

Stormwater Drainage Report

for
North Street Condominiums
Northampton, MA

April 14, 2009

Prepared by:



**The
Berkshire
Design
Group, Inc.**

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Prepared for:

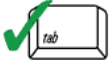
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Hadley, MA 01035



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 8²
- 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.

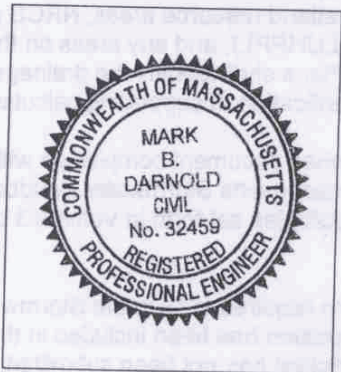
A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

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.

To the best of my knowledge

Registered Professional Engineer Block and Signature



Mark B. Darnold 4/14/09
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): _____

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 Field¹
- 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 **for its respective drainage area.**
- 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) **Not Applicable – Proposed project site is not expected to yield high potential pollutant loads.**

- 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 **Not Applicable – The project site does not discharge to a critical area.**

- 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: **site with only "Hydrologic Group C" Soils however all standards have been met.**
 - 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 **DRAFT** 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.

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- Figure 2** Post Development Drainage Area Map
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Appendices

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- Appendix B** Soil Test Pit Information
- Appendix C** TSS Removal Summary and Calculations
- Appendix D** Standard 3 Recharge Calculations
- Appendix E** Proposed Stormwater Management System Operation & Maintenance Plan
- Appendix F** Long Term Pollution Prevention Plan
- Appendix G** Stormwater Pollution Prevention and Erosion Control Plan

I. Introduction

The following report presents an analysis of the stormwater management system for the proposed development of 23 housing units located off of Northern Avenue in zoning district URB in Northampton, Massachusetts. The proposed development includes 23 new housing units and associated parking areas, driveways (approximately 1009 LF), and sidewalks, utilities, landscape features and stormwater management system. The total site area is approximately 6 acres of which approximately 2.48 acres will be disturbed by construction activities. The impervious area on site will increase by approximately 1.04 acres due to the new development and the stormwater management system has been designed to minimize proposed peak flows to reduce or match existing flows off the site. Mechanisms to reduce runoff and treat water quality include rain gardens, a proprietary treatment chamber, snow melt trenches, dry wells, deep sump hooded catch basins, and a detention basin.

II. Site Terrain and Soils

The project site is comprised of gradual sloping terrain, which generally drains toward the wetlands on the west part of the site.

The USDA Soil Survey of Hampshire County, Massachusetts, Central Part report classifies the site soils as (see attached soil map):

- **(Ra) Raynham Silt Loam**

Hydrologic Group: C
Flood Risk: None
Depth to Water Table: 0.5'-2.0'
Depth to Bedrock: >60"

- **(Au) Amostown-Windsor Silty Substratum**

Hydrologic Group: C
Flood Risk: None
Depth to Water Table: 1.5'-3.0'
Depth to Bedrock: >60"

- **(Ud) Udorthents Smooth**

Soil formed by cutting or filling developed area.
Reference pedon not given.
Assumed Hydrologic Group: C

A series of test pits were conducted on site to determine subsurface conditions. The purpose of the test pits was to evaluate the site for the existence of ledge, the ability of the site to support stormwater drainage components, and for groundwater information. In general, the test pits confirmed the USDA Soil Survey findings for the site as ground water is generally very high throughout the site, thereby reducing the potential areas where infiltration would be feasible. The test pit logs are attached in Appendix B.

III. Existing Conditions

The existing site includes one drainage area: E-1. The existing drainage area boundary is depicted on the Pre-Development Drainage Area Plan (Figure 1). The overall curve number (CN) in existing conditions is 74. The control point to determine peak flow in existing conditions is the stream located on the property line west of the site shown on Figure 1 as E-CP. The following is a brief description of the drainage area:

E-1

E-1 is approximately 7.84 acres in size (approximately 0.14 acres of impervious area) and contains existing houses, pavement, grass, wooded areas, and a large wetland area on the west part of the site. Runoff flows overland in a southwestern direction through the wetlands and to the stream located southwest of the site.

