DRAINAGE REPORT

For

THE LANNAN COMPANY
REAL ESTATE INVESTMENT & DEVELOPMENT

PROPOSED

Urgent Care and Commercial Use

3 Flagstone Drive
Hudson, New Hampshire
Hillsborough County

Prepared by:

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I. EXECUTIVE SUMMARY

This report examines the changes in drainage that have been calculated in support of the development of a proposed urgent care and commercial use space located on the northerly side of Flagstone Drive in the Town of Hudson, New Hampshire. The site, which contains approximately 0.81± acres of land, consists of a currently maintained lawn and an easement containing an access drive to the Burger King on Lowell Road located north of the site.

The proposed project includes the construction of a new 5,400± SF freestanding building, which will contain a proposed urgent care facility and a proposed commercial use space, along with new paved parking areas, landscaping, storm water management components, and associated utilities. This report addresses a comparative analysis of the pre- and post-development site runoff conditions. Additionally, this report provides calculations documenting the design of the proposed stormwater conveyance/management system as illustrated within the accompanying Site Development Plans. The project also proposes erosion and sedimentation controls during the demolition and construction periods, as well as long term stabilization of the site.

For the purposes of this analysis the pre- and post-development drainage conditions were analyzed at two "Points of Analysis" (POA) where stormwater runoff currently drains to under existing conditions. This design point is described in further detail in Section 2 below. A summary of the pre- and post-development conditions peak runoff rates for the 2-, 10-, 25-, and 50-year storms can be found in **Table 1.1** below.

Table 1.1: Pre- and Post-Development Runoff Rate Summary*

Point of Analysis	2-Year Storm			10-Year Storm			25-Year Storm			50-Year Storm		
	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ
POA1	1.07	0.36	**-0.71**	2.21	1.76	**-0.45**	3.15	2.63	**-0.52**	4.06	3.96	**-0.10**
POA2	0.04	0.04	**0**	0.18	0.14	**-0.04**	0.31	0.25	**-0.06**	0.44	0.35	**-0.09**

**Flows are represented in cubic feet per second (cfs)*

II. EXISTING SITE CONDITIONS

Existing Site Description

The overall site consists of approximately 0.81± acres of land located along the northerly side of Flagstone Drive in the Town of Hudson, New Hampshire. The site primarily contains an existing maintained lawn. The eastern part of the site contains an easement with an access driveway to the Burger King on Lowell Road located north of the site.

On-Site Soil Information

The soils at the site are mapped as Scituate fine sandy loam, Canton fine sandy loam, and Pipestone loamy sand, which are classified by the Natural Resource Conservation Service (NRCS) as Hydrologic Soil Groups (HSG) "C," "A," and "D," respectively. Refer to **Appendix B** for additional information.

On site soil evaluations determined that an area at the northwest top of the site contained a loamy sand material consistent with the mapped HSG "A." Conservatively a 1.5 inches per hour infiltration rate was assumed or 25% of the NRCS published rate.

Existing Collection and Conveyance

The property contains a gravel area in the southern part of the property through which water flows into a drainage pipe, connecting into the Hudson municipal drainage system. There is also a drainage pipe located on the western side of the site which connects into the Hudson municipal drainage system. Slopes within the site range from about 17% to 1.3%.

Existing Watersheds and Design Point Information

The pre- and post-development drainage conditions for the site were analyzed at two (2) "Points of Analysis" (POA) where stormwater runoff currently drains to under existing conditions.

Point of Analysis #1 (POA 1) represents the existing pipe in the southwest portion of the site that connects into the Flagstone Drive drainage system. Under existing conditions, this design point receives stormwater flows from approximately 0.80 acres of land within the study area, designated as watershed "E-1". This watershed includes areas of pavement and grass.

Point of Analysis #2 (POA 2) represents the existing property west of the site. Under existing conditions, this design point receives stormwater flows from approximately 0.14 acres of land

within the study area, designated as watershed “E-2”. This watershed includes only grassed areas.

The study area has been designated as two (2) sub catchments for the existing conditions as described below to analyze existing and proposed flow rates at the two points of analysis.

Subcatchment E-1 contains approximately 0.80± acres with the access driveway, pavement from the Burger King north of the site, and grassed areas. This area generally flows southwest across the site where it is collected in an existing gravel area and piped into the drainage network in Flagstone Drive (POA 1).

Subcatchment E-2 contains approximately 0.14 acres consisting entirely of grassed area. This area generally flows west off of the site (POA 2).

Refer to **Table 1.1** for the calculated existing conditions peak rates of runoff. For additional hydrologic information, refer to **Appendix C** and the Drainage Area Maps in the appendices of this report for a graphical representation of the existing drainage areas.

III. PROPOSED SITE CONDITIONS

Proposed Development Description

The proposed project consists of the construction of a new 5,400± SF freestanding building, which will contain a proposed urgent care facility and a proposed commercial use space, along with new paved parking areas, landscaping, storm water management components, and associated utilities. The proposed redevelopment area, including the proposed parking area, has been designed to drain via deep-sump, hooded catch basins to a proposed underground infiltration basin. Overflow from this basin will be routed to the existing drainage system. Rooftop runoff has been designed to flow to the basin as well.

Proposed Development Collection and Conveyance

The proposed development has been designed to collect and route runoff from the paved parking area via catch basins to a proposed underground infiltration basin. Pipes have been designed for the 25-year storm using the Rational Method. Pipe sizing calculations are included in **Appendix E**.

The best management practices (BMPs) incorporated into the proposed stormwater management system have been designed to meet the design criteria outlined in Volume 2 of the New Hampshire Stormwater Manual. Refer to **Appendix E** for stormwater design calculations and **Appendix F** for the enclosed Operation & Maintenance Plan. The Stormwater Operation and Maintenance (O&M) Plan includes scheduled maintenance and periodic inspections of stormwater management structures.

Low Impact Development (LID) techniques were implemented into the project to the extent practicable given the limited development size. The project proposes to disconnect 'clean' roof runoff from the pretreatment of runoff from paved surface, and infiltrate same. Additionally, soil testing was performed throughout the site, and the location of the site which was identified as most conducive to infiltration was utilized for same.

Proposed Watersheds and Design Point Information

The project has been designed to maintain existing drainage patterns to the extent practicable, with the same design points described in **Section II** above. The site, under proposed conditions, was subdivided into four (4) separate sub catchments as described below. The minimum time of concentration for all proposed areas is calculated as 6 minutes (0.1 hr).

Subcatchment P-1 contains 0.58± acres of the proposed parking lot area. Runoff generated by this subcatchment is routed to the underground infiltration basin through two (2) catch basins via underground HDPE piping. The infiltration basin is designed to treat/infiltrate the requisite water quality and recharge volumes. The infiltration basin is proposed with an overflow weir directing treated runoff to the existing town drainage system.

Subcatchment P-2 contains 0.12± acres of the proposed building roof area which is designed to be collected in a deep-sump hooded catch basin and directed to the proposed underground infiltration basin via underground HDPE piping. The infiltration basin is designed to treat/infiltrate the requisite water quality and recharge volumes. The infiltration basin is proposed with an overflow weir directing treated runoff to the existing town drainage system.

Subcatchment P-3 collects runoff from the landscaped area, approximately 0.11± acres, located on the western side of the site. Runoff generated as a part of this subcatchment is designed to sheet flow directly offsite to POA-2.

Subcatchment P-4 contains 0.12± acres of primarily landscaped area. Stormwater is routed to the existing town drainage system.

Refer to **Table 1.1** for the calculated proposed conditions peak rates of runoff. For additional hydrologic information, refer to **Appendix C** and the Watershed Maps in the appendices of this report for a graphical representation of the proposed drainage areas.

IV. METHODOLOGY

Peak Flow Calculations

Methodology utilized to design the proposed stormwater management system includes compliance with the design criteria set forth in the latest edition of the New Hampshire Department of Environmental Services (NHDES) Stormwater Manual. The pre- and post-development runoff rates being discharged from the site were computed using the HydroCAD computer program. The drainage area and outlet information were entered into the program, which routes storm flows based on NRCS TR-20 and TR-55 methods. The other components of the model were determined following standard NRCS procedures for Curve Numbers (CNs) and times of concentrations documented in the appendices of this report. The rainfall data utilized and listed below in Table 4.1 below for stormwater calculations is based the current Northeast Regional Climate Center Data. Refer to **Appendix E** for more information.

Table 4.1: Town of Hudson Rainfall Intensities

Frequency	2 year	10 year	25 year	50 year
Rainfall* (inches)	2.97	4.48	5.66	6.76

*Values derived from the current Northeast Regional Climate Center Data

The proposed stormwater management, as designed, is proposed to provide a decrease in peak rates of runoff from the proposed facility for the 2-, 10-, 25- and 50-year design storm events.

Water Quality Volume

The proposed stormwater management system has been designed to provide removal of Total Suspended Solids (TSS) through several Best Management Practices (BMPs), including a deep-sump catch basins and an underground infiltration basin. Additional information and calculations regarding storm water quality volume can be found in **Appendix E**. An Operation and Maintenance Plan is included in **Appendix F**.

Groundwater Recharge Volume

The project proposes the creation of approximately 0.56± acres of new impervious area. Based on the underlying Hydrologic Soil Group 'C' soils, a groundwater recharge volume of 156± cubic feet is required to be infiltrated to satisfy NHDES requirements as established in Env-Wq 1504.14 (See Appendix E). The project has been designed to capture and infiltrate 1,944± cubic feet of stormwater runoff, which represents the cumulative storage of the infiltration basins below its lowest respective outlets.

Channel Protection

To provide protection of stream channels, the project has been designed to satisfy the requirements of Env-Wq 1507.05. As stated in Section 1507.05, the 2-year, 24-hour post-development peak flow rate is less than or equal to the 2-year, 24-hour pre-development peak flow rate with a flow rate less than 2 cfs and post-development volume less than the pre-development volume.

The post-development drainage conditions satisfy these channel protection standards as demonstrated in **Table 4.2** below.

Table 4.2 – Calculated Stormwater Volume Generated by 2-year, 24-hour Storm

	2-yr, 24-hr Storm Volume, Pre-Development (ac-ft)	2-yr, 24-hr Storm Volume, Post-Development (ac-ft)	2-yr, 24-hr Storm Peak Flow Rate, Pre-Development (cfs)	2-yr, 24-hr Storm Peak Flow Rate, Pre-Development (cfs)
POA1	0.078	0.034	1.07	0.36
POA2	0.005	0.004	0.04	0.04

Sedimentation and Erosion Control

The project proposes construction period erosion and sedimentation controls. The following is a list of sediment and erosion control devices which are proposed to be installed and implemented prior to and during construction to prevent sedimentation and erosion on-site.

