TIMMONS GROUP

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Sediment & Erosion Control Report

Project: Prospect Hill Quarry & Distribution Center
Wrenn Road, Prospect Hill
Caswell County, NC

PROJECT No.: 44089

8/28/2019

REVISIONS:

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Sediment & Erosion Control Narrative

Sediment & Erosion Control Narrative

Existing Conditions Description

The proposed quarry and distribution center project is located northeast of the intersection of Ridgeville Road and Wrenn Road in Prospect Hill, Caswell County, NC. The parcel identification numbers are as follows: 0133 002; 0133 005; 0133 045; 0133 075; 0148 002. The site consists approximately 630 acres of mainly of agricultural fields and wooded land. Jurisdictional streams and wetlands are located throughout the site. The existing soils are Louisburg coarse sandy loam "LoC/ LoD/ LoE" in the Hydrologic Soils Group "A"; Chewacla loam "ChA", Cullen clay loam "CuB2", Riverview loam "RvA", and Rowan-Poindexter complex "RxE" in the Hydrologic Soils Group "B/D" and "B"; Enon sandy loam "EnB/ EnC/ EnD" and Vance sandy loam in the Hydrologic Soils Group "C"; and Helena sandy loam "HeB/ HeC" in the Hydrologic Soils Group "D". The majority of the site drains east toward Sugartree Creek and South Hyco Creek in the Roanoke River Basin. The surface water classification is WS-II; HQW. FIRM Panels 3710994200J and 3710995200K indicate the site does not lie within a special flood hazard area.

Erosion Control Summary

This project proposes a quarry and distribution center. Approximately 426.1 acres of land will be disturbed. Temporary sediment basins will be installed throughout the site to treat the majority of the disturbed area. The remainder of the disturbed area will be protected by silt fence with silt fence stone outlets. As the quarry and distribution center are developed, the site will be stabilized per NCDEQ requirements.

Erosion control measures for this site have been designed in accordance with NCDEQ standards and specifications.

NPDES/NCG01 Plan

The site has been designed to comply with NCDEQ NPDES Guidelines.

Sediment & Erosion Control Calculations

BASIN NAME		PROJECT NAME
BASIN 1	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 1

Modified Rational

Highest Elevation =	698	feet
Inlet Elevation =	687	feet
Difference =	11	feet
Travel Length =	900	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	8.02	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	7.68	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	7.68	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **17.83** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 1	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 1 TYPE OF BASIN: SKIMMER

Disturbed Area:	7.68	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	7.68	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**17.83**	cfs

Sizing of Basin

13824 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)

5796 Required Surface Area ft^2 **(Q25 x 325)**

53.8 Suggested Width ft

107.7 Suggested Length ft

65 Width at Surface Area (ft)

130 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**

3 Side Slope Ratio Z:1

2 Depth (ft)

53 Bottom Width (ft)

118 Bottom Length (ft)

6254 Bottom Area ($ft^{2)}$

14656 Actual Volume (ft^3) **Okay**

8450 Actual Surface Area (ft^2) **Okay**

20 Emergency Spillway Width (ft)

0.5 Depth of Flow (ft)

21.2 Spillway Capacity (cfs) **Okay**

2 Skimmer Size (in)

0.167 Head on Skimmer (ft)

1.75 Orifice Size (1/4 inch increments)

4.78 Dewatering Time (days)

Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
685.00	**6254**	0.00	0	0
686.00	**7316**	1.00	6785	6785
687.00	**8450**	2.00	7883	14668
688.00	**9656**	3.00	9053	23721

Emergency Spillway Elevation:	687.00	ft
Top of Embankment Elevation:	688.00	ft
Bottom Elevation:	685.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 2	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 2

Modified Rational

Highest Elevation =	702	feet
Inlet Elevation =	661	feet
Difference =	41	feet
Travel Length =	1,900	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc =Time of Concentration (min)

H =Height of the most remote point on the watershed above the outlet (ft)

L =Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	11.45	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	22.82	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	22.82	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **52.99** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 2	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 2 TYPE OF BASIN: RISER

Disturbed Area:	22.82	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	22.82	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**52.99**	cfs

Sizing of Basin

41076 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)
23050 Required Surface Area ft^2 **(Q25 x 435)**
107.4 Suggested Width ft
214.7 Suggested Length ft

110 Width at Surface Area (ft)
220 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**
3 Side Slope Ratio Z:1
2 Depth (ft)
98 Bottom Width (ft)
208 Bottom Length (ft)
20384 Bottom Area ($ft^{2)}$
44536 Actual Volume (ft^3) **Okay**
24200 Actual Surface Area (ft^2) **Okay**

50 Emergency Spillway Width (ft)
0.5 Depth of Flow (ft)
53.0 Spillway Capacity (cfs) **Okay**

3 Skimmer Size (in)
0.25 Head on Skimmer (ft)
3 Orifice Size (1/4 inch increments)
3.95 Dewatering Time (days)
Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
659.00	**20384**	0.00	0	0
660.00	**22256**	1.00	21320	21320
661.00	**24200**	2.00	23228	44548
662.00	**26216**	3.00	25208	69756
663.00	**28304**	4.00	27260	97016

Riser Elevation:	661.00	ft
Emergency Spillway Elevation:	662.00	ft
Top of Embankment Elevation:	663.00	ft
Bottom Elevation:	659.00	ft
Embankment Width:	**10**	ft

Sizing of Barrel & Riser

12 Barrel Size (in)
43 Barrel Length (LF)
659 Upstream Barrel Invert Elevation
658 Downstream Barrel Invert Elevation
2.33% Slope of Barrel (%)
HDPE Barrel Pipe Material
CMP Riser Material
18 Riser Size (in) **Okay (Riser = 1.5 Barrel Size)**

Anti-Flotation Device (Only use for circular riser)

1.5 Riser Diameter (ft)
3.0 Height (ft)

380 Buoyant Force (lbs) — Area Riser x Ht Riser x Density Water x Safety Factor (.25)(pi)(Diameter)2 x (Height) x 62.4 pcf x 1.15 FS
2.5 Volume Required (cf) — Buoyant force / Density Of Concrete (150 pcf)
1.6 Square Root of Volume (ft) — (Assume 1 ft thick concrete footing)
2.0 Length of Concrete Footing
2.0 Width of Concrete Footing
1.0 Height of Concrete Footing (Thickness)
4 Volume Provided (cf)

***RED IS USER INPUT**

BASIN NAME		PROJECT NAME
BASIN 3	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 3

Modified Rational

Highest Elevation =	680	feet
Inlet Elevation =	654	feet
Difference =	26	feet
Travel Length =	970	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc =Time of Concentration (min)

H =Height of the most remote point on the watershed above the outlet (ft)

L =Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	6.28	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	13.45	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	13.45	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **31.23** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 3	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 3 TYPE OF BASIN: RISER

Disturbed Area:	13.45	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	13.45	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**31.23**	cfs

Sizing of Basin

24210 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)
13585 Required Surface Area ft^2 **(Q25 x 435)**
82.4 Suggested Width ft
164.8 Suggested Length ft

90 Width at Surface Area (ft)
180 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**
3 Side Slope Ratio Z:1
2 Depth (ft)
78 Bottom Width (ft)
168 Bottom Length (ft)
13104 Bottom Area ($ft^{2)}$
29256 Actual Volume (ft^3) **Okay**
16200 Actual Surface Area (ft^2) **Okay**

30 Emergency Spillway Width (ft)
0.5 Depth of Flow (ft)
31.8 Spillway Capacity (cfs) **Okay**

2.5 Skimmer Size (in)
0.208 Head on Skimmer (ft)
2.5 Orifice Size (1/4 inch increments)
3.68 Dewatering Time (days)
Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
652.00	**13104**	0.00	0	0
653.00	**14616**	1.00	13860	13860
654.00	**16200**	2.00	15408	29268
655.00	**17856**	3.00	17028	46296
656.00	**19584**	4.00	18720	65016

Riser Elevation:	654.00	ft
Emergency Spillway Elevation:	655.00	ft
Top of Embankment Elevation:	656.00	ft
Bottom Elevation:	652.00	ft
Embankment Width:	**10**	ft

Sizing of Barrel & Riser

12 Barrel Size (in)
38 Barrel Length (LF)
652 Upstream Barrel Invert Elevation
651.5 Downstream Barrel Invert Elevation
1.32% Slope of Barrel (%)
HDPE Barrel Pipe Material
CMP Riser Material
18 Riser Size (in) **Okay (Riser = 1.5 Barrel Size)**

Anti-Flotation Device (Only use for circular riser)

1.5 Riser Diameter (ft)
3.0 Height (ft)

380 Buoyant Force (lbs) — Area Riser x Ht Riser x Density Water x Safety Factor (.25)(pi)(Diameter)2 x (Height) x 62.4 pcf x 1.15 FS
2.5 Volume Required (cf) — Buoyant force / Density Of Concrete (150 pcf)
1.6 Square Root of Volume (ft) — (Assume 1 ft thick concrete footing)
2.0 Length of Concrete Footing
2.0 Width of Concrete Footing
1.0 Height of Concrete Footing (Thickness)
4 Volume Provided (cf)

***RED IS USER INPUT**

BASIN NAME		PROJECT NAME
BASIN 4	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 4

Modified Rational

Highest Elevation =	692	feet
Inlet Elevation =	648	feet
Difference =	44	feet
Travel Length =	1,485	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	8.38	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	11.47	acres
Additional Drainage Area =	0.33	acres
Total Drainage Area=	11.80	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **27.40** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 4	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 4 TYPE OF BASIN: RISER

Disturbed Area:	11.47	ac
Additional Drainage Area:	0.33	ac
Total Drainage Area:	11.80	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**27.40**	cfs

Sizing of Basin

20646 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)
11919 Required Surface Area ft^2 **(Q25 x 435)**
77.2 Suggested Width ft
154.4 Suggested Length ft

80 Width at Surface Area (ft)
160 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**
3 Side Slope Ratio Z:1
2 Depth (ft)
68 Bottom Width (ft)
148 Bottom Length (ft)
10064 Bottom Area ($ft^{2)}$
22816 Actual Volume (ft^3) **Okay**
12800 Actual Surface Area (ft^2) **Okay**

30 Emergency Spillway Width (ft)
0.5 Depth of Flow (ft)
31.8 Spillway Capacity (cfs) **Okay**

2.5 Skimmer Size (in)
0.208 Head on Skimmer (ft)
2 Orifice Size (1/4 inch increments)
4.90 Dewatering Time (days)
Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
646.00	**10064**	0.00	0	0
647.00	**11396**	1.00	10730	10730
648.00	**12800**	2.00	12098	22828
649.00	**14276**	3.00	13538	36366
650.00	**15824**	4.00	15050	51416

Riser Elevation:	648.00	ft
Emergency Spillway Elevation:	649.00	ft
Top of Embankment Elevation:	650.00	ft
Bottom Elevation:	646.00	ft
Embankment Width:	**10**	ft

Sizing of Barrel & Riser

12 Barrel Size (in)
53 Barrel Length (LF)
646 Upstream Barrel Invert Elevation
645 Downstream Barrel Invert Elevation
1.89% Slope of Barrel (%)
HDPE Barrel Pipe Material
CMP Riser Material
18 Riser Size (in) **Okay (Riser = 1.5 Barrel Size)**

Anti-Flotation Device (Only use for circular riser)

1.5 Riser Diameter (ft)
3.0 Height (ft)

380 Buoyant Force (lbs) — Area Riser x Ht Riser x Density Water x Safety Factor (.25)(pi)(Diameter)2 x (Height) x 62.4 pcf x 1.15 FS
2.5 Volume Required (cf) — Buoyant force / Density Of Concrete (150 pcf)
1.6 Square Root of Volume (ft) — (Assume 1 ft thick concrete footing)
2.0 Length of Concrete Footing
2.0 Width of Concrete Footing
1.0 Height of Concrete Footing (Thickness)
4 Volume Provided (cf)

***RED IS USER INPUT**

BASIN NAME		PROJECT NAME
BASIN 5	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 5

Modified Rational

Highest Elevation =	678	feet
Inlet Elevation =	653	feet
Difference =	25	feet
Travel Length =	450	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	2.62	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	3.34	acres
Additional Drainage Area =	0.35	acres
Total Drainage Area=	3.69	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **8.57** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 5	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 5 TYPE OF BASIN: SKIMMER

Disturbed Area:	3.34	ac
Additional Drainage Area:	0.35	ac
Total Drainage Area:	3.69	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**8.57**	cfs

Sizing of Basin

6012 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)
2785 Required Surface Area ft^2 **(Q25 x 325)**
37.3 Suggested Width ft
74.6 Suggested Length ft

45 Width at Surface Area (ft)
90 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**
3 Side Slope Ratio Z:1
2 Depth (ft)
33 Bottom Width (ft)
78 Bottom Length (ft)
2574 Bottom Area ($ft^{2)}$
6576 Actual Volume (ft^3) **Okay**
4050 Actual Surface Area (ft^2) **Okay**

10 Emergency Spillway Width (ft)
0.5 Depth of Flow (ft)
10.6 Spillway Capacity (cfs) **Okay**

2.5 Skimmer Size (in)
0.208 Head on Skimmer (ft)
1.25 Orifice Size (1/4 inch increments)
3.65 Dewatering Time (days)
Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
651.00	**2574**	0.00	0	0
652.00	**3276**	1.00	2925	2925
653.00	**4050**	2.00	3663	6588
654.00	**4896**	3.00	4473	11061

Emergency Spillway Elevation:	653.00	ft
Top of Embankment Elevation:	654.00	ft
Bottom Elevation:	651.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 6	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 6

Modified Rational

Highest Elevation =	677	feet
Inlet Elevation =	638	feet
Difference =	39	feet
Travel Length =	1,000	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc =Time of Concentration (min)

H =Height of the most remote point on the watershed above the outlet (ft)

L =Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	5.56	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	6.18	acres
Additional Drainage Area =	1.71	acres
Total Drainage Area=	7.89	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **18.32** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 6	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 6 TYPE OF BASIN: SKIMMER

Disturbed Area:	6.18	ac
Additional Drainage Area:	1.71	ac
Total Drainage Area:	7.89	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**18.32**	cfs

Sizing of Basin

11124 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)
5954 Required Surface Area ft^2 **(Q25 x 325)**
54.6 Suggested Width ft
109.1 Suggested Length ft

60 Width at Surface Area (ft)
120 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**
3 Side Slope Ratio Z:1
2 Depth (ft)
48 Bottom Width (ft)
108 Bottom Length (ft)
5184 Bottom Area ($ft^{2)}$
12336 Actual Volume (ft^3) **Okay**
7200 Actual Surface Area (ft^2) **Okay**

20 Emergency Spillway Width (ft)
0.5 Depth of Flow (ft)
21.2 Spillway Capacity (cfs) **Okay**

2 Skimmer Size (in)
0.167 Head on Skimmer (ft)
1.75 Orifice Size (1/4 inch increments)
3.85 Dewatering Time (days)
Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
636.00	**5184**	0.00	0	0
637.00	**6156**	1.00	5670	5670
638.00	**7200**	2.00	6678	12348
639.00	**8316**	3.00	7758	20106

Emergency Spillway Elevation:	638.00	ft
Top of Embankment Elevation:	639.00	ft
Bottom Elevation:	636.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 7	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 7

Modified Rational

Highest Elevation =	666	feet
Inlet Elevation =	628	feet
Difference =	38	feet
Travel Length =	873	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	4.80	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	8.58	acres
Additional Drainage Area =	0.84	acres
Total Drainage Area=	9.42	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **21.87** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 7	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 7 TYPE OF BASIN: SKIMMER

Disturbed Area:	8.58	ac
Additional Drainage Area:	0.84	ac
Total Drainage Area:	9.42	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**21.87**	cfs

Sizing of Basin

15444 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)
7109 Required Surface Area ft^2 **(Q25 x 325)**
59.6 Suggested Width ft
119.2 Suggested Length ft

65 Width at Surface Area (ft)
140 Length at Surface Area (ft) L/W Ratio = 2.2 **Okay**
3 Side Slope Ratio Z:1
2 Depth (ft)
53 Bottom Width (ft)
128 Bottom Length (ft)
6784 Bottom Area ($ft^{2)}$
15836 Actual Volume (ft^3) **Okay**
9100 Actual Surface Area (ft^2) **Okay**

25 Emergency Spillway Width (ft)
0.5 Depth of Flow (ft)
26.5 Spillway Capacity (cfs) **Okay**

2.5 Skimmer Size (in)
0.208 Head on Skimmer (ft)
2 Orifice Size (1/4 inch increments)
3.66 Dewatering Time (days)
Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
626.00	**6784**	0.00	0	0
627.00	**7906**	1.00	7345	7345
628.00	**9100**	2.00	8503	15848
629.00	**10366**	3.00	9733	25581

Emergency Spillway Elevation:	628.00	ft
Top of Embankment Elevation:	629.00	ft
Bottom Elevation:	626.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 8	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 8

Modified Rational

Highest Elevation =	634	feet
Inlet Elevation =	612	feet
Difference =	22	feet
Travel Length =	535	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	3.37	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	2.05	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	2.05	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **4.76** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 8	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 8 TYPE OF BASIN: SKIMMER

Disturbed Area:	2.05	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	2.05	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**4.76**	cfs

Sizing of Basin

3690 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)
1547 Required Surface Area ft^2 **(Q25 x 325)**
27.8 Suggested Width ft
55.6 Suggested Length ft

35 Width at Surface Area (ft)
70 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**
3 Side Slope Ratio Z:1
2 Depth (ft)
23 Bottom Width (ft)
58 Bottom Length (ft)
1334 Bottom Area ($ft^{2)}$
3736 Actual Volume (ft^3) **Okay**
2450 Actual Surface Area (ft^2) **Okay**

10 Emergency Spillway Width (ft)
0.5 Depth of Flow (ft)
10.6 Spillway Capacity (cfs) **Okay**

2 Skimmer Size (in)
0.167 Head on Skimmer (ft)
1 Orifice Size (1/4 inch increments)
3.91 Dewatering Time (days)
Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
610.00	**1334**	0.00	0	0
611.00	**1856**	1.00	1595	1595
612.00	**2450**	2.00	2153	3748
613.00	**3116**	3.00	2783	6531

Emergency Spillway Elevation:	612.00	ft
Top of Embankment Elevation:	613.00	ft
Bottom Elevation:	610.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 9	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 9

Modified Rational

Highest Elevation =	676	feet
Inlet Elevation =	636	feet
Difference =	40	feet
Travel Length =	1,370	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc =Time of Concentration (min)

H =Height of the most remote point on the watershed above the outlet (ft)

L =Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	7.92	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	10.69	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	10.69	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **24.82** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 9	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 9 TYPE OF BASIN: RISER

Disturbed Area:	10.69	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	10.69	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**24.82**	cfs

Sizing of Basin

19242 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)
10798 Required Surface Area ft^2 **(Q25 x 435)**
73.5 Suggested Width ft
147.0 Suggested Length ft

75 Width at Surface Area (ft)
150 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**
3 Side Slope Ratio Z:1
2 Depth (ft)
63 Bottom Width (ft)
138 Bottom Length (ft)
8694 Bottom Area ($ft^{2)}$
19896 Actual Volume (ft^3) **Okay**
11250 Actual Surface Area (ft^2) **Okay**

25 Emergency Spillway Width (ft)
0.5 Depth of Flow (ft)
26.5 Spillway Capacity (cfs) **Okay**

2.5 Skimmer Size (in)
0.208 Head on Skimmer (ft)
2 Orifice Size (1/4 inch increments)
4.57 Dewatering Time (days)
Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
634.00	**8694**	0.00	0	0
635.00	**9936**	1.00	9315	9315
636.00	**11250**	2.00	10593	19908
637.00	**12636**	3.00	11943	31851
638.00	**14094**	4.00	13365	45216

Riser Elevation:	636.00	ft
Emergency Spillway Elevation:	637.00	ft
Top of Embankment Elevation:	638.00	ft
Bottom Elevation:	634.00	ft
Embankment Width:	**10**	ft

Sizing of Barrel & Riser

12 Barrel Size (in)
42 Barrel Length (LF)
634 Upstream Barrel Invert Elevation
633 Downstream Barrel Invert Elevation
2.38% Slope of Barrel (%)
HDPE Barrel Pipe Material
CMP Riser Material
18 Riser Size (in) **Okay (Riser = 1.5 Barrel Size)**

Anti-Flotation Device (Only use for circular riser)

1.5 Riser Diameter (ft)
3.0 Height (ft)

		Area Riser x Ht Riser x Density Water x Safety Factor
380	Buoyant Force (lbs)	(.25)(pi)(Diameter)2 x (Height) x 62.4 pcf x 1.15 FS
2.5	Volume Required (cf)	Buoyant force / Density Of Concrete (150 pcf)
1.6	Square Root of Volume (ft)	(Assume 1 ft thick concrete footing)

2.0 Length of Concrete Footing
2.0 Width of Concrete Footing
1.0 Height of Concrete Footing (Thickness)
4 Volume Provided (cf)

***RED IS USER INPUT**

BASIN NAME		PROJECT NAME
BASIN 10	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 10 TYPE OF BASIN: SKIMMER

Disturbed Area:	7.71	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	7.71	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**17.90**	cfs

Sizing of Basin

13878 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)

5818 Required Surface Area ft^2 **(Q25 x 325)**

53.9 Suggested Width ft

107.9 Suggested Length ft

65 Width at Surface Area (ft)

130 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**

3 Side Slope Ratio Z:1

2 Depth (ft)

53 Bottom Width (ft)

118 Bottom Length (ft)

6254 Bottom Area ($ft^{2)}$

14656 Actual Volume (ft^3) **Okay**

8450 Actual Surface Area (ft^2) **Okay**

20 Emergency Spillway Width (ft)

0.5 Depth of Flow (ft)

21.2 Spillway Capacity (cfs) **Okay**

2.5 Skimmer Size (in)

0.208 Head on Skimmer (ft)

2 Orifice Size (1/4 inch increments)

3.29 Dewatering Time (days)

Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
647.00	**6254**	0.00	0	0
648.00	**7316**	1.00	6785	6785
649.00	**8450**	2.00	7883	14668
650.00	**9656**	3.00	9053	23721

Emergency Spillway Elevation:	649.00	ft
Top of Embankment Elevation:	650.00	ft
Bottom Elevation:	647.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 10	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 10 TYPE OF BASIN: SKIMMER

Disturbed Area:	7.71	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	7.71	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**17.90**	cfs

Sizing of Basin

13878 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)

5818 Required Surface Area ft^2 **(Q25 x 325)**

53.9 Suggested Width ft

107.9 Suggested Length ft

65 Width at Surface Area (ft)

130 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**

3 Side Slope Ratio Z:1

2 Depth (ft)

53 Bottom Width (ft)

118 Bottom Length (ft)

6254 Bottom Area ($ft^{2)}$

14656 Actual Volume (ft^3) **Okay**

8450 Actual Surface Area (ft^2) **Okay**

20 Emergency Spillway Width (ft)

0.5 Depth of Flow (ft)

21.2 Spillway Capacity (cfs) **Okay**

2.5 Skimmer Size (in)

0.208 Head on Skimmer (ft)

2 Orifice Size (1/4 inch increments)

3.29 Dewatering Time (days)

Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
647.00	**6254**	0.00	0	0
648.00	**7316**	1.00	6785	6785
649.00	**8450**	2.00	7883	14668
650.00	**9656**	3.00	9053	23721

Emergency Spillway Elevation:	649.00	ft
Top of Embankment Elevation:	650.00	ft
Bottom Elevation:	647.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 11	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 11

Modified Rational

Highest Elevation =	669	feet
Inlet Elevation =	628	feet
Difference =	41	feet
Travel Length =	1,320	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc =Time of Concentration (min)

H =Height of the most remote point on the watershed above the outlet (ft)

L =Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	7.52	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	13.65	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	13.65	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **31.70** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 11	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 11 TYPE OF BASIN: RISER

Disturbed Area:	13.65	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	13.65	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**31.70**	cfs

Sizing of Basin

24570	Required Volume ft^3	(Disturbed Area x 1800 cf/ac)	
13787	Required Surface Area ft^2	**(Q25 x 435)**	
83.0	Suggested Width ft		
166.1	Suggested Length ft		
85	Width at Surface Area (ft)		
170	Length at Surface Area (ft)	L/W Ratio = 2.0	**Okay**
3	Side Slope Ratio Z:1		
2	Depth (ft)		
73	Bottom Width (ft)		
158	Bottom Length (ft)		
11534	Bottom Area ($ft^{2)}$		
25936	Actual Volume (ft^3)	**Okay**	
14450	Actual Surface Area (ft^2)	**Okay**	
35	Emergency Spillway Width (ft)		
0.5	Depth of Flow (ft)		
37.1	Spillway Capacity (cfs)	**Okay**	
2.5	Skimmer Size (in)		
0.208	Head on Skimmer (ft)		
2.5	Orifice Size (1/4 inch increments)		
3.73	Dewatering Time (days)		
	Suggest about 3 days		

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
626.00	**13104**	0.00	0	0
627.00	**14606**	1.00	13855	13855
628.00	**16200**	2.00	15403	29258
629.00	**17856**	3.00	17028	46286
630.00	**19576**	4.00	18716	65002

Riser Elevation:	628.00	ft
Emergency Spillway Elevation:	629.00	ft
Top of Embankment Elevation:	630.00	ft
Bottom Elevation:	626.00	ft
Embankment Width:	**10**	ft

Sizing of Barrel & Riser

12	Barrel Size (in)	
78	Barrel Length (LF)	
629	Upstream Barrel Invert Elevation	
628	Downstream Barrel Invert Elevation	
1.28%	Slope of Barrel (%)	
HDPE	Barrel Pipe Material	
CMP	Riser Material	
18	Riser Size (in)	**Okay (Riser = 1.5 Barrel Size)**

Anti-Flotation Device (Only use for circular riser)

1.5	Riser Diameter (ft)	
3.0	Height (ft)	
380	Buoyant Force (lbs)	Area Riser x Ht Riser x Density Water x Safety Factor (.25)(pi)(Diameter)2 x (Height) x 62.4 pcf x 1.15 FS
2.5	Volume Required (cf)	Buoyant force / Density Of Concrete (150 pcf)
1.6	Square Root of Volume (ft)	(Assume 1 ft thick concrete footing)
2.0	Length of Concrete Footing	
2.0	Width of Concrete Footing	
1.0	Height of Concrete Footing (Thickness)	
4	Volume Provided (cf)	

***RED IS USER INPUT**

BASIN NAME		PROJECT NAME
BASIN 12	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 12

Modified Rational

Highest Elevation =	666	feet
Inlet Elevation =	621	feet
Difference =	45	feet
Travel Length =	840	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	4.30	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	5.05	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	5.05	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **11.73** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 12	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 12 TYPE OF BASIN: SKIMMER

Disturbed Area:	5.05	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	5.05	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**11.73**	cfs

Sizing of Basin

9090 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)
3811 Required Surface Area ft^2 **(Q25 x 325)**
43.7 Suggested Width ft
87.3 Suggested Length ft

55 Width at Surface Area (ft)
110 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**
3 Side Slope Ratio Z:1
2 Depth (ft)
43 Bottom Width (ft)
98 Bottom Length (ft)
4214 Bottom Area ($ft^{2)}$
10216 Actual Volume (ft^3) **Okay**
6050 Actual Surface Area (ft^2) **Okay**

15 Emergency Spillway Width (ft)
0.5 Depth of Flow (ft)
15.9 Spillway Capacity (cfs) **Okay**

2.5 Skimmer Size (in)
0.208 Head on Skimmer (ft)
1.5 Orifice Size (1/4 inch increments)
3.83 Dewatering Time (days)
Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
619.00	**4214**	0.00	0	0
620.00	**5096**	1.00	4655	4655
621.00	**6050**	2.00	5573	10228
622.00	**7076**	3.00	6563	16791

Emergency Spillway Elevation:	621.00	ft
Top of Embankment Elevation:	622.00	ft
Bottom Elevation:	619.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 13	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 13

Modified Rational

Highest Elevation =	666	feet
Inlet Elevation =	618	feet
Difference =	48	feet
Travel Length =	1,370	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc =Time of Concentration (min)

H =Height of the most remote point on the watershed above the outlet (ft)

L =Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	7.39	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	8.25	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	8.25	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **19.16** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 13	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 13 TYPE OF BASIN: SKIMMER

Disturbed Area:	8.25	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	8.25	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**19.16**	cfs

Sizing of Basin

14850 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)
6226 Required Surface Area ft^2 **(Q25 x 325)**
55.8 Suggested Width ft
111.6 Suggested Length ft

60 Width at Surface Area (ft)
120 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**
3 Side Slope Ratio Z:1
3 Depth (ft)
42 Bottom Width (ft)
102 Bottom Length (ft)
4284 Bottom Area ($ft^{2)}$
17064 Actual Volume (ft^3) **Okay**
7200 Actual Surface Area (ft^2) **Okay**

20 Emergency Spillway Width (ft)
0.5 Depth of Flow (ft)
21.2 Spillway Capacity (cfs) **Okay**

2.5 Skimmer Size (in)
0.208 Head on Skimmer (ft)
2 Orifice Size (1/4 inch increments)
3.52 Dewatering Time (days)
Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
615.00	**4284**	0.00	0	0
616.00	**5184**	1.00	4734	4734
617.00	**6156**	2.00	5670	10404
618.00	**7200**	3.00	6678	17082
619.00	**8316**	4.00	7758	24840

Emergency Spillway Elevation:	618.00	ft
Top of Embankment Elevation:	619.00	ft
Bottom Elevation:	615.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 14	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 14

Modified Rational

Highest Elevation =	641	feet
Inlet Elevation =	599	feet
Difference =	42	feet
Travel Length =	775	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	4.03	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	3.95	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	3.95	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **9.17** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 14	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 14 TYPE OF BASIN: SKIMMER

Disturbed Area:	3.95	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	3.95	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**9.17**	cfs

Sizing of Basin

7110 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)
2981 Required Surface Area ft^2 **(Q25 x 325)**
38.6 Suggested Width ft
77.2 Suggested Length ft

50 Width at Surface Area (ft)
100 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**
3 Side Slope Ratio Z:1
2 Depth (ft)
38 Bottom Width (ft)
88 Bottom Length (ft)
3344 Bottom Area ($ft^{2)}$
8296 Actual Volume (ft^3) **Okay**
5000 Actual Surface Area (ft^2) **Okay**

10 Emergency Spillway Width (ft)
0.5 Depth of Flow (ft)
10.6 Spillway Capacity (cfs) **Okay**

2 Skimmer Size (in)
0.167 Head on Skimmer (ft)
1.5 Orifice Size (1/4 inch increments)
3.35 Dewatering Time (days)
Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
597.00	**3344**	0.00	0	0
598.00	**4136**	1.00	3740	3740
599.00	**5000**	2.00	4568	8308
600.00	**5936**	3.00	5468	13776

Emergency Spillway Elevation:	599.00	ft
Top of Embankment Elevation:	600.00	ft
Bottom Elevation:	597.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 15	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 15

Modified Rational

Highest Elevation =	666	feet
Inlet Elevation =	618	feet
Difference =	48	feet
Travel Length =	780	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	3.85	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	5.50	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	5.50	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **12.77** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 15	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 15 TYPE OF BASIN: SKIMMER

Disturbed Area:	5.50	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	5.50	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**12.77**	cfs

Sizing of Basin

9900 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)

4151 Required Surface Area ft^2 **(Q25 x 325)**

45.6 Suggested Width ft

91.1 Suggested Length ft

50 Width at Surface Area (ft)

100 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**

3 Side Slope Ratio Z:1

3 Depth (ft)

32 Bottom Width (ft)

82 Bottom Length (ft)

2624 Bottom Area ($ft^{2)}$

11274 Actual Volume (ft^3) **Okay**

5000 Actual Surface Area (ft^2) **Okay**

15 Emergency Spillway Width (ft)

0.5 Depth of Flow (ft)

15.9 Spillway Capacity (cfs) **Okay**

2 Skimmer Size (in)

0.167 Head on Skimmer (ft)

1.75 Orifice Size (1/4 inch increments)

3.42 Dewatering Time (days)

Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
615.00	**2624**	0.00	0	0
616.00	**3344**	1.00	2984	2984
617.00	**4136**	2.00	3740	6724
618.00	**5000**	3.00	4568	11292
619.00	**6026**	4.00	5513	16805

Emergency Spillway Elevation:	618.00	ft
Top of Embankment Elevation:	619.00	ft
Bottom Elevation:	615.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 16	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 16

Modified Rational

Highest Elevation =	634	feet
Inlet Elevation =	584	feet
Difference =	50	feet
Travel Length =	1,150	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc =Time of Concentration (min)

H =Height of the most remote point on the watershed above the outlet (ft)

L =Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	5.94	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	3.65	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	3.65	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **8.48** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 16	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 16 TYPE OF BASIN: SKIMMER

Disturbed Area:	3.65	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	3.65	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**8.48**	cfs

Sizing of Basin

6570 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)

2754 Required Surface Area ft^2 **(Q25 x 325)**

37.1 Suggested Width ft

74.2 Suggested Length ft

45 Width at Surface Area (ft)

90 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**

3 Side Slope Ratio Z:1

3 Depth (ft)

27 Bottom Width (ft)

72 Bottom Length (ft)

1944 Bottom Area ($ft^{2)}$

8829 Actual Volume (ft^3) **Okay**

4050 Actual Surface Area (ft^2) **Okay**

10 Emergency Spillway Width (ft)

0.5 Depth of Flow (ft)

10.6 Spillway Capacity (cfs) **Okay**

2 Skimmer Size (in)

0.167 Head on Skimmer (ft)

1.5 Orifice Size (1/4 inch increments)

3.09 Dewatering Time (days)

Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
581.00	**1944**	0.00	0	0
582.00	**2574**	1.00	2259	2259
583.00	**3276**	2.00	2925	5184
584.00	**4050**	3.00	3663	8847
585.00	**4896**	4.00	4473	13320

