A-9

SCA Final Cover System Stormwater Management System

Beech and Bonaparte
engineering p.c.

an affiliate of Geosyntec Consultants

CALCULATION PACKAGE COVER SHEET

Client: Honeywell **Project:** Onondaga Lake SCA Final Cover Design **Project/Proposal #:** GD5497

TITLE OF COMPUTATIONS **STORMWATER MANAGEMENT SYSTEM FOR SCA FINAL COVER DESIGN**

COMPUTATIONS BY:	Signature		09/11/15 DATE
	Printed Name and Title	Antonio Sanchez, P.E. Project Engineer	
ASSUMPTIONS AND PROCEDURES CHECKED BY:	Signature		05/04/16 DATE
	Printed Name and Title	Tom Fendley, P.E. Principal	
COMPUTATIONS CHECKED BY:	Signature		05/04/16 DATE
	Printed Name and Title	James Crawford / Mark Schillinger, P.E. Senior Staff Engineer / Project Engineer	
COMPUTATIONS BACKCHECKED BY:	Signature		05/05/16 DATE
	Printed Name and Title	Antonio Sanchez, P.E. Project Engineer	
APPROVED BY:	Signature		05/05/16 DATE
	Printed Name and Title	Jay Beech, Ph.D., P.E. Senior Principal	

STATE OF NEW YORK · JOHN F. BEECH · No. 066337 · LICENSED PROFESSIONAL ENGINEER

APPROVAL NOTES:

REVISIONS (Number and initial all revisions)

NO.	SHEET	DATE	BY	CHECKED BY	APPROVAL

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ATTACHMENTS

STORMWATER MANAGEMENT SYSTEM FOR SCA FINAL COVER DESIGN

1. PURPOSE

This calculation package was prepared in support of the Sediment Consolidation Area (SCA) final cover design as part of the Onondaga Lake remediation project. The SCA has been constructed on Wastebed 13 (WB-13). Dredged materials from Onondaga Lake have been transported to the SCA for dewatering and containment within geotextile tubes.

Specifically, this package presents the design and analysis of the stormwater management system (SWMS) for the SCA final cover system.

2. SITE SETTING

The SCA is located in Camillus, New York, in northwestern Onondaga County. The proposed SCA final cover system (i.e., post-development condition) of the SCA is presented in **Figure 1**, in which topography outside the SCA footprint is presented as the existing condition. The SWMS collects and routes stormwater runoff through various conveyance features to two stormwater basins currently shown in the northwest and northeast corners of the SCA. The detailed basin design (including discharge structures) and conveyance system of basin discharges to outfalls will be presented in subsequent design documents that will be prepared in parallel and in conjunction with the Wastebed 9 through 15 Closure Program.

3. DESIGN CRITERIA (DC)

The SWMS is designed in accordance with the New York State Stormwater Management Design Manual [NYSDEC, 2010] (Manual). Other guidance documents and additional design criteria are referenced to supplement the regulatory requirements of the Manual for site-specific operations, as needed.

DC 1.0: Wet Extended Detention Basin [NYSDEC, 2010]

- DC 1.01: Maintain 1 foot (ft) of freeboard when discharging the 100-year (yr), 24-hour (hr) storm event through the emergency spillway.
- DC 1.02: Design basin geometry with a minimum surface area to drainage area ratio of 1 to 100.
- DC 1.03: Design basin geometry with side slopes less than 3 horizontal (H): 1 vertical (V). *The SCA stormwater basins are already constructed with 3H:1V side slopes.*
- DC 1.04: Include a 4- to 6-ft deep forebay at each inlet, unless the inlet contributes less than 10% of the total inflow. Forebay shall be sized to contain 10% of the water quality volume (WQ_V).
- DC 1.05: Inlet areas should be stabilized to ensure that non-erosive conditions exist for at least the 2-yr, 24-hr storm event.

DC 2.0 Open Channel Conveyance

The following design guidance was prepared using a combination of design criteria for vegetated swales and open channel systems from the Manual. The Manual presents a complete suite of design criteria for these features that is intended to provide treatment of stormwater runoff in addition to conveyance. However, the SWMS is designed to achieve treatment solely within the stormwater basins (rather than through open channel systems). As such, the DC listed below focus solely on conveying stormwater runoff in a non-erosive and controlled manner.

- DC 2.01: Design vegetated open channel conveyance with maximum side slopes of 2H:1V [NYSDEC, 2010].
- DC 2.02: Design vegetated open channel conveyance with a longitudinal slope between 0.5 and 4% [NYSDEC, 2010].
- DC 2.03: Design vegetated open channel conveyances for the 10-yr, 24-hr storm with 6 inches (in.) of freeboard and a discharge velocity less than 4 feet per second (fps). *The velocity threshold assumes a grass-legume mixture for channel lining [NYSDEC, 2010]*.

- DC 2.04: Drainage control structures must be designed, graded, and maintained to prevent ponding and erosion on the cover. The surface drainage system must be designed and constructed to protect the cover from, at a minimum, the peak discharge of a 25-yr, 24-hr storm event [NYSDS, 2014]. *This criterion is interpreted as requiring grass and riprap lined open channel conveyances to produce non-erosive flows for the 25-yr, 24-hr storm event. The non-erosive flows are evaluated by the allowable shear stresses for grass and riprap, which are cited in the design calculations [NRCS, 2014]*.

- DC 2.05: Design open channel conveyance to convey 100-yr, 24-hr storm event without overtopping [NYSDEC, 2010].

- DC 2.06: Design energy dissipation aprons downstream of open channel conveyances for the 10-yr, 24-hr storm [NYSDEC, 2010].

DC 3.0 Design Criteria to be addressed in Future Submittal

The design and analyses for SWMS components related to the stormwater basins will be presented in future design submittals. These components will be designed to satisfy the additional DC as presented in the Stormwater Management Design Manual [NYSDEC, 2010 The basins and their discharge structures will be designed to satisfy the applicable DC as presented in the Manual. Specifically, the basins and discharge structures will be designed to maintain post-development peak discharge rates below pre-development peak discharge rates in accordance with Manual.

4. COMPONENTS OF THE SWMS

The components of the SWMS are presented in **Figure 1**. The list below provides a description of each component.

- **Stormwater basins.** Stormwater runoff generated by the SCA will be routed to existing stormwater basins in the northwest and northeast corners of the site. The stormwater basins will provide flow attenuation and water quality treatment for the post-development condition of the SCA footprint. Detailed design of the stormwater basins will be provided in a future design submittal.

- **Stormwater basin forebays.** Filter berms located within the stormwater basins create

forebays for the inflows to the stormwater basins (from road spillways). The forebays are intended to impound a majority of sediments that enter the basins and to facilitate long-term maintenance.

- **Diversion berms.** Stormwater runoff generated by the main and top decks will flow toward diversion berms located along their perimeter. The diversion berms will convey flows towards the riprap chutes.

- **Interception benches.** Stormwater runoff generated by portions of the main and top decks and the side slopes will flow toward interception benches. The interception benches will be installed along the side slopes, direct concentrated flows to central locations along the side slopes, and discharge runoff into the perimeter channels.

- **Riprap chutes.** The upper riprap chutes located on the top deck side slopes will receive discharge from the top deck diversion berms. The lower riprap chutes located on the side slopes of the main deck will receive discharge from the main deck diversion berms and channels, which convey flows from the top deck. The lower riprap chutes will direct runoff to the inlet areas of the road spillways.

- **Main deck channels.** The channels located on the main deck receive discharge from the top deck riprap chutes. The main deck channels then convey flow towards the inlet area of the lower riprap chutes.

- **Perimeter channels.** Stormwater runoff that is generated along the side slopes of the main deck and below the diversion berms and interception benches will be collected and conveyed by perimeter channels. The perimeter channels will convey the runoff toward two low spots at the inlet areas of the road spillways.

- **Road spillways.** The existing SCA perimeter road dike will be incised above the existing perimeter culverts and graded to create a channelized spillway (at the low spots of the perimeter channels and the outlets of the lower riprap chutes). The road spillways will be designed to convey the flows from the riprap chutes and perimeter channels into the adjacent stormwater basins while still being drivable to maintain road functionality. The existing culverts will be filled and abandoned in-place.

- **Stormwater basin outlet structures/conveyance system to outfalls.** This calculation package does not provide a detailed design for the outlet structures of the stormwater basins and the conveyance from the outlet structure to the outfalls. This design will be provided in future design submittals.

- **Energy dissipation aprons.** Energy dissipation aprons are located at: i) the outlet area of riprap chutes within the main deck and perimeter channels; ii) the base of the road spillway into the forebays; and iii) the toe of the filter berm exterior side slopes into the basins. The energy dissipation aprons mitigate the potential for erosion by reducing flow velocities.

5. MAJOR ASSUMPTIONS

- **Subcatchment Properties.** The subcatchments considered for the design and analyses presented herein are delineated in **Figure 1**. The subcatchment properties (i.e., area, hydrologic condition, etc.) are provided in **Attachment 1**. The flow path properties, used to evaluate the time of concentration of the subcatchments, are presented in **Attachment 2**.

- **Nodal Network Diagram.** The connectivity of the subcatchments to the SWMS features are presented within a nodal network diagrams in **Attachment 3**. These diagrams are a depiction of the modeling interface within HydroCAD [HydroCAD, 2009], described in Section 6.

- **Stormwater Basins.** The stage-storage relationships for the existing configuration of the west and east stormwater basins are presented in **Attachment 4**. The stage-storage relationship was developed from a combination of previous design information and as-built survey data collected by Parsons on 7 December 2014. The stormwater basins were previously designed in Design of Surface Water Management System for Operational Conditions [Geosyntec, 2010]. At that time, the basins were designed to contain the stormwater runoff generated by the 25-yr, 24-hr storm from exposed geotubes within a larger SCA footprint than actually constructed. The contributing drainage area from the SCA in this design scenario was 64 acres (contributing drainage area in this design scenario is 59 acres). The stage-storage relationships do not include the impounded volume within the forebays as this volume is negligible compared to the storage downgradient of the forebay (**Figure 1**). The potential re-design of the basins to store stormwater runoff from

contributing areas and to provide leachate storage will be presented in a future design submittal. The future design submittal will also include the outlet structure designs to manage stormwater discharged from the stormwater basins.

- **Rainfall Distribution.** The site is located in a region designated as having a Type II rainfall distribution as shown in **Attachment 5** [SCS, 1986].

- **Rainfall Depth.** The rainfall depths for various storm events are summarized below. The source information for the rainfall depths are provided in **Attachment 6**.

Frequency	Rainfall Depth (inches)	[Source, Year]
Water Quality Volume	0.85	[NYSDEC, 2010]
1-year	2.10	[NYSDEC, 2010]
2-year	2.55	[SCS, 1986]
5-year	3.25	[SCS, 1986]
10-year	3.80	[SCS, 1986]
25-year	4.40	[SCS, 1986]
50-year	4.75	[SCS, 1986]
100-year	5.00	[SCS, 1986]

- **Hydrologic Soil Group (HSG).** For the design of the SWMS, it is assumed that the proposed SCA final cover system and perimeter dike road soils are HSG D (i.e., clay loam, silty clay loam, sandy clay, silty clay, or clay). This is a conservative design approach as HSG D soils have the lowest infiltration potential and, therefore, will result in larger runoff volumes of greater intensity.

- **Runoff Curve Number (CN).** Curve numbers assigned to the subcatchments presented in **Figure 1** are shown in **Attachment 1**. Land use and hydrologic conditions are assigned to each subcatchment for the proposed SCA final cover system design. The curve numbers are applied to each subcatchment based on the guidance in **Attachment 7** [SCS, 1986].

6. METHODS & SOFTWARE

Hydrologic and hydraulic calculations for the design and analysis of the post-development conditions and SWMS were performed using methodologies presented in "Urban Hydrologic of Small Watersheds: Technical Release No. 55 (TR-55)" [SCS, 1986]. The computer program HydroCAD Version 9.1 [HydroCAD, 2009] was used to perform the computations described in TR-55, as well as Manning's kinematic equation, and other recognized hydraulic engineering procedures.

7. DESIGN OF THE SWMS COMPONENTS

The analyses presented herein were conducted to demonstrate satisfaction of the DC presented previously, which are based on peak flow rate, velocity, and/or depth for various storm events. The post-development condition modeling results are presented in **Attachment 8**. A summary of the open channel conveyance features designed with grass lining is presented in **Attachment 9**.

7.1 Stormwater Basins

Note – The design of the stormwater basin outlet structures, conveyance systems, and discharge locations will be provided in future design submittals. At this time, design related to the stormwater basins is limited to evaluation of the freeboard within the basins (assuming no discharge for the design storm event) and forebay sizing.

Methodology

The calculations presented herein demonstrate that the ponded water (peak stage) within basins do not overtop the basin embankments when receiving stormwater runoff from the 100-yr, 24-hr storm. Although the outlet structure and emergency spillway designs will be included in a future submittal, the freeboard results presented below demonstrate that an emergency spillway design can be prepared to satisfy DC 1.01.

Calculation Parameters

The stage-storage relationships for the stormwater basins from the prior study [Geosyntec, 2010] were utilized for hydrograph routing. The relationships are detailed in the modeling results

presented in **Attachment 4**.

Results

The west and east stormwater basin peak water surface elevations for the 100-yr, 24-hr storm event are 429.8 and 431.4 ft, respectively. The resulting freeboards in the basins are 1.2 and 0.6 ft, respectively. These results indicate that each basin has sufficient storage capacity to impound (without discharging) the full volume of the design storm without overtopping. Although the peak water surface elevation does not account for discharge from an outlet structure, it can be expected that such a structure would lower the peak water surface elevation. As such, an emergency spillway for each basin can be designed to meet the freeboard requirement in DC 1.01. The results of additional storm events are summarized below:

Design Info	West Basin	East Basin
Channel Protection Volume: 24-hour, 1-year storm event		
Peak Inflow Rate (cfs)	17	18
Total Inflow Volume (ac-ft)	1.897	1.873
Minimum Freeboard (ft)	4.4	2.4
Overbank Flood: 24-hour, 10-year storm event		
Peak Inflow Rate (cfs)	60	56
Total Inflow Volume (ac-ft)	5.265	4.935
Minimum Freeboard (ft)	2.5	1.3
Extreme Flood: 24-hour, 100-year storm event		
Peak Inflow Rate (cfs)	95	86
Total Inflow Volume (ac-ft)	7.951	7.351
Minimum Freeboard (ft)	1.2	0.6

In addition, the surface areas of the west and east basins at the maximum impoundment elevation (431 and 432 ft, respectively) are 2.206 and 3.579 acres, respectively. Compared to their contributing drainage areas of 28.543 and 23.380 (west and east basins, respectively), the calculated drainage area to surface area ratios of 8:100 and 15:100 satisfy DC 1.02.

7.2 Stormwater Basin Forebays

Methodology

Forebays were designed to provide sediment storage capacity at the inlet area of each stormwater basin. This inlet area initiates the initial sedimentation of suspended solids for the majority of inflows to the stormwater basin, which limits routine sediment removal to the forebay. The forebays were sized to contain at least 10% of the WQ_v of each stormwater basin to comply with DC 1.04. The WQ_v is calculated as follows.

$$R_v = 0.05 + 0.009 * I$$

$$WQ_v = (P * R_v * A)/12$$

Where: WQ_v = water quality volume (acre-ft); P = 90% rainfall event number (in.); A = drainage area (acre); and I = impervious cover (%). Note: R_v = 0.2 since the SWMS design does not utilize green infrastructure techniques upstream of the forebay to replicate pre-development hydrology.

In addition to the forebay impoundment volume, the top width and breadth of the berm creating the forebay were sized to demonstrate sufficient discharge capacity. The overflow was analyzed as a broad-crested rectangular weir within HydroCAD. It should be noted that additional discharge capacity will be provided through the porous rock filter berm creating the forebays; however, this capacity was neglected in this analysis.

Calculation Parameters

The following inputs were used to calculate the WQv to each stormwater basin.

- P = 0.85 in. (**Attachment 6**)
- Impervious Cover
    - West Stormwater Basin
        - Total Upstream Drainage Area (A) = 28.543 acres (**Attachment 8**)

- Impervious (perimeter road) Upstream Drainage Area = 0.33 acres (**Attachment 1 – 11S and 19S**)

- East Stormwater Basin
  - Total Upstream Drainage Area (A) = 23.380 acres (**Attachment 8**)
  - Impervious (perimeter road) Upstream Drainage Area = 0.37 acres (**Attachment 1 – 15S, 16S, and 20S**)

The top elevation of the rock filter berms (which convey overflow from the forebay to the basin) was selected to achieve the required 4 to 6 ft depth (DC 1.04). The low spot within the west and east stormwater basin designs are at elevation 423 and 427 ft, respectively. As such, the selected depths are 5 and 4 ft, respectively. The corresponding top elevations of the rock filter berms are 428 and 431 ft, respectively.

Results

The WQ_v of the west and east stormwater basins were calculated as 0.404 and 0.331 acre-ft, respectively. 10% of these volumes (1,761 and 1,443 cu-ft, respectively) were used as the minimum sizes of the forebays within the stormwater basins (**Attachment 10**).

Furthermore, based on the required impoundment volume of the forebays (**Attachment 10**), semicircular geometry stores the required 10% WQ_v, which satisfies DC 1.04. In addition, modeling results (**Attachment 8**) indicate that a minimum top width of 65 ft and 60 ft for the West and East Basins, respectively, and with a 2 ft breadth would convey the forebay overflows into the stormwater basins without overtopping, which reinforces satisfaction of DC 1.01.

7.3 Diversion Berms

Methodology

The diversion berms were designed to convey the stormwater runoff generated from the main and top decks of the SCA final cover system. The design was evaluated using the largest contributing drainage to a diversion berm, along with the berm geometry and hydraulic properties.

Calculation Parameters

The largest contributing drainage to a diversion berm is through Reach Node D6 as shown in **Figure 1**. The diversion berms were designed with the following geometry and hydraulic properties:

- Design Flow Rates for Reach Node D6 (**Attachment 8**):
    - 13 cubic feet per second (cfs) (10-yr, 24-hr storm event)
    - 16 cfs (25-yr, 24-hr storm event)
    - 20 cfs (100-yr, 24-hr storm event)
- Bottom Width = 0 ft (v-channel)
- Left Side Slope = 2H:1V (diversion berm) (satisfies DC 2.01)
- Right Side Slope = 10H:1V (SCA final cover system, assumed maximum slope along top deck) (satisfies DC 2.01)
- Longitudinal Slope = 1.0% (satisfies DC 2.02)
- Manning's roughness coefficient = 0.030 [HydroCAD, 2009]; grass channel lining
- Depth = 2 ft
- Allowable shear stress = 0.7 pounds per square ft (psf) (**Attachment 11**)

Results

The diversion berm design calculations presented in **Attachment 12** show the following results, with applicable DC that is satisfied:

- The 10-yr, 24-hr flow rate results in a freeboard of 13 in. and discharge velocity of 2.8 fps (DC 2.03).
- The 25-yr, 24-hr flow rate results in an allowable shear stress of 0.3 psf (DC 2.04).

- The 100-yr, 24-hr flow rate depth is 1.0 ft, which results in a freeboard of 1.0 ft. (DC 2.05).

7.4 Main Deck Channels

Methodology

The main deck channels were designed to convey the stormwater runoff generated from the top deck of the SCA final cover system. The design was evaluated using the largest contributing drainage to a main deck channel, along with the main deck channel geometry and hydraulic properties.

Calculation Parameters

The largest contributing drainage to a main deck channel is through Reach Node C1 as shown in **Figure 1**. The main deck channel was designed with the following geometry and hydraulic properties:

- Design Flow Rates for Reach Node C1 (**Attachment 8**):
    - 20 cfs (10-yr, 24-hr storm event)
    - 26 cfs (25-yr, 24-hr storm event)
    - 32 cfs (100-yr, 24-hr storm event)
- Minimum Bottom Width = 20 ft (trapezoidal channel)
- Side Slopes = 3H:1V (fill atop the main deck) (satisfies DC 2.01)
- Manning's roughness coefficient = 0.030; grass channel lining [HydroCAD, 2009]
- Minimum Longitudinal Slope = 0.012% (satisfies DC 2.02)
- Minimum Depth = 1.0 ft
- Allowable shear stress = 0.7 psf (**Attachment 11**)

Results

The design calculations for the main deck channel design presented in **Attachment 13** show the following, with the applicable DC that is satisfied:

- The 10-yr, 24-hr flow rate results in a freeboard of 7 in. and discharge velocity of 3.0 fps (DC 2.03).
- The 25-yr, 24-hr flow rate results in an allowable shear stress of 0.3 psf (DC 2.04).
- The 100-yr, 24-hr flow rate depth is 0.6 ft, which results in a freeboard of 0.4 ft (DC 2.05).

7.5 Interception Benches

Methodology

The interception benches were designed to convey the stormwater runoff generated from the side slopes and portions of the upper decks of the SCA final cover system. The design was evaluated using the largest contributing drainage to an interception bench, along with the bench geometry and hydraulic properties.

Calculation Parameters

Two interception bench designs were evaluated. The two bench designs have similar geometry but they differ in longitudinal slope. The first has a 1% longitudinal slope and second has a 0.5% longitudinal slope.

The largest contributing drainage to the steeper slope interception bench design occurs at Reach Node I2A as shown in **Figure 1**. These interception benches were designed with the following geometry and hydraulic properties:

- Design Flow Rates for Reach Node I2A (**Attachment 8**):
    - 3 cfs (10-yr, 24-hr storm event)
    - 3 cfs (25-yr, 24-hr storm event)
    - 4 cfs (100-yr, 24-hr storm event)

- Bottom Width = 0 ft (v-channel)
- Left Side Slope = 2H:1V (interception bench) (satisfies DC 2.01)
- Right Side Slope = 20H:6V (proposed SCA final cover system, assumed maximum slope alongside slopes) (DC 2.01)
- Longitudinal Slope = 1% (satisfies DC 2.02)Manning's roughness coefficient = 0.030 [HydroCAD, 2009]; grass channel lining
- Depth = 2.0 ft
- Allowable shear stress = 0.7 psf (**Attachment 11**)

The contributing drainage to the shallower slope interception bench design occurs at Reach Node I2C as shown in **Figure 1**. These interception benches were designed with the following geometry and hydraulic properties:

- Design Flow Rates for Reach Node I2C (**Attachment 8**):
    - 9 cfs (10-yr, 24-hr storm event)
    - 12 cfs (25-yr, 24-hr storm event)
    - 15 cfs (100-yr, 24-hr storm event)
- Bottom Width = 0 ft (v-channel)
- Left Side Slope = 2H:1V (interception bench) (satisfies DC 2.01)
- Right Side Slope = 20H:6V (SCA final cover system, assumed maximum slope alongside slopes) (satisfies DC 2.01)
- Longitudinal Slope = 0.5% (satisfies DC 2.02)
- Manning's roughness coefficient = 0.030 [HydroCAD, 2009]; grass channel lining
- Depth = 2.0 ft

- Allowable shear stress = 0.7 psf (**Attachment 11**)

Results

The interception bench design calculations presented in **Attachment 14** show the following results with applicable DC that is satisfied:

- Steeper Slope Interception Bench
    - The 10-yr, 24-hr flow rate results in a freeboard of 16 in. and discharge velocity of 2.2 fps (DC 2.03).
    - The 25-yr, 24-hr flow rate results in an allowable shear stress of 0.2 psf (DC 2.04).
    - The 100-yr, 24-hr flow rate depth is 0.8 ft, which results in a freeboard of 1.2 ft. (DC 2.05).
- Shallower Slope Interception Bench
    - The 10-yr, 24-hr flow rate results in a freeboard of 10 in. and discharge velocity of 2.4 fps (DC 2.03).
    - The 25-yr, 24-hr flow rate results in an allowable shear stress of 0.2 psf (DC 2.04).
    - The 100-yr, 24-hr flow rate depth is 1.4 ft, which results in a freeboard of 0.6 ft. (DC 2.05).

7.6 Riprap Chutes

Methodology

The riprap chutes were designed to direct the stormwater runoff generated from the top and main decks, using the largest contributing drainage area associated with each deck. As such, the chute geometry and hydraulic properties were evaluated for the larger contributing drainage to the riprap chutes at each deck.

Furthermore, the Manning's roughness coefficient was calculated as a function of flow rate, channel width, slope, and riprap size. This iterative calculation process is detailed in **Attachment**

15. This attachment presents the calculation of tractive stresses within the riprap chute. Tractive stress is evaluated to assess whether the hydrodynamic forces applied by the design flow rates along the riprap chute are sufficient to cause movement of the channel lining. This threshold (permissible shear stress) is defined as the maximum unit tractive force that will not cause serious erosion of channel bed material from a level channel bed [Chow, 1959].

Calculation Parameters

The largest contributing drainage to the top deck riprap chute discharges into Reach Node R3 as shown in **Figure 1**. The riprap chutes were designed with the following geometry and hydraulic properties:

- Design Flow Rates for Reach Node R3 (**Attachment 8**):
    - 26 cfs (25-yr, 24-hr storm event)
    - 32 cfs (100-yr, 24-hr storm event)
- Bottom Width = 20 ft (trapezoidal channel)
- Left Side Slope = 3H:1V
- Right Side Slope = 3H:1V
- Manning's roughness coefficient calculated based on a riprap size of D_{50} = 12 in.
- Longitudinal Slope = 20H:6V
- Depth = 1.0 ft
- Allowable shear stress = 4.7 psf (**Attachment 11**)

The largest contributing drainage to the main deck riprap chute discharges into Reach Node R1 as shown in **Figure 1**. The riprap chutes were designed with the following geometry and hydraulic properties:

- Design Flow Rates for Reach Node R1 (**Attachment 8**):

- 41 cfs (25-yr, 24-hr storm event)
- 51 cfs (100-yr, 24-hr storm event)

- Bottom Width = 35 ft (trapezoidal channel)
- Left Side Slope = 3H:1V
- Right Side Slope = 3H:1V
- Manning's roughness coefficient calculated based on a riprap size of D_{50} = 12 in.
- Longitudinal Slope = 20H:6V
- Depth = 1.0 ft
- Allowable shear stress = 4.7 psf (**Attachment 11**)

Results

The top deck riprap chute (R3) design calculations presented in **Attachment 15** show the following:

- The 25-yr, 24-hr flow rate results in an allowable shear stress of 4.2 psf (DC 2.04).
- The 100-yr, 24-hr flow rate depth is 0.26 ft, which results in a freeboard of 0.74 ft. (DC 2.05).
- A D_{50} of 12 in. was selected, which corresponds to a 27 in. bed thickness [NYSDEC, 2005].

The main deck riprap chute (R1) design calculations presented in **Attachment 15** show the following:

- The 25-yr, 24-hr flow rate results in an allowable shear stress of 4.1 psf (DC 2.04).
- The 100-yr, 24-hr flow rate depth is 0.25 ft, which results in a freeboard of 0.75 ft. (DC 2.05).

- A D_{50} of 12 in. was selected, which corresponds to a 27 in. bed thickness [NYSDEC, 2005].

7.7 Perimeter Channels

Methodology

The perimeter drainage channels were designed to convey the stormwater runoff generated from the portion of the side slopes of the SCA final cover system below the diversion berms and interception benches. The perimeter channels along the SCA perimeter vary in geometry and hydraulic properties.

There are four perimeter channels surrounding the SCA that discharge to the two road spillways. Each channel is designed and modeled as multiple segments that differ in their varying geometry and longitudinal slope. Perimeter Channel P2 (P2A, P2B, P2C, P2D) has the largest contributing drainage to each of the four channel designs that were evaluated. As such, these channels are utilized to evaluate four channel designs.

Calculation Parameters

Four channel design calculations were prepared. The first, and most general, channel design is based on a 0.5% longitudinal slope; a 4-ft bottom width; 2.5H:1V side slopes; and a 1-ft minimum depth. The second channel design was based on increasing bottom width (4-ft minimum) and depth (1-ft minimum) with a 0.6% longitudinal slope and 2.5H:1V side slopes. The third channel segment is based on a 2% longitudinal slope; a 4-ft (minimum) bottom width; 2.5H:1V and 2.5H:1V side slopes; and a 1-ft minimum depth. The fourth channel segment is based on a 1% longitudinal slope; a 10-ft (minimum) bottom width; 2.5H:1V and 3.3H:1V side slopes; and a 2-ft minimum depth.

The largest contributing drainage to the first channel design is through Reach Node P2A as shown in **Figure 1**. The first channel was designed with the following geometry and hydraulic properties:

- Design Flow Rates for Reach Node P2A (**Attachment 8**):
    - 4 cfs (10-yr, 24-hr storm event)
    - 5 cfs (25-yr, 24-hr storm event)

    - 6 cfs (100-yr, 24-hr storm event)
- Minimum Bottom Width = 4 ft (trapezoidal channel)
- Side Slopes = 2.5H:1V (excavation through SCA perimeter dike) (satisfies DC 2.01)
- Manning's roughness coefficient = 0.030; grass channel lining [HydroCAD, 2009]
- Minimum Longitudinal Slope = 0.5% (satisfies DC 2.02)
- Minimum Depth = 1.0 ft
- Allowable shear stress = 0.7 psf (**Attachment 11**)

The largest contributing drainage to the second channel design (Reach Node P2B) is shown in **Figure 1**. The third channel was designed with the following geometry and hydraulic properties:

- Design Flow Rates for Reach Node P2B (**Attachment 8**):
    - 4 cfs (10-yr, 24-hr storm event)
    - 5 cfs (25-yr, 24-hr storm event)
    - 7 cfs (100-yr, 24-hr storm event)
- Minimum Bottom Width = 4 ft (minimum, trapezoidal channel)
- Side Slopes = 2.5H:1V (excavation through SCA perimeter dike) (satisfies DC 2.01)
- Manning's roughness coefficient = 0.030; grass channel lining [HydroCAD, 2009]
- Minimum Longitudinal Slope = 0.6% (satisfies DC 2.02)
- Minimum Depth = 1.0 ft (minimum)
- Allowable shear stress = 0.7 psf (**Attachment 11**)

The largest contributing drainage to the third channel design (Reach Node P2C) is shown in **Figure 1**. The third channel was designed with the following geometry and hydraulic properties:

- Design Flow Rates for Reach Node P2C (**Attachment 8**):
    - 4 cfs (10-yr, 24-hr storm event)
    - 5 cfs (25-yr, 24-hr storm event)
    - 7 cfs (100-yr, 24-hr storm event)
- Minimum Bottom Width = 4 ft (minimum, trapezoidal channel)
- Side Slopes = 2.5H:1V (excavation through SCA perimeter dike) (satisfies DC 2.01)
- Manning's roughness coefficient = 0.030; grass channel lining [HydroCAD, 2009]
- Minimum Longitudinal Slope = 2.0% (satisfies DC 2.02)
- Minimum Depth = 1.0 ft
- Allowable shear stress = 0.7 psf (**Attachment 11**)

The largest contributing drainage to the fourth channel design (Reach Node P2D) is shown in **Figure 1**. The fourth channel was designed with the following geometry and hydraulic properties:

- Design Flow Rates for Reach Node P2D (**Attachment 8**):
    - 18 cfs (10-yr, 24-hr storm event)
    - 23 cfs (25-yr, 24-hr storm event)
    - 29 cfs (100-yr, 24-hr storm event)
- Minimum Bottom Width = 10 ft (minimum, trapezoidal channel)

- Perimeter Berm Side Slope = 2.5H:1V (satisfies DC 2.01)
- SCA Final Cover Side Slope = 3.3H:1V (satisfies DC 2.01)
- Manning's roughness coefficient = 0.030; grass channel lining [HydroCAD, 2009]
- Minimum Longitudinal Slope = 1.1% (satisfies DC 2.02)
- Minimum Depth = 2.0 ft

Allowable shear stress = 0.7 psf (**Attachment 11**)

Results

The design calculations for the first channel (P2A) design presented in **Attachment 16** show the following, with the applicable DC that is satisfied:

- The 10-yr, 24-hr flow rate results in a freeboard of 7 in. and discharge velocity of 1.7 fps (DC 2.03).
- The 25-yr, 24-hr flow rate results in an allowable shear stress of 0.1 psf (DC 2.04).
- The 100-yr, 24-hr flow rate depth is 0.6 ft, which results in a freeboard of 0.4 ft (DC 2.05).

The design calculations for the second channel (P2B) design presented in **Attachment 16** show the following, with the applicable DC that is satisfied:

- The 10-yr, 24-hr flow rate results in a freeboard of 7 in. and discharge velocity of 1.9 fps (DC 2.03).
- The 25-yr, 24-hr flow rate results in an allowable shear stress of 0.1 psf (DC 2.04).
- The 100-yr, 24-hr flow rate depth is 0.6 ft, which results in a freeboard of 0.4 ft (DC 2.05).

The design calculations for the third channel (P2C) design presented in **Attachment 16** show the following, with the applicable DC that is satisfied:

- The 10-yr, 24-hr flow rate results in a freeboard of 8 in. and discharge velocity of 2.9 fps

(DC 2.03).

- The 25-yr, 24-hr flow rate results in an allowable shear stress of 0.4 psf (DC 2.04).
- The 100-yr, 24-hr flow rate depth is 0.4 ft, which results in a freeboard of 0.6 ft (DC 2.05).

The design calculations for the fourth channel (P2D) design presented in **Attachment 16** show the following, with the applicable DC that is satisfied:

- The 10-yr, 24-hr flow rate results in a freeboard of 18 in. and discharge velocity of 3.1 fps (DC 2.03).
- The 25-yr, 24-hr flow rate results in an allowable shear stress of 0.3 psf (DC 2.04).
- The 100-yr, 24-hr flow rate depth is 0.7 ft, which results in a freeboard of 1.3 ft (DC 2.05).

7.8 Road Spillways

Methodology

The road spillways were designed to convey flows from the lower riprap chutes and perimeter channels into the stormwater basins. They replace the existing perimeter culverts on the west and east side of the SCA, which will be removed where in conflict with the proposed design, or otherwise grouted and abandoned in place. The spillways were conservatively modeled as rectangular broad-crested weirs due to their breadth (at least 40 ft) and width. The discharge velocity through the road spillways was used to size the riprap used as a lining material.

Calculation Parameters

The west and east road spillways were designed using the following dimensions:

- Design Flow Rates
    - West Road Spillway for Node S1 (**Attachment 8**):
        - 55 cfs (10-yr, 24-hr storm event)
        - 88 cfs (100-yr, 24-hr storm event)

- East Road Spillway for Node S2 (**Attachment 8**):
  - 45 cfs (10-yr, 24-hr storm event)
  - 71 cfs (100-yr, 24-hr storm event)
- Minimum Bottom Width = 15 ft (rectangular)
- Minimum Depth
  - 3.0 ft for West Road Spillway
  - 2.4 ft for East Road Spillway

Results

The west road spillway (S1) modeling results presented in **Attachment 17** are summarized below:

- The 10-yr, 24-hr flow rate results in a freeboard of 20 in. and discharge velocity of 2.8 fps.
- The 100-yr, 24-hr flow rate depth is 1.8 ft (DC 2.05). The corresponding freeboard is 1.2 ft.

The east road spillway (S2) modeling results presented in **Attachment 17** are summarized below:

- The 10-yr, 24-hr flow rate results in a freeboard of 16 in. and discharge velocity of 2.7 fps.
- The 100-yr, 24-hr flow rate depth is 1.5 ft (DC 2.05). The corresponding freeboard is 0.9 ft.

In addition, the maximum 10-yr, 24-hr storm event flow velocity through the weirs (2.8 fps) was used to size the spillway lining (**Attachment 17**). A D_{50} of 4 in. was selected, which corresponds to a 9 in. bed thickness [NYSDEC, 2005].

7.9 Energy Dissipation Aprons

Methodology

Rock outlet protection aprons (i.e., energy dissipation aprons) were designed for (i) the outlets of the upper riprap chutes into the main deck channels; (ii) the outlets of the lower riprap chutes into the perimeter channels; (iii) the outlet of the road spillway into the stormwater basin forebay; and (iv) the outside toe of the filter berm. The rock outlet protection aprons were designed to mitigate the potential for erosion in these downstream areas. In addition, rock outlet protection aprons were designed for the features discharging into the riprap chutes, which include the diversion berms and the main deck channels.

Design methodology presented within the Standards and Specifications for Erosion and Sediment Control [NYSDEC, 2005] was used to size the structures. Energy dissipation aprons will be designed for the principal outlet structure from the basins in future design submittals.

Calculation Parameters

The rock outlet protection aprons were sized using the following design flow rates:

- Rock Outlet Protection Apron for Diversion Berms into Upper Riprap Chutes
    - Design Flow Rates for Reach Node D6 (**Attachment 8**):
        - 13 cfs (10-yr, 24-hr storm event) (DC 2.06)
- Rock Outlet Protection Apron for Upper Riprap Chutes Outlet Area
    - Design Flow Rates for Reach Node R3 (**Attachment 8**):
        - 20 cfs (10-yr, 24-hr storm event) (DC 2.06)
- Rock Outlet Protection Apron for Diversion Berms into Lower Riprap Chutes
    - Design Flow Rates for Reach Node D2 (**Attachment 8**):
        - 10 cfs (10-yr, 24-hr storm event) (DC 2.06)

- Rock Outlet Protection Apron for Main Deck Channel into Lower Riprap Chutes
    - Design Flow Rates for Reach Node C1 (**Attachment 8**):
        - 20 cfs (10-yr, 24-hr storm event) (DC 2.06)
- Rock Outlet Protection Apron for Lower Riprap Chutes Outlet Area
    - Design Flow Rates for Reach Node R1 (**Attachment 8**):
        - 32 cfs (10-yr, 24-hr storm event) (DC 2.06)
- Rock Outlet Protection Apron for Road Spillways
    - Design Flow Rates for Reach Node S1 (**Attachment 8**):
        - 25 cfs (2-yr, 24-hr storm event) (DC 1.05)
- Rock Outlet Protection for Area at Toe of Filter Berms
    - Design Flow Rates for Reach Node F1 (**Attachment 8**):
        - 25 cfs (2-yr, 24-hr storm event) (DC 1.05)

For the riprap chutes, the flow depth within the main deck and perimeter channels will be greater than half of the riprap chute flow depth thereby creating a maximum tailwater condition. Similarly, the road spillways and filter berms, the depth of water in the downstream areas will be greater than half of the flow depth. As such, the road spillways and filter berms rock outlet protection designs were performed for the maximum tailwater condition. The remaining rock outlet protection for features discharging into the riprap chutes (diversion berms and the main deck channel) were performed using the minimum tailwater condition.

Results

The rock outlet protection apron sizing charts are presented in **Attachment 18**. The charts present the following minimum dimensions of the armored area downstream of the riprap chutes and perimeter channels:

- Dimensions of Rock Outlet Protection Apron for Diversion Berms (D6) into Upper Riprap Chutes
    - Apron Length = 16 ft (based on flow depth and width in diversion berm Reach Node D6; length is parallel to the direction of flow for the diversion berms)
    - Apron Width = 24 ft (full flow width for diversion berms)
    - Selected Riprap Size: D_{50} = 4 in.
    - Thickness of Riprap = 9 in.
- Dimensions of Rock Outlet Protection Apron for Upper Riprap Chutes (R3) Outlet Area
    - Apron Length = 42 ft (extends into main deck channel)
    - Apron Width = 20 ft (bottom width of chute)
    - Selected Riprap Size: D_{50} = 4 in.
    - Thickness of Riprap = 9 in.
- Dimensions of Rock Outlet Protection Apron for Diversion Berms (D2) into Lower Riprap Chutes
    - Apron Length = 14 ft (based on flow depth and width in diversion berm Reach Node D6; length is parallel to the direction of flow for the diversion berms)
    - Apron Width = 24 ft (full flow width for diversion berms)
    - Selected Riprap Size: D_{50} = 4 in.
    - Thickness of Riprap = 9 in.
- Dimensions of Rock Outlet Protection Apron for Main Deck Channel (C1) into Lower Riprap Chutes
    - Apron Length = 18 ft

- Apron Width = 20 ft (bottom width of main deck channel)
- Selected Riprap Size: D_{50} = 4 in.
- Thickness of Riprap = 9 in.

- Dimensions of Rock Outlet Protection Apron for Lower Riprap Chutes (R1) Outlet Area
  - Apron Length = 51 ft (extends into road spillway)
  - Apron Width = 35 ft (bottom width of chute)
  - Selected Riprap Size: D_{50} = 4 in.
  - Thickness of Riprap = 9 in.
- Dimensions of Rock Outlet Protection Apron for Road Spillways (F1)
  - Apron Length = 48 ft (from berm toe of slope into forebay)
  - Apron Width = 20 ft (into each forebay)
  - Selected Riprap Size: D_{50} = 4 in.
  - Thickness of Riprap = 9 in.
- Dimensions of Rock Outlet Protection for Area at Toe of Filter Berms (S1)
  - Apron Length = 48 ft (from berm toe of slope into basin)
  - Apron Width = 65 and 60 ft (alongside entire length of each filter berm)
  - Selected Riprap Size: D_{50} = 4 in.
  - Thickness of Riprap = 9 in.

