ZEBULON
NORTH CAROLINA

Zebulon Public Safety Station

201 W Judd St
Zebulon, NC 27597

Erosion & Sediment Control Design Narrative & Calculations

Submittal Date
July 2025

NORTH CAROLINA PROFESSIONAL SEAL 022625 ENGINEER STEVEN J. MILLER

Digitally signed by Steven Miller
Date: 2025.07.21 13:33:50-04'00'

Prepared by:
CLH Design, pa

CONTENTS

E&SC Design Narrative
Zebulon Public Safety Station
CLH Project No.: 22-154
July 2025

PROJECT DESCRIPTION

The Zebulon Public Safety Station project site is located on a 11.13-acre property in Zebulon, NC. This project proposes dividing the existing property and extending the street right-of-way, creating a new 4.93-acre property for the construction of a new emergency responder facility. The proposed construction includes a new building and associated parking, curb and gutter, sidewalks, storm drainage, utilities, landscaping, etc. The construction area is currently undeveloped. The proposed elements will result in a Built-Upon Area (BUA) of 1.97-acres, approximately 40% of the new property.

Soils on the site consist mostly of Wedowee-Urban land complex (WgB – Hydrologic Soil Group B).

The site is located within the Neuse river basin and stormwater runoff from the property discharges southwest towards Little River (Stream Index: 27-57-(8.5), Classification WS-V;NSW).

FEMA FIRM #3720270500K, dated 07/19/2022, indicates that the site does not reside within any flood hazard areas. The FEMA map is provided for reference.

PLANNED EROSION & SEDIMENT CONTROL PRACTICES

1. Silt Fence: Silt fence will be utilized to filter sediment laden runoff in locations where the drainage area is less than ¼ acre per 100-ft of fence.

2. Reinforced Silt Fence Outlets: Reinforced silt fence outlets will be utilized in conjunction with temporary compost socks to provide a stable discharge location for runoff during heavy storm events. The outlets are located where the drainage area is less than ½ acre.

3. Compost Sock Fences: Compost filled geotextile tubes will be installed on existing paved surfaces to filter runoff from adjacent disturbed areas where silt fence cannot be installed.

4. Tree Protection Fencing: Tree protection fencing will be installed to protect existing trees that are intended to remain.

5. Construction Entrance: Temporary gravel construction entrances will be utilized to minimize soil being tracked off the site by construction traffic.

6. Outlet Protection: Riprap outlet protection aprons will be installed at outlets as they are constructed to slow storm-water velocities and dissipate energy to protect downstream channels from erosion.

7. Inlet Protection: Block/gravel inlet protection devices, compost sock inlet protection devices, and excavated inlet protection devices will be installed at new inlets to filter sediment-laden runoff prior to the runoff entering the storm drainage system.

8. Temporary Skimmer Sediment Basins: The proposed SCM will be used as temporary skimmer sediment basins to filter concentrated sediment laden runoff prior to discharge from the site.

9. Channel Matting: Curled wood or excelsior matting will be installed in channels and swales to stabilize the seedbed and promote vegetative growth.

10. Compost Sock Check Dams: Compost filled geotextile tubes check dams will be installed in channels to reduce flow velocities and erosion in the channel.

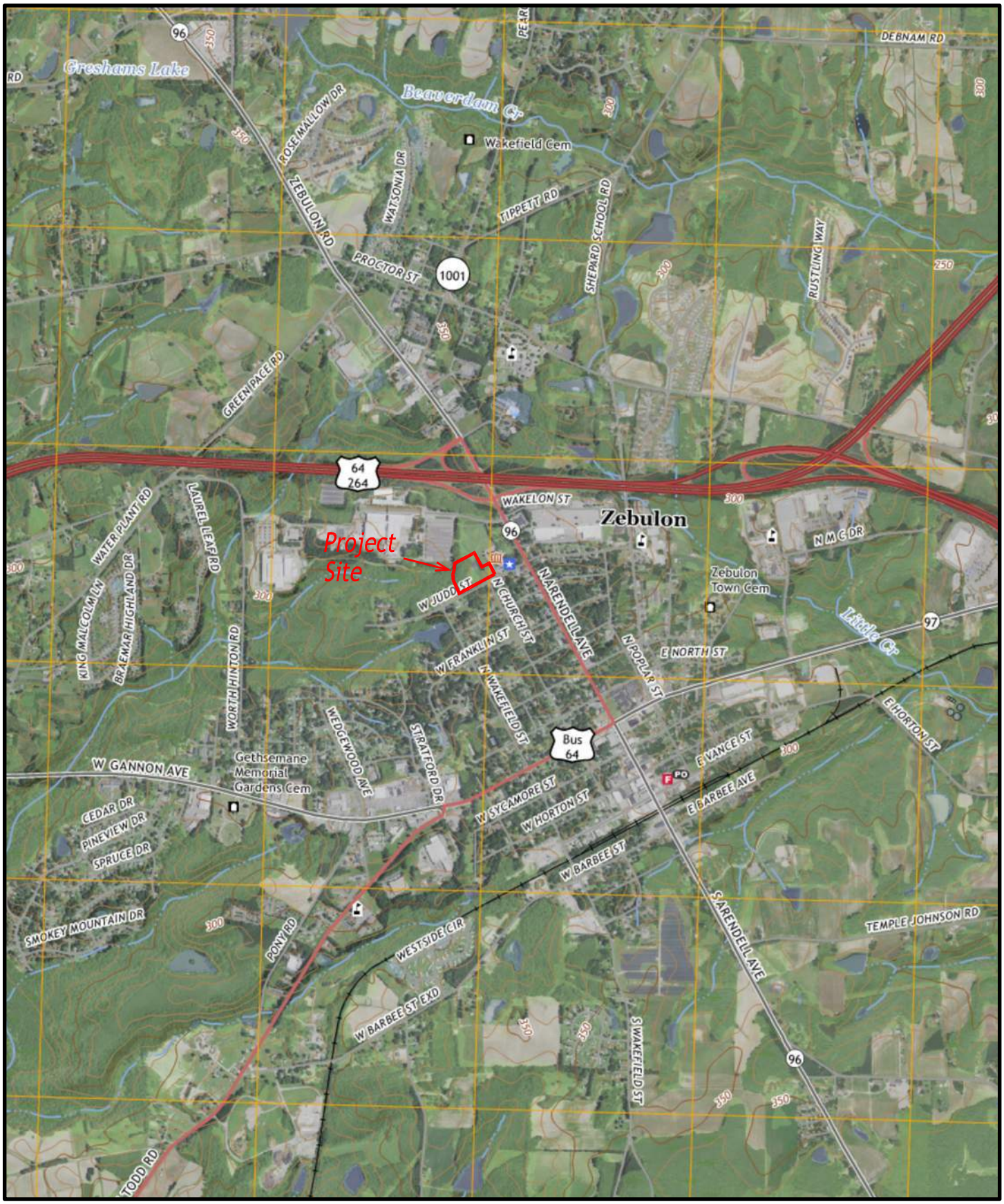
11. Slope Matting: Excelsior matting will be installed on steep slopes to stabilize the seedbed and promote vegetative growth.

12. Diversions: Temporary diversion ditches and berms will be utilized to divert sediment laden runoff to sediment basins.

13. Dewatering Sediment Filter Bag: Permeable sediment filter bags and dewatering pumps will be utilized to dewater sediment basins prior to their removal or conversion to stormwater SCM.

14. Seeding and Mulching: Temporary and permanent seeding and mulching will be employed to stabilize ground surfaces which grading activities have paused or are completed.

