

Tighe & Bond

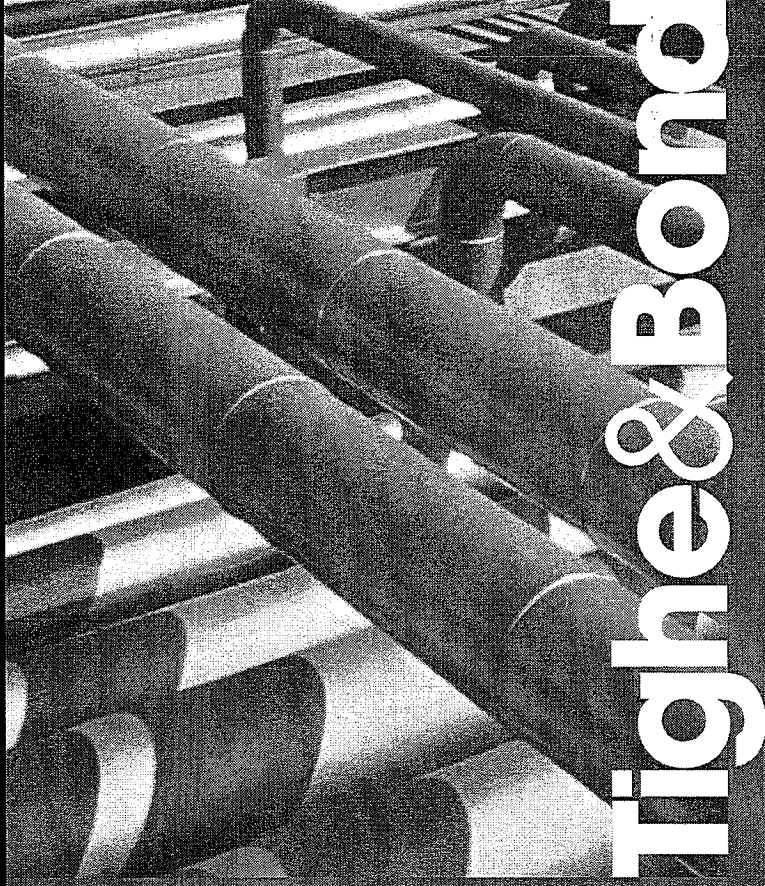
Oyster River High School
Proposed Track & Field
Durham, NH

Drainage Study

Prepared For:

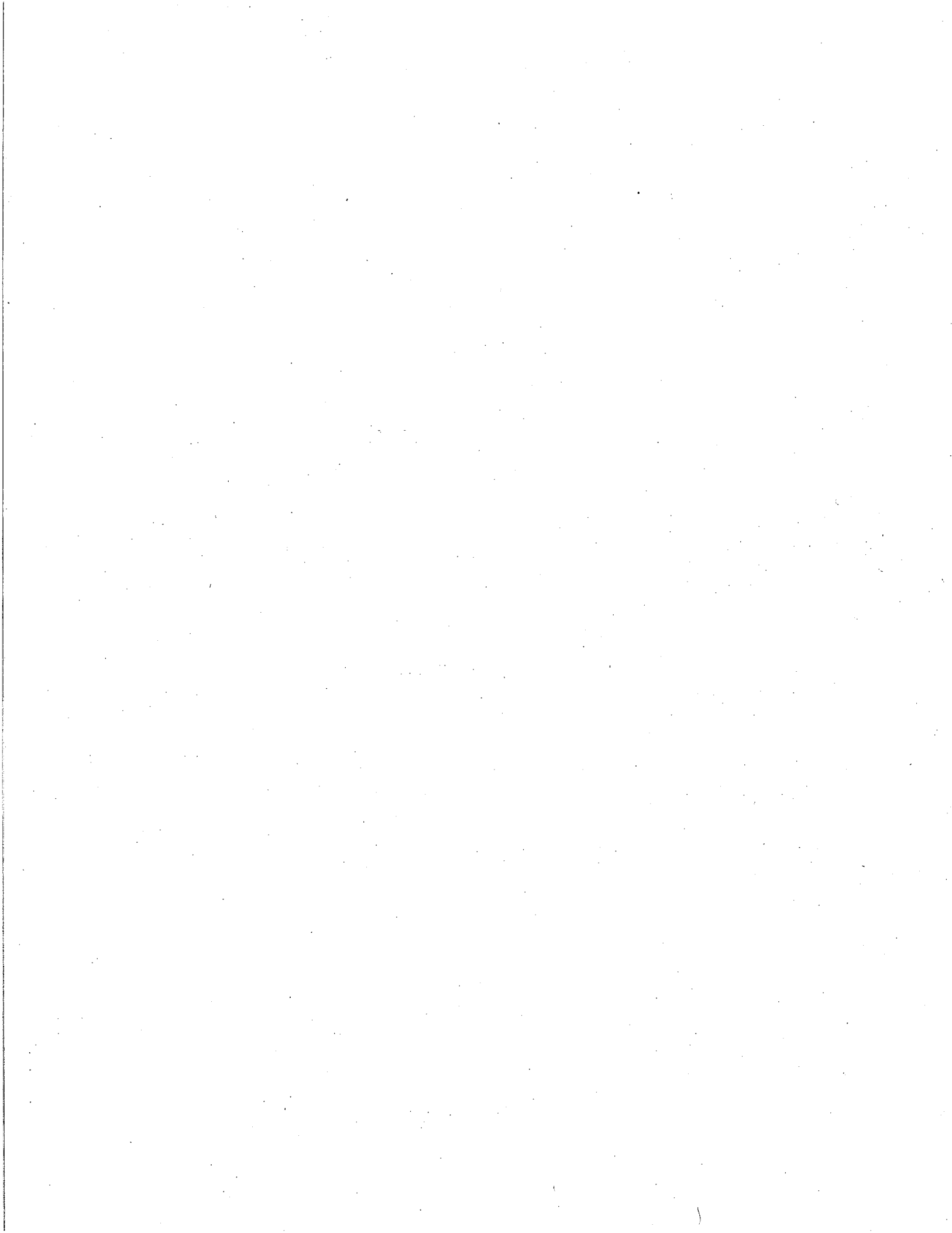
**Oyster River Cooperative School
District
Durham, NH 03824**

August 20, 2014



Tighe & Bond

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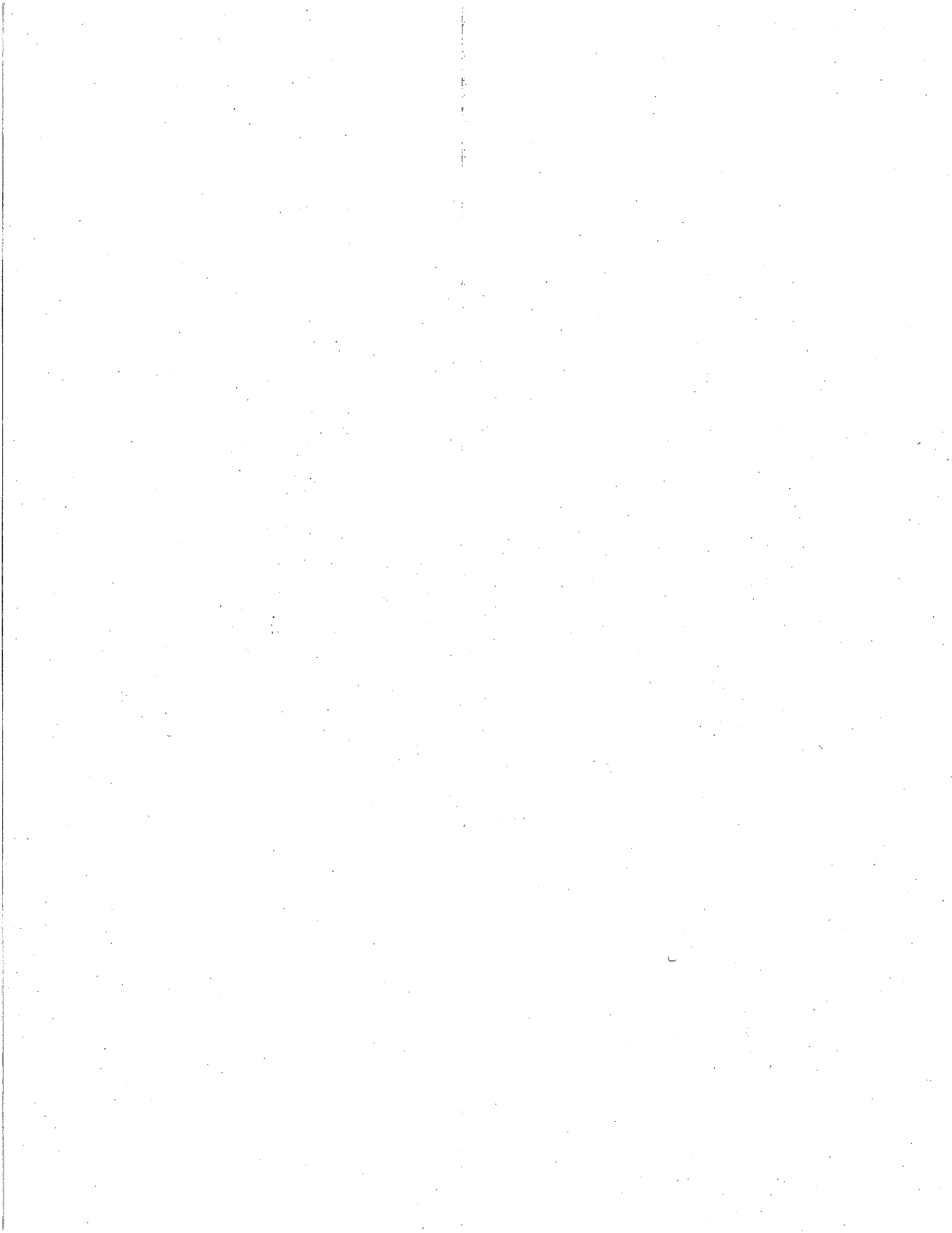
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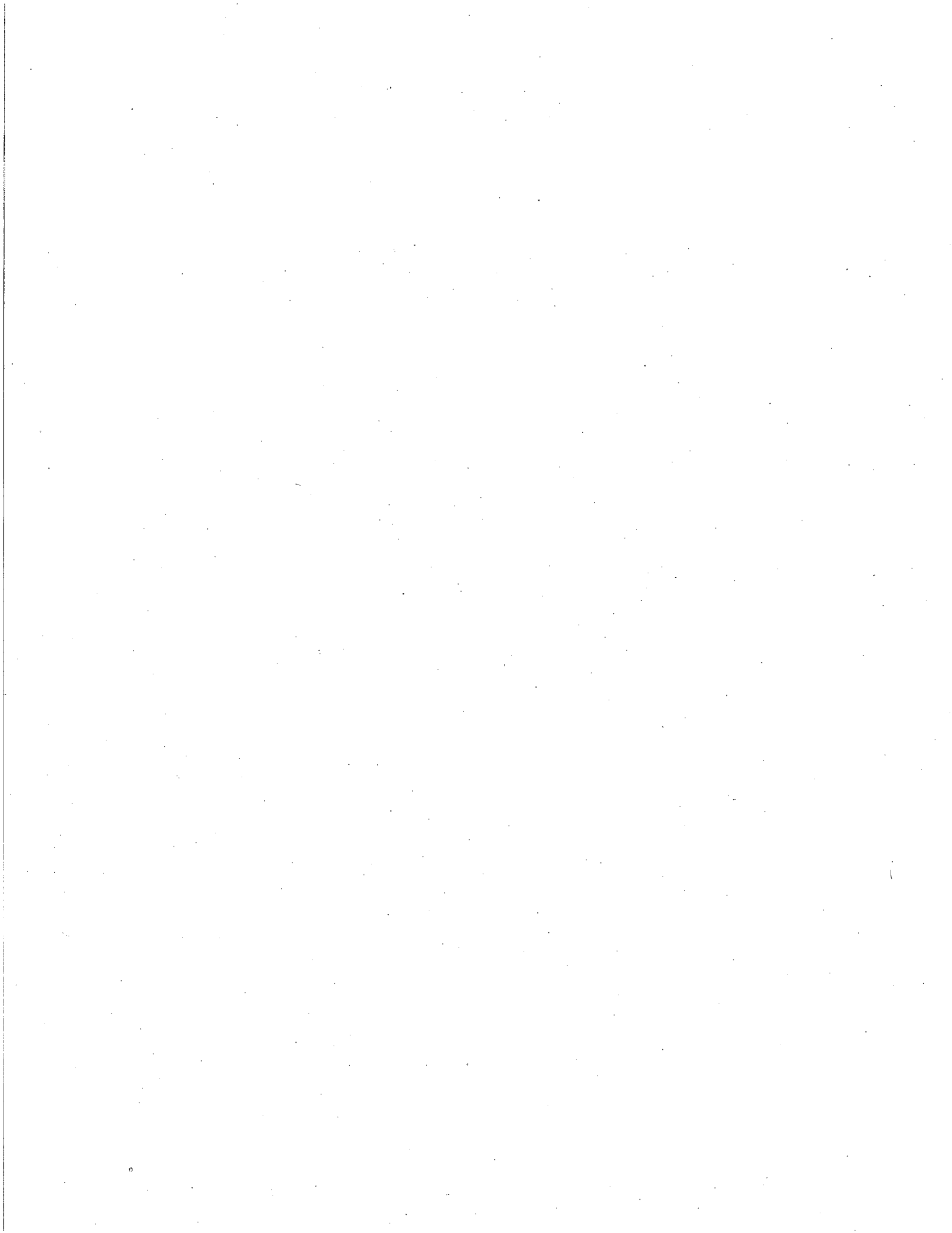
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SECTION 1



Section 1 Narrative

The proposed project is located at 36 Coe Drive (Town of Durham Tax Map 3 Block 4) and consists of the construction of a multi-use athletic field, a track, field event areas, and all associated utilities. The multi-use field will be synthetic rubber and sand infill, the track will be latex rubber or polyurethane, and the practice fields will be natural loam and seed. The site within the limit of work currently consists mainly of athletic fields with some wooded area. The drainage analysis herein assumes pre-development conditions as surveyed in June 2014. Previous drainage improvements (i.e. swales, ponds) are incorporated into the pre-development calculations.

Stormwater runoff generated by the proposed impervious track surface will drain to and be collected in the proposed synthetic multi-use field prior to discharge to the wetland area located north of the project area.

The proposed project will result in approximately 430,000 square feet of disturbance. The majority of the disturbance results from reconstruction of the baseball field and softball field within the limits of the existing ball field area and construction of the track and multi-use field within the limits of the existing athletic field area. The 167,445 square feet of proposed impervious area will consist of the synthetic multi-use field, the track, and minimal proposed concrete and asphalt surfaces. Construction is anticipated to begin in May 2015 and be completed by September 2015.

1.1 On Site Soil Description

The Site Specific Soil Survey performed by Gove Environmental Services, Inc. on July 2, 2014 indicates the soils within the limit of work include Agawam (24), Deerfield (313), Deerfield Variant, (915), and Scarboro-Poorly Drained (115/P). The Agawam soils and Deerfield soils are Hydrologic Soil Group B, the Deerfield Variant soils are Hydrologic Soil Group C, and the Scarboro-Poorly Drained soils are Hydrologic Soil Group D.

1.2 Pre- and Post-Development Flow Comparison

Two (2) points of analysis were analyzed in the Pre- and Post-Development conditions. Three (3) sub-watersheds were analyzed in the Pre-Development condition and four (4) sub-watersheds were analyzed in the Post-Development condition. The overall contributing area (17.649 acres) remained constant.