Emergency Spillway Elevation:	584.00	ft
Top of Embankment Elevation:	585.00	ft
Bottom Elevation:	581.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 17	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 17

Modified Rational

Highest Elevation =	638	feet
Inlet Elevation =	598	feet
Difference =	40	feet
Travel Length =	782	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	4.15	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	8.60	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	8.60	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **19.97** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 17	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 17 TYPE OF BASIN: SKIMMER

Disturbed Area:	8.60	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	8.60	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**19.97**	cfs

Sizing of Basin

15480	Required Volume ft^3	(Disturbed Area x 1800 cf/ac)	
6490	Required Surface Area ft^2	**(Q25 x 325)**	
57.0	Suggested Width ft		
113.9	Suggested Length ft		
70	Width at Surface Area (ft)		
156	Length at Surface Area (ft)	L/W Ratio = 2.2	**Okay**
3	Side Slope Ratio Z:1		
2	Depth (ft)		
58	Bottom Width (ft)		
144	Bottom Length (ft)		
8352	Bottom Area ($ft^{2)}$		
19224	Actual Volume (ft^3)	**Okay**	
10920	Actual Surface Area (ft^2)	**Okay**	
20	Emergency Spillway Width (ft)		
0.5	Depth of Flow (ft)		
21.2	Spillway Capacity (cfs)	**Okay**	
2.5	Skimmer Size (in)		
0.208	Head on Skimmer (ft)		
2	Orifice Size (1/4 inch increments)		
3.67	Dewatering Time (days)		
	Suggest about 3 days		

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
596.00	**8352**	0.00	0	0
597.00	**9600**	1.00	8976	8976
598.00	**10920**	2.00	10260	19236
599.00	**12312**	3.00	11616	30852

Emergency Spillway Elevation:	598.00	ft
Top of Embankment Elevation:	599.00	ft
Bottom Elevation:	596.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 18	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 18

Modified Rational

Highest Elevation =	616	feet
Inlet Elevation =	583	feet
Difference =	33	feet
Travel Length =	544	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc =Time of Concentration (min)

H =Height of the most remote point on the watershed above the outlet (ft)

L =Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	2.94	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	3.38	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	3.38	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **7.85** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 18	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 18 TYPE OF BASIN: SKIMMER

Disturbed Area:	3.38	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	3.38	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**7.85**	cfs

Sizing of Basin

6084 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)

2551 Required Surface Area ft^2 **(Q25 x 325)**

35.7 Suggested Width ft

71.4 Suggested Length ft

45 Width at Surface Area (ft)

90 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**

3 Side Slope Ratio Z:1

2 Depth (ft)

33 Bottom Width (ft)

78 Bottom Length (ft)

2574 Bottom Area ($ft^{2)}$

6576 Actual Volume (ft^3) **Okay**

4050 Actual Surface Area (ft^2) **Okay**

10 Emergency Spillway Width (ft)

0.5 Depth of Flow (ft)

10.6 Spillway Capacity (cfs) **Okay**

2 Skimmer Size (in)

0.167 Head on Skimmer (ft)

1.25 Orifice Size (1/4 inch increments)

4.12 Dewatering Time (days)

Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
581.00	**2574**	0.00	0	0
582.00	**3276**	1.00	2925	2925
583.00	**4050**	2.00	3663	6588
584.00	**4896**	3.00	4473	11061

Emergency Spillway Elevation:	583.00	ft
Top of Embankment Elevation:	584.00	ft
Bottom Elevation:	581.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 19	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 19

Modified Rational

Highest Elevation =	623	feet
Inlet Elevation =	598	feet
Difference =	25	feet
Travel Length =	715	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	4.48	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	4.30	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	4.30	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **9.98** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 19	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 19 TYPE OF BASIN: SKIMMER

Disturbed Area:	4.30	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	4.30	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**9.98**	cfs

Sizing of Basin

7740 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)

3245 Required Surface Area ft^2 **(Q25 x 325)**

40.3 Suggested Width ft

80.6 Suggested Length ft

45 Width at Surface Area (ft)

90 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**

3 Side Slope Ratio Z:1

3 Depth (ft)

27 Bottom Width (ft)

72 Bottom Length (ft)

1944 Bottom Area ($ft^{2)}$

8829 Actual Volume (ft^3) **Okay**

4050 Actual Surface Area (ft^2) **Okay**

10 Emergency Spillway Width (ft)

0.5 Depth of Flow (ft)

10.6 Spillway Capacity (cfs) **Okay**

2 Skimmer Size (in)

0.167 Head on Skimmer (ft)

1.5 Orifice Size (1/4 inch increments)

3.64 Dewatering Time (days)

Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
595.00	**1944**	0.00	0	0
596.00	**2574**	1.00	2259	2259
597.00	**3276**	2.00	2925	5184
598.00	**4050**	3.00	3663	8847
599.00	**4896**	4.00	4473	13320

Emergency Spillway Elevation:	598.00	ft
Top of Embankment Elevation:	599.00	ft
Bottom Elevation:	595.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 20	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 20

Modified Rational

Highest Elevation =	605	feet
Inlet Elevation =	564	feet
Difference =	41	feet
Travel Length =	918	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	4.94	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	1.66	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	1.66	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **3.85** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 20	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 20 TYPE OF BASIN: SKIMMER

Disturbed Area:	1.66	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	1.66	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**3.85**	cfs

Sizing of Basin

2988 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)
1253 Required Surface Area ft^2 **(Q25 x 325)**
25.0 Suggested Width ft
50.1 Suggested Length ft

35 Width at Surface Area (ft)
70 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**
3 Side Slope Ratio Z:1
2 Depth (ft)
23 Bottom Width (ft)
58 Bottom Length (ft)
1334 Bottom Area ($ft^{2)}$
3736 Actual Volume (ft^3) **Okay**
2450 Actual Surface Area (ft^2) **Okay**

10 Emergency Spillway Width (ft)
0.5 Depth of Flow (ft)
10.6 Spillway Capacity (cfs) **Okay**

2 Skimmer Size (in)
0.167 Head on Skimmer (ft)
1 Orifice Size (1/4 inch increments)
3.17 Dewatering Time (days)
Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
562.00	**1334**	0.00	0	0
563.00	**1856**	1.00	1595	1595
564.00	**2450**	2.00	2153	3748
565.00	**3116**	3.00	2783	6531

Emergency Spillway Elevation:	564.00	ft
Top of Embankment Elevation:	565.00	ft
Bottom Elevation:	562.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 21	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 21

Modified Rational

Highest Elevation =	619	feet
Inlet Elevation =	572	feet
Difference =	47	feet
Travel Length =	700	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	3.43	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	3.62	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	3.62	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **8.41** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 21	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 21 TYPE OF BASIN: SKIMMER

Disturbed Area:	3.62	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	3.62	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**8.41**	cfs

Sizing of Basin

6516 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)

2732 Required Surface Area ft^2 **(Q25 x 325)**

37.0 Suggested Width ft

73.9 Suggested Length ft

40 Width at Surface Area (ft)

80 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**

3 Side Slope Ratio Z:1

3 Depth (ft)

22 Bottom Width (ft)

62 Bottom Length (ft)

1364 Bottom Area ($ft^{2)}$

6684 Actual Volume (ft^3) **Okay**

3200 Actual Surface Area (ft^2) **Okay**

10 Emergency Spillway Width (ft)

0.5 Depth of Flow (ft)

10.6 Spillway Capacity (cfs) **Okay**

2 Skimmer Size (in)

0.167 Head on Skimmer (ft)

1.5 Orifice Size (1/4 inch increments)

3.07 Dewatering Time (days)

Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
569.00	**1354**	0.00	0	0
570.00	**1904**	1.00	1629	1629
571.00	**2516**	2.00	2210	3839
572.00	**3200**	3.00	2858	6697
573.00	**3956**	4.00	3578	10275

Emergency Spillway Elevation:	572.00	ft
Top of Embankment Elevation:	573.00	ft
Bottom Elevation:	569.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 22	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 22

Modified Rational

Highest Elevation =	619	feet
Inlet Elevation =	564	feet
Difference =	55	feet
Travel Length =	990	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	4.82	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	4.10	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	4.10	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **9.52** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 22	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 22 TYPE OF BASIN: SKIMMER

Disturbed Area:	4.10	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	4.10	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**9.52**	cfs

Sizing of Basin

7380 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)

3094 Required Surface Area ft^2 **(Q25 x 325)**

39.3 Suggested Width ft

78.7 Suggested Length ft

45 Width at Surface Area (ft)

90 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**

3 Side Slope Ratio Z:1

3 Depth (ft)

27 Bottom Width (ft)

72 Bottom Length (ft)

1944 Bottom Area ($ft^{2)}$

8829 Actual Volume (ft^3) **Okay**

4050 Actual Surface Area (ft^2) **Okay**

10 Emergency Spillway Width (ft)

0.5 Depth of Flow (ft)

10.6 Spillway Capacity (cfs) **Okay**

2 Skimmer Size (in)

0.167 Head on Skimmer (ft)

1.5 Orifice Size (1/4 inch increments)

3.47 Dewatering Time (days)

Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
561.00	**1944**	0.00	0	0
562.00	**2574**	1.00	2259	2259
563.00	**3276**	2.00	2925	5184
564.00	**4050**	3.00	3663	8847
565.00	**4896**	4.00	4473	13320

Emergency Spillway Elevation:	564.00	ft
Top of Embankment Elevation:	565.00	ft
Bottom Elevation:	561.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 23	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 23

Modified Rational

Highest Elevation =	619	feet
Inlet Elevation =	581	feet
Difference =	38	feet
Travel Length =	655	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc =Time of Concentration (min)

H =Height of the most remote point on the watershed above the outlet (ft)

L =Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	3.45	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	7.18	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	7.18	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **16.67** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 23	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 23 TYPE OF BASIN: SKIMMER

Disturbed Area:	7.18	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	7.18	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**16.67**	cfs

Sizing of Basin

12924 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)

5418 Required Surface Area ft^2 **(Q25 x 325)**

52.0 Suggested Width ft

104.1 Suggested Length ft

65 Width at Surface Area (ft)

130 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**

3 Side Slope Ratio Z:1

2 Depth (ft)

53 Bottom Width (ft)

118 Bottom Length (ft)

6254 Bottom Area ($ft^{2)}$

14656 Actual Volume (ft^3) **Okay**

8450 Actual Surface Area (ft^2) **Okay**

20 Emergency Spillway Width (ft)

0.5 Depth of Flow (ft)

21.2 Spillway Capacity (cfs) **Okay**

2.5 Skimmer Size (in)

0.208 Head on Skimmer (ft)

2 Orifice Size (1/4 inch increments)

3.07 Dewatering Time (days)

Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
579.00	**6254**	0.00	0	0
580.00	**7316**	1.00	6785	6785
581.00	**8450**	2.00	7883	14668
582.00	**9656**	3.00	9053	23721

Emergency Spillway Elevation:	581.00	ft
Top of Embankment Elevation:	582.00	ft
Bottom Elevation:	579.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 24	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 24

Modified Rational

Highest Elevation =	619	feet
Inlet Elevation =	583	feet
Difference =	36	feet
Travel Length =	800	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	4.43	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	9.41	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	9.41	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **21.85** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 24	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 24 TYPE OF BASIN: SKIMMER

Disturbed Area:	9.41	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	9.41	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**21.85**	cfs

Sizing of Basin

16938	Required Volume ft^3	(Disturbed Area x 1800 cf/ac)	
7101	Required Surface Area ft^2	**(Q25 x 325)**	
59.6	Suggested Width ft		
119.2	Suggested Length ft		
65	Width at Surface Area (ft)		
130	Length at Surface Area (ft)	L/W Ratio = 2.0	**Okay**
3	Side Slope Ratio Z:1		
3	Depth (ft)		
47	Bottom Width (ft)		
112	Bottom Length (ft)		
5264	Bottom Area ($ft^{2)}$		
20409	Actual Volume (ft^3)	**Okay**	
8450	Actual Surface Area (ft^2)	**Okay**	
25	Emergency Spillway Width (ft)		
0.5	Depth of Flow (ft)		
26.5	Spillway Capacity (cfs)	**Okay**	
2.5	Skimmer Size (in)		
0.208	Head on Skimmer (ft)		
2	Orifice Size (1/4 inch increments)		
4.02	Dewatering Time (days)		
	Suggest about 3 days		

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
580.00	**5264**	0.00	0	0
581.00	**6254**	1.00	5759	5759
582.00	**7316**	2.00	6785	12544
583.00	**8450**	3.00	7883	20427
584.00	**9656**	4.00	9053	29480

Emergency Spillway Elevation:	583.00	ft
Top of Embankment Elevation:	584.00	ft
Bottom Elevation:	580.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 25	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 25

Modified Rational

Highest Elevation =	660	feet
Inlet Elevation =	604	feet
Difference =	56	feet
Travel Length =	1,250	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	6.26	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	9.30	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	9.30	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **21.59** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 25	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 25 TYPE OF BASIN: SKIMMER

Disturbed Area:	9.30	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	9.30	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**21.59**	cfs

Sizing of Basin

16740	Required Volume ft^3	(Disturbed Area x 1800 cf/ac)	
7018	Required Surface Area ft^2	**(Q25 x 325)**	
59.2	Suggested Width ft		
118.5	Suggested Length ft		
65	Width at Surface Area (ft)		
130	Length at Surface Area (ft)	L/W Ratio = 2.0	**Okay**
3	Side Slope Ratio Z:1		
3	Depth (ft)		
47	Bottom Width (ft)		
112	Bottom Length (ft)		
5264	Bottom Area ($ft^{2)}$		
20409	Actual Volume (ft^3)	**Okay**	
8450	Actual Surface Area (ft^2)	**Okay**	
25	Emergency Spillway Width (ft)		
0.5	Depth of Flow (ft)		
26.5	Spillway Capacity (cfs)	**Okay**	
2.5	Skimmer Size (in)		
0.208	Head on Skimmer (ft)		
2	Orifice Size (1/4 inch increments)		
3.97	Dewatering Time (days)		
	Suggest about 3 days		

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
601.00	**5264**	0.00	0	0
602.00	**6254**	1.00	5759	5759
603.00	**7316**	2.00	6785	12544
604.00	**8450**	3.00	7883	20427
605.00	**9656**	4.00	9053	29480

Emergency Spillway Elevation:	604.00	ft
Top of Embankment Elevation:	605.00	ft
Bottom Elevation:	601.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 26	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 26

Modified Rational

Highest Elevation =	662	feet
Inlet Elevation =	600	feet
Difference =	62	feet
Travel Length =	1,170	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	5.58	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	11.51	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	11.51	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **26.73** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 26	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 26 TYPE OF BASIN: RISER

Disturbed Area:	11.51	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	11.51	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**26.73**	cfs

Sizing of Basin

20718	Required Volume ft^3	(Disturbed Area x 1800 cf/ac)	
11626	Required Surface Area ft^2	**(Q25 x 435)**	
76.2	Suggested Width ft		
152.5	Suggested Length ft		
80	Width at Surface Area (ft)		
160	Length at Surface Area (ft)	L/W Ratio = 2.0	**Okay**
3	Side Slope Ratio Z:1		
2	Depth (ft)		
68	Bottom Width (ft)		
148	Bottom Length (ft)		
10064	Bottom Area ($ft^{2)}$		
22816	Actual Volume (ft^3)	**Okay**	
12800	Actual Surface Area (ft^2)	**Okay**	
30	Emergency Spillway Width (ft)		
0.5	Depth of Flow (ft)		
31.8	Spillway Capacity (cfs)	**Okay**	
2.5	Skimmer Size (in)		
0.208	Head on Skimmer (ft)		
2.25	Orifice Size (1/4 inch increments)		
3.88	Dewatering Time (days)		
	Suggest about 3 days		

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
598.00	**10064**	0.00	0	0
599.00	**11396**	1.00	10730	10730
600.00	**12800**	2.00	12098	22828
601.00	**14492**	3.00	13646	36474
602.00	**16279**	4.00	15386	51860

Riser Elevation:	600.00	ft
Emergency Spillway Elevation:	601.00	ft
Top of Embankment Elevation:	602.00	ft
Bottom Elevation:	598.00	ft
Embankment Width:	**10**	ft

Sizing of Barrel & Riser

12	Barrel Size (in)	
55	Barrel Length (LF)	
598	Upstream Barrel Invert Elevation	
597	Downstream Barrel Invert Elevation	
1.82%	Slope of Barrel (%)	
HDPE	Barrel Pipe Material	
CMP	Riser Material	
18	Riser Size (in)	**Okay (Riser = 1.5 Barrel Size)**

Anti-Flotation Device (Only use for circular riser)

1.5	Riser Diameter (ft)	
3.0	Height (ft)	
380	Buoyant Force (lbs)	Area Riser x Ht Riser x Density Water x Safety Factor (.25)(pi)(Diameter)2 x (Height) x 62.4 pcf x 1.15 FS
2.5	Volume Required (cf)	Buoyant force / Density Of Concrete (150 pcf)
1.6	Square Root of Volume (ft)	(Assume 1 ft thick concrete footing)
2.0	Length of Concrete Footing	
2.0	Width of Concrete Footing	
1.0	Height of Concrete Footing (Thickness)	
4	Volume Provided (cf)	

***RED IS USER INPUT**

BASIN NAME		PROJECT NAME
BASIN 27	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 27

Modified Rational

Highest Elevation =	664	feet
Inlet Elevation =	589	feet
Difference =	75	feet
Travel Length =	2,357	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc =Time of Concentration (min)

H =Height of the most remote point on the watershed above the outlet (ft)

L =Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	11.64	min
T_C =	10	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	12.46	acres
Additional Drainage Area =	0.64	acres
Total Drainage Area=	13.10	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **30.42** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 27	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 27 TYPE OF BASIN: RISER

Disturbed Area:	12.46	ac
Additional Drainage Area:	0.64	ac
Total Drainage Area:	13.10	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**30.42**	cfs

Sizing of Basin

22428 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)
13232 Required Surface Area ft^2 **(Q25 x 435)**
81.3 Suggested Width ft
162.7 Suggested Length ft

90 Width at Surface Area (ft)
180 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**
3 Side Slope Ratio Z:1
2 Depth (ft)
78 Bottom Width (ft)
168 Bottom Length (ft)
13104 Bottom Area ($ft^{2)}$
29256 Actual Volume (ft^3) **Okay**
16200 Actual Surface Area (ft^2) **Okay**

35 Emergency Spillway Width (ft)
0.5 Depth of Flow (ft)
37.1 Spillway Capacity (cfs) **Okay**

2.5 Skimmer Size (in)
0.208 Head on Skimmer (ft)
2.25 Orifice Size (1/4 inch increments)
4.21 Dewatering Time (days)
Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
587.00	**13104**	0.00	0	0
588.00	**14616**	1.00	13860	13860
589.00	**16200**	2.00	15408	29268
590.00	**17856**	3.00	17028	46296
591.00	**19584**	4.00	18720	65016

Riser Elevation:	589.00	ft
Emergency Spillway Elevation:	590.00	ft
Top of Embankment Elevation:	591.00	ft
Bottom Elevation:	587.00	ft
Embankment Width:	**10**	ft

Sizing of Barrel & Riser

12 Barrel Size (in)
41 Barrel Length (LF)
587 Upstream Barrel Invert Elevation
586 Downstream Barrel Invert Elevation
2.44% Slope of Barrel (%)
HDPE Barrel Pipe Material
CMP Riser Material
18 Riser Size (in) **Okay (Riser = 1.5 Barrel Size)**

Anti-Flotation Device (Only use for circular riser)

1.5 Riser Diameter (ft)
3.0 Height (ft)

380 Buoyant Force (lbs) — Area Riser x Ht Riser x Density Water x Safety Factor (.25)(pi)(Diameter)2 x (Height) x 62.4 pcf x 1.15 FS
2.5 Volume Required (cf) — Buoyant force / Density Of Concrete (150 pcf)
1.6 Square Root of Volume (ft) — (Assume 1 ft thick concrete footing)
2.0 Length of Concrete Footing
2.0 Width of Concrete Footing
1.0 Height of Concrete Footing (Thickness)
4 Volume Provided (cf)

***RED IS USER INPUT**

BASIN NAME		PROJECT NAME
BASIN 28	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 28

Modified Rational

Highest Elevation =	642	feet
Inlet Elevation =	592	feet
Difference =	50	feet
Travel Length =	910	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	4.53	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	6.80	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	6.80	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **15.79** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 28	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 28 TYPE OF BASIN: SKIMMER

Disturbed Area:	6.80	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	6.80	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**15.79**	cfs

Sizing of Basin

12240	Required Volume ft^3	(Disturbed Area x 1800 cf/ac)	
5132	Required Surface Area ft^2	**(Q25 x 325)**	
50.7	Suggested Width ft		
101.3	Suggested Length ft		
60	Width at Surface Area (ft)		
120	Length at Surface Area (ft)	L/W Ratio = 2.0	**Okay**
3	Side Slope Ratio Z:1		
2	Depth (ft)		
48	Bottom Width (ft)		
108	Bottom Length (ft)		
5184	Bottom Area ($ft^{2)}$		
12336	Actual Volume (ft^3)	**Okay**	
7200	Actual Surface Area (ft^2)	**Okay**	
20	Emergency Spillway Width (ft)		
0.5	Depth of Flow (ft)		
21.2	Spillway Capacity (cfs)	**Okay**	
2.5	Skimmer Size (in)		
0.208	Head on Skimmer (ft)		
1.75	Orifice Size (1/4 inch increments)		
3.79	Dewatering Time (days)		
	Suggest about 3 days		

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
590.00	**5184**	0.00	0	0
591.00	**6156**	1.00	5670	5670
592.00	**7200**	2.00	6678	12348
593.00	**8316**	3.00	7758	20106

Emergency Spillway Elevation:	592.00	ft
Top of Embankment Elevation:	593.00	ft
Bottom Elevation:	590.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 29	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 29

Modified Rational

Highest Elevation =	617	feet
Inlet Elevation =	591	feet
Difference =	26	feet
Travel Length =	518	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	3.04	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	2.85	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	2.85	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **6.62** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 29	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 29 TYPE OF BASIN: SKIMMER

Disturbed Area:	2.85	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	2.85	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**6.62**	cfs

Sizing of Basin

5130 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)
2151 Required Surface Area ft^2 **(Q25 x 325)**
32.8 Suggested Width ft
65.6 Suggested Length ft

40 Width at Surface Area (ft)
80 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**
3 Side Slope Ratio Z:1
3 Depth (ft)
22 Bottom Width (ft)
62 Bottom Length (ft)
1364 Bottom Area ($ft^{2)}$
6684 Actual Volume (ft^3) **Okay**
3200 Actual Surface Area (ft^2) **Okay**

10 Emergency Spillway Width (ft)
0.5 Depth of Flow (ft)
10.6 Spillway Capacity (cfs) **Okay**

2 Skimmer Size (in)
0.167 Head on Skimmer (ft)
1.25 Orifice Size (1/4 inch increments)
3.48 Dewatering Time (days)
Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
588.00	**1364**	0.00	0	0
589.00	**1904**	1.00	1634	1634
590.00	**2516**	2.00	2210	3844
591.00	**3200**	3.00	2858	6702
592.00	**3956**	4.00	3578	10280

Emergency Spillway Elevation:	591.00	ft
Top of Embankment Elevation:	592.00	ft
Bottom Elevation:	588.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 30	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 30

Modified Rational

Highest Elevation =	604	feet
Inlet Elevation =	585	feet
Difference =	19	feet
Travel Length =	615	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	4.18	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	2.20	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	2.20	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **5.11** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 30	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 30 TYPE OF BASIN: SKIMMER

Disturbed Area:	2.20	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	2.20	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**5.11**	cfs

Sizing of Basin

3960 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)
1660 Required Surface Area ft^2 **(Q25 x 325)**
28.8 Suggested Width ft
57.6 Suggested Length ft

35 Width at Surface Area (ft)
70 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**
3 Side Slope Ratio Z:1
3 Depth (ft)
17 Bottom Width (ft)
52 Bottom Length (ft)
884 Bottom Area ($ft^{2)}$
4839 Actual Volume (ft^3) **Okay**
2450 Actual Surface Area (ft^2) **Okay**

5 Emergency Spillway Width (ft)
0.5 Depth of Flow (ft)
5.3 Spillway Capacity (cfs) **Okay**

1.5 Skimmer Size (in)
0.125 Head on Skimmer (ft)
1.25 Orifice Size (1/4 inch increments)
3.10 Dewatering Time (days)
Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
582.00	**504**	0.00	0	0
583.00	**864**	1.00	684	684
584.00	**1296**	2.00	1080	1764
585.00	**1800**	3.00	1548	3312
586.00	**2376**	4.00	2088	5400

Emergency Spillway Elevation:	585.00	ft
Top of Embankment Elevation:	586.00	ft
Bottom Elevation:	582.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 31	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 31

Modified Rational

Highest Elevation =	619	feet
Inlet Elevation =	576	feet
Difference =	43	feet
Travel Length =	475	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	2.27	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	4.36	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	4.36	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **10.12** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 31	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 31 TYPE OF BASIN: SKIMMER

Disturbed Area:	4.36	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	4.36	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**10.12**	cfs

Sizing of Basin

7848 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)
3290 Required Surface Area ft^2 **(Q25 x 325)**
40.6 Suggested Width ft
81.1 Suggested Length ft

45 Width at Surface Area (ft)
90 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**
3 Side Slope Ratio Z:1
3 Depth (ft)
27 Bottom Width (ft)
72 Bottom Length (ft)
1944 Bottom Area ($ft^{2)}$
8829 Actual Volume (ft^3) **Okay**
4050 Actual Surface Area (ft^2) **Okay**

10 Emergency Spillway Width (ft)
0.5 Depth of Flow (ft)
10.6 Spillway Capacity (cfs) **Okay**

2 Skimmer Size (in)
0.167 Head on Skimmer (ft)
1.5 Orifice Size (1/4 inch increments)
3.69 Dewatering Time (days)
Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
573.00	**1944**	0.00	0	0
574.00	**2574**	1.00	2259	2259
575.00	**3276**	2.00	2925	5184
576.00	**4050**	3.00	3663	8847
577.00	**4896**	4.00	4473	13320

Emergency Spillway Elevation:	576.00	ft
Top of Embankment Elevation:	577.00	ft
Bottom Elevation:	573.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 32	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 32

Modified Rational

Highest Elevation =	614	feet
Inlet Elevation =	571	feet
Difference =	43	feet
Travel Length =	768	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	3.95	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	6.79	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	6.79	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **15.77** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 32	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 32 TYPE OF BASIN: SKIMMER

Disturbed Area:	6.79	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	6.79	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**15.77**	cfs

Sizing of Basin

12222 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)

5124 Required Surface Area ft^2 **(Q25 x 325)**

50.6 Suggested Width ft

101.2 Suggested Length ft

55 Width at Surface Area (ft)

110 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**

3 Side Slope Ratio Z:1

3 Depth (ft)

37 Bottom Width (ft)

92 Bottom Length (ft)

3404 Bottom Area ($ft^{2)}$

14019 Actual Volume (ft^3) **Okay**

6050 Actual Surface Area (ft^2) **Okay**

15 Emergency Spillway Width (ft)

0.5 Depth of Flow (ft)

15.9 Spillway Capacity (cfs) **Okay**

2.5 Skimmer Size (in)

0.208 Head on Skimmer (ft)

1.75 Orifice Size (1/4 inch increments)

3.79 Dewatering Time (days)

Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
568.00	**3404**	0.00	0	0
569.00	**4214**	1.00	3809	3809
570.00	**5096**	2.00	4655	8464
571.00	**6050**	3.00	5573	14037
572.00	**7076**	4.00	6563	20600

Emergency Spillway Elevation:	571.00	ft
Top of Embankment Elevation:	572.00	ft
Bottom Elevation:	568.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 33	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 33

Modified Rational

Highest Elevation =	613	feet
Inlet Elevation =	561	feet
Difference =	52	feet
Travel Length =	1,467	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	7.75	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	6.74	acres
Additional Drainage Area =	2.19	acres
Total Drainage Area=	8.93	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **20.74** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 33	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 33 TYPE OF BASIN: SKIMMER

Disturbed Area:	6.74	ac
Additional Drainage Area:	2.19	ac
Total Drainage Area:	8.93	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**20.74**	cfs

Sizing of Basin

12132 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)
6739 Required Surface Area ft^2 **(Q25 x 325)**
58.0 Suggested Width ft
116.1 Suggested Length ft

60 Width at Surface Area (ft)
120 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**
3 Side Slope Ratio Z:1
3 Depth (ft)
42 Bottom Width (ft)
102 Bottom Length (ft)
4284 Bottom Area ($ft^{2)}$
17064 Actual Volume (ft^3) **Okay**
7200 Actual Surface Area (ft^2) **Okay**

20 Emergency Spillway Width (ft)
0.5 Depth of Flow (ft)
21.2 Spillway Capacity (cfs) **Okay**

2.5 Skimmer Size (in)
0.208 Head on Skimmer (ft)
1.75 Orifice Size (1/4 inch increments)
3.76 Dewatering Time (days)
Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
558.00	**4284**	0.00	0	0
559.00	**5184**	1.00	4734	4734
560.00	**6156**	2.00	5670	10404
561.00	**7200**	3.00	6678	17082
562.00	**8316**	4.00	7758	24840

Emergency Spillway Elevation:	561.00	ft
Top of Embankment Elevation:	562.00	ft
Bottom Elevation:	558.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 34	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 34

Modified Rational

Highest Elevation =	619	feet
Inlet Elevation =	547	feet
Difference =	72	feet
Travel Length =	775	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	3.27	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	8.25	acres
Additional Drainage Area =	1.48	acres
Total Drainage Area=	9.73	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **22.59** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 34	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 34 TYPE OF BASIN: RISER

Disturbed Area:	8.25	ac
Additional Drainage Area:	1.48	ac
Total Drainage Area:	9.73	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**22.59**	cfs

Sizing of Basin

14850	Required Volume ft^3	(Disturbed Area x 1800 cf/ac)	
9828	Required Surface Area ft^2	**(Q25 x 435)**	
70.1	Suggested Width ft		
140.2	Suggested Length ft		
80	Width at Surface Area (ft)		
160	Length at Surface Area (ft)	L/W Ratio = 2.0	**Okay**
3	Side Slope Ratio Z:1		
2	Depth (ft)		
68	Bottom Width (ft)		
148	Bottom Length (ft)		
10064	Bottom Area ($ft^{2)}$		
22816	Actual Volume (ft^3)	**Okay**	
12800	Actual Surface Area (ft^2)	**Okay**	
30	Emergency Spillway Width (ft)		
0.5	Depth of Flow (ft)		
31.8	Spillway Capacity (cfs)	**Okay**	
2.5	Skimmer Size (in)		
0.208	Head on Skimmer (ft)		
2	Orifice Size (1/4 inch increments)		
3.52	Dewatering Time (days)		
	Suggest about 3 days		

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
545.00	**10064**	0.00	0	0
546.00	**11396**	1.00	10730	10730
547.00	**12800**	2.00	12098	22828
548.00	**14276**	3.00	13538	36366
549.00	**15824**	4.00	15050	51416

Riser Elevation:	547.00	ft
Emergency Spillway Elevation:	548.00	ft
Top of Embankment Elevation:	549.00	ft
Bottom Elevation:	545.00	ft
Embankment Width:	**10**	ft

Sizing of Barrel & Riser

12	Barrel Size (in)	
42	Barrel Length (LF)	
545	Upstream Barrel Invert Elevation	
544	Downstream Barrel Invert Elevation	
2.38%	Slope of Barrel (%)	
HDPE	Barrel Pipe Material	
CMP	Riser Material	
18	Riser Size (in)	**Okay (Riser = 1.5 Barrel Size)**

Anti-Flotation Device (Only use for circular riser)

1.5	Riser Diameter (ft)	
3.0	Height (ft)	
380	Buoyant Force (lbs)	Area Riser x Ht Riser x Density Water x Safety Factor (.25)(pi)(Diameter)2 x (Height) x 62.4 pcf x 1.15 FS
2.5	Volume Required (cf)	Buoyant force / Density Of Concrete (150 pcf)
1.6	Square Root of Volume (ft)	(Assume 1 ft thick concrete footing)
2.0	Length of Concrete Footing	
2.0	Width of Concrete Footing	
1.0	Height of Concrete Footing (Thickness)	
4	Volume Provided (cf)	

***RED IS USER INPUT**

BASIN NAME		PROJECT NAME
BASIN 35	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 35

Modified Rational

Highest Elevation =	619	feet
Inlet Elevation =	514	feet
Difference =	105	feet
Travel Length =	1,500	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	6.07	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	28.53	acres
Additional Drainage Area =	0.22	acres
Total Drainage Area=	28.75	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **66.76** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 35	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 35 TYPE OF BASIN: RISER

Disturbed Area:	28.53	ac
Additional Drainage Area:	0.22	ac
Total Drainage Area:	28.75	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**66.76**	cfs

Sizing of Basin

51354 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)
29040 Required Surface Area ft^2 **(Q25 x 435)**
120.5 Suggested Width ft
241.0 Suggested Length ft

122 Width at Surface Area (ft)
244 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**
3 Side Slope Ratio Z:1
2 Depth (ft)
110 Bottom Width (ft)
232 Bottom Length (ft)
25520 Bottom Area ($ft^{2)}$
55240 Actual Volume (ft^3) **Okay**
29768 Actual Surface Area (ft^2) **Okay**

