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# STORMWATER REPORT

FOR

Demolition of an Existing Dwelling and Construction of  
a New Dwelling at

**73 KINGLAND ROAD  
STOW, MASSACHUSETTS**

Assessors Map U-04 Parcel 66



June 5, 2023

**Prepared for:**

Dion Family Revocable Nominee Trust  
73 Kingland Road  
Stow, Massachusetts 01775

**Prepared by:**

FORESITE Engineering Associates, Inc.  
16 Gleasondale Road, Suite 1-1  
Stow, Massachusetts 01775

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## **I. Introduction**

73 Kingland Road (Stow Assessor's Map U-04 Parcel 66) is the site of an existing single-family home in the Residential Zone on Lake Boon constructed in 1925. A special permit is sought under Zoning Bylaw Section 4.1.6 for demolition of the existing dwelling and construction of a new dwelling on the lot. A special permit is required because the lot is dimensionally non-conforming for current minimum frontage (191.54' existing; 200-ft min. required) and area (41,273 sq.ft. existing; 65,340 sq.ft. min. required) in the Residential Zone.

The proposed dwelling will be located substantially in the same location as the existing dwelling with a larger footprint. All proposed construction will occur within the existing developed dwelling/driveway/yard area with only minor grade changes and tree removal required for construction. By limiting grade and surface cover changes to the site, drainage patterns are not substantially altered by redevelopment, however, increases in impervious roof cover would increase the rate and volume of runoff from the site if unmitigated. To mitigate this impact, a roof infiltration system is proposed to infiltrate roof runoff and reduce runoff rates and volumes from the site to similar or lesser amounts following construction. Subsurface infiltration for recharge of roof runoff takes advantage of the well-drained soils and relatively deep-water table on site to effectively mitigate runoff rates and volumes from the site.

Erosion and sediment from construction activities will be mitigated by installation of a staked straw wattle erosion control barrier surrounding the down-gradient limit of work to prevent soil erosion and sediment migration.

## II. Methodology & References

### *Methodology:*

SCS TR-55 & SCS TR-20 utilizing HydroCAD (ver. 10) software.

### *References:*

A Guide to Hydrologic Analysis Using SCS Methods, Richard McCuen, copyright 1982, Prentice Hall, Inc.

USGS Quadrangle Hudson, Massachusetts, 1987

Natural Resources Conservation Service (NRCS), Web Soil Survey

Rawls (1982) Infiltration Rates

Northeast Regional Climate Center (NRCC) Rainfall Data

### **III. Results**

The drainage study area is limited to the effect of the increase in proposed impervious roof area since all other characteristics of the site (lawn/yard area, driveway, etc.) are not being substantially altered by the project. Increase in roof impervious area is the only substantial change occurring in site surface cover. The existing roof area is approximately 1,800 sq.ft. and runs off from the site unmitigated. The proposed roof area is more than double the existing roof area at 5,060 sq.ft., and, if unmitigated, this increase in roof area would substantially increase rates and volumes of runoff from the site.

The proposed roof areas are separated into two subcatchment areas that each represent half of the proposed roof areas (Sub 1S = rear ½ of roof; Sub 2S = front ½ of roof). These areas are directed to the modeled subsurface roof infiltration beds (Pond 10P (rear), Pond 11P (front)) which have been sized to detain and infiltrate fully a 10-yr, 24-hr rainfall event and effectively reduce rate and volume of runoff from a 100-yr, 24-hr rainfall event. Reach 50R represents the total off-site rate and volume of flow from proposed roof drywell overflow during a 100-yr, 24-hr storm event.

The off-site areas were analyzed for rate and volume of runoff under existing conditions for the 2-yr, 10-yr and 100-yr, 24-hr design storms. Under post-development conditions increases in runoff from the proposed roof area are controlled through the proposed roof drywell system.

### **Conclusions**

The calculations demonstrate that the proposed drainage system for the redevelopment of 73 Kingland Road will adequately manage increases in rate and volume of runoff and meet the requirements of Stow Zoning Bylaw Section 3.8.1.9 (Drainage).

(AYER)

071° 29' 24.03" W  
 042° 24' 49.39" N

(STERLING)

(MAYNARD)



042° 23' 25.60" N  
 071° 30' 44.13" W

(MARLBOROUGH)  
 SCALE 1:12000

Copyright (C) 2009 MyTopo, 2006-2023 TomTom  
 Printed: Thu Jun 01, 2023  
 071° 29' 24.03" W  
 042° 23' 25.60" N

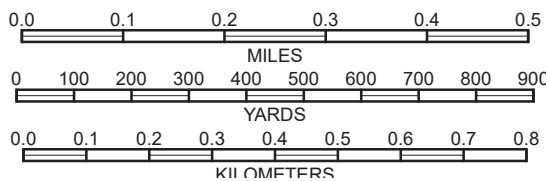
(FRAMINGHAM)

(WORCESTER  
 NORTH)

Produced by MyTopo Terrain Navigator  
 Topography based on USGS 1:24,000  
 Maps

North American 1983 Datum (NAD83)  
 Universal Transverse Mercator Projection

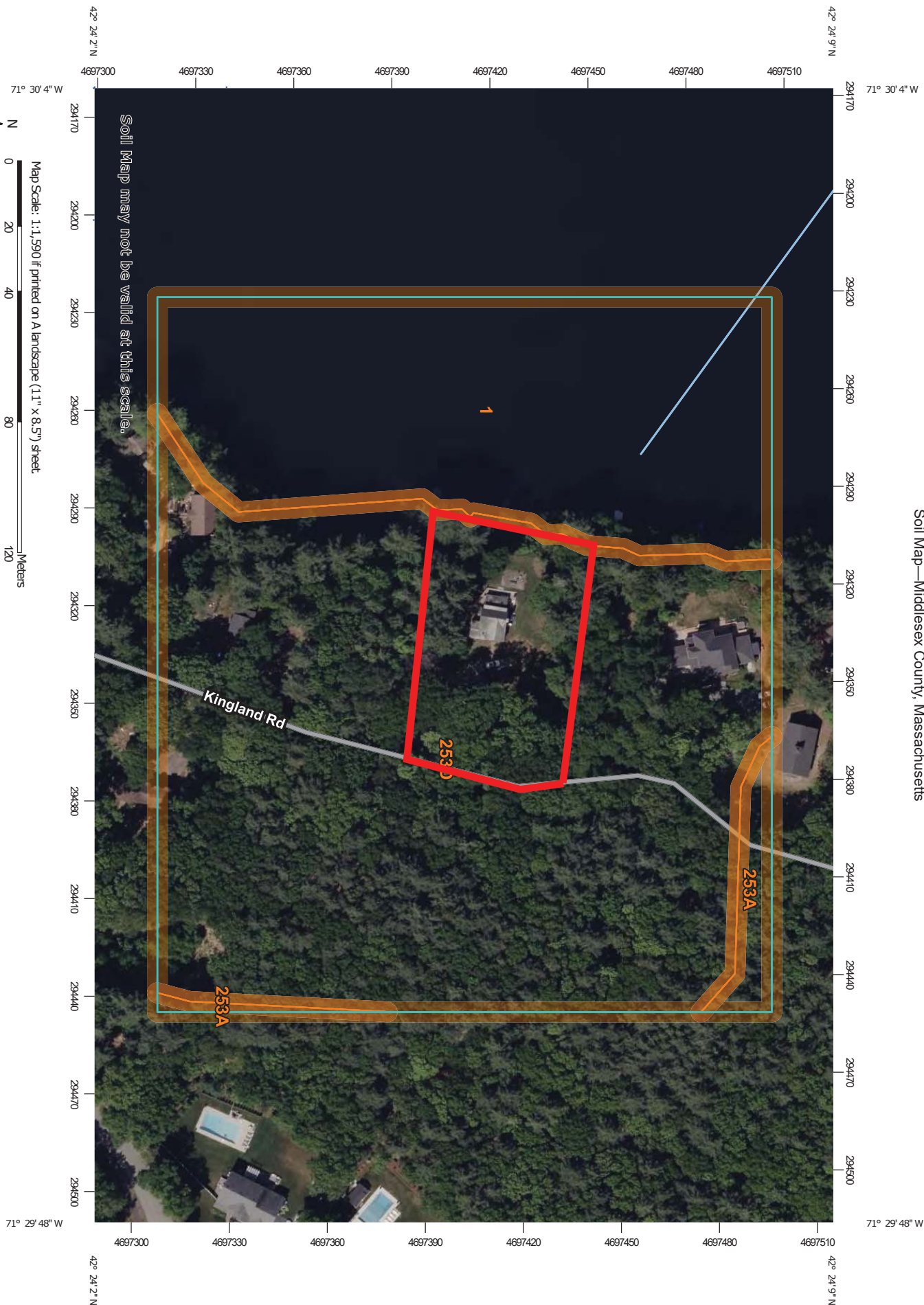
To place on the predicted North American  
 1927 move the projection lines 10M N and  
 40M E



CONTOUR INTERVAL 3 METERS  
 NATIONAL GEODETIC VERTICAL DATUM 1929

HUDSON, MA  
 1999

Soil Map—Middlesex County, Massachusetts



Soil Map may not be valid at this scale.

