

STORMWATER MANAGEMENT REPORT

for

HIGHFIELD COMMONS

at

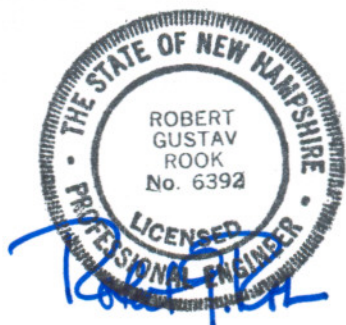
**Washington Street, NH Route 202
Rochester, NH**

VOLUME I WESTERLY DRAINAGE DIVIDE (Existing Route 202 & Spaulding Turnpike)

Prepared for:

**Highfield Commons, LLC
89 South State Street
Concord, NH 03301**

Prepared By:
Robert G. Rook, P.E.
72 Pleasant Street
Concord, NH 03301



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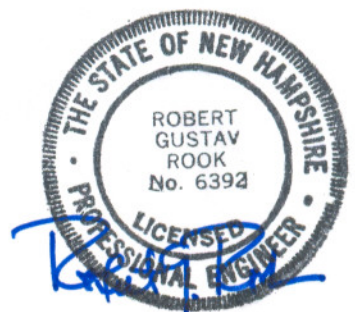
**Washington Street, NH Route 202
Rochester, NH**

VOLUME II EASTERLY DRAINAGE DIVIDE (Existing Route 202 & Spaulding Turnpike)

Prepared for:

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STORMWATER MANAGEMENT REPORT

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**Washington Street, NH Route 202
Rochester, NH**

VOLUME III EASTERLY DRAINAGE DIVIDE (with NHDOT's Preliminary Improvements at Route 202 & Spaulding Turnpike)

Prepared for:

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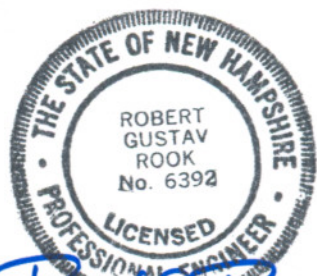


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PROJECT SUMMARY:

The proposed project involves a development of about 220 acre of land on and around the Hayes Hill in Rochester, New Hampshire. The property is located to the north side of Route 202 at Hussey Hill Road, and about 0.3 miles west of NH Route 16, the Spaulding Turnpike. The land will be designed and developed as a traditional neighborhood, with a mixture of residential housing types (detached, row houses, 55 and older units), small commercial site developments and apartment units. The majority of the acreage will remain undeveloped. The existing site is mostly wooded, although a grassy pasture exists in the central portion of the site. An existing cellular tower is located near the site's highest point. The tower is scheduled to be removed in the near future. As shown of the project location map, the site is bisected by Hussey Hill Road and its northerly extension. This report focuses on the development of the first half of the project, the eastern portion, generally north and east of Hussey Hill Road.

Under this proposal the development would, in its final finish stage, incorporate a system of paved internal roadways and drives with its primary access, Highfield Drive, from NH Route 202. Highfield Drive would originate at NH Route 202 (Washington Street) near the easterly property boundary, and loop through the site generally in a northerly and westerly direction, toward Hussey Hill Road. A boulevard type entrance design is provided along the initial 1200 linear feet of Highfield Drive to the site of a planned Apartment complex. A temporary connector road would also be constructed to connect to Hussey Hill Road. Although not to be used by the development under normal conditions, Hussey Hill Road would provide a second means of access for fire and emergency vehicles.

In order to minimize pavement width consistent with the neighborhood design theme, portions of the roadways would be restricted to one-way travel patterns. Roadways would be curbed with grass strips, and sidewalks on one side. A combination of closed drainage systems, with surface roadway swales, would be provided to handle stormwater runoff from the development.

To mitigate for increases in runoff peaks due to proposed impervious surfaces, several stormwater detention ponds will be constructed. Drainage systems are designed to maintain pre-development flow patterns to the extent possible. Runoff will be treated, prior to discharge, in accordance with the requirements of the NH Department of Environmental Services (NHDES).