8. CONCLUSION

The SCA final cover system SWMS consists of the following components: diversion berms; interception benches; perimeter and main deck channels; riprap chutes; road spillways; energy dissipation aprons; and stormwater basins. Each of these features was designed to satisfy design criteria within the New York Codes, Rules and Regulations and NYSDEC Stormwater Management and Erosion and Sediment Control Manuals. Where necessary, explanations for deviating from the design criteria were provided.

The components of the SWMS convey stormwater runoff from the proposed SCA final cover system to the west and east stormwater basins. Further, detailed design of stormwater basins appurtenances, outlet structures, and conveyance systems to the outfall will be completed as part of future submittal.

9. REFERENCES

Chow, V.T., "*Open Channel Hydraulics*", McGraw-Hill, 1959.

Geosyntec, "Design of Surface Water Management System for Operational Conditions", Honeywell, Onondaga Lake SCA Design, January 2010.

HydroCAD, "*HydroCAD™: Stormwater Modeling System, Version 9.10*", HydroCAD Software Solutions LLC., Second Edition, Chocorua, New Hampshire, 2009.

New York State Department of Environmental Conservation (NYSDEC), "*Standards and Specifications for Erosion and Sediment Control*", New York State, Department of Environmental Conservation, Division of Water, August 2005.

NYSDEC, "*Stormwater Management Design Manual*", New York State, Department of Environmental Conservation, Division of Water, August 2010.

New York State Department of State (NYSDS), "6 NYCRR Part 360, Subpart 360-2.15(k)(2)", http://www.dec.ny.gov/regs/14639.html, Accessed, September 2014.

Natural Resources Conservation Service (NRCS), "*Allowable Velocity and Maximum Shear Stress, Streambank Protection Code 580*", http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_024130.pdf, NRCS, United States Department of Agriculture, Accessed, August 2014

NRCS, http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm, United States Department of Agriculture, NRCS, Web Soil Survey, Accessed, August 2014.

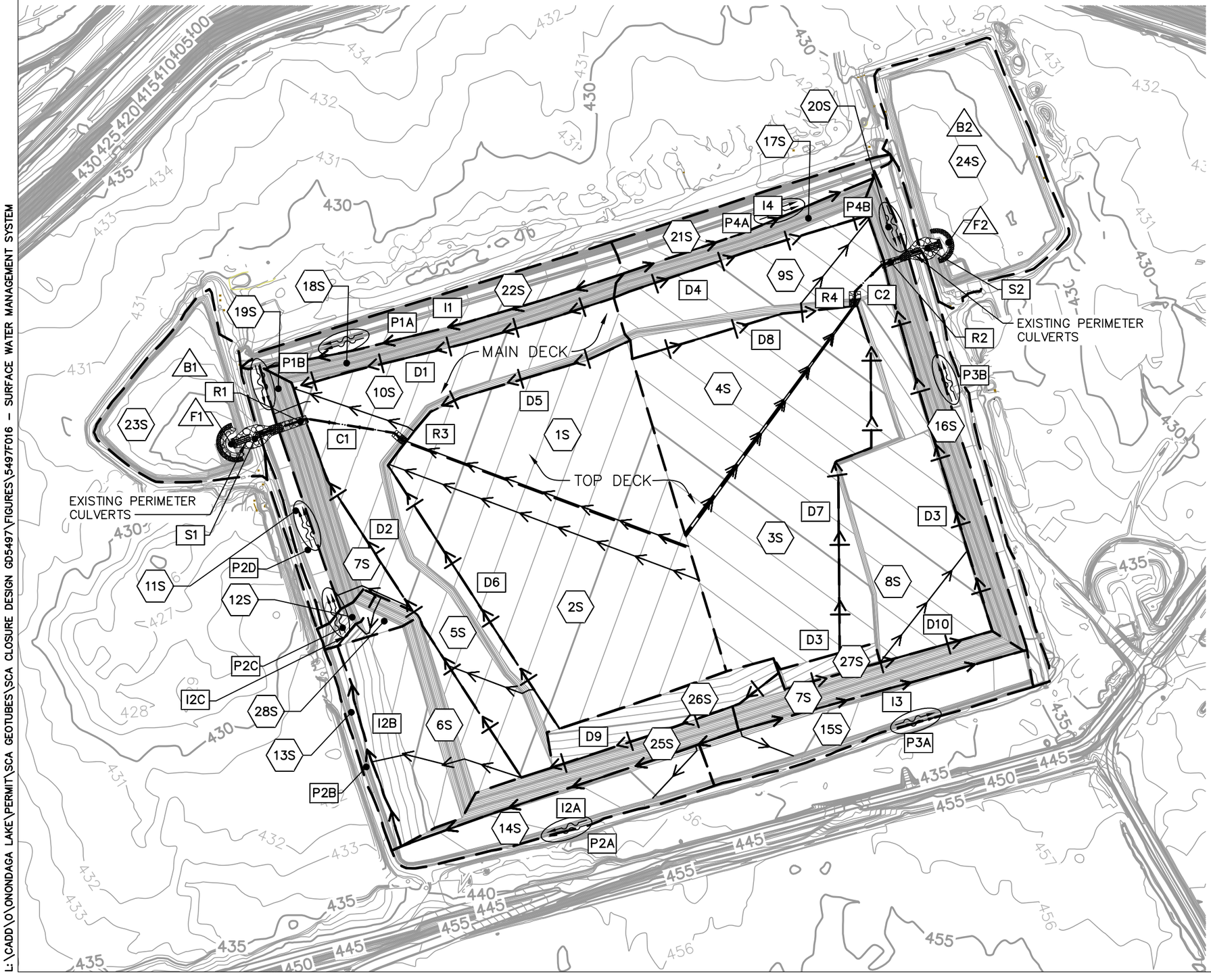
O'Brien & Gere, "*Stormwater Pollution Prevention Plan, Water Treatment Plant and Sediment Consolidation Area, Towns of Camillus and Geddes, Onondaga County, New York*", April 2011.

Soil Conservation Service (SCS), "*TR-55 Urban Hydrology for Small Watersheds, Technical Release 55 (TR-55)*", United States Department of Agriculture, Soil Conservation Service, 2nd ed., Washington, D.C., 1986.

United States Geological Survey (USGS), "*New York, Baldwinsville Quadrangle*", USGS, Department of the Interior, 1898.

Figures

POST-DEVELOPMENT CONDITIONS
STORMWATER MANAGEMENT SYSTEM



LEGEND

- LONGEST FLOW PATH
- SUBCATCHMENT DIVIDE
- EXISTING PERIMETER CULVERTS
- P1 — PERIMETER CHANNEL
- I1 — INTERCEPTION BENCH
- R1 — RIPRAP CHUTE
- S1 — ROAD SPILLWAY
- 1S — SUBCATCHMENT
- F1 — FOREBAY
- D1 — DIVERSION BERM
- B1 — STORAGE BASIN
- ROCK OUTLET PROTECTION APRON
- C1 — MAIN DECK CHANNEL

NOTES:

1. THE EXISTING GROUND TOPOGRAPHIC CONTOURS OUTSIDE THE LIMITS OF THE SCA SHOWN ON THIS DRAWING WERE OBTAINED FROM A TOPOGRAPHIC MAP COMPILED BY TVGA CONSULTANTS USING PHOTOGRAMMETRIC METHODS BASED ON AERIAL PHOTOGRAPHY PERFORMED ON 6 APRIL 2008. THE MAP WAS COMPILED IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS FOR 1 INCH EQUAL TO 50 FEET SCALE. THE TOPOGRAPHIC MAP WAS PROVIDED TO GEOSYNTEC BY PARSONS.

2. CONTOURS OF THE EAST AND WEST BASINS SHOWN HAVE BEEN DEVELOPED FROM SURVEY CONDUCTED 4–5 DECEMBER, 2014. THE EAST BASIN SUMP BOTTOM ELEVATIONS AND ASSOCIATED CONTOURS ARE BASED ON THE DRAWING "TOP OF SECONDARY LINER PLAN FOR SUMPS", 444853–201–C–005, DATED JANUARY 2011, IN THE SEDIMENT CONSOLIDATION AREA BASIN DESIGN DRAWING SET.

0 250' 500'

SCALE IN FEET

Beech and Bonaparte engineering p.c. KENNESAW, GA

an affiliate of Geosyntec Consultants

DATE:	JAN 15	SCALE:	AS SHOWN
PROJECT NO.	GD5497	FILE NO.	5497F016
DOCUMENT NO.	GA140562	FIGURE NO.	1

L:\CADD\O\ONONDAGA LAKE\PERMIT\SCA GEOTUBES\SCA CLOSURE DESIGN GD5497\FIGURES\5497F016 – SURFACE WATER MANAGEMENT SYSTEM

Written by:	**Antonio Sanchez**	Date:	**09/11/15**	Reviewed by:	**Tom Fendley / Jay Beech**	Date:	**09/11/15**

Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Cover Design**	Project No.:	**GD5497**	Phase No.:	**03**

Attachments

Written by:	**Antonio Sanchez**	Date:	**09/11/15**	Reviewed by:	**Tom Fendley / Jay Beech**	Date:	**09/11/15**

Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Cover Design**	Project No.:	**GD5497**	Phase No.:	**03**

Attachment 1: Post-Development Subcatchment Area Properties

`

Subcatchment ID	Area (sq. ft.)	Area (acre)	Total Area (acre)	Land Use Description	CN	Weighted CN
01S	167,078	3.836	3.836	Open Space; >75% Grass cover, Good; HSG D	80	80
02S	287,369	6.597	6.597	Open Space; >75% Grass cover, Good; HSG D	80	80
03S	223,104	5.122	5.122	Open Space; >75% Grass cover, Good; HSG D	80	80
04S	131,082	3.009	3.009	Open Space; >75% Grass cover, Good; HSG D	80	80
05S	141,157	3.241	3.241	Open Space; >75% Grass cover, Good; HSG D	80	80
06S	130,254	2.990	2.990	Open Space; >75% Grass cover, Good; HSG D	80	80
07S	48,210	1.107	1.107	Open Space; >75% Grass cover, Good; HSG D	80	80
08S	196,237	4.505	4.505	Open Space; >75% Grass cover, Good; HSG D	80	80
09S	109,391	2.511	2.511	Open Space; >75% Grass cover, Good; HSG D	80	80
10S	105,550	2.423	2.423	Open Space; >75% Grass cover, Good; HSG D	80	80
11S	30,062	0.690	1.965	Open Space; >75% Grass cover, Good; HSG D	80	81
	6,831	0.157		Impervious Areas; Streets and Roads; Gravel ; HSG D	91	
	48,697	1.118		Open Space; >75% Grass cover, Good; HSG D	80	
12S	4,437	0.102	0.102	Open Space; >75% Grass cover, Good; HSG D	80	80
13S	15,262	0.350	0.350	Open Space; >75% Grass cover, Good; HSG D	80	80
14S	72,596	1.667	1.667	Open Space; >75% Grass cover, Good; HSG D	80	80
15S	85,281	1.958	1.997	Open Space; >75% Grass cover, Good; HSG D	80	80
	1,728	0.040		Impervious Areas; Streets and Roads; Gravel ; HSG D	91	91
16S	40,564	0.931	2.429	Open Space; >75% Grass cover, Good; HSG D	80	80
	61,969	1.423		Open Space; >75% Grass cover, Good; HSG D	80	
	3,264	0.075		Impervious Areas; Streets and Roads; Gravel ; HSG D	91	
17S	35,369	0.812	0.812	Open Space; >75% Grass cover, Good; HSG D	80	80
18S	42,663	0.979	0.979	Open Space; >75% Grass cover, Good; HSG D	80	80
19S	15,963	0.366	0.539	Open Space; >75% Grass cover, Good; HSG D	80	84
	7,499	0.172		Impervious Areas; Streets and Roads; Gravel ; HSG D	91	
20S	11,054	0.254	0.487	Impervious Areas; Streets and Roads; Gravel ; HSG D	91	86
	10,168	0.233		Open Space; >75% Grass cover, Good; HSG D	80	
21S	48,778	1.120	1.120	Open Space; >75% Grass cover, Good; HSG D	80	80
22S	68,000	1.561	1.561	Open Space; >75% Grass cover, Good; HSG D	80	80
23S	20,888	0.480	2.685	Impervious Areas; Streets and Roads; Gravel ; HSG D	91	97
	96,069	2.205		Pond and Lake Surfaces; Open Water; Water Surface	98	
24S	29,079	0.668	4.368	Impervious Areas; Streets and Roads; Gravel ; HSG D	91	97
	161,192	3.700		Pond and Lake Surfaces; Open Water; Water Surface	98	
25S	43,074	0.989	0.989	Open Space; >75% Grass cover, Good; HSG D	80	80
26S	47,206	1.084	1.084	Open Space; >75% Grass cover, Good; HSG D	80	80
27S	12,191	0.280	0.280	Open Space; >75% Grass cover, Good; HSG D	80	80
28S	9,632	0.221	0.221	Open Space; >75% Grass cover, Good; HSG D	80	80

Written by:	**Antonio Sanchez**	Date:	**09/11/15**	Reviewed by:	**Tom Fendley / Jay Beech**	Date:	**09/11/15**

Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Cover Design**	Project No.:	**GD5497**	Phase No.:	**03**

Attachment 2: Post-Development Subcatchment Flow Path Properties

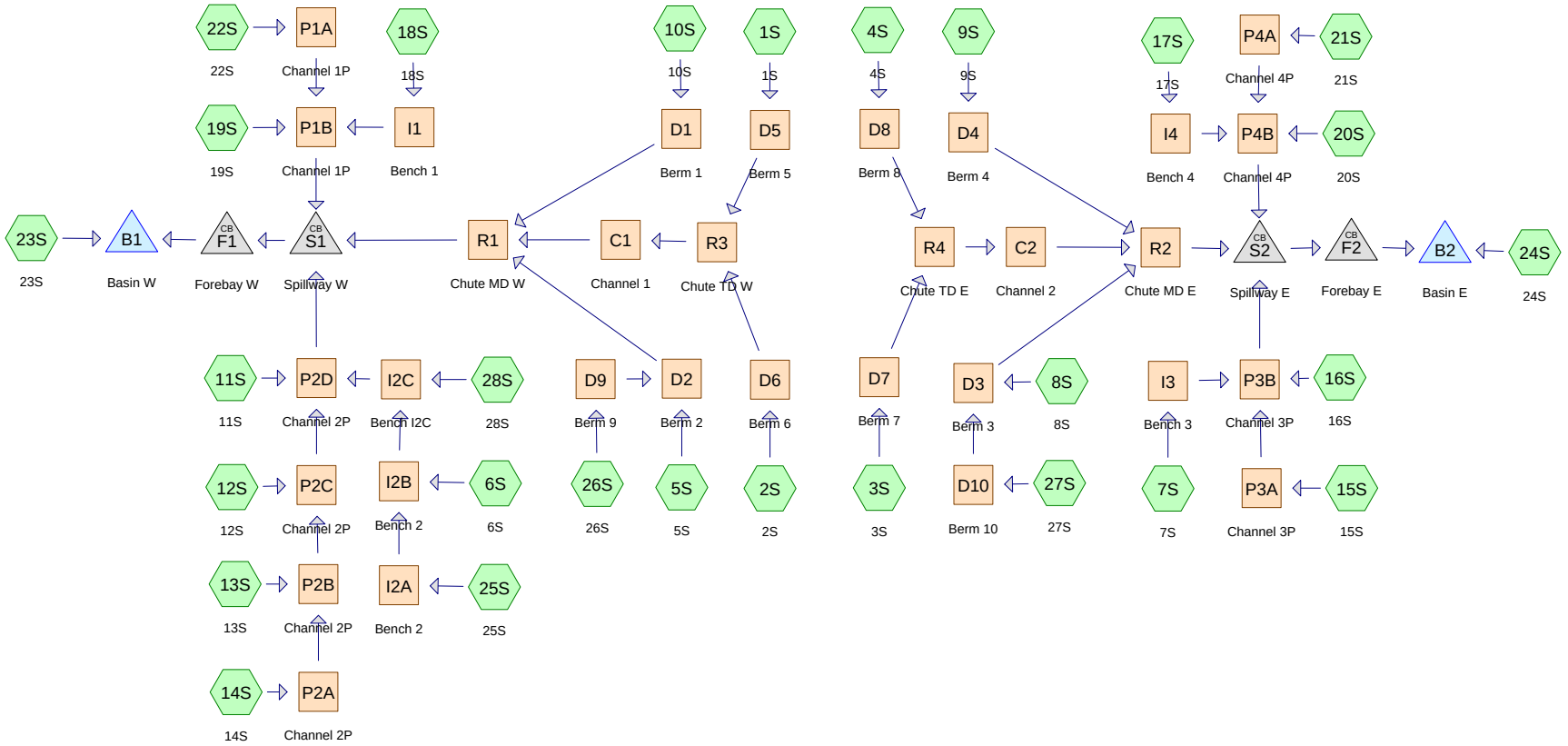
Subcatchment ID	Sheet Flow					Shallow Concentrated Flow				
	Flow Length (ft)	Surface Description[1]	Start Elevation (ft-MSL)	End Elevation (ft-MSL)	Land Slope (ft/ft)^2	Flow Length (ft)	Surface Description	Start Elevation (ft-MSL)	End Elevation (ft-MSL)	Land Slope (ft/ft)^2
01S	100	Grass: Short	467.30	466.00	0.0125	632	Unpaved	466.00	458.10	0.0125
02S	100	Grass: Short	467.90	466.70	0.0120	707	Unpaved	466.70	457.80	0.0126
03S	100	Grass: Short	467.10	465.90	0.0120	596	Unpaved	465.90	458.40	0.0126
04S	100	Grass: Short	467.00	465.80	0.0120	587	Unpaved	465.80	458.50	0.0124
05S	100	Grass: Short	464.40	458.30	0.0610	120	Unpaved	458.30	456.80	0.0125
06S	100	Grass: Short	460.00	458.80	0.0120	277	Unpaved	458.80	440.50	0.0661
07S	-	**Direct Rainfall**	-	-	-	-	-	-	-	-
08S	100	Grass: Short	463.40	462.10	0.0130	239	Unpaved	462.10	459.20	0.0121
09S	100	Grass: Short	459.20	453.40	0.0580	181	Unpaved	453.40	451.20	0.0122
10S	100	Grass: Short	457.35	452.10	0.0525	212	Unpaved	452.10	449.50	0.0123
11S	100	Grass: Short	455.10	453.90	0.0120	97	Unpaved	453.90	433.10	0.2153
12S	-	**Direct Rainfall**	-	-	-	-	-	-	-	-
13S	-	**Direct Rainfall**	-	-	-	-	-	-	-	-
14S	100	Grass: Short	449.10	445.40	0.0370	70	Unpaved	445.40	444.80	0.0086
15S	100	Grass: Short	450.00	445.40	0.0460	49	Unpaved	445.40	445.25	0.0031
16S	-	**Direct Rainfall**	-	-	-	-	-	-	-	-
17S	100	**Direct Rainfall**	459.27	453.44	0.0583	80	-	453.44	451.16	0.0285
18S	-	**Direct Rainfall**	-	-	-	-	-	-	-	-
19S	-	**Direct Rainfall**	-	-	-	-	-	-	-	-
20S	-	**Direct Rainfall**	-	-	-	-	-	-	-	-
21S	-	**Direct Rainfall**	-	-	-	-	-	-	-	-
22S	-	**Direct Rainfall**	-	-	-	-	-	-	-	-
23S	-	**Direct Rainfall**	-	-	-	-	-	-	-	-
24S	-	**Direct Rainfall**	-	-	-	-	-	-	-	-
25S	-	**Direct Rainfall**	-	-	-	-	-	-	-	-
26S	-	**Direct Rainfall**	-	-	-	-	-	-	-	-
27S	-	**Direct Rainfall**	-	-	-	-	-	-	-	-
28S	100	Grass: Short	454.00	442.00	0.1200	32	Unpaved	442.00	439.00	0.0938

Notes.

1. A 'Direct Rainfall' Surface Description indicates that the calculated overall time of concentration will be less than the 0.1 hours (6 minutes). As such, the time of concentration is set of 6 minutes in accordance with the methodology provided in Technical Report 55 (TR-55) [SCS, 1986].

2. Land slopes were calculated over as an average slope over the flow length.

Attachment 3: Post-Development Nodal Network Diagram



Subcat Reach Pond Link

Drainage Diagram for Post-Development Conditions (As-Builts)

Prepared by Geosyntec Consultants, Printed 1/30/2015

Written by:	**Antonio Sanchez**	Date:	**09/11/15**	Reviewed by:	**Tom Fendley / Jay Beech**	Date:	**09/11/15**

Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Cover Design**	Project No.:	**GD5497**	Phase No.:	**03**

Attachment 4: Stormwater Basins Stage-Storage Relationships

West Stormwater Basin	
Contour Elevation (ft)	Contour Area (acres)
423	0.063
424	0.317
425	0.667
426	1.063
427	1.569
428	1.900
429	2.047
430	2.130
431	2.206

East Stormwater Basin	
Contour Elevation (ft)	Contour Area (acres)
427	0.104
428	0.372
429	1.305
430	2.773
431	3.420
432	3.579

Notes.

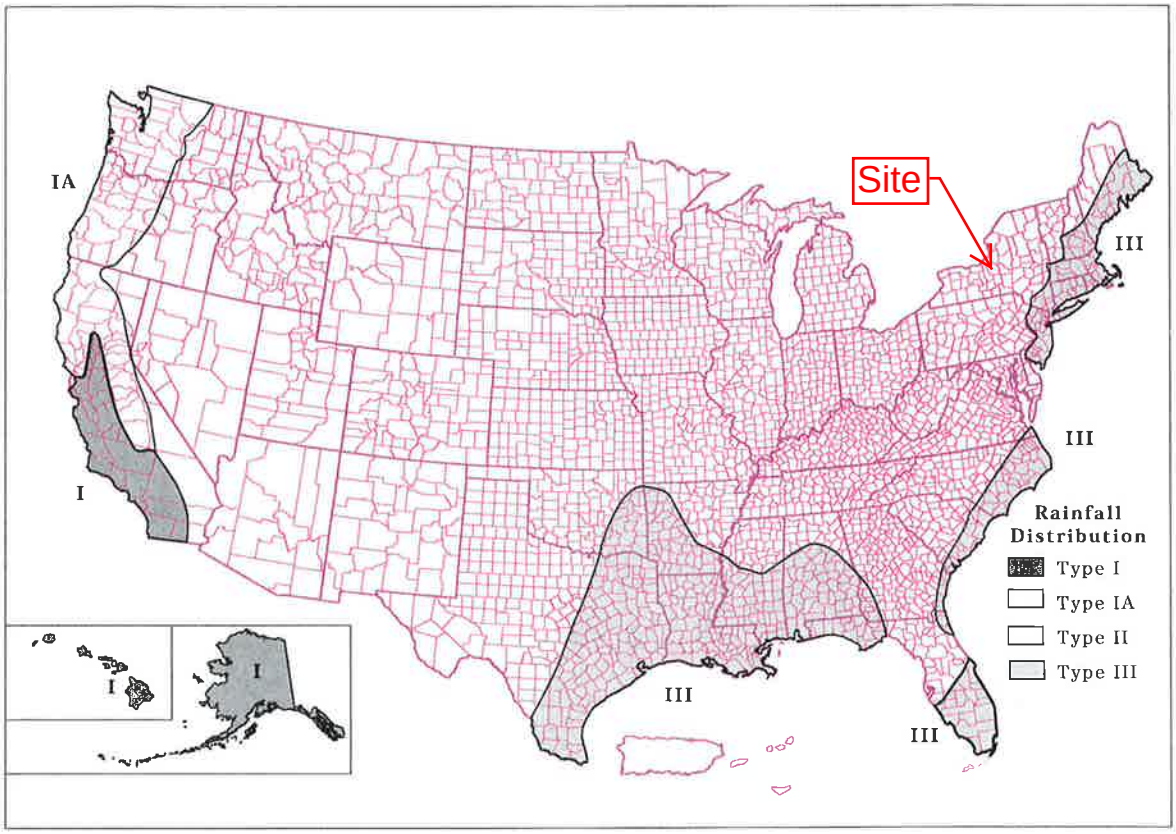
1. Contour Elevations for the West and East Stormwater Basins have been developed from survey conducted 4th to 5th of December, 2014. The East Basin sump bottom elevations and associated contours are based on the drawing "Top of Secondary Liner Plan for Sumps", 444853-201-C-005, dated January 2011, in the sediment consolidation area basin design drawing set.

Written by:	**Antonio Sanchez**	Date:	**09/11/15**	Reviewed by:	**Tom Fendley / Jay Beech**	Date:	**09/11/15**

Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Cover Design**	Project No.:	**GD5497**	Phase No.:	**03**

Attachment 5: Rainfall Distribution [SCS, 1986]

Figure B-2 Approximate geographic boundaries for NRCS (SCS) rainfall distributions



Rainfall data sources

This section lists the most current 24-hour rainfall data published by the National Weather Service (NWS) for various parts of the country. Because NWS Technical Paper 40 (TP-40) is out of print, the 24-hour rainfall maps for areas east of the 105th meridian are included here as figures B-3 through B-8. For the area generally west of the 105th meridian, TP-40 has been superseded by NOAA Atlas 2, the Precipitation-Frequency Atlas of the Western United States, published by the National Ocean and Atmospheric Administration.

East of 105th meridian

Hershfield, D.M. 1961. Rainfall frequency atlas of the United States for durations from 30 minutes to 24 hours and return periods from 1 to 100 years. U.S. Dept. Commerce, Weather Bur. Tech. Pap. No. 40. Washington, DC. 155 p.

West of 105th meridian

Miller, J.F., R.H. Frederick, and R.J. Tracey. 1973. Precipitation-frequency atlas of the Western United States. Vol. I Montana; Vol. II, Wyoming; Vol III, Colorado; Vol. IV, New Mexico; Vol V, Idaho; Vol. VI, Utah; Vol. VII, Nevada; Vol. VIII, Arizona; Vol. IX, Washington; Vol. X, Oregon; Vol. XI, California. U.S. Dept. of Commerce, National Weather Service, NOAA Atlas 2. Silver Spring, MD.

Alaska

Miller, John F. 1963. Probable maximum precipitation and rainfall-frequency data for Alaska for areas to 400 square miles, durations to 24 hours and return periods from 1 to 100 years. U.S. Dept. of Commerce, Weather Bur. Tech. Pap. No. 47. Washington, DC. 69 p.

Hawaii

Weather Bureau. 1962. Rainfall-frequency atlas of the Hawaiian Islands for areas to 200 square miles, durations to 24 hours and return periods from 1 to 100 years. U.S. Dept. Commerce, Weather Bur. Tech. Pap. No. 43. Washington, DC. 60 p.

Puerto Rico and Virgin Islands

Weather Bureau. 1961. Generalized estimates of probable maximum precipitation and rainfall-frequency data for Puerto Rico and Virgin Islands for areas to 400 square miles, durations to 24 hours, and return periods from 1 to 100 years. U.S. Dept. Commerce, Weather Bur. Tech. Pap. No. 42. Washington, DC. 94 P.

Attachment 6: Rainfall Depths

90% Rainfall [NYSDEC, 2010]

The Water Quality Volume (denoted as the WQ_v) is designed to improve water quality sizing to capture and treat 90% of the average annual stormwater runoff volume. The WQ_v is directly related to the amount of impervious cover created at a site. Contour lines of the 90% rainfall event are presented in Figure 4.1.

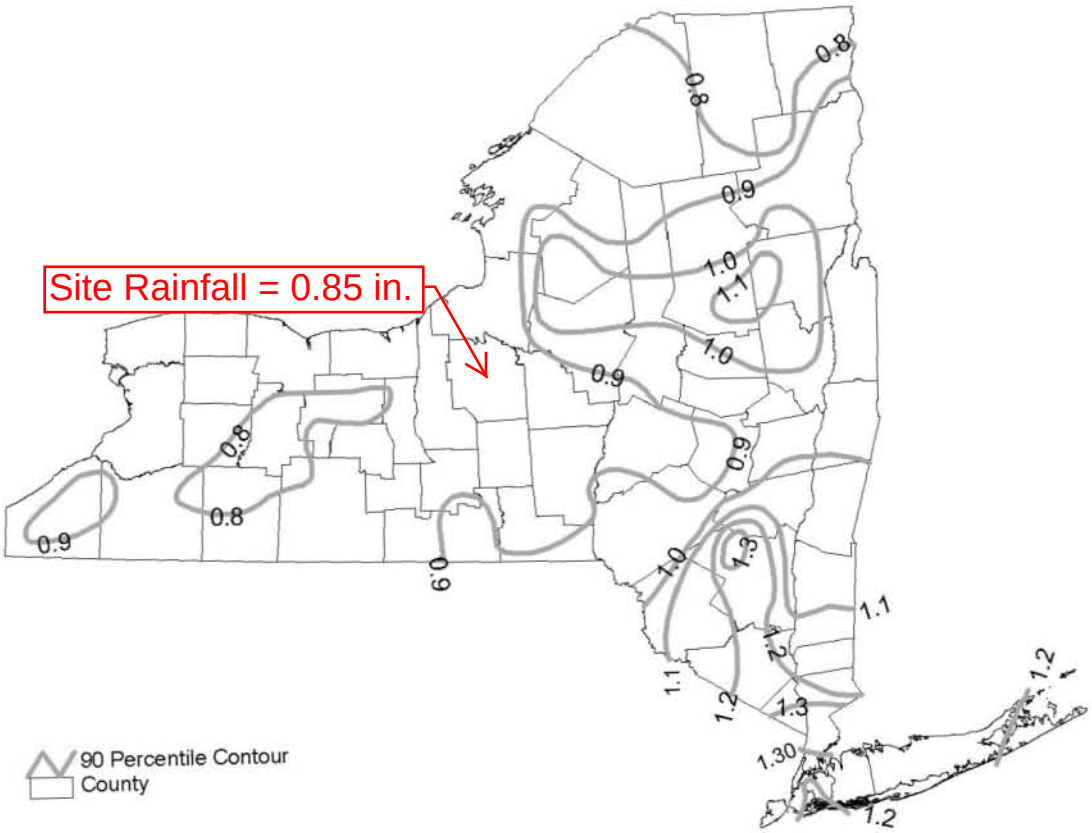
The following equation can be used to determine the water quality storage volume WQ_v (in acre-feet of storage):

$$WQ_v = \frac{(P)\,(R_v)(A)}{12}$$

where:
WQ_v = water quality volume (in acre-feet)
P = 90% Rainfall Event Number (see Figure 4.1)
R_v = 0.05 + 0.009(I), where I is percent impervious cover
A = site area in acres (Contributing area)

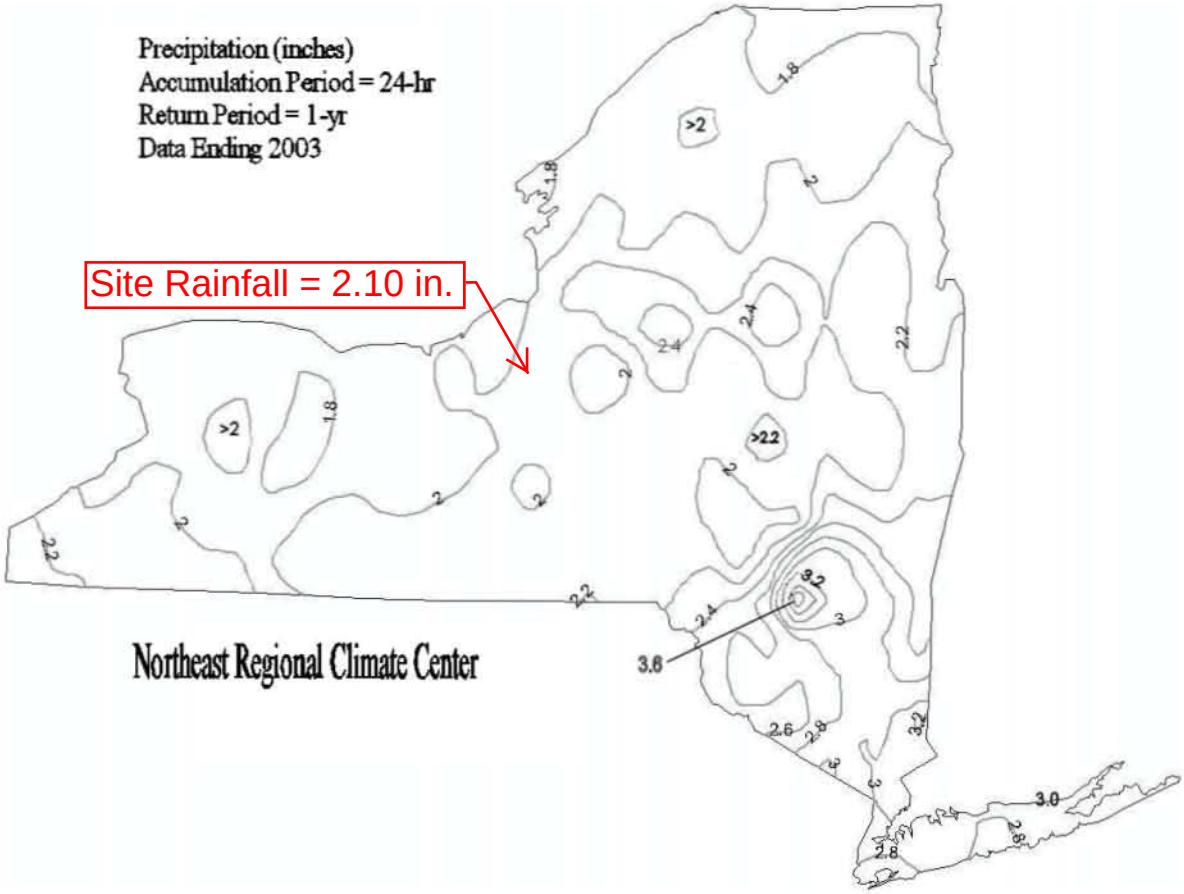
A minimum Rv of 0.2 will be applied to regulated sites.

Figure 4.1 90% Rainfall in New York State (NYSDEC, 2000)



1-Year, 24-Hour Rainfall [NYSDEC, 2010]

Figure 4.2 One-Year Design Storm



The primary purpose of the overbank flood control sizing criterion is to prevent an increase in the frequency and magnitude of out-of-bank flooding generated by urban development (i.e., flow events that exceed the bankfull capacity of the channel, and therefore must spill over into the floodplain).

Overbank control requires storage to attenuate the post development 10-year, 24-hour peak discharge rate (Q_p) to predevelopment rates.

The overbank flood control requirement (Q_p) does not apply in certain conditions, including:

- The site discharges directly tidal waters or fifth order (fifth downstream) or larger streams. Refer to Section 4.3 for instructions.
- A downstream analysis reveals that overbank control is not needed (see section 4.10).

10-Year, 24-Hour Rainfall [NYSDEC, 2010]

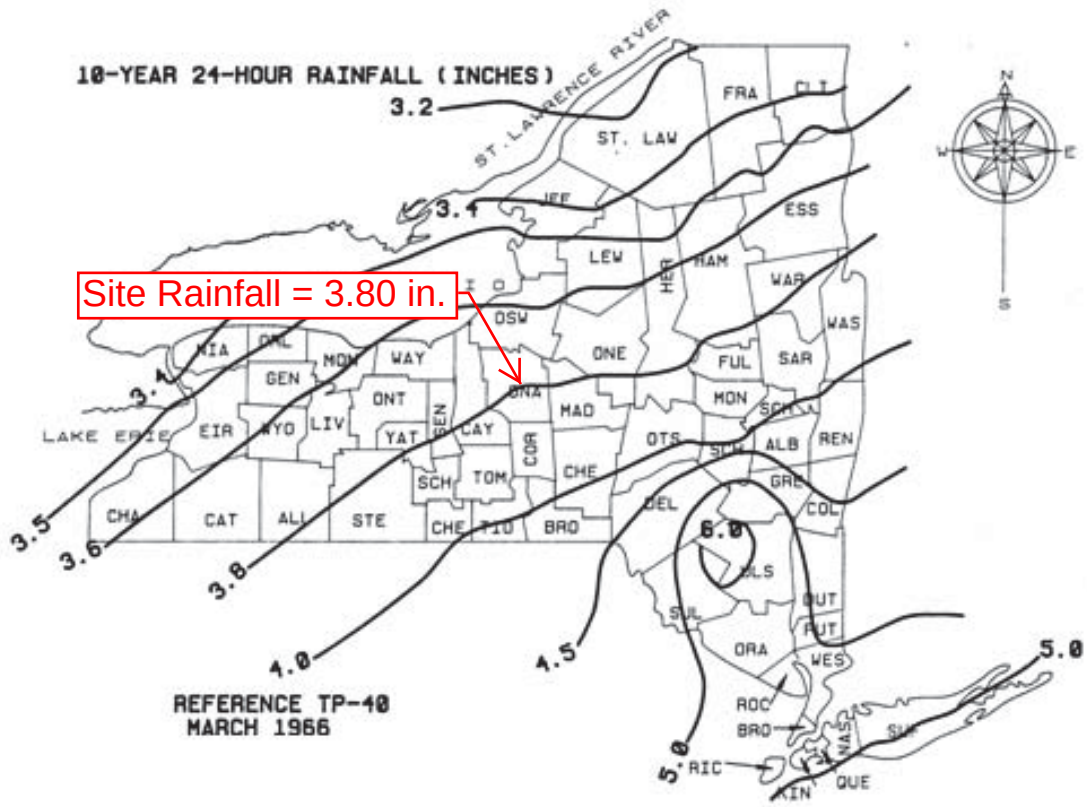
Basis for Design of Overbank Flood Control

When addressing the overbank flooding design criteria, the following represent the minimum basis for design:

- TR-55 and TR-20 (or approved equivalent) will be used to determine peak discharge rates.
- When the predevelopment land use is agriculture, the curve number for the pre-developed condition shall be “taken as meadow”.
- Off-site areas should be modeled as "present condition" for the 10-year storm event.
- Figure 4.3 indicates the depth of rainfall (24 hour) associated with the 10-year storm event throughout the State of New York.

  The length of overland flow used in t_c calculations is limited to no more than 150 feet for predevelopment conditions and 100 feet for post development conditions. On areas of extremely flat terrain (<1% average slope), this maximum distance is extended to 250 feet for predevelopment conditions and 150 feet for post development conditions.