Map Scale: 1:1,590 if printed on A landscape (11" x 8.5") sheet  
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84



## Map Unit Legend

| Map Unit Symbol                    | Map Unit Name                                | Acres in AOI | Percent of AOI |
|------------------------------------|--|--------------|----------------|
| 1                                  | Water  | 3.2          | 31.1%          |
| 253A                               | Hinckley loamy sand, 0 to 3 percent slopes   | 0.3          | 2.5%           |
| 253D                               | Hinckley loamy sand, 15 to 25 percent slopes | 6.8          | 66.4%          |
| <b>Totals for Area of Interest</b> |  | <b>10.2</b>  | <b>100.0%</b>  |



Table D.13.1 Hydrologic Soil Properties Classified by Soil Texture\*

| Texture Class   | Effective Water Capacity ( $C_w$ )<br>(inch per inch) | Minimum Infiltration Rate ( $f$ )<br>(inches per hour) | Hydrologic Soil Grouping |
|-----------------|---|--|--------------------------|
| Sand            | 0.35  | 8.27   | A                        |
| Loamy Sand      | 0.31  | 2.41   | A                        |
| Sandy Loam      | 0.25  | 1.02   | A                        |
| Loam            | 0.19  | 0.52   | B                        |
| Silt Loam       | 0.17  | 0.27   | B                        |
| Sandy Clay Loam | 0.14  | 0.17   | C                        |
| Clay Loam       | 0.14  | 0.09   | D                        |
| Silty Clay Loam | 0.11  | 0.06   | D                        |
| Sandy Clay      | 0.09  | 0.05   | D                        |
| Silty Clay      | 0.09  | 0.04   | D                        |
| Clay            | 0.08  | 0.02   | D                        |

\* Source: Rawls, Brakensiek and Saxton, 1982

Based on the soil textural classes and the corresponding minimum infiltration rates, a restriction is established to eliminate unsuitable soil conditions. Soil textures with minimum infiltration rates less than 0.52 inches per hour are not suitable for usage of infiltration practices. These include soils that have a 30 percent clay content, making these soils susceptible to frost heaving and structurally unstable, in addition to having a poor capacity to percolate runoff. Soil textures that are recommended for infiltration systems include those soils with infiltration rates of 0.52 inches per hour or greater, which include loam, sandy loam, loamy sand, and sand.



# CULTEC Recharger® 330XLHD Stormwater Chamber

The Recharger® 330XLHD is a 30.5" (775 mm) tall, high capacity chamber. Typically when using this model, fewer chambers are required resulting in less labor and a smaller installation area. The Recharger® 330XLHD has the side portal internal manifold feature. HVLV® FC-24 Feed Connectors are inserted into the side portals to create the internal manifold.



|                                    |   |
|------------------------------------|---|
| Size (L x W x H)                   | 8.5' x 52" x 30.5"<br>2.59 m x 1321 mm x 775 mm   |
| Installed Length                   | 7'<br>2.13 m  |
| Length Adjustment per Run          | 1.50'<br>0.46 m   |
| Chamber Storage                    | 7.46 ft <sup>3</sup> /ft<br>0.69 m <sup>3</sup> /m<br>52.21 ft <sup>3</sup> /unit<br>1.48 m <sup>3</sup> /unit  |
| Min. Installed Storage             | 11.32 ft <sup>3</sup> /ft<br>1.05 m <sup>3</sup> /m<br>79.26 ft <sup>3</sup> /unit<br>2.24 m <sup>3</sup> /unit |
| Min. Area Required                 | 33.83 ft <sup>2</sup><br>3.14 m <sup>2</sup>  |
| Chamber Weight                     | 73.0 lbs<br>33.11 kg  |
| Shipping                           | 30 chambers/skid<br>2,335 lbs/skid<br>10 skids/48' flatbed  |
| Min. Center-to-Center Spacing      | 4.83'<br>1.47 m   |
| Max. Allowable Cover               | 12'<br>3.66 m   |
| Max. Inlet Opening in End Wall     | 24" HDPE, PVC<br>600 mm HDPE, PVC   |
| Max. Allowable O.D. in Side Portal | 10" HDPE, 12" PVC<br>250 mm HDPE, 300 mm PVC  |
| Compatible Feed Connector          | HVLV FC-24 Feed Connector   |

Calculations are based on installed chamber length.  
All above values are nominal.  
Min. installed storage includes 6" (152 mm) stone base, 6" (152 mm) stone above crown of chamber and typical stone surround at 58" (1473 mm) center-to-center spacing.

|                                       | Stone Foundation Depth                       |  |  |
|---------------------------------------|--|--|--|
|                                       | 6"<br>152 mm                                 | 12"<br>305 mm                                | 18"<br>457 mm                                |
| Chamber and Stone Storage Per Chamber | 79.26 ft <sup>3</sup><br>2.24 m <sup>3</sup> | 86.03 ft <sup>3</sup><br>2.44 m <sup>3</sup> | 92.79 ft <sup>3</sup><br>2.63 m <sup>3</sup> |
| Min. Effective Depth                  | 3.54'<br>1.08 m                              | 4.04'<br>1.23 m                              | 4.54'<br>1.38 m                              |
| Stone Required Per Chamber            | 2.50 yd <sup>3</sup><br>1.91 m <sup>3</sup>  | 3.13 yd <sup>3</sup><br>2.39 m <sup>3</sup>  | 3.76 yd <sup>3</sup><br>2.87 m <sup>3</sup>  |

Calculations are based on installed chamber length.  
Includes 6" (305 mm) stone above crown of chamber and typical stone surround at 58" (1473 mm) center-to-center spacing and stone foundation as listed in table.  
Stone void calculated at 40%.

Recharger® 330XLHD Bare Chamber Storage Volumes

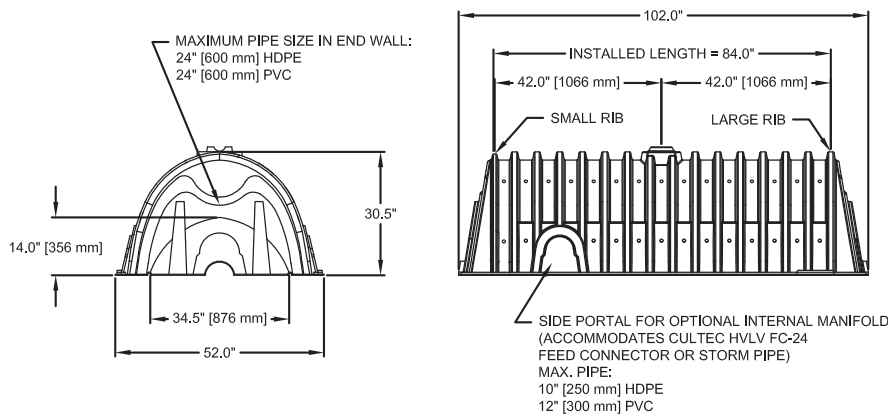
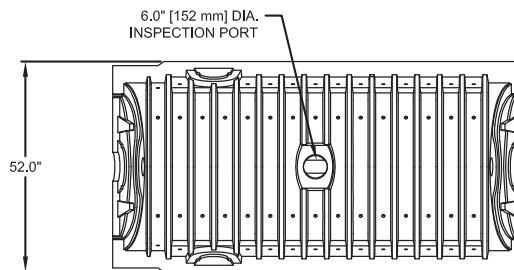
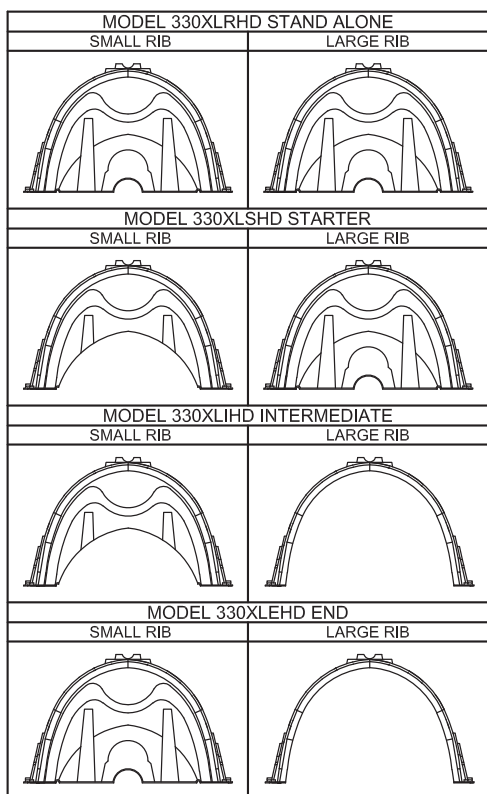
| Elevation |     | Incremental Storage Volume |                   |                 |                | Cumulative Storage |                |
|-----------|-----|----------------------------|-------------------|-----------------|----------------|--------------------|----------------|
| in.       | mm  | ft <sup>3</sup> /ft        | m <sup>3</sup> /m | ft <sup>3</sup> | m <sup>3</sup> | ft <sup>3</sup>    | m <sup>3</sup> |
| 30.5      | 775 | 0.000                      | 0.000             | 0.000           | 0.000          | 52.213             | 1.479          |
| 30        | 762 | 0.019                      | 0.002             | 0.133           | 0.004          | 52.213             | 1.479          |
| 29        | 737 | 0.051                      | 0.005             | 0.357           | 0.010          | 52.080             | 1.475          |
| 28        | 711 | 0.084                      | 0.008             | 0.588           | 0.017          | 51.723             | 1.465          |
| 27        | 686 | 0.124                      | 0.012             | 0.868           | 0.025          | 51.135             | 1.448          |
| 26        | 660 | 0.150                      | 0.014             | 1.05            | 0.030          | 50.267             | 1.424          |
| 25        | 635 | 0.173                      | 0.016             | 1.211           | 0.034          | 49.217             | 1.394          |
| 24        | 609 | 0.191                      | 0.018             | 1.337           | 0.038          | 48.006             | 1.360          |
| 23        | 584 | 0.207                      | 0.019             | 1.449           | 0.041          | 46.669             | 1.322          |
| 22        | 559 | 0.221                      | 0.021             | 1.547           | 0.044          | 45.220             | 1.281          |
| 21        | 533 | 0.233                      | 0.022             | 1.631           | 0.046          | 43.673             | 1.237          |
| 20        | 508 | 0.244                      | 0.023             | 1.708           | 0.048          | 42.042             | 1.191          |
| 19        | 483 | 0.254                      | 0.024             | 1.778           | 0.050          | 40.334             | 1.142          |
| 18        | 457 | 0.264                      | 0.025             | 1.848           | 0.052          | 38.556             | 1.092          |
| 17        | 432 | 0.271                      | 0.025             | 1.897           | 0.054          | 36.708             | 1.040          |
| 16        | 406 | 0.283                      | 0.026             | 1.981           | 0.056          | 34.811             | 0.986          |
| 15        | 381 | 0.294                      | 0.027             | 2.058           | 0.058          | 32.830             | 0.930          |
| 14        | 356 | 0.296                      | 0.027             | 2.072           | 0.059          | 30.772             | 0.871          |
| 13        | 330 | 0.299                      | 0.028             | 2.093           | 0.059          | 28.700             | 0.813          |
| 12        | 305 | 0.301                      | 0.028             | 2.107           | 0.060          | 26.607             | 0.754          |
| 11        | 279 | 0.303                      | 0.028             | 2.121           | 0.060          | 24.500             | 0.694          |
| 10        | 254 | 0.304                      | 0.028             | 2.128           | 0.060          | 22.379             | 0.634          |
| 9         | 229 | 0.306                      | 0.028             | 2.142           | 0.061          | 20.251             | 0.574          |
| 8         | 203 | 0.313                      | 0.029             | 2.191           | 0.062          | 18.109             | 0.513          |
| 7         | 178 | 0.321                      | 0.030             | 2.247           | 0.064          | 15.918             | 0.451          |
| 6         | 152 | 0.322                      | 0.030             | 2.254           | 0.064          | 13.671             | 0.387          |
| 5         | 127 | 0.323                      | 0.030             | 2.261           | 0.064          | 11.417             | 0.323          |
| 4         | 102 | 0.324                      | 0.030             | 2.268           | 0.064          | 9.156              | 0.259          |
| 3         | 76  | 0.325                      | 0.030             | 2.275           | 0.064          | 6.888              | 0.195          |
| 2         | 51  | 0.327                      | 0.030             | 2.289           | 0.065          | 4.613              | 0.131          |
| 1         | 25  | 0.332                      | 0.031             | 2.324           | 0.066          | 2.324              | 0.066          |
| Total     |     | 7.459                      | 0.693             | 52.213          | 1.479          | 52.213             | 1.479          |

