Definitive Subdivision Plan
147 Shade Street

SITE SENSITIVE DEVELOPMENT
LEXINGTON, MA

JANUARY 7, 2020

Prepared For:
Shumin w. Whu & Chen Ho
147 Shade Street
Lexington, MA 02420
# 147 Shade Street
Lexington, MA 02420
Site Sensitive Development
DEFINITIVE PLAN

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### PLAN

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<td>Site Sensitive Development Site Construction Plan</td>
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<td>Site Sensitive Development Landscape Plan</td>
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<td>Sheet 7</td>
<td>Site Sensitive Development Site Utilities Plan</td>
</tr>
</tbody>
</table>
On behalf of the owners, Shumin W. Whu and Chen Ho, we are pleased to submit the following information for a Definitive Site Sensitive Plan located at 147 Shade Street. The Lexington Planning Board previously approved the project and issued a Certificate of Action and favorable Special Permit Decision (attached herewith) on June 30, 2010, that has since expired.

The property contains approximately 1.13 acres of land, containing woods and lawn and an existing single-family dwelling. No wetlands exist on or near the property. The proposed development shows the creation of two lots under SECTION 135-6.0: SPECIAL REGULATIONS. One lot will contain the existing dwelling at 147 Shade Street and the second lot will contain a new single-family dwelling.

The attached “Proof Plan” yields the following maximum dimensional standards:

- Maximum Gross Floor Area: 14,142 SF
- Maximum Site Coverage: 4,755 SF
- Maximum Impervious Surface: 19,900 SF

The Site Sensitive Development, as proposed, will create the following dimensional standards:

- Total Gross Floor Area: 12,910+/−SF
- Total Site Coverage: 3,500+/−SF
- Total Impervious Coverage: 8,400+/−SF
FORM B
GENERAL APPLICATION FOR APPROVAL OF A PLAN FOR DEVELOPMENT

Date: November 10, 2019

To the Planning Board:

NAME OF PROJECT: 147 Shade Street

A. TYPE OF APPLICATION

- Preliminary or definitive subdivision plan, per §175-5.0 or §175-6.0
- Minor site plan review, per §176-9.0
- Major site plan review, per §176-9.0
- X Special permit residential development, per §135-6.9
- Adequacy determination of an unaccepted street, per § 176-7.0
- Review of a zoning amendment for a planned development (PD) district, per §135-7.3

B. A. TYPE OF PLAN

The accompanying plan is a:

- Sketch
- Preliminary
- X Definitive
- Extension
- Rescission

For a:

- X Residential Development
- Non-residential Development

Received by Planning Board:

Space for Town Clerk

Revised: Monday, March 05, 2018
B. DESCRIPTION OF LAND
All property included in the plan:

1. Street Address: 147 Shade Street  Map-Lot #: 34-97
2. Street Address: ___________________  Map-Lot #: ______________
3. Street Address: ___________________  Map-Lot #: ______________

Please add more if necessary.

C. COST ESTIMATE
For projects filed under §135-6.9 please complete Form SC

D. APPLICANT AND OWNER INFORMATION
Note: The Zoning and Subdivision Regulations permit a person other than the owner to file an application, with the written permission of the owner, and if the applicant states the nature of their interest.*

Applicant's Name: Shumin W. Whu

Is the applicant also the owner?  [X] Yes  [ ] No

Signature of Applicant: ________________________________

Applicant's Business address: 147 Shade Street, Lexington, MA 02420

Applicant's Phone Number: 781-674-2794

Applicant’s Email Address: wendywhu@gmail.com

If the applicant is not the owner what is the nature of interest in the land?

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________

*For projects filed under §135-6.9 if the applicant is not the owner the applicant must attach a copy of a purchase and sale agreement, or other instrument of future sale, to this application. Note: The Planning Department requires that one-person act as coordinator/contact person for an application. That person is assumed the applicant unless a member of the development team is designated.
SIGNATURES OF OWNERS

Note: The owners of all land affected by this development must sign this application. If necessary, complete table two, or file a separate sheet, for multiple parcels/owners.

**Table 1**

<table>
<thead>
<tr>
<th>Map-Lot #:</th>
<th>Owner 1: Shumin Whu</th>
<th>Owner 2: Chen Ho</th>
</tr>
</thead>
<tbody>
<tr>
<td>34-97</td>
<td></td>
<td></td>
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</table>

**Signature of Owner 1**

[Signature]

**Signature of Owner 2**

[Signature]

**Table 2**

<table>
<thead>
<tr>
<th>Map-Lot #:</th>
<th>Owner 1:</th>
<th>Owner 2:</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</tbody>
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**Signature of Owner 1**

[Signature]

**Signature of Owner 2**

[Signature]
E. CALCULATION OF FEE

<table>
<thead>
<tr>
<th>Type of Application or Action:</th>
<th>Number of Lots</th>
<th>Rate per Lot</th>
<th>Sub Total</th>
<th>Fixed Rate</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>Filing Fee:</td>
<td>2</td>
<td>* $500.00</td>
<td>= $1,000.00</td>
<td>+$2000.00</td>
<td>= $3000.00</td>
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*Creditable Prior Payment

Total Filing Fee due with application $3000.00

Schedule of Administrative Fees. The following schedules apply to the types of applications to the Board:

<table>
<thead>
<tr>
<th>Application Types</th>
<th>Fees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential Preliminary Subdivision</td>
<td></td>
</tr>
<tr>
<td>1 to 3 Lots</td>
<td>$1,000 plus 500 per lot</td>
</tr>
<tr>
<td>4 to 8 Lots</td>
<td>$1,500 plus 500 per lot</td>
</tr>
<tr>
<td>More than 9</td>
<td>$2,000 plus 500 per lot</td>
</tr>
<tr>
<td>Non-Residential Preliminary Subdivision</td>
<td>$2,000 plus 500 per lot</td>
</tr>
<tr>
<td>Residential Definitive Subdivision</td>
<td></td>
</tr>
<tr>
<td>1 to 3 Lots</td>
<td>$2,000 plus 500 per lot</td>
</tr>
<tr>
<td>4 to 8 Lots</td>
<td>$3,000 plus 500 per lot</td>
</tr>
<tr>
<td>More than 9</td>
<td>$4,000 plus 500 per lot</td>
</tr>
<tr>
<td>Non-Residential Definitive Subdivision</td>
<td>$4,000 plus 500 per lot</td>
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<tr>
<td>Modifications</td>
<td>$1,500</td>
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<table>
<thead>
<tr>
<th>Application Types</th>
<th>Fees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unaccepted Street Determination, §176-7.0</td>
<td>$2,000</td>
</tr>
<tr>
<td>Special Permitting, §176-6.0</td>
<td></td>
</tr>
<tr>
<td>Residential Sketch Plan</td>
<td>$1,500 plus $500 per proof plan lot</td>
</tr>
<tr>
<td>Residential Special Permit</td>
<td>$3,000 plus $500 per proof plan lot</td>
</tr>
<tr>
<td>Nonresidential Sketch Plan</td>
<td>$1,500 plus $50 per 1,000 SF of GFA</td>
</tr>
<tr>
<td>Nonresidential Special Permit</td>
<td>$3,000 plus $50 per 1,000 SF of GFA</td>
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<tr>
<td>Site Plan Review, §176-9.0</td>
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<td>Minor site plan review</td>
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<tr>
<td>Major site plan review</td>
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<td>PD rezoning, §176-8.0</td>
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<td>Sketch PSDUP</td>
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<tr>
<td>Final PSDUP</td>
<td>$2,000</td>
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</table>

*One payment of a fee for a residential preliminary plan is creditable to the initial fee for a definitive plan. If more than one fee is paid for a preliminary plan, only the first of those payments is creditable to the initial fee for a definitive plan.

One payment of a fee for a sketch plan is creditable to the initial fee for a special permit application or PSDUP rezoning request. If more than one fee is paid for a sketch plan, only the first of those payments is creditable to the initial fee for a special permit application.
### F. DEVELOPMENT TEAM

<table>
<thead>
<tr>
<th></th>
<th>Landscape Architect</th>
<th>Civil Engineer</th>
<th>Land Surveyor</th>
<th>Attorney</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Laurie Tarr-Ellsworth</td>
<td>Frederick W. Russell</td>
<td>James R. Keenan</td>
<td></td>
</tr>
<tr>
<td>Mass. Registration #</td>
<td>1099</td>
<td>36713</td>
<td>30751</td>
<td></td>
</tr>
<tr>
<td>Name of Firm</td>
<td>LTE Landscape Archtecture</td>
<td>Frederick W. Russell, PE</td>
<td>Keenan Survey</td>
<td></td>
</tr>
<tr>
<td>Mailing Address</td>
<td>219 Ellis Road, Suite B Westminster, MA 01473</td>
<td>154 Aldrich Road Wilmington, MA 01887</td>
<td>8 Winchester Place Winchester, MA 01890</td>
<td></td>
</tr>
<tr>
<td>Telephone #</td>
<td>978-549-0337</td>
<td>978-604-6590</td>
<td>781-729-4213</td>
<td></td>
</tr>
</tbody>
</table>

(If applicant is not coordinator/contact person, designate one person for that role)
Chen Ho
Shumin Wendy Whu
147 Shade Street
Lexington, MA 02421

Bank of America
1761 Mass Avenue
Lexington, MA 02421

PAY TO THE ORDER OF
Town of Lexington
Three Thousand $3000.00 DOLLARS

12-10-2019

Shumin Whu

FOR

4768
FORM G-CE

DESIGNER'S CERTIFICATE
CIVIL ENGINEER

January 7, 2020
(date)

To the Planning Board:

Assessor’s map and lot #: 34-97

Development application type: Site Sensitive Development

I hereby certify that: (Please fill in the relevant blanks.)

