3.4 Surface Water Resources

3.4.1 Introduction

Increases in the peak rates of stormwater discharge following development of the Union Place project, as well as, erosion and sedimentation during construction, and post construction increases in pollutant loading in stormwater, could impact on- and off-site surface water resources and downstream properties. Furthermore, the project site is located in the New York City's East of Hudson public drinking water supply watershed, and stormwater from the project would enter the City's Amawalk and Muscoot Reservoirs following construction impacts on and off the property as set forth herein.

This Chapter of the Union Place Draft Environmental Impact Statement (DEIS) describes the existing characteristics of surface water resources and stormwater associated with the project site. Pursuant to the requirements of the Scoping Document, the Applicant has thoroughly assessed the potential impacts on surface water resources anticipated from development of the site and has proposed mitigation measures to offset those impacts on and off the property.

3.4.2 Existing Conditions

Existing On-Site Drainage Patterns and Watersheds

Existing drainage patterns on the project site are primarily dictated by on-site topography which consists of two hills separated by a valley. One hill is located on the northeastern portion of the project site. A second hill is located on the southwestern portion of the site. Surface water from these two hills drains to a north to south aligned valley between the hills. Approximately 39.4 acres of the ±50 acre New York State Department of Environmental Conservation (NYSDEC) Freshwater Wetland ML-11 is located on the project site along the valley floor. The majority of the watershed draining to Wetland ML-11 is located on the project site.

There is a high point in the valley, adjacent to the William Koehler Memorial Senior Center, which causes surface water in Wetland ML-11 to flow in two directions. Most of the surface water in this wetland drains northwest across the site, then is piped under Baldwin Place Road and Stillwater Road, and discharges into the Muscoot River, in the Amawalk Reservoir Watershed.

Surface water in the remainder of this wetland flows south into an existing, onsite, manmade water body that is approximately 1.5 acres. From there, surface water in this wetland continues south and enters a stormwater collection system (owned and maintained by the local municipality and the State), which conveys the water in a series of pipes under U.S. Route 6 to an open channel flowing south of Kennard Road. Ultimately this southerly flowing surface water reaches Lake Baldwin which also discharges into the Muscoot River in the Amawalk Reservoir Watershed.

Runoff that concentrates on the east side of the hill located in the northeastern corner of the project site is conveyed as surface water flow to a wetland on the west side of US Route 6. Runoff from impervious surfaces on neighboring properties including US Route 6 also likely contribute water to this wetland. Water flows from this wetland under US Route 6 via an existing culvert. While it is unclear where these piped flows are conveyed, it appears that they are discharged to a wetland located east of the existing residential area on the east side of US

Route 6. This off-site wetland forms the headwaters of the Plum Brook which ultimately drains into the Muscoot Reservoir Basin.

Refer to Figure 3.4-1, Pre-Development Drainage Areas Map, for the locations of pre-development stormwater drainage areas and surface water discharge points from the site.

Subbasins of the Croton Watershed

The Union Place site is located in two of New York City's Croton drinking water supply watersheds. The eastern half of the site, and most of the western half, are tributary to the Amawalk Reservoir. There is a small portion of the northeastern corner of the project site, however, that is located in the Muscoot Reservoir watershed. Both the Amawalk and Muscoot Reservoirs are located in New York City's East-of-Hudson (Croton) Watershed, for which Total Maximum Daily Loads (TMDLs) have been established for phosphorus (in the Amawalk and Muscoot Reservoirs) and for mercury (in the Amawalk Reservoir only). As documented in detail below, the burden for reducing current phosphorous loading to achieve the reservoir TMDLs lies with the Town of Carmel and its regional Municipal Separate Storm Sewer System (MS4) partners in the two watersheds. Also documented below, a program for achieving the required phosphorous reductions has been established in the NYSDEC's January 14, 2009, *Croton Watershed Phase II Phosphorous TMDL Implementation Plan* (TMDL Implementation Plan).

The NYSDEC has classified the Amawalk and Muscoot Reservoirs as Class "AA" water bodies. That classification, which indicates that the best uses of the water is as a source for drinking, culinary or food processing, primary and secondary contact recreation, and fishing, is the basis for the very high water quality standards that have been established to protect the reservoirs. The Amawalk and Muscoot Reservoirs are also classified as eutrophic (having high levels of mineral and organic nutrients that promote a proliferation of plant life, including algae, which reduces dissolved oxygen content), by the New York City Department of Environmental Protection (NYCDEP), based upon algae populations, bacteria levels, phosphorus concentrations, and water color[1].

Amawalk Reservoir Basin

Formed by the damming of the Muscoot River, the approximately three mile long Amawalk Reservoir holds 6.7 billion gallons of water at full capacity. The Amawalk watershed occupies 20 square miles (12,800 acres). The Applicant notes that the 239.9 acres of the Union Place site currently in the Amawalk Reservoir Watershed occupy approximately 1.9 percent of the reservoir's watershed.

Muscoot Reservoir Basin

The approximately eight mile long Muscoot Reservoir has a capacity of 4.9 billion gallons of water and receives water from all other Croton reservoirs with the exception of New Croton Reservoir. The Muscoot also receives surface water from its 76 square mile (48,640 acre) watershed. The 47.3 acres of the Union Place site currently in the Muscoot Reservoir Watershed occupy roughly one tenth of one percent of the reservoir's watershed.

[1] New York City Department of Environmental Protection. 2002. 2001 Watershed Water Quality Annual Report.

Existing Stormwater Discharge Points and Runoff Quantity

There are currently seven drainage areas on the project site. Stormwater from these areas discharges to seven locations or design points. These design points represent locations on existing surface water conveyance systems and were selected for the analysis of stormwater discussed in detail below. Table 3.4-1 identifies the location of each existing design point, the reservoir watershed in which they are located and the approximate acreage of the existing drainage areas that are tributary to the design points. The boundaries of the existing drainage areas contributing to the seven design points are shown on Figure 3.4-1, Pre-Development Drainage Areas Map.

Table 3.4-1
Summary of Existing Design Points

Design Point	Location	New York City Reservoir Watershed	Approximate Pre-development Tributary Area (acres)*
DP-1	Existing culvert crossing under Baldwin Place Road.	Amawalk Reservoir	174.6
DP-2	Existing culvert crossing under Baldwin Place Road.		18.7
DP-3	Existing culvert crossing under Baldwin Place Road.		10.6
DP-4	Existing culvert crossing under Baldwin Place Road.		3.1
DP-5	Point on existing open channel conveyance system south of Kennard Road.		59.8
DP-6	Existing culvert crossing at Lupi Court	Muscoot Reservoir	51.9
DP-7	Existing culvert crossing under U.S. Route 6.		23.5

Source: INSITE Engineering, Surveying & Landscape Architecture, PC., 2009.
* Approximate Pre-development Tributary Area includes acreage on-site and off-site.
Note: Refer to Figure 3.4-1, Pre Development Drainage Areas Map for the delineated pre-construction drainage areas contributing to Design Points 1 through 7.

Existing Stormwater Runoff Quantity

Pre-development peak stormwater discharge rates at Design Points 1 through 7 were analyzed using the "HydroCAD Stormwater Modeling System," by HydroCAD Software Solutions LLC of

Tamworth, New Hampshire. HydroCAD is a computer aided design program for modeling the hydrology and hydraulics of stormwater runoff. It is based primarily on hydrology techniques developed by the United States Department of Agriculture, Soil Conservation Service (USDA, SCS) Technical Release 20 (TR-20) combined with standard hydraulic calculations.

The TR-20 is a computer based program that allows for a hydraulic analysis of a watershed under its present conditions and is used in more complex watersheds, such as the Amawalk and Muscoot. This program was used to develop runoff hydrographs for the Union Place project. A hydrograph is defined by the US Department of Agriculture, Soil Conservation Services as a graph of stage, discharge, velocity or other properties of water flow with respect to time.[2]

Estimates of existing runoff quantity (peak discharge rates) generated by the 2-year, 10-year, 25-year and 100-year (24 hour) design storms were made using the noted methodology, which is accepted by the NYSDEC and NYCDEP. These estimates are included in the Preliminary Stormwater Pollution Prevention Plan (SWPPP) prepared for the Union Place project (Appendix E of this DEIS) and are summarized in Table 3.4-2, below. The estimates are based, in part, upon regional precipitation values obtained from the Northeast Regional Climate Center.

Table 3.4-2
Existing Peak Stormwater Discharge Summary
24-Hour Design Storms
(Cubic Feet per Second (cfs))

Design Point	2-Year	10-Year	25-Year	100-Year
DP-1	106.23	226.05	299.78	516.03
DP-2	17.05	33.49	43.34	71.61
DP-3	8.97	19.23	25.51	43.92
DP-4	2.94	6.48	8.66	15.06
DP-5	64.20	119.76	152.56	245.12
DP-6	64.50	116.55	146.78	232.07
DP-7	20.97	40.47	52.07	85.23

Source: INSITE Engineering, Surveying and Landscape Architecture, PC, 2010

Existing Stormwater Runoff Quality

There are no stormwater management facilities currently on the project site and no data is available concerning the quality of stormwater currently discharging from the site. The quality of runoff leaving the site during storm events, at present, is dictated primarily by existing on-site land uses, soils, vegetation, and any erosion on the site.

*Total Phosphorus - Total Maximum Daily Load*s

Phosphorus is typically identified as the limiting nutrient in freshwater ecosystems. Elevated levels of phosphorus may lead to mesotrophic (medium plant productivity, relatively balanced nutrient levels), or eutrophic (high plant productivity due to high nutrient levels), conditions which accelerate the growth of aquatic vegetation in the form of both rooted plants and suspended, or attached, algae species. Eutrophic conditions may result in die off of algal and plant blooms, resulting in high bacterial activity and periods of low oxygen.

[2] US Department of Agriculture, Soil Conservation Services, Hydrology Training Series, Module 107, Hydrographs. September 1989.

The Amawalk and Muscoot Reservoir Basins, into which stormwater from the site now discharges, and would discharge following construction, are classified as phosphorus restricted by NYCDEP. A phosphorus-restricted basin is defined in the Watershed Rules and Regulations as a "drainage basin of a reservoir or controlled lake in which the total phosphorous load [the amount of phosphorous entering a reservoir from point and nonpoint sources in the reservoir's watershed] results in phosphorus concentrations above those established in the *NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1, Ambient Water Quality and Guidance Values, October 24, 1993*."

Under the provisions of the United States Clean Water Act, the NYSDEC has established specific Phase II TMDL limitations for phosphorus inputs into the Amawalk and Muscoot Reservoirs. A phosphorous TMDL is a reservoir's loading capacity for total phosphorous and is considered to be a watershed budget for the pollutant. A TMDL represents the amount of total phosphorous (from point and nonpoint sources) that can be assimilated by a reservoir without causing impairment or exceeding water quality standards, including the New York State TOGS guidance values. TMDLs also represent the sum of the point source wasteload allocations (WLAs), or the amount of phosphorous being discharged to the reservoir from point sources such as wastewater treatment plants, the nonpoint source load allocations (LA), or the amount of phosphorous entering the reservoir from nonpoint sources, including urban stormwater runoff. A "margin of safety" of 10 percent is also added to the TMDL to account for uncertainty in the loading calculations.

NYSDEC's *Phase II Phosphorus Total Maximum Daily Loads for the Reservoirs in the New York City Water Supply Watershed*, June 2000 (the Phase II Report)[3], includes the following information concerning the Phase II TMDLs, and phosphorus, in the Amawalk and Muscoot Reservoirs.

Phosphorous in the Amawalk Reservoir

The Phase II Report indicates that the existing 1,329 kg/yr phosphorus TMDL established for the Amawalk Reservoir (the amount of daily phosphorous input that the reservoir can assimilate) is based upon a 20 microgram per liter (ug/l) value (the recommended concentration of phosphorus in the reservoir). This load limit includes a 10 percent margin of safety or 133 kg/yr. As such, 1,196 kg/yr is available for allocation between the contributing point sources and nonpoint sources. At a point source WLA of 390 kg/yr, the volume set for the identified point sources in the Amawalk watershed, the nonpoint source LA is 806 kg/yr.

The Phase II Report further indicates that the Amawalk Reservoir TMDL is being exceeded and that water quality in the reservoir is impaired as a consequence of existing phosphorous inputs into the reservoir from its watershed. The current load (phosphorous input from point and nonpoint sources) of 1,318 kg/yr to the reservoir from its watershed is greater than the load that can be assimilated by 122 kg/yr. Even after reductions in point source loading in the reservoir watershed due to the application of the Watershed Rules and Regulations, the available load (additional input of phosphorous that can be assimilated) would be exceeded by 122 kg/yr.

Finally, the Phase II Report notes that a four year average of 1992-1996 annual geometric means of reservoir data indicates a phosphorus concentration of 19.6 ug/l can be expected as a growing season average.

[3] NYSDEC, Division of Water, Bureau of Watershed Management. June 2000. Phase II Phosphorous Total Maximum Daily Loads for Reservoirs in the New York City Water Supply Watershed (Delaware, Dutchess, Greene, Putnam, Schoharie, Sullivan, Ulster, and Westchester Counties).

Phosphorous in the Muscoot Reservoir

The Phase II Report indicates that the existing 9,397 kg/yr phosphorus TMDL established for the Muscoot Reservoir is based upon the 20 ug/l value and includes a margin of safety of 10 percent or 940 kg/yr. As such, 8,457 kg/yr of total phosphorus is available for allocation between the contributing point sources and nonpoint sources. At a point source WLA of 1,405 kg/yr, the volume set for the identified point source in the Muscoot watershed, the nonpoint source LA is then 7,052 kg/yr.

The Phase II Report further indicates that the Muscoot Reservoir TMDL is being exceeded and that water quality in the reservoir is impaired as a consequence of existing phosphorous inputs into the reservoir from its watershed. The current phosphorous load of 11,560 kg/yr to the reservoir from its watershed is greater than the load that can be assimilated by 2,058 kg/yr. Even after reductions in point source loading in the reservoir watershed due to the application of the Watershed Rules and Regulations, the available load would be exceeded by 2,058 kg/yr.