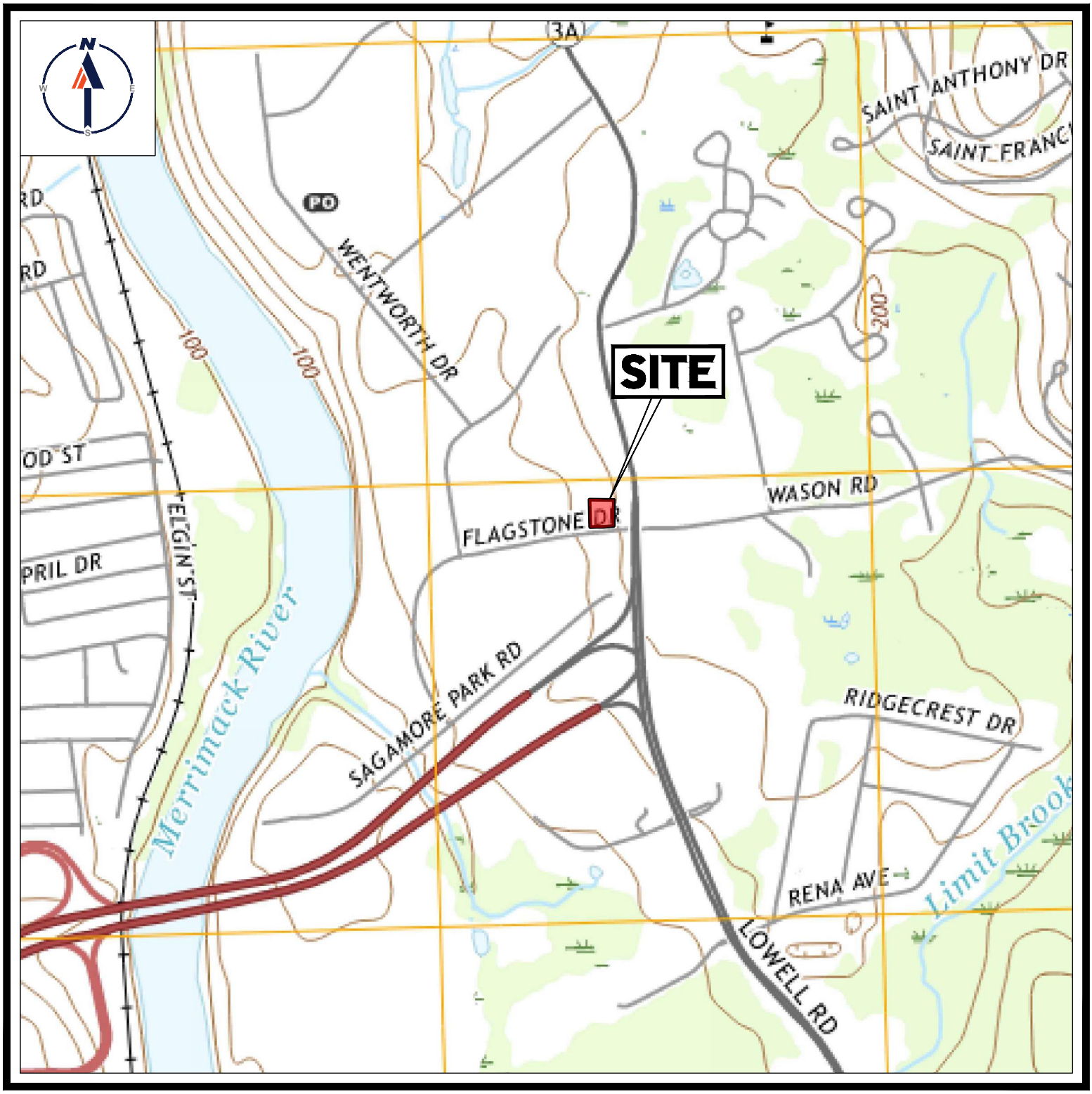
- Prior to any work being performed on the subject parcel, erosion control barriers (i.e. silt fence, straw wattles, etc.) shall be installed in those areas delineated as limit of work and shown on the Sediment and Erosion Control Plans.
- Temporary construction exits are proposed to be constructed at the entrance and exit of the site in order to prevent the tracking of silt into the existing municipal storm drainage system or onto adjacent streets.
- Existing catch basins are proposed to be fit with filter sacs to prevent silt from entering the municipal storm drainage system.
- Once cut-slopes and fill-slopes have been completed, every effort should be made to stabilize and hydroseed those slopes as soon as possible.
- Drainage out-falls are proposed to be fit with appropriately sized rip-rap aprons to reduce velocity and minimize any potential for erosion.
- Perimeter controls with straw and/or silt fence.

V. SUMMARY

In summary, the proposed stormwater management system design, as illustrated within the Site Development Plans prepared by Bohler, is calculated to result in no net increase in stormwater peak runoff rates and volume from the subject site when compared to pre-development conditions for the 2-, 10-, 25-, and 50-year storm frequencies for flows directed to the POAs. The design was cognizant not to introduce erosive drainage flow to the subject points of analysis by the use of velocity dissipating devices. Best management infrastructure was implemented to provide the water quality and recharge to the requisite stormwater runoff as illustrated in the 2008 New Hampshire Department of Environmental Services (NHDES) Stormwater Manual guidelines. Best Management Practices being implemented as part of the proposed stormwater management system design are consistent with the guidelines established within the 2008 New Hampshire Department of Environmental Services (NHDES) Stormwater Manual and Town of Sunapee Regulations, as applicable.

APPENDIX A: PROJECT LOCATION MAPS

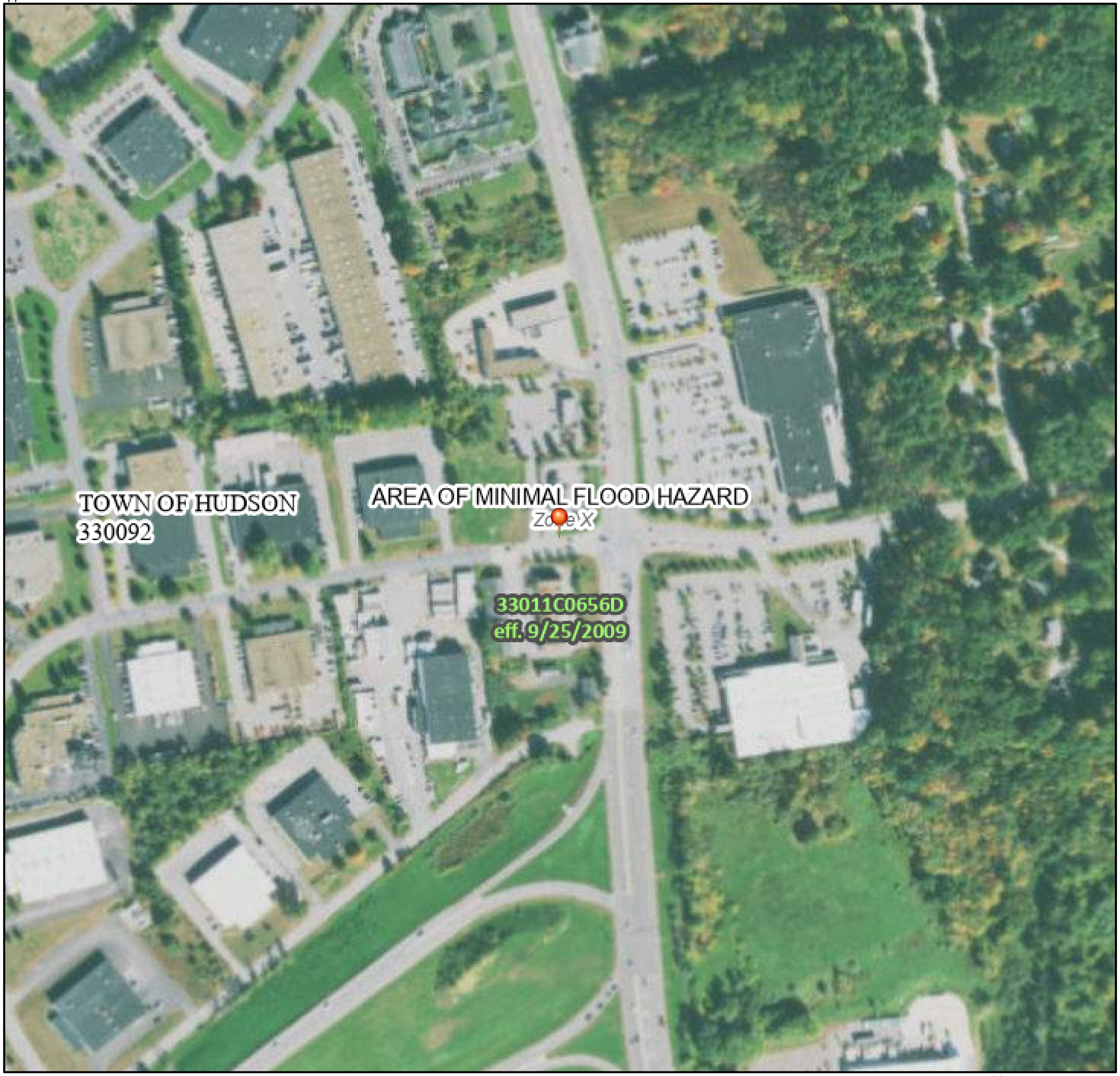
- *USGS MAP*
- *FEMA FIRMETTE*



USGS MAP

SCALE: 1" = 1,000'
SOURCE: USGS NASHUA SOUTH
QUADRANGLE

1DWLRQDO)ORRG +D]DUG /D\HU)L50HWWH



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-)XWXUH &RQGLWLRQV $QQXDO &KDQFH)ORRG +D]DUG =RQH ;
- $UHD ZLWK 5HGXFHG)ORRG 5LVN GXH WR /HYHH 6HH 1RWHV =RQH ;
- $UHD ZLWK)ORRG 5LVN GXH WR /HYHH =RQH '

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- /HYHH 'LNH RU)ORRGZDOO

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- &URVV 6HFWLRQV ZLWK $QQXDO &KDQFH :DWHU 6XUIDFH (OHYDWLRQ
- &RDVWDO 7UDQVHFW
- %DVH)ORRG (OHYDWLRQ /LQH %)(
- /LPLW RI 6WXG\
- -XULVGLFWLRQ %RXQGDU\
- &RDVWDO 7UDQVHFW %DVHOLQH
- 3URILOH %DVHOLQH
- +\GURJUDSKLF)HDWXUH

0$3 3$1(/6

- 'LJLWDO 'DWD $YDLODEOH
- 1R 'LJLWDO 'DWD $YDLODEOH
- 8QPDSSHG

7KH SLQ GLVSOD\HG RQ WKH PDS LV DQ DSSUR[LPDWH SRLQW VHOHFWHG E\ WKH XVHU DQG GRHV QRW UHSUHVHQW DQ DXWKRULWDWLYH SURSHUW\ ORFDWLRQ

7KLV PDS FRPSOLHV ZLWK)(0$ V VWDQGDUGV IRU WKH XVH RI GLJLWDO IORRG PDSV LI LW LV QRW YRLG DV GHVFULEHG EHORZ 7KH EDVHPDS VKRZQ FRPSOLHV ZLWK)(0$ V EDVHPDS DFFXUDF\ VWDQGDUGV

