Nesra Engineering, LLC
111 Washington Street, Unit 2A
Plainville, MA 02762

STORMWATER MANAGEMENT REPORT AND ACCOMPANYING NOTICE OF INTENT

MARSHALL SIMONDS MIDDLE SCHOOL ATHLETIC FIELDS RENOVATION PROJECT

114 WINN STREET
BURLINGTON, MA 01803

Prepared For:

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1.0 Project Description

The natural turf athletic fields at Marshall Simonds School are located to the north of the Middle School building, east of the 400-meter running track and inset turf field, and are bordered by resource areas to the north and east. The current facility includes natural grass athletic fields, perimeter fencing, netting, and lighting. Electrical and drainage utilities are installed below the surface to provide power for the lighting system and facilitate stormwater drainage. A pedestrian pathway connects Mooney Road to the rear parking area at the middle school, with additional walkways linking the school to the existing track and field facility. However, the existing walkways do not currently meet ADA/AAB regulations.

The proposed project involves upgrading the athletic fields with one full size state-of-the-art synthetic turf, and one youth synthetic turf field, new lighting, two scoreboards, and walkways. The two fields will be separated by a walkway in between. The project will also include ADA/AAB-compliant routes from the fields to the school building. Terraced seating will be provided along the hillside, and ADA/AAB-compliant parking will be striped on the existing pavement located adjacent to the school.

Currently, the grass fields are sloped at 1.5% from the southern corner to the north and east. The site is outside of the 100-year floodplain.

According to the Massachusetts Natural Heritage Maps, there are no certified vernal pools located in close proximity to the project site. The same database indicates that there are no priority habitats of rare species or estimated habitats of rare wildlife located on or near the project site. Similarly, there are no areas of critical environmental concern (ACEC). The site is however designated as outstanding resource waters (ORW).

According to the Soil Conservation Service's "Soil Map," the historical soils on-site are as follows:

- **Udorthents-Urban Land Complex (656)** (indicating filled soils) – 90% of the site.
- **Whitman fine sandy loam (73B)** – 10% of the site.

Udorthents-Urban Land Complex is typically categorized as hydrologic soil group D. Whitman fine sandy loam is also categorized as hydrologic soil group D.

Additional information is provided in the wetland report completed by our wetland specialist, dated January 6, 2025, and included in the Notice of Intent application under a separate cover.

2.0 Background Data

Topographic conditions are based on survey data acquired by Nesra Engineering, LLC. Bordering vegetated wetlands and river front flags were placed by a wetlands consultant and the locations shown on the plans for these flags were field surveyed by Nesra Engineering, LLC. Field survey equipment used was a Leica GS18 GNSS receiver with a CS20 data collector, as well as a Leica

TS16 robotic total station. The topographic survey is on the North American Vertical Datum (NAVD 88) and the horizontal datum is on the NAD83 Massachusetts State Planes, Mainland Zone, US Foot (MA83F) coordinate system.

Resource area delineation has been performed by Nesra's wetland consultant, Stephen Chmiel. The Delineation Report is dated January 6, 2025, and is included in the Notice of Intent application under a separate cover

Based on subsequent site review with the Conservation Department, a portion of the site was revised and the additional resource areas have been updated on the existing conditions plans and referenced on all subsequent design documents.

3.0 Stormwater Management Concepts

The project has been re-designed to result in no disturbance to the existing wetlands.

3.1 Hydraulic Sub Areas

In the **pre-development** condition, the site consists of three distinct sub-catchment areas within the analyzed limits. These areas discharge runoff to two locations along the adjacent resource areas. One of the sub-catchment areas drains into a catch basins that outlet to the resource areas, while the remaining two areas sheet flow directly to the wetlands located to the north and west of the site.

In the **post-development** condition, the same sub-catchment areas remain; however, a portion of the runoff is intercepted by the synthetic turf, which directs flow to the base stone layer. This layer provides storage, promotes infiltration, and delays outflow. Effectively, the synthetic turf outfield functions as a retention and infiltration basin. As a result, the proposed development enhances site drainage and improves overall hydrologic conditions. Furthermore, the synthetic turf drainage has been updated to outflow to a rain garden, which further treats the runoff before directing it into the existing drainage system which ultimately outflows in the northwest corner of the site.