Calculations are based on installed chamber length.

Visit <http://cultec.com/downloads/> for Product Downloads and CAD details.

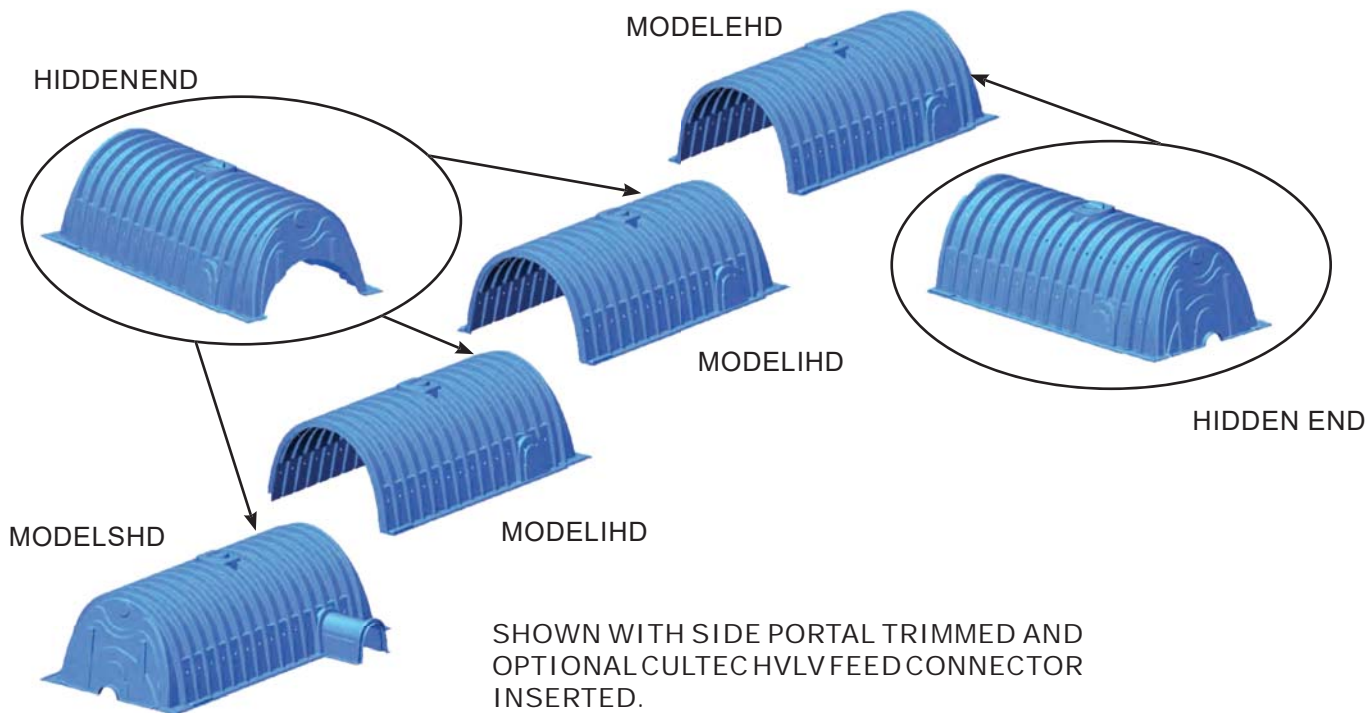
For more information, contact CULTEC at (203) 775-4416 or visit [www.cultec.com](http://www.cultec.com).

## Three View Drawing

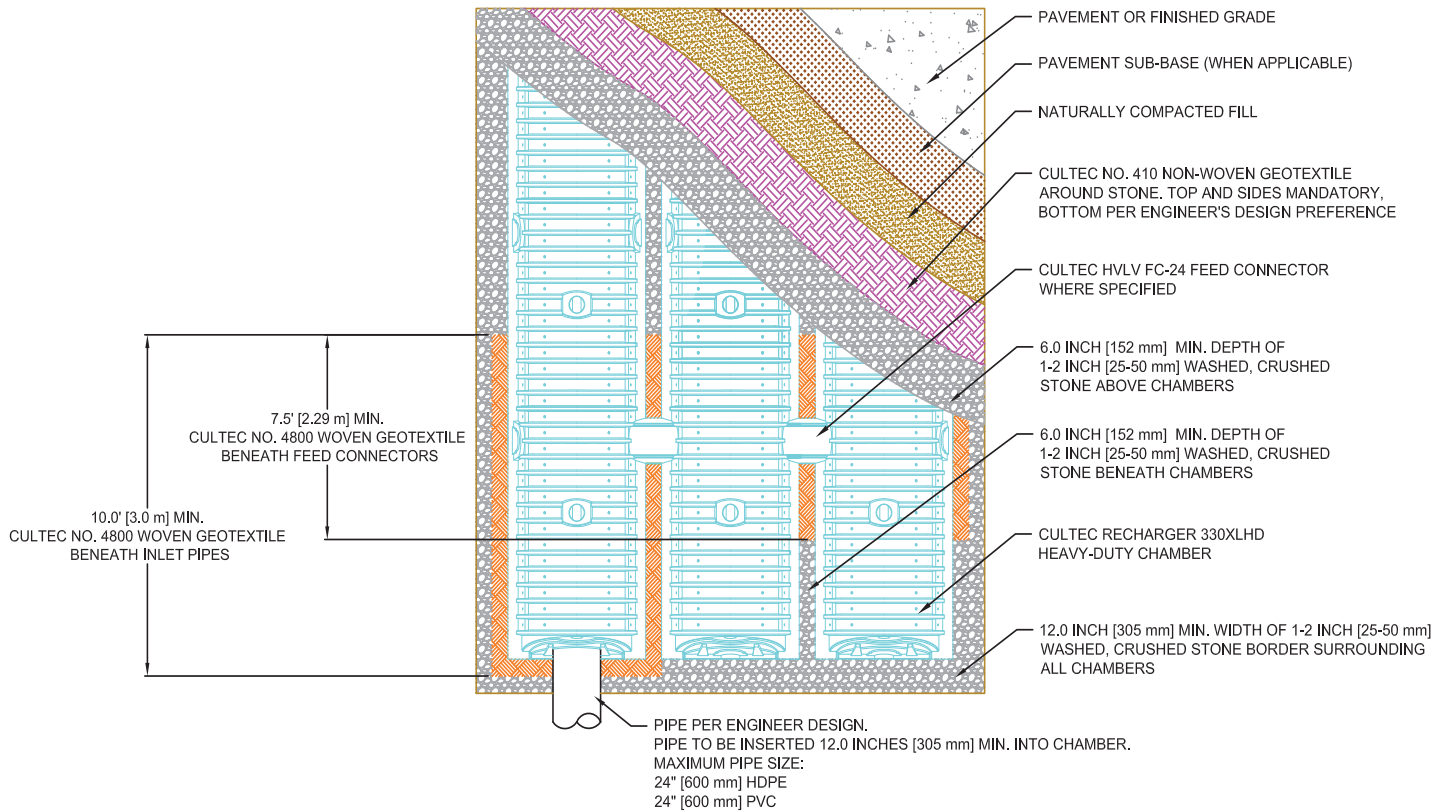


CULTEC RECHARGER 330XLHD CHAMBER STORAGE = 7.459 CF/FT [0.693 m³/m]  
 INSTALLED LENGTH ADJUSTMENT = 1.5" [0.46 m]  
 SIDE PORTAL ACCEPTS CULTEC HVLV FC-24 FEED CONNECTOR