Figure 4.3 10-Year Design Storm



2- & 5-Year, 24-Hour Rainfall [SCS, 1986]

Figure B-3 2-year, 24-hr rainfall

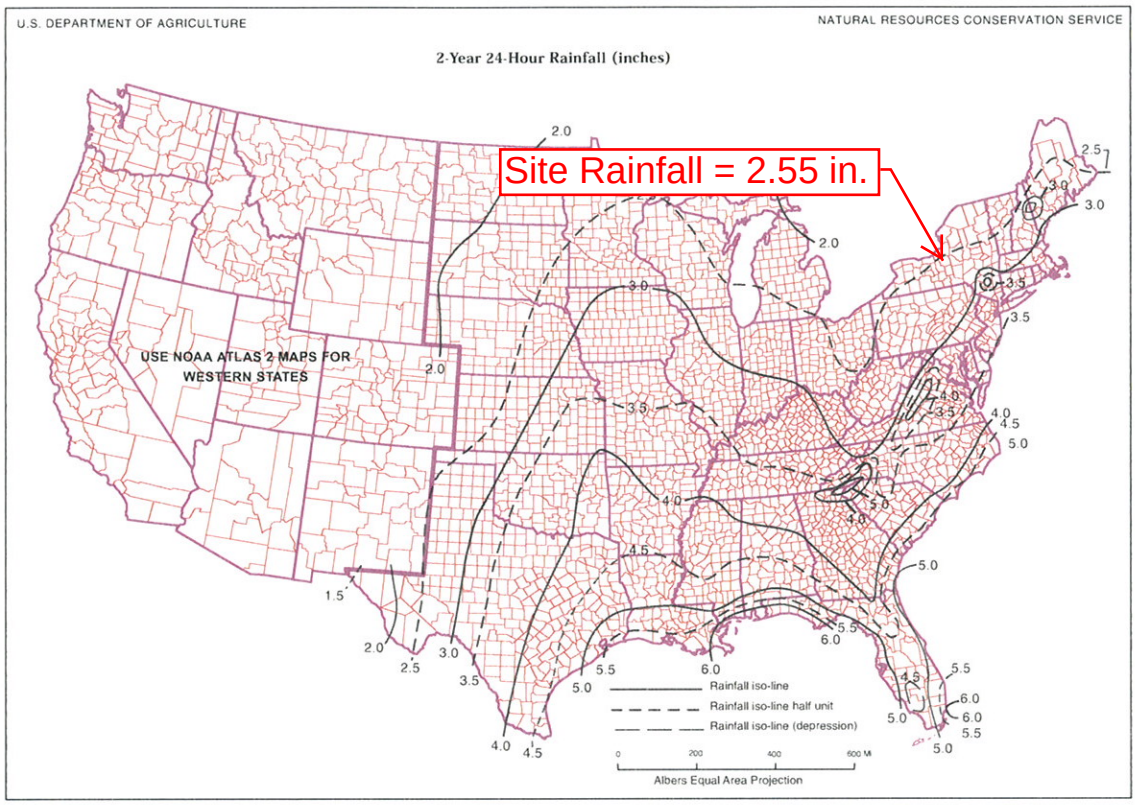
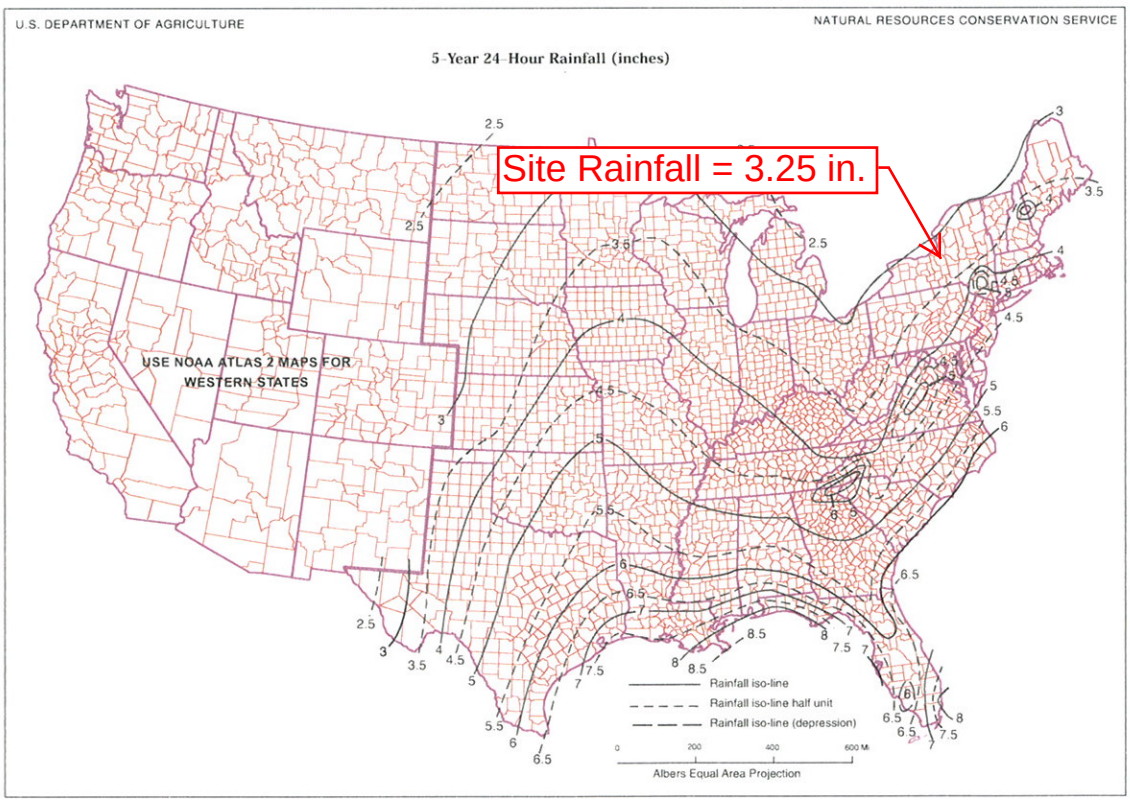


Figure B-4 5-year, 24-hour rainfall



25-Year, 24-Hour Rainfall [SCS, 1986]

Figure B-5 10-year, 24-hour rainfall

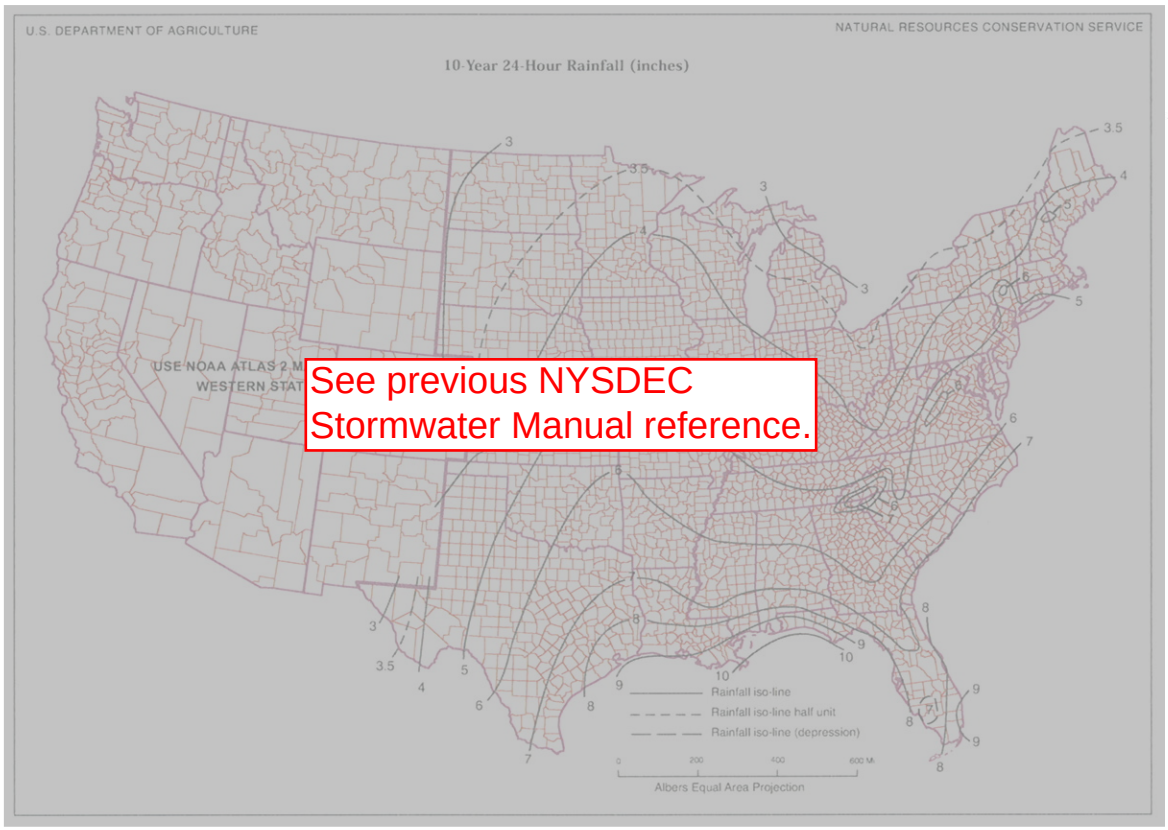
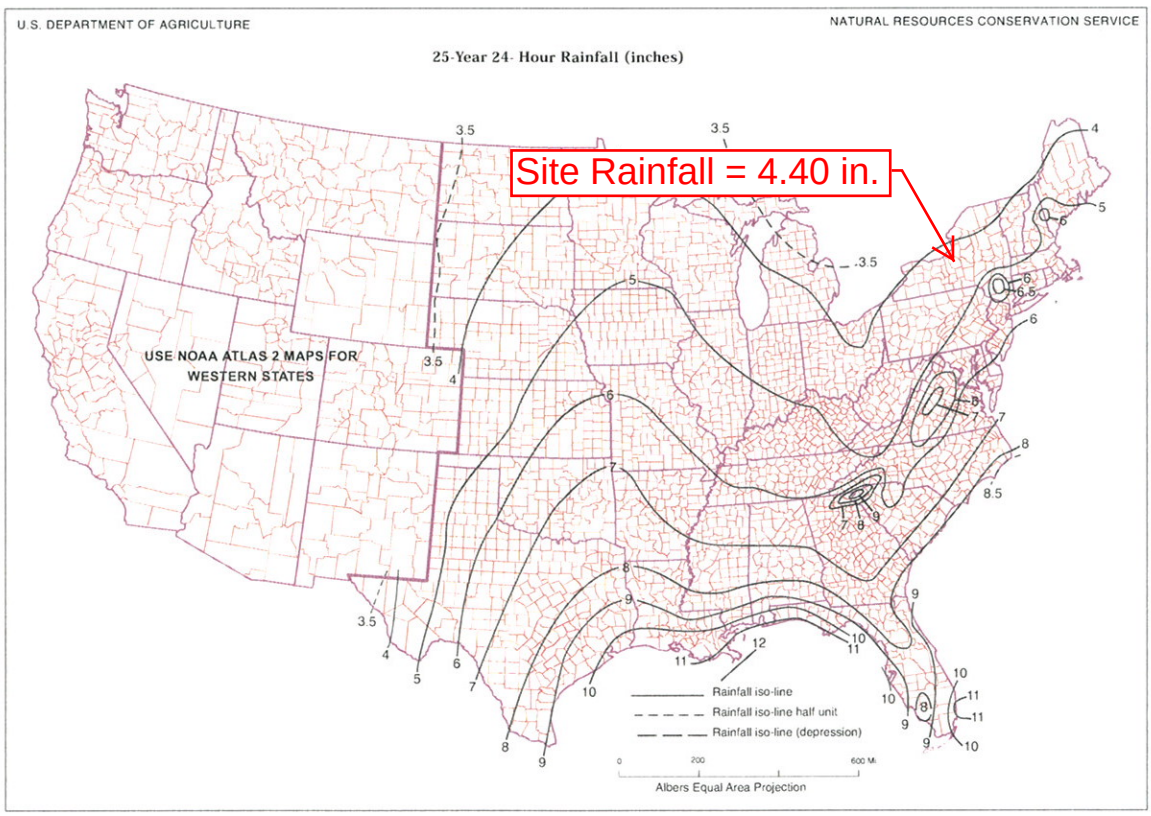


Figure B-6 25-year, 24-hour rainfall



50- & 100-Year, 24-Hour Rainfall [SCS, 1986]

Figure B-7 50-year, 24-hour rainfall

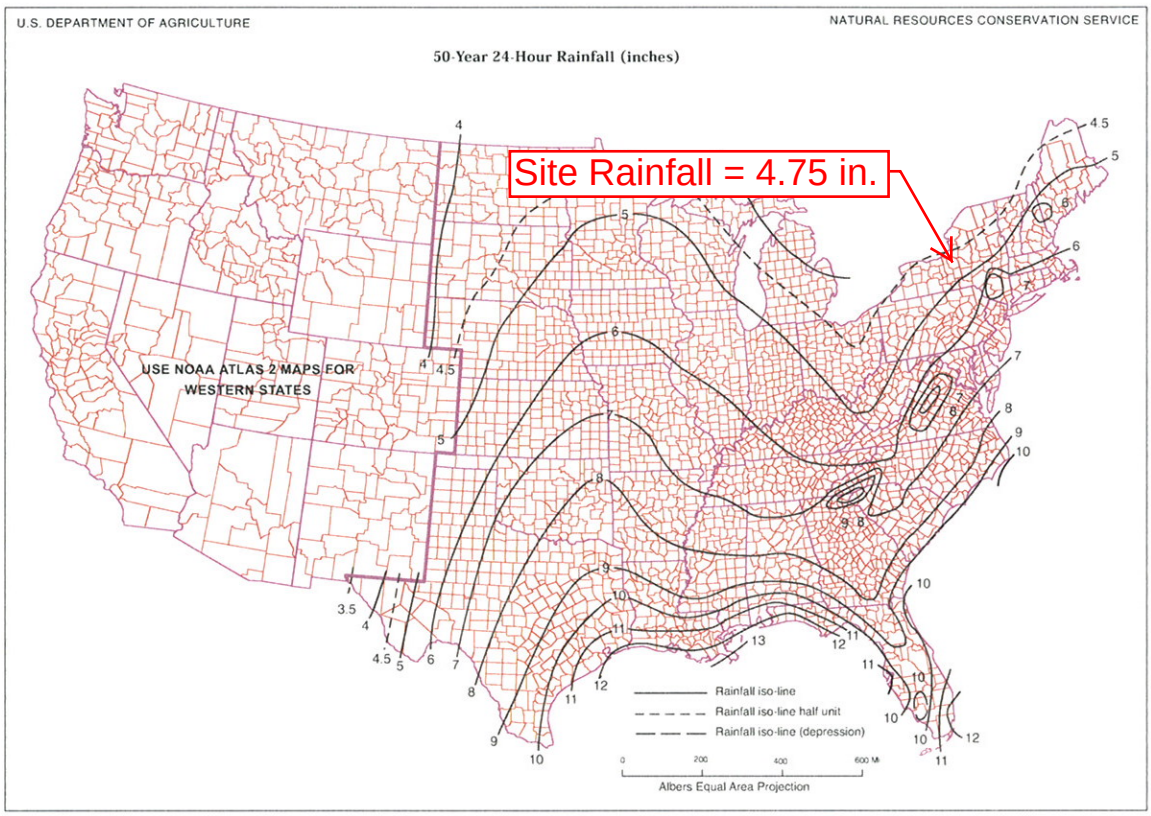
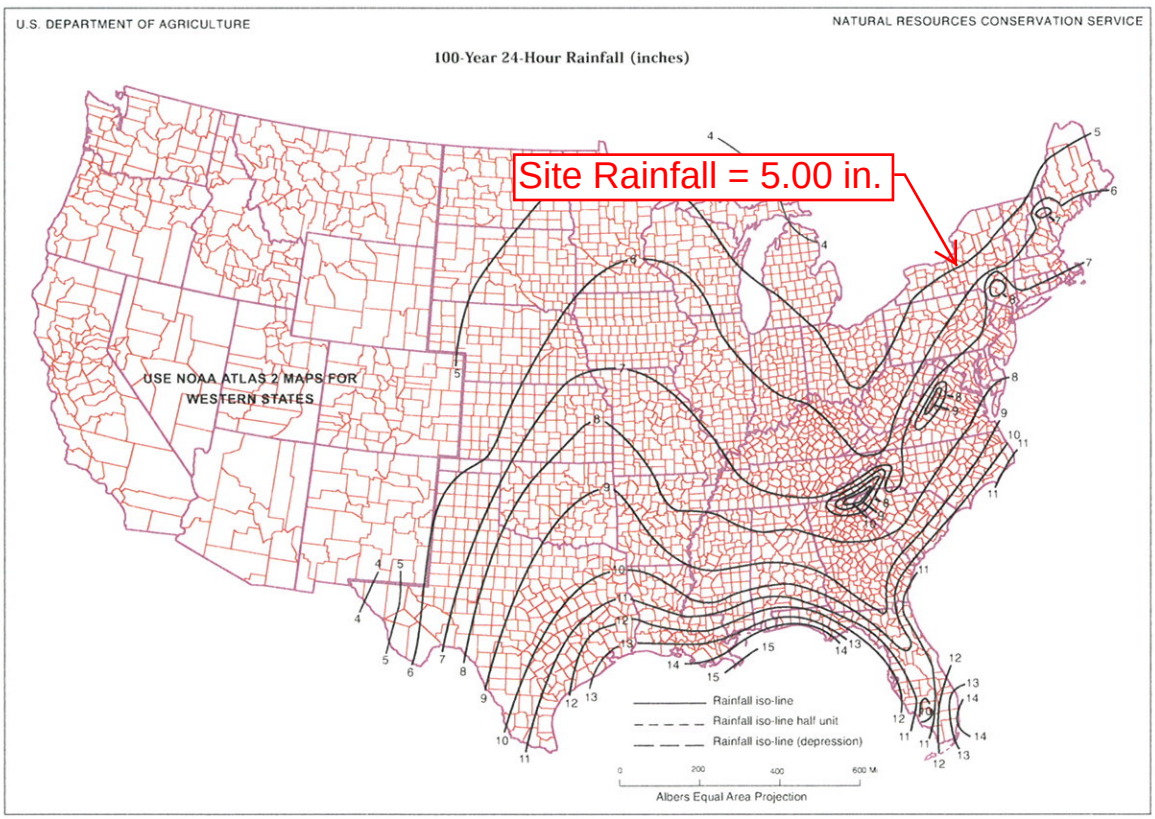


Figure B-8 100-year, 24-hour rainfall



Written by:	**Antonio Sanchez**	Date:	**09/11/15**	Reviewed by:	**Tom Fendley / Jay Beech**	Date:	**09/11/15**

Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Cover Design**	Project No.:	**GD5497**	Phase No.:	**03**

Attachment 7: Runoff Curve Number Definitions [SCS, 1986]

Table 2-2a Runoff curve numbers for urban areas [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2/]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

1 Average runoff condition, and $I_a = 0.2S$.

2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

4 Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

5 Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2c Runoff curve numbers for other agricultural lands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2/]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3/]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4/]	48	65	73
Woods—grass combination (orchard or tree farm). [5/]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6/]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4/]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

1 Average runoff condition, and $I_a = 0.2S$.

2 *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.

3 *Poor*: <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

4 Actual curve number is less than 30; use CN = 30 for runoff computations.

5 CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

6 *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Written by:	**Antonio Sanchez**	Date:	**09/11/15**	Reviewed by:	**Tom Fendley / Jay Beech**	Date:	**09/11/15**

Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Cover Design**	Project No.:	**GD5497**	Phase No.:	**03**

Attachment 8: Modeling Results—Post-Development Conditions

Post-Development Conditions
2-yr,24-hr storm event
(Road Spillways and Forebays only)

Summary for Pond F1: Forebay W

[57] Hint: Peaked at 428.48' (Flood elevation advised)

Inflow Area = 28.543 ac, 0.00% Impervious, Inflow Depth = 0.93" for 2-yr, 24-hr event
Inflow = 24.67 cfs @ 12.14 hrs, Volume= 2.216 af
Outflow = 24.67 cfs @ 12.14 hrs, Volume= 2.216 af, Atten= 0%, Lag= 0.0 min
Primary = 24.67 cfs @ 12.14 hrs, Volume= 2.216 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 428.48' @ 12.14 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	428.20'	**65.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=24.57 cfs @ 12.14 hrs HW=428.48' TW=425.52' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 24.57 cfs @ 1.36 fps)

Summary for Pond F2: Forebay E

[57] Hint: Peaked at 431.26' (Flood elevation advised)

Inflow Area = 23.380 ac, 0.00% Impervious, Inflow Depth = 0.93" for 2-yr, 24-hr event
Inflow = 19.85 cfs @ 12.14 hrs, Volume= 1.814 af
Outflow = 19.85 cfs @ 12.14 hrs, Volume= 1.814 af, Atten= 0%, Lag= 0.0 min
Primary = 19.85 cfs @ 12.14 hrs, Volume= 1.814 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 431.26' @ 12.14 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	431.00'	**60.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=19.74 cfs @ 12.14 hrs HW=431.25' TW=429.03' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 19.74 cfs @ 1.29 fps)

Summary for Pond S1: Spillway W

[57] Hint: Peaked at 428.97' (Flood elevation advised)
[62] Hint: Exceeded Reach P1B OUTLET depth by 0.64' @ 12.15 hrs
[62] Hint: Exceeded Reach P2D OUTLET depth by 0.45' @ 12.15 hrs

Inflow Area = 28.543 ac, 0.00% Impervious, Inflow Depth = 0.93" for 2-yr, 24-hr event
Inflow = 24.67 cfs @ 12.14 hrs, Volume= 2.216 af
Outflow = 24.67 cfs @ 12.14 hrs, Volume= 2.216 af, Atten= 0%, Lag= 0.0 min
Primary = 24.67 cfs @ 12.14 hrs, Volume= 2.216 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 428.97' @ 12.15 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	428.20'	**15.0' long x 53.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=24.47 cfs @ 12.14 hrs HW=428.97' TW=428.48' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 24.47 cfs @ 2.12 fps)

Summary for Pond S2: Spillway E

[57] Hint: Peaked at 432.42' (Flood elevation advised)
[62] Hint: Exceeded Reach P3B OUTLET depth by 0.36' @ 12.15 hrs
[62] Hint: Exceeded Reach P4B OUTLET depth by 0.48' @ 12.15 hrs

Inflow Area = 23.380 ac, 0.00% Impervious, Inflow Depth = 0.93" for 2-yr, 24-hr event
Inflow = 19.85 cfs @ 12.14 hrs, Volume= 1.814 af
Outflow = 19.85 cfs @ 12.14 hrs, Volume= 1.814 af, Atten= 0%, Lag= 0.0 min
Primary = 19.85 cfs @ 12.14 hrs, Volume= 1.814 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 432.42' @ 12.14 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	431.80'	**15.0' long x 42.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=19.74 cfs @ 12.14 hrs HW=432.42' TW=431.25' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 19.74 cfs @ 2.12 fps)

Post-Development Conditions
10-yr,24-hr storm event

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: 1S Runoff Area=3.836 ac 0.00% Impervious Runoff Depth=1.88"
Flow Length=732' Slope=0.0125 '/' Tc=19.1 min CN=80 Runoff=8.16 cfs 0.600 af

Subcatchment 2S: 2S Runoff Area=6.597 ac 0.00% Impervious Runoff Depth=1.88"
Flow Length=807' Tc=20.0 min CN=80 Runoff=13.65 cfs 1.032 af

Subcatchment 3S: 3S Runoff Area=5.122 ac 0.00% Impervious Runoff Depth=1.88"
Flow Length=696' Tc=19.0 min CN=80 Runoff=10.93 cfs 0.801 af

Subcatchment 4S: 4S Runoff Area=3.009 ac 0.00% Impervious Runoff Depth=1.88"
Flow Length=687' Tc=19.0 min CN=80 Runoff=6.42 cfs 0.471 af

Subcatchment 5S: 5S Runoff Area=3.241 ac 0.00% Impervious Runoff Depth=1.88"
Flow Length=220' Tc=8.1 min CN=80 Runoff=9.93 cfs 0.507 af

Subcatchment 6S: 6S Runoff Area=2.990 ac 0.00% Impervious Runoff Depth=1.88"
Flow Length=377' Tc=14.6 min CN=80 Runoff=7.30 cfs 0.468 af

Subcatchment 7S: 7S Runoff Area=1.107 ac 0.00% Impervious Runoff Depth=1.88"
Tc=6.0 min CN=80 Runoff=3.58 cfs 0.173 af

Subcatchment 8S: 8S Runoff Area=4.505 ac 0.00% Impervious Runoff Depth=1.88"
Flow Length=339' Tc=15.2 min CN=80 Runoff=10.77 cfs 0.705 af

Subcatchment 9S: 9S Runoff Area=2.511 ac 0.00% Impervious Runoff Depth=1.88"
Flow Length=281' Tc=8.9 min CN=80 Runoff=7.46 cfs 0.393 af

Subcatchment 10S: 10S Runoff Area=2.423 ac 0.00% Impervious Runoff Depth=1.88"
Flow Length=312' Tc=9.5 min CN=80 Runoff=7.03 cfs 0.379 af

Subcatchment 11S: 11S Runoff Area=1.965 ac 0.00% Impervious Runoff Depth=1.95"
Flow Length=197' Tc=13.7 min CN=81 Runoff=5.16 cfs 0.320 af

Subcatchment 12S: 12S Runoff Area=0.102 ac 0.00% Impervious Runoff Depth=1.88"
Tc=6.0 min CN=80 Runoff=0.33 cfs 0.016 af

Subcatchment 13S: 13S Runoff Area=0.350 ac 0.00% Impervious Runoff Depth=1.88"
Tc=6.0 min CN=80 Runoff=1.13 cfs 0.055 af

Subcatchment 14S: 14S Runoff Area=1.667 ac 0.00% Impervious Runoff Depth=1.88"
Flow Length=170' Tc=9.4 min CN=80 Runoff=4.86 cfs 0.261 af

Subcatchment 15S: 15S Runoff Area=1.998 ac 0.00% Impervious Runoff Depth=1.88"
Flow Length=149' Tc=8.8 min CN=80 Runoff=5.96 cfs 0.313 af

Subcatchment 16S: 16S Runoff Area=2.429 ac 0.00% Impervious Runoff Depth=1.88"
Tc=6.0 min CN=80 Runoff=7.85 cfs 0.380 af

Subcatchment 17S: 17S Runoff Area=0.812 ac 0.00% Impervious Runoff Depth=1.88"
Flow Length=180' Tc=7.6 min CN=80 Runoff=2.53 cfs 0.127 af

Subcatchment 18S: 18S Runoff Area=0.979 ac 0.00% Impervious Runoff Depth=1.88"
Tc=6.0 min CN=80 Runoff=3.17 cfs 0.153 af

Subcatchment 19S: 19S Runoff Area=0.538 ac 0.00% Impervious Runoff Depth=2.20"
Tc=6.0 min CN=84 Runoff=2.02 cfs 0.098 af

Subcatchment 20S: 20S Runoff Area=0.487 ac 0.00% Impervious Runoff Depth=2.37"
Tc=6.0 min CN=86 Runoff=1.95 cfs 0.096 af

Subcatchment 21S: 21S Runoff Area=1.120 ac 0.00% Impervious Runoff Depth=1.88"
Tc=6.0 min CN=80 Runoff=3.62 cfs 0.175 af

Subcatchment 22S: 22S Runoff Area=1.561 ac 0.00% Impervious Runoff Depth=1.88"
Tc=6.0 min CN=80 Runoff=5.05 cfs 0.244 af

Subcatchment 23S: 23S Runoff Area=2.685 ac 82.12% Impervious Runoff Depth=3.45"
Tc=6.0 min CN=97 Runoff=13.93 cfs 0.772 af

Subcatchment 24S: 24S Runoff Area=4.368 ac 84.71% Impervious Runoff Depth=3.45"
Tc=6.0 min CN=97 Runoff=22.66 cfs 1.257 af

Subcatchment 25S: 25S Runoff Area=0.989 ac 0.00% Impervious Runoff Depth=1.88"
Tc=6.0 min CN=80 Runoff=3.20 cfs 0.155 af

Subcatchment 26S: 26S Runoff Area=1.084 ac 0.00% Impervious Runoff Depth=1.88"
Tc=6.0 min CN=80 Runoff=3.51 cfs 0.170 af

Subcatchment 27S: 27S Runoff Area=0.280 ac 0.00% Impervious Runoff Depth=1.88"
Tc=6.0 min CN=80 Runoff=0.91 cfs 0.044 af

Subcatchment 28S: 28S Runoff Area=0.221 ac 0.00% Impervious Runoff Depth=1.88"
Tc=6.0 min CN=80 Runoff=0.71 cfs 0.035 af

Reach C1: Channel 1 Avg. Flow Depth=0.36' Max Vel=2.65 fps Inflow=20.21 cfs 1.632 af
n=0.030 L=216.0' S=0.0120 '/' Capacity=114.23 cfs Outflow=20.16 cfs 1.632 af

Reach C2: Channel 2 Avg. Flow Depth=0.30' Max Vel=2.47 fps Inflow=15.80 cfs 1.272 af
n=0.030 L=92.5' S=0.0130 '/' Capacity=118.59 cfs Outflow=15.80 cfs 1.272 af

Reach D1: Berm 1 Avg. Flow Depth=0.65' Max Vel=2.28 fps Inflow=7.03 cfs 0.379 af
n=0.030 L=884.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=5.72 cfs 0.379 af

Reach D10: Berm 10 Avg. Flow Depth=0.30' Max Vel=1.36 fps Inflow=0.91 cfs 0.044 af
n=0.030 L=520.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=0.72 cfs 0.044 af

Reach D2: Berm 2 Avg. Flow Depth=0.80' Max Vel=2.65 fps Inflow=12.69 cfs 0.677 af
n=0.030 L=1,011.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=10.23 cfs 0.677 af

Reach D3: Berm 3 Avg. Flow Depth=0.79' Max Vel=2.63 fps Inflow=11.44 cfs 0.749 af
n=0.030 L=924.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=9.99 cfs 0.749 af

Reach D4: Berm 4 Avg. Flow Depth=0.67' Max Vel=2.34 fps Inflow=7.46 cfs 0.393 af
n=0.030 L=767.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=6.27 cfs 0.393 af

Reach D5: Berm 5 Avg. Flow Depth=0.72' Max Vel=2.46 fps Inflow=8.16 cfs 0.600 af
n=0.030 L=614.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=7.67 cfs 0.600 af

Reach D6: Berm 6 Avg. Flow Depth=0.87' Max Vel=2.79 fps Inflow=13.65 cfs 1.032 af
n=0.030 L=836.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=12.61 cfs 1.032 af

Reach D7: Berm 7 Avg. Flow Depth=0.79' Max Vel=2.62 fps Inflow=10.93 cfs 0.801 af
n=0.030 L=912.5' S=0.0100 '/' Capacity=117.06 cfs Outflow=9.80 cfs 0.801 af

Reach D8: Berm 8 Avg. Flow Depth=0.66' Max Vel=2.32 fps Inflow=6.42 cfs 0.471 af
n=0.030 L=566.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=6.05 cfs 0.471 af

Reach D9: Berm 9 Avg. Flow Depth=0.50' Max Vel=1.91 fps Inflow=3.51 cfs 0.170 af
n=0.030 L=680.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=2.84 cfs 0.170 af

Reach I1: Bench 1 Avg. Flow Depth=0.65' Max Vel=2.22 fps Inflow=3.17 cfs 0.153 af
n=0.030 L=905.6' S=0.0100 '/' Capacity=50.12 cfs Outflow=2.47 cfs 0.153 af

Reach I2A: Bench 2 Avg. Flow Depth=0.65' Max Vel=2.23 fps Inflow=3.20 cfs 0.155 af
n=0.030 L=869.7' S=0.0100 '/' Capacity=50.12 cfs Outflow=2.52 cfs 0.155 af

Reach I2B: Bench 2 Avg. Flow Depth=1.20' Max Vel=2.38 fps Inflow=9.71 cfs 0.623 af
n=0.030 L=514.0' S=0.0050 '/' Capacity=35.43 cfs Outflow=9.07 cfs 0.623 af

Reach I2C: Bench I2C Avg. Flow Depth=1.21' Max Vel=2.39 fps Inflow=9.30 cfs 0.657 af
n=0.030 L=70.0' S=0.0050 '/' Capacity=35.43 cfs Outflow=9.29 cfs 0.657 af

Reach I3: Bench 3 Avg. Flow Depth=0.70' Max Vel=2.33 fps Inflow=3.58 cfs 0.173 af
n=0.030 L=721.0' S=0.0100 '/' Capacity=50.11 cfs Outflow=3.00 cfs 0.173 af

Reach I4: Bench 4 Avg. Flow Depth=0.61' Max Vel=2.14 fps Inflow=2.53 cfs 0.127 af
n=0.030 L=654.0' S=0.0100 '/' Capacity=50.11 cfs Outflow=2.13 cfs 0.127 af

Reach P1A: Channel 1P Avg. Flow Depth=0.36' Max Vel=2.25 fps Inflow=5.05 cfs 0.244 af
n=0.030 L=930.0' S=0.0105 '/' Capacity=104.42 cfs Outflow=4.01 cfs 0.244 af

Reach P1B: Channel 1P Avg. Flow Depth=0.27' Max Vel=2.74 fps Inflow=8.22 cfs 0.496 af
n=0.030 L=144.0' S=0.0194 '/' Capacity=275.51 cfs Outflow=8.15 cfs 0.496 af

Reach P2A: Channel 2P Avg. Flow Depth=0.43' Max Vel=1.71 fps Inflow=4.86 cfs 0.261 af
n=0.030 L=830.0' S=0.0049 '/' Capacity=17.71 cfs Outflow=3.76 cfs 0.261 af

Reach P2B: Channel 2P Avg. Flow Depth=0.43' Max Vel=1.86 fps Inflow=4.37 cfs 0.316 af
n=0.030 L=514.0' S=0.0058 '/' Capacity=19.25 cfs Outflow=4.05 cfs 0.316 af

Reach P2C: Channel 2P Avg. Flow Depth=0.30' Max Vel=2.88 fps Inflow=4.15 cfs 0.332 af
n=0.030 L=67.0' S=0.0209 '/' Capacity=36.43 cfs Outflow=4.15 cfs 0.332 af

Reach P2D: Channel 2P Avg. Flow Depth=0.51' Max Vel=3.02 fps Inflow=18.31 cfs 1.309 af
n=0.030 L=477.0' S=0.0109 '/' Capacity=206.29 cfs Outflow=17.91 cfs 1.309 af

Reach P3A: Channel 3P Avg. Flow Depth=0.49' Max Vel=1.80 fps Inflow=5.96 cfs 0.313 af
n=0.030 L=828.0' S=0.0047 '/' Capacity=17.30 cfs Outflow=4.66 cfs 0.313 af

Reach P3B: Channel 3P Avg. Flow Depth=0.47' Max Vel=2.07 fps Inflow=14.34 cfs 0.866 af
n=0.030 L=1,081.0' S=0.0057 '/' Capacity=149.63 cfs Outflow=11.05 cfs 0.866 af

Reach P4A: Channel 4P Avg. Flow Depth=0.31' Max Vel=2.03 fps Inflow=3.62 cfs 0.175 af
n=0.030 L=678.0' S=0.0100 '/' Capacity=101.87 cfs Outflow=3.05 cfs 0.175 af

Reach P4B: Channel 4P Avg. Flow Depth=0.29' Max Vel=2.10 fps Inflow=6.82 cfs 0.398 af
n=0.030 L=208.0' S=0.0106 '/' Capacity=203.20 cfs Outflow=6.65 cfs 0.398 af

Reach R1: Chute MD W Inflow=31.90 cfs 2.688 af
Outflow=31.90 cfs 2.688 af

Reach R2: Chute MD E Inflow=29.98 cfs 2.414 af
Outflow=29.98 cfs 2.414 af

Reach R3: Chute TD W Inflow=20.21 cfs 1.632 af
Outflow=20.21 cfs 1.632 af

Reach R4: Chute TD E Inflow=15.80 cfs 1.272 af
Outflow=15.80 cfs 1.272 af

Pond B1: Basin W Peak Elev=428.53' Storage=5.629 af Inflow=59.69 cfs 5.265 af
Outflow=0.00 cfs 0.000 af

Pond B2: Basin E Peak Elev=430.70' Storage=5.219 af Inflow=56.00 cfs 4.935 af
Outflow=0.00 cfs 0.000 af

Pond F1: Forebay W Peak Elev=428.67' Inflow=55.43 cfs 4.493 af
Outflow=55.43 cfs 4.493 af

Pond F2: Forebay E Peak Elev=431.43' Inflow=44.88 cfs 3.678 af
Outflow=44.88 cfs 3.678 af

Pond S1: Spillway W Peak Elev=429.53' Inflow=55.43 cfs 4.493 af
Outflow=55.43 cfs 4.493 af

Pond S2: Spillway E Peak Elev=432.89' Inflow=44.88 cfs 3.678 af
Outflow=44.88 cfs 3.678 af

Total Runoff Area = 58.976 ac Runoff Volume = 10.200 af Average Runoff Depth = 2.08"
89.99% Pervious = 53.071 ac 10.01% Impervious = 5.905 ac

Summary for Subcatchment 1S: 1S

Runoff = 8.16 cfs @ 12.12 hrs, Volume= 0.600 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	3.836	80	
	3.836		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.2	100	0.0125	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
5.9	632	0.0125	1.80		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
19.1	732	Total			

Summary for Subcatchment 2S: 2S

Runoff = 13.65 cfs @ 12.13 hrs, Volume= 1.032 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	6.597	80	
	6.597		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0120	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
6.5	707	0.0126	1.81		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
20.0	807	Total			

Summary for Subcatchment 3S: 3S

Runoff = 10.93 cfs @ 12.12 hrs, Volume= 0.801 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	5.122	80	
	5.122		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0120	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
5.5	596	0.0126	1.81		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
19.0	696	Total			

Summary for Subcatchment 4S: 4S

Runoff = 6.42 cfs @ 12.12 hrs, Volume= 0.471 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	3.009	80	
	3.009		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0120	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
5.5	587	0.0124	1.79		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
19.0	687	Total			

Summary for Subcatchment 5S: 5S

Runoff = 9.93 cfs @ 12.00 hrs, Volume= 0.507 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

Area (ac)	CN	Description
* 3.241	80	
3.241		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	100	0.0610	0.24		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
1.1	120	0.0125	1.80		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.1	220	Total			

Summary for Subcatchment 6S: 6S

Runoff = 7.30 cfs @ 12.07 hrs, Volume= 0.468 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

Area (ac)	CN	Description
* 2.990	80	
2.990		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0120	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
1.1	277	0.0661	4.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
14.6	377	Total			

Summary for Subcatchment 7S: 7S

Runoff = 3.58 cfs @ 11.97 hrs, Volume= 0.173 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

Area (ac)	CN	Description
* 1.107	80	
1.107		100.00% Pervious Area

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

Summary for Subcatchment 8S: 8S

Runoff = 10.77 cfs @ 12.08 hrs, Volume= 0.705 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

Area (ac)	CN	Description
* 4.505	80	
4.505		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.0	100	0.0130	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
2.2	239	0.0121	1.77		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
15.2	339	Total			

Summary for Subcatchment 9S: 9S

Runoff = 7.46 cfs @ 12.00 hrs, Volume= 0.393 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	2.511	80	
	2.511		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	100	0.0580	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
1.7	181	0.0122	1.78		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.9	281	Total			

Summary for Subcatchment 10S: 10S

Runoff = 7.03 cfs @ 12.01 hrs, Volume= 0.379 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	2.423	80	
	2.423		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	100	0.0525	0.22		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
2.0	212	0.0123	1.79		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.5	312	Total			

Summary for Subcatchment 11S: 11S

Runoff = 5.16 cfs @ 12.06 hrs, Volume= 0.320 af, Depth= 1.95"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	0.690	80	
*	0.157	91	
*	1.118	80	
	1.965	81	Weighted Average
	1.965		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0120	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
0.2	97	0.2153	7.47		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.7	197	Total			

Summary for Subcatchment 12S: 12S

Runoff = 0.33 cfs @ 11.97 hrs, Volume= 0.016 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	0.102	80	
	0.102		100.00% Pervious Area

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

Summary for Subcatchment 13S: 13S

Runoff = 1.13 cfs @ 11.97 hrs, Volume= 0.055 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	0.350	80	
	0.350		100.00% Pervious Area

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

Summary for Subcatchment 14S: 14S

Runoff = 4.86 cfs @ 12.01 hrs, Volume= 0.261 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	1.667	80	
	1.667		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	100	0.0370	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
0.8	70	0.0086	1.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.4	170	Total			

Summary for Subcatchment 15S: 15S

Runoff = 5.96 cfs @ 12.00 hrs, Volume= 0.313 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	1.958	80	
*	0.040	91	
	1.998	80	Weighted Average
	1.998		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	100	0.0460	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
0.9	49	0.0031	0.90		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.8	149	Total			

Summary for Subcatchment 16S: 16S

Runoff = 7.85 cfs @ 11.97 hrs, Volume= 0.380 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	0.931	80	
*	1.423	80	
*	0.075	91	
	2.429	80	Weighted Average
	2.429		100.00% Pervious Area

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

Summary for Subcatchment 17S: 17S

Runoff = 2.53 cfs @ 11.99 hrs, Volume= 0.127 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	0.812	80	
	0.812		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0586	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
0.5	80	0.0285	2.72		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
7.6	180	Total			

Summary for Subcatchment 18S: 18S

Runoff = 3.17 cfs @ 11.97 hrs, Volume= 0.153 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	0.979	80	
	0.979		100.00% Pervious Area

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

Summary for Subcatchment 19S: 19S

Runoff = 2.02 cfs @ 11.97 hrs, Volume= 0.098 af, Depth= 2.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	0.366	80	
*	0.172	91	
	0.538	84	Weighted Average
	0.538		100.00% Pervious Area

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

Summary for Subcatchment 20S: 20S

Runoff = 1.95 cfs @ 11.97 hrs, Volume= 0.096 af, Depth= 2.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	0.254	91	
*	0.233	80	
	0.487	86	Weighted Average
	0.487		100.00% Pervious Area

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

Summary for Subcatchment 21S: 21S

Runoff = 3.62 cfs @ 11.97 hrs, Volume= 0.175 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	1.120	80	
	1.120		100.00% Pervious Area

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

Summary for Subcatchment 22S: 22S

Runoff = 5.05 cfs @ 11.97 hrs, Volume= 0.244 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	1.561	80	
	1.561		100.00% Pervious Area

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

Summary for Subcatchment 23S: 23S

Runoff = 13.93 cfs @ 11.96 hrs, Volume= 0.772 af, Depth= 3.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	0.480	91	
*	2.205	98	
	2.685	97	Weighted Average
	0.480		17.88% Pervious Area
	2.205		82.12% Impervious Area

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

Summary for Subcatchment 24S: 24S

Runoff = 22.66 cfs @ 11.96 hrs, Volume= 1.257 af, Depth= 3.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	0.668	91	Pond Road
*	3.700	98	Pond
	4.368	97	Weighted Average
	0.668		15.29% Pervious Area
	3.700		84.71% Impervious Area

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

Summary for Subcatchment 25S: 25S

Runoff = 3.20 cfs @ 11.97 hrs, Volume= 0.155 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	0.989	80	
	0.989		100.00% Pervious Area

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

Summary for Subcatchment 26S: 26S

Runoff = 3.51 cfs @ 11.97 hrs, Volume= 0.170 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	1.084	80	
	1.084		100.00% Pervious Area