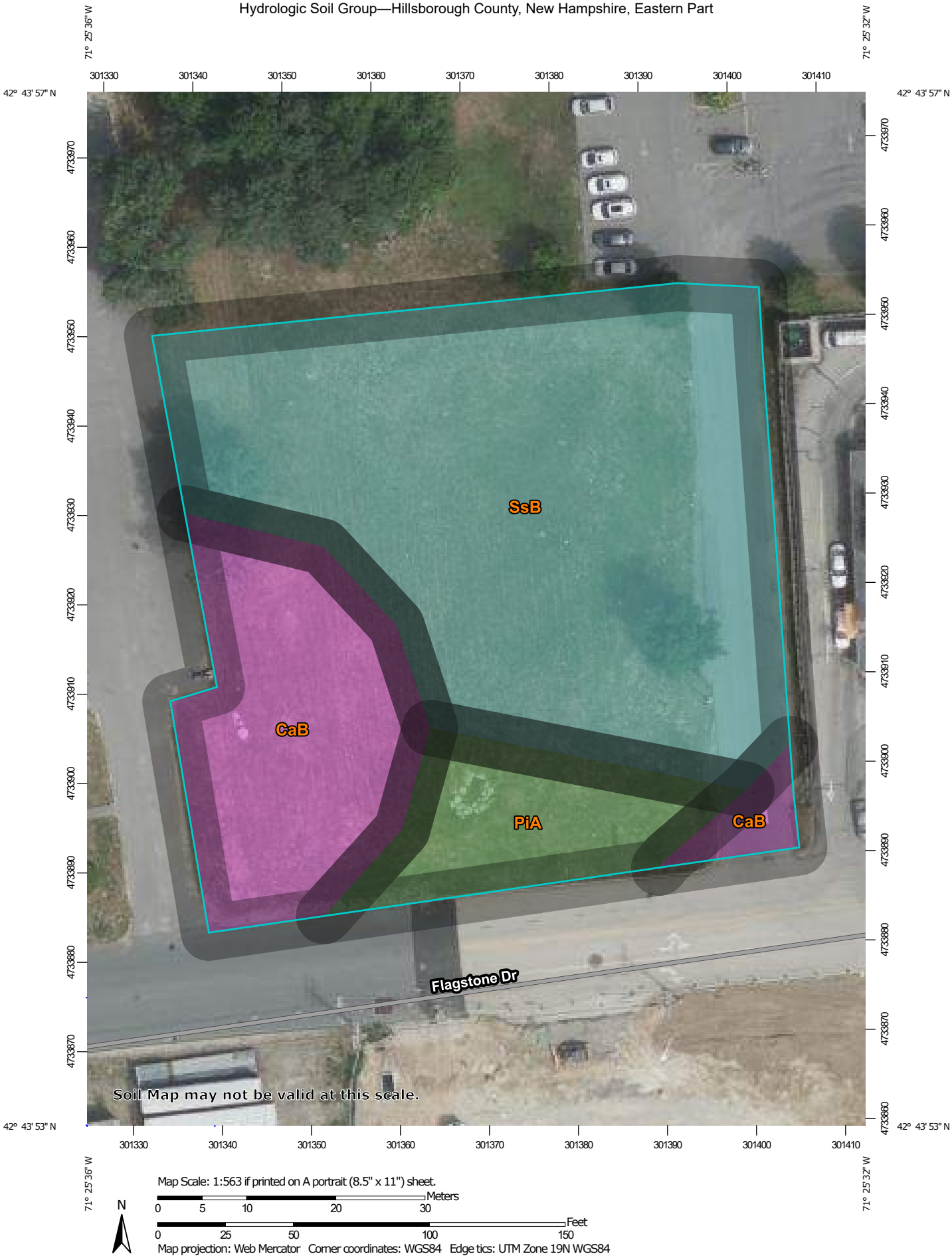
7KH IORRG KD]DUG LQIRUPDWLRQ LV GHULYHG GLUHFWO\ IURP WKH DXWKRULWDWLYH 1)+/ ZHE VHUYLFHV SURYLGHG E\ )(0$ 7KLV PDS ZDV H[SRUWHG RQ DW $0 DQG GRHV QRW UHIOHFW FKDQJHV RU DPHQGPHQWV VXEVHTXHQW WR WKLV GDWH DQG WLPH 7KH 1)+/ DQG HIIHFWLYH LQIRUPDWLRQ PD\ FKDQJH RU EHFRPH VXSHUVHGHG E\ QHZ GDWD RYHU WLPH

7KLV PDS LPDJH LV YRLG LI WKH RQH RU PRUH RI WKH IROORZLQJ PDS HOHPHQWV GR QRW DSSHDU EDVHPDS LPDJHU\ IORRG]RQH ODEHOV OHJHQG VFDOH EDU PDS FUHDWLRQ GDWH FRPPXQLW\ LGHQWLILHUV),50 SDQHO QXPEHU DQG),50 HIIHFWLYH GDWH 0DS LPDJHV IRU XQPDSSHG DQG XQPRGHUQL]HG DUHDV FDQQRW EH XVHG IRU UHJXODWRU\ SXUSRVHV

%DVHPDS 86*6 1DWLRQDO 0DS 2UWKRLPDJHU\ 'DWD UHIUHVKHG 2FWREHU

APPENDIX B: SOIL AND WETLAND INFORMATION

- *NCRS CUSTOM SOIL RESOURCE REPORT*



Map Scale: 1:563 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 5 10 20 30

Feet
0 25 50 100 150

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Hillsborough County, New Hampshire, Eastern Part
Survey Area Data: Version 24, Aug 31, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 19, 2020—Aug 6, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
CaB	Canton fine sandy loam, 0 to 8 percent slopes	A	0.3	23.8%
PiA	Pipestone loamy sand, 0 to 3 percent slopes	A/D	0.1	11.8%
SsB	Scituate fine sandy loam, 3 to 8 percent slopes	C	0.7	64.4%
Totals for Area of Interest			**1.1**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

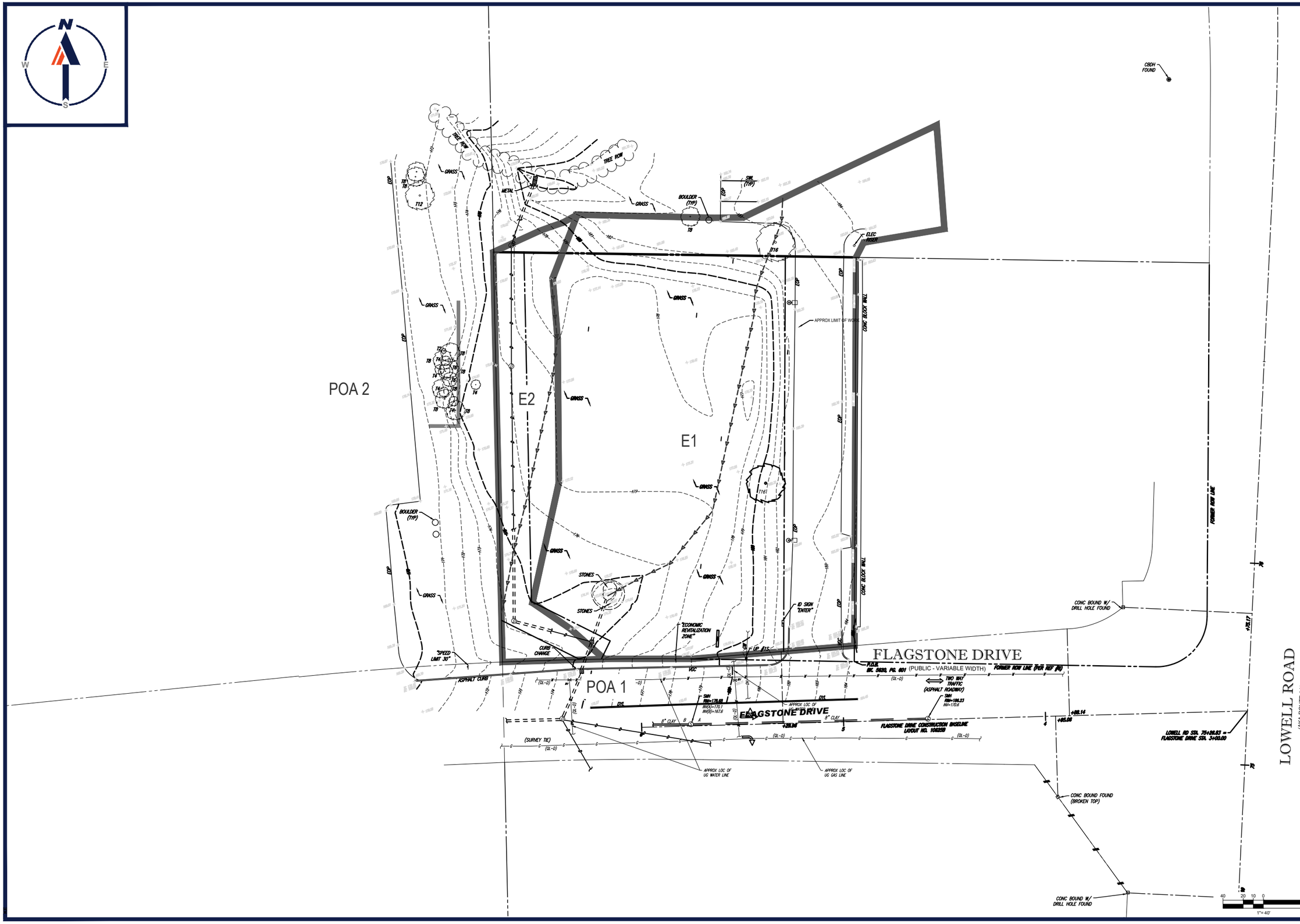
Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

APPENDIX C: EXISTING CONDITIONS HYDROLOGIC ANALYSIS

- *EXISTING CONDITIONS DRAINAGE MAP*
- *EXISTING CONDITIONS HYDROCAD COMPUTATIONS*



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BOHLER

SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
SUSTAINABLE DESIGN
PERMITTING SERVICES
TRANSPORTATION SERVICES

REVISIONS

REV	DATE	COMMENT	DRAWN BY / CHECKED BY

811 Know what's below. Call before you dig.
ALWAYS CALL 811
It's fast. It's free. It's the law.

FOR CONCEPT PURPOSES ONLY

THIS DRAWING IS INTENDED FOR MUNICIPAL AND/OR AGENCY REVIEW AND APPROVAL. IT IS NOT INTENDED AS A CONSTRUCTION DOCUMENT UNLESS INDICATED OTHERWISE

PROJECT No.:	W211235
DRAWN BY:	KME
CHECKED BY:	MKB
DATE:	XXXXX
CAD I.D.:	W211235-CVL-0

PROJECT:

SITE DEVELOPMENT PLANS

FOR

THE LANNAN COMPANY
REAL ESTATE INVESTMENT & DEVELOPMENT

PROPOSED DEVELOPMENT

MAP 222, LOT 14
3 FLAGSTONE DRIVE
HUDSON
HILLSBOROUGH COUNTY,
NEW HAMPSHIRE

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352 TURNPIKE ROAD
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NEW HAMPSHIRE LICENSE No. 15426
CONNECTICUT LICENSE No. 26127
RHODE ISLAND LICENSE No. 9816
MAINE LICENSE No. 21553

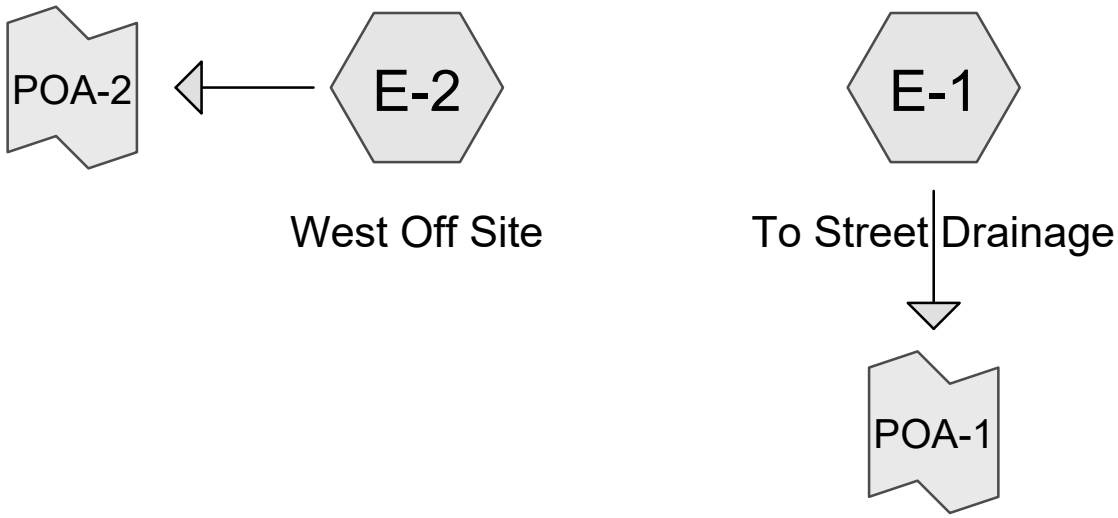
SHEET TITLE:

