Handbook prohibits illicit discharges to stormwater management systems. As stated in the handbook, "The stormwater management system is the system for conveying, treating, and infiltrating stormwater on-site, including stormwater best management practices and any pipes intended to transport stormwater to the groundwater, a surface water, or municipal separate storm sewer system. Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater."

It is fully understood that the Storm Water Pollution Prevention Plan (SWPPP) for the project will include procedures to prevent illicit discharges to the stormwater management system during construction.

Standard 10 also states that "The Illicit Discharge Compliance Statement must be accompanied by a site map that is drawn to scale and that identifies the location of any systems for conveying stormwater on the site and shows that these systems do not allow the entry of any illicit discharges into the stormwater management system. The site map shall identify the location of any systems for conveying wastewater and/or groundwater on the site and show that there are no connections between the stormwater and wastewater management systems and the location of any measures taken to prevent the entry of illicit discharges into the stormwater management system." Included with this report are drawings that display the location of all of the stormwater management components as well as other utilities (existing and proposed) on the project site and conforms to requirements of a "site map" to accompany the Illicit Discharge Compliance Statement.

The Illicit Discharge Compliance Statement for the project is as follows:

Illicit Discharge Compliance Statement

Per the requirements of Standard 10 of the Massachusetts Stormwater Management Standards, it shall be stated that to the best of our knowledge and belief, and based on available information, the project, as designed, does not propose or contain any illicit discharges as defined in the Massachusetts Stormwater Management Standards.

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Appendix

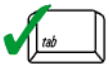
APPENDIX A – MASSACHUSETTS STORMWATER REPORT CHECKLIST AND CERTIFICATION

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☐ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

APPENDIX B – NRCS CUSTOM SOIL RESOURCE REPORT AND GEOTECHNICAL REPORT

United States Department of Agriculture

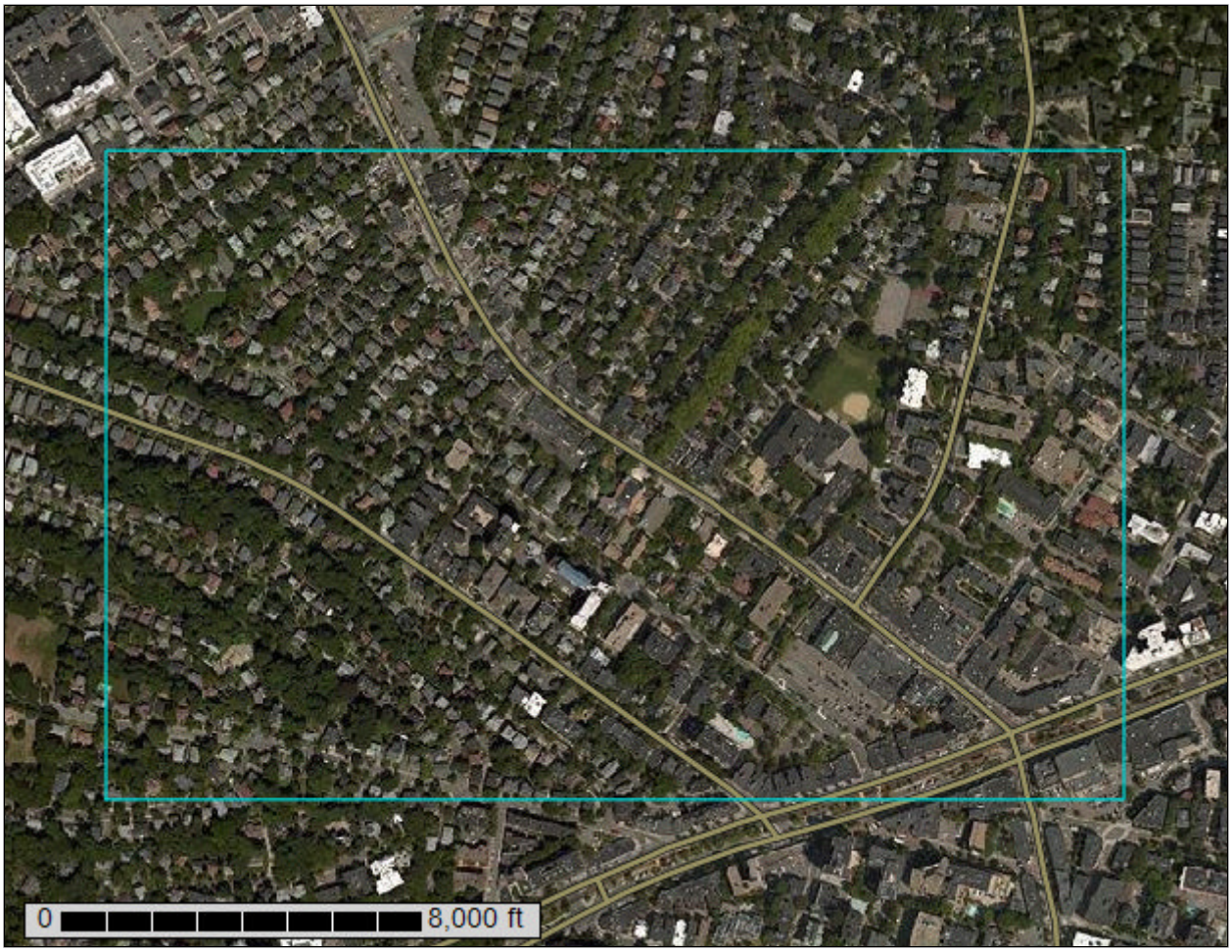
NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Norfolk and Suffolk Counties, Massachusetts

JCHE at Congregation Kehillath Israel



October 4, 2016

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:5,700 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 250 500 1000 1500

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 11, Sep 28, 2015

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

Date(s) aerial images were photographed: Aug 10, 2014—Aug 25, 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**
602	Urban land, 0 to 15 percent slopes	69.1	40.8%
603	Urban land, wet substratum, 0 to 3 percent slopes	10.2	6.0%
627C	Newport-Urban land complex, 3 to 15 percent slopes	42.5	25.1%
628C	Canton-Urban land complex, 3 to 15 percent slopes	47.6	28.1%
Totals for Area of Interest		**169.4**	**100.0%**

Map Unit Descriptions

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

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

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

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic

classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Norfolk and Suffolk Counties, Massachusetts

602—Urban land, 0 to 15 percent slopes

Map Unit Setting

National map unit symbol: vkyj
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 120 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 99 percent
Minor components: 1 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Parent material: Excavated and filled land

Minor Components

Rock outcrops

Percent of map unit: 1 percent
Hydric soil rating: Unranked

603—Urban land, wet substratum, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: vkyl
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 120 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Parent material: Excavated and filled land over herbaceous organic material and/or alluvium and/or marine deposits

Minor Components

Udorthents

Percent of map unit: 13 percent
Hydric soil rating: Unranked

Beaches

Percent of map unit: 2 percent
Hydric soil rating: Unranked

627C—Newport-Urban land complex, 3 to 15 percent slopes

Map Unit Setting

National map unit symbol: vkwv
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 120 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Newport and similar soils: 70 percent
Urban land: 20 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Newport

Setting

Landform: Drumlins
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable coarse-loamy eolian deposits over dense coarse-loamy lodgment till derived from metamorphic rock

Typical profile

H1 - 0 to 9 inches: silt loam
H2 - 9 to 26 inches: channery silt loam
H3 - 26 to 60 inches: channery silt loam

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 20 to 40 inches to densic material
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None

Frequency of ponding: None
Available water storage in profile: Low (about 4.4 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Urban Land

Setting
Parent material: Excavated and filled land

Minor Components

Paxton
Percent of map unit: 4 percent
Hydric soil rating: No

Pittstown
Percent of map unit: 4 percent
Hydric soil rating: No

Udorthents
Percent of map unit: 2 percent
Hydric soil rating: Unranked

628C—Canton-Urban land complex, 3 to 15 percent slopes

Map Unit Setting
National map unit symbol: vktb
Elevation: 0 to 1,000 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 120 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition
Canton and similar soils: 70 percent
Urban land: 20 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canton

Setting
Landform: Ice-contact slopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex

Across-slope shape: Convex
Parent material: Friable coarse-loamy eolian deposits over loose sandy and gravelly ablation till

Typical profile
H1 - 0 to 3 inches: fine sandy loam
H2 - 3 to 18 inches: fine sandy loam
H3 - 18 to 60 inches: gravelly loamy sand

Properties and qualities
Slope: 3 to 8 percent
Depth to restrictive feature: 18 to 36 inches to strongly contrasting textural stratification
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Hydric soil rating: No

Description of Urban Land

Setting
Parent material: Excavated and filled land

Minor Components

Montauk
Percent of map unit: 4 percent
Hydric soil rating: No

Scituate
Percent of map unit: 2 percent
Hydric soil rating: No

Charlton
Percent of map unit: 2 percent
Hydric soil rating: No

Udorthents
Percent of map unit: 2 percent
Hydric soil rating: Unranked

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

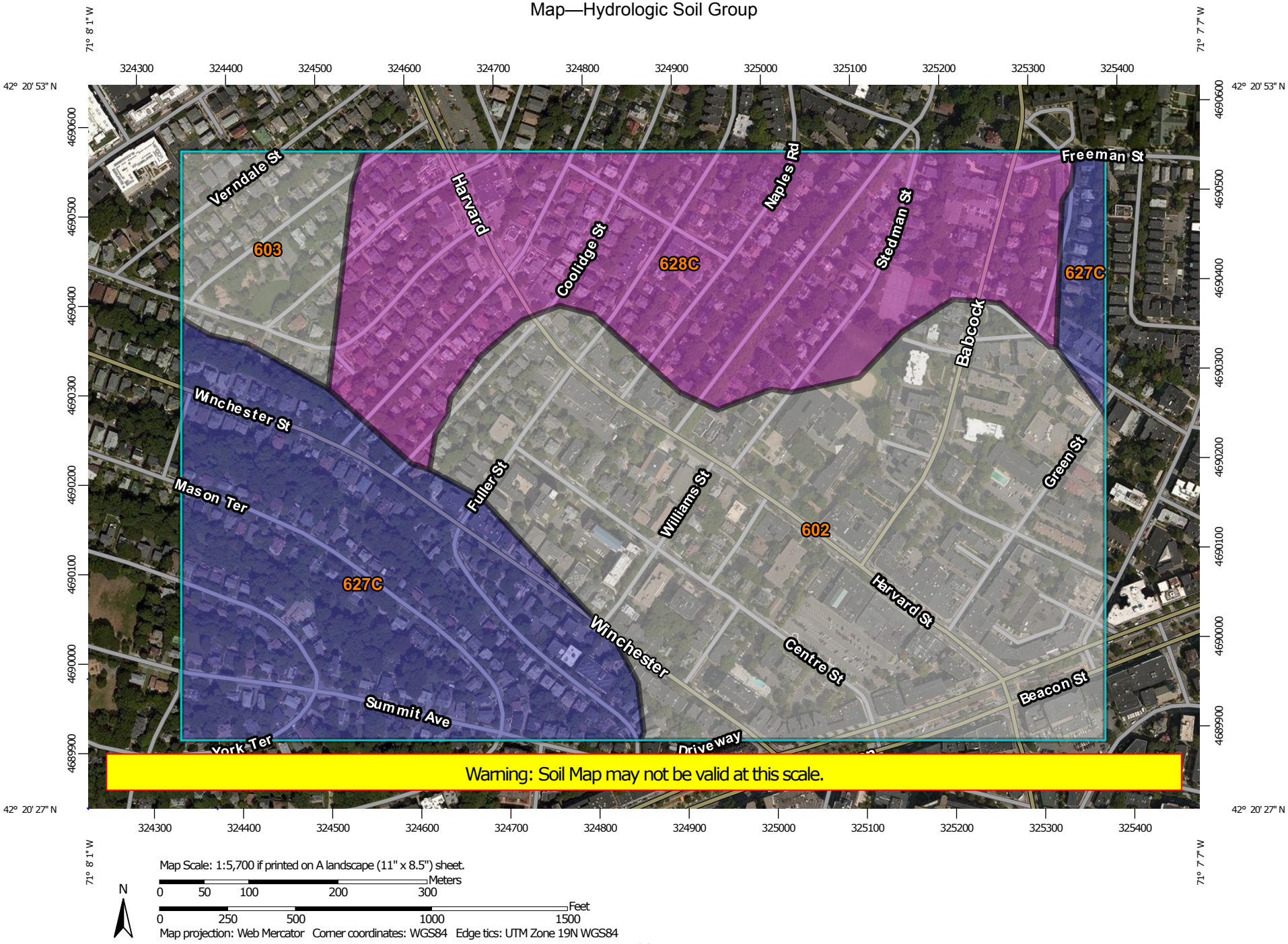
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Custom Soil Resource Report
Map—Hydrologic Soil Group



Map Scale: 1:5,700 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 250 500 1000 1500

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 Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

Streams and Canals

Transportation

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

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: 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.

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Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 11, Sep 28, 2015

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

Date(s) aerial images were photographed: Aug 10, 2014—Aug 25, 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.

Table—Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Norfolk and Suffolk Counties, Massachusetts (MA616)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
602	Urban land, 0 to 15 percent slopes		69.1	40.8%
603	Urban land, wet substratum, 0 to 3 percent slopes		10.2	6.0%
627C	Newport-Urban land complex, 3 to 15 percent slopes	B	42.5	25.1%
628C	Canton-Urban land complex, 3 to 15 percent slopes	A	47.6	28.1%
Totals for Area of Interest			**169.4**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

FOUNDATION ENGINEERING REPORT

PROPOSED ADDITION TO THE CONGREGATION KEHILLATH ISRAEL

BROOKLINE, MASSACHUSETTS

SEPTEMBER 28, 2015

Prepared For:

Kehillath Israel
384 Harvard Street
Brookline, MA 02446

McPHAIL ASSOCIATES, LLC
2269 Massachusetts Avenue
Cambridge, MA 02140
www.mcphailgeo.com
(617) 868-1420

PROJECT NO. 6011

September 28, 2015

Kehillath Israel
384 Harvard Street
Brookline, MA 02446

Attention: Paula Silver

Reference: Proposed Addition to the Congregation Kehillath Israel; Brookline, MA
Foundation Engineering Report

This letter documents the results of our subsurface exploration program and foundation design study for the proposed addition to the Congregation Kehillath Israel located at 384 Harvard Street in Brookline, Massachusetts. Refer to the Project Location Plan (Figure 1) for the general site location.

This report was prepared in accordance with our proposal dated September 11, 2015 and the subsequent authorization of Kehillath Israel. These services are subject to the limitations contained in Appendix A.

Purpose and Scope

The purposes of the subsurface exploration program and foundation design study are to assess the subsurface soil and groundwater conditions at the site as they relate to foundation design and construction, and based on this information, to provide safe and economical foundation design recommendations for the proposed addition.

Foundation design includes foundation support of the proposed addition and its lowest level slab, treatment of the lowest level slab in consideration of groundwater, and seismic design considerations in accordance with the provisions of the Eighth Edition of the Massachusetts State Building Code (Code). Foundation construction considerations relating to geotechnical aspects of the proposed construction are also presented herein.

Available Information

Information provided to McPhail Associates, LLC (McPhail) included the following:

- A survey plan entitled "Existing Conditions Plan" dated December 3, 2012, and prepared by Precision Land Surveying, Inc. (PLS); and
- A set of architectural drawings entitled "Kehillath Israel Additions & Renovations" dated August 18, 2015, and prepared by Handlin, Garrahan & Associates, Inc.

Existing Conditions

The subject site has an approximately rectangular shape, occupies an area of about 1.3-acres, and is bounded by Harvard Street to the north, Williams Street to the east, residential properties to the south, and commercial properties to the west. Currently, the eastern and central portions of the site are primarily occupied by the existing Congregation Kehillath Israel building which has an approximate footprint of 22,600 square feet. The western portion of the site is currently occupied by a lawn area and playground. The existing ground surface across the generally slopes gently downward from about Elevation +70 at the south property line to about Elevation +63 at the north property line, across an approximate horizontal distance of 190 feet.

Elevations cited herein are in feet and are referenced to the Town of Brookline datum which is 5.78 feet below the National Geodetic Vertical Datum (NGVD).

Proposed Development

The scope of development is understood to consist of an addition and renovations to the existing Congregation Kehillath Israel building. The addition is proposed to abut the existing building to the west and occupy an approximate footprint of 6,000 square feet. Further, the addition is understood to consist of three (3) levels with the lowest level slab located partially below-grade at about Elevation +58.3, which is understood to be approximately consistent with the lowest level slab of the existing building. A stormwater recharge system is also proposed to the west of the addition.

Subsurface Exploration Program

A subsurface exploration program consisting of five (5) borings and three (3) test pits was conducted at the site on September 17th and 18th, 2015. The borings were performed by Carr-Dee Corp. of Medford, Massachusetts under contract to McPhail. Logs of the borings prepared by Carr-Dee Corp. are contained in Appendix B. The test pits were performed by Mattuchio Construction Company Inc. of Malden, Massachusetts under contract to McPhail. Logs of the test pits prepared by McPhail are contained in Appendix C. Approximate plan locations of the borings and test pits are as indicated on the enclosed Subsurface Exploration Plan, Figure 2.

The explorations were observed by representatives of McPhail who performed field layout, prepared field logs, obtained and visually classified soil samples, monitored groundwater conditions in the open explorations and groundwater monitoring well, made minor adjustments to the exploration locations, and determined the required exploration depths based upon the actual subsurface conditions encountered.

Field locations of the subsurface explorations were determined by taping from existing site features identified on the survey plan prepared by PLS. The existing ground surface

elevation at each exploration location was determined by a level survey performed by McPhail utilizing vertical control also indicated on the survey plan provided by PLS.

The borings were performed using both truck-mounted and track-mounted drill-rigs and advanced utilizing hollow-stem augers and/or NW casing and the wet rotary drilling method. Standard 1-3/8 inch I.D. split-spoon samples and standard penetration tests were generally obtained at minimum 5-foot intervals of depth in general accordance with the standard procedures described in ASTM D1586.

The test pits were excavated using a rubber-tire backhoe, and were backfilled with the excavated soil upon completion of measurements, documentation and sampling.

To permit monitoring of the groundwater level across the site, a groundwater observation well was installed within the completed borehole B-4(OW).

In-Situ Permeability Testing Procedures

On September 17, 2015, two (2) constant head, in-situ permeability tests were performed at the site. The permeability tests were performed at approximate depths of 5.0 feet below the existing ground surface. The permeability tests were performed within the fill deposit in boreholes B-4(OW) and B-5. The results of the individual in-situ permeability tests are presented in Appendix E and are summarized in Table 1.

The permeability tests were conducted as open-end tests and were performed in general accordance with the U.S. Bureau of Reclamation, Designation E-18 (USBR Method E-18). The general procedures are described below.

Each borehole was advanced inside a 3-inch I.D. steel casing. Once the desired test depth was reached, the soil was carefully cleaned out to the bottom of the casing using wet rotary drilling techniques. Clean water was then introduced into the borehole to a pre-determined level. The flow rate of the water was subsequently adjusted until a relatively constant head could be maintained in the casing at a relatively constant flow rate (steady state).

The coefficient of permeability (k) of the soil was then calculated as:

$$k = \frac{q}{5.5rh}$$

where: q = constant rate of flow into the borehole;
r = inside radius of casing;
h = head of water used to maintain steady state.
(Note: Any consistent units may be used.)

Laboratory Testing

At the completion of our subsurface exploration program, soil samples were returned to our laboratory for more detailed classification, analysis, and testing. The laboratory testing consisted of sieve analyses to determine the grain size distributions and confirm the visual classifications of the fill and glacial outwash deposits. Laboratory test procedures were in general accordance with applicable ASTM Standards. Results of the gradation testing appear on Figures 3 and 4 following the text of this report.

Subsurface Conditions

Detailed descriptions of the subsurface conditions encountered within the borings and test pits are documented on the boring and test logs contained in Appendices B and C, respectively. Based on these explorations, the following is a description of the generalized subsurface conditions encountered across the site from ground surface downward.

A fill deposit was encountered underlying the existing concrete or landscaped surfaces with a thickness ranging from approximately 5 to 11 feet. The fill was observed to vary from a compact to dense, brown sandy gravel with trace silt, to a sand and silt with trace gravel. Traces of ash and cinders were also observed within the fill in borings B-1 and B-2. The test pits were terminated in the fill at depths of 6 to 7 feet below the existing ground surface.

Underlying the fill, a natural glacial outwash deposit was encountered at depths of about 5 to 11 feet below the existing ground surface within the borings, corresponding to levels ranging from about Elevation +58 to Elevation +55. The natural glacial outwash deposit was generally observed to consist of a very dense, brown sand and gravel to sand with trace silt. Lenses of dense, light brown silt with some sand and trace clay were also observed within the glacial outwash deposit at approximate depths of 20 to 24 feet and 20 to 22 feet within borings B-1 and B-2, respectively. Refusal was encountered at a depth of about 11 feet in boring B-3(OW), likely on a cobble or boulder on the surface of the natural glacial outwash deposit. The natural glacial outwash deposit was observed to extend to the bottoms of borings B-1, B-2, B-4, and B-5 at depths of 11.5 to 27 feet below the existing ground surface.

Groundwater was not observed in the groundwater monitoring well installed within the completed borehole B-4(OW), which extended to about 15.2 feet below the existing ground surface. Further, groundwater was not observed within the borings at depths of up to 27 feet. However, it is anticipated that future groundwater levels across the site may vary from those reported herein due to factors such as normal seasonal changes, periods of heavy precipitation, and alterations of existing drainage patterns.

Existing Foundation Conditions

Detailed descriptions of the existing foundation conditions encountered within the test pit explorations are documented on the logs contained in Appendix C. Photos of the test pits are provided in Appendix D. Based on these explorations, the following is a brief description of the generalized foundation conditions encountered at the west side of the existing building.

Within test pit TP-1, the bottom of the existing foundations were encountered at about Elevation +61.2 on the south side of the test pit and about Elevation +59.7 on the east side of the test pit. On the south side of the test pit, the concrete footing was observed to extend outward from the wall approximately 9 inches, with a height varying from about 6 to 12 inches. On the west side of the test pit, the lower 4 feet of the foundation wall stepped inward approximately 12 inches and appeared to be earth-formed. The foundation was observed to bear on a granular fill material.

Test pit TP-2 was performed adjacent to a column which was approximately 34.5 inches in width, and was supported on a footing extending to a depth of about 7 feet below the existing ground surface, corresponding to about Elevation +56.4. The footing was observed to consist of concrete and extended outward from the column approximately 3 inches with a height of about 16 inches. The bearing soils underlying the footing were not observed in the test pit.

Within test pit TP-3, performed at the northwest corner of the existing building, the bottom of the existing footing was observed to extend to a depth of about 6 feet below the existing ground surface, corresponding to about Elevation +57.8. The footing was observed to extend outward from the wall approximately 8 to 13 inches. Also, a portion of the footing appeared to be earth-formed. The foundation was observed to bear on a granular fill material.

Access limitations constrained the test pits from extending to the depth of the natural glacial outwash deposit.

Foundation Design Recommendations

Based on the scope of the proposed construction and the subsurface conditions encountered at the site, it is recommended that foundation support for the proposed addition consist of conventional spread footings in conjunction with a soil-supported slab-on-grade. The foundations should bear directly on the natural, undisturbed glacial outwash deposit, or on compacted structural fill placed directly over the natural, undisturbed glacial outwash deposit after removal of all existing surface treatments and fill within the footprints of the proposed footings and to the lateral extent defined herein.

The footings should be proportioned utilizing a maximum allowable design bearing pressure of 3 tons per square-foot. All foundations should be designed in accordance with the 8th

Edition of the Massachusetts State Building Code (Code). Recommended minimum footing widths for continuous and isolated spread footings are 24 and 36-inches, respectively.

All perimeter foundations and interior foundations located adjacent to unheated areas should be provided with a minimum 4-foot thickness of soil cover as frost protection. Interior footings below heated areas should be located such that the top of the foundation concrete is at least 6 inches below the underside of the lowest level slab.

The bottoms of all footings should be located such that they are below a theoretical line drawn upward and outward at 2 to 1 (horizontal to vertical) from the bottom exterior edge of adjacent foundations and utilities. Where the new foundations are located immediately adjacent to existing foundations, the bottom of the new foundations should extend to the same elevation as the existing foundations.

Preparation of the subgrade for support of the spread footings should include the removal of all surface treatments and fill below the proposed footings down to the surface of the natural glacial outwash deposit. In areas where the existing fill extends deeper than the proposed bottom of footing elevation, compacted structural fill should be placed from the surface of the natural glacial outwash deposit to the proposed bottom of footing elevation. The lateral limits of the excavation for footings supported on structural fill should extend beyond the outside edge of the footing a horizontal distance equal to the distance between the bottom of the proposed footing and the surface of the underlying natural glacial outwash deposit, plus two feet in every plan direction.

Structural fill may consist of suitable excavated on-site fill, glacial outwash, or an imported gravel fill containing less than 8 percent passing the No. 200 sieve. All structural fill placed for support of the spread footings should be placed in lifts having a compacted thickness of 6 inches and be compacted to a minimum of 95 percent of its maximum modified Proctor dry density. Reuse of the on-site soils as structural fill will require special measures to maximize their reuse as discussed in more detail in the "Foundation Construction Considerations" section of this report. Placement and compaction of structural fill should be monitored on a full-time basis in accordance with the requirements of the Code.

Where the lateral limits of excavation recommended for structural fill cannot be achieved due to proximity to property lines and/or adjacent structures, lean concrete should be placed from the surface of the natural glacial outwash deposit to the proposed bottom of foundation elevation. The lateral limits of the excavation for portions of the foundation supported on lean concrete should extend beyond the outside edge of the foundation a horizontal distance of at least 6 inches in all plan dimensions. Lean concrete should have a minimum compressive strength of 1,000 pounds per square-inch (psi).

Based on the results of the borings, the surface of the natural glacial outwash deposit was encountered at elevations ranging from about +58 to +55. Therefore, it is anticipated that about 1 to 2 feet of overexcavation of the fill deposit to the surface of the natural glacial outwash deposit and replacement with structural fill or lean concrete will be required in certain areas, particularly on the west end of the proposed addition.

The lowest level slab of the proposed addition should be designed as a slab-on-grade bearing on the existing fill or natural glacial outwash deposits. Where the subgrade consists of fill, the subgrade should be proofrolled with at least four passes of a 10-ton vibratory drum roller. All soft or compressible areas detected by the proofrolling should be excavated and replaced with compacted gravel fill.

The lowest level slab of the proposed addition should be underlain by a polyethylene vapor barrier spread across the surface of a 9-inch thickness of compacted 3/4-inch crushed stone which is underlain by filter fabric, such as Mirafi 140N, spread across the existing fill or natural glacial outwash subgrade.

As the lowest level slab will be located below the existing ground surface, it is recommended that the lowest level slab of the proposed addition be provided with underslab and perimeter drainage in order to protect against intrusion of groundwater. The underslab and perimeter drainage system should consist of 4-inch diameter perforated PVC pipes having the highest invert a minimum of 12 inches below the underside of the lowest level slab. It is recommended that the pipes be surrounded by a minimum 6-inch thickness of 3/4-inch crushed stone surrounded by a thickness of filter fabric such as Mirafi 140N, or equivalent. All below-grade foundation walls should receive a troweled-on bitumastic damproofing. A prefabricated drainage product, such as Miradrain 6000, should also be installed directly against the below-grade perimeter foundation walls and be tied into the perimeter drainage system.

The perimeter and underslab drains should be gravity drained to a storm drain line which is not subject to surcharge. Further, all localized depressions in the lowest level slabs extending below grade (such as elevator pits, etc.) should be provided with properly tied continuous waterstops in all construction joints and metallic waterproofing to protect against groundwater intrusion.

Below-grade foundation walls receiving lateral support at the top and bottom (i.e. restrained walls) should be designed for a lateral earth pressure corresponding to an equivalent fluid density of 60 pounds per cubic-foot. Similarly, drained cantilevered retaining walls, (i.e. receiving no lateral support at the top) should be designed for a lateral earth pressure corresponding to an equivalent fluid density of 40 pounds per cubic-foot. To these values must be added the pressures attributable to earthquake forces per Section 1610.2 of the Code.

Lateral forces can be considered to be transmitted from the structure to the soil by passive pressure against the perimeter foundation walls utilizing an equivalent fluid density of 120 pounds per cubic foot providing that the foundation walls are designed to resist these pressures. Lateral force can also be considered to be transmitted from the structure to the soil by friction on the base of footings using a coefficient of 0.45, to which a safety factor of 1.5 should be applied.

Permeability Test Results and Recommmendations

The results of the constant head, in-situ permeability tests indicate a coefficient of permeability (k) in the fill deposit ranging from about 1.1×10^{-3} to 3.0×10^{-3} centimeters per second (cm/s).

The coefficient of permeability of the fill deposit was also estimated based on laboratory grain-size distribution using the Kozeny-Carman formula. This method involves the use of additional parameters such as void ratio and particle shape, which are estimated from the boring data and the representative soil samples. The results of the Kozeny-Carman analyses provided an estimated permeability of 6.8×10^{-4} cm/s in boring B-4(OW) at depths of 5.5 to 7.5 feet, and an estimated permeability of 4.0×10^{-3} cm/s in boring B-5 at depths of 5 to 6 feet.

Both the results of the in-situ permeability testing and the Kozeny-Carman formula indicate values of the coefficient of permeability within published ranges for similar soils. In consideration of the above, a design coefficient of permeability of 5×10^{-4} cm/s is recommended for the fill deposit.

It should be noted that the existing fill deposit is heterogeneous in composition and variable in density, thus, it is anticipated that the coefficient of permeability in the fill deposit will be highly variable and the results of our permeability testing may not be representative of the entire fill deposit.

Seismic Design Considerations

For the purposes of determining parameters for structural seismic design, the site is considered to be classified as a Site Class D as defined in Section 1613.5.2 of the Code. Further, the bearing stratum on the proposed site is not considered to be subject to liquefaction during an earthquake based on the criterion of Section 1806.4 of the Code.

Foundation Construction Considerations

The primary construction considerations include underpinning, preparation of the foundation bearing surfaces, subgrade protection, placement and compaction of structural fill, re-use of on-site soils, construction dewatering, and off-site disposal of excess excavated material.

Based on the depths of the existing foundations relative to the anticipated foundation depths for the proposed addition, it is not anticipated that underpinning will be required. However, should any existing foundations be found to be located above a theoretical line drawn upward and outward at 2 to 1 (horizontal to vertical) from the bottom exterior edge of new foundations should be underpinned.

Footing excavations in the natural glacial outwash deposit should be prepared utilizing a smooth-edged or "toothless" excavator bucket to avoid disturbance of the bearing surface, or should be hand-cleared of loose and disturbed material. Immediately following excavation to the final bearing surface, a minimum 3-inch thickness of compacted 3/4-inch crushed stone should be placed over the subgrade to protect the bearing surface from subsequent disturbance.

The excavated fill and glacial outwash soils may be suitable for reuse as structural fill and ordinary fill provided that they are maintained in a relatively dry condition and can be properly compacted. Additionally, prior to reusing these soils, it will be necessary to cull out all material in excess of 4 inches in its largest dimension. It is recommended that excavated fill and glacial outwash soils intended for reuse be excavated in dry conditions, and stockpiles of these soils be protected against increases in moisture content by securely covering the stockpiles prior to and during precipitation events. Therefore, the placement and compaction of the excavated fill and glacial outwash soils should be completed during relatively dry and non-freezing conditions. If the excavated fill or glacial outwash soils become unsuitable for reuse as structural fill and ordinary fill, these soils should be removed from the site and an off-site gravel fill, consisting of a well-graded natural sand and gravel with a maximum of 8 percent by weight passing the No. 200 sieve, be used. Protection of all materials from increases in moisture content is considered to be the responsibility of the Contractor.

In consideration of the observed depth of the groundwater below the existing ground surface, it is not anticipated that significant groundwater control will be required during the construction period. Dewatering by means of conventional sumping should suffice for groundwater control during periods of high precipitation. It is recommended that all pumped groundwater be re-charged on-site. If pumped groundwater cannot be re-charged on-site, it would be necessary to dispose of pumped groundwater into a nearby storm drain or combined sewer which would require the need for a temporary construction dewatering discharge permit.

In consideration of the excavation required for the proposed addition, chemical testing of soil samples will be required for off-site soil disposal of excess generated soil. Off-site disposal of excess generated soil should be conducted in accordance with the current policies of the Massachusetts Department of Environmental Protection. Our scope of services to date specifically excludes geoenvironmental engineering services pursuant to the Massachusetts Oil and Hazardous Materials Release Prevention and Response Act (MGL Chapter 21E) and pursuant to the Massachusetts Contingency Plan (310 CMR 40.0000), however, these services could be provided by McPhail under separate contract, if required.

Final Comments

McPhail has been retained to provide design assistance to the design team during the final design phase of this project. The purpose of this involvement is to review the structural foundation drawings and foundation notes for conformance with the recommendations

presented herein, and to generate the earthwork specification for inclusion into the Contract Documents for construction.

It is recommended that McPhail be retained during the construction period to observe footing excavations and the placement and compaction of fill materials in accordance with the provisions of the Massachusetts State Building Code and the provisions of the Contract Documents. Our involvement during the construction phase of the work should minimize costly delays due to unanticipated field problems since our field engineer would be under the direct supervision of our project manager who was responsible for the subsurface exploration program and foundation design recommendations documented herein.
We trust that the above is sufficient for your present requirements. Should you have any questions concerning the recommendations presented herein, please do not hesitate to contact us.

Very truly yours,

McPHAIL ASSOCIATES, LLC

Scott S. Dennis, P.E.

Ambrose J. Donovan, P.E., L.S.P.

F:\WP5\REPORTS\6011 FER 092515.docx

SSD/ajd

FIGURE 1

McPHAIL ASSOCIATES, LLC
Geotechnical and Geoenvironmental Engineers
2269 Massachusetts Avenue
Cambridge, MA 02140
617/868-1420
617/868-1423 (Fax)
www.mcphailgeo.com

N

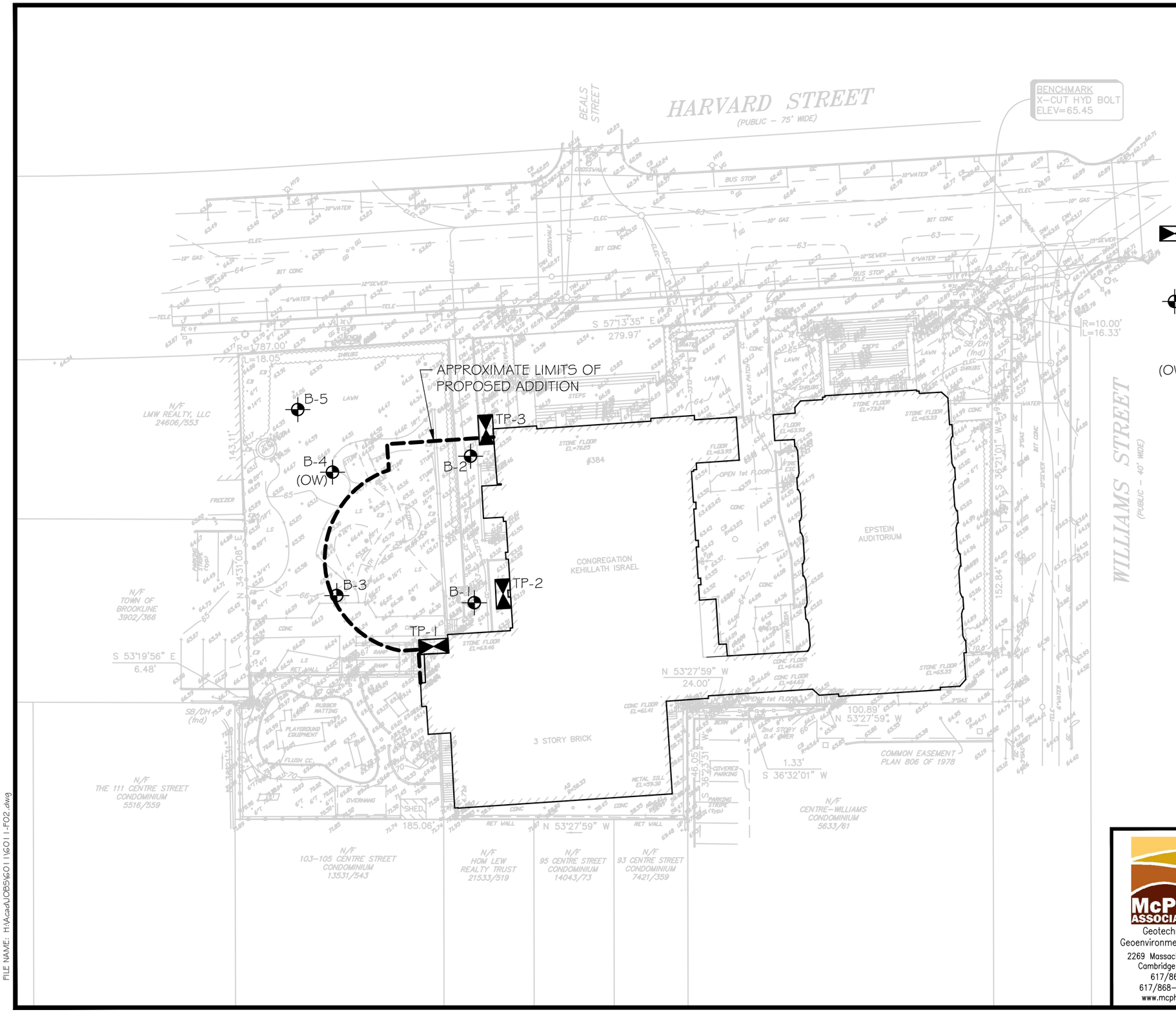
SCALE 1:25,000

PROJECT LOCATION PLAN

CONGREGATION KEHILLATH ISRAEL

BROOKLINE MASSACHUSETTS

FIGURE 2



LEGEND

— APPROXIMATE LOCATION OF TEST PIT PERFORMED BY MATTUCHIO CONSTRUCTION Co. ON SEPTEMBER 17, 2015 FOR McPHAIL ASSOCIATES, LLC

— APPROXIMATE LOCATION OF BORING PERFORMED BY CARR-DEE CORP. ON SEPTEMBER 17 AND 18, 2015 FOR McPHAIL ASSOCIATES, LLC

(OW) — INDICATES OBSERVATION WELL INSTALLED WITHIN COMPLETED BOREHOLE

REFERENCE: THIS PLAN WAS PREPARED FROM A 20-SCALE DRAWING ENTITLED, "EXISTING CONDITIONS PLAN" DATED DECEMBER 3, 2012 PREPARED BY PRECISION LAND SURVEYORS, INC.

GRAPHIC SCALE

40 0 40 80

McPHAIL ASSOCIATES, LLC
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www.mcphailgeo.com

CONGREGATION KEHILLATH ISRAEL

BROOKLINE MASSACHUSETTS

SUBSURFACE EXPLORATION PLAN

FOR

KEHILLATH ISRAEL

BY

McPHAIL ASSOCIATES, LLC

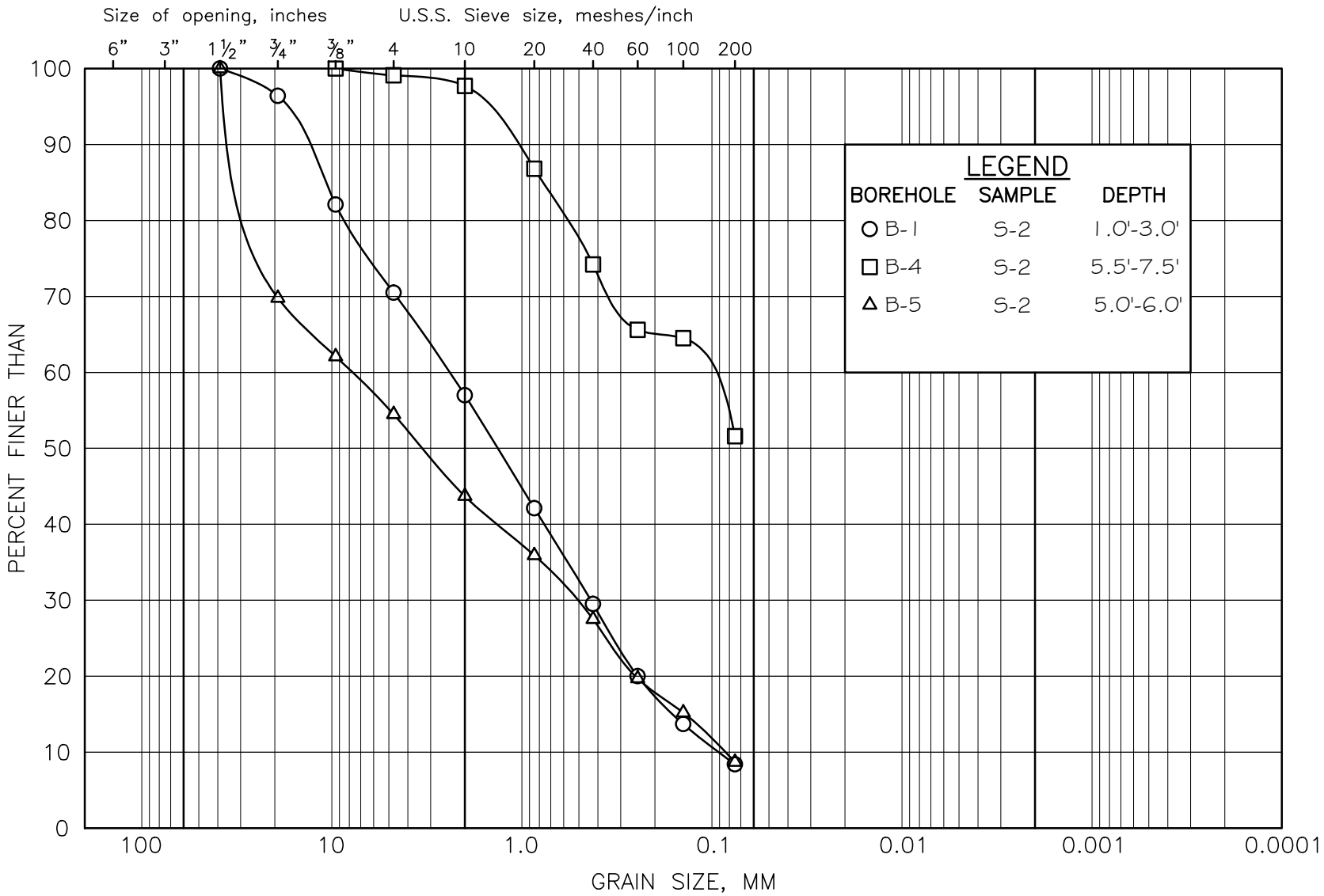
Date: SEPTEMBER 2015	Dwn: M.B.S.	Chkd: S.S.D.	Scale: 1" = 40'
Project No: 6011			

FILE NAME: H:\Acad\JOBS\6011\6011-F02.dwg

FILE NAME: H:\Acad\JOBS\6011\6011-F03_Sieve.dwg

PROJECT No. 6011

M.I.T. GRAIN SIZE SCALE



COBBLE SIZE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE
	GRAVEL SIZE			SAND SIZE			FINE GRAINED	

McPHAIL ASSOCIATES, LLC

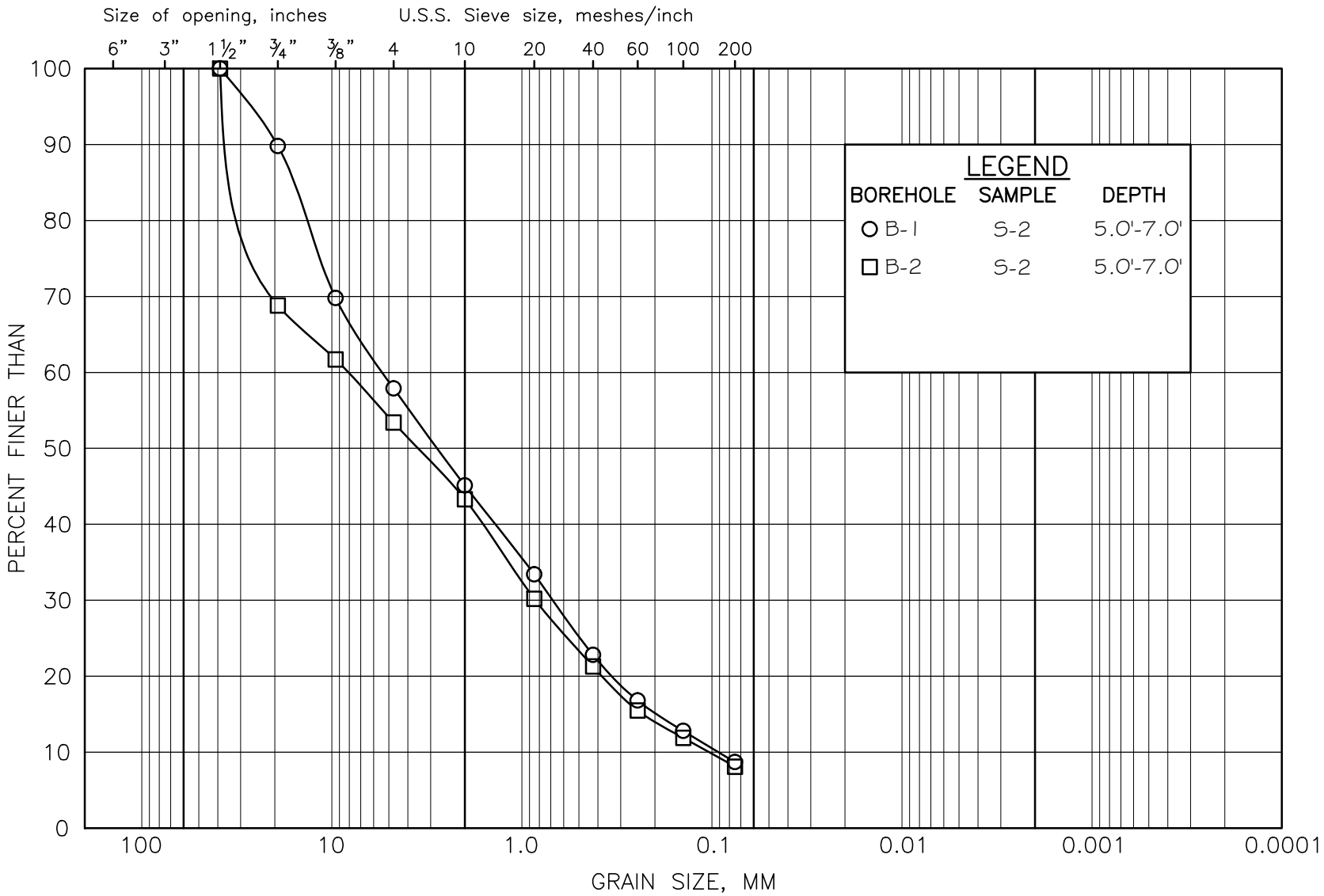
GRAIN SIZE DISTRIBUTION
FILL

FIGURE 3

FILE NAME: H:\Acad\JOBS\6011\6011-F04_Sieve.dwg

PROJECT No. 6011

M.I.T. GRAIN SIZE SCALE



COBBLE SIZE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE
	GRAVEL SIZE			SAND SIZE			FINE GRAINED	

McPHAIL ASSOCIATES, LLC

GRAIN SIZE DISTRIBUTION
GLACIAL OUTWASH

FIGURE 4

TABLE 1
Constant Head Borehole Permeability Tests
Summary

Congregation Kehillath Israel
Brookline, MA
Project No. 6011

Borehole	Test Depth (ft)	Soil Strata	Head (ft)	Flow Rate, q (cm^3/s)	Permeability, k (cm/s)	(ft/day)
B-4(OW)	5	Fill	5.5	4.01	1.14×10^{-3}	3.2
B-5	5	Fill	5.5	10.6	3.01×10^{-3}	8.5

APPENDIX A:

LIMITATIONS

LIMITATIONS

This report has been prepared on behalf of and for the exclusive use of Kehillath Israel for specific application to the proposed addition to the Congregation Kehillath Israel building located at 384 Harvard Street in Brookline, Massachusetts in accordance with generally accepted soil and geotechnical engineering practices. No other warranty, expressed or implied, is made.

In the event that any changes in nature or design of the proposed construction are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by McPhail Associates.

The analyses and recommendations presented in this report are based upon the data obtained from the subsurface explorations performed at the approximate locations indicated on the enclosed plan. If variations in the nature and extent of subsurface conditions between the widely spaced explorations become evident during the course of construction, it will be necessary for a re-evaluation of the recommendations of this report to be made after performing on-site observations during the construction period and noting the characteristics of any variations.

APPENDIX B:

BORING LOGS PREPARED BY CARR-DEE CORP.

CARR-DEE CORP.

