HANCOCK
ASSOCIATES

Data Report
In Support of

Definitive Subdivision
for
Michele Circle
348, 350, 352 Main Street
Acton, Massachusetts

Prepared By:
Hancock Associates
#14188

Prepared For:
Walker Realty, LLC

December 16, 2009

DANVERS OFFICE
185 Centre Street, Danvers, MA 01923
Phone: (978) 777-3050 Fax: (978) 774-7816

MARLBOROUGH OFFICE
315 Elm Street, Marlborough, MA 01752
Phone: (508) 460-1111 Fax: (508) 460-1121

www.hancockassociates.com

December 16, 2009

HANCOCK ASSOCIATES

Town of Acton Planning Board
472 Main Street
Acton, MA. 01720

Re: Notice of Filing Definitive Plan "Michele Circle"
348, 350, 352 Main Street, Acton, MA.

To Whom it May Concern,

Hancock Associates, on behalf of Walker Realty LLC, hereby submits pursuant to the provisions of Massachusetts General Laws, Chapter 41, Section 81 K. et seq, and the Subdivision Rules and Regulations of the Planning Board of Acton, a Definitive Subdivision Plan entitled "Michele Circle", prepared by Hancock Associates dated 12-16-09.

Twenty Four (24) copies of the FORM DP application for approval, together with twenty four (24) copies Development Impact Report (DIR), twenty four (24) copies of the Project Locus, Supplemental Data Report and the required Application Fee and twelve (12) full size prints and twelve (12) 11"x17" prints of the plan is attached hereto. The following information is provided concerning the Plan:

Owner/Applicant:	Walker Realty, LLC
Address:	2 Lan Drive Westford, MA 01886
Date of Filing:	December 16, 2009
Property:	348, 350, 352 Main Street Acton, MA.

Assessors Map: F-3 Parcels: 54, 61 and 61-1

Thank you for your anticipated cooperation.

Sincerely,
On Behalf of Walker Realty, LLC

Katie Enright

Katie Enright, P.E.
Project Manager
Hancock Associates

CC: Acton Board of Health
Acton Town Clerk

RECEIVED
DEC 18 2009
TOWN OF ACTON
PLANNING DEPARTMENT

DANVERS, MA
185 Centre Street
Danvers, MA 01923
Phone: (978) 777-3050
Fax: (978) 774-7816

MARLBOROUGH, MA
315 Elm Street
Marlborough, MA 01752
Phone: (508) 460-1111
Fax: (508) 460-1121

LAKEVILLE, MA
4 Freetown Street
Lakeville, MA 02347
Phone: (508) 923-1002
Fax: (508) 923-0022

CHELMSFORD, MA
313 Littleton Road, Unit 18
Chelmsford, MA 01824
Phone: (978) 244-0110
Fax: (978) 224-1133

SALEM, NH
P.O. Box 205
Salem, NH 03079
Phone: (603) 898-3491
Fax: (603) 898-6263

www.hancockassociates.com

Table of Contents

ACTON PLANNING BOARD

FORM DP

APPLICATION for APPROVAL of DEFINITIVE PLAN

The undersigned herewith submits the accompanying Definitive Plan of property located in the Town of Acton for Approval as a subdivision under the requirements of the Subdivision Control Law and the Rules and Regulations Governing the Subdivision of Land in the Town of Acton.

(Please type or print information in blanks below.)

1. Name of Proposed Subdivision MICHELE CIRCLE
2. Name of Applicant(s) WALKER REALTY, LLC
   Contact Address 2 LAN DRIVE WESTFORD MA Phone 978 692 9450
3. Name of Property Owner(s) WALKER REALTY, LLC
4. Name of Engineer HANCOCK ASSOCIATES
   Address 313 LITTLETON RD #18 CHELMSFORD MA Phone 978 244 0110 EX. 1#
5. Name of Land Surveyor HANCOCK ASSOCIATES
   Address 315 ELM ST. MARLBOROUGH MA Phone 508 460 1111
6. Deed of property recorded in Middlesex South Registry Of Deeds, Book Number 50746, 50967, 50967 Page Number 581, 87, 193; and/or registered in Middlesex Registry of Land Court, Certificate of Title Number _____.
7. Zoning District R2, Town Atlas Map No. F-3 Parcel No. 54, 61, 61-1
   Approximate acreage in subdivision 2.43 AC., Number of Lots 2
   Total length of road(s) in feet 263' ±
   Location and Description of Property 348, 350 & 352 MAIN STREET
8. Said plan has (X)/ has not ( ) evolved from a preliminary plan submitted to the Board on MAY 21 2009; and approved (with modifications) (X) or disapproved ( ) on JUNE 16 20 09.

Walker Realty LLC
by its Manager 12/15/09
Applicant(s) Signature, Date

_____
Applicant(s) Signature, Date

Walker Realty LLC
by its Manager 12/15/09
Owner(s) Signature, Date

_____
Owner(s) Signature, Date

All owners (in the case of a corporation, an authorized officer; in the case of a trust, all trustees) must sign.

RECEIVED
DEC 18 2009
TOWN OF ACTON
PLANNING DEPARTMENT

WAIVER REQUEST

On behalf of Walker realty, LLC, Hancock Associates would like to request the following waivers of the regulations contained within the Acton Subdivision Rules and Regulations Section 5 Procedure for the Submission and Approval of a Definitive Subdivision Plan, 5.3 Contents of Definitive Plan :

- 5.3.9 - House numbers on each lot as determined by the Town Engineer, clearly distinguishable from the lot numbers. *Hancock intends to discuss lot numbers with the Town Engineer and add the numbers during the Planning Board process.*
- 5.3.24 - Location of all proposed septic disposal areas with a minimum of one percolation test and two deep holes per leach area. *Testing on the project site has been completed in multiple locations to determine material and water table elevation. Hancock is confident that suitable material and water table elevation will be found within a suitable are for subsurface disposal. Testing with the Board of Health will be scheduled within the Definitive process.*

DEVELOPMENT IMPACT REPORT

Please type or print information in blanks below.

1. Name of Proposed Subdivision MICHELE CIRCLE
2. Location 348, 350, 352 MAIN STREET, ACTON, MA.
3. Name of Applicant(s) WALKER REALTY, LLC
4. Brief Description of the Proposed Project PROPOSED TWO LOT RESIDENTIAL SUBDIVISION WITH CUL-DE-SAC.
5. Name of Individual Preparing this DIR KATIE ENRIGHT
   Address HANCOCK ASSOCIATES Business Phone 978 244 0110 EX 1#
   313 LITTLETON RD #18 CHELMSFORD MA 01824
6. Professional Credentials PROFESSIONAL ENGINEER MA., CERTIFIED SOIL EVALUATOR MA.

A. Site Description

7. Present permitted and actual land uses by percentage of the site.

Uses	*Percentage*
Industrial	
Commercial	
Residential	100%
Forest	
Agricultural	
Other (specify)	

8. Total acreage on the site: 2.43 acres.

Approximate Acreage	*At Present*	*After Completion*
Meadow or Brushland (non agriculture)	49.2%	66.6%
Forested	43%	15%
Agricultural (includes orchards, cropland, pasture)	NA	NA
Wetland	0.8%	0.8%
Water Surface Area	NA	NA
Flood Plain	NA	NA
Unvegetated (rock, earth, or fill)	NA	NA
Roads, buildings and other impervious surfaces	5.8%	17.6%
Other (indicate type) GRAVEL	1.2%	NA

9. List the zoning districts in which the site is located and indicate the percentage of the site in each district. *Note: be sure to include overlay zoning districts.*

District	Percentage
RESIDENTIAL 2	100%

10. Predominant soil type(s) on the site: WOODBRIDGE FINE SANDY LOAM AND CARLTON-HOLLIS SOILS

Soil drainage (Use the US Natural Resources Conservation Service's definition)

Soil Type	% of the Site
Well drained	50%
Moderately well drained	50%
Poorly drained	0

11. Are there bedrock outcroppings on the site? ____yes X no

12. Approximate percentage of proposed site with slopes between:

Slope	% of the Site
0 - 10%	40%
10 - 15%	30%
greater than 15%	30%

13. In which of the Groundwater Protection Districts in the site located? How close is the site to a public well? Zone(s) 4 Proximity to a public well: 1.5 mi.± ~~feet~~

14. Does the project site contain any species of plant or animal life that is identified as rare or endangered? (Consult with the Massachusetts National Heritage Program and the Acton Natural Resources Director). ____yes X no

If yes, specify: _____

_____

15. Are there any unusual or unique features on the site such as trees larger than 30 inches D.B.H., bogs, kettle ponds, eskers, drumlins, quarries, distinctive rock formation or granite bridges?
____yes X no

If yes, specify: _____

_____

16. Are there any established foot paths running through the site or railroad right of ways?
____yes X no

If yes, specify:_____

_____

17. Is the site presently used by the community or neighborhood as an open space or recreation area? ____yes X no

    Is the site adjacent to conservation land or a recreation area? ____yes X no

    If yes, specify:_____

    _____

18. Does the site include scenic views or will the proposed development cause any scenic vistas to be obstructed from view? ____yes X no

    If yes, specify:_____

    _____

19. Are there wetlands, lakes, ponds, streams, or rivers within or contiguous to the site?
    X yes ____no

    If yes, specify: BORDERING VEGETATED WETLAND TO THE NORTHWEST (PARTIALLY ON-SITE) BETWEEN PROJECT SITE AND ROUTE 2.

20. Is there any farmland or forest land on the site protected under Chapter 61A or 61B of the Massachusetts General Laws? ____yes X no

    If yes, specify:_____

    _____

21. Has the site ever been used for the disposal of hazardous waste? Has a 21E Study been conducted for the site? X yes ____no

    If yes, specify results: "NO APPARENT VISUAL OR HISTORICAL EVIDENCE TO INDICATE" ANY "ENVIRONMENTAL THREAT."

22. Will the proposed activity require use and/or storage of hazardous materials, or generation of hazardous waste? ____yes X no

    If yes, specify_____

    _____

23. Does the project contain any buildings or sites of historic or archaeological significance? (Consult with the Acton Historic Commission or the Action Historical Society.)
    X yes ____no

    If yes, please describe STONEWALLS

24. Is the project contiguous to or does it contain a building in a local historic district or national register district? ___yes X no

25. Is the project contiguous to any section of the Isaac Davis Trail? ___yes X no

If yes, please describe_____

B. Circulation System

26. What is the average weekday traffic and peak hour traffic volumes generated by the proposed subdivision?

Average weekday traffic		20 trips/day
Average peak hour volumes	morning	1.54 trips
Average peak hour volumes	evening	2.02 trips

27. Existing street(s) providing access to proposed subdivision:

Name MAIN STREET Town Classification ARTERIAL

28. Existing intersection(s): list intersections located within 1000 feet of any access to the proposed development:
Name of ways ROUTE 2, HAYWARD ROAD

29. Location of existing sidewalks within 1000 feet of the proposed site? PORTIONS OF MAIN STREET

30. Location of proposed sidewalks and their connection to existing sidewalks:
PROPOSED SIDEWALK ON MICHELE CIRCLE (ONE SIDE)
PROPOSED SIDEWALK ON MAIN ST. TO CONNECT EXISTING SIDEWALK TO PROPOSED

31. Are there parcels of undeveloped land adjacent to the proposed site? ___yes X no

Will access to these undeveloped parcels been provided within the proposed site?
___yes X no

If yes, please describe NA

If no, please explain why NA

C. Utilities and Municipal Services

32. If dwelling units are to be constructed, what is the total number of bedrooms proposed?
6

33. If the proposed use of the site is nonresidential, what will the site be specifically used for and how many feet of Gross floor area will be constructed? NA

34. How will sewage be handled? ON SITE SUBSURFACE DISPOSAL SYSTEMS

35. Storm Drainage

a. Describe nature, location and surface water body receiving current surface water of the site:
BORDERING VEGETATED WETLAND LOCATED BETWEEN SITE AND ROUTE 2.

b. Describe the proposed storm drainage system and how it will be altered by the proposed development: DEEP SUMP HOODED CATCHBASINS COLLECT RUNOFF AND CONVEY FLOW THROUGH A STORMCEPTOR UNIT BEFORE A PORTION OF THE FLOW IS COLLECTED IN A DETENTION BASIN.

c. Will a NPDES Permit be required? X yes ___ no

36. In the event of fire, estimate the response time of the fire department (consult with Fire Dept.)
4 MIN (OR LESS)

37. Schools (if residential)
a. Projected number of new school age children: 4
b. Distance to nearest school: 1/2 MILE

D. Measures to Mitigate Impacts

Attach brief descriptions of the measures that will be taken to:

38. Prevent surface water contamination.
STORMWATER MANAGEMENT SYSTEM HAS BEEN DESIGNED PER DEP.
39. Prevent groundwater contamination.
STORMWATER COLLECTED AND TREATED ON-SITE. ON-SITE SEPTIC
40. Maximize groundwater recharge. SYSTEMS TO TREAT SEWERAGE DESIGNED
INFILTRATION WITHIN DETENTION BASIN AND PER TITLE 5.
41. Prevent erosion and sedimentation. ROOF DRAIN DRYWELLS PROPOSED.
PROPOSED SILTFENCE AT LIMIT OF WORK. PROPOSED EROSION AND
42. Maintain slope stability. SEDIMENTATION CONTROL PLAN WITHIN REPORT.
PROPOSED MINIMAL SLOPE DISTURBANCE, LOAM AND SEED DISTURBED
43. Design the project to conserve energy. AREAS PER EROSION AND SEDIMENTATION
ENERGY STAR APPLIANCES PROPOSED WITHIN HOMES. CONTROL PLAN.
44. Preserve wildlife habitat.
MINIMAL IMPACT TO UNDISTURBED AREAS.
45. Preserve wetlands.
NO WETLAND IMPACTS PROPOSED, 50' NO DISTURB MAINTAINED.
46. Ensure compatibility with the surrounding land uses.
RESIDENTIAL SINGLE FAMILY HOMES PROPOSED.
47. Control peak runoff from the site so that the post-development rate of runoff will be no greater than the predevelopment rate of runoff for the 10-year storm event.
STORMWATER MANAGEMENT SYSTEM CONTROLS POST DEVELOPMENT RATE
48. Preserve historically significant structures and features on the site. TO EQUAL OR DECREASE
STONEWALLS TO BE PRESERVED WHERE PRACTICAL. FROM PRE DEVELOPMENT RA
49. To mitigate the impact of the traffic generated by the development.
NO INCREASE IN TRAFFIC PROPOSED. TWO SINGLE FAMILY HOMES CURRENTLY EXIST ON-SITE.

Please use layman's terms where possible while still being accurate and comprehensive. Where appropriate, graphics shall be used. List sources of data, reference materials, and methodology used to determine all conclusions. Use additional sheets as necessary.

ACTON PLANNING BOARD

FORM DC

DESIGNER'S CERTIFICATE

I hereby certify that the accompanying plan entitled PLAN OF LAND

dated 12-16-09

is correct, stating that the perimeter traverse of the subdivision before adjustment was closed to an accuracy of a ratio "error of closure" not to exceed 1/15000"; that it is a subdivision of 2.43 AC. acres conveyed by MICHAEL & ASHLEY KING, WENDELL MORGAN GRAHAM & THOMAS O. MCLAUGHLIN to WALKER REALTY, LLC by a deed(s), dated 2/19/08, 3/31/08, 3/3/08 and recorded in Middlesex County Registry of Deeds, South District, Book(s) 50746, 50967, Page(s) 581, 87, 193.

Other sources of information used in the preparation of the plan are:

1. Other deeds and plans, as follows BK 46680 PG 285, BK 42632 PG 11, BK 22173 PG 308, BK 6562 PG 329, BK 5658 PG 104
2. ~~Oral information furnished by~~ PL BK 646 OF 2006, PLAN 108 OF 2008, PL 420 OF 1932, PLAN 1276 OF 1941, 1954 COUNTY LAYOUT
3. ~~Other~~ FOR MAIN ST., 1950 STATE HIGHWAY LAYOUT FOR MAIN ST NOS. 3713 & 3781

Furthermore, I certify that this survey was made on the ground in accordance with the "Procedural and Technical Standards for the Practice of Land Surveying", Section 250 CMR** 5.0 between 2-20-08 (date) and 11-9-09 (date)

HANCOCK ASSOCIATES

JOHN D. DRINKWATER

Signed [signature] 12-16-09
Registered Land Surveyor Date

Address 315 Elm St., Marlborough, MA 01752

Registration No. 35390

As described in the "1989 Manual of Instructions for the Survey of Lands and Preparation of Plans" published by the Land Court of the Commonwealth of Massachusetts, as most recently amended.

** Code of Massachusetts Regulations

* NOTE ALSO - DUE TO SMALL SIZE OF PARCEL A CLOSED LOOP TRAVERSE WAS NOT NECESSARY. POSITIONAL TOLERANCES WERE MET CONSISTENT WITH THE 1/15,000 CLOSED LOOP REQUIREMENT.

Town of Acton
472 Main Street
Acton, MA 01720
Telephone (978) 264-9622
Fax (978) 264-9630

Brian McMullen
Assistant Assessor

Locus: 348-352 MAIN ST
Parcel: F3-64, F3-61-1, F3-54

Location	Parcel ID	Owner	Co-Owner	Mailing Address	City	ST	Zip
52 HAYWARD RD	F3-17-1	PREDERGAST REBECCA	CUOCO EDWARD	52 HAYWARD RD	ACTON	MA	01720
10 ISAAC DAVIS WY	F3-19-1	RYDER JR JOHN ERIC	RYDER HEIDI H	10 ISAAC DAVIS WAY	ACTON	MA	01720
362 MAIN ST	F3-32	KENNEDY MICHAEL J TR	362 MAIN ST REALTY TRUST	362 MAIN ST	ACTON	MA	01720
364 MAIN ST	F3-33	KENNEDY PHYLLIS A TR	MAIN ST AGRICULTURAL REAL TR	362 MAIN ST	ACTON	MA	01720
6 ISAAC DAVIS WY	F3-45	POST MATTHEW R	POST LAURA G	6 ISAAC DAVIS WAY	ACTON	MA	01720
363 MAIN ST	F3-56	GEISSERT JACK O ET UX TRUSTEE	ALLISON REALTY TRUST	363 MAIN ST	ACTON	MA	01720
353 MAIN ST	F3-70	KENNEDY PHYLLIS A TR	MAIN ST AGRICULTURAL TR	362 MAIN ST	ACTON	MA	01720
10 STACYS WY BESIDE	F3-70-17	ACTON TOWN OF		472 MAIN STREET	ACTON	MA	01720

Abutters and owners of land directly opposite on any public or private street or way and abutters to the abutters within three hundred feet of the property line all as they appear on the most recent applicable tax list.