IV. Proposed Conditions

The stormwater management system in proposed conditions has been designed to treat and reduce runoff on site. The proposed site contains four drainage areas: P-1, P-2, P-3, and P-4 (See Figure 2) and the overall curve number (CN) in proposed conditions is 78. The control point to determine peak flow in proposed conditions is the stream located on the property line located west of the site shown on Figure 2 as P-CP. The following is a brief description of each drainage area:

P-1

P-1 is approximately 5.68 acres in size and contains the northwestern area of the site consisting of all of the wetland area, grass and wooded areas, and new roof and pavement, as well as new sidewalks and retaining walls. The drainage follows a similar pattern as in existing conditions. It flows overland in a southwestern direction through the wetlands and to the stream located southwest of the site. The runoff from the new roof areas located within P-1 is directed to dry wells where the water is infiltrated into the ground. These dry wells are designed to be very shallow (approximately one foot in depth) due to high groundwater throughout the site. The dry wells are designed with an overflow

outlet that allows roof water to sheet flow overland toward the wetlands as it does in existing conditions in larger storms.

P-2

P-2 is approximately 0.48 acres in size and is located in the central eastern portion of the site. It contains the front portion of the roof areas from units 15-20 as well as a portion of the new road and grassed areas. The runoff from this area is directed to a rain garden which has been sized to clean and remove pollutants from the stormwater as well as infiltrate it into the ground prior to discharging toward the wetlands.

P-3

P-3 is approximately 0.57 acres in size and is located in the eastern part of the site. It contains new pavement, sidewalks, grass, roof areas from units 1-4, and existing wooded areas. Runoff from this area is directed to a catch basin or stone/sod system which pretreats the stormwater prior to entering a rain garden sized to clean and remove pollutants from the stormwater as well as infiltrate it into the ground prior to discharging toward the wetlands.

P-4

P-4 is approximately 1.10 acres in size and is located in the southern part of the site. It contains the majority of the new pavement and the front roof areas from units 5-14 as well as detention basin and walkways. It also contains existing grass and wooded areas along the property line. Roof runoff is directed into dry wells to be infiltrated and the new paved areas are directed into deep sump hooded catch basins, which flow into a stormwater treatment chamber (STC 900) which removes pollutants prior to discharging into the detention basin located adjacent to unit 14.

V. Calculations and Design

Drainage calculations were performed on Hydrocad Stormwater Modeling System version 8.0 using Soil Conservation Service (SCS) TR-20 methodology. The SCS method is based on rainfall observations, which were used to develop the Intensity-Duration-Frequency relationship, or IDF curve. The mass curve is a dimensionless distribution of rainfall over time, which indicates the fraction of the rainfall event that occurs at a given time within a 24-hour precipitation event. This synthetic distribution develops peak rates for storms of varying duration and intensities. The SCS distribution provides a cumulative rainfall at any point in time and allows volume dependent routing runoff calculations to occur. These calculations are included in the appendices.

The watershed boundaries for calculation purposes are divided according to the proposed site grading and the natural limits of the drainage areas. The curve

numbers (CNs) and times of concentration for the existing and proposed subcatchment areas are based on the soil type and the existing and proposed cover conditions at the site. The soil hydrologic group assumed for the site is noted in Figure 3. Watershed subcatchment areas, runoff coefficients and watercourse slopes are based on survey information.

Calculations were performed for the 2-, 10-, and 100-year frequency storms under existing and proposed conditions. The results of the calculations are presented in Table 1 on the following page. Appendix A presents the Hydrocad calculations.