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

Summary for Subcatchment 27S: 27S

Runoff = 0.91 cfs @ 11.97 hrs, Volume= 0.044 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	0.280	80	
	0.280		100.00% Pervious Area

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

Summary for Subcatchment 28S: 28S

Runoff = 0.71 cfs @ 11.97 hrs, Volume= 0.035 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr, 24-hr Rainfall=3.80"

	Area (ac)	CN	Description
*	0.221	80	
	0.221		100.00% Pervious Area

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

Summary for Reach C1: Channel 1

Inflow Area = 10.433 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 20.21 cfs @ 12.19 hrs, Volume= 1.632 af
Outflow = 20.16 cfs @ 12.20 hrs, Volume= 1.632 af, Atten= 0%, Lag= 0.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.65 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 0.61 fps, Avg. Travel Time= 5.9 min

Peak Storage= 1,642 cf @ 12.20 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 114.23 cfs

20.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 3.0 '/' Top Width= 26.00'
Length= 216.0' Slope= 0.0120 '/'
Inlet Invert= 452.80', Outlet Invert= 450.20'

‡

Summary for Reach C2: Channel 2

Inflow Area = 8.131 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 15.80 cfs @ 12.18 hrs, Volume= 1.272 af
Outflow = 15.80 cfs @ 12.19 hrs, Volume= 1.272 af, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.47 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 0.57 fps, Avg. Travel Time= 2.7 min

Peak Storage= 590 cf @ 12.19 hrs
Average Depth at Peak Storage= 0.30'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 118.59 cfs

20.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 3.0 '/' Top Width= 26.00'
Length= 92.5' Slope= 0.0130 '/'
Inlet Invert= 453.20', Outlet Invert= 452.00'

‡

Summary for Reach D1: Berm 1

Inflow Area = 2.423 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 7.03 cfs @ 12.01 hrs, Volume= 0.379 af
Outflow = 5.72 cfs @ 12.07 hrs, Volume= 0.379 af, Atten= 19%, Lag= 3.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.28 fps, Min. Travel Time= 6.5 min
Avg. Velocity = 0.76 fps, Avg. Travel Time= 19.4 min

Peak Storage= 2,206 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.65'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 884.0' Slope= 0.0100 '/'
Inlet Invert= 457.60', Outlet Invert= 448.76'

‡

Summary for Reach D10: Berm 10

Inflow Area = 0.280 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 0.91 cfs @ 11.97 hrs, Volume= 0.044 af
Outflow = 0.72 cfs @ 12.03 hrs, Volume= 0.044 af, Atten= 21%, Lag= 3.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.36 fps, Min. Travel Time= 6.4 min
Avg. Velocity = 0.50 fps, Avg. Travel Time= 17.3 min

Peak Storage= 274 cf @ 12.03 hrs
Average Depth at Peak Storage= 0.30'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 520.0' Slope= 0.0100 '/'
Inlet Invert= 465.30', Outlet Invert= 460.10'

‡

Summary for Reach D2: Berm 2

[62] Hint: Exceeded Reach D9 OUTLET depth by 0.63' @ 12.10 hrs

Inflow Area = 4.325 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 12.69 cfs @ 12.00 hrs, Volume= 0.677 af
Outflow = 10.23 cfs @ 12.06 hrs, Volume= 0.677 af, Atten= 19%, Lag= 3.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.65 fps, Min. Travel Time= 6.4 min
Avg. Velocity = 0.83 fps, Avg. Travel Time= 20.3 min

Peak Storage= 3,901 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.80'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 1,011.0' Slope= 0.0100 '/'
Inlet Invert= 460.10', Outlet Invert= 449.99'

‡

Summary for Reach D3: Berm 3

[62] Hint: Exceeded Reach D10 OUTLET depth by 0.55' @ 12.20 hrs

Inflow Area = 4.785 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 11.44 cfs @ 12.07 hrs, Volume= 0.749 af
Outflow = 9.99 cfs @ 12.14 hrs, Volume= 0.749 af, Atten= 13%, Lag= 4.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.63 fps, Min. Travel Time= 5.8 min
Avg. Velocity = 0.87 fps, Avg. Travel Time= 17.6 min

Peak Storage= 3,503 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.79'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 924.0' Slope= 0.0100 '/'
Inlet Invert= 460.10', Outlet Invert= 450.86'

‡

Summary for Reach D4: Berm 4

Inflow Area = 2.511 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 7.46 cfs @ 12.00 hrs, Volume= 0.393 af
Outflow = 6.27 cfs @ 12.06 hrs, Volume= 0.393 af, Atten= 16%, Lag= 3.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.34 fps, Min. Travel Time= 5.5 min
Avg. Velocity = 0.78 fps, Avg. Travel Time= 16.3 min

Peak Storage= 2,051 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.67'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 767.0' Slope= 0.0100 '/'
Inlet Invert= 457.60', Outlet Invert= 449.93'

‡

Summary for Reach D5: Berm 5

Inflow Area = 3.836 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 8.16 cfs @ 12.12 hrs, Volume= 0.600 af
Outflow = 7.67 cfs @ 12.17 hrs, Volume= 0.600 af, Atten= 6%, Lag= 3.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.46 fps, Min. Travel Time= 4.2 min
Avg. Velocity = 0.89 fps, Avg. Travel Time= 11.5 min

Peak Storage= 1,908 cf @ 12.17 hrs
Average Depth at Peak Storage= 0.72'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 614.0' Slope= 0.0100 '/'
Inlet Invert= 463.20', Outlet Invert= 457.06'

‡

Summary for Reach D6: Berm 6

Inflow Area = 6.597 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 13.65 cfs @ 12.13 hrs, Volume= 1.032 af
Outflow = 12.61 cfs @ 12.19 hrs, Volume= 1.032 af, Atten= 8%, Lag= 3.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.79 fps, Min. Travel Time= 5.0 min
Avg. Velocity = 0.96 fps, Avg. Travel Time= 14.5 min

Peak Storage= 3,773 cf @ 12.19 hrs
Average Depth at Peak Storage= 0.87'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 836.0' Slope= 0.0100 '/'
Inlet Invert= 465.50', Outlet Invert= 457.14'

‡

Summary for Reach D7: Berm 7

Inflow Area = 5.122 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 10.93 cfs @ 12.12 hrs, Volume= 0.801 af
Outflow = 9.80 cfs @ 12.19 hrs, Volume= 0.801 af, Atten= 10%, Lag= 4.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.62 fps, Min. Travel Time= 5.8 min
Avg. Velocity = 0.89 fps, Avg. Travel Time= 17.0 min

Peak Storage= 3,408 cf @ 12.19 hrs
Average Depth at Peak Storage= 0.79'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.06 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 912.5' Slope= 0.0100 '/'
Inlet Invert= 467.20', Outlet Invert= 458.07'

‡

Summary for Reach D8: Berm 8

Inflow Area = 3.009 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 6.42 cfs @ 12.12 hrs, Volume= 0.471 af
Outflow = 6.05 cfs @ 12.17 hrs, Volume= 0.471 af, Atten= 6%, Lag= 3.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.32 fps, Min. Travel Time= 4.1 min
Avg. Velocity = 0.85 fps, Avg. Travel Time= 11.1 min

Peak Storage= 1,472 cf @ 12.17 hrs
Average Depth at Peak Storage= 0.66'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 566.0' Slope= 0.0100 '/'
Inlet Invert= 463.70', Outlet Invert= 458.04'

‡

Summary for Reach D9: Berm 9

Inflow Area = 1.084 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 3.51 cfs @ 11.97 hrs, Volume= 0.170 af
Outflow = 2.84 cfs @ 12.02 hrs, Volume= 0.170 af, Atten= 19%, Lag= 3.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.91 fps, Min. Travel Time= 5.9 min
Avg. Velocity = 0.66 fps, Avg. Travel Time= 17.2 min

Peak Storage= 1,004 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.50'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 680.0' Slope= 0.0100 '/'
Inlet Invert= 466.60', Outlet Invert= 459.80'

‡

Summary for Reach I1: Bench 1

Inflow Area = 0.979 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 3.17 cfs @ 11.97 hrs, Volume= 0.153 af
Outflow = 2.47 cfs @ 12.03 hrs, Volume= 0.153 af, Atten= 22%, Lag= 3.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.22 fps, Min. Travel Time= 6.8 min
Avg. Velocity = 0.74 fps, Avg. Travel Time= 20.3 min

Peak Storage= 1,003 cf @ 12.03 hrs
Average Depth at Peak Storage= 0.65'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 50.12 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 3.3 '/' Top Width= 10.60'
Length= 905.6' Slope= 0.0100 '/'
Inlet Invert= 443.40', Outlet Invert= 434.34'

Summary for Reach I2A: Bench 2

Inflow Area = 0.989 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 3.20 cfs @ 11.97 hrs, Volume= 0.155 af
Outflow = 2.52 cfs @ 12.03 hrs, Volume= 0.155 af, Atten= 21%, Lag= 3.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.23 fps, Min. Travel Time= 6.5 min
Avg. Velocity = 0.75 fps, Avg. Travel Time= 19.3 min

Peak Storage= 980 cf @ 12.03 hrs
Average Depth at Peak Storage= 0.65'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 50.12 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 3.3 '/' Top Width= 10.60'
Length= 869.7' Slope= 0.0100 '/'
Inlet Invert= 450.00', Outlet Invert= 441.30'

Summary for Reach I2B: Bench 2

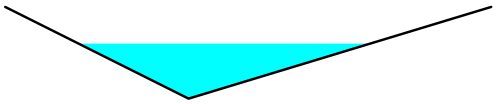
[62] Hint: Exceeded Reach I2A OUTLET depth by 0.83' @ 12.15 hrs

Inflow Area = 3.979 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 9.71 cfs @ 12.06 hrs, Volume= 0.623 af
Outflow = 9.07 cfs @ 12.10 hrs, Volume= 0.623 af, Atten= 7%, Lag= 2.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.38 fps, Min. Travel Time= 3.6 min
Avg. Velocity = 0.75 fps, Avg. Travel Time= 11.4 min

Peak Storage= 1,961 cf @ 12.10 hrs
Average Depth at Peak Storage= 1.20'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 35.43 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 3.3 '/' Top Width= 10.60'
Length= 514.0' Slope= 0.0050 '/'
Inlet Invert= 441.50', Outlet Invert= 438.93'



Summary for Reach I2C: Bench I2C

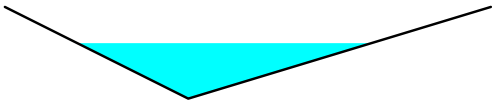
[62] Hint: Exceeded Reach I2B OUTLET depth by 0.10' @ 11.95 hrs

Inflow Area = 4.200 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 9.30 cfs @ 12.10 hrs, Volume= 0.657 af
Outflow = 9.29 cfs @ 12.10 hrs, Volume= 0.657 af, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.39 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 0.76 fps, Avg. Travel Time= 1.5 min

Peak Storage= 272 cf @ 12.10 hrs
Average Depth at Peak Storage= 1.21'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 35.43 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 3.3 '/' Top Width= 10.60'
Length= 70.0' Slope= 0.0050 '/'
Inlet Invert= 439.00', Outlet Invert= 438.65'



Summary for Reach I3: Bench 3

Inflow Area = 1.107 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 3.58 cfs @ 11.97 hrs, Volume= 0.173 af
Outflow = 3.00 cfs @ 12.02 hrs, Volume= 0.173 af, Atten= 16%, Lag= 2.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.33 fps, Min. Travel Time= 5.2 min
Avg. Velocity = 0.79 fps, Avg. Travel Time= 15.2 min

Peak Storage= 926 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.70'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 50.11 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 3.3 '/' Top Width= 10.60'
Length= 721.0' Slope= 0.0100 '/'
Inlet Invert= 450.00', Outlet Invert= 442.79'

Summary for Reach I4: Bench 4

Inflow Area = 0.812 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 2.53 cfs @ 11.99 hrs, Volume= 0.127 af
Outflow = 2.13 cfs @ 12.04 hrs, Volume= 0.127 af, Atten= 16%, Lag= 3.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.14 fps, Min. Travel Time= 5.1 min
Avg. Velocity = 0.74 fps, Avg. Travel Time= 14.6 min

Peak Storage= 649 cf @ 12.04 hrs
Average Depth at Peak Storage= 0.61'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 50.11 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 3.3 '/' Top Width= 10.60'
Length= 654.0' Slope= 0.0100 '/'
Inlet Invert= 443.40', Outlet Invert= 436.86'

Summary for Reach P1A: Channel 1P

Inflow Area = 1.561 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 5.05 cfs @ 11.97 hrs, Volume= 0.244 af
Outflow = 4.01 cfs @ 12.03 hrs, Volume= 0.244 af, Atten= 21%, Lag= 3.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.25 fps, Min. Travel Time= 6.9 min
Avg. Velocity = 0.57 fps, Avg. Travel Time= 27.1 min

Peak Storage= 1,646 cf @ 12.03 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 104.42 cfs

4.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 '/' Top Width= 14.00'
Length= 930.0' Slope= 0.0105 '/'
Inlet Invert= 440.80', Outlet Invert= 431.00'

Summary for Reach P1B: Channel 1P

[61] Hint: Exceeded Reach P1A outlet invert by 0.27' @ 12.00 hrs

Inflow Area = 3.078 ac, 0.00% Impervious, Inflow Depth = 1.93" for 10-yr, 24-hr event
Inflow = 8.22 cfs @ 12.01 hrs, Volume= 0.496 af
Outflow = 8.15 cfs @ 12.02 hrs, Volume= 0.496 af, Atten= 1%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.74 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 0.66 fps, Avg. Travel Time= 3.6 min

Peak Storage= 425 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 275.51 cfs

10.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 3.3 '/' Top Width= 21.60'
Length= 144.0' Slope= 0.0194 '/'
Inlet Invert= 431.00', Outlet Invert= 428.20'

‡

Summary for Reach P2A: Channel 2P

Inflow Area = 1.667 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 4.86 cfs @ 12.01 hrs, Volume= 0.261 af
Outflow = 3.76 cfs @ 12.08 hrs, Volume= 0.261 af, Atten= 22%, Lag= 4.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.71 fps, Min. Travel Time= 8.1 min
Avg. Velocity = 0.37 fps, Avg. Travel Time= 37.4 min

Peak Storage= 1,819 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 17.71 cfs

4.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 '/' Top Width= 9.00'
Length= 830.0' Slope= 0.0049 '/'
Inlet Invert= 441.90', Outlet Invert= 437.80'

‡

Summary for Reach P2B: Channel 2P

[62] Hint: Exceeded Reach P2A OUTLET depth by 0.05' @ 12.25 hrs

Inflow Area = 2.017 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 4.37 cfs @ 12.05 hrs, Volume= 0.316 af
Outflow = 4.05 cfs @ 12.11 hrs, Volume= 0.316 af, Atten= 7%, Lag= 3.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.86 fps, Min. Travel Time= 4.6 min
Avg. Velocity = 0.41 fps, Avg. Travel Time= 21.0 min

Peak Storage= 1,119 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 19.25 cfs

4.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 '/' Top Width= 9.00'
Length= 514.0' Slope= 0.0058 '/'
Inlet Invert= 437.80', Outlet Invert= 434.80'

‡

Summary for Reach P2C: Channel 2P

[61] Hint: Exceeded Reach P2B outlet invert by 0.30' @ 12.10 hrs

Inflow Area = 2.119 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 4.15 cfs @ 12.10 hrs, Volume= 0.332 af
Outflow = 4.15 cfs @ 12.10 hrs, Volume= 0.332 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.88 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 0.65 fps, Avg. Travel Time= 1.7 min

Peak Storage= 96 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.30'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 36.43 cfs

4.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 '/' Top Width= 9.00'
Length= 67.0' Slope= 0.0209 '/'
Inlet Invert= 434.80', Outlet Invert= 433.40'

‡

Summary for Reach P2D: Channel 2P

[62] Hint: Exceeded Reach P2C OUTLET depth by 0.21' @ 12.15 hrs

Inflow Area = 8.284 ac, 0.00% Impervious, Inflow Depth = 1.90" for 10-yr, 24-hr event
Inflow = 18.31 cfs @ 12.09 hrs, Volume= 1.309 af
Outflow = 17.91 cfs @ 12.12 hrs, Volume= 1.309 af, Atten= 2%, Lag= 1.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.02 fps, Min. Travel Time= 2.6 min
Avg. Velocity = 0.67 fps, Avg. Travel Time= 11.9 min

Peak Storage= 2,818 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.51'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 206.29 cfs

10.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 3.3 '/' Top Width= 21.60'
Length= 477.0' Slope= 0.0109 '/'
Inlet Invert= 433.40', Outlet Invert= 428.20'

‡

Summary for Reach P3A: Channel 3P

Inflow Area = 1.998 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 5.96 cfs @ 12.00 hrs, Volume= 0.313 af
Outflow = 4.66 cfs @ 12.07 hrs, Volume= 0.313 af, Atten= 22%, Lag= 3.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.80 fps, Min. Travel Time= 7.7 min
Avg. Velocity = 0.38 fps, Avg. Travel Time= 36.1 min

Peak Storage= 2,137 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.49'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 17.30 cfs

4.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 '/' Top Width= 9.00'
Length= 828.0' Slope= 0.0047 '/'
Inlet Invert= 441.90', Outlet Invert= 438.00'

‡

Summary for Reach P3B: Channel 3P

[62] Hint: Exceeded Reach P3A OUTLET depth by 0.03' @ 12.35 hrs

Inflow Area = 5.534 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 14.34 cfs @ 12.00 hrs, Volume= 0.866 af
Outflow = 11.05 cfs @ 12.07 hrs, Volume= 0.866 af, Atten= 23%, Lag= 4.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.07 fps, Min. Travel Time= 8.7 min
Avg. Velocity = 0.47 fps, Avg. Travel Time= 38.7 min

Peak Storage= 5,745 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.47'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 149.63 cfs

10.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 3.3 2.5 '/' Top Width= 21.60'
Length= 1,081.0' Slope= 0.0057 '/'
Inlet Invert= 438.00', Outlet Invert= 431.80'

‡

Summary for Reach P4A: Channel 4P

Inflow Area = 1.120 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 3.62 cfs @ 11.97 hrs, Volume= 0.175 af
Outflow = 3.05 cfs @ 12.02 hrs, Volume= 0.175 af, Atten= 16%, Lag= 2.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.03 fps, Min. Travel Time= 5.6 min
Avg. Velocity = 0.52 fps, Avg. Travel Time= 21.7 min

Peak Storage= 1,015 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.31'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 101.87 cfs

4.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 '/' Top Width= 14.00'
Length= 678.0' Slope= 0.0100 '/'
Inlet Invert= 440.80', Outlet Invert= 434.00'

Summary for Reach P4B: Channel 4P

[61] Hint: Exceeded Reach P4A outlet invert by 0.29' @ 12.05 hrs

Inflow Area = 2.419 ac, 0.00% Impervious, Inflow Depth = 1.98" for 10-yr, 24-hr event
Inflow = 6.82 cfs @ 12.01 hrs, Volume= 0.398 af
Outflow = 6.65 cfs @ 12.03 hrs, Volume= 0.398 af, Atten= 2%, Lag= 1.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.10 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 0.50 fps, Avg. Travel Time= 6.9 min

Peak Storage= 655 cf @ 12.03 hrs
Average Depth at Peak Storage= 0.29'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 203.20 cfs

10.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 3.3 2.5 '/' Top Width= 21.60'
Length= 208.0' Slope= 0.0106 '/'
Inlet Invert= 434.00', Outlet Invert= 431.80'

‡

Summary for Reach R1: Chute MD W

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 17.181 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 31.90 cfs @ 12.13 hrs, Volume= 2.688 af
Outflow = 31.90 cfs @ 12.13 hrs, Volume= 2.688 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Reach R2: Chute MD E

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 15.427 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 29.98 cfs @ 12.15 hrs, Volume= 2.414 af
Outflow = 29.98 cfs @ 12.15 hrs, Volume= 2.414 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Reach R3: Chute TD W

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10.433 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 20.21 cfs @ 12.19 hrs, Volume= 1.632 af
Outflow = 20.21 cfs @ 12.19 hrs, Volume= 1.632 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Reach R4: Chute TD E

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 8.131 ac, 0.00% Impervious, Inflow Depth = 1.88" for 10-yr, 24-hr event
Inflow = 15.80 cfs @ 12.18 hrs, Volume= 1.272 af
Outflow = 15.80 cfs @ 12.18 hrs, Volume= 1.272 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Pond B1: Basin W

[80] Warning: Exceeded Pond F1 by 0.33' @ 26.20 hrs (31.99 cfs 6.616 af)

Inflow Area = 31.228 ac, 7.06% Impervious, Inflow Depth = 2.02" for 10-yr, 24-hr event
Inflow = 59.69 cfs @ 12.08 hrs, Volume= 5.265 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Starting Elev= 424.44' Surf.Area= 0.471 ac Storage= 0.363 af
Peak Elev= 428.53' @ 36.00 hrs Surf.Area= 1.978 ac Storage= 5.629 af (5.265 af above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	423.00'	10.828 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
423.00	0.063	0.000	0.000
424.00	0.317	0.190	0.190
425.00	0.667	0.492	0.682
426.00	1.063	0.865	1.547
427.00	1.569	1.316	2.863
428.00	1.900	1.735	4.597
429.00	2.047	1.974	6.571
430.00	2.130	2.088	8.659
431.00	2.206	2.168	10.828

Summary for Pond B2: Basin E

Inflow Area = 27.748 ac, 13.33% Impervious, Inflow Depth = 2.13" for 10-yr, 24-hr event
Inflow = 56.00 cfs @ 12.02 hrs, Volume= 4.935 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Starting Elev= 428.11' Surf.Area= 0.475 ac Storage= 0.285 af
Peak Elev= 430.70' @ 36.00 hrs Surf.Area= 3.227 ac Storage= 5.219 af (4.935 af above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	427.00'	9.711 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
427.00	0.104	0.000	0.000
428.00	0.372	0.238	0.238
429.00	1.305	0.838	1.076
430.00	2.773	2.039	3.115
431.00	3.420	3.097	6.212
432.00	3.579	3.499	9.711

Summary for Pond F1: Forebay W

[57] Hint: Peaked at 428.67' (Flood elevation advised)
[80] Warning: Exceeded Pond S1 by 0.33' @ 26.30 hrs (7.66 cfs 3.568 af)

Inflow Area = 28.543 ac, 0.00% Impervious, Inflow Depth = 1.89" for 10-yr, 24-hr event
Inflow = 55.43 cfs @ 12.11 hrs, Volume= 4.493 af
Outflow = 55.43 cfs @ 12.11 hrs, Volume= 4.493 af, Atten= 0%, Lag= 0.0 min
Primary = 55.43 cfs @ 12.11 hrs, Volume= 4.493 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 428.67' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	428.20'	**65.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=54.96 cfs @ 12.11 hrs HW=428.67' TW=426.32' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 54.96 cfs @ 1.79 fps)

Summary for Pond F2: Forebay E

[57] Hint: Peaked at 431.43' (Flood elevation advised)

Inflow Area = 23.380 ac, 0.00% Impervious, Inflow Depth = 1.89" for 10-yr, 24-hr event
Inflow = 44.88 cfs @ 12.11 hrs, Volume= 3.678 af
Outflow = 44.88 cfs @ 12.11 hrs, Volume= 3.678 af, Atten= 0%, Lag= 0.0 min
Primary = 44.88 cfs @ 12.11 hrs, Volume= 3.678 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 431.43' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	431.00'	**60.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=44.56 cfs @ 12.11 hrs HW=431.43' TW=429.51' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 44.56 cfs @ 1.72 fps)

Summary for Pond S1: Spillway W

[57] Hint: Peaked at 429.53' (Flood elevation advised)
[62] Hint: Exceeded Reach P1B OUTLET depth by 1.11' @ 12.15 hrs
[62] Hint: Exceeded Reach P2D OUTLET depth by 0.81' @ 12.10 hrs

Inflow Area = 28.543 ac, 0.00% Impervious, Inflow Depth = 1.89" for 10-yr, 24-hr event
Inflow = 55.43 cfs @ 12.11 hrs, Volume= 4.493 af
Outflow = 55.43 cfs @ 12.11 hrs, Volume= 4.493 af, Atten= 0%, Lag= 0.0 min
Primary = 55.43 cfs @ 12.11 hrs, Volume= 4.493 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 429.53' @ 12.12 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	428.20'	**15.0' long x 53.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=54.67 cfs @ 12.11 hrs HW=429.52' TW=428.67' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 54.67 cfs @ 2.76 fps)

Summary for Pond S2: Spillway E

[57] Hint: Peaked at 432.89' (Flood elevation advised)
[62] Hint: Exceeded Reach P3B OUTLET depth by 0.63' @ 12.15 hrs
[62] Hint: Exceeded Reach P4B OUTLET depth by 0.86' @ 12.15 hrs

Inflow Area = 23.380 ac, 0.00% Impervious, Inflow Depth = 1.89" for 10-yr, 24-hr event
Inflow = 44.88 cfs @ 12.11 hrs, Volume= 3.678 af
Outflow = 44.88 cfs @ 12.11 hrs, Volume= 3.678 af, Atten= 0%, Lag= 0.0 min
Primary = 44.88 cfs @ 12.11 hrs, Volume= 3.678 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 432.89' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	431.80'	**15.0' long x 42.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=44.56 cfs @ 12.11 hrs HW=432.88' TW=431.43' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 44.56 cfs @ 2.74 fps)

Post-Development Conditions
25-yr,24-hr storm event

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: 1S Runoff Area=3.836 ac 0.00% Impervious Runoff Depth=2.38"
Flow Length=732' Slope=0.0125 '/' Tc=19.1 min CN=80 Runoff=10.36 cfs 0.760 af

Subcatchment 2S: 2S Runoff Area=6.597 ac 0.00% Impervious Runoff Depth=2.38"
Flow Length=807' Tc=20.0 min CN=80 Runoff=17.33 cfs 1.307 af

Subcatchment 3S: 3S Runoff Area=5.122 ac 0.00% Impervious Runoff Depth=2.38"
Flow Length=696' Tc=19.0 min CN=80 Runoff=13.87 cfs 1.014 af

Subcatchment 4S: 4S Runoff Area=3.009 ac 0.00% Impervious Runoff Depth=2.38"
Flow Length=687' Tc=19.0 min CN=80 Runoff=8.15 cfs 0.596 af

Subcatchment 5S: 5S Runoff Area=3.241 ac 0.00% Impervious Runoff Depth=2.38"
Flow Length=220' Tc=8.1 min CN=80 Runoff=12.52 cfs 0.642 af

Subcatchment 6S: 6S Runoff Area=2.990 ac 0.00% Impervious Runoff Depth=2.38"
Flow Length=377' Tc=14.6 min CN=80 Runoff=9.25 cfs 0.592 af

Subcatchment 7S: 7S Runoff Area=1.107 ac 0.00% Impervious Runoff Depth=2.38"
Tc=6.0 min CN=80 Runoff=4.51 cfs 0.219 af

Subcatchment 8S: 8S Runoff Area=4.505 ac 0.00% Impervious Runoff Depth=2.38"
Flow Length=339' Tc=15.2 min CN=80 Runoff=13.66 cfs 0.892 af

Subcatchment 9S: 9S Runoff Area=2.511 ac 0.00% Impervious Runoff Depth=2.38"
Flow Length=281' Tc=8.9 min CN=80 Runoff=9.42 cfs 0.497 af

Subcatchment 10S: 10S Runoff Area=2.423 ac 0.00% Impervious Runoff Depth=2.38"
Flow Length=312' Tc=9.5 min CN=80 Runoff=8.88 cfs 0.480 af

Subcatchment 11S: 11S Runoff Area=1.965 ac 0.00% Impervious Runoff Depth=2.46"
Flow Length=197' Tc=13.7 min CN=81 Runoff=6.49 cfs 0.403 af

Subcatchment 12S: 12S Runoff Area=0.102 ac 0.00% Impervious Runoff Depth=2.38"
Tc=6.0 min CN=80 Runoff=0.42 cfs 0.020 af

Subcatchment 13S: 13S Runoff Area=0.350 ac 0.00% Impervious Runoff Depth=2.38"
Tc=6.0 min CN=80 Runoff=1.43 cfs 0.069 af

Subcatchment 14S: 14S Runoff Area=1.667 ac 0.00% Impervious Runoff Depth=2.38"
Flow Length=170' Tc=9.4 min CN=80 Runoff=6.13 cfs 0.330 af

Subcatchment 15S: 15S Runoff Area=1.998 ac 0.00% Impervious Runoff Depth=2.38"
Flow Length=149' Tc=8.8 min CN=80 Runoff=7.52 cfs 0.396 af

Subcatchment 16S: 16S Runoff Area=2.429 ac 0.00% Impervious Runoff Depth=2.38"
Tc=6.0 min CN=80 Runoff=9.90 cfs 0.481 af

Subcatchment 17S: 17S Runoff Area=0.812 ac 0.00% Impervious Runoff Depth=2.38"
Flow Length=180' Tc=7.6 min CN=80 Runoff=3.19 cfs 0.161 af

Subcatchment 18S: 18S Runoff Area=0.979 ac 0.00% Impervious Runoff Depth=2.38"
Tc=6.0 min CN=80 Runoff=3.99 cfs 0.194 af

Subcatchment 19S: 19S Runoff Area=0.538 ac 0.00% Impervious Runoff Depth=2.73"
Tc=6.0 min CN=84 Runoff=2.48 cfs 0.122 af

Subcatchment 20S: 20S Runoff Area=0.487 ac 0.00% Impervious Runoff Depth=2.91"
Tc=6.0 min CN=86 Runoff=2.38 cfs 0.118 af

Subcatchment 21S: 21S Runoff Area=1.120 ac 0.00% Impervious Runoff Depth=2.38"
Tc=6.0 min CN=80 Runoff=4.56 cfs 0.222 af

Subcatchment 22S: 22S Runoff Area=1.561 ac 0.00% Impervious Runoff Depth=2.38"
Tc=6.0 min CN=80 Runoff=6.36 cfs 0.309 af

Subcatchment 23S: 23S Runoff Area=2.685 ac 82.12% Impervious Runoff Depth=4.05"
Tc=6.0 min CN=97 Runoff=16.20 cfs 0.906 af

Subcatchment 24S: 24S Runoff Area=4.368 ac 84.71% Impervious Runoff Depth=4.05"
Tc=6.0 min CN=97 Runoff=26.35 cfs 1.474 af

Subcatchment 25S: 25S Runoff Area=0.989 ac 0.00% Impervious Runoff Depth=2.38"
Tc=6.0 min CN=80 Runoff=4.03 cfs 0.196 af

Subcatchment 26S: 26S Runoff Area=1.084 ac 0.00% Impervious Runoff Depth=2.38"
Tc=6.0 min CN=80 Runoff=4.42 cfs 0.215 af

Subcatchment 27S: 27S Runoff Area=0.280 ac 0.00% Impervious Runoff Depth=2.38"
Tc=6.0 min CN=80 Runoff=1.14 cfs 0.055 af

Subcatchment 28S: 28S Runoff Area=0.221 ac 0.00% Impervious Runoff Depth=2.38"
Tc=6.0 min CN=80 Runoff=0.90 cfs 0.044 af

Reach C1: Channel 1 Avg. Flow Depth=0.42' Max Vel=2.91 fps Inflow=25.85 cfs 2.066 af
n=0.030 L=216.0' S=0.0120 '/' Capacity=114.23 cfs Outflow=25.80 cfs 2.066 af

Reach C2: Channel 2 Avg. Flow Depth=0.35' Max Vel=2.71 fps Inflow=20.28 cfs 1.610 af
n=0.030 L=92.5' S=0.0130 '/' Capacity=118.59 cfs Outflow=20.23 cfs 1.610 af

Reach D1: Berm 1 Avg. Flow Depth=0.71' Max Vel=2.44 fps Inflow=8.88 cfs 0.480 af
n=0.030 L=884.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=7.37 cfs 0.480 af

Reach D10: Berm 10 Avg. Flow Depth=0.33' Max Vel=1.45 fps Inflow=1.14 cfs 0.055 af
n=0.030 L=520.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=0.93 cfs 0.055 af

Reach D2: Berm 2 Avg. Flow Depth=0.88' Max Vel=2.83 fps Inflow=16.09 cfs 0.857 af
n=0.030 L=1,011.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=13.24 cfs 0.857 af

Reach D3: Berm 3 Avg. Flow Depth=0.87' Max Vel=2.80 fps Inflow=14.50 cfs 0.948 af
n=0.030 L=924.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=12.83 cfs 0.948 af

Reach D4: Berm 4 Avg. Flow Depth=0.73' Max Vel=2.50 fps Inflow=9.42 cfs 0.497 af
n=0.030 L=767.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=8.05 cfs 0.497 af

Reach D5: Berm 5 Avg. Flow Depth=0.79' Max Vel=2.62 fps Inflow=10.36 cfs 0.760 af
n=0.030 L=614.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=9.80 cfs 0.760 af

Reach D6: Berm 6 Avg. Flow Depth=0.95' Max Vel=2.97 fps Inflow=17.33 cfs 1.307 af
n=0.030 L=836.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=16.14 cfs 1.307 af

Reach D7: Berm 7 Avg. Flow Depth=0.87' Max Vel=2.79 fps Inflow=13.87 cfs 1.014 af
n=0.030 L=912.5' S=0.0100 '/' Capacity=117.06 cfs Outflow=12.57 cfs 1.014 af

Reach D8: Berm 8 Avg. Flow Depth=0.72' Max Vel=2.47 fps Inflow=8.15 cfs 0.596 af
n=0.030 L=566.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=7.72 cfs 0.596 af

Reach D9: Berm 9 Avg. Flow Depth=0.55' Max Vel=2.04 fps Inflow=4.42 cfs 0.215 af
n=0.030 L=680.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=3.66 cfs 0.215 af

Reach I1: Bench 1 Avg. Flow Depth=0.71' Max Vel=2.36 fps Inflow=3.99 cfs 0.194 af
n=0.030 L=905.6' S=0.0100 '/' Capacity=50.12 cfs Outflow=3.18 cfs 0.194 af

Reach I2A: Bench 2 Avg. Flow Depth=0.72' Max Vel=2.37 fps Inflow=4.03 cfs 0.196 af
n=0.030 L=869.7' S=0.0100 '/' Capacity=50.12 cfs Outflow=3.26 cfs 0.196 af

Reach I2B: Bench 2 Avg. Flow Depth=1.32' Max Vel=2.53 fps Inflow=12.33 cfs 0.788 af
n=0.030 L=514.0' S=0.0050 '/' Capacity=35.43 cfs Outflow=11.60 cfs 0.788 af

Reach I2C: Bench I2C Avg. Flow Depth=1.33' Max Vel=2.54 fps Inflow=11.90 cfs 0.832 af
n=0.030 L=70.0' S=0.0050 '/' Capacity=35.43 cfs Outflow=11.90 cfs 0.832 af

Reach I3: Bench 3 Avg. Flow Depth=0.76' Max Vel=2.48 fps Inflow=4.51 cfs 0.219 af
n=0.030 L=721.0' S=0.0100 '/' Capacity=50.11 cfs Outflow=3.85 cfs 0.219 af

Reach I4: Bench 4 Avg. Flow Depth=0.67' Max Vel=2.28 fps Inflow=3.19 cfs 0.161 af
n=0.030 L=654.0' S=0.0100 '/' Capacity=50.11 cfs Outflow=2.73 cfs 0.161 af

Reach P1A: Channel 1P Avg. Flow Depth=0.42' Max Vel=2.45 fps Inflow=6.36 cfs 0.309 af
n=0.030 L=930.0' S=0.0105 '/' Capacity=104.42 cfs Outflow=5.20 cfs 0.309 af

Reach P1B: Channel 1P Avg. Flow Depth=0.32' Max Vel=3.01 fps Inflow=10.55 cfs 0.625 af
n=0.030 L=144.0' S=0.0194 '/' Capacity=275.51 cfs Outflow=10.48 cfs 0.625 af

Reach P2A: Channel 2P Avg. Flow Depth=0.50' Max Vel=1.85 fps Inflow=6.13 cfs 0.330 af
n=0.030 L=830.0' S=0.0049 '/' Capacity=17.71 cfs Outflow=4.90 cfs 0.330 af

Reach P2B: Channel 2P Avg. Flow Depth=0.50' Max Vel=2.03 fps Inflow=5.68 cfs 0.399 af
n=0.030 L=514.0' S=0.0058 '/' Capacity=19.25 cfs Outflow=5.31 cfs 0.399 af

Reach P2C: Channel 2P Avg. Flow Depth=0.35' Max Vel=3.16 fps Inflow=5.45 cfs 0.420 af
n=0.030 L=67.0' S=0.0209 '/' Capacity=36.43 cfs Outflow=5.45 cfs 0.420 af

Reach P2D: Channel 2P Avg. Flow Depth=0.60' Max Vel=3.30 fps Inflow=23.54 cfs 1.655 af
n=0.030 L=477.0' S=0.0109 '/' Capacity=206.29 cfs Outflow=23.11 cfs 1.655 af

Reach P3A: Channel 3P Avg. Flow Depth=0.57' Max Vel=1.95 fps Inflow=7.52 cfs 0.396 af
n=0.030 L=828.0' S=0.0047 '/' Capacity=17.30 cfs Outflow=6.04 cfs 0.396 af

Reach P3B: Channel 3P Avg. Flow Depth=0.55' Max Vel=2.28 fps Inflow=18.38 cfs 1.096 af
n=0.030 L=1,081.0' S=0.0057 '/' Capacity=149.63 cfs Outflow=14.63 cfs 1.096 af

Reach P4A: Channel 4P Avg. Flow Depth=0.36' Max Vel=2.21 fps Inflow=4.56 cfs 0.222 af
n=0.030 L=678.0' S=0.0100 '/' Capacity=101.87 cfs Outflow=3.93 cfs 0.222 af

Reach P4B: Channel 4P Avg. Flow Depth=0.34' Max Vel=2.29 fps Inflow=8.69 cfs 0.501 af
n=0.030 L=208.0' S=0.0106 '/' Capacity=203.20 cfs Outflow=8.51 cfs 0.501 af

Reach R1: Chute MD W Inflow=41.20 cfs 3.403 af
Outflow=41.20 cfs 3.403 af

Reach R2: Chute MD E Inflow=38.47 cfs 3.055 af
Outflow=38.47 cfs 3.055 af

Reach R3: Chute TD W Inflow=25.85 cfs 2.066 af
Outflow=25.85 cfs 2.066 af

Reach R4: Chute TD E Inflow=20.28 cfs 1.610 af
Outflow=20.28 cfs 1.610 af

Pond B1: Basin W Peak Elev=429.19' Storage=6.952 af Inflow=77.30 cfs 6.588 af
Outflow=0.00 cfs 0.000 af

Pond B2: Basin E Peak Elev=431.06' Storage=6.411 af Inflow=70.63 cfs 6.126 af
Outflow=0.00 cfs 0.000 af

Pond F1: Forebay W Peak Elev=429.18' Inflow=71.48 cfs 5.683 af
Outflow=71.48 cfs 5.682 af

Pond F2: Forebay E Peak Elev=431.52' Inflow=57.95 cfs 4.652 af
Outflow=57.95 cfs 4.652 af

Pond S1: Spillway W Peak Elev=429.78' Inflow=71.48 cfs 5.683 af
Outflow=71.48 cfs 5.683 af

Pond S2: Spillway E Peak Elev=433.09' Inflow=57.95 cfs 4.652 af
Outflow=57.95 cfs 4.652 af

Total Runoff Area = 58.976 ac Runoff Volume = 12.715 af Average Runoff Depth = 2.59"
89.99% Pervious = 53.071 ac 10.01% Impervious = 5.905 ac

Summary for Subcatchment 1S: 1S

Runoff = 10.36 cfs @ 12.12 hrs, Volume= 0.760 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	3.836	80	
	3.836		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.2	100	0.0125	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
5.9	632	0.0125	1.80		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
19.1	732	Total			

Summary for Subcatchment 2S: 2S

Runoff = 17.33 cfs @ 12.13 hrs, Volume= 1.307 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	6.597	80	
	6.597		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0120	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
6.5	707	0.0126	1.81		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
20.0	807	Total			

Summary for Subcatchment 3S: 3S

Runoff = 13.87 cfs @ 12.12 hrs, Volume= 1.014 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	5.122	80	
	5.122		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0120	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
5.5	596	0.0126	1.81		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
19.0	696	Total			

Summary for Subcatchment 4S: 4S

Runoff = 8.15 cfs @ 12.12 hrs, Volume= 0.596 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	3.009	80	
	3.009		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0120	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
5.5	587	0.0124	1.79		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
19.0	687	Total			

Summary for Subcatchment 5S: 5S

Runoff = 12.52 cfs @ 12.00 hrs, Volume= 0.642 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	3.241	80	
	3.241		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	100	0.0610	0.24		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
1.1	120	0.0125	1.80		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.1	220	Total			

Summary for Subcatchment 6S: 6S

Runoff = 9.25 cfs @ 12.07 hrs, Volume= 0.592 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	2.990	80	
	2.990		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0120	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
1.1	277	0.0661	4.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
14.6	377	Total			