Finally, the Phase II Report notes that a four year average of 1992-1996 annual geometric means of reservoir data indicates a phosphorus concentration of 24.6 ug/l can be expected as a growing season average.

Total Nitrogen

Nitrogen is often cited as the second limiting nutrient for plant growth in aquatic systems. Dissolved nitrogen primarily occurs as ammonia (NH_3), nitrite (NO_2), or nitrate (NO_3) compounds, and both bacterial and plant metabolic processes act to convert these three classes of nitrogen compounds into biomass or atmospheric releases of nitrogen.

Total Suspended Solids

Suspended solids measurements, or TSS, in surface water indicates the amount of particulate matter carried in the water column, and also serves as an indirect indication of levels of coloring and turbidity. Increased levels of TSS may result in brown or green colored water, leading to reduced light penetration, increased sediments, and rooted plant growth within a water body. Additionally, the public may perceive water bodies with higher levels of TSS as having impaired water quality.

Biological Oxygen Demand

In aquatic systems, most organic constituents may be degraded over time by bacterial metabolism. The amount of oxygen used in the metabolism of biodegradable organics is termed Biological Oxygen Demand (BOD). Therefore, the BOD loads measured in water samples are commonly used as an indirect indicator of the total organic load carried in water.

To satisfy the requirements of New York City's May 1, 1997, Final Rules and Regulations for the Protection from Contamination, Degradation, and Pollution of the New York City Water Supply and its Sources (the Watershed Rules and Regulations), and to aid in the assessment of potential impacts on surface water resources, a mathematical pollutant loading analysis was performed. This analysis is included in the SWPPP and summarized in Table 3.4-3 below. The analysis estimated pre-development loads of Total Nitrogen (TN), Total Phosphorous (TP),

Total Suspended Solids (TSS), and Biological Oxygen Demand (BOD). These constituents, and other pollutants of concern in stormwater, are discussed below.

Table 3.4-3
Annual Pollutant Load Summary (lbs/yr)

Design Point	BOD	TP	TN	TSS
	Pre	Pre	Pre	Pre
DP-1	3,172.8	44.2	483.4	25580.1
DP-2	503	39.69	189.9	3714.5
DP-3	240.4	6.6	47.2	1941.0
DP-4	26.7	0.3	5.9	283.0
DP-5	3,994.7	57.8	333.3	20394.9
DP-6	3,934.6	18.6	162.9	19089.0
DP-7	1,172.4	5.9	40.1	6374.7

Source: INSITE Engineering, Surveying and Landscape Architecture, P.C., 2010
* Range of expected loadings based on pollutant removal efficiencies cited in NYSDEC publications.

Presence of NYCDEP Regulated Watercourses

Three watercourses, two of which are within NYSDEC Wetland ML-11, are present on the project site. In accordance with Section 18-23(b)(5) of the Watershed Rules and Regulations, NYCDEP staff has visited the site and verified the locations and extent of these three watercourses. Refer to Figure 3.4-1 for the preliminary locations of these watercourses on the project site. A map is in preparation for submission to the DEP for final validation and signature. Additionally, refer to section 3.2 for a detailed description of the aforementioned watercourses.

Federal Emergency Management Agency Flood Plain Mapping

There are no flood plains, or flood hazard areas, depicted on the Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map (FIRM) of the project site. Refer to Figure 3.4-2 for a copy of FEMA FIRM of the project site.

Relationship of the Project Site to all Applicable Subbasins

As indicated in Table 3.4-1, 239.9 acres of the project site are currently located in the Amawalk Reservoir Watershed and 47.3 acres are currently in the Muscoot Reservoir Watershed. Table 3.4-1 also identifies the seven design points to which runoff from the drainage areas on-site discharge, the reservoir watershed in which each design point and its tributary area are located, and the acreage of each subbasin draining to the discharge points.

3.4.3 Potential Impacts

The Proposed Action involves clearing and grading of portions of the site, and the construction of residential and non-residential building space, and associated infrastructure, including roads, parking areas, landscaped areas, and stormwater management and wastewater treatment facilities. Table 3.4-4 indicates the extent and types of existing and proposed land coverage on the project site as utilized in the calculations provided in the project SWPPP, and that vegetative cover on more than 205 acres of the approximately 287 acre site would be preserved, or restored, following development of the site. It is noted that these areas may differ from those

presented as habitat coverages in Section 3.3, which are based predominantly on vegetative cover types.

Proposed modifications of the site would expose soil to possible erosion and sedimentation. The proposed modifications would also increase on-site imperviousness, which could change the volume and rate of runoff, the amount of suspended and dissolved substances entering on- and off-site surface waters, and result in flooding and bed and bank erosion in receiving watercourses. In some cases, changes in land cover, including increased impervious area, in existing drainage basins can also change the distribution of surface water in a given basin and affect local water bodies and wetlands. Table 3.4-4 presents post construction changes in the existing drainage areas. The project SWPPP specifies measures that would reduce post-development changes in runoff characteristics and the adverse impacts on surface waters that could result from those changes.

Table 3.4-4
Summary of Pre- and Post-Construction Land Coverage (acres)

	Pre-Development	**Post-Development**
Impervious	4.5	79.4
Dirt Road	5.9	2.2
Grass	5.7	32.6
Row Crop	25.7	0.0
Meadow	40.1	63.6
Woods	199.3	107
Pervious Pavement	0	2.4
Total	**287.2**	**287.2**

Source: INSITE Engineering, Surveying and Landscape Architecture, P.C., 2010

Post-Development Runoff Quantity and Quality

Runoff Quantity

Following construction, stormwater from the drainage areas on the site would be collected and conveyed to treatment facilities, constructed in series, that would control post-development increases in the peak rates of discharge. The conveyance system will consist of drain inlets, catch basins, HDPE pipe, and open channel swales which will discharge to Micropool Extended Detention Basins and Pocket Wetlands. The commercial segment of the proposed development will have stormwater collected in a closed storm sewer system and conveyed to twelve stormwater management basins located along the perimeter of the commercial side of the property. In the residential portion of the proposed development, stormwater will be collected in an open and closed stormwater sewer system and conveyed to ten stormwater management basins located adjacent the on-site wetland and along the residential access to US Route 6. These stormwater management facilities will form combinations of Design 2 Extended Detention Basins, Design 3 Extended Detention Basins, and Design 14 – low gradient grass swales with stone check dams as treatment trains.

After treatment by these facilities, including pollutant fallout and biological uptake, stormwater from the site (residential and commercial segments) would discharge at the seven design points shown on Figure 3.4-3 (Post Development Drainage Areas Map). As summarized in Table 3.4-5, the proposed micro pool extended detention basins, and stormwater wetlands, would reduce post construction increases in peak rates of discharge to below existing peak rates at

each design point. Accordingly, potential adverse impacts on surface water resources from post construction increases in runoff quantity are not anticipated.

Table 3.4-5
Pre- and Post-Construction Peak Stormwater Discharge Rate Summary
(Cubic Feet per Second (cfs))

DesignPoint	2-Year		10-Year (Overbank Flood Control)		25-Year		100-Year (Extreme Flood Control)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
DP-1	106.23	70.09	226.05	181.68	299.78	260.71	516.03	502.99
DP-2	17.06	5.85	33.49	22.42	43.34	34.39	71.61	59.14
DP-3	8.97	3.43	19.23	7.3	25.51	9.68	43.92	16.58
DP-4	2.94	1.56	6.48	3.24	8.66	4.26	15.06	7.22
DP-5	64.20	45.12	119.76	88.32	152.56	115.37	245.12	237.64
DP-6	64.5	54.45	116.55	90.15	146.78	110.29	232.07	171.4
DP-7	20.97	13.86	40.47	24.3	52.07	30.3	85.23	47.04

Source: Insite Engineering, Surveying and Landscape Architecture, P.C., 2009

New York State stormwater sizing criteria, found in the New York State Stormwater Management Design Manual (the Manual), requires the control of the peak discharge from the 10-year storm to provide Overbank Flood (Qp) control. The primary purpose of the Qp sizing criterion is to prevent increases in the frequency and magnitude of out-of-bank flooding generated by urban development. As seen in the table, the proposed stormwater treatment practices for Union Place have been sized to satisfy this criteria and accomplish the required reduction.

The criteria for Extreme Flood Control (Qf) in the Manual requires the control of the peak discharge from the 100-year storm to pre-development rates, and the safe passage of the flows generated by a 100-year storm event. The intent of the Qf is to prevent the increased risk of flood damage from large storm events, to maintain the boundaries of any pre-development 100-year floodplains, and to protect the physical integrity of any stormwater management practices. As evidenced in Table 3.4-5, the proposed stormwater treatment facility designs for Union Place satisfy the Qf sizing criteria.

To meet NYSDEC Stream Channel Protection requirements, 24-hour center of mass detention time of the 1-year, 24-hour storm event has also been provided in the proposed stormwater treatment facilities.

Runoff Quality

The proposed land clearing and disturbance activities, as well as, construction of impervious roads, parking areas, and other impervious and landscaped areas on the project site has the potential to alter runoff quality and impact receiving surface water resources. Potential impacts on surface water quality on and off the project site that might be expected from the Proposed Action are associated with sedimentation during construction and post-development increases in pollutant loading in stormwater. These potential impacts will be mitigated through the implementation of temporary, and permanent, structural and non-structural stormwater controls that are specified in the Union Place SWPPP.

The Union Place SWPPP has been prepared in accordance with the Watershed Rules and Regulations and with New York State Pollutant Discharge Elimination System General Permit for Stormwter Discharges From Construction Activities (GP-0-10-001). To gain coverage under GP-0-10-001, and comply with the Watershed Rules and Regulations, the erosion control and stormwater management facilities specified in the SWPPP for the proposed development have been designed to comply with all conditions of GP-0-10-001.

With regard to NYCDEP requirements, Section 18-39 of the Rules and Regulations for the Protection from Contamination, Degradation, and Pollution of the New York City Water Supply and its Sources (Rules and Regulations), requires a SWPPP Approval for this project. This initial project SWPPP was developed prior to the April 4, 2010 amendment of the Rules and Regulations. The Union Place SWPPP generally conforms to the amended regulations in that multiple stormwater management practices have been placed in series, for subcatchments with an impervious cover greater than 20%. As the project is refined, the SWPPP will be updated to remain in compliance with the Rules and Regulations.

As documented below, GP-0-10-001 requires that the water quality volume (WQv) be treated to remove post-construction increases in pollutants. By meeting the WQv requirements for the proposed project with micro pool extended detention ponds and stormwater wetlands that are part of the project SWPPP, the NYSDEC water quality objectives, including the enhanced phosphorous treatment specified in Chapter 10 of the Manual, are met.

The Manual was prepared, in part, to provide standards for the selection and design of stormwater management practices (SMPs) to be included in project specific SWPPPs to protect the waters of the State of New York from the impacts of urban stormwater runoff. The Manual establishes specifications and uniform criteria for the SMPs that are to be part of a SWPPP.
The primary SMPs designed by the project engineer, and included in the preliminary Union Place SWPPP, (micro pool extended detention basins and stormwater wetlands) were selected from the Manual and meet State WQv requirements. Since the Union Place project is located in the New York City East of Hudson Watershed, compliance with Chapter 10 (Enhanced Phosphorus Removal Standards) is required. In accordance with Chapter 10, the proposed practices were designed to capture and treat the water quality volume, which is equivalent to the volume of runoff generated by the one year 24 hour storm event.. By treating the one year 24 hour storm event volume, impacts associated with post-development increases in pollutant loading would be satisfactorily offset. In addition, outlets are proposed in the basins to discharge the 2-year, 24-hour storm over a minimum of 24 hours as required by the Watershed Rules and Regulations.

The qualitative stormwater analysis performed during development of the preliminary Union Place SWPPP was based, in part, upon existing and proposed on-site topography, soils and groundcover, and included an assessment of pre-construction and post-construction pollutant loads in stormwater discharges at Design Points 1 through 7 as shown on Figure 3.4-3 (Post-Development Drainage Areas). Table 3.4-6 provides the calculated pre-development and post-development loads for the parameters set forth in the Watershed Rules and Regulations for comparison. As seen in the table, in most cases, for the individual design points, the calculated range of post-development pollutant loads are similar to, or below, pre-development loads. More importantly these loads can be attenuated to levels below existing loading rates for the overall site with the implementation of proper treatment practices. Accordingly, post-construction changes in pollutant loading do not represent the potential to significantly impact the receiving surface water resources.

Table 3.4-6
Pre- and Post-Construction Annual Pollutant Load Summary (lbs/yr)

Design Point	BOD		TP		TN		TSS	
	Pre	Post*	Pre	Post*	Pre	Post*	Pre	Post*
DP-1	3,172.8	3,194.5 to 2,284.9	44.2	22.85 to 16.31	483.4	391.04 to 293.7	25,580.1	14,647.0 to 13,540.8
DP-2	503.0	956.2 to 699.4	39.59	4.24 to 3.12	189.9	43.3 to 35.8	3,741.5	2,257.6 to 1,115.8
DP-3	240.4	109.2	6.63	0.5	47.2	7.6	1,941.0	714.2
DP-4	26.7	33.3	0.31	0.2	5.9	1.1	283.0	151.0
DP-5	3,994.7	4,166.4 to 3,045.4	57.76	18.10 to 13.30	333.3	191.6 to 140.6	20,394.9	11,998.7 to 10,348.1
DP-6	3,934.6	4,214.5 to 3,929.8	18.58	21.12 to 18.40	162.9	211.0 to 170.1	19,089.0	17,385.8 to 16,727.1
DP-7	1,172.4	1,123.7	5.89	4.9	65.5	45.2	6,374.7	5,695.9
Overall	13,044.6	13,797.8 to 11,225.7	172.94	71.8 to 56.7	1,288.1	890.8 to 694.1	77,404.2	52,850.2 to 48.292.5

Source: Insite Engineering, Surveying and Landscape Architecture, P.C., 2010
* Range of expected loadings based on pollutant removal efficiencies cited in NYSDEC publications.