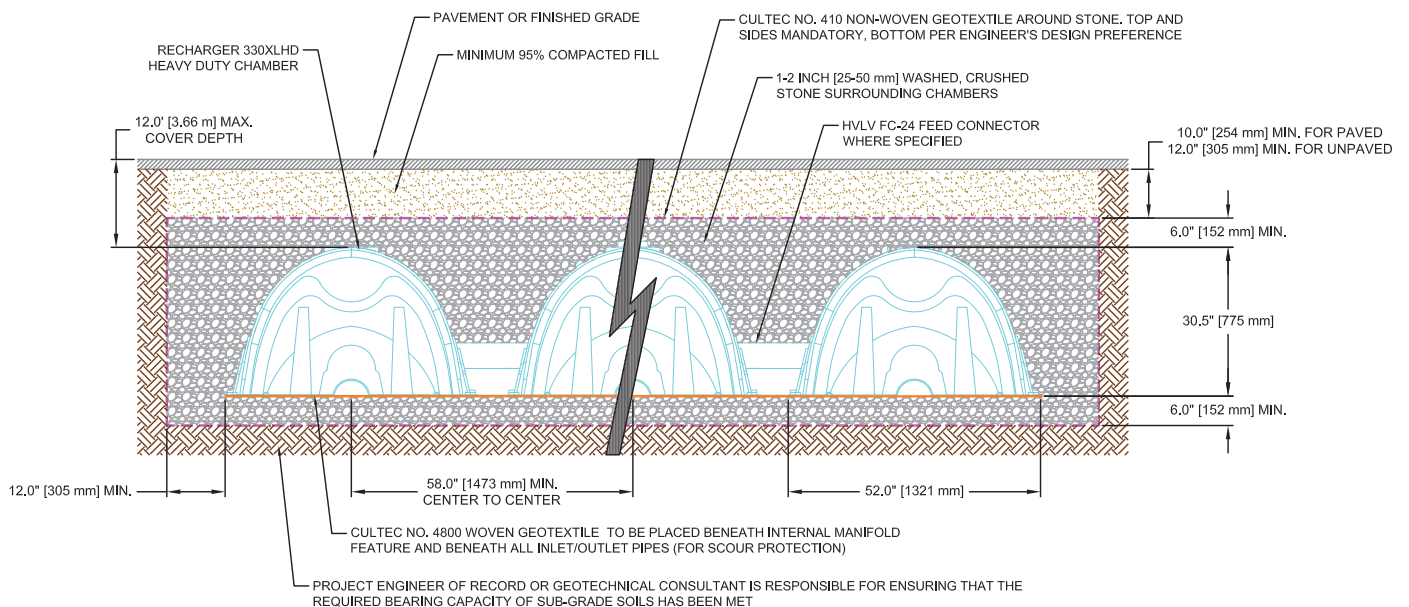
## Typical Interlock Installation



## Plan View Drawing



## Typical Cross Section for Traffic Application





## CULTEC Recharger® 330XLHD Specifications

### GENERAL

CULTEC Recharger® 330XLHD chambers are designed for underground stormwater management. The chambers may be used for retention, recharging, detention or controlling the flow of on-site stormwater runoff.

### CHAMBER PARAMETERS

1. The chambers shall be manufactured in the U.S.A. by CULTEC, Inc. of Brookfield, CT (cultec.com, 203-775-4416).
2. The chamber shall be vacuum thermoformed of polyethylene with a black interior and blue exterior.
3. The chamber shall be arched in shape.
4. The chamber shall be open-bottomed.
5. The chamber shall be joined using an interlocking overlapping rib method. Connections must be fully shouldered overlapping ribs, having no separate couplings or separate end walls.
6. The nominal chamber dimensions of the CULTEC Recharger® 330XLHD shall be 30.5 inches (775 mm) tall, 52 inches (1321 mm) wide and 8.5 feet (2.59 m) long. The installed length of a joined Recharger® 330XLHD shall be 7 feet (2.13 m).
7. Maximum inlet opening on the chamber end wall is 24 inches (600 mm) HDPE, PVC.
8. The chamber shall have two side portals to accept CULTEC HVLV® FC-24 Feed Connectors to create an internal manifold. Maximum allowable O.D. in the side portal is 10 inches (250 mm) HDPE and 12 inches (300 mm) PVC.
9. The nominal chamber dimensions of the CULTEC HVLV® FC-24 Feed Connector shall be 12 inches (305 mm) tall, 16 inches (406 mm) wide and 24.2 inches (614 mm) long.
10. The nominal storage volume of the Recharger® 330XLHD chamber shall be 7.459 ft<sup>3</sup> / ft (0.693 m<sup>3</sup> / m) - without stone. The nominal storage volume of a single Recharger® 330XLHD Stand Alone unit shall be 63.40 ft<sup>3</sup> (1.80 m<sup>3</sup>) - without stone. The nominal storage volume of a joined Recharger® 330XLHD Intermediate unit shall be 52.213 ft<sup>3</sup> (1.478 m<sup>3</sup>) - without stone. The nominal storage volume of the length adjustment amount per run shall be 11.19 ft<sup>3</sup> (1.04 m<sup>3</sup>) - without stone.
11. The nominal storage volume of the HVLV® FC-24 Feed Connector shall be 0.913 ft<sup>3</sup> / ft (0.026 m<sup>3</sup> / m) - without stone.
12. The Recharger® 330XLHD chamber shall have fifty-six discharge holes bored into the sidewalls of the unit's core to promote lateral conveyance of water.
13. The Recharger® 330XLHD chamber shall have 16 corrugations.
14. The end wall of the chamber, when present, shall be an integral part of the continuously formed unit. Separate end plates cannot be used with this unit.
15. The Recharger® 330XLHD Stand Alone unit must be formed as a whole chamber having two fully formed integral end walls and having no separate end plates or separate end walls.
16. The Recharger® 330XLHD Starter unit must be formed as a whole chamber having one fully formed integral end wall and one partially formed integral end wall with a lower transfer opening of 14 inches (356 mm) high x 34.5 inches (876 mm) wide.
17. The Recharger® 330XLHD Intermediate unit must be formed as a whole chamber having one fully open end wall and one partially formed integral end wall with a lower transfer opening of 14 inches (356 mm) high x 34.5 inches (876 mm) wide.
18. The Recharger® 330XLHD End unit must be formed as a whole chamber having one fully formed integral end wall and one fully open end wall and having no separate end plates or end walls.
19. The HVLV® FC-24 Feed Connector must be formed as a whole chamber having two open end walls and having no separate end plates or separate end walls. The unit shall fit into the side portals of the Recharger® 330XLHD and act as cross feed connections.
20. Chambers must have horizontal stiffening flex reduction steps between the ribs.
21. The chamber shall have a raised integral cap at the top of the arch in the center of each unit to be used as an optional inspection port or clean-out.
22. The units may be trimmed to custom lengths by cutting back to any corrugation on the large rib end.
23. The chamber shall be manufactured in an ISO 9001:2015 certified facility.
24. The chamber shall be designed and manufactured to meet the material and structural requirements of IAPMO PS 63-2019, including resistance to AASHTO H-10 and H-20 highway live loads, when installed in accordance with CULTEC's installation instructions.
25. The chamber shall be designed and manufactured in accordance with the specifications of NSAI Irish Agreement Board Certificate for Cultec Attenuation and Infiltration.
26. Maximum allowable cover over the top of the chamber shall be 12' (3.66 m).
27. The chamber shall be designed to withstand traffic loads when installed according to CULTEC's recommended installation instructions.

## **Drywell Operation & Maintenance Plan**

The property owner of record shall be responsible for the design, performance, operation, and maintenance of the drywell system proposed for this site. Drywells that cease to drain in a 48-hour period due to clogging shall be replaced by the owner.

### **Drywell Inspection**

Drywell inspections are to be performed annually by the owner or whenever ponding is still evident 48 hours after a storm. The inspection procedure should include visual inspection of roof gutter for accumulation of debris and removal of the inspection port cover and inspection of the interior of the system. Inspections shall be documented with a written report and kept on file by the drywell facility owner. Annual inspection reports should also be sent to the Weston Stormwater Engineer.