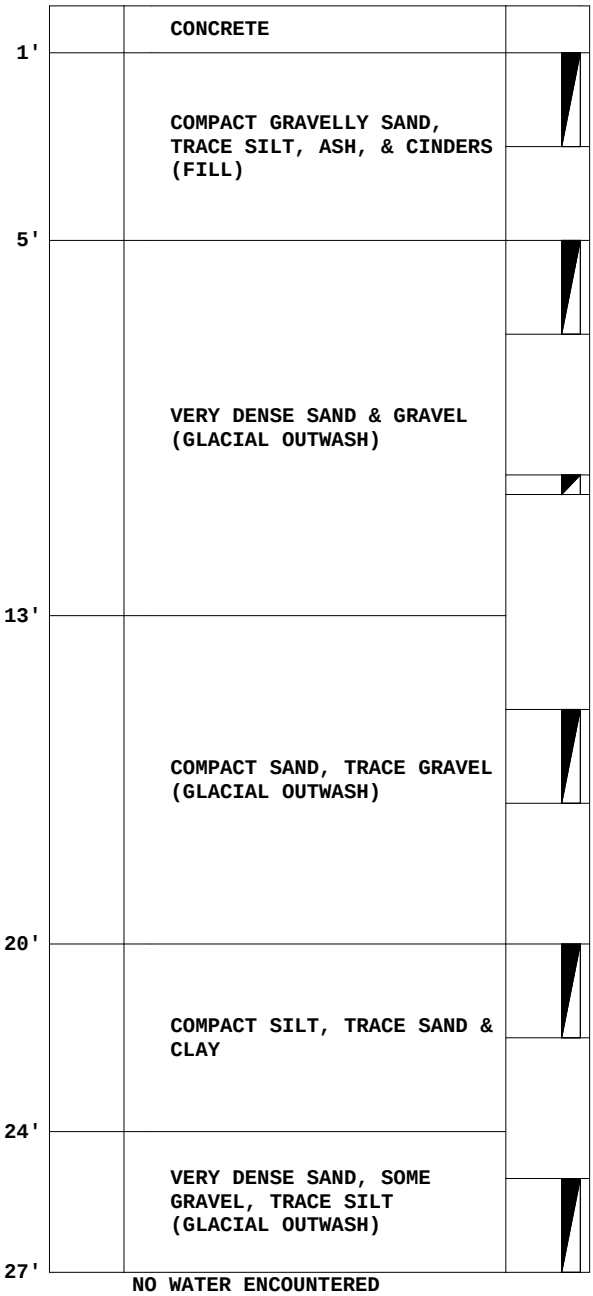
37 LINDEN STREET MEDFORD, MA 02155-0001 Telephone (781) 391-4500

To: MCPHAIL ASSOC., 2269 MASS. AVE., CAMBRIDGE, MA Date: 9-21-2015 Job No.: 2015-132

Location: 384 HARVARD STREET, BROOKLINE, MA Scale: 1 in.= 4 ft.

GROUND SURFACE +63.2

BORING 1



S#1, 1' to 3' (10-9-6-6) RECOVERED 14 in.

S#2, 5' to 7' (20-33-29-36) RECOVERED 10 in.

S#3, 10' to 10'5" (100/5") RECOVERED 2 in.

S#4, 15' to 17' (10-12-13-14) RECOVERED 16 in.

S#5, 20' to 22' (12-9-12-5) RECOVERED 20 in.

S#6, 25' to 27' (10-33-40-68) RECOVERED 6 in.

NO WATER ENCOUNTERED
SIZE OF AUGERS: 3-3/4" I.D., LENGTH: 25'0"
DRILLER: S. DESIMONE, JR., INSPECTOR: S. HILFIKER
DATE STARTED & COMPLETED: 9-18-2015

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

CARR-DEE CORP.

37 LINDEN STREET MEDFORD, MA 02155-0001 Telephone (781) 391-4500

To: MCPHAIL ASSOC., 2269 MASS. AVE., CAMBRIDGE, MA Date: 9-21-2015 Job No.: 2015-132

Location: 384 HARVARD STREET, BROOKLINE, MA Scale: 1 in.= 4 ft.

GROUND SURFACE +63.2

BORING 2

Depth	Description	Sample
6"	CONCRETE	
	COMPACT GRAVELLY SAND, TRACE SILT, ASH, & CINDERS (FILL)	S#1, 6" to 2'6" (7-8-11-10) RECOVERED 8 in.
5'	VERY DENSE SAND, GRAVEL, COBBLES (GLACIAL OUTWASH)	S#2, 5' to 7' (10-21-30-28) RECOVERED 10 in.
		S#3, 10' to 12' (50-51-39-37) RECOVERED 12 in.
13'	DENSE SAND, TRACE SILT, GRAVEL (GLACIAL OUTWASH)	S#4, 15' to 17' (15-13-17-23) RECOVERED 16 in.
20'	DESNE SILT, SOME SAND	S#5, 20' to 22' (10-13-24-23) RECOVERED 20 in.
22'		

NO WATER ENCOUNTERED
SIZE OF AUGERS: 3-3/4" I.D., LENGTH: 20'0"
DRILLER: S. DESIMONE, JR., INSPECTOR: S. HILFIKER
DATE STARTED & COMPLETED: 9-18-2015

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

CARR-DEE CORP.

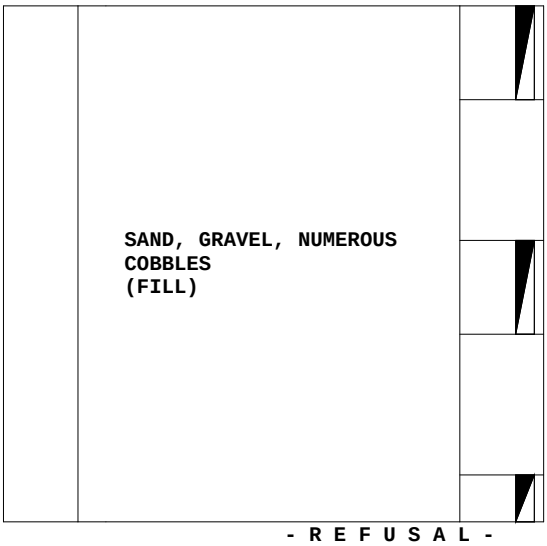
37 LINDEN STREET MEDFORD, MA 02155-0001 Telephone (781) 391-4500

To: MCPHAIL ASSOC., 2269 MASS. AVE., CAMBRIDGE, MA Date: 9-21-2015 Job No.: 2015-132

Location: 384 HARVARD STREET, BROOKLINE, MA Scale: 1 in.= 4 ft.

GROUND
SURFACE
+66.0

BORING 3



SAND, GRAVEL, NUMEROUS
COBBLES
(FILL)

S#1, 0' to 2'
(12-15-16-26)
RECOVERED 13 in.

S#2, 5' to 7'
(11-33-27-30)
RECOVERED 11 in.

S#3, 10' to 11'
(54-98-100/0")
RECOVERED 0 in.

11'

- R E F U S A L -
(NO PENETRATION WITH AUGERS)
NO WATER ENCOUNTERED
SIZE OF AUGERS: 3-3/4" I.D., LENGTH: 11'0"
DRILLER: S. DESIMONE, JR., INSPECTOR: S. HILFIKER
DATE STARTED & COMPLETED: 9-16-2015

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

CARR-DEE CORP.

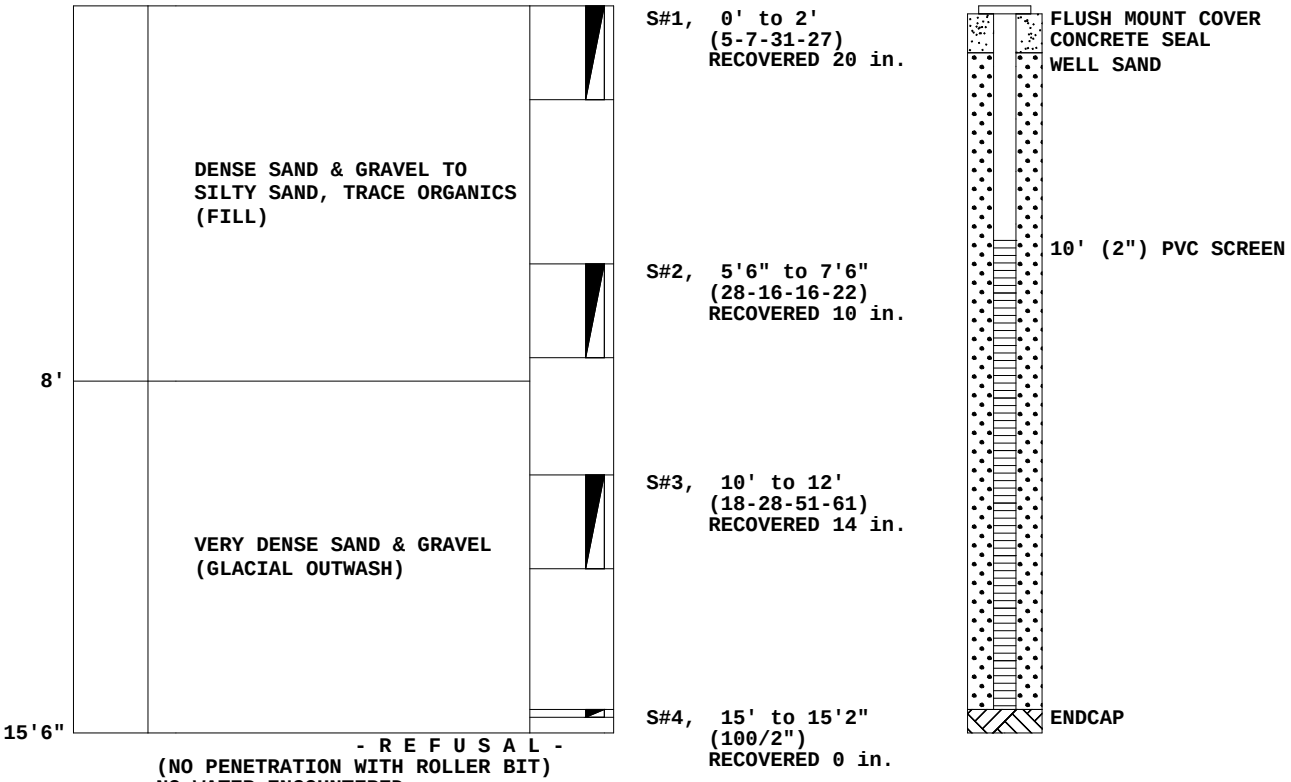
37 LINDEN STREET MEDFORD, MA 02155-0001 Telephone (781) 391-4500

To: MCPHAIL ASSOC., 2269 MASS. AVE., CAMBRIDGE, MA Date: 9-21-2015 Job No.: 2015-132

Location: 384 HARVARD STREET, BROOKLINE, MA Scale: 1 in.= 4 ft.

GROUND SURFACE +64.9

BORING 4



- R E F U S A L -
(NO PENETRATION WITH ROLLER BIT)
NO WATER ENCOUNTERED
SIZE OF CASINGS: NW, LENGTH: 15'0"
DRILLER: S. DESIMONE, JR., INSPECTOR: S. HILFIKER
DATE STARTED & COMPLETED: 9-17-2015

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

CARR-DEE CORP.

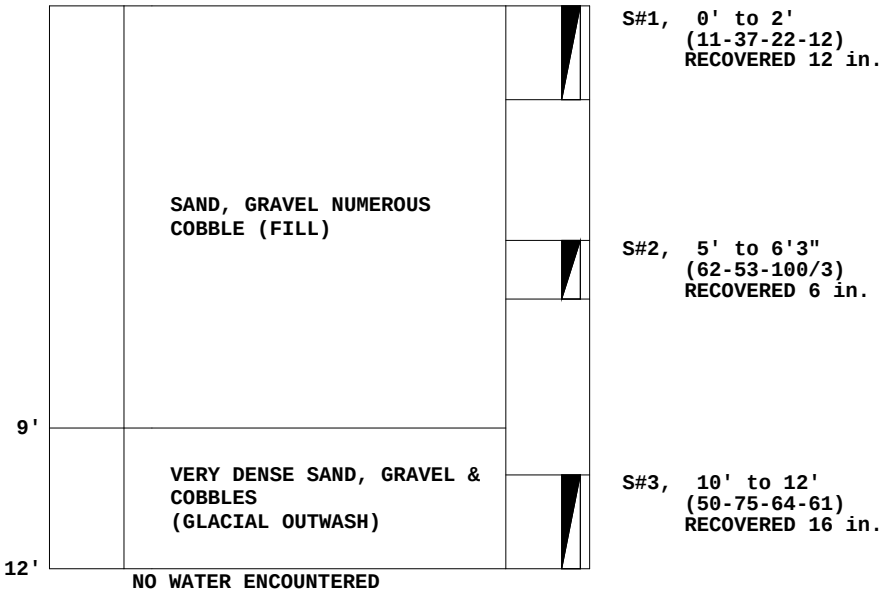
37 LINDEN STREET MEDFORD, MA 02155-0001 Telephone (781) 391-4500

To: MCPHAIL ASSOC., 2269 MASS. AVE., CAMBRIDGE, MA Date: 9-21-2015 Job No.: 2015-132

Location: 384 HARVARD STREET, BROOKLINE, MA Scale: 1 in.= 4 ft.

GROUND SURFACE +64.5

BORING 5



NO WATER ENCOUNTERED
SIZE OF CASINGS: NW, LENGTH: 8'0"
DRILLER: S. DESIMONE, JR., INSPECTOR: S. HILFIKER
DATE STARTED & COMPLETED: 9-17-2015

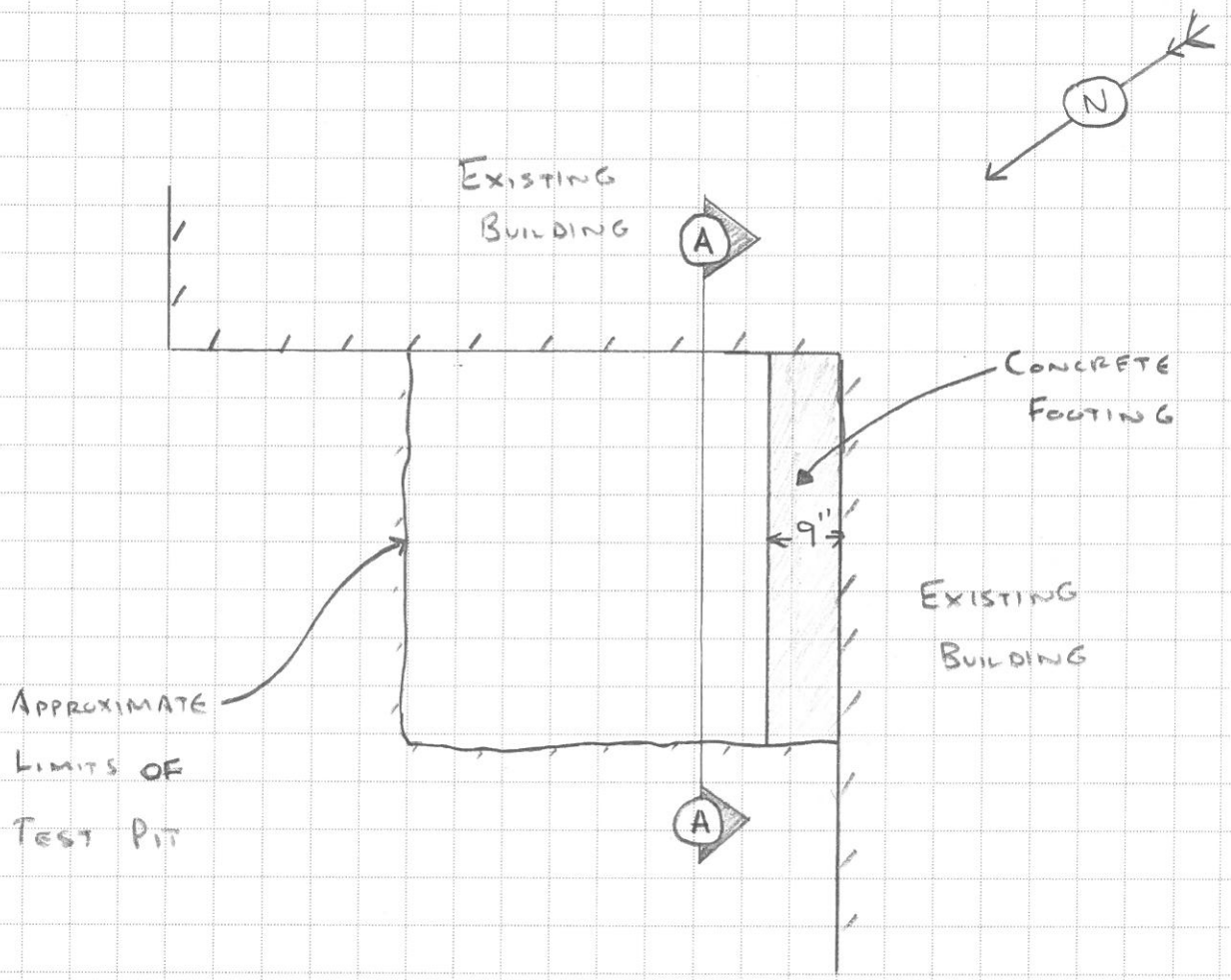
All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

APPENDIX C:

TEST PIT LOGS PREPARED BY McPHAIL ASSOCIATES, LLC

MCPHAIL ASSOCIATES, LLC
Consulting Geotechnical Engineers
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140

JOB 6011 Congregation Kehillath Israel
SHEET NO. TP-1 OF
CALCULATED BY Scott Dennis DATE 9/24/2015
CHECKED BY Ambrose J. Donovan DATE 9/25/2015
SCALE 1" = 2'



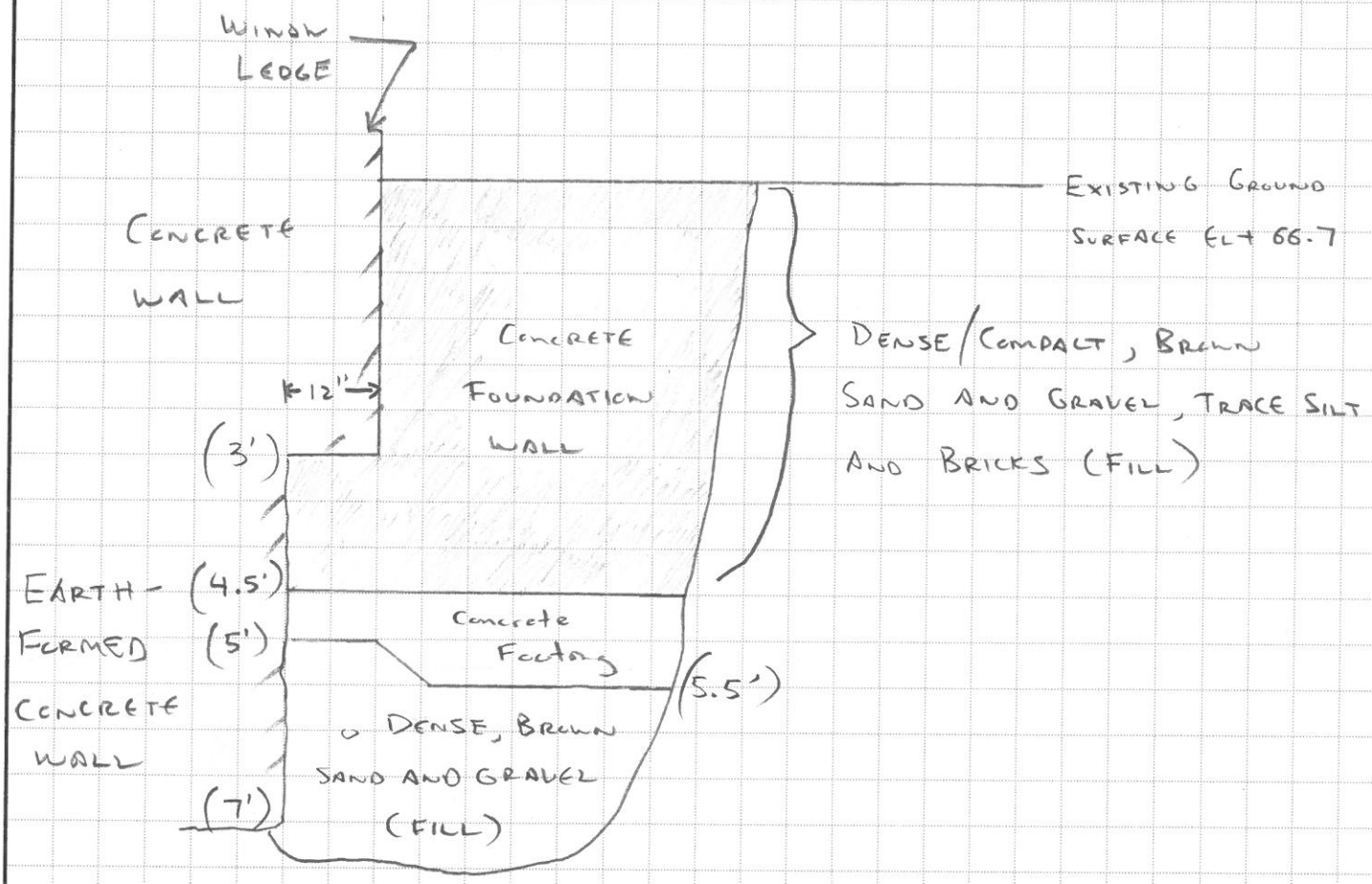
TP-1

PLAN VIEW

* No Groundwater encountered upon completion of test pit.

MCPHAIL ASSOCIATES, LLC
Consulting Geotechnical Engineers
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140

JOB 6011 Congregation Kehillath Israel
SHEET NO. TP-1 OF
CALCULATED BY Scott Dennis DATE 9/24/2015
CHECKED BY Ambrose J. Donovan DATE 9/25/2015
SCALE 1" = 2'



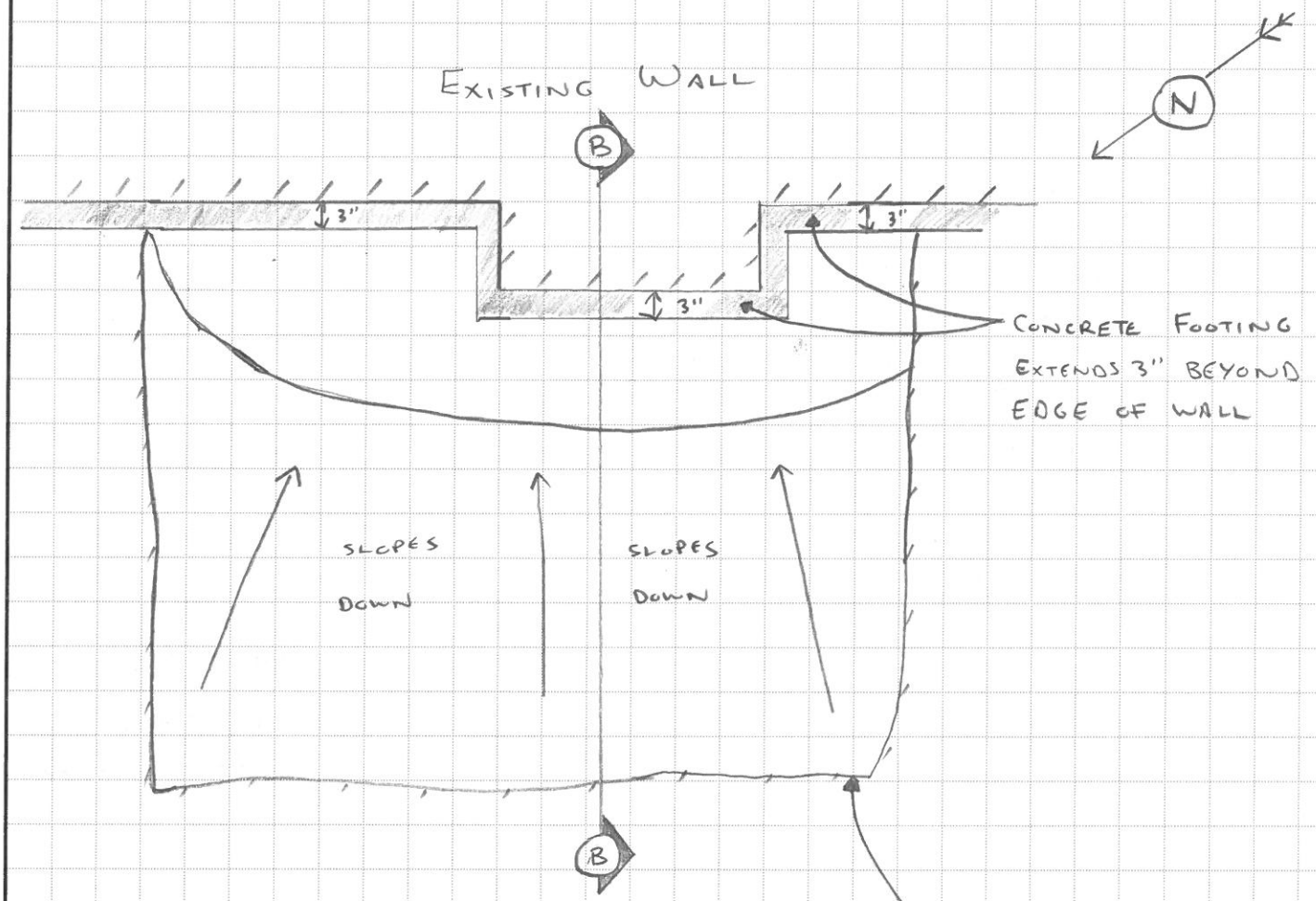
TP-1

SECTION A-A

*NO GROUNDWATER ENCOUNTERED UPON COMPLETION OF TEST PIT.

MCPHAIL ASSOCIATES, LLC
Consulting Geotechnical Engineers
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140

JOB 6011 Congregation Kehillath Israel
SHEET NO. TP-2 OF
CALCULATED BY Scott Dennis DATE 9/24/2015
CHECKED BY Ambrose J. Donovan DATE 9/25/2015
SCALE 1" = 2'

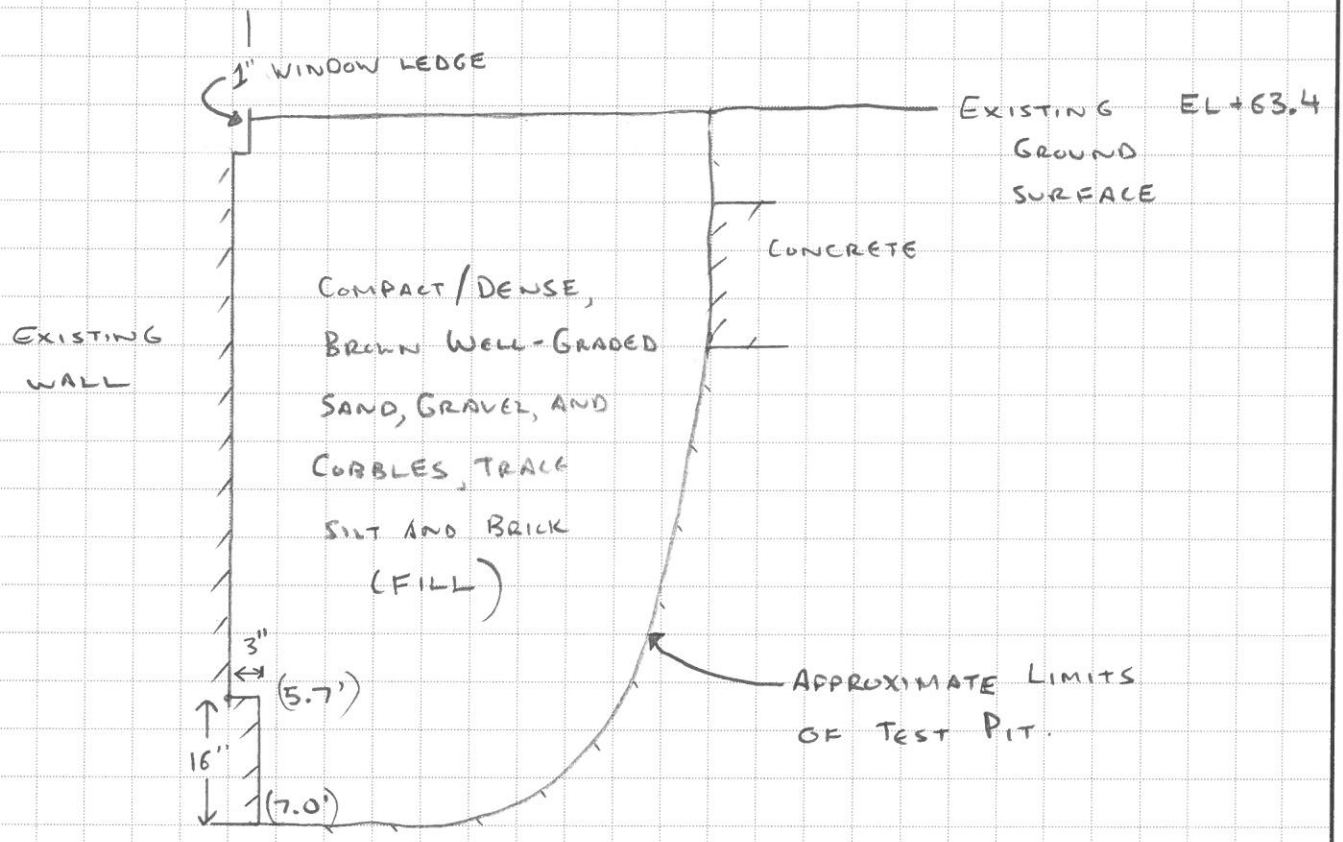


TP-2
PLAN VIEW

* NO GROUNDWATER ENCOUNTERED UPON COMPLETION OF TEST PIT

MCPHAIL ASSOCIATES, LLC
Consulting Geotechnical Engineers
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140

JOB 6011 Congregation Kehillath Israel
SHEET NO. TP-2 OF
CALCULATED BY Scott Dennis DATE 9/24/2015
CHECKED BY Ambrose T. Donovan DATE 9/25/2015
SCALE 1" = 2'

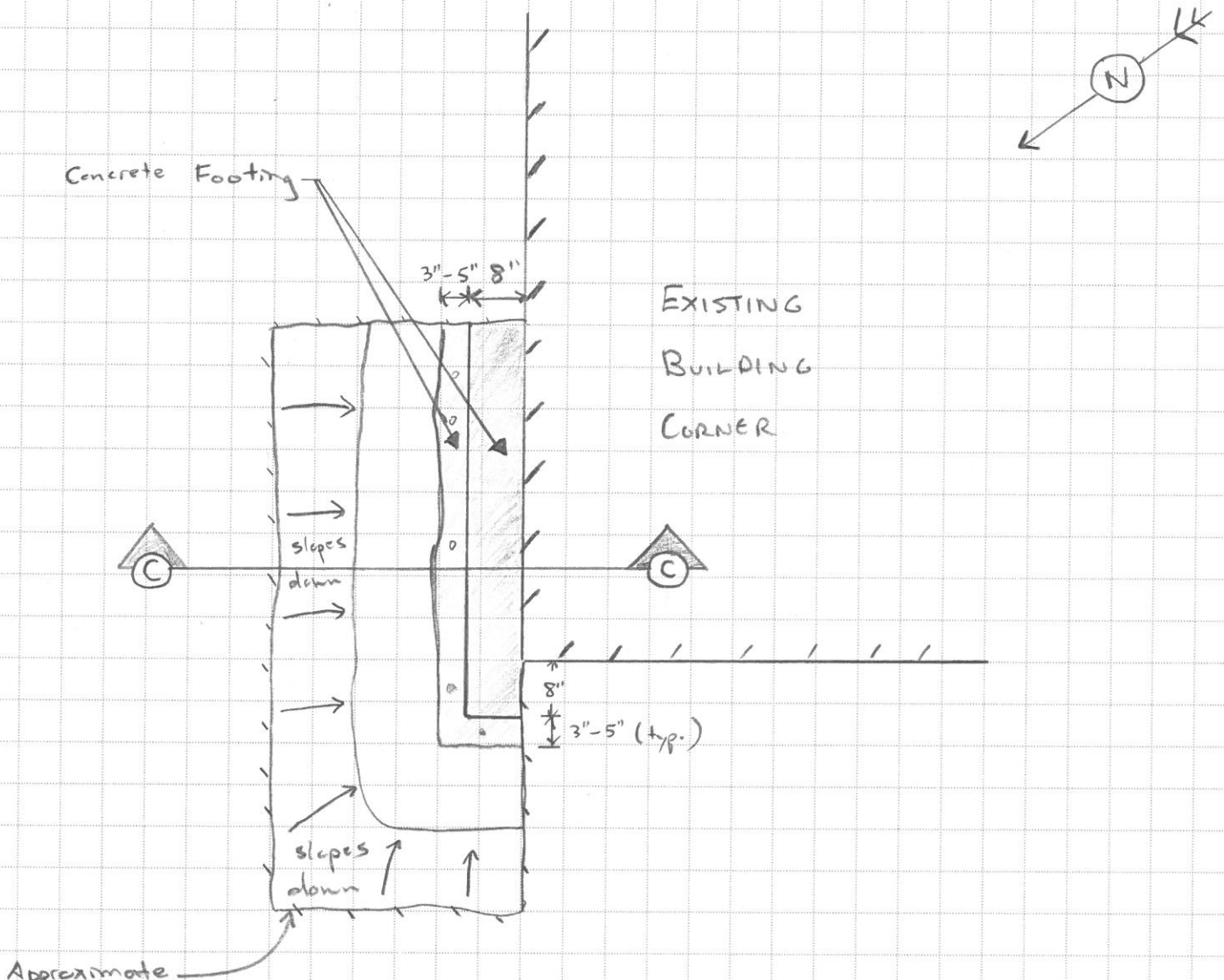


TP-2
SECTION B-B

* NO GROUNDWATER ENCOUNTERED UPON COMPLETION OF TEST PIT.

MCPHAIL ASSOCIATES, LLC
Consulting Geotechnical Engineers
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140

JOB 6011 Congregation Kehillath Israel
SHEET NO. TP-3 OF
CALCULATED BY Scott Dennis DATE 9/24/2015
CHECKED BY Ambrose J. Donovan DATE 9/25/2015
SCALE 1" = 2'



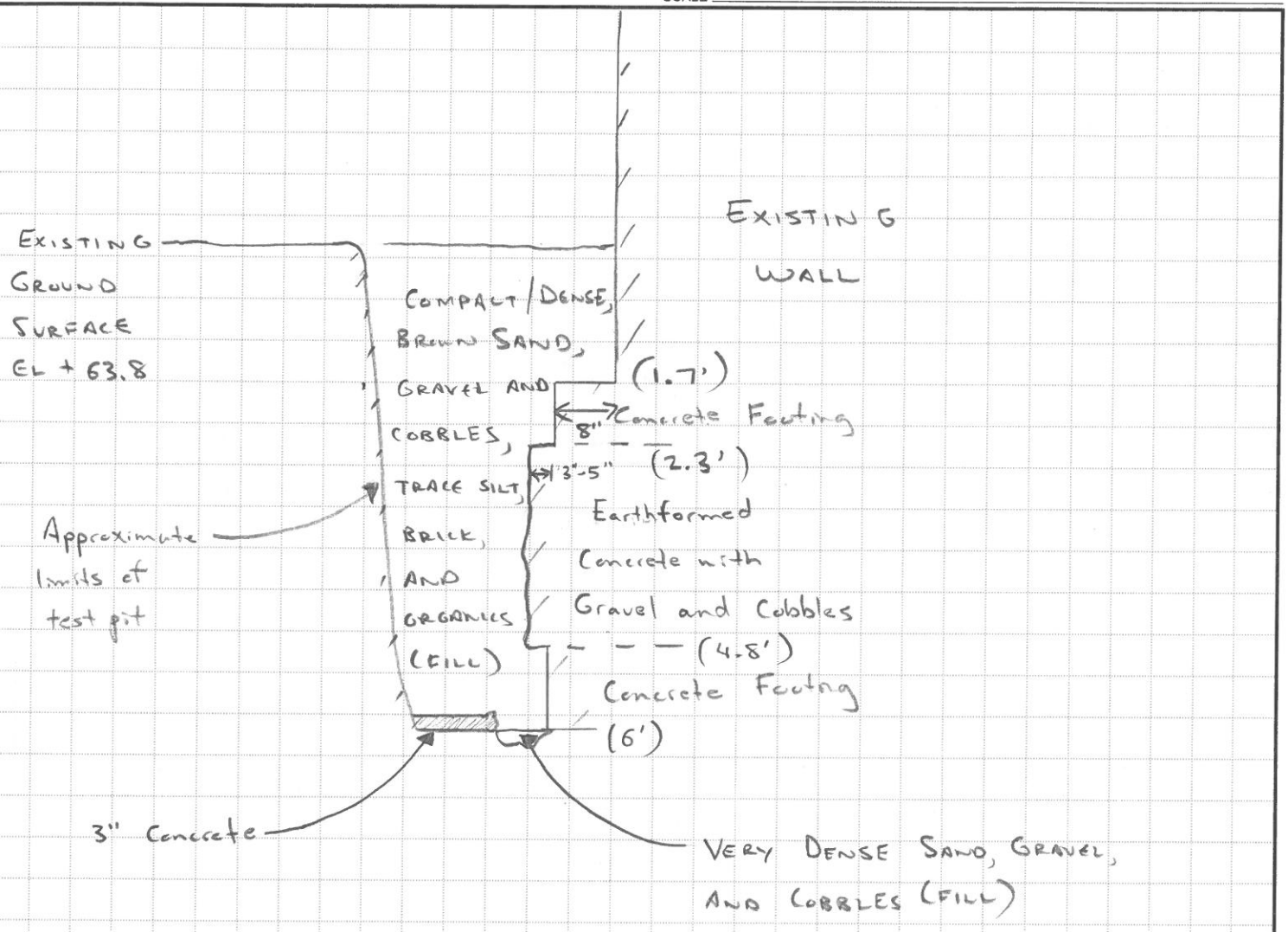
TP-3

PLAN VIEW

* No groundwater encountered upon completion of test pit.

MCPHAIL ASSOCIATES, LLC
Consulting Geotechnical Engineers
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140

JOB 6011 Congregation Kehillath Israel
SHEET NO. TP-3 OF
CALCULATED BY Scott Dennis DATE 9/24/2015
CHECKED BY Ambrose J. Donovan DATE 9/25/2015
SCALE 1" = 2'



TP-3

SECTION C-C

* No Groundwater encountered upon completion of test pit.

APPENDIX D:

TEST PIT PHOTOS PREPARED BY McPHAIL ASSOCIATES, LLC

Test Pit TP-1

Test Pit TP-2

Test Pit TP-3

Test Pit TP-3

APPENDIX E:

CONSTANT HEAD TESTING RESULTS

CONSTANT HEAD
BOREHOLE PERMEABILITY TEST
Field Data

Borehole:	B-4 (OW)		Project:	Congregation Kehillath Israel
Test Depth:	5	feet	Project No.	6011
Casing Radius:	1.5	inch	Driller:	Carr-Dee Corp.
Head (h):	5.5	feet	Engineer:	Steven Hilfiker
Soil Strata:	Fill		Date:	9/17/2015

Water Volume Increment (cm^3)	Elapsed Time (h:m:s)	Time Increment (h:m:s)	Time Increment (s)	Flow Rate, q (cm^3/s)	Permeability, k (cm/s)
230	0:00:45	0:00:45	45	5.11E+00	1.45E-03
275	0:01:35	0:00:50	50	5.50E+00	1.57E-03
265	0:02:45	0:01:10	70	3.79E+00	1.08E-03
295	0:03:55	0:01:10	70	4.21E+00	1.20E-03
260	0:04:50	0:00:55	55	4.73E+00	1.35E-03
265	0:05:50	0:01:00	60	4.42E+00	1.26E-03
270	0:06:45	0:00:55	55	4.91E+00	1.40E-03
325	0:08:05	0:01:20	80	4.06E+00	1.16E-03
260	0:09:05	0:01:00	60	4.33E+00	1.23E-03
260	0:10:00	0:00:55	55	4.73E+00	1.35E-03
260	0:11:00	0:01:00	60	4.33E+00	1.23E-03
250	0:11:55	0:00:55	55	4.55E+00	1.29E-03
270	0:13:10	0:01:15	75	3.60E+00	1.02E-03
350	0:14:35	0:01:25	85	4.12E+00	1.17E-03
300	0:15:45	0:01:10	70	4.29E+00	1.22E-03
280	0:17:00	0:01:15	75	3.73E+00	1.06E-03
380	0:18:40	0:01:40	100	3.80E+00	1.08E-03
315	0:19:40	0:01:00	60	5.25E+00	1.49E-03
250	0:20:35	0:00:55	55	4.55E+00	1.29E-03
280	0:21:55	0:01:20	80	3.50E+00	9.96E-04
290	0:23:15	0:01:20	80	3.63E+00	1.03E-03
260	0:24:35	0:01:20	80	3.25E+00	9.25E-04
200	0:25:35	0:01:00	60	3.33E+00	9.49E-04
200	0:26:35	0:01:00	60	3.33E+00	9.49E-04
220	0:27:45	0:01:10	70	3.14E+00	8.95E-04
200	0:28:45	0:01:00	60	3.33E+00	9.49E-04
240	0:30:10	0:01:25	85	2.82E+00	8.04E-04
7250	**0:30:10**	**0:30:10**	**1810**	**4.01E+00**	**1.14E-03**

CONSTANT HEAD
BOREHOLE PERMEABILITY TEST
Field Data

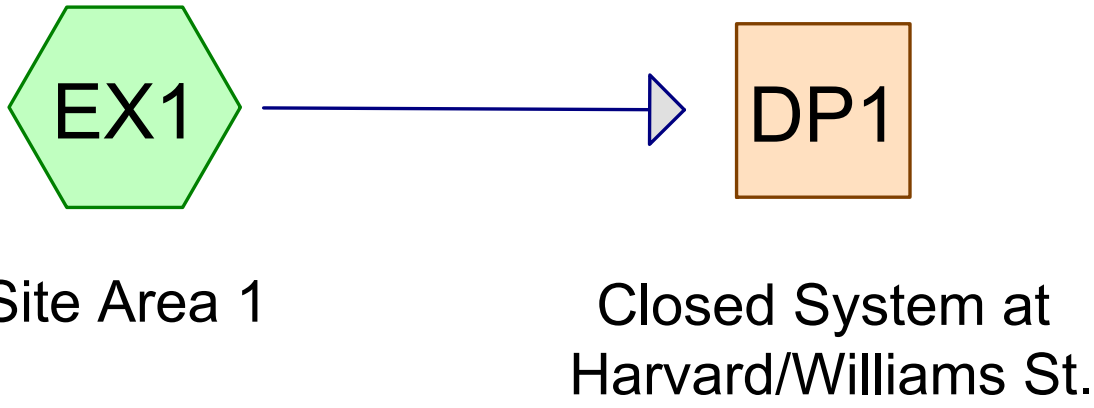
Borehole:	B-5 (OW)		Project:	Congregation Kehillath Israel
Test Depth:	5	feet	Project No.	6011
Casing Radius:	1.5	inch	Driller:	Carr-Dee Corp.
Head (h):	5.5	feet	Engineer:	Steven Hilfiker
Soil Strata:	Fill		Date:	9/17/2015

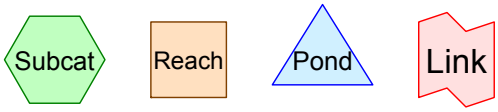
Water Volume Increment (cm^3)	Elapsed Time (h:m:s)	Time Increment (h:m:s)	Time Increment (s)	Flow Rate, q (cm^3/s)	Permeability, k (cm/s)
430	0:00:25	0:00:25	25	1.72E+01	4.90E-03
610	0:01:10	0:00:45	45	1.36E+01	3.86E-03
420	0:01:44	0:00:34	34	1.24E+01	3.52E-03
470	0:02:19	0:00:35	35	1.34E+01	3.82E-03
380	0:02:49	0:00:30	30	1.27E+01	3.61E-03
395	0:03:20	0:00:31	31	1.27E+01	3.63E-03
430	0:03:56	0:00:36	36	1.19E+01	3.40E-03
410	0:04:31	0:00:35	35	1.17E+01	3.33E-03
410	0:05:06	0:00:35	35	1.17E+01	3.33E-03
400	0:05:41	0:00:35	35	1.14E+01	3.25E-03
410	0:06:16	0:00:35	35	1.17E+01	3.33E-03
340	0:06:45	0:00:29	29	1.17E+01	3.34E-03
405	0:07:20	0:00:35	35	1.16E+01	3.29E-03
410	0:07:55	0:00:35	35	1.17E+01	3.33E-03
365	0:08:30	0:00:35	35	1.04E+01	2.97E-03
380	0:09:05	0:00:35	35	1.09E+01	3.09E-03
390	0:09:40	0:00:35	35	1.11E+01	3.17E-03
390	0:10:15	0:00:35	35	1.11E+01	3.17E-03
375	0:10:50	0:00:35	35	1.07E+01	3.05E-03
380	0:11:25	0:00:35	35	1.09E+01	3.09E-03
360	0:12:00	0:00:35	35	1.03E+01	2.93E-03
390	0:12:37	0:00:37	37	1.05E+01	3.00E-03
370	0:13:13	0:00:36	36	1.03E+01	2.93E-03
350	0:13:48	0:00:35	35	1.00E+01	2.85E-03
380	0:14:23	0:00:35	35	1.09E+01	3.09E-03
350	0:14:58	0:00:35	35	1.00E+01	2.85E-03
350	0:15:33	0:00:35	35	1.00E+01	2.85E-03
390	0:16:13	0:00:40	40	9.75E+00	2.78E-03
330	0:16:48	0:00:35	35	9.43E+00	2.68E-03
355	0:17:23	0:00:35	35	1.01E+01	2.89E-03
350	0:17:58	0:00:35	35	1.00E+01	2.85E-03
320	0:18:33	0:00:35	35	9.14E+00	2.60E-03
330	0:19:08	0:00:35	35	9.43E+00	2.68E-03
350	0:19:45	0:00:37	37	9.46E+00	2.69E-03
350	0:20:24	0:00:39	39	8.97E+00	2.55E-03

CONSTANT HEAD
BOREHOLE PERMEABILITY TEST
Field Data

Water Volume Increment (cm^3)	Elapsed Time (h:m:s)	Time Increment (h:m:s)	Time Increment (s)	Flow Rate, q (cm^3/s)	Permeability, k (cm/s)
330	0:20:59	0:00:35	35	9.43E+00	2.68E-03
290	0:21:34	0:00:35	35	8.29E+00	2.36E-03
360	0:22:14	0:00:40	40	9.00E+00	2.56E-03
310	0:22:49	0:00:35	35	8.86E+00	2.52E-03
320	0:23:24	0:00:35	35	9.14E+00	2.60E-03
300	0:23:59	0:00:35	35	8.57E+00	2.44E-03
300	0:24:34	0:00:35	35	8.57E+00	2.44E-03
300	0:25:09	0:00:35	35	8.57E+00	2.44E-03
300	0:25:44	0:00:35	35	8.57E+00	2.44E-03
16335	**0:25:44**	**0:25:44**	**1544**	**1.06E+01**	**3.01E-03**

APPENDIX C – EXISTING CONDITIONS HYDROCAD CALCULATIONS





Routing Diagram for JCHE KI_Existing
Prepared by Stantec Consulting Ltd., Printed 10/20/2016
HydroCAD® 10.00 s/n 01048 © 2013 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.098	61	>75% Grass cover, Good, HSG B (EX1)
0.153	98	Paved parking, HSG B (EX1)
0.191	98	Roofs, HSG B (EX1)
0.442	**90**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.442	HSG B	EX1
0.000	HSG C	
0.000	HSG D	
0.000	Other	
0.442		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.098	0.000	0.000	0.000	0.098	>75% Grass cover, Good	EX1
0.000	0.153	0.000	0.000	0.000	0.153	Paved parking	EX1
0.000	0.191	0.000	0.000	0.000	0.191	Roofs	EX1
0.000	**0.442**	**0.000**	**0.000**	**0.000**	**0.442**	**TOTAL AREA**	

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX1: Site Area 1 Runoff Area=19,264 sf 77.80% Impervious Runoff Depth=2.17"
Tc=5.0 min CN=90 Runoff=1.15 cfs 0.080 af

Reach DP1: Closed System at Harvard/Williams St. Inflow=1.15 cfs 0.080 af
Outflow=1.15 cfs 0.080 af

Total Runoff Area = 0.442 ac Runoff Volume = 0.080 af Average Runoff Depth = 2.17"
22.20% Pervious = 0.098 ac 77.80% Impervious = 0.344 ac

Summary for Subcatchment EX1: Site Area 1

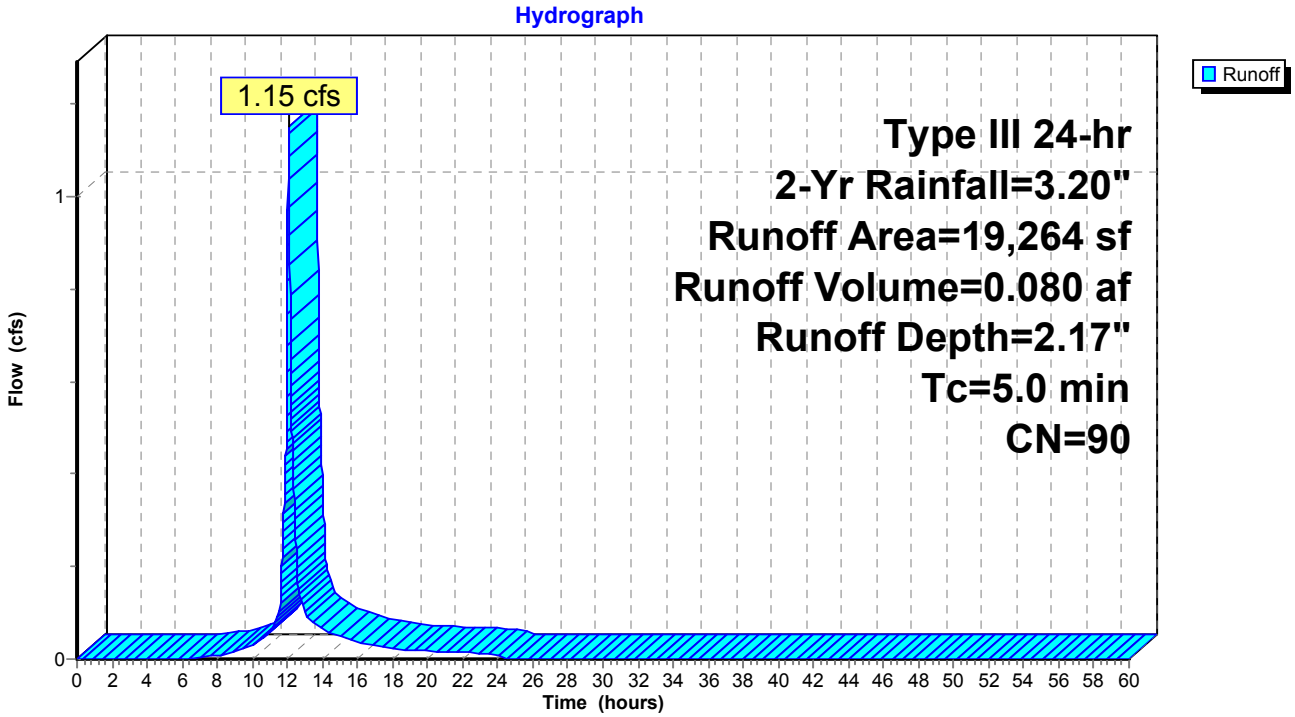
Runoff = 1.15 cfs @ 12.07 hrs, Volume= 0.080 af, Depth= 2.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
6,650	98	Paved parking, HSG B
8,338	98	Roofs, HSG B
4,276	61	>75% Grass cover, Good, HSG B
19,264	90	Weighted Average
4,276		22.20% Pervious Area
14,988		77.80% Impervious Area

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

Subcatchment EX1: Site Area 1



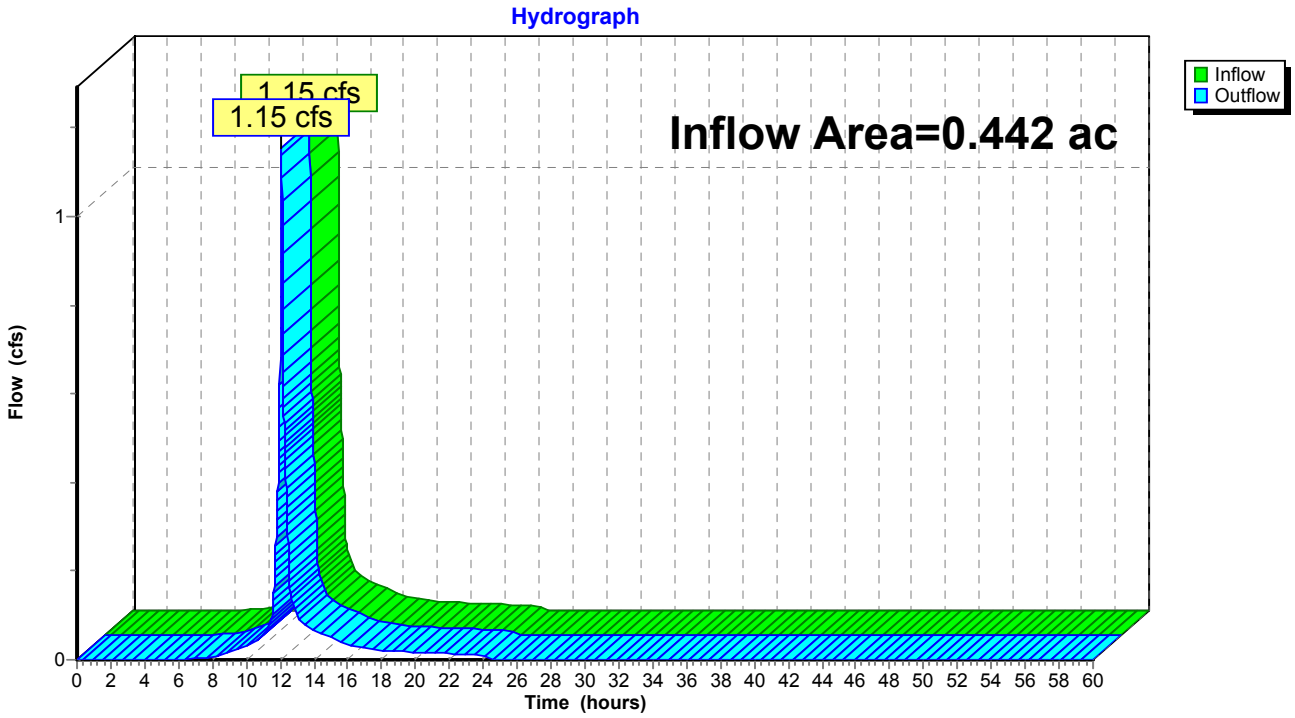
Summary for Reach DP1: Closed System at Harvard/Williams St.