HEARING NOTICES FOR ALL SPECIAL PERMITS MUST BE SENT TO THE PLANNING BOARD, TOWN HALL IN THE FOLLOWING TOWNS:

Boxborough, MA 01729 Maynard, MA 01754 Concord, MA 01742 Littleton, MA 01460
Carlisle, MA 01741 Stow, MA 01775 Westford, MA 01886 Sudbury, MA 01776

Kimberly Hoyt
Assessing Clerk
Acton Assessors Office

10-Dec-09

WALKER REALTY LLC

December 15, 2009

Town of Acton
Att: Planning Board
472 Main Street
Acton, MA 01720

RE: Definitive Subdivision Plan, 348-352 Main Street, Acton, MA

Dear Sir/Madam:

In accordance with Subdivision Rule and Regulation 5.2.7, please be advised that Walker Realty LLC will retain the fee in the street shown as "Michele Circle" on a Definitive Subdivision Pan filed herewith and will upon construction of said street and installation of services will, at the request of the Town of Acton, grant to the Town the fee (or an easement for all purposes for which streets are used) in such streets. Further, Walker Realty LLC will, at the request of the Town of Acton, grant to it any drainage or other easements shown on the

Very truly yours,
WALKER REALTY LLC

WALKER REALTY LLC • 2 LAN DRIVE • WESTFORD, MASSACHUSETTS 01886
TELEPHONE (978) 692-9450 • FAX (978) 692-4424

WALKER REALTY LLC

December 15, 2009

Town of Acton
Att: Planning Board
472 Main Street
Acton, MA 01720

RE: Definitive Subdivision Plan, 348-352 Main Street, Acton, MA

Dear Sir/Madam:

In accordance with Subdivision Rule and Regulation 5.2.9, Walker Realty LLC authorizes Town representatives to enter on the property known as 348-352 Main Street in Acton to complete the street and services shown on the Definitive Subdivision if the developer does not complete them according to his obligations.

Very truly yours,
WALKER REALTY LLC

WALKER REALTY LLC• 2 LAN DRIVE • WESTFORD, MASSACHUSETTS 01886
TELEPHONE (978) 692-9450 • FAX (978) 692-4424

WALKER REALTY LLC

December 15, 2009

Town of Acton
Att: Planning Board
472 Main Street
Acton, MA 01720

RE: Definitive Subdivision Plan, 348-352 Main Street, Acton, MA

Dear Sir/Madam:

In accordance with Subdivision Rule and Regulation 5.2.10, attached hereto please find an authorizing vote.

Very truly yours,
WALKER REALTY LLC

WALKER REALTY LLC• 2 LAN DRIVE • WESTFORD, MASSACHUSETTS 01886
TELEPHONE (978) 692-9450 • FAX (978) 692-4424

MEMBERS' VOTE

The undersigned constituting the holders of one hundred percent (100%) in the interest in the Members of Walker Realty LLC, a Massachusetts limited liability company, do hereby take the following action and make the following decisions:

That Walker Realty LLC is authorized to take all step necessary to file a Definitive Subdivision Plan affecting the premises known as 348-352 Main Street, Acton, Massachusetts and to do things necessary to comply with the Acton Subdivision Rules and Regulations.

Witness the hands and seals of the undersigned members constituting the holders of one hundred percent (100%) in the interest in the Members of Walker Realty, LLC this 14 day of December, 2009.

Robert A. Walker, Member

Michele Walker, Member

2008 00025331
Bk: 50746 Pg: 581 Doc: DEED
Page: 1 of 2 02/20/2008 12:52 PM

QUITCLAIM DEED

WE, MICHAEL KING AND ASHLEY KING, HUSBAND AND WIFE, AS TENANTS BY THE ENTIRETY, of Acton, Middlesex County, Massachusetts

in consideration of TWO HUNDRED SEVENTY-FIVE THOUSAND AND 00/100 ($275,000.00) DOLLARS

grant to Walker Realty LLC a duly organized and existing Massachusetts limited liability company with an address of 2 Lan Drive, Westford, MA

with Quitclaim Covenants

348 main St, Acton, MA.

A certain parcel of land with the buildings thereon situated in said Acton on the northerly side of Main Street and being shown as Lot 1 on a plan entitled "Plan of Land Main Street & Isaac Davis Road, Acton, Massachusetts, Prepared for: Michael King, 14 Glendale Street, Maynard, Mass 01754," Scale 1 inch = 40 feet, Dated: April 25, 2006, by Acton Survey & Engineering, Inc., duly recorded with Middlesex South District Registry of Deeds as Plan No. 646 of 2006.

Said Lot 1 contains 20,438 square feet of land, more or less, according to said plan.

The Grantors, their successors and assigns, hereby reserve the perpetual right and easement to enter upon that portion of Lot 1 shown as "Fill Easement" on a plan of land entitled, "Easement Plan, Main Street, Acton, Massachusetts, prepared for Michael King" by Acton Survey & Engineering, Inc., dated January 10, 2008 and recorded with Middlesex South District Registry of Deeds as Plan No. 108 of 2008. The easement shall include the right to enter upon, remove, deposit, slope, bank and maintaio material, filling or support for the benefit of Lot 2 as shown on the aforementioned plan.

The Grantors, their successors and/or assigns, also hereby reserve the perpetual right and easement to pass and repass by vehicular traffic or otherwise over that portion of Lot 1 shown as "Access and Utility Easement" in order to gain access to Lot 2. The Grantors, their successor and assigns also hereby reserve the perpetual easement, right, and authority to construct, operate, repair and/or maintain utility lines and/or pipes, together with all necessary appurtenances and accessories thereto as the Grantee may now and from time to time hereafter deem necessary to provide utilities for the benefit of Lot 2.

Being a portion of the premises conveyed to the Grantors by deed of Deutsche Bank National Trust Company, as Indenture Trustee for New Century Home Equity Loan Trust 2004-2, dated December 8, 2005 and recorded with said Deeds, Book 46680, Page 285.

MASSACHUSETTS EXCISE TAX
Southern Middlesex District ROD # 001
Date: 02/20/2008 12:52 PM
Ctrl# 105259 27299 Doc# 00025331
Fee: $1,254.00 Cons: $275,000.00

E. Aben
Walker Realty LLC
2 Lan Dr.
Westford, MA 01886

Executed as a sealed instrument this 19th day of February, 2008

Michael King

Ashley King

COMMONWEALTH OF MASSACHUSETTS

Middlesex, ss.

On this 19th day of February, 2008, before me the undersigned notary public, personally appeared Michael King and Ashley King and proved to me through satisfactory evidence of identification, which were Mass driver's license, to be the person whose name is signed on the preceding or attached documents, and acknowledged to me that he/she/they signed it voluntarily for its stated purpose.

Notary public: E. Alleru
My commission expires: 6/21/2013

REGISTRY OF DEEDS
SOUTHERN DISTRICT
ATTEST
REGISTER

2

2008 00051736

Bk: 50967 Pg: 87 Doc: DEED
Page: 1 of 2 03/31/2008 02:52 PM

MASSACHUSETTS EXCISE TAX
Southern Middlesex District ROD # 001
Date: 03/31/2008 02:52 PM
Ctrl# 106662 10887 Doc# 00051736
Fee: $798.00 Cons: $175,000.00

QUITCLAIM DEED

MICHAEL KING AND ASHLEY KING, HUSBAND AND WIFE, AS TENANTS BY THE ENTIRETY, of Acton, Middlesex County, Massachusetts

in consideration of ONE HUNDRED SEVENTY FIVE THOUSAND AND 00/100 ($175,000.00) DOLLARS

grant to WALKER REALTY, LLC, a Massachusetts limited liability company with a principal place of business at 2 Lan Drive, Westford, MA 01886.

with Quitclaim Covenants

348/350 Main St, Acton, MA.

Parcel I

A certain parcel of land with the buildings thereon situated in said Acton on the northerly side of Main Street and being shown as Lot 2 on a plan entitled "Plan of Land Main Street & Isaac Davis Road, Acton, Massachusetts, Prepared for: Michael King, 14 Glendale Street, Maynard, Mass 01754," Scale 1 inch = 40 feet, Dated: April 25, 2006, by Acton Survey & Engineering, Inc., duly recorded with Middlesex South District Registry of Deeds as Plan No. 646 of 2006.

Said Lot 2 contains 40,156 square feet of land, more or less, according to said plan.

Being a portion of the premises conveyed to the Grantors by deed of Deutsche Bank National Trust Company, as Indenture Trustee for New Century Home Equity Loan Trust 2004-2, dated December 8, 2005 and recorded with said Deeds, Book 46680, Page 285.

Parcel II

The land with the buildings thereon situated on Main Street, Middlesex County, Massachusetts, shown as Parcel A on a plan entitled "Plan of Land Main Street & Isaac Davis Road, Acton, Massachusetts, Prepared for: Michael King, 14 Glendale Street, Maynard, Mass 01754," Scale 1 inch = 40 feet, Dated: April 25, 2006, by Acton Survey & Engineering, Inc., duly recorded with Middlesex South District Registry of Deeds as Plan No. 646 of 2006

Said Parcel A contains 2,899 square feet of land, more or less, according to said plan.

Return to:
E. Ahern
Walker Realty LLC
2 Lan Dr.
Westford, MA 01886

Being the same premises conveyed to the Grantor, by deed of Matthew R. Post, et. ux., dated June 16, 2007 and recorded with said Deeds, Book 50660, Page 529.

Executed as a sealed instrument this 31st day of March, 2008

Michael King

Ashley King

COMMONWEALTH OF MASSACHUSETTS

Middlesex, ss.

On this 31st day of March, 2008, before me the undersigned notary public, personally appeared Michael King and Ashley King and proved to me through satisfactory evidence of identification, which were Mass driver's license, to be the person whose name is signed on the preceding or attached documents, and acknowledged to me that he/she/they signed it voluntarily for its stated purpose.

Notary public:
My commission expires: 6/21/2013

~~My commission expires:~~

ELIZABETH A. AHERN
NOTARY PUBLIC
COMMONWEALTH OF MASSACHUSETTS
My Commission Expires on 6/21/2013

Middlesex S. Register

02

2008 00051757
Bk: 50967 Pg: 193 Doc: DEED
Page: 1 of 2 03/31/2008 02:56 PM

Quitclaim Deed

We, Wendell Morgan Graham and Thomas O. McLaughlin,
of 352 Main St., Acton Middlesex County, Massachusetts
for consideration paid $420,000.00 – four hundred twenty thousand and no/100 dollars
grant to Walker Realty, LLC, a Massachusetts limited liability company,
of Two Lan Drive, Westford, Middlesex County, Commonwealth of Massachusetts

with **quitclaim covenants**

A certain parcel of land with the buildings thereon situated in Acton, Middlesex County, Commonwealth of Massachusetts, on Main Street near the Village of Acton Center and being shown as Lot 1 on a plan of land surveyed for Daniel H. Searlett by Horace F. Tuttle, dated November 6, 1941, recorded with Middlesex South District Registry of Deeds in Book 6562, Page 329, being bounded and described as follows:

352 Main St., Acton, MA

BEGINNING: at the Northeasterly corner thereof at an iron pipe by a wall at land now or formerly of L. W. and I. Bennett and land now or formerly of John N. Hamm;

THENCE: N. 76 degrees 03' W. by said land now or formerly of Hamm, 199.70 feet;

THENCE: S. 25 degrees 54' W. by said land now or formerly of Hamm 182.90 feet to a stone bound at land nor or formerly of L. W. and I. Bennett;

THENCE: by stone wall S. 54 degrees 46' E. by said land of Bennett 171.60 feet to Main Street;

THENCE: N. 46 degrees 45' E. along aid Main Street, 216.00 feet to land now or formerly of L. W. and I. Bennett;

THENCE: N. 50 degrees 12' W. by said land of Bennett, 28.00 feet;

THENCE: N. 1 degree 42' W. by said Bennett land, 48.75 feet to the bound first mentioned, the last two courses being the Easterly line of a private way shown on said plan.

Containing 1.04 acres of land.

Intending to convey and hereby conveying Lot 1, as shown on said plan, however otherwise bounded , measured, or described.

The premises is conveyed subject to the rights of way of record in and over that portion of the private way named on said plan, Isaac Davis Way, which is located on the herein granted premises.

return to: E. Ahern
Walker Realty LLC
2 Lan Drive
Westford, MA 01886

MASSACHUSETTS EXCISE TAX
Southern Middlesex District ROD # 001
Date: 03/31/2008 02:56 PM
Ctrl# 106865 28277 Doc# 00051757
Fee: $1,915.20 Cons: $420,000.00

The premises is conveyed subject to and with the benefit of restrictions, easements, covenants and agreement of record, if any there be, insofar as the same are now in force and applicable.

Being the same premises conveyed to the Grantors' by deed of David S. Newman dated June 29, 1992, and recorded with Middlesex South District Registry of Deeds in Book 22173 and Page 309.

Witness our hands and seals this 31st day of March, 2008.

Seller – Wendell Morgan Graham

Seller – Thomas O. McLaughlin

Commonwealth of Massachusetts

Middlesex, ss. March 31st, 2008

Then personally appeared, Wendell Morgan Graham and Thomas O. McLaughlin, and being personally known to me proved to me to be the person whose names are signed on this document and acknowledged the foregoing instrument to be their free act and deed, for its stated purpose, before me.

Notary Public – James K. Ferraro
My commission expires: July 27, 2012

Attest Middlesex S. Register

JAMES K. FERRARO
NOTARY PUBLIC
COMMONWEALTH OF MASSACHUSETTS
MY COMM. EXPIRES JULY 27, 2012

Subdivision Rule/Reg 5.2.12

348-352 Main Street, Acton, MA

Mortgage holder: Hoosac Bank, 93 Main Street, N. Adams, MA

Property Information

Property ID
Location

LOCUS MAP
PER ACTON SUBDIVISION RULES AND REGULATIONS
NEWLY PROPOSED SECTION 5.3.8

MAP FOR REFERENCE ONLY
NOT A LEGAL DOCUMENT

This data set (map) is for planning purposes only and should not be used for larger scale analysis. The Town of Acton shall not be held liable for any use of the data or images shown on this map, nor is any warranty of accuracy expressed. All uses of this data or map are subject to field verification.

EXISTING CONDITIONS

The 2.4-acre site is located on the westerly side of Main Street just to the north of Route 2 and across from the westbound interchange. The parcel is made of Assessors Map F3 Lot 54 (352 Main Street), Lot 1 (348/350 Main Street), Lot 2 and a triangular shaped parcel. A forested wetland exists within the Route 2 layout along the subject property's westerly boundary. The 100-foot buffer zone of this wetland extends onto the subject property. The wetland was flagged as part of a Notice of Intent filing for proposed development of a single-family house. The flags were checked and replaced via survey within the last 30 days. The site is currently developed with two single-family homes with associated driveways and septic systems. Lot 2 and the triangle lot are presently undeveloped. Topography on site ranges from a high elevation of 230 in the easterly section to a low of elevation 206 along Route 2. Stormwater runoff generally flows toward Route 2 with a portion of the site draining to Main Street. Soils on site have been classified by the USDA Natural Resource Conservation Service as Woodbridge Fine Sandy Loam and Carlton-Hollis Rock outcrop complex. Hancock performed soil testing on site in May of 2008 and confirmed this mapping. Municipal water is available in Main Street and currently services the two dwellings.

PROPOSED CONDITIONS

The proposal calls for the construction two single-family house lots off of a 263 foot long roadway, ending in a cul-de-sac (total length including cul-de-sac is 263 feet). The proposed homes will be served by town water, underground gas and underground electric, cable and telephone. On-site subsurface sewage disposal systems have are proposed for both homes.

Stormwater will be managed on site in compliance with the Massachusetts DEP Stormwater Regulations (2008). A standard collection system of deep sump hooded catch basins and pipes will transmit runoff through one of two Stormceptor Units, then either drain to a grassed swale to the bordering vegetated wetland or continue to a detention area where the runoff will either be infiltrated or discharge to the same bordering vegetated wetland.

Proprietary treatment devices (Stormceptors) are proposed to meet TSS removal requirements. A pre-development and post-development stormwater model was developed to analyze flow to Main Street and to the wetlands as two distinct analysis points.

Pre and Post-development rates for various storms are presented herein to demonstrate compliance.

STORMWATER MANAGEMENT DESIGN – DOCUMENTING COMPLIANCE

In accordance with the Massachusetts Stormwater Handbook Volume 3

Stormwater Discharge Velocity

	2-year 24-hour Storm	10-year 24-hour Storm	25-year 24-hour Storm	100-year 24-hour storm
Rainfall – 24 hour	3.1 in	4.5	5.4	6.4
Velocity at Outlet (7R)	0 fps	2.6 fps	4 fps	4.9 fps
Velocity at Outlet (10R)	4 fps	4.7 fps	5 fps	5.3 fps

A velocity of approximately 2 fps is desired for self-cleaning velocity. A velocity of 8 fps or greater can lead to erosive tendencies.

STANDARD 2. PEAK RATE ATTENUATION

To evaluate that the post development runoff rate does not increase from the predevelopment runoff rate at project extents.

Peak Discharge Summary Table

	2-year 24-hour Storm	10-year 24-hour Storm	25-year 24-hour Storm	100-year 24-hour storm
Rainfall – 24 hour	3.1	4.5	5.4	6.4
Pre-development to Wetland (25P)	1.13	3.04	4.42	6.12
Post-development to Wetland (100P)	1.17	2.68	3.77	5.87
Decrease (cfs/af)	+0.04	-0.36	-0.65	-0.25
Pre-development to Main Street (3S)	0.27	0.76	1.13	1.58
Post-development to Main Street (200P)	0.10	0.40	0.64	0.93
Decrease (cfs/af)	-0.17	-0.36	-0.49	-0.65

The proposed drainage design shows an equal or lesser property runoff for the 2, 10, 25 and 100 year storm events. (In the 2 yr storm even,t a +0.04 is an insignificant increase at 3.5% of total flow.)

STANDARD 3. STORMWATER RECHARGE

Multiple Computations are necessary:

a. **Impervious Area**
b. **Required Recharge Volume**
c. **Bottom Area Sizing for Infiltration Structures**

Identify Hydrologic Soil Groups:

Stage 1) Review NRCS Soil Survey
The soil survey for this site shows two (2) soil types. The soil map has been attached for your review. NRCS has mapped soils on site as Woodbridge Fine Sandy Loam and Carlton-Hollis Rock outcrop complex.

Woodbridge Fine Sandy Loam soils have a hydrologic soil group rating of B and Carlton-Hollis soils have a hydrologic soil group rating of C.

Stage 1a.) Site Visit
A Massachusetts Soil Evaluator conducted soil testing on May 29, 2008. Soil testing found fine to medium sandy loam in test hole DH-2008-B, the test pit closest to the proposed infiltration pond.

Stage 1b.) Additional Measures When the NRCS Soil Survey Does Not Identify Hydrologic Soil Group(s) At Site or When Conditions are Found That Are Inconsistent with the NRCS Soil Survey
Not applicable.

Stage 2.) Determine Site Conditions at Specific Location Where Recharge is Proposed
Soil Test Information is contained in Appendix II of this report and depicts the Soil Textural Analysis per NRCS Method for the subsurface layers where infiltration will take place.

Depth to seasonal high groundwater has been identified based upon redox features within the soil of Test Pit DH-2008-B. Estimated seasonal high groundwater at 210.51 was established.

Where the "Static" Method of recharge is to be used, the saturated hydraulic conductivity will be that listed by Rawls for a Sandy Loam, 1.02 in/hr.

Stage 3.) Identify Hydrologic Soil Groups On-site and At Location Where Recharge Proposed
The Hydrologic Soils Group for the specific area and depth of recharge was determined by using the Soil Textural Classification recorded by a Competent Soils Professional and comparing the soil texture to the Rawls Table (Table 2.3.3) in Volume 3: Documenting Compliance with the Massachusetts Stormwater Standards. Materials found throughout the majority of the site consist of Sandy Loam, which according to Rawls Rates, is a NRCS HSG B.

Per Volume 3: Documenting Compliance with the Massachusetts Stormwater Standards, NRCS "classification is based upon the upper and not lower soil horizons. When the lower soil horizons or layers are proposed for stormwater infiltration, the soils must be assigned to a HSG by a Competent Soils Professional". Therefore, the surface HSG may not be the same as the subsurface HSG.

Stage 4.) Prepare a Plan Identifying Hydrologic Soil Groups for the Site
A plan has been created showing the location of all on-site test pits and a soil log has been provided showing the HSG listed for both surface and subsurface soils for consideration in the recharge requirement calculation and infiltration area design. See Plan and Appendix for this information.