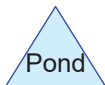
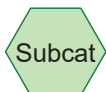
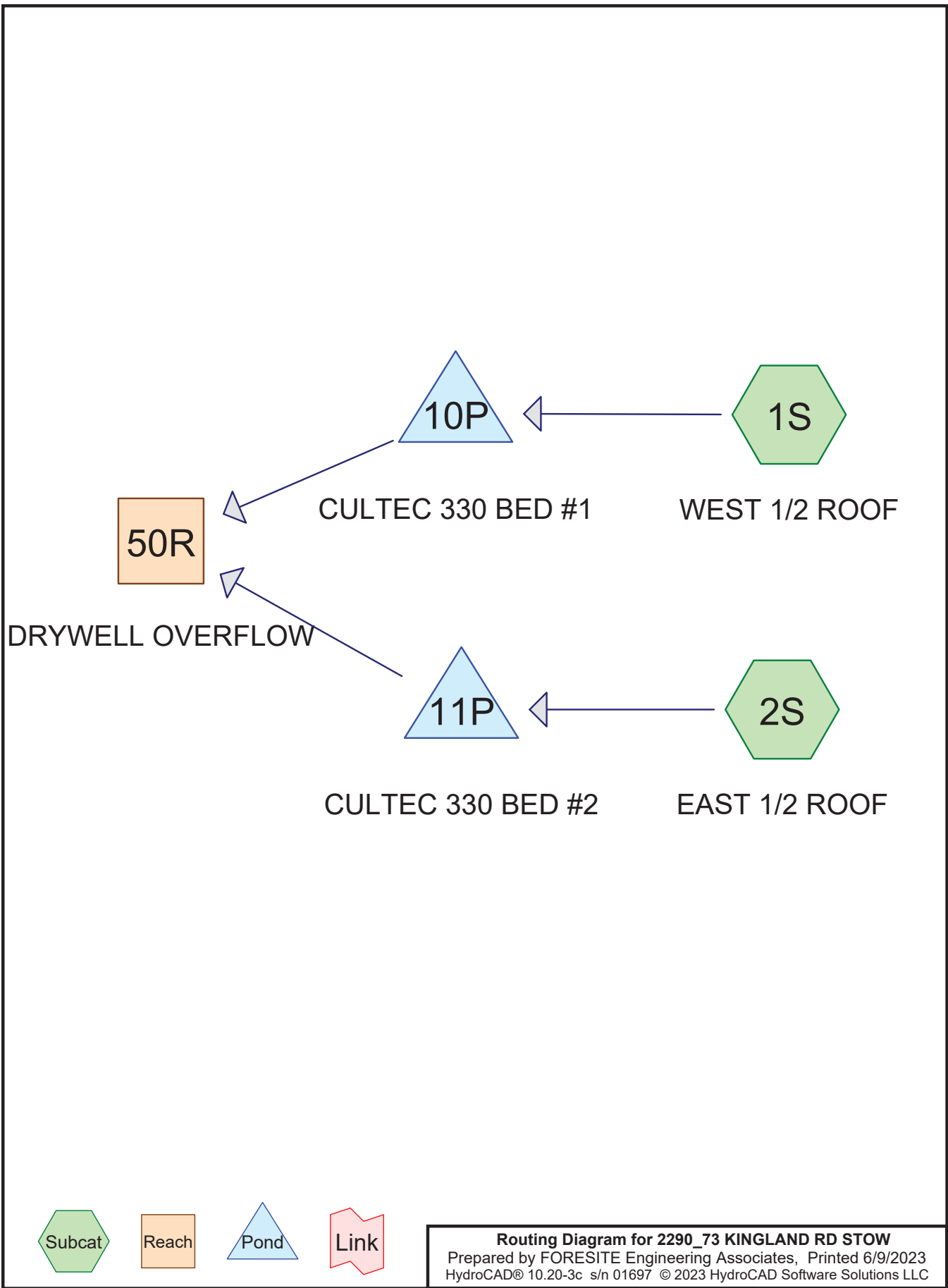
Should inspection reveal that the system is no longer effective and cannot be returned to effective use, a new system should be installed. Drywell maintenance should occur when inspection shows:

- Drainage time has increased beyond 48 hours
- A non-stormwater discharge has entered the system
- Upon change of ownership of the system

### **Drywell Maintenance**

Drywell maintenance may include, but is not limited to;

- Removal of sediment, trash, and debris from the system
- Purging of accumulated silt out of the aggregate fill by jetting, surging, or pumping
- Clearing gutters of accumulated debris



**Routing Diagram for 2290\_73 KINGLAND RD STOW**  
 Prepared by FORESITE Engineering Associates, Printed 6/9/2023  
 HydroCAD® 10.20-3c s/n 01697 © 2023 HydroCAD Software Solutions LLC

**2290\_73 KINGLAND RD STOW**Prepared by FORESITE Engineering Associates  
HydroCAD® 10.20-3c s/n 01697 © 2023 HydroCAD Software Solutions LLCPrinted 6/9/2023  
Page 2**Rainfall Events Listing (selected events)**

| Event# | Event Name | Storm Type | Curve | Mode    | Duration (hours) | B/B | Depth (inches) | AMC |
|--------|------------|------------|-------|---------|------------------|-----|----------------|-----|
| 1      | 2-Year     | NRCC 24-hr | D     | Default | 24.00            | 1   | 3.09           | 2   |
| 2      | 10-Year    | NRCC 24-hr | D     | Default | 24.00            | 1   | 4.65           | 2   |
| 3      | 25-Year    | NRCC 24-hr | D     | Default | 24.00            | 1   | 5.87           | 2   |
| 4      | 100-Year   | NRCC 24-hr | D     | Default | 24.00            | 1   | 8.36           | 2   |



**2290\_73 KINGLAND RD STOW**

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**Area Listing (all nodes)**

| Area<br>(sq-ft) | CN        | Description<br>(subcatchment-numbers) |
|-----------------|-----------|---------------------------------------|
| 5,060           | 98        | Roofs, HSG A (1S, 2S)                 |
| <b>5,060</b>    | <b>98</b> | <b>TOTAL AREA</b>                     |

**2290\_73 KINGLAND RD STOW**

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**Soil Listing (all nodes)**

| Area<br>(sq-ft) | Soil<br>Group | Subcatchment<br>Numbers |
|-----------------|---------------|-------------------------|
| 5,060           | HSG A         | 1S, 2S                  |
| 0               | HSG B         |                         |
| 0               | HSG C         |                         |
| 0               | HSG D         |                         |
| 0               | Other         |                         |
| <b>5,060</b>    |               | <b>TOTAL AREA</b>       |

**2290\_73 KINGLAND RD STOW**

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**Ground Covers (all nodes)**

| HSG-A<br>(sq-ft) | HSG-B<br>(sq-ft) | HSG-C<br>(sq-ft) | HSG-D<br>(sq-ft) | Other<br>(sq-ft) | Total<br>(sq-ft) | Ground<br>Cover       | Subcatchment<br>Numbers |
|------------------|------------------|------------------|------------------|------------------|------------------|-----------------------|-------------------------|
| 5,060            | 0                | 0                | 0                | 0                | 5,060            | Roofs                 | 1S                      |
|                  |                  |                  |                  |                  |                  |                       | ,<br>2S                 |
| <b>5,060</b>     | <b>0</b>         | <b>0</b>         | <b>0</b>         | <b>0</b>         | <b>5,060</b>     | <b>TOTAL<br/>AREA</b> |                         |

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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 1S: WEST 1/2 ROOF** Runoff Area=2,530 sf 100.00% Impervious Runoff Depth>2.85"  
Flow Length=20' Slope=0.5000 '/' Tc=6.0 min CN=98 Runoff=0.16 cfs 602 cf

**Subcatchment 2S: EAST 1/2 ROOF** Runoff Area=2,530 sf 100.00% Impervious Runoff Depth>2.85"  
Flow Length=20' Slope=0.5000 '/' Tc=6.0 min CN=98 Runoff=0.16 cfs 602 cf

**Reach 50R: DRYWELL OVERFLOW** Inflow=0.00 cfs 0 cf  
Outflow=0.00 cfs 0 cf

**Pond 10P: CULTEC 330 BED #1** Peak Elev=207.18' Storage=104 cf Inflow=0.16 cfs 602 cf  
Discarded=0.03 cfs 602 cf Primary=0.00 cfs 0 cf Outflow=0.03 cfs 602 cf

**Pond 11P: CULTEC 330 BED #2** Peak Elev=201.18' Storage=104 cf Inflow=0.16 cfs 602 cf  
Discarded=0.03 cfs 602 cf Primary=0.00 cfs 0 cf Outflow=0.03 cfs 602 cf

**Total Runoff Area = 5,060 sf Runoff Volume = 1,203 cf Average Runoff Depth = 2.85"**  
**0.00% Pervious = 0 sf 100.00% Impervious = 5,060 sf**

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### Summary for Subcatchment 1S: WEST 1/2 ROOF

Runoff = 0.16 cfs @ 12.13 hrs, Volume= 602 cf, Depth> 2.85"  
Routed to Pond 10P : CULTEC 330 BED #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
NRCC 24-hr D 2-Year Rainfall=3.09"

| Area (sf) | CN | Description             |
|-----------|----|-------------------------|
| 2,530     | 98 | Roofs, HSG A            |
| 2,530     |    | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft)                            | Velocity (ft/sec) | Capacity (cfs) | Description   |
|----------|---------------|--|-------------------|----------------|---|
| 0.1      | 20            | 0.5000                                   | 3.61              |                | <b>Sheet Flow, IMP SHEET FLOW</b><br>Smooth surfaces n= 0.011 P2= 3.20" |
| 0.1      | 20            | Total, Increased to minimum Tc = 6.0 min |                   |                |   |

### Summary for Subcatchment 2S: EAST 1/2 ROOF

Runoff = 0.16 cfs @ 12.13 hrs, Volume= 602 cf, Depth> 2.85"  
Routed to Pond 11P : CULTEC 330 BED #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
NRCC 24-hr D 2-Year Rainfall=3.09"

| Area (sf) | CN | Description             |
|-----------|----|-------------------------|
| 2,530     | 98 | Roofs, HSG A            |
| 2,530     |    | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft)                            | Velocity (ft/sec) | Capacity (cfs) | Description   |
|----------|---------------|--|-------------------|----------------|---|
| 0.1      | 20            | 0.5000                                   | 3.61              |                | <b>Sheet Flow, IMP SHEET FLOW</b><br>Smooth surfaces n= 0.011 P2= 3.20" |
| 0.1      | 20            | Total, Increased to minimum Tc = 6.0 min |                   |                |   |

### Summary for Reach 50R: DRYWELL OVERFLOW

Inflow Area = 5,060 sf, 100.00% Impervious, Inflow Depth = 0.00" for 2-Year event  
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf  
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

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### Summary for Pond 10P: CULTEC 330 BED #1