4.0 Compliance With Stormwater Standards

4.1 Untreated Stormwater (Standard 1)

The project is designed so that new stormwater conveyances (outfall/discharges) do not discharge untreated stormwater into, or cause erosion to, the wetland.

4.2 Post-Development Peak Rates (Standard 2)

A hydrologic study was performed to determine the rate of runoff for the 2, 10, 25, and 100-year storm events under pre-development (existing) conditions. Unmitigated post-development rates were then computed in a similar manner. The study points for the peak

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rates were taken at four locations to match the outflows from the four sub-catchment areas. From this analysis, it was determined that the proposed project and its stormwater management system would not increase the peak runoff rates above existing levels. It is the intent of the stormwater management system to minimize impacts to drainage patterns, downstream property, and wetlands while simultaneously providing water quality treatment to runoff prior to its release from the site, or discharge to wetlands.

The U.S.D.A. Soil Conservation Services (SCS) Technical Release 55 (TR-55), 1986, was used as the procedure of estimating runoff. A SCS TR-20 based computer program was used for estimating peak discharges. TR-55 is a generally accepted model for use on small sites that begin with a rainfall amount uniformly imposed on the watershed over a specified time distribution. Mass rainfall is converted to mass runoff by using a runoff curve number (CN). CN is based on soils, plant cover, impervious areas, interception, and surface storage. Runoff is then transformed into a hydrograph that depends on runoff travel time through segments of the watershed.

Development in a watershed changes its response to precipitation. The most common effects are reduced infiltration and decreased travel time, which result in significantly higher peak rates of runoff. The volume of runoff is determined primarily by the amount of precipitation and by infiltration characteristics related to soil type, antecedent rainfall, type of vegetation cover, impervious surfaces, and surface retention. Travel time is determined primarily by slope, flow length, depth of flow, and roughness of flow surfaces. Peak rates of discharge are based on the relationship of the above parameters, as well as the total drainage areas of the watershed, the location of the development in relation to the total drainage area, and the effect of any flood control works or other manmade storage. Peak rates of discharge are also influenced by the distribution of rainfall within a given storm event.

Stormwater management computations for the full-build were performed using SCS-based ‘HydroCAD’ for existing and proposed conditions, curve numbers, time of concentrations and unit hydrograph computations.

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4.2.1 Existing Conditions

Table 4.2.1 shows the curve numbers, areas and times of concentration used to develop the pre-development hydrologic model of the site.

Table 4.2.1 – Existing Conditions					
Area	Surface Cover	Curve Number (CN)	Area (Acres)	Tc (Min)	Description
Sub 1S				13.0	
(Sub A)	Grass Cover	80	0.967		Grass Lawn
Sub 2S				3.9	
(Sub B)	Impervious Areas	98*	0.084		Pathway
	Grass Cover	80*	0.501		Grass Lawn
Sub 3S				14.4	
(Sub D)	Impervious Areas	98*	0.037		Pathways
	Grass Field	80*	2.703		Athletic Field
* CN is based on soil Class D, as depicted on the soils map.					

4.2.2 Proposed Conditions

For the analysis of the developed site, the analysis points are the same. There are four sub-catchment areas.

Table 4.2.2 shows the curve numbers, areas and times of concentration used to develop post-development hydrologic model of the site.

Table 4.2.2 – Proposed Conditions					
Area	Surface Cover	Curve Number (CN)	Area (Acres)	Tc (Min)	Description
Sub 1S				5.5	
(Sub A)	Grass Cover	80	0.647		Grass Lawn
Sub 2S				0.7	
(Sub B)	Impervious Areas	98*	0.310		Pathway
	Grass Cover	80*	0.129		Grass Lawn
Sub 3S				480	
(Sub D)	Impervious Areas	98*	0.282		Pathways
	Grass Field	80*	0.468		Athletic Field
	Synthetic Turf	98*	2.456		Synthetic Turf Field
* CN is based on soil Class D, as depicted on the soils map.					

*Synthetic turf Field utilizes a curve number of 98 to collect the entire volume of runoff and direct it into the base stone materials. This is because the entirety of the runoff flows directly into the base stone, since synthetic turf has an infiltration rate of 16 inches per hour. The time of concentration for the base material is calculated utilizing the hydraulic conductivity of the base material and documentation of those calculations are provided.