70 Emergency Spillway Width (ft)
0.5 Depth of Flow (ft)
74.2 Spillway Capacity (cfs) **Okay**

3 Skimmer Size (in)
0.25 Head on Skimmer (ft)
3 Orifice Size (1/4 inch increments)
4.94 Dewatering Time (days)
Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
512.00	**18800**	0.00	0	0
513.00	**20600**	1.00	19700	19700
514.00	**22472**	2.00	21536	41236
515.00	**24416**	3.00	23444	64680
516.00	**26432**	4.00	25424	90104

Riser Elevation:	514.00	ft
Emergency Spillway Elevation:	515.00	ft
Top of Embankment Elevation:	516.00	ft
Bottom Elevation:	512.00	ft
Embankment Width:	**10**	ft

Sizing of Barrel & Riser

12 Barrel Size (in)
48 Barrel Length (LF)
512 Upstream Barrel Invert Elevation
510 Downstream Barrel Invert Elevation
4.17% Slope of Barrel (%)
HDPE Barrel Pipe Material
CMP Riser Material
18 Riser Size (in) **Okay (Riser = 1.5 Barrel Size)**

Anti-Flotation Device (Only use for circular riser)

1.5 Riser Diameter (ft)
3.0 Height (ft)

380 Buoyant Force (lbs) — Area Riser x Ht Riser x Density Water x Safety Factor (.25)(pi)(Diameter)2 x (Height) x 62.4 pcf x 1.15 FS
2.5 Volume Required (cf) — Buoyant force / Density Of Concrete (150 pcf)
1.6 Square Root of Volume (ft) — (Assume 1 ft thick concrete footing)
2.0 Length of Concrete Footing
2.0 Width of Concrete Footing
1.0 Height of Concrete Footing (Thickness)
4 Volume Provided (cf)

***RED IS USER INPUT**

BASIN NAME		PROJECT NAME
BASIN 36	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 36

Modified Rational

Highest Elevation =	613	feet
Inlet Elevation =	508	feet
Difference =	105	feet
Travel Length =	1,310	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	5.19	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	22.48	acres
Additional Drainage Area =	0.43	acres
Total Drainage Area=	22.91	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **53.20** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 36	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 36 TYPE OF BASIN: RISER

Disturbed Area:	22.48	ac
Additional Drainage Area:	0.43	ac
Total Drainage Area:	22.91	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**53.20**	cfs

Sizing of Basin

40464 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)
23141 Required Surface Area ft^2 **(Q25 x 435)**
107.6 Suggested Width ft
215.1 Suggested Length ft

110 Width at Surface Area (ft)
220 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**
3 Side Slope Ratio Z:1
2 Depth (ft)
98 Bottom Width (ft)
208 Bottom Length (ft)
20384 Bottom Area ($ft^{2)}$
44536 Actual Volume (ft^3) **Okay**
24200 Actual Surface Area (ft^2) **Okay**

60 Emergency Spillway Width (ft)
0.5 Depth of Flow (ft)
63.6 Spillway Capacity (cfs) **Okay**

3 Skimmer Size (in)
0.25 Head on Skimmer (ft)
3 Orifice Size (1/4 inch increments)
3.89 Dewatering Time (days)
Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
506.00	**20384**	0.00	0	0
507.00	**22256**	1.00	21320	21320
508.00	**24200**	2.00	23228	44548
509.00	**26216**	3.00	25208	69756
510.00	**28304**	4.00	27260	97016

Riser Elevation:	508.00	ft
Emergency Spillway Elevation:	509.00	ft
Top of Embankment Elevation:	510.00	ft
Bottom Elevation:	506.00	ft
Embankment Width:	**10**	ft

Sizing of Barrel & Riser

12 Barrel Size (in)
45 Barrel Length (LF)
506 Upstream Barrel Invert Elevation
504 Downstream Barrel Invert Elevation
4.44% Slope of Barrel (%)
HDPE Barrel Pipe Material
CMP Riser Material
18 Riser Size (in) **Okay (Riser = 1.5 Barrel Size)**

Anti-Flotation Device (Only use for circular riser)

1.5 Riser Diameter (ft)
3.0 Height (ft)

380 Buoyant Force (lbs) — Area Riser x Ht Riser x Density Water x Safety Factor (.25)(pi)(Diameter)2 x (Height) x 62.4 pcf x 1.15 FS
2.5 Volume Required (cf) — Buoyant force / Density Of Concrete (150 pcf)
1.6 Square Root of Volume (ft) — (Assume 1 ft thick concrete footing)
2.0 Length of Concrete Footing
2.0 Width of Concrete Footing
1.0 Height of Concrete Footing (Thickness)
4 Volume Provided (cf)

***RED IS USER INPUT**

BASIN NAME		PROJECT NAME
BASIN 37	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 37

Modified Rational

Highest Elevation =	630	feet
Inlet Elevation =	525	feet
Difference =	105	feet
Travel Length =	1,745	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	7.23	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	30.13	acres
Additional Drainage Area =	0.14	acres
Total Drainage Area=	30.27	acres

Equation 2.1 Rational Equation

Q = C I A

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **70.29** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 37	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 37 TYPE OF BASIN: RISER

Disturbed Area:	30.13	ac
Additional Drainage Area:	0.14	ac
Total Drainage Area:	30.27	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**70.29**	cfs

Sizing of Basin

54234 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)
30575 Required Surface Area ft^2 **(Q25 x 435)**
123.6 Suggested Width ft
247.3 Suggested Length ft

125 Width at Surface Area (ft)
250 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**
3 Side Slope Ratio Z:1
2 Depth (ft)
113 Bottom Width (ft)
238 Bottom Length (ft)
26894 Bottom Area ($ft^{2)}$
58096 Actual Volume (ft^3) **Okay**
31250 Actual Surface Area (ft^2) **Okay**

70 Emergency Spillway Width (ft)
0.5 Depth of Flow (ft)
74.2 Spillway Capacity (cfs) **Okay**

4 Skimmer Size (in)
0.333 Head on Skimmer (ft)
3.5 Orifice Size (1/4 inch increments)
3.32 Dewatering Time (days)
Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
523.00	**26894**	0.00	0	0
524.00	**29036**	1.00	27965	27965
525.00	**31250**	2.00	30143	58108
526.00	**33536**	3.00	32393	90501
527.00	**35894**	4.00	34715	125216

Riser Elevation:	525.00	ft
Emergency Spillway Elevation:	526.00	ft
Top of Embankment Elevation:	527.00	ft
Bottom Elevation:	523.00	ft
Embankment Width:	**10**	ft

Sizing of Barrel & Riser

12 Barrel Size (in)
41 Barrel Length (LF)
523 Upstream Barrel Invert Elevation
522 Downstream Barrel Invert Elevation
2.44% Slope of Barrel (%)
HDPE Barrel Pipe Material
CMP Riser Material
18 Riser Size (in) **Okay (Riser = 1.5 Barrel Size)**

Anti-Flotation Device (Only use for circular riser)

1.5 Riser Diameter (ft)
3.0 Height (ft)

380 Buoyant Force (lbs) — Area Riser x Ht Riser x Density Water x Safety Factor (.25)(pi)(Diameter)2 x (Height) x 62.4 pcf x 1.15 FS
2.5 Volume Required (cf) — Buoyant force / Density Of Concrete (150 pcf)
1.6 Square Root of Volume (ft) — (Assume 1 ft thick concrete footing)
2.0 Length of Concrete Footing
2.0 Width of Concrete Footing
1.0 Height of Concrete Footing (Thickness)
4 Volume Provided (cf)

***RED IS USER INPUT**

BASIN NAME		PROJECT NAME
BASIN 38	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 38

Modified Rational

Highest Elevation =	623	feet
Inlet Elevation =	552	feet
Difference =	71	feet
Travel Length =	1,040	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	4.62	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	10.26	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	10.26	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **23.82** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 38	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 38 TYPE OF BASIN: RISER

Disturbed Area:	10.26	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	10.26	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**23.82**	cfs

Sizing of Basin

18468 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)
10363 Required Surface Area ft^2 **(Q25 x 435)**
72.0 Suggested Width ft
144.0 Suggested Length ft

75 Width at Surface Area (ft)
150 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**
3 Side Slope Ratio Z:1
2 Depth (ft)
63 Bottom Width (ft)
138 Bottom Length (ft)
8694 Bottom Area ($ft^{2)}$
19896 Actual Volume (ft^3) **Okay**
11250 Actual Surface Area (ft^2) **Okay**

25 Emergency Spillway Width (ft)
0.5 Depth of Flow (ft)
26.5 Spillway Capacity (cfs) **Okay**

2.5 Skimmer Size (in)
0.208 Head on Skimmer (ft)
2 Orifice Size (1/4 inch increments)
4.38 Dewatering Time (days)
Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
550.00	**8694**	0.00	0	0
551.00	**9936**	1.00	9315	9315
552.00	**11250**	2.00	10593	19908
553.00	**12636**	3.00	11943	31851
554.00	**14094**	4.00	13365	45216

Riser Elevation:	552.00	ft
Emergency Spillway Elevation:	553.00	ft
Top of Embankment Elevation:	554.00	ft
Bottom Elevation:	550.00	ft
Embankment Width:	**10**	ft

Sizing of Barrel & Riser

12 Barrel Size (in)
39 Barrel Length (LF)
550 Upstream Barrel Invert Elevation
549 Downstream Barrel Invert Elevation
2.56% Slope of Barrel (%)
HDPE Barrel Pipe Material
CMP Riser Material
18 Riser Size (in) **Okay (Riser = 1.5 Barrel Size)**

Anti-Flotation Device (Only use for circular riser)

1.5 Riser Diameter (ft)
3.0 Height (ft)

380 Buoyant Force (lbs) — Area Riser x Ht Riser x Density Water x Safety Factor (.25)(pi)(Diameter)2 x (Height) x 62.4 pcf x 1.15 FS
2.5 Volume Required (cf) — Buoyant force / Density Of Concrete (150 pcf)
1.6 Square Root of Volume (ft) — (Assume 1 ft thick concrete footing)
2.0 Length of Concrete Footing
2.0 Width of Concrete Footing
1.0 Height of Concrete Footing (Thickness)
4 Volume Provided (cf)

***RED IS USER INPUT**

BASIN NAME		PROJECT NAME
BASIN 39	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 39

Modified Rational

Highest Elevation =	610	feet
Inlet Elevation =	556	feet
Difference =	54	feet
Travel Length =	538	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	2.40	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	4.18	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	4.18	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **9.71** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 39	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 39 TYPE OF BASIN: SKIMMER

Disturbed Area:	4.18	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	4.18	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**9.71**	cfs

Sizing of Basin

7524 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)
3154 Required Surface Area ft^2 **(Q25 x 325)**
39.7 Suggested Width ft
79.4 Suggested Length ft

50 Width at Surface Area (ft)
100 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**
3 Side Slope Ratio Z:1
2 Depth (ft)
38 Bottom Width (ft)
88 Bottom Length (ft)
3344 Bottom Area ($ft^{2)}$
8296 Actual Volume (ft^3) **Okay**
5000 Actual Surface Area (ft^2) **Okay**

10 Emergency Spillway Width (ft)
0.5 Depth of Flow (ft)
10.6 Spillway Capacity (cfs) **Okay**

2 Skimmer Size (in)
0.167 Head on Skimmer (ft)
1.5 Orifice Size (1/4 inch increments)
3.54 Dewatering Time (days)
Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
554.00	**3344**	0.00	0	0
555.00	**4136**	1.00	3740	3740
556.00	**5000**	2.00	4568	8308
557.00	**5936**	3.00	5468	13776

Emergency Spillway Elevation:	556.00	ft
Top of Embankment Elevation:	557.00	ft
Bottom Elevation:	554.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 40	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 40

Modified Rational

Highest Elevation =	613	feet
Inlet Elevation =	565	feet
Difference =	48	feet
Travel Length =	1,040	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc	=Time of Concentration (min)
H	=Height of the most remote point on the watershed above the outlet (ft)
L	=Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	5.37	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	5.70	acres
Additional Drainage Area =	0.00	acres
Total Drainage Area=	5.70	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **13.24** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 40	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 40 TYPE OF BASIN: SKIMMER

Disturbed Area:	5.70	ac
Additional Drainage Area:	0.00	ac
Total Drainage Area:	5.70	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**13.24**	cfs

Sizing of Basin

10260 Required Volume ft^3 (Disturbed Area x 1800 cf/ac)

4302 Required Surface Area ft^2 **(Q25 x 325)**

46.4 Suggested Width ft

92.8 Suggested Length ft

48 Width at Surface Area (ft)

96 Length at Surface Area (ft) L/W Ratio = 2.0 **Okay**

3 Side Slope Ratio Z:1

3 Depth (ft)

30 Bottom Width (ft)

78 Bottom Length (ft)

2340 Bottom Area ($ft^{2)}$

10260 Actual Volume (ft^3) **Okay**

4608 Actual Surface Area (ft^2) **Okay**

15 Emergency Spillway Width (ft)

0.5 Depth of Flow (ft)

15.9 Spillway Capacity (cfs) **Okay**

2 Skimmer Size (in)

0.167 Head on Skimmer (ft)

1.75 Orifice Size (1/4 inch increments)

3.55 Dewatering Time (days)

Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
562.00	**2340**	0.00	0	0
563.00	**3024**	1.00	2682	2682
564.00	**3780**	2.00	3402	6084
565.00	**4608**	3.00	4194	10278
566.00	**5508**	4.00	5058	15336

Emergency Spillway Elevation:	565.00	ft
Top of Embankment Elevation:	566.00	ft
Bottom Elevation:	562.00	ft
Embankment Width:	**5**	ft

BASIN NAME		PROJECT NAME
BASIN 41	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
Sol Rios Moore		44089

Time of Concentration Calculation

BASIN NAME: BASIN 41

Modified Rational

Highest Elevation =	630	feet
Inlet Elevation =	587	feet
Difference =	43	feet
Travel Length =	800	feet

Equation 2.3 Kirpich Equation

$$Tc = \frac{(L^3 / H)^{0.385}}{128}$$

Where :

Tc =Time of Concentration (min)

H =Height of the most remote point on the watershed above the outlet (ft)

L =Length of flow from the most remote point on the watershed to the outlet (ft)

(Civil Engineering, Vol. 10, No. 6,June 1940,p.362.)

A graph of the Kirpich Equation also appears in Figure 2.4.

T_C =	4.14	min
T_C =	5	min
Intensity 25 year =	7.74	in/hr
C =	0.30	
Disturbed Area =	10.48	acres
Additional Drainage Area =	0.48	acres
Total Drainage Area=	10.96	acres

Equation 2.1 Rational Equation

$$Q = C\ I\ A$$

Where:

Q	=	Peak flow from the drainage area (cfs)
C	=	Coefficient of runoff (dimensionless)
I	=	Rainfall intensity for a given time to peak (in/hr)
A	=	Drainage area (acres)

Q25 = **25.45** cfs

*RED IS USER INPUT

BASIN NAME		PROJECT NAME
BASIN 41	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		**PROJECT NUMBER**
Sol Rios Moore		44089

Sediment Basin Design

Basin Name: BASIN 41 TYPE OF BASIN: RISER

Disturbed Area:	10.48	ac
Additional Drainage Area:	0.48	ac
Total Drainage Area:	10.96	ac
Runoff Coeff [Cc]:	0.30	
25-yr Rainfall Intensity [I]:	7.74	in/hr
25-yr Discharge [Q25]:	**25.45**	cfs

Sizing of Basin

18864	Required Volume ft^3	(Disturbed Area x 1800 cf/ac)	
11070	Required Surface Area ft^2	**(Q25 x 435)**	
74.4	Suggested Width ft		
148.8	Suggested Length ft		
75	Width at Surface Area (ft)		
150	Length at Surface Area (ft)	L/W Ratio = 2.0	**Okay**
3	Side Slope Ratio Z:1		
2	Depth (ft)		
63	Bottom Width (ft)		
138	Bottom Length (ft)		
8694	Bottom Area ($ft^{2)}$		
19896	Actual Volume (ft^3)	**Okay**	
11250	Actual Surface Area (ft^2)	**Okay**	
25	Emergency Spillway Width (ft)		
0.5	Depth of Flow (ft)		
26.5	Spillway Capacity (cfs)	**Okay**	
2.5	Skimmer Size (in)		
0.208	Head on Skimmer (ft)		
2.25	Orifice Size (1/4 inch increments)		
3.54	Dewatering Time (days)		
	Suggest about 3 days		

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumulative Volume (cf)
585.00	**8694**	0.00	0	0
586.00	**9936**	1.00	9315	9315
587.00	**11250**	2.00	10593	19908
588.00	**12636**	3.00	11943	31851
589.00	**14094**	4.00	13365	45216

Riser Elevation:	587.00	ft
Emergency Spillway Elevation:	588.00	ft
Top of Embankment Elevation:	589.00	ft
Bottom Elevation:	585.00	ft
Embankment Width:	**10**	ft

Sizing of Barrel & Riser

12	Barrel Size (in)	
38	Barrel Length (LF)	
585	Upstream Barrel Invert Elevation	
584	Downstream Barrel Invert Elevation	
2.63%	Slope of Barrel (%)	
HDPE	Barrel Pipe Material	
CMP	Riser Material	
18	Riser Size (in)	**Okay (Riser = 1.5 Barrel Size)**

Anti-Flotation Device (Only use for circular riser)

1.5	Riser Diameter (ft)	
3.0	Height (ft)	
380	Buoyant Force (lbs)	Area Riser x Ht Riser x Density Water x Safety Factor (.25)(pi)(Diameter)2 x (Height) x 62.4 pcf x 1.15 FS
2.5	Volume Required (cf)	Buoyant force / Density Of Concrete (150 pcf)
1.6	Square Root of Volume (ft)	(Assume 1 ft thick concrete footing)
2.0	Length of Concrete Footing	
2.0	Width of Concrete Footing	
1.0	Height of Concrete Footing (Thickness)	
4	Volume Provided (cf)	

***RED IS USER INPUT**

DITCH NAME		PROJECT NAME
TDD 1A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 1A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	5.81	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	13.5	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	470 LF
Slope =	0.026	(ft/ft)		Highest Elevation =	700
Z Required =	1.70	Ratio		Lowest Elevation =	688
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	1.00	ft	12.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.59 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

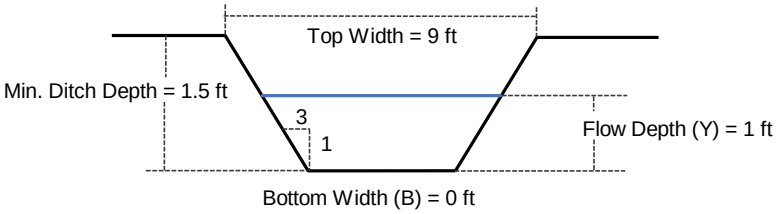
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	3.00	SF		
New P =	6.32	Wetted perimeter		
New R =	0.47	Hydraulic radius		
Z Actual =	1.82	Must be greater than z required=>	1.70	Okay
New V =	4.83	fps		

Minimum Design Geometry

Liner: North American Green, S150 — **1.75** LB/SF > 1.6 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.50	0.00	1.00	9	3:1

Ditch Liner
North American Green, S150

*RED IS USER INPUT

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CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

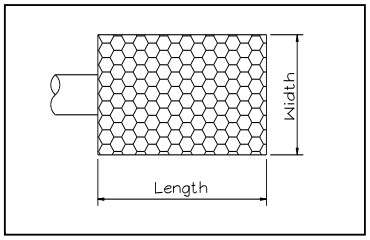
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 1A

Velocity =	4.83	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	9	ft			
Ditch Area =	3	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	23.45	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**24**	in	Apron Length =	8.0	ft
			Apron Width = Top Width.=	9.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 1B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 1B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	0.25	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	0.6	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	470 LF
Slope =	0.009	(ft/ft)		Highest Elevation =	692
Z Required =	0.13	Ratio		Lowest Elevation =	688
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.50	ft	6.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 0.27 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

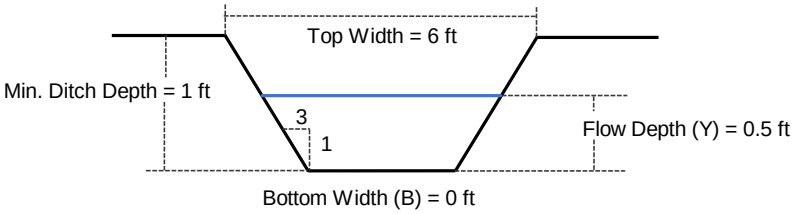
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	0.29	Must be greater than z required=>	0.13	Okay
New V =	1.76	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 0.27 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

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CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

TIMMONS GROUP
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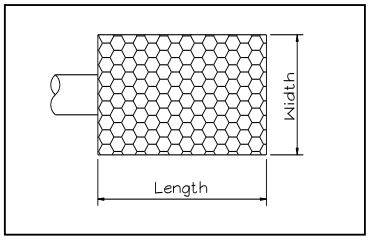
Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 1B

Velocity =	1.76	fps	From Fig. 8.06.c:	ZONE =	1
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	12	in	Apron Length =	4.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 2A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 2A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	11.52	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	**26.7**	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	505 LF
Slope =	0.010	(ft/ft)		Highest Elevation =	668
Z Required =	5.41	Ratio		Lowest Elevation =	663
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	1.25	ft	15.0	in
Bottom Width (B) =	1.75	ft	21.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 0.77 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

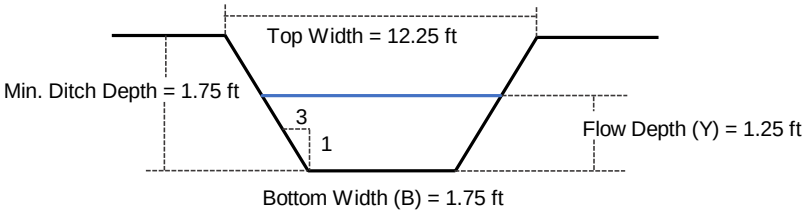
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	6.88	SF		
New P =	9.66	Wetted perimeter		
New R =	0.71	Hydraulic radius		
Z Actual =	**5.48**	Must be greater than z required=>	**5.41**	**Okay**
New V =	3.94	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 0.78 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.75	1.75	1.25	12.25	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:23 AM

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

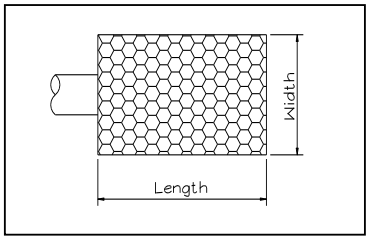
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 2A

Velocity =	3.94	fps	From Fig. 8.06.c: ZONE =	**2**	
Top Width =	12.25	ft			
Ditch Area =	6.875	sf	Rip Rap Class =	B	
Equivalent Pipe Diameter =	35.50	in	Apron Thickness =	18	in
Equivalent Pipe Diameter =	**26**	in	Apron Length =	13.0	ft
			Apron Width = Top Width.=	12.3	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 2B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 2B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	9.84	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	22.8	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	200 LF
Slope =	0.005	(ft/ft)		Highest Elevation =	664
Z Required =	6.51	Ratio		Lowest Elevation =	663
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	1.50	ft	18.0	in
Bottom Width (B) =	1.00	ft	12.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 0.47 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

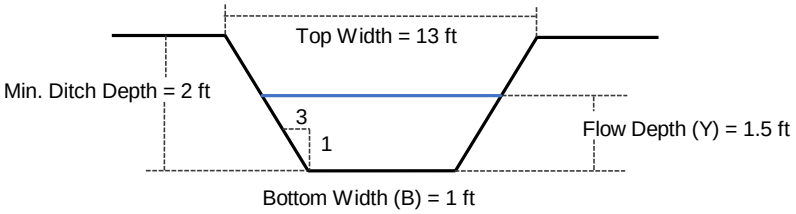
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	8.25	SF		
New P =	10.49	Wetted perimeter		
New R =	0.79	Hydraulic radius		
Z Actual =	7.03	Must be greater than z required=>	6.51	Okay
New V =	2.99	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 0.47 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
2.00	1.00	1.50	13	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:23 AM

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

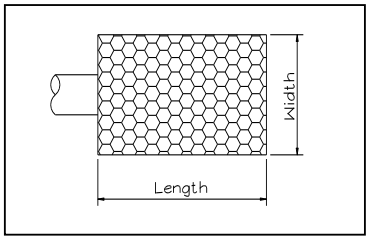
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 2B

Velocity =	2.99	fps	From Fig. 8.06.c:	ZONE =	2
Top Width =	13	ft			
Ditch Area =	8.25	sf	Rip Rap Class =	B	
Equivalent Pipe Diameter =	38.89	in	Apron Thickness =	18	in
Equivalent Pipe Diameter =	42	in	Apron Length =	21.0	ft
			Apron Width = Top Width.=	13.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 3A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 3A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	7.62	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	17.7	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	595 LF
Slope =	0.012	(ft/ft)		Highest Elevation =	663
Z Required =	3.28	Ratio		Lowest Elevation =	656
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	1.00	ft	12.0	in
Bottom Width (B) =	1.75	ft	21.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 0.73 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

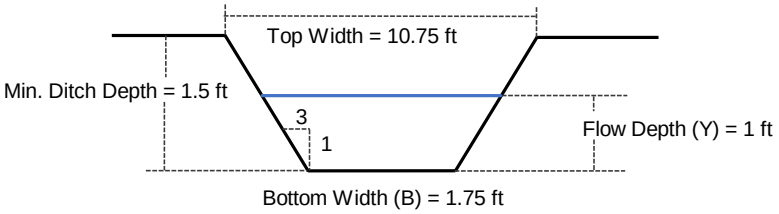
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	4.75	SF		
New P =	8.07	Wetted perimeter		
New R =	0.59	Hydraulic radius		
Z Actual =	3.33	Must be greater than z required=>	3.28	Okay
New V =	3.78	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 0.74 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.50	1.75	1.00	10.75	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:52 AM

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

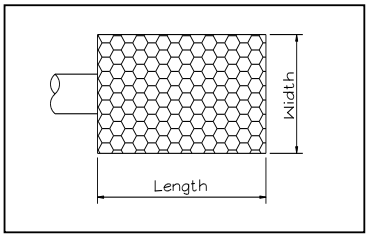
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 3A

Velocity =	3.78	fps	From Fig. 8.06.c: ZONE =	**2**	
Top Width =	10.75	ft			
Ditch Area =	4.75	sf	Rip Rap Class =	B	
Equivalent Pipe Diameter =	29.51	in	Apron Thickness =	18	in
Equivalent Pipe Diameter =	**30**	in	Apron Length =	15.0	ft
			Apron Width = Top Width.=	10.8	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 4A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 4A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	3.52	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	8.2	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	1450 LF
Slope =	0.025	(ft/ft)		Highest Elevation =	686
Z Required =	1.04	Ratio		Lowest Elevation =	650
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	1.00	ft	12.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.55 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

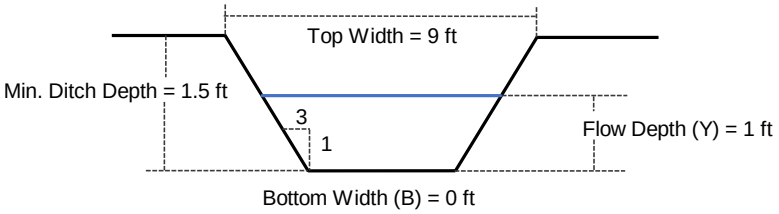
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	3.00	SF		
New P =	6.32	Wetted perimeter		
New R =	0.47	Hydraulic radius		
Z Actual =	1.82	Must be greater than z required=>	1.04	Okay
New V =	4.76	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 1.55 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.50	0.00	1.00	9	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:34 AM

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

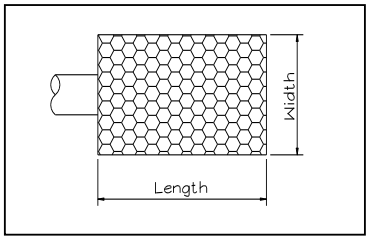
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 4A

Velocity =	4.76	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	9	ft			
Ditch Area =	3	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	23.45	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**24**	in	Apron Length =	8.0	ft
			Apron Width = Top Width.=	9.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 4B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 4B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	7.32	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	17.0	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	1300 LF
Slope =	0.023	(ft/ft)		Highest Elevation =	680
Z Required =	2.25	Ratio		Lowest Elevation =	650
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	1.00	ft	12.0	in
Bottom Width (B) =	0.75	ft	9.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.44 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

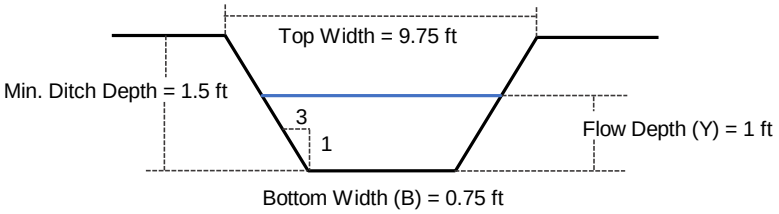
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	3.75	SF		
New P =	7.07	Wetted perimeter		
New R =	0.53	Hydraulic radius		
Z Actual =	2.46	Must be greater than z required=>	2.25	Okay
New V =	4.94	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 1.44 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.50	0.75	1.00	9.75	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:35 AM

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

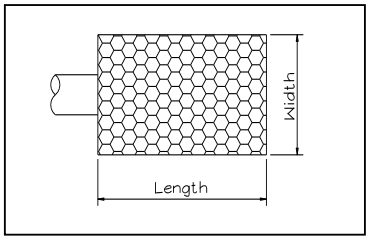
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 4B

Velocity =	4.94	fps	From Fig. 8.06.c: ZONE =	**2**	
Top Width =	9.75	ft			
Ditch Area =	3.75	sf	Rip Rap Class =	B	
Equivalent Pipe Diameter =	26.22	in	Apron Thickness =	18	in
Equivalent Pipe Diameter =	**30**	in	Apron Length =	15.0	ft
			Apron Width = Top Width.=	9.8	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 5A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 5A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	2.08	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	4.8	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	508 LF
Slope =	0.031	(ft/ft)		Highest Elevation =	669
Z Required =	0.55	Ratio		Lowest Elevation =	653
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.75	ft	9.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.47 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

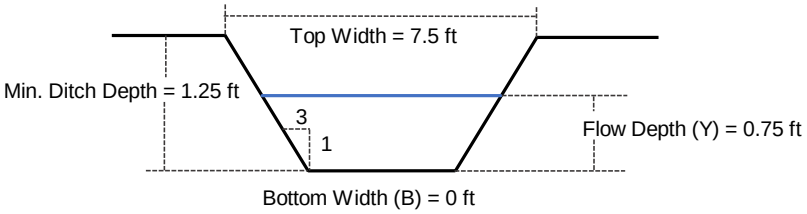
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.69	SF		
New P =	4.74	Wetted perimeter		
New R =	0.36	Hydraulic radius		
Z Actual =	0.85	Must be greater than z required=>	0.55	Okay
New V =	4.43	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 1.48 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.00	0.75	7.5	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:35 AM

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

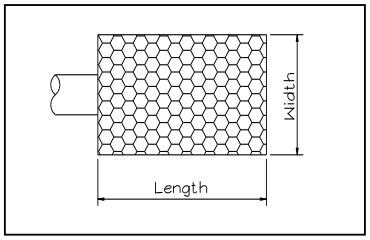
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 5A

Velocity =	4.43	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	7.5	ft			
Ditch Area =	1.6875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	17.59	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**18**	in	Apron Length =	6.0	ft
			Apron Width = Top Width.=	7.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 5B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 5B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	1.17	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	2.7	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	386 LF
Slope =	0.018	(ft/ft)		Highest Elevation =	661
Z Required =	0.41	Ratio		Lowest Elevation =	654
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.75	ft	9.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 0.85 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

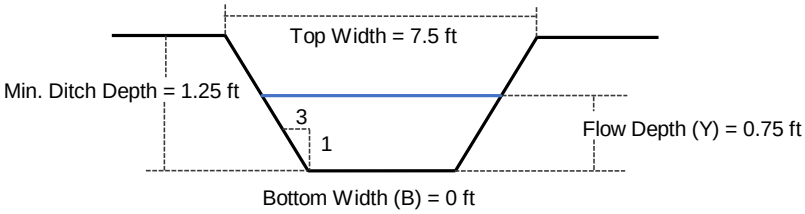
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.69	SF		
New P =	4.74	Wetted perimeter		
New R =	0.36	Hydraulic radius		
Z Actual =	0.85	Must be greater than z required=>	0.41	Okay
New V =	3.36	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 0.85 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.00	0.75	7.5	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:35 AM

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

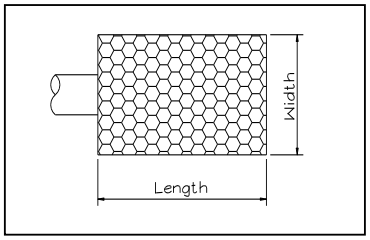
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 5B

Velocity =	3.36	fps	From Fig. 8.06.c:	ZONE =	**1**
Top Width =	7.5	ft			
Ditch Area =	1.6875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	17.59	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**18**	in	Apron Length =	6.0	ft
			Apron Width = Top Width.=	7.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 6A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 6A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	4.59	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	10.7	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	616 LF
Slope =	0.034	(ft/ft)		Highest Elevation =	660
Z Required =	1.16	Ratio		Lowest Elevation =	639
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	1.00	ft	12.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 2.13 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

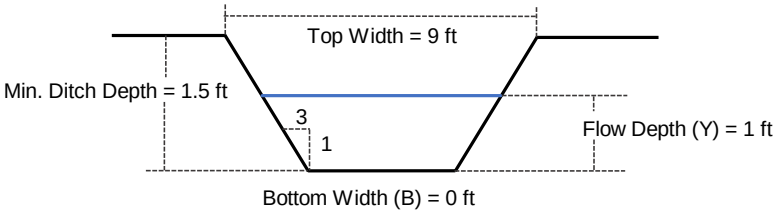
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	3.00	SF		
New P =	6.32	Wetted perimeter		
New R =	0.47	Hydraulic radius		
Z Actual =	1.82	Must be greater than z required=>	1.16	Okay
New V =	5.58	fps		