The peak discharge rates at the points of analysis were determined by analyzing Type III, 24-hour storm events. The storm events and their respective rainfall totals were obtained from the Extreme Precipitation Tables provided by the Northeast Regional Climate Center.

Table 1.2 compares pre- and post-development peak runoff rates during each design storm event.

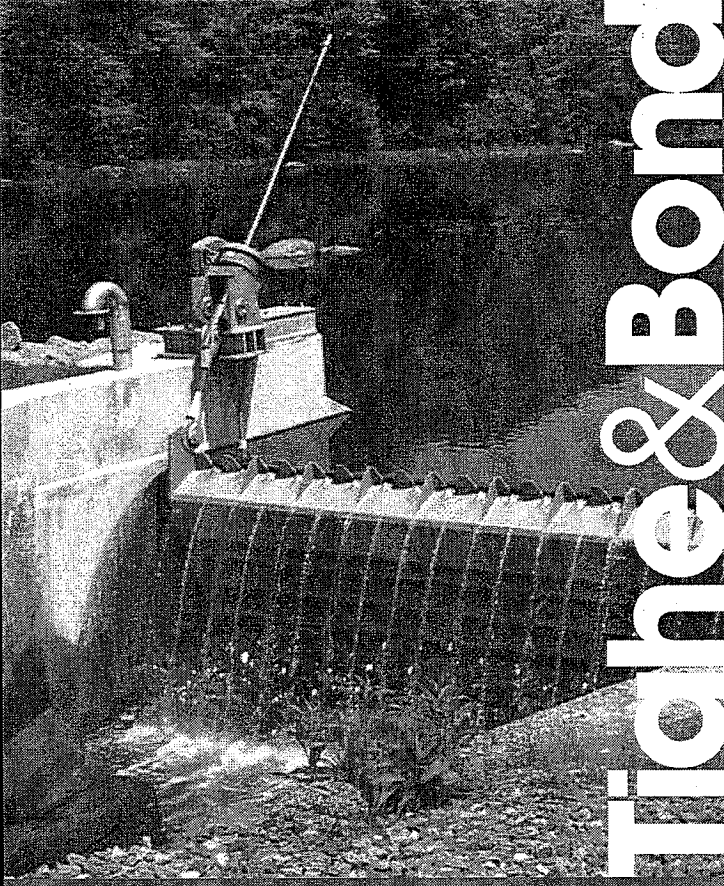
**Table 1.2 - Comparison of
Pre- and Post-Development Flows (cfs)**

	2-Year Storm	10-Year Storm	50-Year Storm
Pre-Development Watershed			
PA-1	4.97	9.88	18.71
PA-2	1.29	5.13	13.11
Post-Development Watershed			
PA-1	4.97	9.07	16.76
PA-2	0.87	3.45	8.84

The 2-year, 24-hour Post-Development storm volume (1.290 acre-feet) has increased over the 2-year, 24-hour Pre-Development storm volume (1.267 acre-feet) by not more than 0.1 acre-feet.

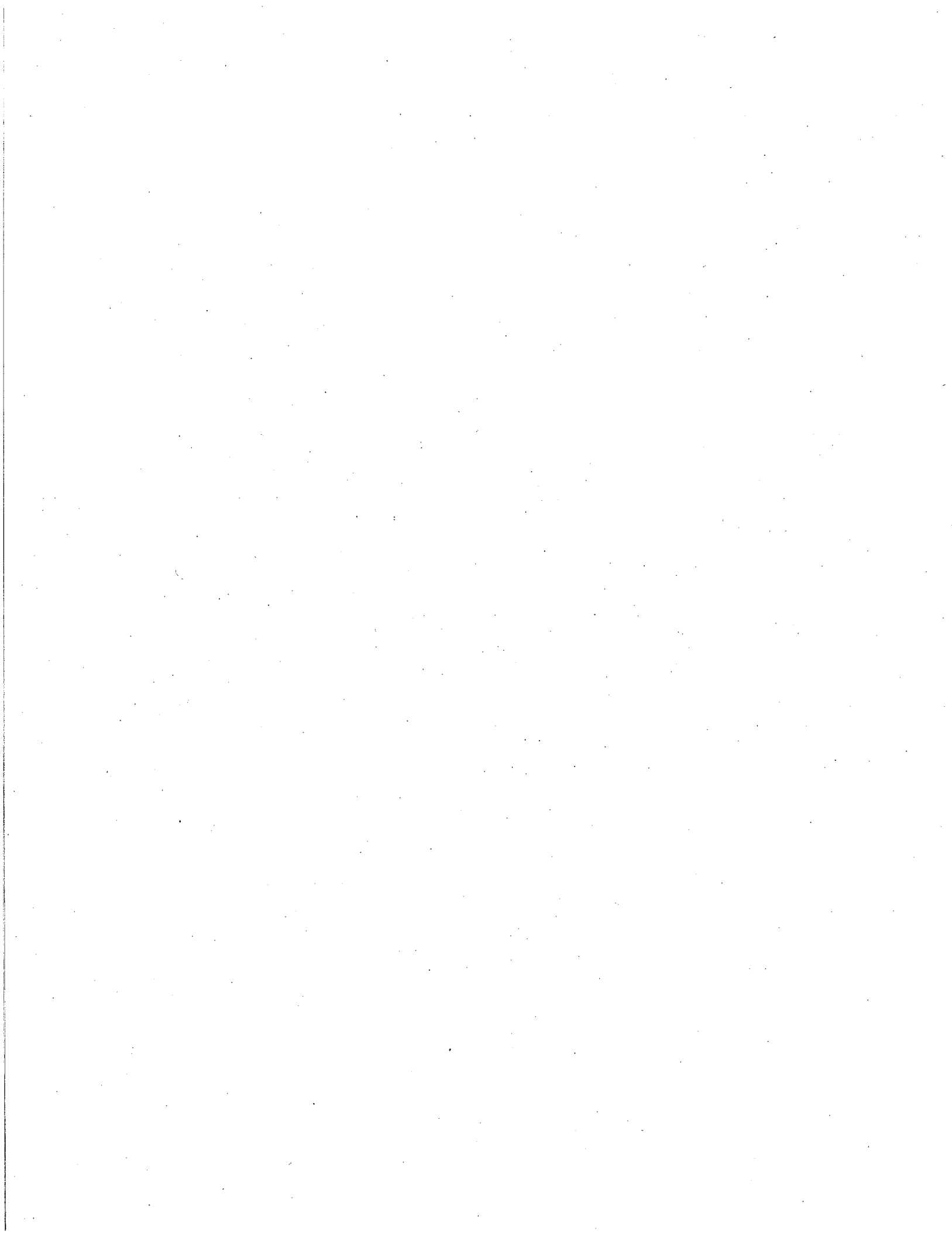
1.3 Best Management Practices

Stormwater runoff from proposed impervious surfaces will be mitigated using stone within the section below the synthetic multi-use field as detention volume. Other Best Management Practices have been incorporated into the drainage design to provide for temporary erosion control measures during construction and permanent erosion control measures after construction is complete. Temporary measures are fully depicted on the sheet titled "Erosion Control Notes and Details" in the Site Plans. Temporary measures include silt fence barriers and provisions for stabilization of inactive areas. Permanent erosion control measures include turf and vegetation establishment on all non-impervious disturbed areas.



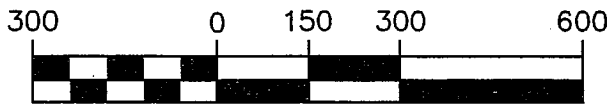
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SECTION 2





HYDROLOGIC SOIL GROUP - SUMMARY BY MAP UNIT STRAFFORD COUNTY, NEW HAMPSHIRE (NH017)		
MAP UNIT SYMBOL	MAP UNIT NAME	RATING
BzB	BUXTON SILT LOAM, 3 TO 8 PERCENT SLOPES	C
GsD	GLOUCESTER VERY STONY FINE SANDY LOAM, 15 TO 25 PERCENT SLOPES	A
HcC	HOLLIS-CHARLTON FINE SAND LOAMS, 8 TO 15 PERCENT SLOPES	C/D
HdB	HOLLIS-CHARLTON VERY ROCKY FINE SANDY LOAMS, 3 TO 8 PERCENT SLOPES	C/D
Sfc	SUFFIELD SILT LOAM, 8 TO 15 PERCENT SLOPES	C
Sfe	SUFFIELD SILT LOAM, 15 TO 35 PERCENT SLOPES	C
Ta	TIDAL MARSH	D



GRAPHIC SCALE

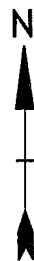
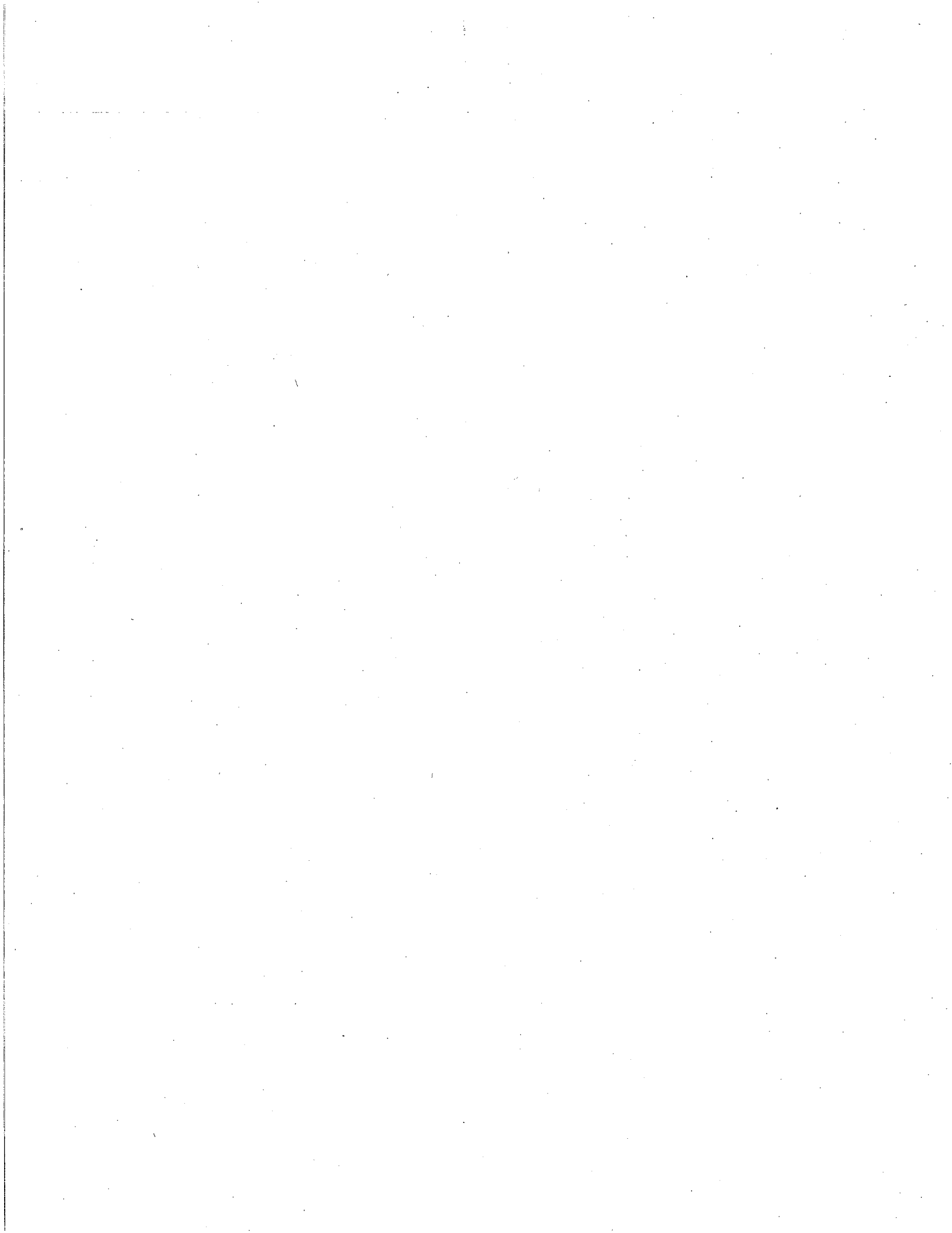
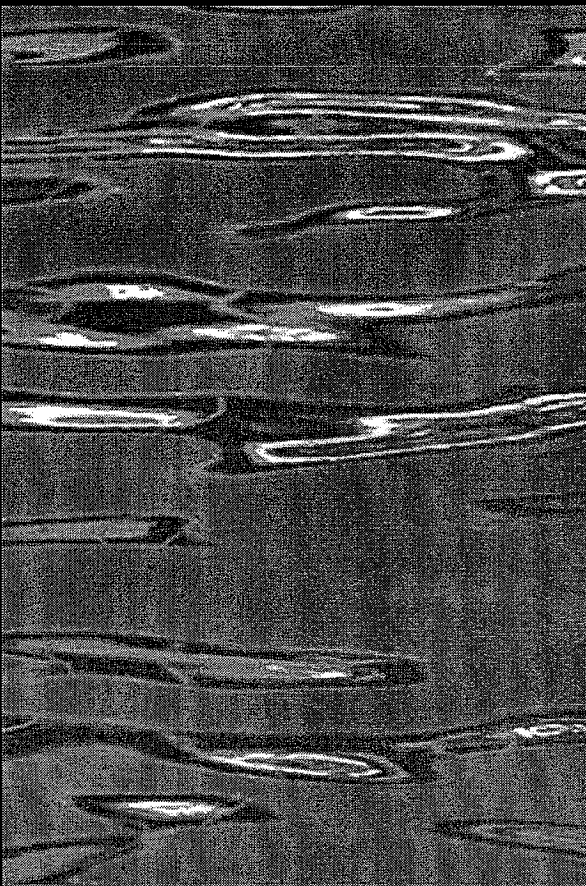


FIGURE 2:
WEB SOIL SURVEY MAP

Oyster River High School,
Proposed Track and Field
55 Coe Drive
Durham, New Hampshire