EXISTING CONDITIONS WATERSHED MAP

SHEET NUMBER:

WS-EX

ORG. DATE - X



Subcat Reach Pond Link

Routing Diagram for Pre Conditions
Prepared by Bohler Engineering, Printed 2/18/2022

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.064	39	>75% Grass cover, Good, HSG A (E-1, E-2)
0.601	74	>75% Grass cover, Good, HSG C (E-1, E-2)
0.106	80	>75% Grass cover, Good, HSG D (E-1, E-2)
0.016	98	Paved parking, HSG A (E-1)
0.143	98	Paved parking, HSG C (E-1)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
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 E-1: To Street Drainage Runoff Area=34,368 sf 20.15% Impervious Runoff Depth=1.17"
Flow Length=228' Tc=6.0 min CN=79 Runoff=1.06 cfs 0.077 af

Subcatchment E-2: West Off Site Runoff Area=6,144 sf 0.00% Impervious Runoff Depth=0.42"
Flow Length=168' Tc=6.1 min CN=63 Runoff=0.04 cfs 0.005 af

Link POA-1: Inflow=1.06 cfs 0.077 af
Primary=1.06 cfs 0.077 af

Link POA-2: Inflow=0.04 cfs 0.005 af
Primary=0.04 cfs 0.005 af

Summary for Subcatchment E-1: To Street Drainage

Runoff = 1.06 cfs @ 12.09 hrs, Volume= 0.077 af, Depth= 1.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=2.97"

Area (sf)	CN	Description
22,825	74	>75% Grass cover, Good, HSG C
6,229	98	Paved parking, HSG C
697	98	Paved parking, HSG A
697	39	>75% Grass cover, Good, HSG A
3,920	80	>75% Grass cover, Good, HSG D
34,368	79	Weighted Average
27,442		79.85% Pervious Area
6,926		20.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.0846	0.25		**Sheet Flow, 183.2 to 179.0** Grass: Short n= 0.150 P2= 2.97"
2.3	178	0.0350	1.31		**Shallow Concentrated Flow, 179 to 172.8** Short Grass Pasture Kv= 7.0 fps
5.6	228	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment E-2: West Off Site

Runoff = 0.04 cfs @ 12.12 hrs, Volume= 0.005 af, Depth= 0.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=2.97"

Area (sf)	CN	Description
3,345	74	>75% Grass cover, Good, HSG C
2,091	39	>75% Grass cover, Good, HSG A
708	80	>75% Grass cover, Good, HSG D
6,144	63	Weighted Average
6,144		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	50	0.0406	0.19		**Sheet Flow, 179.03 to 177** Grass: Short n= 0.150 P2= 2.97"
1.7	118	0.0270	1.15		**Shallow Concentrated Flow, 177 to 173.81** Short Grass Pasture Kv= 7.0 fps
6.1	168	Total			

Summary for Link POA-1:

Inflow Area = 0.789 ac, 20.15% Impervious, Inflow Depth = 1.17" for 2-yr event
Inflow = 1.06 cfs @ 12.09 hrs, Volume= 0.077 af
Primary = 1.06 cfs @ 12.09 hrs, Volume= 0.077 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link POA-2:

Inflow Area = 0.141 ac, 0.00% Impervious, Inflow Depth = 0.42" for 2-yr event
Inflow = 0.04 cfs @ 12.12 hrs, Volume= 0.005 af
Primary = 0.04 cfs @ 12.12 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
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 E-1: To Street Drainage Runoff Area=34,368 sf 20.15% Impervious Runoff Depth=2.36"
Flow Length=228' Tc=6.0 min CN=79 Runoff=2.18 cfs 0.155 af

Subcatchment E-2: West Off Site Runoff Area=6,144 sf 0.00% Impervious Runoff Depth=1.19"
Flow Length=168' Tc=6.1 min CN=63 Runoff=0.18 cfs 0.014 af

Link POA-1: Inflow=2.18 cfs 0.155 af
Primary=2.18 cfs 0.155 af

Link POA-2: Inflow=0.18 cfs 0.014 af
Primary=0.18 cfs 0.014 af

Summary for Subcatchment E-1: To Street Drainage

Runoff = 2.18 cfs @ 12.09 hrs, Volume= 0.155 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.48"

Area (sf)	CN	Description
22,825	74	>75% Grass cover, Good, HSG C
6,229	98	Paved parking, HSG C
697	98	Paved parking, HSG A
697	39	>75% Grass cover, Good, HSG A
3,920	80	>75% Grass cover, Good, HSG D
34,368	79	Weighted Average
27,442		79.85% Pervious Area
6,926		20.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.0846	0.25		**Sheet Flow, 183.2 to 179.0** Grass: Short n= 0.150 P2= 2.97"
2.3	178	0.0350	1.31		**Shallow Concentrated Flow, 179 to 172.8** Short Grass Pasture Kv= 7.0 fps
5.6	228	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment E-2: West Off Site

Runoff = 0.18 cfs @ 12.10 hrs, Volume= 0.014 af, Depth= 1.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.48"

Area (sf)	CN	Description
3,345	74	>75% Grass cover, Good, HSG C
2,091	39	>75% Grass cover, Good, HSG A
708	80	>75% Grass cover, Good, HSG D
6,144	63	Weighted Average
6,144		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	50	0.0406	0.19		**Sheet Flow, 179.03 to 177** Grass: Short n= 0.150 P2= 2.97"
1.7	118	0.0270	1.15		**Shallow Concentrated Flow, 177 to 173.81** Short Grass Pasture Kv= 7.0 fps
6.1	168	Total			

Summary for Link POA-1:

Inflow Area = 0.789 ac, 20.15% Impervious, Inflow Depth = 2.36" for 10-yr event
Inflow = 2.18 cfs @ 12.09 hrs, Volume= 0.155 af
Primary = 2.18 cfs @ 12.09 hrs, Volume= 0.155 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link POA-2:

Inflow Area = 0.141 ac, 0.00% Impervious, Inflow Depth = 1.19" for 10-yr event
Inflow = 0.18 cfs @ 12.10 hrs, Volume= 0.014 af
Primary = 0.18 cfs @ 12.10 hrs, Volume= 0.014 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
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 E-1: To Street Drainage Runoff Area=34,368 sf 20.15% Impervious Runoff Depth=3.38"
Flow Length=228' Tc=6.0 min CN=79 Runoff=3.12 cfs 0.222 af

Subcatchment E-2: West Off Site Runoff Area=6,144 sf 0.00% Impervious Runoff Depth=1.94"
Flow Length=168' Tc=6.1 min CN=63 Runoff=0.31 cfs 0.023 af

Link POA-1: Inflow=3.12 cfs 0.222 af
Primary=3.12 cfs 0.222 af

Link POA-2: Inflow=0.31 cfs 0.023 af
Primary=0.31 cfs 0.023 af

Summary for Subcatchment E-1: To Street Drainage

Runoff = 3.12 cfs @ 12.09 hrs, Volume= 0.222 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=5.66"

Area (sf)	CN	Description
22,825	74	>75% Grass cover, Good, HSG C
6,229	98	Paved parking, HSG C
697	98	Paved parking, HSG A
697	39	>75% Grass cover, Good, HSG A
3,920	80	>75% Grass cover, Good, HSG D
34,368	79	Weighted Average
27,442		79.85% Pervious Area
6,926		20.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.0846	0.25		**Sheet Flow, 183.2 to 179.0** Grass: Short n= 0.150 P2= 2.97"
2.3	178	0.0350	1.31		**Shallow Concentrated Flow, 179 to 172.8** Short Grass Pasture Kv= 7.0 fps
5.6	228	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment E-2: West Off Site

Runoff = 0.31 cfs @ 12.10 hrs, Volume= 0.023 af, Depth= 1.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=5.66"

Area (sf)	CN	Description
3,345	74	>75% Grass cover, Good, HSG C
2,091	39	>75% Grass cover, Good, HSG A
708	80	>75% Grass cover, Good, HSG D
6,144	63	Weighted Average
6,144		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	50	0.0406	0.19		**Sheet Flow, 179.03 to 177** Grass: Short n= 0.150 P2= 2.97"
1.7	118	0.0270	1.15		**Shallow Concentrated Flow, 177 to 173.81** Short Grass Pasture Kv= 7.0 fps
6.1	168	Total			

Summary for Link POA-1:

Inflow Area = 0.789 ac, 20.15% Impervious, Inflow Depth = 3.38" for 25-yr event
Inflow = 3.12 cfs @ 12.09 hrs, Volume= 0.222 af
Primary = 3.12 cfs @ 12.09 hrs, Volume= 0.222 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link POA-2:

Inflow Area = 0.141 ac, 0.00% Impervious, Inflow Depth = 1.94" for 25-yr event
Inflow = 0.31 cfs @ 12.10 hrs, Volume= 0.023 af
Primary = 0.31 cfs @ 12.10 hrs, Volume= 0.023 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
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 E-1: To Street Drainage Runoff Area=34,368 sf 20.15% Impervious Runoff Depth=4.37"
Flow Length=228' Tc=6.0 min CN=79 Runoff=4.01 cfs 0.287 af

Subcatchment E-2: West Off Site Runoff Area=6,144 sf 0.00% Impervious Runoff Depth=2.72"
Flow Length=168' Tc=6.1 min CN=63 Runoff=0.44 cfs 0.032 af

Link POA-1: Inflow=4.01 cfs 0.287 af
Primary=4.01 cfs 0.287 af

Link POA-2: Inflow=0.44 cfs 0.032 af
Primary=0.44 cfs 0.032 af

Summary for Subcatchment E-1: To Street Drainage

Runoff = 4.01 cfs @ 12.09 hrs, Volume= 0.287 af, Depth= 4.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-yr Rainfall=6.76"

Area (sf)	CN	Description
22,825	74	>75% Grass cover, Good, HSG C
6,229	98	Paved parking, HSG C
697	98	Paved parking, HSG A
697	39	>75% Grass cover, Good, HSG A
3,920	80	>75% Grass cover, Good, HSG D
34,368	79	Weighted Average
27,442		79.85% Pervious Area
6,926		20.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.0846	0.25		**Sheet Flow, 183.2 to 179.0** Grass: Short n= 0.150 P2= 2.97"
2.3	178	0.0350	1.31		**Shallow Concentrated Flow, 179 to 172.8** Short Grass Pasture Kv= 7.0 fps
5.6	228	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment E-2: West Off Site

Runoff = 0.44 cfs @ 12.09 hrs, Volume= 0.032 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-yr Rainfall=6.76"

Area (sf)	CN	Description
3,345	74	>75% Grass cover, Good, HSG C
2,091	39	>75% Grass cover, Good, HSG A
708	80	>75% Grass cover, Good, HSG D
6,144	63	Weighted Average
6,144		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	50	0.0406	0.19		**Sheet Flow, 179.03 to 177** Grass: Short n= 0.150 P2= 2.97"
1.7	118	0.0270	1.15		**Shallow Concentrated Flow, 177 to 173.81** Short Grass Pasture Kv= 7.0 fps
6.1	168	Total			

Summary for Link POA-1:

Inflow Area = 0.789 ac, 20.15% Impervious, Inflow Depth = 4.37" for 50-yr event
Inflow = 4.01 cfs @ 12.09 hrs, Volume= 0.287 af
Primary = 4.01 cfs @ 12.09 hrs, Volume= 0.287 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