Minimum Design Geometry

Liner: North American Green, C125 — **2.25** LB/SF > 2.13 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.50	0.00	1.00	9	3:1

Ditch Liner
North American Green, C125

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:34 AM

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

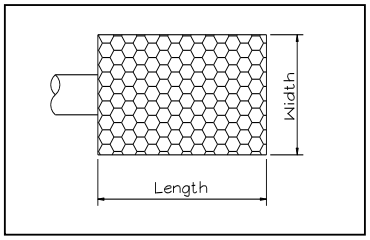
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 6A

Velocity =	5.58	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	9	ft			
Ditch Area =	3	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	23.45	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**24**	in	Apron Length =	8.0	ft
			Apron Width = Top Width.=	9.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 6B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 6B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	2.41	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	5.6	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	610 LF
Slope =	0.025	(ft/ft)		Highest Elevation =	653
Z Required =	0.72	Ratio		Lowest Elevation =	638
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.75	ft	9.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.15 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

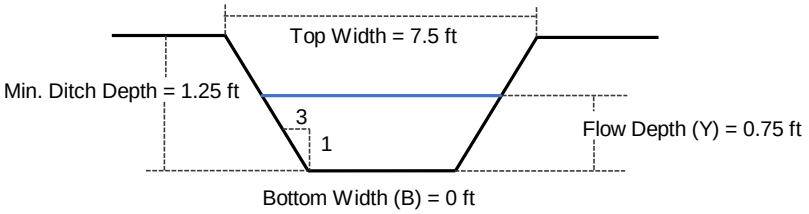
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.69	SF		
New P =	4.74	Wetted perimeter		
New R =	0.36	Hydraulic radius		
Z Actual =	0.85	Must be greater than z required=>	0.72	Okay
New V =	3.91	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 1.16 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.00	0.75	7.5	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:57 AM

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

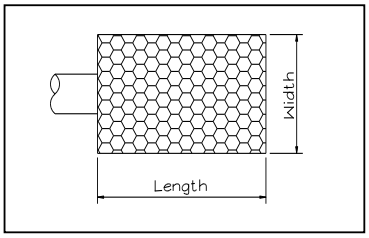
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 6B

Velocity =	3.91	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	7.5	ft			
Ditch Area =	1.6875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	17.59	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**18**	in	Apron Length =	6.0	ft
			Apron Width = Top Width.=	7.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 7A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	CCAC Building Solutions
CALCULATED BY		PROJECT NUMBER
David Hojsan		42929

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 7A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	7.25	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	16.8	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	360 LF
Slope =	0.019	(ft/ft)		Highest Elevation =	636
Z Required =	2.43	Ratio		Lowest Elevation =	629
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	1.25	ft	15.0	in
Bottom Width (B) =	0.25	ft	3.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.52 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

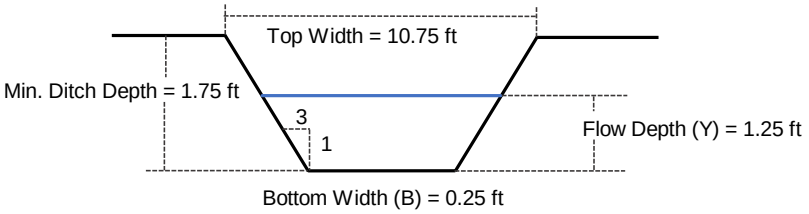
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	5.00	SF		
New P =	8.16	Wetted perimeter		
New R =	0.61	Hydraulic radius		
Z Actual =	3.61	Must be greater than z required=>	2.43	Okay
New V =	5.00	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 1.52 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.75	0.25	1.25	10.75	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:34 AM

CALCULATED BY	PROJECT NAME
David Hojsan	CCAC Building Solutions
	PROJECT NUMBER
	42929

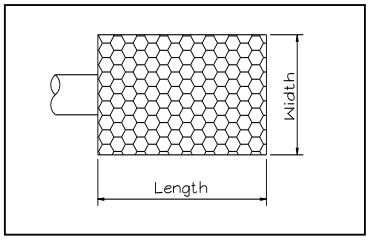
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 7A

Velocity =	5.00	fps	From Fig. 8.06.c: ZONE =	**2**	
Top Width =	10.75	ft			
Ditch Area =	5	sf	Rip Rap Class =	B	
Equivalent Pipe Diameter =	30.28	in	Apron Thickness =	18	in
Equivalent Pipe Diameter =	**30**	in	Apron Length =	15.0	ft
			Apron Width = Top Width.=	10.8	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 7B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	CCAC Building Solutions
CALCULATED BY		PROJECT NUMBER
David Hojsan		42929

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 7B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**1.04**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**2.4**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap	(Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)		Ditch Length =	**513** LF
Slope =	0.037	(ft/ft)		Highest Elevation =	**648**
Z Required =	0.25	Ratio		Lowest Elevation =	**629**
Side Slope (M) =	**3**	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**0.50**	ft	6.0	in
Bottom Width (B) =	**0.00**	ft	0.0	in
Freeboard =	**0.50**	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.16 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

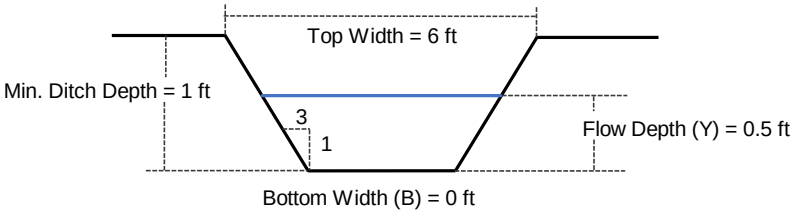
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	**0.29**	Must be greater than z required=>	**0.25**	**Okay**
New V =	3.66	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 1.16 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:36 AM

CALCULATED BY	PROJECT NAME
David Hojsan	CCAC Building Solutions
	PROJECT NUMBER
	42929

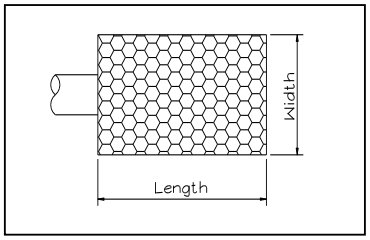
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 7B

Velocity =	3.66	fps	From Fig. 8.06.c: ZONE =	1	
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	12	in	Apron Length =	4.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 8A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	CCAC Building Solutions
CALCULATED BY		PROJECT NUMBER
David Hojsan		42929

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 8A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	0.94	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	2.2	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	250 LF
Slope =	0.044	(ft/ft)		Highest Elevation =	624
Z Required =	0.21	Ratio		Lowest Elevation =	613
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.50	ft	6.0 in
Bottom Width (B) =	0.00	ft	0.0 in
Freeboard =	0.50	ft	6.0 in

Compute Tractive Force

T=YxDxS

T = 1.37 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

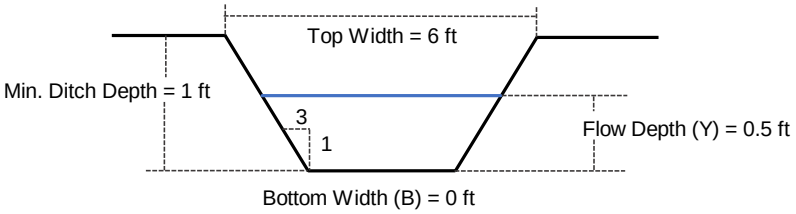
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	0.29	Must be greater than z required=>	0.21	Okay
New V =	3.99	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 1.38 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

CALCULATED BY	PROJECT NAME
David Hojsan	CCAC Building Solutions
	PROJECT NUMBER
	42929

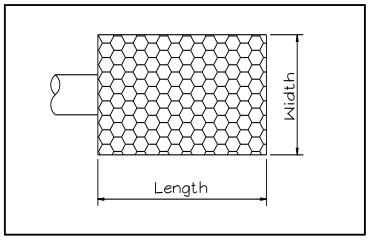
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 8A

Velocity =	3.99	fps	From Fig. 8.06.c:	ZONE =	1
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	12	in	Apron Length =	4.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 8B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	CCAC Building Solutions
CALCULATED BY		PROJECT NUMBER
David Hojsan		42929

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 8B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**0.87**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**2.0**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap	(Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)		Ditch Length =	**493** LF
Slope =	0.039	(ft/ft)		Highest Elevation =	**632**
Z Required =	0.21	Ratio		Lowest Elevation =	**613**
Side Slope (M) =	**3**	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**0.50**	ft	6.0 in
Bottom Width (B) =	**0.00**	ft	0.0 in
Freeboard =	**0.50**	ft	6.0 in

Compute Tractive Force

T=YxDxS

T = 1.20 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

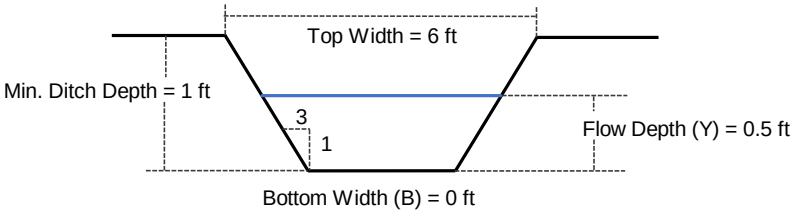
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	**0.29**	Must be greater than z required=>	**0.21**	**Okay**
New V =	3.74	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 1.21 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:25 AM

CALCULATED BY	PROJECT NAME
David Hojsan	CCAC Building Solutions
	PROJECT NUMBER
	42929

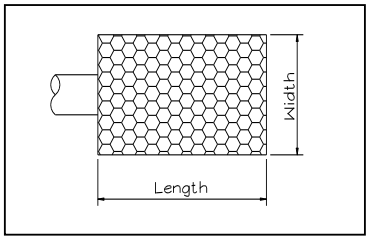
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 8B

Velocity =	3.74	fps	From Fig. 8.06.c:	ZONE =	1
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	12	in	Apron Length =	4.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 9A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 9A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	5.60	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	13.0	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	790 LF
Slope =	0.018	(ft/ft)		Highest Elevation =	657
Z Required =	1.97	Ratio		Lowest Elevation =	643
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	1.00	ft	12.0	in
Bottom Width (B) =	0.25	ft	3.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.11 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

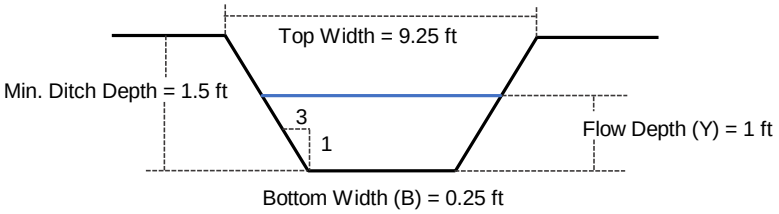
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	3.25	SF		
New P =	6.57	Wetted perimeter		
New R =	0.49	Hydraulic radius		
Z Actual =	2.03	Must be greater than z required=>	1.97	Okay
New V =	4.13	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 1.11 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.50	0.25	1.00	9.25	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:25 AM

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

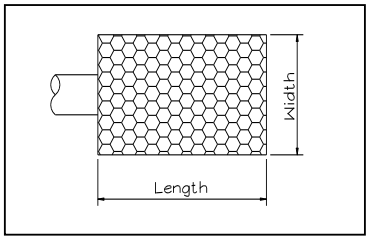
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 9A

Velocity =	4.13	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	9.25	ft			
Ditch Area =	3.25	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	24.41	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**24**	in	Apron Length =	8.0	ft
			Apron Width = Top Width.=	9.3	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 9B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 9B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**4.51**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**10.5**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap	(Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)		Ditch Length =	**780** LF
Slope =	0.014	(ft/ft)		Highest Elevation =	**654**
Z Required =	1.78	Ratio		Lowest Elevation =	**643**
Side Slope (M) =	**3**	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**1.00**	ft	12.0	in
Bottom Width (B) =	**0.25**	ft	3.0	in
Freeboard =	**0.50**	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 0.88 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

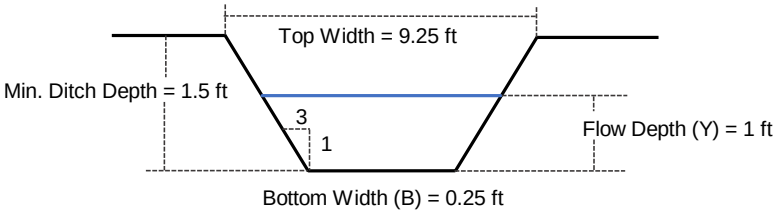
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	3.25	SF		
New P =	6.57	Wetted perimeter		
New R =	0.49	Hydraulic radius		
Z Actual =	**2.03**	Must be greater than z required=>	**1.78**	**Okay**
New V =	3.69	fps		

Minimum Design Geometry

Liner: **North American Green, S75** **1.55** LB/SF > 0.88 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.50	0.25	1.00	9.25	3:1

Ditch Liner
North American Green, S75

***RED IS USER INPUT**

LATEST REVISION: 8/28/2019 11:25 AM

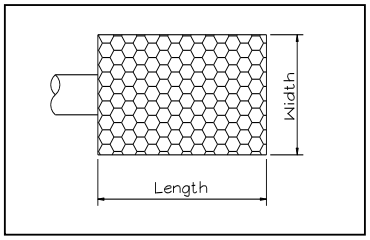
CALCULATED BY		PROJECT NAME
David Hojsan	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
		PROJECT NUMBER
		44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 9B

Velocity =	3.69	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	9.25	ft			
Ditch Area =	3.25	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	24.41	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**24**	in	Apron Length =	8.0	ft
			Apron Width = Top Width.=	9.3	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 10A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 10A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**0.66**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**1.5**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap	(Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)		Ditch Length =	**120** LF
Slope =	0.033	(ft/ft)		Highest Elevation =	**654**
Z Required =	0.17	Ratio		Lowest Elevation =	**650**
Side Slope (M) =	**3**	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**0.50**	ft	6.0	in
Bottom Width (B) =	**0.00**	ft	0.0	in
Freeboard =	**0.50**	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.04 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

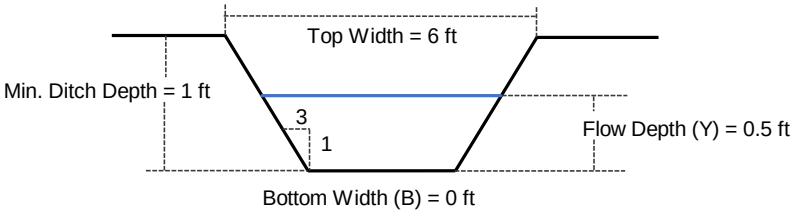
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	**0.29**	Must be greater than z required=>	**0.17**	**Okay**
New V =	3.47	fps		

Minimum Design Geometry

Liner: **North American Green, S75** **1.55** LB/SF > 1.04 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
North American Green, S75

***RED IS USER INPUT**

LATEST REVISION: 8/28/2019 11:24 AM

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

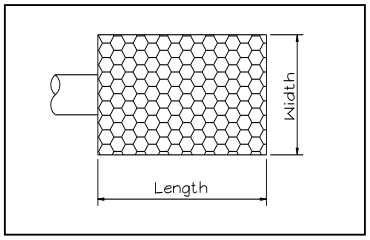
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 10A

Velocity =	3.47	fps	From Fig. 8.06.c: ZONE =	1	
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	12	in	Apron Length =	4.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 10B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 10B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	2.42	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	5.6	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	156 LF
Slope =	0.019	(ft/ft)		Highest Elevation =	653
Z Required =	0.82	Ratio		Lowest Elevation =	650
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.75	ft	9.0 in
Bottom Width (B) =	0.00	ft	0.0 in
Freeboard =	0.50	ft	6.0 in

Compute Tractive Force

T=YxDxS

T = 0.90 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

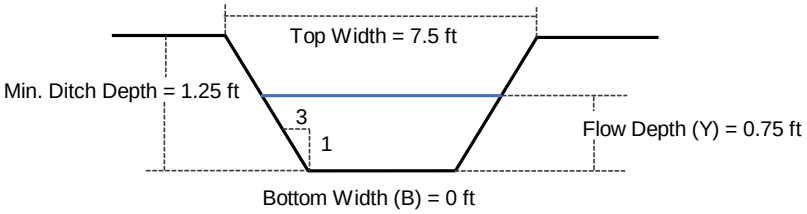
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.69	SF		
New P =	4.74	Wetted perimeter		
New R =	0.36	Hydraulic radius		
Z Actual =	0.85	Must be greater than z required=>	0.82	Okay
New V =	3.46	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 0.9 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.00	0.75	7.5	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:24 AM

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

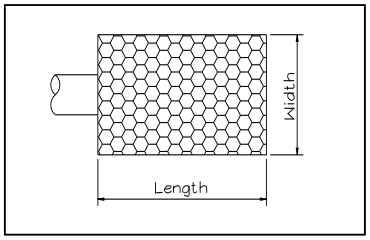
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 10B

Velocity =	3.46	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	7.5	ft			
Ditch Area =	1.6875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	17.59	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**18**	in	Apron Length =	6.0	ft
			Apron Width = Top Width.=	7.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 11A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 11A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	4.06	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	9.4	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	1126 LF
Slope =	0.020	(ft/ft)		Highest Elevation =	653
Z Required =	1.33	Ratio		Lowest Elevation =	630
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	1.00	ft	12.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.27 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

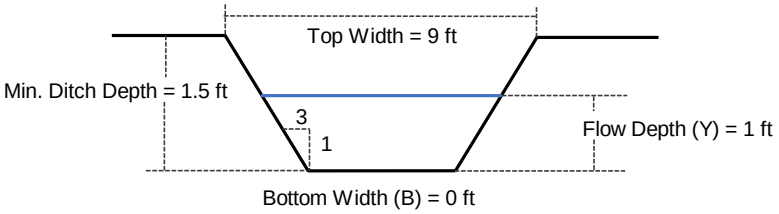
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	3.00	SF		
New P =	6.32	Wetted perimeter		
New R =	0.47	Hydraulic radius		
Z Actual =	1.82	Must be greater than z required=>	1.33	Okay
New V =	4.32	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 1.28 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.50	0.00	1.00	9	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:38 AM

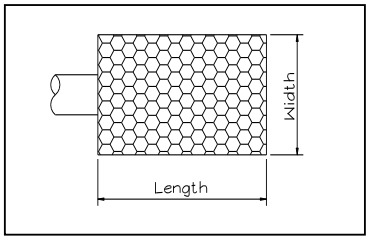
CALCULATED BY		PROJECT NAME
David Hojsan	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
		PROJECT NUMBER
		44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 11A

Velocity =	4.32	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	9	ft			
Ditch Area =	3	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	23.45	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**24**	in	Apron Length =	8.0	ft
			Apron Width = Top Width.=	9.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 11B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 11B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	9.71	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	22.5	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	848 LF
Slope =	0.014	(ft/ft)		Highest Elevation =	642
Z Required =	3.82	Ratio		Lowest Elevation =	630
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	1.25	ft	15.0	in
Bottom Width (B) =	0.50	ft	6.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.10 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

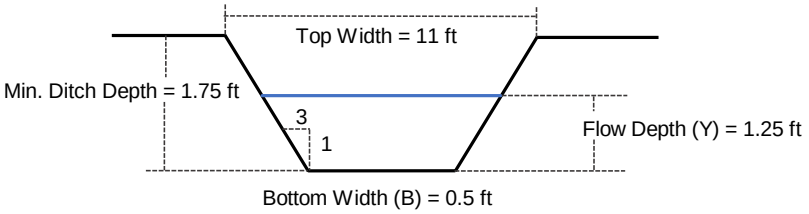
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	5.31	SF		
New P =	8.41	Wetted perimeter		
New R =	0.63	Hydraulic radius		
Z Actual =	3.91	Must be greater than z required=>	3.82	Okay
New V =	4.35	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 1.11 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.75	0.50	1.25	11	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:39 AM

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

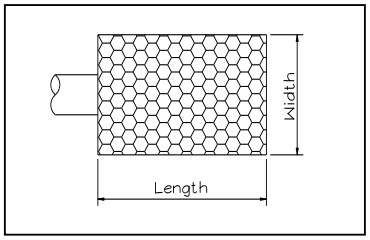
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 11B

Velocity =	4.35	fps	From Fig. 8.06.c:	ZONE =	2
Top Width =	11	ft			
Ditch Area =	5.3125	sf	Rip Rap Class =	B	
Equivalent Pipe Diameter =	31.21	in	Apron Thickness =	18	in
Equivalent Pipe Diameter =	36	in	Apron Length =	18.0	ft
			Apron Width = Top Width.=	11.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 12A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 12A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	0.97	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	2.3	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	410 LF
Slope =	0.049	(ft/ft)		Highest Elevation =	642
Z Required =	0.21	Ratio		Lowest Elevation =	622
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.50	ft	6.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.52 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

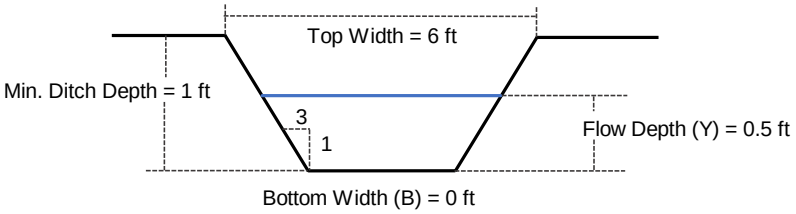
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	0.29	Must be greater than z required=>	0.21	Okay
New V =	4.20	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 1.53 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:39 AM

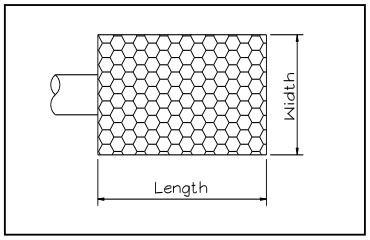
	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	**PROJECT NAME** Carolina Sunrock
CALCULATED BY David Hojsan		**PROJECT NUMBER** 44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 12A

Velocity =	4.20	fps	From Fig. 8.06.c:	ZONE =	**1**
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**12**	in	Apron Length =	4.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 12B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 12B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**1.50**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**3.5**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap	(Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)		Ditch Length =	**565** LF
Slope =	0.035	(ft/ft)		Highest Elevation =	**642**
Z Required =	0.37	Ratio		Lowest Elevation =	**622**
Side Slope (M) =	**3**	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**0.75**	ft	9.0	in
Bottom Width (B) =	**0.00**	ft	0.0	in
Freeboard =	**0.50**	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.66 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

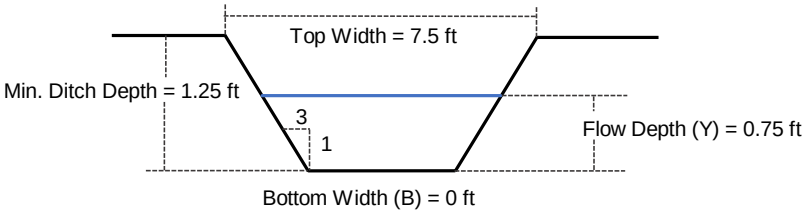
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.69	SF		
New P =	4.74	Wetted perimeter		
New R =	0.36	Hydraulic radius		
Z Actual =	**0.85**	Must be greater than z required=>	**0.37**	**Okay**
New V =	4.69	fps		

Minimum Design Geometry

Liner: North American Green, S150 **1.75** LB/SF > 1.66 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.00	0.75	7.5	3:1

Ditch Liner
North American Green, S150

***RED IS USER INPUT**

LATEST REVISION: 8/28/2019 11:39 AM

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

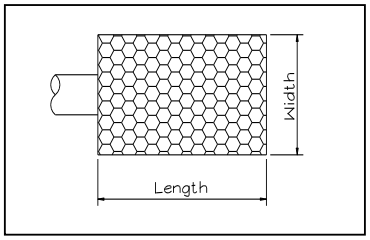
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 12B

Velocity =	4.69	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	7.5	ft			
Ditch Area =	1.6875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	17.59	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**18**	in	Apron Length =	6.0	ft
			Apron Width = Top Width.=	7.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 13A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 13A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	4.69	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	10.9	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	1132 LF
Slope =	0.042	(ft/ft)		Highest Elevation =	666
Z Required =	1.08	Ratio		Lowest Elevation =	619
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	1.00	ft	12.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 2.59 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

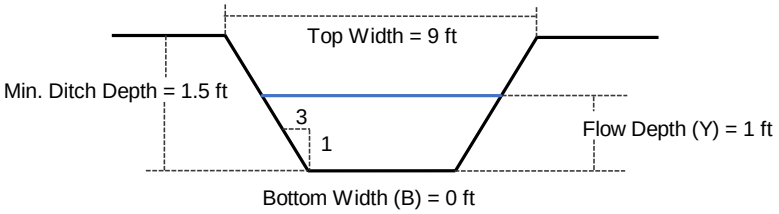
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	3.00	SF		
New P =	6.32	Wetted perimeter		
New R =	0.47	Hydraulic radius		
Z Actual =	1.82	Must be greater than z required=>	1.08	Okay
New V =	6.16	fps		

Minimum Design Geometry

Liner: Class B (8"@18"THK) **3.50** LB/SF > 2.6 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.50	0.00	1.00	9	3:1

Ditch Liner
Class B (8"@18"THK)

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:38 AM

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

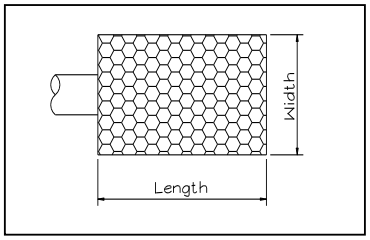
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 13A

Velocity =	6.16	fps	From Fig. 8.06.c:	ZONE =	2
Top Width =	9	ft			
Ditch Area =	3	sf	Rip Rap Class =	B	
Equivalent Pipe Diameter =	23.45	in	Apron Thickness =	18	in
Equivalent Pipe Diameter =	24	in	Apron Length =	12.0	ft
			Apron Width = Top Width.=	9.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 13B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 13B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	3.12	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	7.2	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	710 LF
Slope =	0.004	(ft/ft)		Highest Elevation =	622
Z Required =	2.24	Ratio		Lowest Elevation =	619
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	1.00	ft	12.0	in
Bottom Width (B) =	0.75	ft	9.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 0.26 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

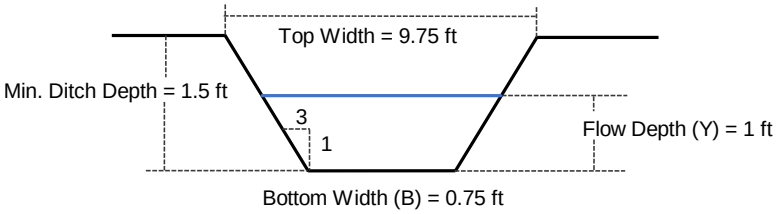
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	3.75	SF		
New P =	7.07	Wetted perimeter		
New R =	0.53	Hydraulic radius		
Z Actual =	2.46	Must be greater than z required=>	2.24	Okay
New V =	2.11	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 0.27 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.50	0.75	1.00	9.75	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:38 AM

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

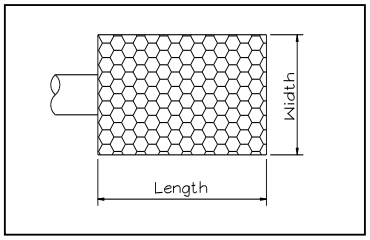
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 13B

Velocity =	2.11	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	9.75	ft			
Ditch Area =	3.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	26.22	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**30**	in	Apron Length =	10.0	ft
			Apron Width = Top Width.=	9.8	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 14A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 14A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**0.25**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**0.6**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap	(Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)		Ditch Length =	**230** LF
Slope =	0.078	(ft/ft)		Highest Elevation =	**618**
Z Required =	0.04	Ratio		Lowest Elevation =	**600**
Side Slope (M) =	**3**	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**0.25**	ft	3.0 in
Bottom Width (B) =	**0.00**	ft	0.0 in
Freeboard =	**0.50**	ft	6.0 in

Compute Tractive Force

T=YxDxS

T = 1.22 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

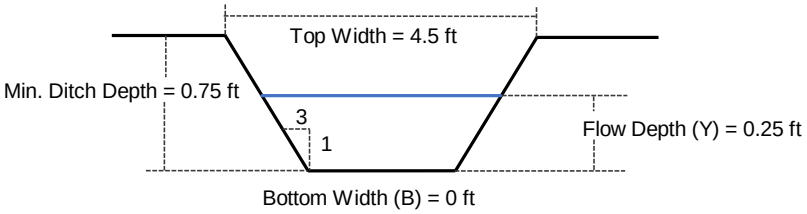
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.19	SF		
New P =	1.58	Wetted perimeter		
New R =	0.12	Hydraulic radius		
Z Actual =	**0.05**	Must be greater than z required=>	**0.04**	**Okay**
New V =	3.35	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 1.23 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
0.75	0.00	0.25	4.5	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:39 AM

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

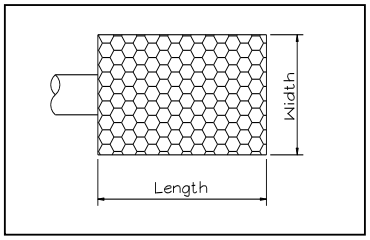
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 14A

Velocity =	3.35	fps	From Fig. 8.06.c: ZONE =	1	
Top Width =	4.5	ft			
Ditch Area =	0.1875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	5.86	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	6	in	Apron Length =	2.0	ft
			Apron Width = Top Width.=	4.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 14B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 14B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	3.25	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	7.5	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	615 LF
Slope =	0.036	(ft/ft)		Highest Elevation =	622
Z Required =	0.80	Ratio		Lowest Elevation =	600
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.75	ft	9.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.67 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

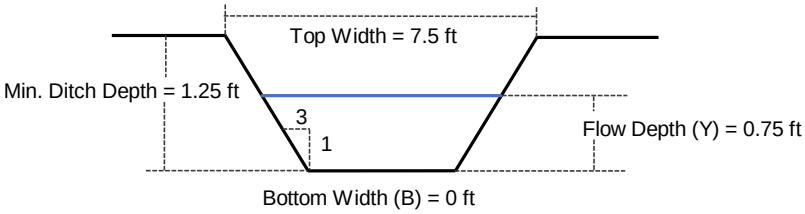
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.69	SF		
New P =	4.74	Wetted perimeter		
New R =	0.36	Hydraulic radius		
Z Actual =	0.85	Must be greater than z required=>	0.80	Okay
New V =	4.72	fps		

Minimum Design Geometry

Liner: North American Green, S150 — **1.75** LB/SF > 1.68 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.00	0.75	7.5	3:1

Ditch Liner
North American Green, S150

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:38 AM

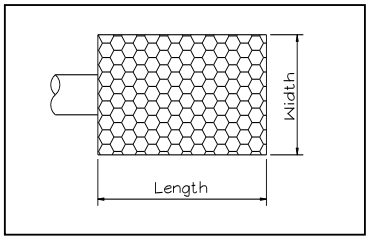
CALCULATED BY		PROJECT NAME
David Hojsan	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
		PROJECT NUMBER
		44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 14B

Velocity =	4.72	fps	From Fig. 8.06.c:	ZONE =	**1**
Top Width =	7.5	ft			
Ditch Area =	1.6875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	17.59	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**18**	in	Apron Length =	6.0	ft
			Apron Width = Top Width.=	7.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 15A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
April Blye		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 15A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	1.34	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	3.1	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	183 LF
Slope =	0.071	(ft/ft)		Highest Elevation =	631
Z Required =	0.24	Ratio		Lowest Elevation =	618
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.50	ft	6.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 2.22 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

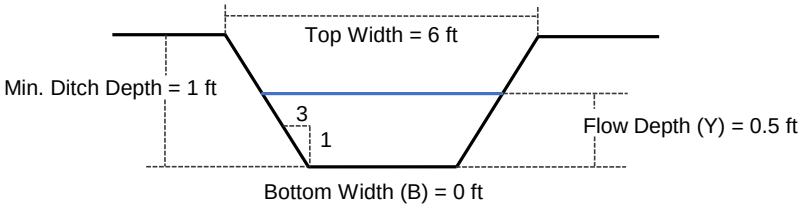
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	0.29	Must be greater than z required=>	0.24	Okay
New V =	5.07	fps		

Minimum Design Geometry

Liner: North American Green, C125 — **2.25** LB/SF > 2.22 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
North American Green, C125

*RED IS USER INPUT

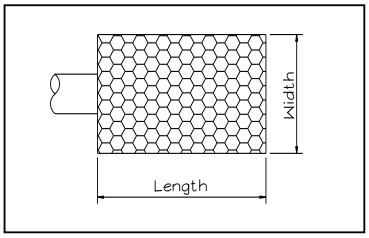
	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	**PROJECT NAME** Carolina Sunrock
CALCULATED BY April Blye		**PROJECT NUMBER** 44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 15A

Velocity =	5.07	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**15**	in	Apron Length =	5.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 15B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
April Blye		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 15B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	0.21	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	0.5	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	139 LF
Slope =	0.086	(ft/ft)		Highest Elevation =	630
Z Required =	0.03	Ratio		Lowest Elevation =	618
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.30	ft	3.6	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.62 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