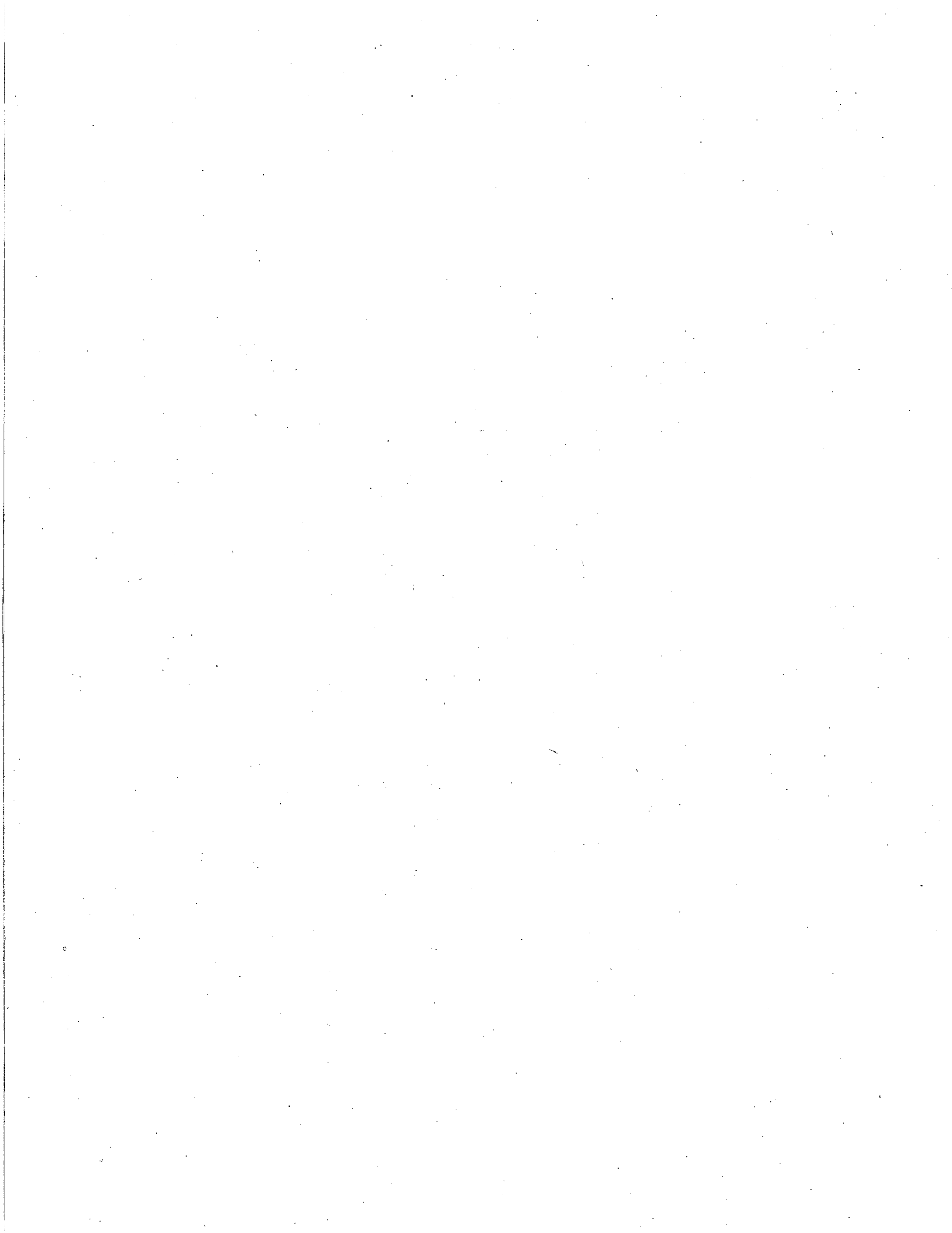
July 2014





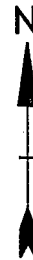
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SECTION 3



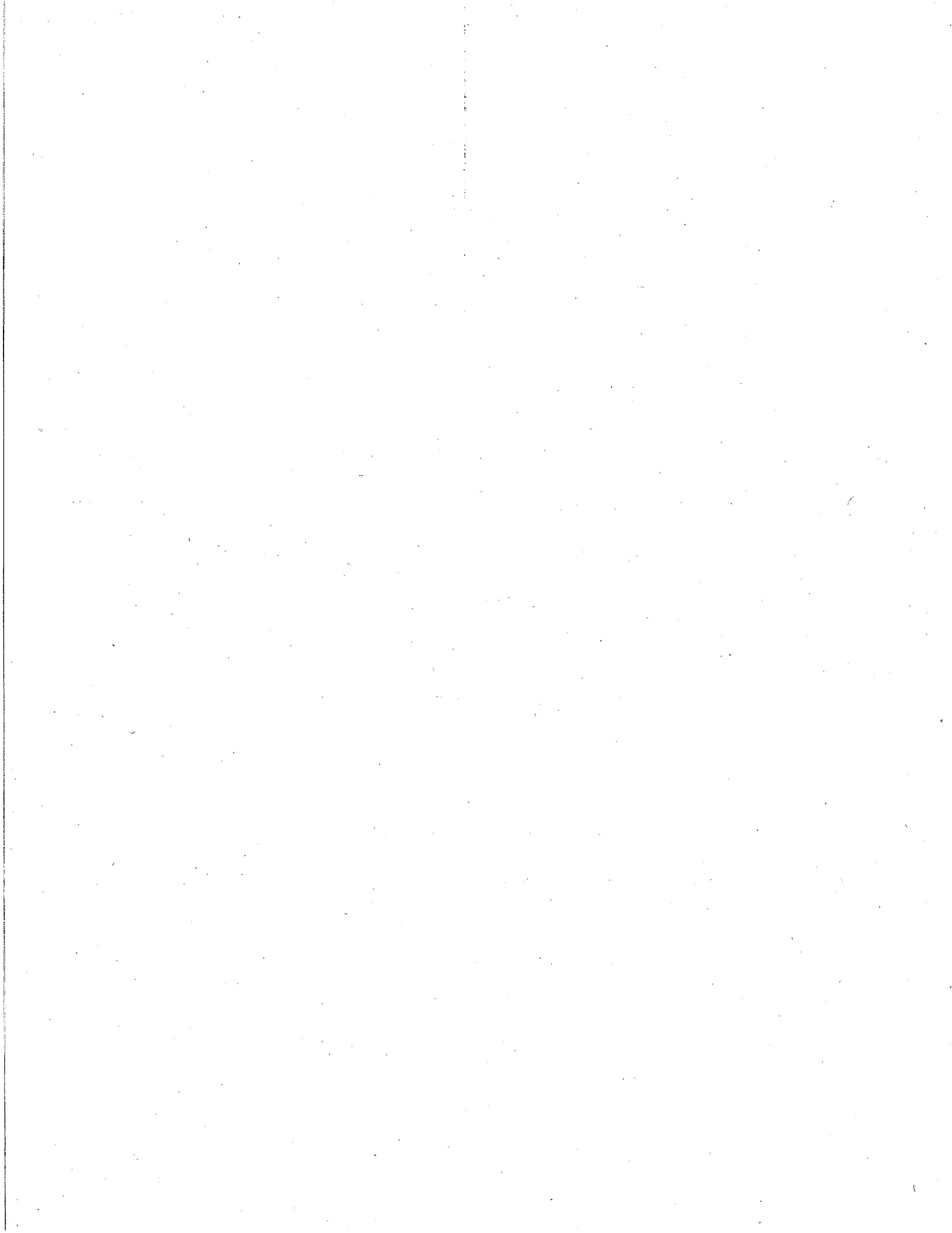



1"=2,000'



**FIGURE 3:
AERIAL PHOTOGRAPH**

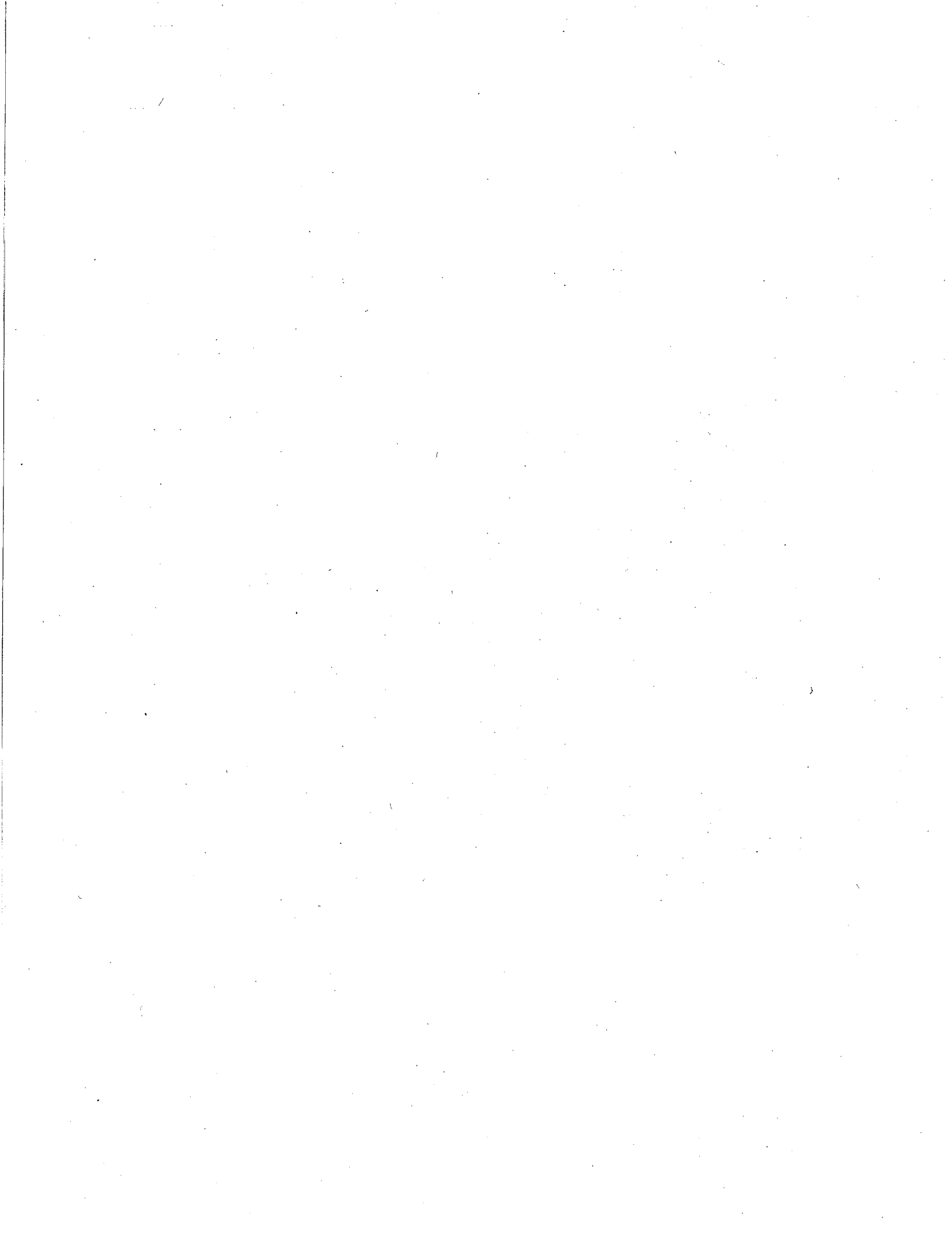
Oyster River High School
Proposed Track and Field
55 Coe Drive
Durham, New Hampshire





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SECTION 4



Section 4 Drainage Analysis

4.1 Calculation Methods

The design storms analyzed in this study are the 2-year, 10-year, and 50-year 24-hour duration storm events. The stormwater modeling system, HydroCAD 10.0 was utilized to predict the peak runoff rates from these storm events. A Type III storm pattern was used in the model.

The time of concentration was computed using the TR-55 Method, which provides a means of determining the time for an entire watershed to contribute runoff to a specific location via sheet flows, shallow concentrated flow, and channel flow. Runoff curve numbers were calculated by estimating the coverage areas and then summing the curve number for the coverage area as a percent of the entire watershed.

References:

1. HydroCAD Stormwater Modeling System, by HydroCAD Software Solutions LLC, Chocorua, New Hampshire.
2. New Hampshire Stormwater Management Manual, Volume 2, Post-Construction Best Management Practices Selection and Design, December 2008.

4.2 Pre-Development Conditions

The Pre-Development condition was analyzed at two (2) points of analysis using three (3) sub-watershed areas.

Point of Analysis One (PA1)

Pre-Development sub-watersheds Pre 1A and Pre 1B encompass the northern part of the project area. The area contains buildings, paved parking areas and walkways, grass athletic and ball fields, and wooded areas. Runoff from these sub-watersheds flow north and west via overland flow and underground piping to the wetland area located north of the project area. Point of Analysis One (PA1) is at this wetland area.

Point of Analysis Two (PA2)

Pre-Development sub-watershed Pre 2 encompasses the southern part of the project area. The area contains paved walkways, grass athletic and ball fields, and wooded areas. Runoff from this sub-watershed flows to the southwest via overland flow to a culvert under Coe Drive. Point of Analysis Two (PA2) is at this culvert.

4.2.1 Pre-Development Calculations

Included at the end of this section.

4.2.2 Pre-Development Watershed Plan, WS-1

Included at the end of this section.

4.2.3 Pre-Development Color-Coded Soil Plan, WS-3

Included at the end of this section.

4.3 Post-Development Conditions

The same points of analysis were maintained in the post-development condition.

Point of Analysis One (PA1)

Post-Development sub-watersheds Post 1A, Post 1B, and Post 1T encompass the northern part of the project area. The area contains buildings, paved parking areas and walkways, grass ball fields, proposed synthetic multi-use field, proposed latex rubber track, and wooded areas. Runoff from these sub-watersheds flows to the north via overland flow and underground piping to the wetland area located north of the project area. Point of Analysis One (PA1) is at this wetland area. Runoff from sub-watershed Post 1T is routed through the turf of the proposed synthetic multi-use field prior to discharge to the wetland. Runoff from sub-watershed Post 1B discharges directly to the wetland because no impervious is proposed within this area. Runoff from Post 1A is routed through the existing drainage swales and pond prior to discharge to the wetland.

Point of Analysis Two (PA2)

Post-Development sub-watershed Post 2 encompasses the southern part of the project area. The area contains walkways, grass ball fields, and wooded areas. Runoff from this sub-watershed flows to the southwest via overland flow to an existing culvert under Coe Drive. Runoff from Post 2 discharges directly to the existing culvert because no impervious is proposed within this area.

4.3.1 Post-Development Calculations

Included at the end of this section.

4.3.2 Post-Development Watershed Plan, WS-2

Included at the end of this section.

4.3.3 Post-Development Color-Coded Soil Plan, WS-4

Included at the end of this section.

4.4 Peak Rate Comparisons

Table 7.4.1 summarizes and compares the pre- and post-development peak runoff rates for the 2-year, 10-year, and 50-year storm events.

Table 4.4.1 - Comparison of Pre- and Post-Development Flows (cfs)

	2-Year Storm	10-Year Storm	50-Year Storm
Pre-Development Watershed			
PA-1	4.97	9.88	18.71
PA-2	1.29	5.13	13.11
Post-Development Watershed			
PA-1	4.97	9.07	16.76
PA-2	0.87	3.45	8.84

The 2-year, 24-hour Post-Development storm volume (1.290 acre-feet) has increased over the 2-year, 24-hour Pre-Development storm volume (1.267 acre-feet) by not more than 0.1 acre-feet.

As depicted in Table 4.4.1, post-development peak runoff rates are less than the pre-development condition.

4.5 Mitigation Description

The proposed development will increase the impervious area on site by approximately 167,445 square feet. The runoff from the new impervious areas will be mitigated using the stone volume within the turf section of the proposed synthetic multi-use field.

4.5.1 Mitigation Calculations

Included at the end of this section.

