Notice of Intent

174 North Avenue - Haverhill

April 2016

Prepared for:
WHC Haverhill AL, LLC

Submitted to:
Haverhill Conservation Commission

Weston&Sampson

Five Centennial Drive
Peabody, MA 01960-7985
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Tel: 978-532-1900
Fax: 978-977-0100

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planning, permitting, design, construction, operation, maintenance, design/build, & equipment

Weston&Sampson®

Haverhill – Wingate
WSE Project No. 2140079.C.08

April 27, 2016

City of Haverhill Conservation Commission
City Hall Room 300
4 summer Street
Haverhill, MA 01830

Re: New NOI Filing
174 North Avenue
Elder Care Facility Construction

Dear Members of the Commission:

On behalf of the WHC Haverhill AL LLC, Weston & Sampson Engineers, Inc. is hereby enclosing one copy of the HCC Form 3 – Notice of Intent Local Application Form, ten (10) paper copies of site plans, one paper copy of all other materials, and one electronic (pdf) version of all materials submitted, to fulfill the requirements of the Massachusetts Wetlands Protection Act, M.G.L. Chapter 131, Section 40 submittal requirements and the City of Haverhill's Municipal Ordinance Chapter 253. This submittal is a formal Notice of Intent for the Elder Care Facility construction project located at 174 North Avenue in Haverhill.

As part of the filing, we have attached the following:

Appendix A: Project Description
Appendix B: Stormwater Report
Appendix C: Project Maps
Appendix D: Contract Specifications
Appendix E: Abutters List / Notice to Abutters
Appendix F: ORAD
Project Plans

If you have any questions regarding this submittal, please contact me at (978) 532-1900.

Very truly yours,

WESTON & SAMPSON

Mel Higgins, PWS
Senior Environmental Scientist

19546

BANK OF AMERICA
5-13-110

WINGATE HEALTHCARE, INC.
ONE CHARLES RIVER PLACE
63 KENDRICK STREET
NEEDHAM, MA 02494

CHECK DATE	CONTROL NUMBER	AMOUNT
4/25/2016	019546	$******9,238.00

PAY Nine Thousand Two Hundred Thirty-Eight and 00/100---------- USD$

TO THE ORDER OF CITY OF HAVERHILL

AUTHORIZED SIGNATURE

Security features. Details on back.

⑈019546⑈ ⑆011000138⑆ 004602281249⑈

19547

BANK OF AMERICA
5-13-110

WINGATE HEALTHCARE, INC.
ONE CHARLES RIVER PLACE
63 KENDRICK STREET
NEEDHAM, MA 02494

CHECK DATE	CONTROL NUMBER	AMOUNT
4/25/2016	019547	$********512.50

PAY Five Hundred Twelve and 50/100---------- USD$

TO THE ORDER OF COMMONWEALTH OF MASS

AUTHORIZED SIGNATURE

Security features. Details on back.

⑈019547⑈ ⑆011000138⑆ 004602281249⑈

19545

BANK OF AMERICA
5-13-110

WINGATE HEALTHCARE, INC.
ONE CHARLES RIVER PLACE
63 KENDRICK STREET
NEEDHAM, MA 02494

CHECK DATE	CONTROL NUMBER	AMOUNT
4/25/2016	019545	$********537.50

PAY Five Hundred Thirty-Seven and 50/100---------- USD$

TO THE ORDER OF CITY OF HAVERHILL

AUTHORIZED SIGNATURE

Security features. Details on back.

⑈019545⑈ ⑆011000138⑆ 004602281249⑈

City of Haverhill Conservation Commission

HCC Form 3 – Notice of Intent Local Application Form

A. STATUTE APPLICABILITY

This application is being filed with the Commission in accordance with the following (check all that apply):

X Massachusetts Wetlands Protection Act, M.G.L. Chapter 131, Section 40

X Haverhill Municipal Ordinance Chapter 253

B. GENERAL INFORMATION

Applicant _WHC Haverhill AL, LLC_____

Property Owner same_____

Representative Weston & Sampson Engineers, Inc._____

Location (Street Address) 174 North Avenue_____

Assessor's Parcel Identification _630 2-1-1A_____

C. APPLICATION CHECKLIST

The Commission requires the submittal of this original, completed Form; ten (10) paper copies of site plans; and one (1) paper copy of all other materials. Additionally, the Commission requires the submittal of individual PDFs of this Form and all listed application materials. If practical, related items may be combined into a single PDF. PDFs should not mix larger format sheets (e.g. site plans) with smaller sheets (e.g. letters). These submittal requirements also apply to supplemental information provided during the public hearing. The following materials shall be submitted with this form (check all that apply):

X Completed, current WPA Form 3, 3A, or 4 and NOI Wetland Fee Transmittal Form

X Project Narrative with description of resource areas & delineation methodology and demonstration of compliance with pertinent Performance Standards

X Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan

X Site Plans clearly describing the location and nature of the work, including such information as site boundaries, wetlands, topography, existing and proposed conditions, vegetation cover, soils, erosion & sedimentation controls, Title 5 compliance, flood storage calculations…(24" x 36" max. sheet size)

- ❑ MassDEP Bordering Vegetated Wetland Delineation Field Data Forms, as appropriate
- ❑ Wetland Resource Area Impact Mitigation Plan prepared in accordance with MA Inland Wetland Replication Guidelines, if applicable
- ❑ Demonstration of compliance with MA River & Stream Crossing Standards, if applicable (The HCC applies the General Standards to all resource area crossings for wildlife passage.)
- ❑ Simplified or Detailed Wildlife Habitat Evaluation (Appendix A or B), if applicable (See "MA Wildlife Habitat Protection Guidance for Inland Wetlands")

X Demonstration of compliance with MA Stormwater Management Standards, including but not limited to

- X Stormwater Report with pertinent calculations
- X Checklist for Stormwater Report
- X Long-Term Pollution Prevention Plan
- X Operation and Maintenance Plan
- X Illicit Discharge Compliance Statement

X 8½" x 11" sections of the following maps with project location clearly identified

- X USGS Quadrangle

X MassGIS Orthophoto
X City of Haverhill Parcel ID Map, also identifying properties within 300' of subject property
X NRCS Soils Map and Resource Report
X FEMA Flood Insurance Rate Map, if applicable
X MA NHESP Estimated Habitats of Rare Wildlife and Priority Habitats of Rare Species, if applicable
☐ MassDEP/UMass-Amherst Habitat of Potential Regional or Statewide Importance, if applicable
☐ Proof of NOI filing with the MA Natural Heritage & Endangered Species Program, if applicable
X Appropriate Filing Fees, payable to the City of Haverhill, under the Act and Ordinance

☐ Other: _____

D. LOCAL PERMIT DOCUMENTATION

In accordance with 310 CMR 10.05(4)(e), list all obtainable permits, variances, and approvals required by local ordinance with respect to the proposed activity and status of same: Sub-division plan approval (in progress) Site Plan Review (in progress)

E. APPLICATION CERTIFICATION

I have read the Department of Environmental Protection's "Instructions for Completing Application" and the City's Municipal Ordinance under Chapter 253, with all applicable regulations and policies, for the filing of this application with the Haverhill Conservation Commission and agree to its terms and conditions, as amended. I understand the submitted NOI, its plans, and all its supporting materials are public records and may be uploaded to the City's website for public review. As required by the Commission, the wetland resource area(s) are flagged, the corners of proposed structures are staked, and the centerline of proposed roadway(s) and/or driveway(s) are marked, as appropriate, to facilitate site inspections by Commissioners and Conservation Staff.

Signed: _____ (APPLICANT) 4/6/16 (DATE)

F. SITE ACCESS ACKNOWLEDGEMENT

I hereby grant the Haverhill Conservation Commission and its officials permission to enter upon my property at 174 North Avenue 630 2-1-1A (STREET ADDRESS AND ASSESSOR'S PARCEL ID) to review the filed Notice of Intent and future site conditions for compliance with the issued Order of Conditions. The sole purpose of this acknowledgement is to allow the Commission and its officials to perform their duties under the Massachusetts Wetlands Protection Act and the City's wetlands protection ordinance.

Signed: _____ (PROPERTY OWNER) 4/6/16 (DATE)

G. LOCAL ORDINANCE FEE CALCULATION FORM

ACTIVITY	LOCAL ORDINANCE FEE	# of Activities or Measurement	Subtotal
***Abbrev. Notice of Resource Area Delineation (ANRAD)**			
Single Family House Project	$1/linear foot, first 100'; $0.50/lf, second 100'; $0.10/lf, each additional foot		
All Other Projects	***$1/linear foot, first 1000'; $0.50/lf, second 1000'; $0.10/lf, each additional foot		
%*Notices of Intent (NOI)			
Category 1 Activity	$100		
Category 2 Activity	$250		
Category 3 Activity	$525	1	$525
Category 4 Activity	$725		
Category 5 Activity	$2/foot		
Category 6 Activity - If no ANRAD was filed for the project site, then a local Cat. 6 fee must be paid in accordance with the ANRAD fee schedule	See ANRAD fee schedule		
Resource Area Alterations			
Buffer Zone, 75'-100' from resource area boundary	$0.05 / square foot	29,900	$1,495
Buffer Zone, 35'-75' from resource area boundary	$0.10 / square foot	52,600	$5,260
Buffer Zone, 0'-35' from resource area boundary	$0.25 / square foot	7,652	$1,913
Bordering Vegetated Wetland	$0.50 / square foot		
Bank	$5 / linear foot		
Land Under Water	$0.50 / square foot		
Land Subject to Flooding	$0.05 / square foot		
Riverfront Area	$0.05 / square foot		
Riverfront Area with the watershed of a potable water supply	$0.50 / square foot		
Land within 100' of a Certified Vernal Pool	$0.25 / square foot		
Local-only Jurisdictional Resource Area	$0.25 / square foot		
Land within 200' of a potable water supply	$0.50 / square foot		
		ADVERTISING FEE*	$45
		LOCAL ORDINANCE FEE TOTAL	$9,238
		For filings resulting from enforcement action, double the Local Ordinance Fee Total	

NOTES:

*****Application is subject to an additional $45 Local Advertising Fee payable to the City of Haverhill prior to **EACH** advertising

*******Local Ordinance Fee maximum of $100, if, when determined necessary by Commission, applicant agrees to ANRAD review by outside consultant under M.G.L. Ch. 44, sec. 53G

%Local Ordinance Fees for RDA, NOI, & RMOC increase 50% when project is also proposed within a Riverfront Area

Local Ordinance Fees passed by a 7 – 0 vote of the Commission on October 28, 2010, effective January 1, 2011

Enter your transmittal number → X269846
Transmittal Number

Your unique Transmittal Number can be accessed online: http://mass.gov/dep/service/online/trasmfrm.shtml

Massachusetts Department of Environmental Protection

Transmittal Form for Permit Application and Payment

1. Please type or print. A separate Transmittal Form must be completed for each permit application.

2. Make your check payable to the Commonwealth of Massachusetts and mail it with a copy of this form to: DEP, P.O. Box 4062, Boston, MA 02211.

3. Three copies of this form will be needed.

Copy 1 - the original must accompany your permit application. **Copy 2** must accompany your fee payment. **Copy 3** should be retained for your records

4. Both fee-paying and exempt applicants must mail a copy of this transmittal form to:

MassDEP
P.O. Box 4062
Boston, MA
02211

*** Note:**
For BWSC Permits, enter the LSP.

A. Permit Information

WPA FORM 3
1. Permit Code: 7 or 8 character code from permit instructions

wetlands
2. Name of Permit Category

housing development
3. Type of Project or Activity

B. Applicant Information – Firm or Individual

WHC Haverhill AL, LLC
1. Name of Firm - Or, if party needing this approval is an individual enter name below:

2. **Last Name** of Individual
3. **First Name** of Individual
4. MI

63 Kendrick Street
5. Street Address

6. City/Town	7. State	8. Zip Code	9. Telephone #	10. Ext. #
Needham	MA	02494	(781) 707-9500	

David Feldman
11. Contact Person

dfeldman@wingatehealthcare.com
12. e-mail address (optional)

C. Facility, Site or Individual Requiring Approval

1. Name of Facility, Site Or Individual

174 North Avenue
2. Street Address

3. City/Town	4. State	5. Zip Code	6. Telephone #	7. Ext. #
Haverhill	MA	01830		

8. DEP Facility Number (if Known)
9. Federal I.D. Number (if Known)
10. BWSC Tracking # (if Known)

D. Application Prepared by (if different from Section B)*

Weston & Sampson Engineers, Inc.
1. Name of Firm Or Individual

5 Centennial Drive
2. Address

3. City/Town	4. State	5. Zip Code	6. Telephone #	7. Ext. #
Peabody	MA	01960	978-977-0110	2332

Mel Higgins
8. Contact Person

9. LSP Number (BWSC Permits only)

E. Permit - Project Coordination

1. Is this project subject to MEPA review? ☐ yes ☒ no
If yes, enter the project's EOEA file number - assigned when an Environmental Notification Form is submitted to the MEPA unit:

EOEA File Number

F. Amount Due

DEP Use Only

Permit No:

Rec'd Date:

Reviewer:

Special Provisions:

1. ☐ **Fee** Exempt (city, town or municipal housing authority)(state agency if fee is $100 or less).
There are no fee exemptions for BWSC permits, regardless of applicant status.
2. ☐ Hardship Request - payment extensions according to 310 CMR 4.04(3)(c).
3. ☐ Alternative Schedule Project (according to 310 CMR 4.05 and 4.10).
4. ☐ Homeowner (according to 310 CMR 4.02).

Check Number	Dollar Amount	Date
19547	$512.50	4/25/16

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Haverhill
City/Town

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

Note: Before completing this form consult your local Conservation Commission regarding any municipal bylaw or ordinance.

A. General Information

1. Project Location (**Note:** electronic filers will click on button to locate project site):

174 North Avenue — a. Street Address
Haverhill — b. City/Town
01830 — c. Zip Code

Latitude and Longitude:
42deg 48' 4.09"N — d. Latitude
71deg 5' 5.21"W — e. Longitude

630 — f. Assessors Map/Plat Number
2-1-1A — g. Parcel /Lot Number

2. Applicant:

David — a. First Name
Feldman — b. Last Name
WHC Haverhill AL, LLC — c. Organization
63 Kendrick Street — d. Street Address
Needham — e. City/Town
MA — f. State
02494 — g. Zip Code
781) 707-9500 — h. Phone Number
i. Fax Number
dfeldman@wingatehealthcare.com — j. Email Address

3. Property owner (required if different from applicant): ☐ Check if more than one owner

a. First Name
b. Last Name
c. Organization
d. Street Address
e. City/Town
f. State
g. Zip Code
h. Phone Number
i. Fax Number
j. Email address

4. Representative (if any):

Mel — a. First Name
Higgins — b. Last Name
Weston & Sampson Engineers, Inc. — c. Company
5 Centennial Drive — d. Street Address
Peabody — e. City/Town
MA — f. State
01960 — g. Zip Code
978-977-0110 — h. Phone Number
i. Fax Number
higginsm@wseinc.com — j. Email address

5. Total WPA Fee Paid (from NOI Wetland Fee Transmittal Form):

$1,050 — a. Total Fee Paid
$512.50 — b. State Fee Paid
$537.50 — c. City/Town Fee Paid

A. General Information (continued)

6. General Project Description:

Construction of a new assisted living facility. See Appendix A for additional information.

7a. Project Type Checklist: (Limited Project Types see Section A. 7b.)

1. ☐ Single Family Home
2. ☐ Residential Subdivision
3. ☐ Commercial/Industrial
4. ☐ Dock/Pier
5. ☐ Utilities
6. ☐ Coastal engineering Structure
7. ☐ Agriculture (e.g., cranberries, forestry)
8. ☐ Transportation
9. ☒ Other

7b. Is any portion of the proposed activity eligible to be treated as a limited project (including Ecological Restoration Limited Project) subject to 310 CMR 10.24 (coastal) or 310 CMR 10.53 (inland)?

1. ☐ Yes ☒ No

If yes, describe which limited project applies to this project. (See 310 CMR 10.24 and 10.53 for a complete list and description of limited project types)

2. Limited Project Type

If the proposed activity is eligible to be treated as an Ecological Restoration Limited Project (310 CMR10.24(8), 310 CMR 10.53(4)), complete and attach Appendix A: Ecological Restoration Limited Project Checklist and Signed Certification.

8. Property recorded at the Registry of Deeds for:

Essex	
a. County	b. Certificate # (if registered land)
29591	575
c. Book	d. Page Number

B. Buffer Zone & Resource Area Impacts (temporary & permanent)

1. ☒ Buffer Zone Only – Check if the project is located only in the Buffer Zone of a Bordering Vegetated Wetland, Inland Bank, or Coastal Resource Area.
2. ☐ Inland Resource Areas (see 310 CMR 10.54-10.58; if not applicable, go to Section B.3, Coastal Resource Areas).

Check all that apply below. Attach narrative and any supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

For all projects affecting other Resource Areas, please attach a narrative explaining how the resource area was delineated.

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☐ Bank	1. linear feet	2. linear feet
b. ☐ Bordering Vegetated Wetland	1. square feet	2. square feet
c. ☐ Land Under Waterbodies and Waterways	1. square feet 3. cubic yards dredged	2. square feet

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
d. ☐ Bordering Land Subject to Flooding	1. square feet 3. cubic feet of flood storage lost	2. square feet 4. cubic feet replaced
e. ☐ Isolated Land Subject to Flooding	1. square feet 2. cubic feet of flood storage lost	3. cubic feet replaced

f. ☐ Riverfront Area

1. Name of Waterway (if available) - **specify coastal or inland**

2. Width of Riverfront Area (check one):

☐ 25 ft. - Designated Densely Developed Areas only

☐ 100 ft. - New agricultural projects only

☐ 200 ft. - All other projects

3. Total area of Riverfront Area on the site of the proposed project: _____ square feet

4. Proposed alteration of the Riverfront Area:

a. total square feet _____ b. square feet within 100 ft. _____ c. square feet between 100 ft. and 200 ft. _____

5. Has an alternatives analysis been done and is it attached to this NOI? ☐ Yes ☐ No

6. Was the lot where the activity is proposed created prior to August 1, 1996? ☐ Yes ☐ No

3. ☐ Coastal Resource Areas: (See 310 CMR 10.25-10.35)

Note: for coastal riverfront areas, please complete **Section B.2.f**. above.

B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

Check all that apply below. Attach narrative and supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

Online Users: Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☐ Designated Port Areas	Indicate size under Land Under the Ocean, below	
b. ☐ Land Under the Ocean	1. square feet 2. cubic yards dredged	
c. ☐ Barrier Beach	Indicate size under Coastal Beaches and/or Coastal Dunes below	
d. ☐ Coastal Beaches	1. square feet	2. cubic yards beach nourishment
e. ☐ Coastal Dunes	1. square feet	2. cubic yards dune nourishment

	Size of Proposed Alteration	Proposed Replacement (if any)
f. ☐ Coastal Banks	1. linear feet	
g. ☐ Rocky Intertidal Shores	1. square feet	
h. ☐ Salt Marshes	1. square feet	2. sq ft restoration, rehab., creation
i. ☐ Land Under Salt Ponds	1. square feet 2. cubic yards dredged	
j. ☐ Land Containing Shellfish	1. square feet	
k. ☐ Fish Runs	Indicate size under Coastal Banks, inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above 1. cubic yards dredged	
l. ☐ Land Subject to Coastal Storm Flowage	1. square feet	

4. ☐ Restoration/Enhancement
If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.2.b or B.3.h above, please enter the additional amount here.

a. square feet of BVW | b. square feet of Salt Marsh

5. ☐ Project Involves Stream Crossings

a. number of new stream crossings | b. number of replacement stream crossings

C. Other Applicable Standards and Requirements

☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section C and complete Appendix A: Ecological Restoration Notice of Intent – Required Actions (310 CMR 10.11).

Streamlined Massachusetts Endangered Species Act/Wetlands Protection Act Review

1. Is any portion of the proposed project located in **Estimated Habitat of Rare Wildlife** as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by the Natural Heritage and Endangered Species Program (NHESP)? To view habitat maps, see the *Massachusetts Natural Heritage Atlas* or go to http://maps.massgis.state.ma.us/PRI_EST_HAB/viewer.htm.

   a. ☐ Yes ☒ No

   If yes, include proof of mailing or hand delivery of NOI to:

   Natural Heritage and Endangered Species Program
   Division of Fisheries and Wildlife
   1 Rabbit Hill Road
   Westborough, MA 01581

   2008
   b. Date of map

   If *yes*, the project is also subject to Massachusetts Endangered Species Act (MESA) review (321 CMR 10.18). To qualify for a streamlined, 30-day, MESA/Wetlands Protection Act review, please complete Section C.1.c, and include requested materials with this Notice of Intent (NOI); *OR* complete Section C.1.f, if applicable. *If MESA supplemental information is not included with the NOI, by completing Section 1 of this form, the NHESP will require a separate MESA filing which may take up to 90 days to review (unless noted exceptions in Section 2 apply, see below).*

   c. Submit Supplemental Information for Endangered Species Review*

      1. ☐ Percentage/acreage of property to be altered:

         (a) within wetland Resource Area _____ percentage/acreage

         (b) outside Resource Area _____ percentage/acreage

      2. ☐ Assessor's Map or right-of-way plan of site

2. ☐ Project plans for entire project site, including wetland resource areas and areas outside of wetlands jurisdiction, showing existing and proposed conditions, existing and proposed tree/vegetation clearing line, and clearly demarcated limits of work **

   (a) ☐ Project description (including description of impacts outside of wetland resource area & buffer zone)

   (b) ☐ Photographs representative of the site

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* Some projects **not** in Estimated Habitat may be located in Priority Habitat, and require NHESP review (see http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/regulatory-review/). Priority Habitat includes habitat for state-listed plants and strictly upland species not protected by the Wetlands Protection Act.

** MESA projects may not be segmented (321 CMR 10.16). The applicant must disclose full development plans even if such plans are not required as part of the Notice of Intent process.

C. Other Applicable Standards and Requirements (cont'd)

(c) ☐ MESA filing fee (fee information available at http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/mesa/mesa_fee_schedule.htm). Make check payable to "Commonwealth of Massachusetts - NHESP" and ***mail to NHESP*** at above address

*Projects altering **10 or more acres** of land, also submit:*

(d) ☐ Vegetation cover type map of site

(e) ☐ Project plans showing Priority & Estimated Habitat boundaries

(f) OR Check One of the Following

1. ☐ Project is exempt from MESA review.
Attach applicant letter indicating which MESA exemption applies. (See 321 CMR 10.14, http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/mesa/mesa_exemptions.htm; the NOI must still be sent to NHESP if the project is within estimated habitat pursuant to 310 CMR 10.37 and 10.59.)

2. ☐ Separate MESA review ongoing. a. NHESP Tracking # _____ b. Date submitted to NHESP _____

3. ☐ Separate MESA review completed.
Include copy of NHESP "no Take" determination or valid Conservation & Management Permit with approved plan.

3. For coastal projects only, is any portion of the proposed project located below the mean high water line or in a fish run?

a. ☒ Not applicable – project is in inland resource area only b. ☐ Yes ☐ No

If yes, include proof of mailing, hand delivery, or electronic delivery of NOI to either:

South Shore - Cohasset to Rhode Island border, and the Cape & Islands:

Division of Marine Fisheries -
Southeast Marine Fisheries Station
Attn: Environmental Reviewer
1213 Purchase Street – 3rd Floor
New Bedford, MA 02740-6694
Email: DMF.EnvReview-South@state.ma.us

North Shore - Hull to New Hampshire border:

Division of Marine Fisheries -
North Shore Office
Attn: Environmental Reviewer
30 Emerson Avenue
Gloucester, MA 01930
Email: DMF.EnvReview-North@state.ma.us

Also if yes, the project may require a Chapter 91 license. For coastal towns in the Northeast Region, please contact MassDEP's Boston Office. For coastal towns in the Southeast Region, please contact MassDEP's Southeast Regional Office.

C. Other Applicable Standards and Requirements (cont'd)

Online Users: Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

4. Is any portion of the proposed project within an Area of Critical Environmental Concern (ACEC)?

   a. ☐ Yes ☒ No If yes, provide name of ACEC (see instructions to WPA Form 3 or MassDEP Website for ACEC locations). **Note:** electronic filers click on Website.

   b. ACEC

5. Is any portion of the proposed project within an area designated as an Outstanding Resource Water (ORW) as designated in the Massachusetts Surface Water Quality Standards, 314 CMR 4.00?

   a. ☐ Yes ☒ No

6. Is any portion of the site subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act (M.G.L. c. 131, § 40A) or the Coastal Wetlands Restriction Act (M.G.L. c. 130, § 105)?

   a. ☐ Yes ☒ No

7. Is this project subject to provisions of the MassDEP Stormwater Management Standards?

   a. ☒ Yes. Attach a copy of the Stormwater Report as required by the Stormwater Management Standards per 310 CMR 10.05(6)(k)-(q) and check if:

      1. ☐ Applying for Low Impact Development (LID) site design credits (as described in Stormwater Management Handbook Vol. 2, Chapter 3)

      2. ☐ A portion of the site constitutes redevelopment

      3. ☐ Proprietary BMPs are included in the Stormwater Management System.

   b. ☐ No. Check why the project is exempt:

      1. ☐ Single-family house

      2. ☐ Emergency road repair

      3. ☐ Small Residential Subdivision (less than or equal to 4 single-family houses or less than or equal to 4 units in multi-family housing project) with no discharge to Critical Areas.

D. Additional Information

☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section D and complete Appendix A: Ecological Restoration Notice of Intent – Minimum Required Documents (310 CMR 10.12).

Applicants must include the following with this Notice of Intent (NOI). See instructions for details.

Online Users: Attach the document transaction number (provided on your receipt page) for any of the following information you submit to the Department.

1. ☒ USGS or other map of the area (along with a narrative description, if necessary) containing sufficient information for the Conservation Commission and the Department to locate the site. (Electronic filers may omit this item.)

2. ☒ Plans identifying the location of proposed activities (including activities proposed to serve as a Bordering Vegetated Wetland [BVW] replication area or other mitigating measure) relative to the boundaries of each affected resource area.

D. Additional Information (cont'd)

3. ☐ Identify the method for BVW and other resource area boundary delineations (MassDEP BVW Field Data Form(s), Determination of Applicability, Order of Resource Area Delineation, etc.), and attach documentation of the methodology.

4. ☒ List the titles and dates for all plans and other materials submitted with this NOI.

Wingate Residences Haverhill - Proposed Assisted Living Facility
a. Plan Title

Weston & Sampson
b. Prepared By

Roger Alcott, PE
c. Signed and Stamped by

April 15, 2016
d. Final Revision Date

1" - 40'
e. Scale

f. Additional Plan or Document Title

g. Date

5. ☐ If there is more than one property owner, please attach a list of these property owners not listed on this form.

6. ☐ Attach proof of mailing for Natural Heritage and Endangered Species Program, if needed.

7. ☐ Attach proof of mailing for Massachusetts Division of Marine Fisheries, if needed.

8. ☒ Attach NOI Wetland Fee Transmittal Form

9. ☒ Attach Stormwater Report, if needed.

E. Fees

1. ☐ Fee Exempt: No filing fee shall be assessed for projects of any city, town, county, or district of the Commonwealth, federally recognized Indian tribe housing authority, municipal housing authority, or the Massachusetts Bay Transportation Authority.

Applicants must submit the following information (in addition to pages 1 and 2 of the NOI Wetland Fee Transmittal Form) to confirm fee payment:

19545
2. Municipal Check Number

4/25/16
3. Check date

19547
4. State Check Number

4/25/16
5. Check date

Wingate Healthcare, Inc.
6. Payor name on check: First Name

7. Payor name on check: Last Name

F. Signatures and Submittal Requirements

I hereby certify under the penalties of perjury that the foregoing Notice of Intent and accompanying plans, documents, and supporting data are true and complete to the best of my knowledge. I understand that the Conservation Commission will place notification of this Notice in a local newspaper at the expense of the applicant in accordance with the wetlands regulations, 310 CMR 10.05(5)(a).

I further certify under penalties of perjury that all abutters were notified of this application, pursuant to the requirements of M.G.L. c. 131, § 40. Notice must be made by Certificate of Mailing or in writing by hand delivery or certified mail (return receipt requested) to all abutters within 100 feet of the property line of the project location.

1. Signature of Applicant	2. Date 4/6/16
3. Signature of Property Owner (if different)	4. Date
5. Signature of Representative (if any)	6. Date 4/6/16

For Conservation Commission:
Two copies of the completed Notice of Intent (Form 3), including supporting plans and documents, two copies of the NOI Wetland Fee Transmittal Form, and the city/town fee payment, to the Conservation Commission by certified mail or hand delivery.

For MassDEP:
One copy of the completed Notice of Intent (Form 3), including supporting plans and documents, one copy of the NOI Wetland Fee Transmittal Form, and a **copy** of the state fee payment to the MassDEP Regional Office (see Instructions) by certified mail or hand delivery.

Other:
If the applicant has checked the "yes" box in any part of Section C, Item 3, above, refer to that section and the Instructions for additional submittal requirements.

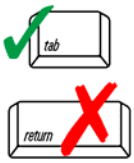
The original and copies must be sent simultaneously. Failure by the applicant to send copies in a timely manner may result in dismissal of the Notice of Intent.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

NOI Wetland Fee Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A. Applicant Information

1. Location of Project:

174 North Avenue	Haverhill
a. Street Address	b. City/Town
19547	$512.50
c. Check number	d. Fee amount

2. Applicant Mailing Address:

David	Feldman	
a. First Name	b. Last Name	
WHC Haverhill AL, LLC		
c. Organization		
63 Kendrick Street		
d. Mailing Address		
Needham	MA	02494
e. City/Town	f. State	g. Zip Code
(781) 707-9500		dfeldman@wingatehealthcare.com
h. Phone Number	i. Fax Number	j. Email Address

3. Property Owner (if different):

a. First Name	b. Last Name	
c. Organization		
d. Mailing Address		
e. City/Town	f. State	g. Zip Code
h. Phone Number	i. Fax Number	j. Email Address

To calculate filing fees, refer to the category fee list and examples in the instructions for filling out WPA Form 3 (Notice of Intent).

B. Fees

Fee should be calculated using the following process & worksheet. ***Please see Instructions before filling out worksheet.***

Step 1/Type of Activity: Describe each type of activity that will occur in wetland resource area and buffer zone.

Step 2/Number of Activities: Identify the number of each type of activity.

Step 3/Individual Activity Fee: Identify each activity fee from the six project categories listed in the instructions.

Step 4/Subtotal Activity Fee: Multiply the number of activities (identified in Step 2) times the fee per category (identified in Step 3) to reach a subtotal fee amount. Note: If any of these activities are in a Riverfront Area in addition to another Resource Area or the Buffer Zone, the fee per activity should be multiplied by 1.5 and then added to the subtotal amount.

Step 5/Total Project Fee: Determine the total project fee by adding the subtotal amounts from Step 4.

Step 6/Fee Payments: To calculate the state share of the fee, divide the total fee in half and subtract $12.50. To calculate the city/town share of the fee, divide the total fee in half and add $12.50.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

NOI Wetland Fee Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

B. Fees (continued)

Step 1/Type of Activity	Step 2/Number of Activities	Step 3/Individual Activity Fee	Step 4/Subtotal Activity Fee
3.b building	1	$1,050	$1,050

Step 5/Total Project Fee: $1,050

Step 6/Fee Payments:

Total Project Fee:	$1,050 a. Total Fee from Step 5
State share of filing Fee:	$512.50 b. 1/2 Total Fee **less $**12.50
City/Town share of filling Fee:	$537.50 c. 1/2 Total Fee **plus** $12.50

C. Submittal Requirements

a.) Complete pages 1 and 2 and send with a check or money order for the state share of the fee, payable to the Commonwealth of Massachusetts.

Department of Environmental Protection
Box 4062
Boston, MA 02211

b.) **To the Conservation Commission:** Send the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and the city/town fee payment.

To MassDEP Regional Office (see Instructions): Send a copy of the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and a **copy** of the state fee payment. (E-filers of Notices of Intent may submit these electronically.)

PROJECT DESCRIPTION

Project Overview

The project consists of construction of a new assisted living facility in Haverhill, MA. The proposed facility on 174 North Avenue is adjacent to an existing nursing home and is owned by WHC Haverhill AL, LLC (Map 630, Block 2, Lot 1 and Book 17216, Page 509) (Figure 1).

Existing Conditions

The parcel at 174 North Avenue is currently an undeveloped lot covered by natural vegetation. The vast majority of the site is considered a meadow with scattered bushed on the edges of the lot (Figure 2).

On May 15, 2014 an ANRAD was submitted for this site to the City of Haverhill Conservation Commission. After reviewing the submittal, the conservation commission issued an ORAD on July 9, 2014for wetland limits at the site. A copy of the ORAD is provided in Appendix F of this submittal.

Proposed Work

The work includes clearing and grubbing, construction of a new assisted living facility, full-depth pavement construction, new granite curb installation, new closed drainage system, swales, and stormwater basins, new cement concrete sidewalk, pavement markings, signage, plantings, and other incidental work.

Demolition debris will be transported in covered container vehicles for off-site disposal or recycling. Erosion control measures, including the use of erosion control devices, will be implemented to mitigate sediment migration outside the limits of work. Catch basin protection will be implemented for all catch basins affected by the work area. Filter sacks will be placed in the catch basin to trap sediment flowing into the catch basin..

Environmental protection measures will also silt socks at the perimeter of the work area, between the work area and wetland resources. Dust control will be used to ensure that generation of on-site dust during work activities will be minimized. Dust control activities will not add to any additional stormwater runoff at the site, as dust control will not be used during storm events. Wet suppression shall be used to provide temporary control of dust. At a minimum, wet suppression shall be applied to demolition debris, excavated material, aggregate piles, and exposed soils and dirt. Dust suppression wetting agents shall be water soluble, non-toxic, non-reactive, non-volatile, and non-foaming and will not result in ponding of water.

Environmental Considerations

There will be no work within resource areas protected under the Wetlands Protection Act. There will be work within the 100-foot buffer zone. There will be no work within the 25-foot no-disturb zone and no structures will be placed within the 50-foot no-build zone.

As noted above, sedimentation and erosion controls will be used to protect nearby wetland resource areas from sediment migration during storm events. These controls include silt socks, catch basin protection and dust control.

Z:\MA-Foxboro-Projects\Haverhill\Wingate at Haverhill-xxxxxxxx\Permitting\NOI\Appendix A - Project Description\PROJECT DESCRIPTION.doc

Stormwater Report

City of Haverhill, MA

Conservation Department
Haverhill, Massachusetts

Wingate Residences Haverhill

Assisted Living Facility

Notice of Intent
Massachusetts Wetland Protection Act
M.G.L. c. 131 § 40

April 2016
JOB NO: 2140079

Weston & Sampson.
100 Foxborough Boulevard
Suite 250
Foxboro, MA 02035
www.westonandsampson.com
Tel: 508-698-3034 Fax: 508-698-0843

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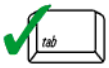
Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

---

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

COMMONWEALTH OF MASSACHUSETTS
S. ROGER ALCOTT
CIVIL
No. 41254
REGISTERED PROFESSIONAL ENGINEER

S. Roger Alcott 4/27/2016
Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☒ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☐ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☐ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☐ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☒ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☐ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Stormwater Report

Project Name: Wingate Residences Haverhill
Project Address: North Ave., Haverhill, MA

Application Prepared by:
Firm: Weston & Sampson, Inc.
Registered PE: S. Roger Alcott, PE

General

The project consists of construction of a new assisted living facility in Haverhill, MA. The proposed facility on North Avenue is adjacent to an existing nursing home and is owned by WHC Haverhill AL, LLC (Map 630, Block 2, Lot 1 and Book 34801, Page 030).

The work includes clearing and grubbing, construction of a new assisted living facility, full-depth pavement construction, new granite curb and asphalt berm installation, new closed drainage system, swales, and stormwater basins, site utilities, new cement concrete sidewalk, pavement markings, signage, landscaping, and other incidental work.

Debris from the site preparation will be transported in covered container vehicles for off-site disposal or recycling. Erosion control measures, including the use of erosion control devices, will be implemented to mitigate sediment migration outside the limits of work. Catch basin protection will be implemented for all catch basins affected by the work area. Filter fabric will be placed over the catch basin, and compost filter tubes will be placed around the catch basin to minimize sediment loading into the catch basin.

Environmental protection measures will also include dust control to ensure that generation of on-site dust during work activities will be minimized. Dust control activities will not add to any additional stormwater runoff at the site, as dust control will not be used during storm events. Wet suppression shall be used to provide temporary control of dust. At a minimum, wet suppression shall be applied to demolition debris, excavated material, aggregate piles, and exposed soils and dirt. Dust suppression wetting agents shall be water soluble, non-toxic, non-reactive, non-volatile, and non-foaming and will not result in ponding of water.

LID Measures

Low Impact Development (LID) Measures will be incorporated where possible, into this project. These measures include no disturbance to wetland resource areas and the addition of grassed swales. Stilling areas, to promote recharge in various places throughout the site, and grassed swales, with check dams to detain runoff and mimic predevelopment conditions, are proposed along the southern portion of the site to further spread out and encourage infiltration throughout the site prior to conveyance to the stormwater basins to the north.

Stormwater Management

Runoff from the driveway and parking areas will be directed to deep sump catch basins prior to reaching the series of swales and stilling areas and the proposed stormwater basins. The purpose of the system is not only to recharge as much of the stormwater runoff as possible, but also to ensure the proposed peak flows and volumes do not exceed the existing parameters.

Stormwater Design

Weston & Sampson utilized HydroCAD computer software to model the stormwater runoff for 2-year, 10-year, 25-year, and 100-year 24-hour storm events. The rainfall depths were 3.10 inches, 4.50 inches, 5.40 inches, and 6.50 inches, respectively. In order to properly simulate the existing and proposed stormwater conditions at each site, specific data was obtained and/or considered, including topography, site layout, soil composition, and groundwater.

Soil information was obtained from the Natural Resources Conservation Service (NRCS) Essex County Web Soil Survey. The soil survey indicated primarily Sutton fine sandy loam, with Canton fine sandy loam and Leicester fine sandy loam also represented. The soil map and description are included in Appendix A.

In addition to review of the soil survey, seven test pits were performed to determine the viability of on-site stormwater infiltration. The test pits were located at potential locations for infiltration. Complete test pit logs are included in Appendix A. In summary, the test pit profiles indicated sandy loam from the surface to a depth ranging from about 12” - 36”. This sandy loam upper horizon is generally underlain by a dense-in-place gray silt/clay with mottles present. In some locations, this restrictive layer is underlain by a sandy loam material. As a result of the reviewed soil surveys and observed test pits, a Rawl’s rate of 1.02 inches per hour was used.

Standard 1: No New Untreated Discharges

The proposed project will create no new untreated discharges. The proposed project was designed to mimic existing conditions as much as possible and improve the condition to the maximum extent practicable.

Existing grades convey runoff to one point of interest: the culvert at the northern property line, adjacent to Interstate 495. As part of the proposed project, surface runoff will be collected in deep sump catch basins and directed through a series of swales and stilling areas prior to treatment in the northern basins and discharge from the site. There will be no new untreated stormwater discharges at the end of the project.

Standard 2: Peak Rate Attenuation

Post construction peak runoff rates at all project sites for the 2-, 10-, 25-, and 100-year storms will not increase. Supporting documentation is included with this report. A summary table is provided to illustrate that post-construction peak discharge rates will nearly mimic pre-construction rates. To ensure that the work incorporates the performance standards recommended in the DEP's Stormwater Management Policy, necessary erosion and sedimentation control measures will be utilized during construction. These measures will include compost filter tubes and catch basin sediment controls, as needed.

Standard 3: Recharge

The impervious area within the proposed project limits will increase at the completion of construction, but with the designed improvements, recharge will be provided in the northern stormwater basins. The recharge volume provided under post-development conditions is greater than the recharge volume required by DEP's Stormwater Management Standards. The recharge requirement calculation is included in this report and illustrates compliance with the current DEP Stormwater policy.

Standard 4: Water Quality

All stormwater within the project limits will be directed into at least one drainage structure for treatment or recharged through the soils into the ground. Stormwater runoff from the site will be directed through a deep sump catch basin and/or stormwater basins. All of these drainage features have been adequately sized to mimic existing conditions and promote recharge to groundwater.

Standard 5: Land Uses with Higher Potential Pollutant Loads (LUHPPLs)
Not applicable

The project site does not have the potential for higher potential pollutant loads.

Standard 6: Critical Areas
Not applicable

The project site is not located within a Critical Area.

Standard 7: Redevelopments and Other Projects Subject to the Standards Only to the Maximum Extent Practicable
Not applicable

This project is not considered a redevelopment.

Standard 8: Construction Period Pollution Prevention and Erosion and Sediment Control

A detailed Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan is required. To ensure that the work incorporates the performance standards recommended in the DEP's Stormwater Management Policy, necessary erosion and sedimentation control measures will be utilized during construction, as shown on the plans. In addition, the contractor will be required to produce the SWPPP prior to any land disturbance.

Standard 9: Operation and Maintenance Plan

An operations and maintenance plan is provided with this report.

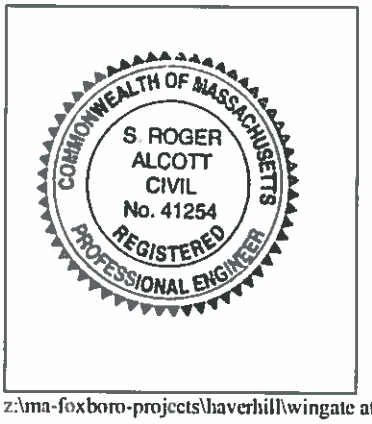
Standard 10: Prohibition of Illicit Discharges

Illicit discharges will be prevented on the site through the use of spill/discharge prevention measures, along with good housekeeping and BMPs, and in accordance with the Long Term Pollution Prevention Plan and O&M plans. An Illicit Discharge Compliance Statement has been developed for this site and is included in Appendix D.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan, the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



S. Roger Alcott 4/27/2016

Signature and Date

Appendix A

FIGURE 1
174 NORTH AVENUE
HAVERHILL, MA

LOCUS MAP

Investigation Area

MA Towns

1,000 0 1,000

Scale In Feet

Weston & Sampson

Path: O:\Haverhill MA\Wingate\GIS\maps\ANRAD\Figure 1 - locus.mxd User: higginsm Saved: 5/12/2014 4:21:57 PM Opened: 5/12/2014 4:22:25 PM

FIGURE 2
174 North Avenue
Haverhill, Massachusetts

ENVIRONMENTAL RESOURCES MAP

200 0 200
Scale In Feet

Weston & Sampson

Path: T:\Water\ERMA\GIS - Constraints Mapping\Haverhill\Wingate 2016\Figure 2 - Env Receptor.mxd User: higginsm Saved: 3/2/2016 5:06:07 PM Opened: 3/2/2016 5:08:11 PM

NOTES TO USERS

is for use in administering the National Flood Insurance Program. It does
oarily identify all areas subject to flooding, particularly from local drainage
f small size. The **community map repository** should be consulted for
pdated or additional flood hazard information.

more detailed information in areas where **Base Flood Elevations** (BFEs)
oodways have been determined, users are encouraged to consult the Flood
nd Floodway Data and/or Summary of Stillwater Elevations tables contained
Flood Insurance Study (FIS) Report that accompanies this FIRM. Users
e aware that BFEs shown on the FIRM represent rounded whole-foot
. These BFEs are intended for flood insurance rating purposes only and
t be used as the sole source of flood elevation information. Accordingly,
ation data presented in the FIS Report should be utilized in conjunction with
for purposes of construction and/or floodplain management.