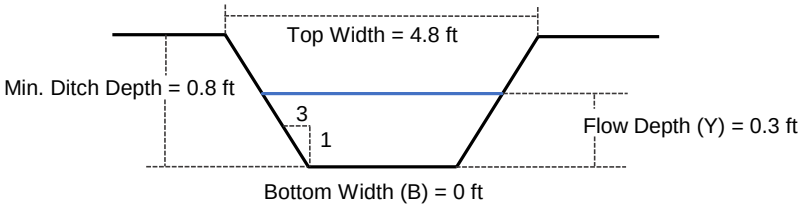
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.27	SF		
New P =	1.90	Wetted perimeter		
New R =	0.14	Hydraulic radius		
Z Actual =	0.07	Must be greater than z required=>	0.03	Okay
New V =	3.98	fps		

Minimum Design Geometry

Liner: North American Green, S150 **1.75** LB/SF > 1.62 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
0.80	0.00	0.30	4.8	3:1

Ditch Liner
North American Green, S150

*RED IS USER INPUT

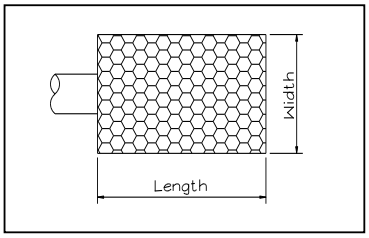
	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	**PROJECT NAME** Carolina Sunrock
CALCULATED BY April Blye		**PROJECT NUMBER** 44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 15B

Velocity =	3.98	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	4.8	ft			
Ditch Area =	0.27	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	7.04	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**12**	in	Apron Length =	4.0	ft
			Apron Width = Top Width.=	4.8	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 16A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 16A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**2.06**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**4.8**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap	(Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)		Ditch Length =	**925** LF
Slope =	0.021	(ft/ft)		Highest Elevation =	**619**
Z Required =	0.67	Ratio		Lowest Elevation =	**600**
Side Slope (M) =	**3**	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**0.75**	ft	9.0	in
Bottom Width (B) =	**0.00**	ft	0.0	in
Freeboard =	**0.50**	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 0.96 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

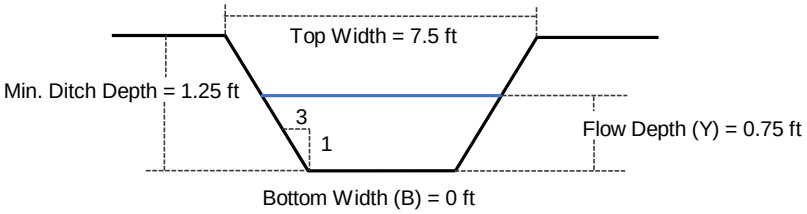
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.69	SF		
New P =	4.74	Wetted perimeter		
New R =	0.36	Hydraulic radius		
Z Actual =	**0.85**	Must be greater than z required=>	**0.67**	**Okay**
New V =	3.57	fps		

Minimum Design Geometry

Liner: **North American Green, S75** **1.55** LB/SF > 0.97 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.00	0.75	7.5	3:1

Ditch Liner
North American Green, S75

***RED IS USER INPUT**

LATEST REVISION: 8/28/2019 11:43 AM

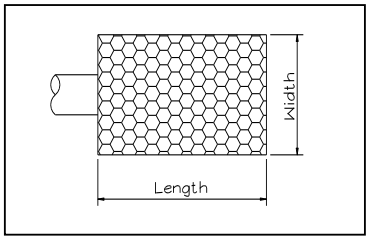
CALCULATED BY		PROJECT NAME
David Hojsan	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
		PROJECT NUMBER
		44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 16A

Velocity =	3.57	fps	From Fig. 8.06.c:	ZONE =	**1**
Top Width =	7.5	ft			
Ditch Area =	1.6875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	17.59	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**18**	in	Apron Length =	6.0	ft
			Apron Width = Top Width.=	7.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 16B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 16B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**1.34**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**3.1**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap	(Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)		Ditch Length =	**665** LF
Slope =	0.014	(ft/ft)		Highest Elevation =	**609**
Z Required =	0.54	Ratio		Lowest Elevation =	**600**
Side Slope (M) =	**3**	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**0.75**	ft	9.0	in
Bottom Width (B) =	**0.00**	ft	0.0	in
Freeboard =	**0.50**	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 0.63 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

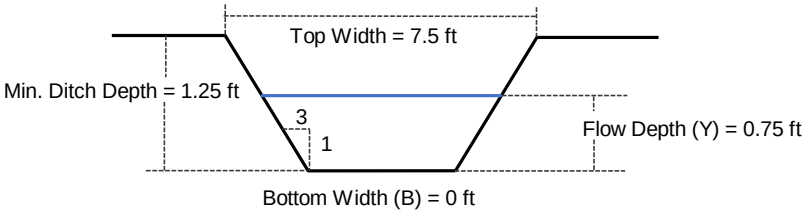
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.69	SF		
New P =	4.74	Wetted perimeter		
New R =	0.36	Hydraulic radius		
Z Actual =	**0.85**	Must be greater than z required=>	**0.54**	**Okay**
New V =	2.90	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 0.64 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.00	0.75	7.5	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:42 AM

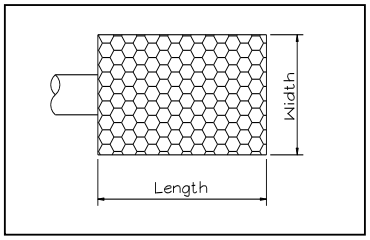
	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	**PROJECT NAME** Carolina Sunrock
CALCULATED BY David Hojsan		**PROJECT NUMBER** 44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 16B

Velocity =	2.90	fps	From Fig. 8.06.c:	ZONE =	**1**
Top Width =	7.5	ft			
Ditch Area =	1.6875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	17.59	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**18**	in	Apron Length =	6.0	ft
			Apron Width = Top Width.=	7.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 17A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 17A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	0.34	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	0.8	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	115 LF
Slope =	0.087	(ft/ft)		Highest Elevation =	609
Z Required =	0.05	Ratio		Lowest Elevation =	599
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.50	ft	6.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 2.71 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

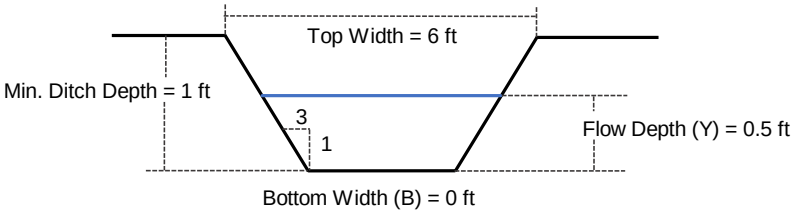
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	0.29	Must be greater than z required=>	0.05	Okay
New V =	5.61	fps		

Minimum Design Geometry

Liner: Class B (8"@18"THK) **3.50** LB/SF > 2.72 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
Class B (8"@18"THK)

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:41 AM

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

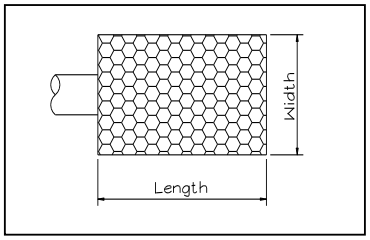
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 17A

Velocity =	5.61	fps	From Fig. 8.06.c: ZONE =	1	
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	12	in	Apron Length =	4.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 17B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 17B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	0.59	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	1.4	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	205 LF
Slope =	0.015	(ft/ft)		Highest Elevation =	609
Z Required =	0.23	Ratio		Lowest Elevation =	606
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.50	ft	6.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 0.46 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

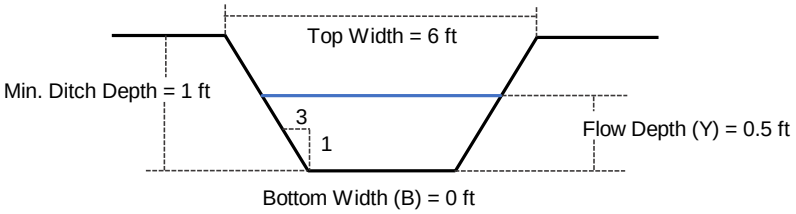
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	0.29	Must be greater than z required=>	0.23	Okay
New V =	2.30	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 0.46 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:42 AM

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

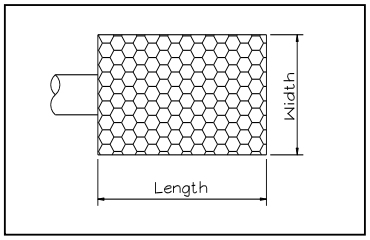
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 17B

Velocity =	2.30	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**12**	in	Apron Length =	4.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 18A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 18A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	2.33	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	5.4	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	550 LF
Slope =	0.040	(ft/ft)		Highest Elevation =	606
Z Required =	0.54	Ratio		Lowest Elevation =	584
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.75	ft	9.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.87 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

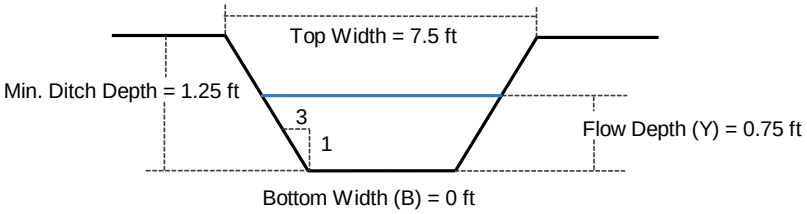
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.69	SF		
New P =	4.74	Wetted perimeter		
New R =	0.36	Hydraulic radius		
Z Actual =	0.85	Must be greater than z required=>	0.54	Okay
New V =	4.99	fps		

Minimum Design Geometry

Liner: North American Green, SC150 — **2.10** LB/SF > 1.88 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.00	0.75	7.5	3:1

Ditch Liner
North American Green, SC150

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:42 AM

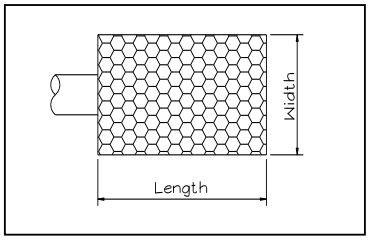
CALCULATED BY		PROJECT NAME
David Hojsan	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
		PROJECT NUMBER
		44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 18A

Velocity =	4.99	fps	From Fig. 8.06.c:	ZONE =	**1**
Top Width =	7.5	ft			
Ditch Area =	1.6875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	17.59	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**18**	in	Apron Length =	6.0	ft
			Apron Width = Top Width.=	7.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 18B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 18B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**0.69**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**1.6**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap	(Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)		Ditch Length =	**510** LF
Slope =	0.035	(ft/ft)		Highest Elevation =	**602**
Z Required =	0.17	Ratio		Lowest Elevation =	**584**
Side Slope (M) =	**3**	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**0.50**	ft	6.0	in
Bottom Width (B) =	**0.00**	ft	0.0	in
Freeboard =	**0.50**	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.10 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

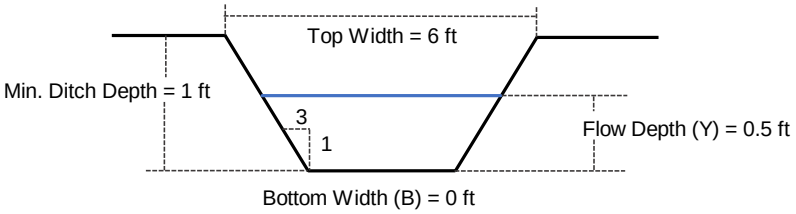
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	**0.29**	Must be greater than z required=>	**0.17**	**Okay**
New V =	3.58	fps		

Minimum Design Geometry

Liner: **North American Green, S75** **1.55** LB/SF > 1.11 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
North American Green, S75

***RED IS USER INPUT**

LATEST REVISION: 8/28/2019 11:41 AM

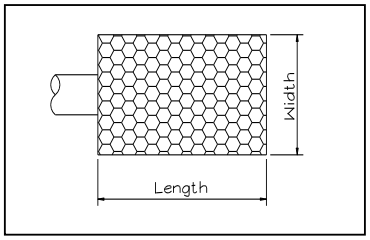
	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	**PROJECT NAME** Carolina Sunrock
CALCULATED BY David Hojsan		**PROJECT NUMBER** 44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 18B

Velocity =	3.58	fps	From Fig. 8.06.c:	ZONE =	1
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	12	in	Apron Length =	4.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 19A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 19A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**0.65**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**1.5**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap	(Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)		Ditch Length =	**380** LF
Slope =	0.016	(ft/ft)		Highest Elevation =	**605**
Z Required =	0.24	Ratio		Lowest Elevation =	**599**
Side Slope (M) =	**3**	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**0.50**	ft	6.0	in
Bottom Width (B) =	**0.00**	ft	0.0	in
Freeboard =	**0.50**	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 0.49 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

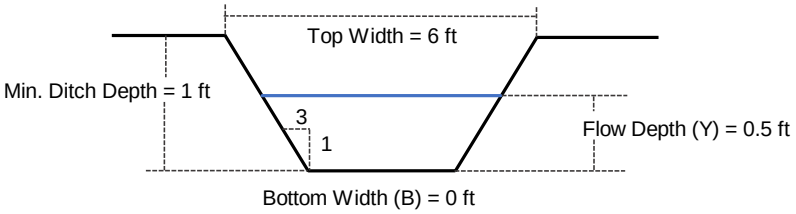
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	**0.29**	Must be greater than z required=>	**0.24**	**Okay**
New V =	2.39	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 0.5 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:41 AM

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

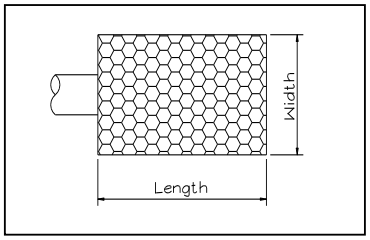
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 19A

Velocity =	2.39	fps	From Fig. 8.06.c: ZONE =	1	
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	12	in	Apron Length =	4.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 20A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 20A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	0.26	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	0.6	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	165 LF
Slope =	0.055	(ft/ft)		Highest Elevation =	574
Z Required =	0.05	Ratio		Lowest Elevation =	565
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.50	ft	6.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.70 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

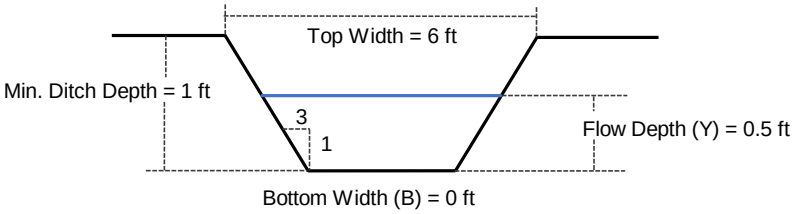
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	0.29	Must be greater than z required=>	0.05	Okay
New V =	4.44	fps		

Minimum Design Geometry

Liner: North American Green, S150 — **1.75** LB/SF > 1.71 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
North American Green, S150

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:40 AM

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

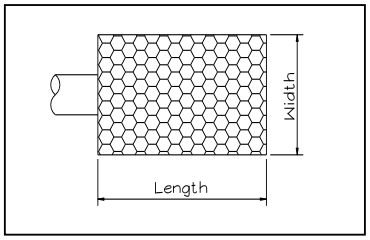
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 20A

Velocity =	4.44	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**12**	in	Apron Length =	4.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 20B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 20B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	0.16	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	0.4	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	135 LF
Slope =	0.089	(ft/ft)		Highest Elevation =	577
Z Required =	0.03	Ratio		Lowest Elevation =	565
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.25	ft	3.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.39 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

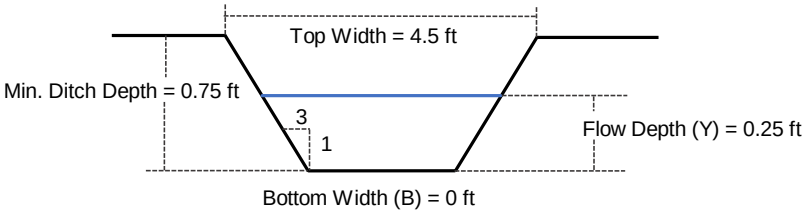
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.19	SF		
New P =	1.58	Wetted perimeter		
New R =	0.12	Hydraulic radius		
Z Actual =	0.05	Must be greater than z required=>	0.03	Okay
New V =	3.57	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 1.39 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
0.75	0.00	0.25	4.5	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

LATEST REVISION: 8/28/2019 11:44 AM

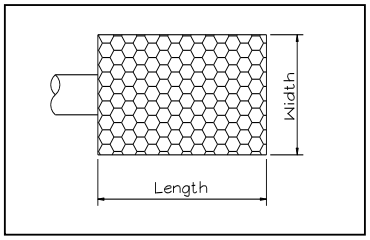
CALCULATED BY		PROJECT NAME
David Hojsan	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
		PROJECT NUMBER
		44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 20B

Velocity =	3.57	fps	From Fig. 8.06.c: ZONE =	1	
Top Width =	4.5	ft			
Ditch Area =	0.1875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	5.86	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	6	in	Apron Length =	2.0	ft
			Apron Width = Top Width.=	4.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 22A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 22A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	3.15	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	7.3	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	490 LF
Slope =	0.035	(ft/ft)		Highest Elevation =	582
Z Required =	0.79	Ratio		Lowest Elevation =	565
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.75	ft	9.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.62 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

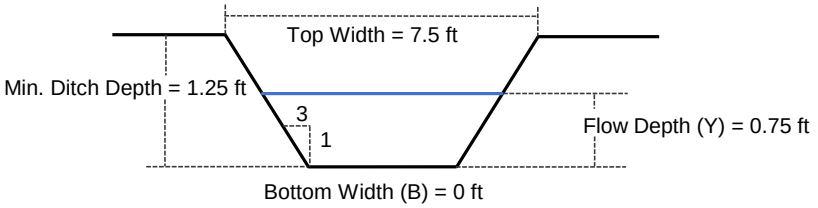
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.69	SF		
New P =	4.74	Wetted perimeter		
New R =	0.36	Hydraulic radius		
Z Actual =	0.85	Must be greater than z required=>	0.79	Okay
New V =	4.64	fps		

Minimum Design Geometry

Liner: North American Green, S150 **1.75** LB/SF > 1.63 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.00	0.75	7.5	3:1

Ditch Liner
North American Green, S150

*RED IS USER INPUT

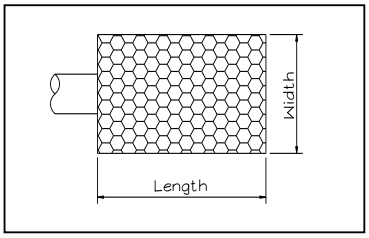
	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	**PROJECT NAME** Carolina Sunrock
CALCULATED BY David Hojsan		**PROJECT NUMBER** 44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 22A

Velocity =	4.64	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	7.5	ft			
Ditch Area =	1.6875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	17.59	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**18**	in	Apron Length =	6.0	ft
			Apron Width = Top Width.=	7.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 22B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 22B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	0.47	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	1.1	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	318 LF
Slope =	0.075	(ft/ft)		Highest Elevation =	589
Z Required =	0.08	Ratio		Lowest Elevation =	565
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.50	ft	6.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 2.35 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

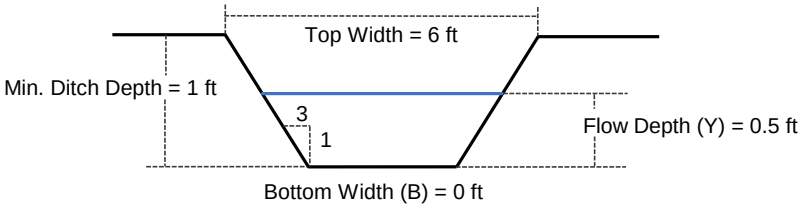
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	0.29	Must be greater than z required=>	0.08	Okay
New V =	5.23	fps		

Minimum Design Geometry

Liner: Class B (8"@18"THK) 3.50 LB/SF > 2.36 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
Class B (8"@18"THK)

*RED IS USER INPUT

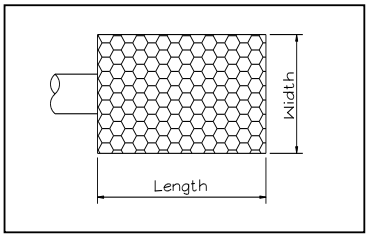
	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	**PROJECT NAME** Carolina Sunrock
CALCULATED BY David Hojsan		**PROJECT NUMBER** 44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 22B

Velocity =	5.23	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**12**	in	Apron Length =	4.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 23A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 23A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**1.59**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**3.7**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap (Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)	Ditch Length =	**462** LF
Slope =	0.017	(ft/ft)	Highest Elevation =	**590**
Z Required =	0.56	Ratio	Lowest Elevation =	**582**
Side Slope (M) =	**3**	:1		

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**0.75**	ft	9.0	in
Bottom Width (B) =	**0.00**	ft	0.0	in
Freeboard =	**0.50**	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 0.81 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

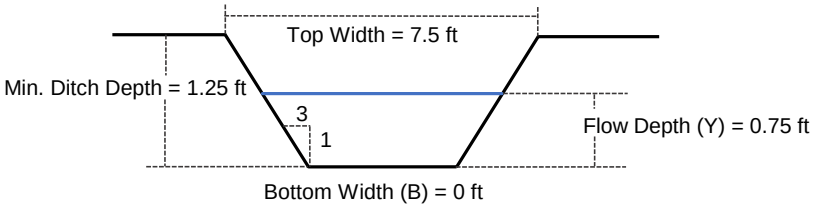
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.69	SF		
New P =	4.74	Wetted perimeter		
New R =	0.36	Hydraulic radius		
Z Actual =	**0.85**	Must be greater than z required=>	**0.56**	**Okay**
New V =	3.28	fps		

Minimum Design Geometry

Liner: North American Green, S75 **1.55** LB/SF > 0.82 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.00	0.75	7.5	3:1

Ditch Liner
North American Green, S75

***RED IS USER INPUT**

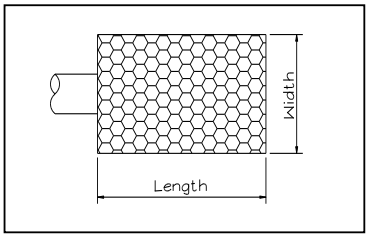
	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	**PROJECT NAME** Carolina Sunrock
CALCULATED BY David Hojsan		**PROJECT NUMBER** 44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 23A

Velocity =	3.28	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	7.5	ft			
Ditch Area =	1.6875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	17.59	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**18**	in	Apron Length =	6.0	ft
			Apron Width = Top Width.=	7.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 23B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 23B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	1.10	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	2.6	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	455 LF
Slope =	0.013	(ft/ft)		Highest Elevation =	588
Z Required =	0.45	Ratio		Lowest Elevation =	582
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.75	ft	9.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 0.62 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

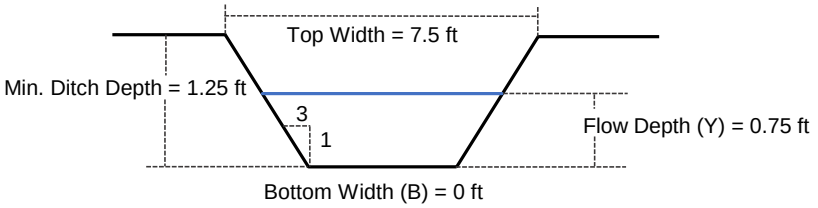
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.69	SF		
New P =	4.74	Wetted perimeter		
New R =	0.36	Hydraulic radius		
Z Actual =	0.85	Must be greater than z required=>	0.45	Okay
New V =	2.86	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 0.62 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.00	0.75	7.5	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

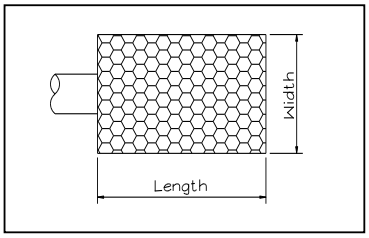
	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	**PROJECT NAME** Carolina Sunrock
CALCULATED BY David Hojsan		**PROJECT NUMBER** 44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 23B

Velocity =	2.86	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	7.5	ft			
Ditch Area =	1.6875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	17.59	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**18**	in	Apron Length =	6.0	ft
			Apron Width = Top Width.=	7.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 24A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 24A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	3.54	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	8.2	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	860 LF
Slope =	0.029	(ft/ft)		Highest Elevation =	609
Z Required =	0.97	Ratio		Lowest Elevation =	584
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	1.00	ft	12.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.81 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

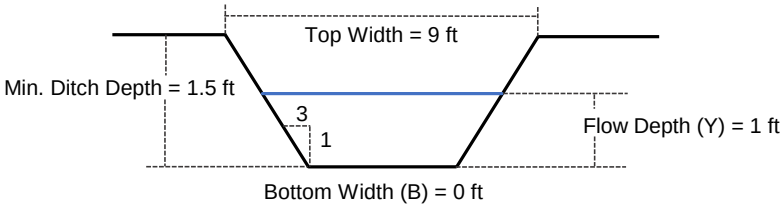
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	3.00	SF		
New P =	6.32	Wetted perimeter		
New R =	0.47	Hydraulic radius		
Z Actual =	1.82	Must be greater than z required=>	0.97	Okay
New V =	5.15	fps		

Minimum Design Geometry

Liner: North American Green, SC150 **2.10** LB/SF > 1.82 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.50	0.00	1.00	9	3:1

Ditch Liner
North American Green, SC150

*RED IS USER INPUT

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

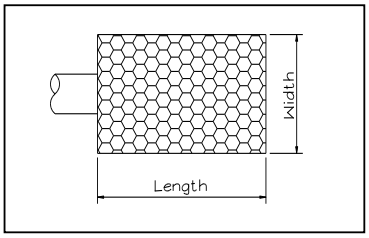
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 24A

Velocity =	5.15	fps	From Fig. 8.06.c: ZONE =	1	
Top Width =	9	ft			
Ditch Area =	3	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	23.45	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	24	in	Apron Length =	8.0	ft
			Apron Width = Top Width.=	9.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 24B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 24B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**0.23**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**0.5**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap	(Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)		Ditch Length =	**165** LF
Slope =	0.024	(ft/ft)		Highest Elevation =	**588**
Z Required =	0.07	Ratio		Lowest Elevation =	**584**
Side Slope (M) =	**3**	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**0.50**	ft	6.0	in
Bottom Width (B) =	**0.00**	ft	0.0	in
Freeboard =	**0.50**	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 0.76 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

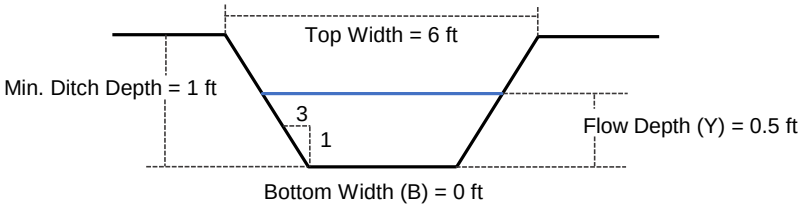
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	**0.29**	Must be greater than z required=>	**0.07**	**Okay**
New V =	2.96	fps		

Minimum Design Geometry

Liner: North American Green, S75 **1.55** LB/SF > 0.76 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
North American Green, S75

***RED IS USER INPUT**

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

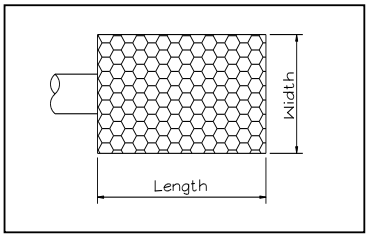
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 24B

Velocity =	2.96	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**12**	in	Apron Length =	4.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 25A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 25A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**4.65**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**10.8**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap (Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)	Ditch Length =	**950** LF
Slope =	0.036	(ft/ft)	Highest Elevation =	**639**
Z Required =	1.15	Ratio	Lowest Elevation =	**605**
Side Slope (M) =	**3**	:1		

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**1.00**	ft	12.0	in
Bottom Width (B) =	**0.00**	ft	0.0	in
Freeboard =	**0.50**	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 2.23 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

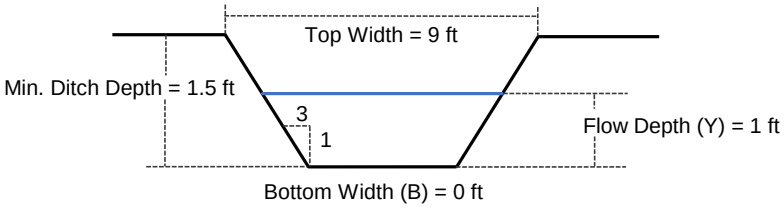
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C350	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	3.00	SF		
New P =	6.32	Wetted perimeter		
New R =	0.47	Hydraulic radius		
Z Actual =	**1.82**	Must be greater than z required=>	**1.15**	**Okay**
New V =	5.71	fps		

Minimum Design Geometry

Liner: **North American Green, C350** **2.25** LB/SF > 2.24 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.50	0.00	1.00	9	3:1

Ditch Liner
North American Green, C350

***RED IS USER INPUT**

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

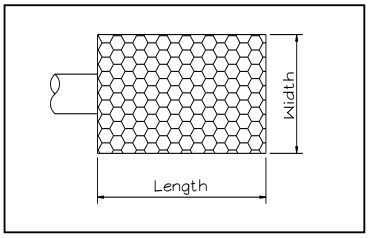
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 25A

Velocity =	5.71	fps	From Fig. 8.06.c: ZONE =	**2**	
Top Width =	9	ft			
Ditch Area =	3	sf	Rip Rap Class =	B	
Equivalent Pipe Diameter =	23.45	in	Apron Thickness =	18	in
Equivalent Pipe Diameter =	**24**	in	Apron Length =	12.0	ft
			Apron Width = Top Width.=	9.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 25B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 25B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	4.65	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	10.8	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	81 LF
Slope =	0.049	(ft/ft)		Highest Elevation =	609
Z Required =	0.98	Ratio		Lowest Elevation =	605
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	1.00	ft	12.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 3.08 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

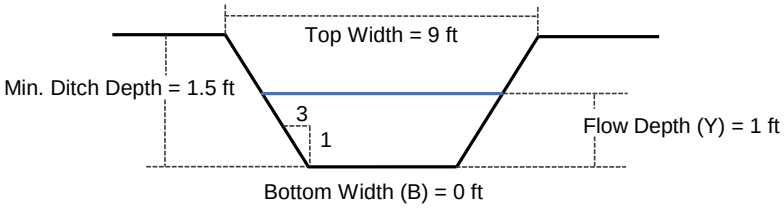
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C350	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	3.00	SF		
New P =	6.32	Wetted perimeter		
New R =	0.47	Hydraulic radius		
Z Actual =	1.82	Must be greater than z required=>	0.98	Okay
New V =	6.71	fps		

Minimum Design Geometry

Liner: Class B (8"@18"THK) **3.50** LB/SF > 3.09 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.50	0.00	1.00	9	3:1

Ditch Liner
Class B (8"@18"THK)

*RED IS USER INPUT

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

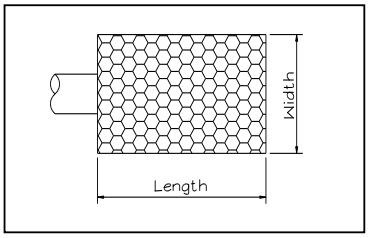
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 25B

Velocity =	6.71	fps	From Fig. 8.06.c: ZONE =	**2**	
Top Width =	9	ft			
Ditch Area =	3	sf	Rip Rap Class =	B	
Equivalent Pipe Diameter =	23.45	in	Apron Thickness =	18	in
Equivalent Pipe Diameter =	**24**	in	Apron Length =	12.0	ft
			Apron Width = Top Width.=	9.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 26A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 26A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	3.71	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	8.6	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	975 LF
Slope =	0.037	(ft/ft)		Highest Elevation =	638
Z Required =	0.90	Ratio		Lowest Elevation =	602
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.75	ft	9.0	in
Bottom Width (B) =	0.25	ft	3.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.73 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

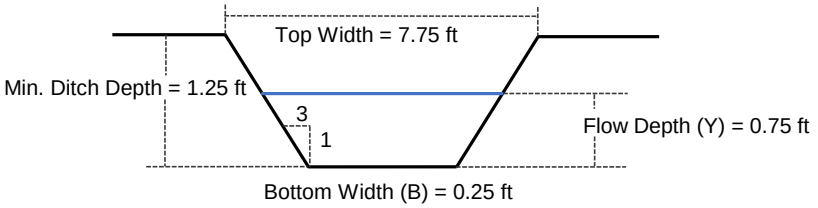
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C350	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.88	SF		
New P =	4.99	Wetted perimeter		
New R =	0.38	Hydraulic radius		
Z Actual =	0.98	Must be greater than z required=>	0.90	Okay
New V =	4.97	fps		

Minimum Design Geometry

Liner: North American Green, S150 — **1.75** LB/SF > 1.73 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.25	0.75	7.75	3:1

Ditch Liner
North American Green, S150

*RED IS USER INPUT

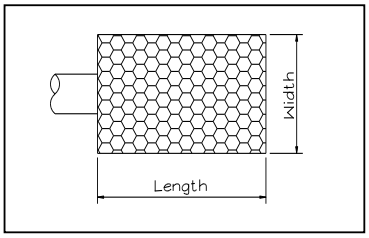
CALCULATED BY		PROJECT NAME
David Hojsan	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
		PROJECT NUMBER
		44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 26A

