Memorandum

To: John Daghlian, Associate City Engineer
Jennifer Caira, Chief Planner
City of Newton

Date: April 18, 2019

Project #: 12239.00

From: VHB

Re: The Northland Newton Development
Water/Sewer/Stormwater Summary

The following memorandum has been prepared to summarize the Project's water/wastewater and stormwater design approach and the Proponent's commitment to best practices. Quantitative analyses and calculations demonstrating compliance with state and local stormwater regulations will be prepared during later design stages and provided to Engineering for design review prior to any applications for building permits.

1.1 Water and Wastewater

The City's sewer system is divided into three primary sewershed areas. Each of those primary sewershed areas are further subdivided into smaller subsets defined by logical flow boundaries for system analysis and location reference. The Project Site resides within the City's Sewer Area A09A.

Existing retail, industrial and office buildings on the site are all presently serviced by gravity sewers in Oak Street and Needham Street. Average daily wastewater flows from existing uses have been on the order of 8,300 gal/day for roughly the past 20 years during which time the offices at 156 Oak Street (Building 1) were fully occupied by Clark's Shoes and the Marshalls plaza was fully tenanted. Obviously, existing wastewater flows from the site have gradually diminished as leases have expired in preparation of this redevelopment project.

The proposed building program reduced since the initial submission in September 2018 now includes 800 residential units of mixed housing types, refurbishing the 180,000 sf office building at 156 Oak Street, and 115,000 sf of flexible commercial space including retail, restaurants and entertainment, health care, and community uses. Proposed uses on the site will generate new wastewater flows on the order of 85,000 gal/day. Refer to Table 1.

A new on-site system of 8" gravity sewer mains will be constructed through the Project Site to collect domestic (non-industrial) wastewater from all new buildings. The new sewer mains will connect to existing sewers in Oak Street at the relocated driveway entrance and in Needham Street at the Main Street entrance. Based upon early discussions with representatives from Engineering and DPW, both the water system and sewer system have capacity to service the project.

101 Walnut Street
PO Box 9151
Watertown, MA 02472-4026
P 617.924.1770

Average daily wastewater generation for the uses proposed is closely correlated to water demand, and the water conservation measures that will be incorporated into the project through the Proponent's commitment to sustainability which will significantly reduce wastewater flows to the system comparatively. For example, residential units will be individually metered and equipped with low flow, high efficiency faucets, which will both reduce demand. Likewise, the commercial space will have low flow, high-efficiency faucets, as well as low-flow water closets and urinals. The office building will be re-fitted with the same. While unrelated to wastewater, the Proponent is also committing to harvest rainwater for irrigation.

Table 1 – Estimated Net New Wastewater Generation

Proposed Use	Size	Title V Design Flow Basis	GPD
Residential	1,200 bedrooms	110 GPD per bedroom	132,000
Retail	60,000 SF	0.05 GPD per SF	3,000
Office	180,000 SF	0.075 GPD per SF	13,500
Restaurant	1,190 Seats	30 GPD per seat*	35,700
Medical Offices	6 Doctors, 2 Dentists	250 GDP per doctor, 200 GDP per dentist**	1,900
Commercial/Flex	10,000 SF	0.075 GPD per SF***	750
Community	4,000 SF	0.05 GPD per SF+	200
		∑ Design Flow	187,050
		Conversion factor design flow to average daily flow(1)	x 0.5
		AVERAGE DAILY FLOW	*93,525*
		Less existing average daily flows(2)	- 8,315
		Net New Wastewater Average Daily Flow	**85,210**

* Varies from 20 GPD/seat for fast food to 35 gpd/seat for other (presumably casual and formal dining). The calculation assumes approximately 25% of restaurant seats will be "fast food".

** Assumes 25% of medical office space will be used by dentists.

*** 10,000 square feet of the flexible commercial space will be tenanted by an undetermined mix of uses. Current trends suggest these spaces will be absorbed by office share space providers, such as WeWork and Regus; and by small specialty exercise providers that offer classes in yoga, palates, spinning, physical therapy and personalized training. None of these uses in small spaces are large water/wastewater users so it is estimated that the wastewater profile of this space will be similar to office use.