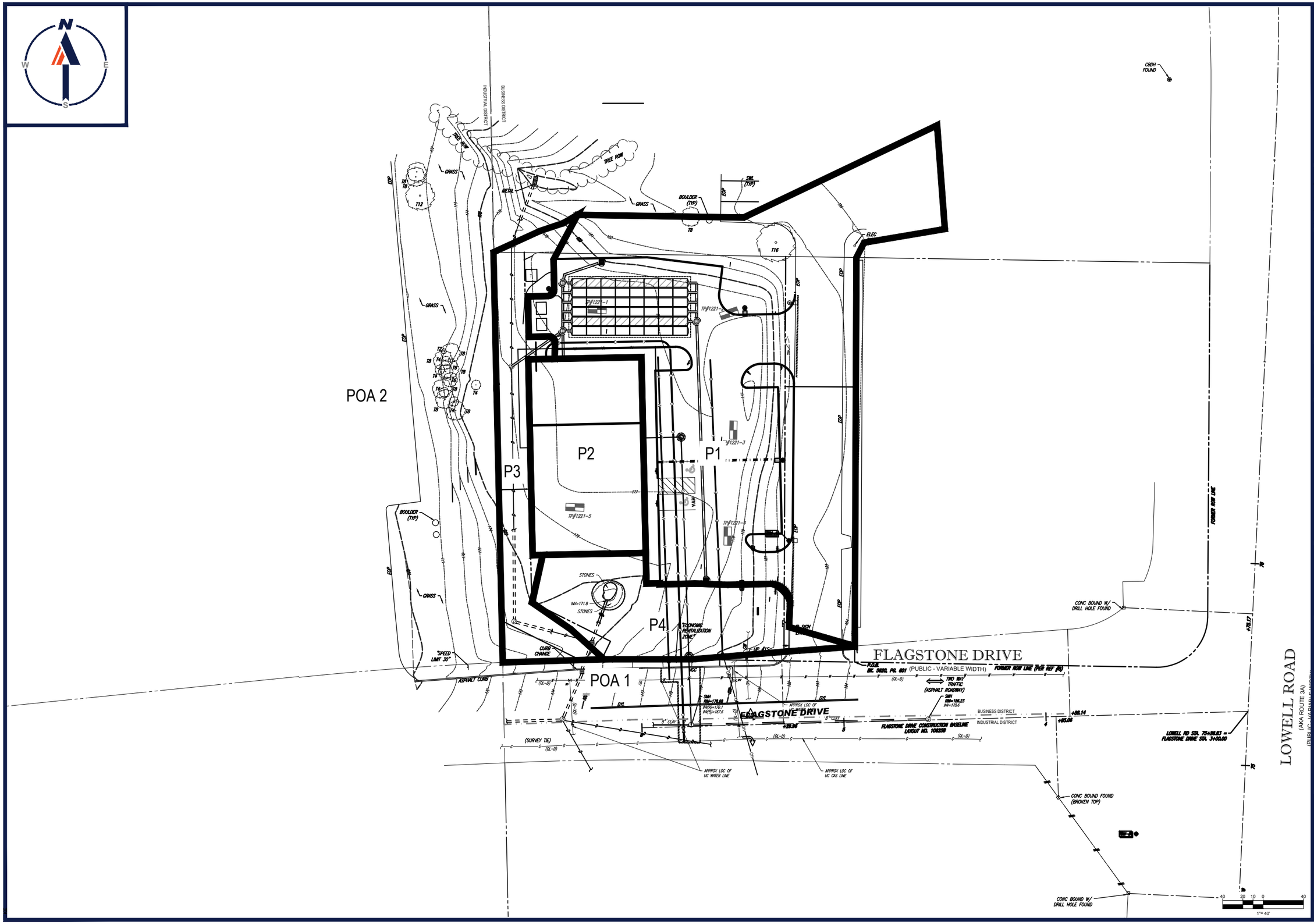
Summary for Link POA-2:

Inflow Area = 0.141 ac, 0.00% Impervious, Inflow Depth = 2.72" for 50-yr event
Inflow = 0.44 cfs @ 12.09 hrs, Volume= 0.032 af
Primary = 0.44 cfs @ 12.09 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

APPENDIX D: PROPOSED CONDITIONS HYDROLOGIC ANALYSIS

- *PROPOSED CONDITIONS DRAINAGE MAP*
- *PROPOSED CONDITIONS HYDROCAD CALCULATIONS*



P:\21\W211235\DRAWINGS\PLAN SETS\REV2\W211235-CVL-3----LAYOUT: WS-PR-PROP- DRAIN MAP

BOHLER

SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROJECT MANAGEMENT
LANDSCAPE ARCHITECTURE
SUSTAINABLE DESIGN
FEASIBILITY STUDIES
TRANSPORTATION SERVICES

REVISIONS

REV	DATE	COMMENT	DRAWN BY / CHECKED BY
1	2/17/22	PEER REVIEW COMMENTS	KME / MKB
2	3/3/22	PB HEARING COMMENTS	KME / MKB

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PROJECT No.:	W211235
DRAWN BY:	KME
CHECKED BY:	MKB
DATE:	01/17/2022
CAD I.D.:	W211235-CVL-2

PROJECT:

SITE DEVELOPMENT PLANS

FOR

THE LANNAN COMPANY
REAL ESTATE INVESTMENT & DEVELOPMENT

PROPOSED DEVELOPMENT

MAP 222, LOT 14
3 FLAGSTONE DRIVE
HUDSON
HILLSBOROUGH COUNTY,
NEW HAMPSHIRE

BOHLER
352 TURNPIKE ROAD
SOUTHBOROUGH, MA 01772
Phone: (508) 480-9900
www.BohlerEngineering.com

J.A. KUCICH

PROFESSIONAL ENGINEER
NEW HAMPSHIRE LICENSE No. 15476

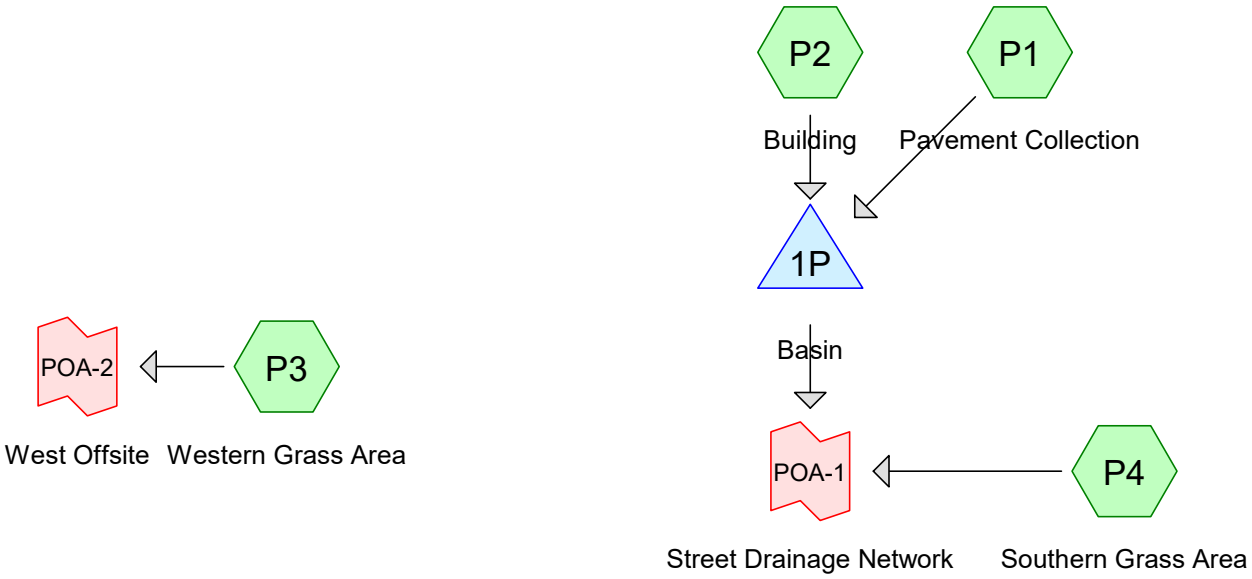
SHEET TITLE:

EXISTING CONDITIONS WATERSHED MAP

SHEET NUMBER:

WS-PR

REV 2 - 03/03/2022



Subcat Reach Pond Link

Routing Diagram for Post Conditions
Prepared by Bohler Engineering, Printed 3/10/2022

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.053	39	>75% Grass cover, Good, HSG A (P1, P3, P4)
0.199	74	>75% Grass cover, Good, HSG C (P1, P3, P4)
0.106	80	>75% Grass cover, Good, HSG D (P3, P4)
0.016	98	Paved parking, HSG A (P1, P4)
0.432	98	Paved parking, HSG C (P1, P3)
0.011	98	Roofs, HSG A (P2)
0.113	98	Roofs, HSG C (P2)
0.930	**87**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.080	HSG A	P1, P2, P3, P4
0.000	HSG B	
0.744	HSG C	P1, P2, P3, P4
0.106	HSG D	P3, P4
0.000	Other	
0.930		**TOTAL AREA**

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
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 P1: Pavement Collection Runoff Area=25,328 sf 75.13% Impervious Runoff Depth=2.13"
Tc=6.0 min CN=92 Runoff=1.43 cfs 0.103 af

Subcatchment P2: Building Runoff Area=5,432 sf 100.00% Impervious Runoff Depth=2.74"
Tc=6.0 min CN=98 Runoff=0.36 cfs 0.028 af

Subcatchment P3: Western Grass Area Runoff Area=4,671 sf 6.12% Impervious Runoff Depth=0.46"
Tc=6.0 min CN=64 Runoff=0.04 cfs 0.004 af

Subcatchment P4: Southern Grass Area Runoff Area=5,071 sf 3.94% Impervious Runoff Depth=1.05"
Tc=6.0 min CN=77 Runoff=0.14 cfs 0.010 af

Pond 1P: Basin Peak Elev=177.09' Storage=2,269 cf Inflow=1.78 cfs 0.132 af
Discarded=0.06 cfs 0.105 af Primary=0.39 cfs 0.027 af Outflow=0.45 cfs 0.132 af

Link POA-1: Street Drainage Network Inflow=0.43 cfs 0.037 af
Primary=0.43 cfs 0.037 af

Link POA-2: West Offsite Inflow=0.04 cfs 0.004 af
Primary=0.04 cfs 0.004 af

Total Runoff Area = 0.930 ac Runoff Volume = 0.146 af Average Runoff Depth = 1.89"
38.41% Pervious = 0.357 ac 61.59% Impervious = 0.573 ac

Summary for Subcatchment P1: Pavement Collection

Runoff = 1.43 cfs @ 12.09 hrs, Volume= 0.103 af, Depth= 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=2.97"

Area (sf)	CN	Description
18,531	98	Paved parking, HSG C
498	98	Paved parking, HSG A
242	39	>75% Grass cover, Good, HSG A
6,057	74	>75% Grass cover, Good, HSG C
25,328	92	Weighted Average
6,299		24.87% Pervious Area
19,029		75.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P2: Building

Runoff = 0.36 cfs @ 12.08 hrs, Volume= 0.028 af, Depth= 2.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=2.97"

Area (sf)	CN	Description
490	98	Roofs, HSG A
4,942	98	Roofs, HSG C
5,432	98	Weighted Average
5,432		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P3: Western Grass Area

Runoff = 0.04 cfs @ 12.12 hrs, Volume= 0.004 af, Depth= 0.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=2.97"

Area (sf)	CN	Description
1,695	39	>75% Grass cover, Good, HSG A
1,987	74	>75% Grass cover, Good, HSG C
703	80	>75% Grass cover, Good, HSG D
286	98	Paved parking, HSG C
4,671	64	Weighted Average
4,385		93.88% Pervious Area
286		6.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P4: Southern Grass Area