Inflow Area = 2,530 sf, 100.00% Impervious, Inflow Depth > 2.85" for 2-Year event  
Inflow = 0.16 cfs @ 12.13 hrs, Volume= 602 cf  
Outflow = 0.03 cfs @ 11.79 hrs, Volume= 602 cf, Atten= 80%, Lag= 0.0 min  
Discarded = 0.03 cfs @ 11.79 hrs, Volume= 602 cf  
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf  
Routed to Reach 50R : DRYWELL OVERFLOW

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Peak Elev= 207.18' @ 12.42 hrs Surf.Area= 165 sf Storage= 104 cf

Plug-Flow detention time= 14.7 min calculated for 602 cf (100% of inflow)  
Center-of-Mass det. time= 14.5 min ( 774.9 - 760.4 )

| Volume | Invert  | Avail.Storage | Storage Description   |
|--------|---------|---------------|---|
| #1A    | 206.00' | 182 cf        | <b>13.17'W x 12.50'L x 3.54'H Field A</b><br>583 cf Overall - 127 cf Embedded = 456 cf x 40.0% Voids  |
| #2A    | 206.50' | 127 cf        | <b>Cultec R-330XLHD x 2 Inside #1</b><br>Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf<br>Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap<br>Row Length Adjustment= +1.50' x 7.45 sf x 2 rows |
|        |         | 309 cf        | Total Available Storage   |

Storage Group A created with Chamber Wizard

| Device | Routing   | Invert  | Outlet Devices   |
|--------|-----------|---------|--|
| #1     | Discarded | 206.00' | <b>8.270 in/hr Exfiltration over Surface area</b>  |
| #2     | Primary   | 208.50' | <b>6.0" Round Culvert</b><br>L= 20.0' CPP, end-section conforming to fill, Ke= 0.500<br>Inlet / Outlet Invert= 208.50' / 208.30' S= 0.0100 1' Cc= 0.900<br>n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf |

**Discarded OutFlow** Max=0.03 cfs @ 11.79 hrs HW=206.04' (Free Discharge)  
↑**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=206.00' (Free Discharge)  
↑**2=Culvert** ( Controls 0.00 cfs)

### Summary for Pond 11P: CULTEC 330 BED #2

Inflow Area = 2,530 sf, 100.00% Impervious, Inflow Depth > 2.85" for 2-Year event  
Inflow = 0.16 cfs @ 12.13 hrs, Volume= 602 cf  
Outflow = 0.03 cfs @ 11.79 hrs, Volume= 602 cf, Atten= 80%, Lag= 0.0 min  
Discarded = 0.03 cfs @ 11.79 hrs, Volume= 602 cf  
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf  
Routed to Reach 50R : DRYWELL OVERFLOW

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

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Peak Elev= 201.18' @ 12.42 hrs Surf.Area= 165 sf Storage= 104 cf

Plug-Flow detention time= 14.7 min calculated for 602 cf (100% of inflow)  
Center-of-Mass det. time= 14.5 min ( 774.9 - 760.4 )

| Volume | Invert  | Avail.Storage | Storage Description   |
|--------|---------|---------------|---|
| #1A    | 200.00' | 182 cf        | <b>13.17'W x 12.50'L x 3.54'H Field A</b><br>583 cf Overall - 127 cf Embedded = 456 cf x 40.0% Voids  |
| #2A    | 200.50' | 127 cf        | <b>Cultec R-330XLHD x 2 Inside #1</b><br>Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf<br>Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap<br>Row Length Adjustment= +1.50' x 7.45 sf x 2 rows |
|        |         | 309 cf        | Total Available Storage   |

Storage Group A created with Chamber Wizard

| Device | Routing   | Invert  | Outlet Devices   |
|--------|-----------|---------|--|
| #1     | Discarded | 200.00' | <b>8.270 in/hr Exfiltration over Surface area</b>  |
| #2     | Primary   | 202.50' | <b>6.0" Round Culvert</b><br>L= 25.0' CPP, end-section conforming to fill, Ke= 0.500<br>Inlet / Outlet Invert= 202.50' / 202.25' S= 0.0100 '/ Cc= 0.900<br>n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf |

**Discarded OutFlow** Max=0.03 cfs @ 11.79 hrs HW=200.04' (Free Discharge)  
↑1=Exfiltration (Exfiltration Controls 0.03 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=200.00' (Free Discharge)  
↑2=Culvert ( Controls 0.00 cfs)

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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 1S: WEST 1/2 ROOF** Runoff Area=2,530 sf 100.00% Impervious Runoff Depth>4.41"  
Flow Length=20' Slope=0.5000 '/' Tc=6.0 min CN=98 Runoff=0.24 cfs 929 cf

**Subcatchment 2S: EAST 1/2 ROOF** Runoff Area=2,530 sf 100.00% Impervious Runoff Depth>4.41"  
Flow Length=20' Slope=0.5000 '/' Tc=6.0 min CN=98 Runoff=0.24 cfs 929 cf

**Reach 50R: DRYWELL OVERFLOW** Inflow=0.00 cfs 0 cf  
Outflow=0.00 cfs 0 cf

**Pond 10P: CULTEC 330 BED #1** Peak Elev=208.23' Storage=210 cf Inflow=0.24 cfs 929 cf  
Discarded=0.03 cfs 929 cf Primary=0.00 cfs 0 cf Outflow=0.03 cfs 929 cf

**Pond 11P: CULTEC 330 BED #2** Peak Elev=202.23' Storage=210 cf Inflow=0.24 cfs 929 cf  
Discarded=0.03 cfs 929 cf Primary=0.00 cfs 0 cf Outflow=0.03 cfs 929 cf

**Total Runoff Area = 5,060 sf Runoff Volume = 1,859 cf Average Runoff Depth = 4.41"**  
**0.00% Pervious = 0 sf 100.00% Impervious = 5,060 sf**



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### Summary for Subcatchment 1S: WEST 1/2 ROOF

Runoff = 0.24 cfs @ 12.13 hrs, Volume= 929 cf, Depth> 4.41"  
Routed to Pond 10P : CULTEC 330 BED #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
NRCC 24-hr D 10-Year Rainfall=4.65"

| Area (sf) | CN | Description             |
|-----------|----|-------------------------|
| 2,530     | 98 | Roofs, HSG A            |
| 2,530     |    | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft)                            | Velocity (ft/sec) | Capacity (cfs) | Description   |
|----------|---------------|--|-------------------|----------------|---|
| 0.1      | 20            | 0.5000                                   | 3.61              |                | <b>Sheet Flow, IMP SHEET FLOW</b><br>Smooth surfaces n= 0.011 P2= 3.20" |
| 0.1      | 20            | Total, Increased to minimum Tc = 6.0 min |                   |                |   |

### Summary for Subcatchment 2S: EAST 1/2 ROOF

Runoff = 0.24 cfs @ 12.13 hrs, Volume= 929 cf, Depth> 4.41"  
Routed to Pond 11P : CULTEC 330 BED #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
NRCC 24-hr D 10-Year Rainfall=4.65"

| Area (sf) | CN | Description             |
|-----------|----|-------------------------|
| 2,530     | 98 | Roofs, HSG A            |
| 2,530     |    | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft)                            | Velocity (ft/sec) | Capacity (cfs) | Description   |
|----------|---------------|--|-------------------|----------------|---|
| 0.1      | 20            | 0.5000                                   | 3.61              |                | <b>Sheet Flow, IMP SHEET FLOW</b><br>Smooth surfaces n= 0.011 P2= 3.20" |
| 0.1      | 20            | Total, Increased to minimum Tc = 6.0 min |                   |                |   |

### Summary for Reach 50R: DRYWELL OVERFLOW

Inflow Area = 5,060 sf, 100.00% Impervious, Inflow Depth = 0.00" for 10-Year event  
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf  
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

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### Summary for Pond 10P: CULTEC 330 BED #1

Inflow Area = 2,530 sf, 100.00% Impervious, Inflow Depth > 4.41" for 10-Year event  
Inflow = 0.24 cfs @ 12.13 hrs, Volume= 929 cf  
Outflow = 0.03 cfs @ 11.55 hrs, Volume= 929 cf, Atten= 87%, Lag= 0.0 min  
Discarded = 0.03 cfs @ 11.55 hrs, Volume= 929 cf  
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf  
Routed to Reach 50R : DRYWELL OVERFLOW

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Peak Elev= 208.23' @ 12.68 hrs Surf.Area= 165 sf Storage= 210 cf

Plug-Flow detention time= 34.9 min calculated for 929 cf (100% of inflow)  
Center-of-Mass det. time= 34.7 min ( 785.7 - 751.0 )

| Volume | Invert  | Avail.Storage | Storage Description   |
|--------|---------|---------------|---|
| #1A    | 206.00' | 182 cf        | <b>13.17'W x 12.50'L x 3.54'H Field A</b><br>583 cf Overall - 127 cf Embedded = 456 cf x 40.0% Voids  |
| #2A    | 206.50' | 127 cf        | <b>Cultec R-330XLHD x 2 Inside #1</b><br>Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf<br>Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap<br>Row Length Adjustment= +1.50' x 7.45 sf x 2 rows |
|        |         | 309 cf        | Total Available Storage   |

Storage Group A created with Chamber Wizard

| Device | Routing   | Invert  | Outlet Devices   |
|--------|-----------|---------|--|
| #1     | Discarded | 206.00' | <b>8.270 in/hr Exfiltration over Surface area</b>  |
| #2     | Primary   | 208.50' | <b>6.0" Round Culvert</b><br>L= 20.0' CPP, end-section conforming to fill, Ke= 0.500<br>Inlet / Outlet Invert= 208.50' / 208.30' S= 0.0100 1' Cc= 0.900<br>n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf |

**Discarded OutFlow** Max=0.03 cfs @ 11.55 hrs HW=206.04' (Free Discharge)  
↑**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=206.00' (Free Discharge)  
↑**2=Culvert** ( Controls 0.00 cfs)

### Summary for Pond 11P: CULTEC 330 BED #2

Inflow Area = 2,530 sf, 100.00% Impervious, Inflow Depth > 4.41" for 10-Year event  
Inflow = 0.24 cfs @ 12.13 hrs, Volume= 929 cf  
Outflow = 0.03 cfs @ 11.55 hrs, Volume= 929 cf, Atten= 87%, Lag= 0.0 min  
Discarded = 0.03 cfs @ 11.55 hrs, Volume= 929 cf  
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf  
Routed to Reach 50R : DRYWELL OVERFLOW

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

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Peak Elev= 202.23' @ 12.68 hrs Surf.Area= 165 sf Storage= 210 cf

Plug-Flow detention time= 34.9 min calculated for 929 cf (100% of inflow)  
Center-of-Mass det. time= 34.7 min ( 785.7 - 751.0 )

| Volume | Invert  | Avail.Storage | Storage Description   |
|--------|---------|---------------|---|
| #1A    | 200.00' | 182 cf        | <b>13.17'W x 12.50'L x 3.54'H Field A</b><br>583 cf Overall - 127 cf Embedded = 456 cf x 40.0% Voids  |
| #2A    | 200.50' | 127 cf        | <b>Cultec R-330XLHD x 2 Inside #1</b><br>Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf<br>Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap<br>Row Length Adjustment= +1.50' x 7.45 sf x 2 rows |
|        |         | 309 cf        | Total Available Storage   |

Storage Group A created with Chamber Wizard

| Device | Routing   | Invert  | Outlet Devices   |
|--------|-----------|---------|--|
| #1     | Discarded | 200.00' | <b>8.270 in/hr Exfiltration over Surface area</b>  |
| #2     | Primary   | 202.50' | <b>6.0" Round Culvert</b><br>L= 25.0' CPP, end-section conforming to fill, Ke= 0.500<br>Inlet / Outlet Invert= 202.50' / 202.25' S= 0.0100 '/ Cc= 0.900<br>n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf |

**Discarded OutFlow** Max=0.03 cfs @ 11.55 hrs HW=200.04' (Free Discharge)

↑1=**Exfiltration** (Exfiltration Controls 0.03 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=200.00' (Free Discharge)

↑2=**Culvert** ( Controls 0.00 cfs)

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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 1S: WEST 1/2 ROOF** Runoff Area=2,530 sf 100.00% Impervious Runoff Depth>5.62"  
Flow Length=20' Slope=0.5000 '/' Tc=6.0 min CN=98 Runoff=0.31 cfs 1,186 cf

**Subcatchment 2S: EAST 1/2 ROOF** Runoff Area=2,530 sf 100.00% Impervious Runoff Depth>5.62"  
Flow Length=20' Slope=0.5000 '/' Tc=6.0 min CN=98 Runoff=0.31 cfs 1,186 cf

**Reach 50R: DRYWELL OVERFLOW** Inflow=0.16 cfs 145 cf  
Outflow=0.16 cfs 145 cf

**Pond 10P: CULTEC 330 BED #1** Peak Elev=208.67' Storage=249 cf Inflow=0.31 cfs 1,186 cf  
Discarded=0.03 cfs 1,113 cf Primary=0.08 cfs 72 cf Outflow=0.11 cfs 1,185 cf

**Pond 11P: CULTEC 330 BED #2** Peak Elev=202.67' Storage=249 cf Inflow=0.31 cfs 1,186 cf  
Discarded=0.03 cfs 1,113 cf Primary=0.08 cfs 72 cf Outflow=0.11 cfs 1,185 cf

**Total Runoff Area = 5,060 sf Runoff Volume = 2,372 cf Average Runoff Depth = 5.62"**  
**0.00% Pervious = 0 sf 100.00% Impervious = 5,060 sf**

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### Summary for Subcatchment 1S: WEST 1/2 ROOF

Runoff = 0.31 cfs @ 12.13 hrs, Volume= 1,186 cf, Depth> 5.62"  
Routed to Pond 10P : CULTEC 330 BED #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
NRCC 24-hr D 25-Year Rainfall=5.87"

| Area (sf) | CN | Description             |
|-----------|----|-------------------------|
| 2,530     | 98 | Roofs, HSG A            |
| 2,530     |    | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft)                            | Velocity (ft/sec) | Capacity (cfs) | Description   |
|----------|---------------|--|-------------------|----------------|---|
| 0.1      | 20            | 0.5000                                   | 3.61              |                | <b>Sheet Flow, IMP SHEET FLOW</b><br>Smooth surfaces n= 0.011 P2= 3.20" |
| 0.1      | 20            | Total, Increased to minimum Tc = 6.0 min |                   |                |   |

### Summary for Subcatchment 2S: EAST 1/2 ROOF

Runoff = 0.31 cfs @ 12.13 hrs, Volume= 1,186 cf, Depth> 5.62"  
Routed to Pond 11P : CULTEC 330 BED #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
NRCC 24-hr D 25-Year Rainfall=5.87"

| Area (sf) | CN | Description             |
|-----------|----|-------------------------|
| 2,530     | 98 | Roofs, HSG A            |
| 2,530     |    | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft)                            | Velocity (ft/sec) | Capacity (cfs) | Description   |
|----------|---------------|--|-------------------|----------------|---|
| 0.1      | 20            | 0.5000                                   | 3.61              |                | <b>Sheet Flow, IMP SHEET FLOW</b><br>Smooth surfaces n= 0.011 P2= 3.20" |
| 0.1      | 20            | Total, Increased to minimum Tc = 6.0 min |                   |                |   |

### Summary for Reach 50R: DRYWELL OVERFLOW

Inflow Area = 5,060 sf, 100.00% Impervious, Inflow Depth = 0.34" for 25-Year event  
Inflow = 0.16 cfs @ 12.27 hrs, Volume= 145 cf  
Outflow = 0.16 cfs @ 12.27 hrs, Volume= 145 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

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### Summary for Pond 10P: CULTEC 330 BED #1

Inflow Area = 2,530 sf, 100.00% Impervious, Inflow Depth > 5.62" for 25-Year event  
Inflow = 0.31 cfs @ 12.13 hrs, Volume= 1,186 cf  
Outflow = 0.11 cfs @ 12.27 hrs, Volume= 1,185 cf, Atten= 64%, Lag= 8.7 min  
Discarded = 0.03 cfs @ 11.25 hrs, Volume= 1,113 cf  
Primary = 0.08 cfs @ 12.27 hrs, Volume= 72 cf  
Routed to Reach 50R : DRYWELL OVERFLOW

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Peak Elev= 208.67' @ 12.27 hrs Surf.Area= 165 sf Storage= 249 cf

Plug-Flow detention time= 39.0 min calculated for 1,185 cf (100% of inflow)  
Center-of-Mass det. time= 38.8 min ( 785.5 - 746.6 )

| Volume | Invert  | Avail.Storage | Storage Description   |
|--------|---------|---------------|---|
| #1A    | 206.00' | 182 cf        | <b>13.17'W x 12.50'L x 3.54'H Field A</b><br>583 cf Overall - 127 cf Embedded = 456 cf x 40.0% Voids  |
| #2A    | 206.50' | 127 cf        | <b>Cultec R-330XLHD x 2 Inside #1</b><br>Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf<br>Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap<br>Row Length Adjustment= +1.50' x 7.45 sf x 2 rows |
|        |         | 309 cf        | Total Available Storage   |

Storage Group A created with Chamber Wizard

| Device | Routing   | Invert  | Outlet Devices   |
|--------|-----------|---------|--|
| #1     | Discarded | 206.00' | <b>8.270 in/hr Exfiltration over Surface area</b>  |
| #2     | Primary   | 208.50' | <b>6.0" Round Culvert</b><br>L= 20.0' CPP, end-section conforming to fill, Ke= 0.500<br>Inlet / Outlet Invert= 208.50' / 208.30' S= 0.0100 1' Cc= 0.900<br>n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf |

**Discarded OutFlow** Max=0.03 cfs @ 11.25 hrs HW=206.04' (Free Discharge)  
↑**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

**Primary OutFlow** Max=0.08 cfs @ 12.27 hrs HW=208.67' (Free Discharge)  
↑**2=Culvert** (Inlet Controls 0.08 cfs @ 1.39 fps)

### Summary for Pond 11P: CULTEC 330 BED #2

Inflow Area = 2,530 sf, 100.00% Impervious, Inflow Depth > 5.62" for 25-Year event  
Inflow = 0.31 cfs @ 12.13 hrs, Volume= 1,186 cf  
Outflow = 0.11 cfs @ 12.27 hrs, Volume= 1,185 cf, Atten= 64%, Lag= 8.7 min  
Discarded = 0.03 cfs @ 11.25 hrs, Volume= 1,113 cf  
Primary = 0.08 cfs @ 12.27 hrs, Volume= 72 cf  
Routed to Reach 50R : DRYWELL OVERFLOW

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

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Peak Elev= 202.67' @ 12.27 hrs Surf.Area= 165 sf Storage= 249 cf

Plug-Flow detention time= 39.0 min calculated for 1,185 cf (100% of inflow)  
Center-of-Mass det. time= 38.8 min ( 785.5 - 746.6 )

| Volume | Invert  | Avail.Storage | Storage Description   |
|--------|---------|---------------|---|
| #1A    | 200.00' | 182 cf        | <b>13.17'W x 12.50'L x 3.54'H Field A</b><br>583 cf Overall - 127 cf Embedded = 456 cf x 40.0% Voids  |
| #2A    | 200.50' | 127 cf        | <b>Cultec R-330XLHD x 2 Inside #1</b><br>Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf<br>Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap<br>Row Length Adjustment= +1.50' x 7.45 sf x 2 rows |
|        |         | 309 cf        | Total Available Storage   |