Velocity =	4.97	fps	From Fig. 8.06.c: ZONE =	**2**	
Top Width =	7.75	ft			
Ditch Area =	1.875	sf	Rip Rap Class =	B	
Equivalent Pipe Diameter =	18.54	in	Apron Thickness =	18	in
Equivalent Pipe Diameter =	**24**	in	Apron Length =	12.0	ft
			Apron Width = Top Width.=	7.8	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 26B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 26B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	7.13	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	**16.6**	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	1300 LF
Slope =	0.039	(ft/ft)		Highest Elevation =	653
Z Required =	1.68	Ratio		Lowest Elevation =	602
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.75	ft	9.0	in
Bottom Width (B) =	0.25	ft	3.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.84 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

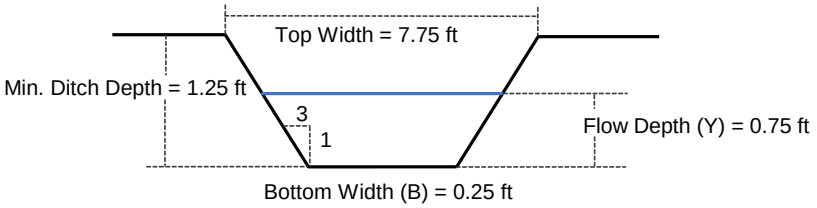
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C350	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.88	SF		
New P =	4.99	Wetted perimeter		
New R =	0.38	Hydraulic radius		
Z Actual =	**0.98**	Must be greater than z required=>	**1.68**	**Resize**
New V =	5.12	fps		

Minimum Design Geometry

Liner: North American Green, SC150 **2.10** LB/SF > 1.84 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.25	0.75	7.75	3:1

Ditch Liner
North American Green, SC150

*RED IS USER INPUT

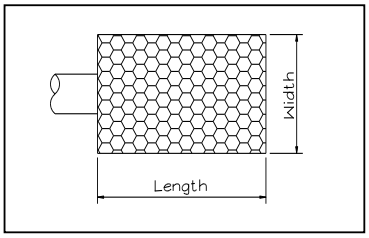
CALCULATED BY		PROJECT NAME
David Hojsan	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
		PROJECT NUMBER
		44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 26B

Velocity =	5.12	fps	From Fig. 8.06.c: ZONE =	**2**	
Top Width =	7.75	ft			
Ditch Area =	1.875	sf	Rip Rap Class =	B	
Equivalent Pipe Diameter =	18.54	in	Apron Thickness =	18	in
Equivalent Pipe Diameter =	**24**	in	Apron Length =	12.0	ft
			Apron Width = Top Width.=	7.8	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 27A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 27A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	9.88	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	22.9	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	2138 LF
Slope =	0.029	(ft/ft)		Highest Elevation =	652
Z Required =	2.73	Ratio		Lowest Elevation =	591
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	1.25	ft	15.0	in
Bottom Width (B) =	0.25	ft	3.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 2.23 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

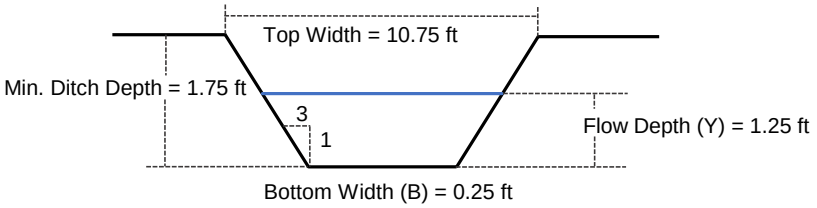
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C350	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	5.00	SF		
New P =	8.16	Wetted perimeter		
New R =	0.61	Hydraulic radius		
Z Actual =	3.61	Must be greater than z required=>	2.73	Okay
New V =	6.05	fps		

Minimum Design Geometry

Liner: North American Green, C350 **2.25** LB/SF > 2.23 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.75	0.25	1.25	10.75	3:1

Ditch Liner
North American Green, C350

*RED IS USER INPUT

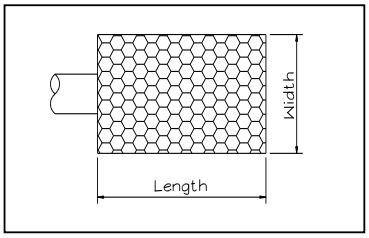
	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	**PROJECT NAME** Carolina Sunrock
CALCULATED BY David Hojsan		**PROJECT NUMBER** 44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 27A

Velocity =	6.05	fps	From Fig. 8.06.c: ZONE =	**2**	
Top Width =	10.75	ft			
Ditch Area =	5	sf	Rip Rap Class =	B	
Equivalent Pipe Diameter =	30.28	in	Apron Thickness =	18	in
Equivalent Pipe Diameter =	**36**	in	Apron Length =	18.0	ft
			Apron Width = Top Width.=	10.8	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 27B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 27B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**1.14**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**2.6**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap	(Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)		Ditch Length =	**231** LF
Slope =	0.022	(ft/ft)		Highest Elevation =	**596**
Z Required =	0.36	Ratio		Lowest Elevation =	**591**
Side Slope (M) =	**3**	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**0.75**	ft	9.0	in
Bottom Width (B) =	**0.00**	ft	0.0	in
Freeboard =	**0.50**	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.01 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

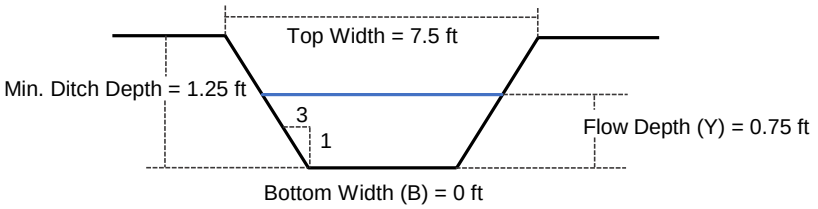
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C350	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.69	SF		
New P =	4.74	Wetted perimeter		
New R =	0.36	Hydraulic radius		
Z Actual =	**0.85**	Must be greater than z required=>	**0.36**	**Okay**
New V =	3.67	fps		

Minimum Design Geometry

Liner: North American Green, S75 **1.55** LB/SF > 1.02 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.00	0.75	7.5	3:1

Ditch Liner
North American Green, S75

***RED IS USER INPUT**

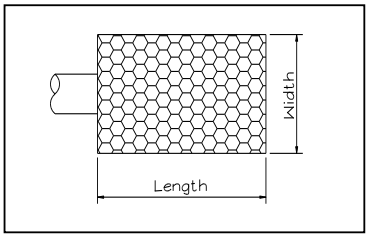
CALCULATED BY		PROJECT NAME
David Hojsan	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
		PROJECT NUMBER
		44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 27B

Velocity =	3.67	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	7.5	ft			
Ditch Area =	1.6875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	17.59	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**18**	in	Apron Length =	6.0	ft
			Apron Width = Top Width.=	7.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 28A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 28A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**0.66**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**1.5**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap	(Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)		Ditch Length =	**190** LF
Slope =	0.016	(ft/ft)		Highest Elevation =	**596**
Z Required =	0.25	Ratio		Lowest Elevation =	**593**
Side Slope (M) =	**3**	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**0.50**	ft	6.0	in
Bottom Width (B) =	**0.00**	ft	0.0	in
Freeboard =	**0.50**	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 0.49 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

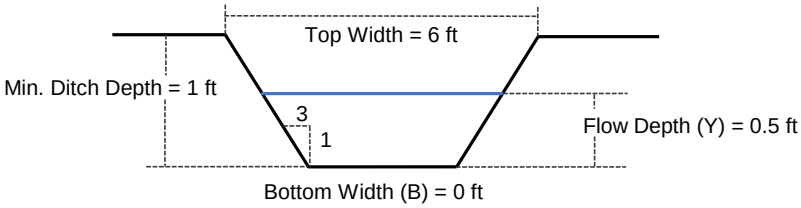
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C350	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	**0.29**	Must be greater than z required=>	**0.25**	**Okay**
New V =	2.39	fps		

Minimum Design Geometry

Liner: **North American Green, S75** **1.55** LB/SF > 0.5 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
North American Green, S75

***RED IS USER INPUT**

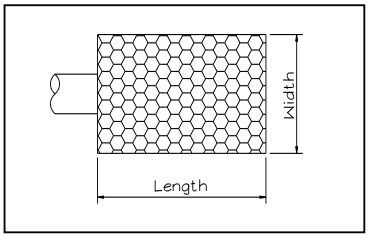
	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	**PROJECT NAME** Carolina Sunrock
CALCULATED BY David Hojsan		**PROJECT NUMBER** 44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 28A

Velocity =	2.39	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**12**	in	Apron Length =	4.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 28B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 28B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	0.91	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	2.1	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	210 LF
Slope =	0.043	(ft/ft)		Highest Elevation =	602
Z Required =	0.21	Ratio		Lowest Elevation =	593
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.50	ft	6.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.34 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

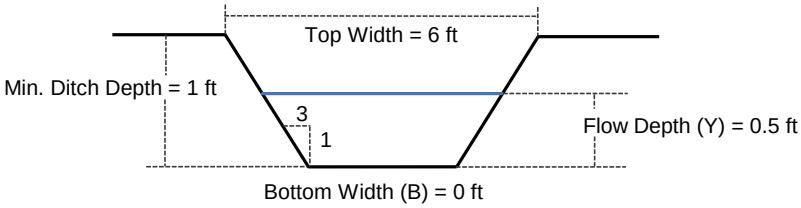
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C350	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	0.29	Must be greater than z required=>	0.21	Okay
New V =	3.94	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 1.34 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

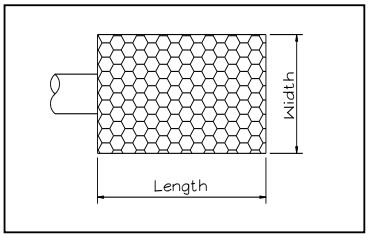
CALCULATED BY		PROJECT NAME
David Hojsan	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
		PROJECT NUMBER
		44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 28B

Velocity =	3.94	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**18**	in	Apron Length =	6.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 29A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 29A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	0.97	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	2.3	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	250 LF
Slope =	0.016	(ft/ft)		Highest Elevation =	596
Z Required =	0.36	Ratio		Lowest Elevation =	592
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.75	ft	9.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 0.75 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

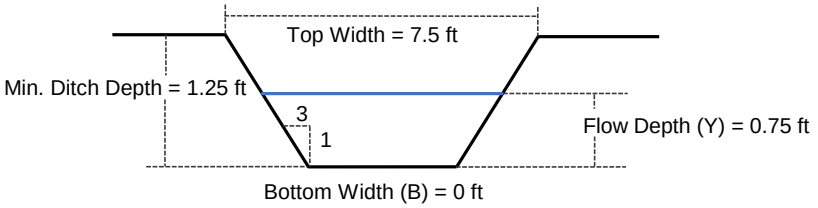
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.69	SF		
New P =	4.74	Wetted perimeter		
New R =	0.36	Hydraulic radius		
Z Actual =	0.85	Must be greater than z required=>	0.36	Okay
New V =	3.15	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 0.75 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.00	0.75	7.5	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

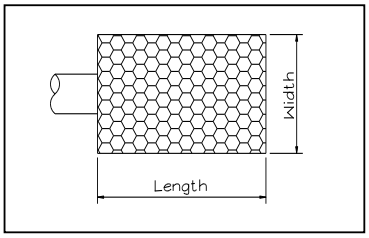
	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	**PROJECT NAME** Carolina Sunrock
CALCULATED BY David Hojsan		**PROJECT NUMBER** 44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 29A

Velocity =	3.15	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	7.5	ft			
Ditch Area =	1.6875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	17.59	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**18**	in	Apron Length =	6.0	ft
			Apron Width = Top Width.=	7.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 29B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 29B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	0.99	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	2.3	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	375 LF
Slope =	0.029	(ft/ft)		Highest Elevation =	603
Z Required =	0.27	Ratio		Lowest Elevation =	592
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.50	ft	6.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 0.92 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

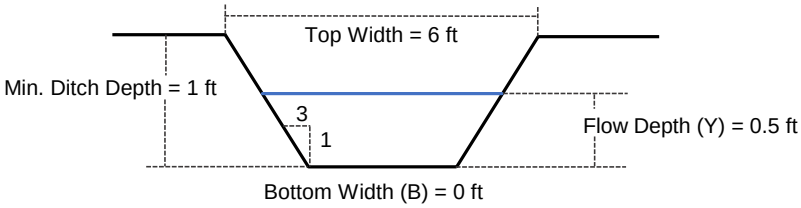
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	0.29	Must be greater than z required=>	0.27	Okay
New V =	3.26	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 0.92 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

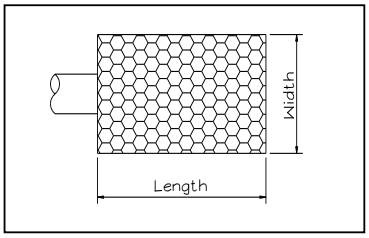
CALCULATED BY		PROJECT NAME
David Hojsan	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
		PROJECT NUMBER
		44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 29B

Velocity =	3.26	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**12**	in	Apron Length =	4.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 30A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 30A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**1.12**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**2.6**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap	(Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)		Ditch Length =	**355** LF
Slope =	0.023	(ft/ft)		Highest Elevation =	**594**
Z Required =	0.35	Ratio		Lowest Elevation =	**586**
Side Slope (M) =	**3**	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**0.75**	ft	9.0	in
Bottom Width (B) =	**0.00**	ft	0.0	in
Freeboard =	**0.50**	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.05 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

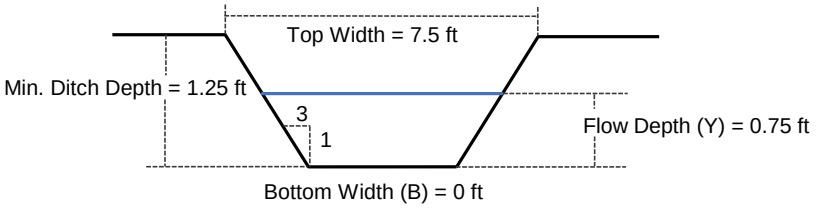
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.69	SF		
New P =	4.74	Wetted perimeter		
New R =	0.36	Hydraulic radius		
Z Actual =	**0.85**	Must be greater than z required=>	**0.35**	**Okay**
New V =	3.74	fps		

Minimum Design Geometry

Liner: North American Green, S75 **1.55** LB/SF > 1.06 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.00	0.75	7.5	3:1

Ditch Liner
North American Green, S75

***RED IS USER INPUT**

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

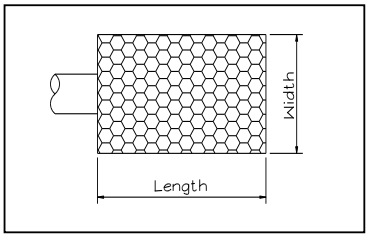
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 30A

Velocity =	3.74	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	7.5	ft			
Ditch Area =	1.6875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	17.59	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**18**	in	Apron Length =	6.0	ft
			Apron Width = Top Width.=	7.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 30B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 30B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**0.82**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**1.9**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap	(Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)		Ditch Length =	**481** LF
Slope =	0.021	(ft/ft)		Highest Elevation =	**596**
Z Required =	0.27	Ratio		Lowest Elevation =	**586**
Side Slope (M) =	**3**	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**0.50**	ft	6.0	in
Bottom Width (B) =	**0.00**	ft	0.0	in
Freeboard =	**0.50**	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 0.65 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

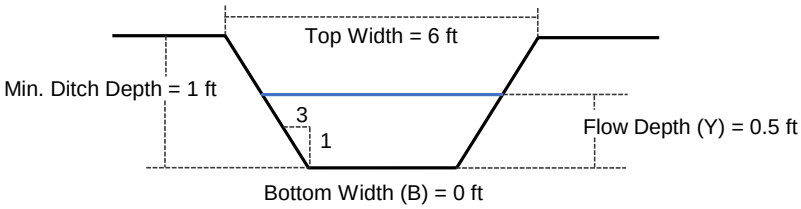
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	**0.29**	Must be greater than z required=>	**0.27**	**Okay**
New V =	2.74	fps		

Minimum Design Geometry

Liner: North American Green, S75 **1.55** LB/SF > 0.65 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
North American Green, S75

***RED IS USER INPUT**

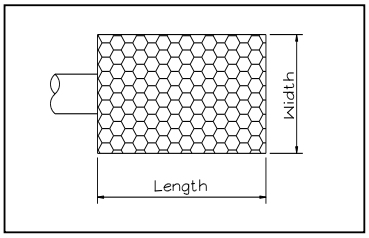
CALCULATED BY		PROJECT NAME
David Hojsan	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
		PROJECT NUMBER
		44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 30B

Velocity =	2.74	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**12**	in	Apron Length =	4.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 31A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 31A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	2.21	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	5.1	(cfs)

Known Quantities

Line channel with:	6	" rip-rap (Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)	Ditch Length =	535 LF
Slope =	0.032	(ft/ft)	Highest Elevation =	594
Z Required =	0.58	Ratio	Lowest Elevation =	577
Side Slope (M) =	3	:1		

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.75	ft	9.0 in
Bottom Width (B) =	0.00	ft	0.0 in
Freeboard =	0.50	ft	6.0 in

Compute Tractive Force

T=YxDxS

T = 1.49 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

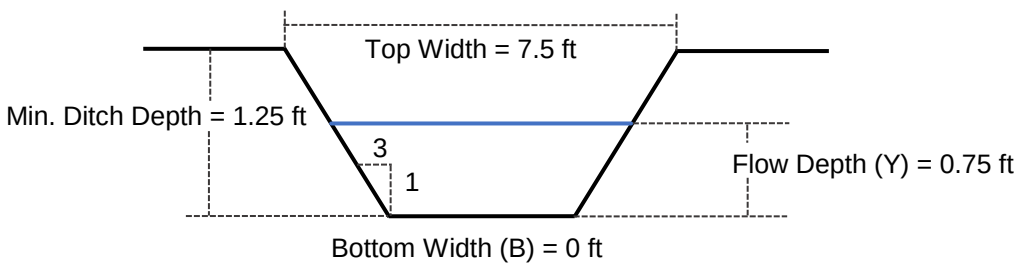
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.69	SF		
New P =	4.74	Wetted perimeter		
New R =	0.36	Hydraulic radius		
Z Actual =	0.85	Must be greater than z required=>	0.58	Okay
New V =	4.45	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 1.49 LB/SF **Okay**



Ditch Geometry

Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.00	0.75	7.5	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

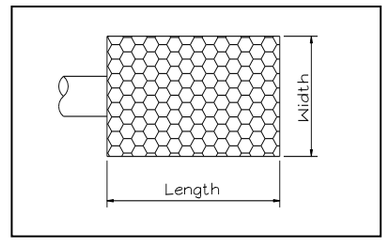
CALCULATED BY		PROJECT NAME
David Hojsan	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
		PROJECT NUMBER
		44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 31A

Velocity =	4.45	fps	From Fig. 8.06.c:	ZONE =	**1**
Top Width =	7.5	ft			
Ditch Area =	1.6875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	17.59	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**18**	in	Apron Length =	6.0	ft
			Apron Width = Top Width.=	7.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 31B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 31B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**0.62**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**1.4**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap	(Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)		Ditch Length =	**175** LF
Slope =	0.040	(ft/ft)		Highest Elevation =	**584**
Z Required =	0.14	Ratio		Lowest Elevation =	**577**
Side Slope (M) =	**3**	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**0.50**	ft	6.0	in
Bottom Width (B) =	**0.00**	ft	0.0	in
Freeboard =	**0.50**	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.25 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

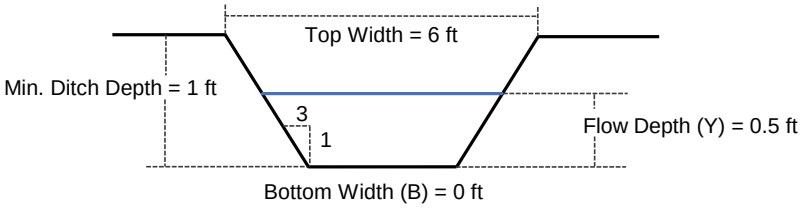
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	**0.29**	Must be greater than z required=>	**0.14**	**Okay**
New V =	3.81	fps		

Minimum Design Geometry

Liner: North American Green, S75 **1.55** LB/SF > 1.25 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
North American Green, S75

***RED IS USER INPUT**

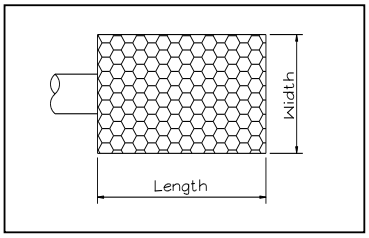
CALCULATED BY		PROJECT NAME
David Hojsan	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
		PROJECT NUMBER
		44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 31B

Velocity =	3.81	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**12**	in	Apron Length =	4.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 32A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 32A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**0.60**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**1.4**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap	(Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)		Ditch Length =	**255** LF
Slope =	0.047	(ft/ft)		Highest Elevation =	**584**
Z Required =	0.13	Ratio		Lowest Elevation =	**572**
Side Slope (M) =	**3**	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**0.50**	ft	6.0	in
Bottom Width (B) =	**0.00**	ft	0.0	in
Freeboard =	**0.50**	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.47 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

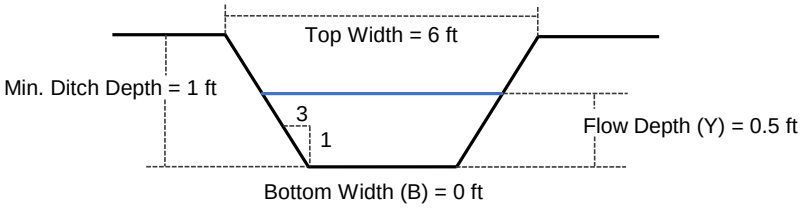
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	**0.29**	Must be greater than z required=>	**0.13**	**Okay**
New V =	4.13	fps		

Minimum Design Geometry

Liner: North American Green, S75 **1.55** LB/SF > 1.47 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
North American Green, S75

***RED IS USER INPUT**

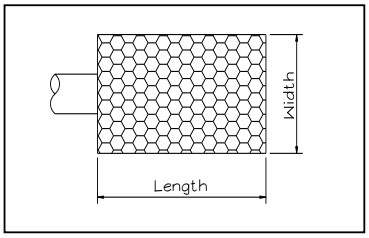
	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	**PROJECT NAME** Carolina Sunrock
CALCULATED BY David Hojsan		**PROJECT NUMBER** 44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 32A

Velocity =	4.13	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**12**	in	Apron Length =	4.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 32B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 32B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	1.37	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	3.2	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	690 LF
Slope =	0.026	(ft/ft)		Highest Elevation =	590
Z Required =	0.40	Ratio		Lowest Elevation =	572
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.75	ft	9.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.22 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

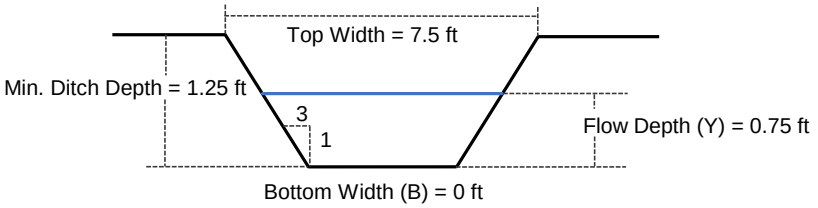
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.69	SF		
New P =	4.74	Wetted perimeter		
New R =	0.36	Hydraulic radius		
Z Actual =	0.85	Must be greater than z required=>	0.40	Okay
New V =	4.03	fps		

Minimum Design Geometry

Liner: North American Green, S75 — **1.55** LB/SF > 1.23 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.00	0.75	7.5	3:1

Ditch Liner
North American Green, S75

*RED IS USER INPUT

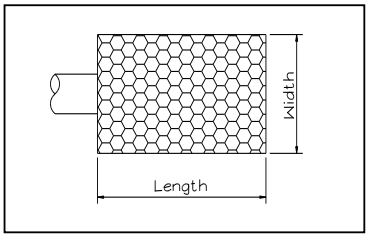
CALCULATED BY		PROJECT NAME
David Hojsan	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
		PROJECT NUMBER
		44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 32B

Velocity =	4.03	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	7.5	ft			
Ditch Area =	1.6875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	17.59	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**18**	in	Apron Length =	6.0	ft
			Apron Width = Top Width.=	7.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 33A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 33A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**2.54**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**5.9**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap	(Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)		Ditch Length =	**620** LF
Slope =	0.032	(ft/ft)		Highest Elevation =	**582**
Z Required =	0.66	Ratio		Lowest Elevation =	**562**
Side Slope (M) =	**3**	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**0.75**	ft	9.0	in
Bottom Width (B) =	**0.00**	ft	0.0	in
Freeboard =	**0.50**	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.51 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

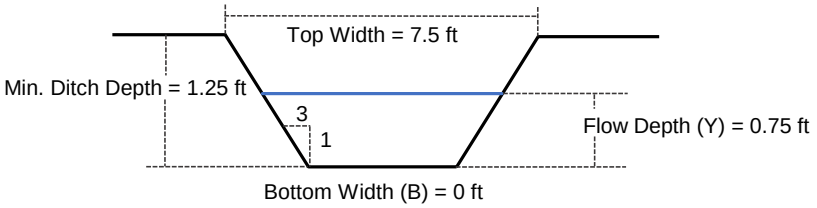
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.69	SF		
New P =	4.74	Wetted perimeter		
New R =	0.36	Hydraulic radius		
Z Actual =	**0.85**	Must be greater than z required=>	**0.66**	**Okay**
New V =	4.48	fps		

Minimum Design Geometry

Liner: North American Green, S75 **1.55** LB/SF > 1.51 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.00	0.75	7.5	3:1

Ditch Liner
North American Green, S75

***RED IS USER INPUT**

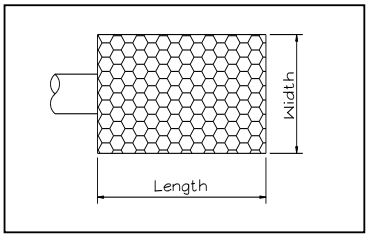
	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	**PROJECT NAME** Carolina Sunrock
CALCULATED BY David Hojsan		**PROJECT NUMBER** 44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 33A

Velocity =	4.48	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	7.5	ft			
Ditch Area =	1.6875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	17.59	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**18**	in	Apron Length =	6.0	ft
			Apron Width = Top Width.=	7.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 33B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 33B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	5.34	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	**12.4**	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	900 LF
Slope =	0.031	(ft/ft)		Highest Elevation =	590
Z Required =	1.42	Ratio		Lowest Elevation =	562
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	1.00	ft	12.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.94 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

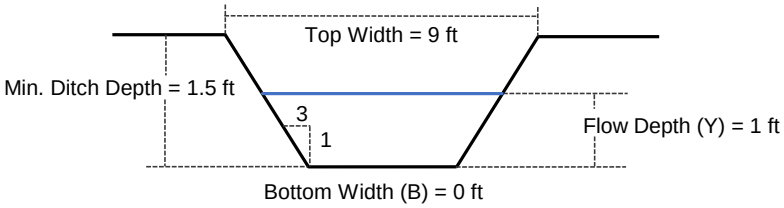
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	3.00	SF		
New P =	6.32	Wetted perimeter		
New R =	0.47	Hydraulic radius		
Z Actual =	**1.82**	Must be greater than z required=>	**1.42**	**Okay**
New V =	5.33	fps		

Minimum Design Geometry

Liner: North American Green, SC150 **2.10** LB/SF > 1.95 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.50	0.00	1.00	9	3:1

Ditch Liner
North American Green, SC150

*RED IS USER INPUT

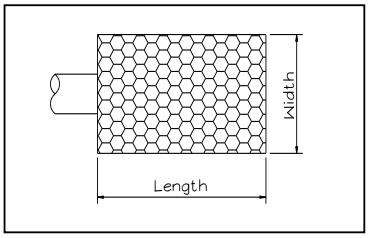
	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	**PROJECT NAME** Carolina Sunrock
CALCULATED BY David Hojsan		**PROJECT NUMBER** 44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 33B

Velocity =	5.33	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	9	ft			
Ditch Area =	3	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	23.45	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**24**	in	Apron Length =	8.0	ft
			Apron Width = Top Width.=	9.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 35A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 35A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	1.81	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	4.2	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	486 LF
Slope =	0.072	(ft/ft)		Highest Elevation =	551
Z Required =	0.32	Ratio		Lowest Elevation =	516
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.75	ft	9.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 3.37 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

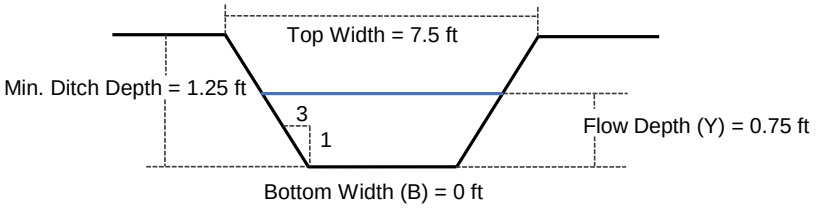
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.69	SF		
New P =	4.74	Wetted perimeter		
New R =	0.36	Hydraulic radius		
Z Actual =	0.85	Must be greater than z required=>	0.32	Okay
New V =	6.69	fps		

Minimum Design Geometry

Liner: Class B (8"@18"THK) **3.50** LB/SF > 3.38 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.00	0.75	7.5	3:1

Ditch Liner
Class B (8"@18"THK)

*RED IS USER INPUT

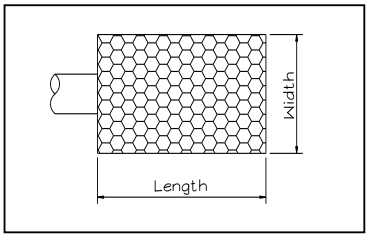
	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	**PROJECT NAME** Carolina Sunrock
CALCULATED BY David Hojsan		**PROJECT NUMBER** 44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 35A

Velocity =	6.69	fps	From Fig. 8.06.c: ZONE =	**2**	
Top Width =	7.5	ft			
Ditch Area =	1.6875	sf	Rip Rap Class =	B	
Equivalent Pipe Diameter =	17.59	in	Apron Thickness =	18	in
Equivalent Pipe Diameter =	**18**	in	Apron Length =	9.0	ft
			Apron Width = Top Width.=	7.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 36A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 36A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	3.16	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	7.3	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	524 LF
Slope =	0.042	(ft/ft)		Highest Elevation =	532
Z Required =	0.72	Ratio		Lowest Elevation =	510
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.75	ft	9.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.96 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

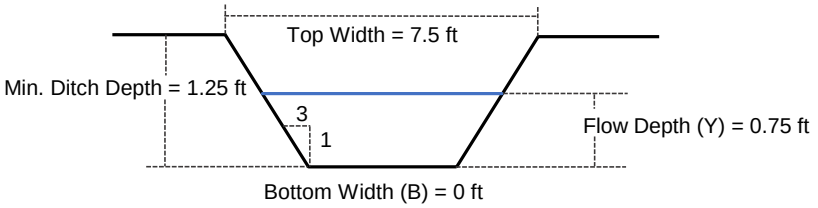
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.69	SF		
New P =	4.74	Wetted perimeter		
New R =	0.36	Hydraulic radius		
Z Actual =	0.85	Must be greater than z required=>	0.72	Okay
New V =	5.11	fps		

Minimum Design Geometry

Liner: North American Green, SC150 **2.10** LB/SF > 1.97 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.00	0.75	7.5	3:1

Ditch Liner
North American Green, SC150

*RED IS USER INPUT

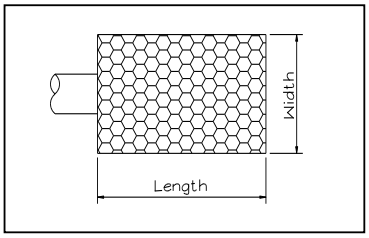
CALCULATED BY		PROJECT NAME
David Hojsan	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
		PROJECT NUMBER
		44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 36A

Velocity =	5.11	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	7.5	ft			
Ditch Area =	1.6875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	17.59	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**18**	in	Apron Length =	6.0	ft
			Apron Width = Top Width.=	7.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 36B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 36B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	2.47	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	5.7	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	470 LF
Slope =	0.051	(ft/ft)		Highest Elevation =	534
Z Required =	0.51	Ratio		Lowest Elevation =	510
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.75	ft	9.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 2.39 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

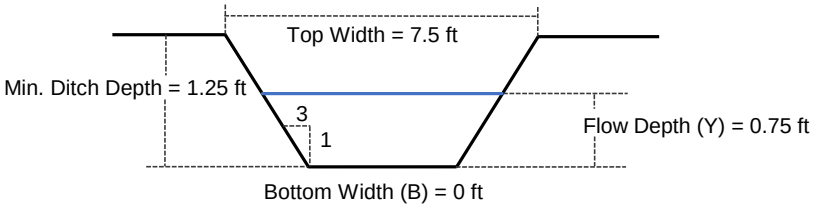
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.69	SF		
New P =	4.74	Wetted perimeter		
New R =	0.36	Hydraulic radius		
Z Actual =	0.85	Must be greater than z required=>	0.51	Okay
New V =	5.63	fps		

Minimum Design Geometry

Liner: Class B (8"@18"THK) **3.50** LB/SF > 2.39 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.00	0.75	7.5	3:1

Ditch Liner
Class B (8"@18"THK)

*RED IS USER INPUT

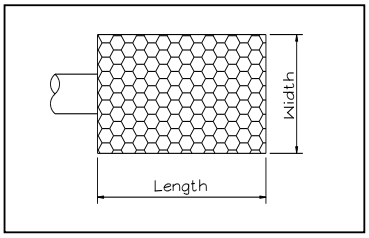
CALCULATED BY		PROJECT NAME
David Hojsan	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
		PROJECT NUMBER
		44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 36B