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.442 ac, 77.80% Impervious, Inflow Depth = 2.17" for 2-Yr event
Inflow = 1.15 cfs @ 12.07 hrs, Volume= 0.080 af
Outflow = 1.15 cfs @ 12.07 hrs, Volume= 0.080 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Reach DP1: Closed System at Harvard/Williams St.



Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX1: Site Area 1 Runoff Area=19,264 sf 77.80% Impervious Runoff Depth=3.49"
Tc=5.0 min CN=90 Runoff=1.82 cfs 0.129 af

Reach DP1: Closed System at Harvard/Williams St. Inflow=1.82 cfs 0.129 af
Outflow=1.82 cfs 0.129 af

Total Runoff Area = 0.442 ac Runoff Volume = 0.129 af Average Runoff Depth = 3.49"
22.20% Pervious = 0.098 ac 77.80% Impervious = 0.344 ac

Summary for Subcatchment EX1: Site Area 1

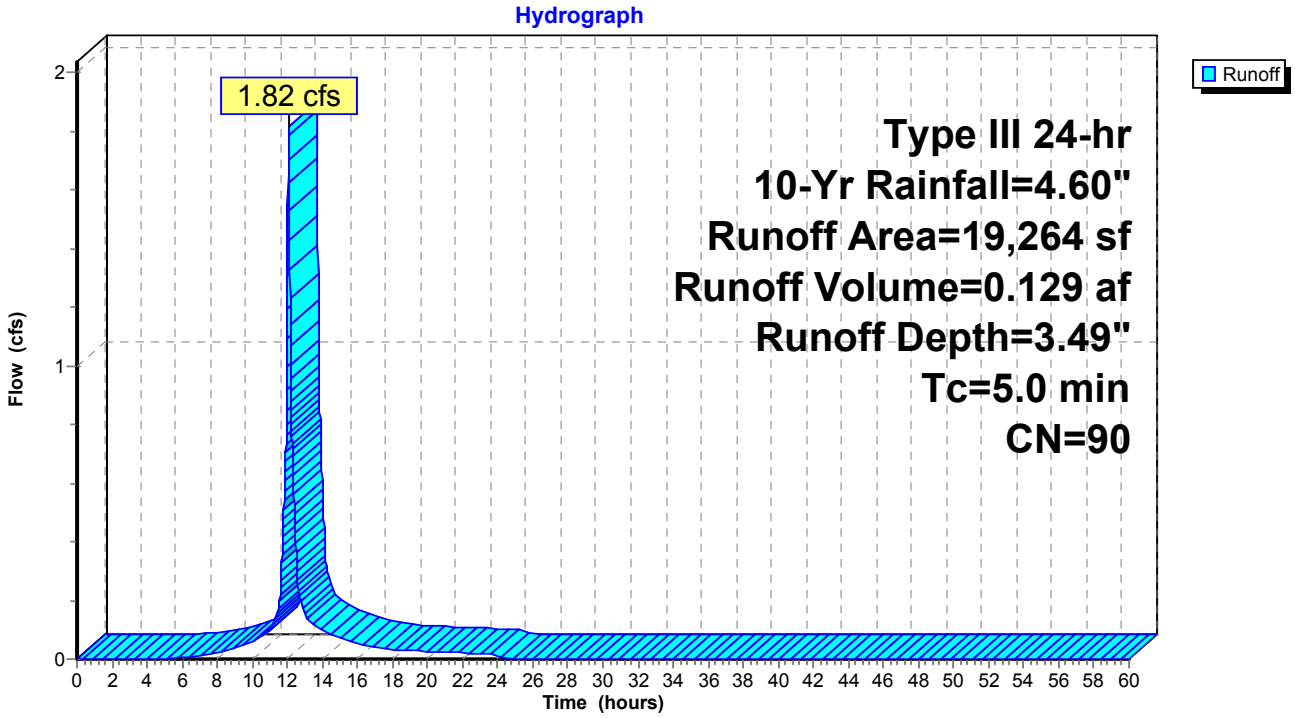
Runoff = 1.82 cfs @ 12.07 hrs, Volume= 0.129 af, Depth= 3.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.60"

Area (sf)	CN	Description
6,650	98	Paved parking, HSG B
8,338	98	Roofs, HSG B
4,276	61	>75% Grass cover, Good, HSG B
19,264	90	Weighted Average
4,276		22.20% Pervious Area
14,988		77.80% Impervious Area

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

Subcatchment EX1: Site Area 1



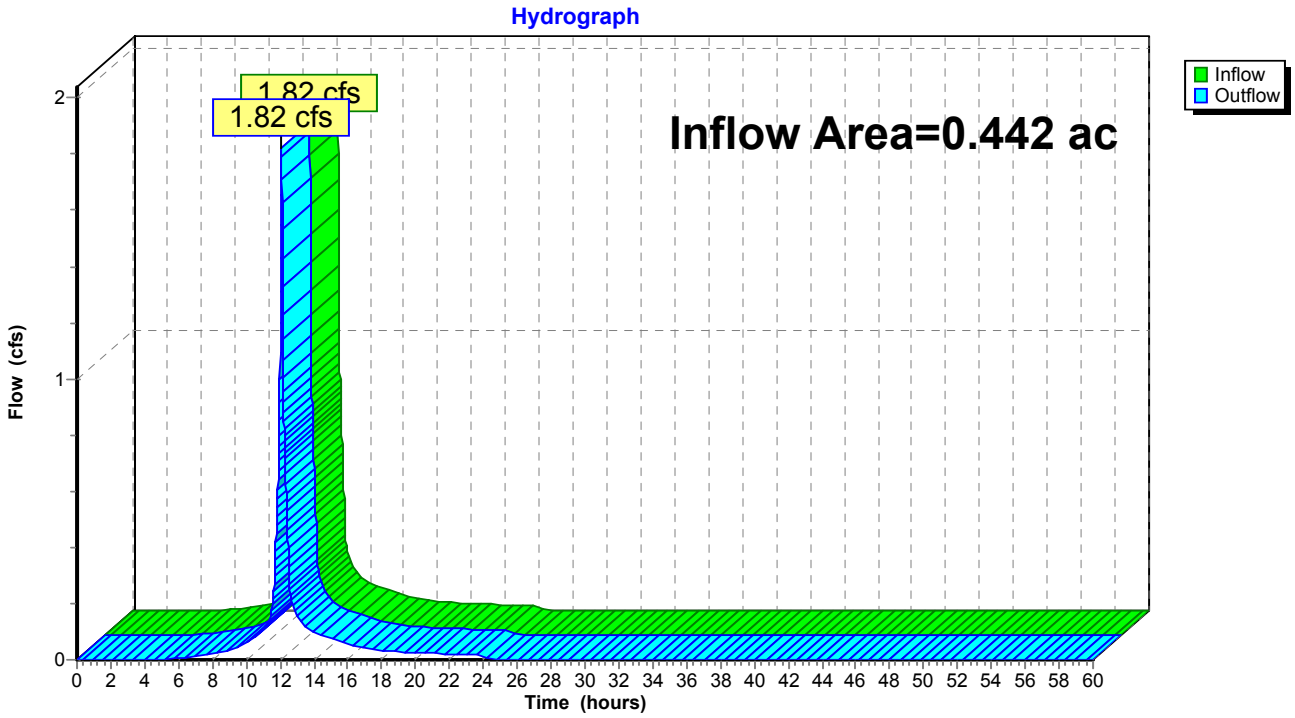
Summary for Reach DP1: Closed System at Harvard/Williams St.

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.442 ac, 77.80% Impervious, Inflow Depth = 3.49" for 10-Yr event
Inflow = 1.82 cfs @ 12.07 hrs, Volume= 0.129 af
Outflow = 1.82 cfs @ 12.07 hrs, Volume= 0.129 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Reach DP1: Closed System at Harvard/Williams St.



Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX1: Site Area 1 Runoff Area=19,264 sf 77.80% Impervious Runoff Depth=4.36"
Tc=5.0 min CN=90 Runoff=2.25 cfs 0.161 af

Reach DP1: Closed System at Harvard/Williams St. Inflow=2.25 cfs 0.161 af
Outflow=2.25 cfs 0.161 af

Total Runoff Area = 0.442 ac Runoff Volume = 0.161 af Average Runoff Depth = 4.36"
22.20% Pervious = 0.098 ac 77.80% Impervious = 0.344 ac

Summary for Subcatchment EX1: Site Area 1

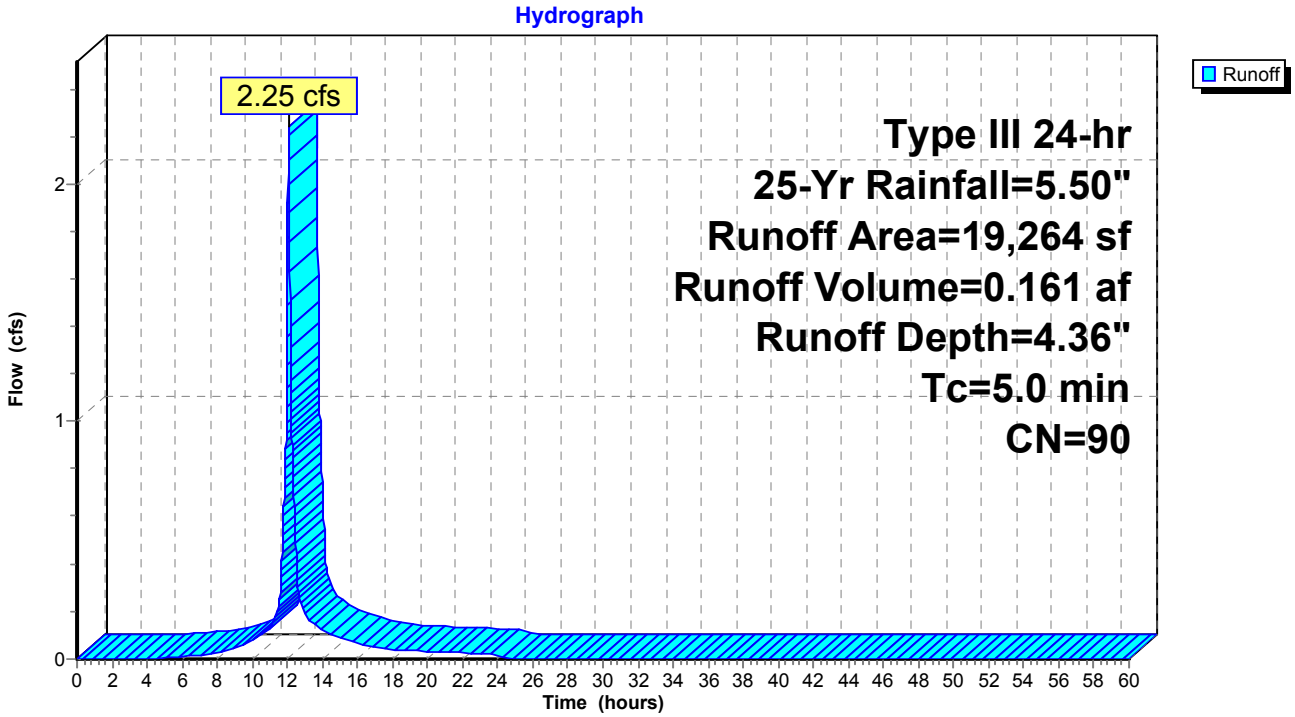
Runoff = 2.25 cfs @ 12.07 hrs, Volume= 0.161 af, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=5.50"

Area (sf)	CN	Description
6,650	98	Paved parking, HSG B
8,338	98	Roofs, HSG B
4,276	61	>75% Grass cover, Good, HSG B
19,264	90	Weighted Average
4,276		22.20% Pervious Area
14,988		77.80% Impervious Area

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

Subcatchment EX1: Site Area 1



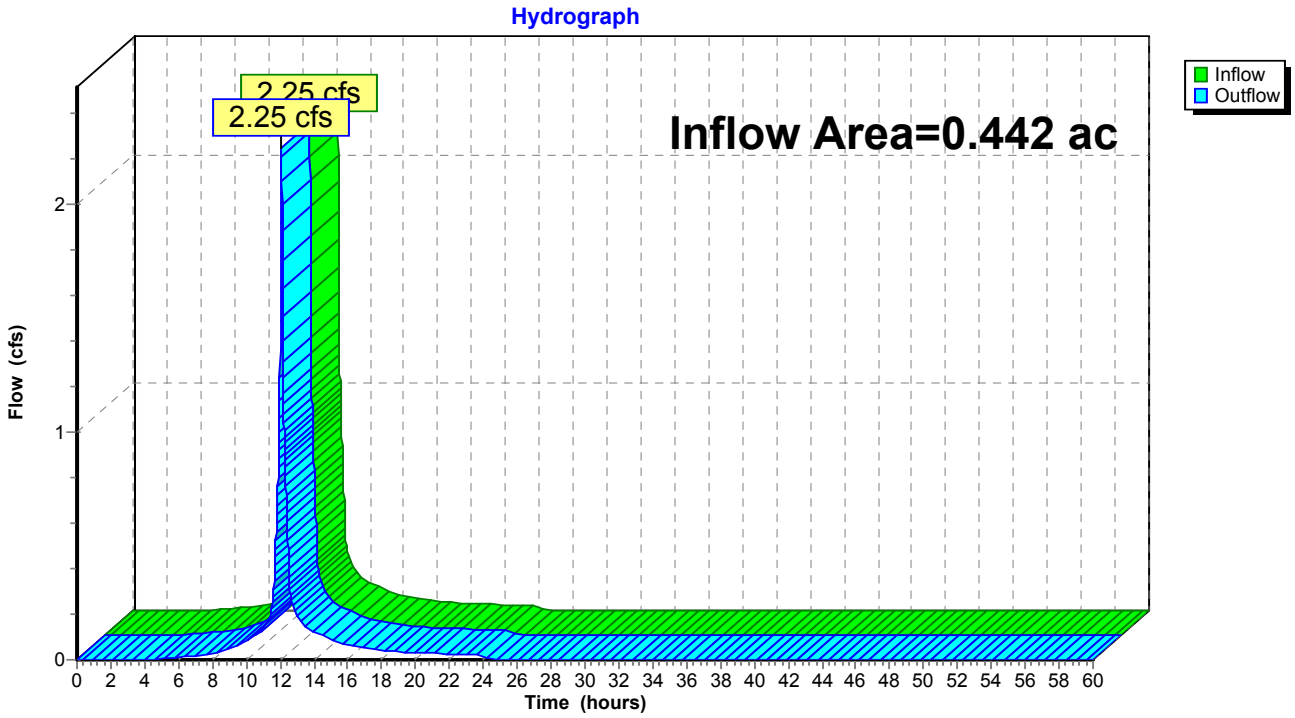
Summary for Reach DP1: Closed System at Harvard/Williams St.

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.442 ac, 77.80% Impervious, Inflow Depth = 4.36" for 25-Yr event
Inflow = 2.25 cfs @ 12.07 hrs, Volume= 0.161 af
Outflow = 2.25 cfs @ 12.07 hrs, Volume= 0.161 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Reach DP1: Closed System at Harvard/Williams St.



Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX1: Site Area 1 Runoff Area=19,264 sf 77.80% Impervious Runoff Depth=5.43"
Tc=5.0 min CN=90 Runoff=2.76 cfs 0.200 af

Reach DP1: Closed System at Harvard/Williams St. Inflow=2.76 cfs 0.200 af
Outflow=2.76 cfs 0.200 af

Total Runoff Area = 0.442 ac Runoff Volume = 0.200 af Average Runoff Depth = 5.43"
22.20% Pervious = 0.098 ac 77.80% Impervious = 0.344 ac

Summary for Subcatchment EX1: Site Area 1

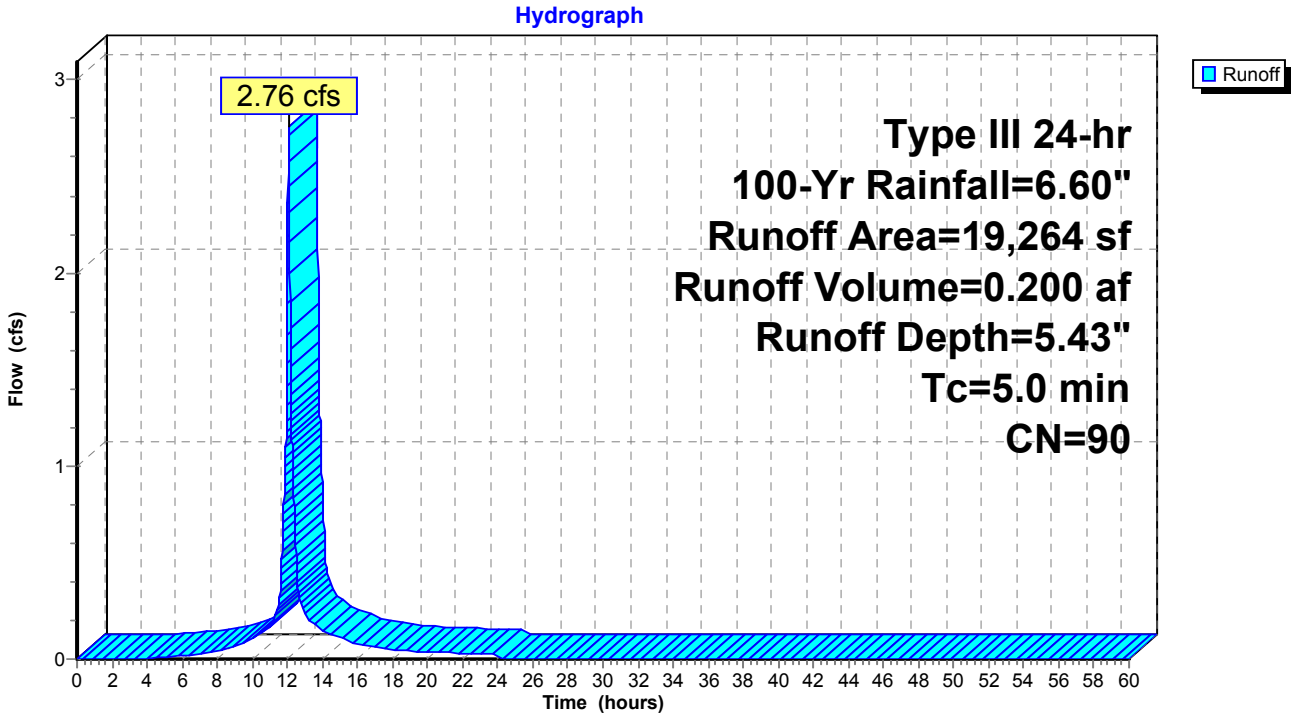
Runoff = 2.76 cfs @ 12.07 hrs, Volume= 0.200 af, Depth= 5.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=6.60"

Area (sf)	CN	Description
6,650	98	Paved parking, HSG B
8,338	98	Roofs, HSG B
4,276	61	>75% Grass cover, Good, HSG B
19,264	90	Weighted Average
4,276		22.20% Pervious Area
14,988		77.80% Impervious Area

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

Subcatchment EX1: Site Area 1



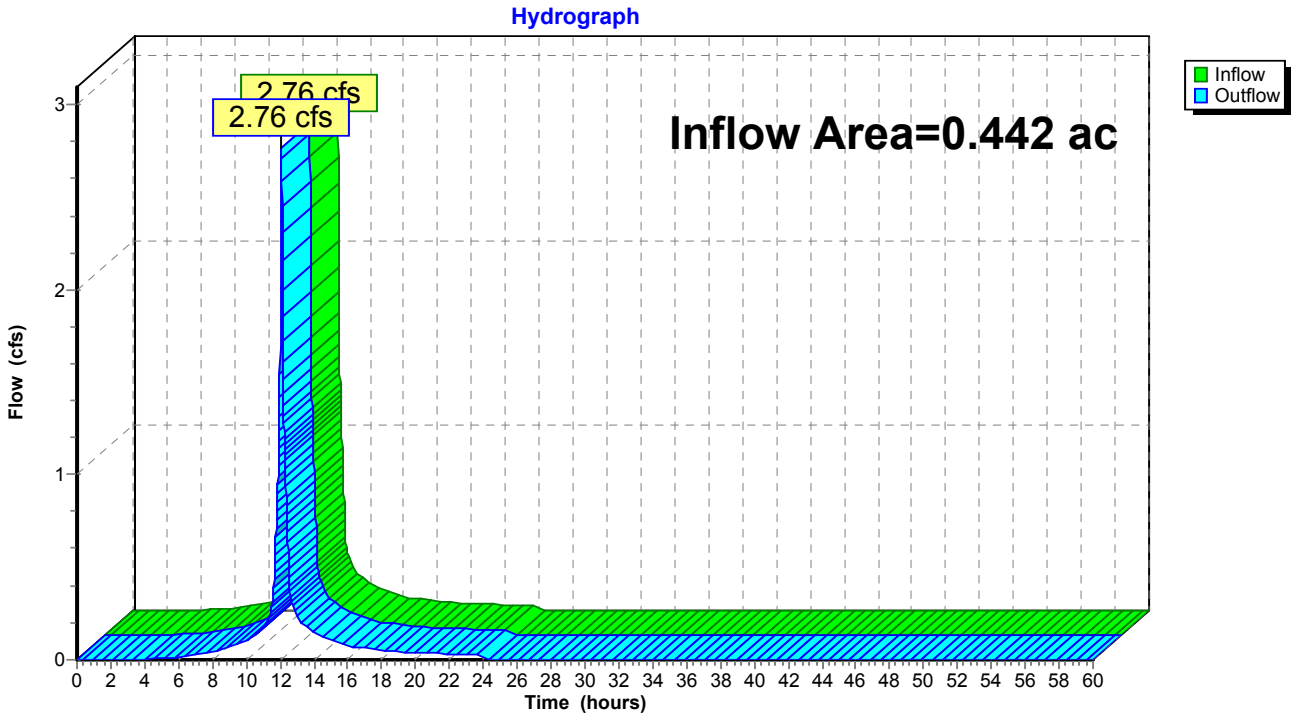
Summary for Reach DP1: Closed System at Harvard/Williams St.

[40] Hint: Not Described (Outflow=Inflow)

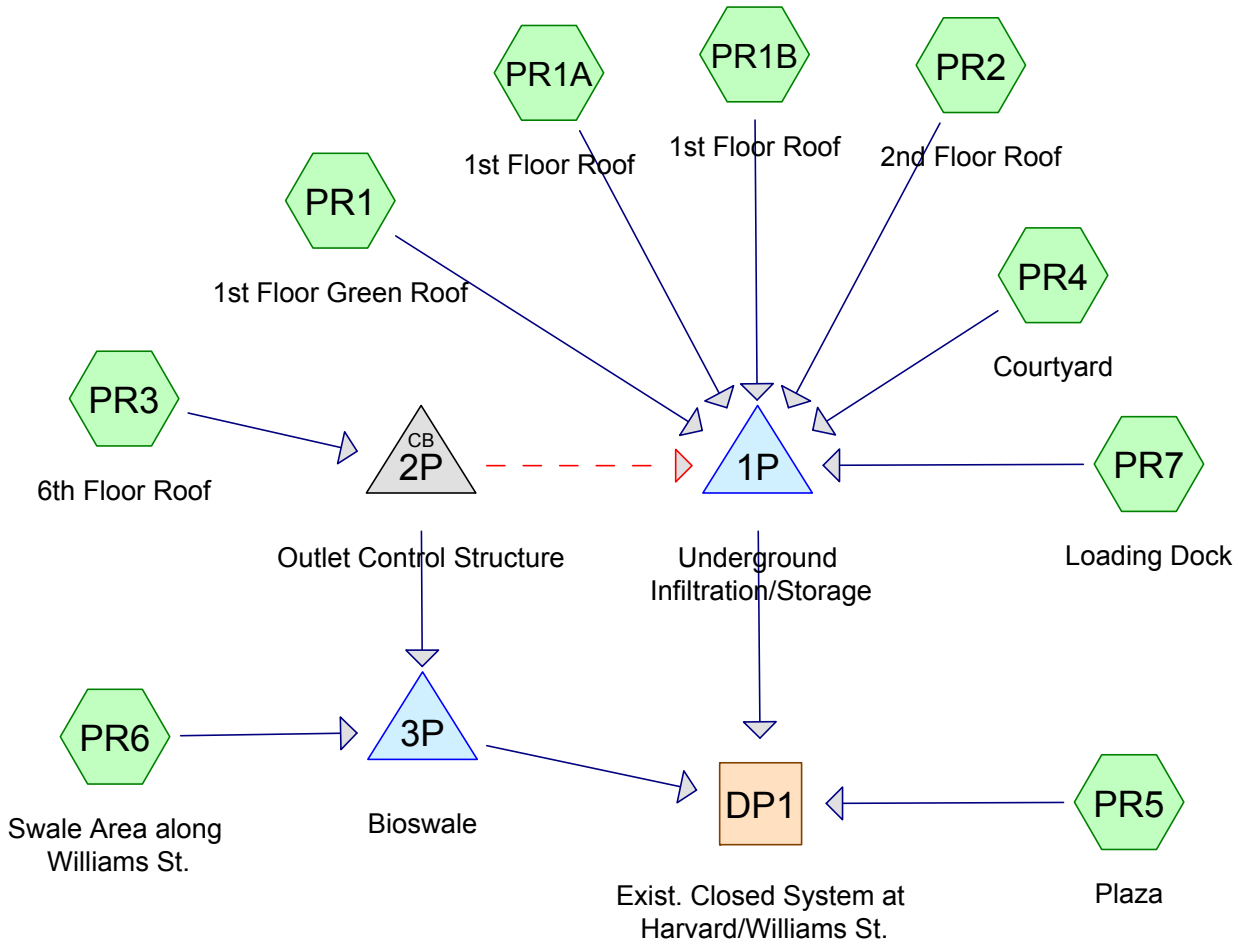
Inflow Area = 0.442 ac, 77.80% Impervious, Inflow Depth = 5.43" for 100-Yr event
Inflow = 2.76 cfs @ 12.07 hrs, Volume= 0.200 af
Outflow = 2.76 cfs @ 12.07 hrs, Volume= 0.200 af, Atten= 0%, Lag= 0.0 min

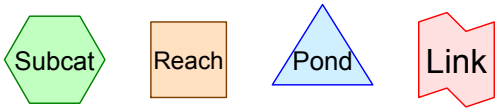
Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Reach DP1: Closed System at Harvard/Williams St.



APPENDIX D – PROPOSED CONDITIONS HYDROCAD CALCULATIONS





Routing Diagram for JCHE KI_Proposed
Prepared by Stantec Consulting Ltd., Printed 10/20/2016
HydroCAD® 10.00 s/n 01048 © 2013 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.093	61	>75% Grass cover, Good, HSG B (PR1, PR4, PR5, PR6)
0.015	98	Paved parking, HSG B (PR7)
0.046	98	Porous Pavers, HSG B (PR4, PR5, PR6)
0.004	98	Retainaing Wall, HSG B (PR5)
0.003	98	Retaining Walls (PR4)
0.275	98	Roofs, HSG B (PR1A, PR1B, PR2, PR3)
0.001	98	Walkway, HSG B (PR4)
0.006	98	Walkways, Walls, Misc. (PR6)
0.442	**90**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.434	HSG B	PR1, PR1A, PR1B, PR2, PR3, PR4, PR5, PR6, PR7
0.000	HSG C	
0.000	HSG D	
0.009	Other	PR4, PR6
0.442		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.093	0.000	0.000	0.000	0.093	>75% Grass cover, Good	PR1, PR4, PR5, PR6
0.000	0.015	0.000	0.000	0.000	0.015	Paved parking	PR7
0.000	0.046	0.000	0.000	0.000	0.046	Porous Pavers	PR4, PR5, PR6
0.000	0.004	0.000	0.000	0.000	0.004	Retainaing Wall	PR5
0.000	0.000	0.000	0.000	0.003	0.003	Retaining Walls	PR4
0.000	0.275	0.000	0.000	0.000	0.275	Roofs	PR1A, PR1B, PR2, PR3
0.000	0.001	0.000	0.000	0.000	0.001	Walkway	PR4
0.000	0.000	0.000	0.000	0.006	0.006	Walkways, Walls, Misc.	PR6
0.000	**0.434**	**0.000**	**0.000**	**0.009**	**0.442**	**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)	Inside-Fill (inches)
1	1P	60.70	60.65	8.0	0.0063	0.013	6.0	0.0	0.0
2	2P	61.00	60.00	65.0	0.0154	0.013	12.0	0.0	0.0

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR1: 1st Floor Green Roof Runoff Area=2,143 sf 0.00% Impervious Runoff Depth=0.44"
Tc=5.0 min CN=61 Runoff=0.02 cfs 0.002 af

Subcatchment PR1A: 1st Floor Roof Runoff Area=396 sf 100.00% Impervious Runoff Depth=2.97"
Tc=5.0 min CN=98 Runoff=0.03 cfs 0.002 af

Subcatchment PR1B: 1st Floor Roof Runoff Area=416 sf 100.00% Impervious Runoff Depth=2.97"
Tc=5.0 min CN=98 Runoff=0.03 cfs 0.002 af

Subcatchment PR2: 2nd Floor Roof Runoff Area=2,135 sf 100.00% Impervious Runoff Depth=2.97"
Tc=5.0 min CN=98 Runoff=0.16 cfs 0.012 af

Subcatchment PR3: 6th Floor Roof Runoff Area=9,029 sf 100.00% Impervious Runoff Depth=2.97"
Tc=5.0 min CN=98 Runoff=0.67 cfs 0.051 af

Subcatchment PR4: Courtyard Runoff Area=1,951 sf 58.69% Impervious Runoff Depth=1.61"
Tc=5.0 min CN=83 Runoff=0.09 cfs 0.006 af

Subcatchment PR5: Plaza Runoff Area=1,433 sf 73.83% Impervious Runoff Depth=2.00"
Tc=5.0 min CN=88 Runoff=0.08 cfs 0.005 af

Subcatchment PR6: Swale Area along Runoff Area=1,106 sf 35.62% Impervious Runoff Depth=1.04"
Tc=5.0 min CN=74 Runoff=0.03 cfs 0.002 af

Subcatchment PR7: Loading Dock Runoff Area=655 sf 100.00% Impervious Runoff Depth=2.97"
Tc=5.0 min CN=98 Runoff=0.05 cfs 0.004 af

Reach DP1: Exist. Closed System at Harvard/Williams St. Inflow=0.08 cfs 0.005 af
Outflow=0.08 cfs 0.005 af

Pond 1P: Underground Infiltration/Storage Peak Elev=58.88' Storage=978 cf Inflow=0.92 cfs 0.048 af
Discarded=0.07 cfs 0.048 af Primary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.048 af

Pond 2P: Outlet Control Structure Peak Elev=63.64' Inflow=0.67 cfs 0.051 af
Primary=0.11 cfs 0.032 af Secondary=0.55 cfs 0.020 af Outflow=0.67 cfs 0.051 af

Pond 3P: Bioswale Peak Elev=63.50' Storage=547 cf Inflow=0.14 cfs 0.034 af
Discarded=0.02 cfs 0.034 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.034 af

Total Runoff Area = 0.442 ac Runoff Volume = 0.087 af Average Runoff Depth = 2.37"
20.95% Pervious = 0.093 ac 79.05% Impervious = 0.350 ac

Summary for Subcatchment PR1: 1st Floor Green Roof

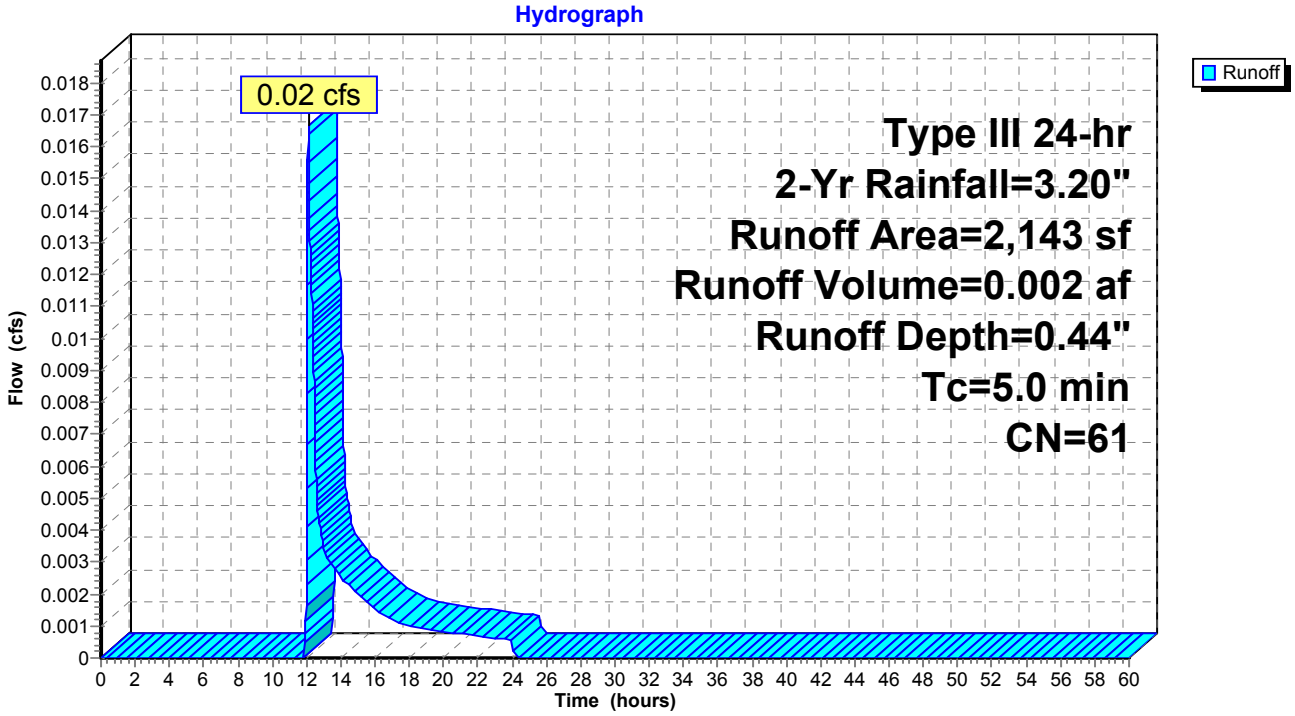
Runoff = 0.02 cfs @ 12.11 hrs, Volume= 0.002 af, Depth= 0.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
2,143	61	>75% Grass cover, Good, HSG B
2,143		100.00% Pervious Area

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

Subcatchment PR1: 1st Floor Green Roof



Summary for Subcatchment PR1A: 1st Floor Roof

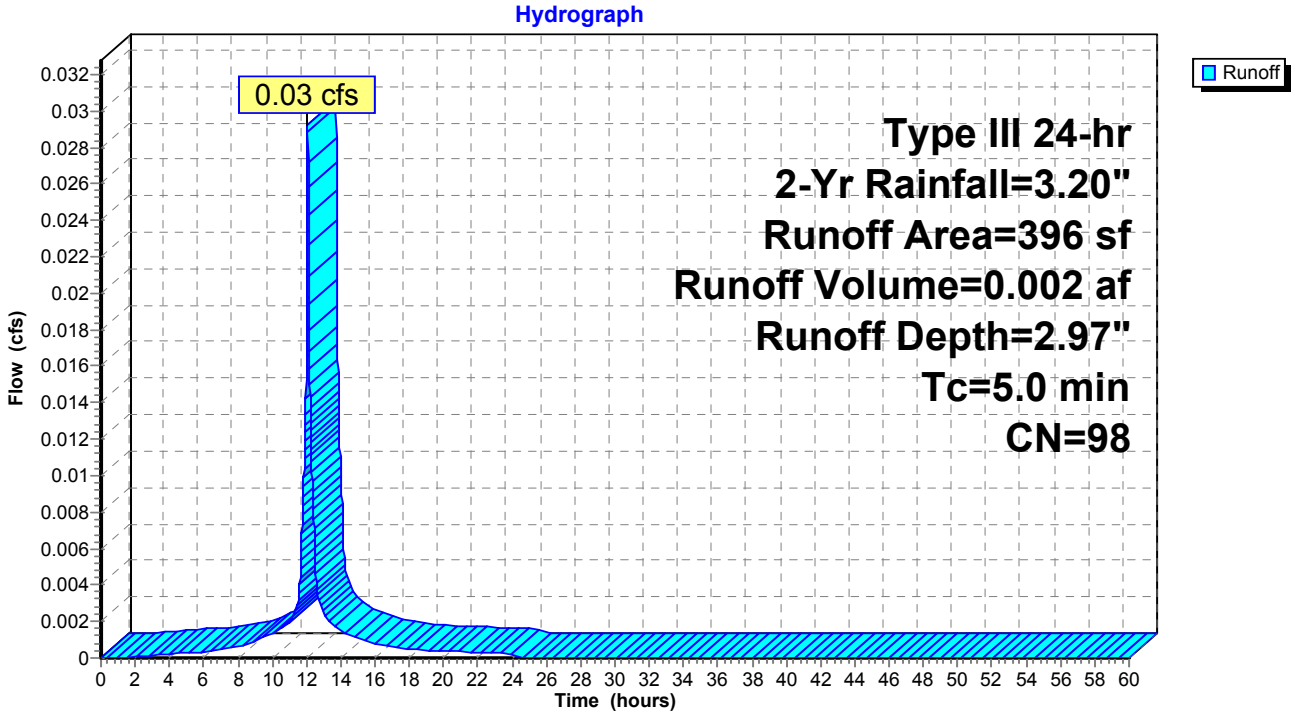
Runoff = 0.03 cfs @ 12.07 hrs, Volume= 0.002 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
396	98	Roofs, HSG B
396		100.00% Impervious Area

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

Subcatchment PR1A: 1st Floor Roof



Summary for Subcatchment PR1B: 1st Floor Roof

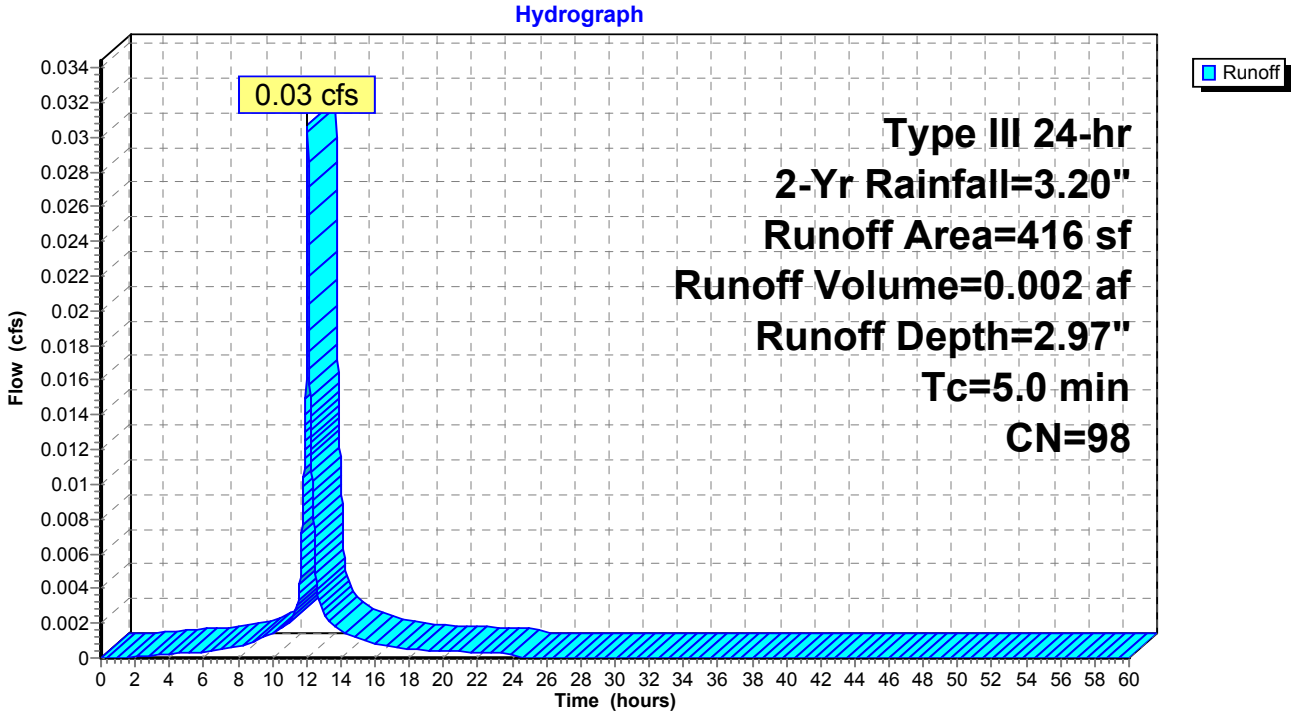
Runoff = 0.03 cfs @ 12.07 hrs, Volume= 0.002 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
416	98	Roofs, HSG B
416		100.00% Impervious Area

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

Subcatchment PR1B: 1st Floor Roof



Summary for Subcatchment PR2: 2nd Floor Roof

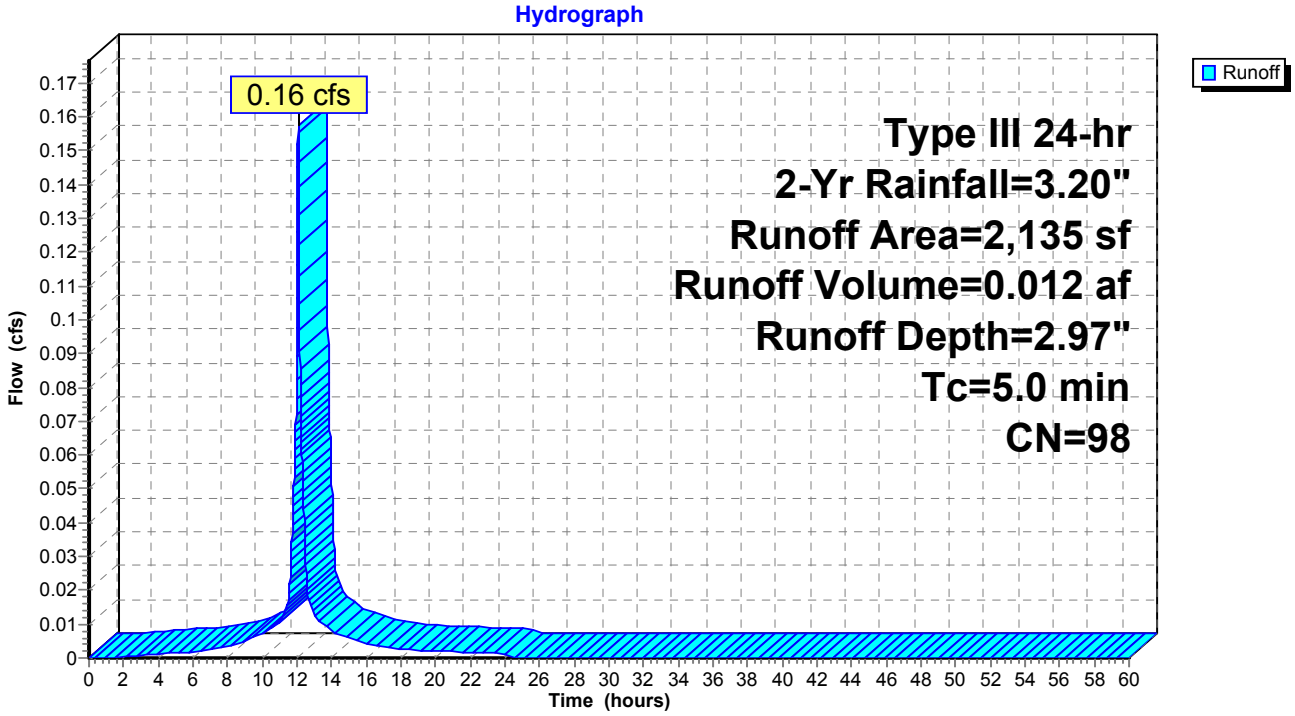
Runoff = 0.16 cfs @ 12.07 hrs, Volume= 0.012 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
2,135	98	Roofs, HSG B
2,135		100.00% Impervious Area