Base Flood Elevations shown on this map apply only landward of 0.0'
erican Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be
t coastal flood elevations are also provided in the Summary of Stillwater
table in the Flood Insurance Study Report for this jurisdiction. Elevations
the Summary of Stillwater Elevations table should be used for construction
odplain management purposes when they are higher than the elevations
this FIRM.

s of the **floodways** were computed at cross sections and interpolated
cross sections. The floodways were based on hydraulic considerations with
requirements of the National Flood Insurance Program. Floodway widths
pertinent floodway data are provided in the Flood Insurance Study Report
isdiction.

eas not in Special Flood Hazard Areas may be protected by **flood control**
s. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance
port for information on flood control structures for this jurisdiction.

ection used in the preparation of this map was Massachusetts State Plane
Zone (FIPS zone 2001). The **horizontal datum** was NAD 83, GRS 1980
Differences in datum, spheroid, projection or UTM zones used in the
n of FIRMs for adjacent jurisdictions may result in slight positional
s in map features across jurisdiction boundaries. These differences do not
accuracy of this FIRM.

vations on this map are referenced to the North American Vertical Datum of
ese flood elevations must be compared to structure and ground elevations
d to the same **vertical datum**. For information regarding conversion
the National Geodetic Vertical Datum of 1929 and the North American
Datum of 1988, visit the National Geodetic Survey website at
.ngs.noaa.gov or contact the National Geodetic Survey at the following

mation Services
NGS12
Geodetic Survey
#9202
-West Highway
ng, Maryland 20910-3282
-3242

current elevation, description, and/or location information for **bench marks**
this map, please contact the Information Services Branch of the National
Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

o information shown on this FIRM was derived from digital orthophotography
by the Massachusetts Geographic Information System. This information was
om photography dated 2005.

e baselines depicted on this map represent the hydraulic modeling baselines
h the flood profiles in the FIS report. As a result of improved topographic data,
e baseline, in some cases, may deviate significantly from the channel
or appear outside the SFHA.

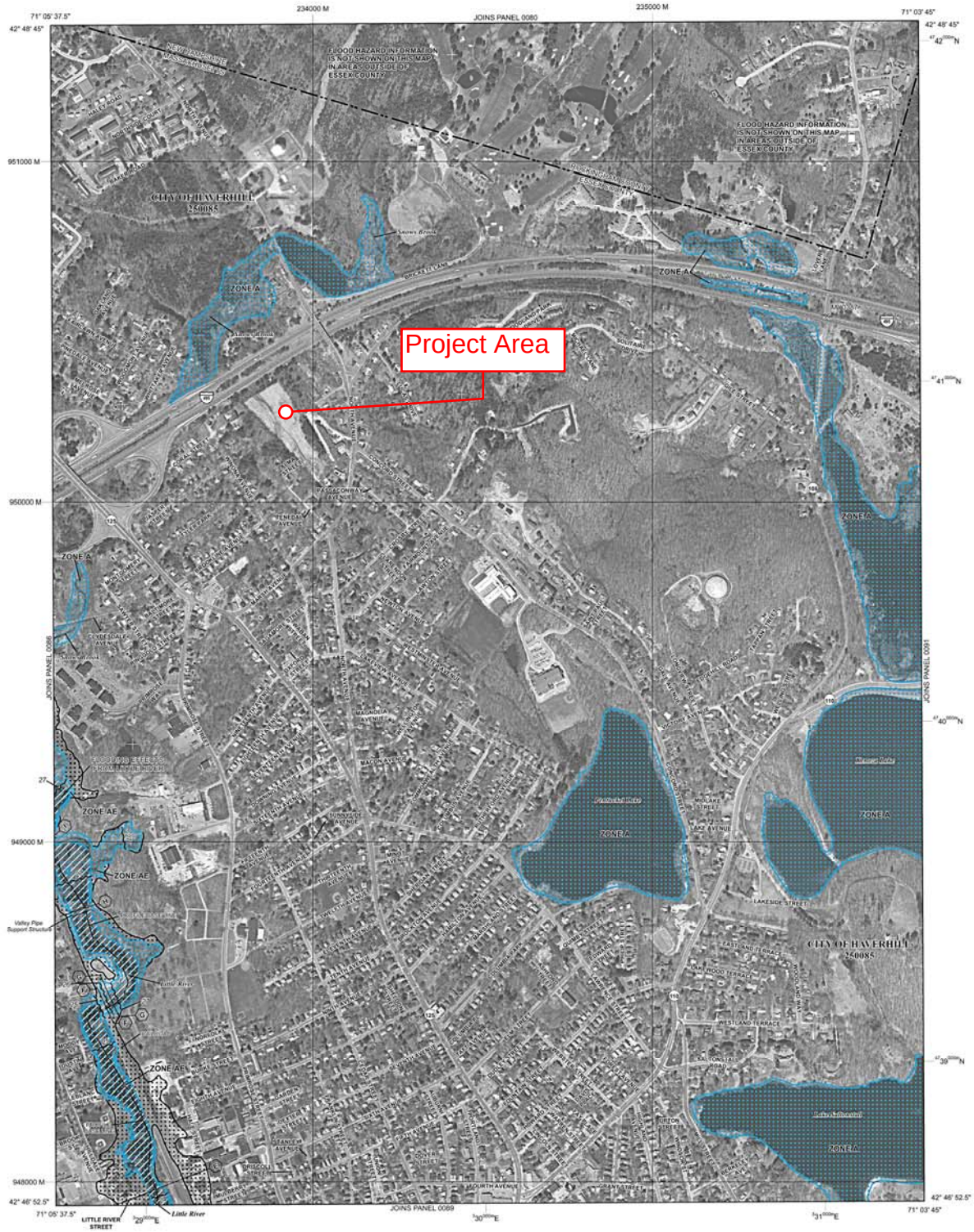
n updated topographic information, this map reflects more detailed and
n stream channel configurations and floodplain delineations than
own on the previous FIRM for this jurisdiction. As a result, the Flood
nd Floodway Data tables for multiple streams in the Flood
Study Report (which contains authoritative hydraulic data) may reflect
annel distances that differ from what is shown on the map. Also, the
loodplain relationships for unrevised streams may differ from what is
previous maps.

e limits shown on this map are based on the best data available at the time
tion. Because changes due to annexations or de-annexations may have
after this map was published, map users should contact appropriate
y officials to verify current corporate limit locations.

fer to the separately printed **Map Index** for an overview map of the
owing the layout of map panels; community map repository addresses;
sting of Communities table containing National Flood Insurance Program
each community as well as a listing of the panels on which each community
.

mation on available products associated with this FIRM visit the **Map
Center (MSC)** website at http://msc.fema.gov. Available products may
reviously issued Letters of Map Change, a Flood Insurance Study Report,
igital versions of this map. Many of these products can be ordered or
directly from the MSC website.

ve **questions about this map**, how to order products, or the National
urance Program in general, please call the **FEMA Map Information
e (FMIX)** at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA
t http://www.fema.gov/business/nfp.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood
a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard
the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazar
include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-s
elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Ele determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); ave depths determined. For areas of alluvial fan flooding, velocities also de
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual ch flood by a flood control system that was subsequently decertified. Zo AR indicates that the former flood control system is being restored to p protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations deter
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Ele determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be k
encroachment so that the 1% annual chance flood can be carried without substantial incr
flood heights.

OTHER FLOOD AREAS

ZONE X — Areas of 0.2% annual chance flood; areas of 1% annual chance flood wit average depths of less than 1 foot or with drainage areas less than 1 squa mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Area

- 1% Annual Chance Floodplain Boundary
- 0.2% Annual Chance Floodplain Boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and bo dividing Special Flood Hazard Areas of different Base Flood flood depths, or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; ele feet*

*Referenced to the North American Vertical Datum of 1988

- A — A: Cross section line
- 23 - - - 23: Transect line
- Culvert
- Bridge
- 45° 02' 08", 93° 02' 12": Geographic coordinates referenced to the North American D 1983 (NAD 83) Western Hemisphere
- 4989000 M: 1000-meter ticks: Massachusetts State Plane Mainland Zone (FIPS Zone 2001), Lambert Conformal Conic projection
- 5000000 N: 1000-meter Universal Transverse Mercator grid values, zone
- DX5510 ×: Bench mark (see explanation in Notes to Users section of th panel)
- M1.5: River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
July 3, 2012

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Communit
Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance ag
or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0087F

FIRM

FLOOD INSURANCE RATE MA

ESSEX COUNTY, MASSACHUSETTS (ALL JURISDICTIONS)

PANEL 87 OF 600

(SEE MAP INDEX FOR FIRM PANEL LAY

CONTAINS:

COMMUNITY	NUMBER	PANEL
HAVERHILL, CITY OF	250085	0087

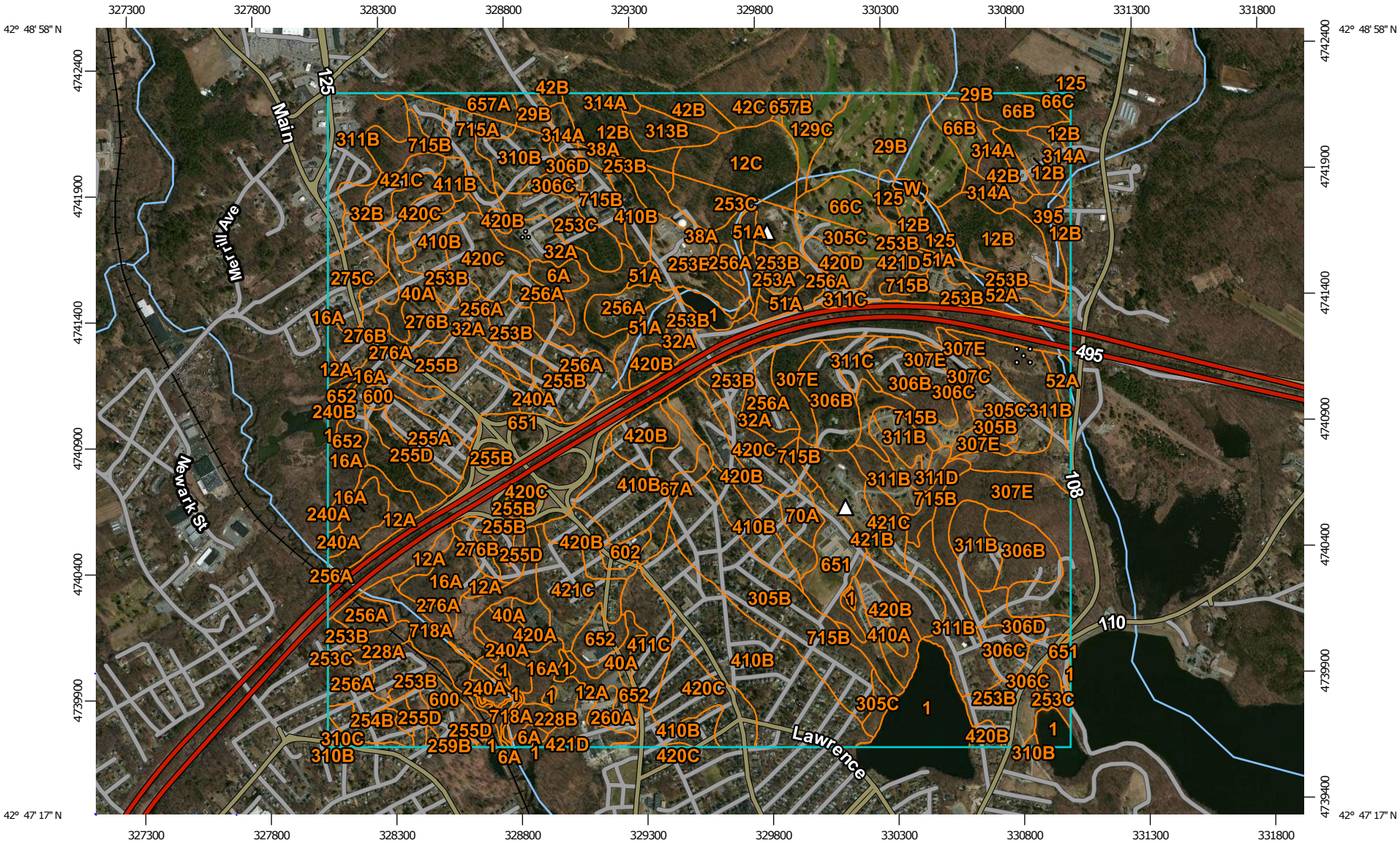
Notice to User: The **Map Number** show
should be used when placing map on
Community Number shown above sh
used on insurance applications for the
community.

MAP NUM
25009CO

EFFECTIVE
JULY 3,

Federal Emergency Management A

Soil Map—Essex County, Massachusetts, Northern Part; and Rockingham County, New Hampshire
(190 North Ave., Haverhill, MA)



Map Scale: 1:22,000 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 300 600 1200 1800

Feet: 0 1000 2000 4000 6000

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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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 scales ranging from 1:15,800 to 1:24,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
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: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 9, Dec 17, 2013

Soil Survey Area: Rockingham County, New Hampshire
Survey Area Data: Version 15, Dec 31, 2013

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Mar 30, 2011—May 1, 2011

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.

Map Unit Legend

Essex County, Massachusetts, Northern Part (MA605)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
1	Water	42.0	2.2%
6A	Scarboro mucky fine sandy loam, 0 to 1 percent slopes	7.5	0.4%
12A	Maybid silt loam, 0 to 3 percent slopes	33.3	1.7%
16A	Scantic silt loam, 0 to 3 percent slopes	49.8	2.6%
32A	Wareham loamy sand, 0 to 3 percent slopes	46.5	2.4%
32B	Wareham loamy sand, 3 to 8 percent slopes	7.3	0.4%
38A	Pipestone loamy sand, 0 to 3 percent slopes	16.7	0.9%
40A	Swanton fine sandy loam, 0 to 3 percent slopes	15.4	0.8%
51A	Swansea muck, 0 to 1 percent slopes	19.2	1.0%
52A	Freetown muck, 0 to 1 percent slopes	12.7	0.7%
67A	Leicester fine sandy loam, 0 to 3 percent slopes	7.1	0.4%
70A	Ridgebury fine sandy loam, 0 to 3 percent slopes	6.4	0.3%
228A	Buxton silt loam, 0 to 3 percent slopes	4.9	0.3%
228B	Buxton silt loam, 3 to 8 percent slopes	4.1	0.2%
240A	Elmwood fine sandy loam, 0 to 3 percent slopes	12.5	0.7%
240B	Elmwood fine sandy loam, 3 to 8 percent slopes	1.1	0.1%
253A	Hinckley loamy sand, 0 to 3 percent slopes	5.0	0.3%
253B	Hinckley loamy sand, 3 to 8 percent slopes	92.6	4.9%
253C	Hinckley loamy sand, 8 to 15 percent slopes	36.5	1.9%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	7.9	0.4%
255A	Windsor loamy sand, 0 to 3 percent slopes	13.1	0.7%
255B	Windsor loamy sand, 3 to 8 percent slopes	58.1	3.0%

Essex County, Massachusetts, Northern Part (MA605)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
255D	Windsor loamy sand, 15 to 25 percent slopes	16.0	0.8%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	65.5	3.4%
259B	Carver loamy coarse sand, 3 to 8 percent slopes	1.9	0.1%
260A	Sudbury fine sandy loam, 0 to 3 percent slopes	4.8	0.3%
275C	Agawam fine sandy loam, 8 to 15 percent slopes	14.9	0.8%
276A	Ninigret fine sandy loam, 0 to 3 percent slopes	8.8	0.5%
276B	Ninigret fine sandy loam, 3 to 8 percent slopes	23.7	1.2%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	59.5	3.1%
305C	Paxton fine sandy loam, 8 to 15 percent slopes	26.9	1.4%
306B	Paxton fine sandy loam, 3 to 8 percent slopes, very stony	45.7	2.4%
306C	Paxton fine sandy loam, 8 to 15 percent slopes, very stony	18.7	1.0%
306D	Paxton fine sandy loam, 15 to 25 percent slopes, very stony	10.7	0.6%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	4.4	0.2%
307E	Paxton fine sandy loam, 25 to 35 percent slopes, extremely stony	61.9	3.2%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	14.0	0.7%
310C	Woodbridge fine sandy loam, 8 to 15 percent slopes	2.7	0.1%
311B	Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony	100.3	5.3%
311C	Woodbridge fine sandy loam, 8 to 15 percent slopes, very stony	8.7	0.5%
311D	Woodbridge fine sandy loam, 15 to 25 percent slopes, very stony	6.7	0.4%
410A	Sutton fine sandy loam, 0 to 3 percent slopes	2.7	0.1%
410B	Sutton fine sandy loam, 3 to 8 percent slopes	135.7	7.1%

Essex County, Massachusetts, Northern Part (MA605)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
411B	Sutton fine sandy loam, 3 to 8 percent slopes, very stony	8.8	0.5%
411C	Sutton fine sandy loam, 8 to 15 percent slopes, very stony	17.2	0.9%
420A	Canton fine sandy loam, 0 to 3 percent slopes	5.7	0.3%
420B	Canton fine sandy loam, 3 to 8 percent slopes	63.7	3.3%
420C	Canton fine sandy loam, 8 to 15 percent slopes	62.7	3.3%
420D	Canton fine sandy loam, 15 to 25 percent slopes	7.7	0.4%
421B	Canton fine sandy loam, 3 to 8 percent slopes, very stony	27.4	1.4%
421C	Canton fine sandy loam, 8 to 15 percent slopes, very stony	37.8	2.0%
421D	Canton fine sandy loam, 15 to 25 percent slopes, very stony	7.4	0.4%
600	Pits, gravel	13.7	0.7%
602	Urban land	4.2	0.2%
651	Udorthents, smoothed	149.3	7.8%
652	Udorthents, refuse substratum	10.4	0.5%
715A	Ridgebury and Leicester fine sandy loams, 0 to 3 percent slopes, extremely stony	9.1	0.5%
715B	Ridgebury and Leicester fine sandy loams, 3 to 8 percent slopes, extremely stony	53.2	2.8%
718A	Saco variant silt loam, 0 to 3 percent slopes	31.3	1.6%
Subtotals for Soil Survey Area		**1,643.9**	**86.3%**
Totals for Area of Interest		**1,904.9**	**100.0%**

Rockingham County, New Hampshire (NH015)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
12B	Hinckley fine sandy loam, 3 to 8 percent slopes	59.4	3.1%
12C	Hinckley fine sandy loam, 8 to 15 percent slopes	27.9	1.5%
29B	Woodbridge fine sandy loam, 3 to 8 percent slopes	50.1	2.6%
42B	Canton gravelly fine sandy loam, 3 to 8 percent slopes	14.6	0.8%
42C	Canton gravelly fine sandy loam, 8 to 15 percent slopes	8.0	0.4%

Rockingham County, New Hampshire (NH015)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
66B	Paxton fine sandy loam, 3 to 8 percent slopes	18.5	1.0%
66C	Paxton fine sandy loam, 8 to 15 percent slopes	15.2	0.8%
125	Scarboro muck, very stony	7.6	0.4%
129C	Woodbridge fine sandy loam, 8 to 15 percent slopes, very stony	10.9	0.6%
313B	Deerfield fine sandy loam, 3 to 8 percent slopes	10.1	0.5%
314A	Pipestone sand, 0 to 5 percent slopes	19.7	1.0%
395	Chocorua mucky peat	8.0	0.4%
657A	Ridgebury very fine sandy loam, 0 to 3 percent slopes, very stony	7.0	0.4%
657B	Ridgebury very fine sandy loam, 3 to 8 percent slopes, very stony	2.0	0.1%
W	Water	1.9	0.1%
Subtotals for Soil Survey Area		**261.1**	**13.7%**
Totals for Area of Interest		**1,904.9**	**100.0%**

Essex County, Massachusetts, Northern Part

420B—Canton fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

Elevation: 0 to 1,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days

Map Unit Composition

Canton and similar soils: 85 percent
Minor components: 15 percent

Description of Canton

Setting

Landform: Hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable coarse-loamy eolian deposits over friable sandy and gravelly basal till derived from granite and gneiss

Typical profile

H1 - 0 to 7 inches: fine sandy loam
H2 - 7 to 33 inches: fine sandy loam
H3 - 33 to 60 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 18 to 36 inches to strongly contrasting textural stratification
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.4 inches)

Interpretive groups

Farmland classification: All areas are prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Minor Components

Scituate

Percent of map unit: 10 percent

Swansea

Percent of map unit: 5 percent
Landform: Bogs

Data Source Information

Soil Survey Area: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 9, Dec 17, 2013

Soil Survey Area: Rockingham County, New Hampshire
Survey Area Data: Version 15, Dec 31, 2013

Essex County, Massachusetts, Northern Part

410B—Sutton fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days

Map Unit Composition

Sutton and similar soils: 85 percent
Minor components: 15 percent

Description of Sutton

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Nose slope, side slope
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Friable coarse-loamy eolian deposits over friable coarse-loamy basal till derived from granite and gneiss

Typical profile

H1 - 0 to 9 inches: fine sandy loam
H2 - 9 to 26 inches: fine sandy loam
H3 - 26 to 60 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: About 18 to 41 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.4 inches)

Interpretive groups

Farmland classification: All areas are prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Minor Components

Leicester

Percent of map unit: 10 percent
Landform: Depressions

Whitman

Percent of map unit: 5 percent
Landform: Depressions

Data Source Information

Soil Survey Area: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 9, Dec 17, 2013

Soil Survey Area: Rockingham County, New Hampshire
Survey Area Data: Version 15, Dec 31, 2013

Essex County, Massachusetts, Northern Part

67A—Leicester fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days

Map Unit Composition

Leicester and similar soils: 85 percent
Minor components: 15 percent

Description of Leicester

Setting

Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Friable coarse-loamy eolian deposits over friable coarse-loamy basal till derived from granite and gneiss

Typical profile

O - 0 to 3 inches: muck
H2 - 3 to 8 inches: fine sandy loam
H3 - 8 to 31 inches: fine sandy loam
H4 - 31 to 60 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.0 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C

Minor Components

Whitman

Percent of map unit: 8 percent
Landform: Depressions

Woodbridge
Percent of map unit: 7 percent

Data Source Information

Soil Survey Area: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 9, Dec 17, 2013

Soil Survey Area: Rockingham County, New Hampshire
Survey Area Data: Version 15, Dec 31, 2013

TEST PIT LOG

PROJECT NAME/NO.	Wingate at Haverhill		TEST PIT NUMBER TP - 1
LOCATION	Haverhill, MA		
CLIENT	Wingate		GROUND SURFACE ELEVATION 103.12
CONTRACTOR	Pipeline	FOREMAN:	
OBSERVED BY	A. Peck	DATE 7/23/14	DEPTH TO GROUNDWATER BELOW SURFACE 98.87 (SHGW)
CHECKED BY		DATE	

DEPTH BELOW GROUND SURFACE (ft.)	TEST PIT DIAGRAM AND SOIL DESCRIPTION
0	DENSE GRASS
12"	DARK BROWN SANDY LOAM
32"	MEDIUM BROWN SANDY LOAM
51"	COARSE SAND
61"	GRAY SILT/CLAY W/ MOTTLES
117"	MEDIUM BROWN FINE SANDY LOAM W/ TRACE SILT + GRAVEL
	BOTTOM OF TEST PIT -

NOTES:
NO WEEPING OR STANDING GW

TEST PIT NUMBER TP - 1

WESTON & SAMPSON ENGINEERS, INC.

T:\ESSE\Forms\[Test pit.XLS]TP-1

TEST PIT LOG

PROJECT NAME/NO.	Wingate at Haverhill		TEST PIT NUMBER TP - 2
LOCATION	Haverhill, MA		
CLIENT	Wingate		GROUND SURFACE ELEVATION 101.59
CONTRACTOR	Pipeline	FOREMAN:	
OBSERVED BY	A. Peck	DATE 7/23/14	DEPTH TO GROUNDWATER BELOW SURFACE 99.09 (SHGW)
CHECKED BY		DATE	

DEPTH BELOW GROUND SURFACE (ft.)	TEST PIT DIAGRAM AND SOIL DESCRIPTION
0	DENSE BRUSH
10"	DARK BROWN SANDY LOAM
24"	MEDIUM BROWN FINE SANDY LOAM
30"	REDDISH BROWN FINE SANDY LOAM
70"	GRAY SILT/CLAY W/ MOTTLES + GRAVEL (VERY DENSE IN PLACE)
117"	(MATERIAL CHANGE - SIDES CAVING IN) LIKELY SILT LOAM / SANDY LOAM
	- BOTTOM OF TEST PIT -

NOTES:
WEEPING GW @ 96"
STANDING GW @ 117"

TEST PIT NUMBER TP - 2

WESTON & SAMPSON ENGINEERS, INC.

T:\ESSE\Forms\[Test pit.XLS]TP-1

TEST PIT LOG

PROJECT NAME/NO.	Wingate at Haverhill		TEST PIT NUMBER TP - 3
LOCATION	Haverhill, MA		
CLIENT	Wingate		GROUND SURFACE ELEVATION 114.42
CONTRACTOR	Pipeline	FOREMAN:	
OBSERVED BY	A. Peck	DATE 7/23/14	DEPTH TO GROUNDWATER BELOW SURFACE
CHECKED BY		DATE	

DEPTH BELOW GROUND SURFACE (ft.)	TEST PIT DIAGRAM AND SOIL DESCRIPTION
0	DENSE GRASS
13"	DARK BROWN SANDY LOAM
30"	GRAY VERY FINE SANDY LOAM W/ SILT W/ MOTTLES (VERY FIRM IN PLACE) ①
45"	GRAVELLY LOAMY SAND (FIRM IN PLACE)
71"	COARSE SAND
107"	SILT LOAM / SANDY LOAM (SLIGHT RIBBON) (SIDES CAVING IN)
	- BOTTOM OF TEST PIT -

NOTES:

WEEPING GW @ 65"
STANDING GW @ 107"

TEST PIT NUMBER TP - 3

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T:\ESSE\Forms\[Test pit.XLS]TP-1

① NOT EXPECTED TO BE SHGW DUE TO CHANGE IN TEXTURE OF UNDERLYING MATERIAL.

TEST PIT LOG

PROJECT NAME/NO.	Wingate at Haverhill		TEST PIT NUMBER TP - 4
LOCATION	Haverhill, MA		
CLIENT	Wingate		GROUND SURFACE ELEVATION 123.62
CONTRACTOR	Pipeline	FOREMAN:	
OBSERVED BY	A. Peck	DATE 7/23/14	DEPTH TO GROUNDWATER BELOW SURFACE 121.79 (SHGW)
CHECKED BY		DATE	

DEPTH BELOW GROUND SURFACE (ft.)	TEST PIT DIAGRAM AND SOIL DESCRIPTION
0"	DENSE GRASS
10"	DARK BROWN SANDY LOAM
22"	MEDIUM BROWN SANDY LOAM
74"	GRAY SILT/CLAY W/ MOTTLES (VERY DENSE IN PLACE) POCKETS OF ANGULAR STONE
113"	VERY FINE SANDY LOAM W/ SOME GRAVEL (SIDES CAVING IN) POCKETS OF COARSE SAND

NOTES:
WEEPING GW @ 97"
STANDING GW @ 113"

TEST PIT NUMBER TP - 4

WESTON & SAMPSON ENGINEERS, INC.

T:\ESSE\Forms\[Test pit.XLS]TP-1

TEST PIT LOG

PROJECT NAME/NO.	Wingate at Haverhill		TEST PIT NUMBER TP - 5
LOCATION	Haverhill, MA		
CLIENT	Wingate		GROUND SURFACE ELEVATION 134.49
CONTRACTOR	Pipeline	FOREMAN:	
OBSERVED BY	A. Peck	DATE 7/23/14	DEPTH TO GROUNDWATER BELOW SURFACE 131.32 (SHGW)
CHECKED BY		DATE	

DEPTH BELOW GROUND SURFACE (ft.)	TEST PIT DIAGRAM AND SOIL DESCRIPTION
0	DENSE GRASS
12"	DARK BROWN SANDY LOAM
25"	MEDIUM BROWN SANDY LOAM
38"	MEDIUM BROWN VERY FINE SANDY LOAM W/ GRAVEL
94"	GREYISH BROWN VERY FINE SANDY LOAM W/ SILT MOTTLES PRESENT (FIRM IN PLACE)
	-BOTTOM OF TEST PIT-

NOTES:
WEEPING GW @ 83"
STANDING GW @ 94"

TEST PIT NUMBER
TP - 5

WESTON & SAMPSON ENGINEERS, INC.

T:\ESSE\Forms\[Test pit.XLS]TP-1

TEST PIT LOG

PROJECT NAME/NO.	Wingate at Haverhill		TEST PIT NUMBER TP - 5a
LOCATION	Haverhill, MA		
CLIENT	Wingate		GROUND SURFACE ELEVATION
CONTRACTOR	Pipeline	FOREMAN:	
OBSERVED BY	A. Peck	DATE 7/23/14	DEPTH TO GROUNDWATER BELOW SURFACE
CHECKED BY		DATE	

DEPTH BELOW GROUND SURFACE (ft.)	TEST PIT DIAGRAM AND SOIL DESCRIPTION
0"	DENSE BRUSH
	Fill
	* clay pipe (aban.) about 36" down
36"	
	DENSE LOAMY SAND w/ SILT w/ SOME COBBLES
78"	
	- BOTTOM OF TEST PIT -

NOTES:
- This test pit was done in the proposed roadway near TP5.

TEST PIT NUMBER TP - 5a

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TEST PIT LOG

PROJECT NAME/NO.	Wingate at Haverhill		TEST PIT NUMBER TP - 6
LOCATION	Haverhill, MA		
CLIENT	Wingate		GROUND SURFACE ELEVATION 104.09
CONTRACTOR	Pipeline	FOREMAN:	
OBSERVED BY	A. Peck	DATE 7/23/14	DEPTH TO GROUNDWATER BELOW SURFACE 100.09 (SHGW)
CHECKED BY		DATE	

DEPTH BELOW GROUND SURFACE (ft.)	TEST PIT DIAGRAM AND SOIL DESCRIPTION
0	DENSE GRASS
9"	DARK BROWN SANDY LOAM
48"	MEDIUM BROWN LOAMY SAND W/ GRAVEL
119"	GRAY SILTY/CLAY W/ MOTTLES (VERY FIRM IN PLACE)

NOTES:
WEEPING GW @ 89"
STANDING GW @ 119"

TEST PIT NUMBER TP - 6

WESTON & SAMPSON ENGINEERS, INC.

T:\ESSE\Forms\[Test pit.XLS]TP-1

TEST PIT LOG

PROJECT NAME/NO.	Wingate at Haverhill		TEST PIT NUMBER TP - 7
LOCATION	Haverhill, MA		
CLIENT	Wingate		GROUND SURFACE ELEVATION 107.74
CONTRACTOR	Pipeline	FOREMAN:	
OBSERVED BY	A. Peck	DATE 7/23/14	DEPTH TO GROUNDWATER BELOW SURFACE 105.99
CHECKED BY		DATE	

DEPTH BELOW GROUND SURFACE (ft.)	TEST PIT DIAGRAM AND SOIL DESCRIPTION
0"	DENSE GRASS
10"	DARK BROWN SANDY LOAM
21"	MEDIUM BROWN VERY FINE SANDY LOAM W/ SOME GRAVEL
48"	GRAY VERY FINE SANDY LOAM W/ SILT (FIRM IN PLACE)
54"	FRACTURED ROCK W/ VERY FINE SANDY LOAM (FIRM IN PLACE)
113"	VERY FINE SANDY LOAM W/SILT W/ ANGULAR COBBLES
	- BOTTOM OF TEST PIT -

NOTES:
WEEPING GW @ 96"
STANDING GW @ 113"

TEST PIT NUMBER TP - 7

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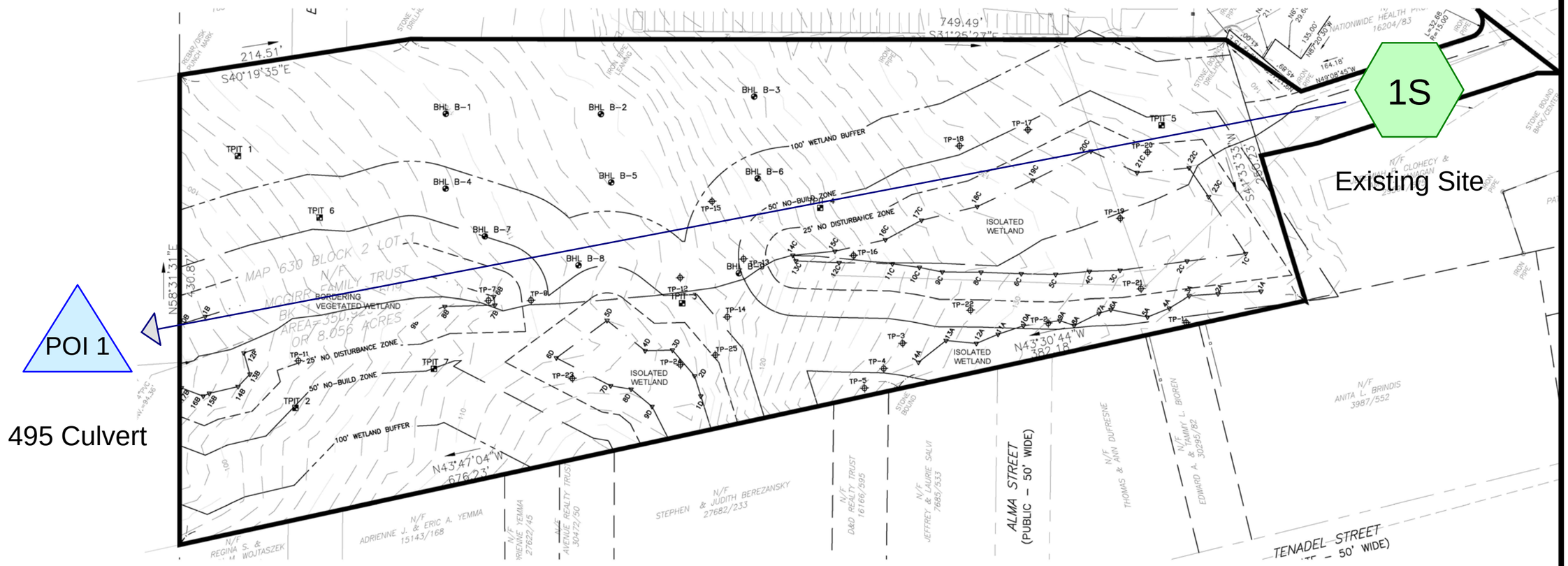
Appendix B

Wingate Residences Haverhill
Haverhill, MA

Pre-Development Conditions vs. Post-Development Conditions

Pre-Development Flows					Post-Development Flows				
Output Subcatchment/Reach	2 year storm 3.10 in Inflow (cfs)	10 year storm 4.50 in Inflow (cfs)	25 year storm 5.40 in Inflow (cfs)	100 year storm 6.50 in Inflow (cfs)	Output Subcatchment/Reach	2 year storm 3.10 in Inflow (cfs)	10 year storm 4.50 in Inflow (cfs)	25 year storm 5.40 in Inflow (cfs)	100 year storm 6.50 in Inflow (cfs)
Point of Interest 1 *495 Culvert*	0.17	2.16	4.52	8.22	Point of Interest 1 *495 Culvert*	0.15	1.50	3.67	8.10
Totals	0.17	2.16	4.52	8.22	**Totals**	0.15	1.50	3.67	8.10

Z:\MA-Foxboro-Projects\Haverhill\Wingate at Haverhill-xxxxxxxx\Stormwater\HydroCAD\[Pre vs Post storm flows 160310 imp areas.xls]Flow



Subcat Reach Pond Link

Routing Diagram for Haverhill Existing Model 160310

Prepared by Weston & Sampson, Printed 4/5/2016

HydroCAD® 10.00-11 s/n 00455 © 2014 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
7,513	61	>75% Grass cover, Good, HSG B (1S)
255,662	48	Brush, Good, HSG B (1S)
3,241	98	Paved driveway (1S)
100,100	55	Woods, Good, HSG B (1S)
366,516	**51**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
363,275	HSG B	1S
0	HSG C	
0	HSG D	
3,241	Other	1S
366,516		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sub Num
0	7,513	0	0	0	7,513	>75% Grass cover, Good	
0	255,662	0	0	0	255,662	Brush, Good	
0	0	0	0	3,241	3,241	Paved driveway	
0	100,100	0	0	0	100,100	Woods, Good	
0	**363,275**	**0**	**0**	**3,241**	**366,516**	**TOTAL AREA**	

Time span=1.00-24.00 hrs, dt=0.04 hrs, 576 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 1S: Existing Site Runoff Area=366,516 sf 0.88% Impervious Runoff Depth>0.13"
Flow Length=1,300' Tc=20.7 min CN=51 Runoff=0.17 cfs 3,881 cf

Pond POI 1: 495 Culvert Inflow=0.17 cfs 3,881 cf
Primary=0.17 cfs 3,881 cf

Total Runoff Area = 366,516 sf Runoff Volume = 3,881 cf Average Runoff Depth = 0.13"
99.12% Pervious = 363,275 sf 0.88% Impervious = 3,241 sf

Summary for Subcatchment 1S: Existing Site

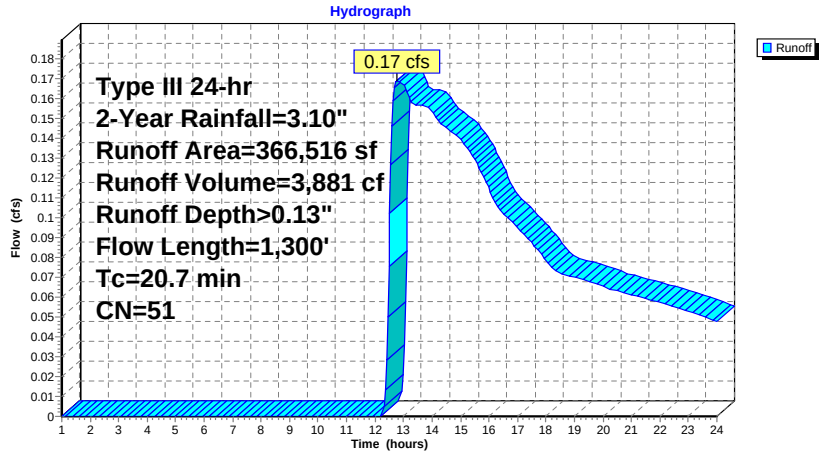
Runoff = 0.17 cfs @ 12.77 hrs, Volume= 3,881 cf, Depth> 0.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	3,241	98	Paved driveway
	100,100	55	Woods, Good, HSG B
	7,513	61	>75% Grass cover, Good, HSG B
	255,662	48	Brush, Good, HSG B
	366,516	51	Weighted Average
	363,275		99.12% Pervious Area
	3,241		0.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0350	1.69		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.4	109	0.0550	4.76		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.0	73	0.0616	1.24		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.6	54	0.0648	1.53		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
4.6	268	0.0261	0.97		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
5.1	386	0.0440	1.26		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
3.7	283	0.0451	1.27		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
4.3	27	0.0833	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
20.7	1,300	Total			

Subcatchment 1S: Existing Site

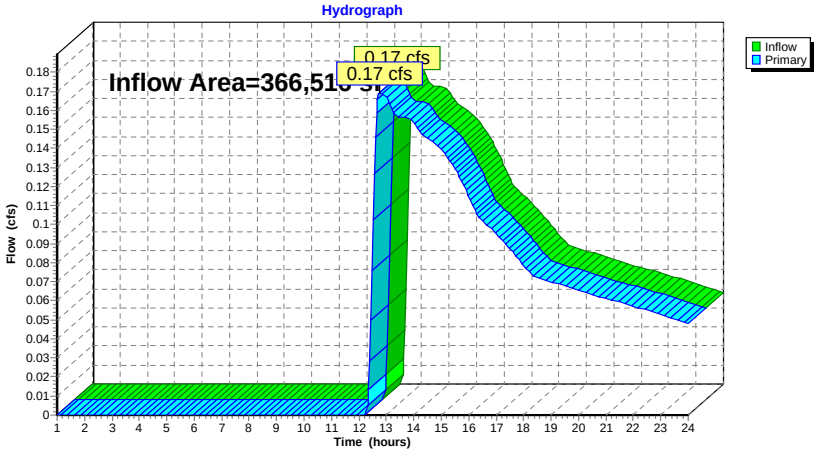


Summary for Pond POI 1: 495 Culvert

Inflow Area = 366,516 sf, 0.88% Impervious, Inflow Depth > 0.13" for 2-Year event
Inflow = 0.17 cfs @ 12.77 hrs, Volume= 3,881 cf
Primary = 0.17 cfs @ 12.77 hrs, Volume= 3,881 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3

Pond POI 1: 495 Culvert



Time span=1.00-24.00 hrs, dt=0.04 hrs, 576 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 1S: Existing Site Runoff Area=366,516 sf 0.88% Impervious Runoff Depth>0.54"
Flow Length=1,300' Tc=20.7 min CN=51 Runoff=2.16 cfs 16,527 cf

Pond POI 1: 495 Culvert Inflow=2.16 cfs 16,527 cf
Primary=2.16 cfs 16,527 cf

Total Runoff Area = 366,516 sf Runoff Volume = 16,527 cf Average Runoff Depth = 0.54"
99.12% Pervious = 363,275 sf 0.88% Impervious = 3,241 sf