The conservative projections of post-construction loads of BOD, TN, TP, and TSS in stormwater represented in Table 3.4-6 are included in the preliminary SWPPP. Total estimated annual loads expressed in pounds per year (lbs/yr) for each of these pollutants were calculated for post-development discharges at Design Point 1 through Design Point 7.

It is important to note that, in keeping with NYCDEP policy, conservative loading coefficients were used for these calculations. Based upon the numerous and redundant stormwater management practices proposed as part of the preliminary Union Place SWPPP, noted previously, and the proposed use of Low Impact Development (LID) techniques (identified in Section 3.4.4 of this chapter) it is expected that pollutant removal efficiencies would be on the higher end of the range for each constituent and more reflective of the reduced loads as shown in the overall ranges of the table. Refer to the SWPPP for additional details pertaining to the proposed stormwater management facilities.

With respect to phosphorus, which, as documented below, is the pollutant of primary concern in New York City's Amawalk and Muscoot Reservoir watersheds, the proposed stormwater treatment facilities are expected to achieve better than the calculated range of post-construction loading as a result of treatment by the adjunct stormwater practices that have been incorporated into the proposed project design, but not considered in the calculation of post-construction phosphorous loading. These adjunct practices include catch basin/drain inlet sumps, permanent pools in the stormwater basins and low gradient grass swales with check dams.

Total Maximum Daily Load

The NYSDEC Phase II Report indicates that the Amawalk and Musccot Reservoirs phosphorous TMDLs are being exceeded as a consequence of existing point and nonpoint phosphorous inputs, and that significant reductions in point source loads, and the urban runoff loads, from the two reservoir watersheds would have to be achieved to meet the target load.

The conservative estimates of post construction phosphorous loads from the Union Place site would result in a modest increase for the Amawalk Reservoir and a slight decrease for the Muscoot Reservoir. Under conservative estimates, the total annual post-construction load of TP to the Amawalk Reservoir from DP-1 through DP-5, shown in Table 3.4-6, would increase by 6.7 lbs (3.0 kg). The total annual post-construction load of TP to the Muscoot Reservoir from DP-6 and DP-7 would decrease by 1.1 lbs (0.5 kg). By applying the higher SMP removal rates in the range, post-construction loads of phosphorous to the Amawalk Reservoir from DP-1 through DP-5 are expected to be reduced from existing loads by 5.5 lbs/yr (2.5 kg/yr), while post-construction loads of phosphorous to the Muscoot Reservoir from DP-6 and DP-7 are expected to be reduced from existing loads by 3.6 lbs/yr (1.6 kg/yr). The conservative estimate of post construction phosphorous load of 3.0 kg/yr to the Amawalk Reservoir represents only 0.2 percent of the total phosphorous load of 1,318 kg/yr currently entering the reservoir and only 0.7 percent of the 442 kg/yr urban runoff phosphorous load entering the reservoir. The conservative post construction phosphorous load of 1.6 kg/yr to the Muscoot Reservoir represents a 0.01 percent reduction in the total existing phosphorous load of 11,560 kg/yr currently entering the reservoir and a 0.6 percent reduction in the current 2,853 kg/yr urban runoff phosphorous load entering the reservoir.

The primary stormwater management practices specified in the SWPPP have been designed to treat the WQv in accordance with the *Enhanced Phosphorus Removal Standards* (Chapter 10) of the Manual, as required by NYSDEC GP-0-10-001. As outlined in Chapter 10, the treatment volume for the WQv is the runoff volume produced during the 1-year 24-hour design storm. NYCDEP standards for treatment of post-development stormwater quality are set forth in GP-93-06, which specifies that “ideally the quantity and quality of stormwater runoff that reaches surface waters during and after development would not be altered from pre-development conditions.” The multiple micro pool extended detention ponds and stormwater wetlands included in the SWPPP and previously noted meet the NYCDEP standards and will be landscaped to remove additional dissolved phosphorous. Refer to the SWPPP for additional details pertaining to the proposed stormwater management facilities.

A program for achieving phosphorous reductions has been established in the January 14, 2009, TMDL Implementation Plan which states that, for simplicity and ease of local government administration, the plan is largely structured to use existing programs to achieve phosphorous reductions. Applicable to the Amawalk and Muscoot Reservoirs, these programs include:

- Potential additional point source reductions;
- NYSDEC SPDES General Permit for Stormwater Discharges for Municipal Separate Stormwater Sewer Systems (MS4s) Permit (GP-0-10-002);
- State and regional source control and agricultural programs;
- US EPA Filtration Avoidance Determination Program;
- Putnam and Westchester County's Croton Plan;
- NYCDEP Croton Strategy;
- NYCDEP EOH Water Quality Investment Funds, including the Putnam County Septic Repair Program;

- New York State Non Point Source Programs; and
- NYSDEC – NYCDEP Coordinated Stormwater Enforcement Protocol.

The Union Place project is consistent with the TMDL Implementation Plan and applicable portions of the above-cited programs with the implementation of stormwater management facilities in series (i.e. treatment trains). Based on the effectiveness of the proposed stormwater management practices presented in the SWPPP in reducing post-construction increases in phosphorous, the Applicant believes that the project will not impact the Town of Carmel's ability to achieve the established TMDLs.

The Applicant notes that the specific goal of the TMDL Implementation Plan, which was prepared in accordance with the January 1997 New York City Watershed Memorandum of Agreement, and Section 303(d) of the Clean Water Act, is to reduce the phosphorus concentration in the eight reservoirs, including the Amawalk and Muscoot, listed in the Phase II Phosphorus TMDL Report as needing further phosphorus reduction than will be achieved by the wastewater treatment plant upgrades required by the Watershed Rules and Regulations.

Erosion and Sedimentation During Construction

Without adequate measures incorporated into the Proposed Action to offset potential impacts, the project would have the potential to increase the velocity of stormwater runoff from the site through land clearing and conversion of existing land forms into impervious surfaces and landscaped areas. If not controlled, these activities may lead to accelerated erosion and sedimentation during construction. Sedimentation of the receiving water resources could result in decreased light penetration and nutrient enrichment, increased turbidity, increased transport of pollutants that are adsorbed to the sediment particles, shielding of pathogens from disinfection, and clogging of gills and filters in aquatic organisms. To reduce stormwater-induced impacts from the project, it was essential that the Applicant design and construct adequate erosion and sediment control practices to mitigate these potential impacts. Accordingly, a Sediment and Erosion Control Plan, that includes detailed construction sequencing, has been included in the SWPPP.

As addressed in Section 3.4.4, below, the purpose of the Sediment and Erosion Control Plan is to minimize the erosion of disturbed soil and to prevent the migration of sediment into surface waters and off-site properties during construction and until the site has received final stabilization. The Sediment and Erosion Control Plan included with the SWPPP accomplishes that purpose through reductions in runoff velocities, limiting the area of disturbed soils at any one time, and rapid stabilization of disturbed soils.

Potential Impacts Anticipated from Pesticides, Fertilizers, and De-icing Materials

Pesticides and Fertilizers

Pesticides and fertilizers conveyed to surface water resources by stormwater, impacts the quality of those water resources. For example, introducing fertilizers in surface water resources can result in excessive nutrient levels which can lead to euthrophication and, in turn, mortality of aquatic species. Pesticides and fertilizers could be applied around the vegetated residential areas as well as the landscaped areas of the commercial segment of the property. Should those materials be applied incorrectly, potential impacts within the central wetland as well as the two reservoir systems could occur.

De-icing Materials

Deicing materials, particularly salt, can have a negative impact on receiving water quality if used in excess. In most cases, only sand would be used for traction following plowing of the parking areas and access road on the Union Place site. In some situations deicing materials would be used if weather conditions require it, but application would follow strict guidelines in accordance with the State of New York, Office of the Attorney General memo regarding Scientific Guidance on Lower-Phosphorus Roadway Deicers.

Groundwater Recharge Impacts

Refer to Chapter 3.5, Groundwater Resources, herein for a description of the existing groundwater recharge area and impacts to groundwater recharge resulting from the Proposed Action.

Project Related Drainage Patterns

The 239.9 acres of the Union Place site currently in the Amawalk Reservoir watershed occupy 0.36 percent of the reservoir's 12,800 acre watershed, while the 47.3 acres of the site currently in the Muscoot Reservoir watershed occupy 0.49 percent of that reservoir's 48,640 acre watershed. Tables 3.4-7 and 3.4-8 summarize existing and proposed characteristics in the seven drainage areas on the project site within the Amawalk and Muscoot Reservoir drainage basins.

As indicated in Table 3.4-7 the existing tributary area to the seven design points will not significantly change following development of the site. In addition, as seen in Table 3.4-8, post construction conditions in the 12,800 acre Amawalk Reservoir watershed, and in the 48,640 acre Muscoot Reservoir watershed, will remain similar to pre-development conditions. Based upon the limited disturbance proposed relative to the extent of the two reservoir watershed's, the post construction modifications to the seven existing drainage areas, and the measures specified in the SWPPP to maintain pre-development stormwater characteristics, no significant adverse impacts on project related drainage patterns or surface waters are anticipated.

Table 3.4-7
Summary of Existing and Post Construction Design Points

Design Point	Location	New York City Reservoir Watershed	Approximate Pre-development Tributary Area (acres)*	Approximate Post-development Tributary Area (acres)*
DP-1	Existing culvert crossing under Baldwin Place Road.	Amawalk Reservoir	174.6	180.5
DP-2	Existing culvert crossing under Baldwin Place Road.		18.7	11.9
DP-3	Existing culvert crossing under Baldwin Place Road.		10.6	2.4
DP-4	Existing culvert crossing under Baldwin Place Road.		3.1	1.2
DP-5	Point on existing open channel conveyance system south of Kennard Road.		59.8	72.1
DP-6	Existing culvert crossing at Lupi Court	Muscoot Reservoir	51.9	65.4
DP-7	Existing culvert crossing under U.S. Route 6.		23.5	11.1

Source: INSITE Engineering, Surveying and Landscape Architecture, 2009.
* Approximate Post-development Tributary Area includes acreage on-site and off-site.
Note: Refer to Figure 3.4-1, Pre Development Drainage Areas Map and Figure 3.4-2, Post Development Drainage Areas Map, for the delineated pre- and post-construction drainage areas contributing to Design Point 1 through 7.

Table 3.4-8 Pre- and Post-Development Drainage Areas (acres)					
On-site Areas Within Muscoot Reservoir Watershed Basin			**On-site Areas Within Amawalk Reservoir Watershed Basin**		
Ground Cover	**Pre-Development**	**Post-Development**	**Ground Cover**	**Pre-Development**	**Post-Development**
Impervious	0	11	Impervious	6	68.4
Dirt Road	2.3	0.5	Dirt Road	3.6	1.7
Grass	0.5	8.9	Grass	5.2	23.7
Row Crop	0.0	0.0	Row Crop	25.7	0.0
Meadow	7.2	19.1	Meadow	32.9	44.5
Woods	37.7	10.3	Woods	161.6	96.7
Total	**47.7**	**49.8**	**Total**	**235**	**237.4**
Source: INSITE Engineering, Surveying and Landscape Architecture, P.C., 2009					

Wetland Impacts

As discussed in detail in Section 3.2 of this DEIS, the central wetland corridor would be protected from direct impacts with two exceptions. Two road crossings of the wetland are proposed to provide access to the site from US Route 6. These crossings are needed to promote safe access, site continuity and improve traffic at the intersection of US Routes 6, NYS Route 118 and Baldwin Place Road (refer to section 3.7 for information on impacts and mitigation related to traffic). The movement of earth to construct these crossings and develop the site as proposed represents the potential for impacts on the wetland systems. Siltation of the on- and off-site wetlands could alter their hydrology, their ability to support wetland vegetation, and their existing plant communities. The Applicant has designed the project such that the crossings, which are necessary to promote access and continuity through the site, minimize impacts to wetlands while allowing for the construction of the proposed roads. Specifically, the northern wetland crossing is located at an existing farm road and the southern crossing is proposed as arches in order to maintain the north-south flow through the area and the hydrology to the existing pond. In addition, as discussed in detail in Section 3.4.4, Mitigation Measures, the Union Place proposal includes a comprehensive plan to control erosion and sedimentation and to mitigate these potential impacts.

A total of 0.3 acres of on-site wetlands will be directly impacted by the Union Place proposal as a result of the unavoidable crossings of the central wetland corridor in two locations. It is expected that permits will be required from the NYSDEC and the Army Corps of Engineers for these crossings. Refer to Chapter 3.2, Wetland and Watercourses for additional information on potential impacts to the on-site wetlands and watercourses and proposed mitigation to offset those impacts.

Other Potential Impacts

Potential Downstream Flooding and Flood Plain Impacts

The Applicant's review of relevant materials has revealed that no portion of the project site falls within any area designated by FEMA as a flood plain, or flood hazard area. Further, as summarized in Table 3.4-5, post-construction peak rates of stormwater would be reduced from existing peak rates at all design points. As such, the proposed project does not represent the potential for downstream impacts associated with the frequency and magnitude of out-of-bank flooding, with flood damage from large storm events, or with any flood plains.

Bed and Bank Erosion in Receiving Watercourses

Increases in the rate of stormwater discharge following development of the site could cause erosion of the bed and banks of the three on-site watercourses. To avoid these impacts, the stormwater management facilities for the Union Place project have been designed to reduce peak discharge rates of stormwater at each design point and to satisfy NYSDEC stream channel protection requirements by providing 24-hour detention of the center of mass of the 1-year, 24-hour storm event.