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

Subcatchment PR2: 2nd Floor Roof



Summary for Subcatchment PR3: 6th Floor Roof

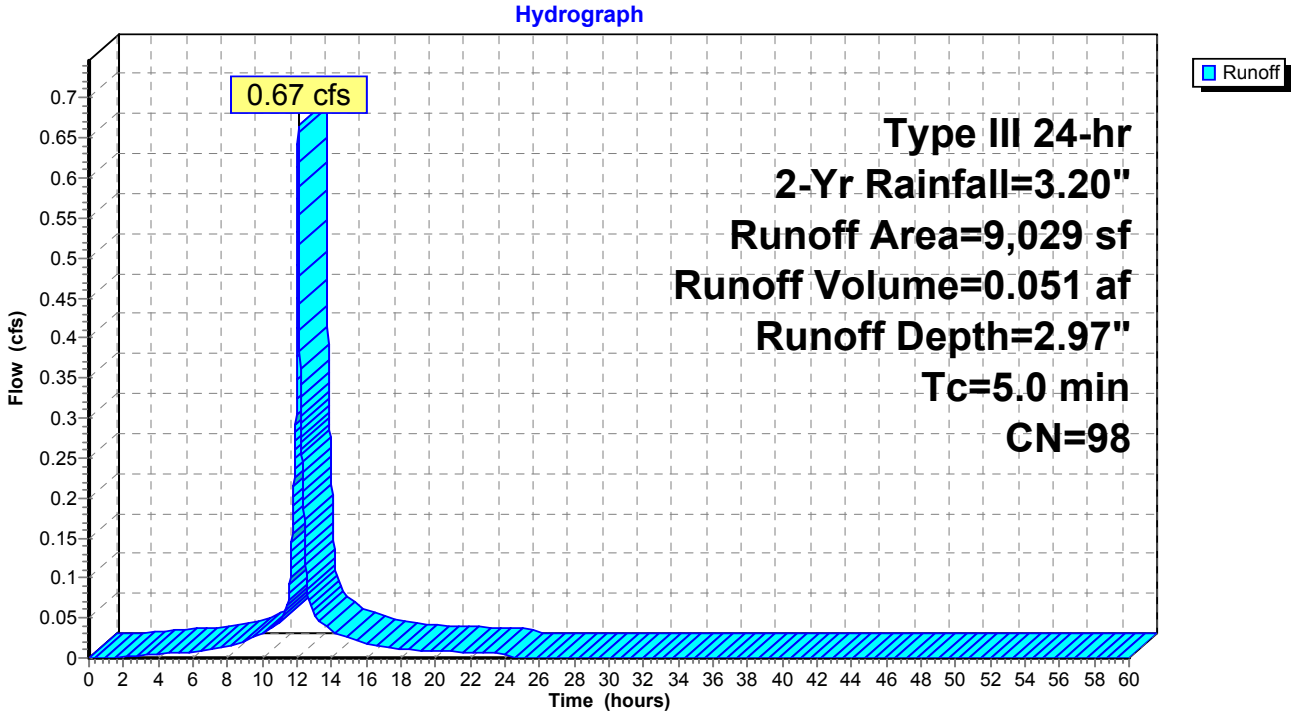
Runoff = 0.67 cfs @ 12.07 hrs, Volume= 0.051 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
9,029	98	Roofs, HSG B
9,029		100.00% Impervious Area

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

Subcatchment PR3: 6th Floor Roof



Summary for Subcatchment PR4: Courtyard

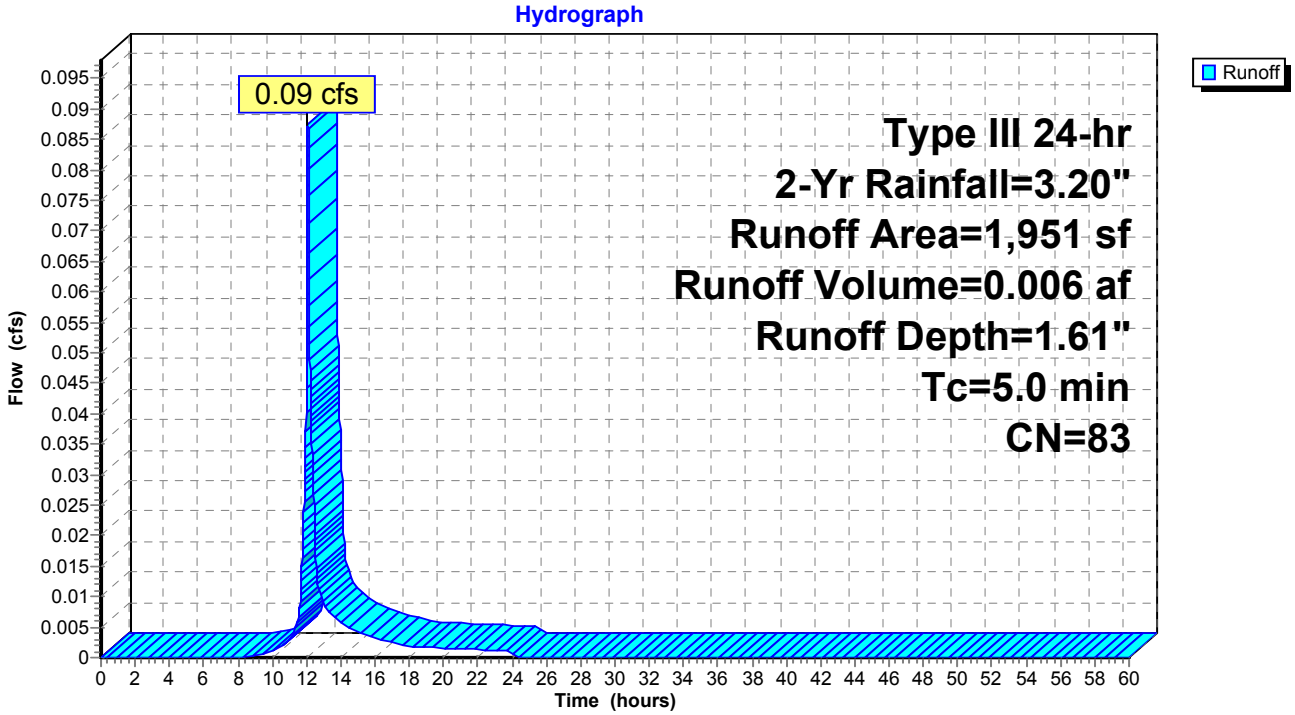
Runoff = 0.09 cfs @ 12.08 hrs, Volume= 0.006 af, Depth= 1.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

	Area (sf)	CN	Description
*	992	98	Porous Pavers, HSG B
*	117	98	Retaining Walls
	806	61	>75% Grass cover, Good, HSG B
*	36	98	Walkway, HSG B
	1,951	83	Weighted Average
	806		41.31% Pervious Area
	1,145		58.69% Impervious Area

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

Subcatchment PR4: Courtyard



Summary for Subcatchment PR5: Plaza

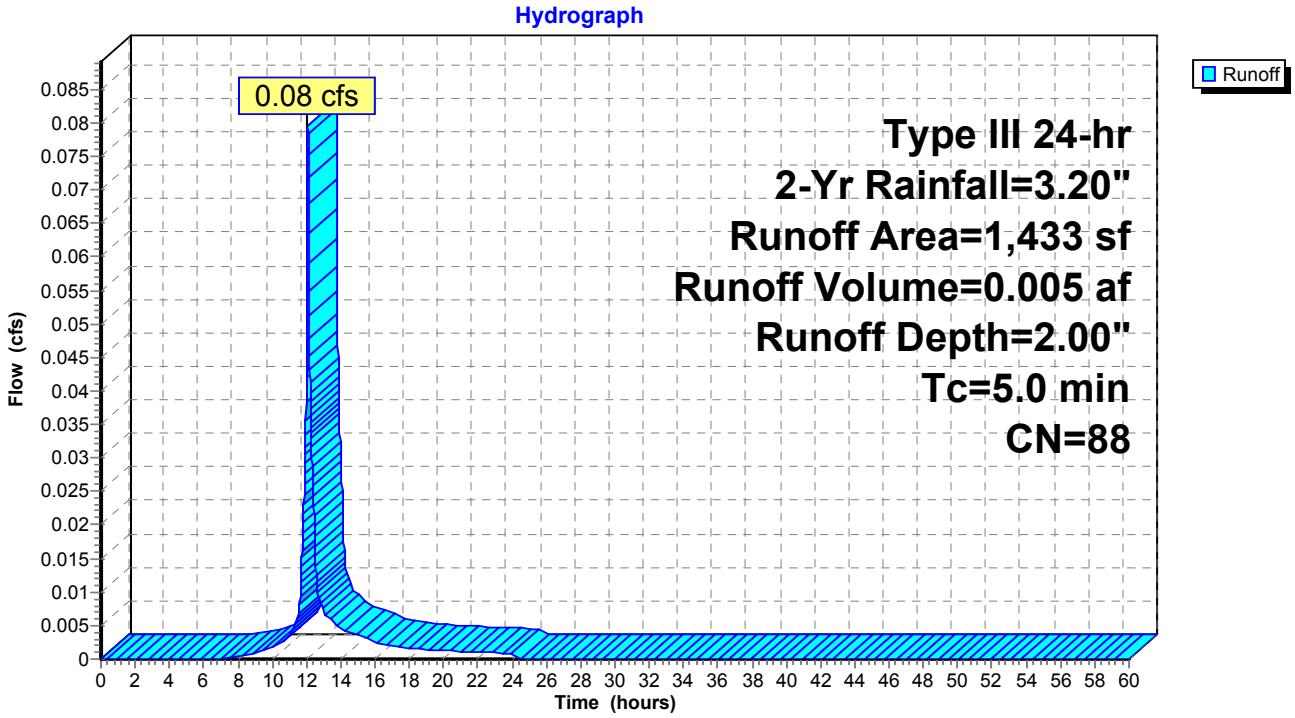
Runoff = 0.08 cfs @ 12.07 hrs, Volume= 0.005 af, Depth= 2.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

	Area (sf)	CN	Description
*	166	98	Retainaing Wall, HSG B
*	892	98	Porous Pavers, HSG B
	375	61	>75% Grass cover, Good, HSG B
	1,433	88	Weighted Average
	375		26.17% Pervious Area
	1,058		73.83% Impervious Area

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

Subcatchment PR5: Plaza



Summary for Subcatchment PR6: Swale Area along Williams St.

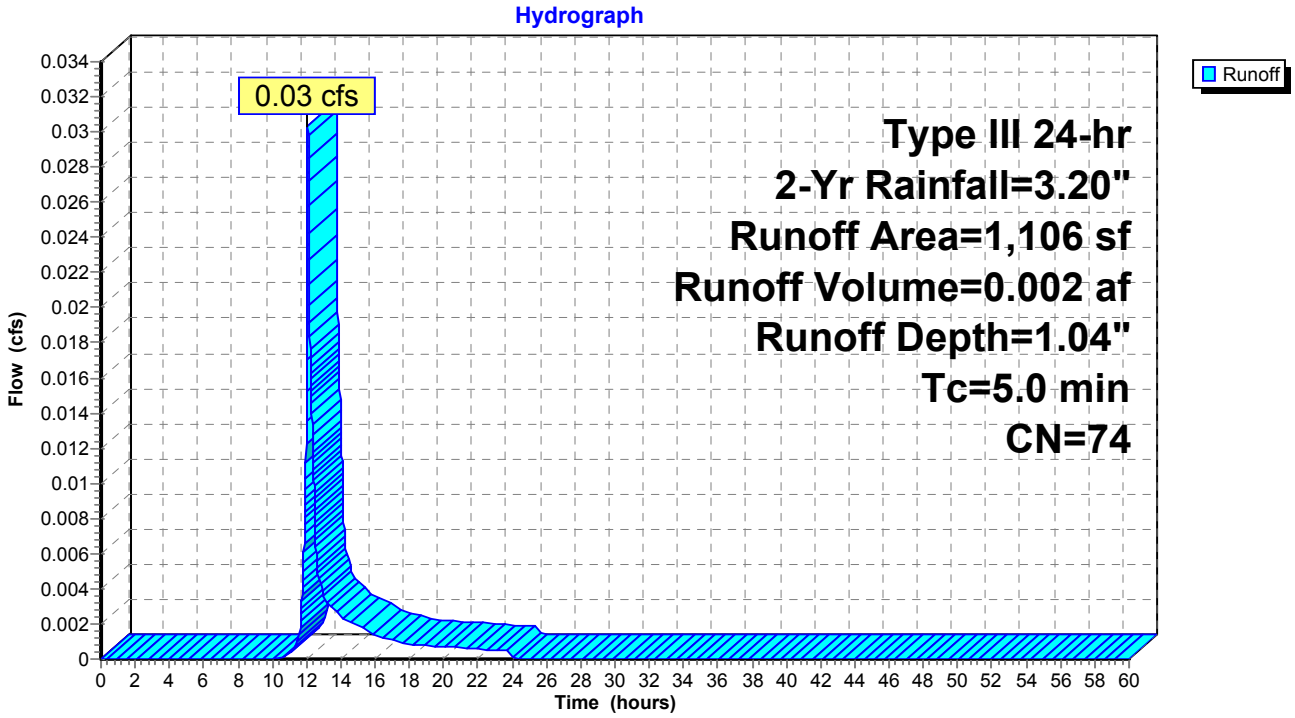
Runoff = 0.03 cfs @ 12.08 hrs, Volume= 0.002 af, Depth= 1.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

	Area (sf)	CN	Description
	712	61	>75% Grass cover, Good, HSG B
*	256	98	Walkways, Walls, Misc.
*	138	98	Porous Pavers, HSG B
	1,106	74	Weighted Average
	712		64.38% Pervious Area
	394		35.62% Impervious Area

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

Subcatchment PR6: Swale Area along Williams St.



Summary for Subcatchment PR7: Loading Dock

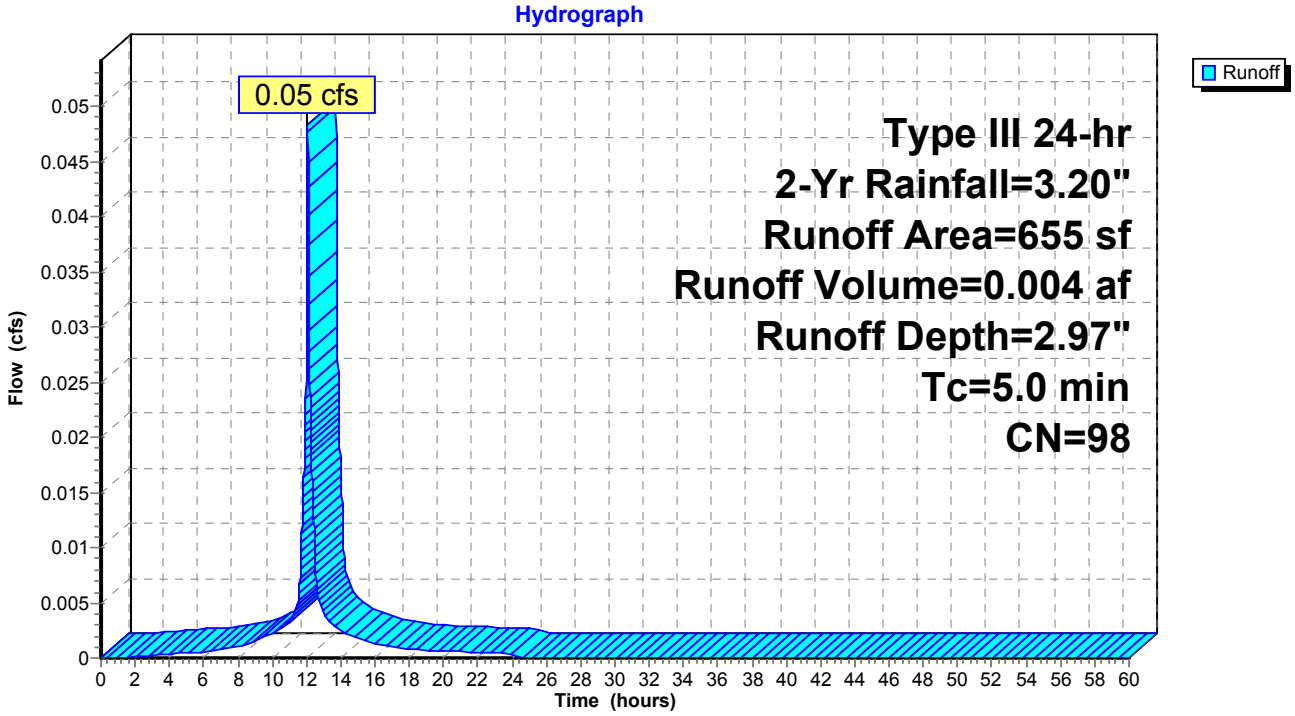
Runoff = 0.05 cfs @ 12.07 hrs, Volume= 0.004 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr Rainfall=3.20"

Area (sf)	CN	Description
655	98	Paved parking, HSG B
655		100.00% Impervious Area

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

Subcatchment PR7: Loading Dock



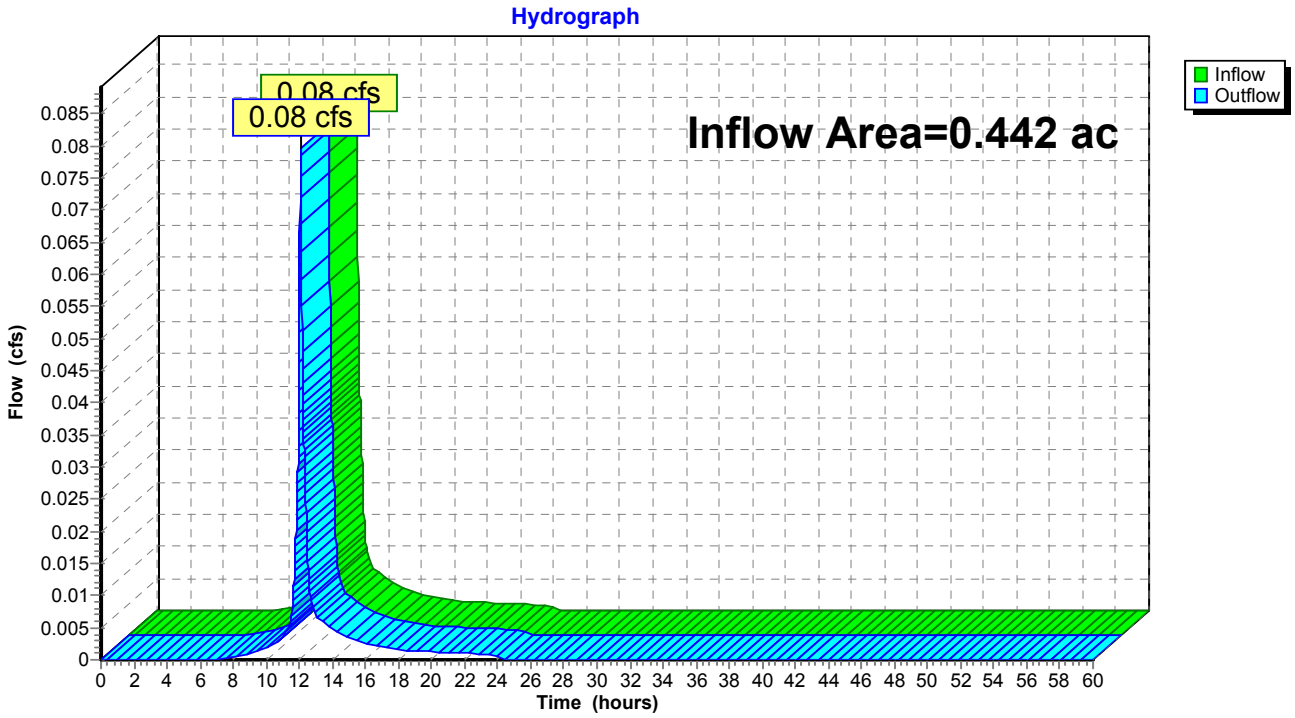
Summary for Reach DP1: Exist. Closed System at Harvard/Williams St.

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.442 ac, 79.05% Impervious, Inflow Depth = 0.15" for 2-Yr event
Inflow = 0.08 cfs @ 12.07 hrs, Volume= 0.005 af
Outflow = 0.08 cfs @ 12.07 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2

Reach DP1: Exist. Closed System at Harvard/Williams St.



Summary for Pond 1P: Underground Infiltration/Storage

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=305)

Inflow Area =	0.177 ac,	61.68% Impervious,	Inflow Depth =	3.26"	for 2-Yr event
Inflow =	0.92 cfs @	12.07 hrs,	Volume=	0.048 af	
Outflow =	0.07 cfs @	11.70 hrs,	Volume=	0.048 af,	Atten= 92%, Lag= 0.0 min
Discarded =	0.07 cfs @	11.70 hrs,	Volume=	0.048 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 58.88' @ 12.71 hrs Surf.Area= 1,960 sf Storage= 978 cf
Flood Elev= 61.50' Surf.Area= 1,960 sf Storage= 4,446 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 102.4 min (863.6 - 761.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	58.00'	989 cf	**35.00'W x 56.00'L x 3.50'H Field A** 6,860 cf Overall - 3,564 cf Embedded = 3,296 cf x 30.0% Voids
#2A	58.50'	3,457 cf	**StormTank 24W** x 396 Inside #1 Inside= 36.0"W x 24.0"H => 5.82 sf x 1.50'L = 8.7 cf Outside= 36.0"W x 24.0"H => 6.00 sf x 1.50'L = 9.0 cf
		4,446 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	58.00'	**1.600 in/hr Exfiltration over Surface area**
#2	Primary	60.70'	**6.0" Round Culvert** L= 8.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 60.70' / 60.65' S= 0.0063 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.07 cfs @ 11.70 hrs HW=58.04' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=58.00' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Controls 0.00 cfs)

Pond 1P: Underground Infiltration/Storage - Chamber Wizard Field A

Chamber Model = StormTank 24W (Brentwood Industries StormTank in wide rows)
Inside= 36.0"W x 24.0"H => 5.82 sf x 1.50'L = 8.7 cf
Outside= 36.0"W x 24.0"H => 6.00 sf x 1.50'L = 9.0 cf

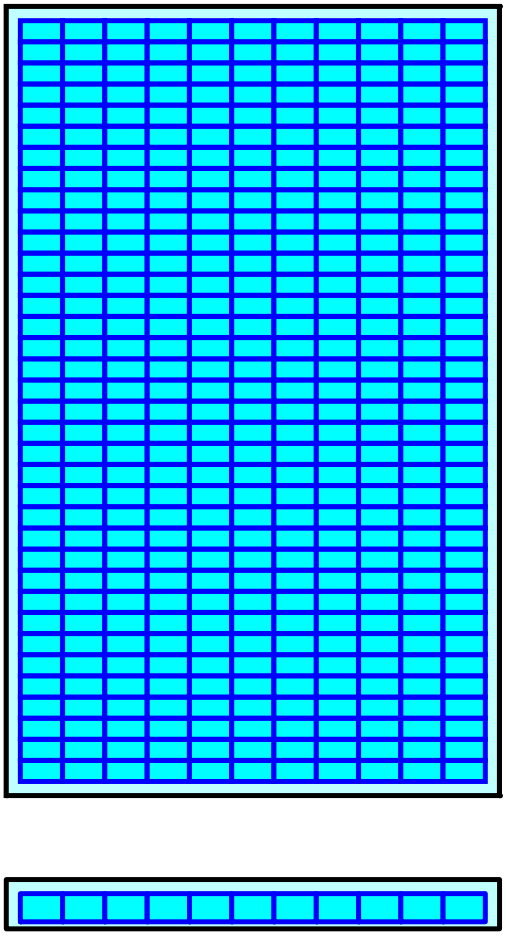
36 Chambers/Row x 1.50' Long = 54.00' Row Length +12.0" End Stone x 2 = 56.00' Base Length
11 Rows x 36.0" Wide + 12.0" Side Stone x 2 = 35.00' Base Width
6.0" Base + 24.0" Chamber Height + 12.0" Cover = 3.50' Field Height

396 Chambers x 8.7 cf = 3,457.1 cf Chamber Storage
396 Chambers x 9.0 cf = 3,564.0 cf Displacement

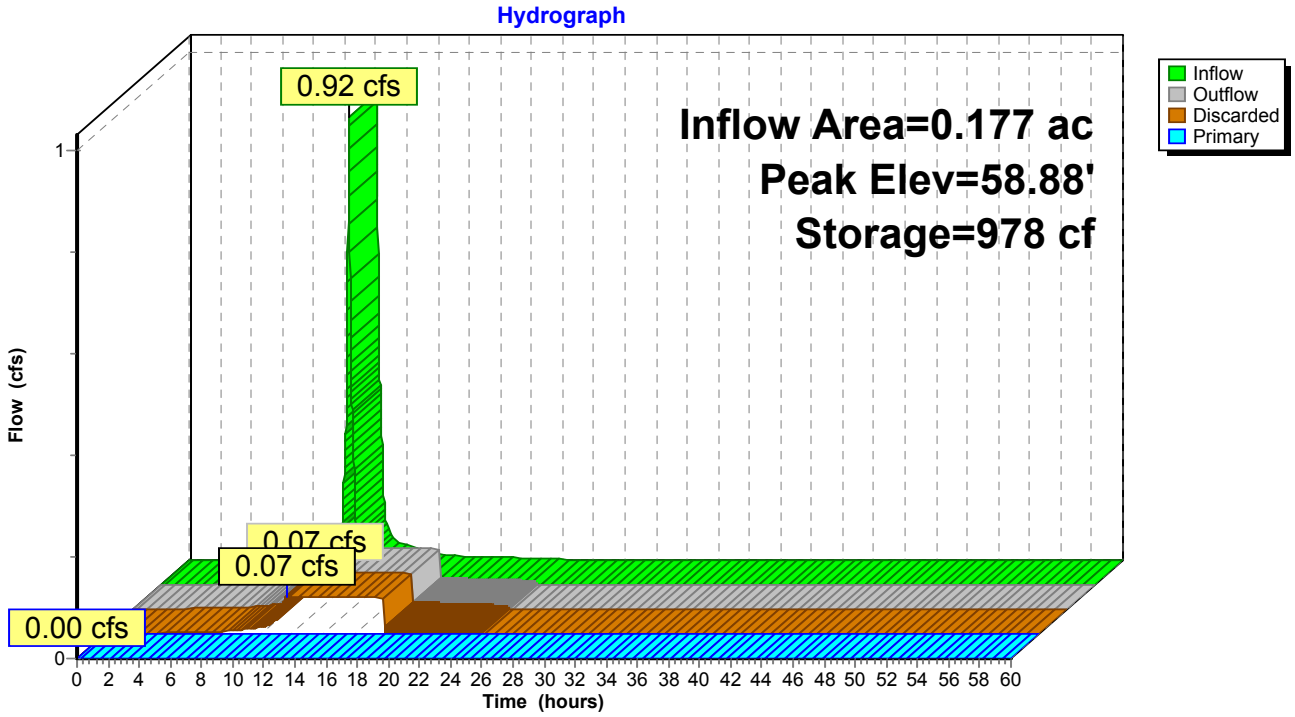
6,860.0 cf Field - 3,564.0 cf Chambers = 3,296.0 cf Stone x 30.0% Voids = 988.8 cf Stone Storage

Chamber Storage + Stone Storage = 4,445.9 cf = 0.102 af
Overall Storage Efficiency = 64.8%

396 Chambers
254.1 cy Field
122.1 cy Stone



Pond 1P: Underground Infiltration/Storage



Summary for Pond 2P: Outlet Control Structure

Inflow Area =	0.207 ac,100.00% Impervious, Inflow Depth = 2.97" for 2-Yr event				
Inflow =	0.67 cfs @	12.07 hrs,	Volume=	0.051 af	
Outflow =	0.67 cfs @	12.07 hrs,	Volume=	0.051 af,	Atten= 0%, Lag= 0.0 min
Primary =	0.11 cfs @	12.07 hrs,	Volume=	0.032 af	
Secondary =	0.55 cfs @	12.07 hrs,	Volume=	0.020 af	

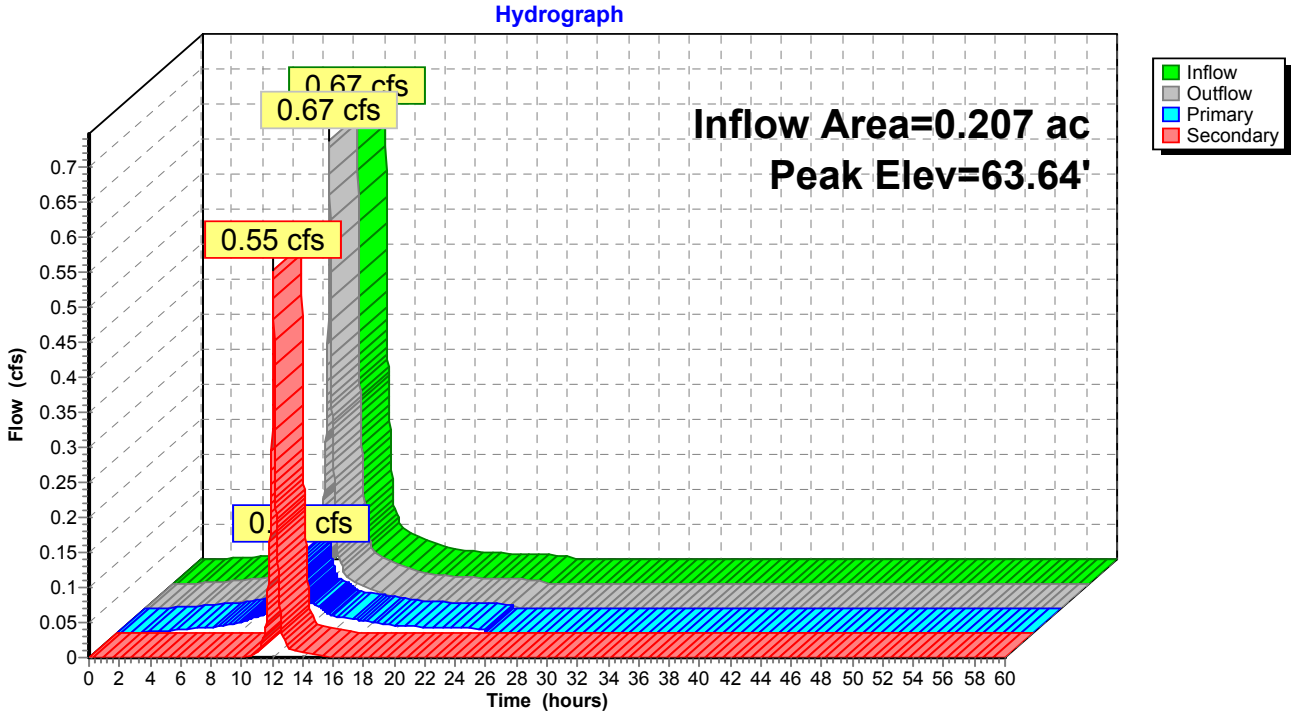
Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 63.64' @ 12.07 hrs
Flood Elev= 66.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	63.40'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	61.00'	**12.0" Round Culvert** L= 65.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 61.00' / 60.00' S= 0.0154 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	63.52'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.11 cfs @ 12.07 hrs HW=63.64' TW=63.22' (Dynamic Tailwater)
└─**1=Orifice/Grate** (Orifice Controls 0.11 cfs @ 1.67 fps)

Secondary OutFlow Max=0.55 cfs @ 12.07 hrs HW=63.64' TW=58.59' (Dynamic Tailwater)
└─**2=Culvert** (Passes 0.55 cfs of 5.44 cfs potential flow)
└─**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.55 cfs @ 1.14 fps)

Pond 2P: Outlet Control Structure



Summary for Pond 3P: Bioswale

Inflow Area = 0.233 ac, 92.97% Impervious, Inflow Depth = 1.74" for 2-Yr event
Inflow = 0.14 cfs @ 12.07 hrs, Volume= 0.034 af
Outflow = 0.02 cfs @ 12.16 hrs, Volume= 0.034 af, Atten= 83%, Lag= 5.2 min
Discarded = 0.02 cfs @ 12.16 hrs, Volume= 0.034 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 63.50' @ 14.62 hrs Surf.Area= 660 sf Storage= 547 cf
Flood Elev= 63.77' Surf.Area= 660 sf Storage= 723 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 255.6 min (1,031.9 - 776.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.51'	743 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

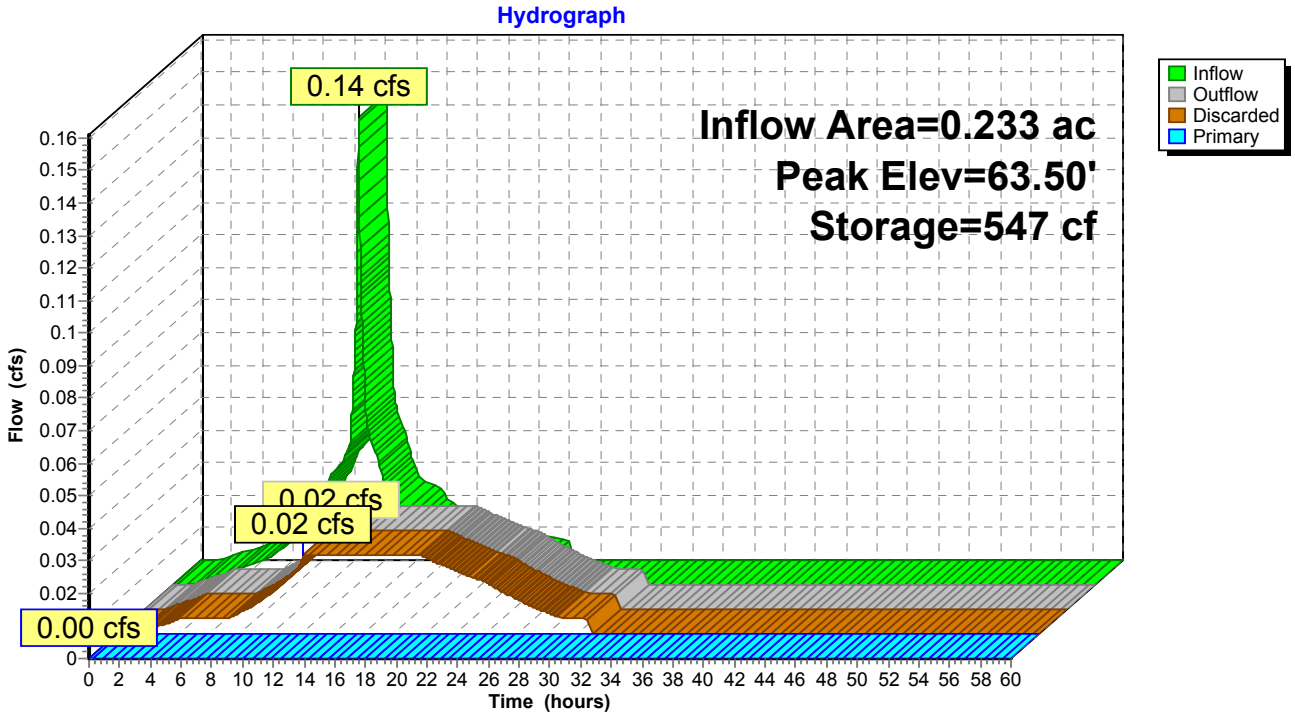
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.51	132	0.0	0	0	132
62.26	132	30.0	30	30	163
62.27	132	100.0	1	31	163
63.27	660	100.0	362	393	695
63.80	660	100.0	350	743	743

Device	Routing	Invert	Outlet Devices
#1	Primary	63.77'	**11.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Discarded	61.51'	**1.600 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.02 cfs @ 12.16 hrs HW=63.27' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.51' TW=0.00' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Bioswale



Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR1: 1st Floor Green Roof Runoff Area=2,143 sf 0.00% Impervious Runoff Depth=1.14"
Tc=5.0 min CN=61 Runoff=0.06 cfs 0.005 af

Subcatchment PR1A: 1st Floor Roof Runoff Area=396 sf 100.00% Impervious Runoff Depth=4.36"
Tc=5.0 min CN=98 Runoff=0.04 cfs 0.003 af

Subcatchment PR1B: 1st Floor Roof Runoff Area=416 sf 100.00% Impervious Runoff Depth=4.36"
Tc=5.0 min CN=98 Runoff=0.04 cfs 0.003 af

Subcatchment PR2: 2nd Floor Roof Runoff Area=2,135 sf 100.00% Impervious Runoff Depth=4.36"
Tc=5.0 min CN=98 Runoff=0.23 cfs 0.018 af

Subcatchment PR3: 6th Floor Roof Runoff Area=9,029 sf 100.00% Impervious Runoff Depth=4.36"
Tc=5.0 min CN=98 Runoff=0.97 cfs 0.075 af

Subcatchment PR4: Courtyard Runoff Area=1,951 sf 58.69% Impervious Runoff Depth=2.81"
Tc=5.0 min CN=83 Runoff=0.15 cfs 0.011 af

Subcatchment PR5: Plaza Runoff Area=1,433 sf 73.83% Impervious Runoff Depth=3.29"
Tc=5.0 min CN=88 Runoff=0.13 cfs 0.009 af

Subcatchment PR6: Swale Area along Runoff Area=1,106 sf 35.62% Impervious Runoff Depth=2.05"
Tc=5.0 min CN=74 Runoff=0.06 cfs 0.004 af

Subcatchment PR7: Loading Dock Runoff Area=655 sf 100.00% Impervious Runoff Depth=4.36"
Tc=5.0 min CN=98 Runoff=0.07 cfs 0.005 af

Reach DP1: Exist. Closed System at Harvard/Williams St. Inflow=0.13 cfs 0.009 af
Outflow=0.13 cfs 0.009 af

Pond 1P: Underground Infiltration/Storage Peak Elev=59.44' Storage=1,963 cf Inflow=1.42 cfs 0.085 af
Discarded=0.07 cfs 0.085 af Primary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.085 af

Pond 2P: Outlet Control Structure Peak Elev=63.68' Inflow=0.97 cfs 0.075 af
Primary=0.14 cfs 0.035 af Secondary=0.82 cfs 0.040 af Outflow=0.97 cfs 0.075 af

Pond 3P: Bioswale Peak Elev=63.59' Storage=605 cf Inflow=0.20 cfs 0.040 af
Discarded=0.02 cfs 0.040 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.040 af

Total Runoff Area = 0.442 ac Runoff Volume = 0.134 af Average Runoff Depth = 3.64"
20.95% Pervious = 0.093 ac 79.05% Impervious = 0.350 ac

Summary for Subcatchment PR1: 1st Floor Green Roof

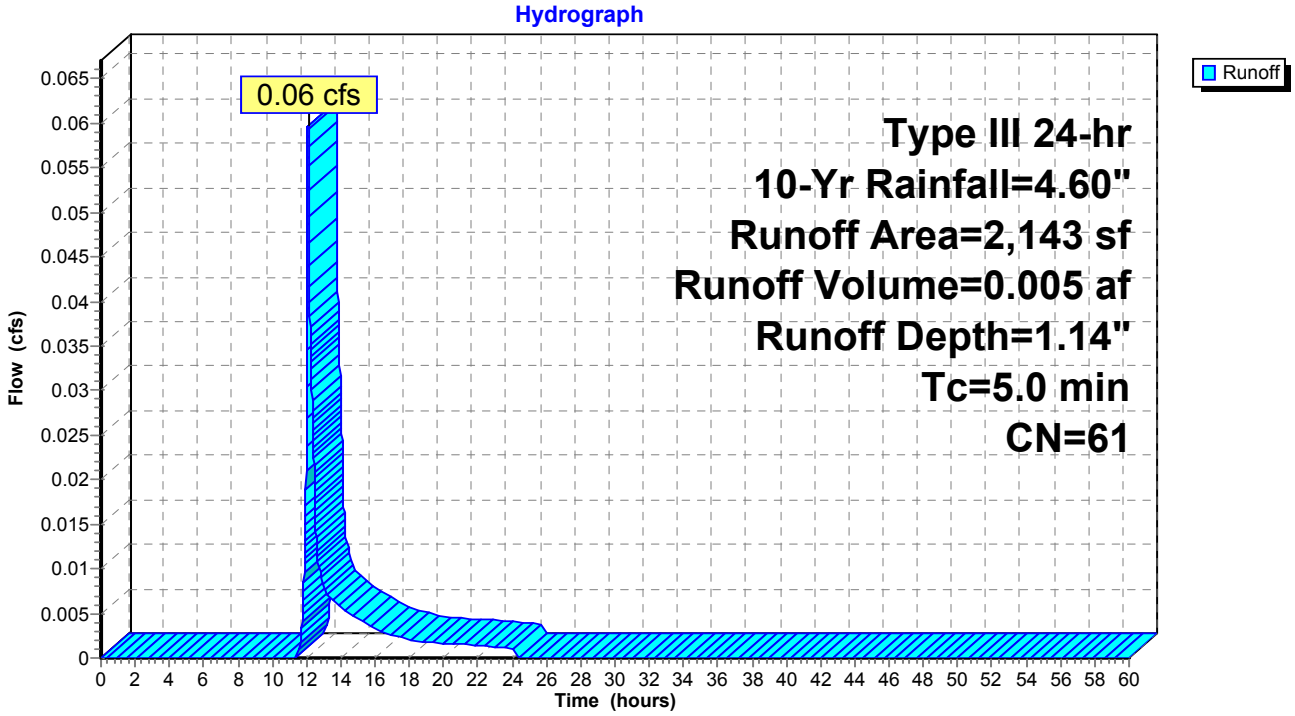
Runoff = 0.06 cfs @ 12.09 hrs, Volume= 0.005 af, Depth= 1.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.60"

Area (sf)	CN	Description
2,143	61	>75% Grass cover, Good, HSG B
2,143		100.00% Pervious Area

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

Subcatchment PR1: 1st Floor Green Roof



Summary for Subcatchment PR1A: 1st Floor Roof

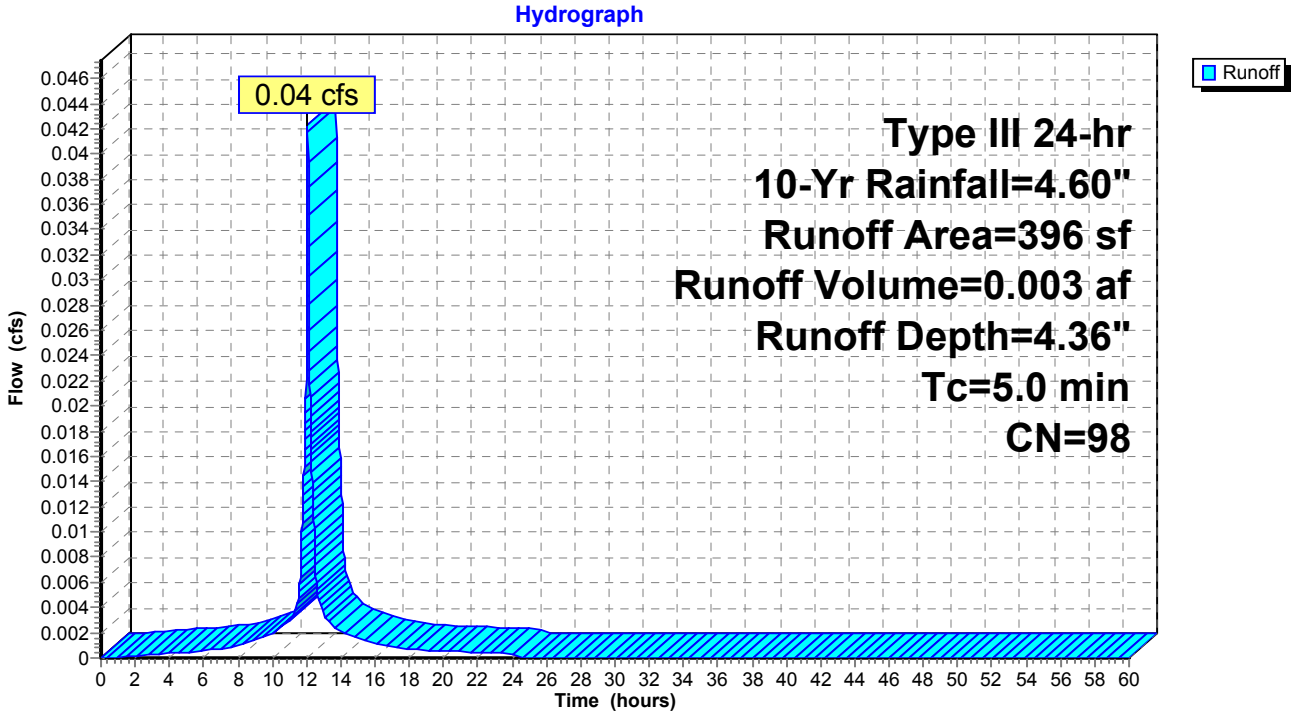
Runoff = 0.04 cfs @ 12.07 hrs, Volume= 0.003 af, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.60"

Area (sf)	CN	Description
396	98	Roofs, HSG B
396		100.00% Impervious Area

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

Subcatchment PR1A: 1st Floor Roof



Summary for Subcatchment PR1B: 1st Floor Roof

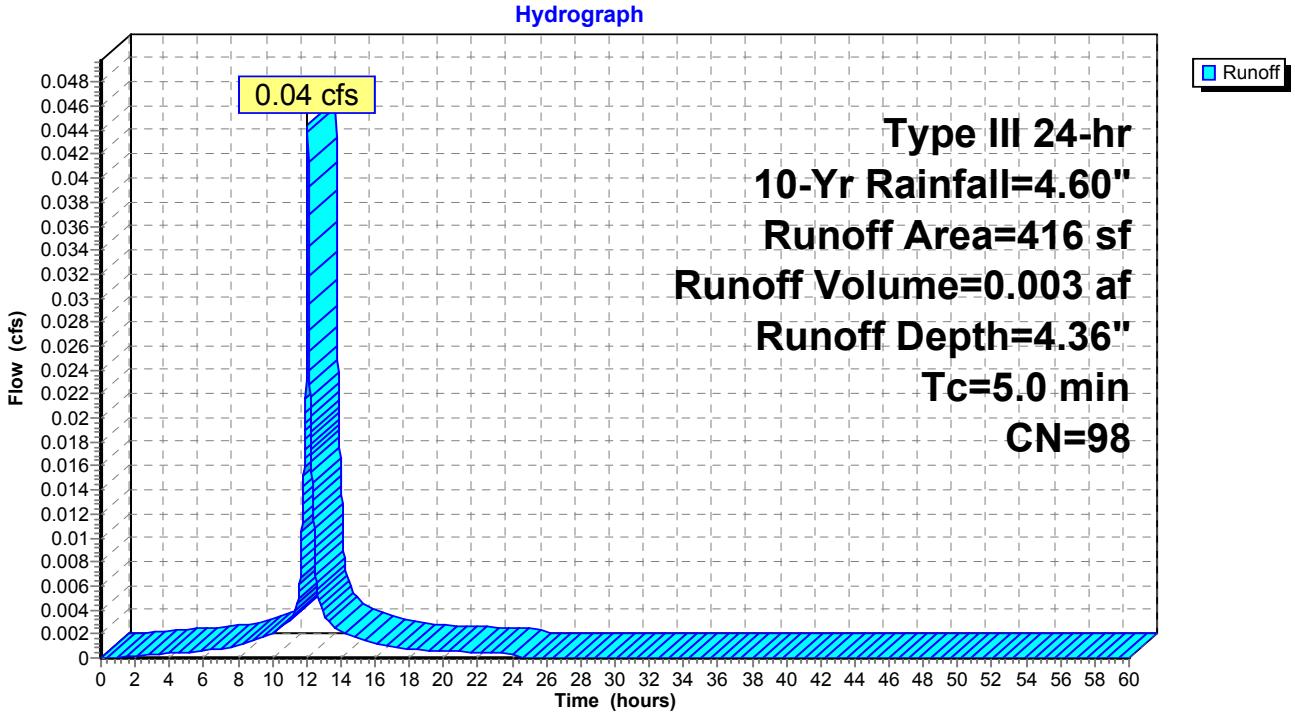
Runoff = 0.04 cfs @ 12.07 hrs, Volume= 0.003 af, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.60"