1. the accompanying plan, entitled: Definitive Site Sensitive Development; Proof Plan
   Site Construction Plan and Site Utilities Plan
   
   and dated December 27, 2019, is true and correct to the accuracy required by the
   Rules and Regulations of the Lexington Planning Board;

2. that the completed construction complies with the approved definitive subdivision plan, any
   written changes made after the approval of the plan and the Standard Specifications;

3. other: ___________________________

Identifying information of Civil Engineer:

Frederick W. Russell, PE
Civil Engineer
154 Aldrich Road
Wilmington, MA 01887

Address
978-604-6590
Phone

Space for Professional Registration Stamp
FORM G-LA

DESIGNER'S CERTIFICATE
LANDSCAPE ARCHITECT
January 7, 2020
(date)

To the Planning Board:

Assessor’s map and lot #: 34-97

Development application type: Site Sensitive Development

I hereby certify that: (Please fill in the relevant blanks.)

1. the accompanying plan, entitled: Definitive Site Sensitive Development;

Site Analysis Plan and Landscape Plan

...and dated December 27, 2019, is true and correct to the accuracy required by the Rules and Regulations of the Lexington Planning Board;

2. the planting of all trees and other plant materials complies with the approved definitive subdivision plan, any written changes made after the approval of the plan and the Standard Specifications;

3. other: ____________________________________________________________

Identifying information of Landscape Architect:

Laurie Tarr-Ellsworth
Landscape Architect

LTE Landscape Architecture
219 Ellis Road, Suite B
Westminster, MA 01473

Address

978-549-0337

Phone

Space for Professional Registration Stamp
To the Planning Board:

Assessor’s map and lot #: 34-97

Development application type: Site Sensitive Development

I hereby certify that: (Please fill in the relevant blanks.)

1. the accompanying plan, entitled: Definitive Site Sensitive Development;

Site Analysis Plan

and dated December 27, 2019 is true and correct to the accuracy required by the Rules and Regulations of the Lexington Planning Board;

2. all required bounds, monuments or markers delineating the right-of-way of any street, or of any easement, or any walk or path, or any lot, as shown on the approved definitive subdivision plan, have been correctly located and permanently set;

3. other

Identifying information of Land Surveyor:

James R. Keenan
Land Surveyor
Keenan Survey
8 Winchester Place
Winchester, MA 01890
Address

781-729-4213
Phone
RE: Definitive Subdivision Plan and Special Permit Application for 147 Shade Street

Dear Ms. Hooper:

The Planning Board, at its June 23, 2010 meeting, having determined that the submitted Definitive Site Development Plan met all the requisite criteria and that the property is a proper parcel to be developed under § 135-45C of the Code of Lexington, voted to approve the Definitive Subdivision Plan and grant a Special Permit with Site Plan Review for a Site Sensitive Development in accordance with the terms and conditions stated below.

PROCEDURAL HISTORY

1. This decision is accompanied and augmented by the Definitive Site Development Plan, entitled “Definitive Subdivision Plan,” dated December 3, 2009, revised through June 11, 2010 (the Plan), which concerns the property located at 147 Shade Street (Assessor’s Map 71, Lot 97). The Plan was prepared by Frederick W. Russell, PE, for the owners and applicants, Shumin W. Whu, Kuo-Ray Whu, and Chen He. It was filed with the Board on January 22, 2010, and depicts a subdivision of the tract into two buildable lots.

2. The Board held a consolidated public hearing on the Definitive Subdivision Plan and the Special Permit Application. The hearing was held on May 26, 2010 and June 23, 2010.

3. The plans and other submission material were reviewed by the Planning Board and the Engineering and Planning staffs. Throughout its deliberations, the Planning Board has been mindful of the statements, as submitted or made at the public hearing, of the applicants, their representative, and the comments of the public.

FINDINGS

1. The subject development project is located at 147 Shade Street, also referred to as Lot 97 on the Town’s Assessors Map 71. The property contains 49,101 SF±, is generally wooded, except for the area around the existing dwelling, and slopes up modestly from Shade Street (less than
15%). The site abuts residential land owners, with the exception of land zoned for a Planned Commercial District (CD-10) directly across the street, although this part of CD-10 is under a conservation restriction and is in its natural (undeveloped) state.

2. The applicant proposes to build a new single-family detached dwelling to the rear of the existing single-family dwelling on the site. The existing dwelling will be expanded to incorporate the addition of an attached garage. Both dwellings will utilize a common driveway, which will be administered via a Homeowner’s Association.

3. The Planning Board finds that the proposed development satisfies all of the criteria detailed in § 175-34B(2) necessary for the approval of a definitive subdivision plan.

4. The Zoning Bylaw states that as the Special Permit Granting Authority, the Planning Board shall review the criteria, objectives, and standards set forth in § 135-12B. The Planning Board has considered all of these criteria and will impose conditions on its approval relating to these criteria.

Specific Findings & Determinations, per § 135-48C

As the SPGA, the Planning Board must also determine that the proposed development is consistent with standards and criteria specific to a special permit residential development, enumerated in § 135-48C of the Zoning By-Law, that are applicable to this project:

1. Common open space is not required as part of a Site Sensitive Development.

2. The proposed dwelling is sited in such a manner to create complementary relationships with adjacent properties without detracting from the surrounding area or environment.

3. While no development can be rendered invisible, the proposed development has made an appropriate effort to screen and minimize the negative impacts associated with development using vegetative screening around the perimeter of the site.

4. There are no proposed recreation facilities, footpaths, or bicycle paths associated with this development.

5. There are no buildings in the development that contain more than one dwelling unit.

6. Provisions have been made for the operation and maintenance of common facilities through the creation of an Homeowner’s Association.

7. There are not enough dwelling units within this development to warrant accommodation of local transportation services.

8. While no green techniques are proposed specifically, the proposal encourages the preservation of more open space, displays a creative approach to land development, conserves more of the site’s natural features and scenic qualities than would result from a conventional subdivision of comparable size.

9. This is not a Public Benefit Development.
WAIVERS

In accordance with § 175-30 of the Planning Board Development Regulations, the Board waives strict compliance with the specific provisions of the Regulations, listed below, as strict compliance does not serve the public interest and would be inconsistent with the intent and purpose of the Board’s rules. These waivers are granted in order to facilitate the creation of a high quality development and minimize the disruption to the area caused by the construction of the proposed street and lots. The waivers granted are from:

1. § 175-45F(3), to allow the applicant to apply the funds that would otherwise be used for street restoration to increase the number of trees planted, enhancing the existing wooded buffer between the proposed dwelling and the abutters to the north of the site.

2. § 175-55D(6)(b) to allow the issuance of a Certificate of Occupancy prior to the installation of the finish course of pavement instead of after the installation of the finish course.

PLAN MODIFICATIONS

The Board requires that the following modifications be made prior to the endorsement of the plans:

1. The six trees between the proposed structure and the northern extent of the limit of work line be noted as “preferably preserved” rather than to be removed. Protective work lines should also be created around these trees in accordance with the general terms for tree protection explained below.

2. The location of the proposed utilities, namely the water and sewer lines, be removed to not intrude into the tree protection area of the large public shade tree.

TERMS & CONDITIONS OF APPROVAL

General Terms

1. The entire tract of land and buildings to be constructed shall not be used, sold, transferred, or leased except:
   a. As granted by this Decision;
   b. As shown on the Definitive Site Development Plan, referenced above; and
   c. In accordance with subsequent approved plans or amendments to this Decision.

2. Any requests to amend this decision will include the submission of all plans and information required by the applicable rules.

3. The terms and conditions of this Decision shall be enforced by the trustees of the Homeowner’s Association to the extent necessary to comply, including if necessary any proceeding at law or in equity against any person or persons violating or attempting to violate any such condition or restriction, either to restrain the violation or to recover damages. If the trustees fail to enforce said conditions and/or restrictions, any Owner or the Town of Lexington may bring a proceeding at law or in equity against any person or
persons or the Association in violation thereof to enforce compliance with said conditions and/or restrictions.

The Association instrument shall contain an article with the foregoing language therein.

4. No site preparation work or construction shall commence until the Planning Department has confirmed in writing that the following conditions have been satisfied:

   a. Trees slated for preservation are protected from damage or loss by construction activities by the use of construction fencing or protective barricades. Such controls shall be located around the base of the tree at a distance equal to one of the following methods:

      i. At the drip line of the tree; or

      ii. One foot for each inch of tree trunk diameter; or

      iii. Five times the diameter of the tree trunk.

   b. Trees noted on the plan as “preferably preserved” or equivalent, shall be protected in the same manner as preserved trees, provided that requests to conduct work within their protective zones, or for their removal, will require the express prior consent of the Planning Department staff, and be subject to any reasonable terms in order to satisfy the intent of this decision.

   c. The approved perimeter Limit of Work (LOW) line is clearly marked with construction fencing, hay bales and silt fencing, or approved substitute, as appropriate. Construction activity outside the LOW is strictly prohibited, except when approved by the Planning Department in advance. All protective fencing and LOW lines shall be maintained until all construction is complete;

5. No work, including site preparation, land disturbance, construction, and redevelopment, shall commence unless and until pollution prevention, erosion and sediment controls are in place. If, and when, applicable, the Stormwater Pollution Plan required by the National Discharge Elimination System Construction General Permit Program shall be implemented until the site is fully stabilized.