\+ The community center building is unprogrammed floor space likely to be used periodically for small gathering and meeting space; therefore, average daily flow generation is expected to be more in line with a retail use than other Title V uses.

(1) Flow generation rates prescribed by Title V (310 CMR 15.416) are "design flows" to be used for the design of ground disposal systems and are defined as ".... [daily] estimated generated flow for the proposed use plus a factor representing flow variations". Title V utilizes a factor of 2.0 to convert average daily flow to design flow (refer to 310 CMR 15.203(6)). Therefore, calculating average daily flow based on Title V is determined by estimating design flow and multiplying by 0.5.

(2) Determined for existing retail and office uses at 275/281 Needham Street and 156 Oak Street using the same methodology as shown for proposed uses.

1.2 Stormwater

The Project proposes to showcase best practices and principles of green infrastructure: restoring the ecological and hydrologic functions of a former industrial site in the heart of Newton. With sustainability, livability, and resilience as guiding principles, the design team has developed a green infrastructure concept design that will exceed stormwater management regulatory requirements while creating public amenities, reducing urban heat island effect, enhancing natural habitat, and reconnecting Newton residents to South Meadow Brook.

The Project's green infrastructure approach will integrate small-scale, decentralized stormwater practices throughout the site, in locations where those practices best fit site conditions and can generate the highest benefits. The proposed green infrastructure practices include water-receiving landscapes, permeable hardscapes, and water conservation practices. These practices, proven effective in installations in Cambridge, Boston, and throughout the Northeast, will be designed with maintenance in mind to ensure that they provide environmental and community benefits well into the future.

Bioretention Planters
North Street, Pittsfield

1.2.1 A Watershed Perspective

Situated within the Charles River Watershed and South Meadow Brook subwatershed, the Project has an opportunity to mitigate the impacts that past development and urban stormwater runoff have had on these waterbodies. To improve upon existing conditions, the Project aims to restore the "sponge" function of the landscape, which has been lost through urbanization. To do this, the Project will reduce impervious cover, increase tree canopy, store and reuse roof runoff for irrigation, daylight a portion of South Meadow Brook, and integrate green infrastructure throughout the site to slow, filter, collect, and infiltrate rainwater where it falls.

The Charles River Watershed is impaired in part due to phosphorus carried by urban stormwater runoff to the river. The Final TMDL for Nutrients in the Upper/Middle Charles River establishes a pollution diet and stormwater management strategies to reduce phosphorus loading to the Charles River. Per Table ES-3 of the TMDL Technical Report (CN 272.0), Commercial/Industrial and High Density/Multi-Family Residential uses require a 65% reduction in annual average phosphorus loading. The Project commits to meeting this phosphorus reduction target, as detailed in Section 1.2.3 below.

Porous Asphalt Parking Lane
Lakeview Ave, Cambridge

South Meadow Brook flows south through the Project site, first through an open channel for approximately 350 feet and then through a culvert for approximately 1,050 feet. After South Meadow Brook passes under Oak Street, it exits the culvert and flows approximately 370 feet to the Charles River (Figure 1). The Project proposes to daylight a portion of South Meadow Brook within the Mill Park area between the mill building (Building 1) and Building 3. The daylighted portion of South Meadow Brook will be a focal point in Mill Park featuring a terraced waterfall that cascades into a settling pool lined with rocks for enhanced aesthetics before resuming flow through the culvert under the mill building.

1.2.2 Finding the Best Fit for Site Conditions

The Project site has had various industrial, commercial, and retail historical uses since the 1800s, resulting in variable soil conditions of fill and natural material. Certain areas may be unsuitable for infiltration; particularly, a former man-made pond located generally below the footprint of the Marshalls building and parking lot which was filled with demolition debris.

According to the National Resources Conservation Service (NRCS), surface soils on the Project site are identified as urban land, which does not have a Hydrologic Soil Group (HSG) rating. Soils adjacent to the Project site in the NRCS soil map are classified with a HSG A rating. Soil evaluations in the geotechnical report completed by Haley & Aldrich show predominately well-draining soils that would be characterized as a HSG A soil. Groundwater is variable on the site ranging from approximately 3.1 feet to 17.6 feet below existing grade.