Summary for Subcatchment 7S: 7S

Runoff = 4.51 cfs @ 11.97 hrs, Volume= 0.219 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	1.107	80	
	1.107		100.00% Pervious Area

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

Summary for Subcatchment 8S: 8S

Runoff = 13.66 cfs @ 12.07 hrs, Volume= 0.892 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	4.505	80	
	4.505		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.0	100	0.0130	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
2.2	239	0.0121	1.77		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
15.2	339	Total			

Summary for Subcatchment 9S: 9S

Runoff = 9.42 cfs @ 12.00 hrs, Volume= 0.497 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	2.511	80	
	2.511		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	100	0.0580	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
1.7	181	0.0122	1.78		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.9	281	Total			

Summary for Subcatchment 10S: 10S

Runoff = 8.88 cfs @ 12.01 hrs, Volume= 0.480 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	2.423	80	
	2.423		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	100	0.0525	0.22		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
2.0	212	0.0123	1.79		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.5	312	Total			

Summary for Subcatchment 11S: 11S

Runoff = 6.49 cfs @ 12.06 hrs, Volume= 0.403 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	0.690	80	
*	0.157	91	
*	1.118	80	
	1.965	81	Weighted Average
	1.965		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0120	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
0.2	97	0.2153	7.47		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.7	197	Total			

Summary for Subcatchment 12S: 12S

Runoff = 0.42 cfs @ 11.97 hrs, Volume= 0.020 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	0.102	80	
	0.102		100.00% Pervious Area

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

Summary for Subcatchment 13S: 13S

Runoff = 1.43 cfs @ 11.97 hrs, Volume= 0.069 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	0.350	80	
	0.350		100.00% Pervious Area

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

Summary for Subcatchment 14S: 14S

Runoff = 6.13 cfs @ 12.01 hrs, Volume= 0.330 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	1.667	80	
	1.667		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	100	0.0370	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
0.8	70	0.0086	1.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.4	170	Total			

Summary for Subcatchment 15S: 15S

Runoff = 7.52 cfs @ 12.00 hrs, Volume= 0.396 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	1.958	80	
*	0.040	91	
	1.998	80	Weighted Average
	1.998		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	100	0.0460	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
0.9	49	0.0031	0.90		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.8	149	Total			

Summary for Subcatchment 16S: 16S

Runoff = 9.90 cfs @ 11.97 hrs, Volume= 0.481 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	0.931	80	
*	1.423	80	
*	0.075	91	
	2.429	80	Weighted Average
	2.429		100.00% Pervious Area

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

Summary for Subcatchment 17S: 17S

Runoff = 3.19 cfs @ 11.99 hrs, Volume= 0.161 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	0.812	80	
	0.812		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0586	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
0.5	80	0.0285	2.72		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
7.6	180	Total			

Summary for Subcatchment 18S: 18S

Runoff = 3.99 cfs @ 11.97 hrs, Volume= 0.194 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	0.979	80	
	0.979		100.00% Pervious Area

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

Summary for Subcatchment 19S: 19S

Runoff = 2.48 cfs @ 11.97 hrs, Volume= 0.122 af, Depth= 2.73"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	0.366	80	
*	0.172	91	
	0.538	84	Weighted Average
	0.538		100.00% Pervious Area

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

Summary for Subcatchment 20S: 20S

Runoff = 2.38 cfs @ 11.97 hrs, Volume= 0.118 af, Depth= 2.91"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	0.254	91	
*	0.233	80	
	0.487	86	Weighted Average
	0.487		100.00% Pervious Area

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

Summary for Subcatchment 21S: 21S

Runoff = 4.56 cfs @ 11.97 hrs, Volume= 0.222 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	1.120	80	
	1.120		100.00% Pervious Area

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

Summary for Subcatchment 22S: 22S

Runoff = 6.36 cfs @ 11.97 hrs, Volume= 0.309 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	1.561	80	
	1.561		100.00% Pervious Area

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

Summary for Subcatchment 23S: 23S

Runoff = 16.20 cfs @ 11.96 hrs, Volume= 0.906 af, Depth= 4.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	0.480	91	
*	2.205	98	
	2.685	97	Weighted Average
	0.480		17.88% Pervious Area
	2.205		82.12% Impervious Area

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

Summary for Subcatchment 24S: 24S

Runoff = 26.35 cfs @ 11.96 hrs, Volume= 1.474 af, Depth= 4.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	0.668	91	Pond Road
*	3.700	98	Pond
	4.368	97	Weighted Average
	0.668		15.29% Pervious Area
	3.700		84.71% Impervious Area

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

Summary for Subcatchment 25S: 25S

Runoff = 4.03 cfs @ 11.97 hrs, Volume= 0.196 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	0.989	80	
	0.989		100.00% Pervious Area

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

Summary for Subcatchment 26S: 26S

Runoff = 4.42 cfs @ 11.97 hrs, Volume= 0.215 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	1.084	80	
	1.084		100.00% Pervious Area

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

Summary for Subcatchment 27S: 27S

Runoff = 1.14 cfs @ 11.97 hrs, Volume= 0.055 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	0.280	80	
	0.280		100.00% Pervious Area

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

Summary for Subcatchment 28S: 28S

Runoff = 0.90 cfs @ 11.97 hrs, Volume= 0.044 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr, 24-hr Rainfall=4.40"

	Area (ac)	CN	Description
*	0.221	80	
	0.221		100.00% Pervious Area

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

Summary for Reach C1: Channel 1

Inflow Area = 10.433 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 25.85 cfs @ 12.18 hrs, Volume= 2.066 af
Outflow = 25.80 cfs @ 12.19 hrs, Volume= 2.066 af, Atten= 0%, Lag= 0.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.91 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 0.65 fps, Avg. Travel Time= 5.6 min

Peak Storage= 1,916 cf @ 12.19 hrs
Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 114.23 cfs

20.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 3.0 '/' Top Width= 26.00'
Length= 216.0' Slope= 0.0120 '/'
Inlet Invert= 452.80', Outlet Invert= 450.20'

‡

Summary for Reach C2: Channel 2

Inflow Area = 8.131 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 20.28 cfs @ 12.17 hrs, Volume= 1.610 af
Outflow = 20.23 cfs @ 12.18 hrs, Volume= 1.610 af, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.71 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 0.61 fps, Avg. Travel Time= 2.5 min

Peak Storage= 688 cf @ 12.18 hrs
Average Depth at Peak Storage= 0.35'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 118.59 cfs

20.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 3.0 '/' Top Width= 26.00'
Length= 92.5' Slope= 0.0130 '/'
Inlet Invert= 453.20', Outlet Invert= 452.00'

‡

Summary for Reach D1: Berm 1

Inflow Area = 2.423 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 8.88 cfs @ 12.01 hrs, Volume= 0.480 af
Outflow = 7.37 cfs @ 12.07 hrs, Volume= 0.480 af, Atten= 17%, Lag= 3.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.44 fps, Min. Travel Time= 6.1 min
Avg. Velocity = 0.79 fps, Avg. Travel Time= 18.6 min

Peak Storage= 2,667 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.71'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 884.0' Slope= 0.0100 '/'
Inlet Invert= 457.60', Outlet Invert= 448.76'

‡

Summary for Reach D10: Berm 10

Inflow Area = 0.280 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 1.14 cfs @ 11.97 hrs, Volume= 0.055 af
Outflow = 0.93 cfs @ 12.02 hrs, Volume= 0.055 af, Atten= 19%, Lag= 3.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.45 fps, Min. Travel Time= 6.0 min
Avg. Velocity = 0.52 fps, Avg. Travel Time= 16.6 min

Peak Storage= 331 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 520.0' Slope= 0.0100 '/'
Inlet Invert= 465.30', Outlet Invert= 460.10'

‡

Summary for Reach D2: Berm 2

[62] Hint: Exceeded Reach D9 OUTLET depth by 0.67' @ 12.10 hrs

Inflow Area = 4.325 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 16.09 cfs @ 12.00 hrs, Volume= 0.857 af
Outflow = 13.24 cfs @ 12.06 hrs, Volume= 0.857 af, Atten= 18%, Lag= 3.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.83 fps, Min. Travel Time= 6.0 min
Avg. Velocity = 0.86 fps, Avg. Travel Time= 19.5 min

Peak Storage= 4,734 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.88'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 1,011.0' Slope= 0.0100 '/'
Inlet Invert= 460.10', Outlet Invert= 449.99'

‡

Summary for Reach D3: Berm 3

[62] Hint: Exceeded Reach D10 OUTLET depth by 0.61' @ 12.15 hrs

Inflow Area = 4.785 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 14.50 cfs @ 12.07 hrs, Volume= 0.948 af
Outflow = 12.83 cfs @ 12.13 hrs, Volume= 0.948 af, Atten= 12%, Lag= 3.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.80 fps, Min. Travel Time= 5.5 min
Avg. Velocity = 0.91 fps, Avg. Travel Time= 16.9 min

Peak Storage= 4,225 cf @ 12.13 hrs
Average Depth at Peak Storage= 0.87'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 924.0' Slope= 0.0100 '/'
Inlet Invert= 460.10', Outlet Invert= 450.86'

‡

Summary for Reach D4: Berm 4

Inflow Area = 2.511 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 9.42 cfs @ 12.00 hrs, Volume= 0.497 af
Outflow = 8.05 cfs @ 12.06 hrs, Volume= 0.497 af, Atten= 14%, Lag= 3.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.50 fps, Min. Travel Time= 5.1 min
Avg. Velocity = 0.82 fps, Avg. Travel Time= 15.6 min

Peak Storage= 2,473 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.73'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 767.0' Slope= 0.0100 '/'
Inlet Invert= 457.60', Outlet Invert= 449.93'

‡

Summary for Reach D5: Berm 5

Inflow Area = 3.836 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 10.36 cfs @ 12.12 hrs, Volume= 0.760 af
Outflow = 9.80 cfs @ 12.17 hrs, Volume= 0.760 af, Atten= 5%, Lag= 3.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.62 fps, Min. Travel Time= 3.9 min
Avg. Velocity = 0.93 fps, Avg. Travel Time= 11.0 min

Peak Storage= 2,294 cf @ 12.17 hrs
Average Depth at Peak Storage= 0.79'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 614.0' Slope= 0.0100 '/'
Inlet Invert= 463.20', Outlet Invert= 457.06'

‡

Summary for Reach D6: Berm 6

Inflow Area = 6.597 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 17.33 cfs @ 12.13 hrs, Volume= 1.307 af
Outflow = 16.14 cfs @ 12.19 hrs, Volume= 1.307 af, Atten= 7%, Lag= 3.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.97 fps, Min. Travel Time= 4.7 min
Avg. Velocity = 1.00 fps, Avg. Travel Time= 13.9 min

Peak Storage= 4,540 cf @ 12.19 hrs
Average Depth at Peak Storage= 0.95'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 836.0' Slope= 0.0100 '/'
Inlet Invert= 465.50', Outlet Invert= 457.14'

‡

Summary for Reach D7: Berm 7

Inflow Area = 5.122 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 13.87 cfs @ 12.12 hrs, Volume= 1.014 af
Outflow = 12.57 cfs @ 12.18 hrs, Volume= 1.014 af, Atten= 9%, Lag= 4.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.79 fps, Min. Travel Time= 5.5 min
Avg. Velocity = 0.93 fps, Avg. Travel Time= 16.3 min

Peak Storage= 4,108 cf @ 12.18 hrs
Average Depth at Peak Storage= 0.87'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.06 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 912.5' Slope= 0.0100 '/'
Inlet Invert= 467.20', Outlet Invert= 458.07'

‡

Summary for Reach D8: Berm 8

Inflow Area = 3.009 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 8.15 cfs @ 12.12 hrs, Volume= 0.596 af
Outflow = 7.72 cfs @ 12.16 hrs, Volume= 0.596 af, Atten= 5%, Lag= 2.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.47 fps, Min. Travel Time= 3.8 min
Avg. Velocity = 0.89 fps, Avg. Travel Time= 10.6 min

Peak Storage= 1,769 cf @ 12.17 hrs
Average Depth at Peak Storage= 0.72'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 566.0' Slope= 0.0100 '/'
Inlet Invert= 463.70', Outlet Invert= 458.04'

‡

Summary for Reach D9: Berm 9

Inflow Area = 1.084 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 4.42 cfs @ 11.97 hrs, Volume= 0.215 af
Outflow = 3.66 cfs @ 12.02 hrs, Volume= 0.215 af, Atten= 17%, Lag= 3.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.04 fps, Min. Travel Time= 5.6 min
Avg. Velocity = 0.69 fps, Avg. Travel Time= 16.5 min

Peak Storage= 1,213 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.55'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 680.0' Slope= 0.0100 '/'
Inlet Invert= 466.60', Outlet Invert= 459.80'

‡

Summary for Reach I1: Bench 1

Inflow Area = 0.979 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 3.99 cfs @ 11.97 hrs, Volume= 0.194 af
Outflow = 3.18 cfs @ 12.03 hrs, Volume= 0.194 af, Atten= 20%, Lag= 3.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.36 fps, Min. Travel Time= 6.4 min
Avg. Velocity = 0.78 fps, Avg. Travel Time= 19.4 min

Peak Storage= 1,213 cf @ 12.03 hrs
Average Depth at Peak Storage= 0.71'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 50.12 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 3.3 '/' Top Width= 10.60'
Length= 905.6' Slope= 0.0100 '/'
Inlet Invert= 443.40', Outlet Invert= 434.34'

Summary for Reach I2A: Bench 2

Inflow Area = 0.989 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 4.03 cfs @ 11.97 hrs, Volume= 0.196 af
Outflow = 3.26 cfs @ 12.02 hrs, Volume= 0.196 af, Atten= 19%, Lag= 3.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.37 fps, Min. Travel Time= 6.1 min
Avg. Velocity = 0.78 fps, Avg. Travel Time= 18.5 min

Peak Storage= 1,187 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.72'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 50.12 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 3.3 '/' Top Width= 10.60'
Length= 869.7' Slope= 0.0100 '/'
Inlet Invert= 450.00', Outlet Invert= 441.30'

Summary for Reach I2B: Bench 2

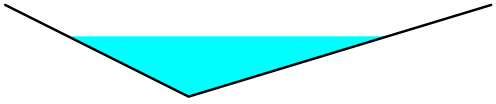
[62] Hint: Exceeded Reach I2A OUTLET depth by 0.89' @ 12.15 hrs

Inflow Area = 3.979 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 12.33 cfs @ 12.05 hrs, Volume= 0.788 af
Outflow = 11.60 cfs @ 12.10 hrs, Volume= 0.788 af, Atten= 6%, Lag= 2.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.53 fps, Min. Travel Time= 3.4 min
Avg. Velocity = 0.79 fps, Avg. Travel Time= 10.9 min

Peak Storage= 2,358 cf @ 12.10 hrs
Average Depth at Peak Storage= 1.32'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 35.43 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 3.3 '/' Top Width= 10.60'
Length= 514.0' Slope= 0.0050 '/'
Inlet Invert= 441.50', Outlet Invert= 438.93'



Summary for Reach I2C: Bench I2C

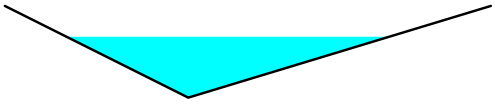
[62] Hint: Exceeded Reach I2B OUTLET depth by 0.10' @ 11.95 hrs

Inflow Area = 4.200 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 11.90 cfs @ 12.09 hrs, Volume= 0.832 af
Outflow = 11.90 cfs @ 12.10 hrs, Volume= 0.832 af, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.54 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 0.79 fps, Avg. Travel Time= 1.5 min

Peak Storage= 327 cf @ 12.10 hrs
Average Depth at Peak Storage= 1.33'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 35.43 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 3.3 '/' Top Width= 10.60'
Length= 70.0' Slope= 0.0050 '/'
Inlet Invert= 439.00', Outlet Invert= 438.65'



Summary for Reach I3: Bench 3

Inflow Area = 1.107 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 4.51 cfs @ 11.97 hrs, Volume= 0.219 af
Outflow = 3.85 cfs @ 12.02 hrs, Volume= 0.219 af, Atten= 15%, Lag= 2.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.48 fps, Min. Travel Time= 4.8 min
Avg. Velocity = 0.82 fps, Avg. Travel Time= 14.6 min

Peak Storage= 1,117 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.76'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 50.11 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 3.3 '/' Top Width= 10.60'
Length= 721.0' Slope= 0.0100 '/'
Inlet Invert= 450.00', Outlet Invert= 442.79'

Summary for Reach I4: Bench 4

Inflow Area = 0.812 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 3.19 cfs @ 11.99 hrs, Volume= 0.161 af
Outflow = 2.73 cfs @ 12.04 hrs, Volume= 0.161 af, Atten= 15%, Lag= 2.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.28 fps, Min. Travel Time= 4.8 min
Avg. Velocity = 0.78 fps, Avg. Travel Time= 14.1 min

Peak Storage= 781 cf @ 12.04 hrs
Average Depth at Peak Storage= 0.67'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 50.11 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 3.3 '/' Top Width= 10.60'
Length= 654.0' Slope= 0.0100 '/'
Inlet Invert= 443.40', Outlet Invert= 436.86'

Summary for Reach P1A: Channel 1P

Inflow Area = 1.561 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 6.36 cfs @ 11.97 hrs, Volume= 0.309 af
Outflow = 5.20 cfs @ 12.02 hrs, Volume= 0.309 af, Atten= 18%, Lag= 3.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.45 fps, Min. Travel Time= 6.3 min
Avg. Velocity = 0.60 fps, Avg. Travel Time= 25.7 min

Peak Storage= 1,962 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 104.42 cfs

4.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 '/' Top Width= 14.00'
Length= 930.0' Slope= 0.0105 '/'
Inlet Invert= 440.80', Outlet Invert= 431.00'

Summary for Reach P1B: Channel 1P

[61] Hint: Exceeded Reach P1A outlet invert by 0.31' @ 12.00 hrs

Inflow Area = 3.078 ac, 0.00% Impervious, Inflow Depth = 2.44" for 25-yr, 24-hr event
Inflow = 10.55 cfs @ 12.01 hrs, Volume= 0.625 af
Outflow = 10.48 cfs @ 12.02 hrs, Volume= 0.625 af, Atten= 1%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.01 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 0.70 fps, Avg. Travel Time= 3.4 min

Peak Storage= 499 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.32'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 275.51 cfs

10.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 3.3 '/' Top Width= 21.60'
Length= 144.0' Slope= 0.0194 '/'
Inlet Invert= 431.00', Outlet Invert= 428.20'

‡

Summary for Reach P2A: Channel 2P

Inflow Area = 1.667 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 6.13 cfs @ 12.01 hrs, Volume= 0.330 af
Outflow = 4.90 cfs @ 12.07 hrs, Volume= 0.330 af, Atten= 20%, Lag= 3.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.85 fps, Min. Travel Time= 7.5 min
Avg. Velocity = 0.39 fps, Avg. Travel Time= 35.2 min

Peak Storage= 2,181 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.50'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 17.71 cfs

4.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 '/' Top Width= 9.00'
Length= 830.0' Slope= 0.0049 '/'
Inlet Invert= 441.90', Outlet Invert= 437.80'

‡

Summary for Reach P2B: Channel 2P

[62] Hint: Exceeded Reach P2A OUTLET depth by 0.05' @ 12.25 hrs

Inflow Area = 2.017 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 5.68 cfs @ 12.05 hrs, Volume= 0.399 af
Outflow = 5.31 cfs @ 12.10 hrs, Volume= 0.399 af, Atten= 6%, Lag= 3.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.03 fps, Min. Travel Time= 4.2 min
Avg. Velocity = 0.43 fps, Avg. Travel Time= 19.8 min

Peak Storage= 1,347 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.50'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 19.25 cfs

4.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 '/' Top Width= 9.00'
Length= 514.0' Slope= 0.0058 '/'
Inlet Invert= 437.80', Outlet Invert= 434.80'

‡

Summary for Reach P2C: Channel 2P

[90] Warning: Qout>Qin may require Finer Routing or smaller dt
[61] Hint: Exceeded Reach P2B outlet invert by 0.35' @ 12.10 hrs

Inflow Area = 2.119 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 5.45 cfs @ 12.09 hrs, Volume= 0.420 af
Outflow = 5.45 cfs @ 12.09 hrs, Volume= 0.420 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.16 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 0.69 fps, Avg. Travel Time= 1.6 min

Peak Storage= 116 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.35'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 36.43 cfs

4.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 '/' Top Width= 9.00'
Length= 67.0' Slope= 0.0209 '/'
Inlet Invert= 434.80', Outlet Invert= 433.40'

‡

Summary for Reach P2D: Channel 2P

[62] Hint: Exceeded Reach P2C OUTLET depth by 0.24' @ 12.15 hrs

Inflow Area = 8.284 ac, 0.00% Impervious, Inflow Depth = 2.40" for 25-yr, 24-hr event
Inflow = 23.54 cfs @ 12.08 hrs, Volume= 1.655 af
Outflow = 23.11 cfs @ 12.11 hrs, Volume= 1.655 af, Atten= 2%, Lag= 1.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.30 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 0.70 fps, Avg. Travel Time= 11.3 min

Peak Storage= 3,332 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.60'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 206.29 cfs

10.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 3.3 '/' Top Width= 21.60'
Length= 477.0' Slope= 0.0109 '/'
Inlet Invert= 433.40', Outlet Invert= 428.20'

‡

Summary for Reach P3A: Channel 3P

Inflow Area = 1.998 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 7.52 cfs @ 12.00 hrs, Volume= 0.396 af
Outflow = 6.04 cfs @ 12.06 hrs, Volume= 0.396 af, Atten= 20%, Lag= 3.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.95 fps, Min. Travel Time= 7.1 min
Avg. Velocity = 0.41 fps, Avg. Travel Time= 34.0 min

Peak Storage= 2,556 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.57'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 17.30 cfs

4.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 '/' Top Width= 9.00'
Length= 828.0' Slope= 0.0047 '/'
Inlet Invert= 441.90', Outlet Invert= 438.00'

‡

Summary for Reach P3B: Channel 3P

[62] Hint: Exceeded Reach P3A OUTLET depth by 0.04' @ 12.35 hrs

Inflow Area = 5.534 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 18.38 cfs @ 12.00 hrs, Volume= 1.096 af
Outflow = 14.63 cfs @ 12.07 hrs, Volume= 1.096 af, Atten= 20%, Lag= 4.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.28 fps, Min. Travel Time= 7.9 min
Avg. Velocity = 0.49 fps, Avg. Travel Time= 36.6 min

Peak Storage= 6,904 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.55'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 149.63 cfs

10.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 3.3 2.5 '/' Top Width= 21.60'
Length= 1,081.0' Slope= 0.0057 '/'
Inlet Invert= 438.00', Outlet Invert= 431.80'

‡

Summary for Reach P4A: Channel 4P

Inflow Area = 1.120 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 4.56 cfs @ 11.97 hrs, Volume= 0.222 af
Outflow = 3.93 cfs @ 12.02 hrs, Volume= 0.222 af, Atten= 14%, Lag= 2.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.21 fps, Min. Travel Time= 5.1 min
Avg. Velocity = 0.55 fps, Avg. Travel Time= 20.6 min

Peak Storage= 1,203 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 101.87 cfs

4.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 '/' Top Width= 14.00'
Length= 678.0' Slope= 0.0100 '/'
Inlet Invert= 440.80', Outlet Invert= 434.00'

Summary for Reach P4B: Channel 4P

[61] Hint: Exceeded Reach P4A outlet invert by 0.33' @ 12.00 hrs

Inflow Area = 2.419 ac, 0.00% Impervious, Inflow Depth = 2.48" for 25-yr, 24-hr event
Inflow = 8.69 cfs @ 12.00 hrs, Volume= 0.501 af
Outflow = 8.51 cfs @ 12.02 hrs, Volume= 0.501 af, Atten= 2%, Lag= 1.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.29 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 0.53 fps, Avg. Travel Time= 6.5 min

Peak Storage= 766 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 203.20 cfs

10.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 3.3 2.5 '/' Top Width= 21.60'
Length= 208.0' Slope= 0.0106 '/'
Inlet Invert= 434.00', Outlet Invert= 431.80'

‡

Summary for Reach R1: Chute MD W

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 17.181 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 41.20 cfs @ 12.12 hrs, Volume= 3.403 af
Outflow = 41.20 cfs @ 12.12 hrs, Volume= 3.403 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Reach R2: Chute MD E

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 15.427 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 38.47 cfs @ 12.14 hrs, Volume= 3.055 af
Outflow = 38.47 cfs @ 12.14 hrs, Volume= 3.055 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Reach R3: Chute TD W

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10.433 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 25.85 cfs @ 12.18 hrs, Volume= 2.066 af
Outflow = 25.85 cfs @ 12.18 hrs, Volume= 2.066 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Reach R4: Chute TD E

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 8.131 ac, 0.00% Impervious, Inflow Depth = 2.38" for 25-yr, 24-hr event
Inflow = 20.28 cfs @ 12.17 hrs, Volume= 1.610 af
Outflow = 20.28 cfs @ 12.17 hrs, Volume= 1.610 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Pond B1: Basin W

[80] Warning: Exceeded Pond F1 by 0.98' @ 26.40 hrs (168.58 cfs 41.598 af)

Inflow Area = 31.228 ac, 7.06% Impervious, Inflow Depth = 2.53" for 25-yr, 24-hr event
Inflow = 77.30 cfs @ 12.07 hrs, Volume= 6.588 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Starting Elev= 424.44' Surf.Area= 0.471 ac Storage= 0.363 af
Peak Elev= 429.19' @ 36.00 hrs Surf.Area= 2.062 ac Storage= 6.952 af (6.588 af above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	423.00'	10.828 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
423.00	0.063	0.000	0.000
424.00	0.317	0.190	0.190
425.00	0.667	0.492	0.682
426.00	1.063	0.865	1.547
427.00	1.569	1.316	2.863
428.00	1.900	1.735	4.597
429.00	2.047	1.974	6.571
430.00	2.130	2.088	8.659
431.00	2.206	2.168	10.828

Summary for Pond B2: Basin E

[80] Warning: Exceeded Pond F2 by 0.06' @ 35.95 hrs (2.13 cfs 1.189 af)

Inflow Area = 27.748 ac, 13.33% Impervious, Inflow Depth = 2.65" for 25-yr, 24-hr event
Inflow = 70.63 cfs @ 12.03 hrs, Volume= 6.126 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Starting Elev= 428.11' Surf.Area= 0.475 ac Storage= 0.285 af
Peak Elev= 431.06' @ 36.00 hrs Surf.Area= 3.429 ac Storage= 6.411 af (6.126 af above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	427.00'	9.711 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
427.00	0.104	0.000	0.000
428.00	0.372	0.238	0.238
429.00	1.305	0.838	1.076
430.00	2.773	2.039	3.115
431.00	3.420	3.097	6.212
432.00	3.579	3.499	9.711

Summary for Pond F1: Forebay W

[57] Hint: Peaked at 429.18' (Flood elevation advised)
[80] Warning: Exceeded Pond S1 by 0.98' @ 26.50 hrs (38.29 cfs 19.432 af)

Inflow Area = 28.543 ac, 0.00% Impervious, Inflow Depth = 2.39" for 25-yr, 24-hr event
Inflow = 71.48 cfs @ 12.10 hrs, Volume= 5.683 af
Outflow = 71.48 cfs @ 12.10 hrs, Volume= 5.682 af, Atten= 0%, Lag= 0.0 min
Primary = 71.48 cfs @ 12.10 hrs, Volume= 5.682 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 429.18' @ 25.15 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	428.20'	**65.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=71.26 cfs @ 12.10 hrs HW=428.76' TW=426.68' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 71.26 cfs @ 1.95 fps)

Summary for Pond F2: Forebay E

[57] Hint: Peaked at 431.52' (Flood elevation advised)

Inflow Area = 23.380 ac, 0.00% Impervious, Inflow Depth = 2.39" for 25-yr, 24-hr event
Inflow = 57.95 cfs @ 12.10 hrs, Volume= 4.652 af
Outflow = 57.95 cfs @ 12.10 hrs, Volume= 4.652 af, Atten= 0%, Lag= 0.0 min
Primary = 57.95 cfs @ 12.10 hrs, Volume= 4.652 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 431.52' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	431.00'	**60.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=57.87 cfs @ 12.10 hrs HW=431.51' TW=429.72' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 57.87 cfs @ 1.87 fps)

Summary for Pond S1: Spillway W

[57] Hint: Peaked at 429.78' (Flood elevation advised)
[62] Hint: Exceeded Reach P1B OUTLET depth by 1.32' @ 12.15 hrs
[62] Hint: Exceeded Reach P2D OUTLET depth by 0.98' @ 35.95 hrs

Inflow Area = 28.543 ac, 0.00% Impervious, Inflow Depth = 2.39" for 25-yr, 24-hr event
Inflow = 71.48 cfs @ 12.10 hrs, Volume= 5.683 af
Outflow = 71.48 cfs @ 12.10 hrs, Volume= 5.683 af, Atten= 0%, Lag= 0.0 min
Primary = 71.48 cfs @ 12.10 hrs, Volume= 5.683 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 429.78' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	428.20'	**15.0' long x 53.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=70.89 cfs @ 12.10 hrs HW=429.77' TW=428.76' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 70.89 cfs @ 3.01 fps)

Summary for Pond S2: Spillway E

[57] Hint: Peaked at 433.09' (Flood elevation advised)
[62] Hint: Exceeded Reach P3B OUTLET depth by 0.75' @ 12.15 hrs
[62] Hint: Exceeded Reach P4B OUTLET depth by 1.02' @ 12.15 hrs

Inflow Area = 23.380 ac, 0.00% Impervious, Inflow Depth = 2.39" for 25-yr, 24-hr event
Inflow = 57.95 cfs @ 12.10 hrs, Volume= 4.652 af
Outflow = 57.95 cfs @ 12.10 hrs, Volume= 4.652 af, Atten= 0%, Lag= 0.0 min
Primary = 57.95 cfs @ 12.10 hrs, Volume= 4.652 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 433.09' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	431.80'	**15.0' long x 42.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=57.87 cfs @ 12.10 hrs HW=433.09' TW=431.51' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 57.87 cfs @ 3.00 fps)

Post-Development Conditions
100-yr,24-hr storm event

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: 1S Runoff Area=3.836 ac 0.00% Impervious Runoff Depth=2.89"
Flow Length=732' Slope=0.0125 '/' Tc=19.1 min CN=80 Runoff=12.61 cfs 0.925 af

Subcatchment 2S: 2S Runoff Area=6.597 ac 0.00% Impervious Runoff Depth=2.89"
Flow Length=807' Tc=20.0 min CN=80 Runoff=21.09 cfs 1.590 af

Subcatchment 3S: 3S Runoff Area=5.122 ac 0.00% Impervious Runoff Depth=2.89"
Flow Length=696' Tc=19.0 min CN=80 Runoff=16.88 cfs 1.235 af

Subcatchment 4S: 4S Runoff Area=3.009 ac 0.00% Impervious Runoff Depth=2.89"
Flow Length=687' Tc=19.0 min CN=80 Runoff=9.92 cfs 0.725 af

Subcatchment 5S: 5S Runoff Area=3.241 ac 0.00% Impervious Runoff Depth=2.89"
Flow Length=220' Tc=8.1 min CN=80 Runoff=15.16 cfs 0.781 af

Subcatchment 6S: 6S Runoff Area=2.990 ac 0.00% Impervious Runoff Depth=2.89"
Flow Length=377' Tc=14.6 min CN=80 Runoff=11.24 cfs 0.721 af

Subcatchment 7S: 7S Runoff Area=1.107 ac 0.00% Impervious Runoff Depth=2.89"
Tc=6.0 min CN=80 Runoff=5.46 cfs 0.267 af

Subcatchment 8S: 8S Runoff Area=4.505 ac 0.00% Impervious Runoff Depth=2.89"
Flow Length=339' Tc=15.2 min CN=80 Runoff=16.60 cfs 1.086 af

Subcatchment 9S: 9S Runoff Area=2.511 ac 0.00% Impervious Runoff Depth=2.89"
Flow Length=281' Tc=8.9 min CN=80 Runoff=11.41 cfs 0.605 af

Subcatchment 10S: 10S Runoff Area=2.423 ac 0.00% Impervious Runoff Depth=2.89"
Flow Length=312' Tc=9.5 min CN=80 Runoff=10.77 cfs 0.584 af

Subcatchment 11S: 11S Runoff Area=1.965 ac 0.00% Impervious Runoff Depth=2.99"
Flow Length=197' Tc=13.7 min CN=81 Runoff=7.84 cfs 0.489 af

Subcatchment 12S: 12S Runoff Area=0.102 ac 0.00% Impervious Runoff Depth=2.89"
Tc=6.0 min CN=80 Runoff=0.50 cfs 0.025 af

Subcatchment 13S: 13S Runoff Area=0.350 ac 0.00% Impervious Runoff Depth=2.89"
Tc=6.0 min CN=80 Runoff=1.73 cfs 0.084 af

Subcatchment 14S: 14S Runoff Area=1.667 ac 0.00% Impervious Runoff Depth=2.89"
Flow Length=170' Tc=9.4 min CN=80 Runoff=7.44 cfs 0.402 af

Subcatchment 15S: 15S Runoff Area=1.998 ac 0.00% Impervious Runoff Depth=2.89"
Flow Length=149' Tc=8.8 min CN=80 Runoff=9.12 cfs 0.482 af

Subcatchment 16S: 16S Runoff Area=2.429 ac 0.00% Impervious Runoff Depth=2.89"
Tc=6.0 min CN=80 Runoff=11.99 cfs 0.586 af

Subcatchment 17S: 17S Runoff Area=0.812 ac 0.00% Impervious Runoff Depth=2.89"
Flow Length=180' Tc=7.6 min CN=80 Runoff=3.86 cfs 0.196 af

Subcatchment 18S: 18S Runoff Area=0.979 ac 0.00% Impervious Runoff Depth=2.89"
Tc=6.0 min CN=80 Runoff=4.83 cfs 0.236 af

Subcatchment 19S: 19S Runoff Area=0.538 ac 0.00% Impervious Runoff Depth=3.27"
Tc=6.0 min CN=84 Runoff=2.96 cfs 0.147 af

Subcatchment 20S: 20S Runoff Area=0.487 ac 0.00% Impervious Runoff Depth=3.47"
Tc=6.0 min CN=86 Runoff=2.81 cfs 0.141 af

Subcatchment 21S: 21S Runoff Area=1.120 ac 0.00% Impervious Runoff Depth=2.89"
Tc=6.0 min CN=80 Runoff=5.53 cfs 0.270 af

Subcatchment 22S: 22S Runoff Area=1.561 ac 0.00% Impervious Runoff Depth=2.89"
Tc=6.0 min CN=80 Runoff=7.70 cfs 0.376 af

Subcatchment 23S: 23S Runoff Area=2.685 ac 82.12% Impervious Runoff Depth=4.65"
Tc=6.0 min CN=97 Runoff=18.47 cfs 1.040 af

Subcatchment 24S: 24S Runoff Area=4.368 ac 84.71% Impervious Runoff Depth=4.65"
Tc=6.0 min CN=97 Runoff=30.04 cfs 1.692 af

Subcatchment 25S: 25S Runoff Area=0.989 ac 0.00% Impervious Runoff Depth=2.89"
Tc=6.0 min CN=80 Runoff=4.88 cfs 0.238 af

Subcatchment 26S: 26S Runoff Area=1.084 ac 0.00% Impervious Runoff Depth=2.89"
Tc=6.0 min CN=80 Runoff=5.35 cfs 0.261 af

Subcatchment 27S: 27S Runoff Area=0.280 ac 0.00% Impervious Runoff Depth=2.89"
Tc=6.0 min CN=80 Runoff=1.38 cfs 0.068 af

Subcatchment 28S: 28S Runoff Area=0.221 ac 0.00% Impervious Runoff Depth=2.89"
Tc=6.0 min CN=80 Runoff=1.09 cfs 0.053 af

Reach C1: Channel 1 Avg. Flow Depth=0.47' Max Vel=3.13 fps Inflow=31.72 cfs 2.515 af
n=0.030 L=216.0' S=0.0120 '/' Capacity=114.23 cfs Outflow=31.59 cfs 2.515 af

Reach C2: Channel 2 Avg. Flow Depth=0.40' Max Vel=2.92 fps Inflow=24.86 cfs 1.960 af
n=0.030 L=92.5' S=0.0130 '/' Capacity=118.59 cfs Outflow=24.79 cfs 1.960 af

Reach D1: Berm 1 Avg. Flow Depth=0.77' Max Vel=2.57 fps Inflow=10.77 cfs 0.584 af
n=0.030 L=884.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=9.07 cfs 0.584 af

Reach D10: Berm 10 Avg. Flow Depth=0.35' Max Vel=1.53 fps Inflow=1.38 cfs 0.068 af
n=0.030 L=520.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=1.14 cfs 0.067 af

Reach D2: Berm 2 Avg. Flow Depth=0.96' Max Vel=2.98 fps Inflow=19.57 cfs 1.043 af
n=0.030 L=1,011.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=16.35 cfs 1.043 af

Reach D3: Berm 3 Avg. Flow Depth=0.94' Max Vel=2.95 fps Inflow=17.63 cfs 1.154 af
n=0.030 L=924.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=15.75 cfs 1.154 af

Reach D4: Berm 4 Avg. Flow Depth=0.79' Max Vel=2.63 fps Inflow=11.41 cfs 0.605 af
n=0.030 L=767.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=9.88 cfs 0.605 af

Reach D5: Berm 5 Avg. Flow Depth=0.85' Max Vel=2.76 fps Inflow=12.61 cfs 0.925 af
n=0.030 L=614.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=11.99 cfs 0.925 af

Reach D6: Berm 6 Avg. Flow Depth=1.03' Max Vel=3.12 fps Inflow=21.09 cfs 1.590 af
n=0.030 L=836.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=19.76 cfs 1.590 af

Reach D7: Berm 7 Avg. Flow Depth=0.94' Max Vel=2.93 fps Inflow=16.88 cfs 1.235 af
n=0.030 L=912.5' S=0.0100 '/' Capacity=117.06 cfs Outflow=15.42 cfs 1.235 af

Reach D8: Berm 8 Avg. Flow Depth=0.78' Max Vel=2.60 fps Inflow=9.92 cfs 0.725 af
n=0.030 L=566.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=9.45 cfs 0.725 af

Reach D9: Berm 9 Avg. Flow Depth=0.59' Max Vel=2.15 fps Inflow=5.35 cfs 0.261 af
n=0.030 L=680.0' S=0.0100 '/' Capacity=117.03 cfs Outflow=4.50 cfs 0.261 af

Reach I1: Bench 1 Avg. Flow Depth=0.77' Max Vel=2.49 fps Inflow=4.83 cfs 0.236 af
n=0.030 L=905.6' S=0.0100 '/' Capacity=50.12 cfs Outflow=3.92 cfs 0.236 af

Reach I2A: Bench 2 Avg. Flow Depth=0.78' Max Vel=2.50 fps Inflow=4.88 cfs 0.238 af
n=0.030 L=869.7' S=0.0100 '/' Capacity=50.12 cfs Outflow=4.01 cfs 0.238 af

Reach I2B: Bench 2 Avg. Flow Depth=1.42' Max Vel=2.66 fps Inflow=15.01 cfs 0.959 af
n=0.030 L=514.0' S=0.0050 '/' Capacity=35.43 cfs Outflow=14.19 cfs 0.959 af

Reach I2C: Bench I2C Avg. Flow Depth=1.43' Max Vel=2.68 fps Inflow=14.57 cfs 1.012 af
n=0.030 L=70.0' S=0.0050 '/' Capacity=35.43 cfs Outflow=14.57 cfs 1.012 af

Reach I3: Bench 3 Avg. Flow Depth=0.83' Max Vel=2.61 fps Inflow=5.46 cfs 0.267 af
n=0.030 L=721.0' S=0.0100 '/' Capacity=50.11 cfs Outflow=4.73 cfs 0.267 af

Reach I4: Bench 4 Avg. Flow Depth=0.72' Max Vel=2.40 fps Inflow=3.86 cfs 0.196 af
n=0.030 L=654.0' S=0.0100 '/' Capacity=50.11 cfs Outflow=3.34 cfs 0.196 af

Reach P1A: Channel 1P Avg. Flow Depth=0.47' Max Vel=2.62 fps Inflow=7.70 cfs 0.376 af
n=0.030 L=930.0' S=0.0105 '/' Capacity=104.42 cfs Outflow=6.41 cfs 0.376 af

Reach P1B: Channel 1P Avg. Flow Depth=0.36' Max Vel=3.25 fps Inflow=12.95 cfs 0.759 af
n=0.030 L=144.0' S=0.0194 '/' Capacity=275.51 cfs Outflow=12.87 cfs 0.759 af

Reach P2A: Channel 2P Avg. Flow Depth=0.56' Max Vel=1.98 fps Inflow=7.44 cfs 0.402 af
n=0.030 L=830.0' S=0.0049 '/' Capacity=17.71 cfs Outflow=6.06 cfs 0.402 af