Potential Thermal Impacts

Potential thermal impacts on receiving waters, resulting from the elimination of shade trees along stream corridors, the addition of impervious surfaces, and prolonged exposure of stormwater in the management practices to sun light, are an important concern in watersheds where there are populations of cold water fish species. Increases in average annual water temperature may impact cold water fisheries.

As documented in Section 3.3, Terrestrial and Aquatic Ecology herein, there were no natural populations of cold water fishes observed on the Union Place project site, nor is there a significant amount of shade tree removal proposed in the vicinity of the existing watercourse as it runs generally in the center of the protected freshwater wetland.

Fecal Coliform Bacteria

Potential adverse impacts associated with fecal coliform bacteria (FCB) in stormwater runoff are not anticipated to result from the development of Union Place. The treatment of wastewater in a wastewater treatment plant approved by the NYSDEC and NYCDEP, would reduce the potential for increased coliform levels in runoff. Other possible FCB sources, including pets and waterfowl, are not anticipated to be significantly greater than the existing wildlife population on site and laws to manage pet waste will be posted and enforced. As such, these sources are not expected to increase FCB loading.

Increase in Other Pollutants Associated with Roadways and Parking Lots

Runoff from the proposed impervious roadways and parking lots may convey vehicle related contaminants to the proposed stormwater treatment practices from which they could be discharged to surface water resources. These contaminants include hydrocarbons, derived primarily from crankcase oil drippings, and uncombusted hydrocarbons in automobile exhaust. Runoff from parking lots and roadways may also contain detectable levels of heavy and trace metals such as lead, zinc, copper, chromium and nickel, which usually result from automobile and truck traffic. The stormwater practices proposed in the preliminary SWPPP have been designed in accordance with the Manual and are expected to assimilate these potential pollutants through pollutant fallout and biological uptake. The NYSDEC has determined that use of NYSDEC acceptable stormwater management practices, such as those proposed in the preliminary Union Place SWPPP, would achieve reductions in these other contaminants similar to the reductions in BOD, TP, TN and TSS documented above.

Required State and NYCDEP Permits

The following is a list of permits required from State Agencies and the NYCDEP and the agency from which the permits must be secured along with the regulated activity.

Wetlands Permit

- New York State Department of Environmental Conservation
  21 South Putt Corners Road
  New Paltz, New York 12561
  Activity: Crossing of wetland and adjacent area.

- Regulatory Branch, New York District
  US Army Corps of Engineers
  26 Federal Plaza
  New York, NY 10278-0090
  Activity: Crossing of wetland.

Stormwater Pollution Prevention Plan / Wastewater Treatment Plant

- New York City Department of Environmental Protection
  465 Columbus Avenue, Suite 350
  Valhalla, New York 10595
  Activity: Discharge of stormwater; discharge of treated effluent.

Stormwater Pollution Prevention Plan / GP-0-10-001 Coverage

- New York State Department of Environmental Conservation
  21 South Putt Corners Road
  New Paltz, New York 12561
  Activity: Discharge of stormwater; discharge of treated effluent.

Highway Work Permit

- New York State Department of Transportation, Region 8
  4 Burnett Boulevard
  Poughkeepsie, New York 12603
  Activity: Construction of site access and Route 6 intersection realignment.

Wastewater Treatment Plant / Well Permits

- New York State Department of Health
  Corning Tower
  Empire State Plaza,
  Albany, New York 12237
  Activity: Taking of potable water; discharge of treated effluent.

State Pollution Discharge Elimination System Wastewater Permit

- New York State Department of Environmental Conservation
  21 South Putt Corners Road
  New Paltz, New York 12561
  Activity: Discharge of treated effluent.

3.4.4 Mitigation Measures

Mitigation Based Upon Subbasins of Each Development Area

As noted previously and indicated in Table 3.4-7 and 3.4-8, only modest modifications are proposed in the Amawalk and Muscoot Reservoir watersheds. More significant alterations are proposed for the seven on-site drainage areas. Table 3.4-8 indicates the extent and types of existing and proposed land coverage on the project site and that vegetative cover on more than 204 acres of the approximately 287 acre site would be preserved during or restored following development of the site. As such, significant impacts on the existing subbasins are not anticipated and no specific mitigation measures are proposed.

Sediment and Erosion Control Plan

A Sediment and Erosion Control Plan, that specifies both structural, and non-structural, erosion and sediment control practices, has been included in the Preliminary SWPPP prepared for the Union Place project. The primary goal of the Sediment and Erosion Control Plan is to prevent erosion of disturbed soil and subsequent migration of sediment into surface water resources on, and off, the project site as these represents the greatest potential impacts associated with the project relative to soil disturbance. The plan will accomplish this goal, in part, through implementation of a construction sequence, by reducing erosive runoff velocities, limiting the extent of disturbed soil at any one time to five acres unless written permission is obtained from the NYSDEC or where in a regulated MS4 area, the MS4 municipality, and by rapid stabilization of disturbed soils.

These measures, which are specified in the SWPPP, and are designed to meet the requirements of the August 2005 New York State Standards and Specifications for Erosion and Sediment Control (Standards and Specifications), are intended to prevent erosion and contain sediment rather than to recover sediment once it has migrated. The project specific Sediment and Erosion Control Plan has been developed to manage erosion and sedimentation through the implementation of both temporary and permanent controls. Drawings SP-4.1 through SP-4.6 of the plan set show these controls.

Temporary Sediment and Erosion Controls

Temporary erosion and sediment controls specified in the SWPPP would be installed prior to any site disturbance and following a pre-construction conference with appropriate New York State, City, and municipal agency staff.

To mitigate construction related impacts on surface water resources associated with erosion and sedimentation, the SWPPP specifies controls based upon four fundamental principles:

- Diversion of clean water;
- Containment of sediment;
- Treatment of dirty water; and
- Stabilization of disturbed areas.

As set forth in the Sediment and Erosion Control Plan developed for the project, temporary erosion and sediment controls would be installed and maintained to reduce potential impacts on- and off-site surface water resources and properties. The owner will be responsible for

maintenance of these temporary controls. Generally, the following methods and materials would be used to control erosion and sedimentation from the project site:

Stabilized Construction Entrances: The stabilized construction entrance would be installed at the entrance to the site as shown on the plan. The purpose of the stabilized construction entrance is to prevent the migration of soil from the site.

Diversion Swales: Diversion of clean water would be accomplished with swales. This diverted water would be safely conveyed around the construction area as necessary and discharged to a stable outlet downstream of the disturbed areas. Sediment would be contained with the use of silt fence at the toe of all disturbed slopes and with temporary sediment traps. Disturbed areas would be permanently stabilized within 14 days of final grading to limit the length of time that the temporary facilities must be utilized.

Sediment Traps: The proposed stormwater management basins will also control sedimentation by acting as temporary sediment traps with optional dewatering devices during construction. Most stormwater runoff from disturbed areas will be directed to the sediment traps. The traps will be sized in accordance with the Standards and Specifications.

Silt Fence Barriers: Siltation barriers constructed of geosynthetic filter cloth would be installed at the toe of all disturbed slopes. The purpose of these barriers is to contain sediment at the source and prevent its transport by stormwater. The siltation barriers will also help reduce the rate of runoff by creating filters through which the stormwater must pass.

Construction Sequencing: In addition, a construction phasing and sequencing plan is included in the Union Place Sediment and Erosion Control Plan. The goal of the plan is to minimize the potential for soil erosion from areas exposed during construction and to prevent sediment from reaching the downgradient receiving waters, including the Amawalk and Muscoot Reservoirs through phasing of the construction. See the Construction Phasing section that follows for additional information on this plan.

Storm Drain Inlet Protection: For areas of the site that proposed the closed storm sewer system, inlet protections for the catch basins shall be provided to decrease the amount of sediment introduced into the system during construction.

Stone Check Dams: Where temporary diversions are constructed across significant slopes, check dams will be installed to decrease the erosive velocity of stormwater runoff.

As specified in the SWPPP, sediment and erosion control measures, such as silt fencing, would be installed following a pre-construction conference with appropriate agency staff, and prior to any construction activities. Refer to the SWPPP in Appendix E of this DEIS, and the accompanying Sediment and Erosion Control Plan sheets (SP-4.1 to SP-4.7), for details on and depiction's of the sediment and erosion control practices to be implemented and monitored.

All soil sediment and erosion control practices would be installed in accordance with GP-0-10-001, the Standards and Specifications, and Town of Carmel code. Prior to the commencement of any phase of this project that would result in the disturbance of soils, the sediment and erosion control measures would be placed in accordance with the specifications on the construction drawings and the SWPPP. These measures would be maintained in effective condition and left in place until permanent vegetative cover is established, or as directed by the Town Engineer or other agent of the NYCDEP or NYSDEC.

Permanent Sediment and Erosion Controls

Permanent sediment and erosion controls, including vegetated swales to direct stormwater runoff from steep slopes, measures to control and reduce stormwater runoff velocities such as stone check dams, and runoff volumes such as vegetated filter strips, and long term vegetative and structural stabilization measures, would be implemented in accordance with the construction phasing plan. Refer to the Detail Sheets included with the construction drawings appended to this DEIS and the descriptions of the controls identified in the preceding *Temporary Sediment and Erosion Controls section* for details on all the proposed sediment and erosion controls.

All of the permanent facilities are relatively maintenance free and only require periodic inspections. The owner will provide maintenance for all the permanent sediment and erosion control facilities. The temporary sediment traps shall be cleaned of all sediment and debris, excavated to their final elevations and dimensions, and stabilized with the vegetation as indicated on the plans transforming them to their permanent purpose of stormwater management. Rip rap aprons will be used to prevent erosion at the discharge end of all piped drainage systems. Runoff velocities will be reduced to levels that are non-erosive to the receiving water bodies through use of these aprons. Other than the areas to be occupied by buildings and paved surfaces, disturbed surfaces will be stabilized with vegetation. The vegetation will control stormwater runoff by preventing soil erosion, reducing runoff volume and velocities, and providing a filter medium. Permanent seeding would be undertaken in the spring from March 21st through May 20th and in late summer/fall from August 15th to October 15th.

Construction Phasing

In addition to the above noted measures, a construction phasing and sequencing plan is included in the preliminary Union Place Sediment and Erosion Control Plan component of the SWPPP, found in Appendix E, and on the accompanying project plans (Sheet SP-4.0, Overall Phasing Plan and SP-4.1 through SP-4.7 Sediment and Erosion Control Plan). The goal of the Sediment and Erosion Control Plan is to minimize the potential for soil erosion from areas exposed during construction and to prevent sediment from reaching the downgradient receiving waters, including the Amawalk and Muscoot Reservoirs through phasing of the construction. The phasing plan specifies nineteen individual construction phases for the Union Heights portion and twenty-four individual construction phases for the Union Place portion that would limit disturbed areas to five acres in accordance with GP-93-06 and GP-0-10-001.

The phases are proposed in sequence, from initial construction of temporary sediment traps to the completion of the proposed development. Each phase includes specific erosion controls and site stabilization measures that are to be installed. The tasks and construction activities that will take place during each of the nineteen Union Heights phases and the twenty-four Union Place phases are detailed in the Construction Sequencing Plan section of Chapter 3.1, Soils and Topography of this DEIS. The areal extent of each phase is depicted on Figure 3.4-4, Overall Phasing Plan and Sheet SP-4.0 of the appended drawing set. The phasing plan was prepared based upon existing and proposed site characteristics, including proposed cuts in rock and the presence of groundwater. Cut and fill in each phase was considered during the development of the Sediment and Erosion Control Plan, and will be balanced to the fullest extent possible.

Should groundwater be exposed during excavation on the site, dewatering of the excavation(s) will be conducted in accordance with the Standards and Specifications, which specifies 1) the

use of upstream and downstream berms (sandbags or inflatable dams) 2) that clean water from the upstream pool be pumped to the downstream pool, 3) that sediment laden water from the work area(s) will be discharged to a silt-trapping device, and 4) that a berm with one foot minimum freeboard be constructed upstream of the excavation.

The proposed sequencing also mitigates potential impacts on surface water resources by shortening the construction period and the length of time that any disturbed soils are subject to erosion. In addition, to further avoid impacts associated with erosion and sedimentation, construction phasing operations will follow site development protocols that provide for rock generated on the site to be placed, and redistributed, in areas where structural fill, subbase, riprap and crushed stone is required in any phase of construction for the development of the site.

In accordance with New York State and City, and Town of Carmel requirements, the area of disturbed soil will be limited. Stabilization would be provided no more than fourteen days after construction activities have temporarily or permanently ceased. The phased construction activities would further minimize the requirements for maintenance of temporary facilities during construction.

As specified in the SWPPP, during construction, areas of active disturbance would be limited and runoff from areas outside of disturbances would be diverted away from erodable soils. GP-0-10-001 requires that no more than five acres of soil be disturbed at any one time without prior written authorization from the Town of Carmel in its capacity as a MS4. At a minimum, the project would comply with the following requirements, as set forth in GP-0-10-001, to gain authorization to disturb greater than five acres of soil at any one time:

a. The owner, or operator, will engage a qualified inspector, as defined in GP-0-10-001, to conduct at least two site inspections in accordance with Part IV. B. of GP-0-10-001, every seven calendar days, for as long as greater than five acres of soil remain disturbed;

b. In areas where soil disturbance activity has been temporarily or permanently ceased, temporary and/or permanent soil stabilization measures shall be installed and/or implemented within seven days from the date the soil disturbance activity ceased. The soil stabilization measures selected shall be in conformance with the Standards and Specifications, August 2005, or the most current version.

c. The owner or operator will not disturb greater than five acres at any one time between November 1 and March 1 without prior written authorization from the Town of Carmel in its capacity as a MS4;

d. The owner or operator will prepare a phasing plan that defines maximum disturbed area in each phase and shows required cuts and fills;

e. Any additional site specific practices needed to protect water quality will be installed;

f. The requirements set forth in “a” through “e” above will be included in the Union Place SWPPP.