Summary for Subcatchment 1S: Existing Site

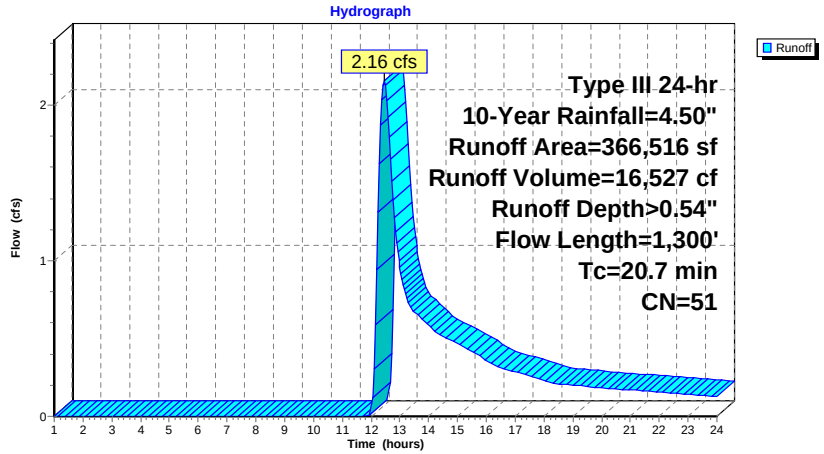
Runoff = 2.16 cfs @ 12.45 hrs, Volume= 16,527 cf, Depth> 0.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	3,241	98	Paved driveway
	100,100	55	Woods, Good, HSG B
	7,513	61	>75% Grass cover, Good, HSG B
	255,662	48	Brush, Good, HSG B
	366,516	51	Weighted Average
	363,275		99.12% Pervious Area
	3,241		0.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0350	1.69		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.4	109	0.0550	4.76		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.0	73	0.0616	1.24		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.6	54	0.0648	1.53		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
4.6	268	0.0261	0.97		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
5.1	386	0.0440	1.26		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
3.7	283	0.0451	1.27		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
4.3	27	0.0833	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
20.7	1,300	Total			

Subcatchment 1S: Existing Site

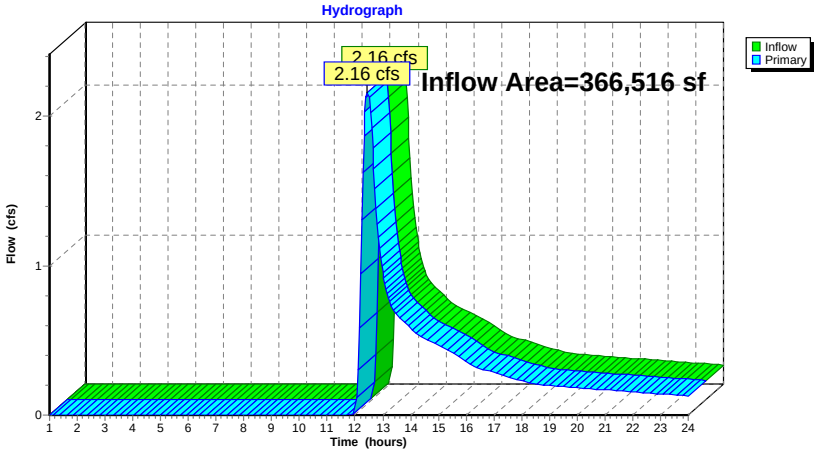


Summary for Pond POI 1: 495 Culvert

Inflow Area = 366,516 sf, 0.88% Impervious, Inflow Depth > 0.54" for 10-Year event
Inflow = 2.16 cfs @ 12.45 hrs, Volume= 16,527 cf
Primary = 2.16 cfs @ 12.45 hrs, Volume= 16,527 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3

Pond POI 1: 495 Culvert



Time span=1.00-24.00 hrs, dt=0.04 hrs, 576 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 1S: Existing Site Runoff Area=366,516 sf 0.88% Impervious Runoff Depth>0.92"
Flow Length=1,300' Tc=20.7 min CN=51 Runoff=4.52 cfs 28,041 cf

Pond POI 1: 495 Culvert Inflow=4.52 cfs 28,041 cf
Primary=4.52 cfs 28,041 cf

Total Runoff Area = 366,516 sf Runoff Volume = 28,041 cf Average Runoff Depth = 0.92"
99.12% Pervious = 363,275 sf 0.88% Impervious = 3,241 sf

Summary for Subcatchment 1S: Existing Site

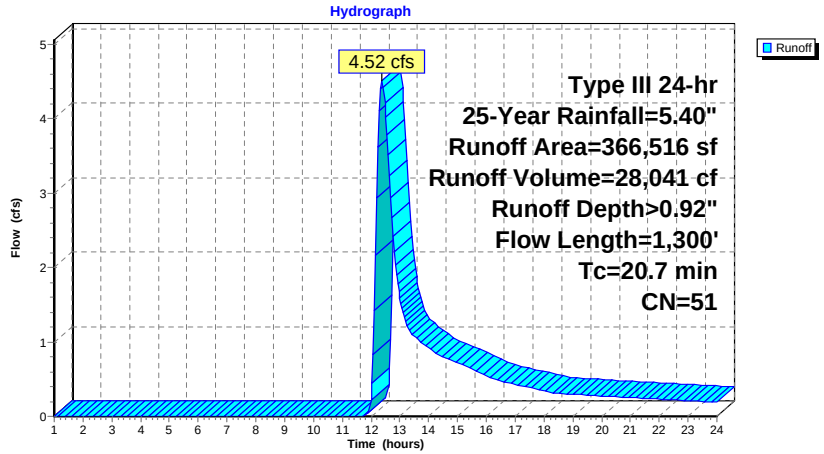
Runoff = 4.52 cfs @ 12.37 hrs, Volume= 28,041 cf, Depth> 0.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-Year Rainfall=5.40"

	Area (sf)	CN	Description
*	3,241	98	Paved driveway
	100,100	55	Woods, Good, HSG B
	7,513	61	>75% Grass cover, Good, HSG B
	255,662	48	Brush, Good, HSG B
	366,516	51	Weighted Average
	363,275		99.12% Pervious Area
	3,241		0.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0350	1.69		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.4	109	0.0550	4.76		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.0	73	0.0616	1.24		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.6	54	0.0648	1.53		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
4.6	268	0.0261	0.97		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
5.1	386	0.0440	1.26		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
3.7	283	0.0451	1.27		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
4.3	27	0.0833	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
20.7	1,300	Total			

Subcatchment 1S: Existing Site

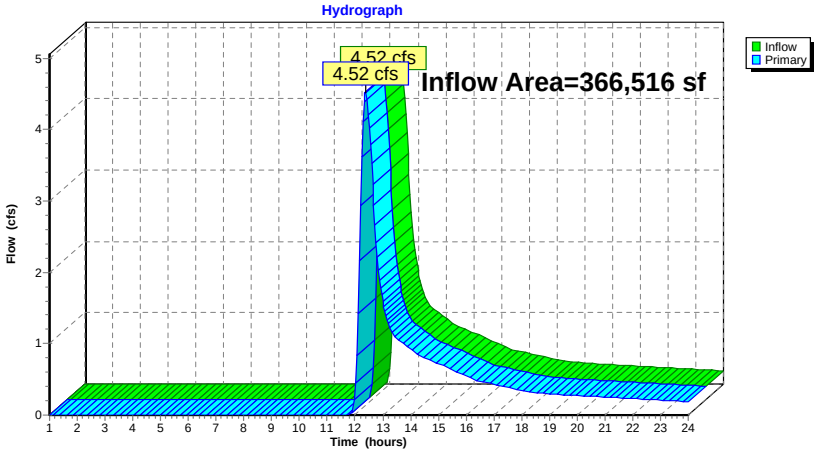


Summary for Pond POI 1: 495 Culvert

Inflow Area = 366,516 sf, 0.88% Impervious, Inflow Depth > 0.92" for 25-Year event
Inflow = 4.52 cfs @ 12.37 hrs, Volume= 28,041 cf
Primary = 4.52 cfs @ 12.37 hrs, Volume= 28,041 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3

Pond POI 1: 495 Culvert



Time span=1.00-24.00 hrs, dt=0.04 hrs, 576 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 1S: Existing Site Runoff Area=366,516 sf 0.88% Impervious Runoff Depth>1.47"
Flow Length=1,300' Tc=20.7 min CN=51 Runoff=8.22 cfs 44,851 cf

Pond POI 1: 495 Culvert Inflow=8.22 cfs 44,851 cf
Primary=8.22 cfs 44,851 cf

Total Runoff Area = 366,516 sf Runoff Volume = 44,851 cf Average Runoff Depth = 1.47"
99.12% Pervious = 363,275 sf 0.88% Impervious = 3,241 sf

Summary for Subcatchment 1S: Existing Site

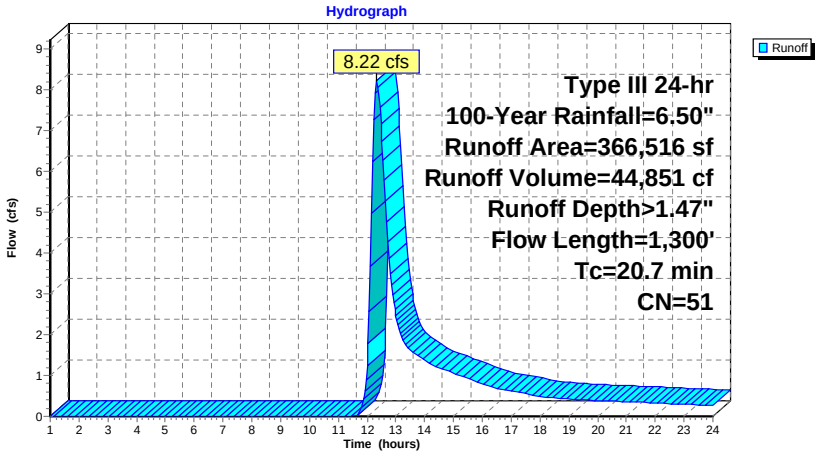
Runoff = 8.22 cfs @ 12.34 hrs, Volume= 44,851 cf, Depth> 1.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
*	3,241	98	Paved driveway
	100,100	55	Woods, Good, HSG B
	7,513	61	>75% Grass cover, Good, HSG B
	255,662	48	Brush, Good, HSG B
	366,516	51	Weighted Average
	363,275		99.12% Pervious Area
	3,241		0.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0350	1.69		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.4	109	0.0550	4.76		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.0	73	0.0616	1.24		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.6	54	0.0648	1.53		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
4.6	268	0.0261	0.97		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
5.1	386	0.0440	1.26		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
3.7	283	0.0451	1.27		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
4.3	27	0.0833	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
20.7	1,300	Total			

Subcatchment 1S: Existing Site

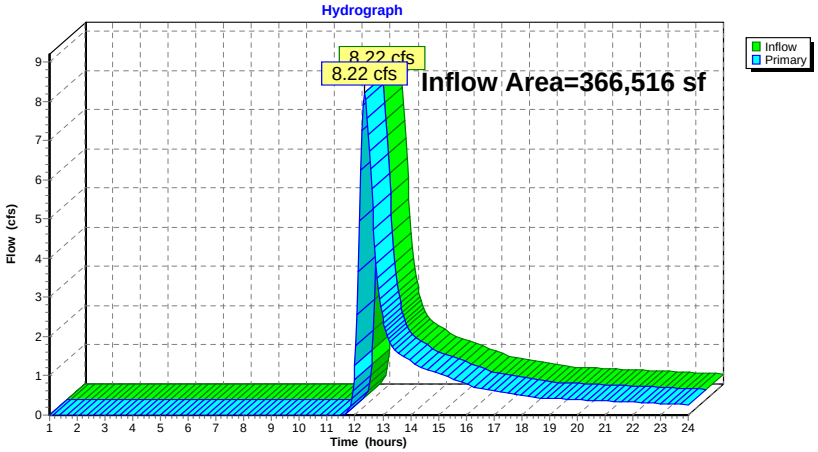


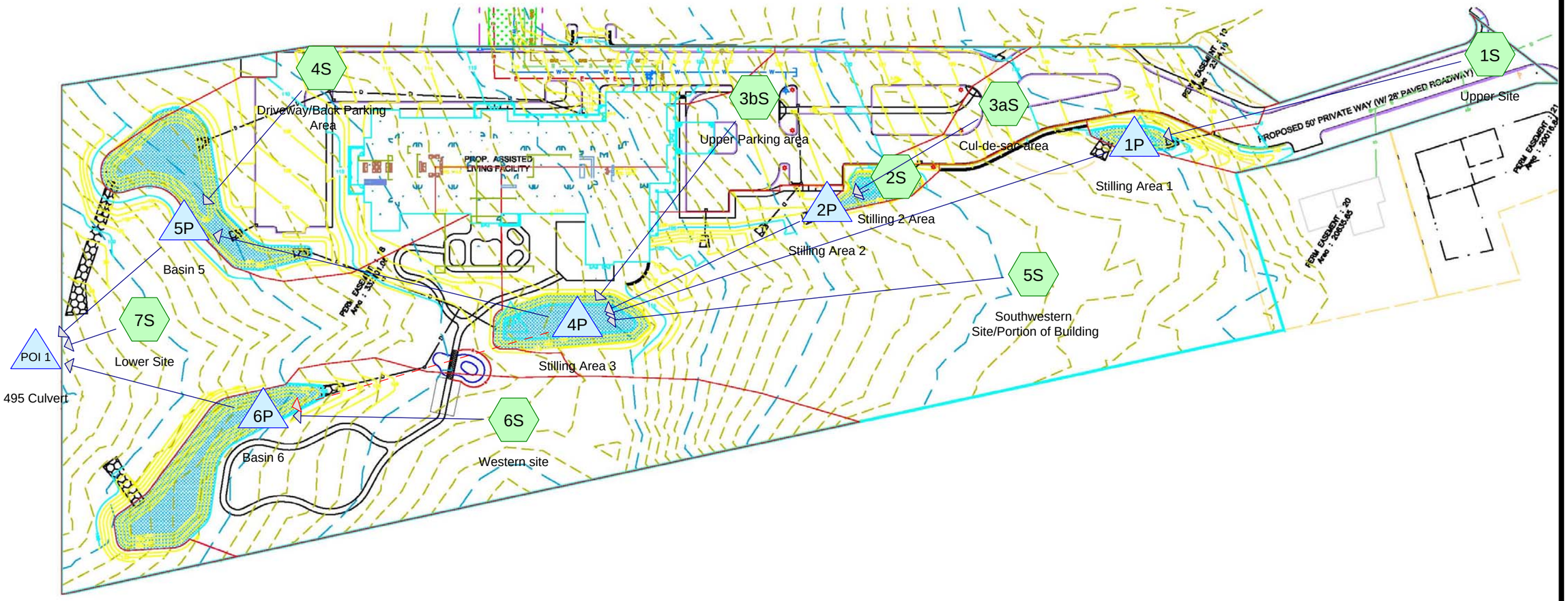
Summary for Pond POI 1: 495 Culvert

Inflow Area = 366,516 sf, 0.88% Impervious, Inflow Depth > 1.47" for 100-Year event
Inflow = 8.22 cfs @ 12.34 hrs, Volume= 44,851 cf
Primary = 8.22 cfs @ 12.34 hrs, Volume= 44,851 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3

Pond POI 1: 495 Culvert





Subcat Reach Pond Link

Routing Diagram for Haverhill Proposed Model 160310 imp ponds

Prepared by Weston & Sampson, Printed 4/22/2016

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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
89,143	61	>75% Grass cover, Good, HSG B (1S, 2S, 3aS, 3bS, 4S, 5S, 6S, 7S)
123,533	48	Brush, Good, HSG B (5S, 6S, 7S)
4,146	98	Concrete Pad and Roof Area (7S)
10,893	98	Impervious Area (5S)
31,954	98	Paved Area (3aS, 3bS)
7,292	98	Paved driveway (1S)
39,437	98	Roof and Paved Areas (4S)
20,868	98	Water Surface, 0% imp, HSG B (1S, 2S, 4S, 5S, 6S)
39,250	55	Woods, Good, HSG B (1S, 3aS, 5S, 6S, 7S)
366,516	**68**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
272,794	HSG B	1S, 2S, 3aS, 3bS, 4S, 5S, 6S, 7S
0	HSG C	
0	HSG D	
93,722	Other	1S, 3aS, 3bS, 4S, 5S, 7S
366,516		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
0	89,143	0	0	0	89,143	>75% Grass cover, Good
0	123,533	0	0	0	123,533	Brush, Good
0	0	0	0	4,146	4,146	Concrete Pad and Roof Area
0	0	0	0	10,893	10,893	Impervious Area
0	0	0	0	31,954	31,954	Paved Area
0	0	0	0	7,292	7,292	Paved driveway
0	0	0	0	39,437	39,437	Roof and Paved Areas
0	20,868	0	0	0	20,868	Water Surface, 0% imp
0	39,250	0	0	0	39,250	Woods, Good
0	**272,794**	**0**	**0**	**93,722**	**366,516**	**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	3bS	0.00	0.00	97.0	0.0100	0.013	12.0	0.0	0.0
2	4S	0.00	0.00	150.0	0.0100	0.013	12.0	0.0	0.0
3	5P	102.60	102.10	30.0	0.0167	0.013	8.0	0.0	0.0

Time span=1.00-24.00 hrs, dt=0.04 hrs, 576 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 1S: Upper Site Runoff Area=16,498 sf 44.20% Impervious Runoff Depth>1.33"
Flow Length=262' Tc=1.6 min CN=80 Runoff=0.66 cfs 1,822 cf

Subcatchment 2S: Stilling 2 Area Runoff Area=2,466 sf 0.00% Impervious Runoff Depth>1.67"
Tc=5.0 min CN=85 Runoff=0.11 cfs 343 cf

Subcatchment 3aS: Cul-de-sac area Runoff Area=16,775 sf 67.74% Impervious Runoff Depth>1.75"
Flow Length=283' Tc=10.4 min CN=86 Runoff=0.68 cfs 2,440 cf

Subcatchment 3bS: Upper Parking area Runoff Area=25,731 sf 80.02% Impervious Runoff Depth>2.16"
Flow Length=352' Tc=2.3 min CN=91 Runoff=1.65 cfs 4,640 cf

Subcatchment 4S: Driveway/Back Parking Runoff Area=63,112 sf 62.49% Impervious Runoff Depth>1.91"
Flow Length=529' Tc=2.6 min CN=88 Runoff=3.59 cfs 10,029 cf

Subcatchment 5S: Southwestern Runoff Area=113,375 sf 9.61% Impervious Runoff Depth>0.27"
Flow Length=596' Tc=28.4 min CN=57 Runoff=0.25 cfs 2,585 cf

Subcatchment 6S: Western site Runoff Area=56,561 sf 0.00% Impervious Runoff Depth>0.40"
Flow Length=486' Tc=18.5 min CN=61 Runoff=0.27 cfs 1,890 cf

Subcatchment 7S: Lower Site Runoff Area=71,998 sf 5.76% Impervious Runoff Depth>0.22"
Flow Length=379' Tc=15.2 min CN=55 Runoff=0.13 cfs 1,323 cf

Pond 1P: Stilling Area 1 Peak Elev=133.89' Storage=423 cf Inflow=0.66 cfs 1,822 cf
Discarded=0.02 cfs 674 cf Primary=0.57 cfs 851 cf Outflow=0.58 cfs 1,525 cf

Pond 2P: Stilling Area 2 Peak Elev=128.39' Storage=443 cf Inflow=0.76 cfs 2,783 cf
Discarded=0.03 cfs 1,397 cf Primary=0.67 cfs 1,387 cf Outflow=0.70 cfs 2,783 cf

Pond 4P: Stilling Area 3 Peak Elev=111.75' Storage=5,518 cf Inflow=2.27 cfs 9,463 cf
Primary=0.16 cfs 2,021 cf Secondary=0.16 cfs 2,021 cf Outflow=0.32 cfs 4,042 cf

Pond 5P: Basin 5 Peak Elev=102.80' Storage=6,456 cf Inflow=3.59 cfs 12,050 cf
Discarded=0.12 cfs 5,565 cf Primary=0.10 cfs 1,346 cf Outflow=0.22 cfs 6,911 cf

Pond 6P: Basin 6 Peak Elev=101.46' Storage=1,380 cf Inflow=0.27 cfs 3,911 cf
Discarded=0.08 cfs 3,217 cf Primary=0.00 cfs 0 cf Outflow=0.08 cfs 3,217 cf

Pond POI 1: 495 Culvert Inflow=0.15 cfs 2,669 cf
Primary=0.15 cfs 2,669 cf

Total Runoff Area = 366,516 sf Runoff Volume = 25,072 cf Average Runoff Depth = 0.82"
74.43% Pervious = 272,794 sf 25.57% Impervious = 93,722 sf

Summary for Subcatchment 1S: Upper Site

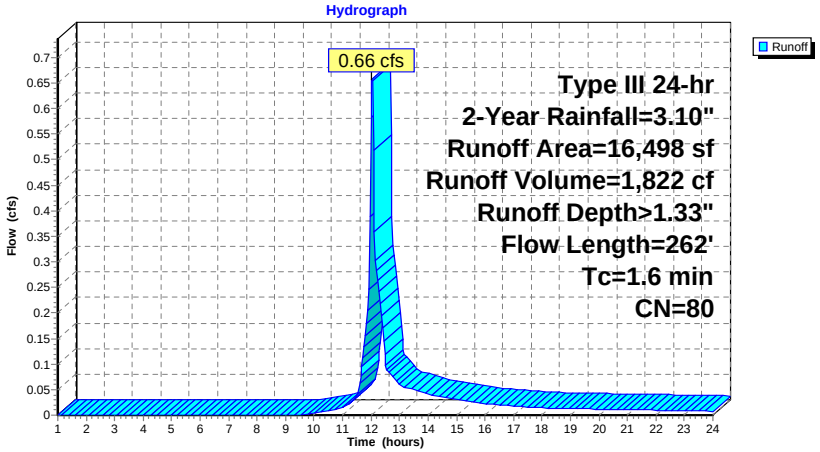
Runoff = 0.66 cfs @ 12.03 hrs, Volume= 1,822 cf, Depth> 1.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	7,292	98	Paved driveway
	354	55	Woods, Good, HSG B
	7,702	61	>75% Grass cover, Good, HSG B
	1,150	98	Water Surface, 0% imp, HSG B
	16,498	80	Weighted Average
	9,206		55.80% Pervious Area
	7,292		44.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0350	1.69		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.6	162	0.0482	4.46		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.6	262	Total			

Subcatchment 1S: Upper Site



Summary for Subcatchment 2S: Stilling 2 Area

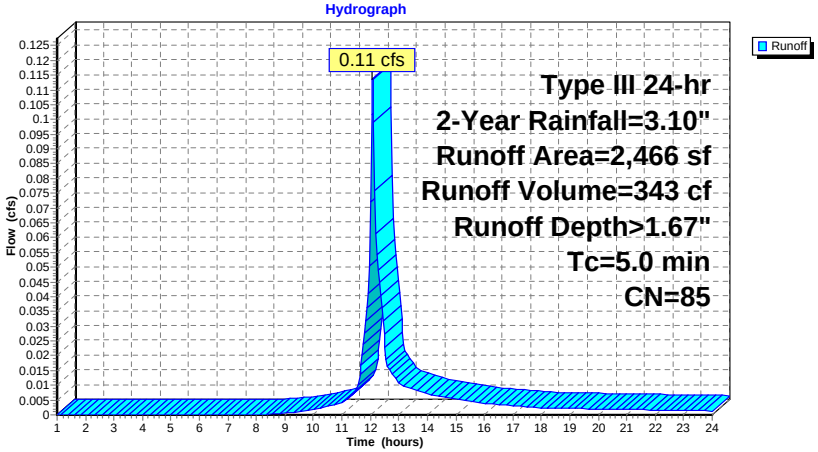
Runoff = 0.11 cfs @ 12.08 hrs, Volume= 343 cf, Depth> 1.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
880	61	>75% Grass cover, Good, HSG B
1,586	98	Water Surface, 0% imp, HSG B
2,466	85	Weighted Average
2,466		100.00% Pervious Area

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

Subcatchment 2S: Stilling 2 Area



Summary for Subcatchment 3aS: Cul-de-sac area

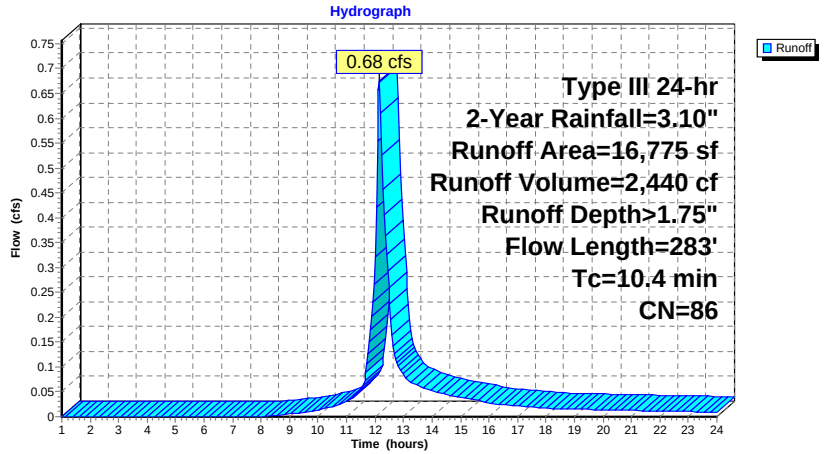
Runoff = 0.68 cfs @ 12.15 hrs, Volume= 2,440 cf, Depth> 1.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	11,363	98	Paved Area
	4,269	61	>75% Grass cover, Good, HSG B
	1,143	55	Woods, Good, HSG B
	16,775	86	Weighted Average
	5,412		32.26% Pervious Area
	11,363		67.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	16	0.0625	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
3.3	29	0.0259	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.7	55	0.0273	1.36		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.8	183	0.0353	3.81		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
10.4	283	Total			

Subcatchment 3aS: Cul-de-sac area



Summary for Subcatchment 3bS: Upper Parking area

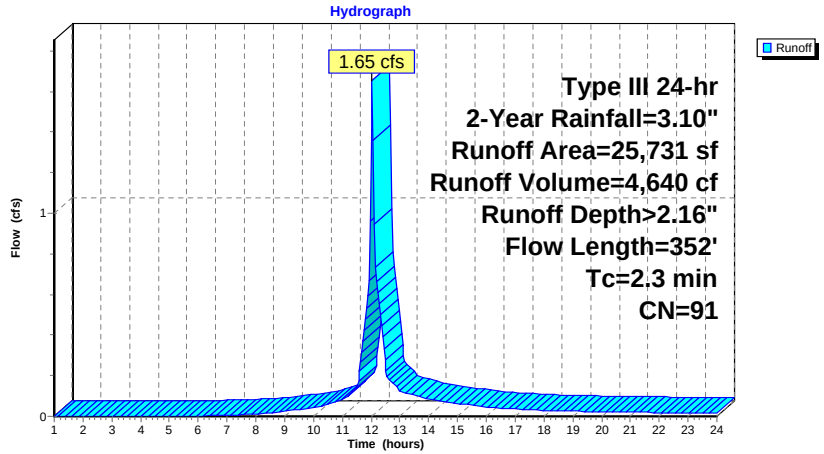
Runoff = 1.65 cfs @ 12.04 hrs, Volume= 4,640 cf, Depth> 2.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	20,591	98	Paved Area
	5,140	61	>75% Grass cover, Good, HSG B
	25,731	91	Weighted Average
	5,140		19.98% Pervious Area
	20,591		80.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	100	0.0400	1.79		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.3	68	0.0331	3.69		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	97	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.7	87	0.0080	2.12	7.07	**Parabolic Channel,** W=10.00' D=0.50' Area=3.3 sf Perim=10.1' n= 0.030 Earth, grassed & winding
2.3	352	Total			

Subcatchment 3bS: Upper Parking area



Summary for Subcatchment 4S: Driveway/Back Parking Area

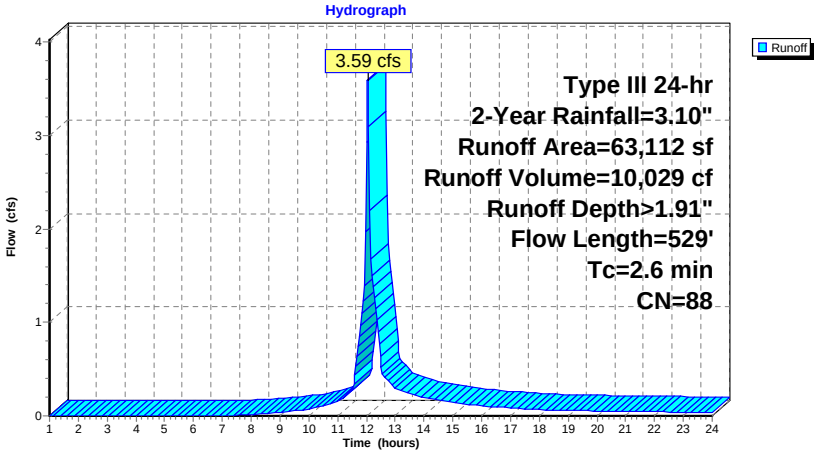
Runoff = 3.59 cfs @ 12.04 hrs, Volume= 10,029 cf, Depth> 1.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
	17,248	61	>75% Grass cover, Good, HSG B
*	39,437	98	Roof and Paved Areas
	6,427	98	Water Surface, 0% imp, HSG B
	63,112	88	Weighted Average
	23,675		37.51% Pervious Area
	39,437		62.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	100	0.0625	2.14		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
1.2	279	0.0358	3.84		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.6	150	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
2.6	529	Total			

Subcatchment 4S: Driveway/Back Parking Area



Summary for Subcatchment 5S: Southwestern Site/Portion of Building

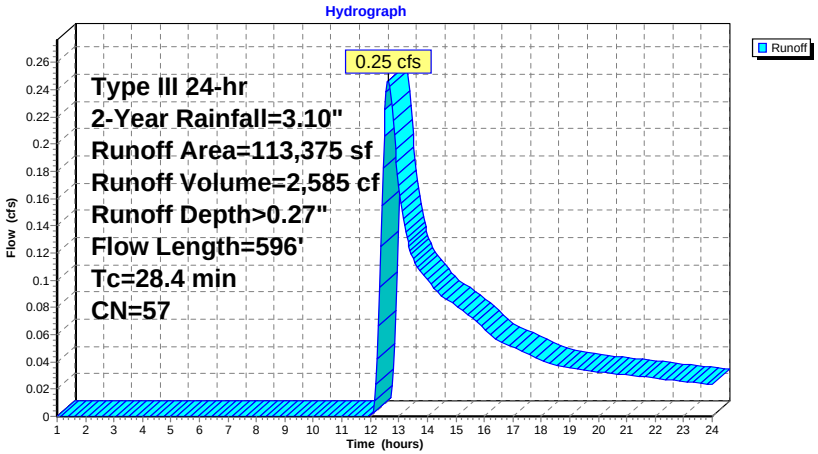
Runoff = 0.25 cfs @ 12.63 hrs, Volume= 2,585 cf, Depth> 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	10,893	98	Impervious Area
	9,507	55	Woods, Good, HSG B
	14,089	61	>75% Grass cover, Good, HSG B
	73,906	48	Brush, Good, HSG B
	4,980	98	Water Surface, 0% imp, HSG B
	113,375	57	Weighted Average
	102,482		90.39% Pervious Area
	10,893		9.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.3	100	0.0200	0.07		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 3.10"
4.1	258	0.0310	1.06		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
1.4	113	0.0531	1.38		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
0.6	125	0.0560	3.55		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
28.4	596	Total			

Subcatchment 5S: Southwestern Site/Portion of Building



Summary for Subcatchment 6S: Western site

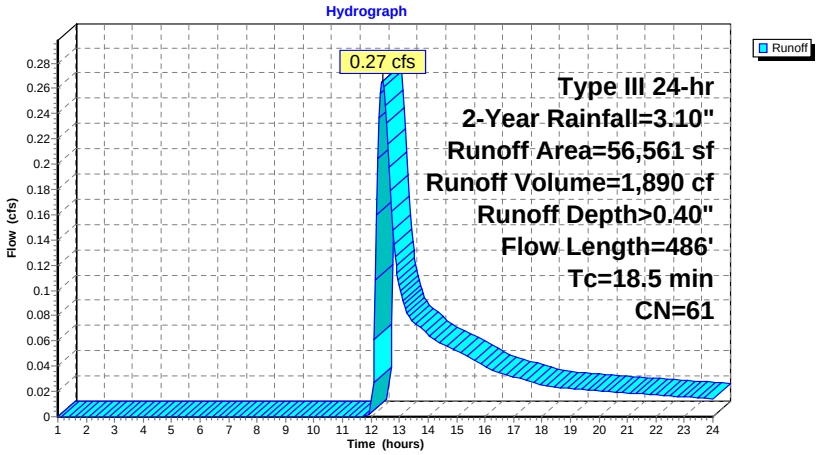
Runoff = 0.27 cfs @ 12.39 hrs, Volume= 1,890 cf, Depth> 0.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
20,354	61	>75% Grass cover, Good, HSG B
17,237	55	Woods, Good, HSG B
12,245	48	Brush, Good, HSG B
6,725	98	Water Surface, 0% imp, HSG B
56,561	61	Weighted Average
56,561		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	61	0.0738	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
6.6	39	0.0641	0.10		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 3.10"
2.2	209	0.0502	1.57		**Shallow Concentrated Flow, Heavy Brush** Kv= 7.0 fps
1.0	177	0.0396	2.98		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
18.5	486	Total			

Subcatchment 6S: Western site



Summary for Subcatchment 7S: Lower Site

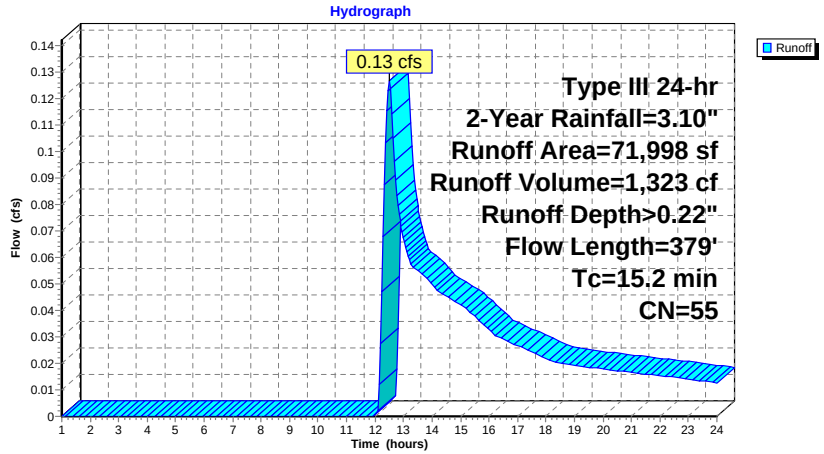
Runoff = 0.13 cfs @ 12.49 hrs, Volume= 1,323 cf, Depth> 0.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	4,146	98	Concrete Pad and Roof Area
	11,009	55	Woods, Good, HSG B
	19,461	61	>75% Grass cover, Good, HSG B
	37,382	48	Brush, Good, HSG B
	71,998	55	Weighted Average
	67,852		94.24% Pervious Area
	4,146		5.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	61	0.0787	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
8.1	39	0.0385	0.08		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 3.10"
2.9	253	0.0435	1.46		**Shallow Concentrated Flow, Heavy Brush** Kv= 7.0 fps
0.3	26	0.0769	1.39		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.2	379	Total			

Subcatchment 7S: Lower Site



Summary for Pond 1P: Stilling Area 1

Inflow Area = 16,498 sf, 44.20% Impervious, Inflow Depth > 1.33" for 2-Year event
Inflow = 0.66 cfs @ 12.03 hrs, Volume= 1,822 cf
Outflow = 0.58 cfs @ 12.09 hrs, Volume= 1,525 cf, Atten= 11%, Lag= 3.4 min
Discarded = 0.02 cfs @ 12.09 hrs, Volume= 674 cf
Primary = 0.57 cfs @ 12.09 hrs, Volume= 851 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3
Peak Elev= 133.89' @ 12.09 hrs Surf.Area= 643 sf Storage= 423 cf

Plug-Flow detention time= 124.9 min calculated for 1,525 cf (84% of inflow)
Center-of-Mass det. time= 55.1 min (895.3 - 840.3)

Volume	Invert	Avail.Storage	Storage Description
#1	133.00'	1,407 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

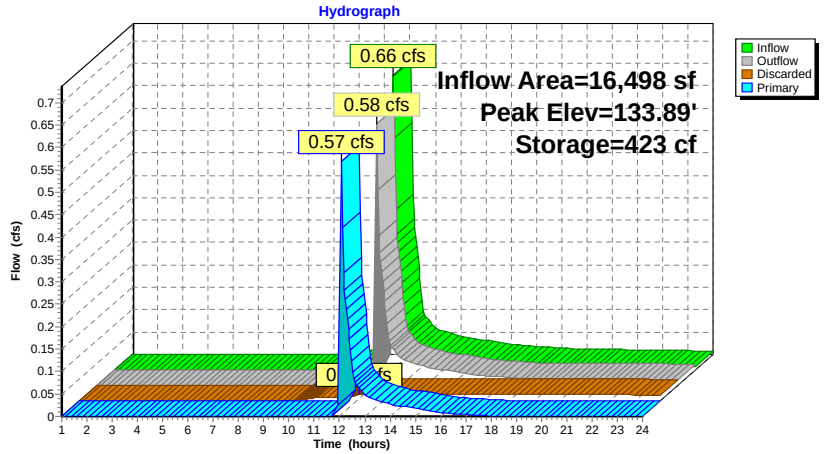
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
133.00	326	0	0	326
134.00	690	497	497	698
135.00	1,150	910	1,407	1,171

Device	Routing	Invert	Outlet Devices
#1	Primary	133.80'	**8.0' long x 15.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Discarded	133.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.02 cfs @ 12.09 hrs HW=133.88' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.52 cfs @ 12.09 hrs HW=133.88' TW=110.77' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 0.52 cfs @ 0.77 fps)

Pond 1P: Stilling Area 1



Summary for Pond 2P: Stilling Area 2

Inflow Area = 19,241 sf, 59.06% Impervious, Inflow Depth > 1.74" for 2-Year event
Inflow = 0.76 cfs @ 12.14 hrs, Volume= 2,783 cf
Outflow = 0.70 cfs @ 12.19 hrs, Volume= 2,783 cf, Atten= 9%, Lag= 3.4 min
Discarded = 0.03 cfs @ 12.19 hrs, Volume= 1,397 cf
Primary = 0.67 cfs @ 12.19 hrs, Volume= 1,387 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3
Peak Elev= 128.39' @ 12.19 hrs Surf.Area= 1,247 sf Storage= 443 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 58.8 min (885.6 - 826.8)

Volume	Invert	Avail.Storage	Storage Description
#1	128.00'	1,312 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

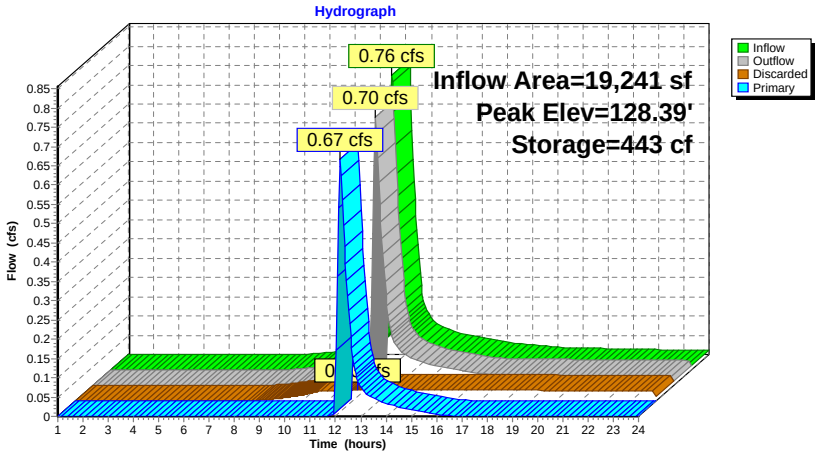
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
128.00	1,055	0	0	1,055
129.00	1,587	1,312	1,312	1,602

Device	Routing	Invert	Outlet Devices
#1	Primary	128.25'	**5.0' long x 190.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Discarded	128.00'	**1.020 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.03 cfs @ 12.19 hrs HW=128.38' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.66 cfs @ 12.19 hrs HW=128.38' TW=110.99' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 0.66 cfs @ 0.98 fps)

Pond 2P: Stilling Area 2



Summary for Pond 4P: Stilling Area 3

Inflow Area = 174,845 sf, 28.68% Impervious, Inflow Depth > 0.65" for 2-Year event
Inflow = 2.27 cfs @ 12.08 hrs, Volume= 9,463 cf
Outflow = 0.32 cfs @ 13.39 hrs, Volume= 4,042 cf, Atten= 86%, Lag= 78.5 min
Primary = 0.16 cfs @ 13.39 hrs, Volume= 2,021 cf
Secondary = 0.16 cfs @ 13.39 hrs, Volume= 2,021 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3
Peak Elev= 111.75' @ 13.39 hrs Surf.Area= 3,870 sf Storage= 5,518 cf

Plug-Flow detention time= 285.9 min calculated for 4,035 cf (43% of inflow)
Center-of-Mass det. time= 158.0 min (995.0 - 837.0)

Volume	Invert	Avail.Storage	Storage Description
#1	110.00'	11,027 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

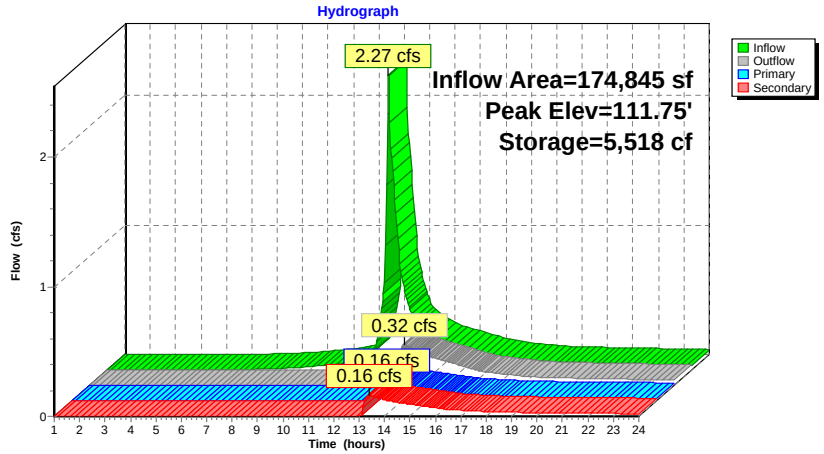
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
110.00	2,448	0	0
111.00	3,235	2,842	2,842
112.00	4,078	3,657	6,498
113.00	4,980	4,529	11,027