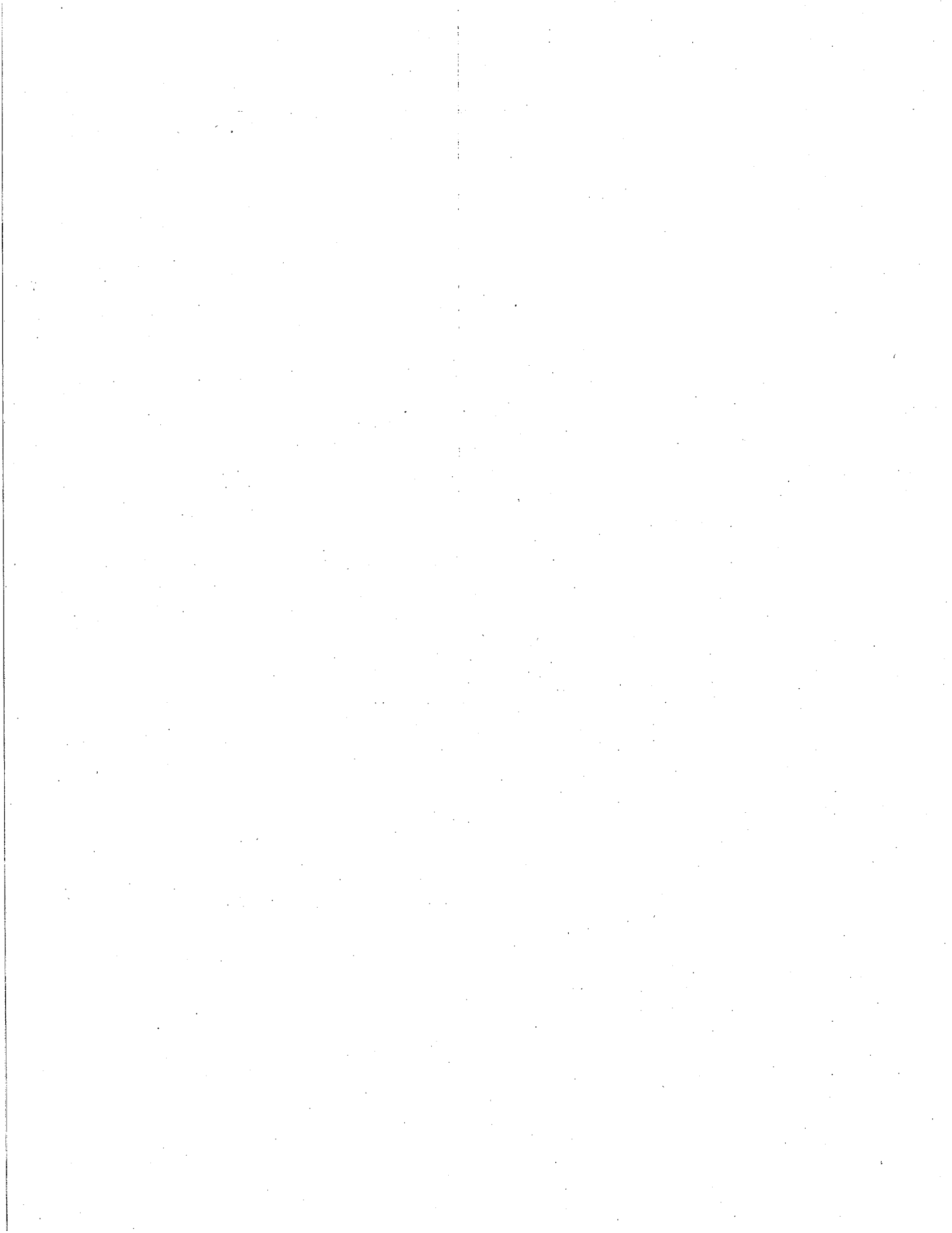
4.5.2 Pre-Treatment Methods for Protecting Water Quality

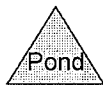
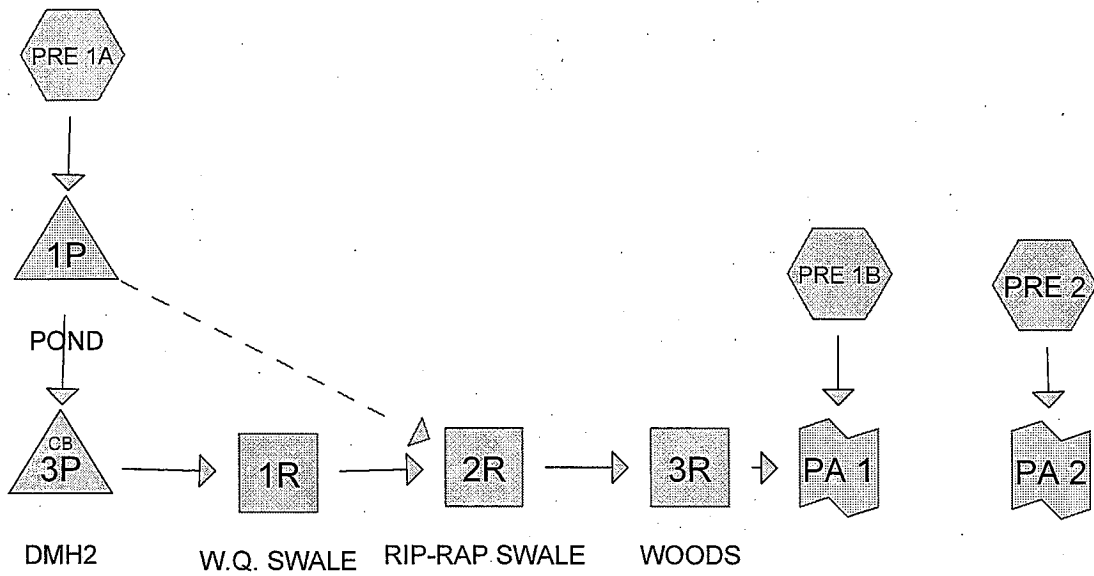
Pre-treatment is not proposed for stormwater runoff generated from the proposed track or field area because the runoff will be clean. The surfaces will not be sanded or salted and will not be trafficked by motor vehicles.

4.5.3 Treatment Methods for Protecting Water Quality

Treatment is not proposed for stormwater runoff generated from the proposed track or field area because the surfaces will not be sanded or salted and will not be trafficked by motor vehicles.

The required groundwater recharge volume for the area contributing to the proposed turf is 3,235 cubic feet. The proposed groundwater recharge volume is 3,412 cubic feet.





Routing Diagram for 2401501_PRE
 Prepared by Tighe & Bond, Printed 8/19/2014
 HydroCAD® 10.00 s/n 03436 © 2013 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
8.190	61	>75% Grass cover, Good, HSG B (PRE 1B, PRE 2)
2.697	74	>75% Grass cover, Good, HSG C (PRE 1A, PRE 1B, PRE 2)
0.024	80	>75% Grass cover, Good, HSG D (PRE 2)
0.115	98	IMPERVIOUS (PRE 1B, PRE 2)
3.992	98	Paved parking & roofs (PRE 1A)
1.734	55	Woods, Good, HSG B (PRE 1B, PRE 2)
0.627	70	Woods, Good, HSG C (PRE 1A, PRE 1B, PRE 2)
0.271	77	Woods, Good, HSG D (PRE 1B, PRE 2)
17.649	72	TOTAL AREA

2401501_PRE

Prepared by Tighe & Bond

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
9.923	HSG B	PRE 1B, PRE 2
3.324	HSG C	PRE 1A, PRE 1B, PRE 2
0.294	HSG D	PRE 1B, PRE 2
4.107	Other	PRE 1A, PRE 1B, PRE 2
17.649		TOTAL AREA

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PRE 1A: Runoff Area=289,731 sf 60.01% Impervious Runoff Depth>1.82"
Flow Length=593' Tc=7.6 min CN=88 Runoff=14.13 cfs 1.008 af

Subcatchment PRE 1B: Runoff Area=204,952 sf 1.42% Impervious Runoff Depth>0.40"
Flow Length=550' Tc=16.7 min CN=62 Runoff=1.20 cfs 0.155 af

Subcatchment PRE 2: Runoff Area=274,092 sf 0.77% Impervious Runoff Depth>0.36"
Flow Length=530' Tc=22.4 min CN=61 Runoff=1.29 cfs 0.190 af

Reach 1R: W.Q. SWALE Avg. Flow Depth=0.37' Max Vel=0.78 fps Inflow=3.88 cfs 0.925 af
n=0.035 L=105.0' S=0.0014 '/' Capacity=96.91 cfs Outflow=3.85 cfs 0.923 af

Reach 2R: RIP-RAP SWALE Avg. Flow Depth=0.08' Max Vel=2.39 fps Inflow=3.85 cfs 0.923 af
n=0.040 L=77.0' S=0.1234 '/' Capacity=274.29 cfs Outflow=3.85 cfs 0.922 af

Reach 3R: WOODS Avg. Flow Depth=0.10' Max Vel=1.99 fps Inflow=3.85 cfs 0.922 af
n=0.050 L=57.0' S=0.1053 '/' Capacity=202.69 cfs Outflow=3.85 cfs 0.922 af

Pond 1P: POND Peak Elev=33.44' Storage=17,969 cf Inflow=14.13 cfs 1.008 af
Primary=3.88 cfs 0.925 af Secondary=0.00 cfs 0.000 af Outflow=3.88 cfs 0.925 af

Pond 3P: DMH2 Peak Elev=33.02' Inflow=3.88 cfs 0.925 af
15.0" Round Culvert n=0.012 L=19.0' S=0.0053 '/' Outflow=3.88 cfs 0.925 af

Link PA 1: Inflow=4.97 cfs 1.077 af
Primary=4.97 cfs 1.077 af

Link PA 2: Inflow=1.29 cfs 0.190 af
Primary=1.29 cfs 0.190 af

Total Runoff Area = 17.649 ac Runoff Volume = 1.354 af Average Runoff Depth = 0.92"
76.73% Pervious = 13.542 ac 23.27% Impervious = 4.107 ac

2401501_PRE

Prepared by Tighe & Bond

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Type III 24-hr 10yr Rainfall=4.75"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PRE 1A: Runoff Area=289,731 sf 60.01% Impervious Runoff Depth>3.23"
 Flow Length=593' Tc=7.6 min CN=88 Runoff=24.53 cfs 1.792 af

Subcatchment PRE 1B: Runoff Area=204,952 sf 1.42% Impervious Runoff Depth>1.16"
 Flow Length=550' Tc=16.7 min CN=62 Runoff=4.61 cfs 0.454 af

Subcatchment PRE 2: Runoff Area=274,092 sf 0.77% Impervious Runoff Depth>1.09"
 Flow Length=530' Tc=22.4 min CN=61 Runoff=5.13 cfs 0.573 af

Reach 1R: W.Q. SWALE Avg. Flow Depth=0.47' Max Vel=0.90 fps Inflow=5.66 cfs 1.687 af
 n=0.035 L=105.0' S=0.0014 '/ Capacity=96.91 cfs Outflow=5.66 cfs 1.684 af

Reach 2R: RIP-RAP SWALE Avg. Flow Depth=0.10' Max Vel=2.78 fps Inflow=5.66 cfs 1.684 af
 n=0.040 L=77.0' S=0.1234 '/ Capacity=274.29 cfs Outflow=5.66 cfs 1.683 af

Reach 3R: WOODS Avg. Flow Depth=0.12' Max Vel=2.32 fps Inflow=5.66 cfs 1.683 af
 n=0.050 L=57.0' S=0.1053 '/ Capacity=202.69 cfs Outflow=5.66 cfs 1.682 af

Pond 1P: POND Peak Elev=34.44' Storage=32,189 cf Inflow=24.53 cfs 1.792 af
 Primary=5.66 cfs 1.687 af Secondary=0.00 cfs 0.000 af Outflow=5.66 cfs 1.687 af

Pond 3P: DMH2 Peak Elev=33.52' Inflow=5.66 cfs 1.687 af
 15.0" Round Culvert n=0.012 L=19.0' S=0.0053 '/ Outflow=5.66 cfs 1.687 af

Link PA 1: Inflow=9.88 cfs 2.136 af
 Primary=9.88 cfs 2.136 af

Link PA 2: Inflow=5.13 cfs 0.573 af
 Primary=5.13 cfs 0.573 af

Total Runoff Area = 17.649 ac Runoff Volume = 2.820 af Average Runoff Depth = 1.92"
76.73% Pervious = 13.542 ac 23.27% Impervious = 4.107 ac

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentPRE 1A: Runoff Area=289,731 sf 60.01% Impervious Runoff Depth>5.47"
Flow Length=593' Tc=7.6 min CN=88 Runoff=40.32 cfs 3.031 af

SubcatchmentPRE 1B: Runoff Area=204,952 sf 1.42% Impervious Runoff Depth>2.70"
Flow Length=550' Tc=16.7 min CN=62 Runoff=11.49 cfs 1.060 af

SubcatchmentPRE 2: Runoff Area=274,092 sf 0.77% Impervious Runoff Depth>2.60"
Flow Length=530' Tc=22.4 min CN=61 Runoff=13.11 cfs 1.364 af

Reach 1R: W.Q. SWALE Avg. Flow Depth=0.57' Max Vel=1.01 fps Inflow=7.83 cfs 2.895 af
n=0.035 L=105.0' S=0.0014 '/ Capacity=96.91 cfs Outflow=7.82 cfs 2.890 af

Reach 2R: RIP-RAP SWALE Avg. Flow Depth=0.12' Max Vel=3.16 fps Inflow=7.82 cfs 2.890 af
n=0.040 L=77.0' S=0.1234 '/ Capacity=274.29 cfs Outflow=7.81 cfs 2.889 af

Reach 3R: WOODS Avg. Flow Depth=0.15' Max Vel=2.63 fps Inflow=7.81 cfs 2.889 af
n=0.050 L=57.0' S=0.1053 '/ Capacity=202.69 cfs Outflow=7.82 cfs 2.888 af

Pond 1P: POND Peak Elev=35.87' Storage=55,233 cf Inflow=40.32 cfs 3.031 af
Primary=7.83 cfs 2.895 af Secondary=0.00 cfs 0.000 af Outflow=7.83 cfs 2.895 af

Pond 3P: DMH2 Peak Elev=34.13' Inflow=7.83 cfs 2.895 af
15.0" Round Culvert n=0.012 L=19.0' S=0.0053 '/ Outflow=7.83 cfs 2.895 af

Link PA 1: Inflow=18.71 cfs 3.949 af
Primary=18.71 cfs 3.949 af

Link PA 2: Inflow=13.11 cfs 1.364 af
Primary=13.11 cfs 1.364 af

Total Runoff Area = 17.649 ac Runoff Volume = 5.455 af Average Runoff Depth = 3.71"
76.73% Pervious = 13.542 ac 23.27% Impervious = 4.107 ac

Summary for Subcatchment PRE 1A:

Runoff = 24.53 cfs @ 12.11 hrs, Volume= 1.792 af, Depth> 3.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10yr Rainfall=4.75"

Area (sf)	CN	Description
173,873	98	Paved parking & roofs
110,028	74	>75% Grass cover, Good, HSG C
5,830	70	Woods, Good, HSG C
289,731	88	Weighted Average
115,858		39.99% Pervious Area
173,873		60.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	52	0.0290	0.16		Sheet Flow, Grass: Short n= 0.150 P2= 2.61"
0.3	63	0.0300	3.52		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.3	86	0.0100	4.91	3.86	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.3	100	0.0100	4.91	3.86	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.3	58	0.0060	3.81	2.99	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.7	152	0.0050	3.47	2.73	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.1	29	0.0050	3.47	2.73	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.1	53	0.0520	14.68	25.95	Pipe Channel, 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012
7.6	593	Total			

Summary for Subcatchment PRE 1B:

Runoff = 4.61 cfs @ 12.26 hrs, Volume= 0.454 af, Depth> 1.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10yr Rainfall=4.75"

2401501_PRE

Type III 24-hr 10yr Rainfall=4.75"

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Area (sf)	CN	Description
*	2,920	98 IMPERVIOUS
	48,870	55 Woods, Good, HSG B
	120,606	61 >75% Grass cover, Good, HSG B
	20,630	70 Woods, Good, HSG C
	280	74 >75% Grass cover, Good, HSG C
	11,646	77 Woods, Good, HSG D
	0	80 >75% Grass cover, Good, HSG D
204,952	62	Weighted Average
202,032		98.58% Pervious Area
2,920		1.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	25	0.0100	0.04		Sheet Flow, Grass: Bermuda n= 0.410 P2= 2.61"
2.1	185	0.0100	1.50		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
0.2	60	0.1000	4.74		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
3.8	280	0.0600	1.22		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
16.7	550	Total			

Summary for Subcatchment PRE 2:

Runoff = 5.13 cfs @ 12.36 hrs, Volume= 0.573 af, Depth> 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10yr Rainfall=4.75"

Area (sf)	CN	Description
*	2,110	98 IMPERVIOUS
	26,650	55 Woods, Good, HSG B
	236,134	61 >75% Grass cover, Good, HSG B
	850	70 Woods, Good, HSG C
	7,174	74 >75% Grass cover, Good, HSG C
	140	77 Woods, Good, HSG D
	1,034	80 >75% Grass cover, Good, HSG D
274,092	61	Weighted Average
271,982		99.23% Pervious Area
2,110		0.77% Impervious Area

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Type III 24-hr 10yr Rainfall=4.75"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.4	50	0.0100	0.05		Sheet Flow, Grass: Bermuda n= 0.410 P2= 2.61"
1.7	150	0.0100	1.50		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
1.3	170	0.0200	2.12		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
0.6	130	0.0600	3.67		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
0.4	30	0.0600	1.22		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
22.4	530	Total			

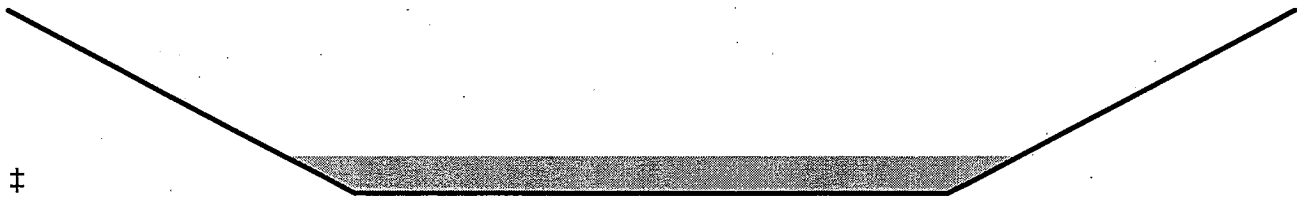
Summary for Reach 1R: W.Q. SWALE

Inflow Area = 6.651 ac, 60.01% Impervious, Inflow Depth > 3.04" for 10yr event
 Inflow = 5.66 cfs @ 12.45 hrs, Volume= 1.687 af
 Outflow = 5.66 cfs @ 12.52 hrs, Volume= 1.684 af, Atten= 0%, Lag= 4.2 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Max. Velocity= 0.90 fps, Min. Travel Time= 1.9 min
 Avg. Velocity = 0.45 fps, Avg. Travel Time= 3.9 min

Peak Storage= 660 cf @ 12.52 hrs
 Average Depth at Peak Storage= 0.47'
 Bank-Full Depth= 2.30' Flow Area= 43.5 sf, Capacity= 96.91 cfs

12.00' x 2.30' deep channel, n= 0.035 Earth, dense weeds
 Side Slope Z-value= 3.0 ' Top Width= 25.80'
 Length= 105.0' Slope= 0.0014 ' / '
 Inlet Invert= 31.65', Outlet Invert= 31.50'



Summary for Reach 2R: RIP-RAP SWALE

Inflow Area = 6.651 ac, 60.01% Impervious, Inflow Depth > 3.04" for 10yr event
 Inflow = 5.66 cfs @ 12.52 hrs, Volume= 1.684 af
 Outflow = 5.66 cfs @ 12.54 hrs, Volume= 1.683 af, Atten= 0%, Lag= 1.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Max. Velocity= 2.78 fps, Min. Travel Time= 0.5 min
 Avg. Velocity = 1.41 fps, Avg. Travel Time= 0.9 min

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Type III 24-hr 10yr Rainfall=4.75"

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Peak Storage= 157 cf @ 12.54 hrs
Average Depth at Peak Storage= 0.10'
Bank-Full Depth= 1.00' Flow Area= 23.0 sf, Capacity= 274.29 cfs

20.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 3.0 '/ Top Width= 26.00'
Length= 77.0' Slope= 0.1234 '/
Inlet Invert= 31.50', Outlet Invert= 22.00'



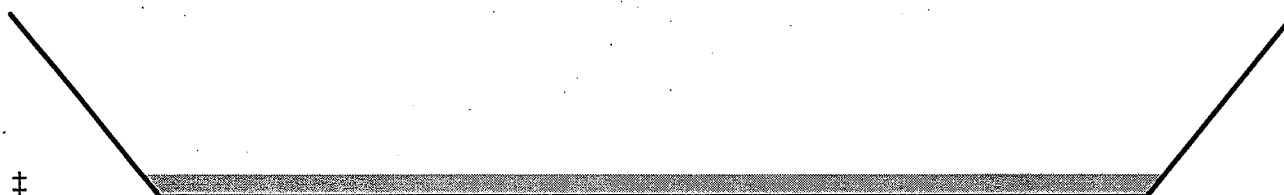
Summary for Reach 3R: WOODS

Inflow Area = 6.651 ac, 60.01% Impervious, Inflow Depth > 3.04" for 10yr event
Inflow = 5.66 cfs @ 12.54 hrs, Volume= 1.683 af
Outflow = 5.66 cfs @ 12.54 hrs, Volume= 1.682 af, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.32 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.16 fps, Avg. Travel Time= 0.8 min

Peak Storage= 139 cf @ 12.54 hrs
Average Depth at Peak Storage= 0.12'
Bank-Full Depth= 1.00' Flow Area= 23.0 sf, Capacity= 202.69 cfs

20.00' x 1.00' deep channel, n= 0.050 Scattered brush, heavy weeds
Side Slope Z-value= 3.0 '/ Top Width= 26.00'
Length= 57.0' Slope= 0.1053 '/
Inlet Invert= 22.00', Outlet Invert= 16.00'



Summary for Pond 1P: POND

Inflow Area = 6.651 ac, 60.01% Impervious, Inflow Depth > 3.23" for 10yr event
Inflow = 24.53 cfs @ 12.11 hrs, Volume= 1.792 af
Outflow = 5.66 cfs @ 12.45 hrs, Volume= 1.687 af, Atten= 77%, Lag= 20.5 min
Primary = 5.66 cfs @ 12.45 hrs, Volume= 1.687 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

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Type III 24-hr 10yr Rainfall=4.75"

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Peak Elev= 34.44' @ 12.53 hrs Surf.Area= 14,960 sf Storage= 32,189 cf
 Flood Elev= 38.00' Surf.Area= 20,603 sf Storage= 95,336 cf

Plug-Flow detention time= 92.8 min calculated for 1.687 af (94% of inflow)
 Center-of-Mass det. time= 71.5 min (841.2 - 769.7)

Volume	Invert	Avail.Storage	Storage Description			
#1	32.00'	95,336 cf	Custom Stage Data (Irregular) Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
32.00	11,526	448.0	0	0	11,526	
34.00	14,325	485.0	25,800	25,800	14,427	
36.00	17,351	523.0	31,628	57,428	17,638	
38.00	20,603	561.0	37,907	95,336	21,090	

Device	Routing	Invert	Outlet Devices	
#1	Primary	32.00'	15.0" Round Culvert L= 32.0' Ke= 0.500 Inlet / Outlet Invert= 32.00' / 31.85' S= 0.0047 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf	
#2	Secondary	36.30'	33.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64	

Primary OutFlow Max=5.60 cfs @ 12.45 hrs HW=34.42' TW=33.52' (Dynamic Tailwater)
 ↑1=Culvert (Inlet Controls 5.60 cfs @ 4.56 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=32.00' TW=31.50' (Dynamic Tailwater)
 ↑2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 3P: DMH2

Inflow Area = 6.651 ac, 60.01% Impervious, Inflow Depth > 3.04" for 10yr event
 Inflow = 5.66 cfs @ 12.45 hrs, Volume= 1.687 af
 Outflow = 5.66 cfs @ 12.45 hrs, Volume= 1.687 af, Atten= 0%, Lag= 0.0 min
 Primary = 5.66 cfs @ 12.45 hrs, Volume= 1.687 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 33.52' @ 12.45 hrs
 Flood Elev= 38.20'

Device	Routing	Invert	Outlet Devices	
#1	Primary	31.75'	15.0" Round Culvert L= 19.0' Ke= 0.500 Inlet / Outlet Invert= 31.75' / 31.65' S= 0.0053 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf	

Primary OutFlow Max=5.66 cfs @ 12.45 hrs HW=33.52' TW=32.12' (Dynamic Tailwater)
 ↑1=Culvert (Barrel Controls 5.66 cfs @ 4.61 fps)

Summary for Link PA 1:

Inflow Area = 11.356 ac, 35.74% Impervious, Inflow Depth > 2.26" for 10yr event
Inflow = 9.88 cfs @ 12.27 hrs, Volume= 2.136 af
Primary = 9.88 cfs @ 12.27 hrs, Volume= 2.136 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

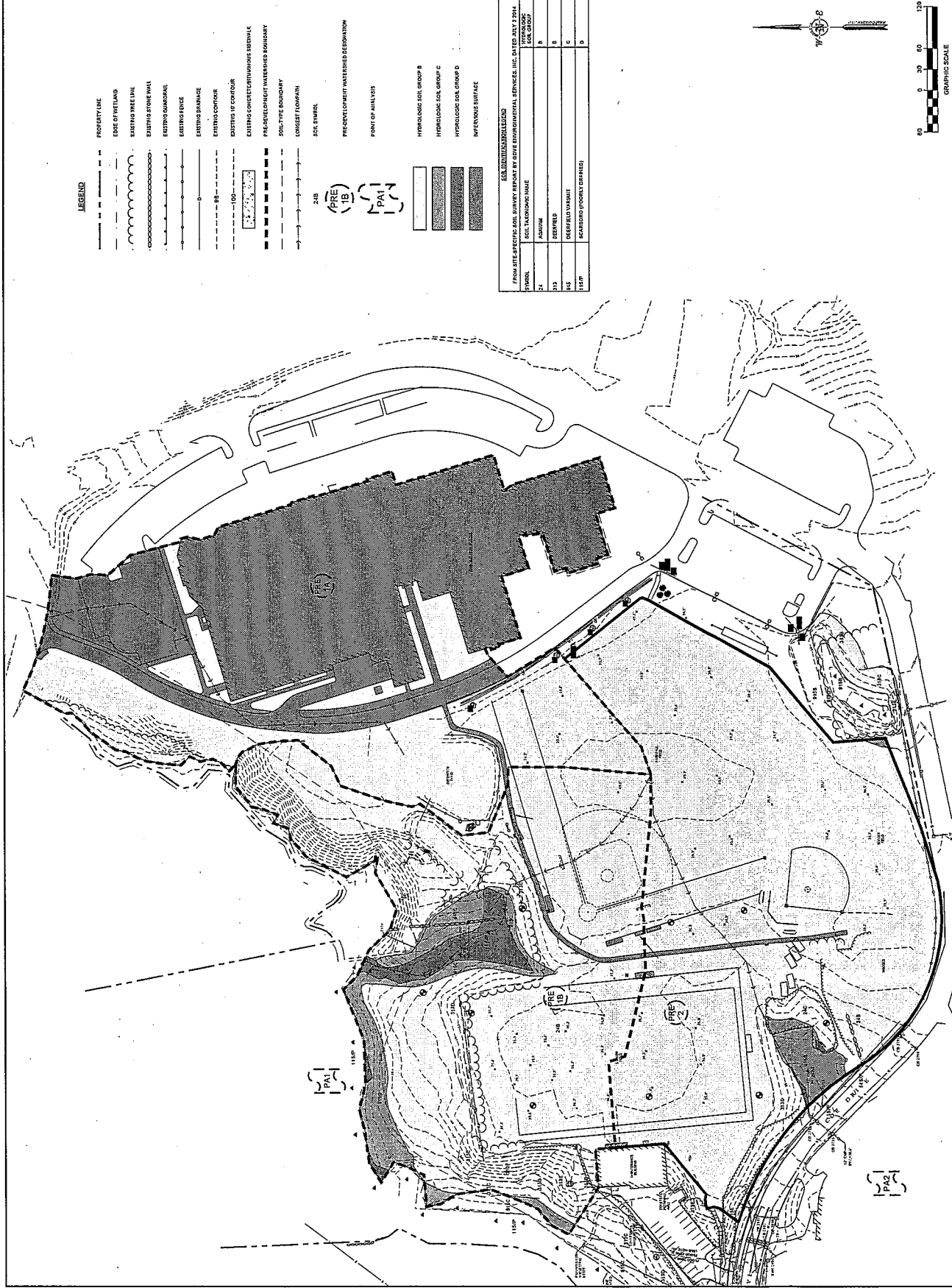
Summary for Link PA 2:

Inflow Area = 6.292 ac, 0.77% Impervious, Inflow Depth > 1.09" for 10yr event
Inflow = 5.13 cfs @ 12.36 hrs, Volume= 0.573 af
Primary = 5.13 cfs @ 12.36 hrs, Volume= 0.573 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

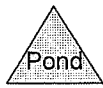
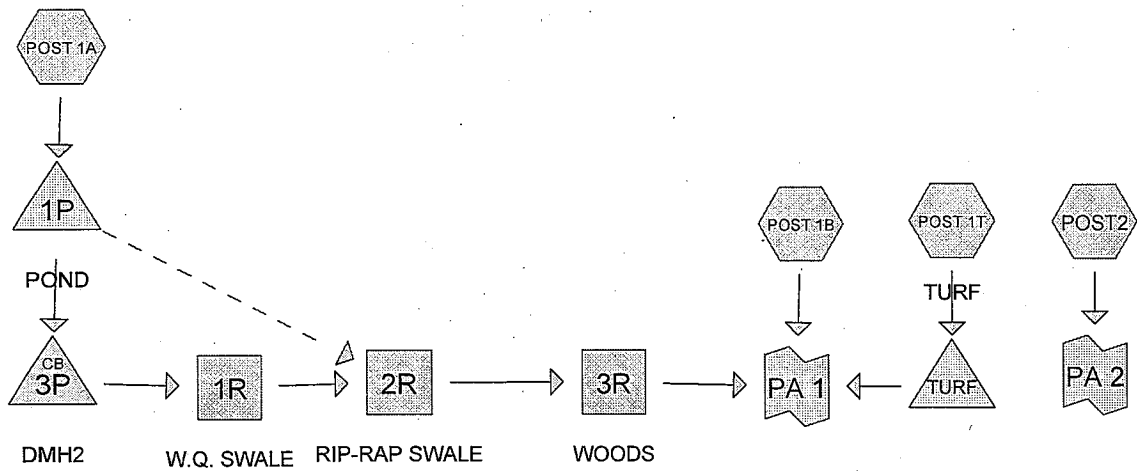
Oyster River High School
Proposed Track and Field
 38 Coe Drive
 Durham, NH

PROJECT NO.	041109
DATE	06/20/13
DRAWN BY	SM
CHECKED BY	SM
APPROVED BY	SM
PRE-DEVELOPMENT COLOR-CODED SOIL PLAN	
SCALE	AS SHOWN



- LEGEND**
- PROPERTY LINE
 - EDGE OF WETLAND
 - EXISTING TREE LINE
 - EXISTING STONE WALL
 - EXISTING DRAINAGE
 - EXISTING FENCE
 - EXISTING SHED
 - EXISTING CONTOUR
 - EXISTING CONTOUR
 - EXISTING CONCRETE/STURDIUMOUS SUBWALL
 - PALEO-DEVELOPMENT WATERBODIED BOUNDARY
 - SOIL-TYPE BOUNDARY
 - LOGS/STUMP
 - SOIL SYMBOL
 - PRE-DEVELOPMENT WATERBODIED DEGRADATION
 - POINT OF ANALYSIS
 - HYDROLOGIC SOIL GROUP B
 - HYDROLOGIC SOIL GROUP C
 - HYDROLOGIC SOIL GROUP D
 - WETLAND SURFACE