Reach P2B: Channel 2P Avg. Flow Depth=0.56' Max Vel=2.17 fps Inflow=7.04 cfs 0.486 af
n=0.030 L=514.0' S=0.0058 '/' Capacity=19.25 cfs Outflow=6.61 cfs 0.486 af

Reach P2C: Channel 2P Avg. Flow Depth=0.40' Max Vel=3.39 fps Inflow=6.80 cfs 0.511 af
n=0.030 L=67.0' S=0.0209 '/' Capacity=36.43 cfs Outflow=6.80 cfs 0.511 af

Reach P2D: Channel 2P Avg. Flow Depth=0.67' Max Vel=3.55 fps Inflow=28.91 cfs 2.012 af
n=0.030 L=477.0' S=0.0109 '/' Capacity=206.29 cfs Outflow=28.45 cfs 2.012 af

Reach P3A: Channel 3P Avg. Flow Depth=0.64' Max Vel=2.08 fps Inflow=9.12 cfs 0.482 af
n=0.030 L=828.0' S=0.0047 '/' Capacity=17.30 cfs Outflow=7.46 cfs 0.482 af

Reach P3B: Channel 3P Avg. Flow Depth=0.63' Max Vel=2.47 fps Inflow=22.54 cfs 1.334 af
n=0.030 L=1,081.0' S=0.0057 '/' Capacity=149.63 cfs Outflow=18.35 cfs 1.334 af

Reach P4A: Channel 4P Avg. Flow Depth=0.41' Max Vel=2.36 fps Inflow=5.53 cfs 0.270 af
n=0.030 L=678.0' S=0.0100 '/' Capacity=101.87 cfs Outflow=4.83 cfs 0.270 af

Reach P4B: Channel 4P Avg. Flow Depth=0.38' Max Vel=2.47 fps Inflow=10.60 cfs 0.606 af
n=0.030 L=208.0' S=0.0106 '/' Capacity=203.20 cfs Outflow=10.40 cfs 0.606 af

Reach R1: Chute MD W Inflow=50.69 cfs 4.142 af
Outflow=50.69 cfs 4.142 af

Reach R2: Chute MD E Inflow=47.21 cfs 3.719 af
Outflow=47.21 cfs 3.719 af

Reach R3: Chute TD W Inflow=31.72 cfs 2.515 af
Outflow=31.72 cfs 2.515 af

Reach R4: Chute TD E Inflow=24.86 cfs 1.960 af
Outflow=24.86 cfs 1.960 af

Pond B1: Basin W Peak Elev=429.84' Storage=8.314 af Inflow=95.20 cfs 7.951 af
Outflow=0.00 cfs 0.000 af

Pond B2: Basin E Peak Elev=431.41' Storage=7.635 af Inflow=86.42 cfs 7.351 af
Outflow=0.00 cfs 0.000 af

Pond F1: Forebay W Peak Elev=429.83' Inflow=88.02 cfs 6.913 af
Outflow=88.02 cfs 6.911 af

Pond F2: Forebay E Peak Elev=431.59' Inflow=71.42 cfs 5.660 af
Outflow=71.42 cfs 5.659 af

Pond S1: Spillway W Peak Elev=430.01' Inflow=88.02 cfs 6.913 af
Outflow=88.02 cfs 6.913 af

Pond S2: Spillway E Peak Elev=433.28' Inflow=71.42 cfs 5.660 af
Outflow=71.42 cfs 5.660 af

Total Runoff Area = 58.976 ac Runoff Volume = 15.304 af Average Runoff Depth = 3.11"
89.99% Pervious = 53.071 ac 10.01% Impervious = 5.905 ac

Summary for Subcatchment 1S: 1S

Runoff = 12.61 cfs @ 12.12 hrs, Volume= 0.925 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	3.836	80	
	3.836		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.2	100	0.0125	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
5.9	632	0.0125	1.80		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
19.1	732	Total			

Summary for Subcatchment 2S: 2S

Runoff = 21.09 cfs @ 12.13 hrs, Volume= 1.590 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	6.597	80	
	6.597		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0120	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
6.5	707	0.0126	1.81		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
20.0	807	Total			

Summary for Subcatchment 3S: 3S

Runoff = 16.88 cfs @ 12.11 hrs, Volume= 1.235 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	5.122	80	
	5.122		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0120	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
5.5	596	0.0126	1.81		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
19.0	696	Total			

Summary for Subcatchment 4S: 4S

Runoff = 9.92 cfs @ 12.11 hrs, Volume= 0.725 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	3.009	80	
	3.009		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0120	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
5.5	587	0.0124	1.79		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
19.0	687	Total			

Summary for Subcatchment 5S: 5S

Runoff = 15.16 cfs @ 11.99 hrs, Volume= 0.781 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	3.241	80	
	3.241		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	100	0.0610	0.24		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
1.1	120	0.0125	1.80		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.1	220	Total			

Summary for Subcatchment 6S: 6S

Runoff = 11.24 cfs @ 12.07 hrs, Volume= 0.721 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	2.990	80	
	2.990		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0120	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
1.1	277	0.0661	4.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
14.6	377	Total			

Summary for Subcatchment 7S: 7S

Runoff = 5.46 cfs @ 11.97 hrs, Volume= 0.267 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	1.107	80	
	1.107		100.00% Pervious Area

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

Summary for Subcatchment 8S: 8S

Runoff = 16.60 cfs @ 12.07 hrs, Volume= 1.086 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	4.505	80	
	4.505		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.0	100	0.0130	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
2.2	239	0.0121	1.77		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
15.2	339	Total			

Summary for Subcatchment 9S: 9S

Runoff = 11.41 cfs @ 12.00 hrs, Volume= 0.605 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	2.511	80	
	2.511		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	100	0.0580	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
1.7	181	0.0122	1.78		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.9	281	Total			

Summary for Subcatchment 10S: 10S

Runoff = 10.77 cfs @ 12.01 hrs, Volume= 0.584 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	2.423	80	
	2.423		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	100	0.0525	0.22		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
2.0	212	0.0123	1.79		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.5	312	Total			

Summary for Subcatchment 11S: 11S

Runoff = 7.84 cfs @ 12.06 hrs, Volume= 0.489 af, Depth= 2.99"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	0.690	80	
*	0.157	91	
*	1.118	80	
	1.965	81	Weighted Average
	1.965		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0120	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
0.2	97	0.2153	7.47		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.7	197	Total			

Summary for Subcatchment 12S: 12S

Runoff = 0.50 cfs @ 11.97 hrs, Volume= 0.025 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	0.102	80	
	0.102		100.00% Pervious Area

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

Summary for Subcatchment 13S: 13S

Runoff = 1.73 cfs @ 11.97 hrs, Volume= 0.084 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	0.350	80	
	0.350		100.00% Pervious Area

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

Summary for Subcatchment 14S: 14S

Runoff = 7.44 cfs @ 12.01 hrs, Volume= 0.402 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	1.667	80	
	1.667		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	100	0.0370	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
0.8	70	0.0086	1.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.4	170	Total			

Summary for Subcatchment 15S: 15S

Runoff = 9.12 cfs @ 12.00 hrs, Volume= 0.482 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	1.958	80	
*	0.040	91	
	1.998	80	Weighted Average
	1.998		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	100	0.0460	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
0.9	49	0.0031	0.90		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.8	149	Total			

Summary for Subcatchment 16S: 16S

Runoff = 11.99 cfs @ 11.97 hrs, Volume= 0.586 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	0.931	80	
*	1.423	80	
*	0.075	91	
	2.429	80	Weighted Average
	2.429		100.00% Pervious Area

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

Summary for Subcatchment 17S: 17S

Runoff = 3.86 cfs @ 11.99 hrs, Volume= 0.196 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	0.812	80	
	0.812		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0586	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.55"
0.5	80	0.0285	2.72		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
7.6	180	Total			

Summary for Subcatchment 18S: 18S

Runoff = 4.83 cfs @ 11.97 hrs, Volume= 0.236 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	0.979	80	
	0.979		100.00% Pervious Area

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

Summary for Subcatchment 19S: 19S

Runoff = 2.96 cfs @ 11.97 hrs, Volume= 0.147 af, Depth= 3.27"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	0.366	80	
*	0.172	91	
	0.538	84	Weighted Average
	0.538		100.00% Pervious Area

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

Summary for Subcatchment 20S: 20S

Runoff = 2.81 cfs @ 11.97 hrs, Volume= 0.141 af, Depth= 3.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	0.254	91	
*	0.233	80	
	0.487	86	Weighted Average
	0.487		100.00% Pervious Area

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

Summary for Subcatchment 21S: 21S

Runoff = 5.53 cfs @ 11.97 hrs, Volume= 0.270 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	1.120	80	
	1.120		100.00% Pervious Area

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

Summary for Subcatchment 22S: 22S

Runoff = 7.70 cfs @ 11.97 hrs, Volume= 0.376 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	1.561	80	
	1.561		100.00% Pervious Area

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

Summary for Subcatchment 23S: 23S

Runoff = 18.47 cfs @ 11.96 hrs, Volume= 1.040 af, Depth= 4.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	0.480	91	
*	2.205	98	
	2.685	97	Weighted Average
	0.480		17.88% Pervious Area
	2.205		82.12% Impervious Area

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

Summary for Subcatchment 24S: 24S

Runoff = 30.04 cfs @ 11.96 hrs, Volume= 1.692 af, Depth= 4.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	0.668	91	Pond Road
*	3.700	98	Pond
	4.368	97	Weighted Average
	0.668		15.29% Pervious Area
	3.700		84.71% Impervious Area

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

Summary for Subcatchment 25S: 25S

Runoff = 4.88 cfs @ 11.97 hrs, Volume= 0.238 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	0.989	80	
	0.989		100.00% Pervious Area

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

Summary for Subcatchment 26S: 26S

Runoff = 5.35 cfs @ 11.97 hrs, Volume= 0.261 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	1.084	80	
	1.084		100.00% Pervious Area

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

Summary for Subcatchment 27S: 27S

Runoff = 1.38 cfs @ 11.97 hrs, Volume= 0.068 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	0.280	80	
	0.280		100.00% Pervious Area

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

Summary for Subcatchment 28S: 28S

Runoff = 1.09 cfs @ 11.97 hrs, Volume= 0.053 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr, 24-hr Rainfall=5.00"

	Area (ac)	CN	Description
*	0.221	80	
	0.221		100.00% Pervious Area

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

Summary for Reach C1: Channel 1

Inflow Area = 10.433 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 31.72 cfs @ 12.17 hrs, Volume= 2.515 af
Outflow = 31.59 cfs @ 12.19 hrs, Volume= 2.515 af, Atten= 0%, Lag= 0.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.13 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 0.69 fps, Avg. Travel Time= 5.3 min

Peak Storage= 2,176 cf @ 12.19 hrs
Average Depth at Peak Storage= 0.47'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 114.23 cfs

20.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 3.0 '/' Top Width= 26.00'
Length= 216.0' Slope= 0.0120 '/'
Inlet Invert= 452.80', Outlet Invert= 450.20'

‡

Summary for Reach C2: Channel 2

Inflow Area = 8.131 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 24.86 cfs @ 12.17 hrs, Volume= 1.960 af
Outflow = 24.79 cfs @ 12.18 hrs, Volume= 1.960 af, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.92 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 0.64 fps, Avg. Travel Time= 2.4 min

Peak Storage= 782 cf @ 12.18 hrs
Average Depth at Peak Storage= 0.40'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 118.59 cfs

20.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 3.0 '/' Top Width= 26.00'
Length= 92.5' Slope= 0.0130 '/'
Inlet Invert= 453.20', Outlet Invert= 452.00'

‡

Summary for Reach D1: Berm 1

Inflow Area = 2.423 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 10.77 cfs @ 12.01 hrs, Volume= 0.584 af
Outflow = 9.07 cfs @ 12.07 hrs, Volume= 0.584 af, Atten= 16%, Lag= 3.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.57 fps, Min. Travel Time= 5.7 min
Avg. Velocity = 0.82 fps, Avg. Travel Time= 17.9 min

Peak Storage= 3,117 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.77'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 884.0' Slope= 0.0100 '/'
Inlet Invert= 457.60', Outlet Invert= 448.76'

‡

Summary for Reach D10: Berm 10

Inflow Area = 0.280 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 1.38 cfs @ 11.97 hrs, Volume= 0.068 af
Outflow = 1.14 cfs @ 12.02 hrs, Volume= 0.067 af, Atten= 17%, Lag= 3.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.53 fps, Min. Travel Time= 5.7 min
Avg. Velocity = 0.54 fps, Avg. Travel Time= 16.1 min

Peak Storage= 387 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.35'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 520.0' Slope= 0.0100 '/'
Inlet Invert= 465.30', Outlet Invert= 460.10'

‡

Summary for Reach D2: Berm 2

[62] Hint: Exceeded Reach D9 OUTLET depth by 0.70' @ 12.10 hrs

Inflow Area = 4.325 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 19.57 cfs @ 12.00 hrs, Volume= 1.043 af
Outflow = 16.35 cfs @ 12.05 hrs, Volume= 1.043 af, Atten= 16%, Lag= 3.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.98 fps, Min. Travel Time= 5.7 min
Avg. Velocity = 0.90 fps, Avg. Travel Time= 18.8 min

Peak Storage= 5,545 cf @ 12.05 hrs
Average Depth at Peak Storage= 0.96'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 1,011.0' Slope= 0.0100 '/'
Inlet Invert= 460.10', Outlet Invert= 449.99'

‡

Summary for Reach D3: Berm 3

[62] Hint: Exceeded Reach D10 OUTLET depth by 0.66' @ 12.15 hrs

Inflow Area = 4.785 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 17.63 cfs @ 12.07 hrs, Volume= 1.154 af
Outflow = 15.75 cfs @ 12.13 hrs, Volume= 1.154 af, Atten= 11%, Lag= 3.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.95 fps, Min. Travel Time= 5.2 min
Avg. Velocity = 0.95 fps, Avg. Travel Time= 16.3 min

Peak Storage= 4,929 cf @ 12.13 hrs
Average Depth at Peak Storage= 0.94'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 924.0' Slope= 0.0100 '/'
Inlet Invert= 460.10', Outlet Invert= 450.86'

‡

Summary for Reach D4: Berm 4

Inflow Area = 2.511 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 11.41 cfs @ 12.00 hrs, Volume= 0.605 af
Outflow = 9.88 cfs @ 12.05 hrs, Volume= 0.605 af, Atten= 13%, Lag= 3.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.63 fps, Min. Travel Time= 4.9 min
Avg. Velocity = 0.85 fps, Avg. Travel Time= 15.1 min

Peak Storage= 2,884 cf @ 12.05 hrs
Average Depth at Peak Storage= 0.79'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 767.0' Slope= 0.0100 '/'
Inlet Invert= 457.60', Outlet Invert= 449.93'

‡

Summary for Reach D5: Berm 5

Inflow Area = 3.836 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 12.61 cfs @ 12.12 hrs, Volume= 0.925 af
Outflow = 11.99 cfs @ 12.16 hrs, Volume= 0.925 af, Atten= 5%, Lag= 2.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.76 fps, Min. Travel Time= 3.7 min
Avg. Velocity = 0.96 fps, Avg. Travel Time= 10.6 min

Peak Storage= 2,668 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.85'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 614.0' Slope= 0.0100 '/'
Inlet Invert= 463.20', Outlet Invert= 457.06'

‡

Summary for Reach D6: Berm 6

Inflow Area = 6.597 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 21.09 cfs @ 12.13 hrs, Volume= 1.590 af
Outflow = 19.76 cfs @ 12.18 hrs, Volume= 1.590 af, Atten= 6%, Lag= 3.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.12 fps, Min. Travel Time= 4.5 min
Avg. Velocity = 1.04 fps, Avg. Travel Time= 13.4 min

Peak Storage= 5,286 cf @ 12.18 hrs
Average Depth at Peak Storage= 1.03'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 836.0' Slope= 0.0100 '/'
Inlet Invert= 465.50', Outlet Invert= 457.14'

‡

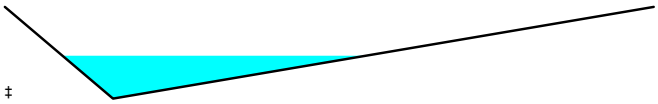
Summary for Reach D7: Berm 7

Inflow Area = 5.122 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 16.88 cfs @ 12.11 hrs, Volume= 1.235 af
Outflow = 15.42 cfs @ 12.18 hrs, Volume= 1.235 af, Atten= 9%, Lag= 3.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.93 fps, Min. Travel Time= 5.2 min
Avg. Velocity = 0.97 fps, Avg. Travel Time= 15.7 min

Peak Storage= 4,788 cf @ 12.18 hrs
Average Depth at Peak Storage= 0.94'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.06 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 912.5' Slope= 0.0100 '/'
Inlet Invert= 467.20', Outlet Invert= 458.07'



‡

Summary for Reach D8: Berm 8

Inflow Area = 3.009 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 9.92 cfs @ 12.11 hrs, Volume= 0.725 af
Outflow = 9.45 cfs @ 12.16 hrs, Volume= 0.725 af, Atten= 5%, Lag= 2.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.60 fps, Min. Travel Time= 3.6 min
Avg. Velocity = 0.92 fps, Avg. Travel Time= 10.3 min

Peak Storage= 2,057 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.78'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 566.0' Slope= 0.0100 '/'
Inlet Invert= 463.70', Outlet Invert= 458.04'

‡

Summary for Reach D9: Berm 9

Inflow Area = 1.084 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 5.35 cfs @ 11.97 hrs, Volume= 0.261 af
Outflow = 4.50 cfs @ 12.02 hrs, Volume= 0.261 af, Atten= 16%, Lag= 2.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.15 fps, Min. Travel Time= 5.3 min
Avg. Velocity = 0.71 fps, Avg. Travel Time= 15.9 min

Peak Storage= 1,417 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.59'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 117.03 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 10.0 '/' Top Width= 24.00'
Length= 680.0' Slope= 0.0100 '/'
Inlet Invert= 466.60', Outlet Invert= 459.80'

‡

Summary for Reach I1: Bench 1

Inflow Area = 0.979 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 4.83 cfs @ 11.97 hrs, Volume= 0.236 af
Outflow = 3.92 cfs @ 12.02 hrs, Volume= 0.236 af, Atten= 19%, Lag= 3.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.49 fps, Min. Travel Time= 6.1 min
Avg. Velocity = 0.81 fps, Avg. Travel Time= 18.7 min

Peak Storage= 1,421 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.77'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 50.12 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 3.3 '/' Top Width= 10.60'
Length= 905.6' Slope= 0.0100 '/'
Inlet Invert= 443.40', Outlet Invert= 434.34'

Summary for Reach I2A: Bench 2

Inflow Area = 0.989 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 4.88 cfs @ 11.97 hrs, Volume= 0.238 af
Outflow = 4.01 cfs @ 12.02 hrs, Volume= 0.238 af, Atten= 18%, Lag= 3.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.50 fps, Min. Travel Time= 5.8 min
Avg. Velocity = 0.81 fps, Avg. Travel Time= 17.9 min

Peak Storage= 1,387 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.78'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 50.12 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 3.3 '/' Top Width= 10.60'
Length= 869.7' Slope= 0.0100 '/'
Inlet Invert= 450.00', Outlet Invert= 441.30'

Summary for Reach I2B: Bench 2

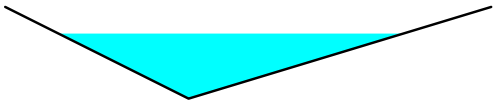
[62] Hint: Exceeded Reach I2A OUTLET depth by 0.95' @ 12.15 hrs

Inflow Area = 3.979 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 15.01 cfs @ 12.05 hrs, Volume= 0.959 af
Outflow = 14.19 cfs @ 12.09 hrs, Volume= 0.959 af, Atten= 5%, Lag= 2.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.66 fps, Min. Travel Time= 3.2 min
Avg. Velocity = 0.82 fps, Avg. Travel Time= 10.5 min

Peak Storage= 2,743 cf @ 12.09 hrs
Average Depth at Peak Storage= 1.42'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 35.43 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 3.3 '/' Top Width= 10.60'
Length= 514.0' Slope= 0.0050 '/'
Inlet Invert= 441.50', Outlet Invert= 438.93'



Summary for Reach I2C: Bench I2C

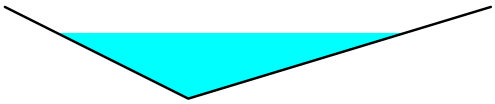
[62] Hint: Exceeded Reach I2B OUTLET depth by 0.11' @ 11.95 hrs

Inflow Area = 4.200 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 14.57 cfs @ 12.09 hrs, Volume= 1.012 af
Outflow = 14.57 cfs @ 12.09 hrs, Volume= 1.012 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.68 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 0.82 fps, Avg. Travel Time= 1.4 min

Peak Storage= 381 cf @ 12.09 hrs
Average Depth at Peak Storage= 1.43'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 35.43 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 3.3 '/' Top Width= 10.60'
Length= 70.0' Slope= 0.0050 '/'
Inlet Invert= 439.00', Outlet Invert= 438.65'



Summary for Reach I3: Bench 3

Inflow Area = 1.107 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 5.46 cfs @ 11.97 hrs, Volume= 0.267 af
Outflow = 4.73 cfs @ 12.01 hrs, Volume= 0.267 af, Atten= 13%, Lag= 2.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.61 fps, Min. Travel Time= 4.6 min
Avg. Velocity = 0.85 fps, Avg. Travel Time= 14.1 min

Peak Storage= 1,302 cf @ 12.01 hrs
Average Depth at Peak Storage= 0.83'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 50.11 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 3.3 '/' Top Width= 10.60'
Length= 721.0' Slope= 0.0100 '/'
Inlet Invert= 450.00', Outlet Invert= 442.79'

Summary for Reach I4: Bench 4

Inflow Area = 0.812 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 3.86 cfs @ 11.99 hrs, Volume= 0.196 af
Outflow = 3.34 cfs @ 12.04 hrs, Volume= 0.196 af, Atten= 14%, Lag= 2.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.40 fps, Min. Travel Time= 4.5 min
Avg. Velocity = 0.80 fps, Avg. Travel Time= 13.6 min

Peak Storage= 909 cf @ 12.04 hrs
Average Depth at Peak Storage= 0.72'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 50.11 cfs

0.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 3.3 '/' Top Width= 10.60'
Length= 654.0' Slope= 0.0100 '/'
Inlet Invert= 443.40', Outlet Invert= 436.86'

Summary for Reach P1A: Channel 1P

Inflow Area = 1.561 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 7.70 cfs @ 11.97 hrs, Volume= 0.376 af
Outflow = 6.41 cfs @ 12.02 hrs, Volume= 0.376 af, Atten= 17%, Lag= 3.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.62 fps, Min. Travel Time= 5.9 min
Avg. Velocity = 0.63 fps, Avg. Travel Time= 24.6 min

Peak Storage= 2,265 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.47'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 104.42 cfs

4.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 '/' Top Width= 14.00'
Length= 930.0' Slope= 0.0105 '/'
Inlet Invert= 440.80', Outlet Invert= 431.00'

Summary for Reach P1B: Channel 1P

[61] Hint: Exceeded Reach P1A outlet invert by 0.36' @ 12.00 hrs

Inflow Area = 3.078 ac, 0.00% Impervious, Inflow Depth = 2.96" for 100-yr, 24-hr event
Inflow = 12.95 cfs @ 12.01 hrs, Volume= 0.759 af
Outflow = 12.87 cfs @ 12.01 hrs, Volume= 0.759 af, Atten= 1%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.25 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 0.73 fps, Avg. Travel Time= 3.3 min

Peak Storage= 569 cf @ 12.01 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 275.51 cfs

10.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 3.3 '/' Top Width= 21.60'
Length= 144.0' Slope= 0.0194 '/'
Inlet Invert= 431.00', Outlet Invert= 428.20'

‡

Summary for Reach P2A: Channel 2P

Inflow Area = 1.667 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 7.44 cfs @ 12.01 hrs, Volume= 0.402 af
Outflow = 6.06 cfs @ 12.07 hrs, Volume= 0.402 af, Atten= 18%, Lag= 3.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.98 fps, Min. Travel Time= 7.0 min
Avg. Velocity = 0.41 fps, Avg. Travel Time= 33.5 min

Peak Storage= 2,527 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.56'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 17.71 cfs

4.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 '/' Top Width= 9.00'
Length= 830.0' Slope= 0.0049 '/'
Inlet Invert= 441.90', Outlet Invert= 437.80'

‡

Summary for Reach P2B: Channel 2P

[62] Hint: Exceeded Reach P2A OUTLET depth by 0.06' @ 12.25 hrs

Inflow Area = 2.017 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 7.04 cfs @ 12.04 hrs, Volume= 0.486 af
Outflow = 6.61 cfs @ 12.09 hrs, Volume= 0.486 af, Atten= 6%, Lag= 2.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.17 fps, Min. Travel Time= 4.0 min
Avg. Velocity = 0.45 fps, Avg. Travel Time= 18.9 min

Peak Storage= 1,568 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.56'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 19.25 cfs

4.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 '/' Top Width= 9.00'
Length= 514.0' Slope= 0.0058 '/'
Inlet Invert= 437.80', Outlet Invert= 434.80'

‡

Summary for Reach P2C: Channel 2P

[90] Warning: Qout>Qin may require Finer Routing or smaller dt
[61] Hint: Exceeded Reach P2B outlet invert by 0.40' @ 12.10 hrs

Inflow Area = 2.119 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 6.80 cfs @ 12.08 hrs, Volume= 0.511 af
Outflow = 6.80 cfs @ 12.09 hrs, Volume= 0.511 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.39 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 0.73 fps, Avg. Travel Time= 1.5 min

Peak Storage= 134 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.40'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 36.43 cfs

4.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 '/' Top Width= 9.00'
Length= 67.0' Slope= 0.0209 '/'
Inlet Invert= 434.80', Outlet Invert= 433.40'

‡

Summary for Reach P2D: Channel 2P

[62] Hint: Exceeded Reach P2C OUTLET depth by 0.27' @ 12.10 hrs

Inflow Area = 8.284 ac, 0.00% Impervious, Inflow Depth = 2.91" for 100-yr, 24-hr event
Inflow = 28.91 cfs @ 12.08 hrs, Volume= 2.012 af
Outflow = 28.45 cfs @ 12.11 hrs, Volume= 2.012 af, Atten= 2%, Lag= 1.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.55 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 0.74 fps, Avg. Travel Time= 10.8 min

Peak Storage= 3,826 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.67'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 206.29 cfs

10.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 3.3 '/' Top Width= 21.60'
Length= 477.0' Slope= 0.0109 '/'
Inlet Invert= 433.40', Outlet Invert= 428.20'

‡

Summary for Reach P3A: Channel 3P

Inflow Area = 1.998 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 9.12 cfs @ 12.00 hrs, Volume= 0.482 af
Outflow = 7.46 cfs @ 12.06 hrs, Volume= 0.482 af, Atten= 18%, Lag= 3.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.08 fps, Min. Travel Time= 6.6 min
Avg. Velocity = 0.43 fps, Avg. Travel Time= 32.3 min

Peak Storage= 2,962 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.64'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 17.30 cfs

4.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 '/' Top Width= 9.00'
Length= 828.0' Slope= 0.0047 '/'
Inlet Invert= 441.90', Outlet Invert= 438.00'

‡

Summary for Reach P3B: Channel 3P

[62] Hint: Exceeded Reach P3A OUTLET depth by 0.04' @ 12.30 hrs

Inflow Area = 5.534 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 22.54 cfs @ 11.99 hrs, Volume= 1.334 af
Outflow = 18.35 cfs @ 12.06 hrs, Volume= 1.334 af, Atten= 19%, Lag= 4.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.47 fps, Min. Travel Time= 7.3 min
Avg. Velocity = 0.52 fps, Avg. Travel Time= 35.0 min

Peak Storage= 8,019 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.63'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 149.63 cfs

10.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 3.3 2.5 '/' Top Width= 21.60'
Length= 1,081.0' Slope= 0.0057 '/'
Inlet Invert= 438.00', Outlet Invert= 431.80'

‡

Summary for Reach P4A: Channel 4P

Inflow Area = 1.120 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 5.53 cfs @ 11.97 hrs, Volume= 0.270 af
Outflow = 4.83 cfs @ 12.01 hrs, Volume= 0.270 af, Atten= 13%, Lag= 2.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.36 fps, Min. Travel Time= 4.8 min
Avg. Velocity = 0.57 fps, Avg. Travel Time= 19.7 min

Peak Storage= 1,383 cf @ 12.01 hrs
Average Depth at Peak Storage= 0.41'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 101.87 cfs

4.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.5 '/' Top Width= 14.00'
Length= 678.0' Slope= 0.0100 '/'
Inlet Invert= 440.80', Outlet Invert= 434.00'

Summary for Reach P4B: Channel 4P

[61] Hint: Exceeded Reach P4A outlet invert by 0.37' @ 12.00 hrs

Inflow Area = 2.419 ac, 0.00% Impervious, Inflow Depth = 3.01" for 100-yr, 24-hr event
Inflow = 10.60 cfs @ 12.00 hrs, Volume= 0.606 af
Outflow = 10.40 cfs @ 12.02 hrs, Volume= 0.606 af, Atten= 2%, Lag= 1.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.47 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 0.55 fps, Avg. Travel Time= 6.3 min

Peak Storage= 872 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.38'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 203.20 cfs

10.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 3.3 2.5 '/' Top Width= 21.60'
Length= 208.0' Slope= 0.0106 '/'
Inlet Invert= 434.00', Outlet Invert= 431.80'

‡

Summary for Reach R1: Chute MD W

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 17.181 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 50.69 cfs @ 12.12 hrs, Volume= 4.142 af
Outflow = 50.69 cfs @ 12.12 hrs, Volume= 4.142 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Reach R2: Chute MD E

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 15.427 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 47.21 cfs @ 12.13 hrs, Volume= 3.719 af
Outflow = 47.21 cfs @ 12.13 hrs, Volume= 3.719 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Reach R3: Chute TD W

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10.433 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 31.72 cfs @ 12.17 hrs, Volume= 2.515 af
Outflow = 31.72 cfs @ 12.17 hrs, Volume= 2.515 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Reach R4: Chute TD E

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 8.131 ac, 0.00% Impervious, Inflow Depth = 2.89" for 100-yr, 24-hr event
Inflow = 24.86 cfs @ 12.17 hrs, Volume= 1.960 af
Outflow = 24.86 cfs @ 12.17 hrs, Volume= 1.960 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Pond B1: Basin W

[80] Warning: Exceeded Pond F1 by 1.64' @ 30.60 hrs (393.34 cfs 116.217 af)

Inflow Area = 31.228 ac, 7.06% Impervious, Inflow Depth = 3.06" for 100-yr, 24-hr event
Inflow = 95.20 cfs @ 12.07 hrs, Volume= 7.951 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Starting Elev= 424.44' Surf.Area= 0.471 ac Storage= 0.363 af
Peak Elev= 429.84' @ 36.00 hrs Surf.Area= 2.117 ac Storage= 8.314 af (7.951 af above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	423.00'	10.828 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
423.00	0.063	0.000	0.000
424.00	0.317	0.190	0.190
425.00	0.667	0.492	0.682
426.00	1.063	0.865	1.547
427.00	1.569	1.316	2.863
428.00	1.900	1.735	4.597
429.00	2.047	1.974	6.571
430.00	2.130	2.088	8.659
431.00	2.206	2.168	10.828

Summary for Pond B2: Basin E

[80] Warning: Exceeded Pond F2 by 0.41' @ 35.95 hrs (41.45 cfs 17.474 af)

Inflow Area = 27.748 ac, 13.33% Impervious, Inflow Depth = 3.18" for 100-yr, 24-hr event
Inflow = 86.42 cfs @ 12.03 hrs, Volume= 7.351 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Starting Elev= 428.11' Surf.Area= 0.475 ac Storage= 0.285 af
Peak Elev= 431.41' @ 36.00 hrs Surf.Area= 3.486 ac Storage= 7.635 af (7.351 af above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	427.00'	9.711 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
427.00	0.104	0.000	0.000
428.00	0.372	0.238	0.238
429.00	1.305	0.838	1.076
430.00	2.773	2.039	3.115
431.00	3.420	3.097	6.212
432.00	3.579	3.499	9.711

Summary for Pond F1: Forebay W

[57] Hint: Peaked at 429.83' (Flood elevation advised)
[87] Warning: Oscillations may require Finer Routing or smaller dt
[80] Warning: Exceeded Pond S1 by 1.63' @ 25.60 hrs (82.10 cfs 46.028 af)

Inflow Area = 28.543 ac, 0.00% Impervious, Inflow Depth = 2.91" for 100-yr, 24-hr event
Inflow = 88.02 cfs @ 12.10 hrs, Volume= 6.913 af
Outflow = 88.02 cfs @ 12.10 hrs, Volume= 6.911 af, Atten= 0%, Lag= 0.0 min
Primary = 88.02 cfs @ 12.10 hrs, Volume= 6.911 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 429.83' @ 24.95 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	428.20'	**65.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=87.80 cfs @ 12.10 hrs HW=428.84' TW=427.02' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 87.80 cfs @ 2.09 fps)

Summary for Pond F2: Forebay E

[57] Hint: Peaked at 431.59' (Flood elevation advised)

Inflow Area = 23.380 ac, 0.00% Impervious, Inflow Depth = 2.90" for 100-yr, 24-hr event
Inflow = 71.42 cfs @ 12.10 hrs, Volume= 5.660 af
Outflow = 71.42 cfs @ 12.10 hrs, Volume= 5.659 af, Atten= 0%, Lag= 0.0 min
Primary = 71.42 cfs @ 12.10 hrs, Volume= 5.659 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 431.59' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	431.00'	**60.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=71.14 cfs @ 12.10 hrs HW=431.59' TW=429.91' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 71.14 cfs @ 2.01 fps)

Summary for Pond S1: Spillway W

[57] Hint: Peaked at 430.01' (Flood elevation advised)
[62] Hint: Exceeded Reach P1B OUTLET depth by 1.63' @ 35.95 hrs
[62] Hint: Exceeded Reach P2D OUTLET depth by 1.63' @ 35.95 hrs

Inflow Area = 28.543 ac, 0.00% Impervious, Inflow Depth = 2.91" for 100-yr, 24-hr event
Inflow = 88.02 cfs @ 12.10 hrs, Volume= 6.913 af
Outflow = 88.02 cfs @ 12.10 hrs, Volume= 6.913 af, Atten= 0%, Lag= 0.0 min
Primary = 88.02 cfs @ 12.10 hrs, Volume= 6.913 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 430.01' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	428.20'	**15.0' long x 53.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=87.34 cfs @ 12.10 hrs HW=430.01' TW=428.84' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 87.34 cfs @ 3.22 fps)

Summary for Pond S2: Spillway E

[57] Hint: Peaked at 433.28' (Flood elevation advised)
[62] Hint: Exceeded Reach P3B OUTLET depth by 0.87' @ 12.10 hrs
[62] Hint: Exceeded Reach P4B OUTLET depth by 1.17' @ 12.15 hrs

Inflow Area = 23.380 ac, 0.00% Impervious, Inflow Depth = 2.90" for 100-yr, 24-hr event
Inflow = 71.42 cfs @ 12.10 hrs, Volume= 5.660 af
Outflow = 71.42 cfs @ 12.10 hrs, Volume= 5.660 af, Atten= 0%, Lag= 0.0 min
Primary = 71.42 cfs @ 12.10 hrs, Volume= 5.660 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 433.28' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	431.80'	**15.0' long x 42.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=71.14 cfs @ 12.10 hrs HW=433.28' TW=431.59' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 71.14 cfs @ 3.21 fps)

Written by:	**Antonio Sanchez**	Date:	**09/11/15**	Reviewed by:	**Tom Fendley / Jay Beech**	Date:	**09/11/15**

Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Cover Design**	Project No.:	**GD5497**	Phase No.:	**03**

Attachment 9: Design Summary for Conveyance Features

24-hour, 10-year storm event					
Reach ID	**Peak Flow Rate (cfs)**	**Peak Flow Velocity[(1)] (fps)**	**Peak Flow Depth (ft)**	**Minimum Channel Depth (ft)**	**Minimum Freeboard[(1)] (ft)**
D1: Berm 1	6	2.3	0.65	2	1.35
D2: Berm 2	10	2.7	0.80	2	1.20
D3: Berm 3	10	2.6	0.79	2	1.21
D4: Berm 4	6	2.3	0.67	2	1.33
D5: Berm 5	8	2.5	0.72	2	1.28
D6: Berm 6	13	2.8	0.87	2	1.13
D7: Berm 7	10	2.6	0.79	2	1.21
D8: Berm 8	6	2.3	0.66	2	1.34
D9: Berm 9	3	1.9	0.50	2	1.50
D10: Berm 10	1	1.4	0.30	2	1.70
I1: Bench 1	2	2.2	0.65	2	1.35
I2A: Bench 2A	3	2.2	0.65	2	1.35
I2B: Bench 2B	9	2.4	1.20	2	0.80
I2C: Bench 2C	9	2.4	1.21	2	0.79
I3: Bench 3	3	2.3	0.70	2	1.30
I4: Bench 4	2	2.1	0.61	2	1.39
P1A: Channel 1P	4	2.3	0.36	2	1.64
P1B: Channel 1P	8	2.7	0.27	2	1.73
P2A: Channel 2P	4	1.7	0.43	1	0.57
P2B: Channel 2P	4	1.9	0.43	1	0.57
P2C: Channel 2P	4	2.9	0.30	1	0.70
P2D: Channel 2P	18	3.0	0.51	3	2.49
P3A: Channel 3P	5	1.8	0.49	1	0.51
P3B: Channel 3P	11	2.1	0.47	2	1.53
P4A: Channel 4P	3	2.0	0.31	2	1.69
P4B: Channel 4P	7	2.1	0.28	2	1.72
C1: Top Deck Channel 1	20	2.7	0.36	1	0.64
C2: Top Deck Channel 2	16	2.5	0.30	1	0.70

Notes.
1. The vegetated open channels were designed to exhibit a minimum freeboard of six (6) inches and peak velocity less than four (4) feet per second (fps) for the 24-hour, 10-year storm event in accordance with DC 2.03.

24-hour, 25-year storm event											
Reach ID	**Peak Flow Rate (cfs)**	**Peak Flow Velocity[(1)] (fps)**	**Peak Flow Depth (ft)**	**Bottom Width (ft)**	**Left Side Slope (H: 1V)**	**Right Side Slope (H: 1V)**	**Flow Area (ft^2)**	**Wetted Perimeter (ft)**	**Hydraulic Radius (ft)**	**Channel Slope (ft/ft)**	**Maximum Shear Stress[(1)] (psf)**
D1: Berm 1	7	2.4	0.71	0	2.0	10.0	3.0	8.7	0.35	0.0100	0.2
D2: Berm 2	13	2.8	0.88	0	2.0	10.0	4.6	10.8	0.43	0.0100	0.3
D3: Berm 3	13	2.8	0.87	0	2.0	10.0	4.5	10.7	0.42	0.0100	0.3
D4: Berm 4	8	2.5	0.73	0	2.0	10.0	3.2	9.0	0.36	0.0100	0.2
D5: Berm 5	10	2.6	0.79	0	2.0	10.0	3.7	9.7	0.39	0.0100	0.2
D6: Berm 6	16	3.0	0.95	0	2.0	10.0	5.4	11.7	0.46	0.0100	0.3
D7: Berm 7	13	2.8	0.87	0	2.0	10.0	4.5	10.7	0.42	0.0100	0.3
D8: Berm 8	8	2.5	0.72	0	2.0	10.0	3.1	8.8	0.35	0.0100	0.2
D9: Berm 9	4	2.0	0.55	0	2.0	10.0	1.8	6.8	0.27	0.0100	0.2
D10: Berm 10	1	1.5	0.33	0	2.0	10.0	0.7	4.1	0.16	0.0100	0.1
I1: Bench 1	3	2.4	0.71	0	2.0	3.3	1.3	4.0	0.33	0.0100	0.2
I2A: Bench 2A	3	2.4	0.72	0	2.0	3.3	1.4	4.1	0.34	0.0100	0.2
I2B: Bench 2B	12	2.5	1.32	0	2.0	3.3	4.6	7.5	0.62	0.0050	0.2
I2C: Bench 2C	12	2.5	1.33	0	2.0	3.3	4.7	7.6	0.62	0.0050	0.2
I3: Bench 3	4	2.5	0.76	0	2.0	3.3	1.5	4.3	0.35	0.0100	0.2
I4: Bench 4	3	2.3	0.67	0	2.0	3.3	1.2	3.8	0.31	0.0100	0.2
P1A: Channel 1A	5	2.5	0.42	4	2.5	2.5	2.1	6.3	0.34	0.0105	0.2
P1B: Channel 1B	10	3.0	0.32	10	2.5	3.3	3.5	12.0	0.29	0.0194	0.4
P2A: Channel 2A	5	1.9	0.50	4	2.5	2.5	2.6	6.7	0.39	0.0049	0.1
P2B: Channel 2B	5	2.0	0.50	4	2.5	2.5	2.6	6.7	0.39	0.0058	0.1
P2C: Channel 2C	5	3.2	0.35	4	2.5	2.5	1.7	5.9	0.29	0.0209	0.4
P2D: Channel 2D	23	3.3	0.60	10	2.5	3.3	7.0	13.7	0.51	0.0109	0.4
P3A: Channel 3A	6	2.0	0.57	4	2.5	2.5	3.1	7.1	0.44	0.0047	0.1
P3B: Channel 3B	15	2.3	0.55	10	3.3	2.5	6.4	13.4	0.48	0.0057	0.2
P4A: Channel 4A	4	2.2	0.36	4	2.5	2.5	1.8	5.9	0.30	0.0100	0.2
P4B: Channel 4B	9	2.3	0.34	10	3.3	2.5	3.7	12.1	0.31	0.0106	0.2
C1: Top Deck Channel 1	26	2.9	0.42	20	3.0	3.0	8.9	22.7	0.39	0.0120	0.3
C2: Top Deck Channel 2	20	2.7	0.35	20	3.0	3.0	7.4	22.2	0.33	0.0130	0.3

Notes.