Maps

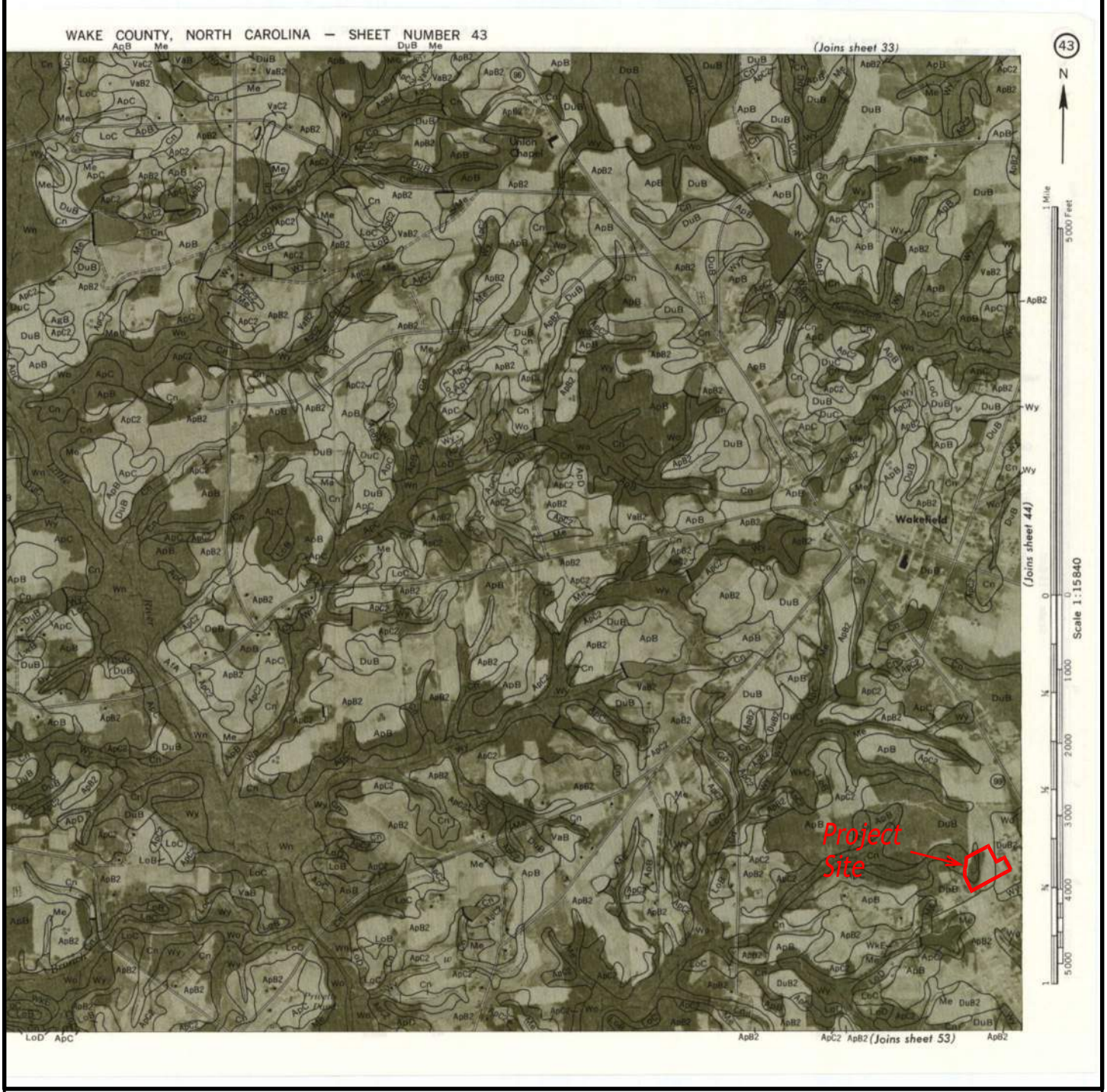


Town of Zebulon
Zebulon Public Safety Station

North
Scale: 1" = 2,000'

Portion of USGS Quad Map

Zebulon, NC - 2022

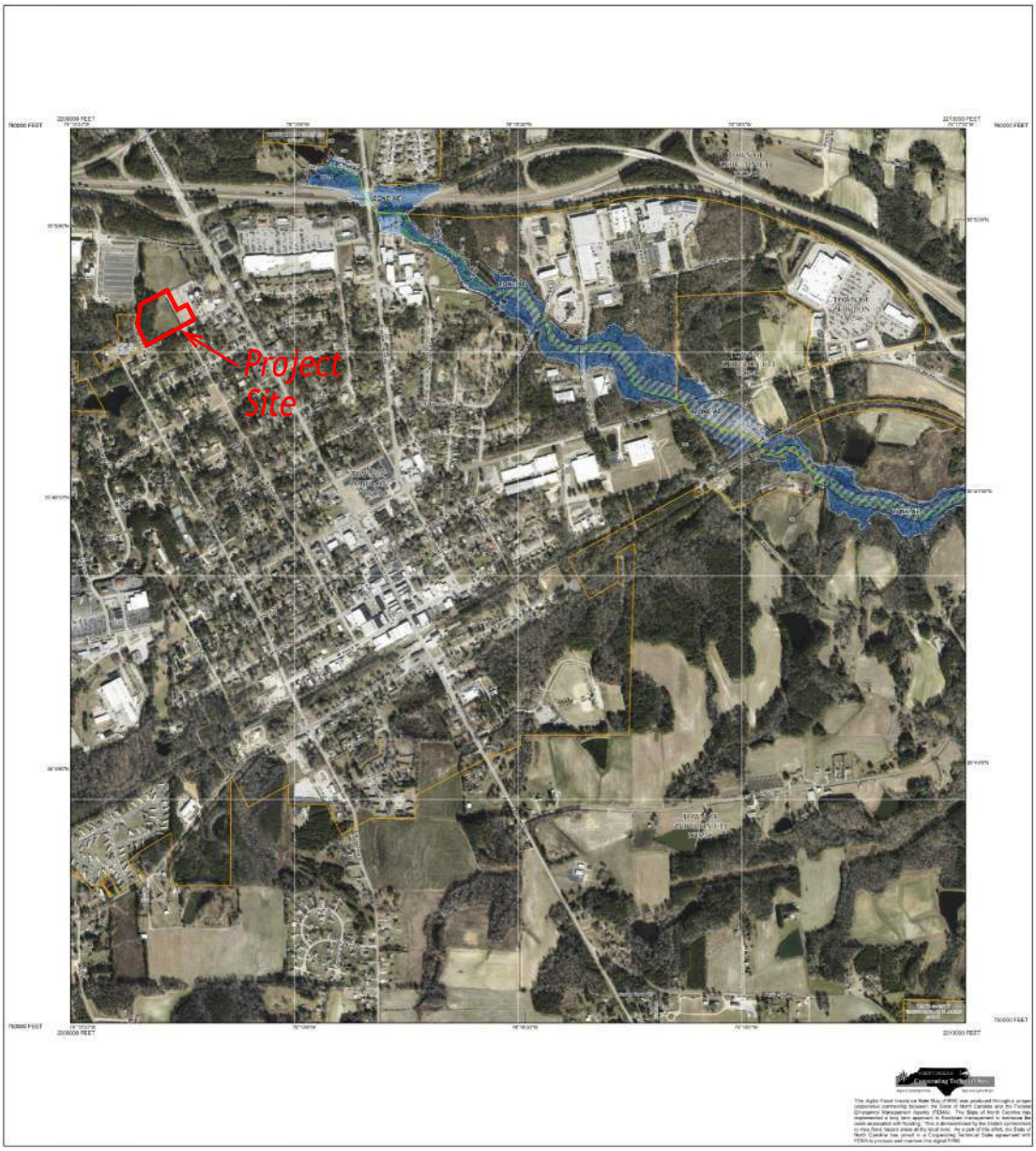


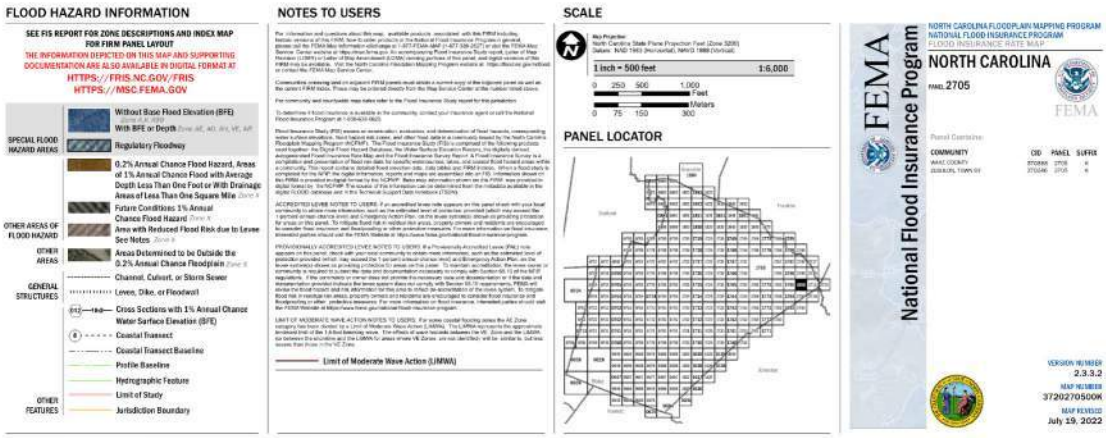
Town of Zebulon
Zebulon Public Safety Station

North
Scale: 1" = 2,000'

Portion of NRCS Soil Map

Wake County, NC - #43





Town of Zebulon
Zebulon Public Safety Station

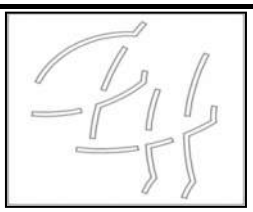
North
Scale: 1" = 2,000'

Portion of FEMA FIRM Panel

#3720270500K

Supporting Calculations

TEMPORARY SKIMMER SEDIMENT BASIN DESIGN	DATE 7/21/2025
PROJECT NAME Zebulon Public Safety Station	PROJECT NO 22-154
LOCATION Zebulon, NC	BY KAS



Skimmer Basin No.: TSSB-1

Site Conditions

		Initial	Final		
Disturbed Area:		1.51	1.71	ac	
Additional Drainage Area:		0.00	0.00	ac	
Total Drainage Area:		1.51	1.71	ac	
Runoff Coeff [Cc]:		0.35	0.74		
10-yr Rainfall Intensity [I]:		7.21	7.21	in/hr	
10-yr Discharge [Q25]:		3.81	9.12	cfs	**Max**
Required Sed. Storage Vol:	Dist.A. x 1800 =	2718	3078	3078	cf
Required Surface Area:	325 sf/cfs =	1238	2965	2965	sf

Basin Volume:

Bottom Elevation of Basin: 324.5 ft

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumm. Vol. (cf)
324.50	2565	0	0	0
325.00	3562	0.5	1532	1532
325.75	4187	1.3	2906	4438

Top of Req. Sediment Pool (per Surface Area): 324.70 ft
Top of Req. Sediment Pool (per Volume): 325.40 ft

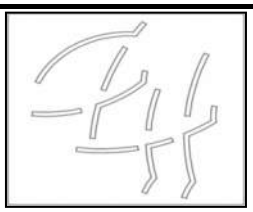
Principle Spillway Design:

Target Dewatering Time:	3-5	days
Draw-down Volume:	3078	cf
Skimmer Size:	2.0	in diameter
Skimmer Orifice Size:	1.000	in diameter
Skimmer Orifice Capacity:	911	cf /day
Calculated Days to Drain:	**3.38**	days
Emergency Spillway Weir Elevation:	328.00	ft
Weir Width:	12.00	ft
Weir Capacity:	10.19	cfs
25-yr Water Surface Elevation:	328.43	ft
Freeboard:	1.00	ft
Min. Embankment Elevation:	329.43	ft
Set Embankment Elevation:	329.50	ft

Results:

Surface Area Required:	2965	sf	
Surface Area Provided:	4187	sf	**OK**
Sediment Storage Volume Required:	3078	cf	
Sediment Storage Provided:	4438	cf	**OK**

TEMPORARY SKIMMER SEDIMENT BASIN DESIGN	DATE 7/21/2025
PROJECT NAME Zebulon Public Safety Station	PROJECT NO 22-154
LOCATION Zebulon, NC	BY KAS