Under existing conditions, illustrated in Figure 2, the Site is developed and is predominately impervious, except for a small wooded area around the open channel section of South Meadow Brook to the north and small isolated landscaped areas dispersed throughout the Site. From a high point

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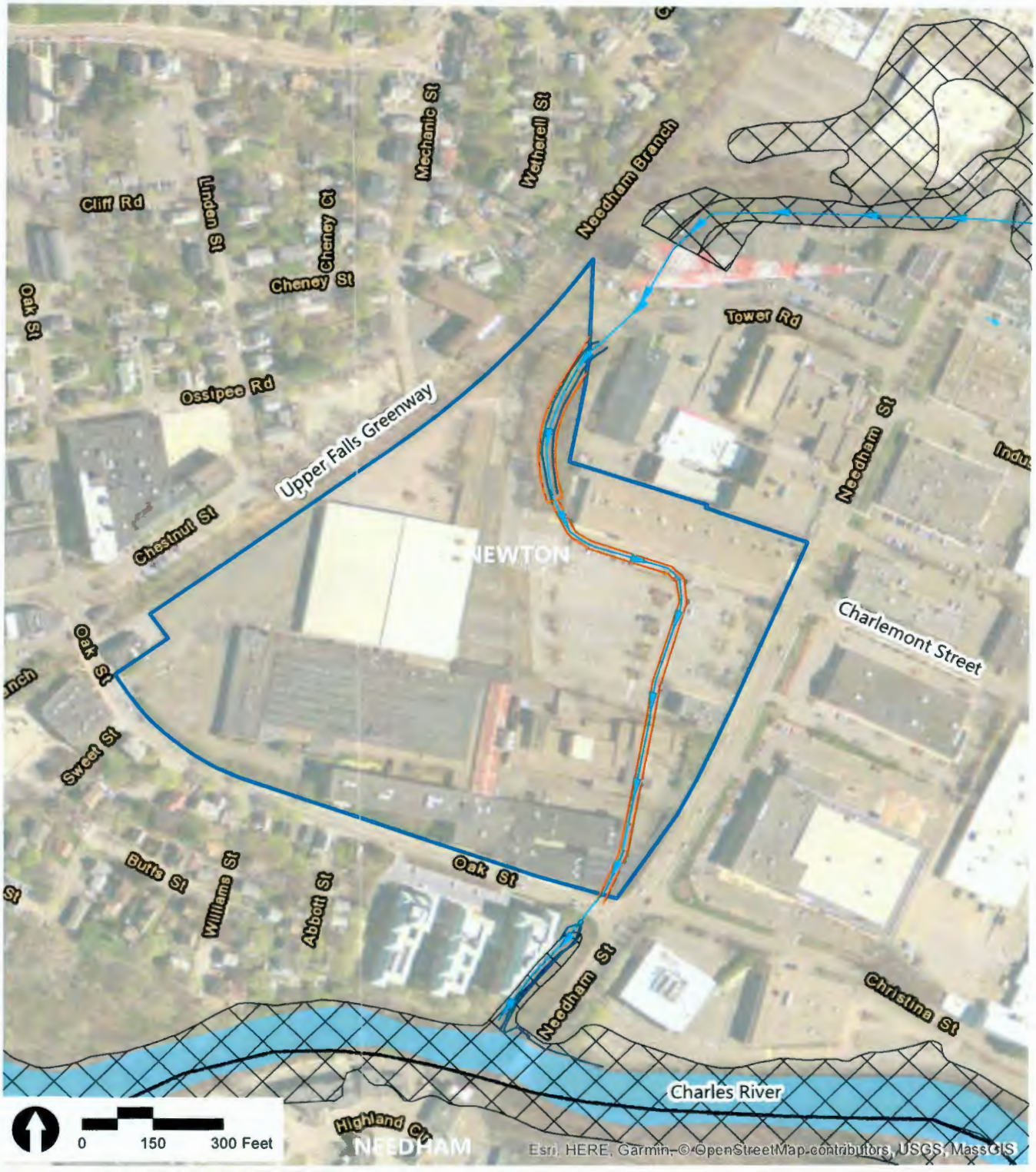