RECHARGE VOLUME
Step 1.) Required Recharge Volume
Rv = F x impervious area
Rv=Required Recharge Volume, expressed in cubic feet
F = Target Depth Factor associated with HSG
Impervious Area = pavement and rooftop area on-site

Recharge to Groundwater

The prescribed stormwater runoff volume to be recharged to groundwater has been determined using the existing site (pre-development) soil conditions from on-site evaluation is as follows:

Hydrologic Group	***Volume to Recharge (x Total Impervious Area)***
A	0.60 inches of runoff -
B	0.35 inches of runoff 17,228 s.f.
C	0.25 inches of runoff ,1,500 s.f.
D	0.10 -

Required Recharge Volume = (17,228 sf of impervious area) x (0.35 inches/12 inches per feet) + (1,500 sf of impervious area) x (0.25 inches/12 inches per feet)
Required Recharge Volume = 534 c.f.

The proposed infiltration area has been designed with a volume of 3086 c.f. below the outlet, therefore this requirement has been met. Pre-treatment is provided prior to the basin via a Stormceptor Unit, which provides in excess of the required 44% TSS removal (see appendix).

Step 2.) Sizing Storage Volume
Choose Method for Sizing.

Step 3.) Static Method
The static method has been chosen to prove sufficient volume has been provided to obtain the minimum recharge requirement.
The proposed infiltration area has been designed with a volume of 3086 c.f. below the outlet, therefore this requirement has been met.

Step 4.) "Simple Dynamic" and Dynamic Field" Methods
Method not chosen.

Step 5.) Drawdown within 72 Hours
See Below Section on Meeting Standards 3 & 4 for increase in infiltration volume, Rv.
Time (drawdown) = Rv/(K)(Bottom Area)

Infiltration Area 1
Infiltration Area Drain Time
Time = 3086 c.f. / (1.02 inches / hour)(1ft / 12inches)(1601 s.f.)
Time = 1.88 hours < 72 hours, OK.

Other Considerations For Standard 3 Capture Area Adjustment: Determining if Enough Runoff is Directed to the Recharge Practice

The majority of the newly paved areas are being directed to an infiltration BMP.

STANDARD 4. WATER QUALITY

Computations that are or may be necessary:

a. Required Water Quality Volume
b. TSS Removal Rate
c. Weight Determination

Water Quality Treatment Volume

Vwq = (Dwq /12 inches / ft) x (Aimp x 43560 sf / acre)
Vwq = Required Water Quality Volume (c.f.)
Dwq = Water Quality Depth : one - inch for discharges within a Zone II or Interim Wellhead Protection Area, to or near another critical area, runoff from LUHPPL, or exfiltration to soils with infiltration rate greater than 2.4 inches / hour or greater, 1/2 inch for discharges near or to other areas.
Aimp = Impervious Area (acres)

Calculation based on 0.5 inch of rainfall over 50,146 S.F.
WQV = 0.5 x 18,728 /12 = ***780.33 c.f.***

The water quality volume is obtained via the Water Quality Units.

TSS Removal Percentage Computations

See attached TSS Removal is shown on the Stormceptor Data Sheets in the Appendix. In each of the the proposed units the 80% TSS requirement is exceeded at the unit. Stormceptor units have been given a rating of "2" through the MASTEP program, which mean "Sound field or laboratory performance studies exist for this technology. Some caveats exist regarding use of the study information".

WHEN ONE PRACTICE IS SIZED TO MEET BOTH STANDARDS 3 AND 4

Per Volume 3: Documenting Compliance with the Massachusetts Stormwater Management Standards Chapter I, "In such and instance, the infiltration BMP must be sized to treat or hold the Target Volume, the larger of the Required Water Quality Volume and the Required Recharge Volume."
The Stormwater Management System does not use one BMP to meet both requirements.

STANDARD 5.) LAND USES WITH HIGHER POTENTIAL POLLUTANT LOADS

The proposed use is not considered a use with a higher potential pollutant load as defined by the Stormwater Management Standards.

STANDARD 6.) CRITICAL AREAS

"Standard 6 applies to discharges within a Zone II, Interim Wellhead Protection Areas or near or to other Critical Areas: Shellfish Growing Areas, Bathing Beaches, Outstanding Resource Waters

Special Resource Waters, and Cold-Water Fisheries" per Volume 3: Documenting Compliance with the Massachusetts Stormwater Management Standards Chapter 1.

This site is not located within or adjacent to a Critical Area.

STANDARD 7.) REDEVELOPMENT

This project is not being proposed as redevelopment.

STANDARD 8.) CONSTRUCTION PERIOD CONTROLS

Necessary Computations :

a. Area to be disturbed.
b. Computations demonstrating that control proposed measures are properly sized.

Construction Period controls have been designed and shown on the Grading, Drainage and Utility Plan.

CONTROL PRACTICES PROPERLY SIZED

Construction Period controls have been designed and shown on the Grading, Drainage and utility Plan.

STANDARD 9.) OPERATION AND MAINTENANCE PLAN

The Operation and Maintenance Plan has been developed and included in Appendix.

STANDARD 10.) ILLICIT DISCHARGES TO DRAINAGE SYSTEM

An illicit discharges statement has been included in the Appendix at this time.

EROSION AND SEDIMENTATION PLAN

Best management practices (BMP) for erosion and sedimentation control are staked straw bales, filter fences, hydro seeding, and phased development. Many stormwater BMP technologies (e.g., infiltration technologies) are not designed to handle the high concentrations of sediments typically found in construction runoff and must be protected from construction-related sediment loadings. Construction BMP's **must** be maintained.

In developing the proposed project certain measures will be implemented to minimize impacts erosion and sedimentation could have on surrounding areas. This section addresses items that involve proper construction techniques, close surveillance of workmanship, and immediate response to emergency situations. The developer must be prepared to provide whatever reasonable measures are necessary to protect the environment during construction and to stabilize all disturbed areas as soon as construction ends.

Pre-Construction

1. The contractor shall have a stockpile of materials required to control erosion on-site to be used to supplement or repair erosion control devices. These materials shall include, but are not limited to straw bales, silt fence and crushed stone.
2. The contractor is responsible for erosion control on site and shall utilize erosion control measures where needed, regardless of whether the measures are specified on the plan or in the order of conditions.

Preliminary Site Work

1. Materials such as gravel to be removed should be stockpiled, separating the topsoil for future use on the site. Erosion control shall be utilized along the down slope side of the piles if the piles are to remain for more than three weeks.
2. If intense rainfall is anticipated, the installation of supplemental straw bale dikes, silt fences, or armored dikes shall be considered.

Drainage System

1. The stormwater treatment systems shall be installed from the downstream end up.
2. Processed stone shall be installed immediately upon the placement of any pipe. If intense rainfall (such as hurricanes) is predicted before all tributary areas are stabilized, all drainage structures shall be inspected and cleared of all sediment and debris.
3. Water shall not be allowed to enter pipes from surfaces that are not stabilized.
4. At the end of all construction activity, parking areas are to be cleaned of all sediment and debris.

Landscaping

1. Landscaping shall occur as soon as possible to provide permanent stabilization of disturbed surfaces.
2. Contractor shall utilize a variety of slope stabilization methods and materials that shall be adjusted to the site conditions. Erosion control blankets or Mirafi Miramat (or similar products) shall be available on site.

3. If the season or adverse weather conditions do not allow the establishment of vegetation, temporary mulching with straw, wood chips weighted with snow fence or branches, or other methods shall be provided.
4. A minimum of 4 inches of topsoil shall be placed and its surface smoothed to the specified grades.
5. The use of herbicides is strongly discouraged.
6. Hydro seeding is encouraged for steep slopes. Application rates on slopes greater than 3:1 shall have a minimum seeding rate of 5-lbs/1000 SF. A latex or fiber tackifier shall be used on these slopes at a minimum rate of 50 lbs. of tackifier per 500 gallons of water used.

STORMWATER OPERATION AND MAINTENANCE PLAN

Stormwater management system owner: Walker Realty, LLC

The party or parties responsible for operation and maintenance: Walker Realty, LLC

Deep Sump Hooded Catch Basins

Inspect or clean deep sump catch basins four times per year at the end of the foliage and snow removal seasons. Sediments must also be removed four times per year or when the depth of deposits is greater than or equal to one half the depth from the bottom of the lowest pipe in the basin.

Vacuum trucks are to be used to remove trapped sediment and supernatant.

Although catch basin debris often contains concentrations of oil and hazardous materials such as petroleum hydrocarbons and metals, MassDEP classifies them as solid waste. Any contaminated materials must be evaluated in accordance with the Hazardous Waste Regulations, 310 CMR 30.00, and handled as hazardous waste.

MassDEP regulations prohibit landfills from accepting materials that contain free draining liquids.

Proprietary Separators - Stormceptor stc 900

Excerpt from Structural BMP's - Volume 2, Chapter 2

Inspect and clean these units in strict accordance with manufacturer's recommendations and requirements.

See attached **Maintenance** literature from **Stormceptor**.

Infiltration Basin

Inspect to ensure proper functioning after every major storm during first 3 months of operation and twice a year thereafter and when there are discharges through the high outlet orifice. Mow the buffer area, side slopes, and basin bottom grassed floor, remove trash and debris; remove grass clippings and accumulated organic matter twice per year. Inspect and clean pretreatment devices, every other month recommended and at least twice a year and after every major storm event.

STORMWATER BEST MANAGEMENT PRACTICES (BMP) YEARLY MAINTENANCE LOG

Approximate yearly cost: $3000/yearly

See Operation and Maintenance Plan for required frequency.

Site Owner: _____

Site Address: _____

Stormwater BMP's On-site: _____

Deep Sump Hooded Catch Basins

Maintenance Schedule: 4 times per year

Date	Inspector	Depth of Sediment	Sediment Disposal Site	Notes

Infiltration Basin

Maintenance Schedule: 2 times per year

Date	Inspector	Depth of Sediment	Sediment Disposal Site	Notes (Mow, debris removal)

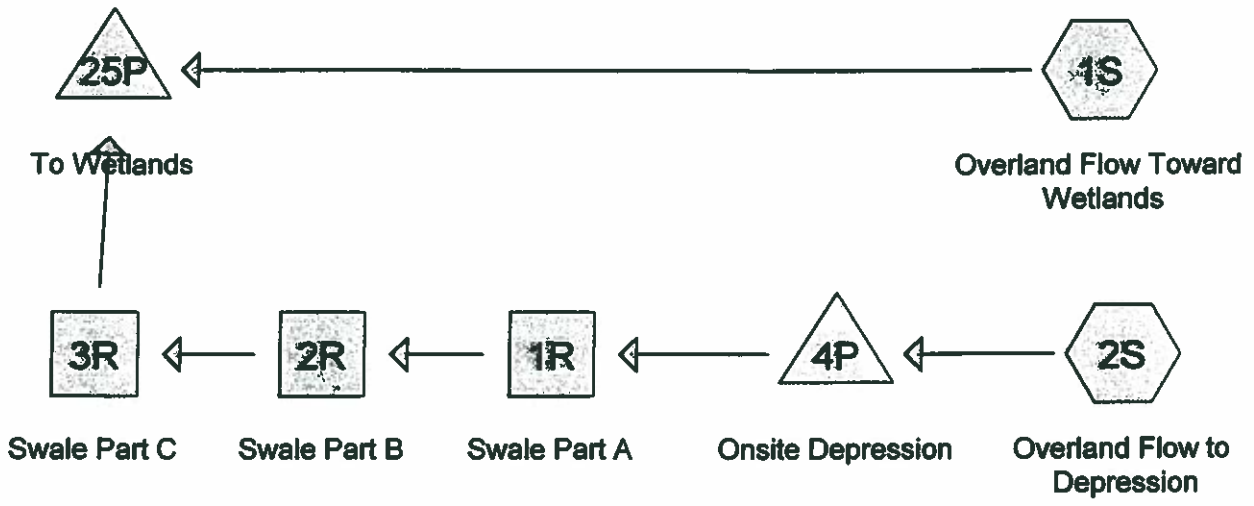
Stormceptor

Maintenance Schedule: 2 times per year

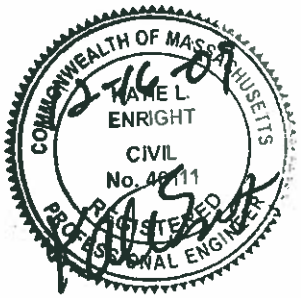
Date	Inspector	Depth of Sediment, Oil	Sediment, Oil Disposal Site	Notes (Mow, debris removal)

APPENDIX

APPENDIX I HydroCAD Output



Overland Flow to Roadway



Subcat Reach Pond Link

Drainage Diagram for 14188_PreDevelopment 4-21-09+
Prepared by HANCOCK ASSOCIATES 12/11/2009

Subcatchment 1S: Overland Flow Toward Wetlands

Runoff = 1.13 cfs @ 12.12 hrs, Volume= 0.097 af, Depth= 0.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
1,019	98	Paved parking & roofs
1,136	98	roofs C Soils
1,279	89	Gravel roads, HSG C
4,486	61	>75% Grass cover, Good, HSG B
28,695	74	>75% Grass cover, Good, HSG C
15,995	55	Woods, Good, HSG B
17,570	70	Woods, Good, HSG C
70,180	69	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	46	0.0600	0.2		**Sheet Flow, Lawn** Grass: Short n= 0.150 P2= 3.10"
0.7	41	0.0400	1.0		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.1	11	0.4000	3.2		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.2	94	0.0700	1.3		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.2	119	0.0600	1.7		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
0.5	42	0.0700	1.3		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
7.1	353	Total			

Subcatchment 2S: Overland Flow to Depression

Runoff = 0.09 cfs @ 12.12 hrs, Volume= 0.012 af, Depth= 0.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
68	98	Paved parking & roofs
9,045	61	>75% Grass cover, Good, HSG B
6,167	55	Woods, Good, HSG B
1,700	74	>75% Grass cover, Good, HSG C
16,980	60	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	37	0.0400	0.2		**Sheet Flow, Lawn** Grass: Short n= 0.150 P2= 3.10"
0.5	27	0.0400	1.0		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.5	50	0.0500	1.6		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
0.7	78	0.1400	1.9		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.1	16	0.1500	2.7		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
5.2	208	Total			

Subcatchment 3S: Overland Flow to Roadway

Runoff = 0.27 cfs @ 12.09 hrs, Volume= 0.024 af, Depth= 0.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
3,945	98	Paved parking & roofs
11,607	61	>75% Grass cover, Good, HSG B
5,340	55	Woods, Good, HSG B
20,892	66	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	28	0.0500	0.2		**Sheet Flow, Lawn** Grass: Short n= 0.150 P2= 3.10"
0.3	28	0.0500	1.6		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
1.2	93	0.0700	1.3		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.1	11	0.1400	2.6		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
0.9					**Direct Entry, To obtain minimum Tc of 5**
5.0	160	Total			

Reach 1R: Swale Part A

Inflow Area = 0.390 ac, Inflow Depth = 0.35" for 2-Year event
Inflow = 0.07 cfs @ 12.31 hrs, Volume= 0.012 af
Outflow = 0.07 cfs @ 12.36 hrs, Volume= 0.012 af, Atten= 0%, Lag= 3.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.7 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 0.3 fps, Avg. Travel Time= 4.0 min

Peak Depth= 0.04' @ 12.33 hrs
Capacity at bank full= 5.87 cfs
Inlet Invert= 210.68', Outlet Invert= 209.78'
2.50' x 0.50' deep channel, n= 0.025 Length= 75.0' Slope= 0.0120 '/'
Side Slope Z-value= 2.0 '/'

Reach 2R: Swale Part B

Inflow Area = 0.390 ac, Inflow Depth = 0.35" for 2-Year event
Inflow = 0.07 cfs @ 12.36 hrs, Volume= 0.012 af
Outflow = 0.07 cfs @ 12.39 hrs, Volume= 0.012 af, Atten= 0%, Lag= 1.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.9 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 0.4 fps, Avg. Travel Time= 2.7 min

Peak Depth= 0.03' @ 12.37 hrs
Capacity at bank full= 7.69 cfs
Inlet Invert= 209.78', Outlet Invert= 208.00'
2.50' x 0.50' deep channel, n= 0.030 Length= 60.0' Slope= 0.0297 '/'
Side Slope Z-value= 2.0 '/'

Reach 3R: Swale Part C

Inflow Area = 0.390 ac, Inflow Depth = 0.35" for 2-Year event
Inflow = 0.07 cfs @ 12.39 hrs, Volume= 0.012 af
Outflow = 0.07 cfs @ 12.41 hrs, Volume= 0.012 af, Atten= 0%, Lag= 1.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.0 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 0.4 fps, Avg. Travel Time= 1.5 min

Peak Depth= 0.03' @ 12.40 hrs
Capacity at bank full= 9.98 cfs
Inlet Invert= 208.00', Outlet Invert= 206.00'
2.50' x 0.50' deep channel, n= 0.030 Length= 40.0' Slope= 0.0500 '/'
Side Slope Z-value= 2.0 '/'

Pond 4P: Onsite Depression

Inflow Area = 0.390 ac, Inflow Depth = 0.37" for 2-Year event
Inflow = 0.09 cfs @ 12.12 hrs, Volume= 0.012 af
Outflow = 0.07 cfs @ 12.31 hrs, Volume= 0.012 af, Atten= 22%, Lag= 11.5 min
Primary = 0.07 cfs @ 12.31 hrs, Volume= 0.012 af

Routing by Stor-Ind method, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Peak Elev= 210.86' @ 12.31 hrs Surf.Area= 179 sf Storage= 44 cf
Plug-Flow detention time= 38.7 min calculated for 0.012 af (96% of inflow)
Center-of-Mass det. time= 17.7 min (941.9 - 924.2)

#	Invert	Avail.Storage	Storage Description
1	210.50'	658 cf	**Custom Stage Data (Irregular)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
210.50	38	28.0	0	0	38
211.00	236	78.0	61	61	461
211.50	626	199.0	208	269	3,129
212.00	938	241.0	388	658	4,603

#	Routing	Invert	Outlet Devices
1	Primary	210.60'	**12.0" x 24.4' long Culvert** Ke= 0.500 Outlet Invert= 210.68' S= -0.0033 '/' n= 0.024 Cc= 0.900

Primary OutFlow Max=0.07 cfs @ 12.31 hrs HW=210.86' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 0.07 cfs @ 0.7 fps)

Pond 25P: To Wetlands

Inflow Area = 2.001 ac, Inflow Depth = 0.65" for 2-Year event
Inflow = 1.13 cfs @ 12.12 hrs, Volume= 0.109 af
Primary = 1.13 cfs @ 12.12 hrs, Volume= 0.109 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs

Subcatchment 1S: Overland Flow Toward Wetlands

Runoff = 2.81 cfs @ 12.11 hrs, Volume= 0.215 af, Depth= 1.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,019	98	Paved parking & roofs
1,136	98	roofs C Soils
1,279	89	Gravel roads, HSG C
4,486	61	>75% Grass cover, Good, HSG B
28,695	74	>75% Grass cover, Good, HSG C
15,995	55	Woods, Good, HSG B
17,570	70	Woods, Good, HSG C
70,180	69	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	46	0.0600	0.2		**Sheet Flow, Lawn** Grass: Short n= 0.150 P2= 3.10"
0.7	41	0.0400	1.0		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.1	11	0.4000	3.2		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.2	94	0.0700	1.3		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.2	119	0.0600	1.7		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
0.5	42	0.0700	1.3		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
7.1	353	Total			