Runoff = 0.14 cfs @ 12.09 hrs, Volume= 0.010 af, Depth= 1.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=2.97"

Area (sf)	CN	Description
365	39	>75% Grass cover, Good, HSG A
613	74	>75% Grass cover, Good, HSG C
3,893	80	>75% Grass cover, Good, HSG D
200	98	Paved parking, HSG A
5,071	77	Weighted Average
4,871		96.06% Pervious Area
200		3.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Pond 1P: Basin

Inflow Area = 0.706 ac, 79.52% Impervious, Inflow Depth = 2.24" for 2-yr event
Inflow = 1.78 cfs @ 12.09 hrs, Volume= 0.132 af
Outflow = 0.45 cfs @ 12.46 hrs, Volume= 0.132 af, Atten= 75%, Lag= 22.6 min
Discarded = 0.06 cfs @ 10.72 hrs, Volume= 0.105 af
Primary = 0.39 cfs @ 12.46 hrs, Volume= 0.027 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 177.09' @ 12.46 hrs Surf.Area= 1,817 sf Storage= 2,269 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 238.0 min (1,029.3 - 791.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	175.25'	1,662 cf	**30.00'W x 60.58'L x 3.50'H Field A** 6,361 cf Overall - 2,205 cf Embedded = 4,155 cf x 40.0% Voids
#2A	175.75'	2,205 cf	**ADS_StormTech SC-740 +Cap** x 48 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 6 Rows of 8 Chambers
		3,867 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	175.25'	**1.500 in/hr Exfiltration over Surface area**
#2	Primary	175.25'	**12.0" Round Culvert** L= 50.0' Ke= 0.900 Inlet / Outlet Invert= 175.25' / 172.85' S= 0.0480 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	178.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 2	176.85'	**12.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.06 cfs @ 10.72 hrs HW=175.29' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.39 cfs @ 12.46 hrs HW=177.09' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.39 cfs of 3.46 cfs potential flow)
  ├**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**4=Orifice/Grate** (Orifice Controls 0.39 cfs @ 1.59 fps)

Summary for Link POA-1: Street Drainage Network

Inflow Area = 0.823 ac, 68.83% Impervious, Inflow Depth = 0.54" for 2-yr event
Inflow = 0.43 cfs @ 12.45 hrs, Volume= 0.037 af
Primary = 0.43 cfs @ 12.45 hrs, Volume= 0.037 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link POA-2: West Offsite

Inflow Area = 0.107 ac, 6.12% Impervious, Inflow Depth = 0.46" for 2-yr event
Inflow = 0.04 cfs @ 12.12 hrs, Volume= 0.004 af
Primary = 0.04 cfs @ 12.12 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
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 P1: Pavement Collection Runoff Area=25,328 sf 75.13% Impervious Runoff Depth=3.58"
Tc=6.0 min CN=92 Runoff=2.34 cfs 0.174 af

Subcatchment P2: Building Runoff Area=5,432 sf 100.00% Impervious Runoff Depth=4.24"
Tc=6.0 min CN=98 Runoff=0.55 cfs 0.044 af

Subcatchment P3: Western Grass Area Runoff Area=4,671 sf 6.12% Impervious Runoff Depth=1.25"
Tc=6.0 min CN=64 Runoff=0.14 cfs 0.011 af

Subcatchment P4: Southern Grass Area Runoff Area=5,071 sf 3.94% Impervious Runoff Depth=2.19"
Tc=6.0 min CN=77 Runoff=0.30 cfs 0.021 af

Pond 1P: Basin Peak Elev=177.58' Storage=2,869 cf Inflow=2.88 cfs 0.218 af
Discarded=0.06 cfs 0.123 af Primary=1.65 cfs 0.095 af Outflow=1.71 cfs 0.218 af

Link POA-1: Street Drainage Network Inflow=1.85 cfs 0.116 af
Primary=1.85 cfs 0.116 af

Link POA-2: West Offsite Inflow=0.14 cfs 0.011 af
Primary=0.14 cfs 0.011 af

Total Runoff Area = 0.930 ac Runoff Volume = 0.250 af Average Runoff Depth = 3.23"
38.41% Pervious = 0.357 ac 61.59% Impervious = 0.573 ac

Summary for Subcatchment P1: Pavement Collection

Runoff = 2.34 cfs @ 12.08 hrs, Volume= 0.174 af, Depth= 3.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.48"

Area (sf)	CN	Description
18,531	98	Paved parking, HSG C
498	98	Paved parking, HSG A
242	39	>75% Grass cover, Good, HSG A
6,057	74	>75% Grass cover, Good, HSG C
25,328	92	Weighted Average
6,299		24.87% Pervious Area
19,029		75.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P2: Building

Runoff = 0.55 cfs @ 12.08 hrs, Volume= 0.044 af, Depth= 4.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.48"

Area (sf)	CN	Description
490	98	Roofs, HSG A
4,942	98	Roofs, HSG C
5,432	98	Weighted Average
5,432		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P3: Western Grass Area

Runoff = 0.14 cfs @ 12.10 hrs, Volume= 0.011 af, Depth= 1.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.48"

Area (sf)	CN	Description
1,695	39	>75% Grass cover, Good, HSG A
1,987	74	>75% Grass cover, Good, HSG C
703	80	>75% Grass cover, Good, HSG D
286	98	Paved parking, HSG C
4,671	64	Weighted Average
4,385		93.88% Pervious Area
286		6.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P4: Southern Grass Area

Runoff = 0.30 cfs @ 12.09 hrs, Volume= 0.021 af, Depth= 2.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.48"

Area (sf)	CN	Description
365	39	>75% Grass cover, Good, HSG A
613	74	>75% Grass cover, Good, HSG C
3,893	80	>75% Grass cover, Good, HSG D
200	98	Paved parking, HSG A
5,071	77	Weighted Average
4,871		96.06% Pervious Area
200		3.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Pond 1P: Basin

Inflow Area = 0.706 ac, 79.52% Impervious, Inflow Depth = 3.70" for 10-yr event
Inflow = 2.88 cfs @ 12.08 hrs, Volume= 0.218 af
Outflow = 1.71 cfs @ 12.19 hrs, Volume= 0.218 af, Atten= 41%, Lag= 6.3 min
Discarded = 0.06 cfs @ 9.32 hrs, Volume= 0.123 af
Primary = 1.65 cfs @ 12.19 hrs, Volume= 0.095 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 177.58' @ 12.19 hrs Surf.Area= 1,817 sf Storage= 2,869 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 179.3 min (958.2 - 778.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	175.25'	1,662 cf	**30.00'W x 60.58'L x 3.50'H Field A** 6,361 cf Overall - 2,205 cf Embedded = 4,155 cf x 40.0% Voids
#2A	175.75'	2,205 cf	**ADS_StormTech SC-740 +Cap** x 48 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 6 Rows of 8 Chambers
		3,867 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	175.25'	**1.500 in/hr Exfiltration over Surface area**
#2	Primary	175.25'	**12.0" Round Culvert** L= 50.0' Ke= 0.900 Inlet / Outlet Invert= 175.25' / 172.85' S= 0.0480 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	178.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 2	176.85'	**12.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.06 cfs @ 9.32 hrs HW=175.29' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=1.65 cfs @ 12.19 hrs HW=177.58' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 1.65 cfs of 4.04 cfs potential flow)
  ├**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**4=Orifice/Grate** (Orifice Controls 1.65 cfs @ 3.30 fps)

Summary for Link POA-1: Street Drainage Network

Inflow Area = 0.823 ac, 68.83% Impervious, Inflow Depth = 1.70" for 10-yr event
Inflow = 1.85 cfs @ 12.17 hrs, Volume= 0.116 af
Primary = 1.85 cfs @ 12.17 hrs, Volume= 0.116 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link POA-2: West Offsite

Inflow Area = 0.107 ac, 6.12% Impervious, Inflow Depth = 1.25" for 10-yr event
Inflow = 0.14 cfs @ 12.10 hrs, Volume= 0.011 af
Primary = 0.14 cfs @ 12.10 hrs, Volume= 0.011 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
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 P1: Pavement Collection Runoff Area=25,328 sf 75.13% Impervious Runoff Depth=4.74"
Tc=6.0 min CN=92 Runoff=3.04 cfs 0.229 af

Subcatchment P2: Building Runoff Area=5,432 sf 100.00% Impervious Runoff Depth=5.42"
Tc=6.0 min CN=98 Runoff=0.69 cfs 0.056 af

Subcatchment P3: Western Grass Area Runoff Area=4,671 sf 6.12% Impervious Runoff Depth=2.02"
Tc=6.0 min CN=64 Runoff=0.25 cfs 0.018 af

Subcatchment P4: Southern Grass Area Runoff Area=5,071 sf 3.94% Impervious Runoff Depth=3.18"
Tc=6.0 min CN=77 Runoff=0.43 cfs 0.031 af

Pond 1P: Basin Peak Elev=178.07' Storage=3,365 cf Inflow=3.73 cfs 0.286 af
Discarded=0.06 cfs 0.133 af Primary=2.36 cfs 0.152 af Outflow=2.43 cfs 0.286 af

Link POA-1: Street Drainage Network Inflow=2.68 cfs 0.183 af
Primary=2.68 cfs 0.183 af

Link POA-2: West Offsite Inflow=0.25 cfs 0.018 af
Primary=0.25 cfs 0.018 af

Total Runoff Area = 0.930 ac Runoff Volume = 0.335 af Average Runoff Depth = 4.32"
38.41% Pervious = 0.357 ac 61.59% Impervious = 0.573 ac

Summary for Subcatchment P1: Pavement Collection

Runoff = 3.04 cfs @ 12.08 hrs, Volume= 0.229 af, Depth= 4.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=5.66"

Area (sf)	CN	Description
18,531	98	Paved parking, HSG C
498	98	Paved parking, HSG A
242	39	>75% Grass cover, Good, HSG A
6,057	74	>75% Grass cover, Good, HSG C
25,328	92	Weighted Average
6,299		24.87% Pervious Area
19,029		75.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P2: Building

Runoff = 0.69 cfs @ 12.08 hrs, Volume= 0.056 af, Depth= 5.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=5.66"

Area (sf)	CN	Description
490	98	Roofs, HSG A
4,942	98	Roofs, HSG C
5,432	98	Weighted Average
5,432		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P3: Western Grass Area

Runoff = 0.25 cfs @ 12.09 hrs, Volume= 0.018 af, Depth= 2.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=5.66"

Area (sf)	CN	Description
1,695	39	>75% Grass cover, Good, HSG A
1,987	74	>75% Grass cover, Good, HSG C
703	80	>75% Grass cover, Good, HSG D
286	98	Paved parking, HSG C
4,671	64	Weighted Average
4,385		93.88% Pervious Area
286		6.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P4: Southern Grass Area

Runoff = 0.43 cfs @ 12.09 hrs, Volume= 0.031 af, Depth= 3.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=5.66"

Area (sf)	CN	Description
365	39	>75% Grass cover, Good, HSG A
613	74	>75% Grass cover, Good, HSG C
3,893	80	>75% Grass cover, Good, HSG D
200	98	Paved parking, HSG A
5,071	77	Weighted Average
4,871		96.06% Pervious Area
200		3.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Pond 1P: Basin