Potential impacts on down-gradient receiving surface water resources, including the Amawalk and Muscoot Reservoirs, will be minimized to the greatest extent practical through the implementation of and adherence to the proposed construction phasing and sequencing plan.

Proposed Monitoring and Maintenance of Erosion Controls

To ensure proper monitoring and maintenance of the erosion control practices, a Site Log Book would be kept onsite for the duration of the construction as required by GP-0-10-001. NYCDEP also requires that the maintenance program set forth in the Union Place SWPPP be implemented to ensure long term effectiveness of the stormwater management measures included in the SWPPP. Sediment and erosion control inspections will be conducted by a "qualified inspector" as required by GP-0-10-001. The Construction Site Log Book included with the Union Place SWPPP is an appendix taken from the Standards and Specifications.

The Applicant would be responsible for ensuring all sediment and erosion controls and stormwater management practices are properly installed and maintained throughout construction. Responsible parties for the implementation and maintenance of each of the erosion control measures would be specifically identified and documented prior to construction. A Certified Professional in Stormwater Quality/Erosion and Sediment Control, or other equally qualified professional, engaged by the Applicant, and approved by the Town of Carmel, will oversee implementation of the SWPPP, including its site specific Sediment and Erosion Control Plan component.

Stormwater Management Plan

In addition to the Sediment and Erosion Control Plan that will be implemented during construction, the Preliminary Union Place SWPPP includes a Stormwater Management Plan that specifies proposed measures as previously noted above, including an open and closed channel system, micro pool extended detention basins, pocket wetlands, and low gradient grass swales, that will convey and treat runoff from the site following construction. Construction details of the proposed stormwater management practices specified in the SWPPP are included on the Site Detail Sheets appended to this DEIS.

The proposed stormwater conveyance system would direct runoff to twenty-two (22) stormwater basins with 14 designated as micropool extended detention basins and pocket wetlands, and following treatment in these practices, to the seven design points from the site. Micropool extended detention ponds, defined as a pond that treats the majority of the water quality volume through extended detention and incorporates a micropool at the outlet of the pond to prevent sediment resuspension, can have smaller surficial area of permanent ponding than a regular extended detention pond. Collectively, these practices would achieve a significant reduction in post development increases in pollutant loads and achieve a post construction reduction of existing peak discharge rates at each of the seven design points. The stormwater management component of the preliminary Union Place SWPPP has been specifically designed to mitigate potential adverse impacts on surface water resources. The designs of the proposed stormwater management practices are based upon State stormwater routing and treatment practice design criteria. The design includes NYSDEC listed stormwater management practices (i.e. Micropool Extended Detention Basins (P-1), and W-4 Pocket Wetlands (W-4)) combined in series with adjunct stormwater practices to form treatment trains. Treatment trains (i.e. a micropool extended detention basin that flows into a second basin and then to a pocket wetland) allow for stormwater to flow though a series of practices providing a mechanism for greater pollutant removal. By supplementing the primary stormwater treatment practices with the Low Impact Design (LID) techniques described below, potential impacts on surface water resources resulting from changes in stormwater characteristics, during and following construction, would be further offset.

Specific attention has been paid to maintaining existing reservoir basin drainage divides, to attenuating post-development increases in peak stormwater discharge rates, and to meeting NYSDEC and NYCDEP stormwater quality treatment criteria. Treatment methods include only natural processes; no chemical treatment of the runoff is proposed or would be permitted.

Developing an effective SWPPP for the Union Place project guided the site plan development process. To mitigate potential adverse impacts, the Applicant first identified sensitive environmental resources, including wetlands, watercourses, and steep slopes (as addressed in detail in their respective chapters of this document) during the site planning process, and then sited critical infrastructure like the stormwater treatment facilities, and the access and egress roads, with consideration given to safety and traffic mitigation, to avoid those resources, to the maximum extent practicable, and ensure the viability of all infrastructure. Refer to the Wetland Impacts subsection in this chapter for additional information on wetlands impacts. The project's compliance with federal, New York State and City, and Town of Carmel, environmental and land use regulations was also an important consideration during development of the site development plans.

The treatment practices specified in the SWPPP will prevent post-construction increases in phosphorus and other pollutant loading in stormwater discharged from the developed site. Based upon accepted loading rates used in the stormwater analysis and the designs of the treatment measures specified in the SWPPP, such as micro pool extended detention ponds and pocket wetlands, while certain pollutant loads will increase at some of the design points, it is expected that pollutant removal rates will be at the high end of the range, and that any increases in post-construction pollutant loading will be controlled to the fullest extent attainable. The SWPPP prepared for the Union Place project describes pre-development and post-development runoff patterns, discharge rates, and pollutant loading. The SWPPP also describes how the proposed stormwater management system will satisfy the NYCDEP requirements.

In addition to satisfying State and Town treatment requirements, 24-hour plug flow detention of the 2 year, 24-hour storm has been provided in all of the proposed stormwater practices to meet the NYCDEP stormwater quality treatment requirements and to further offset potential adverse impacts. With regard to NYCDEP requirements, Section 18-39 of the Rules and Regulations for the Protection from Contamination, Degradation, and Pollution of the New York City Water Supply and its Sources (Rules and Regulations), requires a SWPPP Approval for this project. This initial project SWPPP was developed prior to the April 4, 2010 amendment of the Rules and Regulations. The Union Place SWPPP generally conforms to the amended regulations water quality volume treatment requirements, in that multiple stormwater management practices have been placed in series, for subcatchments with an impervious cover greater than 20 percent. NYCDEP standards for treatment of post construction stormwater quantity also requires the control of the peak discharge rates for the 10 and 100-year, 24-hour design storms, which would be provided in the proposed stormwater management practices. Mathematical analyses substantiating that the post-development water quality, and quantity comply with New York State and City regulations are included in the SWPPP.

The proposed stormwater practices, pollutant removal efficiencies, storage capacities, depths, detention times, and other necessary data required by New York State and New York City regulations are also provided in the SWPPP. The long term maintenance requirements for all stormwater management facilities are included in the SWPPP and summarized below.

Stormwater management techniques which will be used to limit potential increases in stormwater temperature include limiting detention time and exposure of runoff to the sun. Following construction, stormwater discharged from the Union Place site would be conveyed through sections of underground piping prior to discharge to the receiving waters. This would allow heat in the stormwater to dissipate. Further, the proposed stormwater management basins are sited to minimize the potential for solar heating of detained stormwater and are designed to limit detention times so that standing water absorbs less radiant heat. Establishing the proposed vegetation in the stormwater management basins would shade the stormwater and further reduce its exposure to the sun, thereby limiting the warming of the water and avoiding potential thermal impacts on downstream aquatic resources. Finally, the inclusion of porous pavement in place of impervious surface in specified areas of the project will reduce the volume of heated water conveyed into the stormwater treatment facilities.

Monitoring and Maintenance of Stormwater Controls

During Construction

Details associated with the implementation and maintenance of the proposed post construction stormwater facilities are shown on the project plans. The proposed construction phasing plan will guide the contractor in the installation of the erosion control and stormwater management measures. Each phase will be limited to a maximum of five acres of disturbance at any given time unless otherwise approved by NYSDEC and the Town of Carmel. The erosion control plan will include associated details and notes to aid the contractor in implementing the plan. Sediment and erosion control inspections are required to be conducted as necessary under coverage of the permit (minimum once a week) and an updated logbook and a copy of the SWPPP is required to be kept on site for the duration of the construction activities.

Initially the stormwater management basins and pocket wetlands will require regular monitoring and maintenance until the permanent vegetation is established. Vegetation would be inspected every 30 days and after every major storm event until established, after which inspections would take place on a quarterly basis and after every large storm event. Damaged areas would be immediately re-seeded and re-mulched. The floor of the basin will be planted with a seed mixture that contains plants tolerant of occasional flooding. The seed mixtures contain several plant species that vary slightly in their needs for survival.

It is expected that not all of the species will survive within each basin due to variations within each basin such as water, nutrients, and light. During the initial year of planting, the plants may require watering to germinate and establish. Note that several seedings may be required during the first year to completely establish vegetation within the basin. After the initial year, the basin does not need to be fertilized or watered. A natural selection process will occur over the first few years such that the species within the seed mixture most suitable to the conditions will survive.

Post Construction

The proposed stormwater management ponds and stormwater wetlands have been designed to reduce routine maintenance requirements. As noted above, initially the basins, which will serve as sediment traps during construction, would require regular monitoring and maintenance until the site has been stabilized.

The stormwater collection and conveyance systems are composed of concrete drain inlets with cast iron frames and grates, and plastic pipe. Minimal maintenance is typically required for

these facilities. The owner will be responsible for the maintenance of the permanent erosion control and stormwater facilities. Every spring, paved areas would be cleaned to remove accumulations of traction sand and all drain inlet sumps and stormwater management basin forebays would be cleaned. All pipes would also be checked for debris and blockages and cleaned as required. During the cleaning process, the drain inlets and pipes would be inspected for structural integrity and overall condition; and repairs and/or replacements made as required.

Following the establishment of vegetative cover in the stormwater practices, only limited maintenance is required. The basins and outlet structures would be inspected after major storm events and semi-annually. Those inspections would focus on the following:

- Evidence of clogging of outlet structure;
- Erosion of the stormwater flow path in the ponds;
- Subsidence, erosion, cracking or tree growth on embankments/berms;
- Condition of emergency spillways;
- Accumulation of sediment around the outlet structures;
- Adequacy of upstream/downstream channel erosion control measures;
- Erosion of the basin beds and banks;
- Sources of erosion in the contributory drainage, which require stabilization.

Each of the proposed basins is sized to allow sediment to accumulate for a period of 10 to 20 years before removal is required. Sediment removal would restore the original sediment retention capacity of the basins. Maintenance access to the practices will be graded to final grades, seeded and mulched for stabilization in accordance with the Sediment and Erosion Control Plan. The graded accesses and the side slopes and berms of the basins, would be mowed annually to prevent the establishment of woody plants. The bottoms of the basins would not be mowed.

During the mowing operations, debris and litter would be removed from all swales, accesses, basins and stormwater wetlands. Accumulated sediment will be removed from the swales, basins, and stormwater wetlands approximately every 10 to 20 years, or when 50 percent of their capacity has been reached. The property owner(s) would be responsible for providing short and long term maintenance of the practices specified in the SWPPP.

Note, text pertaining to the potential impacts to surface waters resulting from the wastewater treatment plant discharge can be found in Chapter 3.8, Community Services, in the Sewage Disposal section (3.8.5).

Compliance with NYSDEC SPDES GP-0-10-001

In order to comply with GP-0-10-001 and the Watershed Rules and Regulations, the Preliminary Union Place SWPPP includes a Sediment and Erosion Control Plan to be implemented during construction and measures to control changes in stormwater quantity and quality after construction. The measures included in the SWPPP would accomplish the following as required by NYSDEC and NYCDEP:

- Reduce or eliminate erosion and the resulting sedimentation of surface waters during construction;
- Mitigate or eliminate the impact(s) that post-development changes in stormwater, including any increases in pollutants in it, can have on the quality of receiving surface waters;

- Reduce post-construction increases in the peak rates of stormwater discharge during and after construction to prevent downstream erosion and flooding;
- Maintain stormwater controls during and after construction;
- Preserve water quality.

To be authorized under GP-0-10-001 to proceed with a project, and discharge stormwater from a site, an "Operator" must submit a "Notice of Intent" (NOI) to NYSDEC confirming that the SWPPP has been prepared in accordance with the terms of the general permit. Because the proposed project is subject to the requirements of a regulated, traditional land use control MS4, in this case the Town of Carmel, GP-0-10-001 requires that the SWPPP be reviewed and accepted by the Town prior to the submission of the NOI to NYSDEC.

Following the Town's review and approval of the SWPPP, the Applicant will also, in accordance with GP-0-10-001, have an "MS4 SWPPP Acceptance" form signed by the principal executive officer, or ranking elected official, from the Town, or by a duly authorized representative of that person, and submit that form with the NOI to NYSDEC.

Since the proposed project is located in the phosphorous restricted New York City East-of-Hudson Croton Watershed, the stormwater management practices have been designed in accordance with the *Enhanced Phosphorus Removal Standards* (Chapter 10) of the Manual As outlined in Chapter 10, the treatment volume for the WQv is the runoff volume produced during the 1-year 24-hour design storm. In order to treat the required WQv from the proposed development two types of practices have been provided, NYSDEC Micropool Extended Detention Basins (P-1), and W-4 Pocket Wetlands (W-4). By meeting the WQv requirements for the proposed project with the proposed micro pool extended detention basins, and pocket wetlands, water quality objectives, including the enhanced phosphorous treatment requirements set forth in Chapter 10 of the Manual, are met.

The Applicant notes that not all stormwater management basins proposed have been designed in accordance with NYSDEC criteria since NYSDEC criteria only requires one practice to treat the WQv, while NYCDEP requires multiple practices in series to satisfy its water quality objectives.

By implementing the State reviewed and approved SWPPP for the project, the Applicant will reduce post-construction increases in pollutant loading in stormwater and comply with NYSDEC SPDES GP-0-10-001.

Compliance with NYCDEP Rules and Regulations

Recognizing the proposed project is located in the phosphorous restricted Amawalk and Muscoot reservoir basins, the SWPPP developed for the Proposed Action includes measures to capture and treat the runoff by multiple practices placed in series, and from all areas where the post-development perviousness has changed from pre-construction conditions, as required by the Watershed Rules and Regulations.

This initial project SWPPP was developed prior to the April 4, 2010 amendment of the Rules and Regulations. The Union Place SWPPP generally conforms to the amended regulations in that multiple stormwater management practices have been placed in series, for subcatchments with an impervious cover greater than 20%. As the project is refined, the SWPPP will be updated to remain in compliance with the Rules and Regulations.