6. Hours of construction. No construction activity on the property which causes noise, vibrations, glare, dust, debris or other detrimental impact, and is perceptible on, or affects, any adjacent lots, shall take place prior to 7:00 a.m. or after 7:30 p.m.

**Special Conditions**

1. The following sheets of the Plan shall be recorded with the decision (and when required, registered with the Land Court):

   a. The Property Rights and Dimensional Standards Plan

2. Endorsement of the approval is conditional upon the provision of a performance guarantee, duly executed and approved, to be noted on the plan. Said form of guarantee may be varied from time to time by the applicant subject to agreement on the adequacy and amount of said guarantee by the board.
3. All driveways, water, sewer, and drainage facilities, and other utilities within the subdivision shall remain private and any maintenance thereof, snowplowing, and any other associated costs, shall be the responsibility of the Homeowner’s Association. Until such time as the Homeowner’s Association is a legally functioning body, the owners referenced above shall be responsible for compliance with any all conditions and/or restrictions related hereto.

4. The Board may require a change to the plan as a condition of its retaining the status of an approved plan should the number of trees purchased for the additional screening be insufficient, in the opinion of the Board, for the intended purpose of granting the waiver from § 175-45F(3).

In order to maximize the effectiveness of these additional trees, their placement shall be coordinated in the field with the Planning Department staff.

5. Any tree noted as “preferably preserved,” or equivalent, shall not be removed unless the following provisions are satisfied:

   a. Replacement trees shall be required to mitigate the loss, on the basis of 1 ½ inch of caliper of new tree(s) for each inch of DBH of tree(s) removed; and

   b. Each replanted tree must have a minimum caliper of three inches.

6. No building permit shall be issued for construction until the Planning Department staff indicates that:

   a. Foundation and/or perimeter drains, if required, shall not run to daylight, but to a drywell, or approved equivalent; and

   b. Town counsel has approved of the final form of all legal documents, including but not limited to the following:

      i. The Homeowner’s Association, including the Association’s private stormwater facilities operation and maintenance responsibilities.

7. No certificate of occupancy permit shall be issued for any dwelling until the Planning Department indicates that the following conditions have been satisfied:

   a. The final grading and landscaping of the parcel is completed. In certain circumstances the Planning Department may instead accept security sufficient to ensure the performance of this condition, in accordance with the provisions of §175-56B(9).
RECORD OF VOTE

The following members of the Planning Board vote to grant the certificate of action, subject to the above-stated terms and conditions:

_________________________  ____________________________
Charles Hornig               Wendy Manz

_________________________  ____________________________
Gregory Zurlo               Richard Canale

The following members of the Planning Board vote to grant a special permit, subject to the above-stated terms and conditions:

_________________________  ____________________________
Charles Hornig               Wendy Manz

_________________________  ____________________________
Gregory Zurlo               Richard Canale

Courtesy Copy of Decision to:  Applicant (by Certified Mail)
Board of Health
Building Commissioner
Conservation Commission
Fire Chief
Police Chief
Town Assessor
Director of Public Works
Revenue Officer
DRAINAGE ANALYSIS

147 Shade Street
Lexington, MA

January 7, 2020
The property contains approximately 1.13 acres of land, containing woods and lawn and an existing single-family dwelling. No wetlands exist on or near the property. The proposed development shows the creation of two lots under SECTION 135-6.0: SPECIAL REGULATIONS. One lot will contain the existing dwelling at 147 Shade Street and the second lot will contain a new single-family dwelling.

In order to offset the proposed increase in impervious cover, downspouts and roof drains for the proposed dwelling will connect to one infiltration system and a trench drain for the proposed driveway will connect to a second infiltration systems adequately designed for the 100-year storm event, using a 6.50 inch rainfall.

Soils investigations, including two deep-hole observations to establish the estimated annual high water table and soil texture were conducted on-site. Information obtained from this investigation was used in designing the proposed underground infiltration system.

In summary by utilizing the proposed subsurface infiltration systems to mitigate stormwater runoff generated by the proposed dwelling and driveway, peak rates and volume of runoff will be reduced or maintained for post development conditions.

### Pre-Development vs. Post-Development Drainage Summary Table

<table>
<thead>
<tr>
<th>Storm Event</th>
<th>Pre-Development</th>
<th>Post-Development</th>
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<tbody>
<tr>
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<td>Rate (cfs)</td>
<td>Volume (cf)</td>
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<tr>
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<tr>
<td>10</td>
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<td>100</td>
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<td>14,769</td>
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## Pipe Listing (all nodes)

<table>
<thead>
<tr>
<th>Line#</th>
<th>Node</th>
<th>In-Invert (feet)</th>
<th>Out-Invert (feet)</th>
<th>Length (feet)</th>
<th>Slope (ft/ft)</th>
<th>n</th>
<th>Diam/Width (inches)</th>
<th>Height (inches)</th>
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<td>233.70</td>
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<td>0.0100</td>
<td>0.010</td>
<td>6.0</td>
<td>0.0</td>
<td>0.0</td>
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Type III 24-hr 2 yr storm Rainfall=3.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DRIVEWAY:
Runoff Area=4,050 sf  100.00% Impervious  Runoff Depth=2.87"
  Tc=5.0 min  CN=98  Runoff=0.29 cfs  968 cf

Subcatchment EXIST:
Runoff Area=49,100 sf  5.50% Impervious  Runoff Depth=0.97"
  Flow Length=300'  Slope=0.1000 '/'  Tc=12.2 min  CN=74  Runoff=0.98 cfs  3,978 cf

Pond INF-A:
Peak Elev=233.90'  Storage=260 cf  Inflow=0.29 cfs  968 cf
  Outflow=0.05 cfs  968 cf

Pond INF-B:
Peak Elev=240.98'  Storage=137 cf  Inflow=0.16 cfs  526 cf
  Outflow=0.03 cfs  526 cf

Subcatchment PROP:
Runoff Area=42,850 sf  5.02% Impervious  Runoff Depth=0.97"
  Flow Length=300'  Slope=0.1000 '/'  Tc=12.2 min  CN=74  Runoff=0.85 cfs  3,472 cf

Subcatchment ROOF:
Runoff Area=2,200 sf  100.00% Impervious  Runoff Depth=2.87"
  Tc=5.0 min  CN=98  Runoff=0.16 cfs  526 cf

Pond T.D.:
Peak Elev=234.10'  Inflow=0.29 cfs  968 cf
6.0" Round Culvert  n=0.010  L=10.0'  S=0.0100 '/'  Outflow=0.29 cfs  968 cf

Total Runoff Area = 98,200 sf  Runoff Volume = 8,944 cf  Average Runoff Depth = 1.09"
88.70% Pervious = 87,100 sf  11.30% Impervious = 11,100 sf
Summary for Subcatchment DRIVEWAY:

Runoff = 0.29 cfs @ 12.07 hrs, Volume= 968 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type III 24-hr 2 yr storm Rainfall=3.10"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>4,050</td>
<td>98</td>
<td>Paved parking, HSG C</td>
</tr>
<tr>
<td>4,050</td>
<td>100.00% Impervious Area</td>
<td></td>
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Direct Entry,

Subcatchment DRIVEWAY:

Type III 24-hr 2 yr storm Rainfall=3.10"
Runoff Area=4,050 sf
Runoff Volume=968 cf
Runoff Depth=2.87"
Tc=5.0 min
CN=98
Summary for Subcatchment EXIST:

Runoff = 0.98 cfs @ 12.18 hrs, Volume = 3,978 cf, Depth = 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type III 24-hr 2 yr storm Rainfall=3.10"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11,400</td>
<td>79</td>
<td>50-75% Grass cover, Fair, HSG C</td>
</tr>
<tr>
<td>1,520</td>
<td>98</td>
<td>Roofs, HSG C</td>
</tr>
<tr>
<td>1,050</td>
<td>98</td>
<td>Paved parking, HSG C</td>
</tr>
<tr>
<td>130</td>
<td>98</td>
<td>Unconnected pavement, walk, HSG C</td>
</tr>
<tr>
<td>35,000</td>
<td>70</td>
<td>Woods, Good, HSG C</td>
</tr>
<tr>
<td>49,100</td>
<td>74</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>46,400</td>
<td>94</td>
<td>94.50% Pervious Area</td>
</tr>
<tr>
<td>2,700</td>
<td>5.5</td>
<td>5.50% Impervious Area</td>
</tr>
<tr>
<td>130</td>
<td>4.81</td>
<td>4.81% Unconnected</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tc (min)</th>
<th>Length (feet)</th>
<th>Slope (ft/ft)</th>
<th>Velocity (ft/sec)</th>
<th>Capacity (cfs)</th>
<th>Description</th>
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<tbody>
<tr>
<td>11.5</td>
<td>100</td>
<td>0.1000</td>
<td>0.15</td>
<td></td>
<td><strong>Sheet Flow</strong>, Woods: Light underbrush n= 0.400 P2= 3.10&quot;</td>
</tr>
<tr>
<td>0.7</td>
<td>200</td>
<td>0.1000</td>
<td>5.09</td>
<td></td>
<td><strong>Shallow Concentrated Flow</strong>, Unpaved Kv= 16.1 fps</td>
</tr>
<tr>
<td>12.2</td>
<td>300</td>
<td></td>
<td></td>
<td></td>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