Subcatchment 2S: Overland Flow to Depression

Runoff = 0.41 cfs @ 12.09 hrs, Volume= 0.033 af, Depth= 1.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
68	98	Paved parking & roofs
9,045	61	>75% Grass cover, Good, HSG B
6,167	55	Woods, Good, HSG B
1,700	74	>75% Grass cover, Good, HSG C
16,980	60	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	37	0.0400	0.2		**Sheet Flow, Lawn** Grass: Short n= 0.150 P2= 3.10"
0.5	27	0.0400	1.0		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.5	50	0.0500	1.6		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
0.7	78	0.1400	1.9		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.1	16	0.1500	2.7		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
5.2	208	Total			

Subcatchment 3S: Overland Flow to Roadway

Runoff = 0.76 cfs @ 12.08 hrs, Volume= 0.056 af, Depth= 1.40"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
3,945	98	Paved parking & roofs
11,607	61	>75% Grass cover, Good, HSG B
5,340	55	Woods, Good, HSG B
20,892	66	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	28	0.0500	0.2		**Sheet Flow, Lawn** Grass: Short n= 0.150 P2= 3.10"
0.3	28	0.0500	1.6		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
1.2	93	0.0700	1.3		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.1	11	0.1400	2.6		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
0.9					**Direct Entry, To obtain minimum Tc of 5**
5.0	160	Total			

Reach 1R: Swale Part A

Inflow Area = 0.390 ac, Inflow Depth = 1.00" for 10-Year event
Inflow = 0.33 cfs @ 12.15 hrs, Volume= 0.033 af
Outflow = 0.33 cfs @ 12.18 hrs, Volume= 0.033 af, Atten= 0%, Lag= 1.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.3 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 0.4 fps, Avg. Travel Time= 2.9 min

Peak Depth= 0.10' @ 12.16 hrs
Capacity at bank full= 5.87 cfs
Inlet Invert= 210.68', Outlet Invert= 209.78'
2.50' x 0.50' deep channel, n= 0.025 Length= 75.0' Slope= 0.0120 '/'
Side Slope Z-value= 2.0 '/'

Reach 2R: Swale Part B

Inflow Area = 0.390 ac, Inflow Depth = 1.00" for 10-Year event
Inflow = 0.33 cfs @ 12.18 hrs, Volume= 0.033 af
Outflow = 0.33 cfs @ 12.19 hrs, Volume= 0.033 af, Atten= 0%, Lag= 1.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.5 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 0.5 fps, Avg. Travel Time= 2.0 min

Peak Depth= 0.08' @ 12.18 hrs
Capacity at bank full= 7.69 cfs
Inlet Invert= 209.78', Outlet Invert= 208.00'
2.50' x 0.50' deep channel, n= 0.030 Length= 60.0' Slope= 0.0297 '/'
Side Slope Z-value= 2.0 '/'

Reach 3R: Swale Part C

Inflow Area = 0.390 ac, Inflow Depth = 1.00" for 10-Year event
Inflow = 0.33 cfs @ 12.19 hrs, Volume= 0.033 af
Outflow = 0.33 cfs @ 12.21 hrs, Volume= 0.033 af, Atten= 0%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.8 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 0.6 fps, Avg. Travel Time= 1.1 min

Peak Depth= 0.07' @ 12.20 hrs
Capacity at bank full= 9.98 cfs
Inlet Invert= 208.00', Outlet Invert= 206.00'
2.50' x 0.50' deep channel, n= 0.030 Length= 40.0' Slope= 0.0500 '/'
Side Slope Z-value= 2.0 '/'

Pond 4P: Onsite Depression

Inflow Area = 0.390 ac, Inflow Depth = 1.02" for 10-Year event
Inflow = 0.41 cfs @ 12.09 hrs, Volume= 0.033 af
Outflow = 0.33 cfs @ 12.15 hrs, Volume= 0.033 af, Atten= 19%, Lag= 3.5 min
Primary = 0.33 cfs @ 12.15 hrs, Volume= 0.033 af

Routing by Stor-Ind method, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Peak Elev= 211.09' @ 12.15 hrs Surf.Area= 309 sf Storage= 100 cf
Plug-Flow detention time= 17.0 min calculated for 0.033 af (98% of inflow)
Center-of-Mass det. time= 8.6 min (891.6 - 883.0)

#	Invert	Avail.Storage	Storage Description
1	210.50'	658 cf	**Custom Stage Data (Irregular)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
210.50	38	28.0	0	0	38
211.00	236	78.0	61	61	461
211.50	626	199.0	208	269	3,129
212.00	938	241.0	388	658	4,603

#	Routing	Invert	Outlet Devices
1	Primary	210.60'	**12.0" x 24.4' long Culvert** Ke= 0.500 Outlet Invert= 210.68' S= -0.0033 '/' n= 0.024 Cc= 0.900

Primary OutFlow Max=0.33 cfs @ 12.15 hrs HW=211.09' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 0.33 cfs @ 1.3 fps)

Pond 25P: To Wetlands

Inflow Area = 2.001 ac, Inflow Depth = 1.49" for 10-Year event
Inflow = 3.04 cfs @ 12.11 hrs, Volume= 0.248 af
Primary = 3.04 cfs @ 12.11 hrs, Volume= 0.248 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs

Subcatchment 1S: Overland Flow Toward Wetlands

Runoff = 4.03 cfs @ 12.11 hrs, Volume= 0.302 af, Depth= 2.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
1,019	98	Paved parking & roofs
1,136	98	roofs C Soils
1,279	89	Gravel roads, HSG C
4,486	61	>75% Grass cover, Good, HSG B
28,695	74	>75% Grass cover, Good, HSG C
15,995	55	Woods, Good, HSG B
17,570	70	Woods, Good, HSG C
70,180	69	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	46	0.0600	0.2		**Sheet Flow, Lawn** Grass: Short n= 0.150 P2= 3.10"
0.7	41	0.0400	1.0		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.1	11	0.4000	3.2		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.2	94	0.0700	1.3		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.2	119	0.0600	1.7		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
0.5	42	0.0700	1.3		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
7.1	353	Total			

Subcatchment 2S: Overland Flow to Depression

Runoff = 0.67 cfs @ 12.09 hrs, Volume= 0.050 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
68	98	Paved parking & roofs
9,045	61	>75% Grass cover, Good, HSG B
6,167	55	Woods, Good, HSG B
1,700	74	>75% Grass cover, Good, HSG C
16,980	60	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	37	0.0400	0.2		**Sheet Flow, Lawn** Grass: Short n= 0.150 P2= 3.10"
0.5	27	0.0400	1.0		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.5	50	0.0500	1.6		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
0.7	78	0.1400	1.9		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.1	16	0.1500	2.7		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
5.2	208	Total			

Subcatchment 3S: Overland Flow to Roadway

Runoff = 1.13 cfs @ 12.08 hrs, Volume= 0.080 af, Depth= 2.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,945	98	Paved parking & roofs
11,607	61	>75% Grass cover, Good, HSG B
5,340	55	Woods, Good, HSG B
20,892	66	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	28	0.0500	0.2		**Sheet Flow, Lawn** Grass: Short n= 0.150 P2= 3.10"
0.3	28	0.0500	1.6		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
1.2	93	0.0700	1.3		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.1	11	0.1400	2.6		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
0.9					**Direct Entry, To obtain minimum Tc of 5**
5.0	160	Total			

Reach 1R: Swale Part A

Inflow Area = 0.390 ac, Inflow Depth = 1.53" for 25-Year event
Inflow = 0.55 cfs @ 12.14 hrs, Volume= 0.050 af
Outflow = 0.55 cfs @ 12.16 hrs, Volume= 0.050 af, Atten= 0%, Lag= 1.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.5 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 0.5 fps, Avg. Travel Time= 2.6 min

Peak Depth= 0.13' @ 12.15 hrs
Capacity at bank full= 5.87 cfs
Inlet Invert= 210.68', Outlet Invert= 209.78'
2.50' x 0.50' deep channel, n= 0.025 Length= 75.0' Slope= 0.0120 '/'
Side Slope Z-value= 2.0 '/'

Reach 2R: Swale Part B

Inflow Area = 0.390 ac, Inflow Depth = 1.53" for 25-Year event
Inflow = 0.55 cfs @ 12.16 hrs, Volume= 0.050 af
Outflow = 0.55 cfs @ 12.18 hrs, Volume= 0.050 af, Atten= 0%, Lag= 0.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.8 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 0.6 fps, Avg. Travel Time= 1.7 min

Peak Depth= 0.11' @ 12.17 hrs
Capacity at bank full= 7.69 cfs
Inlet Invert= 209.78', Outlet Invert= 208.00'
2.50' x 0.50' deep channel, n= 0.030 Length= 60.0' Slope= 0.0297 '/'
Side Slope Z-value= 2.0 '/'

Reach 3R: Swale Part C

Inflow Area = 0.390 ac, Inflow Depth = 1.53" for 25-Year event
Inflow = 0.55 cfs @ 12.18 hrs, Volume= 0.050 af
Outflow = 0.55 cfs @ 12.19 hrs, Volume= 0.050 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.2 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 0.7 fps, Avg. Travel Time= 1.0 min

Peak Depth= 0.09' @ 12.18 hrs
Capacity at bank full= 9.98 cfs
Inlet Invert= 208.00', Outlet Invert= 206.00'
2.50' x 0.50' deep channel, n= 0.030 Length= 40.0' Slope= 0.0500 '/'
Side Slope Z-value= 2.0 '/'

Pond 4P: Onsite Depression

Inflow Area = 0.390 ac, Inflow Depth = 1.54" for 25-Year event
Inflow = 0.67 cfs @ 12.09 hrs, Volume= 0.050 af
Outflow = 0.55 cfs @ 12.14 hrs, Volume= 0.050 af, Atten= 17%, Lag= 3.3 min
Primary = 0.55 cfs @ 12.14 hrs, Volume= 0.050 af

Routing by Stor-Ind method, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Peak Elev= 211.22' @ 12.14 hrs Surf.Area= 410 sf Storage= 154 cf
Plug-Flow detention time= 12.9 min calculated for 0.050 af (99% of inflow)
Center-of-Mass det. time= 7.2 min (876.3 - 869.1)

#	Invert	Avail.Storage	Storage Description
1	210.50'	658 cf	**Custom Stage Data (Irregular)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
210.50	38	28.0	0	0	38
211.00	236	78.0	61	61	461
211.50	626	199.0	208	269	3,129
212.00	938	241.0	388	658	4,603

#	Routing	Invert	Outlet Devices
1	Primary	210.60'	**12.0" x 24.4' long Culvert** Ke= 0.500 Outlet Invert= 210.68' S= -0.0033 '/' n= 0.024 Cc= 0.900

Primary OutFlow Max=0.55 cfs @ 12.14 hrs HW=211.22' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 0.55 cfs @ 1.5 fps)

Pond 25P: To Wetlands

Inflow Area = 2.001 ac, Inflow Depth = 2.11" for 25-Year event
Inflow = 4.42 cfs @ 12.11 hrs, Volume= 0.352 af
Primary = 4.42 cfs @ 12.11 hrs, Volume= 0.352 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs

Subcatchment 1S: Overland Flow Toward Wetlands

Runoff = 5.48 cfs @ 12.11 hrs, Volume= 0.407 af, Depth= 3.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
1,019	98	Paved parking & roofs
1,136	98	roofs C Soils
1,279	89	Gravel roads, HSG C
4,486	61	>75% Grass cover, Good, HSG B
28,695	74	>75% Grass cover, Good, HSG C
15,995	55	Woods, Good, HSG B
17,570	70	Woods, Good, HSG C
70,180	69	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	46	0.0600	0.2		**Sheet Flow, Lawn** Grass: Short n= 0.150 P2= 3.10"
0.7	41	0.0400	1.0		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.1	11	0.4000	3.2		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.2	94	0.0700	1.3		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.2	119	0.0600	1.7		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
0.5	42	0.0700	1.3		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
7.1	353	Total			

Subcatchment 2S: Overland Flow to Depression

Runoff = 0.99 cfs @ 12.08 hrs, Volume= 0.071 af, Depth= 2.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
68	98	Paved parking & roofs
9,045	61	>75% Grass cover, Good, HSG B
6,167	55	Woods, Good, HSG B
1,700	74	>75% Grass cover, Good, HSG C
16,980	60	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	37	0.0400	0.2		**Sheet Flow, Lawn** Grass: Short n= 0.150 P2= 3.10"
0.5	27	0.0400	1.0		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.5	50	0.0500	1.6		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
0.7	78	0.1400	1.9		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.1	16	0.1500	2.7		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
5.2	208	Total			

Subcatchment 3S: Overland Flow to Roadway

Runoff = 1.58 cfs @ 12.08 hrs, Volume= 0.110 af, Depth= 2.74"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
3,945	98	Paved parking & roofs
11,607	61	>75% Grass cover, Good, HSG B
5,340	55	Woods, Good, HSG B
20,892	66	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	28	0.0500	0.2		**Sheet Flow, Lawn** Grass: Short n= 0.150 P2= 3.10"
0.3	28	0.0500	1.6		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
1.2	93	0.0700	1.3		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.1	11	0.1400	2.6		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
0.9					**Direct Entry, To obtain minimum Tc of 5**
5.0	160	Total			

Reach 1R: Swale Part A

Inflow Area = 0.390 ac, Inflow Depth = 2.17" for 100-Year event
Inflow = 0.84 cfs @ 12.13 hrs, Volume= 0.071 af
Outflow = 0.84 cfs @ 12.15 hrs, Volume= 0.071 af, Atten= 0%, Lag= 1.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.8 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 0.5 fps, Avg. Travel Time= 2.3 min

Peak Depth= 0.17' @ 12.14 hrs
Capacity at bank full= 5.87 cfs
Inlet Invert= 210.68', Outlet Invert= 209.78'
2.50' x 0.50' deep channel, n= 0.025 Length= 75.0' Slope= 0.0120 '/'
Side Slope Z-value= 2.0 '/'

Reach 2R: Swale Part B

Inflow Area = 0.390 ac, Inflow Depth = 2.17" for 100-Year event
Inflow = 0.84 cfs @ 12.15 hrs, Volume= 0.071 af
Outflow = 0.83 cfs @ 12.17 hrs, Volume= 0.071 af, Atten= 0%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.1 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 0.6 fps, Avg. Travel Time= 1.6 min

Peak Depth= 0.14' @ 12.16 hrs
Capacity at bank full= 7.69 cfs
Inlet Invert= 209.78', Outlet Invert= 208.00'
2.50' x 0.50' deep channel, n= 0.030 Length= 60.0' Slope= 0.0297 '/'
Side Slope Z-value= 2.0 '/'

Reach 3R: Swale Part C

Inflow Area = 0.390 ac, Inflow Depth = 2.17" for 100-Year event
Inflow = 0.83 cfs @ 12.17 hrs, Volume= 0.071 af
Outflow = 0.83 cfs @ 12.17 hrs, Volume= 0.071 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.5 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 0.8 fps, Avg. Travel Time= 0.9 min

Peak Depth= 0.12' @ 12.17 hrs
Capacity at bank full= 9.98 cfs
Inlet Invert= 208.00', Outlet Invert= 206.00'
2.50' x 0.50' deep channel, n= 0.030 Length= 40.0' Slope= 0.0500 '/'
Side Slope Z-value= 2.0 '/'

Pond 4P: Onsite Depression

Inflow Area = 0.390 ac, Inflow Depth = 2.19" for 100-Year event
Inflow = 0.99 cfs @ 12.08 hrs, Volume= 0.071 af
Outflow = 0.84 cfs @ 12.13 hrs, Volume= 0.071 af, Atten= 15%, Lag= 2.9 min
Primary = 0.84 cfs @ 12.13 hrs, Volume= 0.071 af

Routing by Stor-Ind method, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs
Peak Elev= 211.37' @ 12.13 hrs Surf.Area= 522 sf Storage= 214 cf
Plug-Flow detention time= 10.5 min calculated for 0.071 af (99% of inflow)
Center-of-Mass det. time= 6.4 min (864.4 - 858.1)

#	Invert	Avail.Storage	Storage Description
1	210.50'	658 cf	**Custom Stage Data (Irregular)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
210.50	38	28.0	0	0	38
211.00	236	78.0	61	61	461
211.50	626	199.0	208	269	3,129
212.00	938	241.0	388	658	4,603

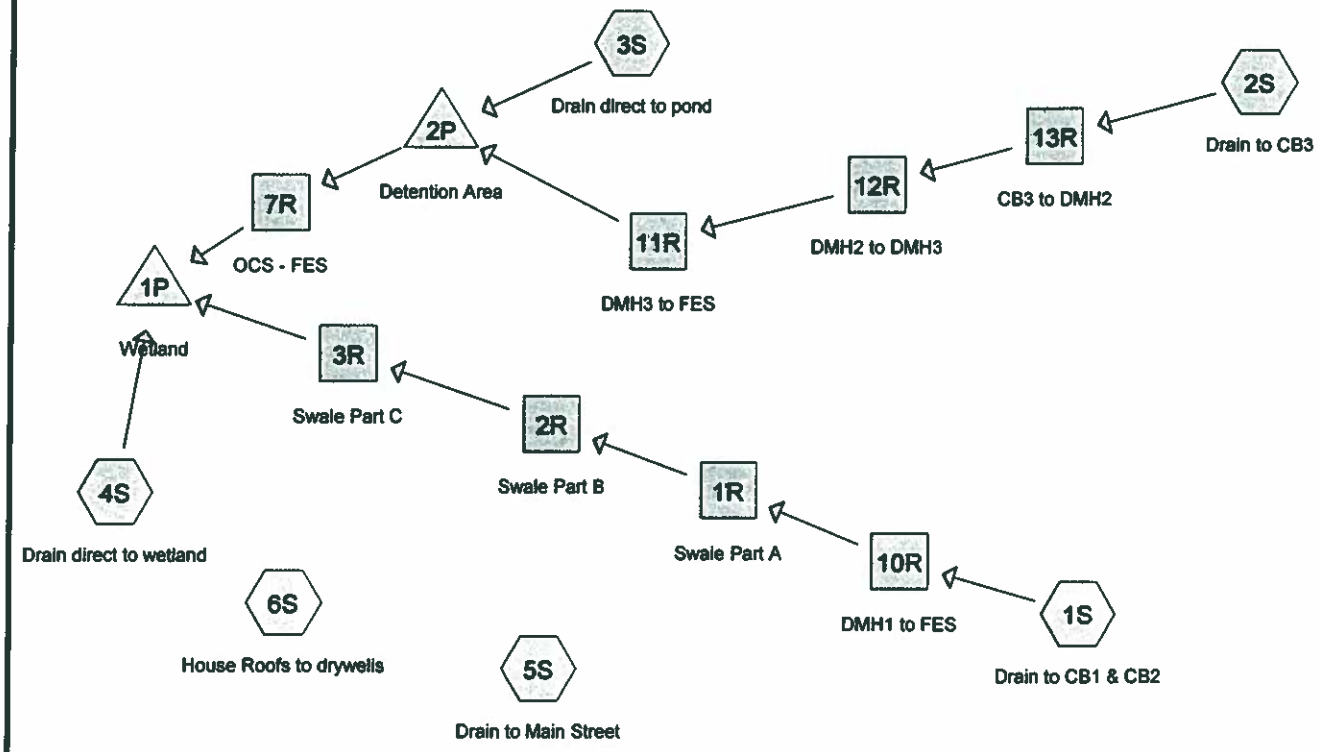
#	Routing	Invert	Outlet Devices
1	Primary	210.60'	**12.0" x 24.4' long Culvert** Ke= 0.500 Outlet Invert= 210.68' S= -0.0033 '/' n= 0.024 Cc= 0.900