In order to meet NYCDEP water quality requirements a combination of Design 2 Extended Detention Basins, Design 3 Extended Detention Basins, and Design 14 - low gradient grass swales with "treatment trains", allowing for multiple stages of treatment of stormwater runoff. Pursuant to NYCDEP design criteria all extend detention basins have been designed to provide the 24-hours of plug flow detention time for the 1-year design storm. To further demonstrate water quality has been maintained to pre-development levels a pollutant loading analysis was performed. .

To meet NYCDEP water quality requirements a pollutant loading analysis was performed. The analysis, which is documented in further detail in the SWPPP, demonstrates that post development pollutant loading rates are within the range of pre-development rates based on low and high removal efficiencies for the proposed stormwater management practices. In addition, peak flows from the 10, 25, and 100-year storms would be attenuated to pre-development levels in the stormwater management practices.

By implementing the City reviewed and approved SWPPP for the project, the Applicant will reduce post-construction increases in pollutant loading in stormwater and reduce post construction peak rates of discharge to below existing rates thereby complying with the NYCDEP Rules and Regulations.

Other Mitigation Measures

Low Impact Development Techniques

Pervious pavement (i.e. pavement that allows for the transmittal of surface water to the ground beneath) has been incorporated into the proposal. Figure 3.4-5 depicts areas where pervious pavement could be used under the Proposed Action. Additional LID techniques could be incorporated into the final development plans to further mitigate impacts anticipated from post construction changes in stormwater characteristics. LID techniques address a variety of stormwater management issues, including compliance with GP-0-10-001, the Watershed Rules and Regulations, TMDL reductions, non-point source program goals, and other specific water quality goals and standards.

The benefits of LID measures were not considered in the stormwater management calculations upon which the SWPPP was based. This resulted in projections of post construction stormwater characteristics that are conservative. The following LID measures could be incorporated into the Proposed Action to further reduce post construction pollutant loading:

- Pervious Paving: Pervious pavement would further reduce post-construction increases in the volume and peak rate stormwater runoff, and would provide water quality treatment, and a disconnection from the impervious surfaces and the stormwater treatment practices.
- Bioretention Cells: The project site and development plan offer ample opportunity for bioretention in the form of depressed islands in the interior of the parking areas. Bioretention would treat stormwater runoff with a combination of a conditioned planting soil bed and planting materials to filter runoff stored within the shallow depressions. The bioretention cells would serve as a pretreatment water quality filter and a disconnection from the impervious surfaces and the final stormwater treatment practices.
- Buffer Strips/Bioretention Slopes: The stormwater runoff from the majority of the developed site would be captured and treated by stormwater quality treatment basins. The stormwater

from the areas below the stormwater basin berms and along the edges of the developed areas that do not discharge to a stormwater basin would be treated through the use of vegetated filter strips/bioretention slopes. The areas outside the proposed limits of disturbance would be maintained and protected as vegetated filter strips. Theses buffers and slopes would filter runoff from a very limited drainage area prior to its discharge to the adjacent wetlands and watercourses.

- Grassed Swales: In addition to the swales that will receive runoff from the proposed stormwater ponds, certain areas adjacent to the proposed parking lots and access road are potential candidates for proposed grassed swales. The swales could pretreat stormwater runoff from developed portions of the site and treat runoff from the impervious surfaces prior to treatment by the stormwater basins.
- Infiltration Trenches: The areas adjacent to the proposed parking and access roads that are potential candidates for grassed swales may also be suitable areas for proposed infiltration trenches. A portion of the stormwater runoff from the parking areas and access roads could be directed to infiltration trenches in these areas. The overflows from these trenches could discharge to grass swales, or directly to the stormwater basins, which in either case would provide additional treatment.
- Planter Boxes and Tree Box Filters: these include elevated structures that intercept, store and filter stormwater from routed downspouts and structures that resemble typical urban street tree planters that are installed below grade along a curb line to collect and treat stormwater.

According to information provided in *Low Impact Development for Big Box Retailers* (The Low Impact Development Center, Incorporated, November 2005, prepared for the United States Environmental Protection Agency Office of Water), LID techniques can allow for a treatment train approach where, as is the case with the Union Place project, there are multiple opportunities to reduce loads of various pollutants by using a system of different techniques. The document indicates the following removal efficiencies can be expected with the above noted LID techniques:

- Bio Retention: typical phosphorus removal efficiencies for bioretention cells are 50 percent for basins that capture 0.5” of runoff from impervious area and 65 percent removal for basins that capture 1.0” of runoff from impervious area;
- Buffer Strip/BioRetention Slope: 60 percent of phosphorus (77 percent of metals, and 88 percent of total suspended solids) contained in stormwater runoff from a water quality storm event;
- Grassed Swales: phosphorus removal efficiency is 15 percent if existing subsoil underlies the swale. The removal rate is 35 percent if an engineered soil mixture is used;
- Rainwater Reuse (cisterns and rain barrels): pollutant removal rates approximate those of infiltration practices and range from 50 percent-60 percent;
- Infiltration Trenches: typically 60 percent phosphorous removal;
- Planter Boxes: phosphorus removal is similar to that achieved with bioretention cells. Phosphorus removal is achieved at the rate of 50 percent for the first one-half inch (0.5”) of runoff that enters the planter box from impervious areas;

- Tree box filters: remove pollutants through the same biological, chemical, and physical mechanisms as bioretention cells. Expected removals are 85 percent total suspended solids, 74 percent total phosphorous, 68 percent total nitrogen, 82 percent total metals.

Additional information concerning the application, design, and effectiveness of LID techniques can be found at www.lowimpactdevelopment.org.

While the pollutant removal achieved with the LID measures, and the adjunct stormwater management practices, listed above was not considered in the calculation of expected post-construction pollutant loads, the final SWPPP could incorporate the use of these measures. As a result of the measures described above, and those incorporated into the preliminary SWPPP, significant adverse impacts on surface water resources, including watercourses, wetlands, and the Amawalk and Muscoot Reservoirs, associated with post-construction changes in stormwater characteristics are not expected.

Pesticides and Fertilizers

To reduce the potential impacts associated with pesticides and fertilizers in stormwater runoff, applications of these materials would comply with State (NYS Environmental Conservation Law, Sections 33-0301 and 33-0303, County (Department of Health), City (Watershed Rules and Regulations), and local regulations (Town Code sections 89 and 120). as required of all development projects in the watershed. Current data indicates that, if applied correctly, contemporary pesticides would not migrate to any great extent, and would break down rather quickly after application. Through careful application of these materials, and by treating stormwater in the proposed management practices significant adverse impacts on surface water resources will be avoided.

De-icing Materials

Since the Amawalk and Muscoot Reservoirs, which receive stormwater runoff from the project site, have been designated as phosphorus restricted by the NYCDEP, the Applicant proposes the use of traction sand, which has a low phosphorus concentration, as the primary winter road safety agent. Due to varying and unpredictable snow and ice accumulations on the traveled surfaces, no specific abrasive sand application rates are proposed. Instead, sand application rates would be dictated by the need to provide safe traveling conditions for the public and emergency vehicles, and by road and parking lot conditions. Traction sand would be applied in accordance with the following specific guidelines excerpted from *Recommendations for Winter Traction Materials Management on Roadways Adjacent to Bodies of Water*, Western Transportation Institute, December 2004.

- The application of sand would be minimized to the extent necessary to ensure that public safety is not compromised;
- Abrasive sands applied to roadways and parking areas would be recovered by street sweeping and snow storage;
- Structural components of the site specific stormwater management plan for the project would be employed to capture abrasive sands before they migrate off-site and into wetlands, watercourses and water bodies.
- The Applicant proposes to restrict the use of anti-icing materials other than traction sand on the site to potassium acetate.

Stormwater Basin Plantings

Various types of wetland vegetation will be planted in the proposed stormwater management basins. Planting zones would be created in the basins and wetland vegetation that is indigenous to the region, and that is appropriate for conditions in each of the zones, would be established. Final designs of the basins would include forebays and micro pools, aquatic benches, and fringe vegetation. The herbaceous plants to be established would enhance the stormwater quality treatment and would provide food and cover for birds and other wildlife. Stormwater basin planting plans would be comprised of regionally native vegetation and seed and be submitted to the Town Planning Board for review prior to final site plan approval. Refer to Figure 3.4-6, Typical Detention Basin Planting Plan, for information on stormwater basin plantings.

TOWN OF SOMERS, WESTCHESTER COUNTY
TOWN OF CARMEL, PUTNAM COUNTY

DESIGN POINT 1
DESIGN POINT 2
DESIGN POINT 3
DESIGN POINT 4
DESIGN POINT 5
DESIGN POINT 6
DESIGN POINT 7

1.0S
2.0S
3.0S
4.0S
5.0S
6.0S
7.0S

SOIL LEGEND

SOILS	DESCRIPTION	HYDROLOGICAL GROUP
ChE	Charlton loam, 25 to 35% slopes	B
PnB	Paxton fine sandy loam 2 to 8% slopes	C
PnC	Paxton fine sandy loam 8 to 15% slopes	C
PnD	Paxton fine sandy loam 15 to 25% slopes	C
RdA	Ridgebury loam 0 to 3% slopes	C
RdB	Ridgebury loam 3 to 8% slopes	C
WdB	Woodbridge loam 3 to 8% slopes	C
WdC	Woodbridge loam 8 to 15% slopes	C
Sh	Sun loam 0 to 3% slopes	D
LcA	Leicester loam 0 to 3% slopes, stony	C
Uc	Udorthents, wet substratum 0 to 3% slopes	C

Note: Soils information shown is based on interpolation of the USDA SCS Soils Survey.

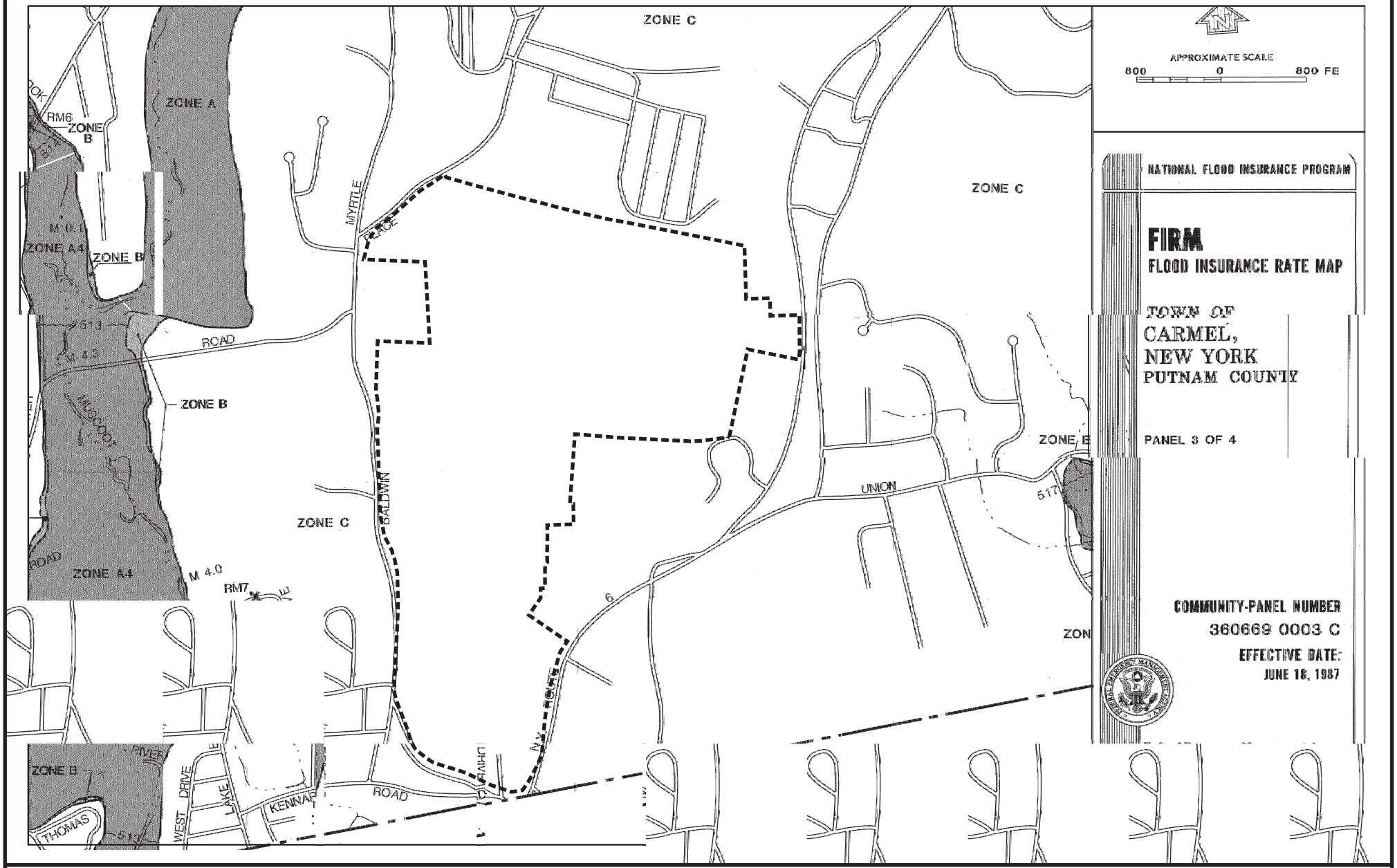
LEGEND

1.0S Subcatchment

Figure 3.4-1: Pre Development Drainage Areas Map
Union Place
Town of Carmel, Putnam County, New York
Source: Insite Engineering, Surveying & Landscape Architecture, P.C., 06/18/10
Scale: 1" = 550'

File 07049 1/29/09
JS/07049

Tim Miller Associates, Inc.,10 North Street, Cold Spring, New York 10516 (845) 265-4400 Fax (845) 265-4418



Site Property Boundary

Figure 3.4-2: Flood Insurance Rate Map
Union Place
Town of Carmel, Putnam County, New York
Source: Federal Emergency Management Agency
Scale: Graphic