NHDES has issued Site Specific Permit No. WPS-7138, a copy of which is included hereinbefore.

The New Hampshire Department of Transportation is planning a major project to reconstruct and upgrade NH Route 16, the Spaulding Turnpike, and portions of NH Route 202 to the east of this development project (**“Rochester 10620-H Spaulding Turnpike Upgrade”**). The stormwater systems for this traditional neighborhood project are designed for both current pre-development conditions, and for those resulting from planned improvements at the Spaulding Turnpike. The drainage system improvements planned for the Spaulding are considered in relevant portions of the existing and proposed hydrologic models prepared for this project.

The drainage studies performed for this easterly portion of the eastern half of the Highfield Commons project include analyses of anticipates impacts associated with this proposed development on:

- the existing major culvert under Florence Drive, and
- the proposed major culvert under Pine Lane Extension.

The stormwater computations performed to analyze drainage systems for the Highfield Commons project are divided into two major models:

- the **Westerly Drainage Divide Model** (includes Axe Handle Brook and tributaries), and
- The **Easterly Drainage Divide Model** (includes the NHDOT Route 202 / Route 16 intersection). Analyses for the Easterly Drainage Divide are further subdivided to include:
 - Current NH Route 202 and Route 16 conditions, and

- Those conditions that would result from implementation of the design shown on NHDOT's preliminary plans for the Spaulding project.

According to the Stormwater Report for the Spaulding Turnpike Project, the proposed culverts shown on plans for the NHDOT project were designed to pass the anticipated flows during a 50-year storm.

In these computations, the analysis point for the Highfield Commons Project with **existing Spaulding Turnpike conditions** is "REACH 8R" (See Volume II, Easterly Drainage Divide, with Existing Route 202 & Spaulding Turnpike).

In these computations, the analysis point for the Highfield Commons Project with **proposed Spaulding Turnpike conditions** is "REACH QC1" (See Volume III, Easterly Drainage Divide, with NHDOT's Preliminary Improvements at Route 202 & Spaulding Turnpike).

Planned improvements in the westerly half of this first design phase of the Highfield Commons project generally drain to Axe Handle Brook and its tributaries. In these computations, the analysis point for the westerly portion of the Highfield Commons Project area is Reach 98 (See Volume I, Westerly Drainage Divide).

Local and state regulations require that there be no increase in peak runoff from a developed or redeveloped site. Detention facilities for the project were designed, where appropriate, to handle the proposed 50-, 25-, 10-, 2-year storm events.

METHODOLOGY:

EAST MODEL: As shown on the project plans, under both Pre- and Post-development conditions, the large majority of stormwater runoff from the eastern portion of the project flows in the northeasterly direction to several existing wetlands. Only a small portion of the existing off-site runoff was (and will be) flowing along the Route 202, discharging via an existing culvert, in the general direction of NHDOT project, into an existing wetland area (modeled as Pond **3P**).

The proposed site design utilizes a combination of closed drainage facilities, with an open drainage swale system, and driveway cross culverts, detention ponds and grass treatment swales. The closed drainage elements (catch basins and pipes) are proposed along all roadways. It is anticipated that similar flow control facilities will be used in the development of development areas (apartments, commercial sites, etc). The design of one of the detention ponds (vicinity of entrance to future apartment site at PSNH) has been coordinated with the site design (in progress by others) to receive certain of the anticipated flows from the southerly most portion of that development

Runoff is routed and discharged similar to existing conditions as far as possible. The detention facilities are designed to reasonably control all storm events analyzed, with discharges directed to the same point of interest as the existing runoff. Each pond's multi-stage outlet control structure(s) and low level outlet(s), and emergency overflows are designed to provide for extended routing (for water quality).

As shown in the summary of results for the point of interest at the Florence Drive and Pine Lane Extension (Reaches 8R and QC1), since the proposed runoff discharge peak rates are equal or less than existing, the downstream impact to existing streams and culverts will be avoided.