Skimmer Basin No.: TSSB-2

Site Conditions

		Initial	Final		
Disturbed Area:		2.00	1.99	ac	
Additional Drainage Area:		0.00	0.00	ac	
Total Drainage Area:		2.00	1.99	ac	
Runoff Coeff [Cc]:		0.35	0.63		
10-yr Rainfall Intensity [I]:		7.21	7.21	in/hr	
10-yr Discharge [Q25]:		5.05	9.04	cfs	**Max**
Required Sed. Storage Vol:	Dist.A. x 1800 =	3600	3582	3600	cf
Required Surface Area:	325 sf/cfs =	1640	2938	2938	sf

Basin Volume:

Bottom Elevation of Basin: 326.25 ft

Elevation	Area(sf)	Depth(ft)	Incr. Vol. (cf)	Cumm. Vol. (cf)
326.25	2259	0	0	0
326.75	3280	0.5	1385	1385
327.50	4074	1.3	2758	4143

Top of Req. Sediment Pool (per Surface Area): 326.58 ft
Top of Req. Sediment Pool (per Volume): 327.35 ft

Principle Spillway Design:

Target Dewatering Time:	3-5	days
Draw-down Volume:	3600	cf
Skimmer Size:	2.0	in diameter
Skimmer Orifice Size:	1.000	in diameter
Skimmer Orifice Capacity:	911	cf /day
Calculated Days to Drain:	**3.95**	days
Emergency Spillway Weir Elevation:	329.00	ft
Weir Width:	12.00	ft
Weir Capacity:	10.09	cfs
25-yr Water Surface Elevation:	329.43	ft
Freeboard:	1.00	ft
Min. Embankment Elevation:	330.43	ft
Set Embankment Elevation:	330.50	ft

Results:

Surface Area Required:	2938	sf	
Surface Area Provided:	4074	sf	**OK**
Sediment Storage Volume Required:	3600	cf	
Sediment Storage Provided:	4143	cf	**OK**

OUTLET RISER ANTI-FLOTATION DESIGN	DATE	DESIGN PHASE
	7/21/2025	SD / /
PROJECT NAME	PROJECT NO	DD / /
Zebulon Public Safety Station	22-154	CD / x /
LOCATION	BY	REV / /
Zebulon, NC	KAS	OTHER / /
	CHECKED BY	(SPECIFY)

Structure: **SCM-1 Riser**

Top of Rim=	327.25	ft		
Floor of Structure =	323.40	ft		
Thickness of Base =	6	in	=	0.50 ft
Thickness of Wall =	6	in	=	0.50 ft
Extended Base =	24	in	=	2.00 ft
I.D. of structure =	4	ft	by	4 ft
O.D. of structure =	5	ft	by	5 ft

Depth of water displaced =	6.4	ft
Vol of water displaced =	159	cf
Density of water =	62.4	pcf
Wt of water displaced =	9,906	lbs

Wt of structure concrete = Wt of riser sections + Wt of base slab

Density of concrete =	150	pcf
Vol. of riser sections =	35	cf
Wt of riser sections =	5,198	lbs
Vol of base =	63	cf
Wt of base =	9,375	lbs
Total wt of structure =	14,573	lbs

Resulting Safety Factor =	1.47	**O.K.**
Req. S.F.=	1.15	

OUTLET RISER ANTI-FLOTATION DESIGN	DATE	DESIGN PHASE
	7/21/2025	SD / /
PROJECT NAME	PROJECT NO	DD / /
Zebulon Public Safety Station	22-154	CD / x /
LOCATION	BY	REV / /
Zebulon, NC	KAS	OTHER / /
	CHECKED BY	(SPECIFY)

Structure: **SCM-2 Riser**

Top of Rim=	328.75 ft			
Floor of Structure =	325.25 ft			
Thickness of Base =	6 in	=	0.50 ft	
Thickness of Wall =	6 in	=	0.50 ft	
Extended Base =	24 in	=	2.00 ft	
I.D. of structure =	4 ft	by	4 ft	
O.D. of structure =	5 ft	by	5 ft	

Depth of water displaced =	6.0	ft
Vol of water displaced =	150	cf
Density of water =	62.4	pcf
Wt of water displaced =	9,360	lbs

Wt of structure concrete = Wt of riser sections + Wt of base slab

Density of concrete =	150	pcf
Vol. of riser sections =	32	cf
Wt of riser sections =	4,725	lbs
Vol of base =	63	cf
Wt of base =	9,375	lbs
Total wt of structure =	14,100	lbs

Resulting Safety Factor =	1.51	**O.K.**
Req. S.F.=	1.15	

EXCAVATED DROP INLET PROTECTION DESIGN	DATE 7/21/2025	
PROJECT NAME Zebulon Public Safety Station	PROJECT NO 22-154	
LOCATION Zebulon, NC	BY KAS	

Excavated Drop Inlet No.: E4

Site Conditions:

Drainage Area:	0.44	Acres
Disturbed Area:	0.44	Acres
Required Sed. Storage Vol: Dist. A x 1800 =	792	cf

Excavated Volume:

Inlet Structure Rim Elevation:	327.56	ft	Side slope:
Excavation Bottom Elevation:	325.56	ft	2 :1
Elevation Interval:	0.50	ft	

Elevation	Length(ft)	Width(ft)	Area(sf)	Volume(cf)	Total Vol(cf)
325.56	15	15	225	0	0
326.06	17	17	289	145	145
326.56	19	19	361	181	325
327.06	21	21	441	221	546
327.56	23	23	529	265	810

Provided Sediment Storage Volume: 810 cf

Adequate Storage Provided

Final Dimensions:

Top Length:	23	ft
Top Width:	23	ft
Depth:	2.0	ft

NOTE: INLET STRUCTURE WILL BE A CATCH BASIN. INLET STRUCTURE RIM ELEVATION USED FOR ANALYSIS IS THE BOTTOM OF CURB ELEVATION AT THE INLET.

STORM DRAINAGE / HYDRAULIC GRADE LINE

ANALYSIS

PROJECT NAME: Zebulon Public Safety Station
LOCATION: Zebulon, NC
DATE: 7/21/2025
PROJECT NO: 22-154
BY: KAS
CHECKED BY: -

DESIGN PHASE: PRELIM / / | CONSTR / X / | REVISION / / | RECORD / / | OTHER / / | (SPECIFY)

Storm Event= 10
n= 0.013
m= -1.99
b= 10.34
I= 7.14

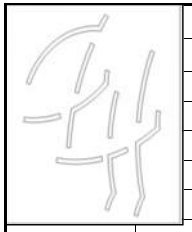
STORM DRAINAGE SCHEDULE

CONTINUED →

FROM	TO	INLET AREA (SF)	INLET AREA (AC)	IMPERVIOUS (%)	INLET Cc RUNOFF COEFF.	INLET DISCHARGE (CFS)	TOTAL AREAS (AC)	INLET TIME (MIN)	PIPE TIME (MIN)	Tc TIME OF CONC. (MIN)	I INTENSITY (IN/HR)	Cc RUNOFF COEFF.
A1	A2	4,350	0.10	63	0.71	0.00	0.10	5.00	0.00	5.00	7.14	0.71
A2	A3	7,210	0.17	56	0.66	0.78	0.27	5.00	0.35	5.35	7.01	0.68
A3	A4	23,350	0.54	95	0.92	3.51	0.80	5.00	1.06	6.06	6.76	0.84
A4	A5	12,010	0.28	99	0.94	1.86	1.08	5.00	1.90	6.90	6.50	0.87
B1	B2	29,340	0.67	53	0.64	0.00	0.67	5.00	0.00	5.00	7.14	0.64
B2	B3	18,270	0.42	35	0.53	1.58	1.09	5.00	0.29	5.29	7.03	0.60
B3	B4	18,170	0.42	66	0.73	2.17	1.51	5.00	0.68	5.68	6.89	0.64
C1	C2	4,710	0.11	92	0.90	0.00	0.11	5.00	0.00	5.00	7.14	0.90
D1	EX1	30,340	0.70	62	0.70	0.00	0.70	5.00	0.00	5.00	7.14	0.70
EX2	E1	22,700	0.52	67	0.74	0.00	0.52	5.00	0.00	5.00	7.14	0.74
E1	EX4	2,260	0.05	76	0.79	0.29	0.57	5.00	0.08	5.08	7.11	0.74
EX4	E2	0	0.00	100	0.95	0.00	0.57	5.00	0.27	5.27	7.04	0.74
E2	E3	0	0.00	100	0.95	0.00	0.57	5.00	0.48	5.48	6.96	0.74
E3	E4	0	0.00	100	0.95	0.00	0.57	5.00	0.76	5.76	6.86	0.74
E4	EX5	84,700	1.94	57	0.67	9.31	2.52	5.00	1.29	6.29	6.69	0.69
EX3	EX4	4,900	0.11	100	0.95	0.00	0.11	5.00	0.00	5.00	7.14	0.95
F1	F2	14,730	0.34	63	0.71	0.00	0.34	5.00	0.00	5.00	7.14	0.71

SCM-1 Outlet Barrel

*Refer to Hydraflow report for discharge calculations



STORM DRAINAGE / HYDRAULIC GRADE LINE ANALYSIS

PROJECT NAME: Zebulon Public Safety Station
LOCATION: Zebulon, NC

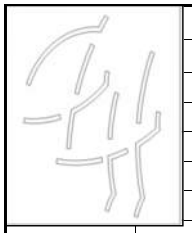
DATE: 7/21/2025
PROJECT NO: 22-154
BY: KAS
CHECKED BY: -

DESIGN PHASE: PRELIM / / ; CONSTR / X / ; REVISION / / ; RECORD / / ; OTHER / / ; (SPECIFY)