Area (sf)	CN	Description
416	98	Roofs, HSG B
416		100.00% Impervious Area

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

Subcatchment PR1B: 1st Floor Roof



Summary for Subcatchment PR2: 2nd Floor Roof

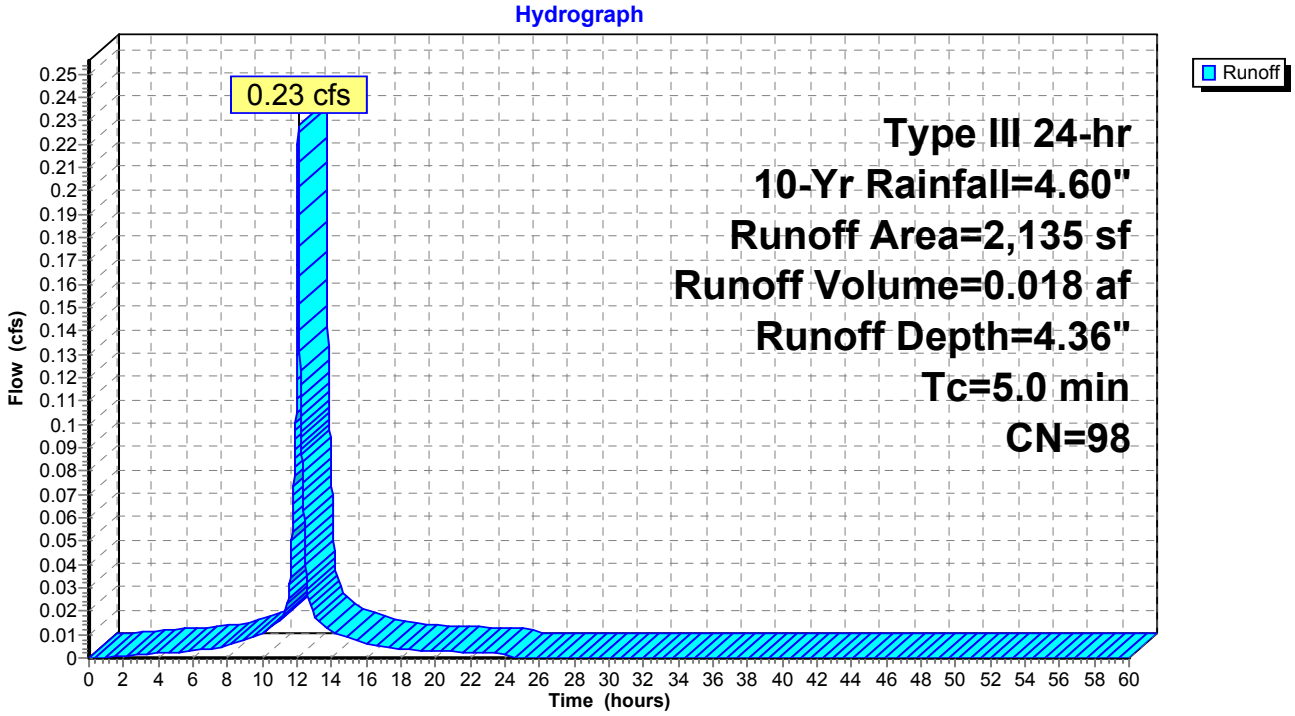
Runoff = 0.23 cfs @ 12.07 hrs, Volume= 0.018 af, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.60"

Area (sf)	CN	Description
2,135	98	Roofs, HSG B
2,135		100.00% Impervious Area

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

Subcatchment PR2: 2nd Floor Roof



Summary for Subcatchment PR3: 6th Floor Roof

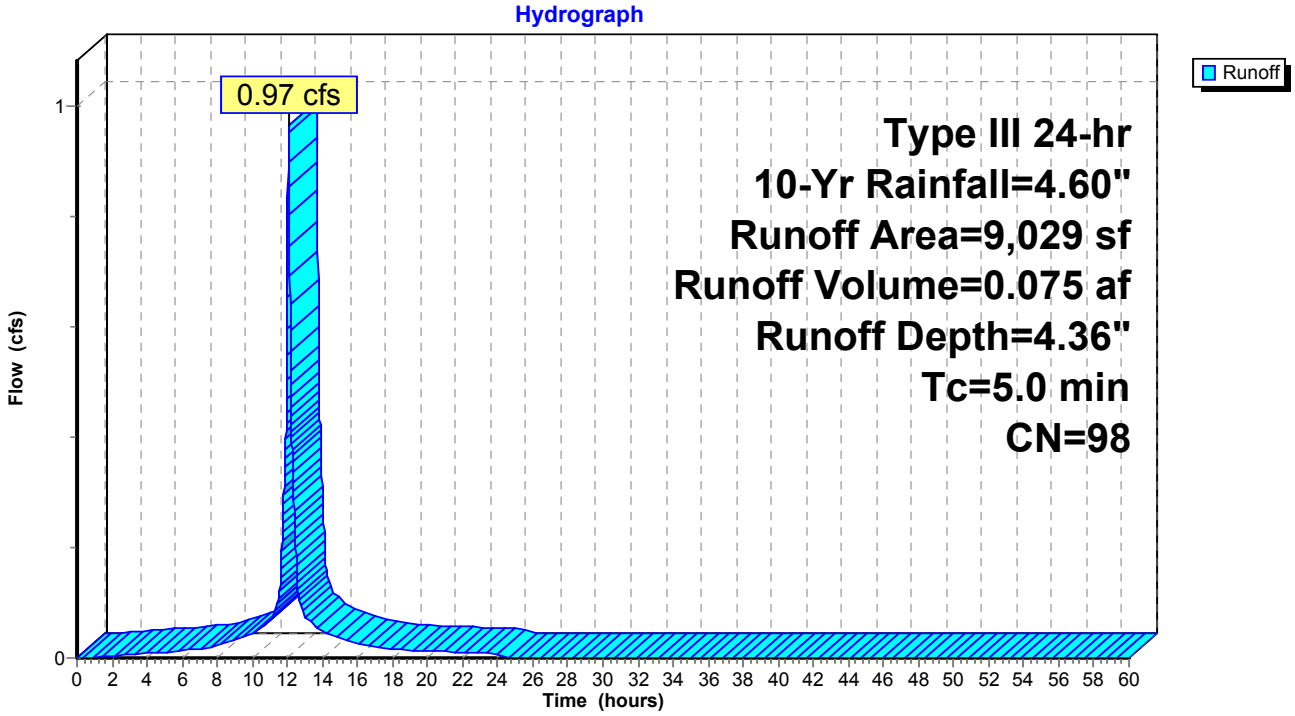
Runoff = 0.97 cfs @ 12.07 hrs, Volume= 0.075 af, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.60"

Area (sf)	CN	Description
9,029	98	Roofs, HSG B
9,029		100.00% Impervious Area

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

Subcatchment PR3: 6th Floor Roof



Summary for Subcatchment PR4: Courtyard

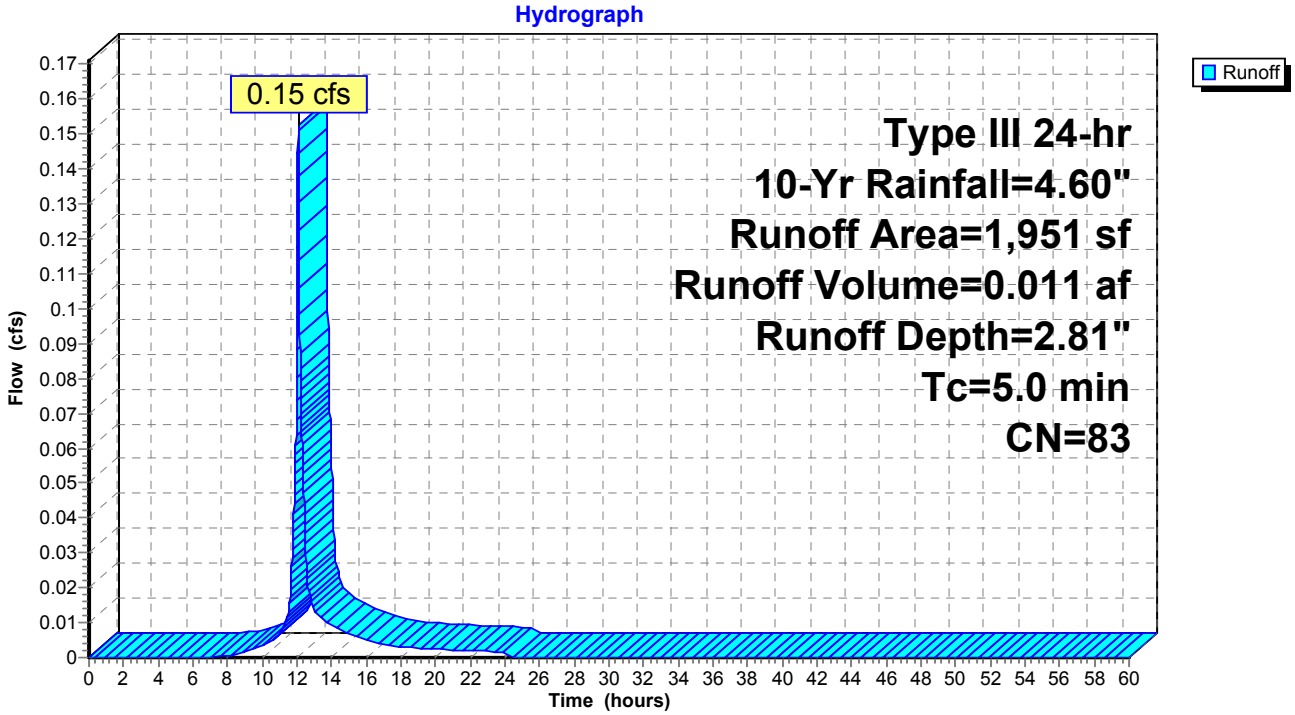
Runoff = 0.15 cfs @ 12.07 hrs, Volume= 0.011 af, Depth= 2.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.60"

	Area (sf)	CN	Description
*	992	98	Porous Pavers, HSG B
*	117	98	Retaining Walls
	806	61	>75% Grass cover, Good, HSG B
*	36	98	Walkway, HSG B
	1,951	83	Weighted Average
	806		41.31% Pervious Area
	1,145		58.69% Impervious Area

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

Subcatchment PR4: Courtyard



Summary for Subcatchment PR5: Plaza

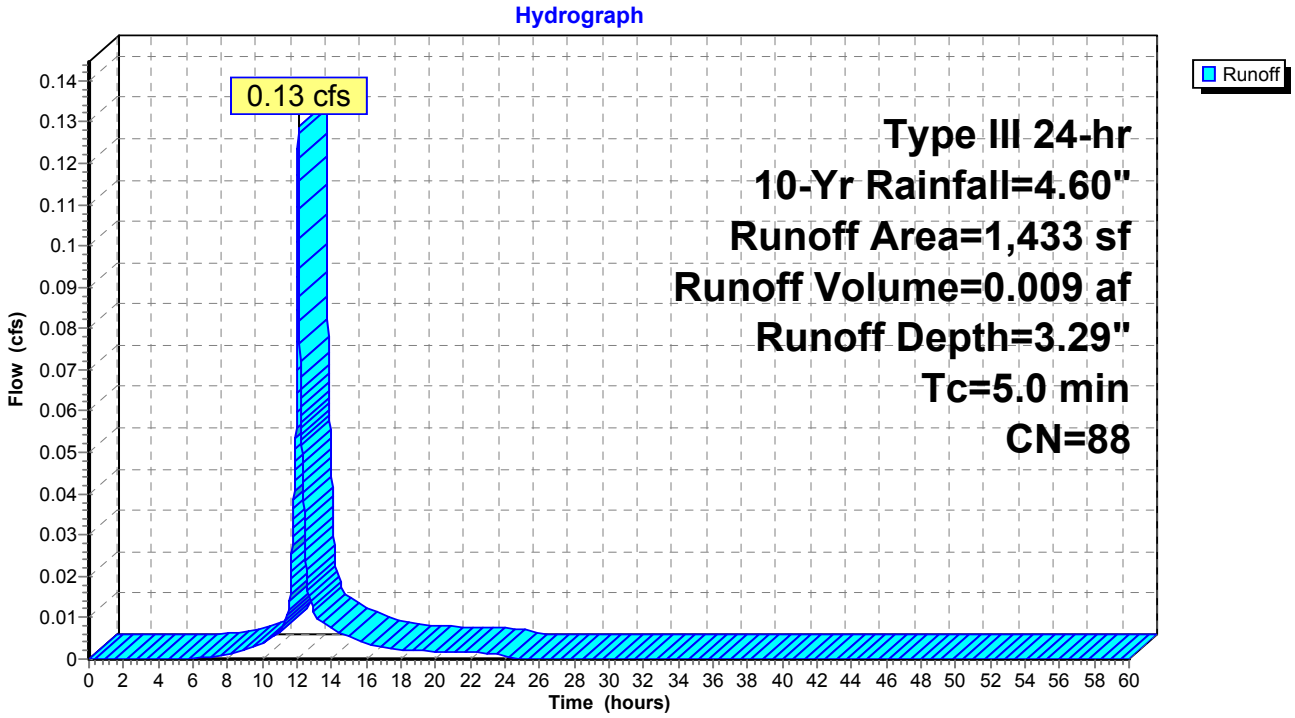
Runoff = 0.13 cfs @ 12.07 hrs, Volume= 0.009 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.60"

	Area (sf)	CN	Description
*	166	98	Retainaing Wall, HSG B
*	892	98	Porous Pavers, HSG B
	375	61	>75% Grass cover, Good, HSG B
	1,433	88	Weighted Average
	375		26.17% Pervious Area
	1,058		73.83% Impervious Area

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

Subcatchment PR5: Plaza



Summary for Subcatchment PR6: Swale Area along Williams St.

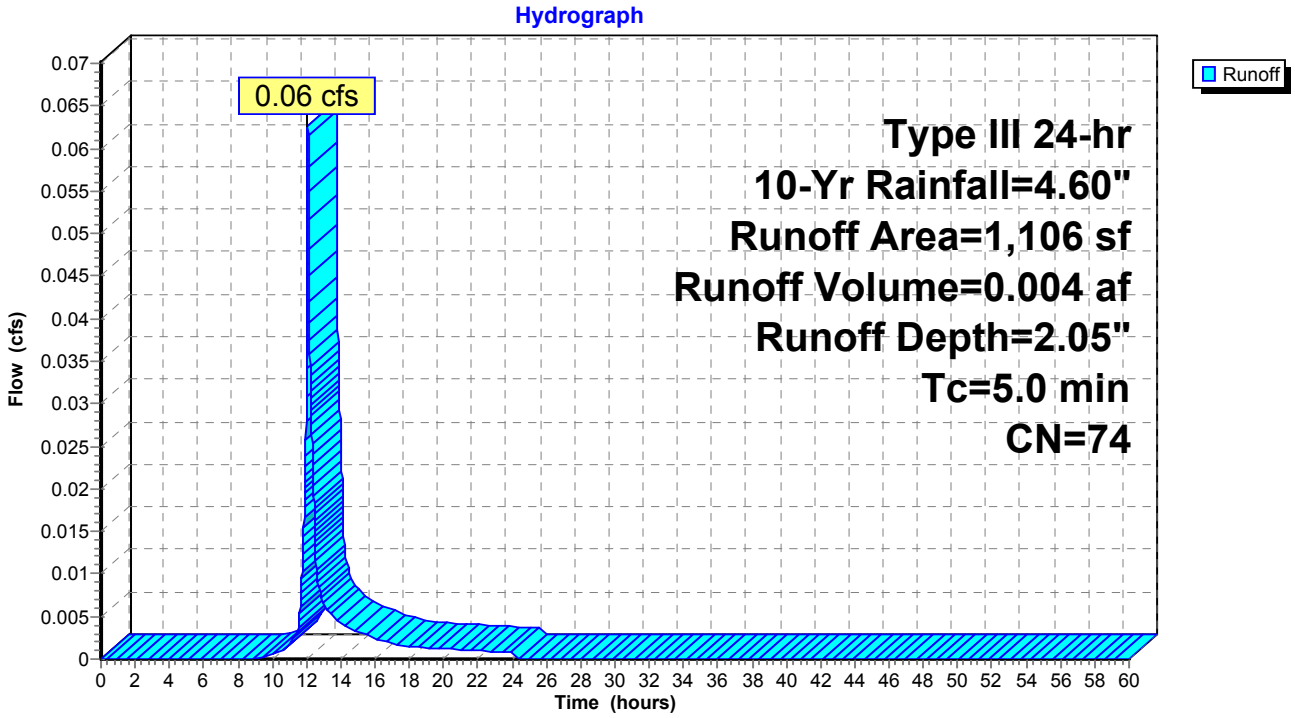
Runoff = 0.06 cfs @ 12.08 hrs, Volume= 0.004 af, Depth= 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.60"

	Area (sf)	CN	Description
	712	61	>75% Grass cover, Good, HSG B
*	256	98	Walkways, Walls, Misc.
*	138	98	Porous Pavers, HSG B
	1,106	74	Weighted Average
	712		64.38% Pervious Area
	394		35.62% Impervious Area

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

Subcatchment PR6: Swale Area along Williams St.



Summary for Subcatchment PR7: Loading Dock

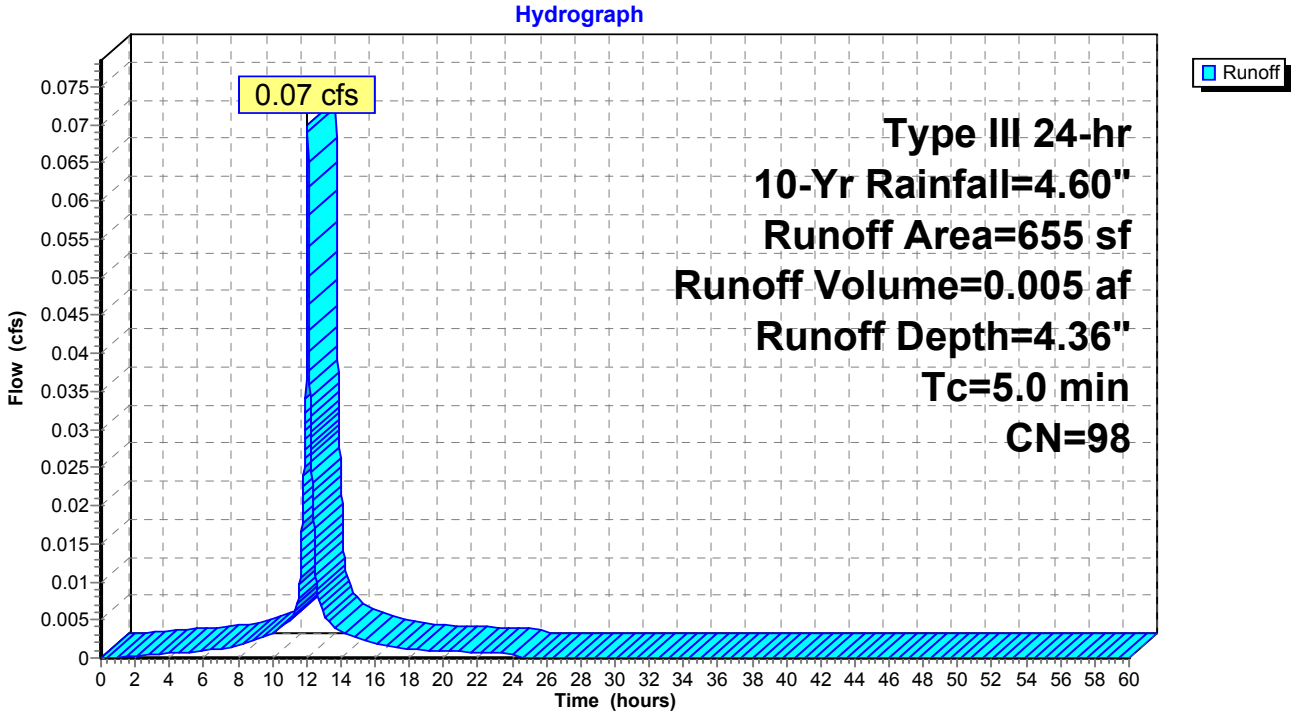
Runoff = 0.07 cfs @ 12.07 hrs, Volume= 0.005 af, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr Rainfall=4.60"

Area (sf)	CN	Description
655	98	Paved parking, HSG B
655		100.00% Impervious Area

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

Subcatchment PR7: Loading Dock



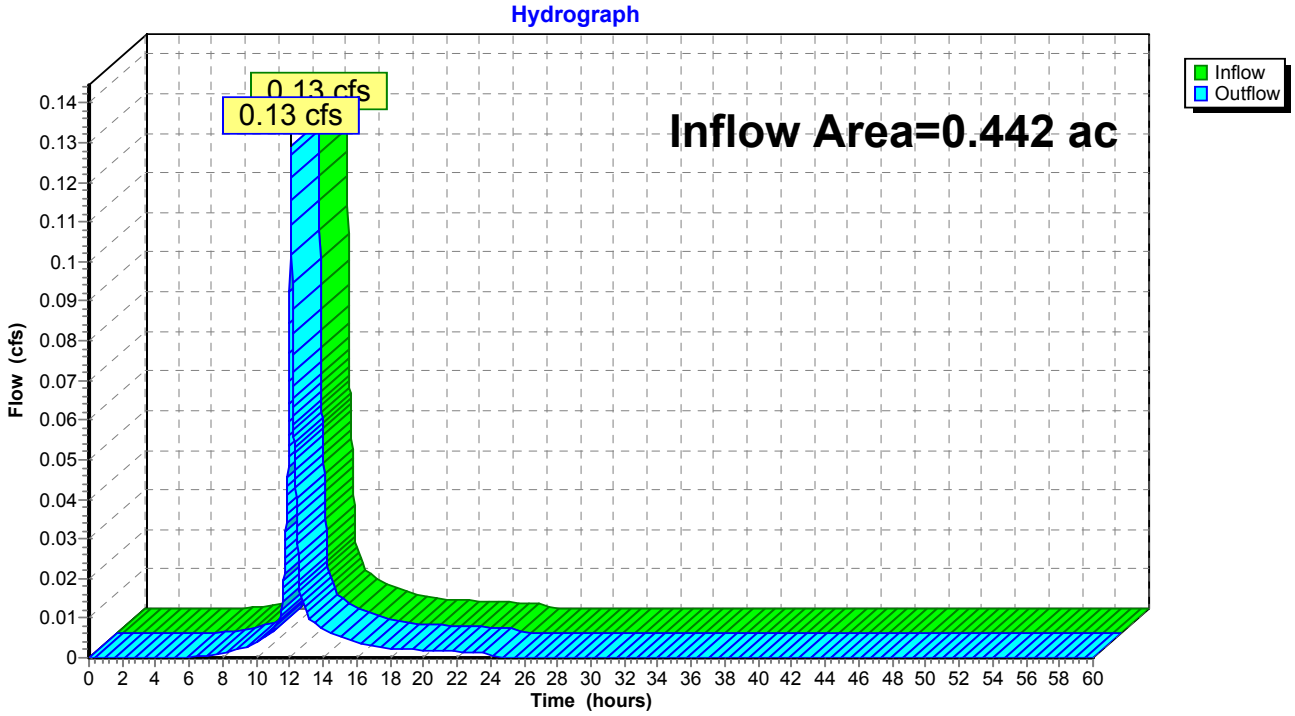
Summary for Reach DP1: Exist. Closed System at Harvard/Williams St.

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.442 ac, 79.05% Impervious, Inflow Depth = 0.24" for 10-Yr event
Inflow = 0.13 cfs @ 12.07 hrs, Volume= 0.009 af
Outflow = 0.13 cfs @ 12.07 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2

Reach DP1: Exist. Closed System at Harvard/Williams St.



Summary for Pond 1P: Underground Infiltration/Storage

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=16)

Inflow Area =	0.177 ac,	61.68% Impervious,	Inflow Depth =	5.80"	for 10-Yr event
Inflow =	1.42 cfs @	12.07 hrs,	Volume=	0.085 af	
Outflow =	0.07 cfs @	11.49 hrs,	Volume=	0.085 af,	Atten= 95%, Lag= 0.0 min
Discarded =	0.07 cfs @	11.49 hrs,	Volume=	0.085 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 59.44' @ 13.81 hrs Surf.Area= 1,960 sf Storage= 1,963 cf
Flood Elev= 61.50' Surf.Area= 1,960 sf Storage= 4,446 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 232.6 min (994.0 - 761.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	58.00'	989 cf	**35.00'W x 56.00'L x 3.50'H Field A** 6,860 cf Overall - 3,564 cf Embedded = 3,296 cf x 30.0% Voids
#2A	58.50'	3,457 cf	**StormTank 24W** x 396 Inside #1 Inside= 36.0"W x 24.0"H => 5.82 sf x 1.50'L = 8.7 cf Outside= 36.0"W x 24.0"H => 6.00 sf x 1.50'L = 9.0 cf
		4,446 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	58.00'	**1.600 in/hr Exfiltration over Surface area**
#2	Primary	60.70'	**6.0" Round Culvert** L= 8.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 60.70' / 60.65' S= 0.0063 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.07 cfs @ 11.49 hrs HW=58.04' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=58.00' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Controls 0.00 cfs)

Pond 1P: Underground Infiltration/Storage - Chamber Wizard Field A

Chamber Model = StormTank 24W (Brentwood Industries StormTank in wide rows)
Inside= 36.0"W x 24.0"H => 5.82 sf x 1.50'L = 8.7 cf
Outside= 36.0"W x 24.0"H => 6.00 sf x 1.50'L = 9.0 cf

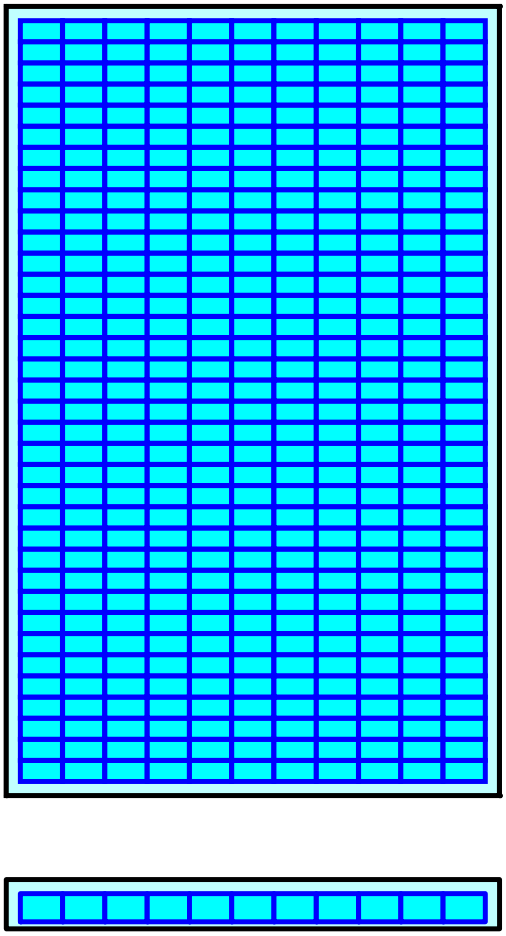
36 Chambers/Row x 1.50' Long = 54.00' Row Length +12.0" End Stone x 2 = 56.00' Base Length
11 Rows x 36.0" Wide + 12.0" Side Stone x 2 = 35.00' Base Width
6.0" Base + 24.0" Chamber Height + 12.0" Cover = 3.50' Field Height

396 Chambers x 8.7 cf = 3,457.1 cf Chamber Storage
396 Chambers x 9.0 cf = 3,564.0 cf Displacement

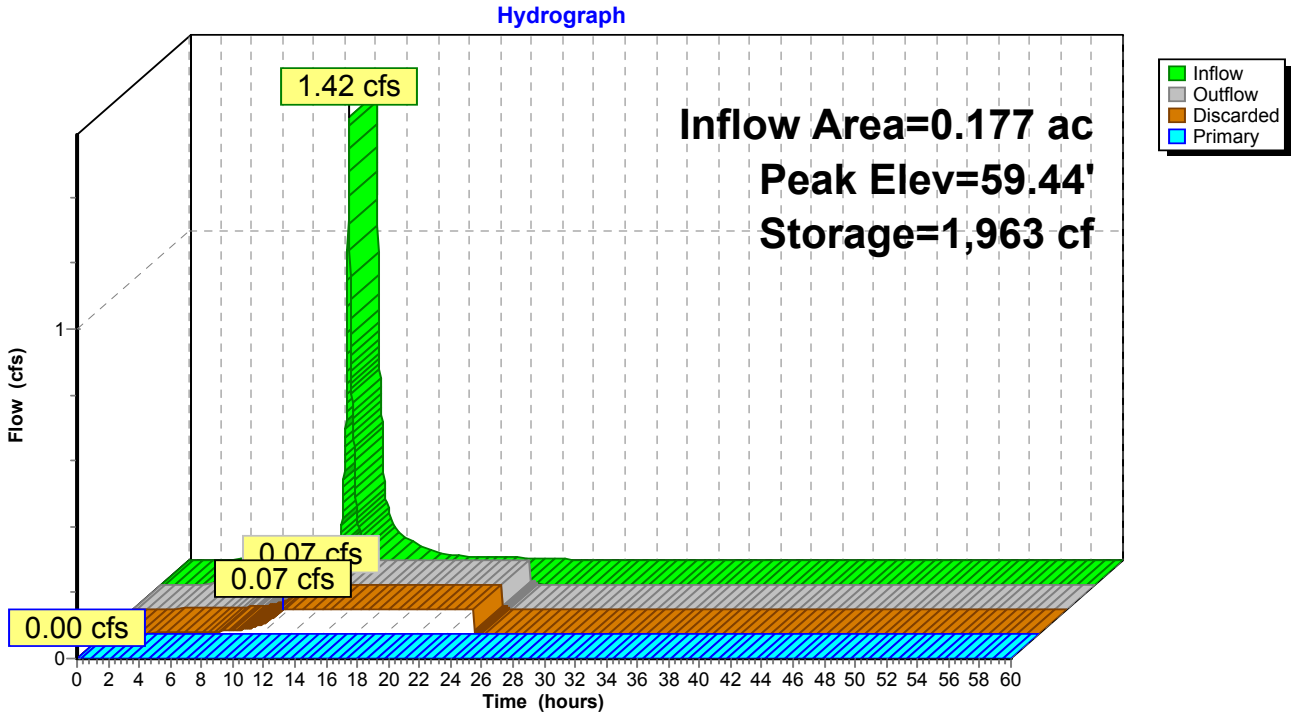
6,860.0 cf Field - 3,564.0 cf Chambers = 3,296.0 cf Stone x 30.0% Voids = 988.8 cf Stone Storage

Chamber Storage + Stone Storage = 4,445.9 cf = 0.102 af
Overall Storage Efficiency = 64.8%

396 Chambers
254.1 cy Field
122.1 cy Stone



Pond 1P: Underground Infiltration/Storage



Summary for Pond 2P: Outlet Control Structure

Inflow Area = 0.207 ac,100.00% Impervious, Inflow Depth = 4.36" for 10-Yr event
Inflow = 0.97 cfs @ 12.07 hrs, Volume= 0.075 af
Outflow = 0.97 cfs @ 12.07 hrs, Volume= 0.075 af, Atten= 0%, Lag= 0.0 min
Primary = 0.14 cfs @ 12.07 hrs, Volume= 0.035 af
Secondary = 0.82 cfs @ 12.07 hrs, Volume= 0.040 af

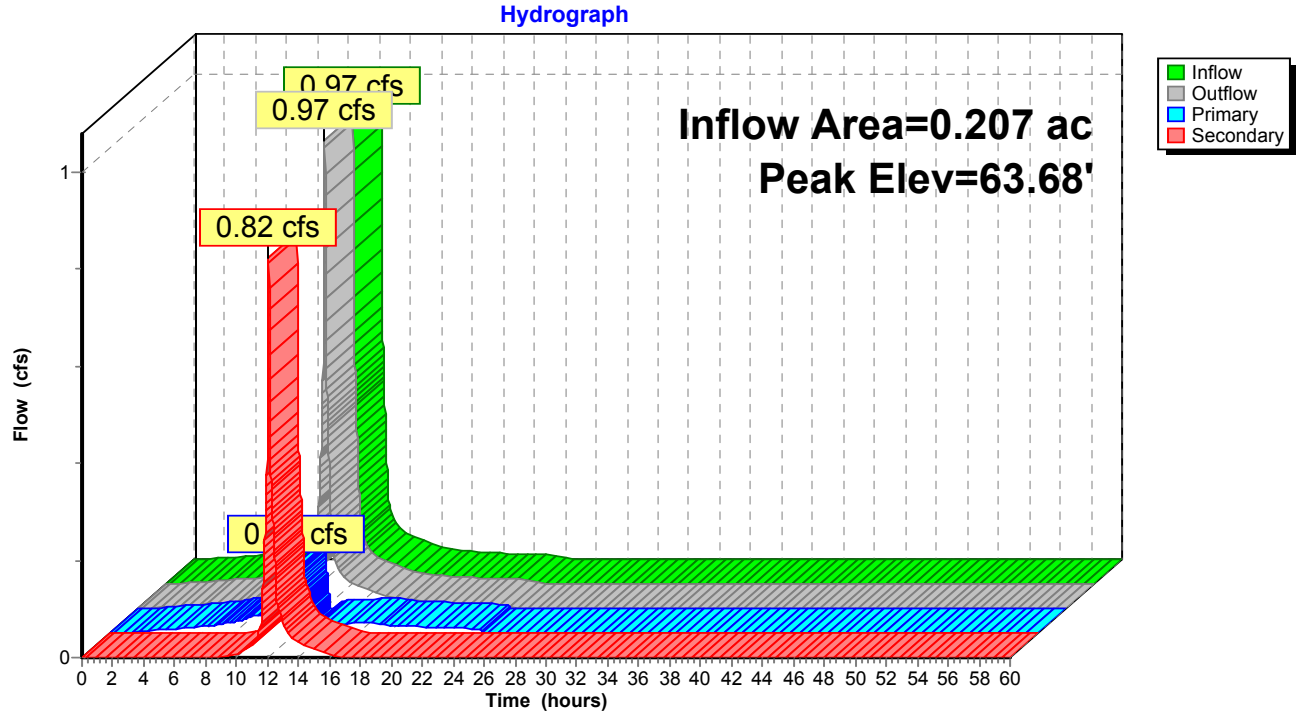
Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 63.68' @ 12.07 hrs
Flood Elev= 66.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	63.40'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	61.00'	**12.0" Round Culvert** L= 65.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 61.00' / 60.00' S= 0.0154 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	63.52'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.14 cfs @ 12.07 hrs HW=63.68' TW=63.44' (Dynamic Tailwater)
└─**1=Orifice/Grate** (Orifice Controls 0.14 cfs @ 1.80 fps)

Secondary OutFlow Max=0.82 cfs @ 12.07 hrs HW=63.68' TW=58.79' (Dynamic Tailwater)
└─**2=Culvert** (Passes 0.82 cfs of 5.48 cfs potential flow)
└─**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.82 cfs @ 1.31 fps)

Pond 2P: Outlet Control Structure



Summary for Pond 3P: Bioswale

[80] Warning: Exceeded Pond 2P by 0.02' @ 12.59 hrs (0.03 cfs 0.001 af)

Inflow Area =	0.233 ac, 92.97% Impervious, Inflow Depth = 2.04" for 10-Yr event				
Inflow =	0.20 cfs @	12.07 hrs,	Volume=	0.040 af	
Outflow =	0.02 cfs @	11.75 hrs,	Volume=	0.040 af,	Atten= 88%, Lag= 0.0 min
Discarded =	0.02 cfs @	11.75 hrs,	Volume=	0.040 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 63.59' @ 12.42 hrs Surf.Area= 660 sf Storage= 605 cf
Flood Elev= 63.77' Surf.Area= 660 sf Storage= 723 cf

Plug-Flow detention time= 274.9 min calculated for 0.040 af (100% of inflow)
Center-of-Mass det. time= 274.9 min (1,039.0 - 764.1)

Volume	Invert	Avail.Storage	Storage Description
#1	61.51'	743 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

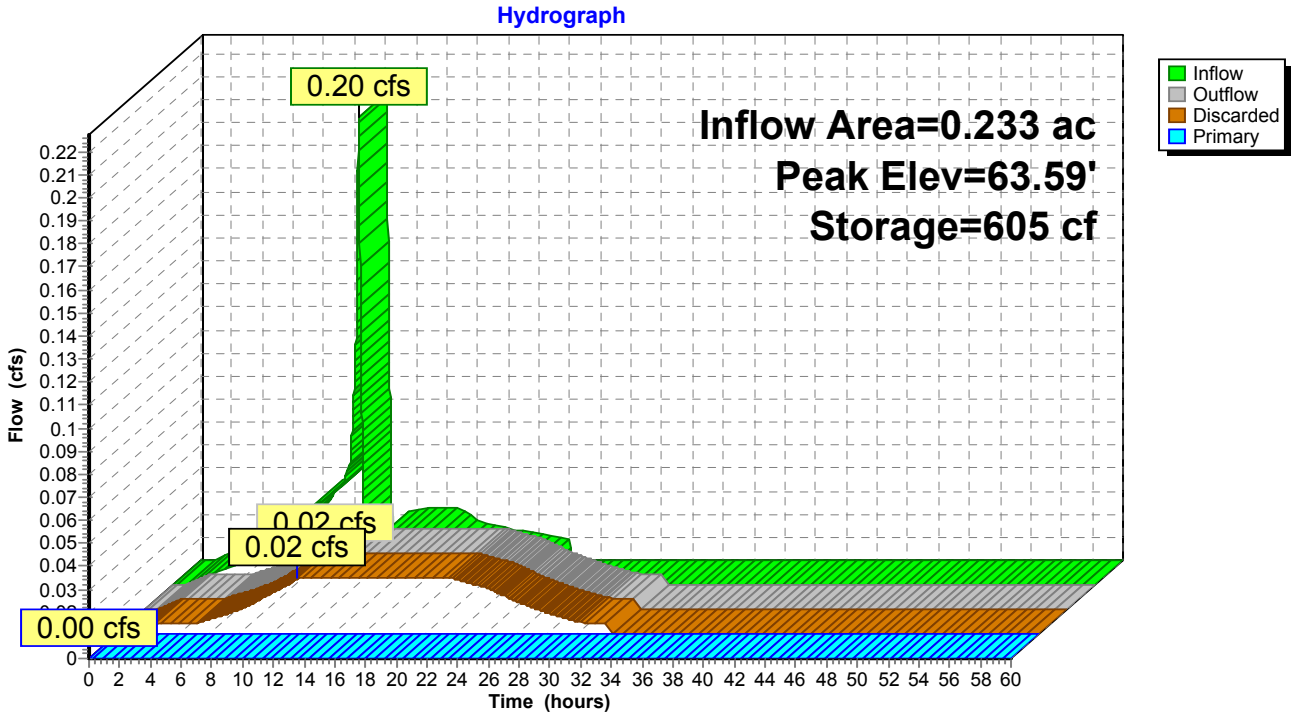
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.51	132	0.0	0	0	132
62.26	132	30.0	30	30	163
62.27	132	100.0	1	31	163
63.27	660	100.0	362	393	695
63.80	660	100.0	350	743	743

Device	Routing	Invert	Outlet Devices
#1	Primary	63.77'	**11.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Discarded	61.51'	**1.600 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.02 cfs @ 11.75 hrs HW=63.27' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.51' TW=0.00' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Bioswale



Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR1: 1st Floor Green Roof Runoff Area=2,143 sf 0.00% Impervious Runoff Depth=1.68"
Tc=5.0 min CN=61 Runoff=0.09 cfs 0.007 af

Subcatchment PR1A: 1st Floor Roof Runoff Area=396 sf 100.00% Impervious Runoff Depth=5.26"
Tc=5.0 min CN=98 Runoff=0.05 cfs 0.004 af

Subcatchment PR1B: 1st Floor Roof Runoff Area=416 sf 100.00% Impervious Runoff Depth=5.26"
Tc=5.0 min CN=98 Runoff=0.05 cfs 0.004 af

Subcatchment PR2: 2nd Floor Roof Runoff Area=2,135 sf 100.00% Impervious Runoff Depth=5.26"
Tc=5.0 min CN=98 Runoff=0.27 cfs 0.021 af

Subcatchment PR3: 6th Floor Roof Runoff Area=9,029 sf 100.00% Impervious Runoff Depth=5.26"
Tc=5.0 min CN=98 Runoff=1.16 cfs 0.091 af

Subcatchment PR4: Courtyard Runoff Area=1,951 sf 58.69% Impervious Runoff Depth=3.63"
Tc=5.0 min CN=83 Runoff=0.20 cfs 0.014 af

Subcatchment PR5: Plaza Runoff Area=1,433 sf 73.83% Impervious Runoff Depth=4.15"
Tc=5.0 min CN=88 Runoff=0.16 cfs 0.011 af

Subcatchment PR6: Swale Area along Runoff Area=1,106 sf 35.62% Impervious Runoff Depth=2.77"
Tc=5.0 min CN=74 Runoff=0.09 cfs 0.006 af

Subcatchment PR7: Loading Dock Runoff Area=655 sf 100.00% Impervious Runoff Depth=5.26"
Tc=5.0 min CN=98 Runoff=0.08 cfs 0.007 af

Reach DP1: Exist. Closed System at Harvard/Williams St. Inflow=0.16 cfs 0.011 af
Outflow=0.16 cfs 0.011 af

Pond 1P: Underground Infiltration/Storage Peak Elev=59.87' Storage=2,739 cf Inflow=1.76 cfs 0.111 af
Discarded=0.07 cfs 0.111 af Primary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.111 af

Pond 2P: Outlet Control Structure Peak Elev=63.70' Inflow=1.16 cfs 0.091 af
Primary=0.15 cfs 0.037 af Secondary=1.01 cfs 0.054 af Outflow=1.16 cfs 0.091 af

Pond 3P: Bioswale Peak Elev=63.66' Storage=654 cf Inflow=0.23 cfs 0.043 af
Discarded=0.02 cfs 0.043 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.043 af

Total Runoff Area = 0.442 ac Runoff Volume = 0.165 af Average Runoff Depth = 4.47"
20.95% Pervious = 0.093 ac 79.05% Impervious = 0.350 ac

Summary for Subcatchment PR1: 1st Floor Green Roof

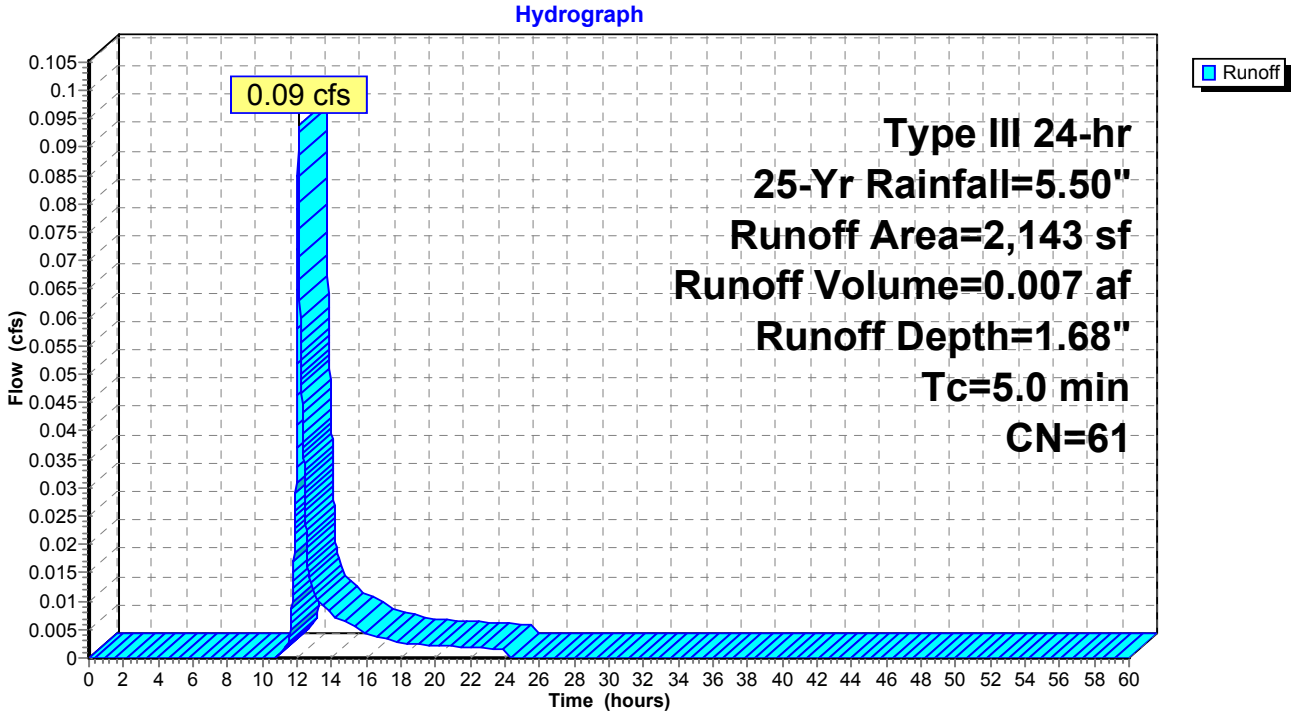
Runoff = 0.09 cfs @ 12.08 hrs, Volume= 0.007 af, Depth= 1.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=5.50"

Area (sf)	CN	Description
2,143	61	>75% Grass cover, Good, HSG B
2,143		100.00% Pervious Area

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

Subcatchment PR1: 1st Floor Green Roof



Summary for Subcatchment PR1A: 1st Floor Roof

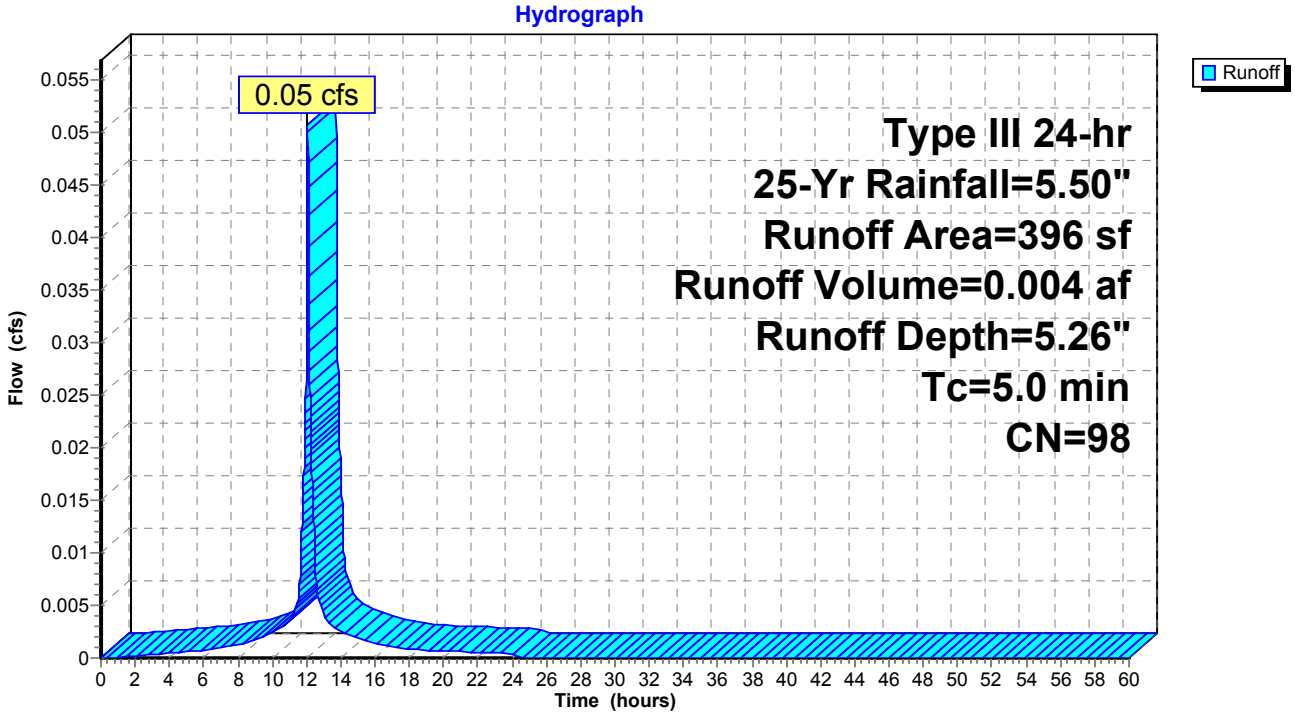
Runoff = 0.05 cfs @ 12.07 hrs, Volume= 0.004 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=5.50"

Area (sf)	CN	Description
396	98	Roofs, HSG B
396		100.00% Impervious Area

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

Subcatchment PR1A: 1st Floor Roof



Summary for Subcatchment PR1B: 1st Floor Roof

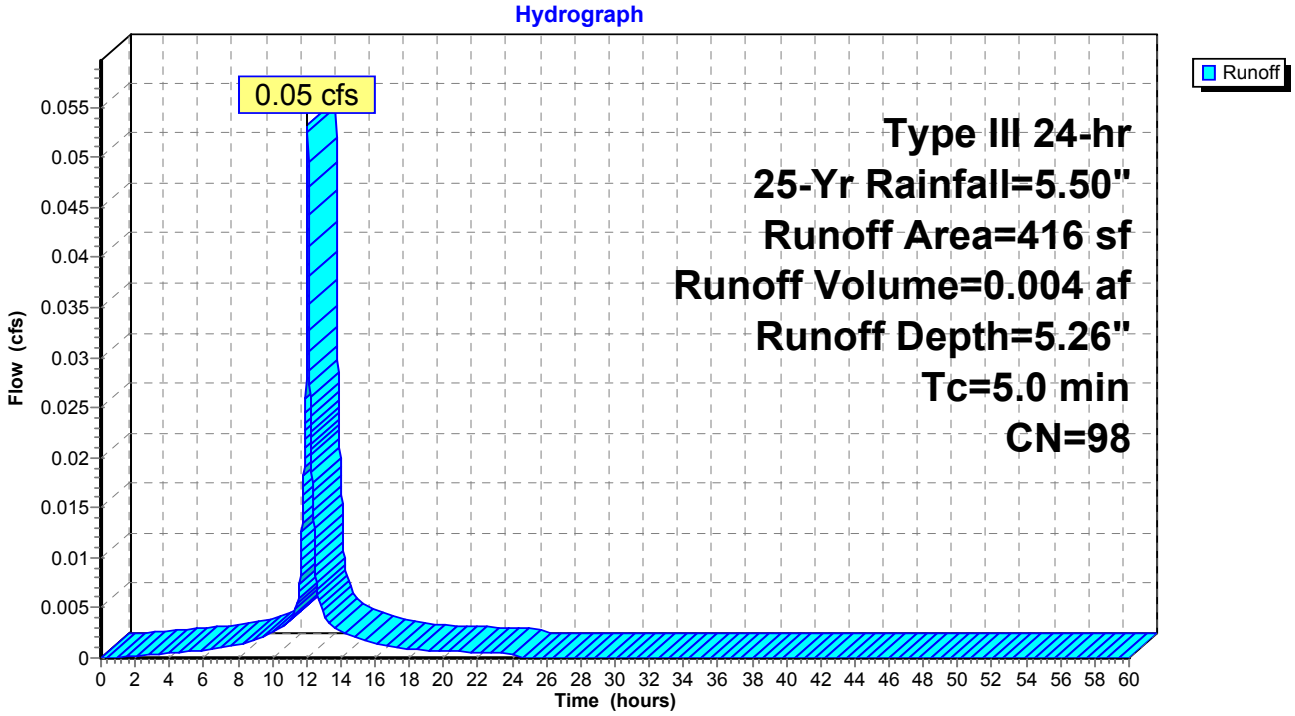
Runoff = 0.05 cfs @ 12.07 hrs, Volume= 0.004 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=5.50"