Subcatchment EXIST:

Type III 24-hr 2 yr storm Rainfall=3.10"
Runoff Area=49,100 sf
Runoff Volume=3,978 cf
Runoff Depth=0.97"
Flow Length=300'
Slope=0.1000 '/'
Tc=12.2 min
CN=74
Summary for Pond INF-A:

Inflow Area = 4,050 sf, 100.00% Impervious, Inflow Depth = 2.87” for 2 yr storm event
Inflow = 0.29 cfs @ 12.07 hrs, Volume = 968 cf
Outflow = 0.05 cfs @ 11.66 hrs, Volume = 968 cf, Atten = 84%, Lag = 0.0 min
Discarded = 0.05 cfs @ 11.66 hrs, Volume = 968 cf

Routing by Stor-Ind method, Time Span = 0.00-30.00 hrs, dt = 0.02 hrs
Peak Elev = 233.90' @ 12.54 hrs, Surf. Area = 808 sf, Storage = 260 cf

Plug-Flow detention time = 32.4 min calculated for 967 cf (100% of inflow)
Center-of-Mass det. time = 32.4 min (788.5 - 756.1)

<table>
<thead>
<tr>
<th>Volume</th>
<th>Invert</th>
<th>Avail. Storage</th>
<th>Storage Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1A</td>
<td>233.20'</td>
<td>458 cf</td>
<td><strong>17.00'W x 47.50'L x 2.04'H Field A</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1,649 cf Overall - 339 cf Embedded = 1,310 cf x 35.0% Voids</td>
</tr>
<tr>
<td>#2A</td>
<td>233.70'</td>
<td>339 cf</td>
<td><strong>Cultec C-100HD</strong> x 24 Inside #1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Effective Size= 32.1&quot;W x 12.0&quot;H =&gt; 1.86 sf x 7.50'L = 14.0 cf</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Overall Size= 36.0&quot;W x 12.5&quot;H x 8.00'L with 0.50' Overlap</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Row Length Adjustment= +0.50' x 1.86 sf x 4 rows</td>
</tr>
</tbody>
</table>

797 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device Routing Invert Outlet Devices
#1 Discarded 233.20' **2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max = 0.05 cfs @ 11.66 hrs HW=233.22' (Free Discharge)
↑1=Exfiltration (Exfiltration Controls 0.05 cfs)
Pond INF-A: - Chamber Wizard Field A

**Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)**

- **Effective Size:** 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf
- **Overall Size:** 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
- **Row Length Adjustment:** +0.50' x 1.86 sf x 4 rows

36.0" Wide + 12.0" Spacing = 48.0" C-C Row Spacing

- **6 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 45.50' Row Length +12.0" End Stone x 2 = 47.50' Base Length**
- **4 Rows x 36.0" Wide + 12.0" Spacing x 3 + 12.0" Side Stone x 2 = 17.00' Base Width**
- **6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height**

- **24 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 4 Rows = 338.8 cf Chamber Storage**

1,648.6 cf Field - 338.8 cf Chambers = 1,309.9 cf Stone x 35.0% Voids = 458.4 cf Stone Storage

- **Chamber Storage + Stone Storage = 797.2 cf = 0.018 af**
- **Overall Storage Efficiency = 48.4%**
- **Overall System Size = 47.50' x 17.00' x 2.04'**

- **24 Chambers**
- **61.1 cy Field**
- **48.5 cy Stone**
Pond INF-A:

Inflow Area=4,050 sf
Peak Elev=233.90'
Storage=260 cf

Hydrograph

Time (hours)
Summary for Pond INF-B:

Inflow Area = 2,200 sf, 100.00% Impervious, Inflow Depth = 2.87" for 2 yr storm event
Inflow = 0.16 cfs @ 12.07 hrs, Volume = 526 cf
Outflow = 0.03 cfs @ 11.68 hrs, Volume = 526 cf, Atten = 84%, Lag = 0.0 min
Discarded = 0.03 cfs @ 11.68 hrs, Volume = 526 cf

Routing by Stor-Ind method, Time Span = 0.00-30.00 hrs, dt = 0.02 hrs
Peak Elev = 240.98' @ 12.53 hrs  Surf.Area = 459 sf  Storage = 137 cf

Plug-Flow detention time = 29.7 min calculated for 525 cf (100% of inflow)
Center-of-Mass det. time = 29.6 min (785.8 - 756.1)

<table>
<thead>
<tr>
<th>Volume</th>
<th>Invert</th>
<th>Avail.Storage</th>
<th>Storage Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1A</td>
<td>240.30'</td>
<td>268 cf</td>
<td><strong>17.00'W x 27.00'L x 2.04'H Field A</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>937 cf Overall - 171 cf Embedded = 766 cf x 35.0% Voids</td>
</tr>
<tr>
<td>#2A</td>
<td>240.80'</td>
<td>171 cf</td>
<td><strong>Cultec C-100HD</strong> x 12 Inside #1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Effective Size= 32.1&quot;W x 12.0&quot;H =&gt; 1.86 sf x 7.50'L = 14.0 cf</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Overall Size= 36.0&quot;W x 12.5&quot;H x 8.00'L with 0.50' Overlap</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Row Length Adjustment= +0.50' x 1.86 sf x 4 rows</td>
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<tr>
<td></td>
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<td></td>
<td>439 cf Total Available Storage</td>
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</table>

Storage Group A created with Chamber Wizard

<table>
<thead>
<tr>
<th>Device</th>
<th>Routing</th>
<th>Invert</th>
<th>Outlet Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>Discarded</td>
<td>240.30'</td>
<td><strong>2.410 in/hr Exfiltration over Surface area</strong></td>
</tr>
</tbody>
</table>

**Discarded OutFlow** Max = 0.03 cfs @ 11.68 hrs  HW=240.32'  (Free Discharge)

↑ 1=Exfiltration  (Exfiltration Controls 0.03 cfs)
Pond INF-B:  - Chamber Wizard Field A

Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)
Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf
Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
Row Length Adjustment= +0.50' x 1.86 sf x 4 rows

36.0" Wide + 12.0" Spacing = 48.0" C-C Row Spacing

3 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 23.00' Row Length +24.0" End Stone x 2 = 27.00' Base Length
4 Rows x 36.0" Wide + 12.0" Spacing x 3 + 12.0" Side Stone x 2 = 17.00' Base Width
6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

12 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 4 Rows = 171.3 cf Chamber Storage

937.1 cf Field - 171.3 cf Chambers = 765.9 cf Stone x 35.0% Voids = 268.1 cf Stone Storage

Chamber Storage + Stone Storage = 439.3 cf = 0.010 af
Overall Storage Efficiency = 46.9%
Overall System Size = 27.00' x 17.00' x 2.04'

12 Chambers
34.7 cy Field
28.4 cy Stone
Pond INF-B:

- Inflow Area = 2,200 sf
- Peak Elev = 240.98'
- Storage = 137 cf

Hydrograph

- Inflow
- Discarded

Flow (cfs) vs. Time (hours)
Summary for Subcatchment PROP:

Runoff = 0.85 cfs @ 12.18 hrs, Volume= 3,472 cf, Depth= 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type III 24-hr 2 yr storm Rainfall=3.10"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11,000</td>
<td>79</td>
<td>50-75% Grass cover, Fair, HSG C</td>
</tr>
<tr>
<td>1,270</td>
<td>98</td>
<td>Roofs, HSG C</td>
</tr>
<tr>
<td>*</td>
<td>98</td>
<td>Unconnected pavement, walk, HSG C</td>
</tr>
<tr>
<td>500</td>
<td>98</td>
<td>Paved parking, HSG C</td>
</tr>
<tr>
<td>22,000</td>
<td>70</td>
<td>Woods, Good, HSG C</td>
</tr>
<tr>
<td>7,700</td>
<td>74</td>
<td>&gt;75% Grass cover, Good, HSG C</td>
</tr>
<tr>
<td>42,850</td>
<td>74</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>40,700</td>
<td></td>
<td>94.98% Pervious Area</td>
</tr>
<tr>
<td>2,150</td>
<td>74</td>
<td>5.02% Impervious Area</td>
</tr>
<tr>
<td>380</td>
<td>74</td>
<td>17.67% Unconnected</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tc (min)</th>
<th>Length (feet)</th>
<th>Slope (ft/ft)</th>
<th>Velocity (ft/sec)</th>
<th>Capacity (cfs)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.5</td>
<td>100</td>
<td>0.1000</td>
<td>0.15</td>
<td></td>
<td>Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10&quot;</td>
</tr>
<tr>
<td>0.7</td>
<td>200</td>
<td>0.1000</td>
<td>5.09</td>
<td></td>
<td>Shallow Concentrated Flow, Unpaved Kv= 16.1 fps</td>
</tr>
<tr>
<td>12.2</td>
<td>300</td>
<td></td>
<td></td>
<td></td>
<td>Total</td>
</tr>
</tbody>
</table>

Subcatchment PROP:

Type III 24-hr 2 yr storm Rainfall=3.10"
Runoff Area=42,850 sf
Runoff Volume=3,472 cf
Runoff Depth=0.97"
Flow Length=300'
Slope=0.1000 '/'
Tc=12.2 min
CN=74
Summary for Subcatchment ROOF:

Runoff = 0.16 cfs @ 12.07 hrs, Volume = 526 cf, Depth = 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span = 0.00-30.00 hrs, dt = 0.02 hrs
Type III 24-hr 2 yr storm Rainfall = 3.10"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
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<tbody>
<tr>
<td>2,200</td>
<td>98</td>
<td>Roofs, HSG C</td>
</tr>
<tr>
<td>2,200</td>
<td>100.00% Impervious Area</td>
<td></td>
</tr>
</tbody>
</table>

Tc = 5.0 min

Direct Entry,

Subcatchment ROOF:

Type III 24-hr 2 yr storm Rainfall = 3.10"
Runoff Area = 2,200 sf
Runoff Volume = 526 cf
Runoff Depth = 2.87"
Tc = 5.0 min
CN = 98
Summary for Pond T.D.:

Inflow Area = 4,050 sf, 100.00% Impervious, Inflow Depth = 2.87" for 2 yr storm event
Inflow = 0.29 cfs @ 12.07 hrs, Volume= 968 cf
Outflow = 0.29 cfs @ 12.07 hrs, Volume= 968 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.29 cfs @ 12.07 hrs, Volume= 968 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Peak Elev= 234.10' @ 12.07 hrs

<table>
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<tr>
<th>Device</th>
<th>Routing</th>
<th>Invert</th>
<th>Outlet Devices</th>
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</thead>
<tbody>
<tr>
<td>#1</td>
<td>Primary</td>
<td>233.70'</td>
<td>6.0&quot; Round Culvert</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>L= 10.0’ CPP, projecting, no headwall, Ke= 0.900</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Inlet / Outlet Invert= 233.70’ / 233.60’ S= 0.0100 '/' Cc= 0.900</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf</td>
</tr>
</tbody>
</table>

Primary OutFlow Max=0.29 cfs @ 12.07 hrs HW=234.10’ (Free Discharge)

1=Culvert (Inlet Controls 0.29 cfs @ 1.70 fps)

Inflow Area=4,050 sf
Peak Elev=234.10’
6.0"
Round Culvert
n=0.010
L=10.0’
S=0.0100 '/'
Type III 24-hr  10 yr storm Rainfall=4.55"

Prepared by Frederick W. Russell, PE

Time span=0.00-30.00 hrs, dt=0.02 hrs, 1501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment DRIVEWAY:**
- Runoff Area=4,050 sf  100.00% Impervious  Runoff Depth=4.31"
  - Tc=5.0 min  CN=98  Runoff=0.43 cfs  1,456 cf

**Subcatchment EXIST:**
- Runoff Area=49,100 sf  5.50% Impervious  Runoff Depth=2.01"
  - Flow Length=300'  Slope=0.1000 '/'  Tc=12.2 min  CN=74  Runoff=2.14 cfs  8,228 cf

**Pond INF-A:**
- Peak Elev=234.27'  Storage=461 cf  Inflow=0.43 cfs  1,456 cf
  - Outflow=0.05 cfs  1,456 cf

**Pond INF-B:**
- Peak Elev=241.35'  Storage=246 cf  Inflow=0.23 cfs  791 cf
  - Outflow=0.03 cfs  791 cf

**Subcatchment PROP:**
- Runoff Area=42,850 sf  5.02% Impervious  Runoff Depth=2.01"
  - Flow Length=300'  Slope=0.1000 '/'  Tc=12.2 min  CN=74  Runoff=1.87 cfs  7,181 cf

**Subcatchment ROOF:**
- Runoff Area=2,200 sf  100.00% Impervious  Runoff Depth=4.31"
  - Tc=5.0 min  CN=98  Runoff=0.23 cfs  791 cf

**Pond T.D.:**
- Peak Elev=234.28'  Inflow=0.43 cfs  1,456 cf
  - 6.0" Round Culvert  n=0.010  L=10.0'  S=0.0100 '/'  Outflow=0.43 cfs  1,456 cf

**Total Runoff Area = 98,200 sf  Runoff Volume = 17,655 cf  Average Runoff Depth = 2.16"**
- 88.70% Pervious = 87,100 sf  11.30% Impervious = 11,100 sf
Summary for Subcatchment DRIVEWAY:

Runoff = 0.43 cfs @ 12.07 hrs, Volume = 1,456 cf, Depth = 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span = 0.00-30.00 hrs, dt = 0.02 hrs
Type III 24-hr 10 yr storm Rainfall = 4.55"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,050</td>
<td>98</td>
<td>Paved parking, HSG C</td>
</tr>
</tbody>
</table>

Tc = 5.0 min

Subcatchment DRIVEWAY:

Type III 24-hr 10 yr storm Rainfall = 4.55"
Runoff Area = 4,050 sf
Runoff Volume = 1,456 cf
Runoff Depth = 4.31"
Tc = 5.0 min
CN = 98
Summary for Subcatchment EXIST:

Runoff = 2.14 cfs @ 12.17 hrs, Volume = 8,228 cf, Depth = 2.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span = 0.00-30.00 hrs, dt= 0.02 hrs
Type III 24-hr 10 yr storm Rainfall=4.55"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11,400</td>
<td>79</td>
<td>50-75% Grass cover, Fair, HSG C</td>
</tr>
<tr>
<td>1,520</td>
<td>98</td>
<td>Roofs, HSG C</td>
</tr>
<tr>
<td>1,050</td>
<td>98</td>
<td>Paved parking, HSG C</td>
</tr>
<tr>
<td>* 130</td>
<td>98</td>
<td>Unconnected pavement, walk, HSG C</td>
</tr>
<tr>
<td>35,000</td>
<td>70</td>
<td>Woods, Good, HSG C</td>
</tr>
<tr>
<td>49,100</td>
<td>74</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>46,400</td>
<td>94</td>
<td>94.50% Pervious Area</td>
</tr>
<tr>
<td>2,700</td>
<td>5.50</td>
<td>5.50% Impervious Area</td>
</tr>
<tr>
<td>130</td>
<td>4.81</td>
<td>4.81% Unconnected</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tc (min)</th>
<th>Length (feet)</th>
<th>Slope (ft/ft)</th>
<th>Velocity (ft/ft/sec)</th>
<th>Capacity (cfs)</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>11.5</td>
<td>100</td>
<td>0.1000</td>
<td>0.15</td>
<td></td>
<td><strong>Sheet Flow,</strong> Woods: Light underbrush n= 0.400 P2= 3.10&quot;</td>
</tr>
<tr>
<td>0.7</td>
<td>200</td>
<td>0.1000</td>
<td>5.09</td>
<td></td>
<td><strong>Shallow Concentrated Flow,</strong> Unpaved Kv= 16.1 fps</td>
</tr>
</tbody>
</table>

12.2 300 Total

Subcatchment EXIST:

Hydrograph

Type III 24-hr 10 yr storm Rainfall=4.55"
Runoff Area=49,100 sf
Runoff Volume=8,228 cf
Runoff Depth=2.01"
Flow Length=300'
Slope=0.1000 '/'
Tc=12.2 min
CN=74
Summary for Pond INF-A:

Inflow Area = 4,050 sf, 100.00% Impervious, Inflow Depth = 4.31” for 10 yr storm event
Inflow = 0.43 cfs @ 12.07 hrs, Volume= 1,456 cf
Outflow = 0.05 cfs @ 11.50 hrs, Volume= 1,456 cf, Atten= 89%, Lag= 0.0 min
Discarded = 0.05 cfs @ 11.50 hrs, Volume= 1,456 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Peak Elev= 234.27’ @ 12.72 hrs  Surf.Area= 808 sf  Storage= 461 cf

Plug-Flow detention time= 65.6 min calculated for 1,455 cf (100% of inflow)
Center-of-Mass det. time= 65.5 min (814.2 - 748.7)

<table>
<thead>
<tr>
<th>Volume</th>
<th>Invert</th>
<th>Avail.Storage</th>
<th>Storage Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1A</td>
<td>233.20’</td>
<td>458 cf</td>
<td>17.00’W x 47.50’L x 2.04’H Field A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1,649 cf Overall - 339 cf Embedded = 1,310 cf x 35.0% Voids</td>
</tr>
<tr>
<td>#2A</td>
<td>233.70’</td>
<td>339 cf</td>
<td>Cultec C-100HD x 24 Inside #1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Effective Size= 32.1”W x 12.0”H =&gt; 1.86 sf x 7.50’L = 14.0 cf</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Overall Size= 36.0”W x 12.5”H x 8.00’L with 0.50’ Overlap</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Row Length Adjustment= +0.50’ x 1.86 sf x 4 rows</td>
</tr>
</tbody>
</table>

797 cf Total Available Storage

Storage Group A created with Chamber Wizard

Discarded OutFlow Max=0.05 cfs @ 11.50 hrs  HW=233.22’ (Free Discharge)
Exfiltration (Exfiltration Controls 0.05 cfs)
Pond INF-A: - Chamber Wizard Field A

Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)
Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf
Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
Row Length Adjustment= +0.50' x 1.86 sf x 4 rows

36.0" Wide + 12.0" Spacing = 48.0" C-C Row Spacing

6 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 45.50' Row Length +12.0" End Stone x 2 = 47.50' Base Length
4 Rows x 36.0" Wide + 12.0" Spacing x 3 + 12.0" Side Stone x 2 = 17.00' Base Width
6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

24 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 4 Rows = 338.8 cf Chamber Storage