Storm Event= 10
n= 0.013
m= -1.99
b= 10.34
I= 7.14

STORM DRAINAGE SCHEDULE - CONTINUED

FROM	TO	Q DISCHARGE (CFS)	Q SIDE-STREAM (CFS)	SLOPE (FT/FT)	DIA. (IN)	CAPACITY (FULL) (CFS)	V FULL (FPS)	LENGTH (FT)	SEGMENT TIME (MIN)	UPPER INV. (FT)	LOWER INV. (FT)	UPSTREAM TOP ELEV. (FT)	PIPE COVER (FT)
A1	A2	0.51	0.00	0.0060	15	5.0	4.1	84	0.35	328.10	327.60	332.00	2.54
A2	A3	1.27	0.00	0.0062	15	5.1	4.1	177	0.71	327.50	326.40	331.90	3.04
A3	A4	4.55	0.00	0.0068	15	5.3	4.4	219	0.84	326.30	324.80	331.15	3.49
A4	A5	6.07	0.00	0.0071	18	8.9	5.0	28	0.09	324.70	324.50	331.82	5.48
B1	B2	3.10	0.00	0.0067	15	5.3	4.3	75	0.29	327.80	327.30	331.25	2.09
B2	B3	4.61	0.00	0.0062	15	5.1	4.1	97	0.39	327.20	326.60	330.75	2.19
B3	B4	6.61	0.00	0.0076	18	9.1	5.2	33	0.11	326.50	326.25	331.05	2.91
C1	C2	0.69	0.00	0.0603	15	15.9	12.9	29	0.04	328.00	326.25	332.00	2.64
D1	EX1	3.50	0.00	0.0091	15	6.2	5.0	11	0.04	325.60	325.50	328.40	1.44
EX2	E1	2.74	0.00	0.0096	15	6.3	5.2	26	0.08	328.24	327.99	331.25	1.65
E1	EX4	3.02	0.00	0.0102	15	6.5	5.3	60	0.19	327.99	327.38	331.25	1.90
EX4	E2	3.75	0.76	0.0109	15	6.7	5.5	67	0.20	327.28	326.55	330.90	2.26
E2	E3	3.72	0.00	0.0053	15	4.7	3.8	66	0.29	326.45	326.10	330.25	2.44
E3	E4	3.67	0.00	0.0051	15	4.6	3.7	118	0.52	326.00	325.40	329.50	2.14
E4	EX5	15.18	2.86	0.0045	24	15.3	4.8	22	0.08	325.30	325.20	328.06	0.58
EX3	EX4	0.76	0.00	0.0208	6	0.8	4.1	106	0.43	330.68	328.48	333.58	2.35
F1	F2	1.71	0.00	0.0255	15	10.3	8.4	110	0.22	327.30	324.50	331.25	2.59
SCM-1 Outlet Barrel		1.73	0.00	0.0103	15	6.5	5.3	39	0.12	324.40	324.00	326.75	0.99



STORM DRAINAGE / HYDRAULIC GRADE LINE ANALYSIS

PROJECT NAME: Zebulon Public Safety Station
LOCATION: Zebulon, NC

DATE: 7/21/2025
PROJECT NO: 22-154
BY: KAS
CHECKED BY: -

DESIGN PHASE: PRELIM / / | CONSTR / X / | REVISION / / | RECORD / / | OTHER / / | (SPECIFY)

Storm Event= 10
n= 0.013
m= -1.99
b= 10.34
l= 7.14

HYDRAULIC GRADE LINE

CONTINUED →

BEND LOSS	K's	
90° = 0.70	70° = 0.61	50° = 0.47	30° = 0.28	20° = 0.16
80° = 0.66	60° = 0.55	40° = 0.38	25° = 0.22	15° = 0.10

FROM	TO	PIPE AREA (FT)	HYDRAULIC RADIUS (FT)	SIDESTREAM SUMMATION (CFS)	HEAD LOSS Hf	Hc	He	Hb	Ht	BEND LOSS K	FRICTION SLOPE (FT/FT)	FRICTION VELOCITY (FPS)
A1	A2	1.2272	0.3125	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.0001	0.41
A2	A3	1.2272	0.3125	0.00	0.07	0.00	0.00	0.00	0.07	0.38	0.0004	1.03
A3	A4	1.2272	0.3125	0.00	1.08	0.05	0.01	0.01	1.15	0.45	0.0049	3.69
A4	A5	1.7671	0.3750	0.00	0.09	0.05	0.07	0.15	0.36	0.70	0.0033	3.42
B1	B2	1.2272	0.3125	0.00	0.17	0.02	0.00	0.00	0.20	0.00	0.0023	2.52
B2	B3	1.2272	0.3125	0.00	0.49	0.05	0.03	0.01	0.59	0.10	0.0051	3.74
B3	B4	1.7671	0.3750	0.00	0.13	0.05	0.08	0.15	0.41	0.70	0.0039	3.72
C1	C2	1.2272	0.3125	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0001	0.56
D1	EX1	1.2272	0.3125	0.00	0.03	0.03	0.00	0.00	0.06	0.00	0.0029	2.84
EX2	E1	1.2272	0.3125	0.00	0.05	0.02	0.00	0.00	0.07	0.00	0.0018	2.22
E1	EX4	1.2272	0.3125	0.00	0.13	0.02	0.03	0.00	0.18	0.00	0.0022	2.45
EX4	E2	1.2272	0.3125	0.76	0.22	0.04	0.03	0.01	0.30	0.10	0.0034	3.04
E2	E3	1.2272	0.3125	0.76	0.22	0.04	0.05	0.03	0.34	0.22	0.0033	3.02
E3	E4	1.2272	0.3125	0.76	0.38	0.03	0.05	0.09	0.56	0.66	0.0032	2.98
E4	EX5	3.1416	0.5000	3.62	0.10	0.09	0.05	0.10	0.33	0.70	0.0045	4.81
EX3	EX4	0.1963	0.1250	0.00	1.96	0.06	0.00	0.00	2.02	0.00	0.0185	3.88
F1	F2	1.2272	0.3125	0.00	0.08	0.01	0.00	0.00	0.08	0.00	0.0007	1.39
SCM-1 Outlet Barrel		1.2272	0.3125	0.00	0.03	0.01	0.00	0.00	0.04	0.00	0.0007	1.40

STORM DRAINAGE / HYDRAULIC GRADE LINE ANALYSIS

PROJECT NAME: Zebulon Public Safety Station
LOCATION: Zebulon, NC

DATE: 7/21/2025
PROJECT NO: 22-154
BY: KAS
CHECKED BY: -

DESIGN PHASE: PRELIM / / | CONSTR / X / | REVISION / / | RECORD / / | OTHER / / | (SPECIFY)

Storm Event= 10
n= 0.013
m= -1.99
b= 10.34
I= 7.14

HYDRAULIC GRADE LINE - CONTINUED

DESIGN CRITERIA:
1. DESIGN FOR THE 10 YR STORM
2. ASSUME TIME OF CONCENTRATION TO AN INDIVIDUAL INLET = 5 MIN.
3. INTENSITY = g/(h+T), FOR 10 YR STORM
4. MANNINGS "n" FACTOR= .013
5. RATIONAL METHOD: C= .30 GRASS, C= .95 PAVEMENT

FROM	TO	OUTLET W.S. ELEV (FT)	INLET W.S. ELEV. OUTLET CONTOL (FT)	INLET W.S. ELEV. INLET CONTROL (FT)	USE (FT)	FLOW CONDITION CONTROL	HGL INSIDE PIPE DOWN (HW/D<1)	HGL INSIDE PIPE UP (HW/D<1)	UPSTREAM INLET TYPE	INSIDE PIPE?	INSIDE STRUCTURE?
A1	A2	328.81	328.82	328.73	328.82	OUTLET	0.97	0.57	CB	OK	OK
A2	A3	328.74	328.81	328.17	328.81	OUTLET	1.87	1.05	CB	USE O-RING	OK
A3	A4	327.59	328.74	327.52	328.74	OUTLET	2.23	1.95	CB	USE O-RING	OK
A4	A5	327.23	327.59	325.96	327.59	OUTLET	1.82	1.93	CB	USE O-RING	OK
				Tailwater Elev=	327.23						
B1	B2	329.51	329.71	328.70	329.71	OUTLET	1.77	1.53	CB	USE O-RING	OK
B2	B3	328.92	329.51	328.43	329.51	OUTLET	1.86	1.85	DI	USE O-RING	OK
B3	B4	328.51	328.92	327.85	328.92	OUTLET	1.51	1.61	CB	USE O-RING	OK
				Tailwater Elev=	328.51						
C1	C2	328.51	328.51	328.64	328.64	INLET	1.81	0.51	CB	USE O-RING	OK
				Tailwater Elev=	328.51						
D1	EX1	326.50	326.56	326.58	326.58	INLET	0.80	0.78	CI	OK	OK
				Tailwater Elev=	326.50						
EX2	E1	328.99	329.06	329.08	329.08	INLET	0.80	0.67	DI	OK	OK
E1	EX4	328.50	328.68	328.88	328.88	INLET	0.90	0.71	DI	OK	OK
EX4	E2	328.20	328.50	328.31	328.50	OUTLET	1.32	0.98	MH	USE O-RING	OK
E2	E3	327.86	328.20	327.47	328.20	OUTLET	1.41	1.40	MH	USE O-RING	OK
E3	E4	327.31	327.86	327.01	327.86	OUTLET	1.53	1.49	MH	USE O-RING	OK
E4	EX5	326.80	327.13	327.31	327.31	INLET	0.80	1.00	DBL CB	USE O-RING	OK
				Tailwater Elev=	326.80						
EX3	EX4	328.88	330.90	331.58	331.58	INLET	0.80	1.80	JB	USE O-RING	OK
				Tailwater Elev=	328.50						
F1	F2	327.23	327.31	328.01	328.01	INLET	2.18	0.57	CB	USE O-RING	OK
				Tailwater Elev=	327.23						
SCM-1 Outlet Barrel		325.00	325.04	325.11	325.11	INLET	0.80	0.57	RISER	OK	OK
				Tailwater Elev=	325.00						