Primary OutFlow Max=0.84 cfs @ 12.13 hrs HW=211.37' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 0.84 cfs @ 1.8 fps)

Pond 25P: To Wetlands

Inflow Area = 2.001 ac, Inflow Depth = 2.86" for 100-Year event
Inflow = 6.12 cfs @ 12.11 hrs, Volume= 0.477 af
Primary = 6.12 cfs @ 12.11 hrs, Volume= 0.477 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-85.00 hrs, dt= 0.01 hrs



Subcat Reach Pond Link

Drainage Diagram for 14188-Post Deve-Definitive
Prepared by HANCOCK ASSOCIATES 12/11/2009

Subcatchment 1S: Drain to CB1 & CB2

Runoff = 0.23 cfs @ 12.08 hrs, Volume= 0.016 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
3,361	98	Pavement
1,404	61	>75% Grass cover, Good, HSG B
4,765	87	Weighted Average

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

Subcatchment 2S: Drain to CB3

Runoff = 0.75 cfs @ 12.08 hrs, Volume= 0.050 af, Depth= 1.49"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
10,730	98	Pavement
6,742	61	>75% Grass cover, Good, HSG B
17,472	84	Weighted Average

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

Subcatchment 3S: Drain direct to pond

Runoff = 0.33 cfs @ 12.10 hrs, Volume= 0.024 af, Depth= 0.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
1,637	98	Pavement 'B'
5,956	61	>75% Grass cover, Good, HSG B
6,366	74	>75% Grass cover, Good, HSG C
750	98	
14,709	73	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0600	0.2		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.3	140	0.0700	1.9		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	67	0.0300	1.2		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	10	0.3000	3.8		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.9	267	Total			

Subcatchment 4S: Drain direct to wetland

Runoff = 1.01 cfs @ 12.09 hrs, Volume= 0.073 af, Depth= 0.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
10,214	61	>75% Grass cover, Good, HSG B
15,635	70	Woods, Good, HSG C
28,785	74	>75% Grass cover, Good, HSG C
54,634	70	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	20	0.0500	0.2		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.3	43	0.1300	2.5		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	58	0.0340	1.3		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	30	0.1300	2.5		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	105	0.0480	1.5		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	40	0.1250	1.8		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4					**Direct Entry,**
5.0	296	Total			

Subcatchment 5S: Drain to Main Street

Runoff = 0.10 cfs @ 12.12 hrs, Volume= 0.011 af, Depth= 0.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
4,963	55	Woods, Good, HSG B
750	98	roof 'B'
10,003	61	>75% Grass cover, Good, HSG B
15,716	61	Weighted Average

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

Subcatchment 6S: House Roofs to drywells

Runoff = 0.12 cfs @ 12.00 hrs, Volume= 0.008 af, Depth= 2.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
1,500	98	roof

Reach 1R: Swale Part A

Inflow Area = 0.109 ac, Inflow Depth = 1.71" for 2-Year event
Inflow = 0.22 cfs @ 12.11 hrs, Volume= 0.016 af
Outflow = 0.21 cfs @ 12.15 hrs, Volume= 0.016 af, Atten= 4%, Lag= 2.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.1 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 0.3 fps, Avg. Travel Time= 3.7 min

Peak Depth= 0.07' @ 12.13 hrs
Capacity at bank full= 5.87 cfs
Inlet Invert= 210.68', Outlet Invert= 209.78'
2.50' x 0.50' deep channel, n= 0.025 Length= 75.0' Slope= 0.0120 '/'
Side Slope Z-value= 2.0 '/'

Reach 2R: Swale Part B

Inflow Area = 0.109 ac, Inflow Depth = 1.70" for 2-Year event
Inflow = 0.21 cfs @ 12.15 hrs, Volume= 0.016 af
Outflow = 0.21 cfs @ 12.17 hrs, Volume= 0.015 af, Atten= 3%, Lag= 1.2 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.3 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 0.4 fps, Avg. Travel Time= 2.5 min

Peak Depth= 0.06' @ 12.16 hrs
Capacity at bank full= 7.69 cfs
Inlet Invert= 209.78', Outlet Invert= 208.00'
2.50' x 0.50' deep channel, n= 0.030 Length= 60.0' Slope= 0.0297 '/'
Side Slope Z-value= 2.0 '/'

Reach 3R: Swale Part C

Inflow Area = 0.109 ac, Inflow Depth = 1.70" for 2-Year event
Inflow = 0.21 cfs @ 12.17 hrs, Volume= 0.015 af
Outflow = 0.20 cfs @ 12.18 hrs, Volume= 0.015 af, Atten= 2%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.5 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 0.5 fps, Avg. Travel Time= 1.4 min

Peak Depth= 0.05' @ 12.17 hrs
Capacity at bank full= 9.98 cfs
Inlet Invert= 208.00', Outlet Invert= 206.00'
2.50' x 0.50' deep channel, n= 0.030 Length= 40.0' Slope= 0.0500 '/'
Side Slope Z-value= 2.0 '/'

Reach 7R: OCS - FES

Inflow Area = 0.739 ac, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.0 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.0 fps, Avg. Travel Time= 0.0 min

Peak Depth= 0.00' @ 5.00 hrs
Capacity at bank full= 3.63 cfs
Inlet Invert= 212.27', Outlet Invert= 212.00'
12.0" Diameter Pipe n= 0.013 Length= 26.0' Slope= 0.0104 '/'

Reach 10R: DMH1 to FES

Inflow Area = 0.109 ac, Inflow Depth = 1.71" for 2-Year event
Inflow = 0.23 cfs @ 12.08 hrs, Volume= 0.016 af
Outflow = 0.22 cfs @ 12.11 hrs, Volume= 0.016 af, Atten= 4%, Lag= 2.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.0 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 1.5 fps, Avg. Travel Time= 3.1 min

Peak Depth= 0.13' @ 12.09 hrs
Capacity at bank full= 6.73 cfs
Inlet Invert= 221.80', Outlet Invert= 212.00'
12.0" Diameter Pipe n= 0.013 Length= 275.0' Slope= 0.0356 '/'

Reach 11R: DMH3 to FES

Inflow Area = 0.401 ac, Inflow Depth = 1.49" for 2-Year event
Inflow = 0.74 cfs @ 12.09 hrs, Volume= 0.050 af
Outflow = 0.74 cfs @ 12.10 hrs, Volume= 0.050 af, Atten= 1%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.6 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.4 fps, Avg. Travel Time= 0.7 min

Peak Depth= 0.31' @ 12.09 hrs
Capacity at bank full= 3.56 cfs
Inlet Invert= 214.80', Outlet Invert= 214.18'
12.0" Diameter Pipe n= 0.013 Length= 62.0' Slope= 0.0100 '/'

Reach 12R: DMH2 to DMH3

Inflow Area = 0.401 ac, Inflow Depth = 1.49" for 2-Year event
Inflow = 0.75 cfs @ 12.08 hrs, Volume= 0.050 af
Outflow = 0.74 cfs @ 12.09 hrs, Volume= 0.050 af, Atten= 1%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.9 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.3 fps, Avg. Travel Time= 0.8 min

Peak Depth= 0.22' @ 12.09 hrs
Capacity at bank full= 7.13 cfs
Inlet Invert= 219.30', Outlet Invert= 214.90'
12.0" Diameter Pipe n= 0.013 Length= 110.0' Slope= 0.0400 '/'

Reach 13R: CB3 to DMH2

Inflow Area = 0.401 ac, Inflow Depth = 1.49" for 2-Year event
Inflow = 0.75 cfs @ 12.08 hrs, Volume= 0.050 af
Outflow = 0.75 cfs @ 12.08 hrs, Volume= 0.050 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.9 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.3 fps, Avg. Travel Time= 0.1 min

Peak Depth= 0.22' @ 12.08 hrs
Capacity at bank full= 7.13 cfs
Inlet Invert= 223.00', Outlet Invert= 222.48'
12.0" Diameter Pipe n= 0.013 Length= 13.0' Slope= 0.0400 '/'

Pond 1P: Wetland

Inflow Area = 2.102 ac, Inflow Depth = 0.50" for 2-Year event
Inflow = 1.17 cfs @ 12.10 hrs, Volume= 0.088 af
Primary = 1.17 cfs @ 12.10 hrs, Volume= 0.088 af, Atten= 0%, Lag= 0.0 min

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

Pond 2P: Detention Area

Inflow Area = 0.739 ac, Inflow Depth = 1.19" for 2-Year event
Inflow = 1.07 cfs @ 12.10 hrs, Volume= 0.073 af
Outflow = 0.05 cfs @ 15.61 hrs, Volume= 0.037 af, Atten= 95%, Lag= 210.6 min
Discarded = 0.05 cfs @ 15.61 hrs, Volume= 0.037 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 213.41' @ 15.61 hrs Surf.Area= 2,177 sf Storage= 1,873 cf
Plug-Flow detention time= 211.2 min calculated for 0.037 af (50% of inflow)
Center-of-Mass det. time= 125.9 min (929.7 - 803.8)

#	Invert	Avail.Storage	Storage Description
1	212.50'	5,948 cf	**Custom Stage Data (Irregular)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
212.50	1,601	176.0	0	0	1,601
214.00	2,550	209.0	3,086	3,086	2,652
215.00	3,187	227.0	2,863	5,948	3,314

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	**0.001400 fpm Exfiltration over entire Surface area**
2	Primary	213.95'	**2.00' x 2.00' Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.05 cfs @ 15.61 hrs HW=213.41' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=212.50' (Free Discharge)
↑**2=Orifice/Grate** (Controls 0.00 cfs)

Subcatchment 1S: Drain to CB1 & CB2

Runoff = 0.39 cfs @ 12.07 hrs, Volume= 0.027 af, Depth= 2.92"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
3,361	98	Pavement
1,404	61	>75% Grass cover, Good, HSG B
4,765	87	Weighted Average

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

Subcatchment 2S: Drain to CB3

Runoff = 1.32 cfs @ 12.08 hrs, Volume= 0.088 af, Depth= 2.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
10,730	98	Pavement
6,742	61	>75% Grass cover, Good, HSG B
17,472	84	Weighted Average

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

Subcatchment 3S: Drain direct to pond

Runoff = 0.73 cfs @ 12.10 hrs, Volume= 0.049 af, Depth= 1.75"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,637	98	Pavement 'B'
5,956	61	>75% Grass cover, Good, HSG B
6,366	74	>75% Grass cover, Good, HSG C
750	98	
14,709	73	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0600	0.2		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.3	140	0.0700	1.9		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	67	0.0300	1.2		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	10	0.3000	3.8		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.9	267	Total			

Subcatchment 4S: Drain direct to wetland

Runoff = 2.40 cfs @ 12.08 hrs, Volume= 0.161 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
10,214	61	>75% Grass cover, Good, HSG B
15,635	70	Woods, Good, HSG C
28,785	74	>75% Grass cover, Good, HSG C
54,634	70	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	20	0.0500	0.2		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.3	43	0.1300	2.5		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	58	0.0340	1.3		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	30	0.1300	2.5		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	105	0.0480	1.5		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	40	0.1250	1.8		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4					**Direct Entry,**
5.0	296	Total			

Subcatchment 5S: Drain to Main Street

Runoff = 0.40 cfs @ 12.09 hrs, Volume= 0.029 af, Depth= 0.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
4,963	55	Woods, Good, HSG B
750	98	roof 'B'
10,003	61	>75% Grass cover, Good, HSG B
15,716	61	Weighted Average

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

Subcatchment 6S: House Roofs to drywells

Runoff = 0.17 cfs @ 12.00 hrs, Volume= 0.011 af, Depth= 3.96"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,500	98	roof

Reach 1R: Swale Part A

Inflow Area = 0.109 ac, Inflow Depth = 2.91" for 10-Year event
Inflow = 0.38 cfs @ 12.10 hrs, Volume= 0.027 af
Outflow = 0.36 cfs @ 12.13 hrs, Volume= 0.027 af, Atten= 5%, Lag= 1.7 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.3 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 0.4 fps, Avg. Travel Time= 3.2 min

Peak Depth= 0.10' @ 12.12 hrs
Capacity at bank full= 5.87 cfs
Inlet Invert= 210.68', Outlet Invert= 209.78'
2.50' x 0.50' deep channel, n= 0.025 Length= 75.0' Slope= 0.0120 '/'
Side Slope Z-value= 2.0 '/'

Reach 2R: Swale Part B

Inflow Area = 0.109 ac, Inflow Depth = 2.91" for 10-Year event
Inflow = 0.36 cfs @ 12.13 hrs, Volume= 0.027 af
Outflow = 0.35 cfs @ 12.15 hrs, Volume= 0.026 af, Atten= 2%, Lag= 1.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.6 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 0.5 fps, Avg. Travel Time= 2.2 min

Peak Depth= 0.09' @ 12.14 hrs
Capacity at bank full= 7.69 cfs
Inlet Invert= 209.78', Outlet Invert= 208.00'
2.50' x 0.50' deep channel, n= 0.030 Length= 60.0' Slope= 0.0297 '/'
Side Slope Z-value= 2.0 '/'

Reach 3R: Swale Part C

Inflow Area = 0.109 ac, Inflow Depth = 2.90" for 10-Year event
Inflow = 0.35 cfs @ 12.15 hrs, Volume= 0.026 af
Outflow = 0.35 cfs @ 12.16 hrs, Volume= 0.026 af, Atten= 1%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.8 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 0.5 fps, Avg. Travel Time= 1.2 min

Peak Depth= 0.07' @ 12.15 hrs
Capacity at bank full= 9.98 cfs
Inlet Invert= 208.00', Outlet Invert= 206.00'
2.50' x 0.50' deep channel, n= 0.030 Length= 40.0' Slope= 0.0500 '/'
Side Slope Z-value= 2.0 '/'

Reach 7R: OCS - FES

Inflow Area = 0.739 ac, Inflow Depth = 0.41" for 10-Year event
Inflow = 0.22 cfs @ 12.69 hrs, Volume= 0.026 af
Outflow = 0.23 cfs @ 12.70 hrs, Volume= 0.026 af, Atten= 0%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.6 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.6 fps, Avg. Travel Time= 0.3 min

Peak Depth= 0.17' @ 12.70 hrs
Capacity at bank full= 3.63 cfs
Inlet Invert= 212.27', Outlet Invert= 212.00'
12.0" Diameter Pipe n= 0.013 Length= 26.0' Slope= 0.0104 '/'

Reach 10R: DMH1 to FES

Inflow Area = 0.109 ac, Inflow Depth = 2.92" for 10-Year event
Inflow = 0.39 cfs @ 12.07 hrs, Volume= 0.027 af
Outflow = 0.38 cfs @ 12.10 hrs, Volume= 0.027 af, Atten= 4%, Lag= 1.8 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.7 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 1.7 fps, Avg. Travel Time= 2.7 min

Peak Depth= 0.16' @ 12.09 hrs
Capacity at bank full= 6.73 cfs
Inlet Invert= 221.80', Outlet Invert= 212.00'
12.0" Diameter Pipe n= 0.013 Length= 275.0' Slope= 0.0356 '/'

Reach 11R: DMH3 to FES

Inflow Area = 0.401 ac, Inflow Depth = 2.64" for 10-Year event
Inflow = 1.31 cfs @ 12.09 hrs, Volume= 0.088 af
Outflow = 1.30 cfs @ 12.09 hrs, Volume= 0.088 af, Atten= 1%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.2 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.6 fps, Avg. Travel Time= 0.7 min

Peak Depth= 0.42' @ 12.09 hrs
Capacity at bank full= 3.56 cfs
Inlet Invert= 214.80', Outlet Invert= 214.18'
12.0" Diameter Pipe n= 0.013 Length= 62.0' Slope= 0.0100 '/'

Reach 12R: DMH2 to DMH3

Inflow Area = 0.401 ac, Inflow Depth = 2.64" for 10-Year event
Inflow = 1.32 cfs @ 12.08 hrs, Volume= 0.088 af
Outflow = 1.31 cfs @ 12.09 hrs, Volume= 0.088 af, Atten= 1%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.9 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.5 fps, Avg. Travel Time= 0.7 min

Peak Depth= 0.29' @ 12.08 hrs
Capacity at bank full= 7.13 cfs
Inlet Invert= 219.30', Outlet Invert= 214.90'
12.0" Diameter Pipe n= 0.013 Length= 110.0' Slope= 0.0400 '/'

Reach 13R: CB3 to DMH2

Inflow Area = 0.401 ac, Inflow Depth = 2.64" for 10-Year event
Inflow = 1.32 cfs @ 12.08 hrs, Volume= 0.088 af
Outflow = 1.32 cfs @ 12.08 hrs, Volume= 0.088 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.9 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.5 fps, Avg. Travel Time= 0.1 min

Peak Depth= 0.29' @ 12.08 hrs
Capacity at bank full= 7.13 cfs
Inlet Invert= 223.00', Outlet Invert= 222.48'
12.0" Diameter Pipe n= 0.013 Length= 13.0' Slope= 0.0400 '/'

Pond 1P: Wetland

Inflow Area = 2.102 ac, Inflow Depth = 1.21" for 10-Year event
Inflow = 2.68 cfs @ 12.09 hrs, Volume= 0.213 af
Primary = 2.68 cfs @ 12.09 hrs, Volume= 0.213 af, Atten= 0%, Lag= 0.0 min

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

Pond 2P: Detention Area

Inflow Area = 0.739 ac, Inflow Depth = 2.23" for 10-Year event
Inflow = 2.03 cfs @ 12.09 hrs, Volume= 0.137 af
Outflow = 0.28 cfs @ 12.69 hrs, Volume= 0.072 af, Atten= 86%, Lag= 35.5 min
Discarded = 0.06 cfs @ 12.69 hrs, Volume= 0.047 af
Primary = 0.22 cfs @ 12.69 hrs, Volume= 0.026 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 213.99' @ 12.69 hrs Surf.Area= 2,544 sf Storage= 3,067 cf
Plug-Flow detention time= 167.1 min calculated for 0.072 af (53% of inflow)
Center-of-Mass det. time= 86.1 min (876.3 - 790.3)

#	Invert	Avail.Storage	Storage Description
1	212.50'	5,948 cf	**Custom Stage Data (Irregular)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
212.50	1,601	176.0	0	0	1,601
214.00	2,550	209.0	3,086	3,086	2,652
215.00	3,187	227.0	2,863	5,948	3,314

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	**0.001400 fpm Exfiltration over entire Surface area**
2	Primary	213.95'	**2.00' x 2.00' Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.06 cfs @ 12.69 hrs HW=213.99' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.22 cfs @ 12.69 hrs HW=213.99' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.22 cfs @ 0.7 fps)

Subcatchment 1S: Drain to CB1 & CB2

Runoff = 0.50 cfs @ 12.07 hrs, Volume= 0.034 af, Depth= 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,361	98	Pavement
1,404	61	>75% Grass cover, Good, HSG B
4,765	87	Weighted Average

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

Subcatchment 2S: Drain to CB3

Runoff = 1.70 cfs @ 12.07 hrs, Volume= 0.114 af, Depth= 3.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
10,730	98	Pavement
6,742	61	>75% Grass cover, Good, HSG B
17,472	84	Weighted Average

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

Subcatchment 3S: Drain direct to pond

Runoff = 1.01 cfs @ 12.09 hrs, Volume= 0.068 af, Depth= 2.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
1,637	98	Pavement 'B'
5,956	61	>75% Grass cover, Good, HSG B
6,366	74	>75% Grass cover, Good, HSG C
750	98	
14,709	73	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0600	0.2		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.3	140	0.0700	1.9		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	67	0.0300	1.2		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	10	0.3000	3.8		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.9	267	Total			