1,648.6 cf Field - 338.8 cf Chambers = 1,309.9 cf Stone x 35.0% Voids = 458.4 cf Stone Storage

Chamber Storage + Stone Storage = 797.2 cf = 0.018 af
Overall Storage Efficiency = 48.4%
Overall System Size = 47.50' x 17.00' x 2.04'

24 Chambers
61.1 cy Field
48.5 cy Stone
Pond INF-A:

Hydrograph

Inflow Area=4,050 sf
Peak Elev=234.27'
Storage=461 cf
Summary for Pond INF-B:

Inflow Area = 2,200 sf, 100.00% Impervious, Inflow Depth = 4.31" for 10 yr storm event
Inflow = 0.23 cfs @ 12.07 hrs, Volume = 791 cf
Outflow = 0.03 cfs @ 11.56 hrs, Volume = 791 cf, Atten = 89%, Lag = 0.0 min
Discarded = 0.03 cfs @ 11.56 hrs, Volume = 791 cf

Routing by Stor-Ind method, Time Span = 0.00-30.00 hrs, dt = 0.02 hrs
Peak Elev = 241.35' @ 12.67 hrs Surf.Area = 459 sf Storage = 246 cf

Plug-Flow detention time = 60.4 min calculated for 790 cf (100% of inflow)
Center-of-Mass det. time = 60.4 min (809.1 - 748.7)

<table>
<thead>
<tr>
<th>Volume</th>
<th>Invert</th>
<th>Avail.Storage</th>
<th>Storage Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1A</td>
<td>240.30'</td>
<td>268 cf</td>
<td><strong>17.00'W x 27.00'L x 2.04'H Field A</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>937 cf Overall - 171 cf Embedded = 766 cf x 35.0% Voids</td>
</tr>
<tr>
<td>#2A</td>
<td>240.80'</td>
<td>171 cf</td>
<td><strong>Cultec C-100HD</strong> x 12 Inside #1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Effective Size= 32.1&quot;W x 12.0&quot;H =&gt; 1.86 sf x 7.50'L = 14.0 cf</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Overall Size= 36.0&quot;W x 12.5&quot;H x 8.00'L with 0.50' Overlap</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Row Length Adjustment= +0.50' x 1.86 sf x 4 rows</td>
</tr>
</tbody>
</table>

439 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device Routing Invert Outlet Devices
#1 Discarded 240.30' **2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max = 0.03 cfs @ 11.56 hrs HW = 240.32' (Free Discharge)

↑-1=Exfiltration (Exfiltration Controls 0.03 cfs)
Pond INF-B: - Chamber Wizard Field A

Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)
Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf
Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
Row Length Adjustment= +0.50' x 1.86 sf x 4 rows

36.0" Wide + 12.0" Spacing = 48.0" C-C Row Spacing

3 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 23.00' Row Length +24.0" End Stone x 2 =
27.00' Base Length
4 Rows x 36.0" Wide + 12.0" Spacing x 3 + 12.0" Side Stone x 2 = 17.00' Base Width
6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

12 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 4 Rows = 171.3 cf Chamber Storage

937.1 cf Field - 171.3 cf Chambers = 765.9 cf Stone x 35.0% Voids = 268.1 cf Stone Storage

Chamber Storage + Stone Storage = 439.3 cf = 0.010 af
Overall Storage Efficiency = 46.9%
Overall System Size = 27.00' x 17.00' x 2.04'

12 Chambers
34.7 cy Field
28.4 cy Stone
Pond INF-B:

Inflow Area=2,200 sf
Peak Elev=241.35'
Storage=246 cf

Hydrograph
Summary for Subcatchment PROP:

Runoff = 1.87 cfs @ 12.17 hrs, Volume = 7,181 cf, Depth = 2.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type III 24-hr 10 yr storm Rainfall=4.55"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11,000</td>
<td>79</td>
<td>50-75% Grass cover, Fair, HSG C</td>
</tr>
<tr>
<td>1,270</td>
<td>98</td>
<td>Roofs, HSG C</td>
</tr>
<tr>
<td>*</td>
<td>98</td>
<td>Unconnected pavement, walk, HSG C</td>
</tr>
<tr>
<td>500</td>
<td>98</td>
<td>Paved parking, HSG C</td>
</tr>
<tr>
<td>22,000</td>
<td>70</td>
<td>Woods, Good, HSG C</td>
</tr>
<tr>
<td>7,700</td>
<td>74</td>
<td>&gt;75% Grass cover, Good, HSG C</td>
</tr>
<tr>
<td>42,850</td>
<td>74</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>40,700</td>
<td></td>
<td>94.98% Pervious Area</td>
</tr>
<tr>
<td>2,150</td>
<td></td>
<td>5.02% Impervious Area</td>
</tr>
<tr>
<td>380</td>
<td></td>
<td>17.67% Unconnected</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tc (min)</th>
<th>Length (feet)</th>
<th>Slope (ft/ft)</th>
<th>Velocity (ft/sec)</th>
<th>Capacity (cfs)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.5</td>
<td>100</td>
<td>0.1000</td>
<td>0.15</td>
<td></td>
<td>Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10&quot;</td>
</tr>
<tr>
<td>0.7</td>
<td>200</td>
<td>0.1000</td>
<td>5.09</td>
<td></td>
<td>Shallow Concentrated Flow, Unpaved Kv= 16.1 fps</td>
</tr>
</tbody>
</table>

12.2 300 Total

Subcatchment PROP:

Type III 24-hr 10 yr storm Rainfall=4.55"
Runoff Area=42,850 sf
Runoff Volume=7,181 cf
Runoff Depth=2.01"
Flow Length=300'
Slope=0.1000 '/'
Tc=12.2 min
CN=74
Summary for Subcatchment ROOF:

Runoff = 0.23 cfs @ 12.07 hrs, Volume = 791 cf, Depth = 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span = 0.00-30.00 hrs, dt = 0.02 hrs
Type III 24-hr 10 yr storm Rainfall=4.55"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,200</td>
<td>98</td>
<td>Roofs, HSG C</td>
</tr>
<tr>
<td>2,200</td>
<td>100.00% Impervious Area</td>
<td></td>
</tr>
</tbody>
</table>

Tc = 5.0 min

Subcatchment ROOF:

Type III 24-hr 10 yr storm Rainfall=4.55"
Runoff Area=2,200 sf
Runoff Volume=791 cf
Runoff Depth=4.31"
Tc=5.0 min
CN=98
Summary for Pond T.D.:

Inflow Area = 4,050 sf, 100.00% Impervious, Inflow Depth = 4.31” for 10 yr storm event
Inflow = 0.43 cfs @ 12.07 hrs, Volume= 1,456 cf
Outflow = 0.43 cfs @ 12.07 hrs, Volume= 1,456 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.43 cfs @ 12.07 hrs, Volume= 1,456 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Peak Elev= 234.28’ @ 12.07 hrs

<table>
<thead>
<tr>
<th>Device</th>
<th>Routing</th>
<th>Invert</th>
<th>Outlet Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>Primary</td>
<td>233.70’</td>
<td>6.0” Round Culvert</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>L= 10.0’ CPP, projecting, no headwall, Ke= 0.900</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Inlet / Outlet Invert= 233.70’ / 233.60’ S= 0.0100 '/' Cc= 0.900</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf</td>
</tr>
</tbody>
</table>

Primary OutFlow Max=0.42 cfs @ 12.07 hrs HW=234.27’ (Free Discharge)
1=Culvert (Inlet Controls 0.42 cfs @ 2.16 fps)

Pond T.D.:

Inflow Area=4,050 sf
Peak Elev=234.28’
6.0” Round Culvert
n=0.010
L=10.0’
S=0.0100 '/'
Type III 24-hr  100 yr storm Rainfall=6.50"

Prepared by Frederick W. Russell, PE
HydroCAD® 10.00-24  s/n 04321  © 2018 HydroCAD Software Solutions LLC

Time span=0.00-30.00 hrs, dt=0.02 hrs, 1501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DRIVEWAY:
Runoff Area=4,050 sf  100.00% Impervious  Runoff Depth=6.26"
Tc=5.0 min  CN=98  Runoff=0.61 cfs  2,113 cf

Subcatchment EXIST:
Runoff Area=49,100 sf  5.50% Impervious  Runoff Depth=3.61"
Flow Length=300’  Slope=0.1000 '/'  Tc=12.2 min  CN=74  Runoff=3.90 cfs  14,769 cf

Pond INF-A:
Peak Elev=235.16’  Storage=773 cf  Inflow=0.61 cfs  2,113 cf
Outflow=0.05 cfs  2,113 cf

Pond INF-B:
Peak Elev=242.17’  Storage=412 cf  Inflow=0.33 cfs  1,148 cf
Outflow=0.03 cfs  1,148 cf

Subcatchment PROP:
Runoff Area=42,850 sf  5.02% Impervious  Runoff Depth=3.61"
Flow Length=300’  Slope=0.1000 '/'  Tc=12.2 min  CN=74  Runoff=3.40 cfs  12,889 cf

Subcatchment ROOF:
Runoff Area=2,200 sf  100.00% Impervious  Runoff Depth=6.26"
Tc=5.0 min  CN=98  Runoff=0.33 cfs  1,148 cf

Pond T.D.:
Peak Elev=234.62’  Inflow=0.61 cfs  2,113 cf
6.0” Round Culvert  n=0.010  L=10.0’  S=0.0100 '/'  Outflow=0.61 cfs  2,113 cf