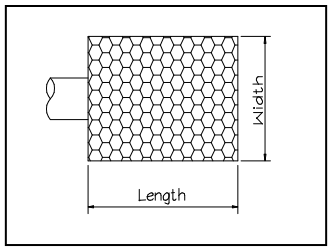
OUTLET PROTECTION DESIGN	DATE	DESIGN PHASE
	7/21/2025	PRELIM / /
PROJECT NAME	PROJECT NO	CONSTR / X /
Zebulon Public Safety Station	22-154	REVISION / /
LOCATION	BY	RECORD / /
Zebulon, NC	KAS	OTHER / /
	CHECKED BY	(SPECIFY)
	-	

Riprap Apron Outlet Protection

FES No.=	A5		Q_{10}/Q_{full} =	0.68	
Pipe Dia=	18	in	V/Vfull =	1.07	
Q_{10} =	6.07	cfs	V =	5.4	fps
Qfull =	8.88	cfs			
Vfull =	5.02	fps			

From Fig. 8.06.b.1: Zone = 2

From Fig. 8.06.b.2:



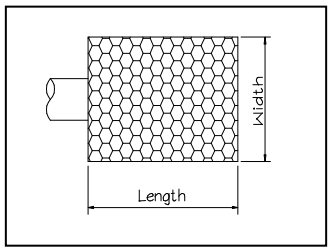
D_{50}	=	8	in
D_{MAX}	=	12	in
Riprap Class	=	B	
Apron Thickness	=	18	in
Apron Length	=	9	ft
Apron Width = 3xDia	=	5	ft

Riprap Apron Outlet Protection

FES No.=	B4		Q_{10}/Q_{full} =	0.72	
Pipe Dia=	18	in	V/Vfull =	1.08	
Q_{10} =	6.61	cfs	V =	5.6	fps
Qfull =	9.14	cfs			
Vfull =	5.17	fps			

From Fig. 8.06.b.1: Zone = 2

From Fig. 8.06.b.2:



D_{50}	=	8	in
D_{MAX}	=	12	in
Riprap Class	=	B	
Apron Thickness	=	18	in
Apron Length	=	9	ft
Apron Width = 3xDia	=	5	ft

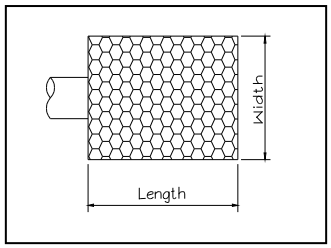
OUTLET PROTECTION DESIGN	DATE	DESIGN PHASE	
	7/21/2025	PRELIM	/ /
PROJECT NAME	PROJECT NO	CONSTR	/ X /
Zebulon Public Safety Station	22-154	REVISION	/ /
LOCATION	BY	RECORD	/ /
Zebulon, NC	KAS	OTHER	/ /
	CHECKED BY	(SPECIFY)	
	-		

Riprap Apron Outlet Protection

FES No.=	C2		Q_{10}/Qfull =	0.04	
Pipe Dia=	15	in	V/Vfull =	0.42	
Q_{10} =	0.69	cfs	V =	5.5	fps
Qfull =	15.87	cfs			
Vfull =	12.91	fps			

From Fig. 8.06.b.1: Zone = 2

From Fig. 8.06.b.2:



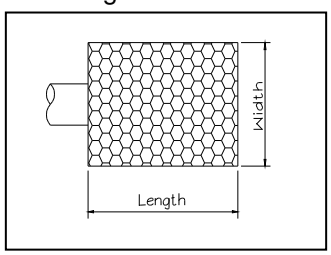
D_{50}	=	8	in
D_{MAX}	=	12	in
Riprap Class	=	B	
Apron Thickness	=	18	in
Apron Length	=	7.5	ft
Apron Width = 3xDia	=	4	ft

Riprap Apron Outlet Protection

FES No.=	SCM-1 Outlet Barrel		Q_{10}/Qfull =	0.26	
Pipe Dia=	15	in	V/Vfull =	0.83	
Q_{10} =	1.73	cfs	V =	4.4	fps
Qfull =	6.54	cfs			
Vfull =	5.32	fps			

From Fig. 8.06.b.1: Zone = 2

From Fig. 8.06.b.2:



D_{50}	=	8	in
D_{MAX}	=	12	in
Riprap Class	=	B	
Apron Thickness	=	18	in
Apron Length	=	7.5	ft
Apron Width = 3xDia	=	4	ft

LINED CHANNEL DESIGN	DATE 7/21/2025	DESIGN PHASE
PROJECT NAME Zebulon Public Safety Station	PROJECT NO 22-154	SD / / DD / / CD / x / REV / /
LOCATION Zebulon, NC	BY KAS	OTHER / / (SPECIFY)
	CHECKED BY	

PERMANENT LINING - Permissible Velocity and Capacity

Channel No:	**TDD-1**		Drainage Area:	1.17	ac
Sta from:			Design Fequency:	10	yrs
Sta to:			Time of Conc:	5	min
Section Length:	335	ft	Intensity:	7.21	in/hr
Section Slope:	1.00	%	Runoff Coeff:	0.35	
Ret Class:	C		Discharge:	2.95	cfs
Permissible Velocity:	4.50	fps			
Allowable Depth:	1.00	ft			

Swale sizing method done by manipulation of Manning's Equation to find the depth of flow that matches the known flow conditions. Performed by trial and error.

INPUT DATA

Qp =	2.95	cfs	flow by Rational Method
n =	0.14	Grass	Manning's Coefficient (dimensionless)
S =	0.01	ft/ft	longitudinal slope (ft of fall per ft of run)
Zreq =	**2.77**		quantity to equate to Zav
M =	2	:1	side slope of channel (ft of run : 1 ft of rise)

NORMAL DEPTH AND VELOCITY

B	D	A	P	R	Zav	Remark
2	0.50	1.50	4.24	0.35	0.75	shallow
2	1.00	4.00	6.47	0.62	2.90	deep
2	0.95	3.71	6.25	0.59	2.61	shallow
2	0.98	3.88	6.38	0.61	**2.79**	OK

B = bottom width of trapezoidal channel
D = normal depth of flow
A = cross-sectional area of flow
P = wetted perimeter of the channel
R = hydraulic radius of the channel

$$Zav = Zreq$$

$$A R^{2/3} = \frac{Qn}{1.49 \sqrt{s}}$$

Normal Depth, D = 0.98 ft **Depth O.K.**
Velocity= 0.76 fps **Vel. O.K.**

SHEAR STRESS

T = yds = shear stress in lb/sq-ft
Y = unit weight of water, 62.4 lb/cu-ft
D = normal depth of flow in ft
S = longitudinal slope in ft/ft

shear stress, T = 0.61 lb/sq-ft

FINAL CHANNEL LINING DIMENSIONS

B = 2 ft **side slopes, M = 2 :1**
D = 1.0 ft **top width, W = 6.0 ft**
Permanent Channel Lining: Grass

(REF: Malcom, 1991)

LINED CHANNEL DESIGN	DATE 7/21/2025	DESIGN PHASE
PROJECT NAME Zebulon Public Safety Station	PROJECT NO 22-154	SD / / DD / / CD / x / REV / /
LOCATION Zebulon, NC	BY KAS	OTHER / / (SPECIFY)
	CHECKED BY	

TEMPORARY LINING - Permissible Shear

Channel No:	**TDD-1**		Drainage Area:	1.17	ac
Sta from:			Design Fequency:	2	yrs
Sta to:			Time of Conc:	5	min
Section Length:	335	ft	Intensity:	5.62	in/hr
Section Slope:	1.00	%	Runoff Coeff:	0.35	
Lining Type:	Curled Wood Mat		Discharge:	2.30	cfs
Permissible Shear:	1.55	lb/sf			
Channel Depth:	1.00	ft			

Swale sizing method done by manipulation of Manning's Equation to find the depth of flow that matches the known flow conditions. Performed by trial and error.

INPUT DATA

Qp =	2.30	cfs	flow by Rational Method
n =	0.066		Manning's Coefficient (dimensionless)
S =	0.01	ft/ft	longitudinal slope (ft of fall per ft of run)
Zreq =	**1.019**		quantity to equate to Zav
M =	2	:1	side slope of channel (ft of run : 1 ft of rise)

NORMAL DEPTH AND VELOCITY

B	D	A	P	R	Zav	Remark
2	0.50	1.50	4.24	0.35	0.751	shallow
2	0.60	1.92	4.68	0.41	1.060	deep
2	0.55	1.71	4.46	0.38	0.898	shallow
2	0.59	1.88	4.64	0.40	**1.026**	OK

B = bottom width of trapezoidal channel
D = normal depth of flow
A = cross-sectional area of flow
P = wetted perimeter of the channel
R = hydraulic radius of the channel

$$Zav = Zreq$$

$$A R^{2/3} = \frac{Qn}{1.49\sqrt{s}}$$

Normal Depth, D = 0.59 ft
Velocity= 1.23 fps

SHEAR STRESS

T = yds = shear stress in lb/sq-ft
Y = unit weight of water, 62.4 lb/cu-ft
D = normal depth of flow in ft
S = longitudinal slope in ft/ft

shear stress, T = 0.37 lb/sq-ft **Temp Liner O.K.**

FINAL CHANNEL LINING DIMENSIONS

B =	**2 ft**	**side slopes, M =**	**2 :1**
D =	**1 ft**	**top width, W =**	**6.0 ft**

Line Channel with: Curled Wood Mat

(REF: Malcom, 1991)

LINED CHANNEL DESIGN	DATE 7/21/2025	DESIGN PHASE
PROJECT NAME Zebulon Public Safety Station	PROJECT NO 22-154	SD / / DD / / CD / x / REV / /
LOCATION Zebulon, NC	BY KAS	OTHER / / (SPECIFY)
	CHECKED BY	

PERMANENT LINING - Permissible Velocity and Capacity

Channel No:	**TDD-2**		Drainage Area:	1.55	ac
Sta from:			Design Fequency:	10	yrs
Sta to:			Time of Conc:	5	min
Section Length:	170	ft	Intensity:	7.21	in/hr
Section Slope:	1.32	%	Runoff Coeff:	0.35	
Ret Class:	C		Discharge:	3.91	cfs
Permissible Velocity:	4.50	fps			
Allowable Depth:	1.00	ft			

Swale sizing method done by manipulation of Manning's Equation to find the depth of flow that matches the known flow conditions. Performed by trial and error.