1. These open channel conveyance features were designed with grass lining. As such, they were designed to exhibit a maximum shear stress for the 24-hour, 25-year storm event less than the allowable shear stress for grass, which is 0.7 pound per square foot (psf) as shown in Attachment 11 [NRCS, 2014].

24-hour, 100-year storm event					
Reach ID	**Peak Flow Rate (cfs)**	**Peak Flow Velocity[(1)] (fps)**	**Peak Flow Depth (ft)**	**Minimum Channel Depth (ft)**	**Minimum Freeboard[(1)] (ft)**
D1: Berm 1	9	2.6	0.77	2	1.23
D2: Berm 2	16	3.0	0.96	2	1.04
D3: Berm 3	16	3.0	0.94	2	1.06
D4: Berm 4	10	2.6	0.79	2	1.21
D5: Berm 5	12	2.8	0.85	2	1.15
D6: Berm 6	20	3.1	1.03	2	0.97
D7: Berm 7	15	2.9	0.94	2	1.06
D8: Berm 8	9	2.6	0.78	2	1.22
D9: Berm 9	5	2.2	0.59	2	1.41
D10: Berm 10	1	1.5	0.35	2	1.65
I1: Bench 1	4	2.5	0.77	2	1.23
I2A: Bench 2A	4	2.5	0.78	2	1.22
I2B: Bench 2B	14	2.7	1.42	2	0.58
I2C: Bench 2C	15	2.7	1.43	2	0.57
I3: Bench 3	5	2.6	0.83	2	1.17
I4: Bench 4	3	2.4	0.72	2	1.28
P1A: Channel 1A	6	2.6	0.47	2	1.53
P1B: Channel 1B	13	3.3	0.36	2	1.64
P2A: Channel 2A	6	2.0	0.56	1	0.44
P2B: Channel 2B	7	2.2	0.56	1	0.44
P2C: Channel 2C	7	3.4	0.40	1	0.60
P2D: Channel 2D	29	3.6	0.68	1	0.32
P3A: Channel 3A	7	2.1	0.64	1	0.36
P3B: Channel 3B	18	2.5	0.63	1	0.37
P4A: Channel 4A	5	2.4	0.41	2	1.59
P4B: Channel 4B	10	2.5	0.38	2	1.62
C1: Top Deck Channel 1	32	3.1	0.47	1	0.53
C2: Top Deck Channel 2	25	2.9	0.40	1	0.60

Notes.

1. The vegetated open channels were designed to prevent overtopping for the 24-hour, 100-year storm event in accordance with DC 2.05.

Written by:	**Antonio Sanchez**	Date:	**09/11/15**	Reviewed by:	**Tom Fendley / Jay Beech**	Date:	**09/11/15**

Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Cover Design**	Project No.:	**GD5497**	Phase No.:	**03**

Attachment 10: Forebay Design Calculations

West Stormwater Basin Forebay Sizing

A_T, Total Drainage Area to Forebay	28.543	acres
A_I, Impervious Drainage Area to Forebay	0.33	acres
Imperviousness of Drainage Area to Forebay	1.2%	
R_v	0.200	
P, 90% Rainfall Event	0.85	in.
WQ_v, Water Quality Volume	0.404	acre-ft
$WQ_{v,10\%}$, 10% of Water Quality Volume	1761	ft^3
Depth	5	ft
Area at Mid Depth of Berm	352	ft^2
Radius at Mid Depth of Semi-Circular Berm	15	ft
Radius at Bottom of Semi-Circular Berm	10	ft
Radius at Top of Semi-Circular Berm	20	ft
Minimum Filter Berm Width(1)	63	ft
Design Filter Berm Width(1)	65	ft

Notes.

1. Minimum Filter Berm Width is based on a semi-circular design of the forebay with the 2H:1V side slopes.

East Stormwater Basin Forebay Sizing

A_T, Total Drainage Area to Forebay	23.380	acres
A_I, Impervious Drainage Area to Forebay	0.368	acres
Imperviousness of Drainage Area to Forebay	1.6%	
R_v	0.200	
P, 90% Rainfall Event	0.85	in.
WQ_v, Water Quality Volume	0.331	acre-ft
$WQ_{v,10\%}$, 10% of Water Quality Volume	1443	ft^3
Depth	4	ft
Area at Mid Depth of Berm	361	ft^2
Radius at Mid Depth of Semi-Circular Berm	15	ft
Radius at Bottom of Semi-Circular Berm	11	ft
Radius at Top of Semi-Circular Berm	19	ft
Minimum Filter Berm Width(1)	60	ft
Design Filter Berm Width(1)	60	ft

Notes.

1. Minimum Filter Berm Width is based on a semi-circular design of the forebay with the 2H:1V side slopes.

Written by:	**Antonio Sanchez**	Date:	**09/11/15**	Reviewed by:	**Tom Fendley / Jay Beech**	Date:	**09/11/15**

Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Cover Design**	Project No.:	**GD5497**	Phase No.:	**03**

Attachment 11: Allowable Velocity and Maximum Shear Stress [NRCS, 2014]

ALLOWABLE VELOCITY AND MAXIMUM SHEAR STRESS
Streambank and Shoreland Protection Code 580

Type of Treatment	Allowable Shear lb/sq ft	Velocity ft/sec
Brush Mattresses[1]		
Staked only w/ rock riprap toe (initial)	0.8 - 4.1	5
Staked only w/ rock riprap toe (grown)	4.0 - 8.0	12
Coir Geotextile Roll[2]		
Roll with coir rope mesh staked only without rock riprap toe	0.2 - 0.8	< 5
Roll with Polypropylene rope mesh staked only without rock riprap toe	0.8 - 3.0	< 8
Roll with Polypropylene rope mesh staked and with rock riprap toe	3.0 - 4.0	< 12
Live Fascine[3]		
LF Bundle w/ rock riprap toe	2.0 - 3.1	8
Soils[4]		
Fine colloidal sand	0.02-0.03	1.5
Sandy loam (noncolloidal)	0.03-0.04	1.75
Alluvial silt (noncolloidal)	0.045-0.05	2
Silty loam (noncolloidal)	0.045-0.05	1.75-2.25
Firm loam	0.075	2.5
Fine gravels	0.075	2.5
Stiff clay	0.26	3-4.5
Alluvial silt (colloidal)	0.26	3.75
Graded loam to cobbles	0.38	3.75
Graded silts to cobbles	0.43	4
Shales and hardpan	0.67	6
Gravel/Cobble[4]		
1-inch	0.33	2.5-5
2-inch	0.67	3-6
6-inch	2	4-7.5
12-inch	4	5.5-12
Vegetation[4]		
Class A turf (ret class)	3.7	6-8
Class B turf (ret class)	2.1	4-7
Class C turf (ret class)	1	3.5
Retardance Class D	0.6	Design of roadside channels HEC-15
Retardance Class E	0.35	
Long native grasses	1.2-1.7	4-6
Short native and bunch grass	0.7-0.95	3-4

Type of Treatment	Allowable Shear lb/sq ft	Velocity ft/sec
Soil Bioengineering[4]		
Wattles	0.2-1.0	3
Reed fascine	0.6-1.25	5
Coir roll	3-5	8
Vegetated coir mat	4-8	9.5
Live brush mattress (initial)	0.4-4.1	4
Live brush mattress (grown)	3.90-8.2	12
Brush layering (initial/grown)	0.4-6.25	12
Live fascine	1.25-3.10	6-8
Live willow stakes	2.10-3.10	3-10
Hard Surfacing[4]		
Gabions	10	14-19
Concrete	12.5	>18
Boulder Clusters[5]		
Boulder		
Very large (>80-inch diameter)	37.4	25
Large (>40-in diameter)	18.7	19
Medium (>20-inch diameter)	9.3	14
Small (>10-inch diameter)	4.7	10
Cobble		
Large (>5-inch diameter)	2.3	7
Small (>2.5-inch diameter)	1.1	5
Gravel		
Very Course (>1.25-inch diameter)	0.54	3
Course (>.63-inch diameter)	0.25	2.5

[1] Brush mattresses (ERDC TN EMRRP-SR-23): http://el.erdc.usace.army.mil/emrrp/pdf/sr23.pdf.
[2] Coir Geotextile roll (ERDC TN EMRRP-SR-04): http://el.erdc.usace.army.mil/emrrp/pdf/sr04.pdf.
[3] Live Fascine (ERDC TN EMRRP-SR-31): http://el.erdc.usace.army.mil/emrrp/pdf/sr31.pdf.
[4] Stream Restoration Materials (ERDC TN EMRRP-SR-29): http://el.erdc.usace.army.mil/emrrp/pdf/sr29.pdf.
[5] Boulder Clusters (ERDC TN EMRRP-SR-11): http://el.erdc.usace.army.mil/emrrp/pdf/sr11.pdf.

Additional Sources:

Wisconsin Department of Transportation, Erosion Control - Product Acceptability List (PAL):
http://www.dot.wisconsin.gov/library/research/docs/finalreports/tau-finalreports/erosion.pdf

Texas Department of Transportation, Approved Products List:
http://www.dot.state.tx.us/mnt/erosion/contents.htm

Written by:	**Antonio Sanchez**	Date:	**09/11/15**	Reviewed by:	**Tom Fendley / Jay Beech**	Date:	**09/11/15**

Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Cover Design**	Project No.:	**GD5497**	Phase No.:	**03**

Attachment 12: Diversion Berm Design Calculations

Design:	Diversion Berm
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	D6
Storm:	10-year, 24-hour

Depth, H =	2.0	ft
Bottom Width, B =	0.0	ft
Left Side Slope, Z_1 =	2.0	horizontal :1 vertical
Right Side Slope, Z_2 =	10.0	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.010	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.0	0.1	0.0	0.1	0	0.00	
0.2	0.2	2.2	0.1	1.0	0	0.05	
0.3	0.7	4.2	0.2	1.5	1	0.10	
0.5	1.5	6.2	0.2	2.0	3	0.15	
0.7	2.7	8.3	0.3	2.4	6	0.21	
0.8	4.2	10.3	0.4	2.7	12	0.26	
1.0	6.1	12.3	0.5	3.1	19	0.31	
1.2	8.2	14.4	0.6	3.4	28	0.36	
1.3	10.7	16.4	0.7	3.7	40	0.41	
1.5	13.5	18.5	0.7	4.0	55	0.46	
1.7	16.7	20.5	0.8	4.3	72	0.51	
1.8	20.2	22.5	0.9	4.6	93	0.56	
2.0	24.0	24.6	1.0	4.9	117	0.61	
0.9	4.5	10.6	0.4	2.8	13	0.3	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Design:	Diversion Berm
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	D6
Storm:	25-year, 24-hour

Depth, H =	2.0	ft
Bottom Width, B =	0.0	ft
Left Side Slope, Z_1 =	2.0	horizontal :1 vertical
Right Side Slope, Z_2 =	10.0	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.010	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.0	0.1	0.0	0.1	0	0.00	
0.2	0.2	2.2	0.1	1.0	0	0.05	
0.3	0.7	4.2	0.2	1.5	1	0.10	
0.5	1.5	6.2	0.2	2.0	3	0.15	
0.7	2.7	8.3	0.3	2.4	6	0.21	
0.8	4.2	10.3	0.4	2.7	12	0.26	
1.0	6.1	12.3	0.5	3.1	19	0.31	
1.2	8.2	14.4	0.6	3.4	28	0.36	
1.3	10.7	16.4	0.7	3.7	40	0.41	
1.5	13.5	18.5	0.7	4.0	55	0.46	
1.7	16.7	20.5	0.8	4.3	72	0.51	
1.8	20.2	22.5	0.9	4.6	93	0.56	
2.0	24.0	24.6	1.0	4.9	117	0.61	
1.0	5.4	11.7	0.5	3.0	16	0.3	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Design:	Diversion Berm
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	D6
Storm:	100-year, 24-hour

Depth, H =	2.0	ft
Bottom Width, B =	0.0	ft
Left Side Slope, Z_1 =	2.0	horizontal :1 vertical
Right Side Slope, Z_2 =	10.0	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.010	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.0	0.1	0.0	0.1	0	0.00	
0.2	0.2	2.2	0.1	1.0	0	0.05	
0.3	0.7	4.2	0.2	1.5	1	0.10	
0.5	1.5	6.2	0.2	2.0	3	0.15	
0.7	2.7	8.3	0.3	2.4	6	0.21	
0.8	4.2	10.3	0.4	2.7	12	0.26	
1.0	6.1	12.3	0.5	3.1	19	0.31	
1.2	8.2	14.4	0.6	3.4	28	0.36	
1.3	10.7	16.4	0.7	3.7	40	0.41	
1.5	13.5	18.5	0.7	4.0	55	0.46	
1.7	16.7	20.5	0.8	4.3	72	0.51	
1.8	20.2	22.5	0.9	4.6	93	0.56	
2.0	24.0	24.6	1.0	4.9	117	0.61	
1.0	6.3	12.6	0.5	3.1	20	0.3	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Written by:	**Antonio Sanchez**	Date:	**09/11/15**	Reviewed by:	**Tom Fendley / Jay Beech**	Date:	**09/11/15**

Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Cover Design**	Project No.:	**GD5497**	Phase No.:	**03**

Attachment 13: Main Deck Channel Design Calculations

Design:	Main Deck Channel
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	C1
Storm:	10-year, 24-hour

Depth, H =	1.0	ft
Bottom Width, B =	20.0	ft
Left Side Slope, Z_1 =	3.0	horizontal :1 vertical
Right Side Slope, Z_2 =	3.0	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.0120	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.2	20.1	0.0	0.3	0	0.01	
0.2	3.6	21.1	0.2	1.7	6	0.13	
0.3	7.2	22.2	0.3	2.6	18	0.24	
0.5	10.9	23.2	0.5	3.3	36	0.35	
0.7	14.8	24.3	0.6	3.9	58	0.46	
0.8	18.9	25.3	0.7	4.5	85	0.56	
1.0	23.1	26.4	0.9	5.0	115	0.66	
1.2	27.5	27.4	1.0	5.5	150	0.75	
1.3	32.1	28.5	1.1	5.9	189	0.84	
1.5	36.8	29.5	1.2	6.3	232	0.93	
1.7	41.7	30.6	1.4	6.7	279	1.02	
1.8	46.8	31.6	1.5	7.1	331	1.11	
2.0	52.0	32.6	1.6	7.4	386	1.19	
0.4	9.2	22.7	0.4	3.0	27	0.3	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Design:	Main Deck Channel
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	C1
Storm:	25-year, 24-hour

Depth, H =	1.0	ft
Bottom Width, B =	20.0	ft
Left Side Slope, Z_1 =	3.0	horizontal :1 vertical
Right Side Slope, Z_2 =	3.0	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.0120	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.2	20.1	0.0	0.3	0	0.01	
0.2	3.6	21.1	0.2	1.7	6	0.13	
0.3	7.2	22.2	0.3	2.6	18	0.24	
0.5	10.9	23.2	0.5	3.3	36	0.35	
0.7	14.8	24.3	0.6	3.9	58	0.46	
0.8	18.9	25.3	0.7	4.5	85	0.56	
1.0	23.1	26.4	0.9	5.0	115	0.66	
1.2	27.5	27.4	1.0	5.5	150	0.75	
1.3	32.1	28.5	1.1	5.9	189	0.84	
1.5	36.8	29.5	1.2	6.3	232	0.93	
1.7	41.7	30.6	1.4	6.7	279	1.02	
1.8	46.8	31.6	1.5	7.1	331	1.11	
2.0	52.0	32.6	1.6	7.4	386	1.19	
0.5	10.8	23.2	0.5	3.3	35	0.3	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Design:	Main Deck Channel
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	C1
Storm:	100-year, 24-hour

Depth, H =	1.0	ft
Bottom Width, B =	20.0	ft
Left Side Slope, Z_1 =	3.0	horizontal :1 vertical
Right Side Slope, Z_2 =	3.0	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.0120	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.2	20.1	0.0	0.3	0	0.01	
0.2	3.6	21.1	0.2	1.7	6	0.13	
0.3	7.2	22.2	0.3	2.6	18	0.24	
0.5	10.9	23.2	0.5	3.3	36	0.35	
0.7	14.8	24.3	0.6	3.9	58	0.46	
0.8	18.9	25.3	0.7	4.5	85	0.56	
1.0	23.1	26.4	0.9	5.0	115	0.66	
1.2	27.5	27.4	1.0	5.5	150	0.75	
1.3	32.1	28.5	1.1	5.9	189	0.84	
1.5	36.8	29.5	1.2	6.3	232	0.93	
1.7	41.7	30.6	1.4	6.7	279	1.02	
1.8	46.8	31.6	1.5	7.1	331	1.11	
2.0	52.0	32.6	1.6	7.4	386	1.19	
0.6	12.2	23.6	0.5	3.5	43	0.4	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Written by:	**Antonio Sanchez**	Date:	**09/11/15**	Reviewed by:	**Tom Fendley / Jay Beech**	Date:	**09/11/15**

Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Cover Design**	Project No.:	**GD5497**	Phase No.:	**03**

Attachment 14: Interception Bench Design Calculations

Design:	Interception Bench
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	I2A
Storm:	10-year, 24-hour

Depth, H =	2.0	ft
Bottom Width, B =	0.0	ft
Left Side Slope, Z_1 =	2.0	horizontal :1 vertical
Right Side Slope, Z_2 =	3.3	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.010	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.0	0.1	0.0	0.1	0	0.00	
0.2	0.1	1.0	0.1	0.9	0	0.05	
0.3	0.3	1.9	0.2	1.5	0	0.10	
0.5	0.7	2.9	0.2	1.9	1	0.15	
0.7	1.2	3.8	0.3	2.3	3	0.20	
0.8	1.9	4.8	0.4	2.7	5	0.24	
1.0	2.7	5.7	0.5	3.0	8	0.29	
1.2	3.6	6.7	0.5	3.3	12	0.34	
1.3	4.7	7.6	0.6	3.6	17	0.39	
1.5	6.0	8.5	0.7	3.9	23	0.44	
1.7	7.4	9.5	0.8	4.2	31	0.49	
1.8	8.9	10.4	0.9	4.5	40	0.53	
2.0	10.6	11.4	0.9	4.7	50	0.58	
0.7	1.1	3.7	0.3	2.2	3	0.2	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Design:	Interception Bench
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	I2A
Storm:	25-year, 24-hour

Depth, H =	2.0	ft
Bottom Width, B =	0.0	ft
Left Side Slope, Z_1 =	2.0	horizontal :1 vertical
Right Side Slope, Z_2 =	3.3	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.010	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.0	0.1	0.0	0.1	0	0.00	
0.2	0.1	1.0	0.1	0.9	0	0.05	
0.3	0.3	1.9	0.2	1.5	0	0.10	
0.5	0.7	2.9	0.2	1.9	1	0.15	
0.7	1.2	3.8	0.3	2.3	3	0.20	
0.8	1.9	4.8	0.4	2.7	5	0.24	
1.0	2.7	5.7	0.5	3.0	8	0.29	
1.2	3.6	6.7	0.5	3.3	12	0.34	
1.3	4.7	7.6	0.6	3.6	17	0.39	
1.5	6.0	8.5	0.7	3.9	23	0.44	
1.7	7.4	9.5	0.8	4.2	31	0.49	
1.8	8.9	10.4	0.9	4.5	40	0.53	
2.0	10.6	11.4	0.9	4.7	50	0.58	
0.7	1.4	4.1	0.3	2.4	3	0.2	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Design:	Interception Bench
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	I2A
Storm:	100-year, 24-hour

Depth, H =	2.0	ft
Bottom Width, B =	0.0	ft
Left Side Slope, Z_1 =	2.0	horizontal :1 vertical
Right Side Slope, Z_2 =	3.3	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.010	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.0	0.1	0.0	0.1	0	0.00	
0.2	0.1	1.0	0.1	0.9	0	0.05	
0.3	0.3	1.9	0.2	1.5	0	0.10	
0.5	0.7	2.9	0.2	1.9	1	0.15	
0.7	1.2	3.8	0.3	2.3	3	0.20	
0.8	1.9	4.8	0.4	2.7	5	0.24	
1.0	2.7	5.7	0.5	3.0	8	0.29	
1.2	3.6	6.7	0.5	3.3	12	0.34	
1.3	4.7	7.6	0.6	3.6	17	0.39	
1.5	6.0	8.5	0.7	3.9	23	0.44	
1.7	7.4	9.5	0.8	4.2	31	0.49	
1.8	8.9	10.4	0.9	4.5	40	0.53	
2.0	10.6	11.4	0.9	4.7	50	0.58	
0.8	1.6	4.4	0.4	2.5	4	0.2	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Design:	Interception Bench
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	I2C
Storm:	10-year, 24-hour

Depth, H =	2.0	ft
Bottom Width, B =	0.0	ft
Left Side Slope, Z_1 =	2.0	horizontal :1 vertical
Right Side Slope, Z_2 =	3.3	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.005	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.0	0.1	0.0	0.1	0	0.00	
0.2	0.1	1.0	0.1	0.7	0	0.03	
0.3	0.3	1.9	0.2	1.0	0	0.05	
0.5	0.7	2.9	0.2	1.3	1	0.07	
0.7	1.2	3.8	0.3	1.6	2	0.10	
0.8	1.9	4.8	0.4	1.9	4	0.12	
1.0	2.7	5.7	0.5	2.1	6	0.15	
1.2	3.6	6.7	0.5	2.3	9	0.17	
1.3	4.7	7.6	0.6	2.6	12	0.19	
1.5	6.0	8.5	0.7	2.8	17	0.22	
1.7	7.4	9.5	0.8	3.0	22	0.24	
1.8	8.9	10.4	0.9	3.2	28	0.27	
2.0	10.6	11.4	0.9	3.4	36	0.29	
1.2	3.9	6.9	0.6	2.4	9	0.2	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Design:	Interception Bench
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	I2C
Storm:	25-year, 24-hour

Depth, H =	2.0	ft
Bottom Width, B =	0.0	ft
Left Side Slope, Z_1 =	2.0	horizontal :1 vertical
Right Side Slope, Z_2 =	3.3	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.005	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.0	0.1	0.0	0.1	0	0.00	
0.2	0.1	1.0	0.1	0.7	0	0.03	
0.3	0.3	1.9	0.2	1.0	0	0.05	
0.5	0.7	2.9	0.2	1.3	1	0.07	
0.7	1.2	3.8	0.3	1.6	2	0.10	
0.8	1.9	4.8	0.4	1.9	4	0.12	
1.0	2.7	5.7	0.5	2.1	6	0.15	
1.2	3.6	6.7	0.5	2.3	9	0.17	
1.3	4.7	7.6	0.6	2.6	12	0.19	
1.5	6.0	8.5	0.7	2.8	17	0.22	
1.7	7.4	9.5	0.8	3.0	22	0.24	
1.8	8.9	10.4	0.9	3.2	28	0.27	
2.0	10.6	11.4	0.9	3.4	36	0.29	
1.3	4.7	7.5	0.6	2.5	12	0.2	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Design:	Interception Bench
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	I2C
Storm:	100-year, 24-hour

Depth, H =	2.0	ft
Bottom Width, B =	0.0	ft
Left Side Slope, Z_1 =	2.0	horizontal :1 vertical
Right Side Slope, Z_2 =	3.3	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.005	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.0	0.1	0.0	0.1	0	0.00	
0.2	0.1	1.0	0.1	0.7	0	0.03	
0.3	0.3	1.9	0.2	1.0	0	0.05	
0.5	0.7	2.9	0.2	1.3	1	0.07	
0.7	1.2	3.8	0.3	1.6	2	0.10	
0.8	1.9	4.8	0.4	1.9	4	0.12	
1.0	2.7	5.7	0.5	2.1	6	0.15	
1.2	3.6	6.7	0.5	2.3	9	0.17	
1.3	4.7	7.6	0.6	2.6	12	0.19	
1.5	6.0	8.5	0.7	2.8	17	0.22	
1.7	7.4	9.5	0.8	3.0	22	0.24	
1.8	8.9	10.4	0.9	3.2	28	0.27	
2.0	10.6	11.4	0.9	3.4	36	0.29	
1.4	5.4	8.1	0.7	2.7	15	0.2	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Written by:	**Antonio Sanchez**	Date:	**09/11/15**	Reviewed by:	**Tom Fendley / Jay Beech**	Date:	**09/11/15**

Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Cover Design**	Project No.:	**GD5497**	Phase No.:	**03**

Attachment 15: Riprap Chute Design Calculations

Design:	Trapezoidal Riprap Chute
Method:	Robinson et.al 1998
Project:	Onandaga Lake SCA
Node ID:	R1
Storm:	10-year, 24-hour

INPUT PARAMETERS

Peak Discharge, Q_{max}=	32	cfs
Bottom Width, B =	35	ft
Left Side Slope, Z_1 =	3.0	horizontal :1 vertical
Right Side Slope, Z_2 =	3.0	horizontal :1 vertical
Longitudinal Channel Slope, S_o =	0.300	ft/ft

ROCK SIZING

Selected Median Rock Diameter, D_{50} =	12.00	inches

MANNING'S ROUGHNESS

Calculated Channel Roughness, n =	0.057

NORMAL DEPTH CALCULATIONS - Using Manning's Equation

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Channel Slope ft/ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.19	6.8	36.2	0.19	0.30	4.7	32	3.5	DESIGN Q

Design:	Trapezoidal Riprap Chute
Method:	Robinson et.al 1998
Project:	Onandaga Lake SCA
Node ID:	R1
Storm:	25-year, 24-hour

INPUT PARAMETERS

Peak Discharge, Q_{max}=	41	cfs
Bottom Width, B =	35	ft
Left Side Slope, Z_1 =	3.0	horizontal :1 vertical
Right Side Slope, Z_2 =	3.0	horizontal :1 vertical
Longitudinal Channel Slope, S_o =	0.300	ft/ft

ROCK SIZING

Selected Median Rock Diameter, D_{50} = 12.00 inches

MANNING'S ROUGHNESS

Calculated Channel Roughness, n = 0.057

NORMAL DEPTH CALCULATIONS - Using Manning's Equation

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Channel Slope ft/ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.22	7.9	36.4	0.22	0.30	5.2	41	4.1	DESIGN Q

Design:	Trapezoidal Riprap Chute
Method:	Robinson et.al 1998
Project:	Onandaga Lake SCA
Node ID:	R1
Storm:	100-year, 24-hour

INPUT PARAMETERS

Peak Discharge, Q_{max}=	51	cfs
Bottom Width, B =	35	ft
Left Side Slope, Z_1 =	3.0	horizontal :1 vertical
Right Side Slope, Z_2 =	3.0	horizontal :1 vertical
Longitudinal Channel Slope, S_o =	0.300	ft/ft

ROCK SIZING

Selected Median Rock Diameter, D_{50} = 12.00 inches

MANNING'S ROUGHNESS

Calculated Channel Roughness, n = 0.057

NORMAL DEPTH CALCULATIONS - Using Manning's Equation

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Channel Slope ft/ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.25	9.0	36.6	0.25	0.30	5.6	51	4.6	DESIGN Q

Design:	Trapezoidal Riprap Chute
Method:	Robinson et.al 1998
Project:	Onandaga Lake SCA
Node ID:	R3
Storm:	10-year, 24-hour

INPUT PARAMETERS

Peak Discharge, Q_{max}=	20	cfs
Bottom Width, B =	20	ft
Left Side Slope, Z_1 =	3.0	horizontal :1 vertical
Right Side Slope, Z_2 =	3.0	horizontal :1 vertical
Longitudinal Channel Slope, S_o =	0.300	ft/ft

ROCK SIZING

Selected Median Rock Diameter, D_{50} =	12.00	inches

MANNING'S ROUGHNESS

Calculated Channel Roughness, n =	0.057

NORMAL DEPTH CALCULATIONS - Using Manning's Equation

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Channel Slope ft/ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.20	4.2	21.3	0.20	0.30	4.8	20	3.7	DESIGN Q

Design:	Trapezoidal Riprap Chute
Method:	Robinson et.al 1998
Project:	Onandaga Lake SCA
Node ID:	R3
Storm:	25-year, 24-hour

INPUT PARAMETERS

Peak Discharge, Q_{max}=	26	cfs
Bottom Width, B =	20	ft
Left Side Slope, Z_1 =	3.0	horizontal :1 vertical
Right Side Slope, Z_2 =	3.0	horizontal :1 vertical
Longitudinal Channel Slope, S_o =	0.300	ft/ft

ROCK SIZING

Selected Median Rock Diameter, D_{50} = 12.00 inches

MANNING'S ROUGHNESS

Calculated Channel Roughness, n = 0.057

NORMAL DEPTH CALCULATIONS - Using Manning's Equation

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Channel Slope ft/ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.23	4.8	21.5	0.23	0.30	5.3	26	4.2	DESIGN Q

Design:	Trapezoidal Riprap Chute
Method:	Robinson et.al 1998
Project:	Onandaga Lake SCA
Node ID:	R3
Storm:	100-year, 24-hour

INPUT PARAMETERS

Peak Discharge, Q_{max}=	32	cfs
Bottom Width, B =	20	ft
Left Side Slope, Z_1 =	3.0	horizontal :1 vertical
Right Side Slope, Z_2 =	3.0	horizontal :1 vertical
Longitudinal Channel Slope, S_o =	0.300	ft/ft

ROCK SIZING

Selected Median Rock Diameter, D_{50} = 12.00 inches

MANNING'S ROUGHNESS

Calculated Channel Roughness, n = 0.057

NORMAL DEPTH CALCULATIONS - Using Manning's Equation

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Channel Slope ft/ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.26	5.5	21.7	0.25	0.30	5.8	32	4.7	DESIGN Q

Written by:	**Antonio Sanchez**	Date:	**09/11/15**	Reviewed by:	**Tom Fendley / Jay Beech**	Date:	**09/11/15**

Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Cover Design**	Project No.:	**GD5497**	Phase No.:	**03**

Attachment 16: Perimeter Channel Design Calculations

Perimeter Channel Design Calculations

Channel Design No. 01 (Reach Node P2A)

Design:	Perimeter Channel Design No. 1
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	P2A
Storm:	10-year, 24-hour

Depth, H =	1.0	ft
Bottom Width, B =	4.0	ft
Left Side Slope, Z_1 =	2.5	horizontal :1 vertical
Right Side Slope, Z_2 =	2.5	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.0049	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.0	4.1	0.0	0.2	0	0.00	
0.2	0.8	4.9	0.2	1.0	1	0.05	
0.3	1.7	5.8	0.3	1.5	2	0.09	
0.5	2.7	6.7	0.4	1.9	5	0.12	
0.7	3.8	7.6	0.5	2.2	8	0.15	
0.8	5.1	8.5	0.6	2.5	13	0.18	
1.0	6.5	9.4	0.7	2.7	18	0.21	
1.2	8.1	10.3	0.8	3.0	24	0.24	
1.3	9.8	11.2	0.9	3.2	31	0.27	
1.5	11.7	12.1	1.0	3.4	40	0.29	
1.7	13.6	13.0	1.0	3.6	49	0.32	
1.8	15.7	13.9	1.1	3.8	60	0.35	
2.0	18.0	14.8	1.2	4.0	71	0.37	
0.4	2.2	6.3	0.3	1.7	4	0.1	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Design:	Perimeter Channel Design No. 1
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	P2A
Storm:	25-year, 24-hour

Depth, H =	1.0	ft
Bottom Width, B =	4.0	ft
Left Side Slope, Z_1 =	2.5	horizontal :1 vertical
Right Side Slope, Z_2 =	2.5	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.0049	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.0	4.1	0.0	0.2	0	0.00	
0.2	0.8	4.9	0.2	1.0	1	0.05	
0.3	1.7	5.8	0.3	1.5	2	0.09	
0.5	2.7	6.7	0.4	1.9	5	0.12	
0.7	3.8	7.6	0.5	2.2	8	0.15	
0.8	5.1	8.5	0.6	2.5	13	0.18	
1.0	6.5	9.4	0.7	2.7	18	0.21	
1.2	8.1	10.3	0.8	3.0	24	0.24	
1.3	9.8	11.2	0.9	3.2	31	0.27	
1.5	11.7	12.1	1.0	3.4	40	0.29	
1.7	13.6	13.0	1.0	3.6	49	0.32	
1.8	15.7	13.9	1.1	3.8	60	0.35	
2.0	18.0	14.8	1.2	4.0	71	0.37	
0.5	2.6	6.7	0.4	1.9	5	0.1	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Design:	Perimeter Channel Design No. 1
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	P2A
Storm:	100-year, 24-hour

Depth, H =	1.0	ft
Bottom Width, B =	4.0	ft
Left Side Slope, Z_1 =	2.5	horizontal :1 vertical
Right Side Slope, Z_2 =	2.5	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.0049	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.0	4.1	0.0	0.2	0	0.00	
0.2	0.8	4.9	0.2	1.0	1	0.05	
0.3	1.7	5.8	0.3	1.5	2	0.09	
0.5	2.7	6.7	0.4	1.9	5	0.12	
0.7	3.8	7.6	0.5	2.2	8	0.15	
0.8	5.1	8.5	0.6	2.5	13	0.18	
1.0	6.5	9.4	0.7	2.7	18	0.21	
1.2	8.1	10.3	0.8	3.0	24	0.24	
1.3	9.8	11.2	0.9	3.2	31	0.27	
1.5	11.7	12.1	1.0	3.4	40	0.29	
1.7	13.6	13.0	1.0	3.6	49	0.32	
1.8	15.7	13.9	1.1	3.8	60	0.35	
2.0	18.0	14.8	1.2	4.0	71	0.37	
0.6	3.0	7.0	0.4	2.0	6	0.1	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Perimeter Channel Design Calculations

Channel Design No. 02 (Reach Node P2B)

Design:	Perimeter Channel Design No. 2
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	P2B
Storm:	10-year, 24-hour

Depth, H =	1.0	ft
Bottom Width, B =	4.0	ft
Left Side Slope, Z_1 =	2.5	horizontal :1 vertical
Right Side Slope, Z_2 =	2.5	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.0058	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.0	4.1	0.0	0.2	0	0.00	
0.2	0.8	4.9	0.2	1.1	1	0.06	
0.3	1.7	5.8	0.3	1.6	3	0.10	
0.5	2.7	6.7	0.4	2.0	5	0.14	
0.7	3.8	7.6	0.5	2.4	9	0.18	
0.8	5.1	8.5	0.6	2.7	14	0.22	
1.0	6.5	9.4	0.7	3.0	19	0.25	
1.2	8.1	10.3	0.8	3.2	26	0.28	
1.3	9.8	11.2	0.9	3.5	34	0.32	
1.5	11.7	12.1	1.0	3.7	43	0.35	
1.7	13.6	13.0	1.0	3.9	53	0.38	
1.8	15.7	13.9	1.1	4.1	65	0.41	
2.0	18.0	14.8	1.2	4.3	78	0.44	
0.4	2.2	6.3	0.3	1.9	4	0.1	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Design:	Perimeter Channel Design No. 2
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	P2B
Storm:	25-year, 24-hour

Depth, H =	1.0	ft
Bottom Width, B =	4.0	ft
Left Side Slope, Z_1 =	2.5	horizontal :1 vertical
Right Side Slope, Z_2 =	2.5	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.0058	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.0	4.1	0.0	0.2	0	0.00	
0.2	0.8	4.9	0.2	1.1	1	0.06	
0.3	1.7	5.8	0.3	1.6	3	0.10	
0.5	2.7	6.7	0.4	2.0	5	0.14	
0.7	3.8	7.6	0.5	2.4	9	0.18	
0.8	5.1	8.5	0.6	2.7	14	0.22	
1.0	6.5	9.4	0.7	3.0	19	0.25	
1.2	8.1	10.3	0.8	3.2	26	0.28	
1.3	9.8	11.2	0.9	3.5	34	0.32	
1.5	11.7	12.1	1.0	3.7	43	0.35	
1.7	13.6	13.0	1.0	3.9	53	0.38	
1.8	15.7	13.9	1.1	4.1	65	0.41	
2.0	18.0	14.8	1.2	4.3	78	0.44	
0.5	2.6	6.7	0.4	2.0	5	0.1	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Design:	Perimeter Channel Design No. 2
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	P2B
Storm:	100-year, 24-hour

Depth, H =	1.0	ft
Bottom Width, B =	4.0	ft
Left Side Slope, Z_1 =	2.5	horizontal :1 vertical
Right Side Slope, Z_2 =	2.5	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.0058	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.0	4.1	0.0	0.2	0	0.00	
0.2	0.8	4.9	0.2	1.1	1	0.06	
0.3	1.7	5.8	0.3	1.6	3	0.10	
0.5	2.7	6.7	0.4	2.0	5	0.14	
0.7	3.8	7.6	0.5	2.4	9	0.18	
0.8	5.1	8.5	0.6	2.7	14	0.22	
1.0	6.5	9.4	0.7	3.0	19	0.25	
1.2	8.1	10.3	0.8	3.2	26	0.28	
1.3	9.8	11.2	0.9	3.5	34	0.32	
1.5	11.7	12.1	1.0	3.7	43	0.35	
1.7	13.6	13.0	1.0	3.9	53	0.38	
1.8	15.7	13.9	1.1	4.1	65	0.41	
2.0	18.0	14.8	1.2	4.3	78	0.44	
0.6	3.1	7.0	0.4	2.2	7	0.2	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Perimeter Channel Design Calculations

Channel Design No. 03 (Reach Node P2C)

Design:	Perimeter Channel Design No. 3
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	P2C
Storm:	10-year, 24-hour

Depth, H =	1.0	ft
Bottom Width, B =	4.0	ft
Left Side Slope, Z_1 =	2.5	horizontal :1 vertical
Right Side Slope, Z_2 =	2.5	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.0209	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.0	4.1	0.0	0.3	0	0.01	
0.2	0.8	4.9	0.2	2.1	2	0.21	
0.3	1.7	5.8	0.3	3.1	5	0.37	
0.5	2.7	6.7	0.4	3.9	10	0.52	
0.7	3.8	7.6	0.5	4.5	17	0.65	
0.8	5.1	8.5	0.6	5.1	26	0.78	
1.0	6.5	9.4	0.7	5.6	37	0.91	
1.2	8.1	10.3	0.8	6.1	50	1.03	
1.3	9.8	11.2	0.9	6.6	65	1.14	
1.5	11.7	12.1	1.0	7.0	82	1.26	
1.7	13.6	13.0	1.0	7.4	101	1.37	
1.8	15.7	13.9	1.1	7.8	123	1.48	
2.0	18.0	14.8	1.2	8.2	147	1.59	
0.3	1.4	5.6	0.3	2.9	4	0.3	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Design:	Perimeter Channel Design No. 3
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	P2C
Storm:	25-year, 24-hour

Depth, H =	1.0	ft
Bottom Width, B =	4.0	ft
Left Side Slope, Z_1 =	2.5	horizontal :1 vertical
Right Side Slope, Z_2 =	2.5	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.0209	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.0	4.1	0.0	0.3	0	0.01	
0.2	0.8	4.9	0.2	2.1	2	0.21	
0.3	1.7	5.8	0.3	3.1	5	0.37	
0.5	2.7	6.7	0.4	3.9	10	0.52	
0.7	3.8	7.6	0.5	4.5	17	0.65	
0.8	5.1	8.5	0.6	5.1	26	0.78	
1.0	6.5	9.4	0.7	5.6	37	0.91	
1.2	8.1	10.3	0.8	6.1	50	1.03	
1.3	9.8	11.2	0.9	6.6	65	1.14	
1.5	11.7	12.1	1.0	7.0	82	1.26	
1.7	13.6	13.0	1.0	7.4	101	1.37	
1.8	15.7	13.9	1.1	7.8	123	1.48	
2.0	18.0	14.8	1.2	8.2	147	1.59	
0.4	1.7	5.9	0.3	3.2	5	0.4	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Design:	Perimeter Channel Design No. 3
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	P2C
Storm:	100-year, 24-hour

Depth, H =	1.0	ft
Bottom Width, B =	4.0	ft
Left Side Slope, Z_1 =	3.3	horizontal :1 vertical
Right Side Slope, Z_2 =	2.5	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.0209	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.0	4.1	0.0	0.3	0	0.01	
0.2	0.8	5.1	0.2	2.1	2	0.20	
0.3	1.7	6.1	0.3	3.1	5	0.36	
0.5	2.8	7.1	0.4	3.8	11	0.51	
0.7	4.0	8.1	0.5	4.5	18	0.64	
0.8	5.4	9.2	0.6	5.0	27	0.77	
1.0	6.9	10.2	0.7	5.6	39	0.89	
1.2	8.7	11.2	0.8	6.1	52	1.01	
1.3	10.5	12.2	0.9	6.5	68	1.12	
1.5	12.6	13.2	0.9	6.9	87	1.24	
1.7	14.7	14.2	1.0	7.3	108	1.35	
1.8	17.1	15.3	1.1	7.7	132	1.46	
2.0	19.6	16.3	1.2	8.1	159	1.57	
0.4	1.8	6.2	0.3	3.1	6	0.4	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Perimeter Channel Design Calculations

Channel Design No. 04 (Reach Node P2D)

Design:	Perimeter Channel Design No. 4
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	P2D
Storm:	10-year, 24-hour

Depth, H =	2.0	ft
Bottom Width, B =	10.0	ft
Left Side Slope, Z_1 =	3.3	horizontal :1 vertical
Right Side Slope, Z_2 =	2.5	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.0109	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.1	10.1	0.0	0.2	0	0.01	
0.2	1.8	11.1	0.2	1.6	3	0.11	
0.3	3.8	12.1	0.3	2.4	9	0.21	
0.5	5.8	13.1	0.4	3.0	18	0.30	
0.7	8.0	14.1	0.6	3.6	29	0.39	
0.8	10.4	15.2	0.7	4.0	42	0.47	
1.0	13.0	16.2	0.8	4.5	58	0.55	
1.2	15.7	17.2	0.9	4.9	77	0.62	
1.3	18.5	18.2	1.0	5.2	97	0.69	
1.5	21.6	19.2	1.1	5.6	121	0.76	
1.7	24.8	20.2	1.2	5.9	147	0.83	
1.8	28.1	21.3	1.3	6.2	175	0.90	
2.0	31.6	22.3	1.4	6.5	207	0.96	
0.5	6.0	13.2	0.5	3.1	18	0.3	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Design:	Perimeter Channel Design No. 4
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	P2D
Storm:	25-year, 24-hour

Depth, H =	2.0	ft
Bottom Width, B =	10.0	ft
Left Side Slope, Z_1 =	3.3	horizontal :1 vertical
Right Side Slope, Z_2 =	2.5	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.0109	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.1	10.1	0.0	0.2	0	0.01	
0.2	1.8	11.1	0.2	1.6	3	0.11	
0.3	3.8	12.1	0.3	2.4	9	0.21	
0.5	5.8	13.1	0.4	3.0	18	0.30	
0.7	8.0	14.1	0.6	3.6	29	0.39	
0.8	10.4	15.2	0.7	4.0	42	0.47	
1.0	13.0	16.2	0.8	4.5	58	0.55	
1.2	15.7	17.2	0.9	4.9	77	0.62	
1.3	18.5	18.2	1.0	5.2	97	0.69	
1.5	21.6	19.2	1.1	5.6	121	0.76	
1.7	24.8	20.2	1.2	5.9	147	0.83	
1.8	28.1	21.3	1.3	6.2	175	0.90	
2.0	31.6	22.3	1.4	6.5	207	0.96	
0.6	7.0	13.7	0.5	3.3	23	0.3	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Design:	Perimeter Channel Design No. 4
Project:	Manning's Equation
Project:	SCA Final Cover Design
Node ID:	P2D
Storm:	100-year, 24-hour

Depth, H =	2.0	ft
Bottom Width, B =	10.0	ft
Left Side Slope, Z_1 =	3.3	horizontal :1 vertical
Right Side Slope, Z_2 =	2.5	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.030	
Longitudinal Channel Slope, S_o =	0.0109	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_o lb/ft^2	Comments
0.0	0.1	10.1	0.0	0.2	0	0.01	
0.2	1.8	11.1	0.2	1.6	3	0.11	
0.3	3.8	12.1	0.3	2.4	9	0.21	
0.5	5.8	13.1	0.4	3.0	18	0.30	
0.7	8.0	14.1	0.6	3.6	29	0.39	
0.8	10.4	15.2	0.7	4.0	42	0.47	
1.0	13.0	16.2	0.8	4.5	58	0.55	
1.2	15.7	17.2	0.9	4.9	77	0.62	
1.3	18.5	18.2	1.0	5.2	97	0.69	
1.5	21.6	19.2	1.1	5.6	121	0.76	
1.7	24.8	20.2	1.2	5.9	147	0.83	
1.8	28.1	21.3	1.3	6.2	175	0.90	
2.0	31.6	22.3	1.4	6.5	207	0.96	
0.7	8.1	14.2	0.6	3.6	29	0.4	DESIGN Q

Notes.