Legend

- Project Site
- Town Boundaries
- 100 Year Floodplain
- South Meadow Brook
- South Meadow Brook Easement
- South Meadow Brook Bank Lines

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Figure 1

Site Locus Map

The Northland Newton Development
Newton, Massachusetts

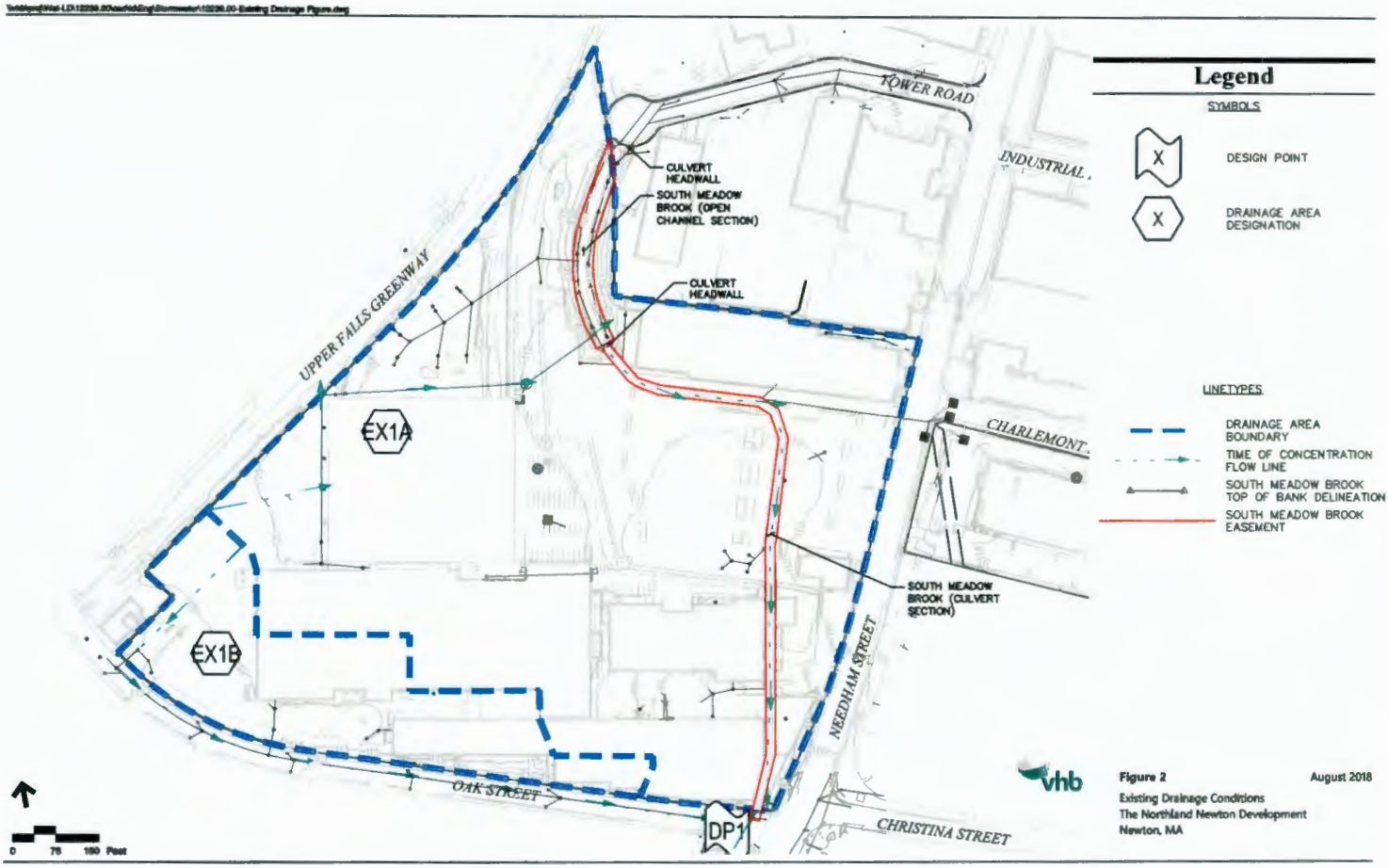

Figure 2 August 2018

Existing Drainage Conditions
The Northland Newton Development
Newton, MA

along the Upper Falls Greenway, the land slopes at approximately 3.5% east/southeast toward the Needham Street/Oak Street intersection or south toward Oak Street.