Flow Rates & Water Quantity

In the post development conditions the runoff from the proposed site will be routed to a detention basin located in the south area of the site. The proposed detention basin is composed of both surface and underground storage. There is a pipe and header system connected to the surface detention basin which provides additional storage. The basin will attenuate peak flows up to the 100-Year Storm in proposed conditions through the use of an outlet control structure. Stormwater will be discharged to the wetlands as runoff does in existing conditions. In addition to the detention basin, 8 infiltration systems are proposed (2 rain gardens and 6 dry wells) which will provide a significant reduction in peak flows (through exfiltration); however these systems were not included in the Hydrocad calculations in order to provide a more conservative runoff quantity calculation. Table 1 on the following page presents the comparison of flow rates and water quantity at both existing and proposed control points based solely on the detention basin’s attenuation capacity.

Table 1 Peak Flow and Volume Summary

Condition & Point of Analysis	2-Year Storm 3.00"		10-Year Storm 4.50"		100-Year Storm 6.50"	
	Peak Flow Rate(cfs)	Volume (acre-ft)	Peak Flow Rate(cfs)	Volume (acre-ft)	Peak Flow Rate(cfs)	Volume (acre-ft)
Existing – Control Pt. (E-CP)*	4.71	0.569	11.07	1.256	21.00	2.346
Proposed – Control Pt. (P-CP)*	4.71	0.705	11.06	1.446	20.85	2.586

**Names in parentheses refer to HydroCad model and calculations.*

VI. MADEP Stormwater Standards Compliance

The following section details how the project will meet DEP Stormwater Management Policy's ten stormwater management standards.

Standard 1 - Untreated Stormwater

The proposed stormwater system is designed to treat the new point source discharge prior to flowing to the resource area. All new outlets are outfitted with flared ends and erosion protection to prevent any erosion from occurring in the area. See Appendix C for TSS removal summary.

Standard 2 - Post-Development Peak Discharge Rates

The stormwater system is designed so that post-development peak discharge rates *are less than* pre-development peak discharge rates leaving the site. In order to reduce runoff rates in proposed conditions a detention basin with an outlet control structures is proposed. Note that although 8 infiltration systems are proposed, they are not included in the runoff calculations in order to maintain a more conservative peak discharge rate. Refer to Table 1 Peak Flow and Volume Summary and Appendix A for HydroCAD calculations.

Standard 3 - Recharge to Groundwater

The proposed site has designed to recharge groundwater to the maximum extent practicable in proposed conditions. The entire site consists of hydrologic group "C" soils and there is very high groundwater throughout most of the site (see Appendix B for test pit logs). The soil conditions caused limitations for infiltration on many areas of the site because the required 2 feet separation from groundwater could not be met. Wherever possible, infiltration has been proposed and approximately 66.4% of the new impervious area will be directed to an infiltration system. The rain garden located between units 19 and 20/21 has been designed to infiltrate the impervious areas located within subcatchment P-2, and the rain garden adjacent to unit 4 has been designed to infiltrate the impervious areas located within subcatchment P-3. In addition to the rain gardens, the new roof areas that are not discharging to a rain garden are connected to a shallow dry well system designed to recharge roof runoff into the ground. Due to restrictions of the site terrain and soil conditions, not all of the impervious area could be directed to an infiltration system, therefore all 8 of the infiltration systems are oversized to maximize the amount of infiltration on site. They are designed to hold at least twice the required recharge volume directed to it and still drawdown within 72 hours in order to fully comply with Standard 3 requirements (see Appendix D for recharge calculations).

Standard 4 – Water Quality

The proposed stormwater management system has been designed to remove the average annual Total Suspended Solids (TSS) load equal to or in excess of 80%

for the proposed site conditions (see Appendix C for calculations). There are 3 treatment chains proposed:

Treatment Train 1(total of 90% TSS removed)

The first treatment chain treats the roof areas and paved impervious areas within P-2. The runoff is directed through a pre-treatment system consisting of a stone diaphragm and grassed area which discharges into a rain garden which achieves a total annual TSS removal rate of approximately 90%. The water quality basin has been designed to hold a larger volume of water (706cf) than the water quality volume required (463cf) for the impervious area directed to it.