Inflow Area = 0.706 ac, 79.52% Impervious, Inflow Depth = 4.86" for 25-yr event
Inflow = 3.73 cfs @ 12.08 hrs, Volume= 0.286 af
Outflow = 2.43 cfs @ 12.17 hrs, Volume= 0.286 af, Atten= 35%, Lag= 5.4 min
Discarded = 0.06 cfs @ 8.58 hrs, Volume= 0.133 af
Primary = 2.36 cfs @ 12.17 hrs, Volume= 0.152 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 178.07' @ 12.17 hrs Surf.Area= 1,817 sf Storage= 3,365 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 155.2 min (927.6 - 772.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	175.25'	1,662 cf	**30.00'W x 60.58'L x 3.50'H Field A** 6,361 cf Overall - 2,205 cf Embedded = 4,155 cf x 40.0% Voids
#2A	175.75'	2,205 cf	**ADS_StormTech SC-740 +Cap** x 48 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 6 Rows of 8 Chambers
		3,867 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	175.25'	**1.500 in/hr Exfiltration over Surface area**
#2	Primary	175.25'	**12.0" Round Culvert** L= 50.0' Ke= 0.900 Inlet / Outlet Invert= 175.25' / 172.85' S= 0.0480 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	178.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 2	176.85'	**12.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.06 cfs @ 8.58 hrs HW=175.29' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=2.36 cfs @ 12.17 hrs HW=178.07' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 2.36 cfs of 4.55 cfs potential flow)
  ├**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**4=Orifice/Grate** (Orifice Controls 2.36 cfs @ 4.72 fps)

Summary for Link POA-1: Street Drainage Network

Inflow Area = 0.823 ac, 68.83% Impervious, Inflow Depth = 2.67" for 25-yr event
Inflow = 2.68 cfs @ 12.15 hrs, Volume= 0.183 af
Primary = 2.68 cfs @ 12.15 hrs, Volume= 0.183 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link POA-2: West Offsite

Inflow Area = 0.107 ac, 6.12% Impervious, Inflow Depth = 2.02" for 25-yr event
Inflow = 0.25 cfs @ 12.09 hrs, Volume= 0.018 af
Primary = 0.25 cfs @ 12.09 hrs, Volume= 0.018 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
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 P1: Pavement Collection Runoff Area=25,328 sf 75.13% Impervious Runoff Depth=5.82"
Tc=6.0 min CN=92 Runoff=3.69 cfs 0.282 af

Subcatchment P2: Building Runoff Area=5,432 sf 100.00% Impervious Runoff Depth=6.52"
Tc=6.0 min CN=98 Runoff=0.83 cfs 0.068 af

Subcatchment P3: Western Grass Area Runoff Area=4,671 sf 6.12% Impervious Runoff Depth=2.82"
Tc=6.0 min CN=64 Runoff=0.35 cfs 0.025 af

Subcatchment P4: Southern Grass Area Runoff Area=5,071 sf 3.94% Impervious Runoff Depth=4.15"
Tc=6.0 min CN=77 Runoff=0.57 cfs 0.040 af

Pond 1P: Basin Peak Elev=178.41' Storage=3,622 cf Inflow=4.52 cfs 0.350 af
Discarded=0.06 cfs 0.141 af Primary=3.60 cfs 0.209 af Outflow=3.67 cfs 0.350 af

Link POA-1: Street Drainage Network Inflow=4.08 cfs 0.249 af
Primary=4.08 cfs 0.249 af

Link POA-2: West Offsite Inflow=0.35 cfs 0.025 af
Primary=0.35 cfs 0.025 af

Total Runoff Area = 0.930 ac Runoff Volume = 0.415 af Average Runoff Depth = 5.36"
38.41% Pervious = 0.357 ac 61.59% Impervious = 0.573 ac

Summary for Subcatchment P1: Pavement Collection

Runoff = 3.69 cfs @ 12.08 hrs, Volume= 0.282 af, Depth= 5.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-yr Rainfall=6.76"

Area (sf)	CN	Description
18,531	98	Paved parking, HSG C
498	98	Paved parking, HSG A
242	39	>75% Grass cover, Good, HSG A
6,057	74	>75% Grass cover, Good, HSG C
25,328	92	Weighted Average
6,299		24.87% Pervious Area
19,029		75.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P2: Building

Runoff = 0.83 cfs @ 12.08 hrs, Volume= 0.068 af, Depth= 6.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-yr Rainfall=6.76"

Area (sf)	CN	Description
490	98	Roofs, HSG A
4,942	98	Roofs, HSG C
5,432	98	Weighted Average
5,432		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P3: Western Grass Area

Runoff = 0.35 cfs @ 12.09 hrs, Volume= 0.025 af, Depth= 2.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-yr Rainfall=6.76"

Area (sf)	CN	Description
1,695	39	>75% Grass cover, Good, HSG A
1,987	74	>75% Grass cover, Good, HSG C
703	80	>75% Grass cover, Good, HSG D
286	98	Paved parking, HSG C
4,671	64	Weighted Average
4,385		93.88% Pervious Area
286		6.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P4: Southern Grass Area

Runoff = 0.57 cfs @ 12.09 hrs, Volume= 0.040 af, Depth= 4.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-yr Rainfall=6.76"

Area (sf)	CN	Description
365	39	>75% Grass cover, Good, HSG A
613	74	>75% Grass cover, Good, HSG C
3,893	80	>75% Grass cover, Good, HSG D
200	98	Paved parking, HSG A
5,071	77	Weighted Average
4,871		96.06% Pervious Area
200		3.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Pond 1P: Basin

Inflow Area = 0.706 ac, 79.52% Impervious, Inflow Depth = 5.94" for 50-yr event
Inflow = 4.52 cfs @ 12.08 hrs, Volume= 0.350 af
Outflow = 3.67 cfs @ 12.14 hrs, Volume= 0.350 af, Atten= 19%, Lag= 3.5 min
Discarded = 0.06 cfs @ 7.86 hrs, Volume= 0.141 af
Primary = 3.60 cfs @ 12.14 hrs, Volume= 0.209 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 178.41' @ 12.14 hrs Surf.Area= 1,817 sf Storage= 3,622 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 138.7 min (906.6 - 767.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	175.25'	1,662 cf	**30.00'W x 60.58'L x 3.50'H Field A** 6,361 cf Overall - 2,205 cf Embedded = 4,155 cf x 40.0% Voids
#2A	175.75'	2,205 cf	**ADS_StormTech SC-740 +Cap** x 48 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 6 Rows of 8 Chambers
		3,867 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	175.25'	**1.500 in/hr Exfiltration over Surface area**
#2	Primary	175.25'	**12.0" Round Culvert** L= 50.0' Ke= 0.900 Inlet / Outlet Invert= 175.25' / 172.85' S= 0.0480 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	178.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 2	176.85'	**12.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.06 cfs @ 7.86 hrs HW=175.29' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=3.60 cfs @ 12.14 hrs HW=178.41' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 3.60 cfs of 4.87 cfs potential flow)
  ├**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.84 cfs @ 1.31 fps)
  └**4=Orifice/Grate** (Orifice Controls 2.75 cfs @ 5.51 fps)

Summary for Link POA-1: Street Drainage Network

Inflow Area = 0.823 ac, 68.83% Impervious, Inflow Depth = 3.63" for 50-yr event
Inflow = 4.08 cfs @ 12.14 hrs, Volume= 0.249 af
Primary = 4.08 cfs @ 12.14 hrs, Volume= 0.249 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link POA-2: West Offsite

Inflow Area = 0.107 ac, 6.12% Impervious, Inflow Depth = 2.82" for 50-yr event
Inflow = 0.35 cfs @ 12.09 hrs, Volume= 0.025 af
Primary = 0.35 cfs @ 12.09 hrs, Volume= 0.025 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

APPENDIX E: STORMWATER CALCULATIONS

- *PIPE AND INLET SIZING*
- *INFILTRATION PRACTICE CRITERIA WORKSHEETS*
- *GROUNDWATER RECHARGE VOLUME CALCULATIONS*

0
3 Flagstone Drive
Hudson, NH
Bohler Job Number: W211235
January 13, 2022

Rational Pipe Sizing Calculations

Design Period Storm:		**25**	**Year**	**Design Period Intensity***			**6.6**	**in/hr**								
LOCATION		IMPERVIOUS			OTHER			SUM	Tc	I	Q	D	S	Material	n	Q Full	V Full
FROM	TO	A	C	CA	A	C	CA	CA	(min)	(in/hr)	(cfs)	(in)	(ft/ft)			(cfs)	(fps)
CB-1	ICS-1	0.14	0.95	0.13	0.02	0.30	0.01	0.14	6	1.585	0.22	12	0.032	HDPE	0.012	6.90	8.79
CB-2	ICS-2	0.25	0.95	0.23	0.06	0.30	0.02	0.25	6	1.585	0.40	12	0.040	HDPE	0.012	7.72	9.83
OCS-1		0.39	0.95	0.37	0.00	0.30	0.00	0.37	6	1.585	0.58	12	0.026	HDPE	0.012	6.22	7.92

*Rainfall intensity provided by TR55 Exhibit 8-14 dated January 2006

Groundwater Recharge Volume (GRV) Calculation

0.01	ac	Area of HSG A soil that was replaced by impervious cover	0.40"
-	ac	Area of HSG B soil that was replaced by impervious cover	0.25"
0.39	ac	Area of HSG C soil that was replaced by impervious cover	0.10"
-	ac	Area of HSG D soil or impervious cover that was replaced by impervious cover	0.0"
0.11	inches	Rd = weighted groundwater recharge depth	
0.0431	ac-in	GRV = AI * Rd	
156	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):

Groundwater Recharge Provided = 1,944± CF

INFILTRATION PRACTICE DESIGN CRITERIA (Env-Wq 1508.05)

Type/Node Name: **Subsurface Infiltration Basin**

Enter the type of infiltration practice (e.g., trench) and the node name in the drainage analysis, if applicable

Yes		Have you reviewed Env-Wq 1508.05(a) to ensure that infiltration is allowed?	
0.71	ac	A = Area draining to the practice	
0.55	ac	A_I = Impervious area draining to the practice	
0.77	decimal	I = percent impervious area draining to the practice, in decimal form	
0.74	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.53	ac-in	WQV= 1" x Rv x A	
1,909	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
477	cf	25% x WQV (check calc for sediment forebay volume)	
Isolator Row		Method of pretreatment? (not required for clean or roof runoff)	
569	cf	V_{SED} = sediment forebay volume, if used for pretreatment	← ≥ 25%WQV
1,944	cf	V = volume[1] (attach a stage-storage table)	← ≥ WQV
1,817	sf	A_{SA} = surface area of the bottom of the pond	
1.50	iph	I_{DESIGN} = design infiltration rate[2]	
8.6	hours	T_{DRAIN} = drain time = V / (A_{SA} * I_{DESIGN})	← ≤ 72-hrs
175.25	feet	E_{BTM} = elevation of the bottom of the practice	
170.00	feet	E_{SHWT} = elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
170.00	feet	E_{ROCK} = elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
5.25	feet	D_{SHWT} = separation from SHWT[3]	← ≥ *[3]
5.3	feet	D_{ROCK} = separation from bedrock[3]	← ≥ *[3]
NA	ft	D_T = depth of trench, if trench proposed	← 4 - 10 ft
NA	Yes/No	If a trench or underground system is proposed, observation well provided	
NA		If a trench is proposed, material in trench	
sand		If a basin is proposed, basin floor material	
Yes	Yes/No	If a basin is proposed, the perimeter should be curvilinear.	
3.0	:1	If a basin is proposed, pond side slopes	← ≥3:1
177.54	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
178.40	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
178.75	ft	Elevation of the top of the practice (if a basin, this is the elevation of the berm)	
YES		10 peak elevation ≤ Elevation of the top of the trench?	← yes
YES		If a basin is proposed, 50-year peak elevation ≤ Elevation of berm?	← yes

1. Volume below the lowest invert of the outlet structure and excludes forebay volume
2. See NH Stormwater Manual, Vol.2, Ch.2-4, for guidance on determining the infiltration rate
3. 1' separation if treatment not required; 4' for treatment in GPAs & WSIPAs; & 3' in all other areas.