SOIL IDENTIFICATION	
FROM SITE SPECIFIC SOIL SAMPLE REPORT BY QUOTE ENVIRONMENTAL SERVICES, INC. DATED JULY 2014	HYDROLOGIC SOIL GROUP
24	A
313	B
345	C
116P	D



Routing Diagram for 2401501_POST
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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
4.793	61	>75% Grass cover, Good, HSG B (POST 1B, POST2)
2.730	74	>75% Grass cover, Good, HSG C (POST 1A, POST 1B, POST2)
0.096	80	>75% Grass cover, Good, HSG D (POST 1B, POST2)
0.336	98	IMPERVIOUS (POST 1B, POST2)
1.556	98	IMPERVIOUS-TRACK (POST 1T)
2.067	98	IMPERVIOUS-TURF (POST 1T)
3.992	98	Paved parking & roofs (POST 1A)
1.640	55	Woods, Good, HSG B (POST 1B, POST2)
0.407	70	Woods, Good, HSG C (POST 1A, POST 1B)
0.031	77	Woods, Good, HSG D (POST 1B)
17.649	79	TOTAL AREA

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Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
6.433	HSG B	POST 1B, POST2
3.137	HSG C	POST 1A, POST 1B, POST2
0.127	HSG D	POST 1B, POST2
7.951	Other	POST 1A, POST 1B, POST 1T, POST2
17.649		TOTAL AREA

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Type III 24-hr 2yr Rainfall=3.14"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment POST 1A: Runoff Area=289,731 sf 60.01% Impervious Runoff Depth>1.82"
Flow Length=593' Tc=7.6 min CN=88 Runoff=14.13 cfs 1.008 af

Subcatchment POST 1B: Runoff Area=138,180 sf 9.07% Impervious Runoff Depth>0.47"
Flow Length=550' Tc=16.7 min CN=64 Runoff=1.04 cfs 0.123 af

Subcatchment POST 1T: TURF Runoff Area=157,820 sf 100.00% Impervious Runoff Depth>2.72"
Tc=5.0 min CN=98 Runoff=11.11 cfs 0.821 af

Subcatchment POST2: Runoff Area=183,040 sf 1.15% Impervious Runoff Depth>0.36"
Flow Length=387' Tc=22.0 min CN=61 Runoff=0.87 cfs 0.127 af

Reach 1R: W.Q. SWALE Avg. Flow Depth=0.37' Max Vel=0.78 fps Inflow=3.88 cfs 0.925 af
n=0.035 L=105.0' S=0.0014 '/ Capacity=96.91 cfs Outflow=3.85 cfs 0.923 af

Reach 2R: RIP-RAP SWALE Avg. Flow Depth=0.08' Max Vel=2.39 fps Inflow=3.85 cfs 0.923 af
n=0.040 L=77.0' S=0.1234 '/ Capacity=274.29 cfs Outflow=3.85 cfs 0.922 af

Reach 3R: WOODS Avg. Flow Depth=0.10' Max Vel=1.99 fps Inflow=3.85 cfs 0.922 af
n=0.050 L=57.0' S=0.1053 '/ Capacity=202.69 cfs Outflow=3.85 cfs 0.922 af

Pond 1P: POND Peak Elev=33.44' Storage=17,969 cf Inflow=14.13 cfs 1.008 af
Primary=3.88 cfs 0.925 af Secondary=0.00 cfs 0.000 af Outflow=3.88 cfs 0.925 af

Pond 3P: DMH2 Peak Elev=33.02' Inflow=3.88 cfs 0.925 af
15.0" Round Culvert n=0.012 L=19.0' S=0.0053 '/ Outflow=3.88 cfs 0.925 af

Pond TURF: Peak Elev=36.60' Storage=0.283 af Inflow=11.11 cfs 0.821 af
Discarded=10.86 cfs 0.544 af Primary=0.20 cfs 0.118 af Outflow=11.05 cfs 0.662 af

Link PA 1: Inflow=4.97 cfs 1.163 af
Primary=4.97 cfs 1.163 af

Link PA 2: Inflow=0.87 cfs 0.127 af
Primary=0.87 cfs 0.127 af

Total Runoff Area = 17.649 ac Runoff Volume = 2.079 af Average Runoff Depth = 1.41"
54.95% Pervious = 9.698 ac 45.05% Impervious = 7.951 ac

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Type III 24-hr 10yr Rainfall=4.75"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment POST 1A: Runoff Area=289,731 sf 60.01% Impervious Runoff Depth>3.23"
 Flow Length=593' Tc=7.6 min CN=88 Runoff=24.53 cfs 1.792 af

Subcatchment POST 1B: Runoff Area=138,180 sf 9.07% Impervious Runoff Depth>1.28"
 Flow Length=550' Tc=16.7 min CN=64 Runoff=3.53 cfs 0.340 af

Subcatchment POST 1T: TURF Runoff Area=157,820 sf 100.00% Impervious Runoff Depth>4.19"
 Tc=5.0 min CN=98 Runoff=16.93 cfs 1.265 af

Subcatchment POST2: Runoff Area=183,040 sf 1.15% Impervious Runoff Depth>1.09"
 Flow Length=387' Tc=22.0 min CN=61 Runoff=3.45 cfs 0.383 af

Reach 1R: W.Q. SWALE Avg. Flow Depth=0.47' Max Vel=0.90 fps Inflow=5.66 cfs 1.687 af
 n=0.035 L=105.0' S=0.0014 '/ Capacity=96.91 cfs Outflow=5.66 cfs 1.684 af

Reach 2R: RIP-RAP SWALE Avg. Flow Depth=0.10' Max Vel=2.78 fps Inflow=5.66 cfs 1.684 af
 n=0.040 L=77.0' S=0.1234 '/ Capacity=274.29 cfs Outflow=5.66 cfs 1.683 af

Reach 3R: WOODS Avg. Flow Depth=0.12' Max Vel=2.32 fps Inflow=5.66 cfs 1.683 af
 n=0.050 L=57.0' S=0.1053 '/ Capacity=202.69 cfs Outflow=5.66 cfs 1.682 af

Pond 1P: POND Peak Elev=34.44' Storage=32,189 cf Inflow=24.53 cfs 1.792 af
 Primary=5.66 cfs 1.687 af Secondary=0.00 cfs 0.000 af Outflow=5.66 cfs 1.687 af

Pond 3P: DMH2 Peak Elev=33.52' Inflow=5.66 cfs 1.687 af
 15.0" Round Culvert n=0.012 L=19.0' S=0.0053 '/ Outflow=5.66 cfs 1.687 af

Pond TURF: Peak Elev=36.66' Storage=0.343 af Inflow=16.93 cfs 1.265 af
 Discarded=10.91 cfs 0.924 af Primary=0.40 cfs 0.136 af Outflow=11.32 cfs 1.061 af

Link PA 1: Inflow=9.07 cfs 2.158 af
 Primary=9.07 cfs 2.158 af

Link PA 2: Inflow=3.45 cfs 0.383 af
 Primary=3.45 cfs 0.383 af

Total Runoff Area = 17.649 ac Runoff Volume = 3.780 af Average Runoff Depth = 2.57"
54.95% Pervious = 9.698 ac 45.05% Impervious = 7.951 ac

2401501_POST

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Type III 24-hr 50yr Rainfall=7.20"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment POST 1A: Runoff Area=289,731 sf 60.01% Impervious Runoff Depth>5.47"
 Flow Length=593' Tc=7.6 min CN=88 Runoff=40.32 cfs 3.031 af

Subcatchment POST 1B: Runoff Area=138,180 sf 9.07% Impervious Runoff Depth>2.90"
 Flow Length=550' Tc=16.7 min CN=64 Runoff=8.35 cfs 0.767 af

Subcatchment POST 1T: TURF Runoff Area=157,820 sf 100.00% Impervious Runoff Depth>6.42"
 Tc=5.0 min CN=98 Runoff=25.76 cfs 1.938 af

Subcatchment POST2: Runoff Area=183,040 sf 1.15% Impervious Runoff Depth>2.60"
 Flow Length=387' Tc=22.0 min CN=61 Runoff=8.84 cfs 0.911 af

Reach 1R: W.Q. SWALE Avg. Flow Depth=0.57' Max Vel=1.01 fps Inflow=7.83 cfs 2.895 af
 n=0.035 L=105.0' S=0.0014 '/ Capacity=96.91 cfs Outflow=7.82 cfs 2.890 af

Reach 2R: RIP-RAP SWALE Avg. Flow Depth=0.12' Max Vel=3.16 fps Inflow=7.82 cfs 2.890 af
 n=0.040 L=77.0' S=0.1234 '/ Capacity=274.29 cfs Outflow=7.81 cfs 2.889 af

Reach 3R: WOODS Avg. Flow Depth=0.15' Max Vel=2.63 fps Inflow=7.81 cfs 2.889 af
 n=0.050 L=57.0' S=0.1053 '/ Capacity=202.69 cfs Outflow=7.82 cfs 2.888 af

Pond 1P: POND Peak Elev=35.87' Storage=55,233 cf Inflow=40.32 cfs 3.031 af
 Primary=7.83 cfs 2.895 af Secondary=0.00 cfs 0.000 af Outflow=7.83 cfs 2.895 af

Pond 3P: DMH2 Peak Elev=34.13' Inflow=7.83 cfs 2.895 af
 15.0" Round Culvert n=0.012 L=19.0' S=0.0053 '/ Outflow=7.83 cfs 2.895 af

Pond TURF: Peak Elev=36.78' Storage=0.455 af Inflow=25.76 cfs 1.938 af
 Discarded=10.91 cfs 1.503 af Primary=1.22 cfs 0.186 af Outflow=12.13 cfs 1.689 af

Link PA 1: Inflow=16.76 cfs 3.841 af
 Primary=16.76 cfs 3.841 af

Link PA 2: Inflow=8.84 cfs 0.911 af
 Primary=8.84 cfs 0.911 af

Total Runoff Area = 17.649 ac Runoff Volume = 6.647 af Average Runoff Depth = 4.52"
54.95% Pervious = 9.698 ac 45.05% Impervious = 7.951 ac

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Type III 24-hr 10yr Rainfall=4.75"

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Summary for Subcatchment POST 1A:

Runoff = 24.53 cfs @ 12.11 hrs, Volume= 1.792 af, Depth> 3.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10yr Rainfall=4.75"

Area (sf)	CN	Description
173,873	98	Paved parking & roofs
110,028	74	>75% Grass cover, Good, HSG C
5,830	70	Woods, Good, HSG C
289,731	88	Weighted Average
115,858		39.99% Pervious Area
173,873		60.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	52	0.0290	0.16		Sheet Flow, Grass: Short n= 0.150 P2= 2.61"
0.3	63	0.0300	3.52		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.3	86	0.0100	4.91	3.86	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.3	100	0.0100	4.91	3.86	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.3	58	0.0060	3.81	2.99	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.7	152	0.0050	3.47	2.73	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.1	29	0.0050	3.47	2.73	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.1	53	0.0520	14.68	25.95	Pipe Channel, 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012
7.6	593	Total			

Summary for Subcatchment POST 1B:

Runoff = 3.53 cfs @ 12.26 hrs, Volume= 0.340 af, Depth> 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10yr Rainfall=4.75"

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Type III 24-hr 10yr Rainfall=4.75"

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Area (sf)	CN	Description
* 12,530	98	IMPERVIOUS
62,780	55	Woods, Good, HSG B
39,550	61	>75% Grass cover, Good, HSG B
11,920	70	Woods, Good, HSG C
6,050	74	>75% Grass cover, Good, HSG C
1,360	77	Woods, Good, HSG D
3,990	80	>75% Grass cover, Good, HSG D
138,180	64	Weighted Average
125,650		90.93% Pervious Area
12,530		9.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	25	0.0100	0.04		Sheet Flow, Grass: Bermuda n= 0.410 P2= 2.61"
2.1	185	0.0100	1.50		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
0.2	60	0.1000	4.74		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
3.8	280	0.0600	1.22		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
16.7	550	Total			

Summary for Subcatchment POST 1T: TURF

[49] Hint: Tc<2dt may require smaller dt

Runoff = 16.93 cfs @ 12.07 hrs, Volume= 1.265 af, Depth> 4.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10yr Rainfall=4.75"

Area (sf)	CN	Description
* 67,790	98	IMPERVIOUS-TRACK
* 90,030	98	IMPERVIOUS-TURF
157,820	98	Weighted Average
157,820		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, INFILTRATION INTO TURF

Summary for Subcatchment POST2:

Runoff = 3.45 cfs @ 12.35 hrs, Volume= 0.383 af, Depth> 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10yr Rainfall=4.75"

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Type III 24-hr 10yr Rainfall=4.75"

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Area (sf)	CN	Description
* 2,110	98	IMPERVIOUS
8,650	55	Woods, Good, HSG B
169,250	61	>75% Grass cover, Good, HSG B
0	70	Woods, Good, HSG C
2,830	74	>75% Grass cover, Good, HSG C
0	77	Woods, Good, HSG D
200	80	>75% Grass cover, Good, HSG D
183,040	61	Weighted Average
180,930		98.85% Pervious Area
2,110		1.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.4	50	0.0100	0.05		Sheet Flow, Grass: Bermuda n=0.410 P2= 2.61"
0.8	87	0.0150	1.84		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
2.8	250	0.0100	1.50		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
22.0	387	Total			

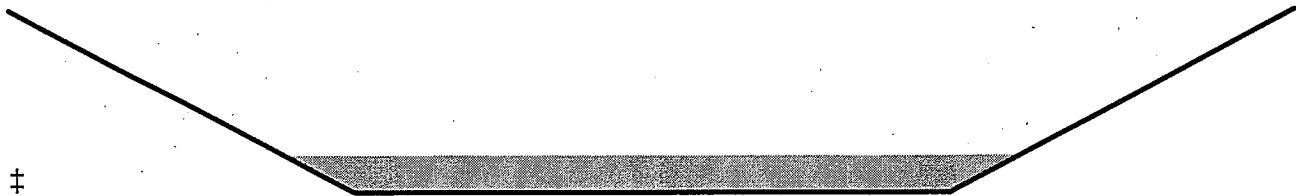
Summary for Reach 1R: W.Q. SWALE

Inflow Area = 6.651 ac, 60.01% Impervious, Inflow Depth > 3.04" for 10yr event
 Inflow = 5.66 cfs @ 12.45 hrs, Volume= 1.687 af
 Outflow = 5.66 cfs @ 12.52 hrs, Volume= 1.684 af, Atten= 0%, Lag= 4.2 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Max. Velocity= 0.90 fps, Min. Travel Time= 1.9 min
 Avg. Velocity = 0.45 fps, Avg. Travel Time= 3.9 min

Peak Storage= 660 cf @ 12.52 hrs
 Average Depth at Peak Storage= 0.47'
 Bank-Full Depth= 2.30' Flow Area= 43.5 sf, Capacity= 96.91 cfs

12.00' x 2.30' deep channel, n= 0.035 Earth, dense weeds
 Side Slope Z-value= 3.0 ' Top Width= 25.80'
 Length= 105.0' Slope= 0.0014 '
 Inlet Invert= 31.65', Outlet Invert= 31.50'