Storage Group A created with Chamber Wizard

| Device | Routing   | Invert  | Outlet Devices   |
|--------|-----------|---------|--|
| #1     | Discarded | 200.00' | <b>8.270 in/hr Exfiltration over Surface area</b>  |
| #2     | Primary   | 202.50' | <b>6.0" Round Culvert</b><br>L= 25.0' CPP, end-section conforming to fill, Ke= 0.500<br>Inlet / Outlet Invert= 202.50' / 202.25' S= 0.0100 '/ Cc= 0.900<br>n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf |

**Discarded OutFlow** Max=0.03 cfs @ 11.25 hrs HW=200.04' (Free Discharge)  
↑1=Exfiltration (Exfiltration Controls 0.03 cfs)

**Primary OutFlow** Max=0.08 cfs @ 12.27 hrs HW=202.67' (Free Discharge)  
↑2=Culvert (Inlet Controls 0.08 cfs @ 1.39 fps)

**2290\_73 KINGLAND RD STOW**

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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 1S: WEST 1/2 ROOF** Runoff Area=2,530 sf 100.00% Impervious Runoff Depth>8.11"  
Flow Length=20' Slope=0.5000 '/' Tc=6.0 min CN=98 Runoff=0.44 cfs 1,710 cf

**Subcatchment 2S: EAST 1/2 ROOF** Runoff Area=2,530 sf 100.00% Impervious Runoff Depth>8.11"  
Flow Length=20' Slope=0.5000 '/' Tc=6.0 min CN=98 Runoff=0.44 cfs 1,710 cf

**Reach 50R: DRYWELL OVERFLOW** Inflow=0.78 cfs 615 cf  
Outflow=0.78 cfs 615 cf

**Pond 10P: CULTEC 330 BED #1** Peak Elev=208.93' Storage=269 cf Inflow=0.44 cfs 1,710 cf  
Discarded=0.03 cfs 1,402 cf Primary=0.39 cfs 308 cf Outflow=0.42 cfs 1,709 cf

**Pond 11P: CULTEC 330 BED #2** Peak Elev=202.92' Storage=268 cf Inflow=0.44 cfs 1,710 cf  
Discarded=0.03 cfs 1,402 cf Primary=0.39 cfs 308 cf Outflow=0.42 cfs 1,709 cf

**Total Runoff Area = 5,060 sf Runoff Volume = 3,419 cf Average Runoff Depth = 8.11"**  
**0.00% Pervious = 0 sf 100.00% Impervious = 5,060 sf**



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**Summary for Subcatchment 1S: WEST 1/2 ROOF**

Runoff = 0.44 cfs @ 12.13 hrs, Volume= 1,710 cf, Depth> 8.11"  
Routed to Pond 10P : CULTEC 330 BED #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
NRCC 24-hr D 100-Year Rainfall=8.36"

| Area (sf) | CN | Description             |
|-----------|----|-------------------------|
| 2,530     | 98 | Roofs, HSG A            |
| 2,530     |    | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft)                            | Velocity (ft/sec) | Capacity (cfs) | Description   |
|----------|---------------|--|-------------------|----------------|---|
| 0.1      | 20            | 0.5000                                   | 3.61              |                | <b>Sheet Flow, IMP SHEET FLOW</b><br>Smooth surfaces n= 0.011 P2= 3.20" |
| 0.1      | 20            | Total, Increased to minimum Tc = 6.0 min |                   |                |   |

**Summary for Subcatchment 2S: EAST 1/2 ROOF**

Runoff = 0.44 cfs @ 12.13 hrs, Volume= 1,710 cf, Depth> 8.11"  
Routed to Pond 11P : CULTEC 330 BED #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
NRCC 24-hr D 100-Year Rainfall=8.36"

| Area (sf) | CN | Description             |
|-----------|----|-------------------------|
| 2,530     | 98 | Roofs, HSG A            |
| 2,530     |    | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft)                            | Velocity (ft/sec) | Capacity (cfs) | Description   |
|----------|---------------|--|-------------------|----------------|---|
| 0.1      | 20            | 0.5000                                   | 3.61              |                | <b>Sheet Flow, IMP SHEET FLOW</b><br>Smooth surfaces n= 0.011 P2= 3.20" |
| 0.1      | 20            | Total, Increased to minimum Tc = 6.0 min |                   |                |   |

**Summary for Reach 50R: DRYWELL OVERFLOW**

Inflow Area = 5,060 sf, 100.00% Impervious, Inflow Depth = 1.46" for 100-Year event  
Inflow = 0.78 cfs @ 12.15 hrs, Volume= 615 cf  
Outflow = 0.78 cfs @ 12.15 hrs, Volume= 615 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

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### Summary for Pond 10P: CULTEC 330 BED #1

Inflow Area = 2,530 sf, 100.00% Impervious, Inflow Depth > 8.11" for 100-Year event  
Inflow = 0.44 cfs @ 12.13 hrs, Volume= 1,710 cf  
Outflow = 0.42 cfs @ 12.15 hrs, Volume= 1,709 cf, Atten= 4%, Lag= 1.2 min  
Discarded = 0.03 cfs @ 10.79 hrs, Volume= 1,402 cf  
Primary = 0.39 cfs @ 12.15 hrs, Volume= 308 cf  
Routed to Reach 50R : DRYWELL OVERFLOW

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs  
Peak Elev= 208.93' @ 12.15 hrs Surf.Area= 165 sf Storage= 269 cf

Plug-Flow detention time= 36.0 min calculated for 1,708 cf (100% of inflow)  
Center-of-Mass det. time= 35.8 min ( 777.0 - 741.2 )

| Volume | Invert  | Avail.Storage | Storage Description   |
|--------|---------|---------------|---|
| #1A    | 206.00' | 182 cf        | <b>13.17'W x 12.50'L x 3.54'H Field A</b><br>583 cf Overall - 127 cf Embedded = 456 cf x 40.0% Voids  |
| #2A    | 206.50' | 127 cf        | <b>Cultec R-330XLHD x 2 Inside #1</b><br>Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf<br>Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap<br>Row Length Adjustment= +1.50' x 7.45 sf x 2 rows |
|        |         | 309 cf        | Total Available Storage   |

Storage Group A created with Chamber Wizard

| Device | Routing   | Invert  | Outlet Devices   |
|--------|-----------|---------|--|
| #1     | Discarded | 206.00' | <b>8.270 in/hr Exfiltration over Surface area</b>  |
| #2     | Primary   | 208.50' | <b>6.0" Round Culvert</b><br>L= 20.0' CPP, end-section conforming to fill, Ke= 0.500<br>Inlet / Outlet Invert= 208.50' / 208.30' S= 0.0100 1' Cc= 0.900<br>n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf |

**Discarded OutFlow** Max=0.03 cfs @ 10.79 hrs HW=206.04' (Free Discharge)  
↑**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

**Primary OutFlow** Max=0.39 cfs @ 12.15 hrs HW=208.93' (Free Discharge)  
↑**2=Culvert** (Barrel Controls 0.39 cfs @ 2.94 fps)

### Summary for Pond 11P: CULTEC 330 BED #2

Inflow Area = 2,530 sf, 100.00% Impervious, Inflow Depth > 8.11" for 100-Year event  
Inflow = 0.44 cfs @ 12.13 hrs, Volume= 1,710 cf  
Outflow = 0.42 cfs @ 12.15 hrs, Volume= 1,709 cf, Atten= 4%, Lag= 1.2 min  
Discarded = 0.03 cfs @ 10.79 hrs, Volume= 1,402 cf  
Primary = 0.39 cfs @ 12.15 hrs, Volume= 308 cf  
Routed to Reach 50R : DRYWELL OVERFLOW

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

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Peak Elev= 202.92' @ 12.15 hrs Surf.Area= 165 sf Storage= 268 cf

Plug-Flow detention time= 36.0 min calculated for 1,709 cf (100% of inflow)  
Center-of-Mass det. time= 35.8 min ( 777.0 - 741.2 )

| Volume | Invert  | Avail.Storage | Storage Description   |
|--------|---------|---------------|---|
| #1A    | 200.00' | 182 cf        | <b>13.17'W x 12.50'L x 3.54'H Field A</b><br>583 cf Overall - 127 cf Embedded = 456 cf x 40.0% Voids  |
| #2A    | 200.50' | 127 cf        | <b>Cultec R-330XLHD x 2 Inside #1</b><br>Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf<br>Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap<br>Row Length Adjustment= +1.50' x 7.45 sf x 2 rows |
|        |         | 309 cf        | Total Available Storage   |

Storage Group A created with Chamber Wizard

| Device | Routing   | Invert  | Outlet Devices   |
|--------|-----------|---------|--|
| #1     | Discarded | 200.00' | <b>8.270 in/hr Exfiltration over Surface area</b>  |
| #2     | Primary   | 202.50' | <b>6.0" Round Culvert</b><br>L= 25.0' CPP, end-section conforming to fill, Ke= 0.500<br>Inlet / Outlet Invert= 202.50' / 202.25' S= 0.0100 '/ Cc= 0.900<br>n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf |

**Discarded OutFlow** Max=0.03 cfs @ 10.79 hrs HW=200.04' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.03 cfs)

**Primary OutFlow** Max=0.39 cfs @ 12.15 hrs HW=202.92' (Free Discharge)

↑2=Culvert (Inlet Controls 0.39 cfs @ 2.21 fps)