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JS:\07049

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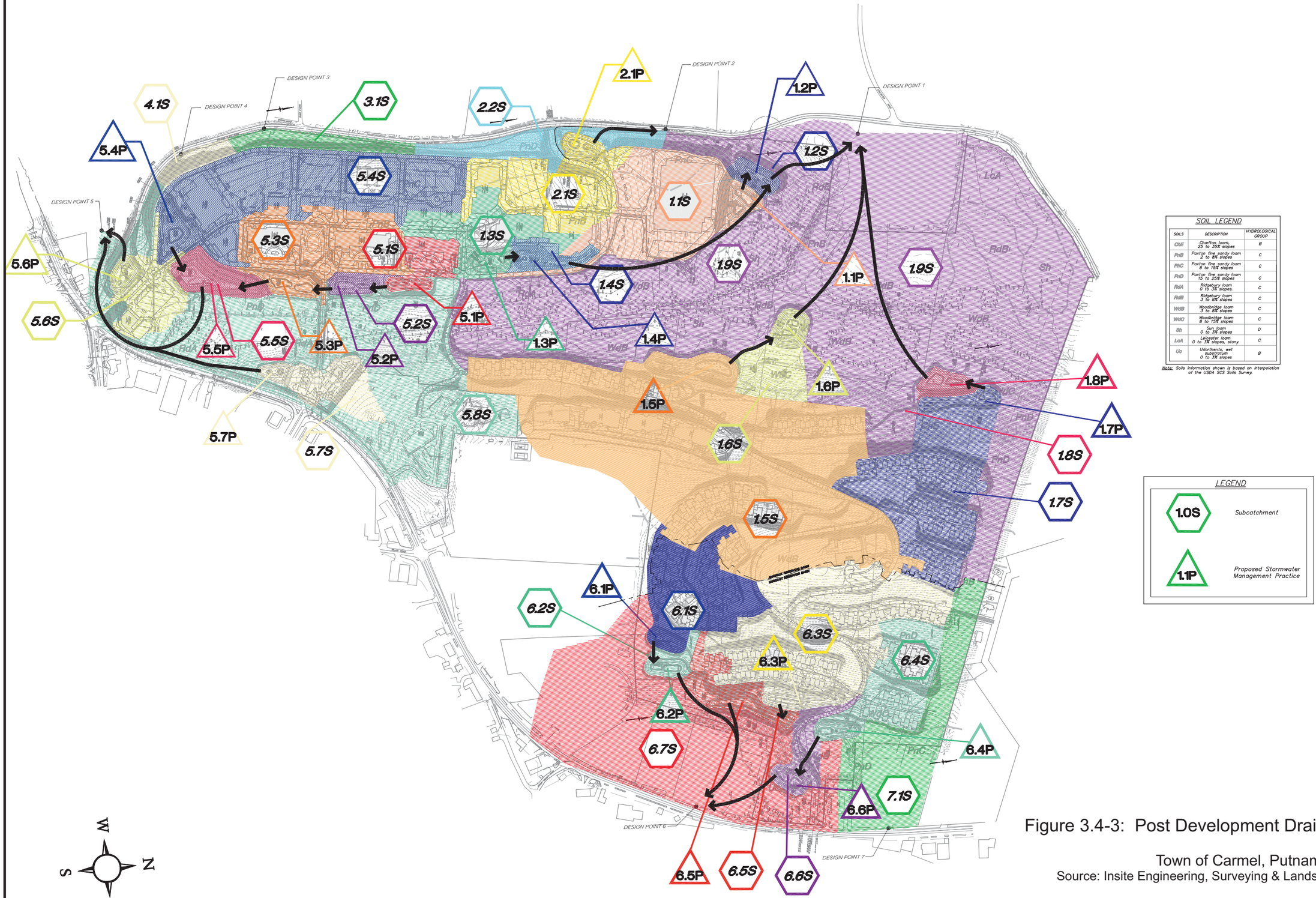

Figure 3.4-3: Post Development Drainage Areas Map
Union Place
Town of Carmel, Putnam County, New York
Source: Insite Engineering, Surveying & Landscape Architecture, P.C.
Scale: 1" = 550'

File 07049 1/29/09
JS/07049

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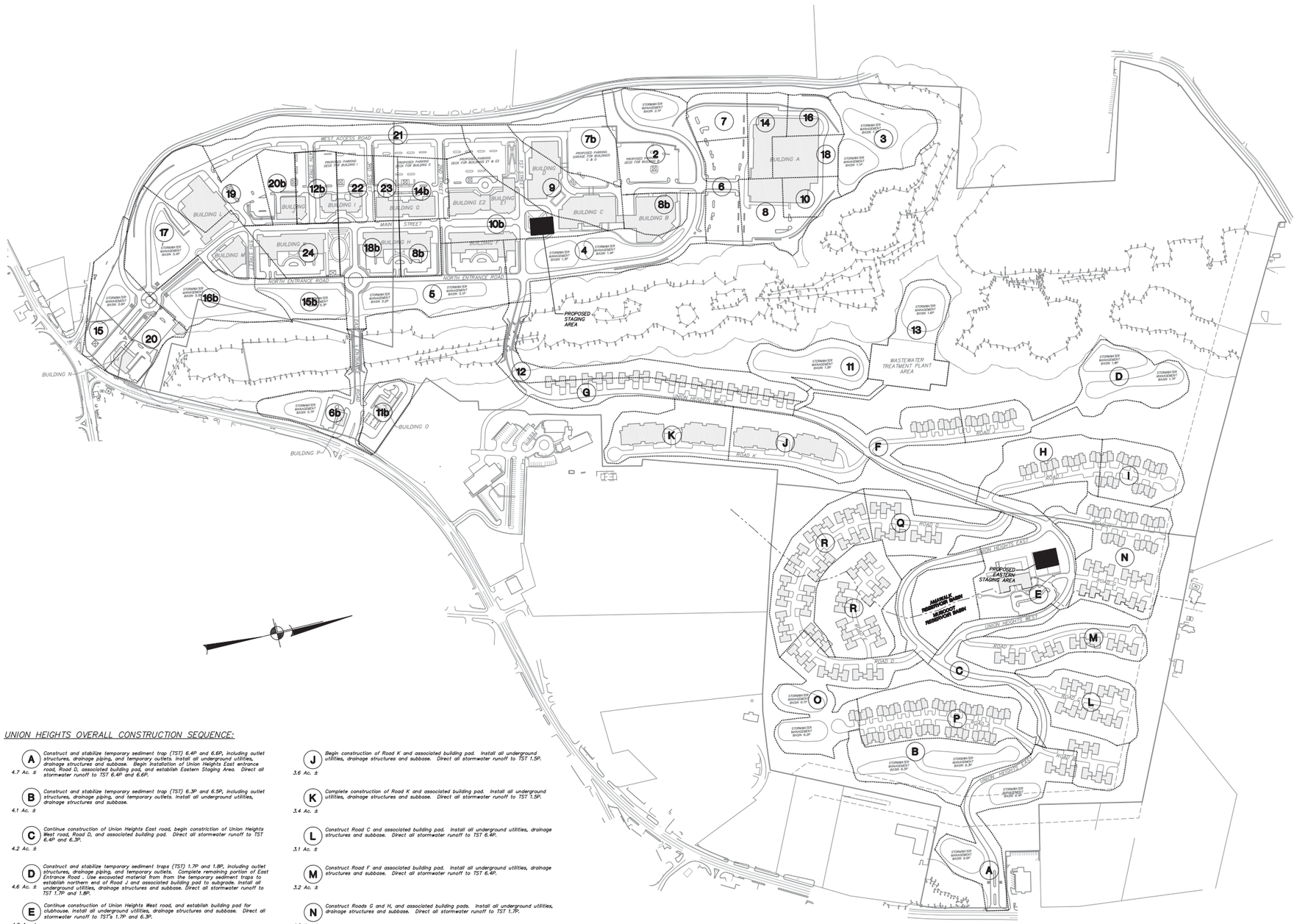


UNION PLACE OVERALL CONSTRUCTION SEQUENCE:

1 — 0.2 Ac. ±
Utilize existing site access and establish Western Staging Area where indicated on the plan.

2 — 4.8 Ac. ±
Construct and stabilize temporary sediment trap (TST) 2.1P, including outlet structure, drainage piping, and temporary outlets. Install all underground utilities, drainage structures and subbase. Begin installing North Entrance Road. Direct all stormwater runoff to TST 2.1P.

3 — 3.6 Ac. ±
Construct and stabilize temporary sediment trap (TST) 1.1P and 1.2P, including outlet structures, drainage piping, and temporary outlets. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff to TST 1.1P and 1.2P.

4 — 4.7 Ac. ±
Construct and stabilize temporary sediment trap (TST) 1.3P and 1.4P, including outlet structures, drainage piping, and temporary outlets. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff to TST 1.3P and 1.4P.

5 — 4.6 Ac. ±
Construct and stabilize temporary sediment trap (TST) 5.1P and 5.2P, including outlet structures, drainage piping, and temporary outlets. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff to TST 1.3P and 1.4P.

6 — 4.9 Ac. ±
Construct and stabilize temporary sediment trap (TST) 5.7P, including outlet structures, drainage piping, and temporary outlets. Complete remaining portion of East Entrance Road . Use excavated material from borrow area 6b for construction and stabilization of the Building A building pad in fill area to subgrade. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff from borrow area 6b to TST 5.7P.

7 — 4.0 Ac. ±
Continue excavation using excavated material for construction and stabilization of the Building A building pad in fill area to subgrade with material from borrow area 7b. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff from borrow area 7b to TST 2.1P, and remaining runoff from Phase 7 to 1.1P.

8 — 4.7 Ac. ±
Continue excavation using excavated material for construction and stabilization of the Building A building pad in fill area to subgrade. Use material from both borrow areas indicated as 8b. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff to from borrow areas to 1.4P and 5.1P, and remainder of Phase 8 to 1.1P.

9 — 4.3 Ac. ±
Continue excavation using excavated material for construction and stabilization of the parking areas and building pads in fill area to subgrade. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff to TST 2.1P.

10 — 5.0 Ac. ±
Continue excavation using excavated material for construction and stabilization of the Building A building pad in fill area to subgrade with material from borrow area 10b. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff from borrow area 10b to TST 2.1P, and remaining runoff from Phase 10 to 1.1P.

11 — 2.5 Ac. ±
Construct and stabilize temporary sediment trap (TST) 1.5P, including outlet structures, drainage piping, and temporary outlets. Install all underground utilities, drainage structures and subbase.

12 — 5.0 Ac. ±
Construct Union Heights West road utilizing material from borrow area 12b. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff from Union Heights West road to TST 1.5P.

13 — 3.6 Ac. ±
Construct and stabilize temporary sediment trap (TST) 1.6P, including outlet structures, drainage piping, and temporary outlets. Install all underground utilities, drainage structures and subbase. Construct Wastewater Treatment Plant and access road. Direct all stormwater runoff to 1.6P.

14 — 4.3 Ac. ±
Continue excavation using excavated material from borrow area 14b for construction and stabilization of the Building A building pad in fill area to subgrade. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff from borrow areas to 2.1P and 5.7P, and remainder of Phase 14 to 1.1P.

15 — 5.0 Ac. ±
Construct and stabilize temporary sediment trap (TST) 5.3P and 5.6P, including outlet structures, drainage piping, and temporary outlets. Install all underground utilities, drainage structures and subbase. Use excess material during construction of 5.3P, borrow area 15b, in the construction of 5.6P and entrance of Main Entrance Rd.

16 — 4.6 Ac. ±
Construct and stabilize temporary sediment trap (TST) 5.5P, including outlet structures, drainage piping, and temporary outlets. Install all underground utilities, drainage structures and subbase. Use excess material during construction of 5.5P, borrow area 16b, in the construction Building A building pad. Direct all stormwater runoff from Building A building pad portion of Phase 16 to 1.1P.

17 — 4.8 Ac. ±
Construct and stabilize temporary sediment trap (TST) 5.4P, including outlet structures, drainage piping, and temporary outlets. Install all underground utilities, drainage structures and subbase.

18 — 3.1 Ac. ±
Continue excavation using excavated material for construction and stabilization of the Building A building pad in fill area to subgrade with material from borrow area 18b. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff from borrow area 18b to TST 5.3P, and remaining runoff from Phase 18 to 1.1P.

19 — 3.7 Ac. ±
Continue excavation of building pad and parking areas. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff to TST 5.4P.

20 — 2.7 Ac. ±
Continue excavation of Building L building pad and parking area. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff to TST 5.4P and 5.6P.

21 — 4.2 Ac. ±
Continue excavation of building pad and parking areas. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff to TST 5.4P.

22 — 1.4 Ac. ±
Excavate Building I building pad and 3rd street using excess material for Phase F (Disturbance = 3.3 Ac.) of Union Heights. Total Disturbance associated with Phase 22 of Union Place and Phase F of Union Heights = 4.7 Ac.

23 — 0.9 Ac. ±
Excavate Building G building pad using excess material for Phase H (Disturbance = 3.0 Ac.) of Union Heights. Total Disturbance associated with Phase 23 of Union Place and Phase H of Union Heights = 3.9 Ac.

24 — 2.2 Ac. ±
Excavate Building K building pad and final portion of Main Street using excess material for Phase I (Disturbance = 2.6 Ac.) of Union Heights. Total Disturbance associated with Phase 24 of Union Place and Phase I of Union Heights = 4.8 Ac.

UNION HEIGHTS OVERALL CONSTRUCTION SEQUENCE:

A — 4.7 Ac. ±
Construct and stabilize temporary sediment trap (TST) 6.4P and 6.6P, including outlet structures, drainage piping, and temporary outlets. Install all underground utilities, drainage structures and subbase. Begin installation of Union Heights East entrance road, Road D, associated building pad, and establish Eastern Staging Area. Direct all stormwater runoff to TST 6.4P and 6.6P.

B — 4.1 Ac. ±
Construct and stabilize temporary sediment trap (TST) 6.3P and 6.5P, including outlet structures, drainage piping, and temporary outlets. Install all underground utilities, drainage structures and subbase.