Area (sf)	CN	Description
416	98	Roofs, HSG B
416		100.00% Impervious Area

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

Subcatchment PR1B: 1st Floor Roof



Summary for Subcatchment PR2: 2nd Floor Roof

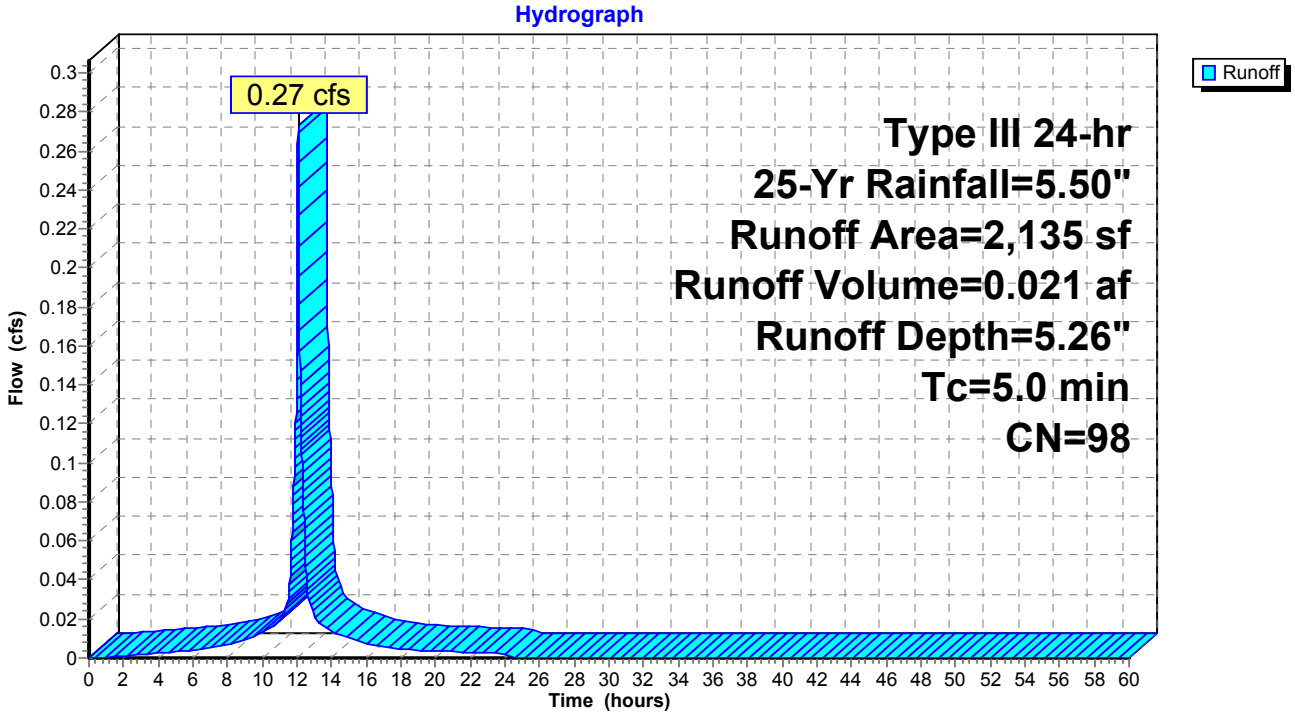
Runoff = 0.27 cfs @ 12.07 hrs, Volume= 0.021 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=5.50"

Area (sf)	CN	Description
2,135	98	Roofs, HSG B
2,135		100.00% Impervious Area

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

Subcatchment PR2: 2nd Floor Roof



Summary for Subcatchment PR3: 6th Floor Roof

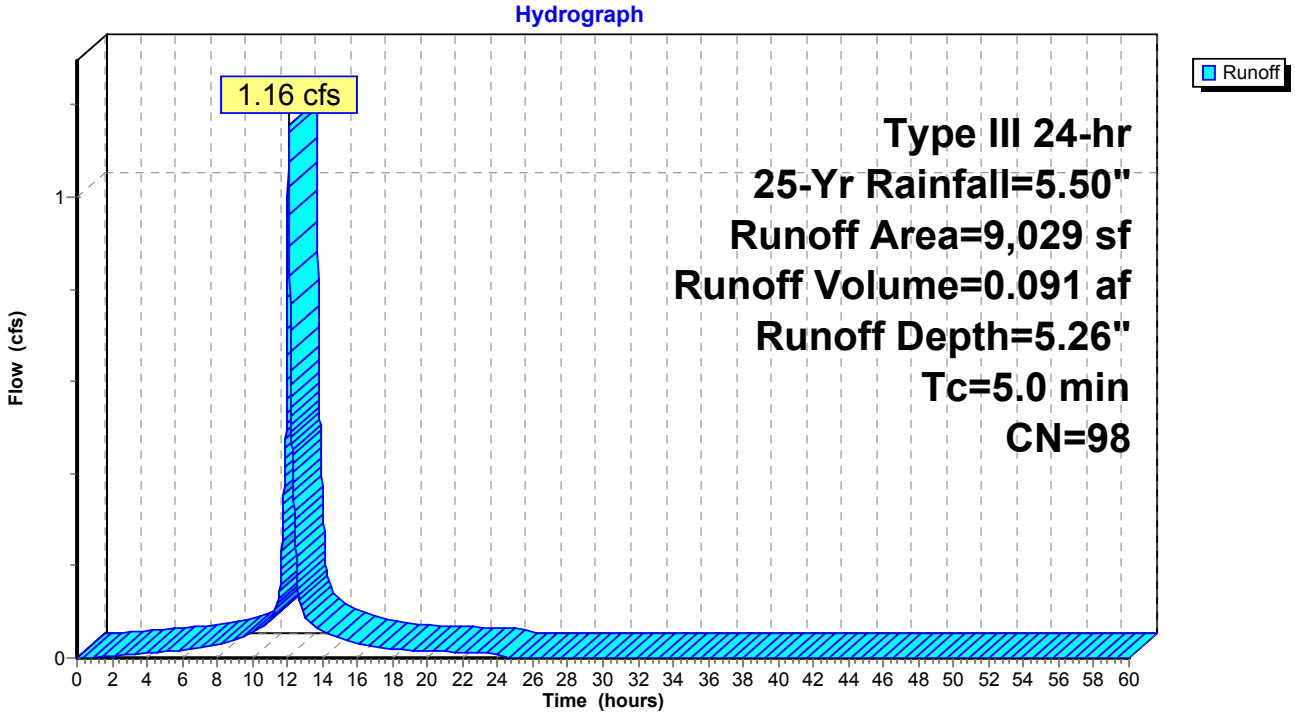
Runoff = 1.16 cfs @ 12.07 hrs, Volume= 0.091 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=5.50"

Area (sf)	CN	Description
9,029	98	Roofs, HSG B
9,029		100.00% Impervious Area

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

Subcatchment PR3: 6th Floor Roof



Summary for Subcatchment PR4: Courtyard

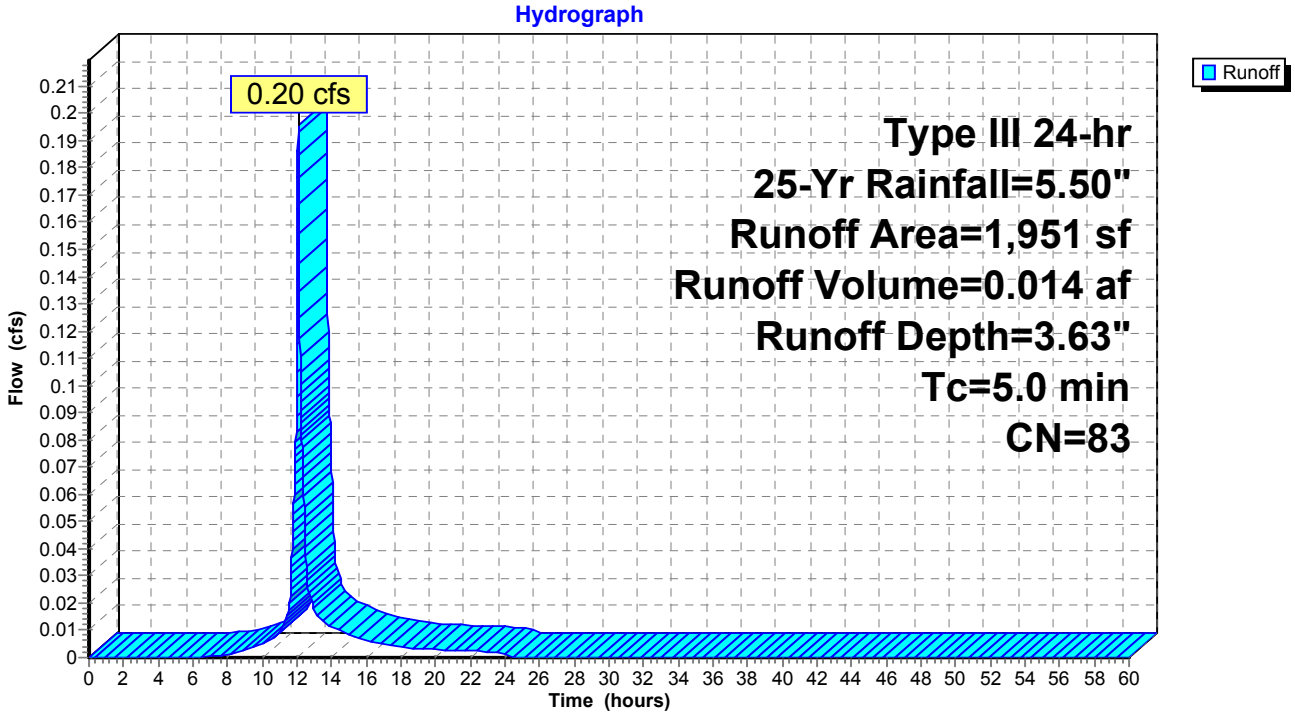
Runoff = 0.20 cfs @ 12.07 hrs, Volume= 0.014 af, Depth= 3.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=5.50"

	Area (sf)	CN	Description
*	992	98	Porous Pavers, HSG B
*	117	98	Retaining Walls
	806	61	>75% Grass cover, Good, HSG B
*	36	98	Walkway, HSG B
	1,951	83	Weighted Average
	806		41.31% Pervious Area
	1,145		58.69% Impervious Area

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

Subcatchment PR4: Courtyard



Summary for Subcatchment PR5: Plaza

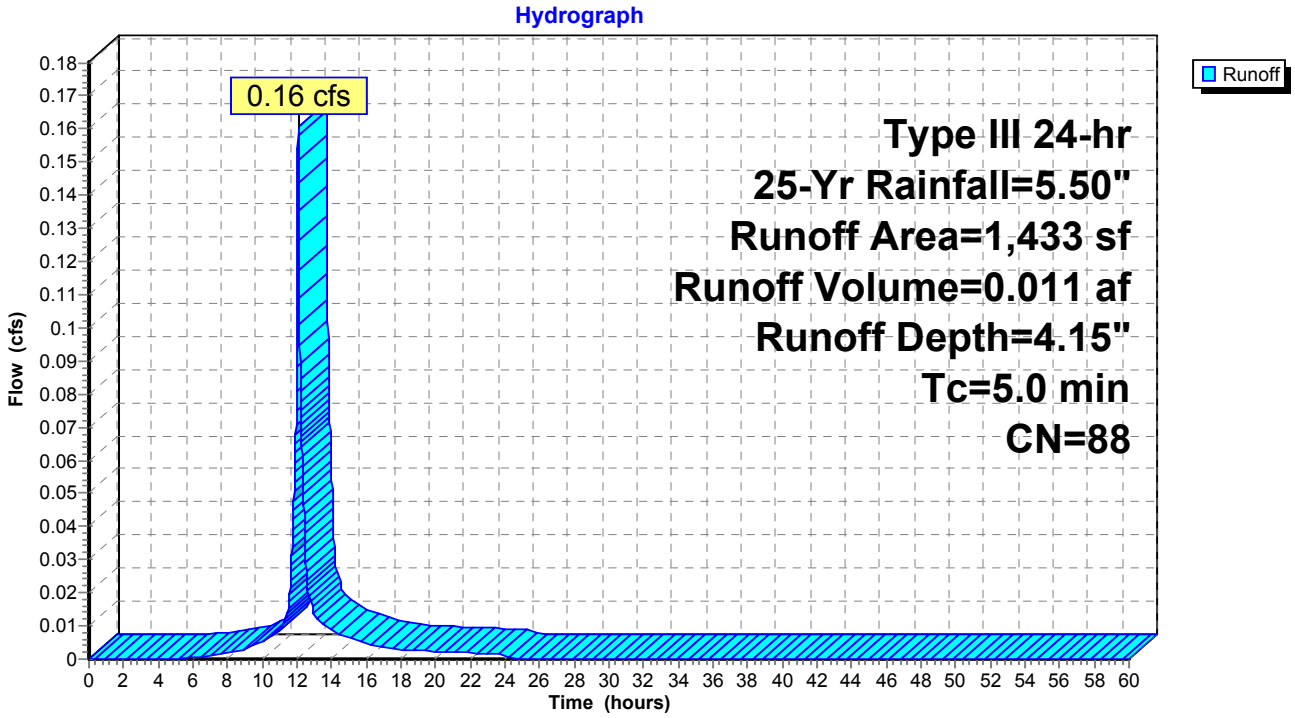
Runoff = 0.16 cfs @ 12.07 hrs, Volume= 0.011 af, Depth= 4.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=5.50"

	Area (sf)	CN	Description
*	166	98	Retainaing Wall, HSG B
*	892	98	Porous Pavers, HSG B
	375	61	>75% Grass cover, Good, HSG B
	1,433	88	Weighted Average
	375		26.17% Pervious Area
	1,058		73.83% Impervious Area

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

Subcatchment PR5: Plaza



Summary for Subcatchment PR6: Swale Area along Williams St.

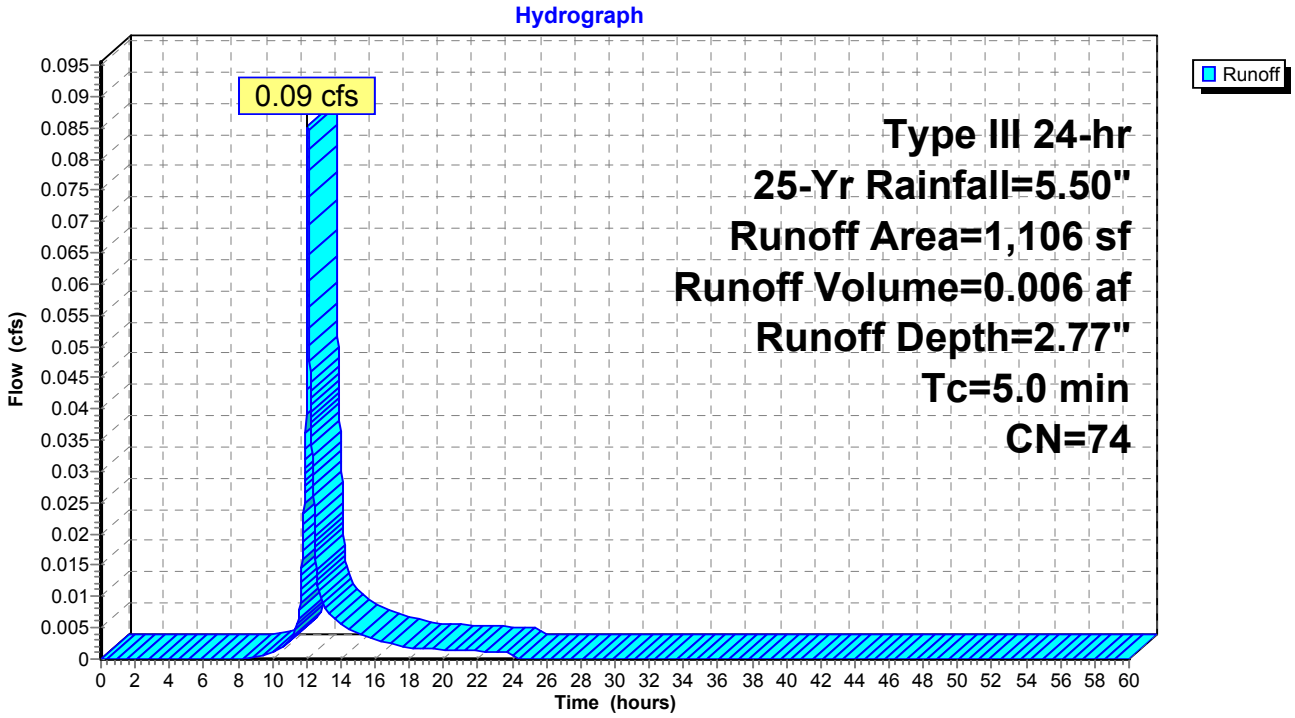
Runoff = 0.09 cfs @ 12.08 hrs, Volume= 0.006 af, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=5.50"

	Area (sf)	CN	Description
	712	61	>75% Grass cover, Good, HSG B
*	256	98	Walkways, Walls, Misc.
*	138	98	Porous Pavers, HSG B
	1,106	74	Weighted Average
	712		64.38% Pervious Area
	394		35.62% Impervious Area

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

Subcatchment PR6: Swale Area along Williams St.



Summary for Subcatchment PR7: Loading Dock

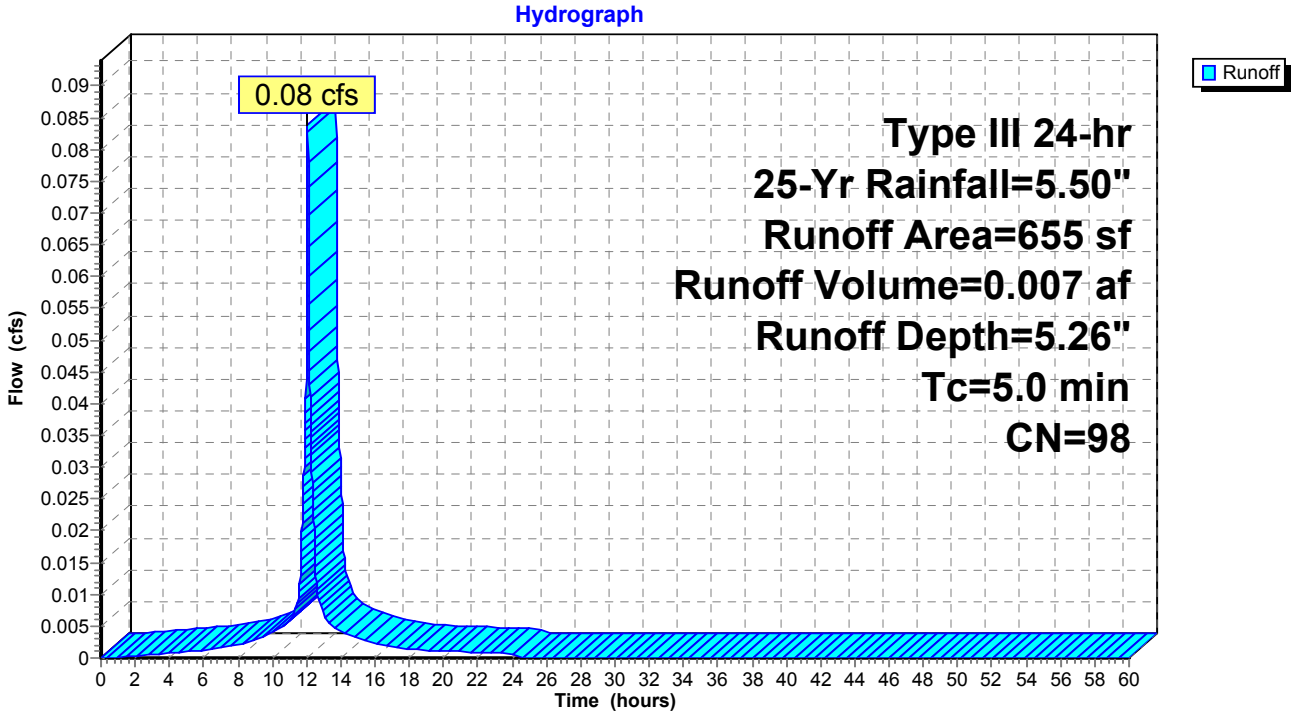
Runoff = 0.08 cfs @ 12.07 hrs, Volume= 0.007 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=5.50"

Area (sf)	CN	Description
655	98	Paved parking, HSG B
655		100.00% Impervious Area

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

Subcatchment PR7: Loading Dock



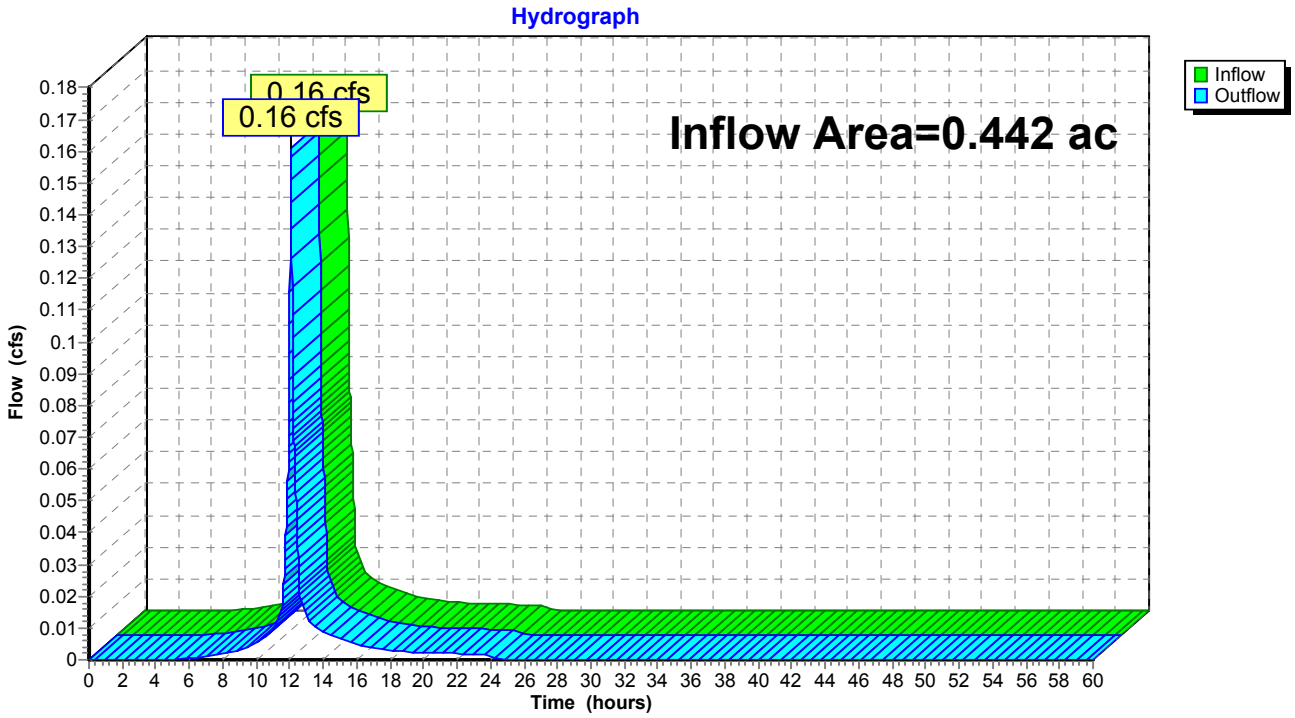
Summary for Reach DP1: Exist. Closed System at Harvard/Williams St.

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.442 ac, 79.05% Impervious, Inflow Depth = 0.31" for 25-Yr event
Inflow = 0.16 cfs @ 12.07 hrs, Volume= 0.011 af
Outflow = 0.16 cfs @ 12.07 hrs, Volume= 0.011 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2

Reach DP1: Exist. Closed System at Harvard/Williams St.



Summary for Pond 1P: Underground Infiltration/Storage

Inflow Area =	0.177 ac, 61.68% Impervious, Inflow Depth = 7.53" for 25-Yr event				
Inflow =	1.76 cfs @	12.07 hrs,	Volume=	0.111 af	
Outflow =	0.07 cfs @	11.28 hrs,	Volume=	0.111 af,	Atten= 96%, Lag= 0.0 min
Discarded =	0.07 cfs @	11.28 hrs,	Volume=	0.111 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 59.87' @ 14.41 hrs Surf.Area= 1,960 sf Storage= 2,739 cf
Flood Elev= 61.50' Surf.Area= 1,960 sf Storage= 4,446 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 328.9 min (1,089.8 - 760.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	58.00'	989 cf	**35.00'W x 56.00'L x 3.50'H Field A** 6,860 cf Overall - 3,564 cf Embedded = 3,296 cf x 30.0% Voids
#2A	58.50'	3,457 cf	**StormTank 24W** x 396 Inside #1 Inside= 36.0"W x 24.0"H => 5.82 sf x 1.50'L = 8.7 cf Outside= 36.0"W x 24.0"H => 6.00 sf x 1.50'L = 9.0 cf
		4,446 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	58.00'	**1.600 in/hr Exfiltration over Surface area**
#2	Primary	60.70'	**6.0" Round Culvert** L= 8.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 60.70' / 60.65' S= 0.0063 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.07 cfs @ 11.28 hrs HW=58.04' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=58.00' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Controls 0.00 cfs)

Pond 1P: Underground Infiltration/Storage - Chamber Wizard Field A

Chamber Model = StormTank 24W (Brentwood Industries StormTank in wide rows)
Inside= 36.0"W x 24.0"H => 5.82 sf x 1.50'L = 8.7 cf
Outside= 36.0"W x 24.0"H => 6.00 sf x 1.50'L = 9.0 cf

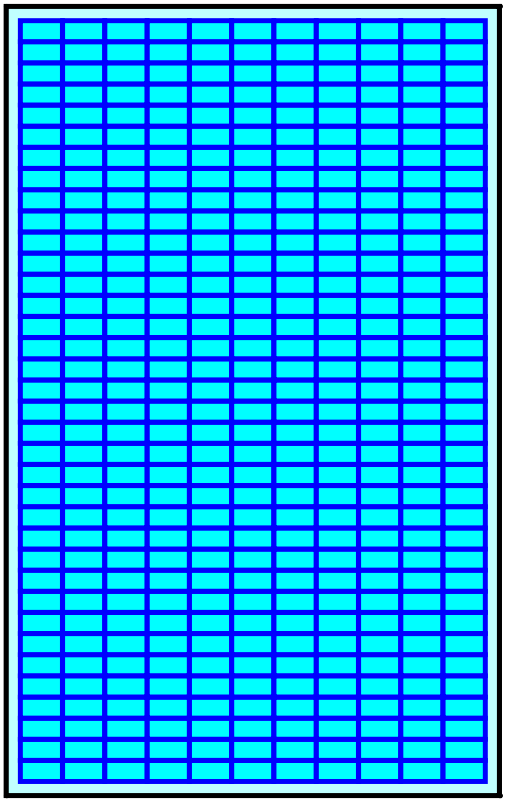
36 Chambers/Row x 1.50' Long = 54.00' Row Length +12.0" End Stone x 2 = 56.00' Base Length
11 Rows x 36.0" Wide + 12.0" Side Stone x 2 = 35.00' Base Width
6.0" Base + 24.0" Chamber Height + 12.0" Cover = 3.50' Field Height

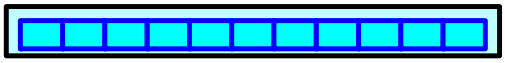
396 Chambers x 8.7 cf = 3,457.1 cf Chamber Storage
396 Chambers x 9.0 cf = 3,564.0 cf Displacement

6,860.0 cf Field - 3,564.0 cf Chambers = 3,296.0 cf Stone x 30.0% Voids = 988.8 cf Stone Storage

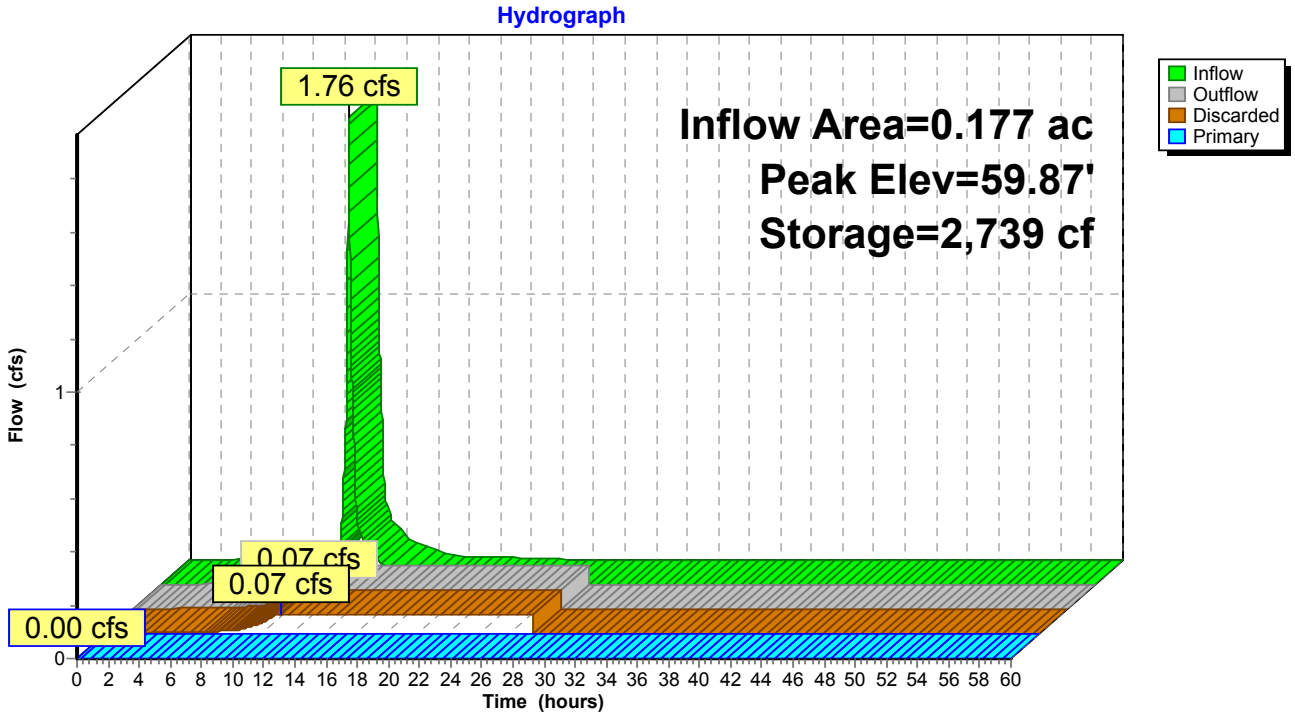
Chamber Storage + Stone Storage = 4,445.9 cf = 0.102 af
Overall Storage Efficiency = 64.8%

396 Chambers
254.1 cy Field
122.1 cy Stone





Pond 1P: Underground Infiltration/Storage



Summary for Pond 2P: Outlet Control Structure

Inflow Area = 0.207 ac,100.00% Impervious, Inflow Depth = 5.26" for 25-Yr event
Inflow = 1.16 cfs @ 12.07 hrs, Volume= 0.091 af
Outflow = 1.16 cfs @ 12.07 hrs, Volume= 0.091 af, Atten= 0%, Lag= 0.0 min
Primary = 0.15 cfs @ 12.05 hrs, Volume= 0.037 af
Secondary = 1.01 cfs @ 12.07 hrs, Volume= 0.054 af

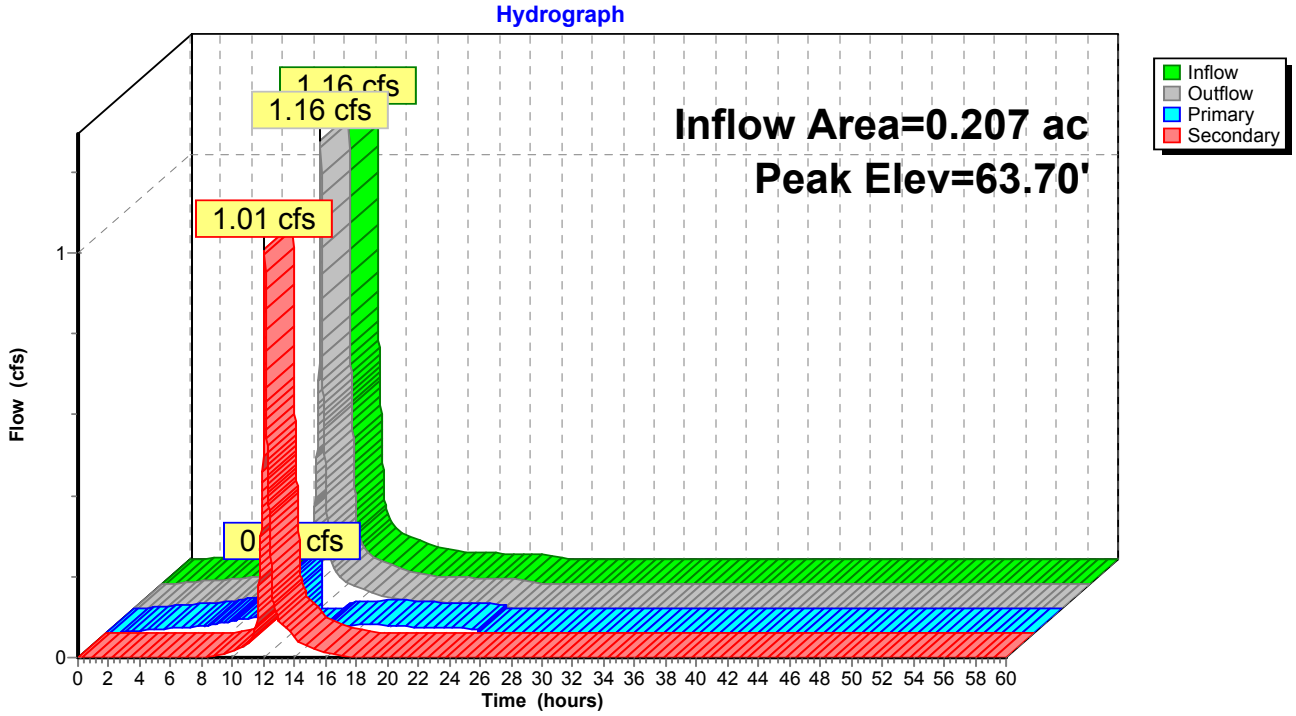
Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 63.70' @ 12.07 hrs
Flood Elev= 66.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	63.40'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	61.00'	**12.0" Round Culvert** L= 65.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 61.00' / 60.00' S= 0.0154 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	63.52'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.15 cfs @ 12.05 hrs HW=63.70' TW=63.55' (Dynamic Tailwater)
└─**1=Orifice/Grate** (Orifice Controls 0.15 cfs @ 1.86 fps)

Secondary OutFlow Max=1.01 cfs @ 12.07 hrs HW=63.70' TW=58.96' (Dynamic Tailwater)
└─**2=Culvert** (Passes 1.01 cfs of 5.51 cfs potential flow)
└─**3=Sharp-Crested Rectangular Weir** (Weir Controls 1.01 cfs @ 1.40 fps)

Pond 2P: Outlet Control Structure



Summary for Pond 3P: Bioswale

[80] Warning: Exceeded Pond 2P by 0.09' @ 12.60 hrs (0.10 cfs 0.009 af)

Inflow Area = 0.233 ac, 92.97% Impervious, Inflow Depth = 2.19" for 25-Yr event
Inflow = 0.23 cfs @ 12.06 hrs, Volume= 0.043 af
Outflow = 0.02 cfs @ 11.30 hrs, Volume= 0.043 af, Atten= 90%, Lag= 0.0 min
Discarded = 0.02 cfs @ 11.30 hrs, Volume= 0.043 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 63.66' @ 12.43 hrs Surf.Area= 660 sf Storage= 654 cf
Flood Elev= 63.77' Surf.Area= 660 sf Storage= 723 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 285.3 min (1,042.2 - 756.9)

Volume	Invert	Avail.Storage	Storage Description
#1	61.51'	743 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

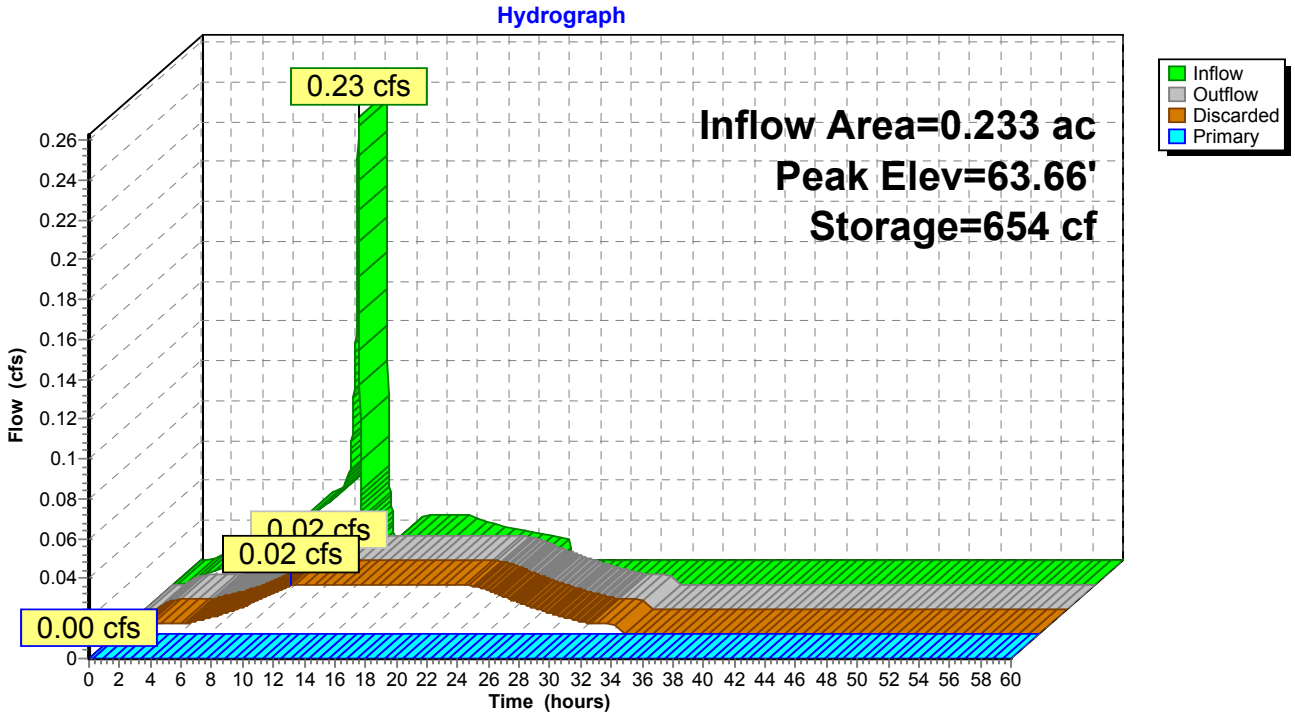
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.51	132	0.0	0	0	132
62.26	132	30.0	30	30	163
62.27	132	100.0	1	31	163
63.27	660	100.0	362	393	695
63.80	660	100.0	350	743	743

Device	Routing	Invert	Outlet Devices
#1	Primary	63.77'	**11.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Discarded	61.51'	**1.600 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.02 cfs @ 11.30 hrs HW=63.27' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.51' TW=0.00' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Bioswale



Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR1: 1st Floor Green Roof Runoff Area=2,143 sf 0.00% Impervious Runoff Depth=2.42"
Tc=5.0 min CN=61 Runoff=0.14 cfs 0.010 af

Subcatchment PR1A: 1st Floor Roof Runoff Area=396 sf 100.00% Impervious Runoff Depth=6.36"
Tc=5.0 min CN=98 Runoff=0.06 cfs 0.005 af

Subcatchment PR1B: 1st Floor Roof Runoff Area=416 sf 100.00% Impervious Runoff Depth=6.36"
Tc=5.0 min CN=98 Runoff=0.06 cfs 0.005 af

Subcatchment PR2: 2nd Floor Roof Runoff Area=2,135 sf 100.00% Impervious Runoff Depth=6.36"
Tc=5.0 min CN=98 Runoff=0.33 cfs 0.026 af

Subcatchment PR3: 6th Floor Roof Runoff Area=9,029 sf 100.00% Impervious Runoff Depth=6.36"
Tc=5.0 min CN=98 Runoff=1.39 cfs 0.110 af

Subcatchment PR4: Courtyard Runoff Area=1,951 sf 58.69% Impervious Runoff Depth=4.65"
Tc=5.0 min CN=83 Runoff=0.25 cfs 0.017 af

Subcatchment PR5: Plaza Runoff Area=1,433 sf 73.83% Impervious Runoff Depth=5.21"
Tc=5.0 min CN=88 Runoff=0.20 cfs 0.014 af

Subcatchment PR6: Swale Area along Runoff Area=1,106 sf 35.62% Impervious Runoff Depth=3.70"
Tc=5.0 min CN=74 Runoff=0.11 cfs 0.008 af

Subcatchment PR7: Loading Dock Runoff Area=655 sf 100.00% Impervious Runoff Depth=6.36"
Tc=5.0 min CN=98 Runoff=0.10 cfs 0.008 af

Reach DP1: Exist. Closed System at Harvard/Williams St. Inflow=0.20 cfs 0.014 af
Outflow=0.20 cfs 0.014 af

Pond 1P: Underground Infiltration/Storage Peak Elev=60.46' Storage=3,783 cf Inflow=2.24 cfs 0.143 af
Discarded=0.07 cfs 0.143 af Primary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.143 af

Pond 2P: Outlet Control Structure Peak Elev=63.74' Inflow=1.39 cfs 0.110 af
Primary=0.11 cfs 0.038 af Secondary=1.30 cfs 0.072 af Outflow=1.39 cfs 0.110 af

Pond 3P: Bioswale Peak Elev=63.77' Storage=725 cf Inflow=0.21 cfs 0.046 af
Discarded=0.02 cfs 0.046 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.046 af

Total Runoff Area = 0.442 ac Runoff Volume = 0.203 af Average Runoff Depth = 5.51"
20.95% Pervious = 0.093 ac 79.05% Impervious = 0.350 ac

Summary for Subcatchment PR1: 1st Floor Green Roof

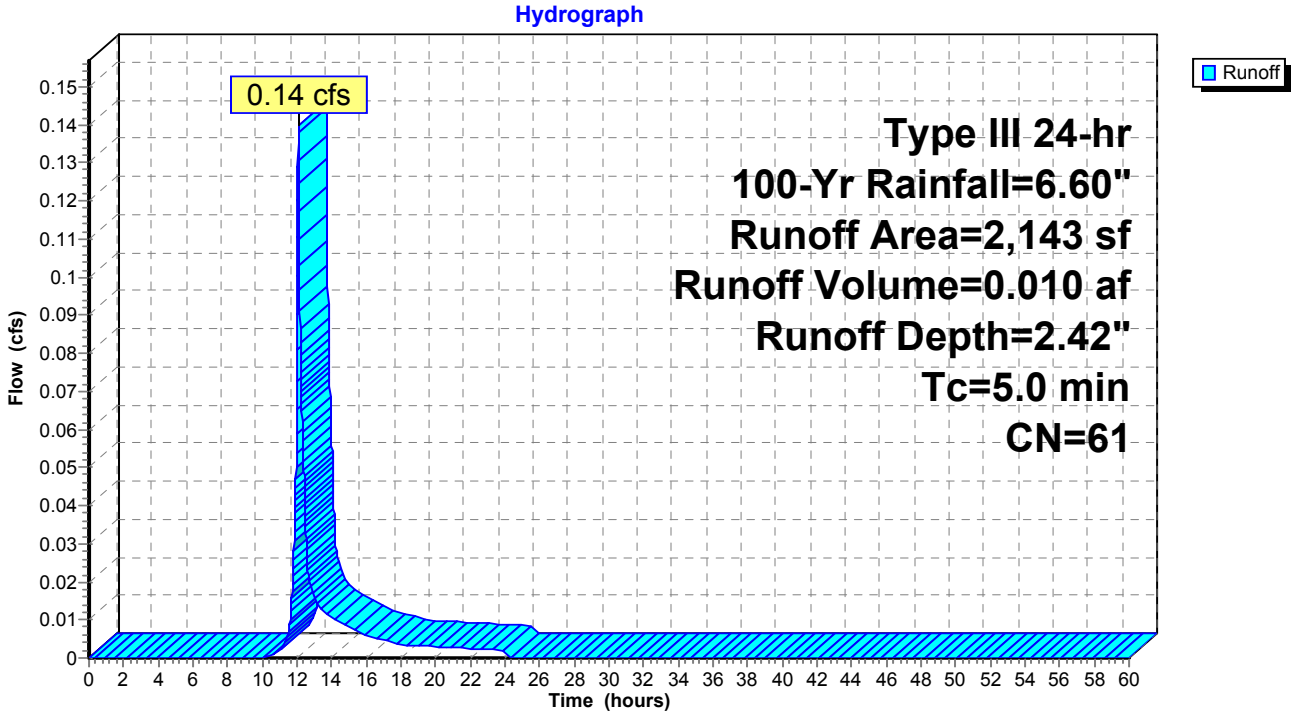
Runoff = 0.14 cfs @ 12.08 hrs, Volume= 0.010 af, Depth= 2.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=6.60"

Area (sf)	CN	Description
2,143	61	>75% Grass cover, Good, HSG B
2,143		100.00% Pervious Area

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

Subcatchment PR1: 1st Floor Green Roof



Summary for Subcatchment PR1A: 1st Floor Roof

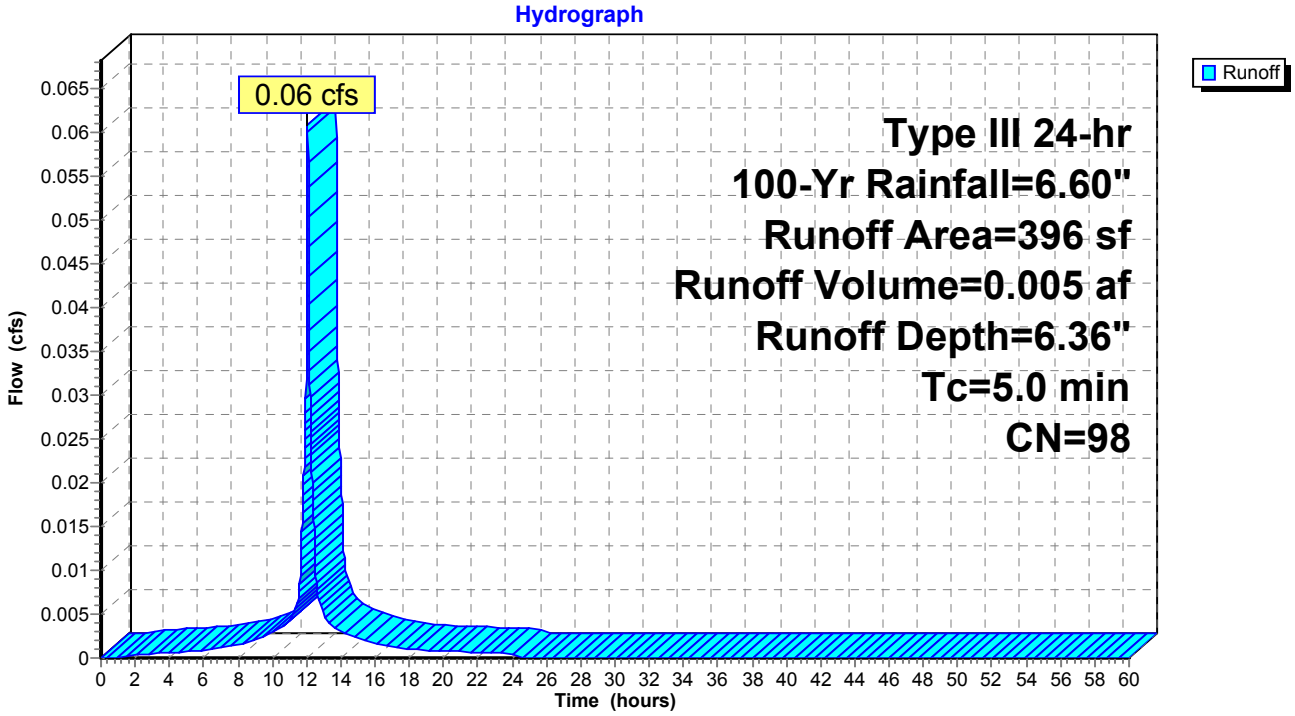
Runoff = 0.06 cfs @ 12.07 hrs, Volume= 0.005 af, Depth= 6.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=6.60"