WEST MODEL: As shown on the project plans, under both Pre- and Post-development conditions, the entire stormwater runoff from the westerly portion of the project flows to several small existing wetlands in the westerly direction, and later to the Axe Handel Brook, flowing southerly and easterly under the Route 202. The westerly model again utilizes closed drainage systems, roadway swales and detention ponds to control proposed discharge. Runoff was collected into small segments, routed and discharged, generally between lot lines, to treatment swales and/or level spreaders. Routing is again similar to existing flow patterns to the extent possible. The westerly model will control the proposed runoff at the lot lines, essentially Axe Handle Brook (see Reach 98).

The overall methodology of both models (East and West) provides for runoff water quality and mitigates for potential increases in peak rates downstream runoff impacts. Both models discharge runoff to points of interest where flow combines with a much larger, off-site drainage area runoff volumes. In some case, if stormwater detention were to be provided,

the timing of the peak outflow from detention basins could subsequently combine with non-project-related runoff peak flows, resulting in increased peak flow rates above those that would otherwise result if detention facilities were not to be provided. Higher peaks could result from combining a delayed project site runoff peak with peak flows from elongated or distant off-site drainage area(s). Therefore, a methodology was developed to allow project related runoff to pass through downstream culvert(s) in advance of runoff from areas outside project influence (project flow passes before off-site peak flows). At locations where project related peak runoff would coincide with off-site, non-project related peak flows, extended stormwater detention is provided. Those facilities are designed as extended detention basins to provide for the required stormwater treatment.

SOILS:

As shown on the NRCS (Soil Conservation Service) mapping (Sheet 65) included herewith, soil types within the project area consist of:

<u>Map Symbol</u>	<u>Name</u>	<u>Hydrologic Group</u>
AcB; AdB,C	Acton fine sandy loam	B
Ru	Rumney fine sandy loam	C
GlB,C; GsB,C,D	Glouster fine sandy loam	A
LcB	Leicester fine sandy loam	C
CsB,C	Charlton very stony fine sandy loam	B
CfC	Charlton fine sandy loam	B
HdC	Hollis-Charlton very rocky sandy loam	B
Sb	Sauquatuck loamy sand	C
LrA	Leicester-Ridgebury very stony fine sand	C

STORMWATER RUNOFF METHODOLOGY:

Runoff volumes and rates have been estimated using the Soil Conservation Service TR55/TR20 methodology using the HydroCAD computer program. The following parameters were used in the computations:

Min. Time of Concentration - Direct Entry (Tc):	5 Min.
Rainfall Distribution:	Type III
Frequency/Rainfall:	2-year = 2.90 in
	10-year = 4.25 in
	25-year = 5.05 in
	50-year = 5.60 in

SUMMARY OF RESULTS:

EAST MODEL:

<u>Storm</u>	<u>Point of Interest</u>	<u>Pre-Development</u>	<u>Post-Development</u>
	(Pine Lane Ext.)	(CFS)	(CFS)
2-year	8R (old culvert)	5.12	5.65
	QC1 (new culvert)	4.11	4.51
10-year	8R (old culvert)	16.77	16.77
	QC1 (new culvert)	14.92	14.59
25-year	8R (old culvert)	28.44	27.73
	QC1 (new culvert)	26.10	25.28
50-year	8R (old culvert)	35.92	35.01
	QC1 (new culvert)	33.35	32.56

WEST MODEL:

<u>Storm</u>	<u>Point of Interest</u>	<u>Pre-Development</u>	<u>Post-Development</u>
		(CFS)	(CFS)
2-year	99 Rickers Brook	0.02	0.47
	98 Axe Handle Brook	2.14	3.75
10-year	99 Rickers Brook	0.50	1.10
	98 Axe Handle Brook	23.12	22.23
25-year	99 Rickers Brook	2.29	2.57
	98 Axe Handle Brook	46.87	41.43
50-year	99 Rickers Brook	3.70	3.67
	98 Axe Handle Brook	62.03	53.49

STORMWATER QUALITY:

Erosion and sediment control measures incorporated in the design are as follows:

- Block and Gravel Inlet Sediment Filters at Catch Basins
- Stone check dam sediment barriers located in swales.
- Silt fences
- Extended Detention Routing Time over 4-Hours during 2-yr storm