4.2.3 Peak Rate Summary

Table 4.2.3. shows the peak runoff and the volume of the runoff for the existing and the developed site during 2, 10 and 100-year design storms.

Table 4.2.3 – Stormwater Runoff Volume and Peak Rate Summary				
Design Storm	Existing Runoff* (CFS)	Existing Volume* (Ac-ft)	Proposed Runoff* (CFS)	Proposed Volume* (Ac-ft)
Outfall 1 (1P				
2-year	1.30	0.118	1.18	0.085
10-year	2.73	0.246	2.23	0.160
25-year	3.67	0.332	2.91	0.210
100-year	5.13	0.468	3.98	0.290
Outfall 2 (4P)				
2-year	4.10	0.409	1.49	0.846
10-year	8.60	0.850	2.49	1.346
25-year	11.53	1.146	3.07	1.659
100-year	16.10	1.616	3.96	2.145

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The project results in increased impervious areas due to the proposed ADA/AAB accessible walkways and spectator seating areas. The rainfall within the limits of the synthetic turf field will infiltrate into the drainage stone. It will then move slowly (increased time of concentration) through the system resulting in significantly more infiltration than in the pre-existing conditions. Additionally, portions of the perimeter bituminous concrete walkway will flow into the turf base stone system as well and be infiltrated. Any excess runoff which builds up in the base stone will outlet through the 12" HDPE pipe to a rain garden, where it will be further treated and filtered. Within the raingarden, some of the runoff fill infiltrate and flow through a perforated pipe at the base of the system, while excess runoff will flow through the vegetation and outlet through the overflow drainage structure Table 4.2.3 shows a reduction in the outflow rates for all Outfalls.

1. Increased Impervious Area:

   - Predevelopment Impervious Area: 5,274 square feet (S.F.)
   - Postdevelopment Impervious Area: 25,778 S.F.
   - Increase in Impervious Area: 25,778 S.F. – 5,274 S.F. = 20,504 S.F.

2. Required Recharge Volume:

   Rv = F x impervious area

For soil group D, the recharge requirement is 0.1 inches over the impervious area as detailed in Table 2.3.2. of Massachusetts Stormwater Handbook.

NRCS HYDROLOGIC SOIL TYPE	APPROX. SOIL TEXTURE	TARGET DEPTH FACTOR (F)
A	sand	**0.6-inch**
B	loam	**0.35-inch**
C	silty loam	**0.25-inch**
D	clay	**0.1-inch**

- Recharge Volume Calculation:

  Required Recharge Volume= Target Depth Factor × Impervious Area

  $$20{,}504 \text{ S.F.} \times \frac{0.1 \text{ inches}}{12 \text{ inches per foot}} = 171 \text{ cubic feet (C.F.)}$$

3. Synthetic Turf Field Storage Capacity:

   - Synthetic Turf Field Area: 106,870 S.F.
   - Stone Base Depth: 18 inches

- Void Ratio: 33%
- Volume Calculation:

Total Volume of Stone Base = Field Area × Depth of Stone Base

= 106,870 S.F. × 1.5 foot = 160,305 cubic feet (C.F.)

Effective Storage Volume = Total Volume × Void Ratio3

= 160,305 C.F. × 0.33 = 53,381 C.F.

Summary:

- The increase in the impervious area is 20,504 S.F.
- The required recharge volume for this increase is 171 C.F.
- The synthetic turf field with its stone base provides 53,381 C.F. of storage.

From these calculations, it's clear that the synthetic turf field's stone base has more than sufficient capacity (53,381 C.F.) to handle the required recharge volume (171 C.F.) for the increased impervious area, even considering the additional volumes and rates through other outfalls. This setup should effectively manage the increased runoff and improve infiltration compared to predevelopment conditions.

Greater than 2-ft of separation is maintained from the base of the athletic field to the seasonal high water table. Adequate volume is captured due to:

- Impervious surfaces flowing to the turf field.
- Large size and rapid infiltration rate of the synthetic turf field.

4.4 Removal of TSS (Standard 4)

The project does not include any new paved parking areas, loading zones, or other high pollutant land uses that would generate significant suspended solids. The only impervious areas proposed consist of ADA-compliant walkways and terraced seating, while the remainder of the site is comprised of synthetic turf fields and landscaped areas.