INPUT DATA

Qp =	3.91	cfs	flow by Rational Method
n =	0.14	Grass	Manning's Coefficient (dimensionless)
S =	0.0132	ft/ft	longitudinal slope (ft of fall per ft of run)
Zreq =	**3.20**		quantity to equate to Zav
M =	2	:1	side slope of channel (ft of run : 1 ft of rise)

NORMAL DEPTH AND VELOCITY

B	D	A	P	R	Zav	Remark
3	0.50	2.00	5.24	0.38	1.05	shallow
3	1.00	5.00	7.47	0.67	3.83	deep
3	0.90	4.32	7.02	0.61	3.12	shallow
3	0.92	4.45	7.11	0.63	**3.26**	OK

B = bottom width of trapezoidal channel
D = normal depth of flow
A = cross-sectional area of flow
P = wetted perimeter of the channel
R = hydraulic radius of the channel

$$Zav = Zreq$$

$$A R^{2/3} = \frac{Qn}{1.49 \sqrt{s}}$$

Normal Depth, D = 0.92 ft **Depth O.K.**
Velocity= 0.88 fps **Vel. O.K.**

SHEAR STRESS

T = yds = shear stress in lb/sq-ft
Y = unit weight of water, 62.4 lb/cu-ft
D = normal depth of flow in ft
S = longitudinal slope in ft/ft

shear stress, T = 0.76 lb/sq-ft

FINAL CHANNEL LINING DIMENSIONS

B =	**3 ft**	**side slopes, M =**	**2 :1**
D =	**1.0 ft**	**top width, W =**	**7.0 ft**
Permanent Channel Lining:		**Grass**	

(REF: Malcom, 1991)

LINED CHANNEL DESIGN	DATE 7/21/2025	DESIGN PHASE
PROJECT NAME Zebulon Public Safety Station	PROJECT NO 22-154	SD / / DD / / CD / x / REV / /
LOCATION Zebulon, NC	BY KAS	OTHER / / (SPECIFY)
	CHECKED BY	

TEMPORARY LINING - Permissible Shear

Channel No:	**TDD-2**		Drainage Area:	1.55	ac
Sta from:			Design Fequency:	2	yrs
Sta to:			Time of Conc:	5	min
Section Length:	170	ft	Intensity:	5.62	in/hr
Section Slope:	1.32	%	Runoff Coeff:	0.35	
Lining Type:	Curled Wood Mat		Discharge:	3.05	cfs
Permissible Shear:	1.55	lb/sf			
Channel Depth:	1.00	ft			

Swale sizing method done by manipulation of Manning's Equation to find the depth of flow that matches the known flow conditions. Performed by trial and error.

INPUT DATA

Qp =	3.05	cfs	flow by Rational Method
n =	0.066		Manning's Coefficient (dimensionless)
S =	0.0132	ft/ft	longitudinal slope (ft of fall per ft of run)
Zreq =	**1.175**		quantity to equate to Zav
M =	2	:1	side slope of channel (ft of run : 1 ft of rise)

NORMAL DEPTH AND VELOCITY

B	D	A	P	R	Zav	Remark
3	0.50	2.00	5.24	0.38	1.053	shallow
3	0.60	2.52	5.68	0.44	1.465	deep
3	0.55	2.26	5.46	0.41	1.251	deep
3	0.54	2.20	5.41	0.41	**1.210**	OK

B = bottom width of trapezoidal channel
D = normal depth of flow
A = cross-sectional area of flow
P = wetted perimeter of the channel
R = hydraulic radius of the channel

$$Zav = Zreq$$

$$A R^{2/3} = \frac{Qn}{1.49\sqrt{s}}$$

Normal Depth, D = 0.54 ft
Velocity= 1.38 fps

SHEAR STRESS

T = yds = shear stress in lb/sq-ft
Y = unit weight of water, 62.4 lb/cu-ft
D = normal depth of flow in ft
S = longitudinal slope in ft/ft

shear stress, T = 0.44 lb/sq-ft **Temp Liner O.K.**

FINAL CHANNEL LINING DIMENSIONS

B =	**3 ft**	**side slopes, M =**	**2 :1**
D =	**1 ft**	**top width, W =**	**7.0 ft**

Line Channel with: Curled Wood Mat

(REF: Malcom, 1991)

TEMPORARY SLOPE DRAIN DESIGN	DATE 7/21/2025
PROJECT NAME Zebulon Public Safety Station	PROJECT NO 22-154
LOCATION Zebulon, NC	BY KAS

Slope Drain No:	TSD-1		Drainage Area:	1.17	ac
Slope Drain Diameter:	15	in	Design Frequency:	10	yrs
Slope drain Material:	HDPE		Time of Conc:	5.00	min
Entrance Type	PLAIN END		Intensity:	7.21	in/hr
			Runoff Coeff:	0.35	
HW Control Elev:	330.00		Discharge:	2.95	cfs
Upper Invert:	326.75				
Lower Invert:	324.50				
Slope Drain Length:	22	ft			
Slope Drain Slope:	0.102273	ft/ft			
Tailwater Elevation:	325.75				

Check Inlet Control

HW/D =	0.8	(from Chart 1)
HW =	1.00	
HW Elev = (upper inv) + (HW) =	327.75	

Check Outlet Control

dc =	0.50	(from Chart 4)
(dc+D)/2 =	0.875	
Ke =	0.9	(from Table 12)
H =	0.21	(from Chart 5)
TW =	1.25	
h = TW or (dc+D)/2 =	1.25	(whichever greater)
HW = h+H =	1.46	
HW Elev = (lower inv) + (HW) =	325.96	

Results

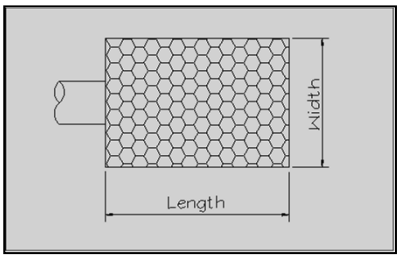
HW Elevation:	327.75	
Flow Condition:	Inlet Control	
Freeboard:	2.25	ft

SLOPE DRAIN IS O.K.

Outlet Protection

Q_{10} =	2.95	cfs	Q_{10}/Q_{full} =	0.14	
Qfull =	20.69	cfs	V/Vfull =	0.68	
Vfull =	16.86	fps	V =	11.52	fps

From Fig. 8.06.c



Zone	=	2	
D_{50}	=	8	in
D_{MAX}	=	12	in
Riprap Class	=	B	
Apron Thickness	=	18	in
Apron Length	=	8	ft
Apron Width = 3xDia	=	4	ft

TEMPORARY SLOPE DRAIN DESIGN	DATE 7/21/2025
PROJECT NAME Zebulon Public Safety Station	PROJECT NO 22-154
LOCATION Zebulon, NC	BY KAS

Slope Drain No:	TSD-2		Drainage Area:	1.55	ac
Slope Drain Diameter:	15	in	Design Frequency:	10	yrs
Slope drain Material:	HDPE		Time of Conc:	5.00	min
Entrance Type	PLAIN END		Intensity:	7.21	in/hr
			Runoff Coeff:	0.35	
HW Control Elev:	330.00		Discharge:	3.91	cfs
Upper Invert:	327.25				
Lower Invert:	326.25				
Slope Drain Length:	31	ft			
Slope Drain Slope:	0.032258	ft/ft			
Tailwater Elevation:	327.50				

Check Inlet Control

HW/D =	0.95	(from Chart 1)
HW =	1.19	
HW Elev = (upper inv) + (HW) =	328.44	

Check Outlet Control

dc =	0.50	(from Chart 4)
(dc+D)/2 =	0.875	
Ke =	0.9	(from Table 12)
H =	0.40	(from Chart 5)
TW =	1.25	
h = TW or (dc+D)/2 =	1.25	(whichever greater)
HW = h+H =	1.65	
HW Elev = (lower inv) + (HW) =	327.90	

Results

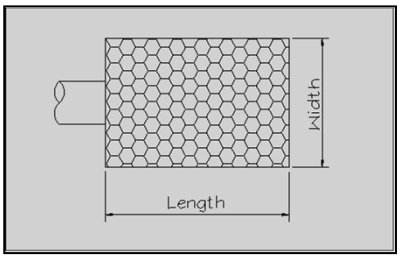
HW Elevation:	328.44	
Flow Condition:	Inlet Control	
Freeboard:	1.56	ft

SLOPE DRAIN IS O.K.

Outlet Protection

Q_{10} =	3.91	cfs	Q_{10}/Q_{full} =	0.34	
Qfull =	11.62	cfs	V/Vfull =	0.89	
Vfull =	9.47	fps	V =	8.46	fps

From Fig. 8.06.c



Zone	=	2	
D_{50}	=	8	in
D_{MAX}	=	12	in
Riprap Class	=	B	
Apron Thickness	=	18	in
Apron Length	=	8	ft
Apron Width = 3xDia	=	4	ft

Deed

WAKE COUNTY, NC
TAMMY L. BRUNNER
REGISTER OF DEEDS
PRESENTED & RECORDED ON
08-31-2021 AT 14:41:20

BOOK: 018674 PAGE: 02490 - 02492

NORTH CAROLINA NON-WARRANTY DEED

Excise Tax:	$0.00
Parcel ID:	2705180148
Mail/Box to:	Grantee
Prepared by:	Smith, Anderson, Blount, Dorsett, Mitchell, & Jernigan, LLP (CAY)
Brief description for the Index:	1005 North Arendell Avenue, Zebulon, North Carolina

THIS NON-WARRANTY DEED ("Deed") is made on the 31st day of August 2021, by and between:

GRANTOR	GRANTEE
GLAXOSMITHKLINE LLC, a Delaware limited liability company fka GLAXO, INC. 5 Moore Drive, PO Box 13398 RTP, NC 27709-3398, United States Mailstop 17.1E	**TOWN OF ZEBULON,** a municipal corporation and public body politic of the State of North Carolina 1003 N. Arendell Avenue Zebulon, NC 27597

Enter in the appropriate block for each Grantor and Grantee their name, mailing address, and, if appropriate, state of organization and character of entity, e.g. North Carolina or other corporation, LLC, or partnership. Grantor and Grantee includes the above parties and their respective heirs, successors, and assigns, whether singular, plural, masculine, feminine or neuter, as required by context.