Device	Routing	Invert	Outlet Devices
#1	Primary	111.72'	**24.0" x 24.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	111.72'	**24.0" x 24.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.16 cfs @ 13.39 hrs HW=111.75' TW=102.63' (Dynamic Tailwater)
└**1=Grate** (Weir Controls 0.16 cfs @ 0.60 fps)

Secondary OutFlow Max=0.16 cfs @ 13.39 hrs HW=111.75' TW=101.18' (Dynamic Tailwater)
└**2=Grate** (Weir Controls 0.16 cfs @ 0.60 fps)

Pond 4P: Stilling Area 3



Summary for Pond 5P: Basin 5

Inflow Area = 237,957 sf, 37.64% Impervious, Inflow Depth > 0.61" for 2-Year event
Inflow = 3.59 cfs @ 12.04 hrs, Volume= 12,050 cf
Outflow = 0.22 cfs @ 15.29 hrs, Volume= 6,911 cf, Atten= 94%, Lag= 194.6 min
Discarded = 0.12 cfs @ 15.29 hrs, Volume= 5,565 cf
Primary = 0.10 cfs @ 15.29 hrs, Volume= 1,346 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3
Peak Elev= 102.80' @ 15.29 hrs Surf.Area= 4,943 sf Storage= 6,456 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 162.4 min (1,006.0 - 843.6)

Volume	Invert	Avail.Storage	Storage Description
#1	101.00'	21,055 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

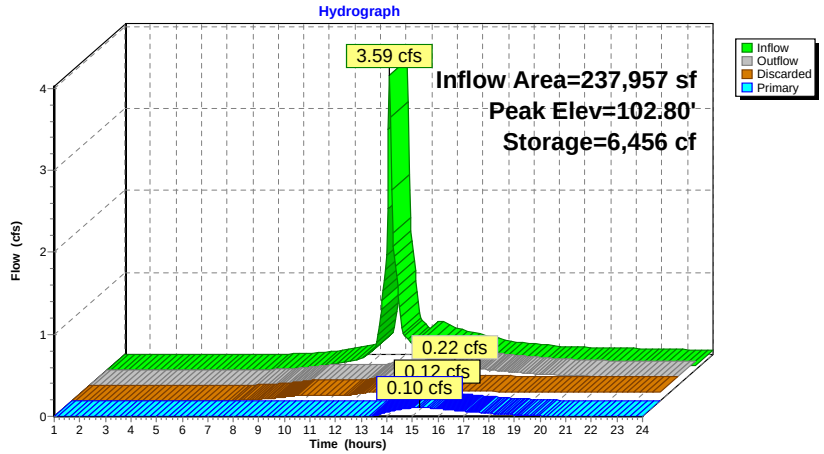
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
101.00	2,700	0	0	2,700
102.00	3,510	3,096	3,096	3,534
103.00	5,343	4,395	7,491	5,382
104.00	6,781	6,048	13,538	6,846
105.00	8,276	7,516	21,055	8,372

Device	Routing	Invert	Outlet Devices
#1	Primary	103.75'	**10.0' long x 80.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Discarded	101.00'	**1.020 in/hr Exfiltration over Wetted area**
#3	Primary	102.60'	**8.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 102.60' / 102.10' S= 0.0167 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.12 cfs @ 15.29 hrs HW=102.80' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=0.10 cfs @ 15.29 hrs HW=102.80' TW=0.00' (Dynamic Tailwater)
├**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Culvert** (Inlet Controls 0.10 cfs @ 1.20 fps)

Pond 5P: Basin 5



Summary for Pond 6P: Basin 6

Inflow Area = 56,561 sf, 0.00% Impervious, Inflow Depth > 0.83" for 2-Year event
Inflow = 0.27 cfs @ 12.39 hrs, Volume= 3,911 cf
Outflow = 0.08 cfs @ 17.03 hrs, Volume= 3,217 cf, Atten= 71%, Lag= 278.1 min
Discarded = 0.08 cfs @ 17.03 hrs, Volume= 3,217 cf
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3
Peak Elev= 101.46' @ 17.03 hrs Surf.Area= 3,301 sf Storage= 1,380 cf

Plug-Flow detention time= 194.7 min calculated for 3,217 cf (82% of inflow)
Center-of-Mass det. time= 123.1 min (1,085.2 - 962.1)

Volume	Invert	Avail.Storage	Storage Description
#1	101.00'	21,468 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

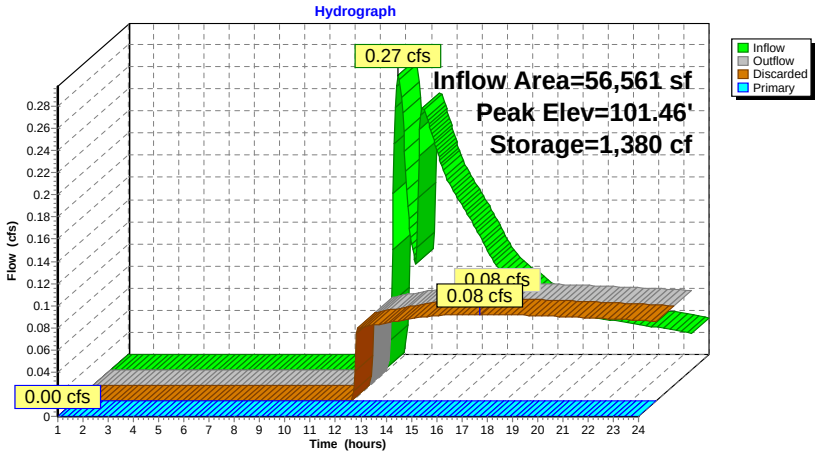
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
101.00	2,767	0	0	2,767
102.00	4,002	3,366	3,366	4,019
103.00	5,320	4,645	8,011	5,359
104.00	6,725	6,009	14,020	6,790
105.00	8,195	7,448	21,468	8,292

Device	Routing	Invert	Outlet Devices
#1	Discarded	101.00'	**1.020 in/hr Exfiltration over Wetted area**
#2	Primary	103.85'	**10.0' long x 43.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.08 cfs @ 17.03 hrs HW=101.46' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=101.00' TW=0.00' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: Basin 6

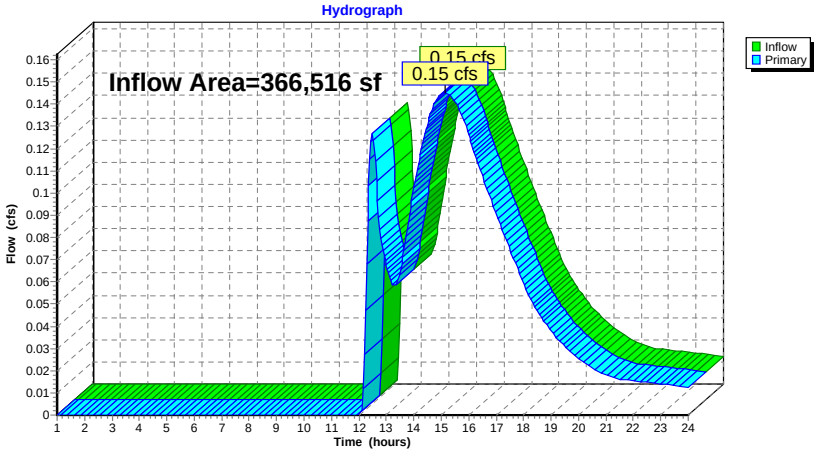


Summary for Pond POI 1: 495 Culvert

Inflow Area = 366,516 sf, 25.57% Impervious, Inflow Depth > 0.09" for 2-Year event
Inflow = 0.15 cfs @ 15.14 hrs, Volume= 2,669 cf
Primary = 0.15 cfs @ 15.14 hrs, Volume= 2,669 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3

Pond POI 1: 495 Culvert



Time span=1.00-24.00 hrs, dt=0.04 hrs, 576 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 1S: Upper Site Runoff Area=16,498 sf 44.20% Impervious Runoff Depth>2.46"
Flow Length=262' Tc=1.6 min CN=80 Runoff=1.23 cfs 3,384 cf

Subcatchment 2S: Stilling 2 Area Runoff Area=2,466 sf 0.00% Impervious Runoff Depth>2.91"
Tc=5.0 min CN=85 Runoff=0.20 cfs 597 cf

Subcatchment 3aS: Cul-de-sac area Runoff Area=16,775 sf 67.74% Impervious Runoff Depth>3.00"
Flow Length=283' Tc=10.4 min CN=86 Runoff=1.15 cfs 4,191 cf

Subcatchment 3bS: Upper Parking area Runoff Area=25,731 sf 80.02% Impervious Runoff Depth>3.50"
Flow Length=352' Tc=2.3 min CN=91 Runoff=2.61 cfs 7,499 cf

Subcatchment 4S: Driveway/Back Parking Runoff Area=63,112 sf 62.49% Impervious Runoff Depth>3.20"
Flow Length=529' Tc=2.6 min CN=88 Runoff=5.92 cfs 16,806 cf

Subcatchment 5S: Southwestern Runoff Area=113,375 sf 9.61% Impervious Runoff Depth>0.84"
Flow Length=596' Tc=28.4 min CN=57 Runoff=1.20 cfs 7,948 cf

Subcatchment 6S: Western site Runoff Area=56,561 sf 0.00% Impervious Runoff Depth>1.07"
Flow Length=486' Tc=18.5 min CN=61 Runoff=0.99 cfs 5,060 cf

Subcatchment 7S: Lower Site Runoff Area=71,998 sf 5.76% Impervious Runoff Depth>0.74"
Flow Length=379' Tc=15.2 min CN=55 Runoff=0.77 cfs 4,432 cf

Pond 1P: Stilling Area 1 Peak Elev=133.94' Storage=459 cf Inflow=1.23 cfs 3,384 cf
Discarded=0.02 cfs 739 cf Primary=1.18 cfs 2,281 cf Outflow=1.20 cfs 3,020 cf

Pond 2P: Stilling Area 2 Peak Elev=128.45' Storage=526 cf Inflow=1.31 cfs 4,789 cf
Discarded=0.03 cfs 1,563 cf Primary=1.21 cfs 3,060 cf Outflow=1.24 cfs 4,623 cf

Pond 4P: Stilling Area 3 Peak Elev=111.87' Storage=5,973 cf Inflow=4.57 cfs 20,789 cf
Primary=1.51 cfs 7,675 cf Secondary=1.51 cfs 7,675 cf Outflow=3.03 cfs 15,351 cf

Pond 5P: Basin 5 Peak Elev=103.48' Storage=10,227 cf Inflow=5.92 cfs 24,481 cf
Discarded=0.14 cfs 6,424 cf Primary=0.98 cfs 12,282 cf Outflow=1.13 cfs 18,706 cf

Pond 6P: Basin 6 Peak Elev=103.03' Storage=8,173 cf Inflow=2.50 cfs 12,735 cf
Discarded=0.13 cfs 5,287 cf Primary=0.00 cfs 0 cf Outflow=0.13 cfs 5,287 cf

Pond POI 1: 495 Culvert Inflow=1.50 cfs 16,714 cf
Primary=1.50 cfs 16,714 cf

Total Runoff Area = 366,516 sf Runoff Volume = 49,918 cf Average Runoff Depth = 1.63"
74.43% Pervious = 272,794 sf 25.57% Impervious = 93,722 sf

Summary for Subcatchment 1S: Upper Site

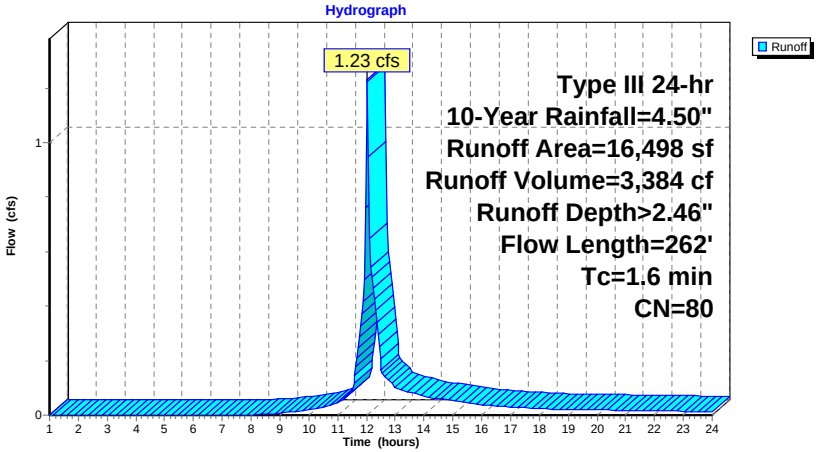
Runoff = 1.23 cfs @ 12.03 hrs, Volume= 3,384 cf, Depth> 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	7,292	98	Paved driveway
	354	55	Woods, Good, HSG B
	7,702	61	>75% Grass cover, Good, HSG B
	1,150	98	Water Surface, 0% imp, HSG B
	16,498	80	Weighted Average
	9,206		55.80% Pervious Area
	7,292		44.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0350	1.69		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.6	162	0.0482	4.46		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.6	262	Total			

Subcatchment 1S: Upper Site



Summary for Subcatchment 2S: Stilling 2 Area

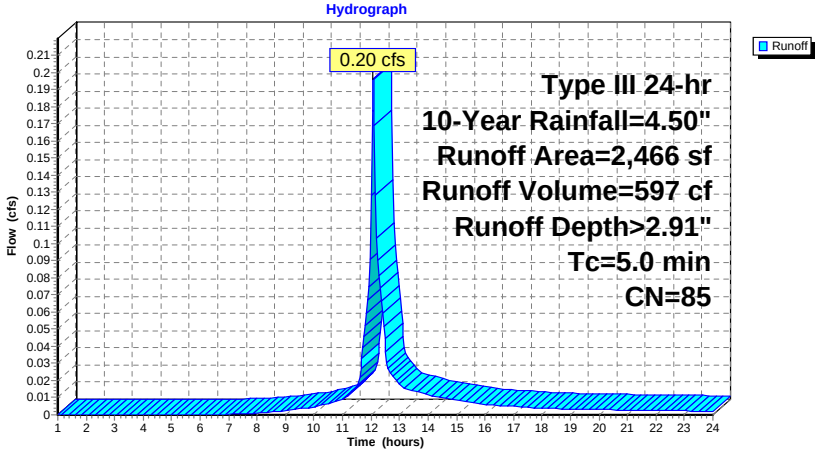
Runoff = 0.20 cfs @ 12.08 hrs, Volume= 597 cf, Depth> 2.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
880	61	>75% Grass cover, Good, HSG B
1,586	98	Water Surface, 0% imp, HSG B
2,466	85	Weighted Average
2,466		100.00% Pervious Area

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

Subcatchment 2S: Stilling 2 Area



Summary for Subcatchment 3aS: Cul-de-sac area

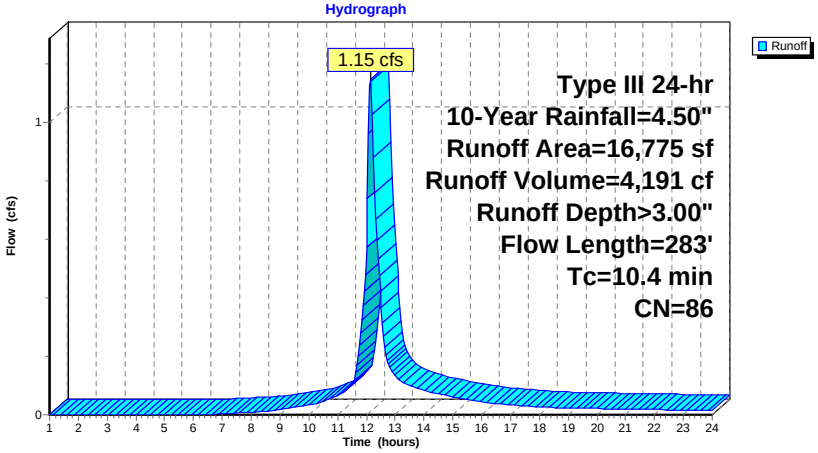
Runoff = 1.15 cfs @ 12.14 hrs, Volume= 4,191 cf, Depth> 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	11,363	98	Paved Area
	4,269	61	>75% Grass cover, Good, HSG B
	1,143	55	Woods, Good, HSG B
	16,775	86	Weighted Average
	5,412		32.26% Pervious Area
	11,363		67.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	16	0.0625	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
3.3	29	0.0259	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.7	55	0.0273	1.36		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.8	183	0.0353	3.81		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
10.4	283	Total			

Subcatchment 3aS: Cul-de-sac area



Summary for Subcatchment 3bS: Upper Parking area

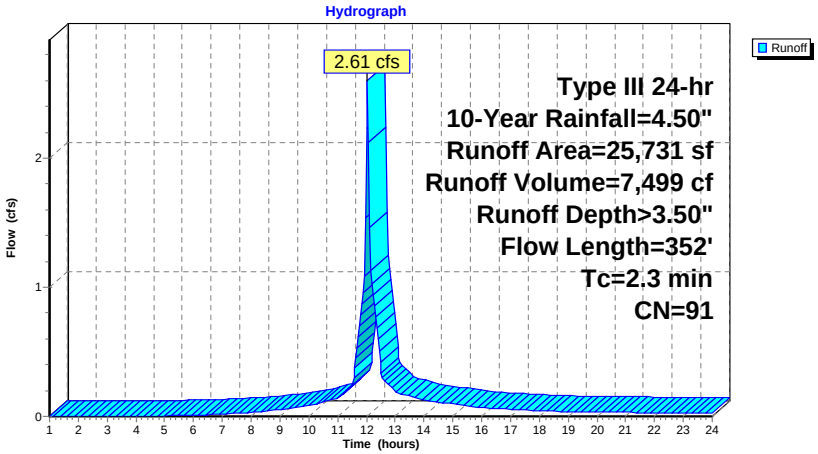
Runoff = 2.61 cfs @ 12.04 hrs, Volume= 7,499 cf, Depth> 3.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	20,591	98	Paved Area
	5,140	61	>75% Grass cover, Good, HSG B
	25,731	91	Weighted Average
	5,140		19.98% Pervious Area
	20,591		80.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	100	0.0400	1.79		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.3	68	0.0331	3.69		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	97	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.7	87	0.0080	2.12	7.07	**Parabolic Channel,** W=10.00' D=0.50' Area=3.3 sf Perim=10.1' n= 0.030 Earth, grassed & winding
2.3	352	Total			

Subcatchment 3bS: Upper Parking area



Summary for Subcatchment 4S: Driveway/Back Parking Area

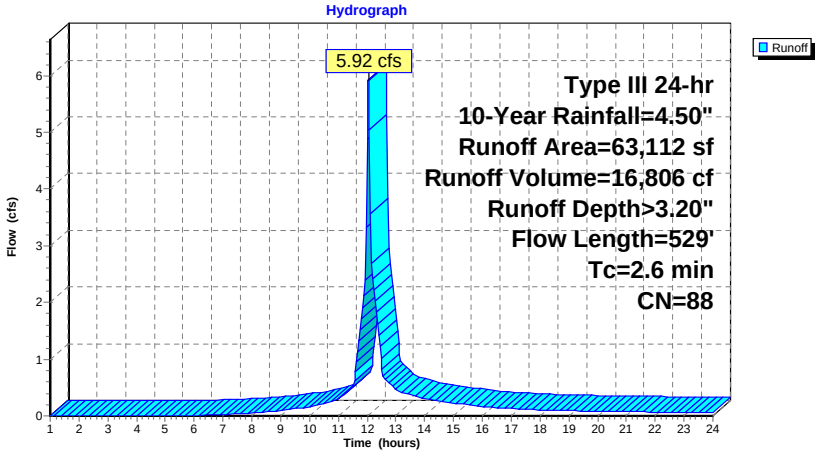
Runoff = 5.92 cfs @ 12.04 hrs, Volume= 16,806 cf, Depth> 3.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
	17,248	61	>75% Grass cover, Good, HSG B
*	39,437	98	Roof and Paved Areas
	6,427	98	Water Surface, 0% imp, HSG B
	63,112	88	Weighted Average
	23,675		37.51% Pervious Area
	39,437		62.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	100	0.0625	2.14		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
1.2	279	0.0358	3.84		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.6	150	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
2.6	529	Total			

Subcatchment 4S: Driveway/Back Parking Area



Summary for Subcatchment 5S: Southwestern Site/Portion of Building

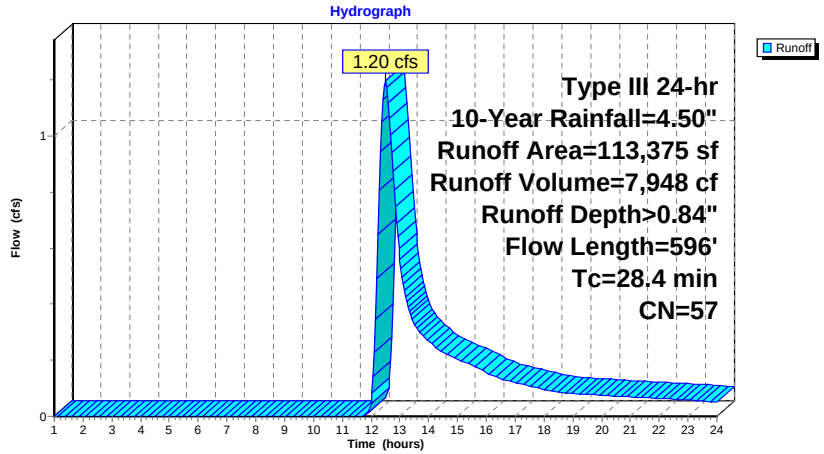
Runoff = 1.20 cfs @ 12.49 hrs, Volume= 7,948 cf, Depth> 0.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	10,893	98	Impervious Area
	9,507	55	Woods, Good, HSG B
	14,089	61	>75% Grass cover, Good, HSG B
	73,906	48	Brush, Good, HSG B
	4,980	98	Water Surface, 0% imp, HSG B
	113,375	57	Weighted Average
	102,482		90.39% Pervious Area
	10,893		9.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.3	100	0.0200	0.07		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 3.10"
4.1	258	0.0310	1.06		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
1.4	113	0.0531	1.38		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
0.6	125	0.0560	3.55		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
28.4	596	Total			

Subcatchment 5S: Southwestern Site/Portion of Building



Summary for Subcatchment 6S: Western site

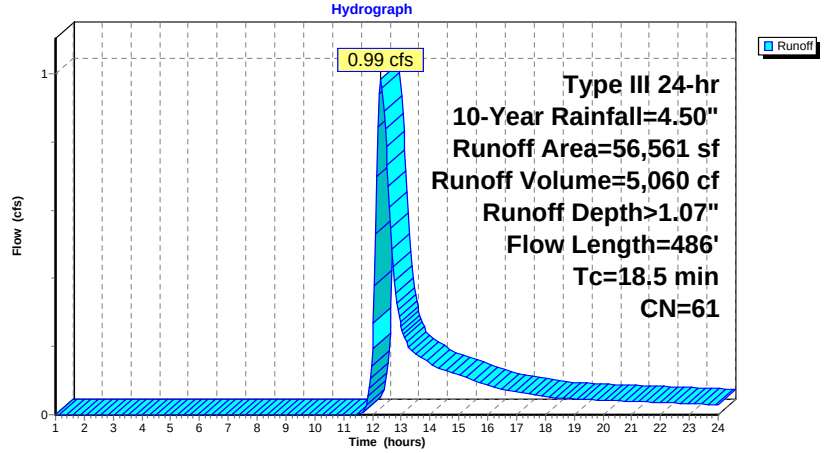
Runoff = 0.99 cfs @ 12.29 hrs, Volume= 5,060 cf, Depth> 1.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
20,354	61	>75% Grass cover, Good, HSG B
17,237	55	Woods, Good, HSG B
12,245	48	Brush, Good, HSG B
6,725	98	Water Surface, 0% imp, HSG B
56,561	61	Weighted Average
56,561		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	61	0.0738	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
6.6	39	0.0641	0.10		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 3.10"
2.2	209	0.0502	1.57		**Shallow Concentrated Flow, Heavy Brush** Kv= 7.0 fps
1.0	177	0.0396	2.98		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
18.5	486	Total			

Subcatchment 6S: Western site



Summary for Subcatchment 7S: Lower Site

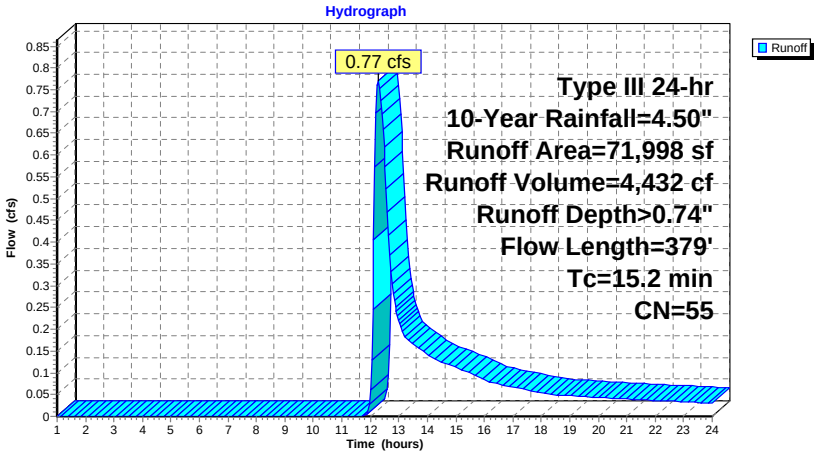
Runoff = 0.77 cfs @ 12.28 hrs, Volume= 4,432 cf, Depth> 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	4,146	98	Concrete Pad and Roof Area
	11,009	55	Woods, Good, HSG B
	19,461	61	>75% Grass cover, Good, HSG B
	37,382	48	Brush, Good, HSG B
	71,998	55	Weighted Average
	67,852		94.24% Pervious Area
	4,146		5.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	61	0.0787	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
8.1	39	0.0385	0.08		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 3.10"
2.9	253	0.0435	1.46		**Shallow Concentrated Flow, Heavy Brush** Kv= 7.0 fps
0.3	26	0.0769	1.39		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.2	379	Total			

Subcatchment 7S: Lower Site



Summary for Pond 1P: Stilling Area 1

Inflow Area = 16,498 sf, 44.20% Impervious, Inflow Depth > 2.46" for 10-Year event
Inflow = 1.23 cfs @ 12.03 hrs, Volume= 3,384 cf
Outflow = 1.20 cfs @ 12.05 hrs, Volume= 3,020 cf, Atten= 3%, Lag= 0.9 min
Discarded = 0.02 cfs @ 12.05 hrs, Volume= 739 cf
Primary = 1.18 cfs @ 12.05 hrs, Volume= 2,281 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3
Peak Elev= 133.94' @ 12.05 hrs Surf.Area= 666 sf Storage= 459 cf

Plug-Flow detention time= 71.5 min calculated for 3,015 cf (89% of inflow)
Center-of-Mass det. time= 20.6 min (842.9 - 822.3)

Volume	Invert	Avail.Storage	Storage Description
#1	133.00'	1,407 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

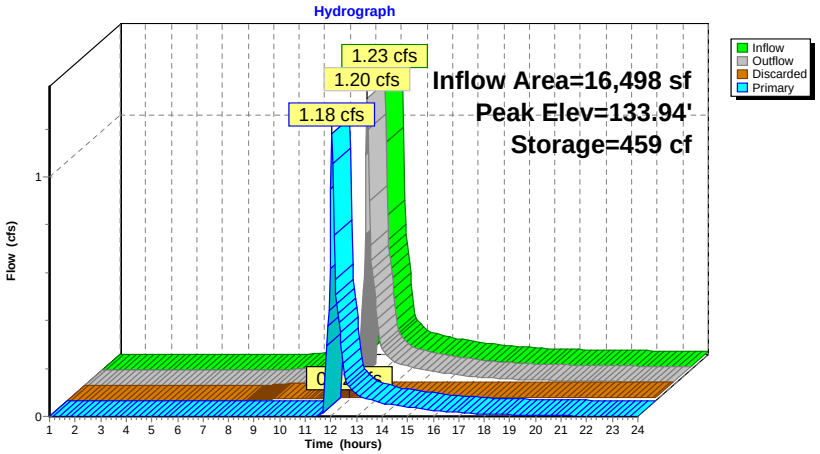
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
133.00	326	0	0	326
134.00	690	497	497	698
135.00	1,150	910	1,407	1,171

Device	Routing	Invert	Outlet Devices
#1	Primary	133.80'	**8.0' long x 15.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Discarded	133.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.02 cfs @ 12.05 hrs HW=133.94' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=1.16 cfs @ 12.05 hrs HW=133.94' TW=111.35' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 1.16 cfs @ 1.01 fps)

Pond 1P: Stilling Area 1



Summary for Pond 2P: Stilling Area 2

Inflow Area =	19,241 sf, 59.06% Impervious, Inflow Depth > 2.99" for 10-Year event				
Inflow =	1.31 cfs @	12.13 hrs,	Volume=	4,789 cf	
Outflow =	1.24 cfs @	12.17 hrs,	Volume=	4,623 cf,	Atten= 5%, Lag= 2.5 min
Discarded =	0.03 cfs @	12.17 hrs,	Volume=	1,563 cf	
Primary =	1.21 cfs @	12.17 hrs,	Volume=	3,060 cf	

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3
Peak Elev= 128.45' @ 12.17 hrs Surf.Area= 1,281 sf Storage= 526 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 25.7 min (837.0 - 811.4)

Volume	Invert	Avail.Storage	Storage Description
#1	128.00'	1,312 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

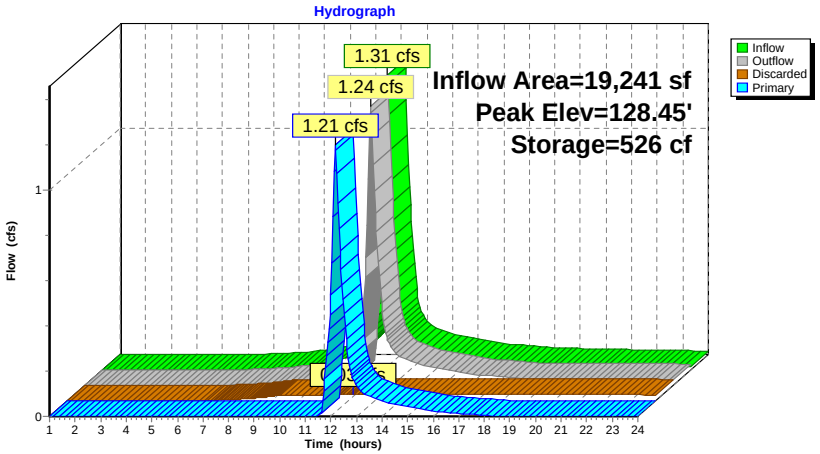
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
128.00	1,055	0	0	1,055
129.00	1,587	1,312	1,312	1,602

Device	Routing	Invert	Outlet Devices
#1	Primary	128.25'	**5.0' long x 190.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Discarded	128.00'	**1.020 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.03 cfs @ 12.17 hrs HW=128.45' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=1.19 cfs @ 12.17 hrs HW=128.45' TW=111.79' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 1.19 cfs @ 1.20 fps)

Pond 2P: Stilling Area 2



Summary for Pond 4P: Stilling Area 3

Inflow Area =	174,845 sf, 28.68% Impervious, Inflow Depth > 1.43" for 10-Year event				
Inflow =	4.57 cfs @	12.05 hrs,	Volume=	20,789 cf	
Outflow =	3.03 cfs @	12.30 hrs,	Volume=	15,351 cf,	Atten= 34%, Lag= 14.9 min
Primary =	1.51 cfs @	12.30 hrs,	Volume=	7,675 cf	
Secondary =	1.51 cfs @	12.30 hrs,	Volume=	7,675 cf	

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3
Peak Elev= 111.87' @ 12.30 hrs Surf.Area= 3,968 sf Storage= 5,973 cf

Plug-Flow detention time= 141.3 min calculated for 15,351 cf (74% of inflow)
Center-of-Mass det. time= 54.3 min (886.2 - 831.8)

Volume	Invert	Avail.Storage	Storage Description
#1	110.00'	11,027 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

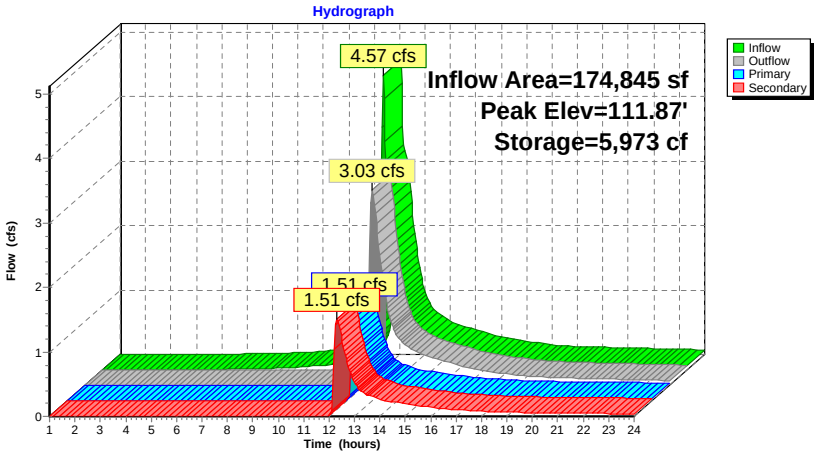
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
110.00	2,448	0	0
111.00	3,235	2,842	2,842
112.00	4,078	3,657	6,498
113.00	4,980	4,529	11,027

Device	Routing	Invert	Outlet Devices
#1	Primary	111.72'	**24.0" x 24.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	111.72'	**24.0" x 24.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.50 cfs @ 12.30 hrs HW=111.87' TW=103.14' (Dynamic Tailwater)
└**1=Grate** (Weir Controls 1.50 cfs @ 1.26 fps)

Secondary OutFlow Max=1.50 cfs @ 12.30 hrs HW=111.87' TW=101.40' (Dynamic Tailwater)
└**2=Grate** (Weir Controls 1.50 cfs @ 1.26 fps)

Pond 4P: Stilling Area 3



Summary for Pond 5P: Basin 5

Inflow Area = 237,957 sf, 37.64% Impervious, Inflow Depth > 1.23" for 10-Year event
Inflow = 5.92 cfs @ 12.04 hrs, Volume= 24,481 cf
Outflow = 1.13 cfs @ 12.90 hrs, Volume= 18,706 cf, Atten= 81%, Lag= 51.6 min
Discarded = 0.14 cfs @ 12.90 hrs, Volume= 6,424 cf
Primary = 0.98 cfs @ 12.90 hrs, Volume= 12,282 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3
Peak Elev= 103.48' @ 12.90 hrs Surf.Area= 6,015 sf Storage= 10,227 cf

Plug-Flow detention time= 176.8 min calculated for 18,706 cf (76% of inflow)
Center-of-Mass det. time= 91.3 min (917.2 - 825.9)

Volume	Invert	Avail.Storage	Storage Description
#1	101.00'	21,055 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

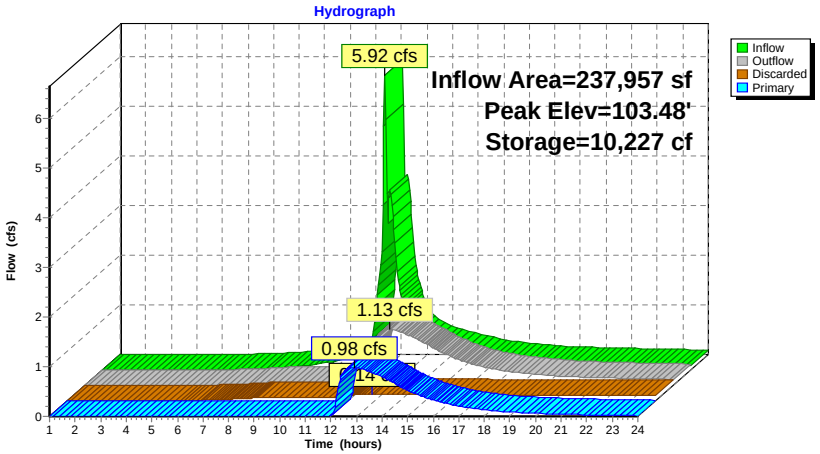
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
101.00	2,700	0	0	2,700
102.00	3,510	3,096	3,096	3,534
103.00	5,343	4,395	7,491	5,382
104.00	6,781	6,048	13,538	6,846
105.00	8,276	7,516	21,055	8,372

Device	Routing	Invert	Outlet Devices
#1	Primary	103.75'	**10.0' long x 80.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Discarded	101.00'	**1.020 in/hr Exfiltration over Wetted area**
#3	Primary	102.60'	**8.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 102.60' / 102.10' S= 0.0167 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.14 cfs @ 12.90 hrs HW=103.48' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.14 cfs)

Primary OutFlow Max=0.98 cfs @ 12.90 hrs HW=103.48' TW=0.00' (Dynamic Tailwater)
├─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└─**3=Culvert** (Inlet Controls 0.98 cfs @ 2.82 fps)

Pond 5P: Basin 5



Summary for Pond 6P: Basin 6

Inflow Area = 56,561 sf, 0.00% Impervious, Inflow Depth > 2.70" for 10-Year event
Inflow = 2.50 cfs @ 12.30 hrs, Volume= 12,735 cf
Outflow = 0.13 cfs @ 18.13 hrs, Volume= 5,287 cf, Atten= 95%, Lag= 349.8 min
Discarded = 0.13 cfs @ 18.13 hrs, Volume= 5,287 cf
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3
Peak Elev= 103.03' @ 18.13 hrs Surf.Area= 5,360 sf Storage= 8,173 cf

Plug-Flow detention time= 339.5 min calculated for 5,278 cf (41% of inflow)
Center-of-Mass det. time= 201.5 min (1,088.8 - 887.3)

Volume	Invert	Avail.Storage	Storage Description
#1	101.00'	21,468 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

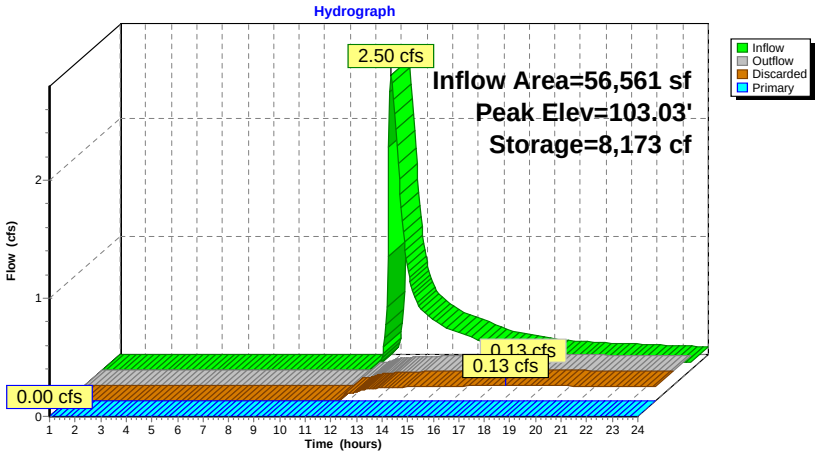
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
101.00	2,767	0	0	2,767
102.00	4,002	3,366	3,366	4,019
103.00	5,320	4,645	8,011	5,359
104.00	6,725	6,009	14,020	6,790
105.00	8,195	7,448	21,468	8,292

Device	Routing	Invert	Outlet Devices
#1	Discarded	101.00'	**1.020 in/hr Exfiltration over Wetted area**
#2	Primary	103.85'	**10.0' long x 43.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.13 cfs @ 18.13 hrs HW=103.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=101.00' TW=0.00' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: Basin 6

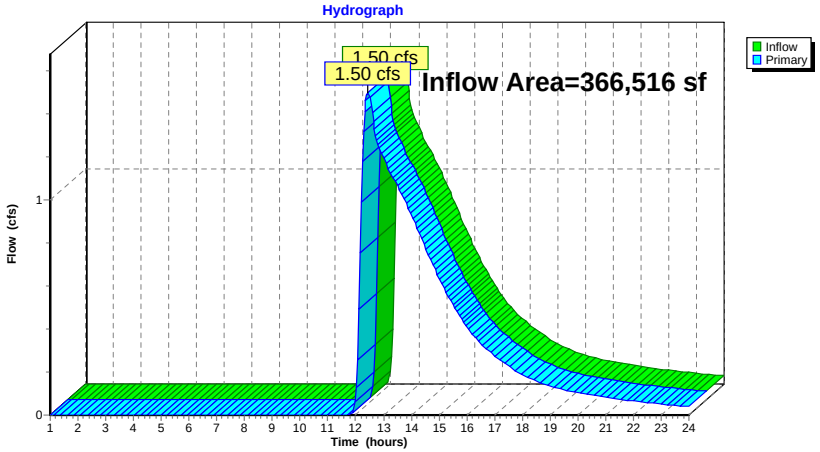


Summary for Pond POI 1: 495 Culvert

Inflow Area = 366,516 sf, 25.57% Impervious, Inflow Depth > 0.55" for 10-Year event
Inflow = 1.50 cfs @ 12.45 hrs, Volume= 16,714 cf
Primary = 1.50 cfs @ 12.45 hrs, Volume= 16,714 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3

Pond POI 1: 495 Culvert



Time span=1.00-24.00 hrs, dt=0.04 hrs, 576 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 1S: Upper Site Runoff Area=16,498 sf 44.20% Impervious Runoff Depth>3.24"
Flow Length=262' Tc=1.6 min CN=80 Runoff=1.62 cfs 4,460 cf

Subcatchment 2S: Stilling 2 Area Runoff Area=2,466 sf 0.00% Impervious Runoff Depth>3.74"
Tc=5.0 min CN=85 Runoff=0.25 cfs 768 cf

Subcatchment 3aS: Cul-de-sac area Runoff Area=16,775 sf 67.74% Impervious Runoff Depth>3.84"
Flow Length=283' Tc=10.4 min CN=86 Runoff=1.46 cfs 5,362 cf

Subcatchment 3bS: Upper Parking area Runoff Area=25,731 sf 80.02% Impervious Runoff Depth>4.37"
Flow Length=352' Tc=2.3 min CN=91 Runoff=3.22 cfs 9,371 cf

Subcatchment 4S: Driveway/Back Parking Runoff Area=63,112 sf 62.49% Impervious Runoff Depth>4.05"
Flow Length=529' Tc=2.6 min CN=88 Runoff=7.42 cfs 21,296 cf

Subcatchment 5S: Southwestern Runoff Area=113,375 sf 9.61% Impervious Runoff Depth>1.31"
Flow Length=596' Tc=28.4 min CN=57 Runoff=2.06 cfs 12,404 cf

Subcatchment 6S: Western site Runoff Area=56,561 sf 0.00% Impervious Runoff Depth>1.61"
Flow Length=486' Tc=18.5 min CN=61 Runoff=1.58 cfs 7,577 cf