Area (sf)	CN	Description
396	98	Roofs, HSG B
396		100.00% Impervious Area

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

Subcatchment PR1A: 1st Floor Roof



Summary for Subcatchment PR1B: 1st Floor Roof

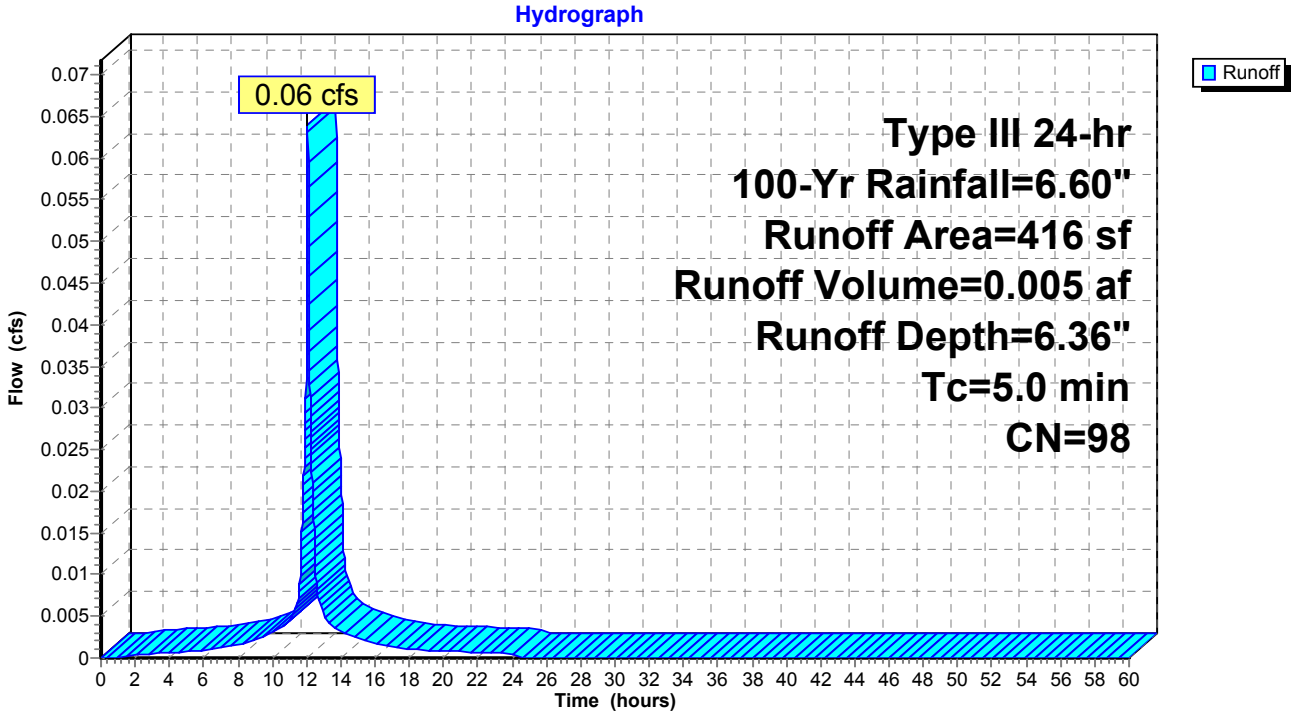
Runoff = 0.06 cfs @ 12.07 hrs, Volume= 0.005 af, Depth= 6.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=6.60"

Area (sf)	CN	Description
416	98	Roofs, HSG B
416		100.00% Impervious Area

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

Subcatchment PR1B: 1st Floor Roof



Summary for Subcatchment PR2: 2nd Floor Roof

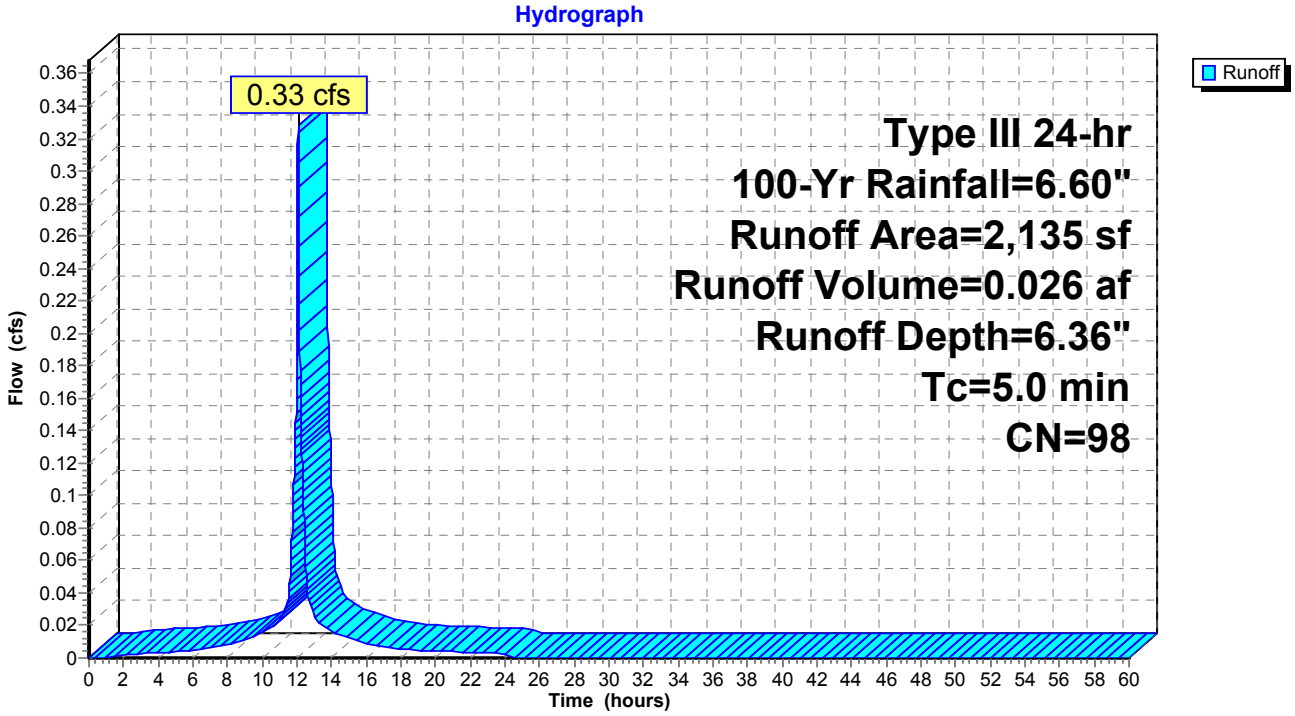
Runoff = 0.33 cfs @ 12.07 hrs, Volume= 0.026 af, Depth= 6.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=6.60"

Area (sf)	CN	Description
2,135	98	Roofs, HSG B
2,135		100.00% Impervious Area

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

Subcatchment PR2: 2nd Floor Roof



Summary for Subcatchment PR3: 6th Floor Roof

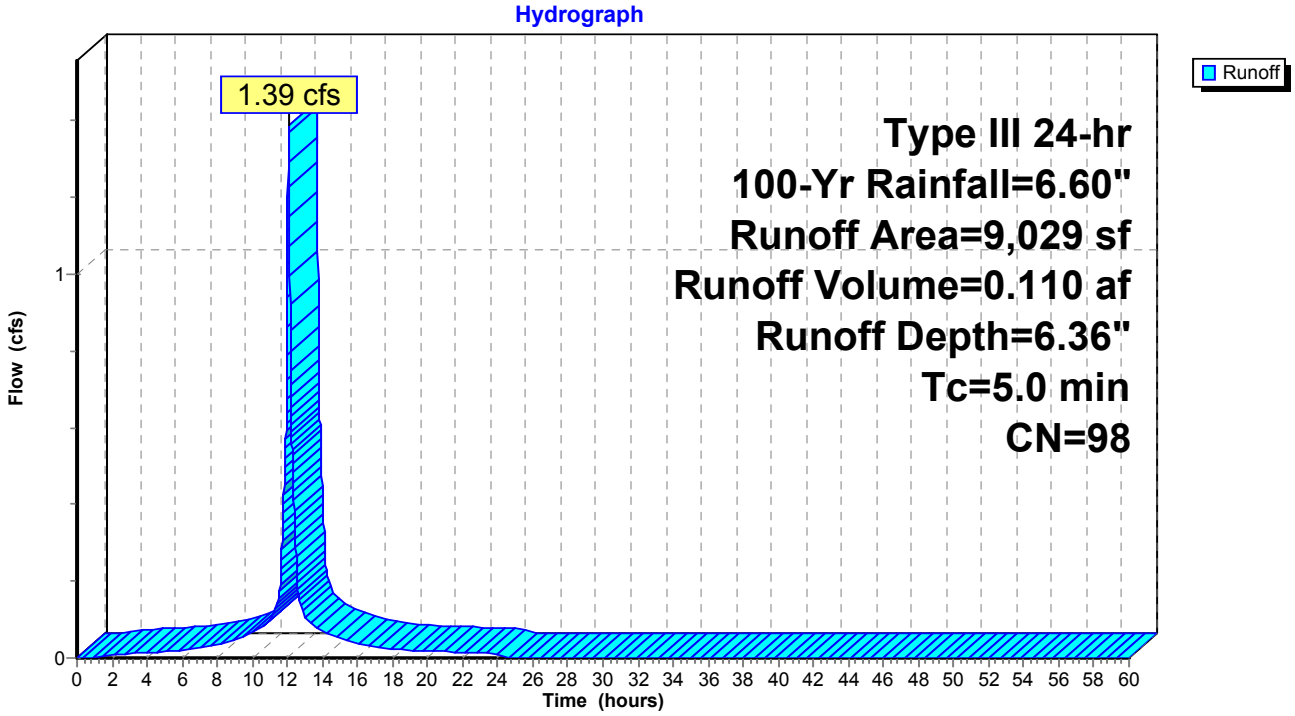
Runoff = 1.39 cfs @ 12.07 hrs, Volume= 0.110 af, Depth= 6.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=6.60"

Area (sf)	CN	Description
9,029	98	Roofs, HSG B
9,029		100.00% Impervious Area

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

Subcatchment PR3: 6th Floor Roof



Summary for Subcatchment PR4: Courtyard

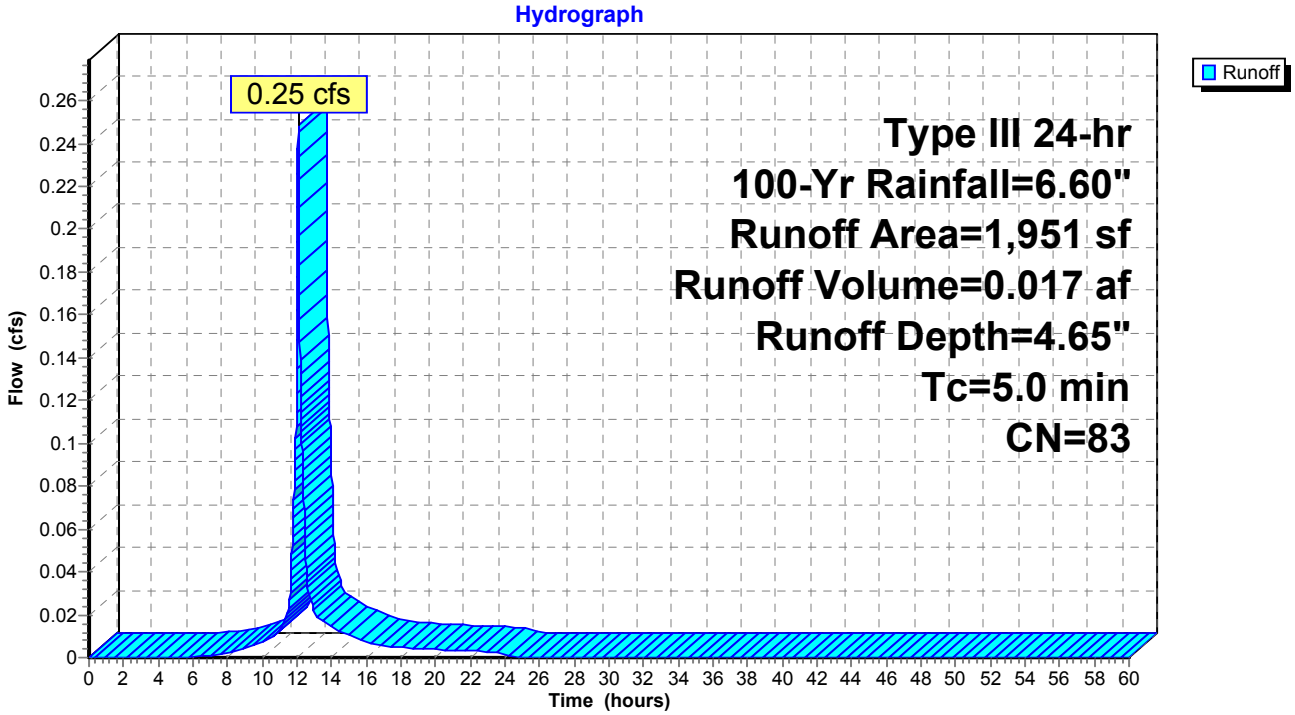
Runoff = 0.25 cfs @ 12.07 hrs, Volume= 0.017 af, Depth= 4.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=6.60"

	Area (sf)	CN	Description
*	992	98	Porous Pavers, HSG B
*	117	98	Retaining Walls
	806	61	>75% Grass cover, Good, HSG B
*	36	98	Walkway, HSG B
	1,951	83	Weighted Average
	806		41.31% Pervious Area
	1,145		58.69% Impervious Area

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

Subcatchment PR4: Courtyard



Summary for Subcatchment PR5: Plaza

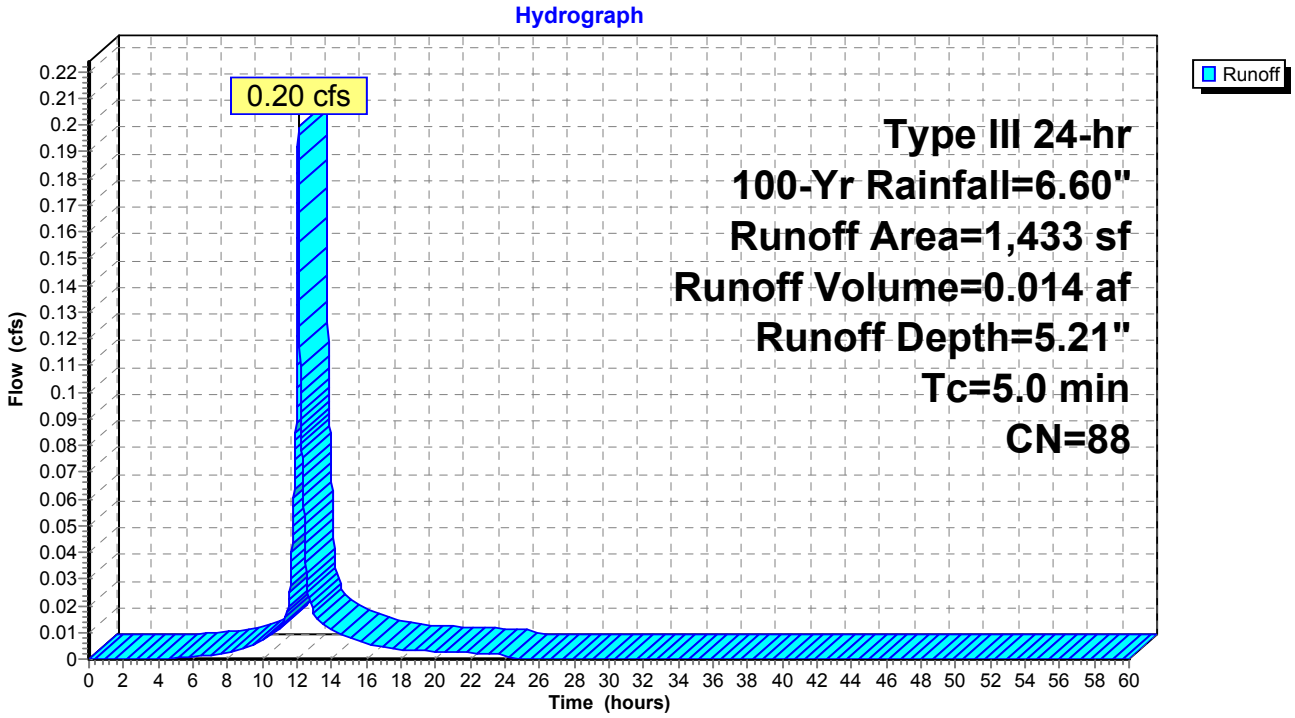
Runoff = 0.20 cfs @ 12.07 hrs, Volume= 0.014 af, Depth= 5.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=6.60"

	Area (sf)	CN	Description
*	166	98	Retainaing Wall, HSG B
*	892	98	Porous Pavers, HSG B
	375	61	>75% Grass cover, Good, HSG B
	1,433	88	Weighted Average
	375		26.17% Pervious Area
	1,058		73.83% Impervious Area

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

Subcatchment PR5: Plaza



Summary for Subcatchment PR6: Swale Area along Williams St.

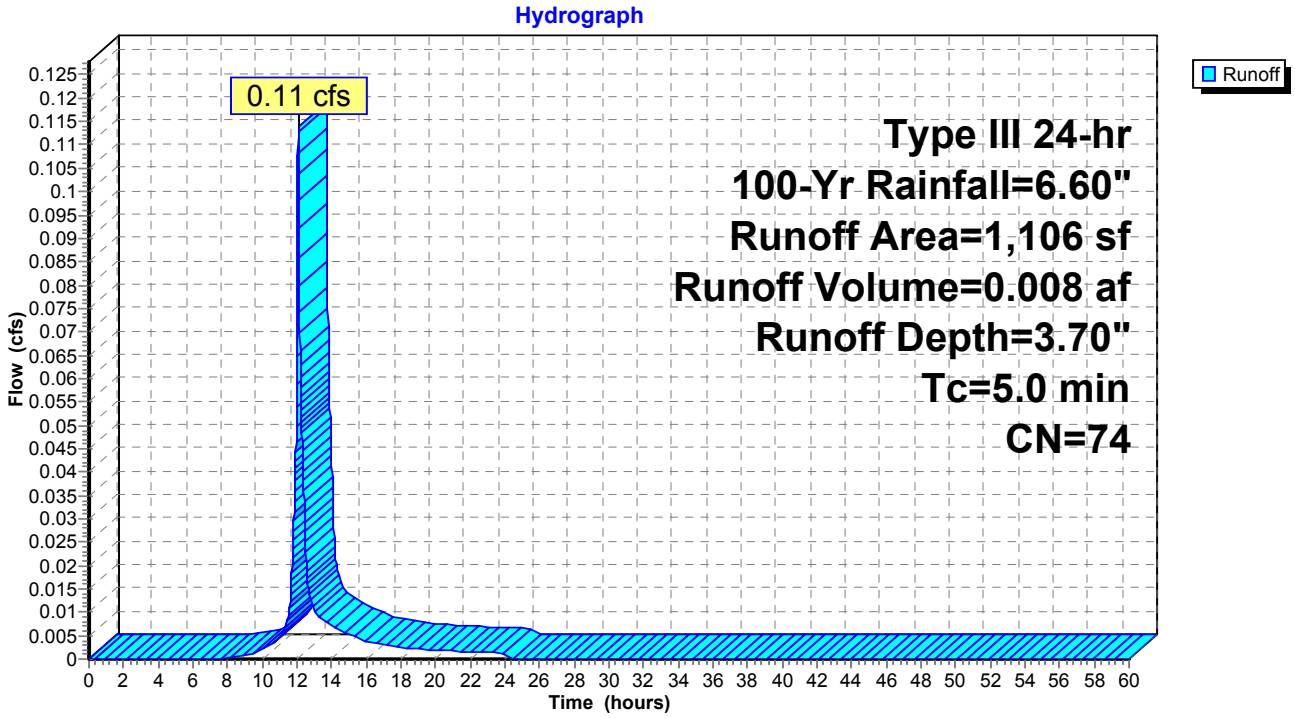
Runoff = 0.11 cfs @ 12.07 hrs, Volume= 0.008 af, Depth= 3.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=6.60"

	Area (sf)	CN	Description
	712	61	>75% Grass cover, Good, HSG B
*	256	98	Walkways, Walls, Misc.
*	138	98	Porous Pavers, HSG B
	1,106	74	Weighted Average
	712		64.38% Pervious Area
	394		35.62% Impervious Area

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

Subcatchment PR6: Swale Area along Williams St.



Summary for Subcatchment PR7: Loading Dock

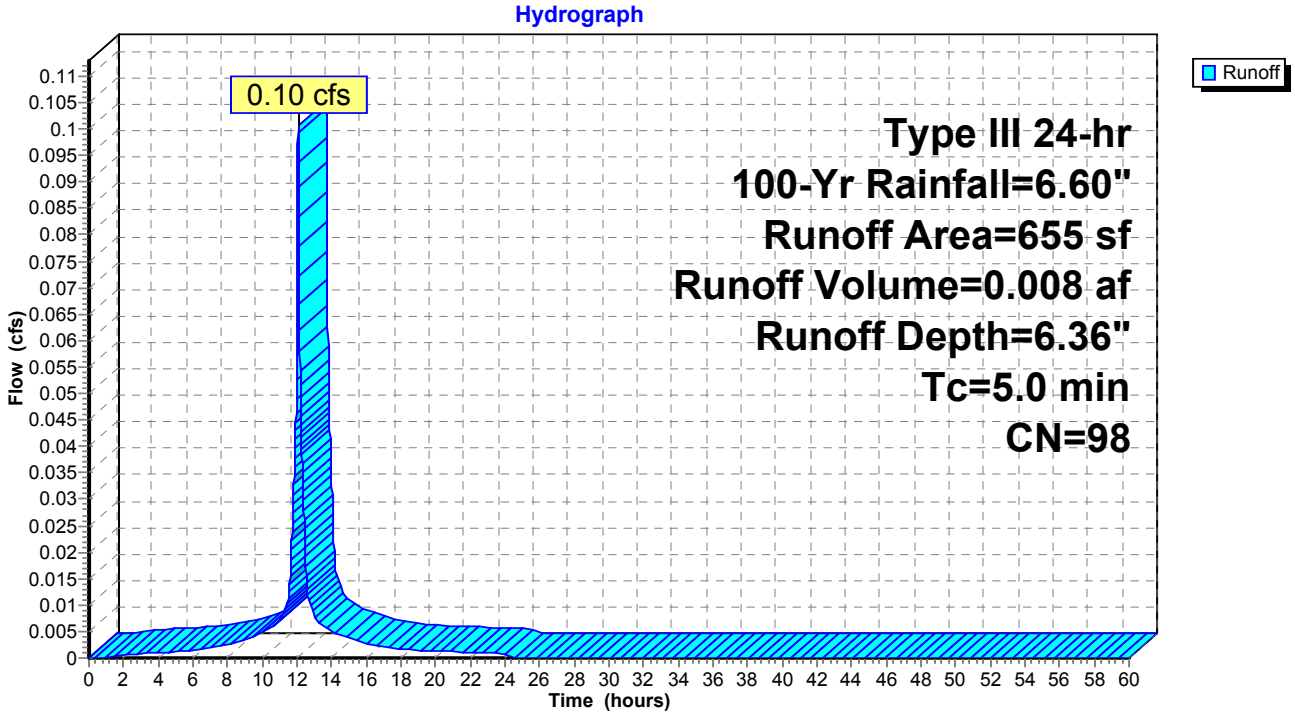
Runoff = 0.10 cfs @ 12.07 hrs, Volume= 0.008 af, Depth= 6.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=6.60"

Area (sf)	CN	Description
655	98	Paved parking, HSG B
655		100.00% Impervious Area

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

Subcatchment PR7: Loading Dock



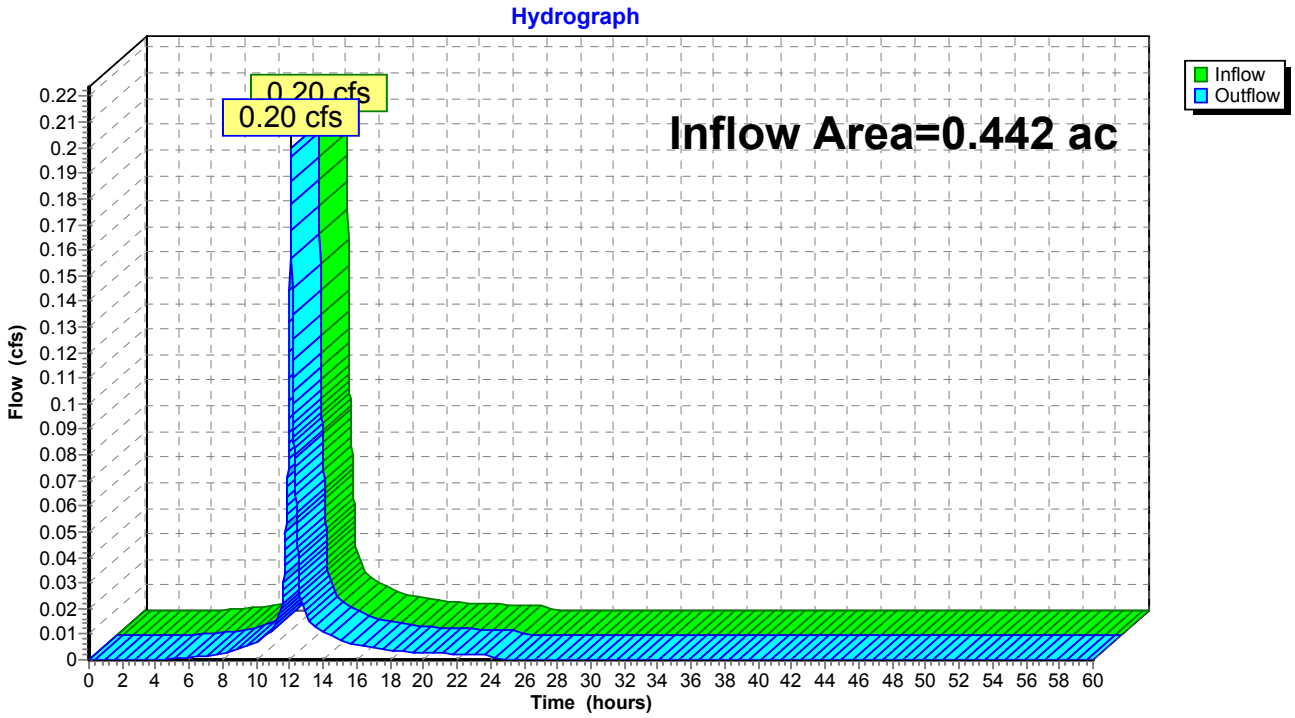
Summary for Reach DP1: Exist. Closed System at Harvard/Williams St.

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.442 ac, 79.05% Impervious, Inflow Depth = 0.39" for 100-Yr event
Inflow = 0.20 cfs @ 12.07 hrs, Volume= 0.014 af
Outflow = 0.20 cfs @ 12.07 hrs, Volume= 0.014 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2

Reach DP1: Exist. Closed System at Harvard/Williams St.



Summary for Pond 1P: Underground Infiltration/Storage

Inflow Area =	0.177 ac, 61.68% Impervious, Inflow Depth = 9.72" for 100-Yr event				
Inflow =	2.24 cfs @	12.07 hrs, Volume=	0.143 af		
Outflow =	0.07 cfs @	10.87 hrs, Volume=	0.143 af, Atten= 97%, Lag= 0.0 min		
Discarded =	0.07 cfs @	10.87 hrs, Volume=	0.143 af		
Primary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 60.46' @ 15.29 hrs Surf.Area= 1,960 sf Storage= 3,783 cf
Flood Elev= 61.50' Surf.Area= 1,960 sf Storage= 4,446 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 454.6 min (1,216.0 - 761.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	58.00'	989 cf	**35.00'W x 56.00'L x 3.50'H Field A** 6,860 cf Overall - 3,564 cf Embedded = 3,296 cf x 30.0% Voids
#2A	58.50'	3,457 cf	**StormTank 24W** x 396 Inside #1 Inside= 36.0"W x 24.0"H => 5.82 sf x 1.50'L = 8.7 cf Outside= 36.0"W x 24.0"H => 6.00 sf x 1.50'L = 9.0 cf
		4,446 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	58.00'	**1.600 in/hr Exfiltration over Surface area**
#2	Primary	60.70'	**6.0" Round Culvert** L= 8.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 60.70' / 60.65' S= 0.0063 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.07 cfs @ 10.87 hrs HW=58.04' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=58.00' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Controls 0.00 cfs)

Pond 1P: Underground Infiltration/Storage - Chamber Wizard Field A

Chamber Model = StormTank 24W (Brentwood Industries StormTank in wide rows)
Inside= 36.0"W x 24.0"H => 5.82 sf x 1.50'L = 8.7 cf
Outside= 36.0"W x 24.0"H => 6.00 sf x 1.50'L = 9.0 cf

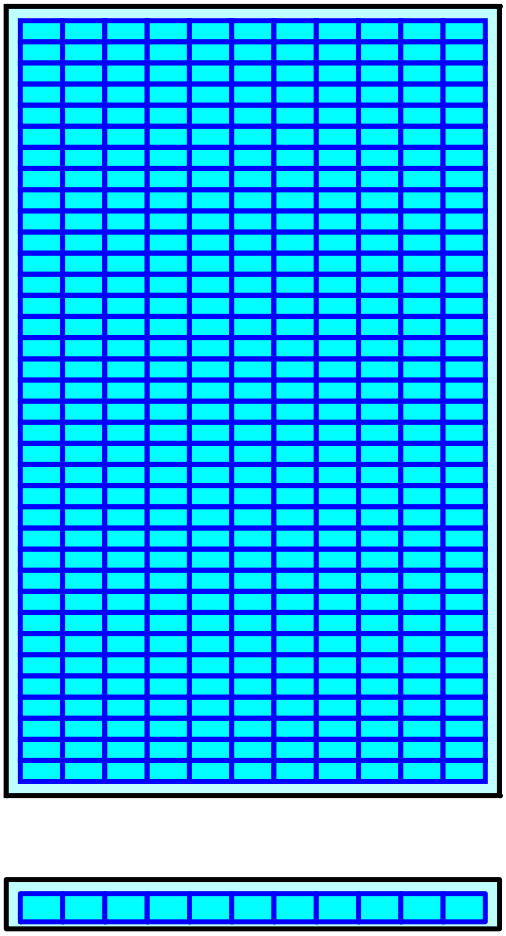
36 Chambers/Row x 1.50' Long = 54.00' Row Length +12.0" End Stone x 2 = 56.00' Base Length
11 Rows x 36.0" Wide + 12.0" Side Stone x 2 = 35.00' Base Width
6.0" Base + 24.0" Chamber Height + 12.0" Cover = 3.50' Field Height

396 Chambers x 8.7 cf = 3,457.1 cf Chamber Storage
396 Chambers x 9.0 cf = 3,564.0 cf Displacement

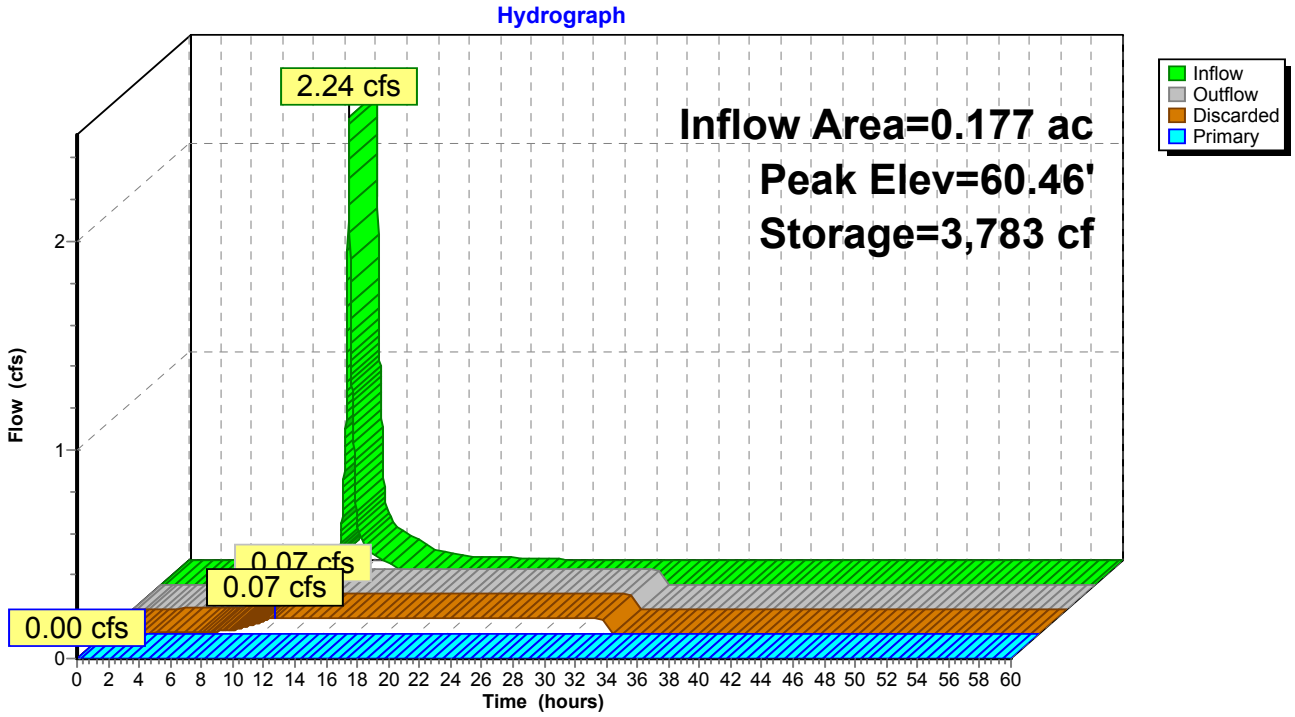
6,860.0 cf Field - 3,564.0 cf Chambers = 3,296.0 cf Stone x 30.0% Voids = 988.8 cf Stone Storage

Chamber Storage + Stone Storage = 4,445.9 cf = 0.102 af
Overall Storage Efficiency = 64.8%

396 Chambers
254.1 cy Field
122.1 cy Stone



Pond 1P: Underground Infiltration/Storage



Summary for Pond 2P: Outlet Control Structure

Inflow Area =	0.207 ac,100.00% Impervious, Inflow Depth = 6.36" for 100-Yr event				
Inflow =	1.39 cfs @	12.07 hrs,	Volume=	0.110 af	
Outflow =	1.39 cfs @	12.07 hrs,	Volume=	0.110 af,	Atten= 0%, Lag= 0.0 min
Primary =	0.11 cfs @	12.04 hrs,	Volume=	0.038 af	
Secondary =	1.30 cfs @	12.07 hrs,	Volume=	0.072 af	

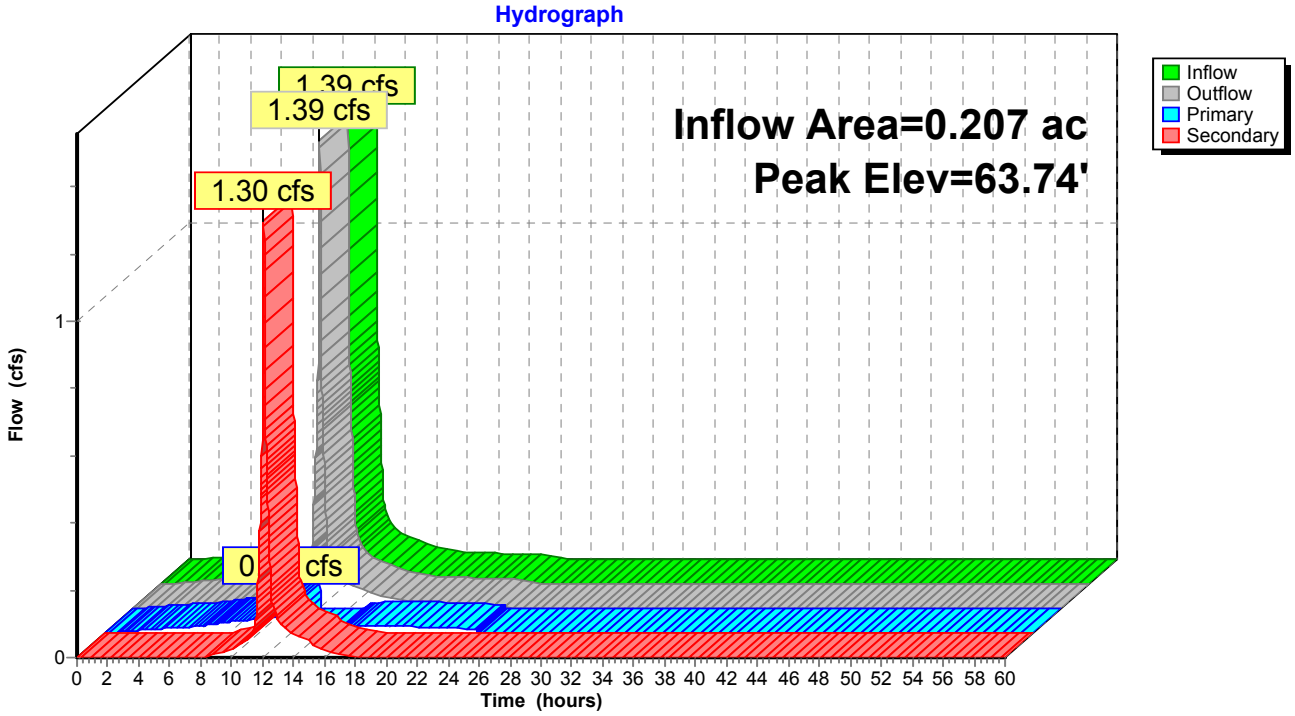
Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 63.74' @ 12.07 hrs
Flood Elev= 66.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	63.40'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	61.00'	**12.0" Round Culvert** L= 65.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 61.00' / 60.00' S= 0.0154 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	63.52'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.11 cfs @ 12.04 hrs HW=63.72' TW=63.65' (Dynamic Tailwater)
└─**1=Orifice/Grate** (Orifice Controls 0.11 cfs @ 1.24 fps)

Secondary OutFlow Max=1.29 cfs @ 12.07 hrs HW=63.74' TW=59.20' (Dynamic Tailwater)
└─**2=Culvert** (Passes 1.29 cfs of 5.54 cfs potential flow)
└─**3=Sharp-Crested Rectangular Weir** (Weir Controls 1.29 cfs @ 1.52 fps)

Pond 2P: Outlet Control Structure



Summary for Pond 3P: Bioswale

[80] Warning: Exceeded Pond 2P by 0.19' @ 12.63 hrs (0.19 cfs 0.030 af)

Inflow Area =	0.233 ac, 92.97% Impervious, Inflow Depth = 2.36" for 100-Yr event				
Inflow =	0.21 cfs @	12.05 hrs, Volume=	0.046 af		
Outflow =	0.03 cfs @	12.47 hrs, Volume=	0.046 af, Atten= 87%, Lag= 24.7 min		
Discarded =	0.02 cfs @	10.63 hrs, Volume=	0.046 af		
Primary =	0.00 cfs @	12.47 hrs, Volume=	0.000 af		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 63.77' @ 12.47 hrs Surf.Area= 660 sf Storage= 725 cf
Flood Elev= 63.77' Surf.Area= 660 sf Storage= 723 cf

Plug-Flow detention time= 300.7 min calculated for 0.046 af (100% of inflow)
Center-of-Mass det. time= 300.8 min (1,045.9 - 745.1)

Volume	Invert	Avail.Storage	Storage Description
#1	61.51'	743 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

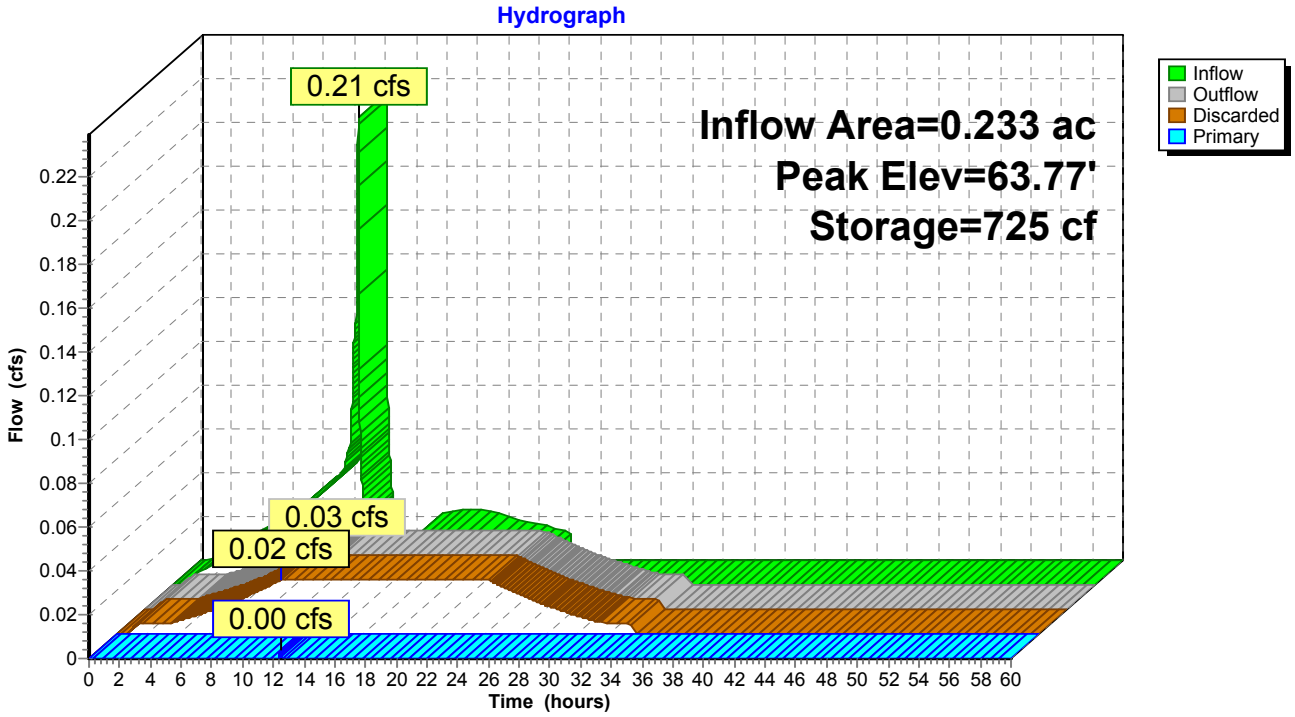
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.51	132	0.0	0	0	132
62.26	132	30.0	30	30	163
62.27	132	100.0	1	31	163
63.27	660	100.0	362	393	695
63.80	660	100.0	350	743	743

Device	Routing	Invert	Outlet Devices
#1	Primary	63.77'	**11.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Discarded	61.51'	**1.600 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.02 cfs @ 10.63 hrs HW=63.27' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 12.47 hrs HW=63.77' TW=0.00' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 0.00 cfs @ 0.14 fps)

Pond 3P: Bioswale



APPENDIX E – PIPE DESIGN CALCULATIONS

Stantec

Stantec Consulting Services, Inc.
226 Causeway Street
Boston, MA 02114
(617) 523-8103

Pipe Calculations

Project: JCHE @ KI
Design Storm (Years): 25Y
Location: Brookline, MA
Designed By: TAT
Checked BY: FH
Date: 10/21/2016
Revised:
Revised:

LOCATION			DRAINAGE AREA				FLOW TIME		RUNOFF		FLOW IN PIPE											
			(Acres)				(min)		(cfs)		PIPE				FULL FLOW		DESIGN FLOW		RIM	INVERT		
Description	From	To	Area Ac	Runoff Coeff., C	Increment CA	Sum CA	Tc	Time In Section	Intensity (In/Hr)	Design Flow	Diam (In.)	Length (Ft.)	Slope (Ft./Ft.)	Manning Coeff.	Capacity (Cfs)	Velocity (Fps)	Depth (Ft.)	Velocity (Fps.)	Upper	Upper	Lower	PIPE % FULL
	AD1	AD2	0.01	0.65	0.01		5.0	0.2	6.0	0.1	**6**	23	0.0052	0.013	0.4	2.1	0.17	1.6	63.37	61.80	61.68	25
	AD2	AD3	0.01	0.65	0.01	0.02	5.2	0.2	6.0	0.1	**6**	23	0.0052	0.013	0.4	2.1	0.17	1.6	63.37	61.58	61.46	25
	AD3	AD4	0.02	0.66	0.01	0.03	5.4	0.2	5.9	0.2	**6**	19	0.0053	0.013	0.4	2.1	0.25	2.1	63.30	61.36	61.26	50
	AD4	WQU1				0.03	5.6	0.1	5.9	0.2	**6**	14	0.0050	0.013	0.4	2.0	0.25	2.1	63.30	61.16	61.09	50
	TD1	WQU1	0.02	0.90	0.02	0.02	5.0	0.0	6.0	0.1	**6**	8	0.0762	0.013	1.6	7.9	0.11	5.3	63.66	61.70	61.09	6
	WQU1	DMH2				0.02	5.0	0.1	6.0	0.1	**6**	16	0.0088	0.013	0.5	2.7	0.15	2.1	63.66	60.84	60.70	20
	DMH1	DMH3	0.21	0.90	0.20	0.20	5.0	0.2	6.0	1.2	**12**	64	0.0156	0.013	4.5	5.7	0.35	4.7	66.00	61.00	60.00	27
	DMH3	DMH2				0.20	5.0	0.1	6.0	1.2	**12**	22	0.0136	0.013	4.2	5.3	0.36	4.5	66.00	60.00	59.70	29
	DMH5	DMH4	0.00	0.00	0.00		5.0	0.3	6.0	0.0	**15**	74	0.0135	0.012	8.1	6.6	0.23	3.9	64.00	59.00	58.00	0

Runoff Coefficients (C)

Stantec Consulting Services, Inc.
226 Causeway Street
Boston, MA 02114
(617) 523-8103

Project: JCHE @ KI
Location: *Brookline, MA*
Design Storm (Years): *25yr*
Designed By: *TAT*
Checked BY: FH
Date: 10/21/2016
Revised:

DRAINAGE AREA (D.A.)	IMPERVIOUS AREA in sf (C=0.9)	IMPERVIOUS AREA in acres (C=0.9)	LANDSCAPE AREA in sf (C=0.3)	LANDSCAPE AREA in acres (C=0.3)	TOTAL AREA (sf)	TOTAL AREA (acres)	WEIGHTED COEFFICIENT (C)
AD1	370	0.01	269	0.01	639	**0.01**	**0.65**
AD2	370	0.01	269	0.01	639	**0.01**	**0.65**
AD3	406	0.01	269	0.01	675	**0.02**	**0.66**
AD4	0	0.00	0	0.00	0	**0.00**	
TD1	655	0.02	0	0.00	655	**0.02**	**0.90**