1. Allowable shear (tractive) stress for open channel with grass-legume mixture lining defined as 0.7 lb/ft^2 for "short native and bunch grass" (NRCS, 2014).

Written by:	**Antonio Sanchez**	Date:	**09/11/15**	Reviewed by:	**Tom Fendley / Jay Beech**	Date:	**09/11/15**

Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Cover Design**	Project No.:	**GD5497**	Phase No.:	**03**

Attachment 17: Road Spillway Design Calculations

Road Spillway	Inlet Invert Elevation (ft)	Spillway Depth (ft)	10-yr, 24-hr Storm			100-yr, 24-hr Storm	
			Flow Rate Velocity (fps)	Peak Water Surface Elevation (ft)	Freeboard (in.)	Peak Water Surface Elevation (ft)	Freeboard (ft)
West	428.2	3.0	2.8	429.5	20	430.0	1.2
East	431.8	2.4	2.7	432.9	16	433.3	0.9

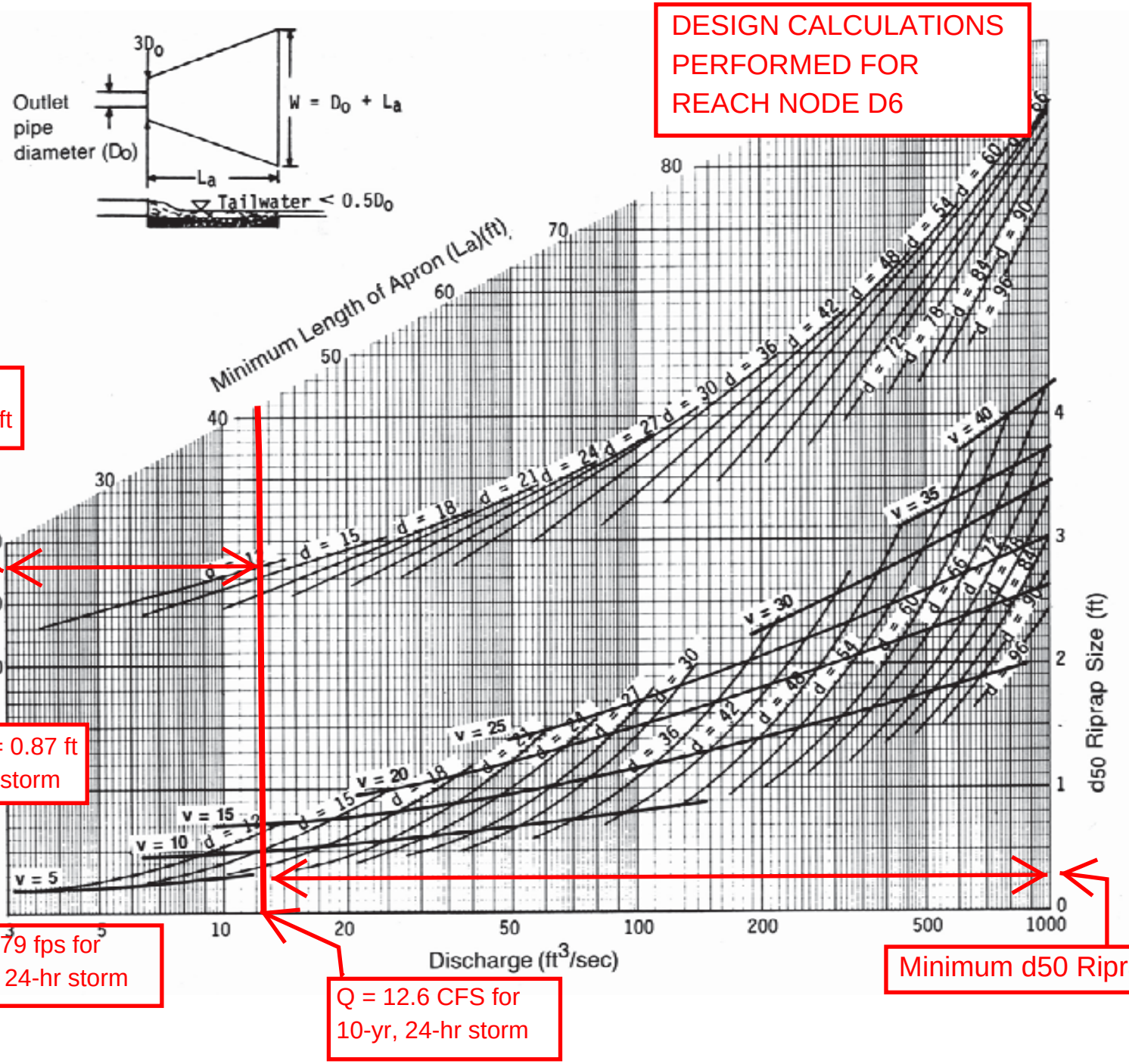
Written by:	**Antonio Sanchez**	Date:	**09/11/15**	Reviewed by:	**Tom Fendley / Jay Beech**	Date:	**09/11/15**

Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Cover Design**	Project No.:	**GD5497**	Phase No.:	**03**

Attachment 18: Rock Outlet Protection Apron Sizing Charts [NYSDEC, 2005]

Rock Outlet Protection Apron Diversion Berm Outlet Area

DESIGN CALCULATIONS PERFORMED FOR REACH NODE D6



Minimum Length of Apron (La) = 16 ft

Depth of Flow = 0.87 ft for 10-yr, 24-hr storm

V = 2.79 fps for 10-yr, 24-hr storm

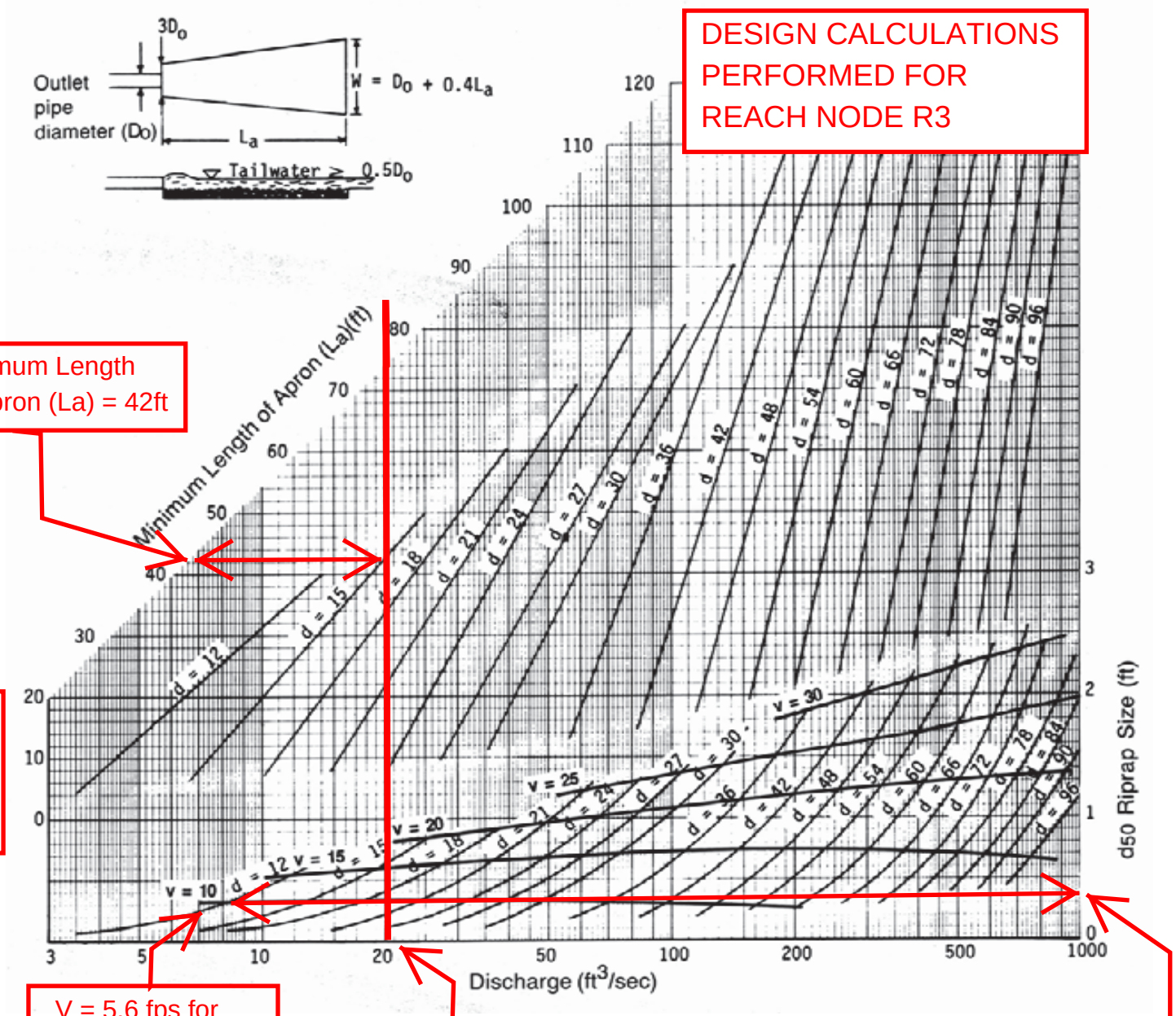
Q = 12.6 CFS for 10-yr, 24-hr storm

Minimum d50 Riprap Size = 0.3ft

Figure 5B.12
Outlet Protection Design—Minimum Tailwater Condition
(Design of Outlet Protection from a Round Pipe Flowing Full, Minimum Tailwater Condition: $T_w < 0.5D_o$) (USDA - NRCS)

Rock Outlet Protection Apron Riprap Chute Outlet Area

DESIGN CALCULATIONS PERFORMED FOR REACH NODE R3



Minimum Length of Apron (La) = 42ft

Depth of Flow = 0.26 ft for 10-yr, 24-hr storm

V = 5.6 fps for 10-yr, 24-hr storm

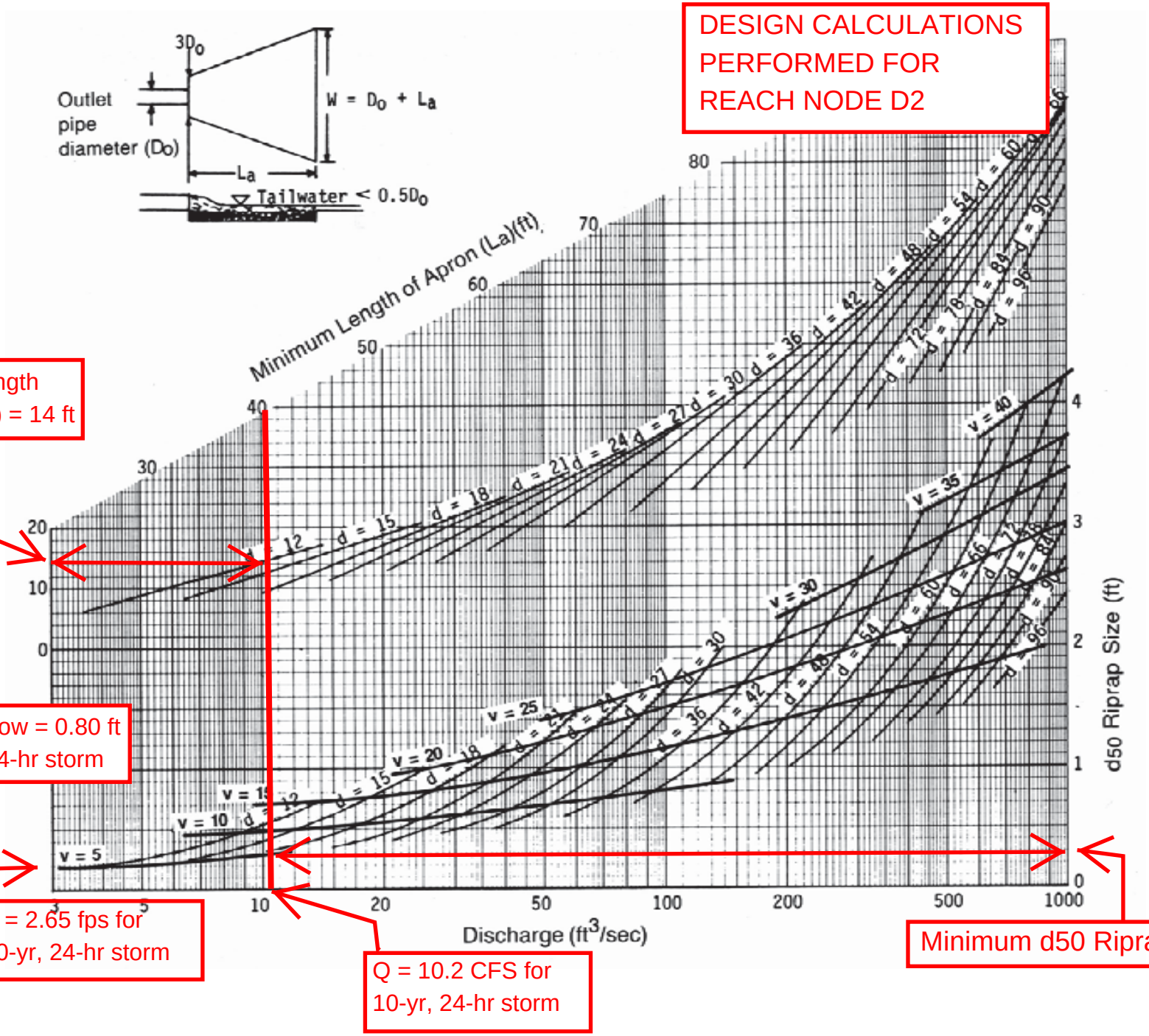
Q = 20.2 CFS for 10-yr, 24-hr storm

Minimum d50 Riprap Size = 0.3ft

Figure 5B.13
Outlet Protection Design—Maximum Tailwater Condition (Design of Outlet Protection from a Round Pipe Flowing Full, Maximum Tailwater Condition: $T_w \geq 0.5D_o$) (USDA - NRCS)

Rock Outlet Protection Apron Diversion Berm Outlet Area

DESIGN CALCULATIONS PERFORMED FOR REACH NODE D2



Minimum Length of Apron (La) = 14 ft

Depth of Flow = 0.80 ft for 10-yr, 24-hr storm

V = 2.65 fps for 10-yr, 24-hr storm

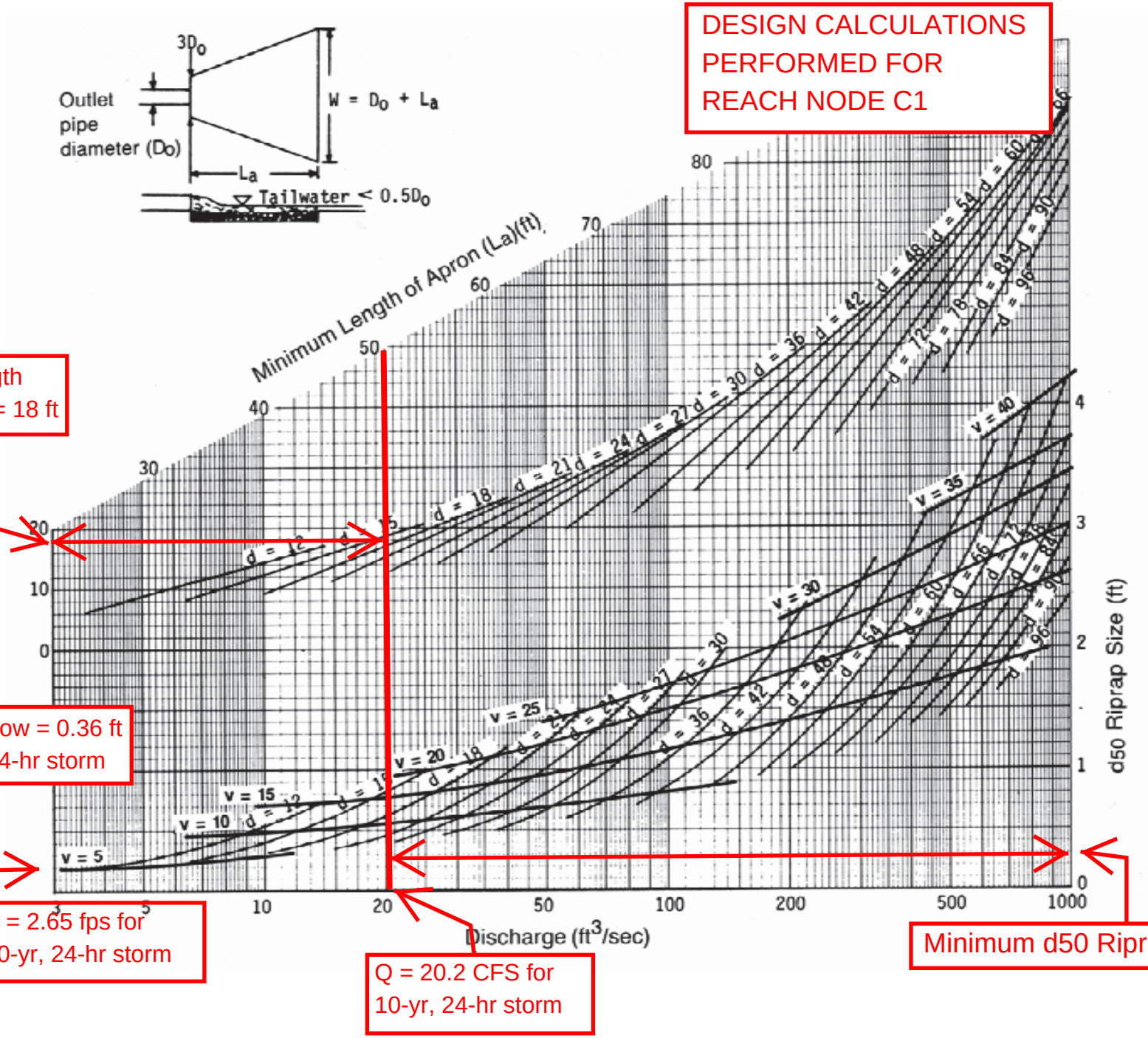
Q = 10.2 CFS for 10-yr, 24-hr storm

Minimum d50 Riprap Size = 0.3ft

Figure 5B.12
Outlet Protection Design—Minimum Tailwater Condition
(Design of Outlet Protection from a Round Pipe Flowing Full, Minimum Tailwater Condition: $T_w < 0.5D_o$) (USDA - NRCS)

Rock Outlet Protection Apron Main Deck Channel Outlet Area

DESIGN CALCULATIONS PERFORMED FOR REACH NODE C1



Minimum Length of Apron (La) = 18 ft

Depth of Flow = 0.36 ft for 10-yr, 24-hr storm

V = 2.65 fps for 10-yr, 24-hr storm

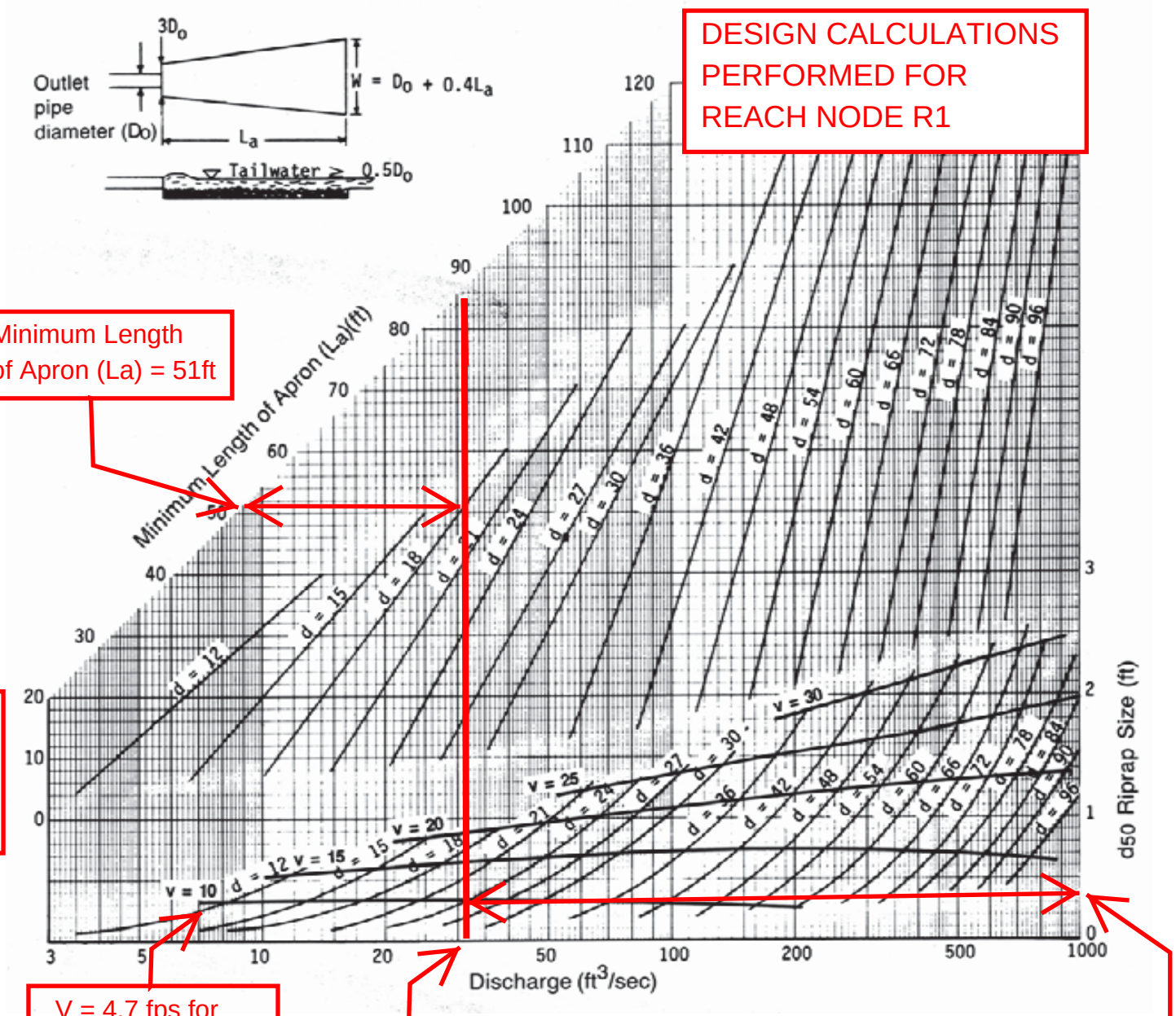
Q = 20.2 CFS for 10-yr, 24-hr storm

Minimum d50 Riprap Size = 0.3ft

Figure 5B.12
Outlet Protection Design—Minimum Tailwater Condition
(Design of Outlet Protection from a Round Pipe Flowing Full, Minimum Tailwater Condition: $T_w < 0.5D_o$) (USDA - NRCS)

Rock Outlet Protection Apron Riprap Chute Outlet Area

DESIGN CALCULATIONS PERFORMED FOR REACH NODE R1



Minimum Length of Apron (La) = 51ft

Depth of Flow = 0.19 ft for 10-yr, 24-hr storm

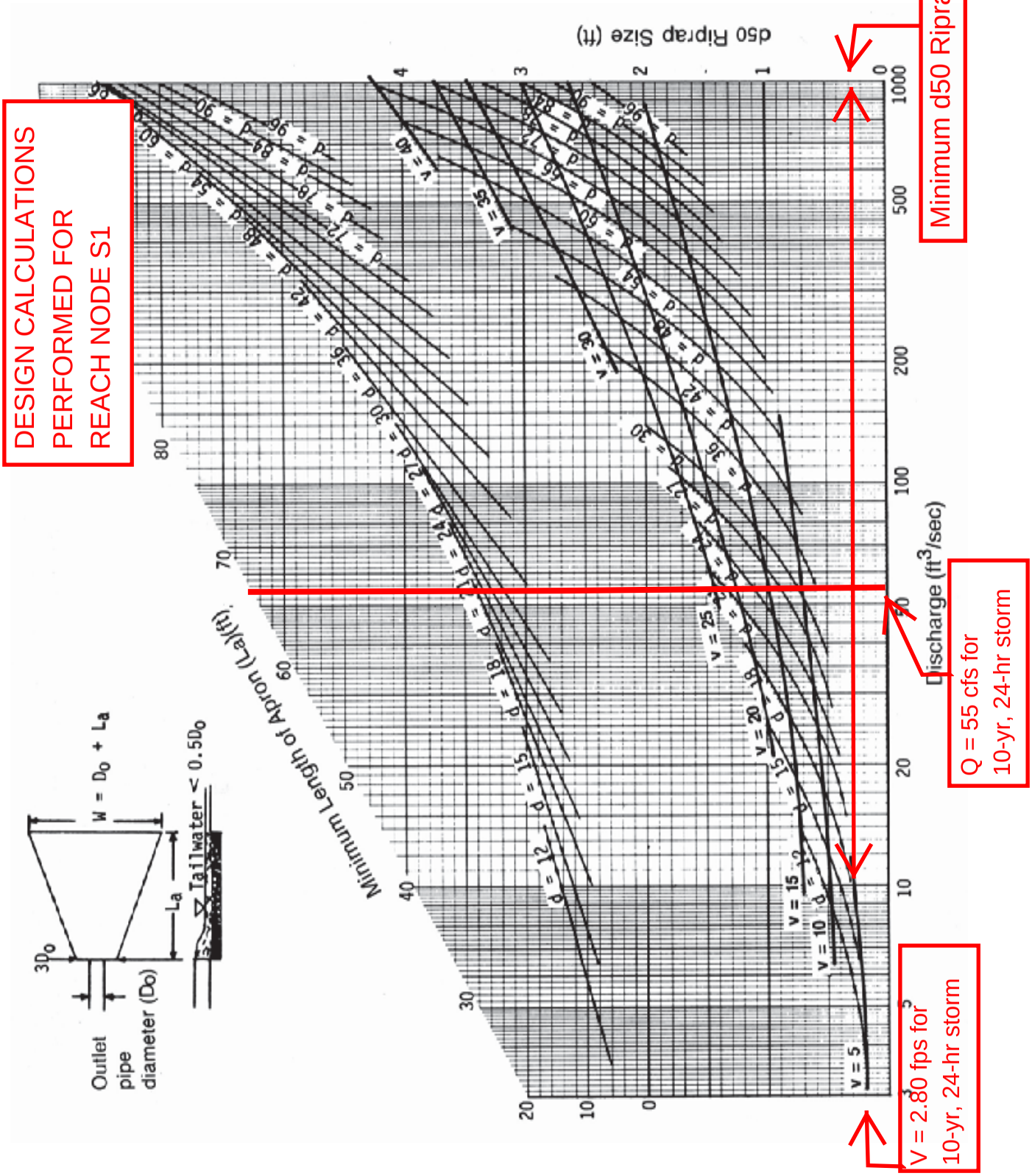
V = 4.7 fps for 10-yr, 24-hr storm

Q = 31.9 CFS for 10-yr, 24-hr storm

Minimum d50 Riprap Size = 0.3ft

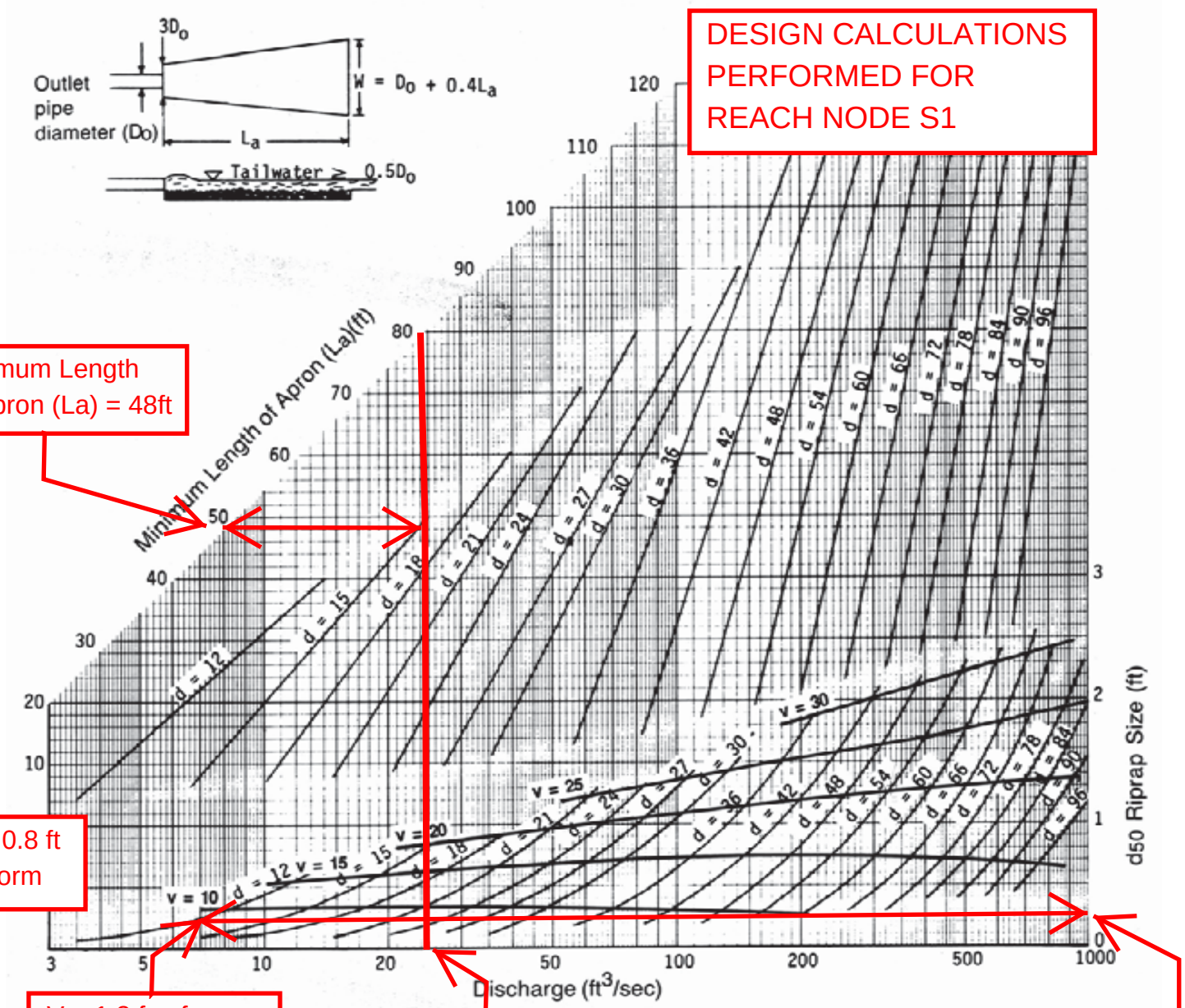
Figure 5B.13
Outlet Protection Design—Maximum Tailwater Condition (Design of Outlet Protection from a Round Pipe Flowing Full, Maximum Tailwater Condition: $T_w \geq 0.5D_o$) (USDA - NRCS)

Figure 5B.12
Outlet Protection Design—Minimum Tailwater Condition
(Design of Outlet Protection from a Round Pipe Flowing Full, Minimum Tailwater Condition: $T_w < 0.5D_o$) (USDA - NRCS)



Rock Outlet Protection Apron for Road Spillway Outlet Area

DESIGN CALCULATIONS PERFORMED FOR REACH NODE S1



Minimum Length of Apron = 48ft

Depth of Flow = 0.8 ft for 2-yr, 24-hr storm

V = 1.8 fps for 2-yr, 24-hr storm

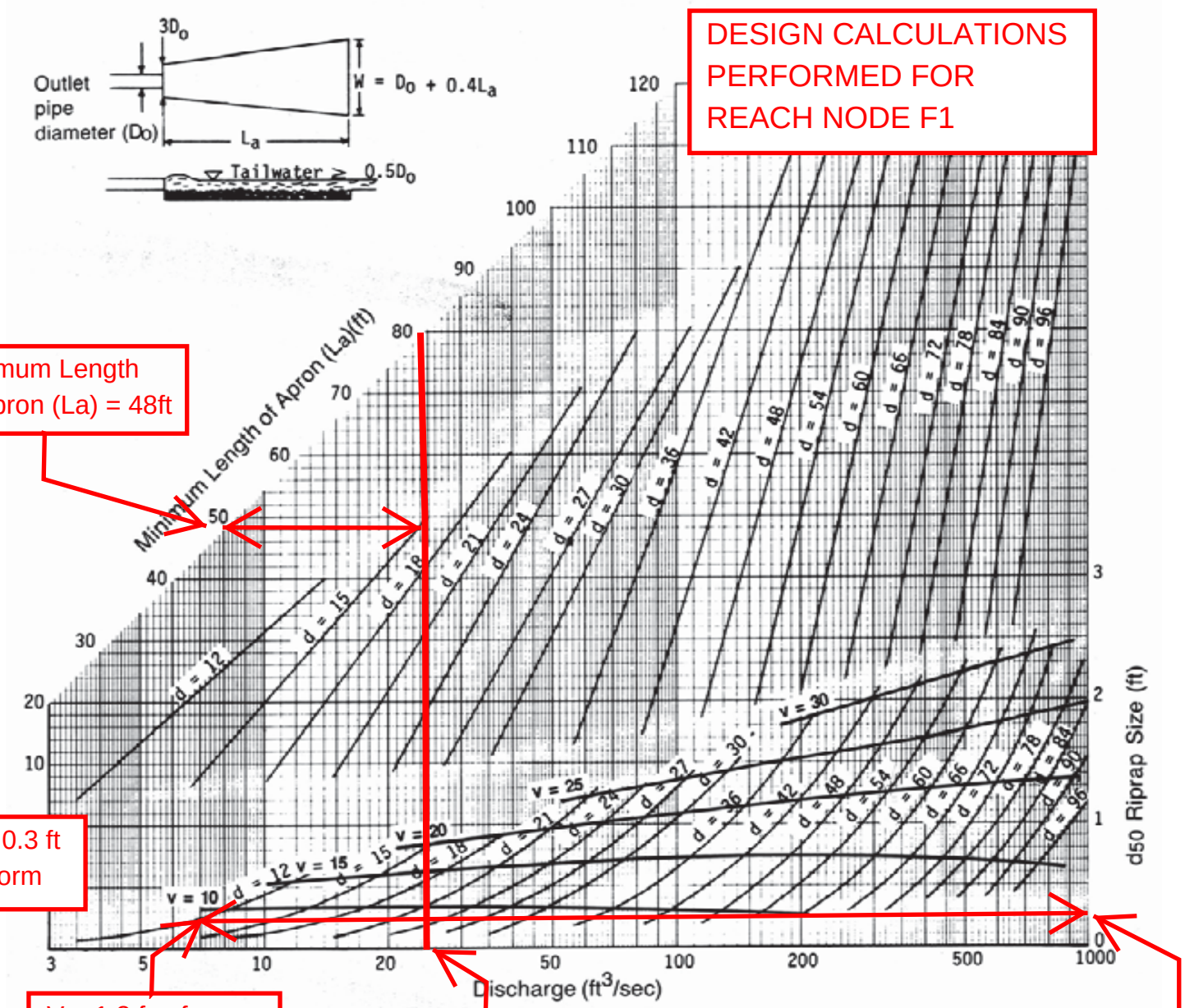
Q = 25 cfs for 2-yr, 24-hr storm

Minimum d50 Riprap Size = 0.3 ft

Figure 5B.13
Outlet Protection Design—Maximum Tailwater Condition
(Design of Outlet Protection from a Round Pipe Flowing Full, Maximum Tailwater Condition: $T_w \geq 0.5D_o$) (USDA - NRCS)

Rock Outlet Protection Apron for Filter Berm Outlet Area

DESIGN CALCULATIONS PERFORMED FOR REACH NODE F1



Minimum Length of Apron (La) = 48ft

Depth of Flow = 0.3 ft for 2-yr, 24-hr storm

V = 1.8 fps for 2-yr, 24-hr storm

Q = 25 cfs for 2-yr, 24-hr storm

Minimum d50 Riprap Size = 0.3 ft

Figure 5B.13
Outlet Protection Design—Maximum Tailwater Condition
(Design of Outlet Protection from a Round Pipe Flowing Full, Maximum Tailwater Condition: $T_w \geq 0.5D_o$) (USDA - NRCS)