Designer's Notes:

APPENDIX F: OPERATION AND MAINTENANCE

- *STORMWATER OPERATION AND MAINTENANCE PLAN*

STORMWATER OPERATION AND MAINTENANCE PLAN

3 Flagstone Drive
Hudson, NH

RESPONSIBLE PARTY DURING CONSTRUCTION:

TBD

RESPONSIBLE PARTY POST CONSTRUCTION:

Attention: Harry Dumont
The Lannan Company (or designee)
7D Taggert Drive
Nashua, NH 03060
T: (603) 888-8950
E: hdumont@lannancompany.com

Construction Phase

During the construction phase, all erosion control devices and measures shall be maintained in accordance with the final record plans, local/state approvals and conditions, the EPA Construction General Permit and the Stormwater Pollution Prevention Plan (SWPPP) if applicable. Additionally, the maintenance of all erosion / siltation control measures during construction shall be the responsibility of the general contractor. Contact information of the OWNER and CONTRACTOR shall be listed in the SWPPP for this site. The SWPPP also includes information regarding construction period allowable and illicit discharges, housekeeping and emergency response procedures. Upon proper notice to the property owner, the Town/City or its authorized designee shall be allowed to enter the property at a reasonable time and in a reasonable manner for the purposes of inspection.

Post Development Controls

Once construction is completed, the post development stormwater controls are to be operated and maintained in compliance with the following permanent procedures (note that the continued implementation of these procedures shall be the responsibility of the Owner or its assignee):

1. Parking lots and on-site driveways: Sweep at least two (2) times per year and on a more frequent basis depending on sanding operations. All resulting sweepings shall be collected and properly disposed of off-site in accordance with NHDES and other applicable requirements. Approximate Maintenance Budget: $1,000/year

2. Catch basins, manholes and piping: Inspect four (4) times per year and at the end of foliage and snow-removal seasons. These features shall be cleaned four (4) times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the catch basin or underground system. Accumulated sediment and hydrocarbons present must be removed and properly disposed of off site in accordance with NHDES and other applicable requirements. Approximate Maintenance Budget: $500/year per structure.

3. Subsurface Infiltration / Detention Basin & Isolator Rows: The infiltration basin shall be inspected a minimum of twice a year to ensure it is operating as intended and that all components are stable and in working order. Inspections shall be by qualified personnel assigned by the property owner. The outlet of the basin shall be inspected for erosion and sedimentation, and rip-rap shall be promptly repaired in the case of erosion. Sediment collecting in the bottom of the basin shall be inspected twice annually, and removal shall commence any time the sediment reaches a depth of six inches anywhere in the basin and/or isolator row in accordance with the enclosed manufacturer's requirements. Any basin sediments removed shall be disposed of in accordance with the latest DEP guidelines for stormwater sediment disposal. Maintenance of the Isolator Row shall be in accordance with the attached manufacturer recommendations. Approximate Maintenance Budget: $2,000/year

STORMWATER MANAGEMENT SYSTEM

POST-CONSTRUCTION INSPECTION REPORT

LOCATION:

3 Flagstone Drive
Hudson, New Hampshire

RESPONSIBLE PARTY:

Attention: Harry Dumont
The Lannan Company (or designee)
7D Taggert Drive
Nashua, NH 03060
T: (603) 888-8950
E: hdumont@lannancompany.com

NAME OF INSPECTOR:	INSPECTION DATE:
Note Condition of the Following (sediment depth, debris, standing water, damage, etc.):	
Deep Sump Catch Basins:	
Subsurface Infiltration / Detention Basin:	
Other:	
Note Recommended Actions to be taken on the Following (sediment and/or debris removal, repairs, etc.):	
Deep Sump Catch Basins:	

Subsurface Infiltration / Detention Basin:
Other:
Other:
Comments:

STORMWATER INSPECTION AND MAINTENANCE LOG FORM

3 Flagstone Drive – Hudson, NH

Stormwater Management Practice	Responsible Party	Date	Maintenance Activity Performed

LONG-TERM POLLUTION PREVENTION PLAN

3 Flagstone Drive
Hudson, NH

RESPONSIBLE PARTY DURING CONSTRUCTION:

TBD

RESPONSIBLE PARTY POST CONSTRUCTION:

Attention: Harry Dumont
The Lannan Company (or designee)
7D Taggert Drive
Nashua, NH 03060
T: (603) 888-8950
E: hdumont@lannancompany.com

For this site, the Long-Term Pollution Prevention Plan will consist of the following:

- No outdoor maintenance or washing of vehicles allowed.
- The property owner shall be responsible for "good housekeeping" including proper periodic maintenance of building and pavement areas, curbing, landscaping, etc.
- Proper storage and removal of solid waste (dumpsters).
- Sweeping of driveways a minimum of twice per year with a commercial cleaning unit. Any sediment removed shall be disposed of in accordance with applicable local and state requirements.
- Regular inspections and maintenance of Stormwater Management System as noted in the "O&M Plan".
- Snow removal shall be the responsibility of the property owner. Snow shall not be plowed, dumped and/or placed in forebays, infiltration basins or similar stormwater controls. Salting and/or sanding of pavement / walkway areas during winter conditions shall only be done in accordance with all state/local requirements and approvals.

OPERATON AND MAINTENANCE TRAINING PROGRAM

The Owner will coordinate an annual in-house training session to discuss the Operations and Maintenance Plan, the Long-Term Pollution Prevention Plan, and the Spill Prevention Plan and response procedures. Annual training will include the following:

Discuss the Operations and Maintenance Plan

- Explain the general operations of the stormwater management system and its BMPs
- Identify potential sources of stormwater pollution and measures / methods of reducing or eliminating that pollution
- Emphasize good housekeeping measures

Discuss the Spill Prevention and Response Procedures

- Explain the process in the event of a spill
- Identify potential sources of spills and procedures for cleanup and /or reporting and notification
- Complete a yearly inventory or Materials Safety Data sheets of all tenants and confirm that no potentially harmful chemicals are in use.
- Trash and other debris shall be removed from all areas of the site at least twice yearly.
- Reseed any bare areas as soon as they occur. Erosion control measures shall be installed in these areas to prevent deposits of sediment from entering the drainage system.
- Grass shall be maintained at a minimum blade height of two to three inches and only 1/3 of the plant height shall be removed at a time. Clippings shall not be disposed of within stormwater management areas or adjacent resource areas.
- Snow piles shall be located adjacent to or on pervious surfaces in upland areas. This will allow snow melt water to filter in to the soil, leaving behind sand and debris which can be removed in the springtime.
- In no case shall snow be disposed of or stored in resource areas (wetlands, floodplain, streams or other water bodies).
- In no case shall snow be disposed of or stored in the detention basins, infiltration basins or bioretention areas.

- If necessary, stockpiled snow will be removed from the Site and disposed of at an off-site location in accordance with all local, state and federal regulations.

- The amount of sand and deicing chemicals shall be kept at the minimum amount required to provide safe pedestrian and vehicle travel.

- Deicing chemicals are recommended as a pretreatment to storm events to minimize the amount of applied sand.

- Sand and deicing chemicals should be stockpiled under covered storage facilities that prevent precipitation and adjacent runoff from coming in contact with the deicing materials. Stockpile areas shall be located outside resource areas.

- The primary agents used for deicing at parking lots, sidewalks and the access roads shall consist of salt alternatives such as calcium carbonate (CaCO3) or potassium chloride (KCl) or sodium chloride.

- Deliveries shall be monitored by owner or owner's representative to ensure proper delivery and in the event that a spillage occurs it shall be contained and cleaned up immediately in accordance with the spill prevention program for the project.

- Recycle materials whenever possible. Provide separate containers for recycle materials. Recycling products will be removed by a certified waste hauler.

SPILL PREVENTION AND RESPONSE PROCEDURES (POST CONSTRUCTION)

In order to prevent or minimize the potential for a spill of Hazardous Substances or Oil or come into contact with stormwater, the following steps will be implemented:

1. All Hazardous Substances or Oil (such as pesticides, petroleum products, fertilizers, detergents, acids, paints, paint solvents, cleaning solvents, etc.) will be stored in a secure location, with their lids on, preferably under cover, when not in use.

2. The minimum practical quantity of all such materials will be kept on site.

3. A spill control and containment kit (containing, for example, absorbent materials, acid neutralizing powder, brooms, dust pans, mops, rags, gloves, goggles, plastic and metal trash containers, etc.) will be provided on site.

4. Manufacturer's recommended methods for spill cleanup will be clearly posted and site personnel will be trained regarding these procedures and the location of the information and cleanup supplies.

5. It is the OWNER's responsibility to ensure that all Hazardous Waste on site is disposed of properly by a licensed hazardous material disposal company. The OWNER is responsible for not exceeding Hazardous Waste storage requirements mandated by the EPA or state and local authorities.

In the event of a spill of Hazardous Substances or Oil, the following procedures should be followed:

1. All measures should be taken to contain and abate the spill and to prevent the discharge of the Hazardous Substance or Oil to stormwater or off-site. (The spill area should be kept well ventilated and personnel should wear appropriate protective clothing to prevent injury from contact with the Hazardous Substances.)

2. For spills of less than five (5) gallons of material, proceed with source control and containment, clean-up with absorbent materials or other applicable means unless an imminent hazard or other circumstances dictate that the spill should be treated by a professional emergency response contractor.

3. For spills greater than five (5) gallons of material immediately contact the NHDES, the local fire department (**9-1-1**) and an approved emergency response contractor. Provide information on the type of material spilled, the location of the spill, the quantity spilled, and the time of the spill to the emergency response contractor or coordinator, and proceed with prevention, containment and/or clean-up if so desired. (Use the form provided, or similar).

4. If there is a Reportable Quantity (RQ) release, then the National Response Center should be notified immediately at (800) 424-8802; within 14 days a report should be submitted to the EPA regional office describing the release, the date and circumstances of the release and the steps taken to prevent another release. This Pollution Prevention Plan should be updated to reflect any such steps or actions taken and measures to prevent the same from reoccurring.

SPILL PREVENTION CONTROL AND COUNTERMEASURE FORM

3 Flagstone Drive
Hudson, NH

Where a release containing a hazardous substance occurs, the following steps shall be taken by the facility manager and/or supervisor:

1. Immediately notify The Hudson Fire Department (at **9-1-1**) and the NHDES Spill Response Section (603)-886-6021.

2. All measures must be taken to contain and abate the spill and to prevent the discharge of the pollutant(s) to off-site locations, receiving waters, wetlands and/or resource areas.

3. Notify the Hudson Conservation Commission at (603) 886-6000 and the Health Officer at (603) 886-6005.

4. Provide documentation from licensed contractor showing disposal and cleanup procedures were completed as well as details on chemicals that were spilled to the Town of Hudson.

5. Complete the Spill Reporting Form located on NHDES's website

Date of spill:_____ Time:_____ Reported By:_____

Weather Conditions:_____

Material Spilled	**Location of Spill**	**Approximate Quantity of Spill (in gallons)**	**Agency(s) Notified**	**Date of Notification**

Cause of Spill:_____

_____

Measures Taken to Clean up Spill:_____

_____

Type of equipment: _____ Make: _____ Size:_____

License or S/N: _____

Location and Method of Disposal_____

_____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring:_____

_____

Additional Contact Numbers:

- NHDES SPILL RESPONSE EMERGENCY PHONE:
  - MON-FRI 8AM-4PM: (603) 271-3899
  - ALL OTHER TIMES: (603) 223-4381
- NATIONAL RESPONSE CENTER PHONE: (800) 424-8802
- U.S. ENVIRONMENTAL PROTECTION AGENCYPHONE: (888) 372-7341