Summary for Reach 2R: RIP-RAP SWALE

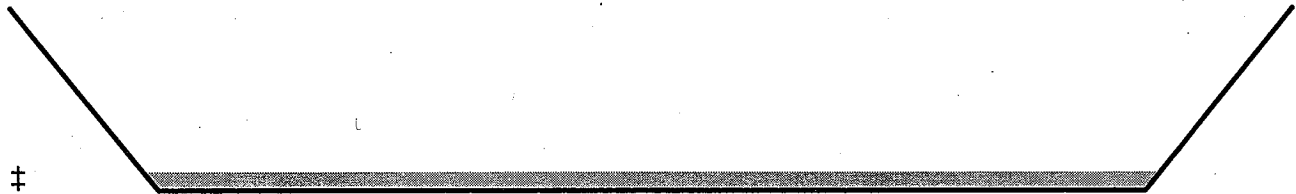
[61] Hint: Exceeded Reach 1R outlet invert by 0.10' @ 12.55 hrs

Inflow Area = 6.651 ac, 60.01% Impervious, Inflow Depth > 3.04" for 10yr event
 Inflow = 5.66 cfs @ 12.52 hrs, Volume= 1.684 af
 Outflow = 5.66 cfs @ 12.54 hrs, Volume= 1.683 af, Atten= 0%, Lag= 1.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Max. Velocity= 2.78 fps, Min. Travel Time= 0.5 min
 Avg. Velocity = 1.41 fps, Avg. Travel Time= 0.9 min

Peak Storage= 157 cf @ 12.54 hrs
 Average Depth at Peak Storage= 0.10'
 Bank-Full Depth= 1.00' Flow Area= 23.0 sf, Capacity= 274.29 cfs

20.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
 Side Slope Z-value= 3.0 '/' Top Width= 26.00'
 Length= 77.0' Slope= 0.1234 '/'
 Inlet Invert= 31.50', Outlet Invert= 22.00'



Summary for Reach 3R: WOODS

[90] Warning: Qout>Qin may require Finer Routing or smaller dt

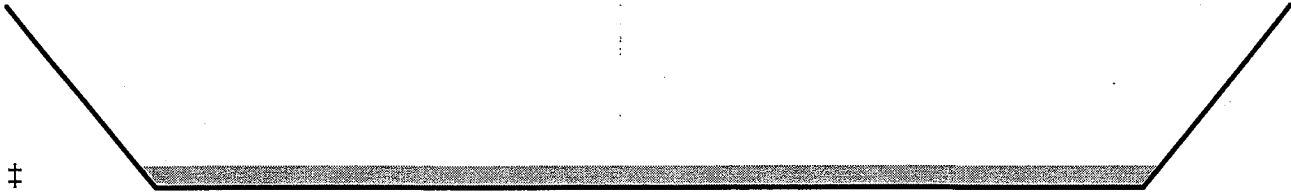
[62] Hint: Exceeded Reach 2R OUTLET depth by 0.02' @ 12.55 hrs

Inflow Area = 6.651 ac, 60.01% Impervious, Inflow Depth > 3.04" for 10yr event
 Inflow = 5.66 cfs @ 12.54 hrs, Volume= 1.683 af
 Outflow = 5.66 cfs @ 12.54 hrs, Volume= 1.682 af, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Max. Velocity= 2.32 fps, Min. Travel Time= 0.4 min
 Avg. Velocity = 1.16 fps, Avg. Travel Time= 0.8 min

Peak Storage= 139 cf @ 12.54 hrs
 Average Depth at Peak Storage= 0.12'
 Bank-Full Depth= 1.00' Flow Area= 23.0 sf, Capacity= 202.69 cfs

20.00' x 1.00' deep channel, n= 0.050 Scattered brush, heavy weeds
 Side Slope Z-value= 3.0 '/' Top Width= 26.00'
 Length= 57.0' Slope= 0.1053 '/'
 Inlet Invert= 22.00', Outlet Invert= 16.00'



Summary for Pond 1P: POND

[87] Warning: Oscillations may require Finer Routing or smaller dt (severity=24)

Inflow Area = 6.651 ac, 60.01% Impervious, Inflow Depth > 3.23" for 10yr event
 Inflow = 24.53 cfs @ 12.11 hrs, Volume= 1.792 af
 Outflow = 5.66 cfs @ 12.45 hrs, Volume= 1.687 af, Atten= 77%, Lag= 20.5 min
 Primary = 5.66 cfs @ 12.45 hrs, Volume= 1.687 af
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 34.44' @ 12.53 hrs Surf.Area= 14,960 sf Storage= 32,189 cf
 Flood Elev= 38.00' Surf.Area= 20,603 sf Storage= 95,336 cf

Plug-Flow detention time= 92.8 min calculated for 1.687 af (94% of inflow)
 Center-of-Mass det. time= 71.5 min (841.2 - 769.7)

Volume	Invert	Avail.Storage	Storage Description			
#1	32.00'	95,336 cf	Custom Stage Data (Irregular) Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
32.00	11,526	448.0	0	0	11,526	
34.00	14,325	485.0	25,800	25,800	14,427	
36.00	17,351	523.0	31,628	57,428	17,638	
38.00	20,603	561.0	37,907	95,336	21,090	

Device	Routing	Invert	Outlet Devices	
#1	Primary	32.00'	15.0" Round Culvert L= 32.0' Ke= 0.500 Inlet / Outlet Invert= 32.00' / 31.85' S= 0.0047 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf	
#2	Secondary	36.30'	33.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64	

Primary OutFlow Max=5.60 cfs @ 12.45 hrs HW=34.42' TW=33.52' (Dynamic Tailwater)
 1=Culvert (Inlet Controls 5.60 cfs @ 4.56 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=32.00' TW=31.50' (Dynamic Tailwater)
 2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

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Type III 24-hr 10yr Rainfall=4.75"

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Summary for Pond 3P: DMH2

Inflow Area = 6.651 ac, 60.01% Impervious, Inflow Depth > 3.04" for 10yr event
 Inflow = 5.66 cfs @ 12.45 hrs, Volume= 1.687 af
 Outflow = 5.66 cfs @ 12.45 hrs, Volume= 1.687 af, Atten= 0%, Lag= 0.0 min
 Primary = 5.66 cfs @ 12.45 hrs, Volume= 1.687 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 33.52' @ 12.45 hrs
 Flood Elev= 38.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	31.75'	15.0" Round Culvert L= 19.0' Ke= 0.500 Inlet / Outlet Invert= 31.75' / 31.65' S= 0.0053 ' / Cc= 0.900 n= 0.012, Flow Area= 1.23 sf

Primary OutFlow Max=5.66 cfs @ 12.45 hrs HW=33.52' TW=32.12' (Dynamic Tailwater)
 ←1=Culvert (Barrel Controls 5.66 cfs @ 4.61 fps)

Summary for Pond TURF:

[82] Warning: Early inflow requires earlier time span
 [87] Warning: Oscillations may require Finer Routing or smaller dt (severity=7)

Inflow Area = 3.623 ac, 100.00% Impervious, Inflow Depth > 4.19" for 10yr event
 Inflow = 16.93 cfs @ 12.07 hrs, Volume= 1.265 af
 Outflow = 11.32 cfs @ 12.16 hrs, Volume= 1.061 af, Atten= 33%, Lag= 5.3 min
 Discarded = 10.91 cfs @ 12.00 hrs, Volume= 0.924 af
 Primary = 0.40 cfs @ 12.16 hrs, Volume= 0.136 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 36.66' @ 12.16 hrs Surf.Area= 2.165 ac Storage= 0.343 af
 Flood Elev= 37.70' Surf.Area= 2.165 ac Storage= 0.930 af

Plug-Flow detention time= 92.2 min calculated for 1.057 af (84% of inflow)
 Center-of-Mass det. time= 45.2 min (779.9 - 734.7)

Volume	Invert	Avail.Storage	Storage Description
#1	36.60'	0.616 af	240.00'W x 380.00'L x 0.75'H Prismatic 1.570 af Overall - 0.031 af Embedded = 1.540 af x 40.0% Voids
#2	36.60'	0.031 af	2.00'W x 4,164.00'L x 0.16'H Prismatic Inside #1
#3	27.05'	0.265 af	3.00'W x 1,034.00'L x 9.55'H Prismatic 0.680 af Overall - 0.019 af Embedded = 0.661 af x 40.0% Voids
#4	29.80'	0.019 af	12.0" Round Pipe Storage Inside #3 L= 1,034.0'
		0.930 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	25.55'	12.0" Round Culvert L= 54.0' Ke= 0.500 Inlet / Outlet Invert= 25.55' / 25.00' S= 0.0102 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	36.60'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#3	Device 1	29.80'	1.7" Vert. Orifice/Grate C= 0.600
#4	Discarded	27.05'	5.000 in/hr Exfiltration over Surface area

Discarded OutFlow Max=10.91 cfs @ 12.00 hrs HW=36.62' (Free Discharge)

↳4=Exfiltration (Exfiltration Controls 10.91 cfs)

Primary OutFlow Max=0.40 cfs @ 12.16 hrs HW=36.66' TW=0.00' (Dynamic Tailwater)

↳1=Culvert (Passes 0.40 cfs of 11.99 cfs potential flow)

↳2=Sharp-Crested Rectangular Weir (Weir Controls 0.20 cfs @ 0.81 fps)

↳3=Orifice/Grate (Orifice Controls 0.20 cfs @ 12.55 fps)

Summary for Link PA 1:

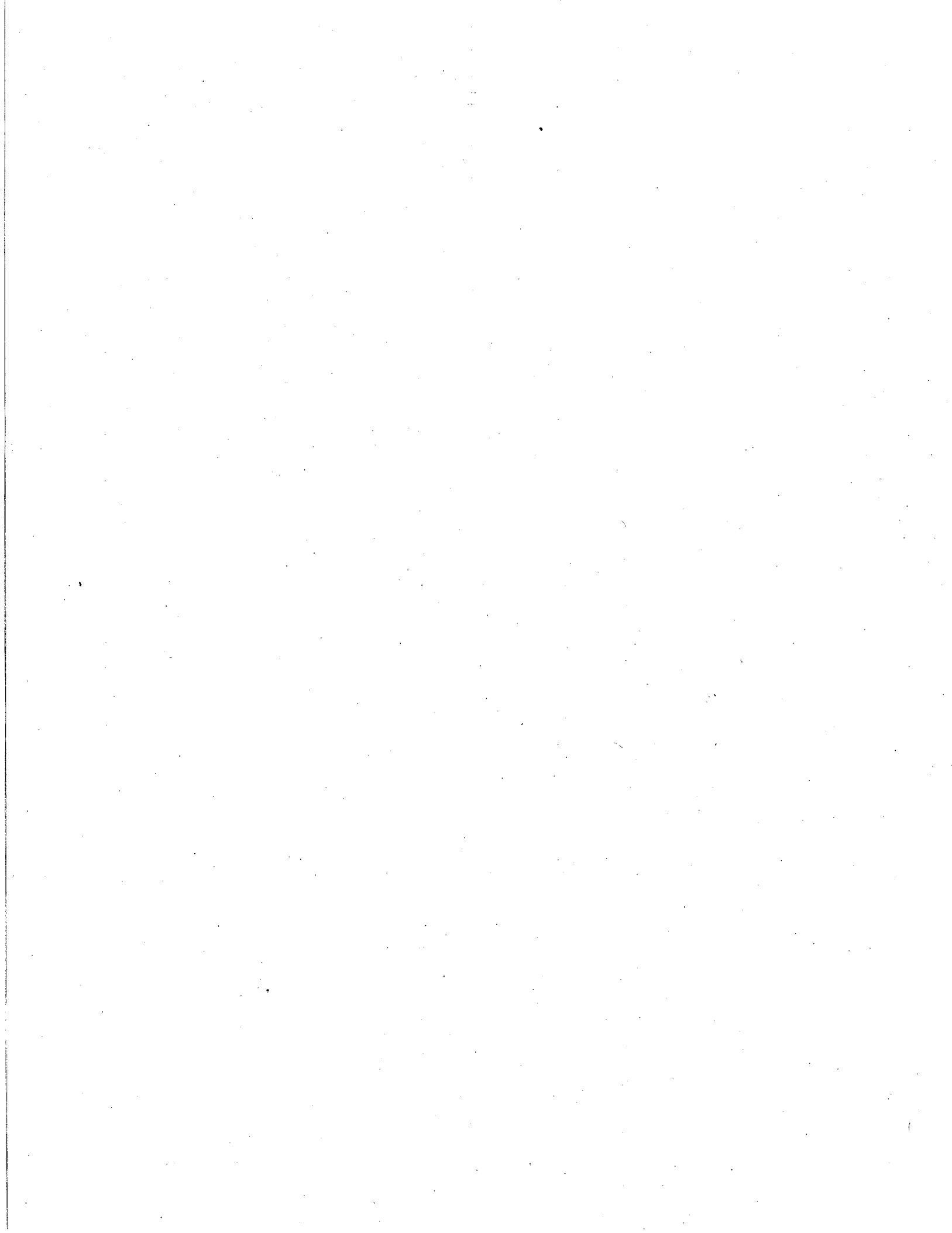
Inflow Area = 13.447 ac, 58.77% Impervious, Inflow Depth > 1.93" for 10yr event
 Inflow = 9.07 cfs @ 12.27 hrs, Volume= 2.158 af
 Primary = 9.07 cfs @ 12.27 hrs, Volume= 2.158 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link PA 2:

Inflow Area = 4.202 ac, 1.15% Impervious, Inflow Depth > 1.09" for 10yr event
 Inflow = 3.45 cfs @ 12.35 hrs, Volume= 0.383 af
 Primary = 3.45 cfs @ 12.35 hrs, Volume= 0.383 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



**Oyster River
 High School**

**Proposed Track
 and Field**

36 Coe Drive
 Durham, NH

PROJECT NO.	041009
DATE	07/20/11
PROJECT NAME	OYSTER RIVER HIGH SCHOOL TRACK & FIELD
CLIENT	BLM
APPROVED BY:	BLM
DATE	07/20/11
POST-CARVEUPMENT COLOR-CODED SOIL PLAN	
SCALE:	AS SHOWN
	W/S-4