Total Runoff Area = 98,200 sf  Runoff Volume = 30,920 cf  Average Runoff Depth = 3.78"
88.70% Pervious = 87,100 sf  11.30% Impervious = 11,100 sf
Summary for Subcatchment DRIVEWAY:

Runoff = 0.61 cfs @ 12.07 hrs, Volume = 2,113 cf, Depth = 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span = 0.00-30.00 hrs, dt = 0.02 hrs
Type III 24-hr 100 yr storm Rainfall = 6.50"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,050</td>
<td>98</td>
<td>Paved parking, HSG C</td>
</tr>
<tr>
<td>4,050</td>
<td>100.00% Impervious Area</td>
<td></td>
</tr>
</tbody>
</table>

Tc Length Slope Velocity Capacity Description
--- --- --- --- --- ---
5.0   --- --- --- --- --- Direct Entry,

Subcatchment DRIVEWAY:

Hydrograph

Type III 24-hr 100 yr storm Rainfall = 6.50"
Runoff Area = 4,050 sf
Runoff Volume = 2,113 cf
Runoff Depth = 6.26"
Tc = 5.0 min
CN = 98
Summary for Subcatchment EXIST:

Runoff = 3.90 cfs @ 12.17 hrs, Volume = 14,769 cf, Depth = 3.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span = 0.00-30.00 hrs, dt = 0.02 hrs

Type III 24-hr 100 yr storm Rainfall=6.50"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11,400</td>
<td>79</td>
<td>50-75% Grass cover, Fair, HSG C</td>
</tr>
<tr>
<td>1,520</td>
<td>98</td>
<td>Roofs, HSG C</td>
</tr>
<tr>
<td>1,050</td>
<td>98</td>
<td>Paved parking, HSG C</td>
</tr>
<tr>
<td>130</td>
<td>98</td>
<td>Unconnected pavement, walk, HSG C</td>
</tr>
<tr>
<td>35,000</td>
<td>70</td>
<td>Woods, Good, HSG C</td>
</tr>
<tr>
<td>49,100</td>
<td>74</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>46,400</td>
<td></td>
<td>94.50% Pervious Area</td>
</tr>
<tr>
<td>2,700</td>
<td></td>
<td>5.50% Impervious Area</td>
</tr>
<tr>
<td>130</td>
<td></td>
<td>4.81% Unconnected</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tc (min)</th>
<th>Length (feet)</th>
<th>Slope (ft/ft)</th>
<th>Velocity (ft/sec)</th>
<th>Capacity (cfs)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.5</td>
<td>100</td>
<td>0.1000</td>
<td>0.15</td>
<td></td>
<td>Sheet Flow, Woods: Light underbrush n = 0.400 P2 = 3.10&quot;</td>
</tr>
<tr>
<td>0.7</td>
<td>200</td>
<td>0.1000</td>
<td>5.09</td>
<td></td>
<td>Shallow Concentrated Flow, Unpaved Kv = 16.1 fps</td>
</tr>
</tbody>
</table>

12.2 300 Total

Subcatchment EXIST:

Hydrograph

Type III 24-hr 100 yr storm Rainfall=6.50"
Runoff Area = 49,100 sf
Runoff Volume = 14,769 cf
Runoff Depth = 3.61"
Flow Length = 300'
Slope = 0.1000 '/'
Tc = 12.2 min
CN = 74
Summary for Pond INF-A:

Inflow Area = 4,050 sf, 100.00% Impervious, Inflow Depth = 6.26" for 100 yr storm event
Inflow = 0.61 cfs @ 12.07 hrs, Volume= 2,113 cf
Outflow = 0.05 cfs @ 11.14 hrs, Volume= 2,113 cf, Atten= 93%, Lag= 0.0 min
Discarded = 0.05 cfs @ 11.14 hrs, Volume= 2,113 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Peak Elev= 235.16' @ 13.08 hrs Surf.Area= 808 sf Storage= 773 cf

Plug-Flow detention time= 122.9 min calculated for 2,113 cf (100% of inflow)
Center-of-Mass det. time= 122.9 min (865.9 - 743.1)

<table>
<thead>
<tr>
<th>Volume</th>
<th>Invert</th>
<th>Avail.Storage</th>
<th>Storage Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1A</td>
<td>233.20'</td>
<td>458 cf</td>
<td><strong>17.00'W x 47.50'L x 2.04'H Field A</strong> 1,649 cf Overall - 339 cf Embedded = 1,310 cf x 35.0% Voids</td>
</tr>
<tr>
<td>#2A</td>
<td>233.70'</td>
<td>339 cf</td>
<td><strong>Cultec C-100HD</strong> x 24 Inside #1 Effective Size= 32.1&quot;W x 12.0&quot;H =&gt; 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0&quot;W x 12.5&quot;H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 4 rows</td>
</tr>
</tbody>
</table>

797 cf Total Available Storage

Storage Group A created with Chamber Wizard

<table>
<thead>
<tr>
<th>Device</th>
<th>Routing</th>
<th>Invert</th>
<th>Outlet Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>Discarded</td>
<td>233.20'</td>
<td><strong>2.410 in/hr Exfiltration over Surface area</strong></td>
</tr>
</tbody>
</table>

Discarded OutFlow Max=0.05 cfs @ 11.14 hrs HW=233.22' (Free Discharge)
↑1=Exfiltration (Exfiltration Controls 0.05 cfs)
Pond INF-A: - Chamber Wizard Field A

Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)
Effective Size= 32.1”W x 12.0”H => 1.86 sf x 7.50’L = 14.0 cf
Overall Size= 36.0”W x 12.5”H x 8.00’L with 0.50’ Overlap
Row Length Adjustment= +0.50’ x 1.86 sf x 4 rows

36.0” Wide + 12.0” Spacing = 48.0” C-C Row Spacing

6 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 45.50' Row Length +12.0'' End Stone x 2 =
47.50’ Base Length
4 Rows x 36.0'' Wide + 12.0'' Spacing x 3 + 12.0'' Side Stone x 2 = 17.00’ Base Width
6.0'' Base + 12.5'' Chamber Height + 6.0'' Cover = 2.04’ Field Height

24 Chambers x 14.0 cf +0.50’ Row Adjustment x 1.86 sf x 4 Rows = 338.8 cf Chamber Storage

1,648.6 cf Field - 338.8 cf Chambers = 1,309.9 cf Stone x 35.0% Voids = 458.4 cf Stone Storage

Chamber Storage + Stone Storage = 797.2 cf = 0.018 af
Overall Storage Efficiency = 48.4%
Overall System Size = 47.50’ x 17.00’ x 2.04’

24 Chambers
61.1 cy Field
48.5 cy Stone
Pond INF-A:

Hydrograph

Inflow Area=4,050 sf
Peak Elev=235.16'
Storage=773 cf
Summary for Pond INF-B:

Inflow Area = 2,200 sf, 100.00% Impervious, Inflow Depth = 6.26" for 100 yr storm event
Inflow = 0.33 cfs @ 12.07 hrs, Volume = 1,148 cf
Outflow = 0.03 cfs @ 11.18 hrs, Volume = 1,148 cf, Atten = 92%, Lag = 0.0 min
Discarded = 0.03 cfs @ 11.18 hrs, Volume = 1,148 cf

Routing by Stor-Ind method, Time Span = 0.00-30.00 hrs, dt = 0.02 hrs
Peak Elev = 242.17' @ 13.03 hrs  Surf.Area = 459 sf  Storage = 412 cf

Plug-Flow detention time = 113.6 min calculated for 1,147 cf (100% of inflow)
Center-of-Mass det. time = 113.5 min (856.6 - 743.1)

<table>
<thead>
<tr>
<th>Volume</th>
<th>Invert</th>
<th>Avail.Storage</th>
<th>Storage Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1A</td>
<td>240.30'</td>
<td>268 cf</td>
<td>17.00'W x 27.00'L x 2.04'H Field A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>937 cf Overall - 171 cf Embedded = 766 cf x 35.0% Voids</td>
</tr>
<tr>
<td>#2A</td>
<td>240.80'</td>
<td>171 cf</td>
<td>Cultec C-100HD x 12 Inside #1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Effective Size = 32.1&quot;W x 12.0&quot;H =&gt; 1.86 sf x 7.50'L = 14.0 cf</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Overall Size = 36.0&quot;W x 12.5&quot;H x 8.00'L with 0.50' Overlap</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Row Length Adjustment = +0.50' x 1.86 sf x 4 rows</td>
</tr>
</tbody>
</table>

439 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device Routing Invert Outlet Devices
#1 Discarded 240.30' 2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max = 0.03 cfs @ 11.18 hrs HW = 240.32' (Free Discharge)
1 = Exfiltration (Exfiltration Controls 0.03 cfs)
Pond INF-B: - Chamber Wizard Field A

**Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)**

- **Effective Size =** 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf
- **Overall Size =** 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
- **Row Length Adjustment =** +0.50' x 1.86 sf x 4 rows

36.0" Wide + 12.0" Spacing = 48.0" C-C Row Spacing

3 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 23.00' Row Length +24.0" End Stone x 2 = 27.00' Base Length

4 Rows x 36.0" Wide + 12.0" Spacing x 3 + 12.0" Side Stone x 2 = 17.00' Base Width

6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

12 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 4 Rows = 171.3 cf Chamber Storage