APPENDIX F – MASSACHUSETTS RAINFALL DATA MAPS

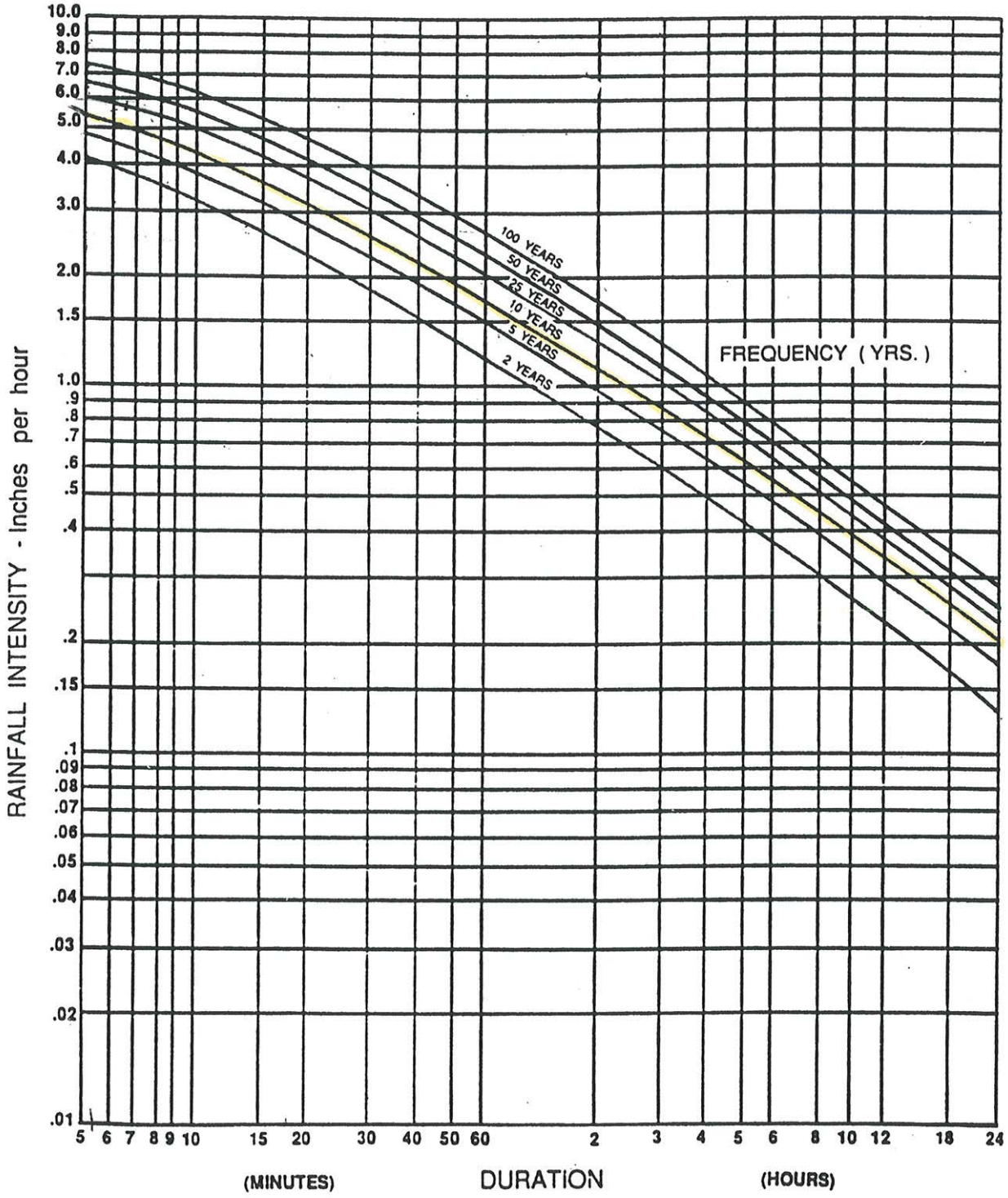
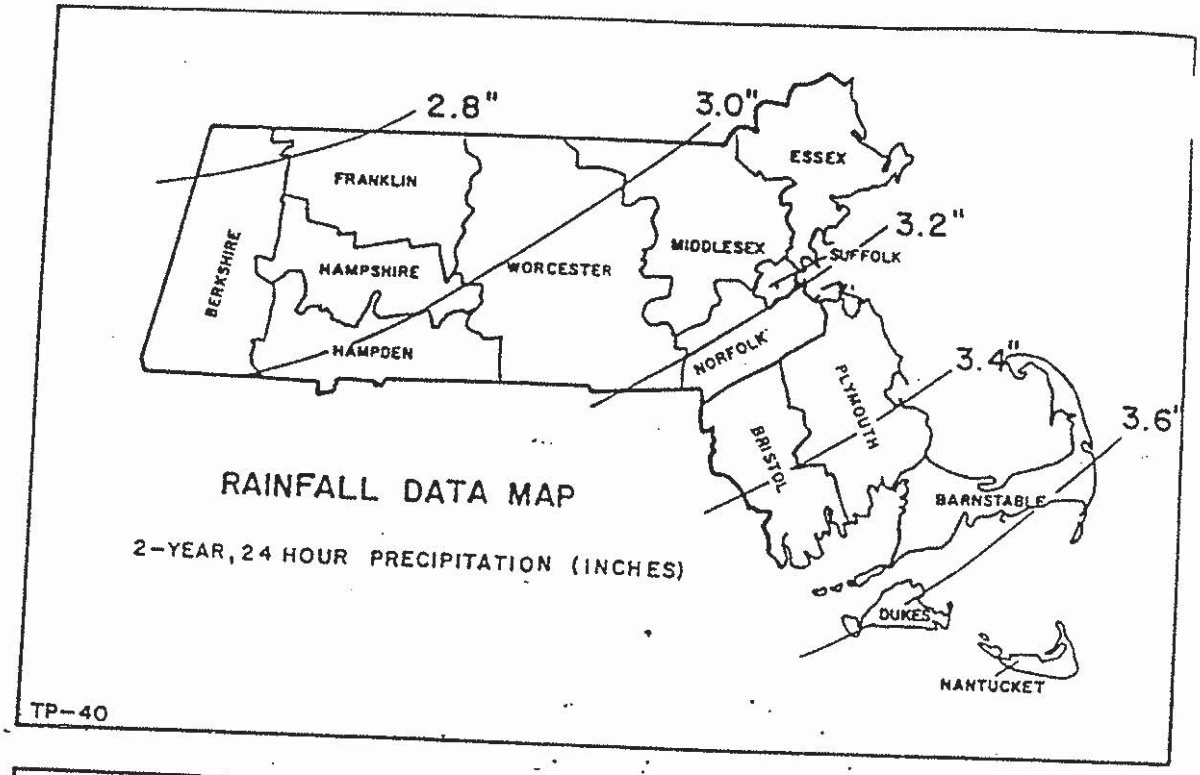


Figure 10-4. Intensity — Duration — Frequency Curve for Boston, MA

1 year storm, 24 hr frequency use 2.5" statewide



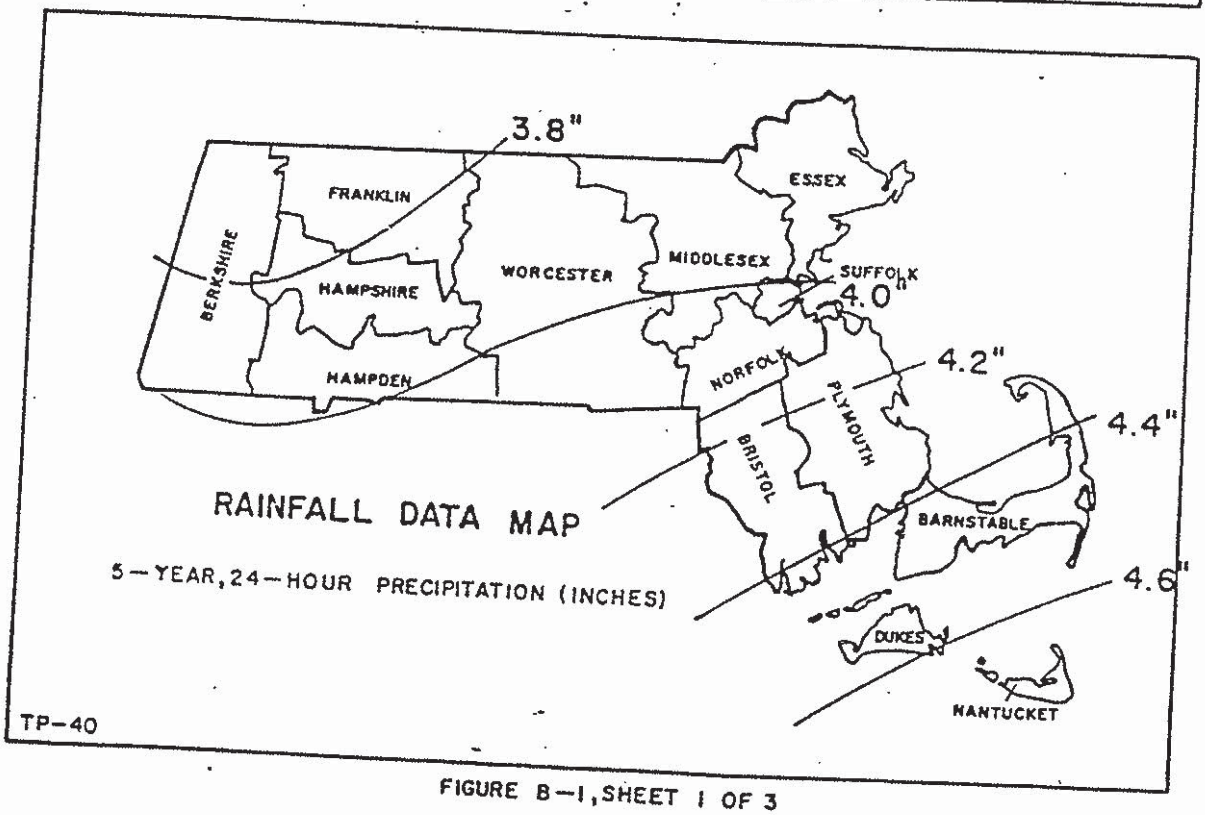
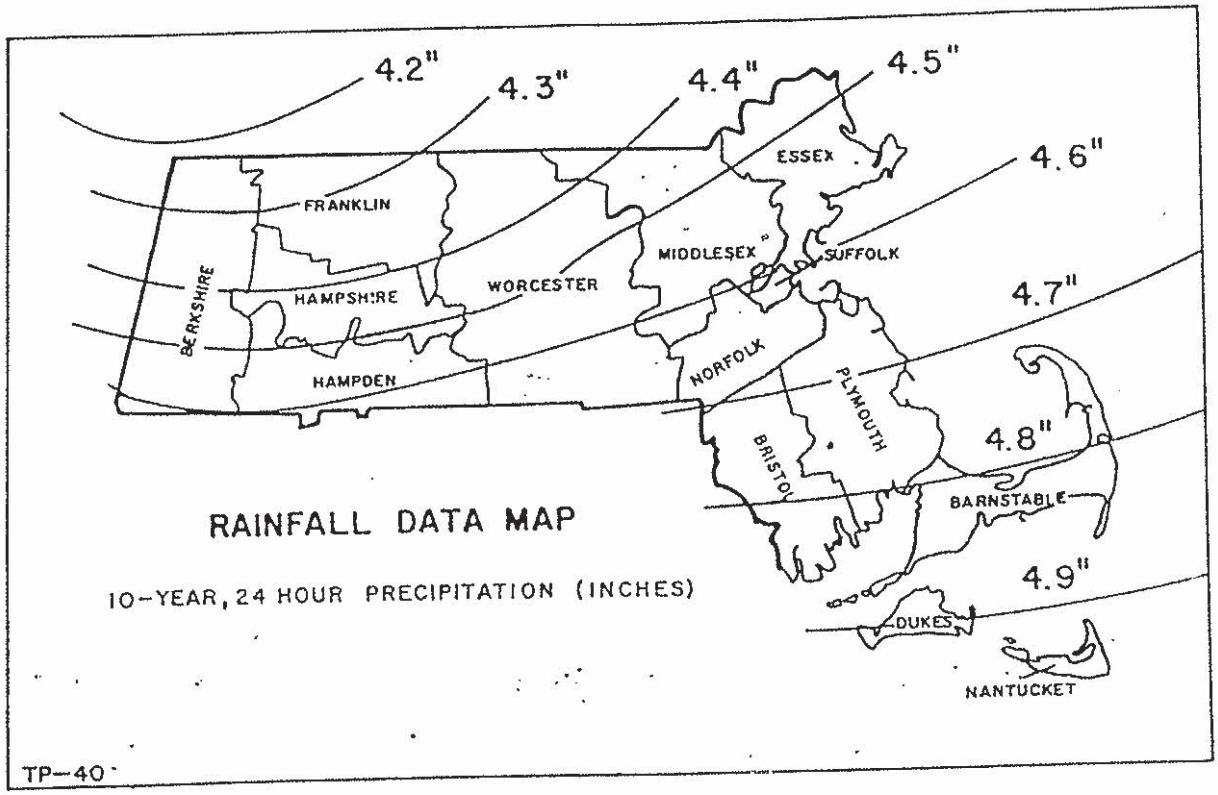


FIGURE B-1, SHEET 1 OF 3



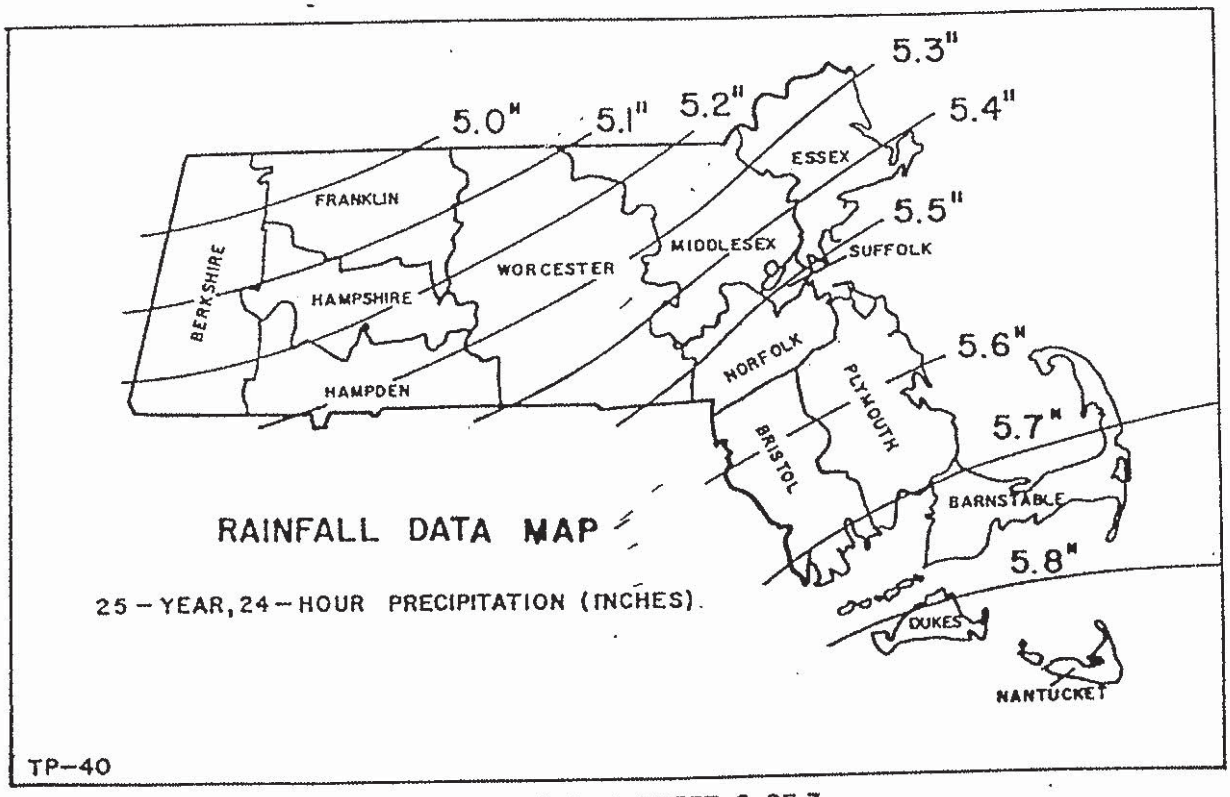
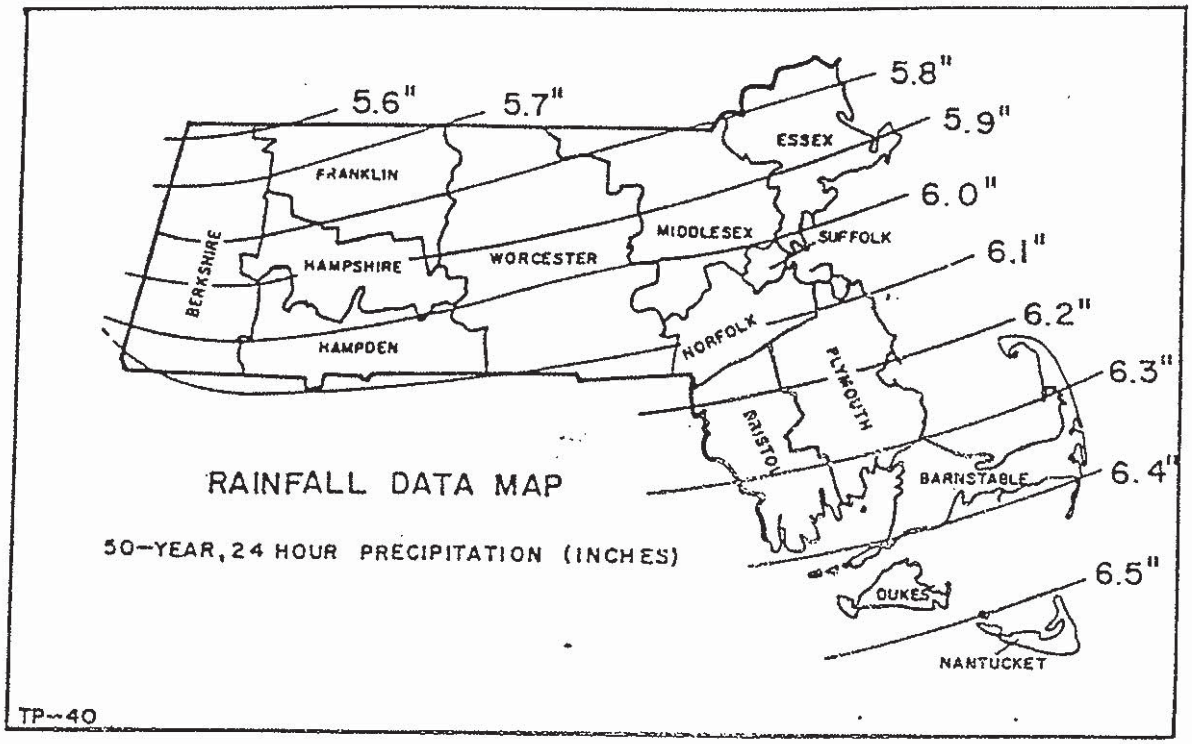


FIGURE B-1, SHEET 2 OF 3



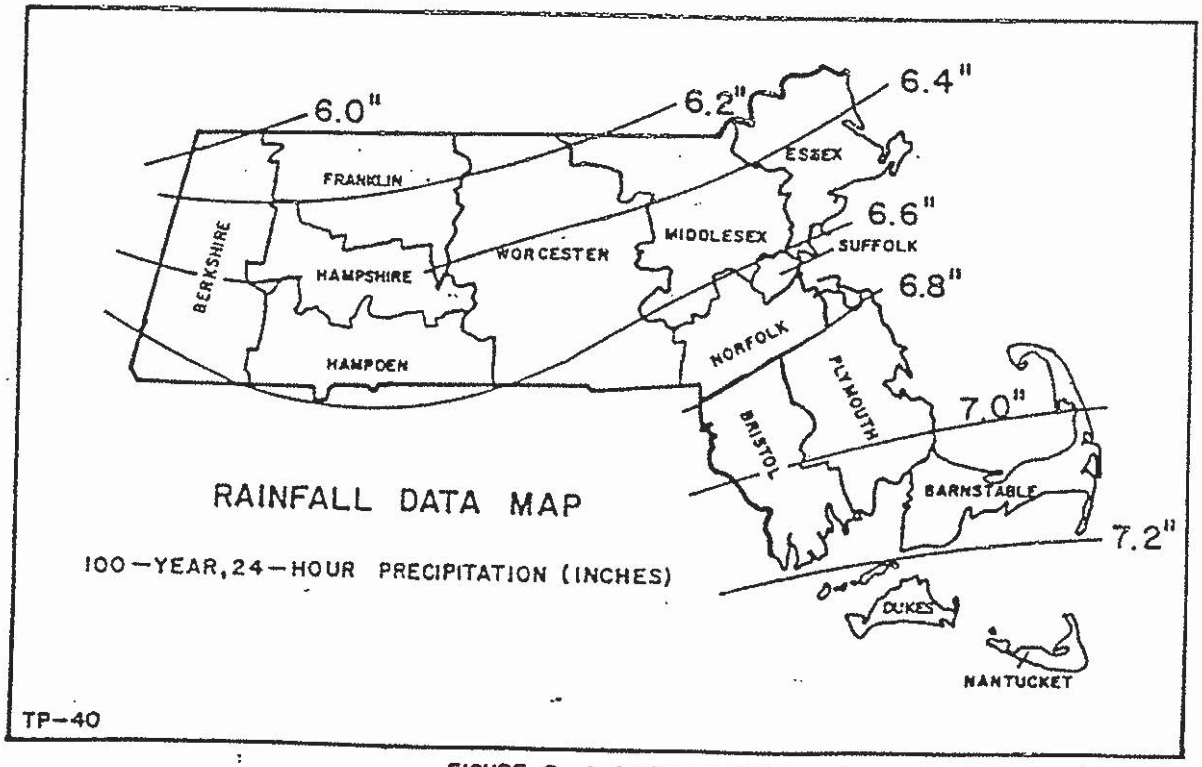


FIGURE B-1, SHEET 3 OF 3

APPENDIX G – RECHARGE VOLUME AND DRAWDOWN TIME CALCULATIONS

Stantec Planning and Landscape Architecture P.C.
226 Causeway Street
Boston MA 02114
Tel: (617) 523-8103
Fax: (617) 523-4333

Recharge / Infiltration Calculations

Project	JCHE at Congregation Kehillath	Project #	210801416
Location	Brookline, MA	Sheet	1 of 1
Calculated by	TAT	Date	10/20/2016
Checked by	FH	Revised	
Title	Recharge Calculations		

Recharge Calculations - Subsurface Infiltration System

Objective: To size a recharge system that will approximate the annual recharge from pre-development conditions

Methodology: MA Department of Environmental Protection (DEP) Stormwater Management (Volume Three)

Design Criteria: Based on the Site Hydrologic Soil Group:

Hydrologic Soil Group	Volume to Recharge (x Total Imp. Area)
A	0.60 inches of runoff
B	0.35 inches of runoff
C	0.25 inches of runoff
D	0.10 inches of runoff

Recharge Area Required:

A and B soils are anticipated based on a combination of information from NRCS soil maps and subsurface explorations peformed adjacent to the project site, as described in Section 2.2.1. This calulation assumes A soil for the entire site to be conservative.

	Impervious "A" Soil (sf)	Total Impervious (sf)
The total impervious area within site =	15,192	15,192
Required Volume to be recharged (Cubic Feet) =	317	**317**

Capture Area Adjustment

Impervious Area Draining to Recharge Volume for Subsurface Stormwater Infiltration/Storage System (sf) =	14,134
Total Impervious Area Draining to Proposed Recharge Facilities (sf) =	14,134
Required Volume Adjustment Factor (Total Impervious Area/Impervious Area Draining to Recharge Volume = 15,192 sf / 14,134 sf) =	**1.07**
Adjusted Required Volume to be Recharged (317 cf * 1.07) (cf) =	**340**

Recharge Area Provided: Recharge Volumes were determined using the Static Method as described in Volume 3 of the "Massachusetts Stormwater Handbook" See the Hydrocad Calculations enclosed for the Storage Volumes provided.

Subsurface Infiltration System

Outlet Elevation =	60.73
Bottom Elevation (Stone) =	58.00
Cumulative Storage (@ Outlet Elev. 60.70) =	*3,975 cubic feet*
	(Volume from Proposed HydroCAD Model)

3,975 > 340 OK.

Stantec Planning and Landscape Architecture P.C.
226 Causeway Street
Boston MA 02114
Tel: (617) 523-8103
Fax: (617) 523-4333

Recharge - 72 Hour Drawdown

JCHE at Congregation Kehillath
Brookline, MA
TAT
FH
Drawdown Calculations

Project # 210801416
Sheet 1 of 1
Date 10/20/2016
Revised

Drawdown Calculations

Objective: To demonstrate the drawdown time for the proposed infiltration BMPs, assuming full storage volume.

Methodology: MA Department of Environmental Protection (DEP) Stormwater Management (Volume Three)

Design Criteria: This calculation is based on B soils for Rawls Rate (Sandy Loam). A and B soils are anticipated based on a combination of information from NRCS soil maps and subsurface explorations performed adjacent to the project site, as described in Section 2.2.1. This calculation assumes A soil for the entire site to be conservative.

Drawdown Calculation

Infiltration BMP	Actual Storage Volume for Each BMP (cf)	Rawls Rate (in/hr)	Bottom Area of BMP's (sf)	**Drawdown (hours)**
Subsurface Infiltration System	3,975	1.02	1,960	**23.86**
Bioswale	717	1.02	132	**63.90**

Notes:
(1) The bioswale is designed to overflow back to the underground infiltration system. The underground infiltration system is designed with with an overflow (in excess of the 100-year storm) to the Town's closed system.
(2) Actual Storage Volume and Bottom Area for each BMP were obtained from the proposed HydroCAD model.

Stage-Area-Storage for Pond 1P: Underground Infiltration/Storage

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
58.00	**1,960**	0
58.05	1,960	29
58.10	1,960	59
58.15	1,960	88
58.20	1,960	118
58.25	1,960	147
58.30	1,960	176
58.35	1,960	206
58.40	1,960	235
58.45	1,960	265
58.50	1,960	294
58.55	1,960	383
58.60	1,960	472
58.65	1,960	561
58.70	1,960	650
58.75	1,960	739
58.80	1,960	829
58.85	1,960	918
58.90	1,960	1,007
58.95	1,960	1,096
59.00	1,960	1,185
59.05	1,960	1,274
59.10	1,960	1,363
59.15	1,960	1,452
59.20	1,960	1,541
59.25	1,960	1,630
59.30	1,960	1,720
59.35	1,960	1,809
59.40	1,960	1,898
59.45	1,960	1,987
59.50	1,960	2,076
59.55	1,960	2,165
59.60	1,960	2,254
59.65	1,960	2,343
59.70	1,960	2,432
59.75	1,960	2,521
59.80	1,960	2,611
59.85	1,960	2,700
59.90	1,960	2,789
59.95	1,960	2,878
60.00	1,960	2,967
60.05	1,960	3,056
60.10	1,960	3,145
60.15	1,960	3,234
60.20	1,960	3,323
60.25	1,960	3,412
60.30	1,960	3,501
60.35	1,960	3,591
60.40	1,960	3,680
60.45	1,960	3,769
60.50	1,960	3,858
60.55	1,960	3,887
60.60	1,960	3,917
60.65	1,960	3,946
60.70	1,960	3,975
60.75	1,960	4,005
60.80	1,960	4,034
60.85	1,960	4,064
60.90	1,960	4,093
60.95	1,960	4,122
61.00	1,960	4,152
61.05	1,960	4,181
61.10	1,960	4,211
61.15	1,960	4,240
61.20	1,960	4,269
61.25	1,960	4,299
61.30	1,960	4,328
61.35	1,960	4,358
61.40	1,960	4,387
61.45	1,960	4,416
61.50	1,960	**4,446**

Stage-Area-Storage for Pond 3P: Bioswale

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
61.51	132	0
61.56	132	2
61.61	132	4
61.66	132	6
61.71	132	8
61.76	132	10
61.81	132	12
61.86	132	14
61.91	132	16
61.96	132	18
62.01	132	20
62.06	132	22
62.11	132	24
62.16	132	26
62.21	132	28
62.26	132	30
62.31	145	37
62.36	163	44
62.41	182	53
62.46	201	62
62.51	222	73
62.56	244	85
62.61	266	97
62.66	290	111
62.71	315	126
62.76	340	143
62.81	367	160
62.86	395	180
62.91	423	200
62.96	453	222
63.01	484	245
63.06	516	270
63.11	548	297
63.16	582	325
63.21	617	355
63.26	**653**	387
63.31	**660**	420
63.36	660	453
63.41	660	486
63.46	660	519
63.51	660	552
63.56	660	585
63.61	660	618
63.66	660	651
63.71	660	684
63.76	660	**717** ←

APPENDIX H – WATER QUALITY VOLUME CALCULATIONS

Stantec Planning and Landscape Architecture P.C.
226 Causeway Street
Boston MA 02114
Tel: (617) 523-8103
Fax: (617) 523-4333

Water Quality Volume Calculations

Project	JCHE at Congregation Kehillath Israel	Project #	210801114
Location	Brookline, MA	Sheet	1 of 1
Calculated by	TAT	Date	10/20/2016
Checked by	FH		

Calculations

Objective: To size a water quality volume.

Methodology: MA Department of Environmental Protection (DEP) Stormwater Management (Volume Three)

Water Quality Volume Required:

The project site is subject to a "Water Quality Depth" of one-half inch (0.5") over the contributing impervious area when computing the required water quality treatment volume based on MassDEP stormwater standards.

Subsurface Infiltration System

The total impervious area within contributing area (SF) =	15,192
Required Water Quality Volume (Cubic Feet) =	**633**

Volume Provided:

Subsurface Infiltration System

Outlet Elevation =	60.73
Bottom Elevation (Stone) =	58.00
Cumulative Storage (@ Outlet Elev. 60.70) =	*3,975 cubic feet*
	(Volume from Proposed HydroCAD Model)

Total Storage Volume = 3,975 cubic feet

3,975	**>**	**633**	**OK**

Water Quality Volume Required:

The project site is subject to a "Water Quality Depth" of one-tenth inch (0.1") over the contributing impervious area when computing the required water quality pre-treatment volume based on MassDEP stormwater standards.

Subsurface Stormwater Isolator Row

The total impervious area within contributing area =	15,192
Required Water Quality Volume (Cubic Feet) =	**127**

Volume Provided:

Subsurface Stormwater Isolator Row

Each Chamber Volume =	8.7 cf
Number of Chambers =	30

Total Storage Volume = 261 cubic feet

261	**>**	**127**	**OK**

Stage-Area-Storage for Pond 1P: Underground Infiltration/Storage

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
58.00	**1,960**	0
58.05	1,960	29
58.10	1,960	59
58.15	1,960	88
58.20	1,960	118
58.25	1,960	147
58.30	1,960	176
58.35	1,960	206
58.40	1,960	235
58.45	1,960	265
58.50	1,960	294
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58.60	1,960	472
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58.95	1,960	1,096
59.00	1,960	1,185
59.05	1,960	1,274
59.10	1,960	1,363
59.15	1,960	1,452
59.20	1,960	1,541
59.25	1,960	1,630
59.30	1,960	1,720
59.35	1,960	1,809
59.40	1,960	1,898
59.45	1,960	1,987
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59.70	1,960	2,432
59.75	1,960	2,521
59.80	1,960	2,611
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59.90	1,960	2,789
59.95	1,960	2,878
60.00	1,960	2,967
60.05	1,960	3,056
60.10	1,960	3,145
60.15	1,960	3,234
60.20	1,960	3,323
60.25	1,960	3,412
60.30	1,960	3,501
60.35	1,960	3,591
60.40	1,960	3,680
60.45	1,960	3,769
60.50	1,960	3,858
60.55	1,960	3,887
60.60	1,960	3,917
60.65	1,960	3,946
60.70	1,960	3,975
60.75	1,960	4,005
60.80	1,960	4,034
60.85	1,960	4,064
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61.00	1,960	4,152
61.05	1,960	4,181
61.10	1,960	4,211
61.15	1,960	4,240
61.20	1,960	4,269
61.25	1,960	4,299
61.30	1,960	4,328
61.35	1,960	4,358
61.40	1,960	4,387
61.45	1,960	4,416
61.50	1,960	**4,446**

APPENDIX I – TSS REMOVAL CALCULATIONS

Stantec
226 Causeway Street, 6th Floor
Boston, MA 02114
(617) 523-8103

TSS Removal Calculations

Project:	*JCHE at Congregation Kehillath Israel*		
Location:	*Brookline, MA*		
Designed By:	TAT	Date:	10/21/2016
Checked by:	FH		

Treatment Train #1

Sequence of Treatment	Description of BMP	Design Removal Rate	TSS Loading	Amount Removed	TSS Final Loading
1	Infiltration Basin	80%	100.0%	80.0%	20.0%

Total TSS Removal = 80%

Note: Pretreatment is being provided through an isolator row in the infiltration basin.

Treatment Train #2

Sequence of Treatment	Description of BMP	Design Removal Rate	TSS Loading	Amount Removed	TSS Final Loading
1	Bioswale	90%	100.0%	90.0%	10.0%

Total TSS Removal = 90%

Note: Bioswale is designed to accomodate low flow stormwater runoff volumes from roof drains, with higher runoff volumes being diverted to the underground infiltration system.

Treatment Train #3

Sequence of Treatment	Description of BMP	Design Removal Rate	TSS Loading	Amount Removed	TSS Final Loading
1	Stormceptor	50%	100.0%	50.0%	50.0%
2	Infiltration Basin	80%	50.0%	40.0%	10.0%

Total TSS Removal = 90%

TESTING SUMMARY

Massachusetts Strategic Envirotechnology Partnership (STEP) Program

Stormceptor® Report

Summary: The Massachusetts STEP Program has completed a six month thorough evaluation of the function and performance tests of the Stormceptor® System. Upon the completion of the evaluation and verification program, which occurred during the end of December 1997, the STEP Program summarized its findings which are listed below:

- Performance data available demonstrates that the Stormceptor® can provide TSS removal rates of 77% when sized according to the "Sensitive Area" criteria.
- Evidence suggests that the Stormceptor® System may be capable of achieving TSS removal rates between 89% and 99% under certain climate conditions and land use intensity when sized accordingly.
- Performance data available suggest that the Stormceptor® System can provide TSS removal rates of 52% when sized according to the "Treatment Train" criteria.
- Use of the Stormceptor® System as a stand alone device may be justified when sized according to the Sensitive Area criteria.
- The Stormceptor® System is useful for new and retrofit installations in Standard 7 of DEP's Stormwater Management Policy and Standards (DEP and CZM 1997), especially where space is limited
- The Stormceptor® System is also suited for secondary sediment control from construction related sediment loads specified in Standard 8 of DEP's Stormwater Management Policy and Standards

In March 1997, the Massachusetts Department of Environmental Protection (DEP) issued Stormwater Management Standards* to address both qualitative and quantitative controls to protect waters of the Commonwealth of Massachusetts from impacts of untreated stormwater runoff. Local Conservation Commissions will implement DEP's new Stormwater Policy through the Standards. The Standards establish the level of required controls that can be achieved primarily through the installation of Best Management Practices (BMPs).

Opportunities exist for the use of innovative stormwater technologies such as the Stormceptor® System especially in areas where site constraints are very difficult to install the more typical BMP's such as retention ponds. With the increase in the use of innovative technologies, DEP has entered into an agreement with the Commonwealth's Strategic Envirotechnology Partnership (STEP) Program to allow for the verification of the function and performance of stormwater innovative systems. Upon verification by the STEP Program, local Conservation Commissions are allowed to accept the use of the innovative systems. DEP also allows for independent verification by local conservation commissions. The Massachusetts STEP is part of a six-state partnership for Environmental Technology including Illinois, California, Pennsylvania, New Jersey and New York.

In summary, the Massachusetts STEP Program reports that the Stormceptor® System "should be capable of providing an effective solution for treatment of stormwater runoff" (STEP Technology Assessment, Draft Report, December 1997**).

APPENDIX J – STORMTANK AND STORMCEPTOR MAINTENANCE GUIDELINES

Maintenance Guidelines

General:

The StormTank™ Stormwater Storage Module is a component in a stormwater collection system, providing storage for the detention or infiltration of runoff. No two systems are the same; with varying shapes, sizes and configurations. Some include pre-treatment to remove sediment and/or contaminants prior to entering the storage area and some do not. Systems without pre-treatment require greater attention to system functionality and may require additional maintenance.

In order to sustain system functionality Brentwood offers the following general maintenance guidelines.

Precautions:

1. Prior to & During Construction - Siltation prevention of the stormwater system.
   a. Conform to all local, state and federal regulations for sediment and erosion control during construction.
   b. Install site erosion and sediment BMP's (Best Management Practices) required to prevent siltation of the stormwater system.
   c. Inspect and maintain erosion and sediment BMP's during construction.
2. Post Construction - Prior to commissioning the StormTank™ system.
   a. Remove and properly dispose of construction erosion and sediment BMP's per all local, state and federal regulations. Care should be taken during removal of the BMP's as not to allow collected sediment or debris into the stormwater system.
   b. Flush the StormTank™ system to remove any sediment or construction debris immediately after the BMP's removal. Follow the maintenance procedure outlined.

Inspections:

Follow all local, state, and federal regulations regarding stormwater BMP inspection requirements.

Brentwood Industries makes the following recommendations:

1. Frequency
   a. During the first service year a visual inspection should be completed during and after each major rainfall event, in addition to semi-annually, to establish a pattern of sediment and debris buildup.
      i. Each stormwater system is unique and multiple criteria can affect maintenance frequency such as:

a) System Design: pre-treatment/no-pretreatment, inlet protection, stand alone device.
b) Surface Area Collecting From: hardscape, gravel, soil.
c) Adjacent Area: soil runoff, gravel, trash.
d) Seasonal Changes: fall-leaves, winter-salt/cinders.

b. Second year plus; establish an annual inspection frequency based on the information collected during the first year. At a minimum an inspection should be perform semi-annually.
c. Seasonal change; regional areas affected by seasonal change (spring, summer, fall, winter) may require additional inspections at the change of seasons in addition to semi-annually.

2. Inspect:
   a. Inspection ports.
   b. Inflow and outflow points including the inlet/manhole and pipes.
   c. Discharge area.
3. Identify and Report maintenance required:
   a. Sediment and debris accumulation.
   b. System backing up.
   c. Flow rate change.

Maintenance Procedures:

1. Conform to all local, state and federal regulations.
2. Determine if maintenance is required. If a pre-treatment device is installed, follow manufacturer recommendations.
3. Using a vacuum pump truck evacuate debris from the inflow and outflow points.
4. Flush the system with clean water forcing debris from the system. Take care to avoid extreme direct water pressure when flushing the system.
5. Repeat steps 3 and 4 until no debris is evident.

These maintenance guidelines were written by Brentwood Industries, Inc. with the express purpose of providing helpful hints. These guidelines are no to be construed as the only Brentwood approved methods for StormTank™ system maintenance or the final authority in system maintenance. Check with the stormwater system owner/project engineer for their contract/specification requirements and or recommendations. Contact your local StormTank™ distributor or Brentwood Industries for additional technical support if required.

610 Morgantown Road, Reading, PA 19611
P: 610-374-5109 F: 610-736-1280 Email: Stormwater@brentwoodindustries.com

Inspection and Maintenance. Easy. Convenient.

When it rains, oils, sediment and other contaminants are captured and contained by over 40,000 Stormceptor units operating worldwide. While Stormceptor's patented scour prevention technology ensures captured pollutants remain in the unit during all rainfall events, the accumulated pollutants must eventually be removed as part of a regular maintenance program.

If neglected, oil and sediment gradually build up and diminish any BMP's efficiency, harming the environment and leaving owners and operators vulnerable to fines, surcharges and bad publicity.

Maintenance is a must

Ease, frequency and cost of maintenance are often overlooked by specifiers when considering the merits of a stormwater treatment system. In reality, maintenance is fundamental to the long-term performance of any stormwater quality treatment device.

While regular maintenance is crucial, it shouldn't be complicated. An ongoing maintenance program with Stormceptor is convenient and practically effortless. With virtually no disruptions, you can concentrate on your core business.

Quick inspections

Inspections are easily carried out above ground from any standard surface access cover through a visual inspection of the orifice and drop tee components. A sludge judge and oil dip-stick are all that are needed for sediment and oil depth measurements.

Easy unit access

Maintenance is typically conducted from the same surface access cover, eliminating the need for confined space entry into the unit. Your site remains undisturbed, saving you time and money.

No muss, no fuss and fast

Maintenance is performed quickly and inexpensively with a standard vacuum truck. Servicing usually takes less than two hours, with no disruption to your site.

A complete stormwater management plan for Stormceptor extends beyond installation and performance to regular maintenance. It's the smart, cost-effective way to ensure your unit continues to remove more pollutants than any other separator for decades to come.

Stormceptor maintenance recommendations

- Units should be inspected post-construction, prior to being put into service.
- Inspect every six months for the first year of operation to determine the oil and sediment accumulation rate.
- In subsequent years, inspections can be based on first-year observations or local requirements.
- Cleaning is recommended once the sediment depth reaches 15% of storage capacity, (generally taking one year or longer). Local regulations for maintenance frequency may vary.
- Inspect the unit immediately after an oil, fuel or chemical spill.
- A licensed waste management company should remove captured petroleum waste products from any oil, chemical or fuel spills and dispose responsibly.

With over 40,000 units operating worldwide, Stormceptor performs and protects every day, in every storm.

imbrium

www.imbriumsystems.com

USA: (888) 279 8826
CANADA: (800) 565 4801

APPENDIX K – OPERATION AND MAINTENANCE LOG

JCHE at Congregation Kehillath Israel

Operation and Maintenance Log

Inspections for Year:_____

Structural Best Management Practice	Action	Date Completed	Comments	Completed By	Action	Date Completed	Comments	Completed By
Catch Basins, Area Drains, & Trench Drains – Inspect two times per year. Clean as necessary or when sump is half full of sediment.	Inspect							
	Inspect							
Drain Manholes – Inspect two times per year. Clean as necessary.	Inspect							
	Inspect							
StormTank Subsurface Infiltration Basin – Inspect the basin after each major rainstorm for the first service year of operation, and per the manufacturer's recommended minimum. Clean and O&M per manufacturer's recommendations.	Inspect							
	Inspect							
Stormceptor Water Quality Unit – Inspect at least two times per year. Clean and O&M per manufacturer's recommendations.	Inspect							
	Inspect							
Roof Drain Leaders – Inspect two times per year. Clean as required.	Inspect							
	Inspect							

JCHE at Congregation Kehillath Israel

Operation and Maintenance Log

Inspections for Year:_____

Structural Best Management Practice	Action	Date Completed	Comments	Completed By	Action	Date Completed	Comments	Completed By
Bioswale – Inspect and remove sediment and debris at least once a year. Mow as needed. Mulch, fertilize, remove dead vegetation and prune annually.	Inspect							
	Inspect							
Vegetated Areas Maintenance – Inspect two times per year. Mow as required.	Inspect							
	Inspect							

NOTE: See Operations and Maintenance Section of Stormwater Report for details.

SECTION 12

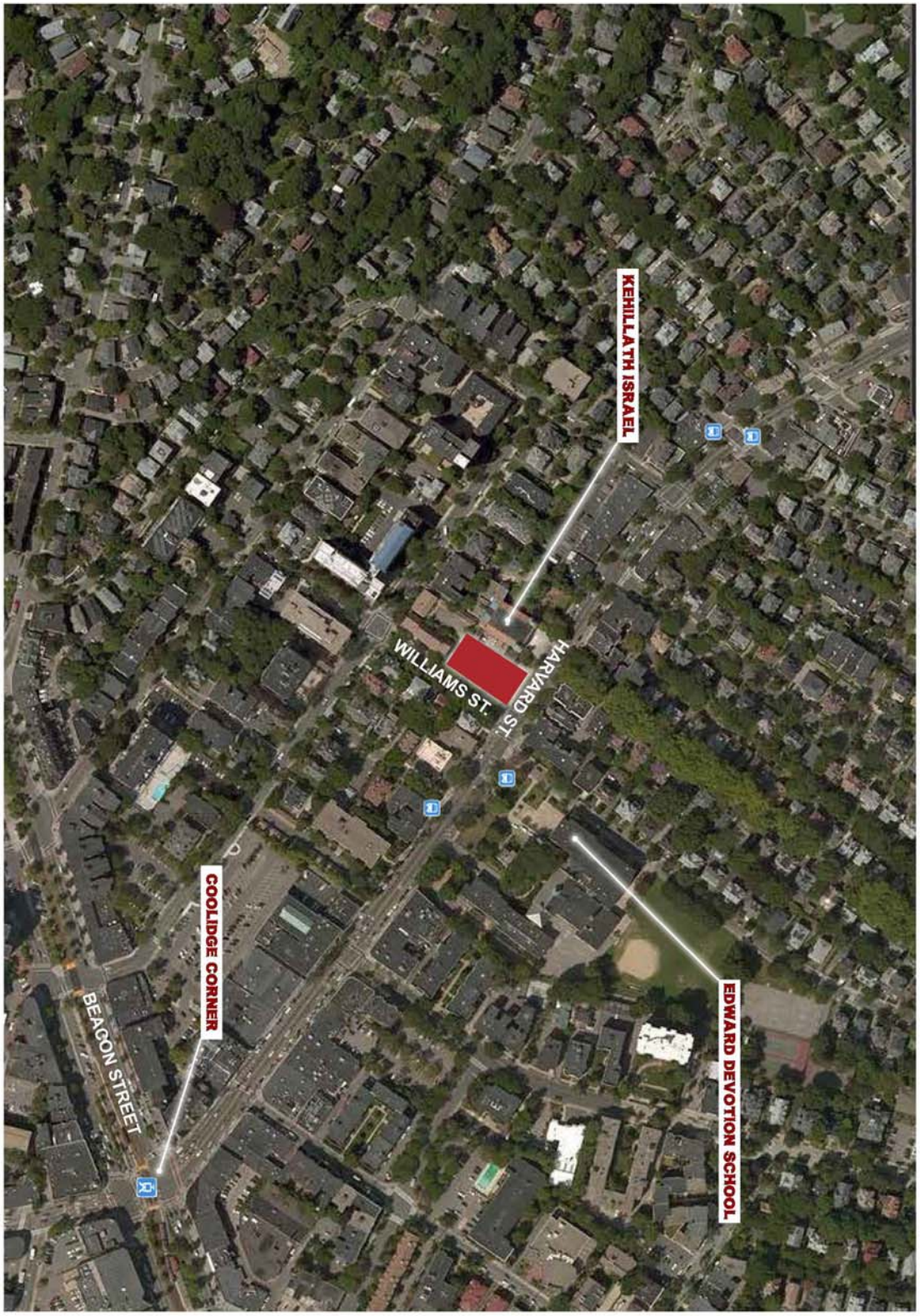
AERIAL PHOTOS & SITE PHOTOS

Stantec

0 1,000 2,000 4,000 6,000 8,000 Feet

N

Figure 1
Site Locus Map
384 Harvard Street
Brookline, Massachusetts
Source: Mass GIS Online Datalayers



JCHE
JEWISH COMMUNITY HOUSING FOR THE ELDERLY

JCHE Conceptual Design
384 Harvard Street, Brookline, Massachusetts

May 16, 2016

PCA
PRELLWITZ CHILINSKI ASSOCIATES
Architecture Planning Interiors

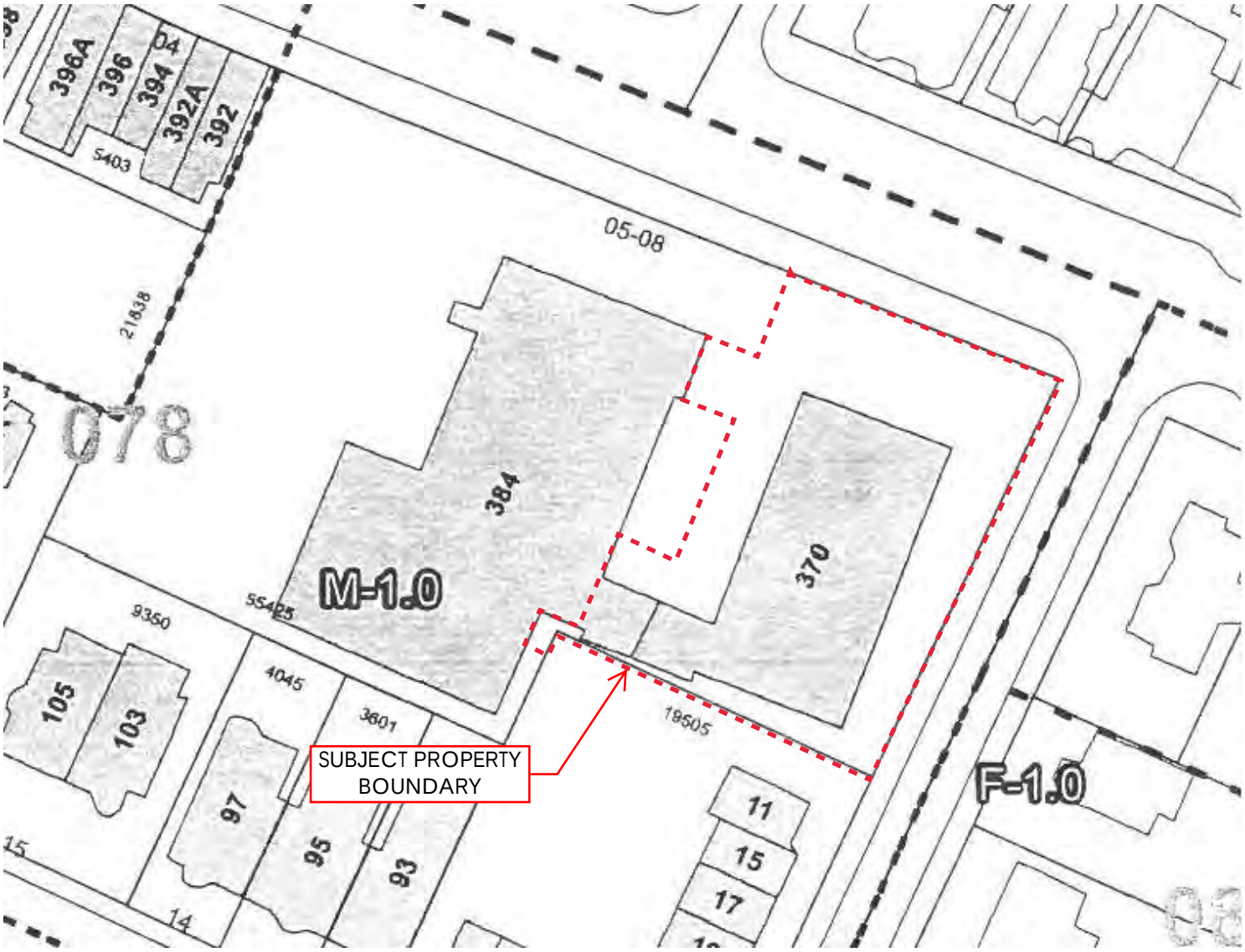


Figure 2
Property Detail Map for
384 Harvard Street
Brookline, Massachusetts

Exhibit 1 - Photographs of Subject Property

Subject property auditorium entrance

Side view of subject building

View of attached Congregation Kehillath Israel building, currently under construction

Auditorium interior

Auditorium interior entrance

Preschool classrooms in building lower level

View of Harvard Street from subject property