Subcatchment 4S: Drain direct to wetland

Runoff = 3.41 cfs @ 12.08 hrs, Volume= 0.226 af, Depth= 2.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
10,214	61	>75% Grass cover, Good, HSG B
15,635	70	Woods, Good, HSG C
28,785	74	>75% Grass cover, Good, HSG C
54,634	70	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	20	0.0500	0.2		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.3	43	0.1300	2.5		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	58	0.0340	1.3		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	30	0.1300	2.5		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	105	0.0480	1.5		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	40	0.1250	1.8		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4					**Direct Entry,**
5.0	296	Total			

Subcatchment 5S: Drain to Main Street

Runoff = 0.64 cfs @ 12.09 hrs, Volume= 0.044 af, Depth= 1.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
4,963	55	Woods, Good, HSG B
750	98	roof 'B'
10,003	61	>75% Grass cover, Good, HSG B
15,716	61	Weighted Average

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

Subcatchment 6S: House Roofs to drywells

Runoff = 0.21 cfs @ 12.00 hrs, Volume= 0.014 af, Depth= 4.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
1,500	98	roof

Reach 1R: Swale Part A

Inflow Area = 0.109 ac, Inflow Depth = 3.72" for 25-Year event
Inflow = 0.48 cfs @ 12.10 hrs, Volume= 0.034 af
Outflow = 0.46 cfs @ 12.13 hrs, Volume= 0.034 af, Atten= 5%, Lag= 1.5 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.5 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 0.4 fps, Avg. Travel Time= 3.0 min

Peak Depth= 0.12' @ 12.11 hrs
Capacity at bank full= 5.87 cfs
Inlet Invert= 210.68', Outlet Invert= 209.78'
2.50' x 0.50' deep channel, n= 0.025 Length= 75.0' Slope= 0.0120 '/'
Side Slope Z-value= 2.0 '/'

Reach 2R: Swale Part B

Inflow Area = 0.109 ac, Inflow Depth = 3.71" for 25-Year event
Inflow = 0.46 cfs @ 12.13 hrs, Volume= 0.034 af
Outflow = 0.45 cfs @ 12.14 hrs, Volume= 0.034 af, Atten= 1%, Lag= 1.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.7 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 0.5 fps, Avg. Travel Time= 2.0 min

Peak Depth= 0.10' @ 12.14 hrs
Capacity at bank full= 7.69 cfs
Inlet Invert= 209.78', Outlet Invert= 208.00'
2.50' x 0.50' deep channel, n= 0.030 Length= 60.0' Slope= 0.0297 '/'
Side Slope Z-value= 2.0 '/'

Reach 3R: Swale Part C

Inflow Area = 0.109 ac, Inflow Depth = 3.71" for 25-Year event
Inflow = 0.45 cfs @ 12.14 hrs, Volume= 0.034 af
Outflow = 0.44 cfs @ 12.15 hrs, Volume= 0.034 af, Atten= 1%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.0 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 0.6 fps, Avg. Travel Time= 1.1 min

Peak Depth= 0.08' @ 12.15 hrs
Capacity at bank full= 9.98 cfs
Inlet Invert= 208.00', Outlet Invert= 206.00'
2.50' x 0.50' deep channel, n= 0.030 Length= 40.0' Slope= 0.0500 '/'
Side Slope Z-value= 2.0 '/'

Reach 7R: OCS - FES

Inflow Area = 0.739 ac, Inflow Depth = 1.06" for 25-Year event
Inflow = 1.03 cfs @ 12.34 hrs, Volume= 0.065 af
Outflow = 1.02 cfs @ 12.33 hrs, Volume= 0.065 af, Atten= 1%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.0 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.9 fps, Avg. Travel Time= 0.2 min

Peak Depth= 0.36' @ 12.30 hrs
Capacity at bank full= 3.63 cfs
Inlet Invert= 212.27', Outlet Invert= 212.00'
12.0" Diameter Pipe n= 0.013 Length= 26.0' Slope= 0.0104 '/'

Reach 10R: DMH1 to FES

Inflow Area = 0.109 ac, Inflow Depth = 3.72" for 25-Year event
Inflow = 0.50 cfs @ 12.07 hrs, Volume= 0.034 af
Outflow = 0.48 cfs @ 12.10 hrs, Volume= 0.034 af, Atten= 4%, Lag= 1.7 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.0 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.8 fps, Avg. Travel Time= 2.6 min

Peak Depth= 0.18' @ 12.09 hrs
Capacity at bank full= 6.73 cfs
Inlet Invert= 221.80', Outlet Invert= 212.00'
12.0" Diameter Pipe n= 0.013 Length= 275.0' Slope= 0.0356 '/'

Reach 11R: DMH3 to FES

Inflow Area = 0.401 ac, Inflow Depth = 3.42" for 25-Year event
Inflow = 1.68 cfs @ 12.08 hrs, Volume= 0.114 af
Outflow = 1.67 cfs @ 12.09 hrs, Volume= 0.114 af, Atten= 1%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.5 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.6 fps, Avg. Travel Time= 0.6 min

Peak Depth= 0.48' @ 12.09 hrs
Capacity at bank full= 3.56 cfs
Inlet Invert= 214.80', Outlet Invert= 214.18'
12.0" Diameter Pipe n= 0.013 Length= 62.0' Slope= 0.0100 '/'

Reach 12R: DMH2 to DMH3

Inflow Area = 0.401 ac, Inflow Depth = 3.42" for 25-Year event
Inflow = 1.69 cfs @ 12.08 hrs, Volume= 0.114 af
Outflow = 1.68 cfs @ 12.08 hrs, Volume= 0.114 af, Atten= 1%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.4 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.7 fps, Avg. Travel Time= 0.7 min

Peak Depth= 0.33' @ 12.08 hrs
Capacity at bank full= 7.13 cfs
Inlet Invert= 219.30', Outlet Invert= 214.90'
12.0" Diameter Pipe n= 0.013 Length= 110.0' Slope= 0.0400 '/'

Reach 13R: CB3 to DMH2

Inflow Area = 0.401 ac, Inflow Depth = 3.42" for 25-Year event
Inflow = 1.70 cfs @ 12.07 hrs, Volume= 0.114 af
Outflow = 1.69 cfs @ 12.08 hrs, Volume= 0.114 af, Atten= 1%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.4 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.7 fps, Avg. Travel Time= 0.1 min

Peak Depth= 0.33' @ 12.07 hrs
Capacity at bank full= 7.13 cfs
Inlet Invert= 223.00', Outlet Invert= 222.48'
12.0" Diameter Pipe n= 0.013 Length= 13.0' Slope= 0.0400 '/'

Pond 1P: Wetland

Inflow Area = 2.102 ac, Inflow Depth = 1.85" for 25-Year event
Inflow = 3.77 cfs @ 12.09 hrs, Volume= 0.325 af
Primary = 3.77 cfs @ 12.09 hrs, Volume= 0.325 af, Atten= 0%, Lag= 0.0 min

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

Pond 2P: Detention Area

Inflow Area = 0.739 ac, Inflow Depth = 2.96" for 25-Year event
Inflow = 2.67 cfs @ 12.09 hrs, Volume= 0.182 af
Outflow = 1.09 cfs @ 12.34 hrs, Volume= 0.115 af, Atten= 59%, Lag= 14.6 min
Discarded = 0.06 cfs @ 12.34 hrs, Volume= 0.050 af
Primary = 1.03 cfs @ 12.34 hrs, Volume= 0.065 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 214.07' @ 12.34 hrs Surf.Area= 2,592 sf Storage= 3,273 cf
Plug-Flow detention time= 126.2 min calculated for 0.115 af (63% of inflow)
Center-of-Mass det. time= 53.3 min (837.4 - 784.0)

#	Invert	Avail.Storage	Storage Description
1	212.50'	5,948 cf	**Custom Stage Data (Irregular)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
212.50	1,601	176.0	0	0	1,601
214.00	2,550	209.0	3,086	3,086	2,652
215.00	3,187	227.0	2,863	5,948	3,314

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	**0.001400 fpm Exfiltration over entire Surface area**
2	Primary	213.95'	**2.00' x 2.00' Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.06 cfs @ 12.34 hrs HW=214.06' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=1.02 cfs @ 12.34 hrs HW=214.06' (Free Discharge)
↑**2=Orifice/Grate** (Weir Controls 1.02 cfs @ 1.1 fps)

Subcatchment 1S: Drain to CB1 & CB2

Runoff = 0.61 cfs @ 12.07 hrs, Volume= 0.042 af, Depth= 4.63"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
3,361	98	Pavement
1,404	61	>75% Grass cover, Good, HSG B
4,765	87	Weighted Average

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

Subcatchment 2S: Drain to CB3

Runoff = 2.12 cfs @ 12.07 hrs, Volume= 0.144 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
10,730	98	Pavement
6,742	61	>75% Grass cover, Good, HSG B
17,472	84	Weighted Average

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

Subcatchment 3S: Drain direct to pond

Runoff = 1.33 cfs @ 12.09 hrs, Volume= 0.090 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
1,637	98	Pavement 'B'
5,956	61	>75% Grass cover, Good, HSG B
6,366	74	>75% Grass cover, Good, HSG C
750	98	
14,709	73	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0600	0.2		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.3	140	0.0700	1.9		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	67	0.0300	1.2		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	10	0.3000	3.8		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.9	267	Total			

Subcatchment 4S: Drain direct to wetland

Runoff = 4.59 cfs @ 12.08 hrs, Volume= 0.303 af, Depth= 2.90"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
10,214	61	>75% Grass cover, Good, HSG B
15,635	70	Woods, Good, HSG C
28,785	74	>75% Grass cover, Good, HSG C
54,634	70	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	20	0.0500	0.2		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.3	43	0.1300	2.5		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	58	0.0340	1.3		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	30	0.1300	2.5		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	105	0.0480	1.5		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	40	0.1250	1.8		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4					**Direct Entry,**
5.0	296	Total			

Subcatchment 5S: Drain to Main Street

Runoff = 0.93 cfs @ 12.09 hrs, Volume= 0.063 af, Depth= 2.09"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
4,963	55	Woods, Good, HSG B
750	98	roof 'B'
10,003	61	>75% Grass cover, Good, HSG B
15,716	61	Weighted Average

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

Subcatchment 6S: House Roofs to drywells

Runoff = 0.25 cfs @ 12.00 hrs, Volume= 0.016 af, Depth= 5.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
1,500	98	roof

Reach 1R: Swale Part A

Inflow Area = 0.109 ac, Inflow Depth = 4.63" for 100-Year event
Inflow = 0.59 cfs @ 12.10 hrs, Volume= 0.042 af
Outflow = 0.57 cfs @ 12.12 hrs, Volume= 0.042 af, Atten= 4%, Lag= 1.3 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.6 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 0.4 fps, Avg. Travel Time= 2.8 min

Peak Depth= 0.13' @ 12.11 hrs
Capacity at bank full= 5.87 cfs
Inlet Invert= 210.68', Outlet Invert= 209.78'
2.50' x 0.50' deep channel, n= 0.025 Length= 75.0' Slope= 0.0120 '/'
Side Slope Z-value= 2.0 '/'

Reach 2R: Swale Part B

Inflow Area = 0.109 ac, Inflow Depth = 4.62" for 100-Year event
Inflow = 0.57 cfs @ 12.12 hrs, Volume= 0.042 af
Outflow = 0.55 cfs @ 12.14 hrs, Volume= 0.042 af, Atten= 2%, Lag= 1.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.8 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 0.5 fps, Avg. Travel Time= 1.9 min

Peak Depth= 0.11' @ 12.13 hrs
Capacity at bank full= 7.69 cfs
Inlet Invert= 209.78', Outlet Invert= 208.00'
2.50' x 0.50' deep channel, n= 0.030 Length= 60.0' Slope= 0.0297 '/'
Side Slope Z-value= 2.0 '/'

Reach 3R: Swale Part C

Inflow Area = 0.109 ac, Inflow Depth = 4.61" for 100-Year event
Inflow = 0.55 cfs @ 12.14 hrs, Volume= 0.042 af
Outflow = 0.55 cfs @ 12.15 hrs, Volume= 0.042 af, Atten= 1%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.2 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 0.6 fps, Avg. Travel Time= 1.1 min

Peak Depth= 0.09' @ 12.14 hrs
Capacity at bank full= 9.98 cfs
Inlet Invert= 208.00', Outlet Invert= 206.00'
2.50' x 0.50' deep channel, n= 0.030 Length= 40.0' Slope= 0.0500 '/'
Side Slope Z-value= 2.0 '/'

Reach 7R: OCS - FES

Inflow Area = 0.739 ac, Inflow Depth = 1.84" for 100-Year event
Inflow = 2.22 cfs @ 12.20 hrs, Volume= 0.113 af
Outflow = 2.24 cfs @ 12.20 hrs, Volume= 0.113 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.9 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.9 fps, Avg. Travel Time= 0.2 min

Peak Depth= 0.57' @ 12.20 hrs
Capacity at bank full= 3.63 cfs
Inlet Invert= 212.27', Outlet Invert= 212.00'
12.0" Diameter Pipe n= 0.013 Length= 26.0' Slope= 0.0104 '/'

Reach 10R: DMH1 to FES

Inflow Area = 0.109 ac, Inflow Depth = 4.63" for 100-Year event
Inflow = 0.61 cfs @ 12.07 hrs, Volume= 0.042 af
Outflow = 0.59 cfs @ 12.10 hrs, Volume= 0.042 af, Atten= 4%, Lag= 1.7 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.3 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.9 fps, Avg. Travel Time= 2.4 min

Peak Depth= 0.20' @ 12.09 hrs
Capacity at bank full= 6.73 cfs
Inlet Invert= 221.80', Outlet Invert= 212.00'
12.0" Diameter Pipe n= 0.013 Length= 275.0' Slope= 0.0356 '/'

Reach 11R: DMH3 to FES

Inflow Area = 0.401 ac, Inflow Depth = 4.31" for 100-Year event
Inflow = 2.09 cfs @ 12.08 hrs, Volume= 0.144 af
Outflow = 2.08 cfs @ 12.09 hrs, Volume= 0.144 af, Atten= 1%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.7 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.7 fps, Avg. Travel Time= 0.6 min

Peak Depth= 0.55' @ 12.09 hrs
Capacity at bank full= 3.56 cfs
Inlet Invert= 214.80', Outlet Invert= 214.18'
12.0" Diameter Pipe n= 0.013 Length= 62.0' Slope= 0.0100 '/'

Reach 12R: DMH2 to DMH3

Inflow Area = 0.401 ac, Inflow Depth = 4.31" for 100-Year event
Inflow = 2.12 cfs @ 12.07 hrs, Volume= 0.144 af
Outflow = 2.09 cfs @ 12.08 hrs, Volume= 0.144 af, Atten= 1%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.9 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.8 fps, Avg. Travel Time= 0.7 min

Peak Depth= 0.37' @ 12.08 hrs
Capacity at bank full= 7.13 cfs
Inlet Invert= 219.30', Outlet Invert= 214.90'
12.0" Diameter Pipe n= 0.013 Length= 110.0' Slope= 0.0400 '/'

Reach 13R: CB3 to DMH2

Inflow Area = 0.401 ac, Inflow Depth = 4.31" for 100-Year event
Inflow = 2.12 cfs @ 12.07 hrs, Volume= 0.144 af
Outflow = 2.12 cfs @ 12.07 hrs, Volume= 0.144 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.8 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.8 fps, Avg. Travel Time= 0.1 min

Peak Depth= 0.37' @ 12.07 hrs
Capacity at bank full= 7.13 cfs
Inlet Invert= 223.00', Outlet Invert= 222.48'
12.0" Diameter Pipe n= 0.013 Length= 13.0' Slope= 0.0400 '/'

Pond 1P: Wetland

Inflow Area = 2.102 ac, Inflow Depth = 2.62" for 100-Year event
Inflow = 5.87 cfs @ 12.15 hrs, Volume= 0.458 af
Primary = 5.87 cfs @ 12.15 hrs, Volume= 0.458 af, Atten= 0%, Lag= 0.0 min

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

Pond 2P: Detention Area

Inflow Area = 0.739 ac, Inflow Depth = 3.80" for 100-Year event
Inflow = 3.41 cfs @ 12.09 hrs, Volume= 0.234 af
Outflow = 2.28 cfs @ 12.20 hrs, Volume= 0.165 af, Atten= 33%, Lag= 6.3 min
Discarded = 0.06 cfs @ 12.20 hrs, Volume= 0.052 af
Primary = 2.22 cfs @ 12.20 hrs, Volume= 0.113 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 214.14' @ 12.20 hrs Surf.Area= 2,641 sf Storage= 3,495 cf
Plug-Flow detention time= 104.7 min calculated for 0.165 af (71% of inflow)
Center-of-Mass det. time= 38.5 min (816.9 - 778.4)

#	Invert	Avail.Storage	Storage Description
1	212.50'	5,948 cf	**Custom Stage Data (Irregular)** Listed below

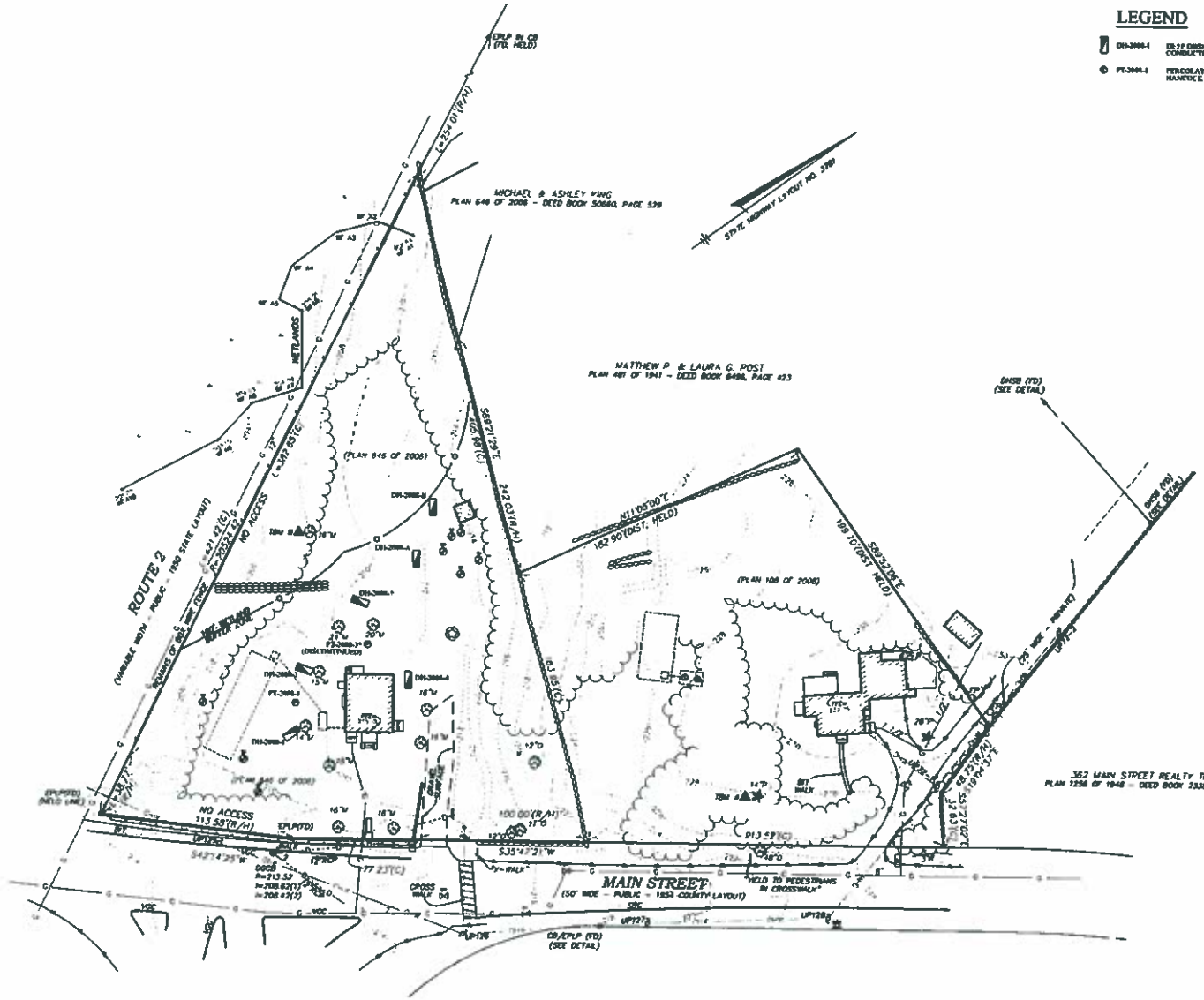
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
212.50	1,601	176.0	0	0	1,601
214.00	2,550	209.0	3,086	3,086	2,652
215.00	3,187	227.0	2,863	5,948	3,314