Velocity =	5.63	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	7.5	ft			
Ditch Area =	1.6875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	17.59	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**18**	in	Apron Length =	6.0	ft
			Apron Width = Top Width.=	7.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 37A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 37A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**5.88**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**13.7**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap	(Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)		Ditch Length =	**1180** LF
Slope =	0.038	(ft/ft)		Highest Elevation =	**572**
Z Required =	1.41	Ratio		Lowest Elevation =	**527**
Side Slope (M) =	**3**	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**1.00**	ft	12.0	in
Bottom Width (B) =	**0.00**	ft	0.0	in
Freeboard =	**0.50**	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 2.38 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

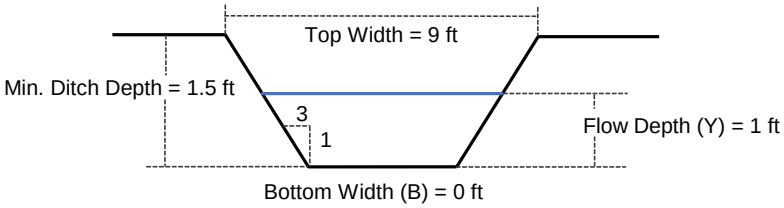
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	3.00	SF		
New P =	6.32	Wetted perimeter		
New R =	0.47	Hydraulic radius		
Z Actual =	**1.82**	Must be greater than z required=>	**1.41**	**Okay**
New V =	5.90	fps		

Minimum Design Geometry

Liner: Class B (8"@18"THK) **3.50** LB/SF > 2.38 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.50	0.00	1.00	9	3:1

Ditch Liner
Class B (8"@18"THK)

***RED IS USER INPUT**

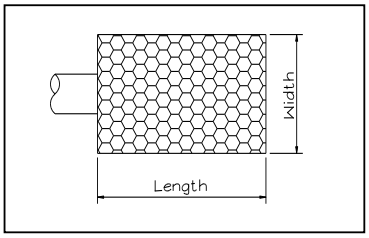
	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	**PROJECT NAME** Carolina Sunrock
CALCULATED BY David Hojsan		**PROJECT NUMBER** 44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 37A

Velocity =	5.90	fps	From Fig. 8.06.c: ZONE =	**2**	
Top Width =	9	ft			
Ditch Area =	3	sf	Rip Rap Class =	B	
Equivalent Pipe Diameter =	23.45	in	Apron Thickness =	18	in
Equivalent Pipe Diameter =	**24**	in	Apron Length =	12.0	ft
			Apron Width = Top Width.=	9.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 38A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 38A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**0.81**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**1.9**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap	(Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)		Ditch Length =	**225** LF
Slope =	0.080	(ft/ft)		Highest Elevation =	**572**
Z Required =	0.13	Ratio		Lowest Elevation =	**554**
Side Slope (M) =	**3**	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**0.50**	ft	6.0	in
Bottom Width (B) =	**0.00**	ft	0.0	in
Freeboard =	**0.50**	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 2.50 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

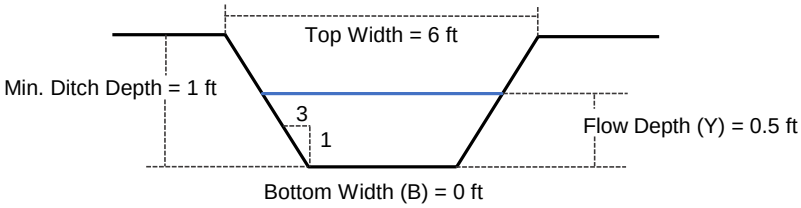
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	**0.29**	Must be greater than z required=>	**0.13**	**Okay**
New V =	5.38	fps		

Minimum Design Geometry

Liner: Class B (8"@18"THK) **3.50** LB/SF > 2.5 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
Class B (8"@18"THK)

***RED IS USER INPUT**

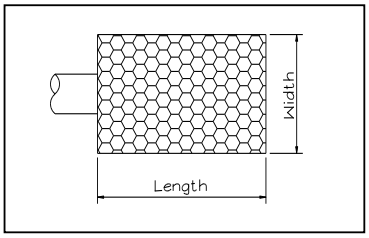
	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	**PROJECT NAME** Carolina Sunrock
CALCULATED BY David Hojsan		**PROJECT NUMBER** 44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 38A

Velocity =	5.38	fps	From Fig. 8.06.c:	ZONE =	**1**
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**12**	in	Apron Length =	4.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 38B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 38B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	0.28	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	0.7	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	132 LF
Slope =	0.197	(ft/ft)		Highest Elevation =	580
Z Required =	0.03	Ratio		Lowest Elevation =	554
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.25	ft	3.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 3.07 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

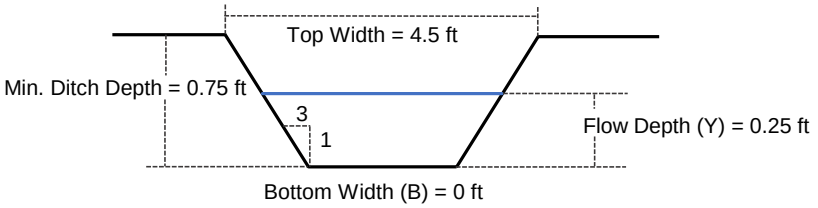
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.19	SF		
New P =	1.58	Wetted perimeter		
New R =	0.12	Hydraulic radius		
Z Actual =	0.05	Must be greater than z required=>	0.03	Okay
New V =	5.32	fps		

Minimum Design Geometry

Liner: Class B (8"@18"THK) **3.50** LB/SF > 3.08 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
0.75	0.00	0.25	4.5	3:1

Ditch Liner
Class B (8"@18"THK)

*RED IS USER INPUT

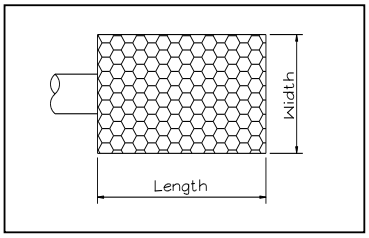
	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	**PROJECT NAME** Carolina Sunrock
CALCULATED BY David Hojsan		**PROJECT NUMBER** 44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 38B

Velocity =	5.32	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	4.5	ft			
Ditch Area =	0.1875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	5.86	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**6**	in	Apron Length =	2.0	ft
			Apron Width = Top Width.=	4.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 39A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 39A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**0.43**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**1.0**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap	(Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)		Ditch Length =	**625** LF
Slope =	0.037	(ft/ft)		Highest Elevation =	**580**
Z Required =	0.10	Ratio		Lowest Elevation =	**557**
Side Slope (M) =	**3**	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**0.50**	ft	6.0	in
Bottom Width (B) =	**0.00**	ft	0.0	in
Freeboard =	**0.50**	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.15 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

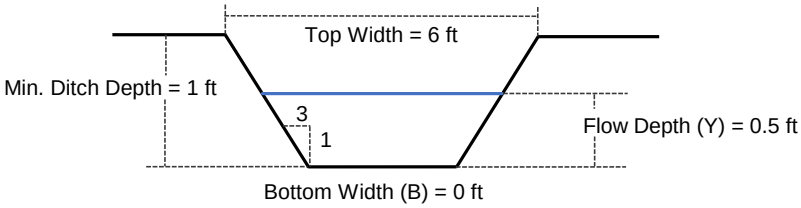
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	**0.29**	Must be greater than z required=>	**0.10**	**Okay**
New V =	3.65	fps		

Minimum Design Geometry

Liner: North American Green, S75 **1.55** LB/SF > 1.15 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
North American Green, S75

***RED IS USER INPUT**

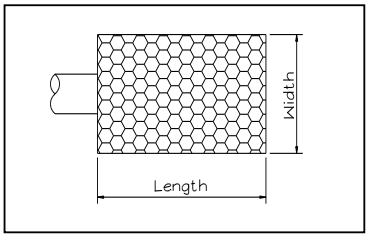
	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	**PROJECT NAME** Carolina Sunrock
CALCULATED BY David Hojsan		**PROJECT NUMBER** 44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 39A

Velocity =	3.65	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**12**	in	Apron Length =	4.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 40A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 40A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	3.59	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	8.3	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	895 LF
Slope =	0.036	(ft/ft)		Highest Elevation =	598
Z Required =	0.89	Ratio		Lowest Elevation =	566
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	1.00	ft	12.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 2.23 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

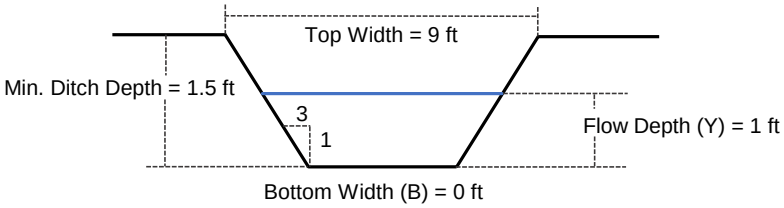
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	3.00	SF		
New P =	6.32	Wetted perimeter		
New R =	0.47	Hydraulic radius		
Z Actual =	1.82	Must be greater than z required=>	0.89	Okay
New V =	5.71	fps		

Minimum Design Geometry

Liner: North American Green, C125 **2.25** LB/SF > 2.24 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.50	0.00	1.00	9	3:1

Ditch Liner
North American Green, C125

*RED IS USER INPUT

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

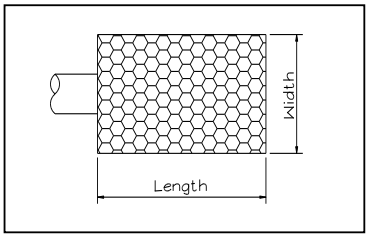
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 40A

Velocity =	5.71	fps	From Fig. 8.06.c: ZONE =	**2**	
Top Width =	9	ft			
Ditch Area =	3	sf	Rip Rap Class =	B	
Equivalent Pipe Diameter =	23.45	in	Apron Thickness =	18	in
Equivalent Pipe Diameter =	**24**	in	Apron Length =	12.0	ft
			Apron Width = Top Width.=	9.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 40B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 40B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**1.85**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**4.3**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap	(Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)		Ditch Length =	**445** LF
Slope =	0.029	(ft/ft)		Highest Elevation =	**579**
Z Required =	0.51	Ratio		Lowest Elevation =	**566**
Side Slope (M) =	**3**	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**0.75**	ft	9.0	in
Bottom Width (B) =	**0.00**	ft	0.0	in
Freeboard =	**0.50**	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 1.37 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

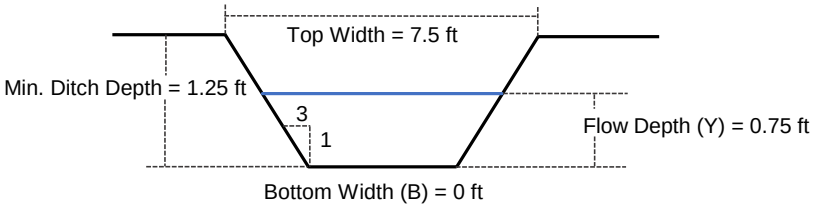
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	1.69	SF		
New P =	4.74	Wetted perimeter		
New R =	0.36	Hydraulic radius		
Z Actual =	**0.85**	Must be greater than z required=>	**0.51**	**Okay**
New V =	4.26	fps		

Minimum Design Geometry

Liner: **North American Green, S75** **1.55** LB/SF > 1.37 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.25	0.00	0.75	7.5	3:1

Ditch Liner
North American Green, S75

***RED IS USER INPUT**

CALCULATED BY	PROJECT NAME
David Hojsan	Carolina Sunrock
	PROJECT NUMBER
	44089

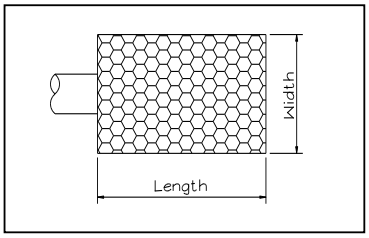
TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 40B

Velocity =	4.26	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	7.5	ft			
Ditch Area =	1.6875	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	17.59	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**18**	in	Apron Length =	6.0	ft
			Apron Width = Top Width.=	7.5	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 41A	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 41A

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	**0.85**	(Acres)
Coef. (C) =	**0.30**	(Dimensionless)
Inte. (I) =	**7.74**	(in/hr)
Flow (Q_{10}) =	**2.0**	(cfs)

Known Quantities

Line channel with:	**6**	" rip-rap	(Assume 6" even if using grass)		
Manning n =	**0.030**	(Dimensionless)		Ditch Length =	**400** LF
Slope =	0.078	(ft/ft)		Highest Elevation =	**620**
Z Required =	0.14	Ratio		Lowest Elevation =	**589**
Side Slope (M) =	**3**	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	**0.50**	ft	6.0	in
Bottom Width (B) =	**0.00**	ft	0.0	in
Freeboard =	**0.50**	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 2.42 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

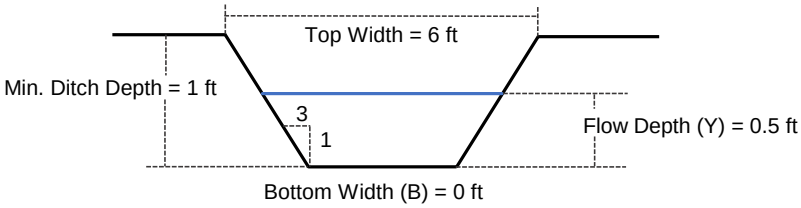
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	**0.29**	Must be greater than z required=>	**0.14**	**Okay**
New V =	5.30	fps		

Minimum Design Geometry

Liner: Class B (8"@18"THK) **3.50** LB/SF > 2.42 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
Class B (8"@18"THK)

***RED IS USER INPUT**

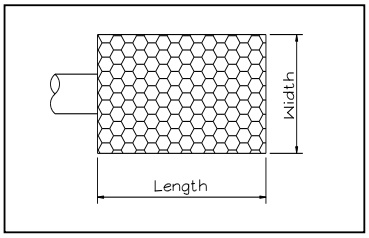
	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	**PROJECT NAME** Carolina Sunrock
CALCULATED BY David Hojsan		**PROJECT NUMBER** 44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 41A

Velocity =	5.30	fps	From Fig. 8.06.c:	ZONE =	**1**
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**12**	in	Apron Length =	4.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



DITCH NAME		PROJECT NAME
TDD 41B	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Carolina Sunrock
CALCULATED BY		PROJECT NUMBER
David Hojsan		44089

Drainage Ditch Design (Velocity Constraint)

TEMPORARY DIVERSION DITCH: TDD 41B

This worksheet is designed to determine channel lining based on flow and ditch geometry (base width, side slope, & channel slope). This program determines depth of flow, velocity and tractive force assuming n=0.03 for grass or rip rap (n can be varied if desired). (Vary depth until z actual equals z required; v & t will be correct; select appropriate lining based on tractive force)

Watershed Data

Area (A) =	0.32	(Acres)
Coef. (C) =	0.30	(Dimensionless)
Inte. (I) =	7.74	(in/hr)
Flow (Q_{10}) =	0.7	(cfs)

Known Quantities

Line channel with:	6	" rip-rap	(Assume 6" even if using grass)		
Manning n =	0.030	(Dimensionless)		Ditch Length =	235 LF
Slope =	0.102	(ft/ft)		Highest Elevation =	613
Z Required =	0.05	Ratio		Lowest Elevation =	589
Side Slope (M) =	3	:1			

Variable Quantities (Ditch Width & Depth)

Flow Depth (Y) =	0.50	ft	6.0	in
Bottom Width (B) =	0.00	ft	0.0	in
Freeboard =	0.50	ft	6.0	in

Compute Tractive Force

T=YxDxS

T = 3.19 LB/SF

Y = Weight of water (62.4 LB/CUFT)
D=Depth of flow in channel (ft)
S=Slope of channel (ft/ft)

General Lining	LB/SF
Jute Net	0.45
Curled Mat	1.55
Class A (4"@9"THK)	2.00
Class B (8"@18"THK)	3.50
Class I (12"@22"THK)	5.00
Class II (18"@30"THK)	7.50

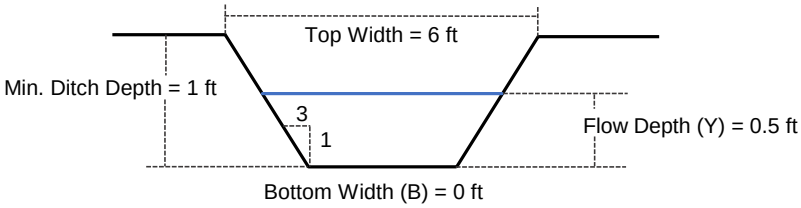
North American Green Lining	LB/SF
S75	1.55
S150	1.75
SC150	2.10
C125	2.25
P300	8.00

Determine If Z Actual Is Greater Than Z Required

New A =	0.75	SF		
New P =	3.16	Wetted perimeter		
New R =	0.24	Hydraulic radius		
Z Actual =	0.29	Must be greater than z required=>	0.05	Okay
New V =	6.08	fps		

Minimum Design Geometry

Liner: Class B (8"@18"THK) **3.50** LB/SF > 3.19 LB/SF **Okay**



Ditch Geometry				
Min. Ditch Depth (ft)	Bottom Width (ft)	Flow Depth (ft)	Top Width (ft)	Side Slope
1.00	0.00	0.50	6	3:1

Ditch Liner
Class B (8"@18"THK)

*RED IS USER INPUT

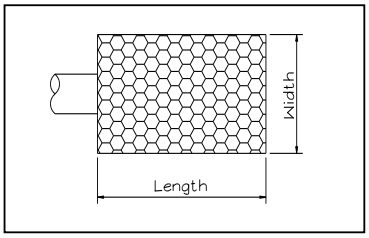
	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	**PROJECT NAME** Carolina Sunrock
CALCULATED BY David Hojsan		**PROJECT NUMBER** 44089

Ditch Outlet Protection (NYDOT Method)

Ditch Name: TDD 41B

Velocity =	6.08	fps	From Fig. 8.06.c: ZONE =	**1**	
Top Width =	6	ft			
Ditch Area =	0.75	sf	Rip Rap Class =	A	
Equivalent Pipe Diameter =	11.73	in	Apron Thickness =	12	in
Equivalent Pipe Diameter =	**12**	in	Apron Length =	4.0	ft
			Apron Width = Top Width.=	6.0	ft

From Fig. 8.06.e:



NOAA Atlas 14, Volume 2, Version 3
Location name: Prospect Hill, North Carolina, USA*
Latitude: 36.2998°, Longitude: -79.1735°
Elevation: 662.84 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	4.60 (4.20-5.02)	5.46 (4.99-5.96)	6.37 (5.82-6.96)	7.02 (6.40-7.66)	7.74 (7.02-8.42)	8.21 (7.42-8.94)	8.65 (7.78-9.42)	9.00 (8.05-9.83)	9.41 (8.34-10.3)	9.67 (8.52-10.6)
10-min	3.67 (3.35-4.01)	4.37 (3.99-4.77)	5.11 (4.66-5.58)	5.61 (5.12-6.12)	6.17 (5.60-6.71)	6.53 (5.91-7.12)	6.87 (6.18-7.48)	7.14 (6.38-7.79)	7.44 (6.60-8.12)	7.61 (6.71-8.33)
15-min	3.06 (2.79-3.34)	3.66 (3.34-4.00)	4.31 (3.93-4.70)	4.73 (4.32-5.16)	5.21 (4.73-5.68)	5.52 (4.99-6.00)	5.79 (5.21-6.30)	6.00 (5.37-6.55)	6.24 (5.54-6.82)	6.37 (5.62-6.97)
30-min	2.10 (1.91-2.29)	2.53 (2.31-2.76)	3.06 (2.79-3.34)	3.43 (3.13-3.74)	3.86 (3.50-4.20)	4.15 (3.75-4.52)	4.43 (3.99-4.83)	4.67 (4.18-5.10)	4.97 (4.41-5.42)	5.16 (4.55-5.64)
60-min	1.31 (1.19-1.43)	1.59 (1.45-1.73)	1.96 (1.79-2.14)	2.23 (2.04-2.44)	2.57 (2.33-2.80)	2.82 (2.54-3.06)	3.05 (2.75-3.33)	3.28 (2.93-3.58)	3.56 (3.16-3.89)	3.77 (3.32-4.12)
2-hr	0.776 (0.709-0.849)	0.942 (0.860-1.03)	1.17 (1.07-1.28)	1.35 (1.23-1.47)	1.57 (1.42-1.71)	1.75 (1.57-1.90)	1.92 (1.71-2.09)	2.09 (1.85-2.27)	2.31 (2.03-2.51)	2.48 (2.16-2.70)
3-hr	0.554 (0.507-0.605)	0.673 (0.617-0.735)	0.839 (0.767-0.916)	0.967 (0.882-1.05)	1.13 (1.02-1.23)	1.26 (1.13-1.37)	1.39 (1.24-1.50)	1.51 (1.34-1.64)	1.68 (1.48-1.82)	1.81 (1.57-1.97)
6-hr	0.338 (0.311-0.371)	0.410 (0.376-0.450)	0.511 (0.467-0.560)	0.591 (0.539-0.646)	0.698 (0.632-0.762)	0.784 (0.705-0.854)	0.873 (0.778-0.949)	0.963 (0.849-1.05)	1.09 (0.946-1.18)	1.19 (1.02-1.29)
12-hr	0.201 (0.185-0.221)	0.244 (0.224-0.268)	0.306 (0.279-0.335)	0.356 (0.324-0.390)	0.426 (0.385-0.464)	0.483 (0.433-0.525)	0.544 (0.482-0.590)	0.608 (0.532-0.658)	0.699 (0.601-0.756)	0.773 (0.653-0.837)
24-hr	0.119 (0.110-0.128)	0.143 (0.133-0.154)	0.178 (0.166-0.192)	0.206 (0.191-0.222)	0.243 (0.225-0.262)	0.273 (0.252-0.295)	0.304 (0.278-0.328)	0.335 (0.306-0.363)	0.378 (0.343-0.410)	0.412 (0.371-0.448)
2-day	0.070 (0.065-0.075)	0.084 (0.078-0.090)	0.103 (0.097-0.111)	0.119 (0.110-0.127)	0.139 (0.129-0.149)	0.155 (0.143-0.166)	0.171 (0.157-0.184)	0.187 (0.172-0.202)	0.209 (0.191-0.226)	0.226 (0.205-0.246)
3-day	0.049 (0.046-0.053)	0.059 (0.055-0.063)	0.073 (0.068-0.078)	0.083 (0.077-0.089)	0.097 (0.090-0.104)	0.109 (0.100-0.117)	0.120 (0.110-0.129)	0.132 (0.121-0.142)	0.147 (0.134-0.160)	0.160 (0.145-0.173)
4-day	0.039 (0.036-0.042)	0.046 (0.043-0.050)	0.057 (0.053-0.061)	0.065 (0.061-0.070)	0.077 (0.071-0.082)	0.085 (0.079-0.092)	0.095 (0.087-0.102)	0.104 (0.095-0.112)	0.116 (0.106-0.126)	0.126 (0.114-0.137)
7-day	0.025 (0.024-0.027)	0.030 (0.028-0.032)	0.037 (0.034-0.039)	0.042 (0.039-0.045)	0.049 (0.046-0.052)	0.054 (0.050-0.058)	0.060 (0.055-0.064)	0.066 (0.060-0.071)	0.073 (0.067-0.079)	0.080 (0.072-0.086)
10-day	0.020 (0.019-0.021)	0.024 (0.023-0.026)	0.029 (0.027-0.031)	0.033 (0.031-0.035)	0.038 (0.035-0.040)	0.042 (0.039-0.045)	0.046 (0.043-0.049)	0.050 (0.046-0.054)	0.056 (0.051-0.060)	0.060 (0.055-0.065)
20-day	0.013 (0.013-0.014)	0.016 (0.015-0.017)	0.019 (0.018-0.020)	0.021 (0.020-0.022)	0.024 (0.023-0.026)	0.027 (0.025-0.029)	0.029 (0.027-0.031)	0.032 (0.030-0.034)	0.036 (0.033-0.038)	0.038 (0.035-0.041)
30-day	0.011 (0.011-0.012)	0.013 (0.012-0.014)	0.015 (0.014-0.016)	0.017 (0.016-0.018)	0.019 (0.018-0.020)	0.021 (0.019-0.022)	0.022 (0.021-0.024)	0.024 (0.022-0.026)	0.026 (0.024-0.028)	0.028 (0.026-0.030)
45-day	0.009 (0.009-0.010)	0.011 (0.010-0.012)	0.013 (0.012-0.013)	0.014 (0.013-0.015)	0.016 (0.015-0.016)	0.017 (0.016-0.018)	0.018 (0.017-0.019)	0.019 (0.018-0.020)	0.021 (0.020-0.022)	0.022 (0.021-0.024)
60-day	0.008 (0.008-0.009)	0.010 (0.009-0.010)	0.011 (0.011-0.012)	0.012 (0.012-0.013)	0.013 (0.013-0.014)	0.014 (0.014-0.015)	0.015 (0.014-0.016)	0.016 (0.015-0.017)	0.017 (0.016-0.018)	0.018 (0.017-0.019)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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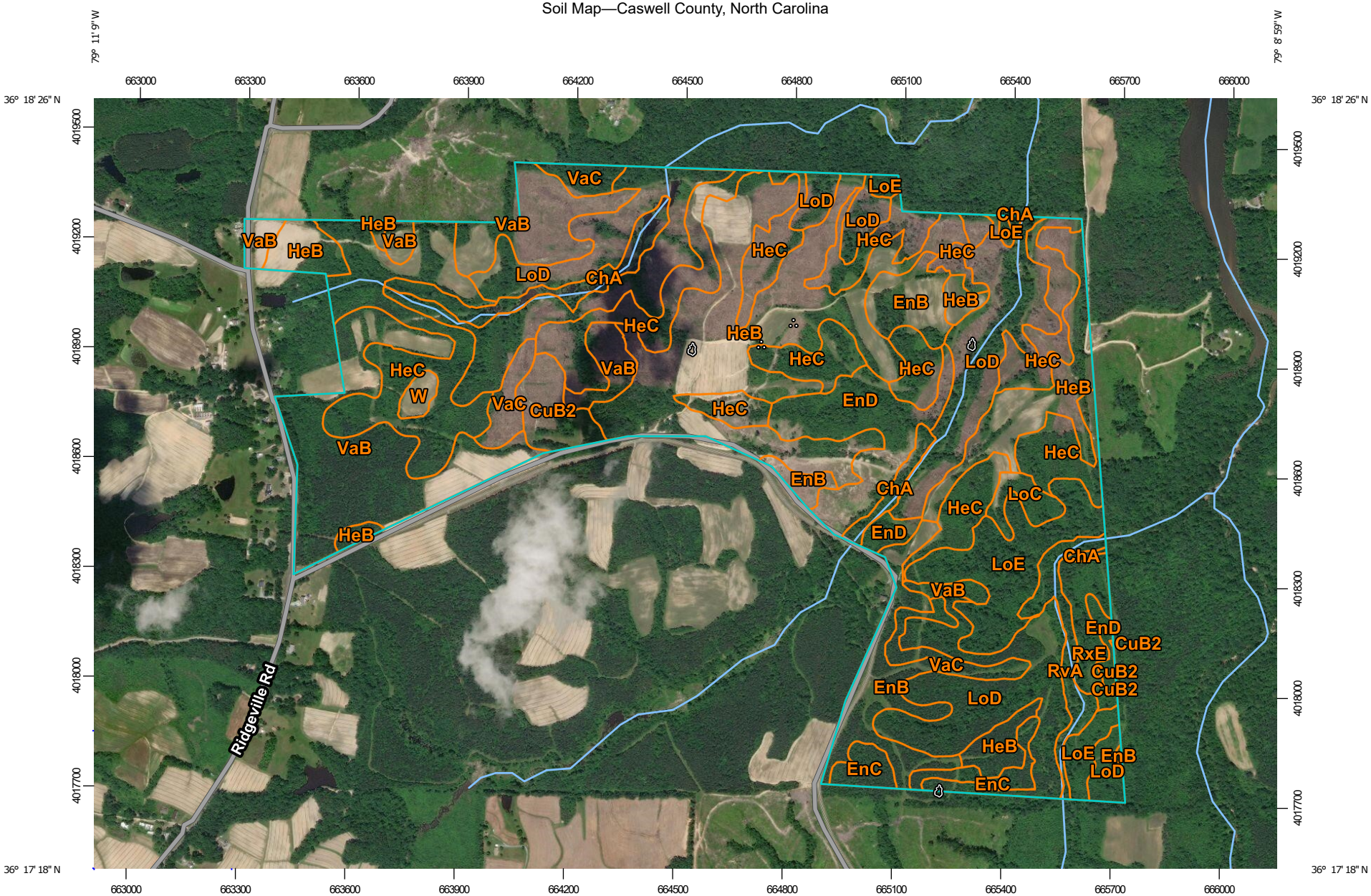
PF graphical

Maps



Map Scale: 1:14,800 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

Soil Survey Area: Caswell County, North Carolina
Survey Area Data: Version 9, Sep 10, 2018

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

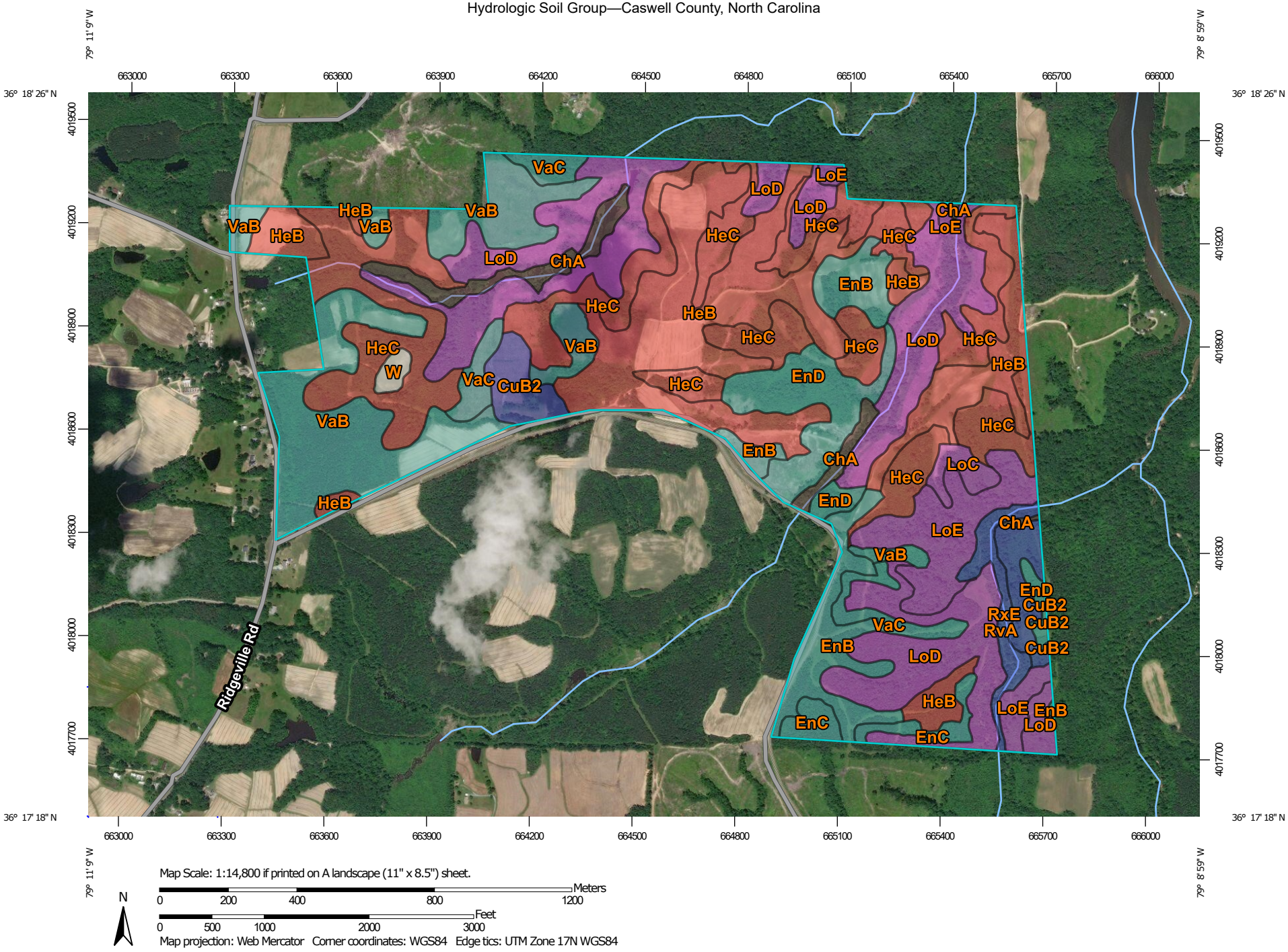
Date(s) aerial images were photographed: Nov 12, 2015—Nov 26, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
ChA	Chewacla loam, 0 to 2 percent slopes, frequently flooded	13.8	2.4%
CuB2	Cullen clay loam, 2 to 6 percent slopes, moderately eroded	9.3	1.6%
EnB	Enon sandy loam, 2 to 6 percent slopes	31.2	5.5%
EnC	Enon sandy loam, 6 to 10 percent slopes	8.6	1.5%
EnD	Enon sandy loam, 10 to 15 percent slopes	28.5	5.0%
HeB	Helena sandy loam, 2 to 6 percent slopes	109.1	19.1%
HeC	Helena sandy loam, 6 to 10 percent slopes	117.4	20.5%
LoC	Louisburg coarse sandy loam, 6 to 10 percent slopes	4.6	0.8%
LoD	Louisburg coarse sandy loam, 10 to 15 percent slopes	111.6	19.5%
LoE	Louisburg coarse sandy loam, 15 to 45 percent slopes	30.2	5.3%
RvA	Riverview loam, 0 to 2 percent slopes, occasionally flooded	9.0	1.6%
RxE	Rowan-Poindexter complex, 15 to 45 percent slopes	8.8	1.5%
VaB	Vance sandy loam, 2 to 6 percent slopes	73.2	12.8%
VaC	Vance sandy loam, 6 to 10 percent slopes	14.7	2.6%
W	Water	2.3	0.4%
Totals for Area of Interest		**572.4**	**100.0%**