FOR VALUABLE CONSIDERATION paid by Grantee, the receipt and legal sufficiency of which is acknowledged, Grantor by this Deed does hereby grant, bargain, sell and convey to Grantee, in fee simple, all that certain lot, parcel of land or condominium unit in the Town of Zebulon, Little River Township, Wake County, North Carolina and more particularly described as follows (the "Property"):

See attached "Exhibit A"

All or a portion of the Property was acquired by Grantor by instrument recorded in Book 5000, Page 50, Wake County Registry.

All or a portion of the Property does not include the primary residence of a Grantor.

A map showing the Property is recorded in Plat Book 2007 page 1609.

TO HAVE AND TO HOLD the Property and all privileges and appurtenances thereto belonging to Grantee in fee simple. **Grantor makes no warranty of title to the Property.**

IN WITNESS WHEREOF, Grantor has duly executed this North Carolina Non-Warranty Deed, if an entity by its duly authorized representative.

GLAXOSMITHKLINE LLC,
a Delaware limited liability company

By: Hatixhe Hoxha
Name: Hatixhe Hoxha
Title: Assistant Secretary

STATE OF PENNSYLVANIA, COUNTY OF DELAWARE

I ARLENE ELIZABETH CANNON, a Notary of the above state and county, certify that the following person(s) personally appeared before me on the 30 day of AUGUST 2021 each acknowledging to me that he or she signed the foregoing document, in the capacity represented and identified therein (if any): ASSISTANT SECRETARY, HATIXHE HOXHA of **GLAXOSMITHKLINE LLC.**

Arlene Elizabeth Cannon
Notary Public (Official Signature)
My commission expires: 21 May 2025

Affix Notary Seal/Stamp

Commonwealth of Pennsylvania - Notary Seal
Arlene Elizabeth Cannon, Notary Public
Delaware County
My commission expires May 21, 2025
Commission number 1022737
Member, Pennsylvania Association of Notaries

Exhibit A

Legal Description

BEING all of the property of Glaxo Inc. described in the Quitclaim Deed recorded in Deed Book 5000, Page 50 in the Office of the Register of Deeds of Wake County, N.C. and being more particularly described as follows:

BEGINNING at an iron rod found in the northern right of way line of Judd Street marking the southwest corner of the property of the Town of Zebulon described in Deed Book 12670, Page 2355, said iron rod found having North Carolina State Plane NAD 83 (2011) coordinates of North 757,762.37 sFT and East 2,201,236.42 sFT, and running thence with the western line of said Town of Zebulon property North 28° 11' 01" West 435.97 feet to an iron rod found marking the northwest corner of said Town of Zebulon property; thence with the northern line of said Town of Zebulon property North 61° 25' 27" East 633.71 feet to an iron rod found in the western right of way line of North Arendell Avenue marking the northeast corner of said Town of Zebulon property; thence with the western right of way line of North Arendell Avenue North 28° 35' 07" West 214.71 feet to an iron rod set marking the southeast corner of the property of Glaxo Inc. described in Deed Book 2993, Page 117, said iron rod set being located South 28° 35' 07" East 119.84 feet from an iron pipe found at the intersection of the western right of way line of North Arendell Avenue with the southern right of way line of the off-ramp from eastbound US Highway 64 to North Arendell Avenue; thence with the southern line of said property of Glaxo Inc. South 85° 49' 08" West 697.58 feet to an iron rod set in the eastern line of the property of Glaxo Inc. described in Deed Book 2993, Page 127; thence with said eastern property line of Glaxo Inc. South 00° 33' 08" West 544.22 feet to a concrete monument found; thence continuing with said eastern property line of Glaxo Inc. South 19° 09' 44" West 126.91 feet to an iron pipe found marking the northeast corner of the property of Privette Property, LLC described in Deed Book 17600, Page 2165; thence with the eastern line of said Privette Property, LLC property South 13° 37' 45" West 81.26 feet to a railroad spike found; thence continuing with the eastern line of said Privette Property, LLC property South 02° 59' 57" East 100.08 feet to a railroad spike found; thence continuing with eastern line of said Privette Property, LLC property South 25° 12' 13" East 7.77 feet to a nail found marking the northeast corner of the property of the Donna P. Eddins Heirs (see estate file 14-E-2376 and Deed Book 14066, Page 2466); thence with the eastern line of said Eddins Heirs property South 25° 12' 13" East 217.13 feet to a railroad spike found in the northern right of way line of Judd Street marking the southeast corner of said Eddins Heirs property; thence with the northern right of way line of Judd Street North 61° 48' 01" East 468.50 feet to the point and place of BEGINNING. Containing 11.12977 acres more or less.

Bearings in this description are North Carolina State Plane NAD 83 (2011) based on information shown on Plat of Property and Topographic Survey prepared for the Town of Zebulon by The Wooten Company dated August 24, 2021 (Doc. No. 2922O-D001).

Specifications

SECTION 31 25 00 - EROSION & SEDIMENT CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following: Soil erosion and sedimentation control for all areas of the site that are graded or disturbed by any construction operations and elsewhere as indicated on the Drawings or specified herein. Erosion control shall be as specified herein and as may be required by actual conditions and governing authorities.

B. The Contractor is fully responsible for all applicable permits and approvals for off-site borrow and waste areas.

C. The Contractor shall have full responsibility for the construction and maintenance of erosion control and sedimentation control facilities as shown on the Drawings and as specified herein. The Contractor shall at all times provide the operation and maintenance necessary to operate the permitted sediment and erosion controls at optimum efficiency.

D. The Contractor shall provide permanent or temporary ground cover as soon as possible over disturbed areas of the site, and shall provide permanent or temporary ground cover in no more than 14 days after construction activities have permanently or temporarily ceased over the disturbed area. Temporary or permanent ground cover shall be provided on slopes within 7 days after construction activities have permanently or temporarily ceased.

E. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 31 Section "Site Clearing"
2. Division 31 Section "Earth Moving"
3. Division 32 Section "Planting"

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 01 Specification Sections.

1. Silt fence fabric, wire support and posts.
2. Tree protection fence, signs and posts.
3. Filter fabric.
4. Channel and slope matting.
5. Compost filter socks.
6. Manufactured inlet sediment control devices.
7. Dewatering silt bags.
8. Polyacrylamide (PAM) turbidity control logs.

1.4 PRODUCT HANDLING

A. Deliver seed, fertilizer and other packaged materials in unopened original packages with labels legible and intact. Seed packages shall bear a guaranteed analysis by a recognized authority.

B. On-site storage of materials shall be kept to a minimum. Wet or damaged seed or other material shall be removed from the project site immediately.

1.5 MONITORING AND RECORD KEEPING

A. Contractor shall abide by all conditions of the General Permit to Discharge Stormwater under the National Pollutant Discharge Elimination System (NPDES), Permit No. NCG010000 (obtain copy from Owner) and the general requirements listed below. NPDES General Permit No. NCG01000 can be viewed at:
https://files.nc.gov/ncdeq/Energy%20Mineral%20and%20Land%20Resources/Stormwater/NCG010000_Final_Permit_2019_04_01.pdf

B. All sediment and erosion control devices and facilities shall be inspected at least once every seven (7) calendar days and within 24 hours after any storm event of greater than 0.5 inches of rain per 24 hour period.

C. Stormwater discharges shall be inspected by observation for stormwater discharge characteristics (as listed below) at the above frequency to evaluate the effectiveness of the sediment control facilities, devices or practices. Observations shall be made at all stormwater discharge outfalls and other locations were concentrated stormwater discharges from the site. Observations shall be qualitative, no analytical testing or sampling is required. If any visible off-site sedimentation is leaving the site, corrective action shall be taken to reduce the discharge of sediments.

1. Color.
2. Odor.
3. Clarity.
4. Floating solids.
5. Suspended solids.
6. Foam.
7. Oil sheen.
8. Other obvious indicators of stormwater pollution.

D. The contractor shall perform and keep records of the above inspections. Visible sedimentation found off the site shall be recorded with a brief explanation as the measures taken to prevent future releases as well as any measures taken to clean up the sediment that has left the site. This record shall be made available to the Owner, Architect and governmental authorities.

PART 2 - PRODUCTS

2.1 SOIL AMENDMENTS AND SEED

A. Refer to Division 32 Section “Planting”.

2.2 MISCELLANEOUS

A. Gravel for Stone Filters: Washed No. 57 stone or as indicated on the drawings.

B. Silt Fence Fabric: A synthetic filter fabric or a pervious sheet of polypropylene, nylon, polyester, or polyethylene yarn, which is certified by the manufacturer or supplier as conforming to the following requirements.

1. Tensile Strength (Grab): 90 x 90-lbs. min., ASTM D 4632.
2. Permittivity: 0.05-sec^{-1} min., ASTM D 4491.
3. Apparent Opening Size: #30 US Sieve (0.60-mm) max., ASTM D 4751.
4. UV Resistance (500-hrs): 70%, ASTM D 4355.

C. Filter Fabric (for installation under riprap): Woven geotextile fabric, apparent opening size no larger than US Standard Sieve no. 70, min. grab strength of 120-lbs.