Subcatchment 7S: Lower Site Runoff Area=71,998 sf 5.76% Impervious Runoff Depth>1.18"
Flow Length=379' Tc=15.2 min CN=55 Runoff=1.44 cfs 7,083 cf

Pond 1P: Stilling Area 1 Peak Elev=133.97' Storage=480 cf Inflow=1.62 cfs 4,460 cf
Discarded=0.02 cfs 773 cf Primary=1.57 cfs 3,319 cf Outflow=1.58 cfs 4,092 cf

Pond 2P: Stilling Area 2 Peak Elev=128.49' Storage=573 cf Inflow=1.66 cfs 6,130 cf
Discarded=0.03 cfs 1,644 cf Primary=1.55 cfs 4,254 cf Outflow=1.58 cfs 5,898 cf

Pond 4P: Stilling Area 3 Peak Elev=111.93' Storage=6,210 cf Inflow=6.03 cfs 29,349 cf
Primary=2.50 cfs 11,950 cf Secondary=2.50 cfs 11,950 cf Outflow=4.99 cfs 23,900 cf

Pond 5P: Basin 5 Peak Elev=103.89' Storage=12,794 cf Inflow=8.40 cfs 33,246 cf
Discarded=0.16 cfs 6,863 cf Primary=2.68 cfs 20,384 cf Outflow=2.84 cfs 27,246 cf

Pond 6P: Basin 6 Peak Elev=103.87' Storage=13,172 cf Inflow=3.79 cfs 19,527 cf
Discarded=0.16 cfs 6,548 cf Primary=0.09 cfs 547 cf Outflow=0.24 cfs 7,095 cf

Pond POI 1: 495 Culvert Inflow=3.67 cfs 28,013 cf
Primary=3.67 cfs 28,013 cf

Total Runoff Area = 366,516 sf Runoff Volume = 68,322 cf Average Runoff Depth = 2.24"
74.43% Pervious = 272,794 sf 25.57% Impervious = 93,722 sf

Summary for Subcatchment 1S: Upper Site

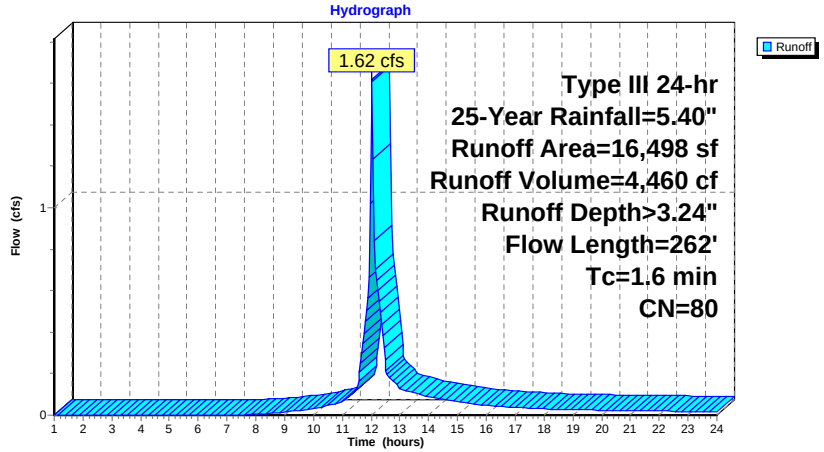
Runoff = 1.62 cfs @ 12.03 hrs, Volume= 4,460 cf, Depth> 3.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-Year Rainfall=5.40"

	Area (sf)	CN	Description
*	7,292	98	Paved driveway
	354	55	Woods, Good, HSG B
	7,702	61	>75% Grass cover, Good, HSG B
	1,150	98	Water Surface, 0% imp, HSG B
	16,498	80	Weighted Average
	9,206		55.80% Pervious Area
	7,292		44.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0350	1.69		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.6	162	0.0482	4.46		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.6	262	Total			

Subcatchment 1S: Upper Site



Summary for Subcatchment 2S: Stilling 2 Area

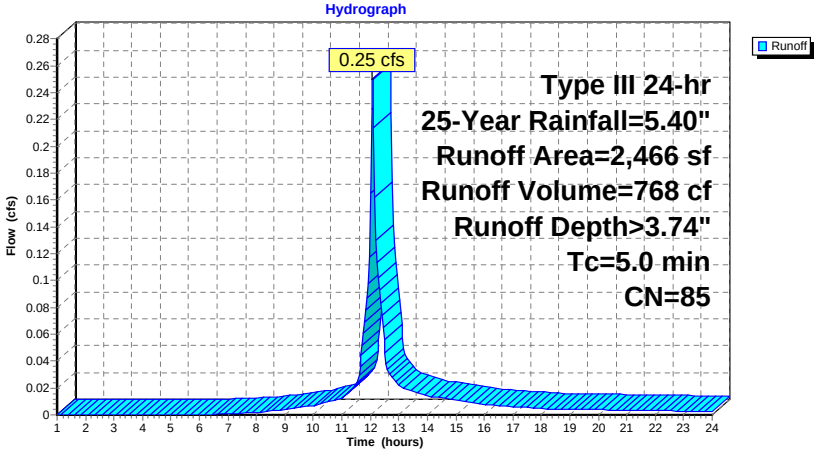
Runoff = 0.25 cfs @ 12.08 hrs, Volume= 768 cf, Depth> 3.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
880	61	>75% Grass cover, Good, HSG B
1,586	98	Water Surface, 0% imp, HSG B
2,466	85	Weighted Average
2,466		100.00% Pervious Area

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

Subcatchment 2S: Stilling 2 Area



Summary for Subcatchment 3aS: Cul-de-sac area

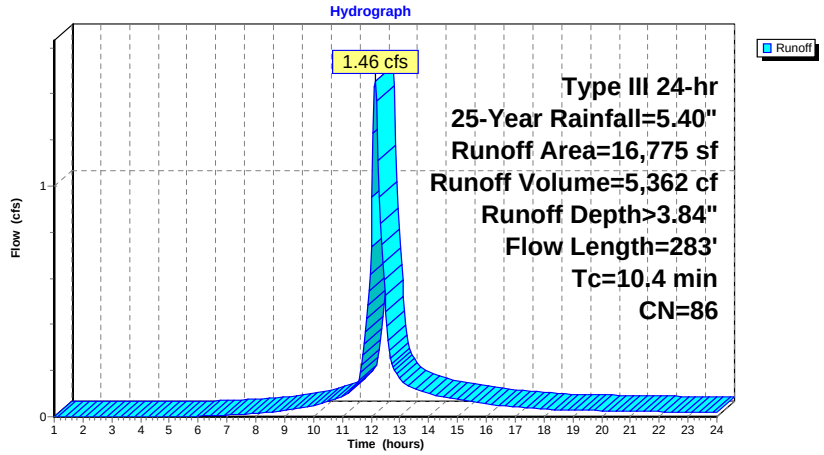
Runoff = 1.46 cfs @ 12.14 hrs, Volume= 5,362 cf, Depth> 3.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-Year Rainfall=5.40"

	Area (sf)	CN	Description
*	11,363	98	Paved Area
	4,269	61	>75% Grass cover, Good, HSG B
	1,143	55	Woods, Good, HSG B
	16,775	86	Weighted Average
	5,412		32.26% Pervious Area
	11,363		67.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	16	0.0625	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
3.3	29	0.0259	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.7	55	0.0273	1.36		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.8	183	0.0353	3.81		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
10.4	283	Total			

Subcatchment 3aS: Cul-de-sac area



Summary for Subcatchment 3bS: Upper Parking area

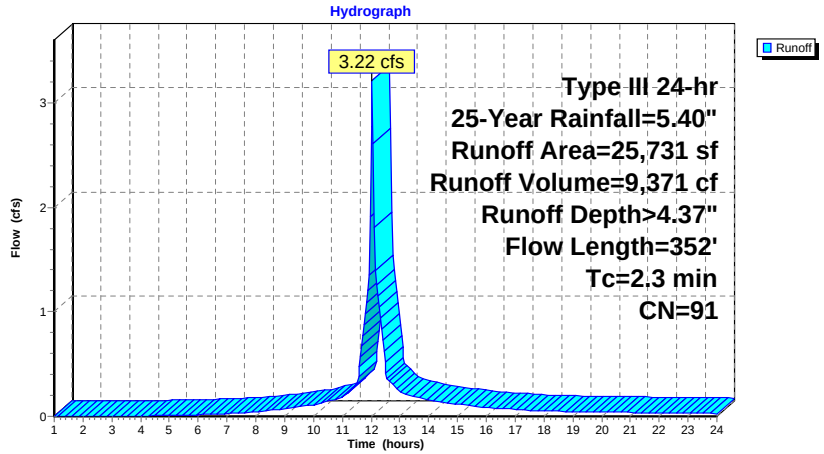
Runoff = 3.22 cfs @ 12.04 hrs, Volume= 9,371 cf, Depth> 4.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-Year Rainfall=5.40"

	Area (sf)	CN	Description
*	20,591	98	Paved Area
	5,140	61	>75% Grass cover, Good, HSG B
	25,731	91	Weighted Average
	5,140		19.98% Pervious Area
	20,591		80.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	100	0.0400	1.79		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.3	68	0.0331	3.69		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	97	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.7	87	0.0080	2.12	7.07	**Parabolic Channel,** W=10.00' D=0.50' Area=3.3 sf Perim=10.1' n= 0.030 Earth, grassed & winding
2.3	352	Total			

Subcatchment 3bS: Upper Parking area



Summary for Subcatchment 4S: Driveway/Back Parking Area

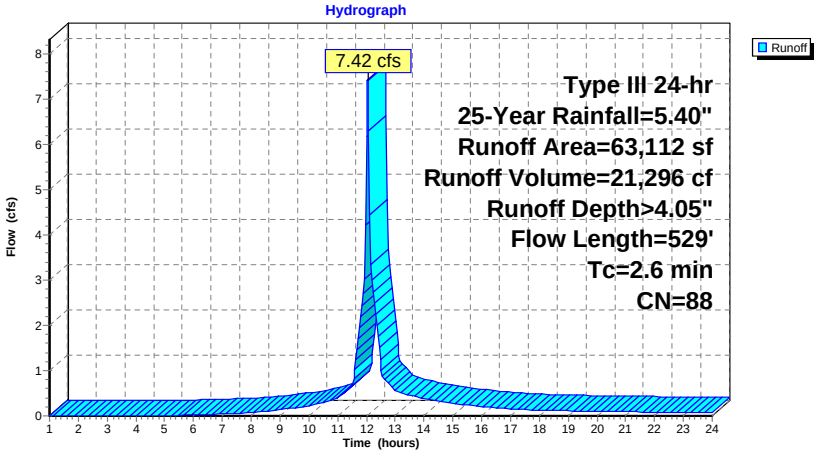
Runoff = 7.42 cfs @ 12.04 hrs, Volume= 21,296 cf, Depth> 4.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-Year Rainfall=5.40"

	Area (sf)	CN	Description
	17,248	61	>75% Grass cover, Good, HSG B
*	39,437	98	Roof and Paved Areas
	6,427	98	Water Surface, 0% imp, HSG B
	63,112	88	Weighted Average
	23,675		37.51% Pervious Area
	39,437		62.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	100	0.0625	2.14		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
1.2	279	0.0358	3.84		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.6	150	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
2.6	529	Total			

Subcatchment 4S: Driveway/Back Parking Area



Summary for Subcatchment 5S: Southwestern Site/Portion of Building

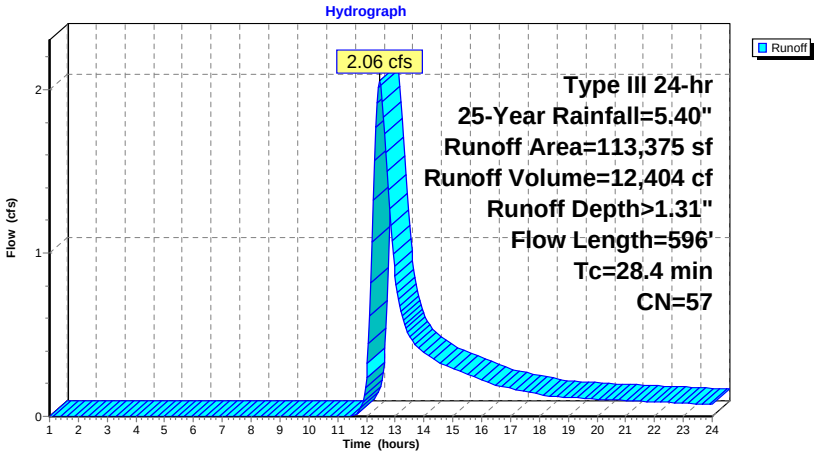
Runoff = 2.06 cfs @ 12.46 hrs, Volume= 12,404 cf, Depth> 1.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-Year Rainfall=5.40"

	Area (sf)	CN	Description
*	10,893	98	Impervious Area
	9,507	55	Woods, Good, HSG B
	14,089	61	>75% Grass cover, Good, HSG B
	73,906	48	Brush, Good, HSG B
	4,980	98	Water Surface, 0% imp, HSG B
	113,375	57	Weighted Average
	102,482		90.39% Pervious Area
	10,893		9.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.3	100	0.0200	0.07		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 3.10"
4.1	258	0.0310	1.06		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
1.4	113	0.0531	1.38		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
0.6	125	0.0560	3.55		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
28.4	596	Total			

Subcatchment 5S: Southwestern Site/Portion of Building



Summary for Subcatchment 6S: Western site

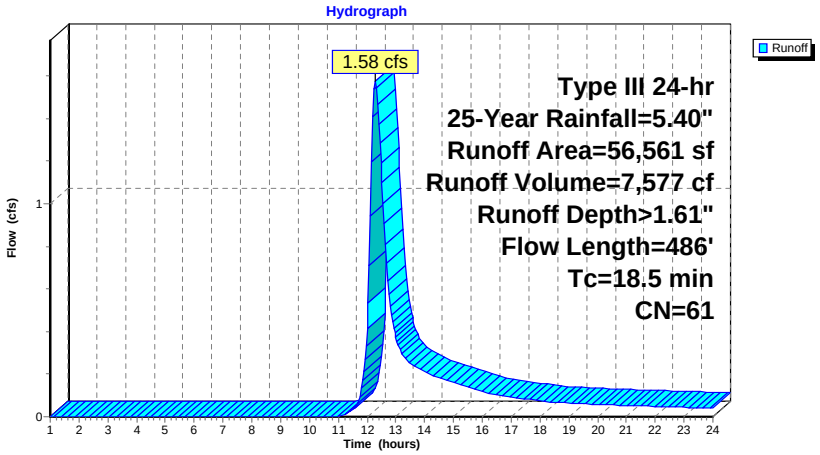
Runoff = 1.58 cfs @ 12.28 hrs, Volume= 7,577 cf, Depth> 1.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
20,354	61	>75% Grass cover, Good, HSG B
17,237	55	Woods, Good, HSG B
12,245	48	Brush, Good, HSG B
6,725	98	Water Surface, 0% imp, HSG B
56,561	61	Weighted Average
56,561		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	61	0.0738	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
6.6	39	0.0641	0.10		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 3.10"
2.2	209	0.0502	1.57		**Shallow Concentrated Flow, Heavy Brush** Kv= 7.0 fps
1.0	177	0.0396	2.98		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
18.5	486	Total			

Subcatchment 6S: Western site



Summary for Subcatchment 7S: Lower Site

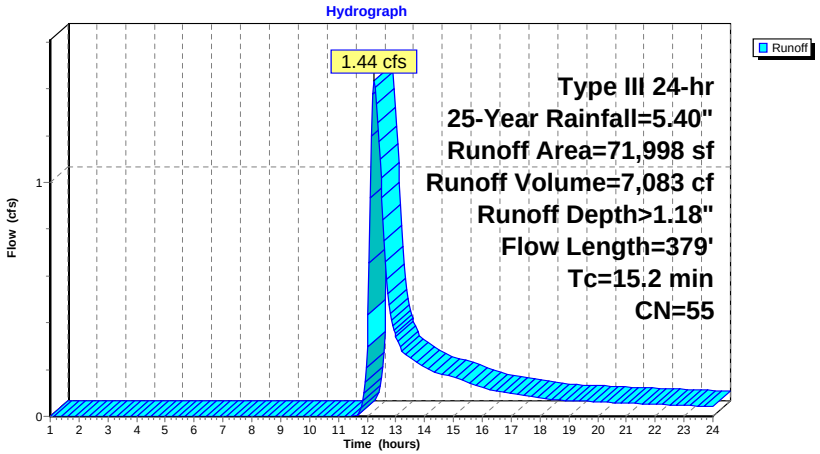
Runoff = 1.44 cfs @ 12.25 hrs, Volume= 7,083 cf, Depth> 1.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-Year Rainfall=5.40"

	Area (sf)	CN	Description
*	4,146	98	Concrete Pad and Roof Area
	11,009	55	Woods, Good, HSG B
	19,461	61	>75% Grass cover, Good, HSG B
	37,382	48	Brush, Good, HSG B
	71,998	55	Weighted Average
	67,852		94.24% Pervious Area
	4,146		5.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	61	0.0787	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
8.1	39	0.0385	0.08		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 3.10"
2.9	253	0.0435	1.46		**Shallow Concentrated Flow, Heavy Brush** Kv= 7.0 fps
0.3	26	0.0769	1.39		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.2	379	Total			

Subcatchment 7S: Lower Site



Summary for Pond 1P: Stilling Area 1

Inflow Area = 16,498 sf, 44.20% Impervious, Inflow Depth > 3.24" for 25-Year event
Inflow = 1.62 cfs @ 12.03 hrs, Volume= 4,460 cf
Outflow = 1.58 cfs @ 12.04 hrs, Volume= 4,092 cf, Atten= 2%, Lag= 0.8 min
Discarded = 0.02 cfs @ 12.04 hrs, Volume= 773 cf
Primary = 1.57 cfs @ 12.04 hrs, Volume= 3,319 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3
Peak Elev= 133.97' @ 12.04 hrs Surf.Area= 679 sf Storage= 480 cf

Plug-Flow detention time= 58.4 min calculated for 4,085 cf (92% of inflow)
Center-of-Mass det. time= 17.0 min (831.3 - 814.4)

Volume	Invert	Avail.Storage	Storage Description
#1	133.00'	1,407 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

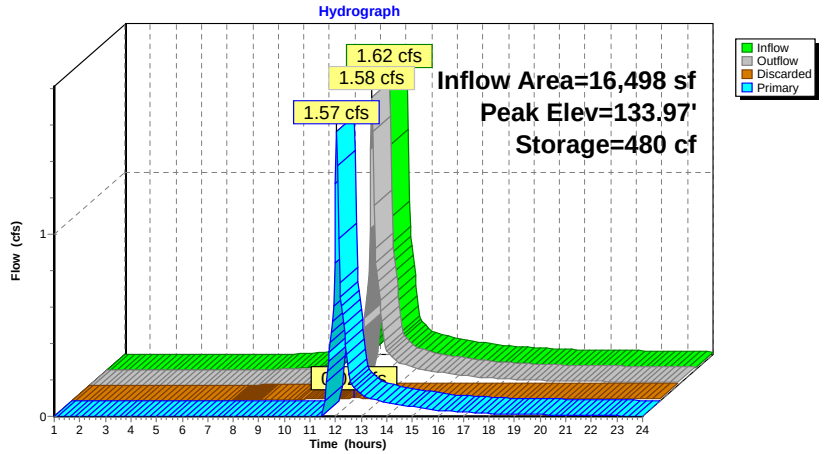
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
133.00	326	0	0	326
134.00	690	497	497	698
135.00	1,150	910	1,407	1,171

Device	Routing	Invert	Outlet Devices
#1	Primary	133.80'	**8.0' long x 15.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Discarded	133.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.02 cfs @ 12.04 hrs HW=133.97' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=1.54 cfs @ 12.04 hrs HW=133.97' TW=111.79' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 1.54 cfs @ 1.12 fps)

Pond 1P: Stilling Area 1



Summary for Pond 2P: Stilling Area 2

Inflow Area = 19,241 sf, 59.06% Impervious, Inflow Depth > 3.82" for 25-Year event
Inflow = 1.66 cfs @ 12.13 hrs, Volume= 6,130 cf
Outflow = 1.58 cfs @ 12.17 hrs, Volume= 5,898 cf, Atten= 5%, Lag= 2.3 min
Discarded = 0.03 cfs @ 12.17 hrs, Volume= 1,644 cf
Primary = 1.55 cfs @ 12.17 hrs, Volume= 4,254 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3
Peak Elev= 128.49' @ 12.17 hrs Surf.Area= 1,301 sf Storage= 573 cf

Plug-Flow detention time= 38.5 min calculated for 5,888 cf (96% of inflow)
Center-of-Mass det. time= 17.1 min (821.5 - 804.4)

Volume	Invert	Avail.Storage	Storage Description
#1	128.00'	1,312 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

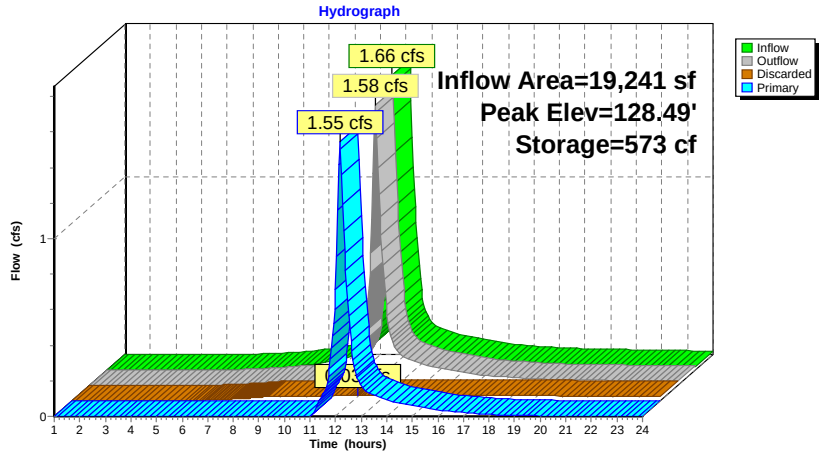
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
128.00	1,055	0	0	1,055
129.00	1,587	1,312	1,312	1,602

Device	Routing	Invert	Outlet Devices
#1	Primary	128.25'	**5.0' long x 190.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Discarded	128.00'	**1.020 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.03 cfs @ 12.17 hrs HW=128.49' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=1.53 cfs @ 12.17 hrs HW=128.49' TW=111.92' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 1.53 cfs @ 1.30 fps)

Pond 2P: Stilling Area 2



Summary for Pond 4P: Stilling Area 3

Inflow Area = 174,845 sf, 28.68% Impervious, Inflow Depth > 2.01" for 25-Year event
Inflow = 6.03 cfs @ 12.05 hrs, Volume= 29,349 cf
Outflow = 4.99 cfs @ 12.13 hrs, Volume= 23,900 cf, Atten= 17%, Lag= 5.0 min
Primary = 2.50 cfs @ 12.13 hrs, Volume= 11,950 cf
Secondary = 2.50 cfs @ 12.13 hrs, Volume= 11,950 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3
Peak Elev= 111.93' @ 12.13 hrs Surf.Area= 4,018 sf Storage= 6,210 cf

Plug-Flow detention time= 110.2 min calculated for 23,900 cf (81% of inflow)
Center-of-Mass det. time= 39.3 min (868.6 - 829.4)

Volume	Invert	Avail.Storage	Storage Description
#1	110.00'	11,027 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

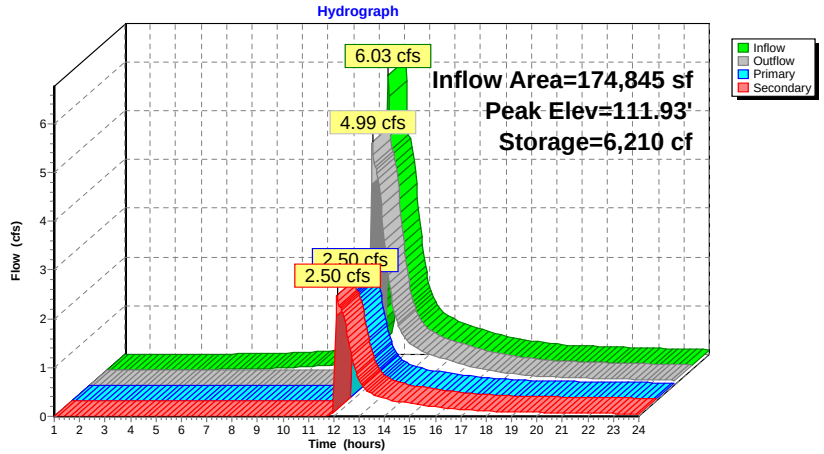
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
110.00	2,448	0	0
111.00	3,235	2,842	2,842
112.00	4,078	3,657	6,498
113.00	4,980	4,529	11,027

Device	Routing	Invert	Outlet Devices
#1	Primary	111.72'	**24.0" x 24.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	111.72'	**24.0" x 24.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.44 cfs @ 12.13 hrs HW=111.93' TW=103.29' (Dynamic Tailwater)
└**1=Grate** (Weir Controls 2.44 cfs @ 1.48 fps)

Secondary OutFlow Max=2.44 cfs @ 12.13 hrs HW=111.93' TW=101.36' (Dynamic Tailwater)
└**2=Grate** (Weir Controls 2.44 cfs @ 1.48 fps)

Pond 4P: Stilling Area 3



Summary for Pond 5P: Basin 5

Inflow Area = 237,957 sf, 37.64% Impervious, Inflow Depth > 1.68" for 25-Year event
Inflow = 8.40 cfs @ 12.07 hrs, Volume= 33,246 cf
Outflow = 2.84 cfs @ 12.51 hrs, Volume= 27,246 cf, Atten= 66%, Lag= 26.5 min
Discarded = 0.16 cfs @ 12.51 hrs, Volume= 6,863 cf
Primary = 2.68 cfs @ 12.51 hrs, Volume= 20,384 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3
Peak Elev= 103.89' @ 12.51 hrs Surf.Area= 6,613 sf Storage= 12,794 cf

Plug-Flow detention time= 151.0 min calculated for 27,199 cf (82% of inflow)
Center-of-Mass det. time= 79.6 min (899.1 - 819.4)

Volume	Invert	Avail.Storage	Storage Description
#1	101.00'	21,055 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

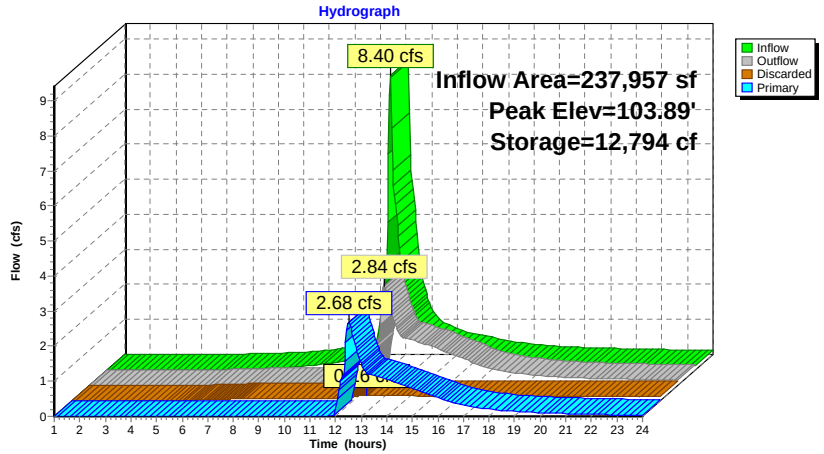
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
101.00	2,700	0	0	2,700
102.00	3,510	3,096	3,096	3,534
103.00	5,343	4,395	7,491	5,382
104.00	6,781	6,048	13,538	6,846
105.00	8,276	7,516	21,055	8,372

Device	Routing	Invert	Outlet Devices
#1	Primary	103.75'	**10.0' long x 80.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Discarded	101.00'	**1.020 in/hr Exfiltration over Wetted area**
#3	Primary	102.60'	**8.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 102.60' / 102.10' S= 0.0167 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.16 cfs @ 12.51 hrs HW=103.89' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.16 cfs)

Primary OutFlow Max=2.67 cfs @ 12.51 hrs HW=103.89' TW=0.00' (Dynamic Tailwater)
├**1=Broad-Crested Rectangular Weir** (Weir Controls 1.38 cfs @ 1.00 fps)
└**3=Culvert** (Inlet Controls 1.30 cfs @ 3.71 fps)

Pond 5P: Basin 5



Summary for Pond 6P: Basin 6

Inflow Area = 56,561 sf, 0.00% Impervious, Inflow Depth > 4.14" for 25-Year event
Inflow = 3.79 cfs @ 12.26 hrs, Volume= 19,527 cf
Outflow = 0.24 cfs @ 16.90 hrs, Volume= 7,095 cf, Atten= 94%, Lag= 277.9 min
Discarded = 0.16 cfs @ 16.90 hrs, Volume= 6,548 cf
Primary = 0.09 cfs @ 16.90 hrs, Volume= 547 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3
Peak Elev= 103.87' @ 16.90 hrs Surf.Area= 6,536 sf Storage= 13,172 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 210.4 min (1,081.8 - 871.4)

Volume	Invert	Avail.Storage	Storage Description
#1	101.00'	21,468 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

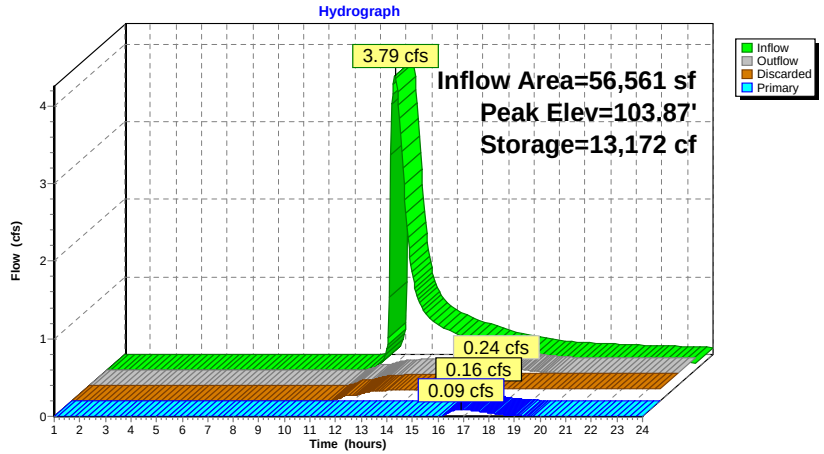
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
101.00	2,767	0	0	2,767
102.00	4,002	3,366	3,366	4,019
103.00	5,320	4,645	8,011	5,359
104.00	6,725	6,009	14,020	6,790
105.00	8,195	7,448	21,468	8,292

Device	Routing	Invert	Outlet Devices
#1	Discarded	101.00'	**1.020 in/hr Exfiltration over Wetted area**
#2	Primary	103.85'	**10.0' long x 43.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.16 cfs @ 16.90 hrs HW=103.87' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.16 cfs)

Primary OutFlow Max=0.09 cfs @ 16.90 hrs HW=103.87' TW=0.00' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 0.09 cfs @ 0.40 fps)

Pond 6P: Basin 6

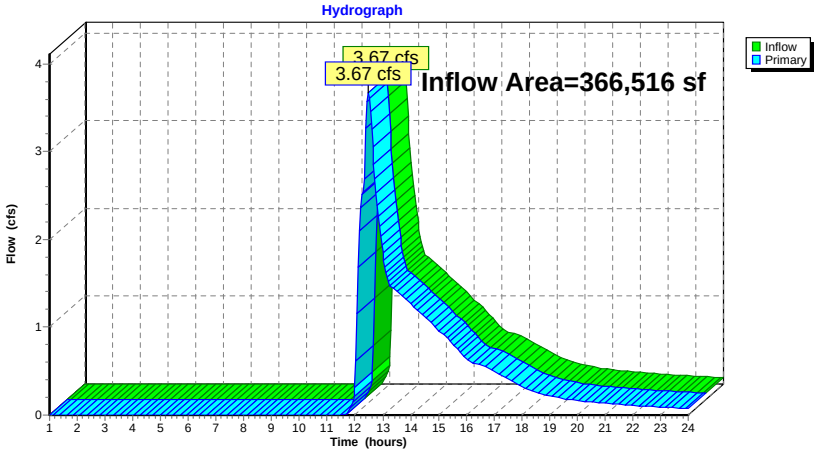


Summary for Pond POI 1: 495 Culvert

Inflow Area = 366,516 sf, 25.57% Impervious, Inflow Depth > 0.92" for 25-Year event
Inflow = 3.67 cfs @ 12.49 hrs, Volume= 28,013 cf
Primary = 3.67 cfs @ 12.49 hrs, Volume= 28,013 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3

Pond POI 1: 495 Culvert



Time span=1.00-24.00 hrs, dt=0.04 hrs, 576 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 1S: Upper Site Runoff Area=16,498 sf 44.20% Impervious Runoff Depth>4.23"
Flow Length=262' Tc=1.6 min CN=80 Runoff=2.10 cfs 5,822 cf

Subcatchment 2S: Stilling 2 Area Runoff Area=2,466 sf 0.00% Impervious Runoff Depth>4.77"
Tc=5.0 min CN=85 Runoff=0.32 cfs 981 cf

Subcatchment 3aS: Cul-de-sac area Runoff Area=16,775 sf 67.74% Impervious Runoff Depth>4.88"
Flow Length=283' Tc=10.4 min CN=86 Runoff=1.84 cfs 6,820 cf

Subcatchment 3bS: Upper Parking area Runoff Area=25,731 sf 80.02% Impervious Runoff Depth>5.45"
Flow Length=352' Tc=2.3 min CN=91 Runoff=3.96 cfs 11,679 cf

Subcatchment 4S: Driveway/Back Parking Runoff Area=63,112 sf 62.49% Impervious Runoff Depth>5.11"
Flow Length=529' Tc=2.6 min CN=88 Runoff=9.25 cfs 26,862 cf

Subcatchment 5S: Southwestern Runoff Area=113,375 sf 9.61% Impervious Runoff Depth>1.97"
Flow Length=596' Tc=28.4 min CN=57 Runoff=3.28 cfs 18,633 cf

Subcatchment 6S: Western site Runoff Area=56,561 sf 0.00% Impervious Runoff Depth>2.34"
Flow Length=486' Tc=18.5 min CN=61 Runoff=2.38 cfs 11,014 cf

Subcatchment 7S: Lower Site Runoff Area=71,998 sf 5.76% Impervious Runoff Depth>1.81"
Flow Length=379' Tc=15.2 min CN=55 Runoff=2.38 cfs 10,835 cf

Pond 1P: Stilling Area 1 Peak Elev=134.01' Storage=503 cf Inflow=2.10 cfs 5,822 cf
Discarded=0.02 cfs 812 cf Primary=2.04 cfs 4,641 cf Outflow=2.06 cfs 5,453 cf

Pond 2P: Stilling Area 2 Peak Elev=128.53' Storage=626 cf Inflow=2.09 cfs 7,801 cf
Discarded=0.03 cfs 1,727 cf Primary=1.97 cfs 5,802 cf Outflow=2.00 cfs 7,530 cf

Pond 4P: Stilling Area 3 Peak Elev=111.99' Storage=6,476 cf Inflow=7.95 cfs 40,754 cf
Primary=3.77 cfs 17,646 cf Secondary=3.77 cfs 17,646 cf Outflow=7.53 cfs 35,292 cf

Pond 5P: Basin 5 Peak Elev=104.05' Storage=13,883 cf Inflow=12.73 cfs 44,508 cf
Discarded=0.16 cfs 7,254 cf Primary=5.83 cfs 31,037 cf Outflow=6.00 cfs 38,290 cf

Pond 6P: Basin 6 Peak Elev=103.97' Storage=13,816 cf Inflow=5.47 cfs 28,660 cf
Discarded=0.16 cfs 6,915 cf Primary=1.11 cfs 8,830 cf Outflow=1.27 cfs 15,746 cf

Pond POI 1: 495 Culvert Inflow=8.10 cfs 50,702 cf
Primary=8.10 cfs 50,702 cf

Total Runoff Area = 366,516 sf Runoff Volume = 92,646 cf Average Runoff Depth = 3.03"
74.43% Pervious = 272,794 sf 25.57% Impervious = 93,722 sf

Summary for Subcatchment 1S: Upper Site

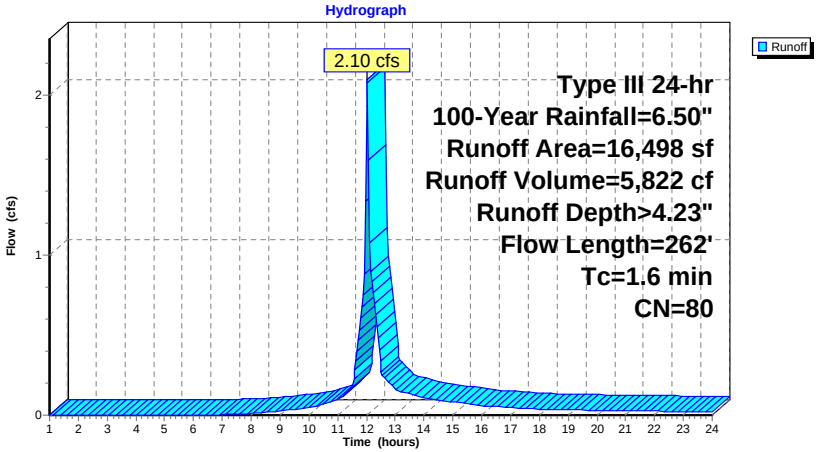
Runoff = 2.10 cfs @ 12.03 hrs, Volume= 5,822 cf, Depth> 4.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
*	7,292	98	Paved driveway
	354	55	Woods, Good, HSG B
	7,702	61	>75% Grass cover, Good, HSG B
	1,150	98	Water Surface, 0% imp, HSG B
	16,498	80	Weighted Average
	9,206		55.80% Pervious Area
	7,292		44.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0350	1.69		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.6	162	0.0482	4.46		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.6	262	Total			

Subcatchment 1S: Upper Site



Summary for Subcatchment 2S: Stilling 2 Area

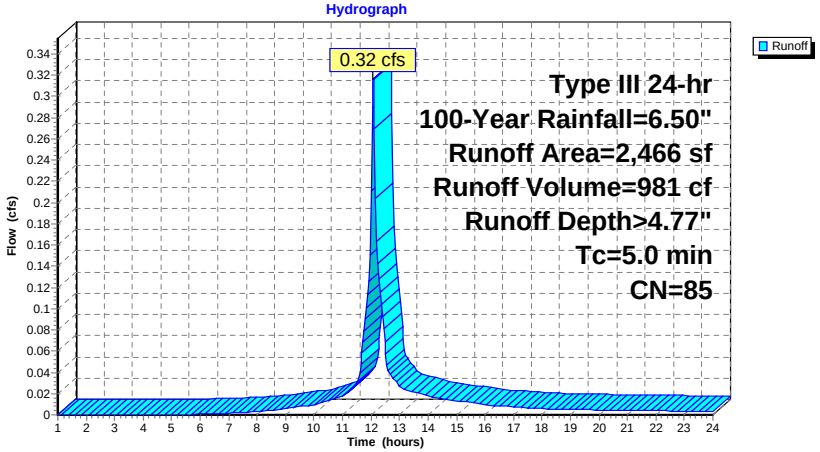
Runoff = 0.32 cfs @ 12.07 hrs, Volume= 981 cf, Depth> 4.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
880	61	>75% Grass cover, Good, HSG B
1,586	98	Water Surface, 0% imp, HSG B
2,466	85	Weighted Average
2,466		100.00% Pervious Area

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

Subcatchment 2S: Stilling 2 Area



Summary for Subcatchment 3aS: Cul-de-sac area

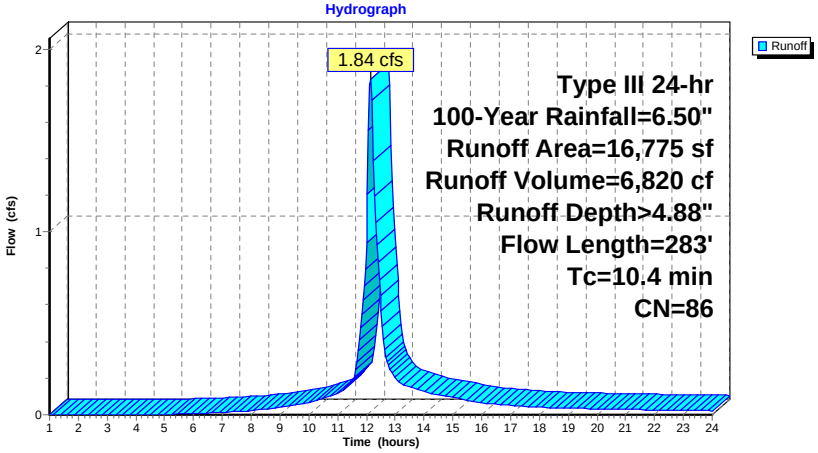
Runoff = 1.84 cfs @ 12.14 hrs, Volume= 6,820 cf, Depth> 4.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
*	11,363	98	Paved Area
	4,269	61	>75% Grass cover, Good, HSG B
	1,143	55	Woods, Good, HSG B
	16,775	86	Weighted Average
	5,412		32.26% Pervious Area
	11,363		67.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	16	0.0625	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.10"
3.3	29	0.0259	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.7	55	0.0273	1.36		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.8	183	0.0353	3.81		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
10.4	283	Total			

Subcatchment 3aS: Cul-de-sac area



Summary for Subcatchment 3bS: Upper Parking area

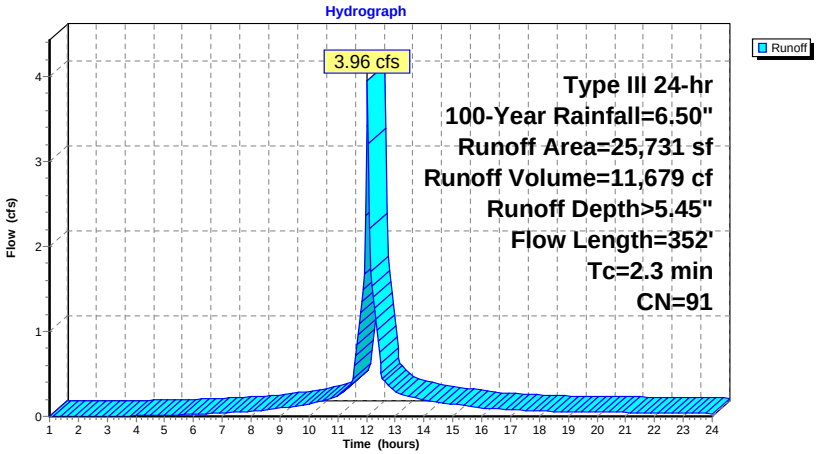
Runoff = 3.96 cfs @ 12.04 hrs, Volume= 11,679 cf, Depth> 5.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
*	20,591	98	Paved Area
	5,140	61	>75% Grass cover, Good, HSG B
	25,731	91	Weighted Average
	5,140		19.98% Pervious Area
	20,591		80.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	100	0.0400	1.79		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.3	68	0.0331	3.69		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	97	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.7	87	0.0080	2.12	7.07	**Parabolic Channel,** W=10.00' D=0.50' Area=3.3 sf Perim=10.1' n= 0.030 Earth, grassed & winding
2.3	352	Total			