Treatment Train 2(total of 90% TSS removed)

The first treatment chain treats the roof areas and paved impervious areas within P-3. The runoff is directed through a pre-treatment system consisting of a stone diaphragm and grassed area which discharges into a rain garden which achieves a total annual TSS removal rate of approximately 90%. The water quality basin has been designed to hold a larger volume of water (317cf) than the water quality volume required (278cf) for the impervious area directed to it.

Treatment Train 3(total of 80% TSS removed)

The third treatment chain treats all of the roof areas from the new units. The roof areas are directed into a shallow dry well sized to hold the water quality volume and achieve a total annual TSS removal rate of approximately 80%. Although each of the roof areas are not hydraulically connected, they are considered to be within the same treatment chain as they all utilize the same BMP (dry well). See Appendix C for water quality and BMP sizing calculations.

Treatment Train 4(total of 83% TSS removed)

The second treatment chain treats the impervious areas from P-4. The runoff is directed into deep sump hooded catch basins (25% TSS removal) and then to a proprietary treatment chamber (*Stormceptor STC 900, 77% TSS removal) which achieves a total TSS removal rate of approximately 83%.

**Note: The stormwater treatment chamber has been sized based on MASTEP test evaluations. The attached table in appendix C displays MASTEP evaluated TSS removal rates based on the impervious area directed to the system.*

In addition to removal of TSS, a Long Term Pollution Prevention Plan has been created to maintain a clean site and ensure that all BMPs are functioning to their maximum potential. See Appendix F for Long Term Pollution Prevention Plan.

Standard 5 - Higher Potential Pollutant Loads

The proposed project is not expected to yield high potential pollutant loads.

Standard 6 - Protection of Critical Areas

The project site does not discharge to critical areas as defined in MA DEP Stormwater Policy Handbook.

Standard 7 - Redevelopment Projects

The redevelopment of previously developed site standard is not applicable for this project.

Standard 8 - Erosion/Sediment Control

Erosion and sediment controls have been incorporated into the project design to prevent erosion, control sediments, and stabilized exposed soils during construction and land disturbance. See Appendix G for Construction Period Pollution Prevention and Erosion Sedimentation Control.

Standard 9 - Operation/Maintenance Plan

An Operation and Maintenance Plan for the proposed project is included in Appendix E. It includes general controls for construction and long term maintenance of the stormwater management system.

Standard 10 – Prohibition of Illicit Discharges

No Illicit Discharge Compliance Statement is included with this report however one will be submitted prior to the discharge of any stormwater to post-construction BMPs.