Of the existing buildings on site, the Project proposes to retain only one – the old mill building at 156 Oak Street. Likewise, the Project proposes to replace most existing utility and roadway infrastructure. In their place, the Project proposes new buildings, roadways, sidewalks, streetscape, parking areas, and green space, as generally illustrated in Figure 3 and as shown in detail on the project landscape plans.

In selecting the conceptual stormwater practices, the design team aimed to maximize benefits by matching stormwater practices to the best setting and site conditions. The conceptual design prioritizes infiltration practices where subsurface conditions allow, and fits those practices under hardscapes (parking lane, bike lane, and plaza) and landscapes (streetscape and open space). Where conditions preclude infiltration, the conceptual design includes lined stormwater practices that filter runoff before draining to the closed drainage system.

Bioretention Basin
Assembly Row, Somerville

1.2.3 Conceptual Green Infrastructure Plan

The overall principles of the conceptual green infrastructure plan are:

1. Make room for stormwater: grading and utility layout to allow green infrastructure to be distributed throughout the site.
2. Divert runoff from sidewalks, bike path, and streets into permeable pavement and bioretention facilities, integrated into the streetscape and transportation design.
3. Capture roof runoff in rainwater cisterns, to be used for landscape irrigation.
4. Prioritize infiltration facilities where conditions are most amenable; particularly, under the proposed village green situated between buildings 3, 4, 5a, and 6a. Infiltration facilities (including rainwater reuse for irrigation) maximize groundwater recharge and phosphorus reduction.
5. Where site conditions are not amenable to infiltration, design facilities with underdrains that direct filtered runoff to the closed drainage system.