Subcatchment 3bS: Upper Parking area



Summary for Subcatchment 4S: Driveway/Back Parking Area

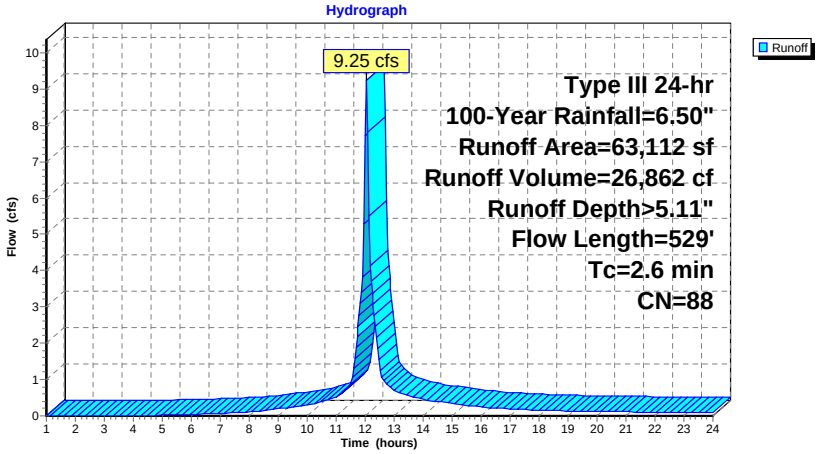
Runoff = 9.25 cfs @ 12.04 hrs, Volume= 26,862 cf, Depth> 5.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
	17,248	61	>75% Grass cover, Good, HSG B
*	39,437	98	Roof and Paved Areas
	6,427	98	Water Surface, 0% imp, HSG B
	63,112	88	Weighted Average
	23,675		37.51% Pervious Area
	39,437		62.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	100	0.0625	2.14		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
1.2	279	0.0358	3.84		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.6	150	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
2.6	529	Total			

Subcatchment 4S: Driveway/Back Parking Area



Summary for Subcatchment 5S: Southwestern Site/Portion of Building

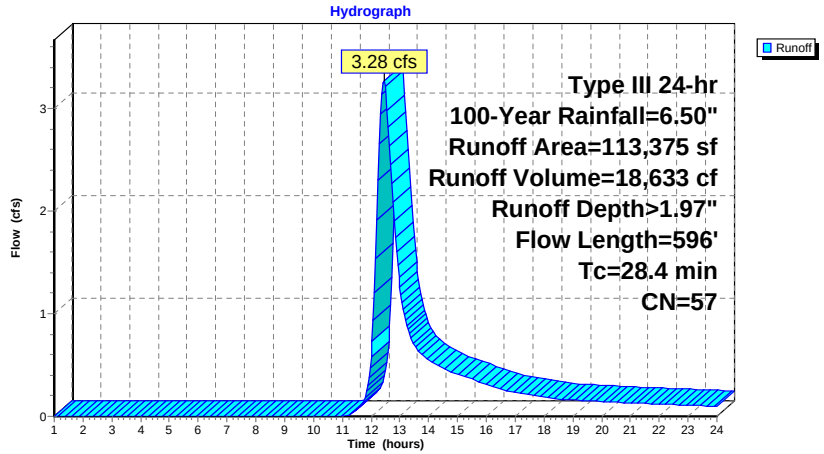
Runoff = 3.28 cfs @ 12.44 hrs, Volume= 18,633 cf, Depth> 1.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
*	10,893	98	Impervious Area
	9,507	55	Woods, Good, HSG B
	14,089	61	>75% Grass cover, Good, HSG B
	73,906	48	Brush, Good, HSG B
	4,980	98	Water Surface, 0% imp, HSG B
	113,375	57	Weighted Average
	102,482		90.39% Pervious Area
	10,893		9.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.3	100	0.0200	0.07		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 3.10"
4.1	258	0.0310	1.06		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
1.4	113	0.0531	1.38		**Shallow Concentrated Flow, Heavy Brush** Kv= 6.0 fps
0.6	125	0.0560	3.55		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
28.4	596	Total			

Subcatchment 5S: Southwestern Site/Portion of Building



Summary for Subcatchment 6S: Western site

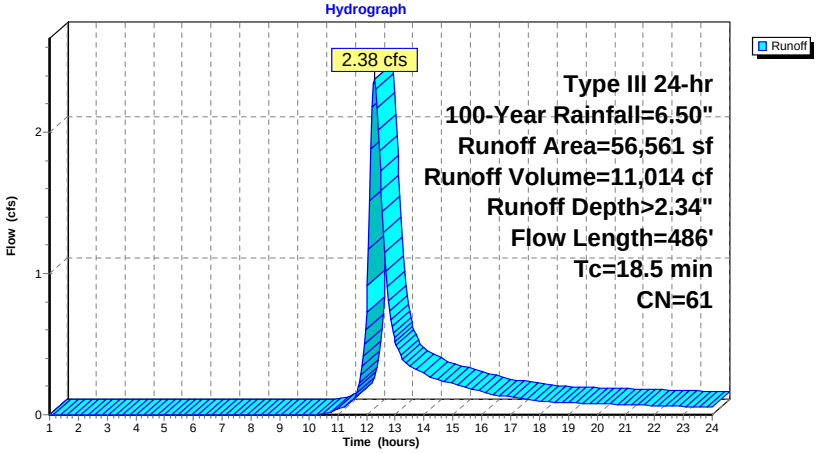
Runoff = 2.38 cfs @ 12.27 hrs, Volume= 11,014 cf, Depth> 2.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
20,354	61	>75% Grass cover, Good, HSG B
17,237	55	Woods, Good, HSG B
12,245	48	Brush, Good, HSG B
6,725	98	Water Surface, 0% imp, HSG B
56,561	61	Weighted Average
56,561		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	61	0.0738	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
6.6	39	0.0641	0.10		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 3.10"
2.2	209	0.0502	1.57		**Shallow Concentrated Flow, Heavy Brush** Kv= 7.0 fps
1.0	177	0.0396	2.98		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
18.5	486	Total			

Subcatchment 6S: Western site



Summary for Subcatchment 7S: Lower Site

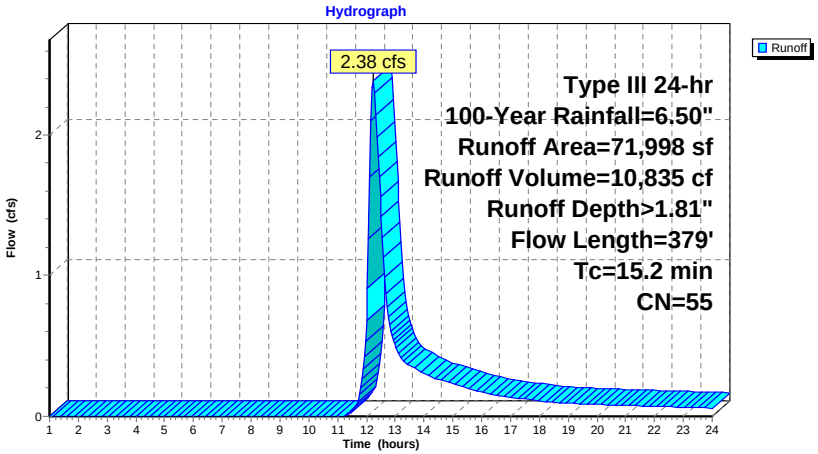
Runoff = 2.38 cfs @ 12.23 hrs, Volume= 10,835 cf, Depth> 1.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
*	4,146	98	Concrete Pad and Roof Area
	11,009	55	Woods, Good, HSG B
	19,461	61	>75% Grass cover, Good, HSG B
	37,382	48	Brush, Good, HSG B
	71,998	55	Weighted Average
	67,852		94.24% Pervious Area
	4,146		5.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	61	0.0787	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
8.1	39	0.0385	0.08		**Sheet Flow,** Grass: Bermuda n= 0.410 P2= 3.10"
2.9	253	0.0435	1.46		**Shallow Concentrated Flow, Heavy Brush** Kv= 7.0 fps
0.3	26	0.0769	1.39		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.2	379	Total			

Subcatchment 7S: Lower Site



Summary for Pond 1P: Stilling Area 1

Inflow Area = 16,498 sf, 44.20% Impervious, Inflow Depth > 4.23" for 100-Year event
Inflow = 2.10 cfs @ 12.03 hrs, Volume= 5,822 cf
Outflow = 2.06 cfs @ 12.04 hrs, Volume= 5,453 cf, Atten= 2%, Lag= 0.8 min
Discarded = 0.02 cfs @ 12.04 hrs, Volume= 812 cf
Primary = 2.04 cfs @ 12.04 hrs, Volume= 4,641 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3
Peak Elev= 134.01' @ 12.04 hrs Surf.Area= 693 sf Storage= 503 cf

Plug-Flow detention time= 48.9 min calculated for 5,453 cf (94% of inflow)
Center-of-Mass det. time= 15.0 min (821.8 - 806.8)

Volume	Invert	Avail.Storage	Storage Description
#1	133.00'	1,407 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

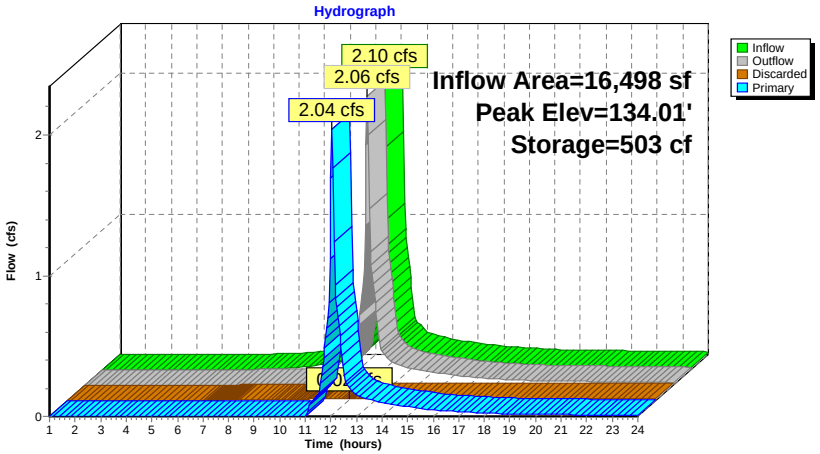
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
133.00	326	0	0	326
134.00	690	497	497	698
135.00	1,150	910	1,407	1,171

Device	Routing	Invert	Outlet Devices
#1	Primary	133.80'	**8.0' long x 15.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Discarded	133.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.02 cfs @ 12.04 hrs HW=134.01' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=2.02 cfs @ 12.04 hrs HW=134.01' TW=111.98' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 2.02 cfs @ 1.22 fps)

Pond 1P: Stilling Area 1



Summary for Pond 2P: Stilling Area 2

Inflow Area =	19,241 sf, 59.06% Impervious, Inflow Depth > 4.87" for 100-Year event				
Inflow =	2.09 cfs @	12.13 hrs,	Volume=	7,801 cf	
Outflow =	2.00 cfs @	12.17 hrs,	Volume=	7,530 cf,	Atten= 4%, Lag= 2.2 min
Discarded =	0.03 cfs @	12.17 hrs,	Volume=	1,727 cf	
Primary =	1.97 cfs @	12.17 hrs,	Volume=	5,802 cf	

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3
Peak Elev= 128.53' @ 12.17 hrs Surf.Area= 1,322 sf Storage= 626 cf

Plug-Flow detention time= 32.8 min calculated for 7,530 cf (97% of inflow)
Center-of-Mass det. time= 12.6 min (810.4 - 797.7)

Volume	Invert	Avail.Storage	Storage Description
#1	128.00'	1,312 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

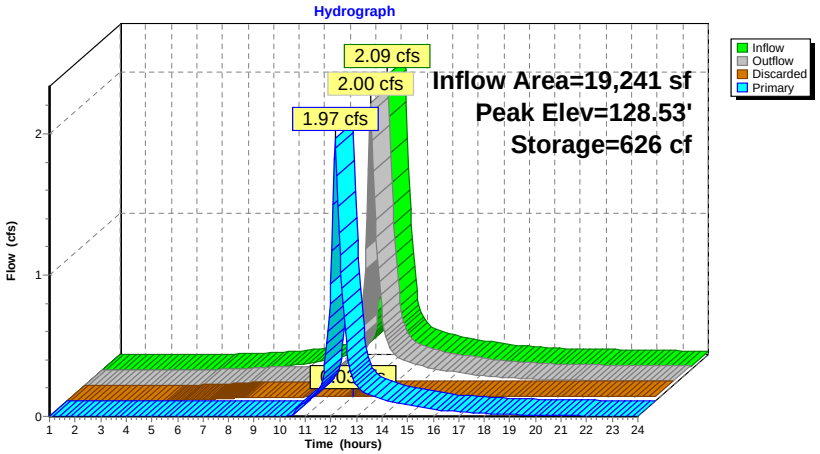
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
128.00	1,055	0	0	1,055
129.00	1,587	1,312	1,312	1,602

Device	Routing	Invert	Outlet Devices
#1	Primary	128.25'	**5.0' long x 190.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Discarded	128.00'	**1.020 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.03 cfs @ 12.17 hrs HW=128.53' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=1.95 cfs @ 12.17 hrs HW=128.53' TW=111.97' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 1.95 cfs @ 1.41 fps)

Pond 2P: Stilling Area 2



Summary for Pond 4P: Stilling Area 3

Inflow Area =	174,845 sf, 28.68% Impervious, Inflow Depth > 2.80" for 100-Year event				
Inflow =	7.95 cfs @	12.05 hrs,	Volume=	40,754 cf	
Outflow =	7.53 cfs @	12.08 hrs,	Volume=	35,292 cf,	Atten= 5%, Lag= 2.1 min
Primary =	3.77 cfs @	12.08 hrs,	Volume=	17,646 cf	
Secondary =	3.77 cfs @	12.08 hrs,	Volume=	17,646 cf	

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3
Peak Elev= 111.99' @ 12.08 hrs Surf.Area= 4,073 sf Storage= 6,476 cf

Plug-Flow detention time= 87.9 min calculated for 35,292 cf (87% of inflow)
Center-of-Mass det. time= 30.6 min (857.1 - 826.5)

Volume	Invert	Avail.Storage	Storage Description
#1	110.00'	11,027 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

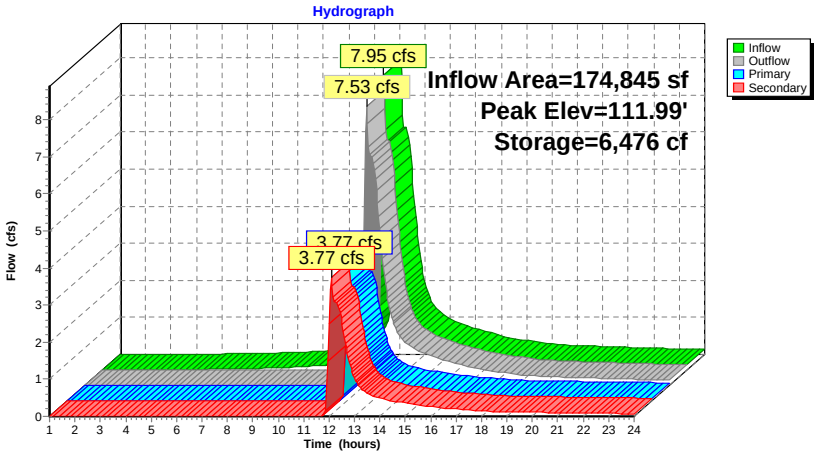
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
110.00	2,448	0	0
111.00	3,235	2,842	2,842
112.00	4,078	3,657	6,498
113.00	4,980	4,529	11,027

Device	Routing	Invert	Outlet Devices
#1	Primary	111.72'	**24.0" x 24.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	111.72'	**24.0" x 24.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.74 cfs @ 12.08 hrs HW=111.99' TW=103.69' (Dynamic Tailwater)
└**1=Grate** (Weir Controls 3.74 cfs @ 1.71 fps)

Secondary OutFlow Max=3.74 cfs @ 12.08 hrs HW=111.99' TW=101.67' (Dynamic Tailwater)
└**2=Grate** (Weir Controls 3.74 cfs @ 1.71 fps)

Pond 4P: Stilling Area 3



Summary for Pond 5P: Basin 5

Inflow Area = 237,957 sf, 37.64% Impervious, Inflow Depth > 2.24" for 100-Year event
Inflow = 12.73 cfs @ 12.05 hrs, Volume= 44,508 cf
Outflow = 6.00 cfs @ 12.30 hrs, Volume= 38,290 cf, Atten= 53%, Lag= 15.3 min
Discarded = 0.16 cfs @ 12.30 hrs, Volume= 7,254 cf
Primary = 5.83 cfs @ 12.30 hrs, Volume= 31,037 cf

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3
Peak Elev= 104.05' @ 12.30 hrs Surf.Area= 6,853 sf Storage= 13,883 cf

Plug-Flow detention time= 125.2 min calculated for 38,224 cf (86% of inflow)
Center-of-Mass det. time= 65.1 min (878.9 - 813.9)

Volume	Invert	Avail.Storage	Storage Description
#1	101.00'	21,055 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

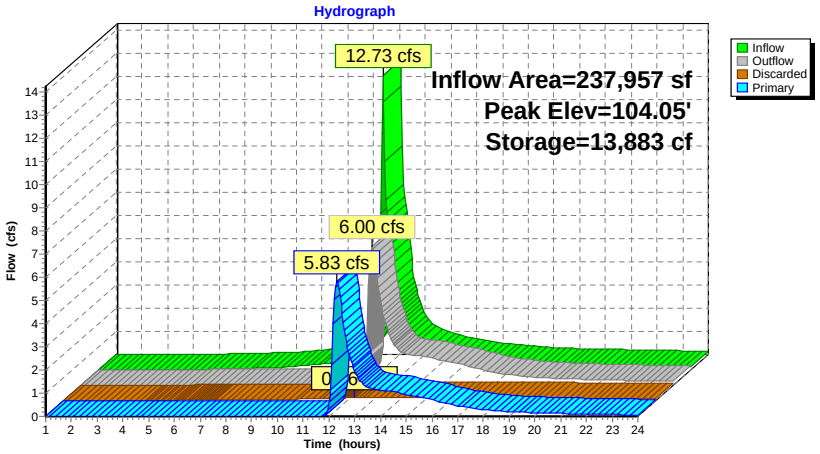
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
101.00	2,700	0	0	2,700
102.00	3,510	3,096	3,096	3,534
103.00	5,343	4,395	7,491	5,382
104.00	6,781	6,048	13,538	6,846
105.00	8,276	7,516	21,055	8,372

Device	Routing	Invert	Outlet Devices
#1	Primary	103.75'	**10.0' long x 80.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Discarded	101.00'	**1.020 in/hr Exfiltration over Wetted area**
#3	Primary	102.60'	**8.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 102.60' / 102.10' S= 0.0167 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.16 cfs @ 12.30 hrs HW=104.05' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.16 cfs)

Primary OutFlow Max=5.82 cfs @ 12.30 hrs HW=104.05' TW=0.00' (Dynamic Tailwater)
├─**1=Broad-Crested Rectangular Weir** (Weir Controls 4.41 cfs @ 1.47 fps)
└─**3=Culvert** (Inlet Controls 1.40 cfs @ 4.02 fps)

Pond 5P: Basin 5



Summary for Pond 6P: Basin 6

Inflow Area =	56,561 sf,	0.00% Impervious,	Inflow Depth >	6.08"	for 100-Year event
Inflow =	5.47 cfs @	12.27 hrs,	Volume=	28,660 cf	
Outflow =	1.27 cfs @	13.16 hrs,	Volume=	15,746 cf,	Atten= 77%, Lag= 53.4 min
Discarded =	0.16 cfs @	13.16 hrs,	Volume=	6,915 cf	
Primary =	1.11 cfs @	13.16 hrs,	Volume=	8,830 cf	

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3
Peak Elev= 103.97' @ 13.16 hrs Surf.Area= 6,680 sf Storage= 13,816 cf

Plug-Flow detention time= 226.9 min calculated for 15,718 cf (55% of inflow)
Center-of-Mass det. time= 112.4 min (972.3 - 859.9)

Volume	Invert	Avail.Storage	Storage Description
#1	101.00'	21,468 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

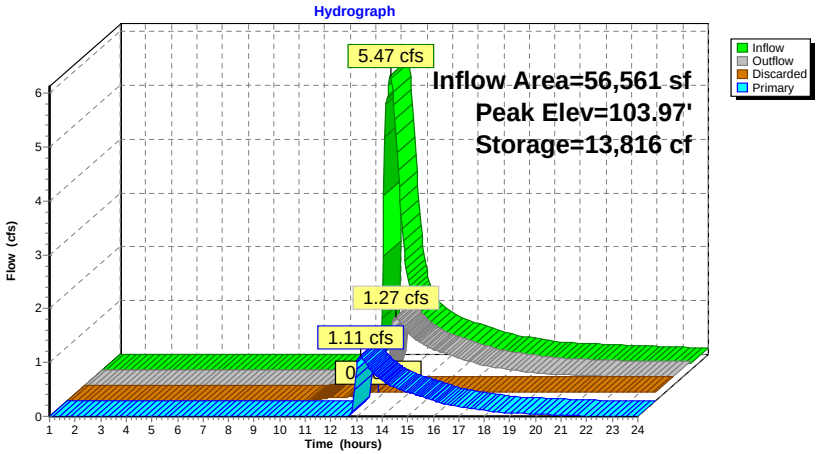
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
101.00	2,767	0	0	2,767
102.00	4,002	3,366	3,366	4,019
103.00	5,320	4,645	8,011	5,359
104.00	6,725	6,009	14,020	6,790
105.00	8,195	7,448	21,468	8,292

Device	Routing	Invert	Outlet Devices
#1	Discarded	101.00'	**1.020 in/hr Exfiltration over Wetted area**
#2	Primary	103.85'	**10.0' long x 43.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.16 cfs @ 13.16 hrs HW=103.97' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.16 cfs)

Primary OutFlow Max=1.11 cfs @ 13.16 hrs HW=103.97' TW=0.00' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 1.11 cfs @ 0.93 fps)

Pond 6P: Basin 6

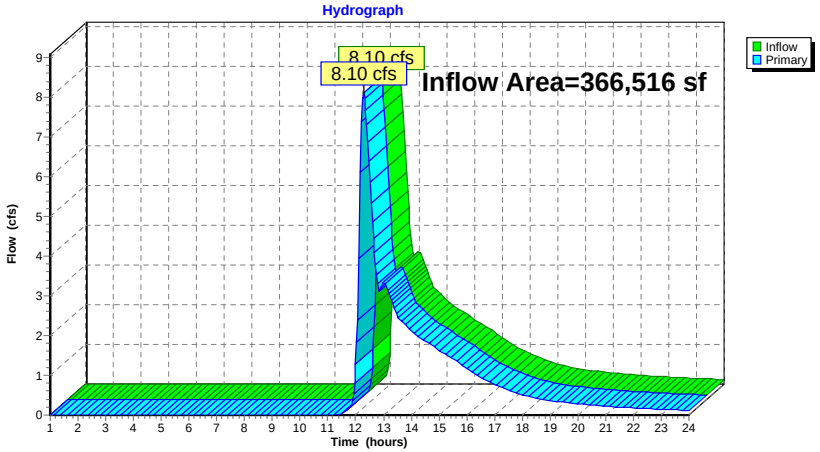


Summary for Pond POI 1: 495 Culvert

Inflow Area = 366,516 sf, 25.57% Impervious, Inflow Depth > 1.66" for 100-Year event
Inflow = 8.10 cfs @ 12.28 hrs, Volume= 50,702 cf
Primary = 8.10 cfs @ 12.28 hrs, Volume= 50,702 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs / 3

Pond POI 1: 495 Culvert



Appendix C

Wingate Residences Haverhill
Recharge Calculation

Required Recharge

Area Summary	
	Area (SF)*
Existing Impervious	3,241
Proposed Impervious	114,590
Required Recharge Area *(Proposed - Existing)*	111,349

* Areas calculated in HydroCAD

Note: Site consists of both HSG B and C soils; therefore, HSG B will be used to calculate the required recharge volume, providing a more conservative value.

Hydrologic Soil Group Summary		
Group	Target Depth Factor (in)	Area (SF)
A	0.6	0
B	0.35	111,349
C	0.25	0
D	0.1	0

Required Recharge (*Rv*) Calculation:

Rv = Target Depth Factor x Δ Impervious Area
Rv = 0.35 x (1/12) x 111,349
Rv = 3,248 CF

Proposed Recharge Summary
Detailed calculations included on following pages

Location	Volume (CF)
Large Stormwater Basin (5P)	5,379
Large Stormwater Basin (6P)	13,177
Total	18,556

Rv = 3,248 CF
Provided recharge = 18,556 CF

Recharge Requirement is met.

Proposed Recharge

Large Stormwater Basin (Pond 5P)

Bottom of Basin elevation	101.00	FT
Culvert elevation	102.60	FT
Storage Height	1.60	FT
Area @ Bottom of Basin	2,700	SF
Area @ Culvert	4,024	SF
Storage Area = (2,700 SF + 4,024 SF) / 2 =	3,362	SF
Storage Volume = Storage height x Storage Area =	5,379	CF

Large Stormwater Basin (Pond 6P)

Bottom of Basin elevation	101.00	FT
Weir elevation	103.85	FT
Storage Height	2.85	FT
Area @ Bottom of Basin	2,767	SF
Area @ Weir	6,480	SF
Storage Area = (2,767 SF + 6,480 SF) / 2 =	4,624	SF
Storage Volume = Storage height x Storage Area =	13,177	CF

Wingate at Haverhill
Drawdown Calculation

-- Maximum drawdown time is 72 hours **--**

Time to drawdown calculation

$$\text{Time} = \frac{Rv}{k * \text{bottom area}}$$

where,

Rv = storage volume

k = saturated hydraulic conductivity rate

bottom area = average surface storage area of recharge structure

Proposed Storage Drawdown Calcuations

Large Stormwater Basin (5P)			
Net storage volume		5,379	CF
Bottom area		2,700	SF
k		1.02	in/hr *
Time =	23.44	hours	

Proposed drawdown time is acceptable.

* Rawl's Rate for sandy loam

Large Stormwater Basin (6P)			
Net storage volume		13,177	CF
Bottom area		2,767	SF
k		1.02	in/hr *
Time =	56.03	hours	

Proposed drawdown time is acceptable.

* Rawl's Rate for sandy loam

Wingate Residences Haverhill
Water Quality Volume

Standard 4 Water Quality

As stated in the Stormwater Handbook, the required water quality volume equals 0.5 inches of runoff times the total impervious area of the post-development site.

Proposed Impervious Area				114,590	SF
Req'd Water Quality Volume					
114,590 sf	x	0.5"	x 1'/12"=	4,775	CF
Provided Recharge Volume =				18,556	CF

WQV Requirement is met.

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: All Treatment Trains

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Street Sweeping - 5%	**0.05**	**1.00**	**0.05**	**0.95**
Deep Sump and Hooded Catch Basin	**0.25**	**0.95**	**0.24**	**0.71**
Infiltration Basin	**0.80**	**0.71**	**0.57**	**0.14**
	0.00	**0.14**	**0.00**	**0.14**
	0.00	**0.14**	**0.00**	**0.14**

Total TSS Removal = 86%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: **Wingate Residences**
Prepared By: **Alyssa Peck**
Date: **4/7/2016**

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

Appendix D

Long Term Pollution Prevention Plan
Wingate Residences Haverhill

To meet the requirements of Standard 4 of the Massachusetts Stormwater Handbook, this Long Term Pollution Prevention Plan is provided to identify the proper procedures of practices for source control and pollution prevention.

Storage and Handling of Oil and other Hazardous Materials

No oil or other hazardous materials will be stored at this site.

De-icing & Snow Disposal

The Owner will utilize salt and sand to treat the paved surfaces and sidewalks. No salt will be stored on site. Snow storage will consist of pushing the snow towards grassed areas off the paved areas.

Vehicle Storage and Washing

No vehicles will be stored or washed at this site.

Landscaping

The property will be maintained by a landscaper selected by the Owner. Fertilizer may be used on site; however, no fertilizer will be stored.

Pet Waste Management

It is not expected that pets will be accessing the facility; therefore, it is not necessary to design to manage pet waste.

Septic System

Wastewater generated on site will be directed to the City's sewer system. No septic is proposed on-site.

Operation and Maintenance of Stormwater Control Structures

Included within this Appendix is the Operation and Maintenance plan for this site.

The Owner will be responsible for the implementation of the plans. Additional details will be provided in a final combined plan, which will incorporate the requirements of the following:

- Stormwater Operation and Maintenance Plan
- Long Term Pollution Prevention Plan

In addition to the basic components described above, additional Best Management Practices (BMPs) and Good Housekeeping measures will be provided.

Z:\MA-Foxboro-Projects\Haverhill\Wingate at Haverhill-xxxxxxxx\Stormwater\Report\Working Files\Wingate LTPPP.doc

Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan

SECTION 1: Introduction

The project consists of construction of a new assisted living facility in Haverhill, MA. The site is currently owned by the McGirr Family Trust (Map 630, Block 2). The site will be purchased by WHC Haverhill AL, LLC in March 2016. The project site is adjacent to an existing nursing home. The work includes clearing and grubbing, construction of the new assisted living facility, full-depth pavement construction, new granite curb, new closed drainage system, swales, and stormwater basins, new cement concrete sidewalk, pavement markings, signage, plantings, and other incidental work.

As part of this project, this "Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan" has been created to insure that no disturbance to the wetland resource is created during the construction of these repairs.

SECTION 2: Construction Period Pollution Prevention Measures

Best Management Practices (BMPs) will be utilized as Construction Period Pollution Prevention Measures to reduce potential pollutants and prevent any off-site discharge. The objectives of the BMPs for construction activity are to minimize the disturbed areas, stabilize any disturbed areas, control the site perimeter and retain sediment. Both erosion and sedimentation controls and non-stormwater best management measures will be used to minimize site disturbance and ensure compliance with the performance standards of the Wetlands Protection Act (WPA) and MassDEP Stormwater Standards. Measures will be taken to minimize the area disturbed by construction activities to reduce the potential for soil erosion and stormwater pollution problems. In addition, good housekeeping measures will be followed for the day-to-day operation of the construction site under the control of the contractor to minimize the impact of construction. This section describes the control practices that will be in place during construction activities. All recommended control practices will comply with the standards set in the MassDEP Stormwater Handbook.

2.1 Minimize Disturbed Area and Protect Natural Features and Soil

In order to minimize disturbed areas, all work will be completed within well-defined work limits. These work limits are shown on the site plans included with this submission. The Contractor shall not disturb native vegetation in the undisturbed wetland area without prior approval from the Engineer. The Contractor will be responsible to make sure that all workers know the proper work limits and do not extend their work into the undisturbed areas. The protective measures are described in more detail in the following sections.

2.2 Control Stormwater Flowing onto and through the project

The Contractor will be required to install straw wattles and silt fence between the work area and the wetland resource area.

2.3 Stabilize Soils

The Contractor shall limit the area of land which is exposed and free from vegetation during the project. The soils will be exposed for no longer that one week.

2.4 Proper storage and cover of any stockpiles

The location of the Contractor's storage areas for equipment and/or materials shall be upon cleared portions of the job site or areas to be cleared as a part of this project, and shall require written approval of the Engineer.

Adequate measures for erosion and sediment control such as the placement of straw wattles around the downstream perimeter of stockpiles, and silt fence behind straw wattles and in front of water body, shall be employed to protect any downstream areas from siltation.

There shall be no storage of equipment or materials in areas designated as wetlands.

The Engineer may designate a particular area or areas where the Contractor may store materials used in his operations.

2.5 Perimeter Controls and Sediment Barriers

Erosion control lines as described in Section 5 will be utilized to ensure that no sedimentation occurs outside the perimeter of the work area.

2.6 Storm Drain Inlet Protection

Catch basin protection will be implemented for all catch basins affected by the work area. Filter fabric will be placed over the catch basin and straw bales will be placed around the catch basin to minimize sediment loading into the catch basin.

2.7 Retain Sediment On-Site

The Contractor will be responsible to monitor all erosion control measures. Whenever necessary, the Contractor will clear all sediment from the straw wattles and silt fence. Daily monitoring should be conducted using the attached Inspection Form.

2.8 Material Handling and Waste Management

All materials stored on-site will be stored in a neat, orderly manner in appropriate containers. All materials will be kept in their original containers with the original manufacturer’s label. Substances will not be mixed with one another unless recommended by the manufacturer.

All waste materials will be collected and stored in a securely lidded metal container from a licensed management company. The waste and any construction debris from the site will be hauled off-site daily and disposed of properly. The contractor will be responsible for all waste removal. Manufacturer's recommendations for proper use and disposal will be followed for all materials.

2.9 Designated Washout Areas

The Contractor shall use washout facilities at their own plants, unless otherwise directed by the Engineer.

2.10 Proper Equipment/Vehicle Fueling and Maintenance Practices

On-site vehicles will be monitored for leaks and receive regular preventative maintenance to reduce the risk of leakage. To ensure that leaks on stored equipment do not contaminate the site oil-absorbing mats will be placed under all equipment during storage. Regular fueling and service of the equipment may be performed using approved methods and with care taken to minimize chance of spills. Repair of equipment or machinery within the 100' water resources area shall not be allowed without the prior approval of the Engineer. Any petroleum products will be stored in tightly sealed containers that are clearly labeled.

2.11 Equipment/Vehicle Washing

The Contractor will be responsible to ensure that no equipment is washed on-site except to remove sediments prior to transport from the site.

SECTION 3: Spill Prevention and Control Plan

The Contractor will be responsible for preventing spills in accordance with the project specifications and applicable federal, state and local regulations. The Contractor will identify a properly trained site employee, involved with the day-to-day site operations to be the spill prevention and cleanup coordinator. The name(s) of the responsible spill personnel will be posted on-site. Each employee will be instructed that all spills are to be reported to the spill prevention and cleanup coordinator.

3.1 Spill Control Equipment

Spill control/containment equipment will be kept in the Work Area. Materials and equipment necessary for spill cleanup will be kept either in the Work Area or in an otherwise accessible on-site location. Equipment and materials will include, but not be limited to, absorbent booms/mats, brooms, dust pans, mops, rags, gloves, goggles, sand, plastic and metal containers specifically for this purpose. It is the responsibility of the Contractor to ensure the inventory will be readily accessible and maintained.

3.2 Notification

All workers will be directed to inform the on-site supervisor of a spill event. The supervisor will assess the incident and initiate proper containment and response procedures immediately upon notification. Workers should avoid direct contact with spilled materials during the containment procedures. Primary notification of a spill should be made to the local Fire Department and Police Departments. Secondary Notification will be to the certified cleanup contractor if deemed necessary by Fire and/or Police personnel. The third level of notification is to the DEP. The specific cleanup contractor to be used will be identified by the Contractor prior to commencement of construction activities.

3.3 Spill Containment and Clean-Up Measures

Spills will be contained with granular sorbent material, sand, sorbent pads, booms or all of the above to prevent spreading. Certified cleanup contractors should complete spill cleanup. The material manufacturer's recommended methods for spill cleanup will be clearly posted and on-site personnel will be made aware of the procedures and the location of the information and cleanup supplies.

3.4 Hazardous Materials Spill Report

The Contractor will report and record any spill. The spill report will present a description of the release, including the quantity and type of material, date of the spill, circumstances leading to the release, location of spill, response actions and personnel, documentation of notifications and corrective measures implemented to prevent reoccurrence.

This document does not relieve the Contractor of the Federal reporting requirements of 40 CFR Part 110, 40 CFR Part 117, 40 CFR Part 302 and the State requirements specified under the Massachusetts Contingency Plan (M.C.P) relating to spills or other releases of oils or hazardous substances. Where a release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity established under either 40 CFR Part 110, 40 CFR Part 117 or 40 CFR Part 302, occurs during a twenty-four (24) hour period, the Contractor is required to comply with the response requirements of the above mentioned regulations. Spills of oil or hazardous material in excess of the reportable quantity will be reported to the National Response Center (NRC).

SECTION 4: Contact Information/Responsible Parties

Owner/Operator:
David Feldman
WHC Haverhill, AL, LLC
63 Kendrick Street
Needham, MA 02494
(781) 707-9527

Engineer:
Roger Alcott
Weston & Sampson, Inc.
5 Centennial Drive
Peabody, MA 01960
978-532-1900

Site Inspector:
TBD

Contractor:
TBD

SECTION 5: Erosion and Sedimentation Control

Erosion and Sedimentation Control details and layout can be found in the attached plan set. In addition, a technical specification (Section 01570, Environmental Protection) has been included with this report, which details all Erosion and Sedimentation controls.

SECTION 6: Site Development Plan

The Site Development Plan is included in the attached plan set.

SECTION 7: Operation and Maintenance of Erosion Control

The erosion control measures will be installed as detailed in the technical specification Section 01570, Environmental Protection. If there is a failure to the controls, the Contractor will be required to stop work until the failure is repaired.

Periodically throughout the work, whenever the Engineer deems it necessary, the sediment that has been deposited against the controls will be removed to ensure that the controls are working properly.

SECTION 8: Inspection Schedule

During construction the erosion and sedimentation controls will be inspected daily. Once the contractor is selected, an on-site inspector will be selected to work closely with the Engineer to insure that all erosion and sedimentation controls are in place and working properly. An Inspection Form is included.

Inspection Form

Inspected By: _____ Date: _____Time:_____

YES	NO	DOES NOT APPLY	ITEM
			Do any erosion/siltation control measures require repair or clean out to maintain adequate function?
			Is there any evidence that sediment is leaving the site and entering the wetlands?
			Are any temporary soil stockpiles or construction materials located in non-approved areas?
			Are on-site construction traffic routes, parking, and storage of equipment and supplies located in areas not specifically designed for them?

Specific location, current weather conditions, and action to be taken:

_____

_____

_____

_____

_____

Other Comments:

_____

_____

Pending the actions noted above I certify that the site is in compliance with the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan.

Signature: _____ Date: _____

Illicit Discharge Compliance Statement

Section I – Purpose/Intent

The purpose of this document is to provide for the health, safety, and general welfare of the citizens of Haverhill, Massachusetts through the regulation of non-stormwater discharges into existing outstanding resource areas near the proposed public works facility sites to the maximum extent practicable, as required by federal and state law. This document establishes methods for controlling the introduction of pollutants into existing outstanding resource areas to comply with requirements of the National Pollutant Discharge Elimination System (NPDES) permit process.

Section II - Definitions

For the purposes of this statement, the following shall mean:

Best Management Practices (BMPs): Schedules of activities, prohibitions of practices, general good housekeeping practices, pollution prevention and educational practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants directly or indirectly to stormwater, receiving waters, or stormwater conveyance systems. BMPs also include treatment practices, operating procedures, and practices to control site runoff, spillage or leaks, sludge or water disposal, or drainage from raw materials storage.

Clean Water Act: The federal Water Pollution Control Act (33 U.S.C § 1251 et seq.), and any subsequent amendments thereto.

Construction Activity: Activities subject to the Massachusetts Erosion and Sedimentation Control Act or NPDES Construction Permits. Such activities include but are not limited to clearing and grubbing, grading, excavating, and demolition.

Hazardous Materials: Any material, including any substance, waste, or combination thereof, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or significantly contribute to, a substantial present or potential hazard to human health, safety, property, or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

Illegal Connection: An illegal connection is defined as either of the following:

a. Any pipe, open channel, drain or conveyance, whether on the surface or subsurface, which allows an illicit discharge to enter the outstanding resource area including but not limited to any conveyances which allow any non-stormwater discharge including sewage, process wastewater, and wash water, regardless of whether said drain or connection has been previously allowed, permitted, or approved by an authorized enforcement agency; or
b. Any pipe, open channel, drain or conveyance connected to the City of Haverhill storm water treatment system which has not been documented in plans, maps, or equivalent records and approved by an authorized enforcement agency.

Illicit Discharge: Any direct or indirect non-stormwater discharge to the City of Haverhill stormwater treatment system, except as exempted in Section II of this ordinance.

Industrial Activity: Activities subject to NPDES Industrial Permits as defined in 40CFR, Section 122.26 (b) (14).

National Pollutant Discharge Elimination System (NPDES) Stormwater Discharge Permit: A permit issued by MassDEP under authority delegated pursuant to 33 USC § 1342 (b) that authorizes the discharge of pollutants to waters of the United States, whether the permit is applicable on an individual, group, or general area-wide basis.

City of Haverhill Stormwater Treatment System: Any facility, owned or maintained by the city, designed or used for collecting and/or conveying stormwater, including but not limited to roads with drainage systems, City of Haverhill streets, curbs, gutters, inlets, catch basins, piped storm drains, pumping facilities, infiltration, retention and detention basins, natural and man-made or altered drainage channels, reservoirs, and other drainage structures.

Non-Stormwater Discharge: Any discharge to the storm drain system that is not composed entirely of stormwater.

Person: Any individual, association, organization, partnership, firm, joint venture, public or private corporation, trust, estate, commission, board, public or private institution, utility, cooperative, city, county or other political subdivision of the State, interstate body, or any other legal entity.

Pollutant: Anything which causes or contributes to pollution. Pollutants may include, but are not limited to: paints, varnishes, and solvents; petroleum hydrocarbons; automotive fluids; cooking grease; detergents (biodegradable or otherwise); degreasers; cleaning chemicals; non-hazardous liquid and solid wastes; refuse, rubbish, garbage, litter, or other discarded or abandoned objects and accumulations, so that same may cause or contribute to pollution; floatables; pesticides, herbicides, and fertilizers; liquid and solid wastes; sewage, fecal coliform and pathogens; dissolved and particulate metals; animal wastes; wastes and residues that result from constructing a building or structure; concrete and cement; and noxious or offensive matter of any kind.

Pollution: Contamination or other alteration of any water's physical, chemical, or biological properties by addition of any constituent including but not limited to a change in temperature, taste, color, turbidity, or odor of such waters, or the discharge of any liquid, gaseous, solid, radioactive, or other substance into any such waters as will or is likely to create a nuisance or render such waters harmful, detrimental, or injurious to the public health, safety, welfare, or environment, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish or other aquatic life.