LEGEND

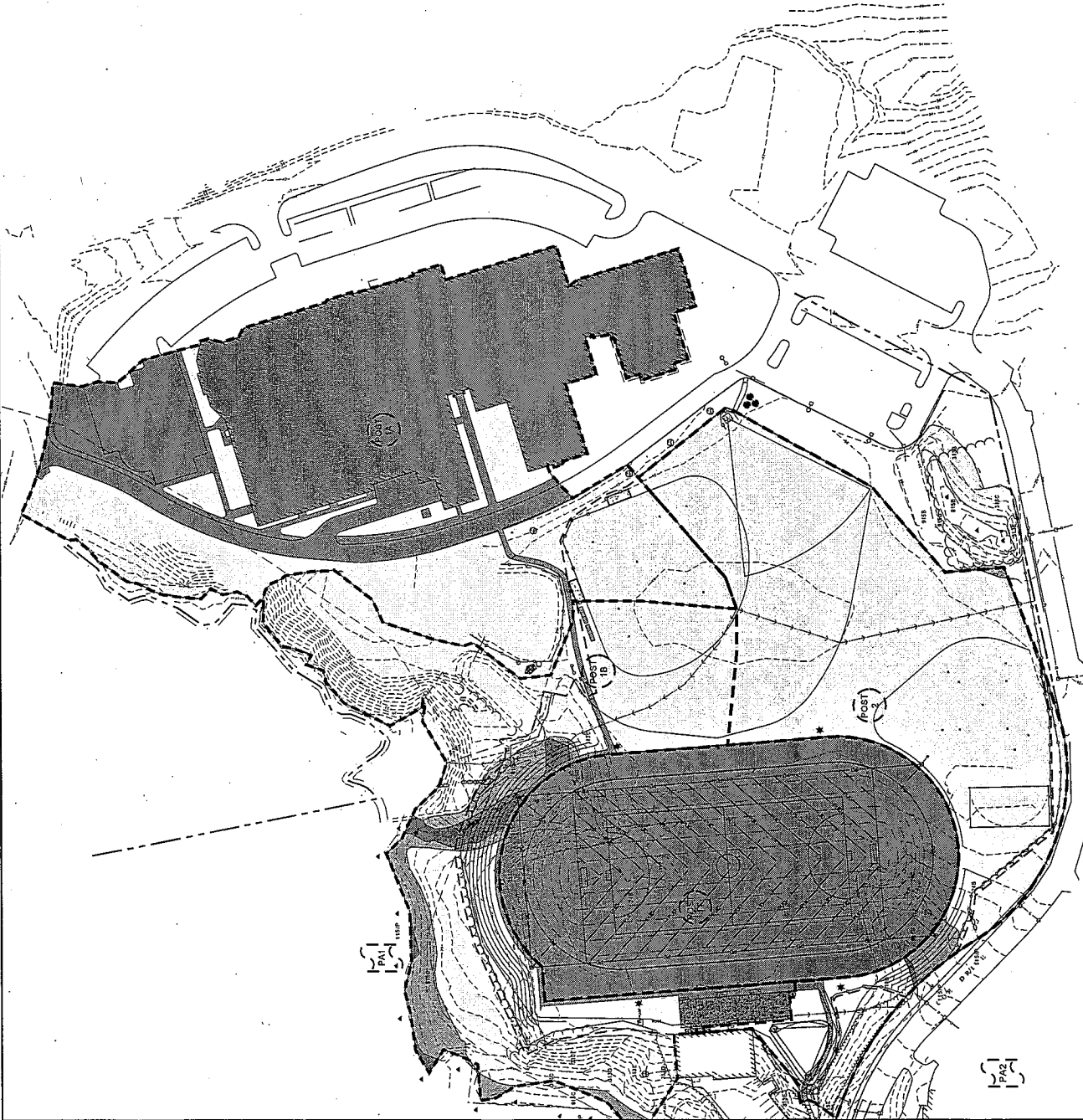
- PROPERTY LINE
- EDGE OF WETLAND
- EXISTING TREE LINE
- PROPOSED TREE LINE
- EXISTING STONE WALL
- EXISTING CHAINLINK
- PROPOSED CHAINLINK
- EXISTING FENCE
- PROPOSED FENCE
- EXISTING CONTOUR
- EXISTING 10' CONTIGUOUS
- FINISHED GRADE
- EXISTING DRAINAGE
- PROPOSED DRAINAGE
- EXISTING CONCRETE/STURDY SURFACE
- PROPOSED CONCRETE/STURDY SURFACE
- PROPOSED CONCRETE PAD
- POST WATERBARRIERS/RETAINMENT WALL
- SOIL TYPE BOUNDARY
- LOGS/ST FLOWWAY
- SOIL SYMBOL
- POST DEVELOPMENT WATERFED RESTORATION
- POINT OF ANALYSIS
- HYDROLOGIC SOIL GROUP S
- HYDROLOGIC SOIL GROUP C
- HYDROLOGIC SOIL GROUP D
- IMPERVIOUS SURFACE

SOIL IDENTIFICATION LEGEND

FROM SITE-SPECIFIC SOIL SURVEY REPORT BY GOWE ENVIRONMENTAL SERVICES, INC. DATED JULY 2, 2011

SYMBOL	SOIL TAXONOMY NAME	HYDROLOGIC SOIL GROUP	PERMEABILITY
1A	LOESSIAL	S	LOW
2B	CLAYEY SAND	C	MODERATE
3B	CLAYEY SILT	C	MODERATE
4EP	SCARIFIED (POORLY DRAINING)	D	VERY LOW

GRAPHIC SCALE





Groundwater Recharge Volume (GRV) Calculation

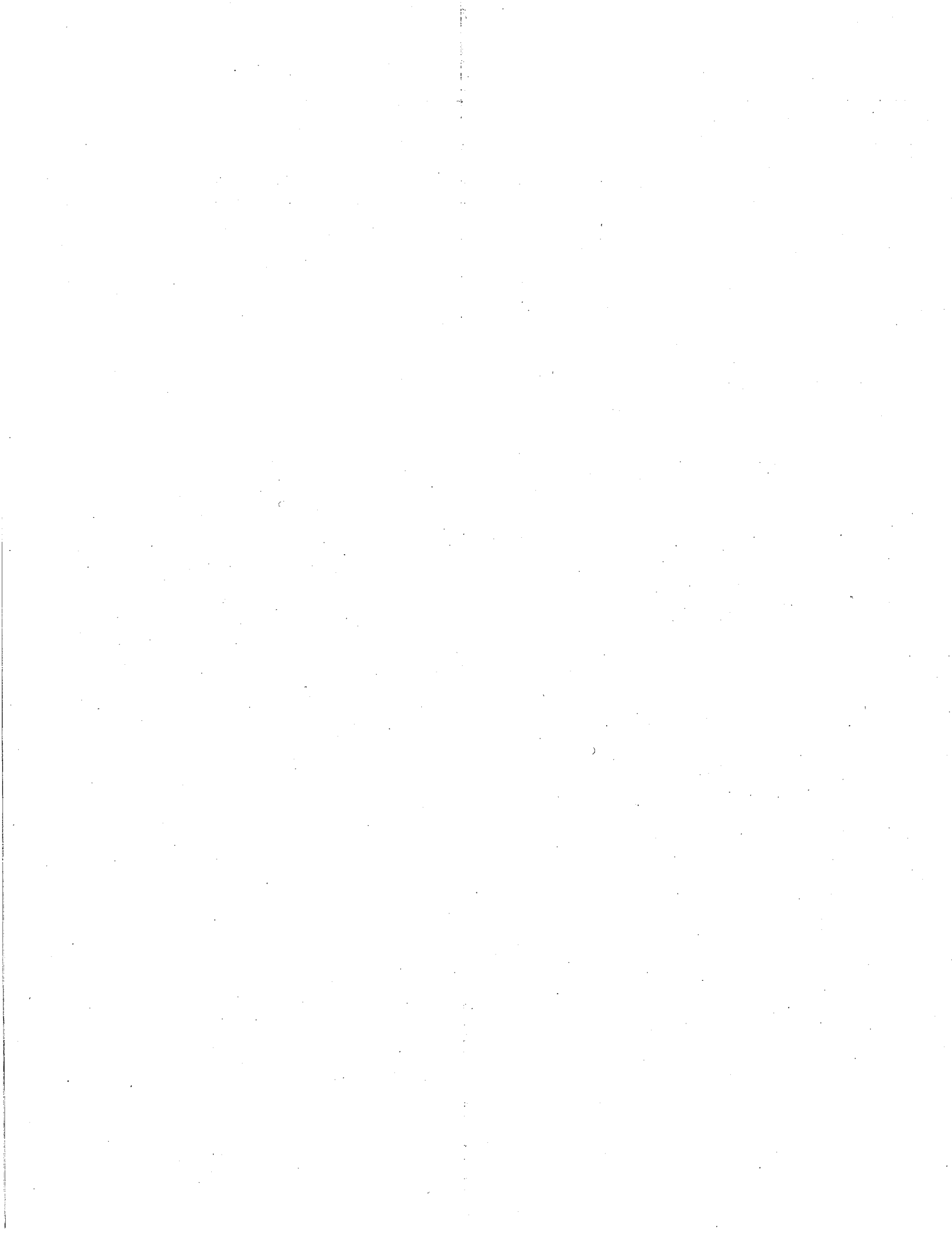
-	ac	Area of HSG A soil that was replaced by impervious cover	0.40"
3.49	ac	Area of HSG B soil that was replaced by impervious cover	0.25"
0.19	ac	Area of HSG C soil that was replaced by impervious cover	0.10"
0.17	ac	Area of HSG D soil or impervious cover that was replaced by impervious cover	0.0"
0.23	inches	Rd = weighted groundwater recharge depth	
0.8912	ac-in	GRV = AI * Rd	
3.235	cf	GRV conversion (ac-in x 43,560 sf/ac x 1ft/12")	


Provide calculations below showing that the project meets the groundwater recharge requirements (Env-Wq 1507.04):

TURF FIELD

(volume available in trenches below 12" perforated pipe)

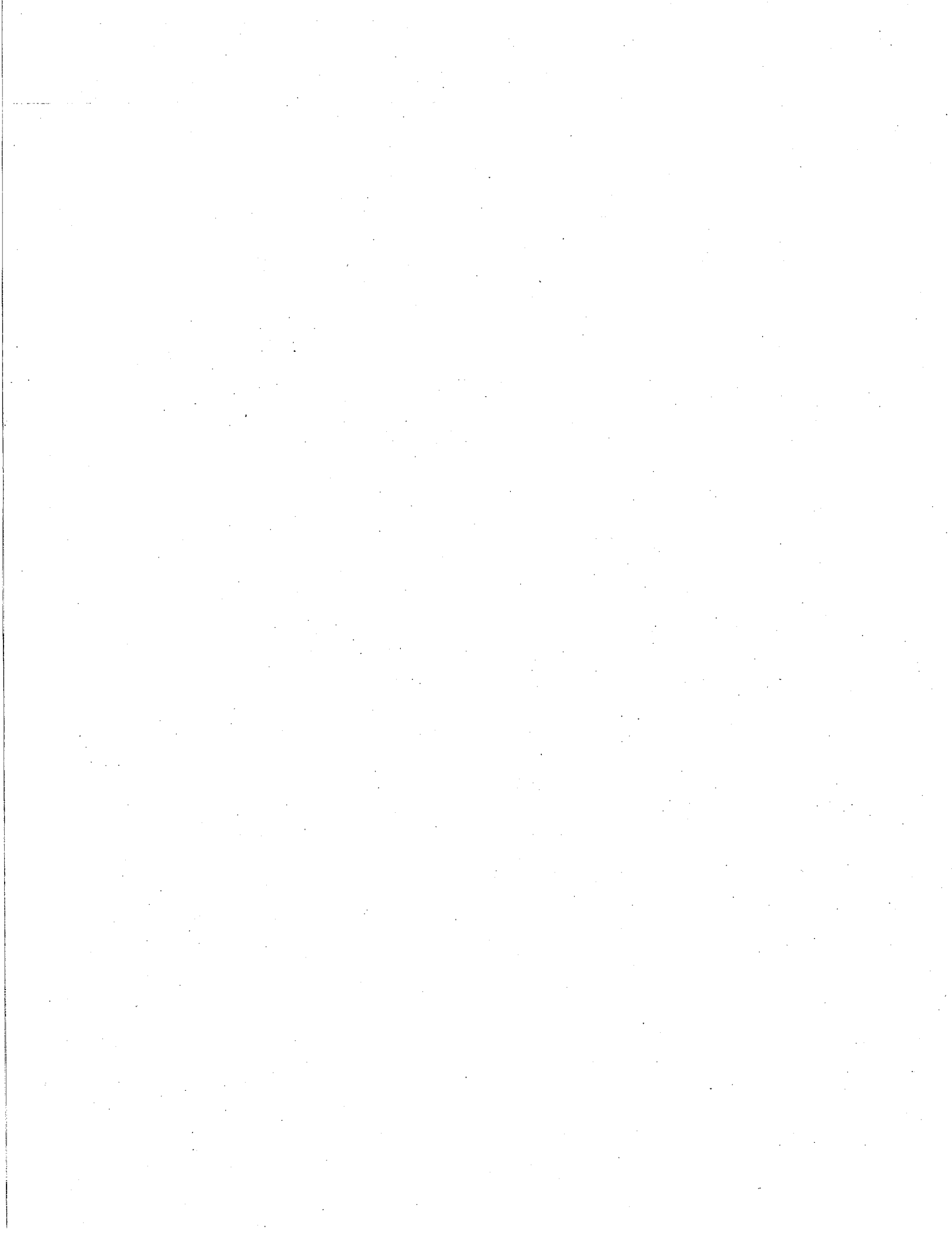
3ft wide x 1,034ft long x 2.75ft deep x 0.40 void space = 3,412cf





Tighe & Bond

SECTION 5



Section 5 Long Term Operation & Maintenance Plan

The intent of this Long Term Operation and Maintenance Plan is to identify the areas of this site that need special attention and consideration as well as implement a plan to assure routine maintenance.

By identifying the areas of concern as well as implementing a frequent and routine maintenance schedule, the site will maintain a high quality of stormwater runoff.

5.1 Contact/Responsible Party

5.1.1 Individual

Sue Caswell
Oyster River Cooperative School District
36 Coe Drive
Durham, New Hampshire 03824

(Note: The contact information for the Contact/Responsible Party shall be kept current. If ownership changes, the Operation and Maintenance Plan must be transferred to the new party.)

5.2 Maintenance Items

Maintenance of the following items shall be recorded:

- Litter/Debris Removal
- Landscaping
- Catchbasin Cleaning
- Pavement Sweeping

The following maintenance items and schedule represent the minimum action required. Periodic site inspections shall be conducted and all measures must be maintained in effective operating condition. The following items shall be observed during site inspection and maintenance:

- Inspect vegetated areas, particularly slopes and embankments for areas of erosion. Replant and restore as necessary
- Inspect catchbasins for sediment buildup
- Inspect site for trash and debris

5.3 Overall Site Operation & Maintenance Schedule

Overall Site Operation and Maintenance Schedule		
Maintenance Item	Frequency of Maintenance	Operation
Litter/Debris Removal	Weekly	Management Company
Pavement - Sweep pavement to remove sand and litter.	2 - 4 times annually	Parking Lot Sweeper
Rip Rap Aprons - Trash and debris to be removed. - Any required maintenance shall be addressed.	Annually	Management Company
Catch Basin (CB) Cleaning - CB to be cleaned of solids and oils.	Annually	Vacuum Truck
Landscaping - Landscaped areas to be maintained and mulched.	Maintained as required and mulched each Spring	Management Company

Rip Rap Inspection/Maintenance Requirements		
Inspection/Maintenance	Frequency	Action
Visual Inspection	Annually	- Visually inspect for damage and deterioration. - Repair damages immediately.

5.3.1 Disposal Requirements

Disposal of debris, trash, sediment, and other waste material should be done at suitable disposal/recycling sites and in compliance with all applicable local, state, and federal waste regulations.

5.3.2 Snow Storage

Snow storage areas shall be located such that no direct untreated discharges are possible to receiving waters from the storage site. Salt storage areas shall be covered or located such that no direct untreated discharges are possible to receiving waters from the storage site. Salt and sand shall be used to the minimum extent practical (refer to the NHDES AOT Stormwater Management Manual, Volume 2, for de-icing application rate guidelines).

5.3.3 Individual

The Owner and/or Contact/Responsible Party shall review this Operation and Maintenance Plan once per year for its effectiveness and adjust the plan and deed as necessary.

Stormwater Management Report						
Pelham High School Building Addition						
Project Name	Date of Inspection	Inspector	BMP Installed and Operating Properly?	Cleaning / Corrective Action Needed	Date of Cleaning / Repair	Performed By
			<input type="checkbox"/> Yes <input type="checkbox"/> No			
			<input type="checkbox"/> Yes <input type="checkbox"/> No			
			<input type="checkbox"/> Yes <input type="checkbox"/> No			
			<input type="checkbox"/> Yes <input type="checkbox"/> No			
			<input type="checkbox"/> Yes <input type="checkbox"/> No			
			<input type="checkbox"/> Yes <input type="checkbox"/> No			
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			<input type="checkbox"/> Yes <input type="checkbox"/> No			

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