C — 4.2 Ac. ±
Continue construction of Union Heights East road, begin constriction of Union Heights West road, Road D, and associated building pad. Direct all stormwater runoff to TST 6.4P and 6.3P.

D — 4.6 Ac. ±
Construct and stabilize temporary sediment traps (TST) 1.7P and 1.8P, including outlet structures, drainage piping, and temporary outlets. Complete remaining portion of East Entrance Road . Use excavated material from from the temporary sediment traps to establish northern end of Road J and associated building pad to subgrade. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff to TST 1.7P and 1.8P.

E — 4.8 Ac. ±
Continue construction of Union Heights West road, and establish building pad for clubhouse. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff to TST's 1.7P and 6.3P.

F — 3.3 Ac. ±
Continue construction of Union Heights West road, complete Road J, and associated building pad. Install all underground utilities, drainage structures and subbase. Use excess material from Phase 22 (Disturbance = 1.4 Ac.) of Union Place for establishment of fill areas. Direct all stormwater runoff to TST 1.5P. Total Disturbance associated with Phase F of Union Heights and Phase 22 of Union Place is 4.7 Ac.

G — 2.9 Ac. ±
Complete construction of Union Heights West road. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff to TST 1.5P.

H — 3.0 Ac. ±
Begin construction of Road I and associated Building pad with excess material from Phase 23 of Union Place (Disturbance = 0.9 Ac.). Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff to TST 1.7P. Total Disturbance associated with Phase H of Union Heights and Phase 23 of Union Place is 3.9 Ac.

I — 2.6 Ac. ±
Complete construction of Road I and associated Building pad with excess material from Phase 24 of Union Place (Disturbance = 2.2 Ac.). Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff to TST 1.7P. Total Disturbance associated with Phase I of Union Heights and Phase 24 of Union Place is 4.8 Ac.

J — 3.6 Ac. ±
Begin construction of Road K and associated building pad. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff to TST 1.5P.

K — 3.4 Ac. ±
Complete construction of Road K and associated building pad. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff to TST 1.5P.

L — 3.1 Ac. ±
Construct Road C and associated building pad. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff to TST 6.4P.

M — 3.2 Ac. ±
Construct Road F and associated building pad. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff to TST 6.4P.

N — 4.9 Ac. ±
Construct Roads G and H, and associated building pads. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff to TST 1.7P.

O — 5.0 Ac. ±
Construct and stabilize temporary sediment traps (TST) 6.1P and 6.2P including outlet structures, drainage piping, and temporary outlets. Complete remaining portion of East Entrance Road . Use excavated material from from the temporary sediment traps to begin construction of Road D and associated building pad to subgrade. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff to TST 6.1P.

P — 4.8 Ac. ±
Construct Road A, and associated building pad. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff to TST 6.3P.

Q — 4.1 Ac. ±
Continue construction of Road D, associated building pad, and complete construction of Union Heights East road. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff to TST 1.5P.

R — 4.4 Ac. ±
Complete construction of Road D, and associated building pad. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff to TST 1.5P.

S — 4.2 Ac. ±
Construct Road E and associated building pad. Install all underground utilities, drainage structures and subbase. Direct all stormwater runoff to TST 1.5P and 6.1P.

CONSTRUCTION SEQUENCE NOTES:

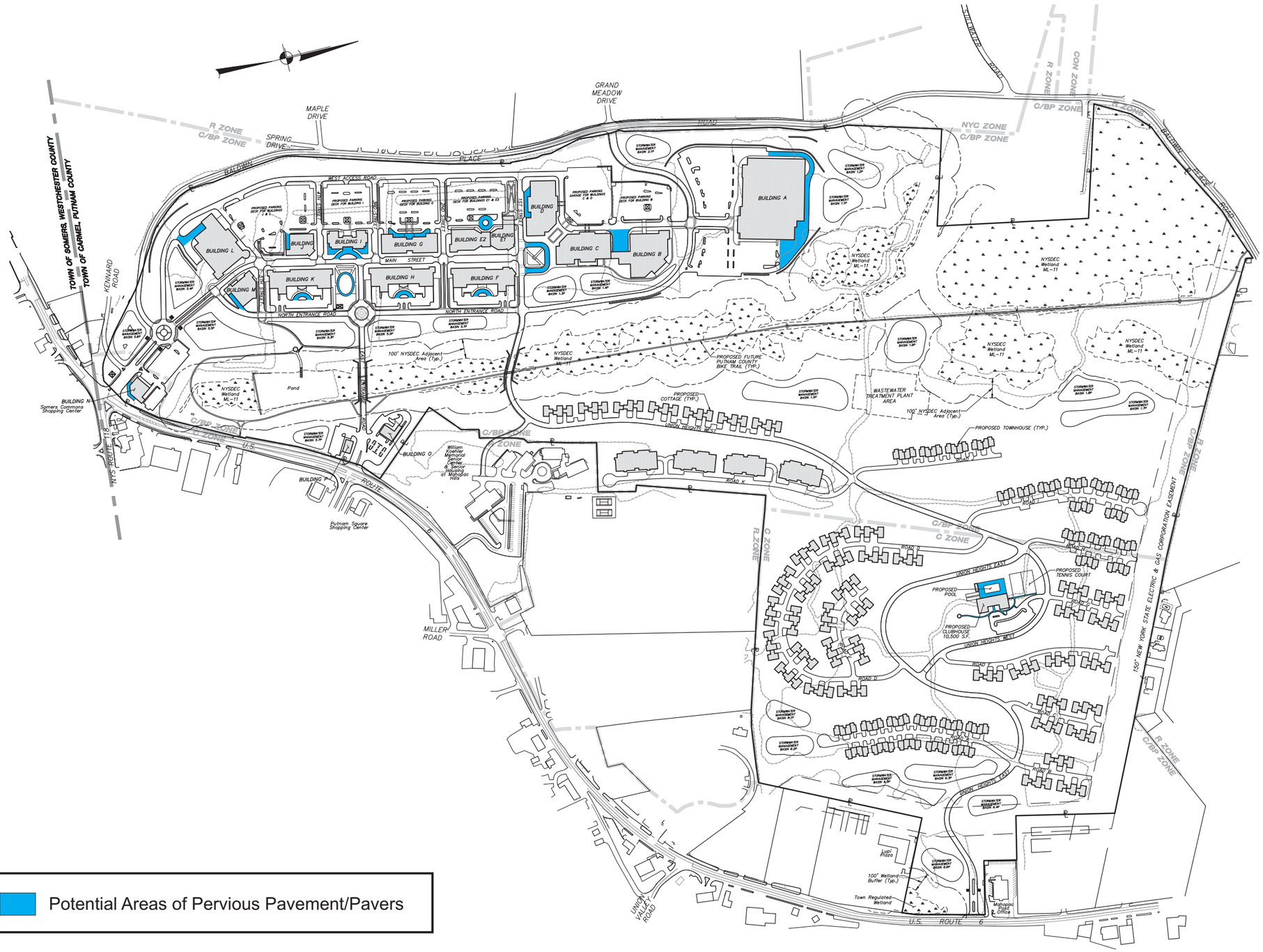
1. For Erosion and Sediment Control Notes, see Drawing D–5.
2. Each phase of work implies that all sediment and erosion control measures will be installed in accordance with best management practices and prior to any clearing and grubbing operations.
3. Each phase of work implies the removal of existing trees and grubbing of all tree root systems.
4. All topsoil is to be stripped and stockpiled in appropriate locations for future use on the site. All stockpiled soil areas are to be appropriately stabilized and protected.
5. All finished slopes greater than 3:1 are to be immediately stabilized.
6. No more than 5 acres of disturbance shall be permitted at any one time without prior written approval from the New York State Department of Environmental Conservation.
7. Should groundwater be encountered during excavation the contractor shall contact the project's certified erosion control specialist immediately to assess the situation. Dewatering, should groundwater be encountered, shall be discharged from the sump to a splash pad or energy dissipator with silt fence down gradient.

GRAPHIC SCALE
200 0 100 200 400 800
(IN FEET)

Figure 3.4-4: Overall Phasing Plan
Union Place
Town of Carmel, Putnam County, New York
Source: Insite Engineering, Surveying & Landscape Architecture, P.C.. 2/20/09
Scale: 1” = 550’

File 07049 1/29/09
JS/07049

Tim Miller Associates, Inc.,10 North Street, Cold Spring, New York 10516 (845) 265-4400 Fax (845) 265-4418



Potential Areas of Pervious Pavement/Pavers

GRAPHIC SCALE

200 0 100 200 400 800

(IN FEET)

Figure 3.4-5: Potential Areas of Pervious Pavement

Union Place

Town of Carmel, Putnam County, New York

Source: Insite Engineering, Surveying & Landscape Architecture, P.C.

Drawing Date: 06/18/10

Scale: As Shown

File 07049 10/29/10
JS/07049

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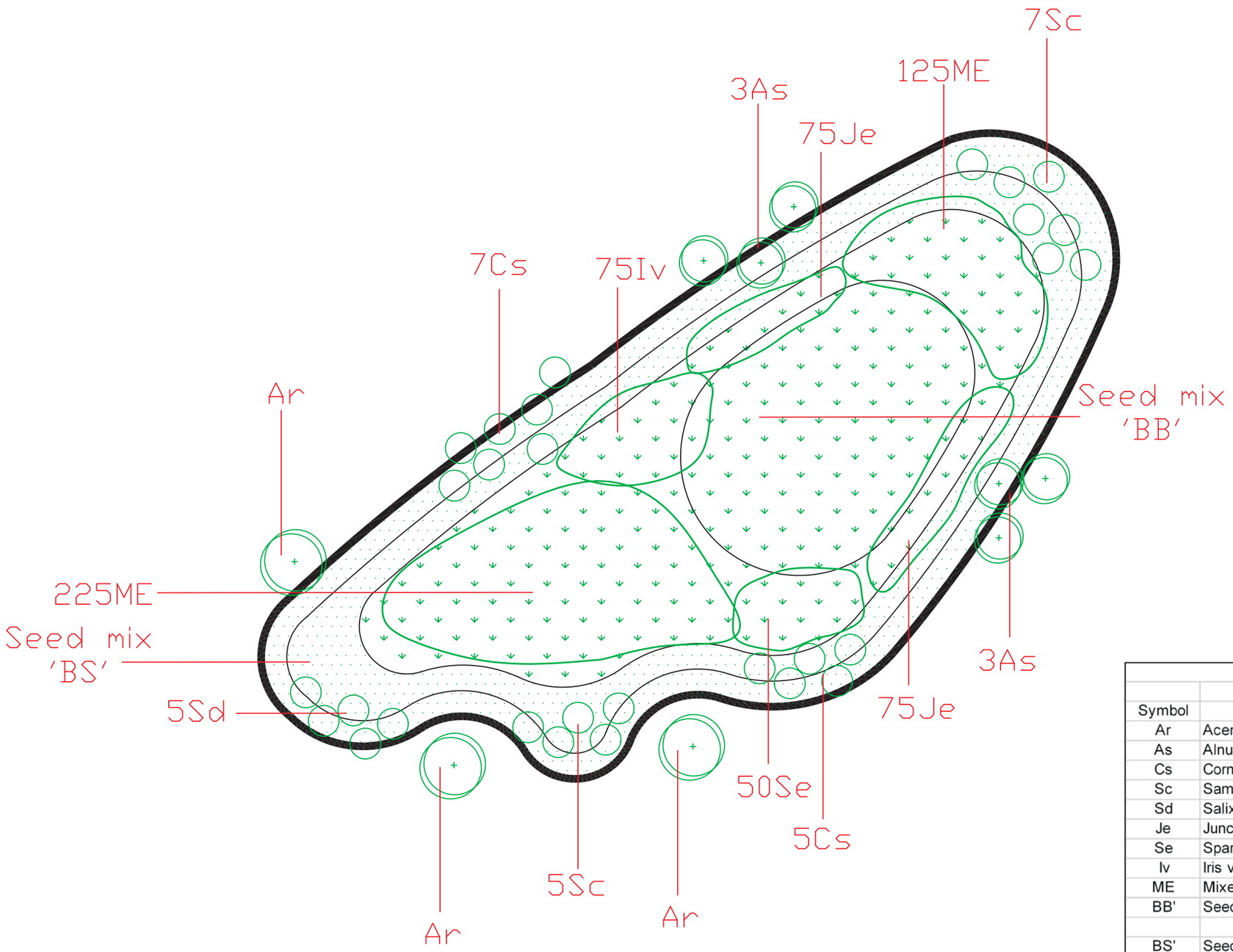

Typical Detention Basin Plant List				
Symbol	Species	Common name	Qty	Size
Ar	Acer rubrum	Red maple	3	1-1/2 - 2"
As	Alnus rugosa	Speckled alder	6	5-gal
Cs	Cornus sericea	Redosier dogwood	12	3-gal
Sc	Sambucus canadensis	Elderberry	12	3-gal
Sd	Salix discolor	Pussy willow	5	3-gal
Je	Juncus effusus	Soft rush	150	2" plug
Se	Sparganium eurycarpum	Giant bur-reed	50	2" plug
Iv	Iris versicolor	Blueflag iris	50	2" plug
ME	Mixed emergents		350	2" plug
BB'	Seed mix 'Basin Bottom'	Pinelands 'Basin Bottom	7.5 lbs/ac	
		Wetland Mix' or equivalent		
BS'	Seed mix 'Basin Slope'	Pinelands 'Basin Slope	7.5 lbs/ac	
		Upland Mix' or equivalent		

Figure 3.4-6: Typical Detention Basin Planting Plan
Union Place
Town of Carmel, Putnam County, New York
Source: Tim Miller Associates
Scale: 1” = 20”

Tim Miller Associates, Inc.,10 North Street, Cold Spring, New York 10516 (845) 265-4400 Fax (845) 265-4418