Premises: Any building, lot, parcel of land, or portion of land whether improved or unimproved including adjacent sidewalks and parking strips.

Stormwater: Any surface flow, runoff, and drainage consisting entirely of water from any form of natural precipitation, and resulting from such precipitation.

Wastewater: Any water or other liquid discharged from a facility, that has been used, as for washing, flushing, or in a manufacturing process, and so contains waste products.

Section III - Prohibitions

Prohibition of Illicit Discharges:

No person shall throw, drain, or otherwise discharge, cause or allow others under its control to throw, drain, or otherwise discharge into the City of Haverhill stormwater treatment system or watercourses any materials, including but not limited to, any pollutants or waters containing any pollutants, other than stormwater. The commencement, conduct or continuance of any illicit discharge to the storm drain system is prohibited except as described as follows:

1. Water line flushing performed by a government agency, other potable water sources, landscape irrigation or lawn watering, diverted stream flows, rising ground water, ground water infiltration to storm drains, uncontaminated pumped ground water, foundation or footing drains (not including active groundwater dewatering systems), crawl space pumps, air conditioning condensation, springs, natural riparian habitat or wetland flows, and any other water source not containing pollutants;

2. Discharges or flows from fire fighting, and other discharges specified in writing by the City of Haverhill as being necessary to protect public health and safety;

3. Dye testing is an allowable discharge, but requires a verbal notification to the City of Haverhill prior to the time of the test;

4. Any non-stormwater discharge permitted under an NPDES permit, waiver, or waste discharge order issued to the discharger and administered under the authority of the Federal Environmental Protection Agency, provided that the discharger is in full compliance with all requirements of the permit, waiver, or order and other applicable laws and regulations, and provided that written approval has been granted for a discharge to the City of Haverhill stormwater treatment system.

Section IV - Industrial or Construction Activity Discharges

Any person subject to an industrial or construction activity NPDES stormwater discharge permit shall comply with all provisions of such permit. Proof of compliance with said permit may be required in a form acceptable to the City of Haverhill Public Works Department prior to allowing discharges to the Haverhill stormwater treatment system.

Section V - Notification of Spills and Accidental Discharges

Notwithstanding other requirements of law, as soon as any person responsible for a facility, activity or operation, or responsible for emergency response for a facility, activity or operation has information of any known or suspected release of pollutants or non-stormwater discharges from that facility, activity, or operation which are resulting or may result in illicit discharges or pollutants discharging into stormwater, the City of Haverhill stormwater treatment system, State Waters, or Waters of the U.S., said person shall take all necessary steps to ensure the discovery, containment, and cleanup of such release so as to minimize the effects of the discharge. In the event of such a release of hazardous materials, said person shall immediately notify emergency response agencies of the occurrence via emergency dispatch services. In the event of a release of non-hazardous materials, said person shall notify the City of Haverhill Public Works Department in person or by phone no later than the next business day, including the nature, quantity and time of occurrence of the discharge. Notifications in person or by phone shall be confirmed by written notice, via certified mail return receipt requested addressed to the City of Haverhill Public Works Department within three (3) business days of the initial notice. If the discharge of prohibited materials emanates from a commercial or industrial establishment, the owner or operator of such establishment shall also retain an on-site written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least three years.

IN WITNESS WHEREOF the parties hereto have executed copies of this Agreement on the _____ day of **_____, _____.**

_____

David Feldman
WHC Haverhill AL, LLC

Operations and Maintenance Plan

Wingate Residences Haverhill

1.0 Introduction

WHC Haverhill AL, LLC is planning to construct a new assisted living facility on vacant land on North Avenue in Haverhill, adjacent to the Wingate at Haverhill Nursing Home. The stormwater guidelines were implemented in the Commonwealth of Massachusetts by the Department of Environmental Protection. The intent of these guidelines is to encourage Low Impact Development techniques to improve the quality of the stormwater runoff. These techniques, also known as Best Management Practices (BMPs) collect, store, and treat the runoff before discharging to adjacent environmental resources.

2.0 Purpose

This Operation and Maintenance Plan (O&M Plan) is intended to provide a mechanism for the consistent inspection and maintenance of each BMP installed on the project site. Included in this O&M Plan is a description of each BMP type and an inspection form for each BMP. WHC Haverhill AL, LLC is the owner and operator of the system and is responsible for its upkeep, maintenance, and repair. This work will be funded on an annual basis through WHC Haverhill AL, LLC's operating budget. The estimated budget to maintain these BMPs utilizing independent contractors is approximately $10,000 per year.

In the event the Owner sells the property, it is the Owner's responsibility to transfer this plan as well as the past three years of operation and maintenance records to the new property owner.

3.0 BMP Description and Locations

3.1 Deep Sump Catch Basins

There are a number of deep sump catch basins that collect stormwater runoff over the entire site. Deep sump catch basins are collection systems that are designed to remove trash, debris, and coarse sediment from the stormwater runoff.

3.2 Street Sweeping

Street sweeping involves the use of mechanical street sweeping equipment which utilizes brooms or rotary brushes to scour the pavement to improve TSS removal from stormwater. Good housekeeping measures for the site should call for keeping the pavement clear of sediment buildup.

3.3 Drainage Swales

Drainage swales are vegetated channels that are designed to provide non-erosive conveyance of stormwater runoff. There are three drainage swales located behind the building.

3.4 Stilling Areas / Stormwater Basins

There are five areas that will be maintained as stormwater basins: the three stilling areas and the two northern stormwater basins. They store and/or attenuate runoff from the storm event until it exfiltrates through the basin floor or discharges over the spillway.

3.5 Flared Ends / Rip Rap Spillways

While the spillways are not BMP's, all outfalls, including any riprap, should be inspected on a semiannual basis.

4.0 Inspection, Maintenance Checklist and Schedule

4.1 Deep Sump Catch Basins

Inspect and/or clean catch basins at least four times per year and at the end of foliage and snow removal seasons. Sediments must be removed 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 basin. Each catch basin should be cleaned a minimum of four times per year regardless of the amount of sediment in the basin. Catch basins shall be cleaned using clamshell buckets or vacuum trucks.

In the event of contamination by a spill or other means, all catch basins cleanings must be evaluated in accordance with the Hazardous Waste Regulations, 310 CMR 30.000 and handled as hazardous waste.

In the absence of evidence of contamination, catch basin cleanings may be taken to a landfill or other facility permitted by MassDEP to accept Solid Waste without any prior approval by MassDEP. Please note that current MassDEP regulations prevent landfills from accepting materials that contain free-draining liquids.

4.2 Street Sweeping

Street sweeping shall take place on a quarterly average, with sweeping scheduled primarily in spring and fall. All sediment and debris should be disposed of in accordance with local, state, and federal regulations.

4.3 Stormwater Basins

Stormwater basins should be inspected at least twice per year and after any storm event in which the drainage discharges through the highest outlet. Once a basin is in use, it should be inspected after every major storm for the first few months to ensure it is stabilized and is functioning properly. Take corrective actions if the system is not functioning properly.

Upon establishing that the system is functioning properly, the basin shall be inspected at least twice per year. The following items should be checked:

- Signs of differential settlement
- Cracking
- Erosion
- Leakage in embankments
- Tree growth on the embankments
- Condition of riprap
- Sedimentation accumulation
- Health of the turf
- Draining completely within 72 hours of rain events

At least twice a year, mow the buffer area, side slopes, and basin bottom. Remove all grass clippings and accumulated organic matter to prevent an impervious organic mat from forming. In addition, remove all trash, debris, and sediment from the basin bottom. Sediment shall only be removed when the bottom of the basin is thoroughly dry and shall be accomplished with the use of light equipment. Removal activities shall remove the top layer without compacting the underlying soil. Repair damage to vegetated areas by deep tilling and re-vegetating accordingly. All sediment and debris should be disposed of in accordance with local, state, and federal regulations.

4.4 Flared Ends / Rip Rap Spillways

While not BMP's, the rip rap spillways should be inspected and cleaned twice a year and after heavy rainstorms. Sediment and debris should be removed by hand and disposed of in accordance with local, state and federal regulations.

4.5 Inspections and Record Keeping

- An inspection form should be filled out each and every time maintenance work is performed.
- A binder should be kept at the Facility that contains all of the completed inspection forms and any other related materials.
- A review of all Operation & Maintenance actions should take place annually to ensure that these Stormwater BMPs are being taken care of in the manner illustrated in this Operation & Maintenance Plan.
- All operation and maintenance log forms for the last three years, at a minimum, shall be kept on site at the Facility.
- The inspection and maintenance schedule may be refined in the future based on the findings and results of this operation and maintenance program or policy.

Wingate Residences Haverhill
North Avenue, Haverhill, MA
Permanent BMP Inspection Checklist

☐ **Street Sweeping**

Frequency: Street sweeping shall be done quarterly.

Inspected By: _____ Date: _____
Observations: _____
_____
_____

Actions Taken: _____
_____
_____

Instructions: Sweep all paved areas of sediment and debris. Dispose of sediment and debris in accordance with local, state, and federal laws.

☐ **Deep Sump Catch Basins**

Frequency: Inspect and clean deep sump catch basins and leaching galleys in March, June, September and December.

Structure Number: _____

Inspected By: _____ Date: _____

Observations: _____
_____
_____

Actions Taken: _____
_____
_____

Instructions: Clean unit four times per year or whenever the depth of the deposits is greater than or equal to one half the depth from the bottom of the invert to lowest pipe in the basin/galley.

☐ **Drainage Swales**

Frequency: Drainage swales shall be inspected at least twice per year and after major storm events.

Structure Number: _____

Inspected By: _____ Date: _____

Observations: _____

_____

_____

Actions Taken: _____

_____

_____

Instructions: Keep grass cut to six inches in height. Remove accumulated trash and debris. All trash and debris should be disposed of in accordance with local, state, and federal regulations.

☐ **Stilling Areas / Stormwater Basins**

Frequency: The basins shall be inspected at least twice per year (preferably in May and November) and after major storm events. At least twice a year, mow the buffer area, side slopes, and basin bottom.

Inspected By: _____ Date: _____
Observations: _____
_____
_____

Actions Taken: _____
_____
_____

Instructions: The following items should be checked:

1. Signs of differential settlement
2. Cracking
3. Erosion
4. Leakage in embankments
5. Tree growth on the embankments
6. Condition of riprap
7. Sedimentation accumulation
8. Health of the turf
9. Draining completely w/in 72 hrs. of rain events

When mowing is conducted, remove all grass clippings and accumulated organic matter to prevent an impervious organic mat from forming. In addition, remove all trash, debris, and sediment from the basin bottom. Sediment shall only be removed when the bottom of the basin is thoroughly dry and shall be accomplished with the use of light equipment. Removal activities shall remove the top layer without compacting the underlying soil. Repair damage to vegetated areas by deep tilling and re-vegetating accordingly. All sediment and debris should be disposed of in accordance with local, state, and federal regulations.

SECTION 01570

ENVIRONMENTAL PROTECTION

PART 1 – GENERAL

1.01 DESCRIPTION:

A. The work covered by this section of the specifications consists of furnishing all labor, materials, tools and equipment and performing all work required for the prevention of environmental pollution during and as a result of construction operations under this contract.

B. The requirements set forth in this section of the specifications apply to construction in and adjacent to wetlands, unless otherwise specifically stated.

C. All work under this Contract shall be in accordance with the Conservation Commissions' Orders of Conditions, as well as any conditional requirements applied, all of which are attached to Section 00890, PERMITS.

D. Prior to commencement of work, the Contractor shall meet with representatives of the Engineer to develop mutual understandings relative to compliance of the environmental protection program.

1.02 RELATED WORK:

A. Section 01562, DUST CONTROL

1.03 SUBMITTALS:

A. The Contractor shall submit for approval six sets of details and literature fully describing environmental protection methods to be employed in carrying out construction activities within 100 feet of wetlands or in areas designated as wetlands.

PART 2 - PRODUCTS

2.01 COMPOST FILTER TUBES:

A . Compost filter tubes shall be jute mesh or approved biodegradable material. Compost filter tubes shall be a minimum of 12 inches in diameter with an effective height of 9.5 inches.

B. 2-inch x 2-inch x 3-feet untreated hardwood stakes shall be used to secure compost filter tubes in place. A 2-inch x 12-inch wide layer of loose compost material shall be placed on the uphill/flow side of the compost filter tubes to fill the space between the soil surface and the compost filter tubes.

PART 3- EXECUTION

3.01 NOTIFICATION AND STOPPAGE OF WORK:

A. The Engineer will notify the Contractor in writing of any non-compliance with the provisions of the Order of Conditions. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails to act promptly, the Owner may order stoppage of all or part of the work through the Engineer until satisfactory corrective action has been taken. No claim for an extension of time or for excess costs or damage incurred by the Contractor as a result of time lost due to any stop work orders shall be made unless it was later determined that the Contractor was in compliance.

3.02 AREA OF CONSTRUCTION ACTIVITY:

A. Insofar as possible, the Contractor shall confine his construction activities to those areas defined by the plans and specifications. All land resources within the project boundaries and outside the limits of permanent work performed under this contract shall be preserved in their present condition or be restored to a condition after completion of construction at least equal to that which existed prior to work under this contract.

3.03 PROTECTION OF WATER RESOURCES:

A. The Contractor shall not pollute streams, lakes or reservoirs with fuels, oils, bitumens, calcium chloride, acids or other harmful materials. It is the Contractor's responsibility to comply with all applicable Federal, State, County and Municipal laws regarding pollution of rivers and streams.

B. Special measures should be taken to insure against spillage of any pollutants into public waters.

3.04 CONSTRUCTION IN AREAS DESIGNATED AS WETLANDS ON THE DRAWINGS:

A. Insofar as possible, the Contractor shall make every effort to minimize disturbance within areas designated as wetlands.

B. The Contractor shall perform his work in such a way that these areas are left in the condition existing prior to construction.

C. The elevations of areas designated as wetlands shall not be unduly disturbed by the Contractor's operations. If such disturbance does occur, the Contractor shall take all

measures necessary to return these areas to the elevations which existed prior to construction.

D. Excavated materials shall not be permanently placed or temporarily stored in areas designated as wetlands. Temporary storage areas for excavated material shall be as required by the Engineer.

3.05 PROTECTING AND MINIMIZING EXPOSED AREAS:

A. The Contractor shall limit the area of land which is exposed and free from vegetation during construction. In areas where the period of exposure will be greater than two (2) months, temporary vegetation, mulching or other protective measures shall be provided as specified.

B. The Contractor shall take account of the conditions of the soil where temporary cover crop will be used to insure that materials used for temporary vegetation are adaptive to the sediment control. Materials to be used for temporary vegetation shall be approved by the Engineer.

3.06 LOCATION OF STORAGE AREAS:

A. The location of the Contractor's storage areas for equipment and/or materials shall be upon cleared portions of the job site or areas to be cleared as a part of this project, and shall require written approval of the Engineer. Plans showing storage facilities for equipment and materials shall be submitted for approval of the Engineer.

B. No excavated materials or materials used in backfill operations shall be deposited within a minimum distance of one hundred (100) feet of any watercourse or any drainage facility. Adequate measures for erosion and sediment control such as the placement of compost filter tubes around the downstream perimeter of stockpiles shall be employed to protect any downstream areas from siltation.

C. There shall be no storage of equipment or materials in areas designated as wetlands.

D. The Engineer may designate a particular area or areas where the Contractor may store materials used in his operations.

3.07 PROTECTION OF LANDSCAPE:

A. The Contractor shall not deface, injure, or destroy trees or shrubs nor remove or cut them without written authority from the Owner. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorages unless specifically authorized by the Engineer. Excavating machinery and cranes shall be of suitable type and be operated with care to prevent injury to trees which are not to be removed, particularly overhanging branches and limbs. The Contractor shall, in any event, be responsible for any damage resulting from such use.

B. Branches, limbs, and roots shall not be cut except by permission of the Engineer. All cutting shall be smoothly and neatly done without splitting or crushing. When there is unavoidable injury to branches, limbs and trunks of trees, the injured portions shall be neatly trimmed and covered with an application of grafting wax or tree healing paint as directed.

C Where, in the opinion of the Engineer, trees may possibly be defaced, bruised, injured, or otherwise damaged by the Contractor's equipment or by his blasting or other operations, the Engineer may require the Contractor to adequately protect such trees by placing boards, planks, poles or fencing around them. Any trees or landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the expense of the Contractor.

D. Cultivated hedges, shrubs, and plants which could be injured by the Contractor's operations shall be protected by suitable means or shall be dug up, balled and temporarily replanted and maintained. After construction operations have been substantially completed, they shall be replanted in their original positions and cared for until growth is re-established. If cultivated hedges, shrubs, and plants are injured to such a degree as to affect their growth or diminish their beauty or usefulness, they shall be replaced by items of a kind and quality at least equal to that existing at the start of the work.

3.08 CLEARING AND GRUBBING:

A. The Contractor shall clear and grub only on the Owner's land or the Owner's easements, and only the area required for construction operations, as approved by the Engineer.

3.09 DISCHARGE OF DEWATERING OPERATIONS:

A. Any water that is pumped and discharged from the trench and/or excavation as part of the Contractor's water handling shall be filtered by an approved method prior to its discharge into a receiving water or drainage system.

B. Under no circumstances shall the Contractor discharge water to the areas designated as wetlands. When constructing in a wetlands area, the Contractor shall discharge water from dewatering operations directly to the nearest drainage system, stream, or waterway after filtering by an approved method.

C. The pumped water shall be filtered through filter fabric and baled straw, a vegetative filter strip or a vegetated channel to trap sediment occurring as a result of the construction operations. The vegetated channel shall be constructed such that the discharge flow rate shall not exceed a velocity of more than 1 foot per second. Accumulated sediment shall be cleared from the channel periodically.

3.10 DUST CONTROL:

A. During the progress of the work, the Contractor shall conduct his operations and maintain the area of his activities, including sweeping and sprinkling of streets as necessary, to minimize creation and dispersion of dust. If the Engineer decides it is necessary to use calcium chloride for more effective dust control, the Contractor shall furnish and spread the material, as directed. Calcium chloride shall be as specified under Section 01562, DUST CONTROL.

B. Calcium Chloride shall not be used for dust control within a drainage basin or in the vicinity of any source of potable water.

3.11 CATCH BASIN PROTECTION:

A. Catch basin protection shall be used for every catch basin, shown on the plans or as required by the Engineer, to trap sediment and prevent it from clogging drainage systems and entering wetlands. Siltation fabric shall be securely installed under the catch basin grate. Care shall be taken to keep the siltation fabric from breaking apart or clogging. All deposited sediment shall be removed periodically and at times prior to predicted precipitation to allow free drainage flow. Prior to working in areas where catch basins are to be protected, each catch basin sump shall be cleaned of all debris and protected. The contractor shall properly dispose of all debris at no additional cost to the Owner.

3.12 COMPOST FILTER TUBES:

A. The compost filter tubes will be placed on the ground and staked in the ground using wooden stakes. The wooden stakes will be placed at a minimum depth of 24-inches into the ground.

END OF SECTION

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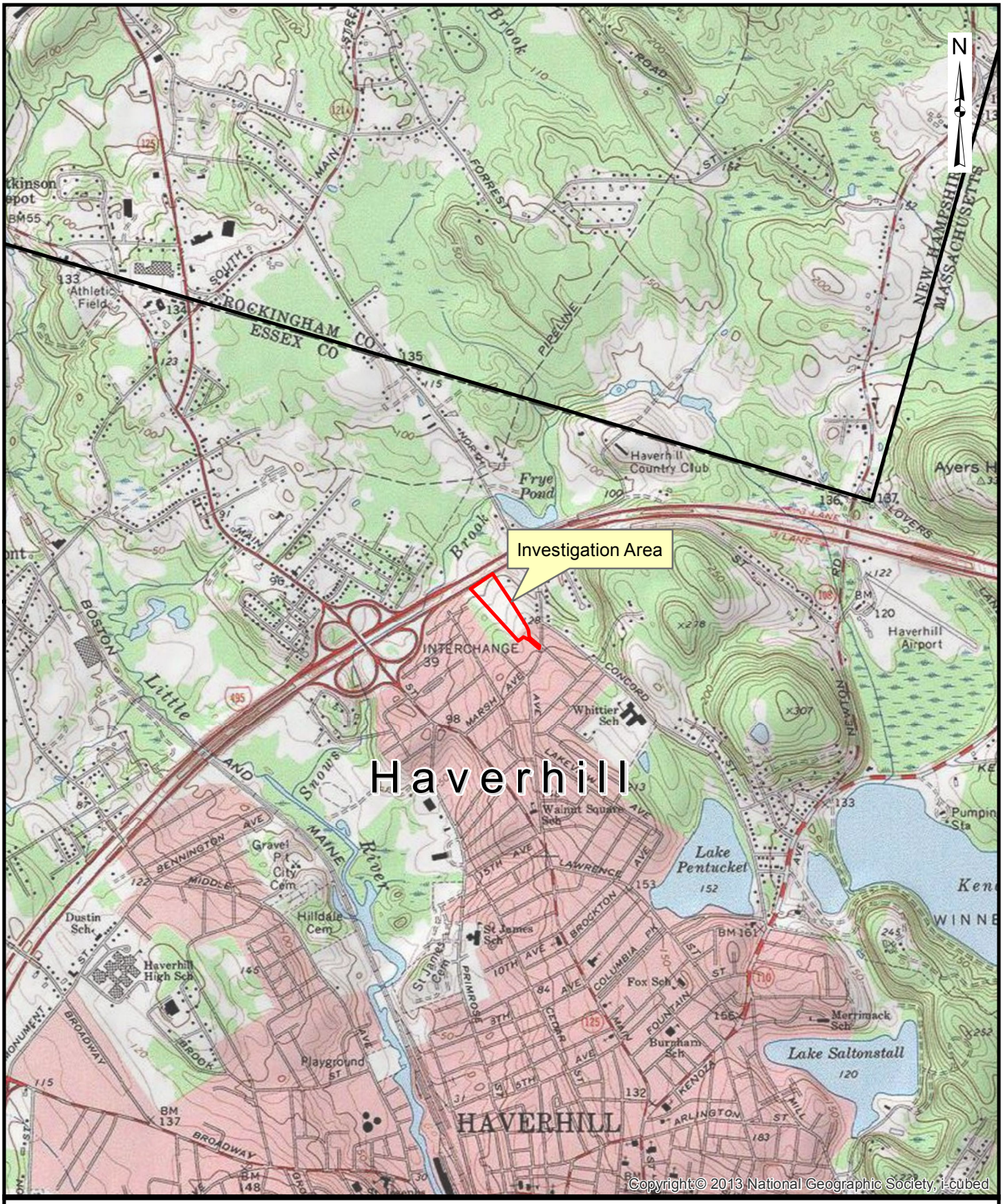


FIGURE 2
174 North Avenue
Haverhill, Massachusetts

LOCUS MAP

investigation area

MA Towns

2,000 0 2,000

Scale In Feet

Weston & Sampson

Path: T:\Water\ERMA\GIS - Constraints Mapping\Haverhill\Wingate 2016\Figure 1 - locus.mxd User: higginsm Saved: 3/2/2016 5:12:09 PM Opened: 3/2/2016 5:12:18 PM

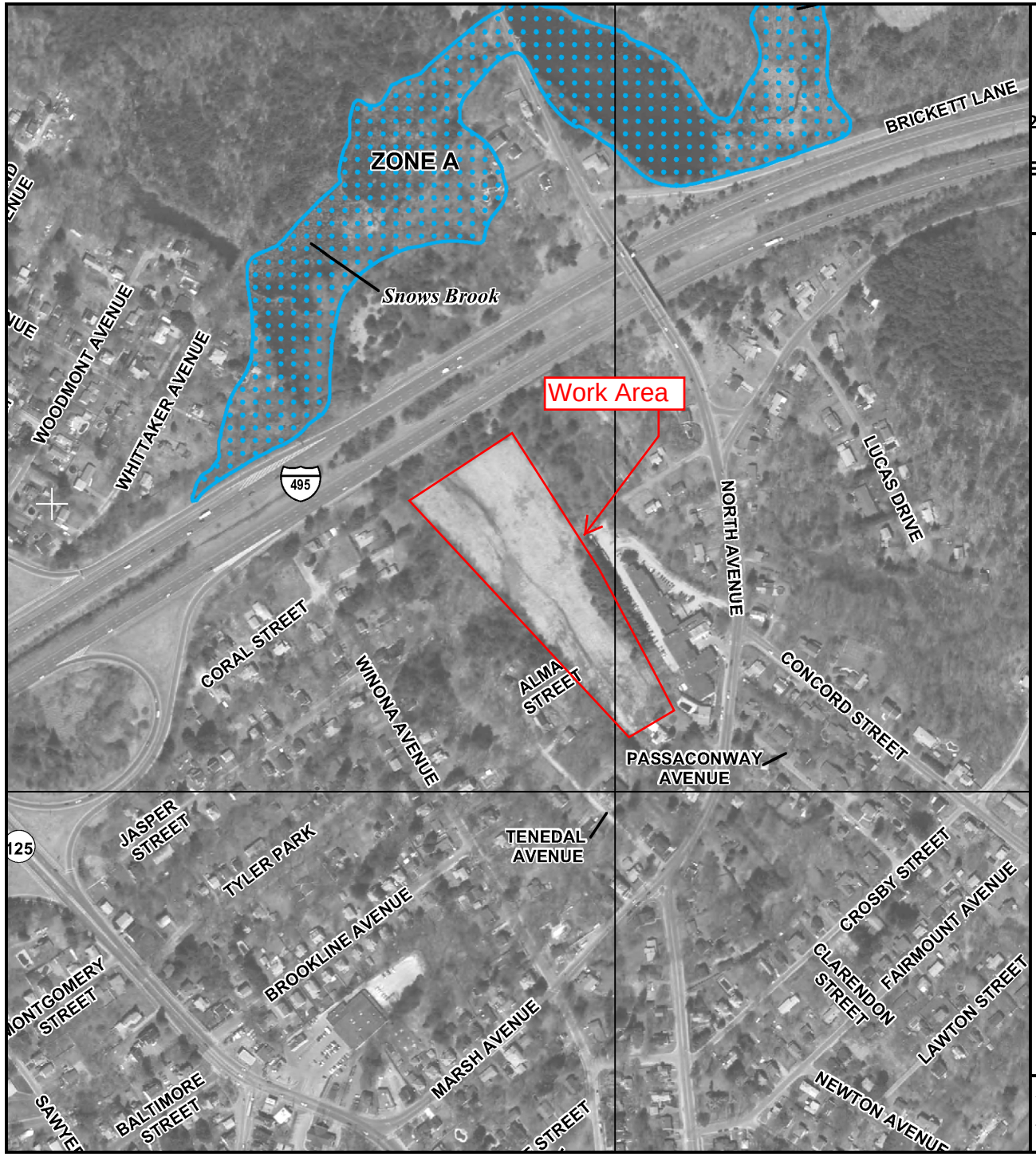
FIGURE 2
174 North Avenue
Haverhill, Massachusetts

ENVIRONMENTAL RESOURCES MAP

200 0 200
Scale In Feet

Weston & Sampson

Path: T:\Water\ERMA\GIS - Constraints Mapping\Haverhill\Wingate 2016\Figure 2 - Env Receptor.mxd User: higginsm Saved: 3/2/2016 5:06:07 PM Opened: 3/2/2016 5:08:11 PM



MAP SCALE 1" = 500'

250 0 500 1000

FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0087F

FIRM

FLOOD INSURANCE RATE MAP

ESSEX COUNTY, MASSACHUSETTS

(ALL JURISDICTIONS)

PANEL 87 OF 600

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
HAVERHILL, CITY OF	250085	0087	F

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

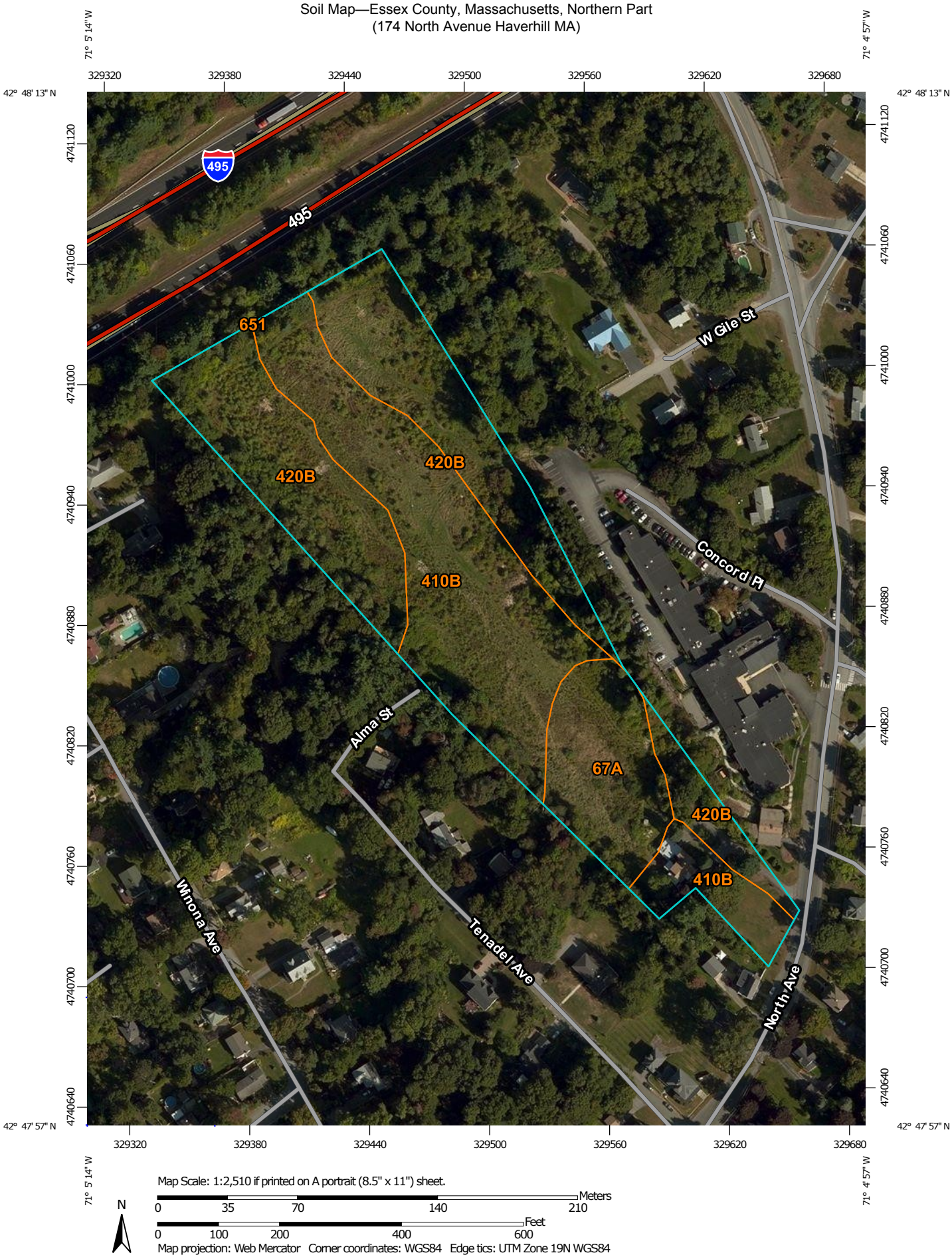
MAP NUMBER
25009C0087F

EFFECTIVE DATE
JULY 3, 2012

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Soil Map—Essex County, Massachusetts, Northern Part
(174 North Avenue Haverhill MA)



Map Scale: 1:2,510 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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 1:15,800.

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: http://websoilsurvey.nrcs.usda.gov
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: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 11, Sep 28, 2015

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

Date(s) aerial images were photographed: Aug 29, 2014—Sep 19, 2014

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.

Map Unit Legend

Essex County, Massachusetts, Northern Part (MA605)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
67A	Leicester fine sandy loam, 0 to 3 percent slopes	1.2	14.0%
410B	Sutton fine sandy loam, 3 to 8 percent slopes	3.7	42.1%
420B	Canton fine sandy loam, 3 to 8 percent slopes	3.9	43.8%
651	Udorthents, smoothed	0.0	0.0%
Totals for Area of Interest		**8.9**	**100.0%**

SECTION 01562

DUST CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION:

This section of the specification covers the control of dust via water. No calcium chloride shall be used for dust control for this project.

PART 2 - PRODUCTS

2.01 WATER:

A. Water shall not be brackish and shall be free from oil, acid, and injurious alkali or vegetable matter.

PART 3 - EXECUTION

3.01 APPLICATION:

A. Water may be sprinkler applied with equipment including a tank with gauge-equipped pressure pump and a nozzle-equipped spray bar.

B. Water shall be dispersed through the nozzle under a minimum pressure of 20 pounds per square inch, gauge pressure.

END OF SECTION

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SECTION 01570

ENVIRONMENTAL PROTECTION

PART 1 – GENERAL

1.01 DESCRIPTION:

A. The work covered by this section of the specifications consists of furnishing all labor, materials, tools and equipment and performing all work required for the prevention of environmental pollution during and as a result of construction operations under this contract.

B. The requirements set forth in this section of the specifications apply to construction in and adjacent to wetlands, unless otherwise specifically stated.

C. All work under this Contract shall be in accordance with the Conservation Commissions' Orders of Conditions as well as any conditional requirements applied, all of which are attached to Section 00890, PERMITS.

D. Prior to commencement of work, the Contractor shall meet with representatives of the Engineer to develop mutual understandings relative to compliance of the environmental protection program.

1.02 RELATED WORK:

A. Section 01562, DUST CONTROL

1.03 SUBMITTALS:

A. The Contractor shall submit for approval six sets of details and literature fully describing environmental protection methods to be employed in carrying out construction activities within 100 feet of wetlands or across areas designated as wetlands.

PART 2 - PRODUCTS

2.01 COMPOST FILTER TUBES:

A . Compost filter tubes shall be jute mesh or approved biodegradable material. Compost filter tubes shall be a minimum of 12 inches in diameter with an effective height of 9.5 inches.

B. 2-inch x 2-inch x 3-feet untreated hardwood stakes shall be used to secure compost filter tubes in place. A 2-inch x 12-inch wide layer of loose compost material shall be placed on the uphill/flow side of the compost filter tubes to fill the space between the soil surface and the compost filter tubes.

PART 3- EXECUTION

3.01 NOTIFICATION AND STOPPAGE OF WORK:

A. The Engineer will notify the Contractor in writing of any non-compliance with the provisions of the Order of Conditions. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails to act promptly, the Owner may order stoppage of all or part of the work through the Engineer until satisfactory corrective action has been taken. No claim for an extension of time or for excess costs or damage incurred by the Contractor as a result of time lost due to any stop work orders shall be made unless it was later determined that the Contractor was in compliance.

3.02 AREA OF CONSTRUCTION ACTIVITY:

A. Insofar as possible, the Contractor shall confine his construction activities to those areas defined by the plans and specifications. All land resources within the project boundaries and outside the limits of permanent work performed under this contract shall be preserved in their present condition or be restored to a condition after completion of construction at least equal to that which existed prior to work under this contract.

3.03 PROTECTION OF WATER RESOURCES:

A. The Contractor shall not pollute streams, lakes or reservoirs with fuels, oils, bitumens, calcium chloride, acids or other harmful materials. It is the Contractor's responsibility to comply with all applicable Federal, State, County and Municipal laws regarding pollution of rivers and streams.

B. Special measures should be taken to insure against spillage of any pollutants into public waters.

3.04 CONSTRUCTION IN AREAS DESIGNATED AS WETLANDS ON THE DRAWINGS:

A. Insofar as possible, the Contractor shall make every effort to minimize disturbance within areas designated as wetlands.

B. The Contractor shall perform his work in such a way that these areas are left in the condition existing prior to construction.

C. The elevations of areas designated as wetlands shall not be unduly disturbed by the Contractor's operations. If such disturbance does occur, the Contractor shall take all measures necessary to return these areas to the elevations which existed prior to construction.

D. Excavated materials shall not be permanently placed or temporarily stored in areas designated as wetlands. Temporary storage areas for excavated material shall be as required by the Engineer.

3.05 PROTECTING AND MINIMIZING EXPOSED AREAS:

A. The Contractor shall limit the area of land which is exposed and free from vegetation during construction. In areas where the period of exposure will be greater than two (2) months, temporary vegetation, mulching or other protective measures shall be provided as specified.

B. The Contractor shall take account of the conditions of the soil where temporary cover crop will be used to insure that materials used for temporary vegetation are adaptive to the sediment control. Materials to be used for temporary vegetation shall be approved by the Engineer.

3.06 LOCATION OF STORAGE AREAS:

A. The location of the Contractor's storage areas for equipment and/or materials shall be upon cleared portions of the job site or areas to be cleared as a part of this project, and shall require written approval of the Engineer. Plans showing storage facilities for equipment and materials shall be submitted for approval of the Engineer.

B. No excavated materials or materials used in backfill operations shall be deposited within a minimum distance of one hundred (100) feet of any watercourse or any drainage facility. Adequate measures for erosion and sediment control such as the placement of compost filter tubes around the downstream perimeter of stockpiles shall be employed to protect any downstream areas from siltation.

C. There shall be no storage of equipment or materials in areas designated as wetlands.

D. The Engineer may designate a particular area or areas where the Contractor may store materials used in his operations.

3.07 PROTECTION OF LANDSCAPE:

A. The Contractor shall not deface, injure, or destroy trees or shrubs nor remove or cut them without written authority from the Owner. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorages unless specifically authorized by the Engineer. Excavating machinery and cranes shall be of suitable type and be operated with care to prevent injury to trees which are not to be removed, particularly overhanging branches and limbs. The Contractor shall, in any event, be responsible for any damage resulting from such use.

B. Branches, limbs, and roots shall not be cut except by permission of the Engineer. All cutting shall be smoothly and neatly done without splitting or crushing. When there

is unavoidable injury to branches, limbs and trunks of trees, the injured portions shall be neatly trimmed and covered with an application of grafting wax or tree healing paint as directed.

C Where, in the opinion of the Engineer, trees may possibly be defaced, bruised, injured, or otherwise damaged by the Contractor's equipment or by his blasting or other operations, the Engineer may require the Contractor to adequately protect such trees by placing boards, planks, poles or fencing around them. Any trees or landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the expense of the Contractor.

D. Cultivated hedges, shrubs, and plants which could be injured by the Contractor's operations shall be protected by suitable means or shall be dug up, balled and temporarily replanted and maintained. After construction operations have been substantially completed, they shall be replanted in their original positions and cared for until growth is re-established. If cultivated hedges, shrubs, and plants are injured to such a degree as to affect their growth or diminish their beauty or usefulness, they shall be replaced by items of a kind and quality at least equal to that existing at the start of the work.

3.08 CLEARING AND GRUBBING:

A. The Contractor shall clear and grub only on the Owner's land or the Owner's easements, and only the area required for construction operations, as approved by the Engineer.

3.09 DISCHARGE OF DEWATERING OPERATIONS:

A. Any water that is pumped and discharged from the trench and/or excavation as part of the Contractor's water handling shall be filtered by an approved method prior to its discharge into a receiving water or drainage system.

B. Under no circumstances shall the Contractor discharge water to the areas designated as wetlands. When constructing in a wetlands area, the Contractor shall discharge water from dewatering operations directly to the nearest drainage system, stream, or waterway after filtering by an approved method.

C. The pumped water shall be filtered through filter fabric and baled straw, a vegetative filter strip or a vegetated channel to trap sediment occurring as a result of the construction operations. The vegetated channel shall be constructed such that the discharge flow rate shall not exceed a velocity of more than 1 foot per second. Accumulated sediment shall be cleared from the channel periodically.

3.10 DUST CONTROL:

A. During the progress of the work, the Contractor shall conduct his operations and maintain the area of his activities, including sweeping and sprinkling of streets as necessary, to minimize creation and dispersion of dust. If the Engineer decides it is necessary to use calcium chloride for more effective dust control, the Contractor shall furnish and spread the material, as directed. Calcium chloride shall be as specified under Section 01562, DUST CONTROL.

B. Calcium Chloride shall not be used for dust control within a drainage basin or in the vicinity of any source of potable water.

3.15 CATCH BASIN PROTECTION:

A. Catch basin protection shall be used for every catch basin, shown on the plans or as required by the Engineer, to trap sediment and prevent it from clogging drainage systems and entering wetlands. Siltation fabric shall be securely installed under the catch basin grate. Care shall be taken to keep the siltation fabric from breaking apart or clogging. All deposited sediment shall be removed periodically and at times prior to predicted precipitation to allow free drainage flow. Prior to working in areas where catch basins are to be protected, each catch basin sump shall be cleaned of all debris and protected. The contractor shall properly dispose of all debris at no additional cost to the Owner.

3.16 COMPOST FILTER TUBES:

A. The compost filter tubes will be placed on the ground and staked in the ground using wooden stakes. The wooden stakes will be placed at a minimum depth of 24-inches into the ground.

END OF SECTION

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SECTION 01740

CLEANING UP

PART 1 - GENERAL

1.01 DESCRIPTION:

The Contractor must employ at all times during the progress of his work adequate cleanup measures and safety precautions to prevent injuries to persons or damage to property. The Contractor shall immediately, upon direction by the Engineer provide adequate material, equipment and labor to cleanup and make safe any and all areas deemed necessary by the Engineer.

1.02 RELATED WORK:

A. Section 00700 GENERAL CONDITIONS

B. Section 01110 CONTROL OF WORK AND MATERIALS

C. Section 01140 SPECIAL PROVISIONS

D. Section 01570 ENVIRONMENTAL PROTECTION

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

2.01 DAILY CLEANUP:

A. The Contractor shall clean up, at least daily, all refuse, rubbish, scrap and surplus material, debris and unneeded construction equipment resulting from the construction operations and sweep the area. The site of the work and the adjacent areas affected thereby shall at all times present a neat, orderly and workmanlike appearance.

B. Upon written notification by the Engineer, the Contractor shall within 24 hours clean up those areas, which in the Engineer's opinion are in violation of this section and the above referenced sections of the specifications.

C. If in the opinion of the Engineer, the referenced areas are not satisfactorily cleaned up, all other work on the project shall stop until the cleanup is satisfactory.

2.02 MATERIAL OR DEBRIS IN DRAINAGE FACILITIES:

A. Where material or debris has washed or flowed into or has been placed in existing watercourses, ditches, gutters, drains, pipes, structures, such material or debris shall be entirely removed and satisfactorily disposed of during progress of the work, and the ditches, channels, drains, pipes, structures, and work shall, upon completion of the work, be left in a clean and neat condition.