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	**0.001400 fpm Exfiltration over entire Surface area**
2	Primary	213.95'	**2.00' x 2.00' Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.06 cfs @ 12.20 hrs HW=214.14' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=2.20 cfs @ 12.20 hrs HW=214.14' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 2.20 cfs @ 1.4 fps)

APPENDIX II Soil Testing Information



▲	ELEVATION BENCH MARKS DATUM: (SEE NOTE 1)	
NO.	DESCRIPTION	ELEV
A.	MAG NAIL FOUND 0.4' UP A 14" PINE TREE	229.30
B.	MAG NAIL SCRIBED 2' UP A 36" MAPLE TREE	200.00

SCALE: 1" = 30'

SITE ADDRESS

348, 350 & 352 MAIN STREET

Acton, Massachusetts 01720

PREPARED FOR

WALKER REALTY, LLC

2 Lan Drive
Westford, Massachusetts 01886

HANCOCK ASSOCIATES

Civil Engineers

Land Surveyors

Landscape Architects

Environmental Consultants

[illegible]

NO.	BY	APP	DATE	REVISION / BOOK DESCRIPTION

DATE:	6/02/2008	DRAWN BY:	BT
SCALE:	1" = 30'	CHECKED BY:	-

SOIL TESTING LOCATION SKETCH PLAN

DWG: 14188_soil_testing.dwg
LAYOUT: TEST
SHEET: 1 OF 1

TEST

PROJECT NO. 14188

HSA# 14188 5/29/2008

Commonwealth of Massachusetts
City/Town of ACTON

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

MassDEP has provided this form for use by on-site professionals and local Boards of Health. Other forms may be used, but the information must be substantially the same as provided here. Before using this form, check with your local Board of Health to determine the form they use.

A. Facility Information

WALKER REALTY, LLC.
Owner Name

348 350 & 352 MAIN STREET
Street Address

MAP F-3, LOTS 59 & 61
Map/Lot #

ACTON
City

MA
State

01720
Zip Code

B. Site Information

1. (Check one) ■ New Construction ☐ Upgrade ☐ Repair NRCS WEB SOIL SURVEY

2. Published Soil Survey Available? ■ Yes ☐ No If yes: Year Published ✓ Publication Scale ✓ Soil Map Unit 103 B, 311 B
103 B – CHARLTON HOLLIS ROCK OUTCROP COMPLEX
311 B – WOODBRIDGE FINE SANDY LOAM
Soil Name
HIGH GROUND WATER
Soil Limitations

3. Surficial Geological Report Available? ☐ Yes ☐ No If yes: Year Published ✓ Publication Scale ✓ Map Unit ✓
TILL
Geologic Material
NOT DETERMINED
Landform

4. Flood Rate Insurance Map COMMUNITY-PANEL NUMBER 250176 0004 C, REVISED JANUARY 6, 1988

Above the 500-year flood boundary? ■ Yes ☐ No Within the 100-year flood boundary? ☐ Yes ■ No

Within the 500-year flood boundary? ☐ Yes ■ No Within a velocity zone? ☐ Yes ■ No

5. Wetland Area: National Wetland Inventory Map N/A Map Unit N/A Name

Wetlands Conservancy Program Map N/A Map Unit N/A Name

JM

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

348 MAIN STREET, ACTON, MA

B. Site Information (Continued)

MOST CURRENT GW CONDITIONS MAP AVAILABLE ONLINE IS APRIL 2008 (AS OF 6/3/2008)

6. Current Water Resource Conditions (USGS): 04/2008 (Month/Year) Range: ☐ Above Normal ■ Normal ☐ Below Normal

7. Other references reviewed: /

/

C. On-Site Review (*minimum of two holes required at every proposed primary and reserved disposal area*)

Deep Observation Hole Number: DH-2008-1 | 5/29/2008 (Date) | 8:05 AM (Time) | SUNNY, 70'S (Weather)

1. Location

Ground Elevation at Surface of Hole: 211.3 +/- Location (identify on plan): SEE ATTACHED SKETCH

2. Land Use: RESIDENTIAL - LAWN (e.g., woodland, agricultural field, vacant lot, etc.) | NOT OBSERVED (Surface Stones) | 4% +/- (Slope (%))

LAWN (Vegetation) | N/D (NOT DETERMINED) (Landform) | LEVEL AREA (Position on Landscape (attach sheet))

3. Distances from:

Open Water Body	>150 feet	Drainage Way	>50 feet	Possible Wet Area	>100 feet
Property Line	>50 feet	Drinking Water Well	>100 feet	Other	/ feet

4. Parent Material: TILL Unsuitable Materials Present: ■ Yes ☐ No

If Yes: ■ Disturbed Soil ■ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ■ Bedrock

5. Groundwater Observed: ■ Yes ☐ No If yes: 101" (Depth Weeping from Pit) 151" (Depth Standing Water in Hole)

Estimated Depth to High Groundwater: 72" (inches) 205.3 +/- (elevation)

JM

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Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitablity Assessment for On-Site Sewage Disposal

348 MAIN STREET, ACTON, MA

C. On-Site Review (Continued)

Deep Observation Hole Number: DH-2008-1

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-54"	FILL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
54"-64"	DISTURBED SOILS & RELIC B	10YR5/6	N/O	N/A	N/A	FSL	SUBANG. 10%	<5%	✓	✓	✓
64"-180"	C	2.5Y6/3	72"	5YR5/8	75%	MLS	SUBRND 10%	SUBRND 10%	STRUCTURELESS (S/LOOSE)	SL. FRIABLE	✓

Additional Notes:

WEEPING AT 101", SIGNIFICANT AMOUNT OF COBBLES AT 126" AND BELOW (20%),

REFUSAL AT 180", STANDING WATER AT 151" (10:22 AM)

JM

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City/Town of ACTON

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

348 MAIN STREET

C. On-Site Review (Continued)

Deep Observation Hole Number: DH-2008-2 | 5/29/2008 (Date) | 9:25 AM (Time) | SUNNY, 70's (Weather)

1. Location

   Ground Elevation at Surface of Hole: 210.9 | Location (identify on plan): SEE ATTACHED PLAN

2. Land Use: RESIDENTIAL - LAWN (e.g., woodland, agricultural field, vacant lot, etc.) | N/O (Surface Stones) | 5% +/- (Slope (%))

   LAWN (Vegetation) | N/D (Landform) | GENTLE SLOPE (Position on Landscape (attach sheet))

3. Distances from:

Open Water Body	> 120 feet	Drainage Way	> 50 feet	Possible Wet Area	> 100 feet
Property Line	> 75 feet	Drinking Water Well	> 100 feet	Other	/ feet

4. Parent Material: TILL | Unsuitable Materials Present: ☒ Yes ☐ No

   If Yes: ☒ Disturbed Soil ☒ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☒ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No | If yes: 119" (Depth Weeping from Pit) | 172" (Depth Standing Water in Hole)

   Estimated Depth to High Groundwater: 58" (inches) | 206.06 +/- (elevation)

JM

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

348 MAIN STREET

C. On-Site Review (Continued)

Deep Observation Hole Number: DH-2008-2

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-48"	FILL & DISTURBED	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
48"-56"	REMAINS OF RELIC B.	10YR 5/6	N/O	N/A	N/A	SL	SUBANG 10%	< 5%	MASSIVE	FRIABLE	
56"-197"	C	2.5Y6/3	58"	5YR5/8	75%	MLS	SUBRND 10%	SUBRND 15%	S/LESS	SL. FRIABLE	

Additional Notes:

WEEPING AT 119", STANDING AT 172", MOTTLES/ESHGWT AT 58", REFUSAL AT 197".

JM

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

348 MAIN STREET

D. Determination of High Groundwater Elevation

1. Method Used:

	DH-2008-1 (211.3)	DH-2008-2 (210.9)
☒ Depth observed standing water in observation hole	A. 151" (198.72) inches	B. 172" (196.57) inches
☒ Depth weeping from side of observation hole	A. 101" (202.88) inches	B. 119" (200.98) inches
☒ Depth to soil redoximorphic features (mottles)	A. 72" (205.30) inches	B. 58" (206.06) inches
☑ Groundwater adjustment (USGS methodology)	A. N/A inches	B. N/A inches

2. N/A Index Well Number — N/A Reading Date — N/A Index Well Level

N/A Adjustment Factor — N/A Adjusted Groundwater Level

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

   ☒ Yes ☐ No

   b. If yes, at what depth was it observed?

	Upper boundary:	Lower boundary:
DH-2008-1	64"	180" (116")
DH-2008-2	56"	197" (141")
	inches	inches

JM

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

348 MAIN STREET

Field Diagrams

Use this sheet for field diagrams:

SEE ATTACHED SKETCH

JM

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348 MAIN STREET

C. On-Site Review (Continued)

Deep Observation Hole Number: DH-2008-3 | 5/29/2008 (Date) | 9:30 AM (Time) | SUNNY, 70's (Weather)

1. Location

Ground Elevation at Surface of Hole: 210.5 +/- Location (identify on plan): SEE ATTACHED SKETCH

2. Land Use: RESIDENTIAL - LAWN (e.g., woodland, agricultural field, vacant lot, etc.) | N/O (Surface Stones) | 5% (Slope (%))

LAWN (Vegetation) | N/D (Landform) | GENTLE SLOPE (Position on Landscape (attach sheet))

3. Distances from:

Open Water Body	>100 feet	Drainage Way	>50 feet	Possible Wet Area	>100 feet
Property Line	>75 feet	Drinking Water Well	>100 feet	Other	✓ feet

4. Parent Material: TILL — Unsuitable Materials Present: ☒ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☒ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No — If yes: 77" (Depth Weeping from Pit) | 114" (Depth Standing Water in Hole)

Estimated Depth to High Groundwater: 36" (inches) | 207.5 +/- (elevation)

JM

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348 MAIN STREET

C. On-Site Review (Continued)

Deep Observation Hole Number: DH-2008-3

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-6"	Ap	10YR 3/2	N/O	N/A	N/A	VFSL	ANG. 10%	N/O	CRUMB	FRIABLE	✓
6"- 14"	B_w	10YR 5/6	N/O	N/A	N/A	FSL	ANG. 10%	N/O	MASSIVE	SL. FRI.	✓
14"-121"	C	2.5Y 6/3	36"	5YR 5/8	75%	LS	SUBRND 10%	SUBRND 15%	S/LESS	SL. FRI.	✓

Additional Notes:

WEEPING AT 77", STANDING AT 114", POCKETS OF FINE SAND BETWEEN 24" AND 36" (MAY BE RESTRICTIVE RELATIVE TO REST OF MATERIAL, BUT NOT IMPERVIOUS), REFUSAL AT 121"

JM

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348 MAIN STREET

C. On-Site Review (Continued)

Deep Observation Hole Number: DH-2008-4 | 5/29/2008 (Date) | 10:20 AM (Time) | SUNNY, 70's (Weather)

1. Location

Ground Elevation at Surface of Hole: 212.20 +/- | Location (identify on plan): SEE ATTACHED PLAN.

2. Land Use: RESIDENTIAL - LAWN (e.g., woodland, agricultural field, vacant lot, etc.) | N/O (Surface Stones) | 6% +/- (Slope (%))

LAWN (Vegetation) | N/D (Landform) | GENTLE SLOPE (Position on Landscape (attach sheet))

3. Distances from:

Open Water Body	>150 feet	Drainage Way	>33* feet	Possible Wet Area	>100 feet
Property Line	>80 feet	Drinking Water Well	>100 feet	Other	✓ feet

4. Parent Material: TILL | Unsuitable Materials Present: ☒ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☒ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No | If yes: 72" (Depth Weeping from Pit) | 120" +/- (Depth Standing Water in Hole)

Estimated Depth to High Groundwater: 34" (MOTTLES) (inches) | 209.36 (elevation)

*SAID DRAINAGE WAY TO BE REMOVED AS PART OF PROJECT.

JM

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348 MAIN STREET

C. On-Site Review (Continued)

Deep Observation Hole Number: DH-2008-4

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-6"	A_P	10YR3/2	N/O	N/A	N/A	VFSL	ANG. 10%	N/O	CRUMB	FRIABLE	✓
6"-14"	B_W	10YR5/6	N/O	N/A	N/A	FSL	SUBANG 10%	N/O	MASSIVE	SL. FRIABLE	✓
14"-126"	C	2.5Y6/3	34"	5YR5/8	75%	MLS	SUBRND 10%	SUBRND 15%	S/LESS	SL. FRIABLE	✓

Additional Notes:

WEEPING AT 72", STANDING AT 120" +/-, REFUSAL AT 126"

JM

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

348 MAIN STREET

D. Determination of High Groundwater Elevation

1. Method Used:

		(210.5) DH-2008-3	(212.20) DH-2008-4
☒	Depth observed standing water in observation hole	A. 114" (201.00) inches	B. 120" (202.20) inches
☒	Depth weeping from side of observation hole	A. 77" (204.08) inches	B. 72" (206.20) inches
☒	Depth to soil redoximorphic features (mottles)	A. 36" (207.50) inches	B. 34" (209.36) inches
☐	Groundwater adjustment (USGS methodology)	A. N/A inches	B. N/A inches

2. N/A (Index Well Number) — N/A (Reading Date) — N/A (Index Well Level)
   N/A (Adjustment Factor) — N/A (Adjusted Groundwater Level)

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material
   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?
      ☒ Yes ☐ No
   b. If yes, at what depth was it observed?

	Upper boundary:	Lower boundary:
DH-2008-3	14" inches	121" inches
DH-2008-4	14" inches	126" inches

JM

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348 MAIN STREET.

C. On-Site Review (Continued)

Deep Observation Hole Number: DH-2008-A | 5/29/2008 (Date) | 10:30 AM (Time) | SUNNY, 70's (Weather)

1. Location

Ground Elevation at Surface of Hole: 211.6 +/- Location (identify on plan): SEE ATTACHED SKETCH

2. Land Use: RESIDENTIAL – LAWN (e.g., woodland, agricultural field, vacant lot, etc.) | N/O (Surface Stones) | 6% (Slope (%))

LAWN / FIELD (Vegetation) | N/D (Landform) | GENTLE SLOPE (Position on Landscape (attach sheet))

3. Distances from:

Open Water Body	>115 feet	Drainage Way	>50 feet	Possible Wet Area	>100 feet
Property Line	>50 feet	Drinking Water Well	>100 feet	Other	/ feet

4. Parent Material: TILL Unsuitable Materials Present: ☒ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☒ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 62" Depth Weeping from Pit | 96" Depth Standing Water in Hole

Estimated Depth to High Groundwater: 39 Inches | 208.35 +/- elevation

JM

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

348 MAIN STREET

C. On-Site Review (Continued)

Deep Observation Hole Number: PH-2008-A

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-6"	A_p	10YR3/2	N/O	N/A	N/A	VFSL	ANG. 10%	/	CRUMB	FRIABLE	/
6"-15"	B_w	10YR5/6	N/O	N/A	N/A	FSL	SUBANG. 10%	/	MASSIVE	FRIABLE	/
15"-104"	C	2.5Y6/3	39"	5YR5/8	>5%	MSL	SUBRND 10%	SUBRND 15%	S/LESS	SL. FRI.	/

Additional Notes:

WEEPING AT 62", STANDING AT 96", MOTTLES AT 39", REFUSAL AT 104"

JM

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

348 MAIN STREET

C. On-Site Review (Continued)

Deep Observation Hole Number: DH-2008-B | 5/29/2008 (Date) | 11:15 AM (Time) | SUNNY, 70's (Weather)

1. Location

Ground Elevation at Surface of Hole: 213.1 +/- | Location (identify on plan): SEE ATTACHED SKETCH

2. Land Use: RESIDENTIAL - LAWN (e.g., woodland, agricultural field, vacant lot, etc.) | N/O (Surface Stones) | 6% +/- (Slope (%))

LAWN / FIELD (Vegetation) | N/D (Landform) | GENTLE SLOPE (Position on Landscape (attach sheet))

3. Distances from:

Open Water Body	> 100 feet	Drainage Way	> 50 feet	Possible Wet Area	> 100 feet
Property Line	> 34 feet	Drinking Water Well	> 100 feet	Other	/ feet

4. Parent Material: TILL | Unsuitable Materials Present: ☒ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☒ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No | If yes: 68" (Depth Weeping from Pit) | 96" (Depth Standing Water in Hole)

Estimated Depth to High Groundwater: 31" (Inches) | 210.51 (elevation)

JM

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City/Town of ACTON

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

348 MAIN STREET

C. On-Site Review (Continued)

Deep Observation Hole Number: DH-2008-B

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-6"	Ap	10YR3/2	N/O	N/A	N/A	VFSL	ANG. 10%	/	CRUMB	FRIABLE	/
6"- 12"	Bw	10YR5/6	N/O	N/A	N/A	FSL	SUBANG 10%	/	MASSIVE	SL. FRIABLE	/
12"- 108"	C	2.5YG/3	31"	5YR5/8	75%	MSL	SUBRND 10%	SUBRND 15%	S/LESS	SL. FRIABLE	/

Additional Notes:

WEEPING AT 68", STANDING AT 96", REFUSAL AT 108"

JM

HSA# 14188 5/29/2008

Commonwealth of Massachusetts
City/Town of ACTON

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

348 MAIN STREET

D. Determination of High Groundwater Elevation

1. Method Used:	(211.00) DH-2008-A	(213.10) DH-2008-B
■ Depth observed standing water in observation hole	A. 96" (203.60) inches	B. 96" (205.10) inches
■ Depth weeping from side of observation hole	A. 62" (206.43) inches	B. 68" (207.43) inches
■ Depth to soil redoximorphic features (mottles)	A. 39" (208.35) inches	B. 31" (210.51) inches
☐ Groundwater adjustment (USGS methodology)	A. / inches	B. / inches

2. Index Well Number: N/A — Reading Date: N/A — Index Well Level: N/A
   Adjustment Factor: N/A — Adjusted Groundwater Level: N/A

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

   ■ Yes ☐ No

   b. If yes, at what depth was it observed?

	Upper boundary:	Lower boundary:
DH-2008-A	15"	104"
DH-2008-B	12"	108"

JM

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F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Jeffrey Morrissette
Signature of Soil Evaluator

5/29/2008
Date

JEFFREY MORRISSETTE
Typed or Printed Name of Soil Evaluator / License #

OCTOBER 1997
Date of Soil Evaluator Exam

HEATHER
Name of Board of Health Witness

ACTON BOH
Board of Health

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

JM

HSA # 14188

Commonwealth of Massachusetts
City/Town of
Percolation Test
Form 12

Percolation test results must be submitted with the Soil Suitability Assessment for On-site Sewage Disposal. DEP has provided this form for use by local Boards of Health. Other forms may be used, but the information must be substantially the same as that provided here. Before using this form, check with the local Board of Health to determine the form they use.