Hydrologic Soil Group—Caswell County, North Carolina



Map Scale: 1:14,800 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

Soil Survey Area: Caswell County, North Carolina
Survey Area Data: Version 9, Sep 10, 2018

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

Date(s) aerial images were photographed: Nov 12, 2015—Nov 26, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
ChA	Chewacla loam, 0 to 2 percent slopes, frequently flooded	B/D	13.8	2.4%
CuB2	Cullen clay loam, 2 to 6 percent slopes, moderately eroded	B	9.3	1.6%
EnB	Enon sandy loam, 2 to 6 percent slopes	C	31.2	5.5%
EnC	Enon sandy loam, 6 to 10 percent slopes	C	8.6	1.5%
EnD	Enon sandy loam, 10 to 15 percent slopes	C	28.5	5.0%
HeB	Helena sandy loam, 2 to 6 percent slopes	D	109.1	19.1%
HeC	Helena sandy loam, 6 to 10 percent slopes	D	117.4	20.5%
LoC	Louisburg coarse sandy loam, 6 to 10 percent slopes	A	4.6	0.8%
LoD	Louisburg coarse sandy loam, 10 to 15 percent slopes	A	111.6	19.5%
LoE	Louisburg coarse sandy loam, 15 to 45 percent slopes	A	30.2	5.3%
RvA	Riverview loam, 0 to 2 percent slopes, occasionally flooded	B	9.0	1.6%
RxE	Rowan-Poindexter complex, 15 to 45 percent slopes	B	8.8	1.5%
VaB	Vance sandy loam, 2 to 6 percent slopes	C	73.2	12.8%
VaC	Vance sandy loam, 6 to 10 percent slopes	C	14.7	2.6%
W	Water		2.3	0.4%
Totals for Area of Interest			**572.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

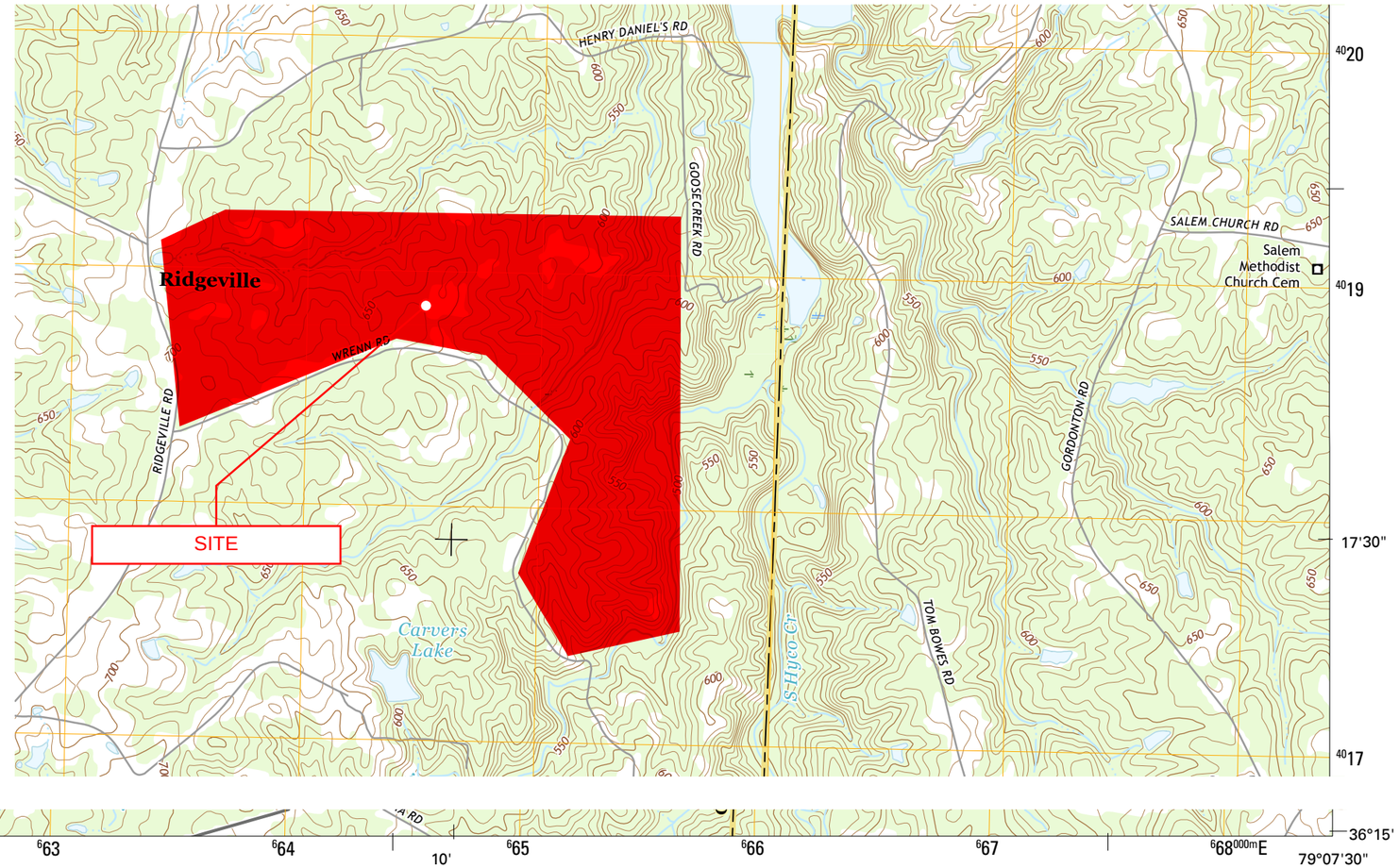
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



SCALE 1:24 000

KILOMETERS: 1 0.5 0 1 2

METERS: 1000 500 0 1000 2000

MILES: 1 0.5 0 1

FEET: 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the
National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.19

QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 Yanceyville
2 Leasburg
3 Olive Hill
4 Anderson
5 Hurdle Mills
6 Burlington NE
7 Cedar Grove
8 Caldwell

ADJOINING QUADRANGLES

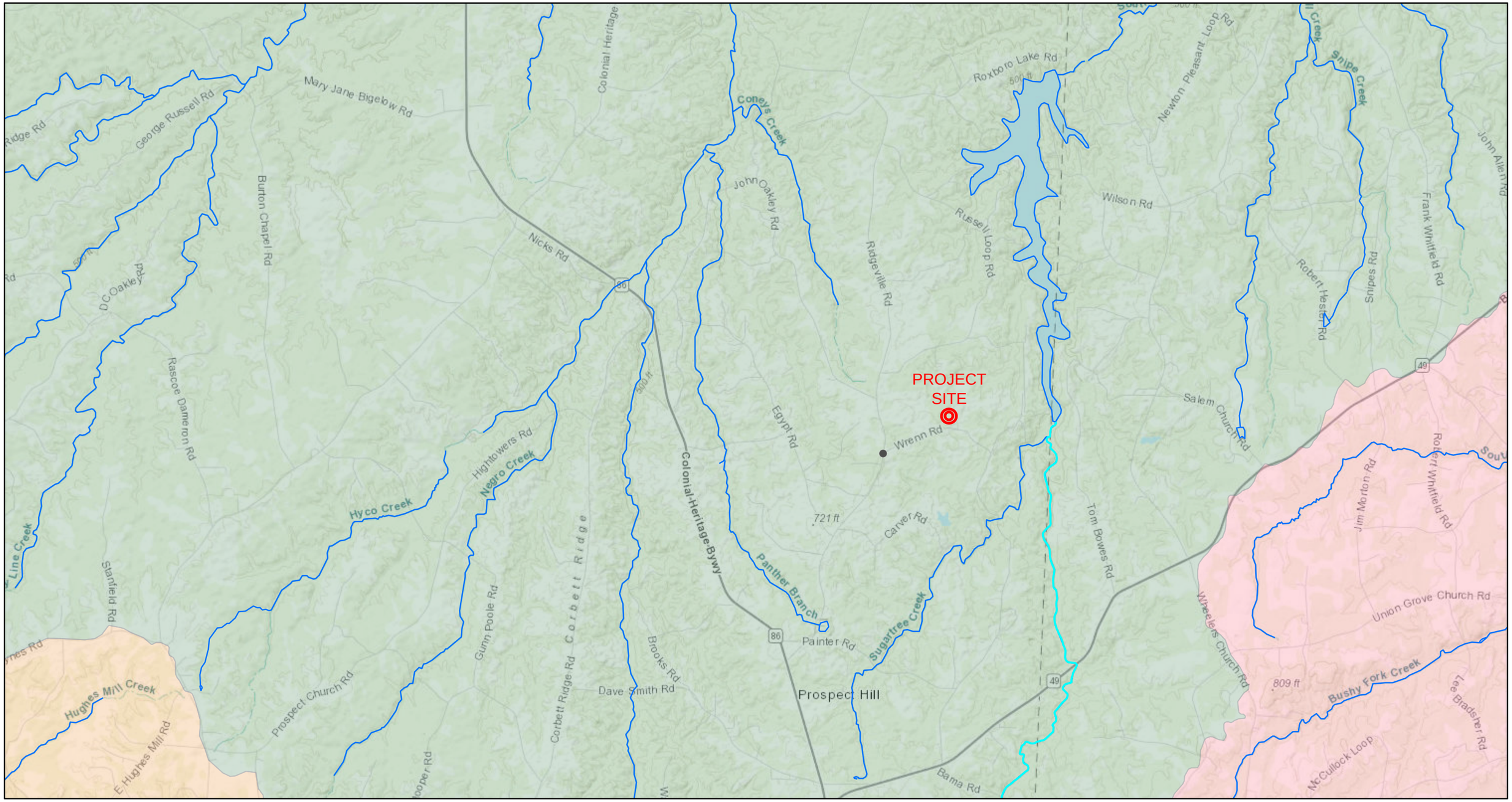
ROAD CLASSIFICATION

Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

RIDGEVILLE, NC

2016

NC Surface Water Classification



8/28/2019 10:24:50 AM

Surface Water Classifications

River Basins

- CPF
- NEU
- ROA

Stream Index: 22-58-4-(0.5)
Stream Name: South Hyco Creek
Description: From source to backwaters of Lake Roxboro
Classification: WS-II;HQW
Date of Class.: August 2, 1992
River Basin: Roanoke

1:72,224

0 0.75 1.5 3 mi

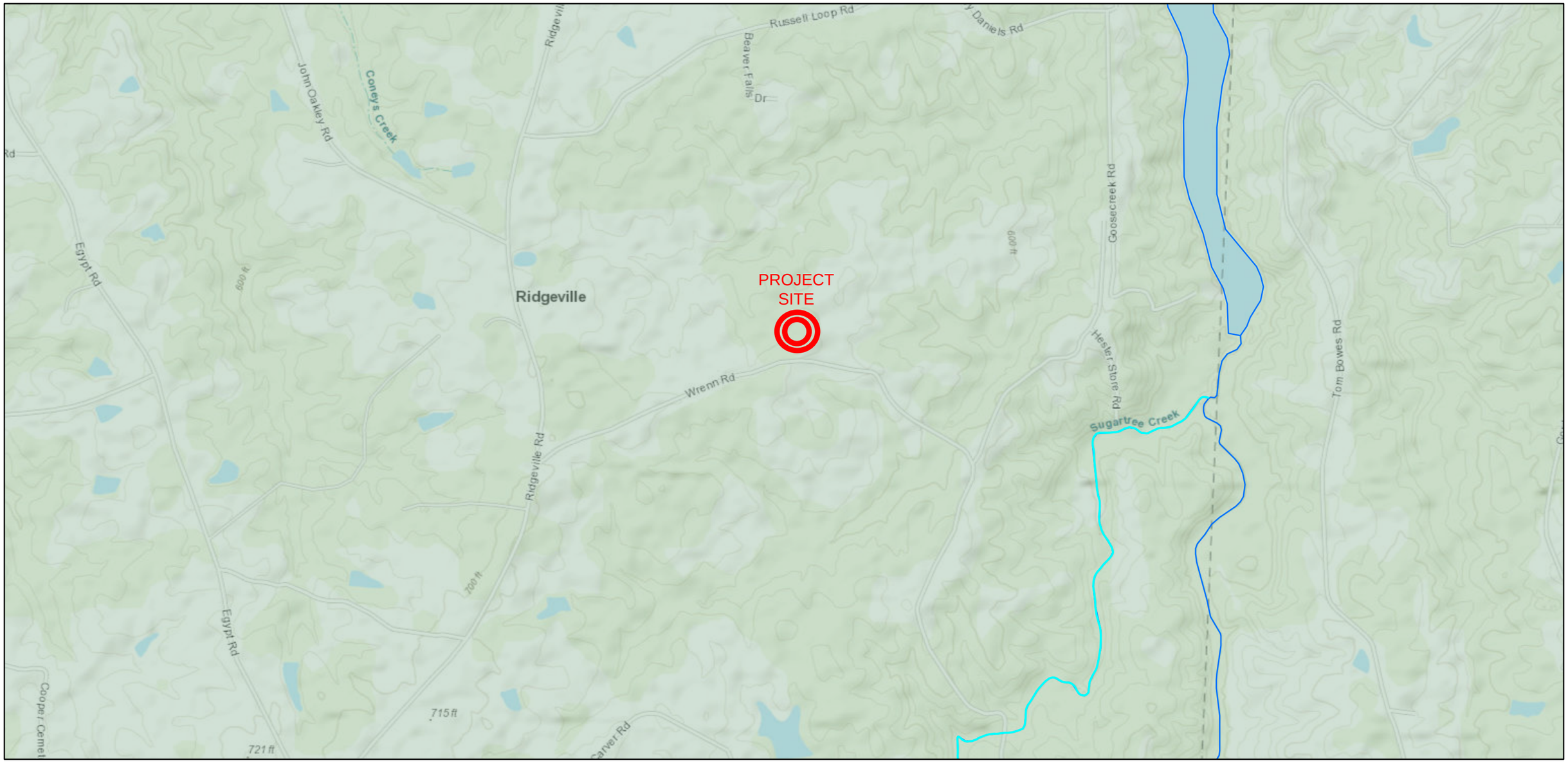
0 1 2 4 km

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

NCDENR Div. Water Resources

State of North Carolina DOT, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, NGA, EPA, USDA | NCDENR - Division of Water Resources |

NC Surface Water Classification



7/24/2019, 11:25:44 AM

Surface Water Classifications

River Basins

ROA

Stream Index: 22-58-4-1
Stream Name: Sugartree Creek
Description: From source to South Hyco Creek
Classification: WS-II;HQW
Date of Class.: August 2, 1992
River Basin: Roanoke

1:18,056

0 0.17 0.35 0.7 mi

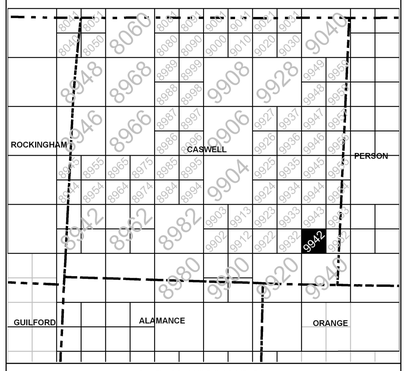
0 0.28 0.55 1.1 km

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

NCDENR Div. Water Resources

State of North Carolina DOT, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, EPA, USDA | NCDENR - Division of Water Resources |

STATE OF NORTH CAROLINA FIRM PANEL LOCATOR DIAGRAM



DATUM INFORMATION

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1 U.S. Survey Foot = 1200/3937 Meters.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988 (NAVD 88). These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. An average offset between NAVD 88 and the National Geodetic Vertical Datum of 1929 (NGVD 29) has been computed for each North Carolina county. This offset was then applied to the NGVD 29 flood elevations that were not revised during the creation of this statewide format FIRM. The offsets for each county shown on this FIRM panel are shown in the vertical datum offset table below. Where a county boundary and a flooding source with unrevised NGVD 29 flood elevations are coincident, an individual offset has been calculated and applied during the creation of this statewide format FIRM. See Section 6.1 of the accompanying Flood Insurance Study report to obtain further information on the conversion of elevations between NAVD 88 and NGVD 29. To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the North Carolina Geodetic Survey at the address shown below. You may also contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

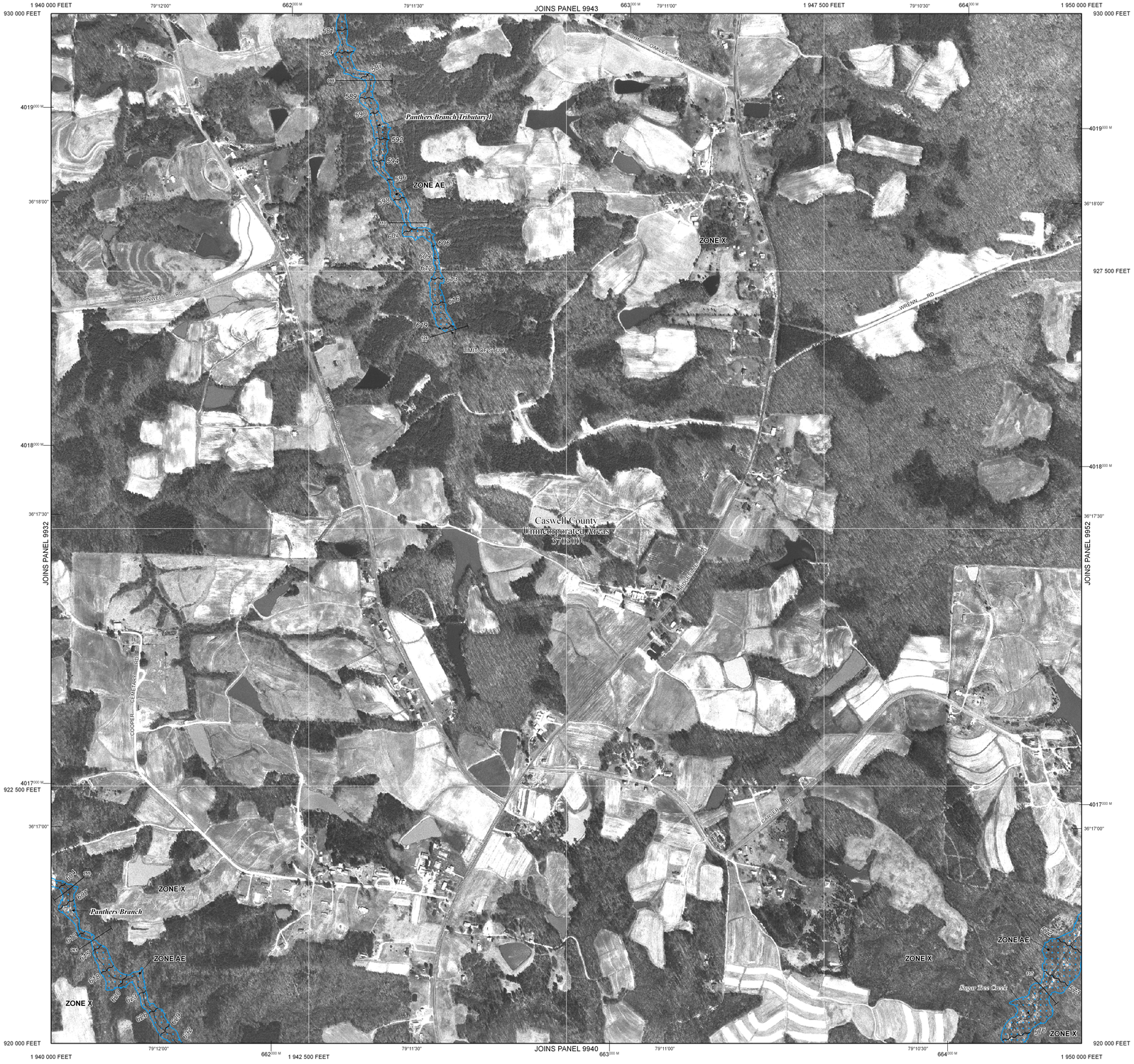
North Carolina Geodetic Survey
121 West Jones Street
Raleigh, NC 27601
(919) 733-3836
http://www.ncgs.state.nc.us

County Average Vertical Datum Offset Table

County	Vertical Datum Offset (ft)
CASWELL	-0.77

Example: NAVD 88 = NGVD 29 + (-0.77)

All streams listed in the **Flood Hazard Data Table** below were studied by detailed methods using field survey. Other flood hazard data shown on this map may have been derived using either a coastal analysis or limited detailed Riverine analysis. More information on the flooding sources studied by these analyses is contained in the Flood Insurance Study report.



LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

1% annual chance floodplain boundary
0.2% annual chance floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

512	Cross section line
23 — 23	Transect line
97°07'30", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000 M	1000-meter Universal Transverse Mercator grid ticks, zone 17
1 477 500 FEET	2500-foot grid values: North Carolina State Plane coordinate system (FIPSZONE 3200, State Plane NAD 83 feet)
BM5510	North Carolina Geodetic Survey bench mark (for more information visit http://www.ncgs.state.nc.us)
BM5510	National Geodetic Survey bench mark (for more information visit http://www.ngs.noaa.gov)
BM5510	NGS-58 GPS 2-5 cm Vertical Control Marks or Contractor-Established NCFMP Bench Marks (for more information visit http://www.ncgs.state.nc.us)
● M1.5	River Mile

GRID NORTH

MAP SCALE 1" = 500' (1 : 6,000)

250 0 250 500 750 1,000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 9942J

FIRM

FLOOD INSURANCE RATE MAP

NORTH CAROLINA

PANEL 9942

(SEE LOCATOR DIAGRAM OR MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	CID No.	PANEL	SUFFIX
CASWELL COUNTY	370300	9942	J

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

EFFECTIVE DATE
SEPTEMBER 28, 2007

MAP NUMBER
3710994200J

State of North Carolina
Federal Emergency Management Agency

NORTH CAROLINA Cooperating Technical State
FEMA'S COOPERATING TECHNICAL PARTNER

This digital Flood Insurance Rate Map (FIRM) was produced through a unique cooperative partnership between the State of North Carolina and the Federal Emergency Management Agency (FEMA). The State of North Carolina has implemented a long term approach of floodplain management to decrease the costs associated with flooding. This is demonstrated by the State's commitment to map floodplain areas at the local level. As a part of this effort, the state of North Carolina has joined in a Cooperating Technical State agreement with FEMA to produce and maintain this digital FIRM.

www.ncfloodmaps.com

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles, Floodway Data, Limited Detailed Flood Hazard Data, and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Boundaries of **regulatory floodways** shown on the FIRM for flooding sources studied by detailed methods were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data for flooding sources studied by detailed methods as well as **non-encroachment widths** for flooding sources studied by limited detailed methods are provided in the Flood Insurance Study (FIS) report for this jurisdiction. The FIS report also provides instructions for determining a floodway using non-encroachment widths for flooding sources studied by limited detailed methods.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 4.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures in this jurisdiction.

Base map information and geospatial data used to develop this FIRM were obtained from various organizations, including the participating local community(ies), state and federal agencies, and/or other sources. The primary base for this FIRM is aerial imagery acquired by Caswell County. The time period of collection for the imagery is 2004. Information and geospatial data supplied by the local community(ies) that met FEMA base map specifications were considered the preferred source for development of the base map. See geospatial metadata for the associated digital FIRM for additional information about base map preparation.

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This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels, community map repository addresses, and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

If you have **questions about this map**, or questions concerning the National Flood Insurance Program in general, please call **1 – 877 – FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov.

An accompanying Flood Insurance Study report, Letter of Map Revision (LOMR) or Letter of Map Amendment (LOMA) revising portions of this panel, and digital versions of this FIRM may be available. Visit the **North Carolina Floodplain Mapping Program** website at http://www.ncfloodmaps.com, or contact the **FEMA Map Service Center** at 1-800-358-9616 for information on all related products associated with this FIRM. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov.

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index or visit http://www.ncfloodmaps.com.

EFFECTIVE DATE OF FLOOD INSURANCE RATE MAP PANEL
SEPTEMBER 28, 2007

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

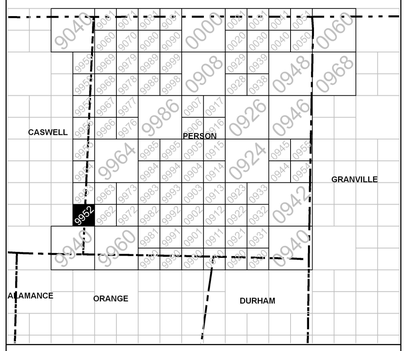
For community map revision history prior to statewide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent, the North Carolina Division of Emergency Management or the National Flood Insurance Program at the following phone numbers or websites:

NC Division of Emergency Management
(919) 715-8000 http://www.nccrimecontrol.org/nfip

National Flood Insurance Program
1-800-638-6620 http://www.fema.gov/nfip

STATE OF NORTH CAROLINA FIRM PANEL LOCATOR DIAGRAM



DATUM INFORMATION

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Flood elevations on this map are referenced to the North American Vertical Datum of 1988 (NAVD 88). These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. An average offset between NAVD 88 and the National Geodetic Vertical Datum of 1929 (NGVD 29) has been computed for each North Carolina county. This offset was then applied to the NGVD 29 flood elevations that were not revised during the creation of this statewide format FIRM. The offsets for each county shown on this FIRM panel are shown in the vertical datum offset table below. Where a county boundary and a flooding source with unrevised NGVD 29 flood elevations are coincident, an individual offset has been calculated and applied during the creation of this statewide format FIRM. See Section 6.1 of the accompanying Flood Insurance Study report to obtain further information on the conversion of elevations between NAVD 88 and NGVD 29. To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the North Carolina Geodetic Survey at the address shown below. You may also contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

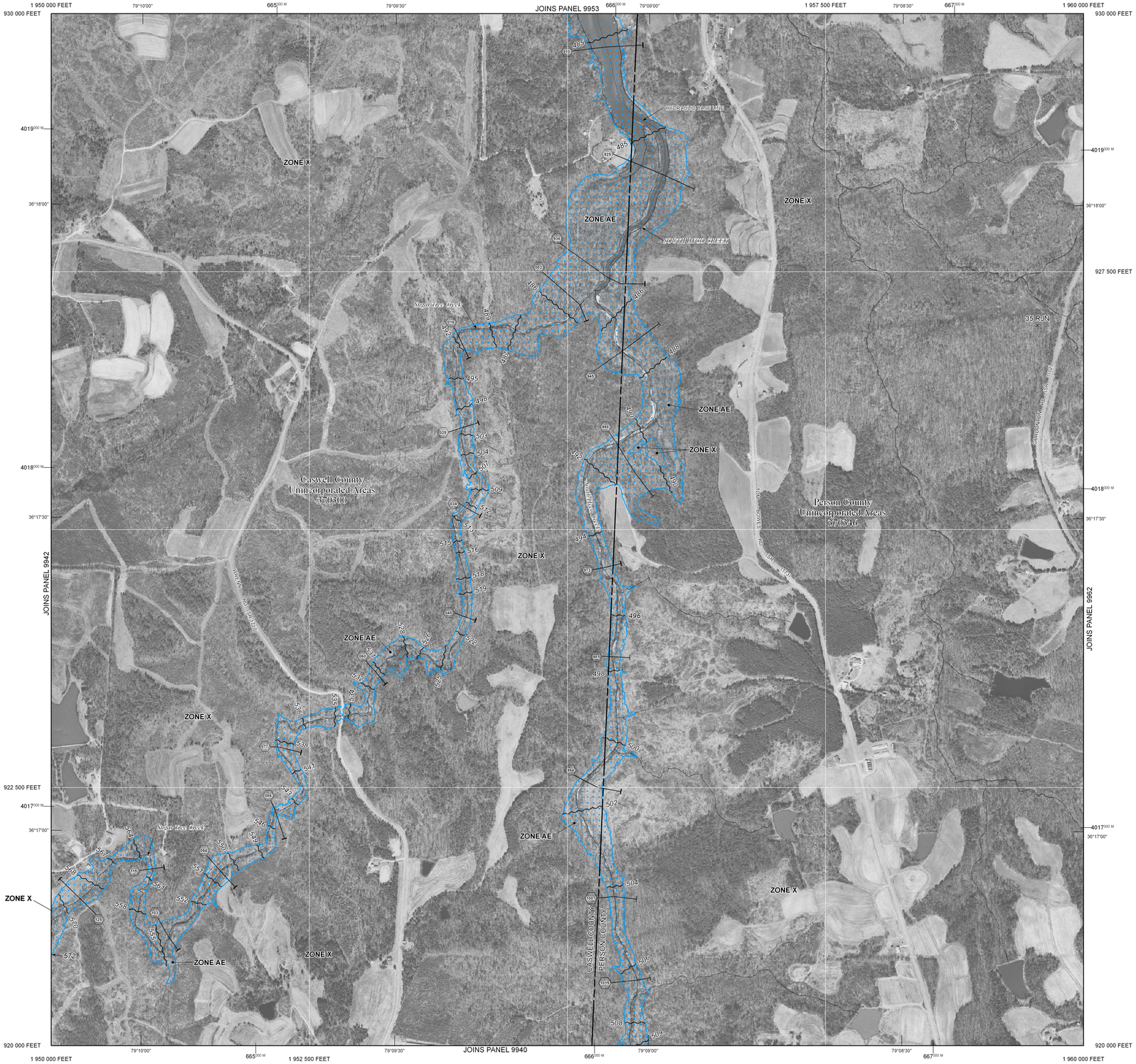
North Carolina Geodetic Survey
121 West Jones Street
Raleigh, NC 27601
(919) 733-3836
http://www.ncgs.state.nc.us

County Average Vertical Datum Offset Table

County	Vertical Datum Offset (ft)
CASWELL	-0.77
PERSON	-0.86

Example: NAVD 88 = NGVD 29 + (-0.77)

All streams listed in the **Flood Hazard Data Table** below were studied by detailed methods using field survey. Other flood hazard data shown on this map may have been derived using either a coastal analysis or limited detailed Riverine analysis. More information on the flooding sources studied by these analyses is contained in the Flood Insurance Study report.



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

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

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ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
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ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

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1% annual chance floodplain boundary
0.2% annual chance floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

012	Cross section line
23 — 23	Transect line
97°07'30", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000 M	1000-meter Universal Transverse Mercator grid ticks, zone 17
1 477 500 FEET	2500-foot grid values: North Carolina State Plane coordinate system (FIPSZONE 3200, State Plane NAD 83 feet)
BM5510	North Carolina Geodetic Survey bench mark (for more information visit http://www.ncgs.state.nc.us)
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● M1.5	River Mile

GRID NORTH
MAP SCALE 1" = 500' (1 : 6,000)
250 0 250 500 750 1,000 FEET
150 0 150 300 METERS

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Base map information and geospatial data used to develop this FIRM were obtained from various organizations, including the participating local community(ies), state and federal agencies, and/or other sources. The primary base for this FIRM is aerial imagery acquired by Caswell County and Person County. The time period of collection for the Caswell imagery is 2004. The time period of collection for the Person imagery is 2004. Information and geospatial data supplied by the local community(ies) that met FEMA base map specifications were considered the preferred source for development of the base map. See geospatial metadata for the associated digital FIRM for additional information about base map preparation.

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Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels, community map repository addresses, and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

If you have **questions about this map**, or questions concerning the National Flood Insurance Program in general, please call **1 – 877 – FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov.

An accompanying Flood Insurance Study report, Letter of Map Revision (LOMR) or Letter of Map Amendment (LOMA) revising portions of this panel, and digital versions of this FIRM may be available. Visit the **North Carolina Floodplain Mapping Program** website at http://www.ncfloodmaps.com, or contact the **FEMA Map Service Center** at 1-800-358-9616 for information on all related products associated with this FIRM. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov.

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index or visit http://www.ncfloodmaps.com.

EFFECTIVE DATE OF FLOOD INSURANCE RATE MAP PANEL
JUNE 4, 2007

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
SEPTEMBER 28, 2007

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

To determine if flood insurance is available in this community, contact your insurance agent, the North Carolina Division of Emergency Management or the National Flood Insurance Program at the following phone numbers or websites:

NC Division of Emergency Management
(919) 715-8000 http://www.nccrimecontrol.org/nfip

National Flood Insurance Program
1-800-638-6620 http://www.fema.gov/nfip

NORTH CAROLINA Cooperating Technical State
FEMA'S COOPERATING TECHNICAL PARTNER

This digital Flood Insurance Rate Map (FIRM) was produced through a unique cooperative partnership between the State of North Carolina and the Federal Emergency Management Agency (FEMA). The State of North Carolina has implemented a long term approach of floodplain management to decrease the costs associated with flooding. This is demonstrated by the State's commitment to map floodplain areas at the local level. As a part of this effort, the state of North Carolina has joined in a Cooperating Technical State agreement with FEMA to produce and maintain this digital FIRM.

www.ncfloodmaps.com

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 9952K

FIRM
FLOOD INSURANCE RATE MAP
NORTH CAROLINA

PANEL 9952
(SEE LOCATOR DIAGRAM OR MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	CID No.	PANEL	SUFFIX
CASWELL COUNTY	370300	9952	K
PERSON COUNTY	370346	9952	K

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

MAP REVISED
SEPTEMBER 28, 2007

MAP NUMBER
371099520K

State of North Carolina
Federal Emergency Management Agency