Although pollutant generation is minimal, the proposed stormwater management system has been designed to provide full water-quality treatment consistent with MassDEP Stormwater Standard 4. Runoff from the walkways and turf fields is directed into the permeable synthetic turf system, where it infiltrates through the engineered stone base that provides initial filtration and sedimentation. From there, the treated flow is conveyed to a rain-garden bioretention area that provides additional pollutant removal and infiltration prior to discharge through the existing storm drain network.

The combination of infiltration through the turf base materials and bioretention within the rain garden provides a cumulative TSS removal efficiency exceeding 90 %, satisfying both

the baseline 80 % TSS removal requirement and the enhanced treatment standard applicable to the site's location within an Outstanding Resource Water (ORW) watershed.

4.5 Land Uses with Higher Potential Pollutant Loads (Standard 5)

The proposed project does not include any Land Uses with Higher Potential Pollutant Loads (LUHPPLs) as defined by the Massachusetts Stormwater Handbook. The site is and will remain an athletic and recreational facility, which is not categorized as a LUHPPL. No vehicle fueling, maintenance, or equipment storage areas are proposed. Accordingly, Standard 5 is not applicable to this project.

4.6 Critical Areas (Standard 6 – Critical Areas)

The project is located within the watershed of an Outstanding Resource Water (ORW). In accordance with MassDEP Stormwater Standard 6, the proposed stormwater management system has been designed to provide enhanced (≥ 90 % TSS removal) treatment and to maintain or improve existing water quality prior to any discharge to the ORW.
Runoff from the synthetic turf fields and adjacent walkways is captured at the surface and conveyed into the engineered stone base layer beneath the turf, which functions as a high-permeability infiltration and storage medium. The turf system is situated more than two feet above seasonal high groundwater, providing adequate vertical separation for recharge and pollutant attenuation. Flow from the walkways is directed onto the turf surface, infiltrates through the turf and stone base, and is then routed to a rain-garden bioretention area that provides pretreatment and final treatment of the runoff prior to release through the existing stormwater infrastructure to the downgradient resource areas.

This treatment train—consisting of infiltration through the turf base materials followed by bioretention—achieves the required enhanced water-quality treatment for Critical Areas, prevents untreated or direct discharges to the ORW, and is supported by a detailed operation and maintenance plan ensuring long-term functionality and protection of the receiving waters.

4.7 Redevelopment (Standard 7)

Redevelopment projects are defined by the Massachusetts Stormwater Standards as those involving development, rehabilitation, expansion, or phased projects on previously developed sites, provided the work results in no net increase in impervious area and improves existing site conditions through implementation of stormwater best management practices.

The proposed project does not qualify as a redevelopment project because it results in a net increase of approximately 20,504 square feet of impervious area associated primarily with new ADA walkways and ancillary site features. Therefore, the project is evaluated under the full stormwater management standards applicable to new development.

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4.8 Erosion and Sedimentation Controls (Standard 8)

An Erosion and Sedimentation Control Plan is provided with the construction documents. Erosion control measures will be installed prior to any construction activity. Additionally, a NPDES Construction General Permit will be obtained through the Department of Environmental Protection. A stormwater Pollution Prevention Plan is provided in Attachment I.

4.9 Operation and Maintenance (O&M) Plan (Standard 9)

An operation and maintenance plan is provided in Attachment J.

4.10 Illicit Discharge Compliance Statement (Standard 10)

Per Standard 10 of the Massachusetts Department of Environmental Protection Stormwater Management Standards, there shall be no illicit discharges to the stormwater management system. The Project Manager is responsible for implementing the Operation and Maintenance Plan and overseeing activities at the facility to prevent illicit discharge to the drainage system from occurring

It is strictly prohibited to discharge any products of substances onto the ground surface or into any drainage structures, such as catch basin inlets, manholes, water quality units, forebays, basin or drainage outlets.

Should a spill occur, immediate action steps must be implemented to contain the spill, cordon off the area, clean it up immediately and dispose of it properly to prevent an illicit discharge to the stormwater management system.

4.11 Floodplain (310 CMR 10.57)

The project site is not within a floodplain based on the latest FEMA maps. Flood Insurance Rate Map (FIRM) is provided as an attachment to this report.