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

A. Site Information

WALKER REALTY, LLC
Owner Name

348 MAIN STREET
Street Address or Lot #

ACTON | MA | 01720
City/Town | State | Zip Code

JOE PEZNOLA / HANCOCK ASSOCIATES | (508) 460-1111
Contact Person (If different from Owner) | Telephone Number

B. Test Results

	PT-2008-1			
	5/29/2008 Date	/ Time	Date	Time
Observation Hole #	PH-2008-1			
Depth of Perc	63" + 14" = 77"			
Start Pre-Soak	10:10 AM			
End Pre-Soak	10:25 AM			
Time at 12"	10:25 AM			
Time at 9"	10:38 AM			
Time at 6"	10:57 AM			
Time (9"-6")	19 MINUTES			
Rate (Min./Inch)	7 MINUTES PER INCH			
	Test Passed: ☒ Test Failed: ☐		Test Passed: ☐ Test Failed: ☐	

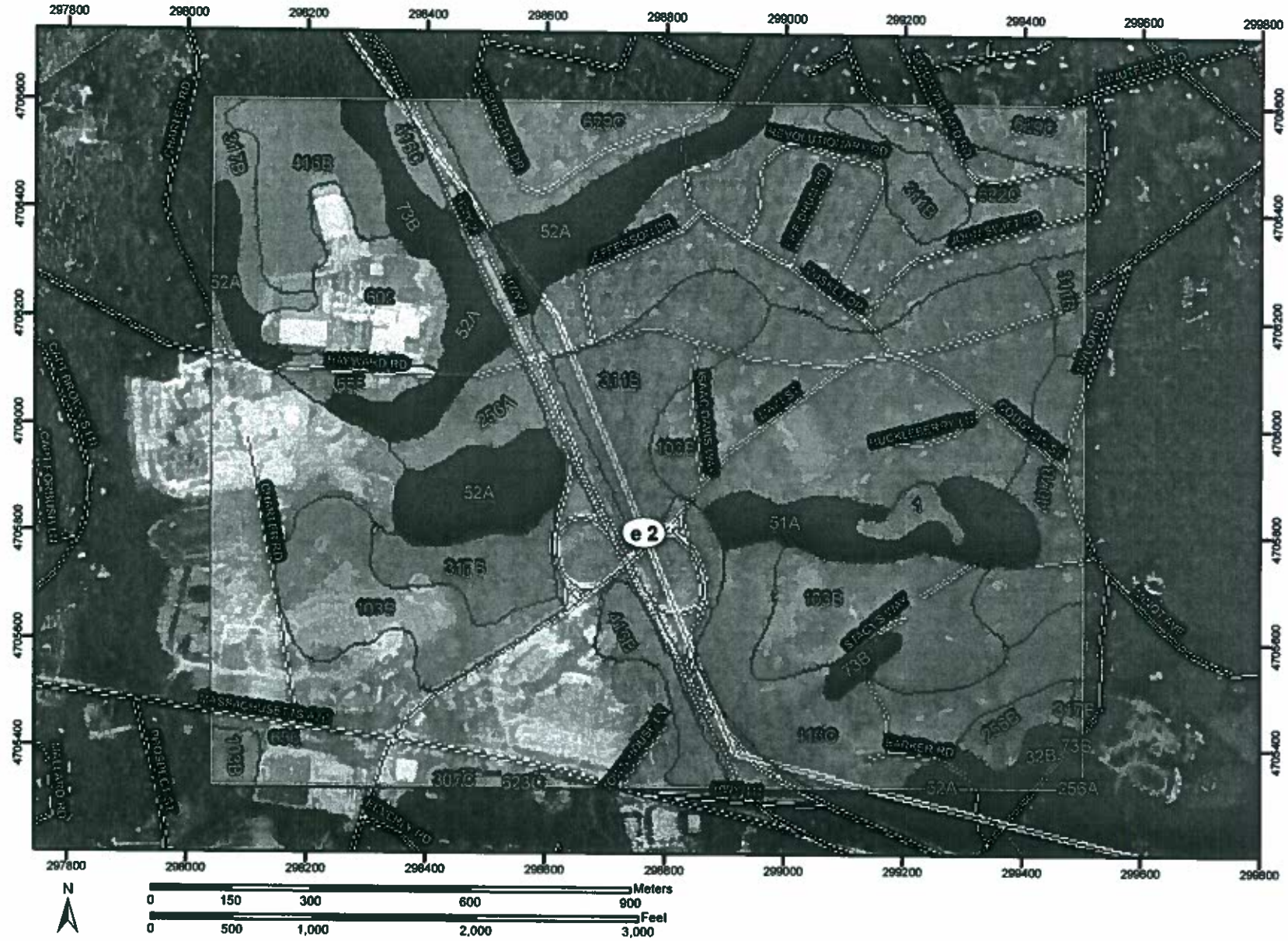
JEFFREY MORRISSETTE / HANCOCK ASSOCIATES
Test Performed By:

Witnessed By:

Comments:

APPENDIX III NRCS Soils Mapping

Drainage Class–Middlesex County, Massachusetts
(348, 305, 352 Main Street, Acton, MA)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Soil Ratings
- Excessively drained
- Somewhat excessively drained
- Well drained
- Moderately well drained
- Somewhat poorly drained
- Poorly drained
- Very poorly drained
- Not rated or not available

Political Features

Municipalities
- Cities
- Urban Areas

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails

Roads
- Interstate Highways
- US Routes
- State Highways
- Local Roads
- Other Roads

MAP INFORMATION

Original soil survey map sheets were prepared at publication scale. Viewing scale and printing scale, however, may vary from the original. Please rely on the bar scale on each map sheet for proper map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 19N

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 5, Jan 3, 2007

Date(s) aerial images were photographed: 3/29/1995

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.

Drainage Class

Drainage Class— Summary by Map Unit — Middlesex County, Massachusetts				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Water		2.9	0.6%
32B	Wareham loamy fine sand, 0 to 5 percent slopes	Poorly drained	5.2	1.0%
51A	Swansea muck, 0 to 1 percent slopes	Very poorly drained	14.3	2.6%
52A	Freetown muck, 0 to 1 percent slopes	Very poorly drained	36.9	7.5%
73B	Whitman fine sandy loam, 0 to 5 percent slopes, extremely stony	Very poorly drained	6.1	1.6%
103B	Charlton-Hollis-Rock outcrop complex, 3 to 6 percent slopes	Well drained	102.0	19.7%
256A	Deerfield loamy sand, 0 to 3 percent slopes	Moderately well drained	7.6	1.5%
256B	Deerfield loamy sand, 3 to 6 percent slopes	Moderately well drained	4.4	0.8%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	Well drained	0.3	0.1%
311B	Woodbridge fine sandy loam, 3 to 8 percent slopes, very stony	Moderately well drained	29.7	5.6%
317B	Scituate fine sandy loam, 3 to 8 percent slopes, extremely stony	Moderately well drained	16.2	3.1%
407B	Charlton fine sandy loam, 3 to 6 percent slopes, extremely stony	Well drained	15.2	2.9%
416B	Narragansett silt loam, 3 to 8 percent slopes, very stony	Well drained	21.6	4.2%
416C	Narragansett silt loam, 6 to 15 percent slopes, very stony	Well drained	33.8	6.5%
602	Urban land		16.6	3.2%
622C	Paxton-Urban land complex, 3 to 15 percent slopes		59.7	11.6%
623C	Woodbridge-Urban land complex, 3 to 15 percent slopes		1.2	0.2%

Drainage Class— Summary by Map Unit — Middlesex County, Massachusetts				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
629C	Canton-Charlton-Urban land complex, 3 to 15 percent slopes	Well drained	25.5	4.9%
655	Udorthents, wet substratum		4.4	0.9%
656	Udorthents-Urban land complex		109.1	21.1%
Totals for Area of Interest (AOI)			516.7	100.0%

Description

"Drainage class (natural)" refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized-excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the "Soil Survey Manual."

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

APPENDIX IV STEP Information for Stormceptor

Fact Sheet #4

Stormwater Technology: Stormceptor

(Hydro Conduit, formerly CSR New England Pipe)

Revised February 2003

*The **Stormceptor Fact Sheet** is one in a series of fact sheets for stormwater technologies and related performance evaluations, which are undertaken by the Massachusetts STrategic Envirotechnology Partnership (STEP).*

A summary of the STEP evaluation entitled, *Technology Assessment, Stormceptor CSR New England Pipe*, January 1998 is provided in this fact sheet. When a more thorough understanding of a system is required, the full *Technology Assessment* should be reviewed. Copies are available for downloading from the STEP Web site (www.stepsite.org/progress/reports) or by contacting the STEP Program (Phone: 617/626/1197, FAX: 617/626/1180, email: linda.benevides@state.ma.us). The information in this fact sheet is subject to future updates as additional performance information becomes available.

Description/Definition

Stormceptor is a prefabricated, underground unit that separates oils, grease, and sediment from stormwater runoff when installed with an existing or new pipe conveyance system. The unit is divided into two chambers–a treatment and a flow bypass chamber. During typical storm events, runoff is directed by the inflow weir through a drop pipe into the lower treatment chamber where sediment, oil, and grease are separated from the flow by gravity. The bypass chamber is designed to convey excess stormwater, which overtops the inflow weir, through the system without treatment.

Equipment and Sizing

The on-line Stormceptor units are available in eight sizes ranging from six and twelve feet in diameter with capacities of 900 to 7200 gallons. Since issuing the STEP assessment in 1998, the manufacturer has expanded the Stormceptor product line to include a storm drain inlet (STC 450i) and three units (Models STC 11000, STC 13000, and STC16000). These systems are not included in the STEP evaluation. Users and decision-makers may require additional field test results and new data for these new systems in order to accept performance ratings, particularly if they are higher than those reported in the STEP technology assessment and this fact sheet.

Stormceptor units are available in either precast concrete or fiberglass for special applications. Concrete units are pre-engineered for HS-20 min. traffic loading at the surface. Fiberglass units can be used in areas where

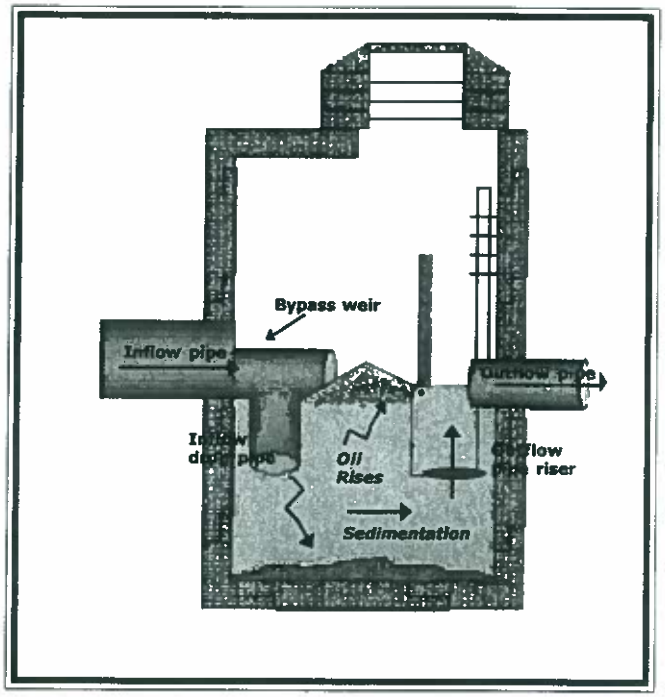


Figure 1. Stormceptor operation during average flow conditions.

there is a potential for oil and chemical spills.

Performance/Effectiveness

The system is designed to provide separation of sediment, oil, and grease from stormwater by routing runoff into a low-turbulence environment where solids settle and oils float out of solution. The system sizing is based on the drainage area, historical rainfall data, and

the solids removal efficiency required. It is recommended that the system be used in combination with other stormwater controls to conform with the Massachusetts Stormwater Management Policy and standards.

An Imperial Model STC 2000 (equivalent to the Model STC 2400) in Edmonton, Canada treats flow from a 9.8 acre commercial parking lot. This system was monitored during four storm events in 1996 and shown to have an average total suspended solids (TSS) removal efficiency of 52 percent. In designing a system to achieve a comparable removal efficiency, the relationship between system size and impervious drainage area should be considered, as detailed in Table 1 and the Technology Assessment Report.

A Model STC 1200 in Westwood, Massachusetts treats flow from 0.65 acres consisting of a paved truck loading area at a manufacturing facility. The unit was monitored for six storm events in 1997, but only four events had measurable TSS influent concentrations. Of these four events, the average TSS removal efficiency was calculated to be 77 percent, which is less than the 80 percent removal targeted by the manufacturer.

Based on these field monitoring results, and when the unit sizing follows the guidance in Table 1, removal efficiencies between 52 percent and 77 percent may be achieved where installations have similar rainfall and land use characteristics as those reviewed for the STEP evaluation. It is recommended that additional field research and new data be evaluated to validate performance ratings higher than those verified by STEP.

Stormceptor Model Number	Maximum Impervious Area (acres)	
	77% TSS removal	52% TSS removal
STC 900	0.45	0.9
STC 1200	0.7	1.45
STC 1800	1.25	2.55
STC 2400	1.65	3.35
STC 3600	2.6	5.3
STC 4800	3.6	7.25
STC 6000	4.6	9.25
STC 7200	5.55	11.25

Table 1: Adapted from the Stormceptor sizing for TSS removal in the STEP Technology Assessment. Notes: 1) On some sites, the maximum impervious area may need to be reduced to achieve these TSS removal rates. 2) The terms "critical area sizing" (to achieve 77 percent TSS removal) and "treatment train sizing" (for 52 percent removal) are no longer used by the manufacturer, but unit sizing is still applicable.

Specific performance claims for oil and grease were not evaluated by STEP. However, total petroleum hydrocarbons (TPH) were analyzed during the Westwood study. Results indicated that the unit was effective in capturing oils.

Technology Status

The Stormceptor system provides greater solids separation and higher TSS removal efficiencies than oil and grit separators. Stormceptor systems are among the category of hydrodynamic separators, which are flow-through devices with the capacity to settle or separate grit, oil, sediment, or other pollutants from stormwater. According to the U.S. Environmental Protection Agency, "Hydrodynamic separators are most effective where the materials to be removed from runoff are heavy particulates - which can be settled - or floatables - which can be captured, rather than solids with poor settleability or dissolved pollutants."

Although Stormceptor appears to remove sediment, grit, oil, and grease as claimed by the manufacturer, additional research is needed to determine how much sediment moves through the system untreated. The field studies evaluated for the STEP assessment predate the Stormwater Best Management Practice Demonstration Tier II Protocol (2001), which is applicable in Massachusetts and other states in the Technology Acceptance Reciprocity Partnership (TARP), to ensure quality controlled studies that can be shared among participating states. Therefore, interstate reciprocity is not available to the manufacturer, based on performance claims that were evaluated by STEP in 1998. If the TARP Protocol requirements are fulfilled in the future, the manufacturer could pursue reciprocal verification for Stormceptor systems in participating TARP states. More information on the TARP Protocol is available on the following Web site: www.dep.state.pa.us/dep/deputate/pollprev/techservices/tarp.

Applications/Advantages

- Stormceptor systems identified in Table 1 should be used in combination with other BMPs to remove 80 percent of the average annual load of TSS (DEP Stormwater Policy Standard 4). Systems may be well suited for pretreatment in a mixed component system designed for stormwater recharge.
- Performance data show that Stormceptor may provide TSS removal rates in the range of 52 percent to 77 percent when sized according to Table 1. Higher TSS removal rates were achieved during low flow, low intensity storms with less than one third of an inch of runoff. Also, by reducing the impervious drainage area,

relative to the system size, the STEP Technology Assessment Report indicated that higher removal efficiencies may be achievable. However, STEP recommends collection of additional data "representing a varied set of operating conditions over a realistic maintenance cycle to verify TSS removal rates greater than 80 percent."

- The Stormceptor system is suitable for new and retrofit applications. For retrofit applications, it should not take the place of a catch basin for the systems that have been verified. Also, for retrofit applications, it should be installed in lateral lines and not main trunk lines.
- The system is particularly well suited in constricted areas and where space is limited.
- It also is suitable for use in areas of high potential pollutant loads (DEP Stormwater Policy Standard 5), where it may be used effectively in capturing and containing oil and chemical spills. *Web site:* www.state.ma.us/dep/brp/stormwtr/stormpub.htm.

Considerations/Limitations

- Systems are not expected to provide significant nutrient (nitrogen and phosphorus) or fecal coliform removal.
- The systems are not recommended for use in critical areas, such as public drinking water supplies, certified vernal pools, public swimming beaches, shellfish growing areas, cold water fisheries, and some Areas of Critical Environmental Concern (ACECs), except as a pretreatment device for BMPs that have been approved by DEP for use in critical areas. The structural BMPs approved for use in critical areas are described in Standard 6 of the Stormwater Management Policy, www.state.ma.us/dep/brp/stormwtr/stormpub.htm.
- There is a limited set of useful data for predicting the relationship between treatment efficiency and loading rates. Removal efficiencies have not been demonstrated for all unit sizes.
- Further research is needed to determine how much TSS bypasses the treatment chamber during certain, higher velocity storm events which recur less frequently.
- Systems require regular maintenance to minimize the potential for washout of the accumulated sediments.

Reliability/Maintenance

All BMPs require scheduled, routine maintenance to ensure that they operate as efficiently as possible. Although maintenance requirements are site specific, a general relationship between cleaning needs and depths of sediment has been established by the manufacturer. Inspection of the Stormceptor interior should be done after major storm events, particularly in the first year of operation. It is recommended that material in the treatment chamber be pumped out by a vacuum truck semiannually, or when the sediment and pollutant loads reach about 15 percent of the total storage. If the unit is used for spill containment, it should be pumped after the event is contained. Typical cleaning costs were estimated by the manufacturer in 1998 to be $250, with disposal costs averaging $300 to $500. The expected life of a system has been estimated to be 50 to 100 years.

Sediment Depths Indicating Required Maintenance	
Model Number	Sediment Depth (feet)
STC 900	0.5
STC 1200	0.75
STC 1800	1
STC 2400	1
STC 3600	1.25
STC 4800	1
STC 6000	1.5
STC 7200	1.25

Table 2: The Stormceptor system clean out is based on 15 percent of the sediment storage volume in the unit.

References

Winkler, E.S. 1998. "Technology Assessment, Stormceptor." University of Massachusetts, Amherst, MA.
STEP Web site: www.stepsite.org/progress/reports

Massachusetts Department of Environmental Protection and Office of Coastal Zone Management. 1997. "Stormwater Management Handbooks, Volumes One and Two." Boston, MA. *Handbooks Web site:* www.state.ma.us/dep/brp/stormwtr/stormpub.htm.

"Performance of a Proprietary Stormwater Treatment Device: The Stormceptor. The Practice of Watershed Protection: Article 120. Thomas. R. Schueler and Heather K. Holland editors. 2000. Ellicott City, MD.

United States Environmental Protection Agency. "Storm Water Technology Fact Sheet Hydrodynamic Separators." EPA 832-F-99-017.

Stormceptor Web sites: www.rinkermaterials.com/stormceptor

TARP Web site: www.dep.state.pa.us/dep/deputate/pollprev/techservices/tarp.