937.1 cf Field - 171.3 cf Chambers = 765.9 cf Stone x 35.0% Voids = 268.1 cf Stone Storage

Chamber Storage + Stone Storage = 439.3 cf = 0.010 af

Overall Storage Efficiency = 46.9%

Overall System Size = 27.00' x 17.00' x 2.04'

12 Chambers

34.7 cy Field

28.4 cy Stone
Pond INF-B:

Hydrograph

Inflow Area = 2,200 sf
Peak Elev = 242.17'
Storage = 412 cf
Summary for Subcatchment PROP:

Runoff = 3.40 cfs @ 12.17 hrs, Volume= 12,889 cf, Depth= 3.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type III 24-hr 100 yr storm Rainfall=6.50"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11,000</td>
<td>79</td>
<td>50-75% Grass cover, Fair, HSG C</td>
</tr>
<tr>
<td>1,270</td>
<td>98</td>
<td>Roofs, HSG C</td>
</tr>
<tr>
<td>*</td>
<td>98</td>
<td>Unconnected pavement, walk, HSG C</td>
</tr>
<tr>
<td>500</td>
<td>98</td>
<td>Paved parking, HSG C</td>
</tr>
<tr>
<td>22,000</td>
<td>70</td>
<td>Woods, Good, HSG C</td>
</tr>
<tr>
<td>7,700</td>
<td>74</td>
<td>&gt;75% Grass cover, Good, HSG C</td>
</tr>
<tr>
<td>42,850</td>
<td>74</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>40,700</td>
<td>94.98%</td>
<td>Pervious Area</td>
</tr>
<tr>
<td>2,150</td>
<td>74</td>
<td>&gt;75% Grass cover, Good, HSG C</td>
</tr>
<tr>
<td>380</td>
<td>5.02%</td>
<td>Impervious Area</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tc (min)</th>
<th>Length (feet)</th>
<th>Slope (ft/ft)</th>
<th>Velocity (ft/ft/sec)</th>
<th>Capacity (cfs)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.5</td>
<td>100</td>
<td>0.1000</td>
<td>0.15</td>
<td></td>
<td>Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10&quot;</td>
</tr>
<tr>
<td>0.7</td>
<td>200</td>
<td>0.1000</td>
<td>5.09</td>
<td></td>
<td>Shallow Concentrated Flow, Unpaved Kv= 16.1 fps</td>
</tr>
<tr>
<td>12.2</td>
<td>300</td>
<td>Total</td>
<td></td>
<td></td>
<td>3.40 cfs</td>
</tr>
</tbody>
</table>

Subcatchment PROP:

Hydrograph

Type III 24-hr
100 yr storm Rainfall=6.50"
Runoff Area=42,850 sf
Runoff Volume=12,889 cf
Runoff Depth=3.61"
Flow Length=300'
Slope=0.1000 '/'
Tc=12.2 min
CN=74
Summary for Subcatchment ROOF:

Runoff = 0.33 cfs @ 12.07 hrs, Volume = 1,148 cf, Depth = 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span = 0.00-30.00 hrs, dt = 0.02 hrs
Type III 24-hr 100 yr storm Rainfall=6.50"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,200</td>
<td>98</td>
<td>Roofs, HSG C</td>
</tr>
<tr>
<td>2,200</td>
<td>100.00% Impervious Area</td>
<td></td>
</tr>
</tbody>
</table>

Direct Entry,

Subcatchment ROOF:

Hydrograph

Type III 24-hr 100 yr storm Rainfall=6.50"
Runoff Area=2,200 sf
Runoff Volume=1,148 cf
Runoff Depth=6.26"
Tc=5.0 min
CN=98
Summary for Pond T.D.:

Inflow Area = 4,050 sf, 100.00% Impervious, Inflow Depth = 6.26" for 100 yr storm event
Inflow = 0.61 cfs @ 12.07 hrs, Volume= 2,113 cf
Outflow = 0.61 cfs @ 12.07 hrs, Volume= 2,113 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.61 cfs @ 12.07 hrs, Volume= 2,113 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Peak Elev= 234.62' @ 12.07 hrs

<table>
<thead>
<tr>
<th>Device</th>
<th>Routing</th>
<th>Invert</th>
<th>Outlet Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>Primary</td>
<td>233.70'</td>
<td>6.0&quot; Round Culvert</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>L= 10.0' CPP, projecting, no headwall, Ke= 0.900</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Inlet / Outlet Invert= 233.70' / 233.60' S= 0.0100 '/' Cc= 0.900</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf</td>
</tr>
</tbody>
</table>

Primary OutFlow Max=0.61 cfs @ 12.07 hrs HW=234.61' (Free Discharge)

---

Inflow Area=4,050 sf  
Peak Elev=234.62'  
6.0" Round Culvert  
n=0.010  
L=10.0'  
S=0.0100 '/'
147 Shade Street
Site Sensitive Development

Stormwater Operation & Maintenance Plan

January 7, 2020
Owner’s & Applicant’s Name(s) & Responsible for Maintenance until transfer:

Applicant/Owner:
Shumin W. Whu & Chen Ho
147 Shade Street
Lexington, MA 02420

Stormwater System Description:
The proposed drainage system consists of two (2) subsurface infiltration systems. Infiltration System-1 will recharge runoff generated by the proposed driveway and will contain twenty-four (24) Stormtech SC-310© chambers. Infiltration System-2 will recharge runoff generated by the proposed dwelling and will contain twelve (12) Stormtech SC-310© chambers.

Planned Erosion and Sedimentation Control Measures During construction Activities

Erosion Control
Tubular sediment control shall consist of a 12-inch minimum diameter, 100% organic hessian fabric (burlap), filled with compost. Sediment control shall be placed along the limit of work as indicated on the plan. 1-in by 1-in by 3-ft oak stakes shall be installed at 8-ft maximum intervals. Ends of sediment control should overlap a minimum of six inches as per detail.

Drain Inlet Protection
A temporary storm inlet protection, filter fabric, shall be placed in the proposed trench drain during construction. In addition, “silt sacks” shall be placed in any existing catch basins in Shade Street within 50 feet downstream of the project during construction. The purpose of the filter fabric and silt sacks is to prevent the inflow of sediments into the closed drainage system. The filter fabric and silt sacks shall remain in place until the proposed driveway is paved and a permanent vegetative cover is established, so that the transport of sediment is no longer visibly apparent. The filter fabric and silt sacks shall be inspected and maintained on a weekly basis, while in place.

Surface Stabilization
The surface of all disturbed areas shall be stabilized during and after construction. Temporary measures shall be taken during construction to prevent erosion and siltation. No construction sediment shall be allowed to enter the infiltration system. All disturbed slopes will be stabilized with a permanent vegetative cover. Some or all of the following measures will be utilized on this project as conditions may warrant.

a. Temporary Seeding
b. Temporary Mulching
c. Permanent Seeding
d. Placement of Sod
e. Hydoseeding
f. Placement of Hay
g. Placement of Jute Netting

**Subsurface Infiltration Systems:**
Erosion controls (such as haybales or silt fencing) and temporary swales should be installed around the perimeter of the excavation to collect and/or divert runoff containing fines and sediments from entering the infiltration system during construction. The existing subgrade under the system bed area shall not be compacted or subject to excessive construction equipment traffic. Once the site is stabilized and final grade over the system is established, ensure that proper signs and/or barricades around the system are installed to avoid compaction or vehicular traffic over the system. During construction, the Infiltration Systems should be inspected weekly and after every major storm event. Ponded water inside the system (as visible from the observation wells) after several days often indicates that the bottom of the system is clogged. If the system is found to be clogged, flushing and vacuuming of the system using a sewer vacuum truck will be required (search “sewer vacuum truck services”).

**Long-Term Inspection and Maintenance Measures After Construction**

**Erosion Control**
Eroded sediments can adversely affect the performance of the stormwater management system. Eroding or barren areas should be immediately re-vegetated.

**Subsurface Infiltration Systems:**
The subsurface infiltration system should be inspected after the first several rainfall events or a few months after construction, after all major storms (>3.1 inches), and on regular bi-annual (April and October) scheduled dates. Ponded water inside the system (as visible from the observation wells) after several days often indicates that the bottom of the system is clogged. If the system is found to be clogged, flushing and vacuuming of the system using a sewer vacuum truck will be required (search “sewer vacuum truck services”).

**Inspection and Maintenance of Trench Drain:**
The trench drain shall be inspected two (2) times per year, and if necessary, any maintenance shall be performed so that it functions as designed. The trench drain shall be cleaned twice per year, or as necessary. Outlet pipe should also be checked for clogging. At a minimum, inspection of the trench drain shall be performed during April and October each year.
**Inspection and Maintenance of Sediment Basin:**
The sediment basin shall be inspected two (2) times per year, and if necessary, any maintenance shall be performed so that it functions as designed. The sediment basin shall be cleaned twice per year, and when sediment in the bottom of the sump reaches within 2 inches below the bottom of the outlet. Inlet and outlet pipes should be checked for clogging. At a minimum, inspection of the sediment basin shall be performed during the last week of April and the first week of October each year.

**Debris and Leaf Removal:**
Roof gutters should be inspected every April and October and cleaned of any debris and leaves. Installation of “gutter guards” or similar material is recommended.

**Erosion Control**
Once all areas are stabilized, tubular sediment erosion control shall be cut and compost spread evenly. Burlap sock shall be removed and disposed of accordingly.