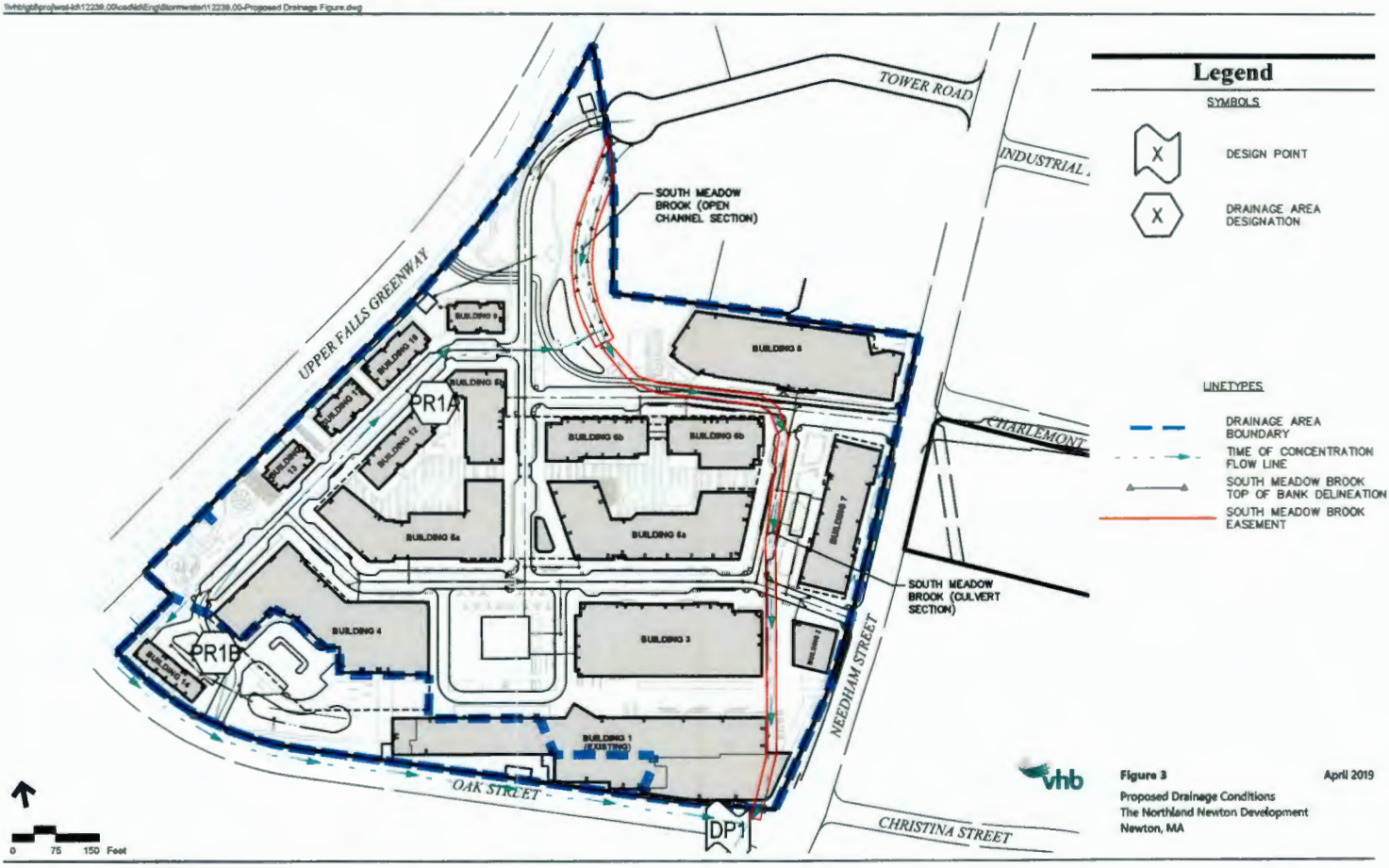

Figure 3 April 2019

Proposed Drainage Conditions
The Northland Newton Development
Newton, MA

6. Maximize tree canopy, and support tree health by extending sand-based structural soil under the sidewalk adjacent to tree wells.
7. Design with maintenance and longevity in mind.
8. Reduce runoff volume and peak discharge rates to the municipal drainage system.

The conceptual green infrastructure plan is illustrated in Figure 4. The following describe where runoff from impervious surfaces will be directed and treated.

- Main Street will be crowned, which will direct roadway and sidewalk stormwater to permeable pavement parking on both sides of the street.
- Hardscape surfaces within the Village Green will be constructed in part with permeable pavers.
- Roof runoff from Buildings 3, 4, 5a, and 6a will be routed to a large subsurface infiltration system below the Village Green.
- On Pettee Lane, roadway and sidewalk runoff will be treated in bioretention bump-outs along the eastern side of the street. Runoff from the western end will be treated in a bioretention basin before discharge to South Meadow Brook.

Bioretention Curb Bump-out
Edenfield Ave, Watertown

- The surface parking lot south of Building 4, roof and driveway at Building 14, and a portion of Pettee Lane will be directed to a surface bioretention basin for water quality treatment prior to discharge to the municipal drainage system in Oak Street.
- Roof runoff from Buildings 9, 10, 11 and 12 will be routed to a subsurface infiltration system near Building 9. Building 5b roof and a portion of Petee Lane will be collected in a bioretention basin at South Meadow Brook park.
- Stormwater from Unnamed Road, Charlemont Street, Building 7, and portions of Building 8 will be routed to an infiltration system adjacent to Building 7.
- Runoff from the north end of Tower Road, which drains directly into South Meadow Brook today will be intercepted and routed to a subsurface infiltration system.

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SOUTH MEADOW BROOK EASEMENT

BIKE PATH

0 75 150 Feet

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Figure 4 April 2019

Conceptual Green Infrastructure Plan
The Northland Newton Development
Newton, MA

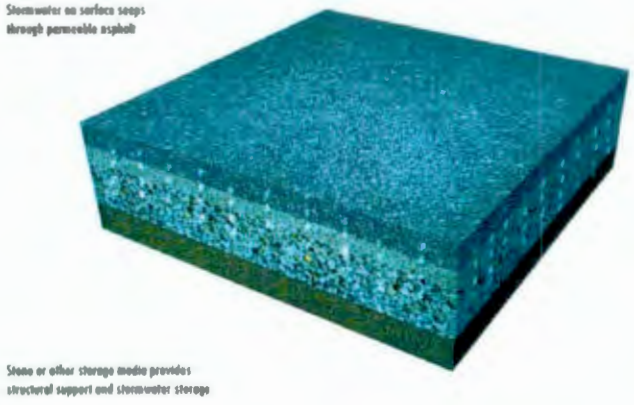
Specific green infrastructure practices are described below and illustrated in Figure 4.