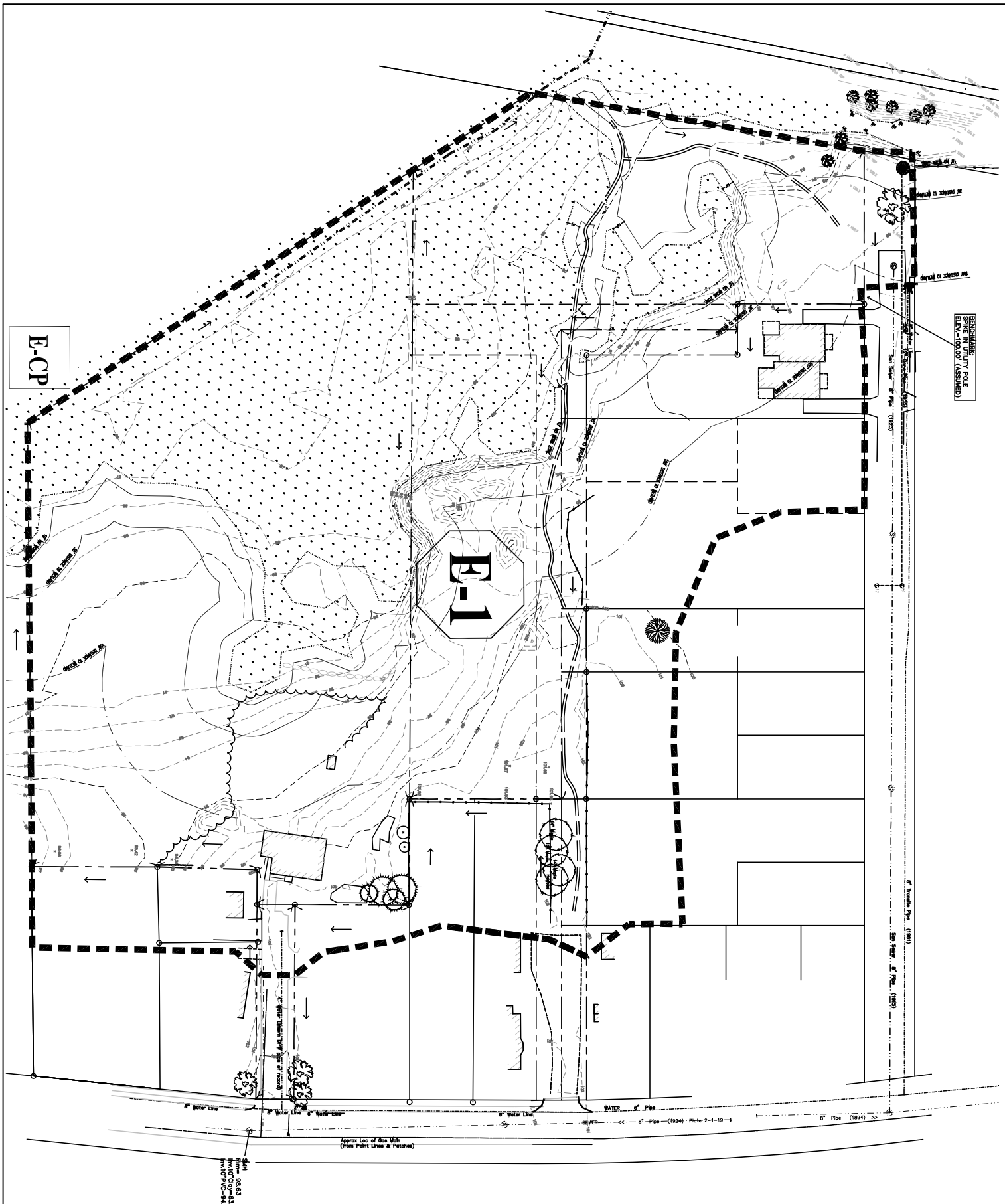
VII. Summary

The impervious area from existing to proposed conditions will increase by approximately 1.04 acres from the new roadway, walks, walls, and housing units. The proposed stormwater management system is designed to maintain or reduce the peak flow rates in proposed conditions for the 2-, 10-, and 100-year storm frequencies. Special care has been taken to treat runoff with a series of best management practices to ensure water quality and annual TSS removal rates equal to or in excess of 80%. These methods include deep sump hooded catch basins, rain gardens, dry wells, and a stormwater treatment chamber.

VIII. References

United States Department of Agriculture. 1998. Soil Survey of Hampshire County (Central Part), Massachusetts.