2.03 REMOVAL OF TEMPORARY BUILDINGS, STRUCTURES AND EQUIPMENT:

A. On or before completion of the work, the Contractor shall, unless otherwise specifically directed or permitted in writing, tear down and remove all temporary buildings and structures built by him; shall remove all temporary works, tools and machinery or other construction equipment furnished by him; shall remove all rubbish from any grounds which he has occupied; shall remove silt fences and hay bales used for trapping sediment; and shall leave the roads and all parts of the property and adjacent property affected by his operations in a neat and satisfactory condition.

2.04 RESTORATION OF DAMAGED PROPERTY:

A. The Contractor shall restore or replace, when and as directed, any property damaged by his work, equipment or employees, to a condition at least equal to that existing immediately prior to the beginning of operations. To this end the Contractor shall do as required all necessary highway or driveway, walk and landscaping work. Materials, equipment, and methods for such restoration shall be as approved by the Engineer.

2.05 FINAL CLEANUP:

A. Before acceptance by the Owner, the Contractor shall perform a final cleanup to bring the construction site to its original or specified condition. This cleanup shall include removing all trash and debris off of the premises. Before acceptance, the Engineer shall approve the condition of the site.

END OF SECTION

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Haverhill Abutters List
Verified 3/10/16 on Patriot Properties

Work Area			
Lot Address	**Map# - Lot #**	**Owner Name**	**Owner Address**
North Ave. Haverhill, MA 01830 (8.06	630-2-1-1A	1. McGirr Family Trust 2. Trustee - Rudolph J. McGirr	34 Old Mill Rd. Falmouth, ME 04105

Abutters			
Lot Address	**Map# - Lot #**	**Owner Name**	**Owner Address**
190 North Ave.	630-3-2 (includes 630-4-all)	CCP Haverhill 1747 LLC	353 N. Clark St. Suite 2900 Chicago, IL 60654
182 North Ave.	630-3-2B (incl. 2C)	CCP Haverhill 1747 LLC	353 N. Clark St. Suite 2900 Chicago, IL 60654
12 West Gile St.	630-5-80 (incl. 78, 79)	1. James J. Gallagher 2. Kerry E. Sheehan	12 West Gile St. Haverhill, MA 01830
20 West Gile St.	630-5-81 (incl. 82, 83)	1. Edward S. English 2. Ann English	20 West Gile St. Haverhill, MA 01830
220 North Ave.	630-5-86 (incl. 87, 90, 91)	1. Lillie J. Torrence 2. Theresa L. Brown	220 North Ave. Haverhill, MA 01830
212 North Ave	630-5-88	1. Jose A. Rivera Sr. 2. Yolanda I. Rivera	212 North Ave. Haverhill, MA 01830
North Ave.	630-5-89	CCP Haverhill 1747 LLC	353 N. Clark St. Suite 2900 Chicago, IL 60654
228 North Ave.	630-5-92 (incl. 93, 84, 85)	1. Victoria Sherwood	28 Emery St. Merrimac, MA 01860
Concord Pl.	630-6-14 (incl. 15, 16, 17)	1. Jennie L. Mudzinski 2. Stanley P. Mudzinski	6 Loudon Parkway Loudonville, NY 12221
East Coral St.	630-7-66 (incl.67, 68)	1. Parevoliotis Trust 2. Cynthia Demakes	111 Laighton St. Lynn, MA 01902
21 West Gile St.	630-7-69	1. Matilda M. Quinn 2. Michael J. Quinn	21 West Gile St. Haverhill, MA 01830
9 West Gile St.	630-7-73 (incl.74, 75)	1. Parevoliotis Trust 2. Cynthia Demakes	111 Laighton St. Lynn, MA 01902
Concord Pl.	631-8-18 (incl. 19, 20)	1. Aida E. Khali	77 Route 125 Kingston, NH 03848
Concord Pl.	631-9-60 (incl. 56)	1. D+D Realty Trust 2. Trustee - Richard P. Early Sr.	77 Route 125 Kingston, NH 03848
156 East Coral St.	631-9-62 (incl. 61)	1. Robert G. Bodwell	156 East Coral St. Haverhill, MA 01830
131 Winona Ave.	647-4-16 (incl. 42)	1. Steven M. Benjamin 2. Christine A. Benjamin	131 Winona Ave. Haverhill, MA 01830
141 Winona Ave.	647-4-18	1. Lindsey A. Rudolph 2. Matthew Kelly	141 Winona Ave. Haverhill, MA 01830
147 Winona Ave.	647-4-20	1. Mary T. Ruth	141 Winona Ave. Haverhill, MA 01830
97 Coral St.	647-4-38 (incl. 39)	1. Adrienne J. Yemma 2. Eric A. Yemma	97 Coral St. Haverhill, MA 01830
Tendal Ave.	647-4-40 (incl. 41)	1. D+D Realty Trust 2. Trustee - Richard P. Early Sr.	77 Route 125 Kingston, NH 03848

Haverhill Abutters List
Verified 3/10/16 on Patriot Properties

Tendal Ave.	647-4-44 (incl. 15)	1. Fatek Elhashem 2. Donna Elhashem 3. Haickel Paul Elhashem	119 Winona Ave. Haverhill, MA 01830
159 Winona Ave.	647-5-23	1. Michael J. Carron	159 Winona Ave. Haverhill, MA 01830
98 Coral St.	647-5-36 (incl. 26, 27, 35, 37)	Clifton & Brittany McIntire	98 Coral Street Haverhill, MA 01830
Tendal Ave.	647-7-18	1. Stephen A. Berezansky 2. Judith A. Berezansky	18 Euclid Ave. Bradford, MA 01835
Tendal Ave.	647-7-19	1. Stephen A. Berezansky 2. Judith A. Berezansky	18 Euclid Ave. Bradford, MA 01835
Tendal Ave.	647-7-20	1. Stephen A. Berezansky 2. Judith A. Berezansky	18 Euclid Ave. Bradford, MA 01835
Tendal Ave.	647-7-21	1. Tendal Avenue Realty Trust 2. Trustee - Steven M. Benjamin	131 Winona Ave. Haverhill, MA 01830
Tendal Ave.	647-7-22	1. Adrienne J. Yemma	97 Coral St. Haverhill, MA 01830
Tendal Ave.	647-7-23 (incl. 24, 25)	1. Adrienne J. Yemma	97 Coral St. Haverhill, MA 01830
2 Alma St.	648-1-12 (incl. 13, 14, 15)	1. Jeffrey Salvi 2. Laurie Salvi	2 Alma St. Haverhill, MA 01830
Tendal Ave.	648-1-16	1. D+D Realty Trust 2. Trustee - Richard P. Early Sr.	77 Route 125 Kingston, NH 03848
Tendal Ave.	648-1-17	1. Stephen A. Berezansky 2. Judith A. Berezansky	18 Euclid Ave. Bradford, MA 01835
15 Tendal Ave.	648-2-2 (incl. 1, 3,4,5,6)	Elizabeth Jerez	15 Tendal Ave. Haverhill, MA 01830
29 Tendal Ave.	648-2-7	1. Edward A. Bioren 2. Tammy L. Bioren	29 Tendal Ave. Haverhill, MA 01830
33 Tendal Ave.	648-2-8	1. Thomas Dufresne 2. Ann Dufresne	33 Tendal Ave. Haverhill, MA 01830
150 North Ave.	648-2-18	David Snow	36 Village Road Unit 34 Middleton, MA
158 North Ave.	648-2-19	1. Robert A. Peabody 2. Karn J. H. Peabody	158 North Ave. Haverhill, MA 01830
162 North Ave.	648-2-20	1. Patricia Barett	162 North Ave. Haverhill, MA 01830
66 Marsh Ave.	648-3-15 (incl. 61)	1. Kevin J. Gmyrek 2. Meredith M. Whiting	66 Marsh Ave. Haverhill, MA 01830
76 Marsh Ave.	648-3-17	1. Marsh Realty Trust 2. Marcy McHale	37 Pear Tree Rd. Haverhill, MA 01830
Tendal Ave.	648-3-48	1. Steven W. Roberts 2. Patricia E. Stevens	16 West Parish Court Haverhill, MA 01830
20 Tendal Ave.	648-3-56 (incl. 53, 54, 55, 57)	1. R D Revoccable Trust 2011 2. Trustee - Richard G. Pierce	20 Tendal Ave. Haverhill, MA 01830
16 Tendal Ave.	648-3-59 (incl. 58, 60)	1. Eleanor A. Sweetman	16 Tendal Ave. Haverhill, MA 01830
141 North Ave.	656-3-18	1. William A. Hallett 2. Charlotte L. Hallett	P.O. Box 1467 Plaistow, NH 03865-1467

Haverhill Abutters List
Verified 3/10/16 on Patriot Properties

17 Passaconaway Ave.	656-3-26	1. Windmill Road Realty Trust 2. Trustee - William P. Provencher 3. Trustee - Karen M. Provencher	17 Passaconaway Ave. Haverhill, MA 01830
15 Passaconaway Ave.	656-3-28	1. William Brady 2. Elisabeth Brady	15 Passaconaway Ave. Haverhill, MA 01830
175 North Ave.	656-3-32	1. Philippe W. Putnam	175 North Ave. Haverhill, MA 01830
171 North Ave.	656-3-34	1. David E. Shaw 2. Ann B. Shaw	171 North Ave. Haverhill, MA 01830
North Ave.	656-3-45	1. David E. Shaw 2. Ann B. Shaw	171 North Ave. Haverhill, MA 01830
147 North Ave.	656-3-47 (incl.16A, 46, 49)	Natasha Jain	147 North Ave. Haverhill, MA 01830
145 North Ave.	656-3-48	1. Charles E. Sarcione 2. Lisa Walsh	145 North Ave. Haverhill, MA 01830
16 Passaconaway Ave.	668-1-27	1. Kelly M. Townsend 2. Dennis W. Mitchell	16 Passaconaway Ave. Haverhill, MA 01830
14 Passaconaway Ave.	668-1-31	Elaine Hebbron	14 Passaconaway Ave. Haverhill, MA 01830
189 North Ave.	668-1-34	1. Clifton H. Perkins Jr. 2. Sandra J. Perkins	189 North Ave. Haverhill, MA 01830
378 Concord St.	668-1-46	1. Kyle Britton 2. Diane Britton	378 Concord St. Haverhill, MA 01830
370 Concord St.	668-1-45	1. Steven J. Burns 2. Jayson C. Burns	370 Concord St. Haverhill, MA 01830
364 Concord St.	668-1-44	1. Robert A. Durgin 2. Linda A. Durgin	364 Concord St. Haverhill, MA 01830

City of Haverhill Conservation Commission

HCC Form 3 – Notice of Intent Local Application Form

AFFIDAVIT OF SERVICE FOR ABUTTER NOTIFICATION

I, __Mel Higgins_____, hereby certify under the pains and penalties of perjury that on
(NAME OF PERSON MAKING AFFIDAVIT)
_____April 27, 2016____ I gave notification to all abutters pursuant to the requirements of the second
(DATE)
paragraph of Massachusetts General Laws Chapter 131, Section 40, the DEP Guide to Abutter Notification dated April 8, 1994, and Haverhill Municipal Ordinance Chapter 253, Section 5 in connection with the following matter:

A Notice of Intent filed under the Massachusetts Wetlands Protection Act and said ordinance by WHC Haverhill AL, LLC_____ with the Haverhill Conservation Commission on
(NAME OF APPLICANT)
__April 27, 2016_____ for property located at 174 North Avenue Map 630 Parcel 2-1-1A_____
(DATE) (STREET ADDRESS AND ASSESSOR'S PARCEL ID)

The list of the abutters to whom the Abutter Notification Form sent, with their addresses and Assessor's parcel identification information that corresponds with the submitted map section, are attached to this application.

Signed: _____ April 27, 2016
(NAME OF PERSON MAKING AFFIDAVIT) (DATE)

City of Haverhill Conservation Commission

HCC Form 3 – Notice of Intent Local Application Form

ABUTTER NOTIFICATION FORM

In accordance with the second paragraph of Massachusetts General Laws Chapter 131, Section 40 (the Wetlands Protection Act) and Haverhill Municipal Ordinance Chapter 253, Section 5, you are hereby notified of the following:

1. The name of the applicant is _WHC Haverhill AL, LLC_____
2. Brief Project Description: ___Construction of a new assisted living facility_____
   _____
3. The applicant has filed a Notice of Intent ("NOI") with the Haverhill Conservation Commission seeking permission to remove, fill, dredge or alter an Area Subject to Protection Under the Wetlands Protection Act and/or Haverhill Municipal Ordinance Chapter 253 and/or to perform work within the buffer zone of such an Area.
4. The address of the lot where the activity is proposed is ____174 North Avenue Map 630 Parcel 2-1-1A
   (INCLUDE ASSESSOR'S MAP/BLOCK/LOT)
5. Copies of the NOI may be examined at *the Haverhill Conservation Department Office* between the hours of *8am and 4pm* from *Monday through Friday*. Contact information is below. You may also find helpful application materials on the "Projects Under Review" section of the Commission's website.
6. Copies of the NOI may be obtained from either (check one) the applicant _____, or the applicant's representative _X_, by calling this telephone number (978) _977-_0110 x 2332 between the hours of _9:00_ and 5:00 on the following days of the week _Monday - Friday_____
7. Information regarding the *date, time, and place* of the public hearing may be obtained from the *Haverhill Conservation Department Office* between the hours of *8am and 4pm* from *Monday through Friday*. Contact information is below. You may also consult the "Agenda" section of the Commission's website.

NOTE: Notice of the public hearing, including its date, time and place, will be published at least five (5) days in advance in the *Haverhill Gazette newspaper*.

NOTE: Notice of the public hearing, including its date, time, and place, will be posted in Haverhill City Hall not less than forty-eight (48) hours in advance.

NOTE: You may contact the Haverhill Conservation Department for more information about this application, the Wetlands Protection Act, and Haverhill Municipal Ordinance Chapter 253. Please note the Department has only one staff person; every effort will be made to assist you in a timely manner.

Website: http://www.cityofhaverhill.org/departments/conservation_commission/index.php.
Email: conservation@cityofhaverhill.com
Phone: 978.374.2334

NOTE: For additional information about this application and the Act, you may contact the MA Department of Environmental Protection Northeast Regional Office Service Center.

Website: http://www.mass.gov/eea/agencies/massdep/about/contacts/northeast-region.html
Phone: 978.694.3200

GJR
7-22-67

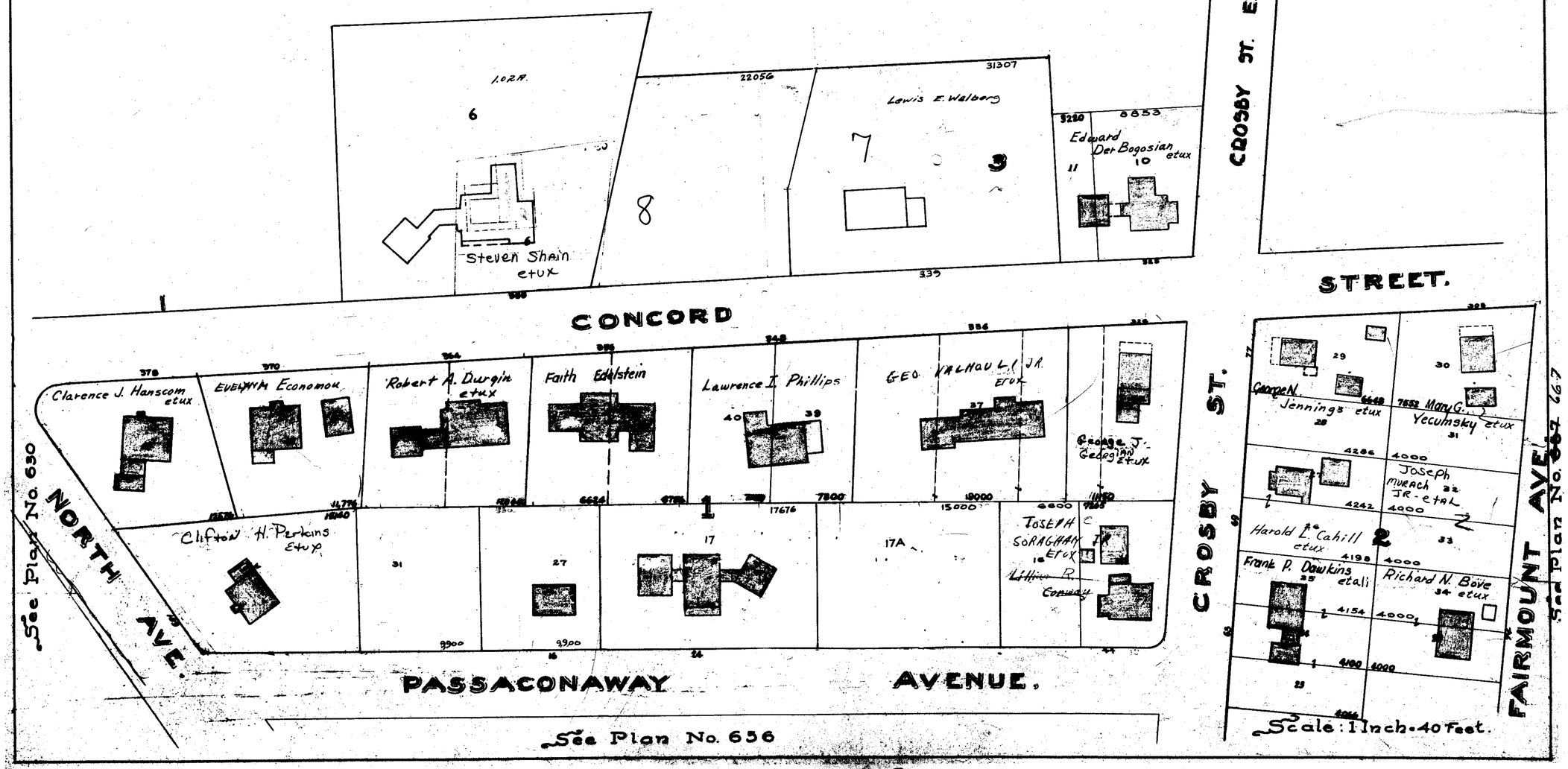
5/26/71

BOARD OF ASSESSORS City Hall, HAVERHILL, MASS.

668

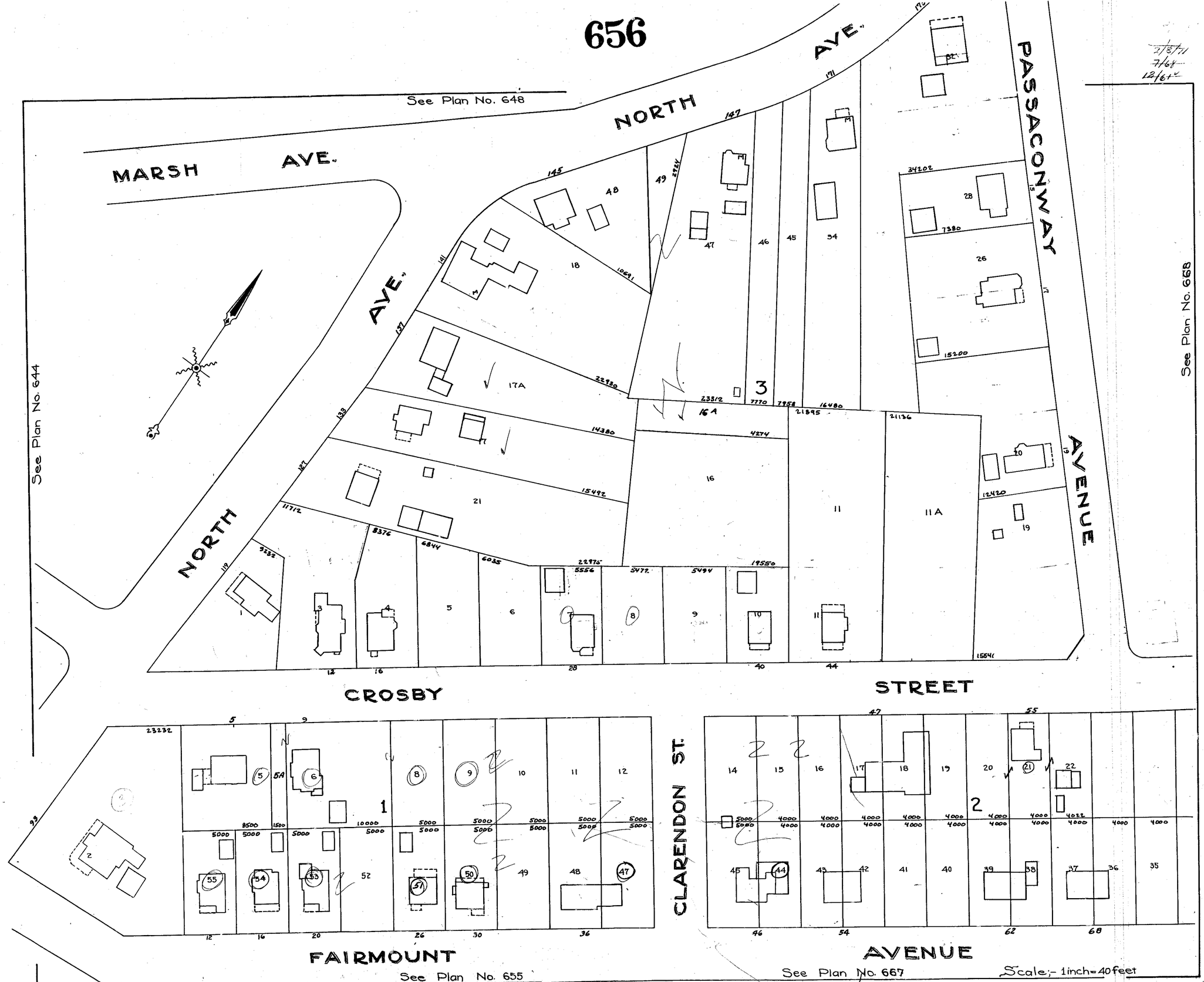
BOARD OF ASSESSORS City Hall, HAVERHILL, MASS.

See Plan No. 670



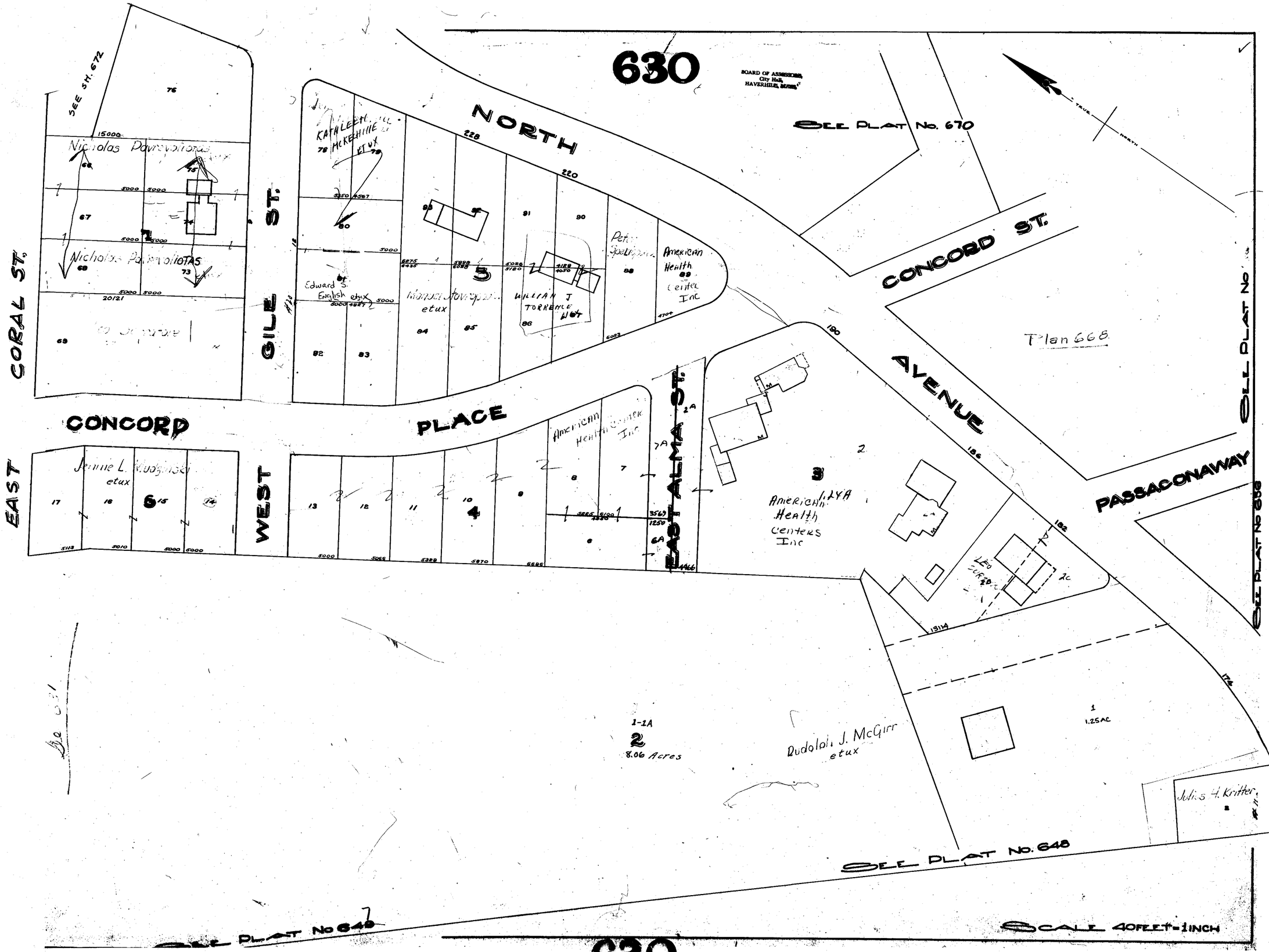
668

7/8/04


See Plan No. 648
MARSH AVE.
NORTH AVE.
NORTH AVE.
PASSACONWAY AVENUE
CROSBY STREET
FAIRMOUNT AVENUE
CLARENDON ST.
See Plan No. 644
See Plan No. 668
See Plan No. 655
See Plan No. 667
Scale;- 1 inch = 40 feet
656

630

BOARD OF ASSESSORS
City Hall
HAVERHILL, MASS.



630

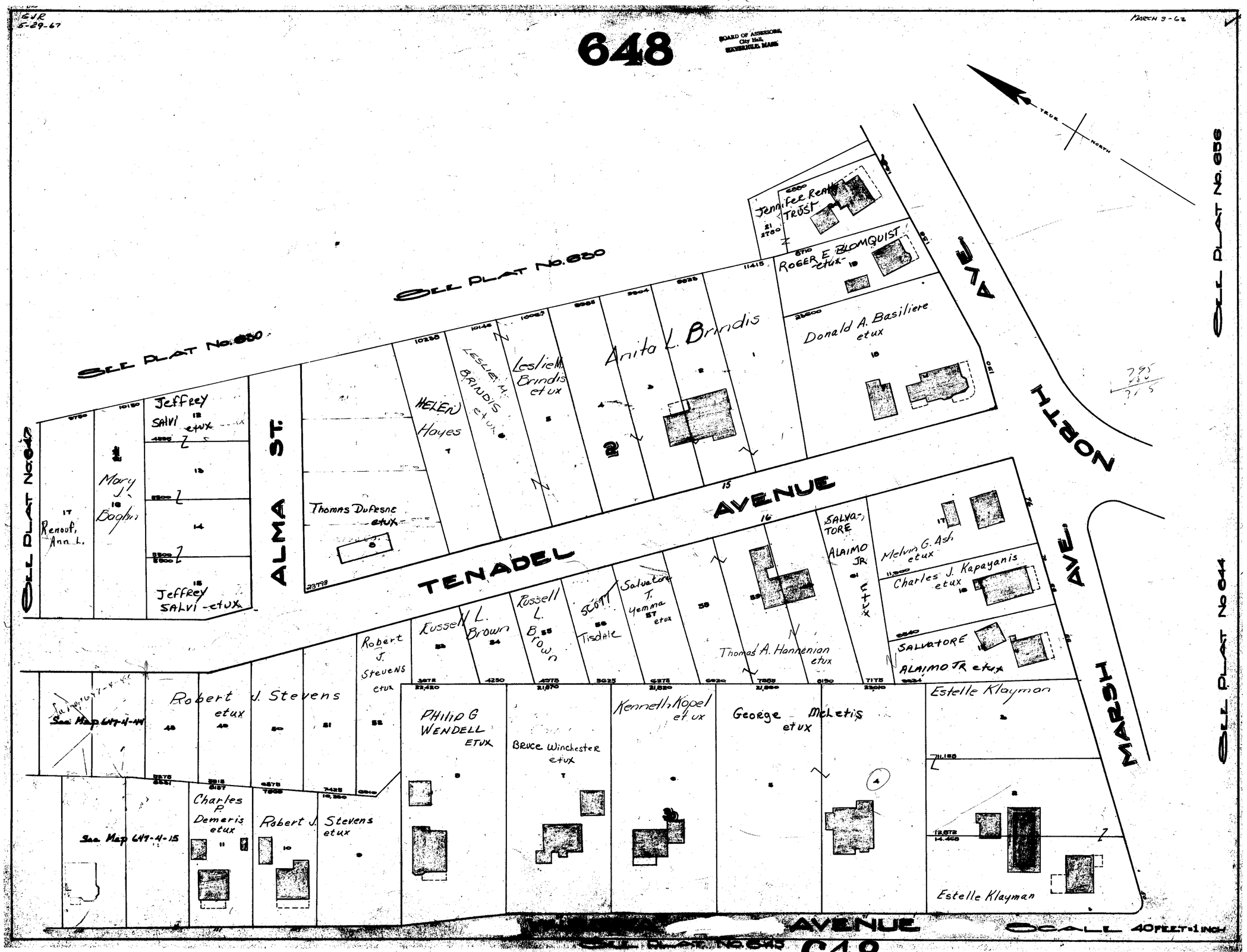
11/19/11

GJR
5-29-67

MARCH 9-62

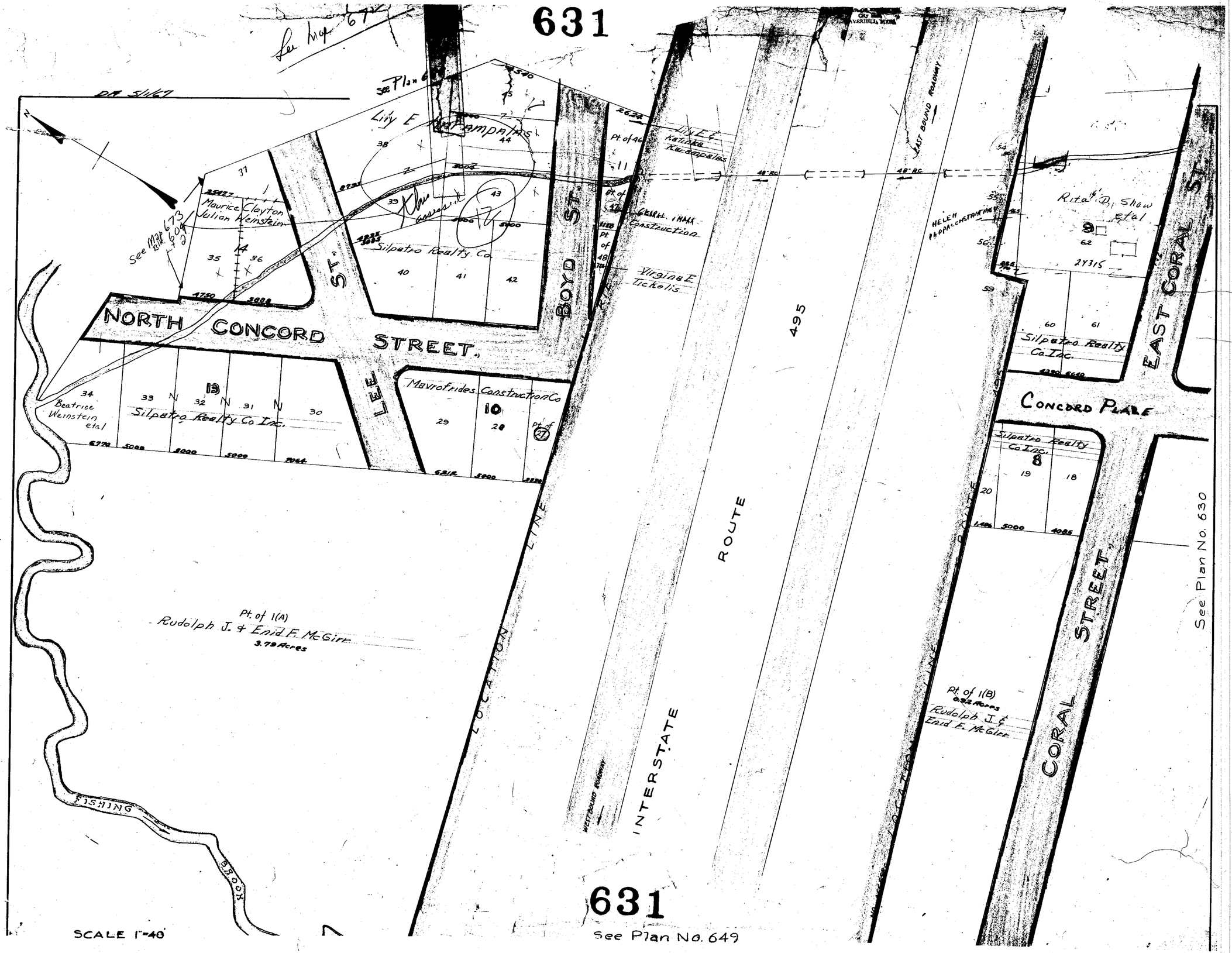
648

BOARD OF ASSESSORS
City Hall,
HAVERHILL, MASS.



648

SEE PLAN No. 659
SEE PLAN No. 633
SEE PLAN No. 633
647
SNOW'S BROOK
OLD EASEMENT LINE
STATE HIGHWAY LOCATION LINE
STATE HIGHWAY LOCATION LINE
EASEMENT LINE
Essex County Greenhouse Assoc.
BRIAN BOLLARD ETUX
CUL DE SAC
CORAL ST.
CORAL ST.
Raymond D. Segelberg Etal
(649-BLOCK 1)
Peter J. Wojtoszek etux
PETER J. Wojtoszek ETUX
(649-BLOCK 2)
647-5-36
John C. Bryant etal
Salvatore Yemma etux
Wm. A. Condon etal
Wm. A. Condon etux
(649-BLOCK 4)
AURELIA KELLEY
VIRGINIA B. BERNARD
SALVATORE T. YEMMA
(649-BLOCK 3)
Salvatore T. Yemma etux
Priscilla B. Johnson
Renouf, Ann L.
ZIZONA AVENUE
TENADEL AVENUE
Paul H. Lawson etux
John J. Lynch Jr.
Frank A. Rocco
(647-BLOCK 2)
Ernest D. Bombard etux
Donald J. Bellefeuille etux
Helen F. Rhodes
John J. Dommer etux
James L. Willett etux
MICHAEL HARLAN ETUX
JASPER STREET
CONSTANCE Smith etux
Frank C. Hoyt etux
HARRY R. Allen etux
Bernard R. Dole etux
Saul A. Silverman etux
Robert I. Allen etux
Richard C. Corbone etux
Thomas McLaughlin etal
Ralph Portors etux
RICHARD W. RYAN ETUX
Angelina Crespi etal
Tyler Park
SEE PLAN No. 646
SEE PLAN No. 631
SEE PLAN No. 648
647
Scale 1" = 40'
3/3/06


See Plan No. 633
See Plan No. 630
See Plan No. 649
NORTH CONCORD STREET
LEE ST.
BOYD ST.
EAST CORAL ST.
CORAL STREET
CONCORD PLACE
INTERSTATE ROUTE 495
LOCATION LINE
EAST BOUND ROADWAY
WESTBOUND ROADWAY
FISHING BROOK
Maurice Clayton
Julian Weinstein
Silpatro Realty Co.
Silpatro Realty Co. Inc.
Beatrice Weinstein etal
Mavrofrides Construction Co
Pt. of 1(A)
Rudolph J. & Enid F. McGirr
3.79 Acres
Pt. of 1(B)
Rudolph J. & Enid F. McGirr
Rita D. Shaw etal
Virginia E. Tickelis
SCALE 1"=40'

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 4B – Order of Resource Area Delineation

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
33-1350
MassDEP File Number

eDEP Transaction Number

Haverhill
City/Town

A. General Information

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

Note: Before completing this form consult your local Conservation Commission regarding any municipal bylaw or ordinance.

From: Haverhill
1. Conservation Commission

2. This Issuance is for (check one):

a. ☒ Order of Resource Area Delineation

b. ☐ Amended Order of Resource Area Delineation

3. Applicant:

David — a. First Name
Feldman — b. Last Name
Wingate Healthcare — c. Organization
63 Kendrick Street — d. Mailing Address
Needham — e. City/Town
MA — f. State
02494 — g. Zip Code

4. Property Owner (if different from applicant):

Robert — a. First Name
McGirr — b. Last Name
McGirr Family Trust — c. Organization
174 North Avenue — d. Mailing Address
Haverhill — e. City/Town
MA — f. State
01830 — g. Zip Code

5. Project Location:

174 North Avenue — a. Street Address
Haverhill — b. City/Town
01830 — c. Zip Code
Parcel ID: 630-2-1-1A — d. Assessors Map/Plat Number
e. Parcel/Lot Number

Latitude and Longitude (in degrees, minutes, seconds):
42d48m4.09Ns — f. Latitude
71d5m5.21Ws — g. Longitude

6. Dates:
May 15, 2014 — a. Date ANRAD filed
June 19, 2014 — b. Date Public Hearing Closed
July 9, 2014 — c. Date of Issuance

7. Title and Date (or Revised Date if applicable) of Final Plans and Other Documents:

"Existing Conditions Plan, Sheet #C-2", prepared by Weston & Sampson — a. Title
June 5, 2014 — b. Date
c. Title
d. Date

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 4B – Order of Resource Area Delineation

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
33-1350
MassDEP File Number

eDEP Transaction Number

Haverhill
City/Town

B. Order of Delineation

1. The Conservation Commission has determined the following (check whichever is applicable):

   a. ☒ **Accurate**: The boundaries described on the referenced plan(s) above and in the Abbreviated Notice of Resource Area Delineation are accurately drawn for the following resource area(s):

      1. ☒ Bordering Vegetated Wetlands **Wetland "B"**

      2. ☒ Other resource area(s), specifically: **Locally-jurisdictional, Isolated Wetlands "A", "C", and "D"**

      a. NOTE: Other jurisdictional resource areas may exist on this property, but are not subject to review under this application. The boundaries of these other resource areas are neither confirmed nor denied by the Haverhill Conservation Commission.

   b. ☐ **Modified**: The boundaries described on the plan(s) referenced above, as modified by the Conservation Commission from the plans contained in the Abbreviated Notice of Resource Area Delineation, are accurately drawn from the following resource area(s):

      1. ☐ Bordering Vegetated Wetlands

      2. ☐ Other resource area(s), specifically:

      a. _____

   c. ☐ **Inaccurate**: The boundaries described on the referenced plan(s) and in the Abbreviated Notice of Resource Area Delineation were found to be inaccurate and cannot be confirmed for the following resource area(s):

      1. ☐ Bordering Vegetated Wetlands

      2. ☐ Other resource area(s), specifically:

      3. ☐ The boundaries were determined to be inaccurate because:

C. Findings

This Order of Resource Area Delineation determines that the boundaries of those resource areas noted above, have been delineated and approved by the Commission and are binding as to all decisions rendered pursuant to the Massachusetts Wetlands Protection Act (M.G.L. c.131, § 40) and its regulations (310 CMR 10.00). This Order does not, however, determine the boundaries of any resource area or Buffer Zone to any resource area not specifically noted above, regardless of whether such boundaries are contained on the plans attached to this Order or to the Abbreviated Notice of Resource Area Delineation.

This Order must be signed by a majority of the Conservation Commission. The Order must be sent by certified mail (return receipt requested) or hand delivered to the applicant. A copy also must be mailed or hand delivered at the same time to the appropriate DEP Regional Office (see http://www.mass.gov/eea/agencies/massdep/about/contacts/find-the-massdep-regional-office-for-your-city-or-town.html).

D. Appeals

The applicant, the owner, any person aggrieved by this Order, any owner of land abutting the land subject to this Order, or any ten residents of the city or town in which such land is located, are hereby notified of their right to request the appropriate DEP Regional Office to issue a Superseding Order of Resource Area Delineation. When requested to issue a Superseding Order of Resource Area Delineation, the Department's review is limited to the objections to the resource area delineation(s) stated in the appeal request. The request must be made by certified mail or hand delivery to the Department, with the appropriate filing fee and a completed Request for Departmental Action Fee Transmittal Form, as provided in 310 CMR 10.03(7) within ten business days from the date of issuance of this Order. A copy of the request shall at the same time be sent by certified mail or hand delivery to the Conservation Commission and to the applicant, if he/she is not the appellant.

Any appellants seeking to appeal the Department's Superseding Order of Resource Area Delineation will be required to demonstrate prior participation in the review of this project. Previous participation in the permit proceeding means the submission of written information to the Conservation Commission prior to the close of the public hearing, requesting a Superseding Order or Determination, or providing written information to the Department prior to issuance of a Superseding Order or Determination.

The request shall state clearly and concisely the objections to the Order which is being appealed and how the Order does not contribute to the protection of the interests identified in the Massachusetts Wetlands Protection Act, (M.G.L. c. 131, § 40) and is inconsistent with the wetlands regulations (310 CMR 10.00). To the extent that the Order is based on a municipal bylaw or ordinance, and not on the Massachusetts Wetlands Protection Act or regulations, the Department of Environmental Protection has no appellate jurisdiction.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 4B – Order of Resource Area Delineation

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
33-1350
MassDEP File Number

eDEP Transaction Number

Haverhill
City/Town

E. Signatures

July 9, 2014
Date of Issuance

Please indicate the number of members who will sign this form. five
1. Number of Signers

Signature of Conservation Commission Member

Signature of Conservation Commission Member

Signature of Conservation Commission Member

Signature of Conservation Commission Member

Signature of Conservation Commission Member

Signature of Conservation Commission Member

Signature of Conservation Commission Member

Signature of Conservation Commission Member

This Order is valid for three years from the date of issuance.

If this Order constitutes an Amended Order of Resource Area Delineation, this Order does not extend the issuance date of the original Final Order, which expires on * unless extended in writing by the issuing authority.

*July 9, 2017

This Order is issued to the applicant and the property owner (if different) as follows:

2. ☐ By hand delivery on

a. Date

3. ☒ By certified mail, return receipt requested on

July 9, 2014
a. Date