Bioretention basins, planters and curb bump-outs

Gutter flow, sidewalk runoff, and parking lot runoff will be diverted into bioretention basins, curb bump-outs, and planters distributed throughout the Site. While facility designs will be tailored to each location, each bioretention facility will feature an inlet directing runoff into a sediment forebay for pretreatment. After passing through the forebay, runoff will infiltrate through layers of mulch, bioretention media, and peastone into a reservoir layer of open-graded crushed stone. Once ponding reaches the desired ponding depth, an outlet or standpipe with beehive grate will drain each bioretention facility to the next downstream catch basin or manhole. Where conditions preclude infiltration, these facilities will be designed with a waterproof liner and perforated underdrain to fully drain the facility within 72 hours.

Permeable Pavement

The bike path, several on-street parking lanes, and other hardscape plaza areas will feature permeable pavement. Rain falling on the pavement or running onto it from adjacent surfaces will infiltrate through the pavement and choker stone into a reservoir layer of open-graded crushed stone. Where conditions preclude infiltration, these facilities will be designed with a sand filter layer (for phosphorus reduction), a waterproof liner, and a perforated underdrain to fully drain the facility within 72 hours.



Street Trees with Sand-Based Structural Soil

Sand-Based Structural Soil (SBSS) is a non-propriety mix of stone and soil that supports the sidewalk while allowing tree roots to grow normally. A SBSS system, located adjacent to a tree wells, will include sidewalk set on a minimum of six inches of open graded crushed stone over a minimum of 30 inches of SBSS. Where appropriate for each site, the tree wells and SBSS will be paired with permeable pavement or diversion of gutter flow into a depressed tree well.

Rainwater Harvesting and Infiltration Chambers.

Roof runoff from several buildings will be routed through cisterns with overflow piping to direct the water to prefabricated stormwater chambers below the Village Green. This system will serve two functions: 1) storage for rainwater harvesting, and 2) infiltration for groundwater recharge, water quality treatment, and peak rate reduction.

1.2.4 Regulatory Compliance

Through the integrated green infrastructure approach described above, the Project will meet stormwater management regulatory requirements while providing broad environmental and community benefits. Regulatory requirements applicable to the Project stormwater management plan include:

- Final TMDL for Nutrients in the Upper/Middle Charles River, CN 272.0 (May 2011);
- Massachusetts Stormwater Management Standards; and
- City of Newton Requirements for On-Site Drainage.

In addition, the open channel section of South Meadow Brook on-site is regulated by the Massachusetts Wetlands Protection Act and is under the jurisdiction of the Newton Conservation Commission. Proposed work within jurisdictional resource area buffers will be documented in a Notice of Intent that will be prepared and filed in due course.

At the conceptual design level, the Project is focused on designing for four primary regulatory objectives:

- Protecting receiving waterbodies;
- Peak Rate Attenuation;

- Groundwater Recharge; and
- Water Quality: total suspended solids and phosphorus reduction.

The Project proposes to reduce impervious cover from 86% to 83%, which does not account for converting paved areas to permeable pavers. When counting the approximately one acre of proposed permeable pavers the impervious cover is reduced to 80%. Under proposed conditions, new pervious spaces will infiltrate rainwater where it falls, thereby increasing groundwater recharge and reducing peak discharge rates compared to existing conditions. In addition, all runoff from the site will be collected in or passed through one or more BMPs, as described above, designed specifically to recharge groundwater and/or remove TSS and phosphorus to levels prescribed by DEP, prior to connecting into the municipal drainage system in Oak Street and or to South Meadow Brook. All proposed Project stormwater outlets and conveyances will be designed with rip-rap energy dissipators, geofabric protection, and/or other vegetative cover to prevent erosion or scour that would transport sediments to wetlands or receiving waters.