Figures

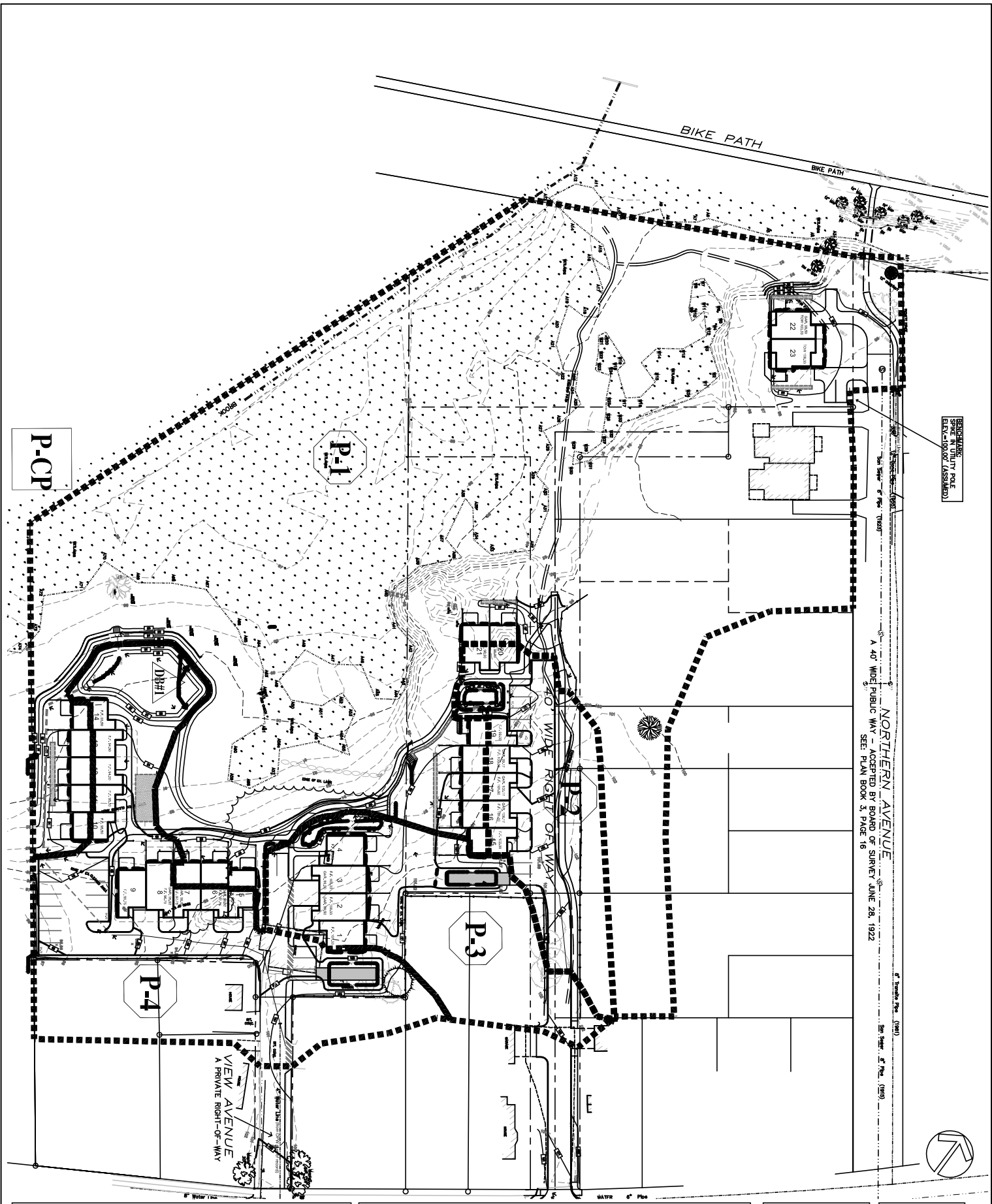



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Figure Title:
Pre-Development Drainage Area Map
North Street Condominiums
 NORTHAMPTON MASSACHUSETTS

Reference:
 Date: 04/14/09
 Scale: 1"=100'

Figure Number:
1



BENCHMARK:
SPIKE IN UTILITY POLE
ELEVATION ASSUMED

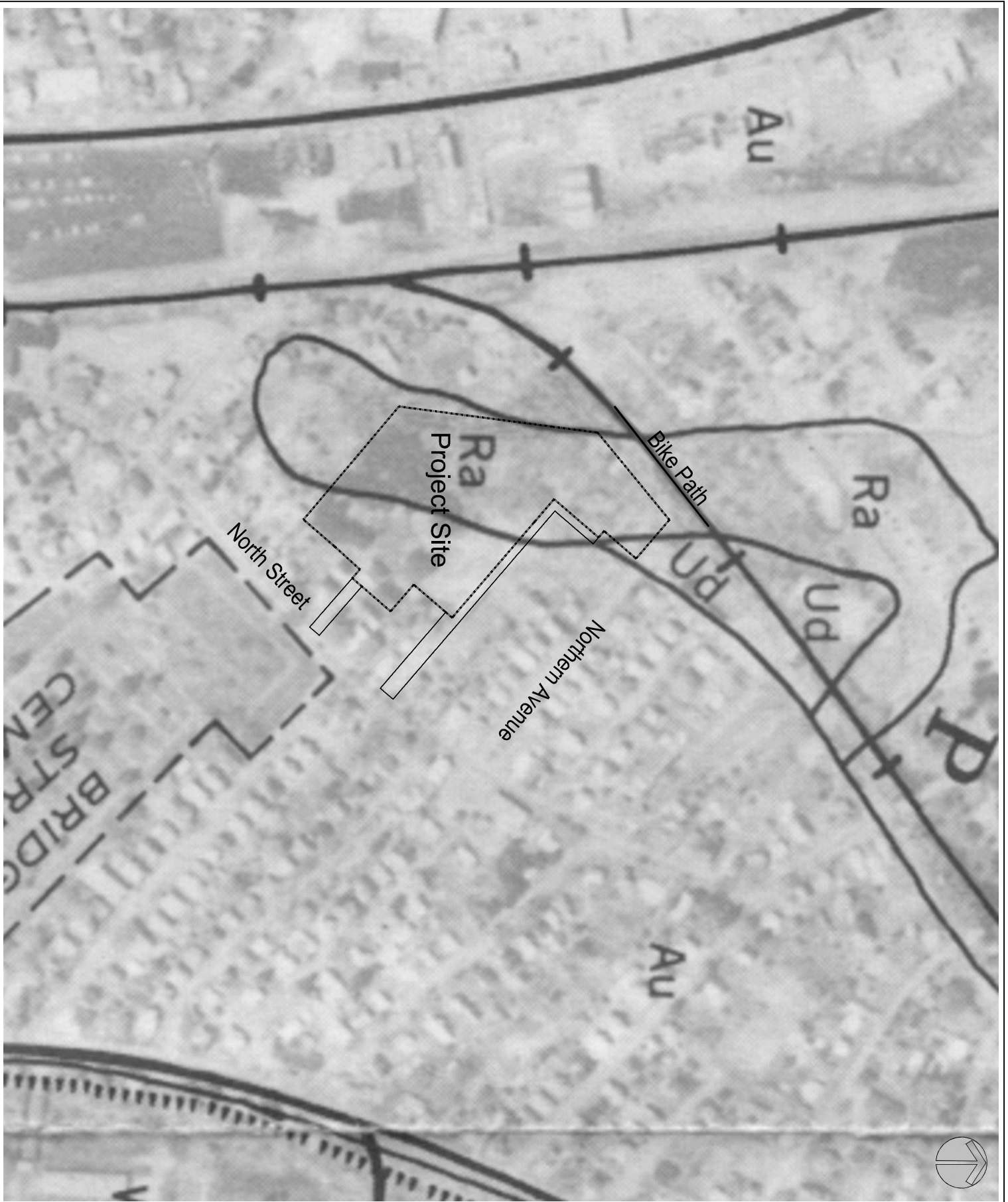
NORTHERN AVENUE
ACCEPTED BY BOARD OF SURVEY JUNE 28, 1922
A 40' WIDE PUBLIC WAY SEE PLAN BOOK 03, PAGE 16

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North Street Condominiums
NORTHAMPTON MASSACHUSETTS

Reference:
Date: 04/14/09
Scale: 1"=100'

Figure Number:
2



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Figure Title:

USDA Soils Map

North Street Condominiums

NORTHAMPTON

MASSACHUSETTS

Reference:

Date:
04/14/09

Scale:
1"=300'

Figure Number:

3