D. Polyacrylamide (PAM) Turbidity Control Log: Soil specific tailored, solid form PAM product containing blends of water treatment components and polyacrylamide co-polymer for water clarification (25 NTU

max. at outlet of sediment basin) and erosion control. Product shall be designed for site specific soil and water conditions. APS-700 Series Floc Log by Applied Polymer Systems, Inc. or approved equal.

E. Dewatering Silt Bag: Permeable, non-woven geotextile bag manufactured to accept and filter pumped, sediment-laden water from dewatering activities. Silt bag shall be sized as appropriate for the dewatering pump discharge rate and shall be fitted with a fill spout large enough to accommodate the discharge piping of the dewatering pump. Silt bag shall be Dirtbag as manufactured by ACF Environmental, Inc. or approved equal.

F. Compost Filter Sock: Three-dimensional tubular sediment control device comprised of an organic compost filter media contained in a tubular knitted mesh sock.

1. Filter media shall be mature compost that has been certified by the US Composting Council's Seal of Testing Assurance Program and meeting the following specifications.

   a. pH: 5.0 – 8.5.
   b. Moisture Content: < 60%.
   c. Organic Matter: >25%, dry weight.
   d. Particle Size: 99% passing 2-in sieve, 30-50% passing 3/8-in sieve.

2. Filter sock netting shall be 5-mm thick continuous HDPE filament, tubular knitted mesh with 3/8-in openings. Filled sock shall be a minimum of 12-in in diameter.
3. Stakes shall be 2x2-in x 3-ft wooden stakes.

2.3 INLET PROTECTION MEASURES

A. Manufactured Inlet Sediment Control Device: Storm drainage inlet sediment control device shall be manufactured from woven polypropylene geotextile to fit the opening of a catch basin or drop inlet to filter sediment from runoff entering the inlet. The device shall be a High Flow Siltsack as manufactured by ACF Environmental, Inc. or approved equal. Device shall be provided with an integral curb deflector if installed at a catch basin with a vertical opening adjacent to a horizontal grate.

B. Floor Drain / Area Drain Sediment Filter Device: Small size storm drainage inlet sediment control device shall be manufactured from woven polypropylene geotextile to fit into small diameter floor drains to filter sediment from runoff entering the inlet. The device shall be a Round Drain Insert as manufactured by New Pig Corp. or approved equal.

2.4 CHANNEL AND SLOPE MATTING

A. Channel Matting: Erosion Control blankets for installation in channels shall be a machine-produced mat of curled wood fiber (excelsior) or synthetic polypropylene fiber as specified below. The blanket shall be of consistent thickness with the fiber evenly distributed over the entire area of the mat. The blanket shall be covered with a photo degradable plastic netting secured to the fiber mat. Channel liners shall be excelsior mat unless otherwise indicated on the drawings.

1. Excelsior Mat:

   a. Fiber: Curled wood excelsior of 80% six inch or longer fiber length with a consistent width of fibers evenly distributed throughout the mat. Mat shall be smolder resistant with no chemical additives.
   b. Top and Bottom Netting: Photo degradable extruded plastic netting with maximum mesh size of ¾" x ¾".

2. Wire Staples: 16 gauge steel wire, with minimum of 3" top and 6" long legs. 1.75 staples per square yard of matting minimum.

B. Slope Matting: Erosion Control blankets for installation on slopes (not channels) shall be a machine-produced mat of crimped wood fiber and/or other degradable fibers manufactured without nets or threads.

Staples or stakes used to secure the mat shall be wood or 100% biodegradable natural material. No nets or metal staples shall be used on any areas other than within channels.

1. Excelsior Mat:

   a. Fiber: Net-free, curled wood excelsior of 80% six inch or longer fiber length with a consistent width of fibers evenly distributed throughout the mat. Mat shall be smolder resistant with no chemical additives.

2. Stakes or Staples: Wood or 100% biodegradable natural material with additive to cause breakdown and 100% degradation within 24-36 months after installation.

2.5 RIPRAP

A. Riprap: Provide riprap of the class and quantity indicated on the Drawings. While no specific gradation is required, the various sizes of the stone shall be equally distributed within the required size range. The size of an individual stone shall be determined by measuring its long dimension. Stone shall meet the requirements of the following table for class and size distribution. No more than 5% of the material furnished can be less than the minimum size specified nor no more than 10% of the material can exceed the maximum size specified.

REQUIRED STONE SIZES - INCHES			
CLASS	MINIMUM	MIDRANGE	MAXIMUM
A	2	4	6
B	5	8	12
1	5	10	17
2	9	14	23

PART 3 - EXECUTION

3.1 GENERAL

A. Existing Structures and Facilities

1. Existing structures, facilities, and water courses shall be protected from sedimentation.
2. The Contractor shall be responsible for the construction of necessary measures, and all costs shall be at the expense of the Contractor.
3. Items to be protected from sedimentation deposits shall include, but are not limited to, all downstream property, natural waterways, streams, lakes and ponds, catch basins, drainage ditches, road gutters, and natural buffer zones.
4. Control measures such as the erection of silt fences, barriers, dams, or other structures shall begin prior to any land disturbing activity. Additional measures shall be constructed as required during the construction.
5. All facilities installed shall be maintained continuously during construction until the disturbed areas are stabilized. Contractor shall remove all erosion control measures at the end of the project at his expense unless otherwise directed by the Owner or his representative.
6. Perform monitoring and record keeping as specified in this section.

3.2 PROTECTIVE MEASURES

A. Protective measures shall conform to all State and Local requirements.

B. Construction and maintenance of sediment and erosion control measures shall be in accordance with all applicable laws, codes, ordinances, rules and regulations.

1. Silt Fence: Hog wire or wire mesh fastened to posts as recommended by the Manufacturer and covered with silt fabric.

2. Berms and Diversion Ditches: These shall be graded channels with a supporting ridge on the lower side constructed across a sloping land surface. Diversion ditches and berms shall be planted in vegetative cover as soon as completed.
3. Mulching: Mulching shall be used to prevent erosion and to hold soil and seed in place during the establishment of vegetation.
4. **Matting: Temporary slope and channel matting shall be used for temporary stabilization during the establishment of seeded cover in all grassed ditches, channels, long slopes, and steep banks (6:1 or steeper) and additional areas as indicated on plans**. Matting shall be installed on any area on site as needed to provide temporary stabilization whether or not matting is indicated on the plan. Install as indicated or per manufacturer's instructions. The installation of matting may be waived by the Architect is surface stabilization is obtained by other methods within the appropriate and agreed time frames. If adequate stabilization is not obtained, the Contractor shall install matting where required at no additional cost to the Owner.
5. Build Berm, Pits and Gravel Filter as shown on Drawings. Maintain during construction to keep erosion and sedimentation to a minimum. When it is necessary to remove berm, pits, and gravel, return area to required profiles and condition.
6. Construction Entrances: Construct all entrances in accordance with plans. Maintain all ingress/egress points to prevent tracking of soil onto the Owner's, public or private roads. Any soil that is tracked onto the roads shall be removed immediately.
7. Riprap: Stone shall be graded so that the smaller stones are uniformly distributed throughout the mass. Stone may be placed by mechanical methods, augmented by hand placing where necessary, provided that when the riprap is completed it forms a properly graded, dense, neat layer of stone.
8. Manufactured Inlet Sediment Control Device: Install device in accordance with manufacturer's instructions and install a curb deflector if appropriate. Inspect device after each rain event and at intervals not exceeding two weeks during construction. Remove, empty, clean, and replace the device as needed during construction. Empty collected sediment in approved, protected location. Remove and dispose of device following full and permanent stabilization of the contributing drainage area.
9. PAM Turbidity Logs: At a minimum, install logs in drainage structures located immediately upstream of sediment basins and traps. Install additional logs in any other locations indicated on the drawings. Install per manufacturer's instructions. Check logs regularly and after every runoff producing rainfall and replace as needed throughout the duration of construction.
10. Dewatering Silt Bag: Install silt bag on an undisturbed slope so incoming water flows downhill through the bag without causing erosion. Remove and replace silt bag when device no longer drains efficiently due to accumulated sediment in bag. Empty bag within disturbed limits of the site protected by other sediment control measures.
11. Compost Filter Logs: Stake filter log every 10-ft. Drive stakes through the center of the log and 1-ft into the ground. If sock netting must be joined, fit beginning of the new sock over the end of the old sock, overlapping by 1-2 ft. Fill with compost and stake the joint.
12. Other Measures: Other methods of protecting existing structures and facilities, such as vegetative filter strips, diversions, rip-rap, baffle boards, and ditch checks used for reduction of sediment movement and erosion, may be used at the option of the Contractor when approved by the appropriate State or local authorities.

C. Provide the following, at a minimum, to prevent windblown dust.

1. Apply straw mulch and establish temporary or permanent ground cover on exposed soil where work is not being actively performed.
2. Cover or establish vegetative cover on stockpiles.
3. Apply water or other approved dust suppressant as needed to soil surfaces before they become excessively dry.
4. Sweep and collect soil that has been tracked onto paved surfaces.

3.3 STABILIZATION

A. Permanently protect stabilized areas prior to the removal of protective devices.

B. After the final establishment of permanent stabilization, remove temporary sediment control measures. Re-spread accumulated sediments as specified.

C. Permanently stabilize all areas disturbed by the removal and re-spreading operations immediately.

3.4 TEMPORARY SEEDING

A. In accordance with the schedule as detailed on the drawings.

3.5 PERMANENT SEEDING

A. In accordance with the schedule as detailed on the drawings.

3.6 MULCHING AND MATTING

A. Apply mulch or matting to retain soil and grass.

B. Mulch areas with slope greater than 5% by spreading a light cover of mulch over seeded area at the rate of not less than 85 lbs. per 1000 sq. ft.

C. Install temporary matting in all grassed ditches, channels, long slopes, and steep banks (6:1 or steeper) and additional areas indicated on plans or where extra protection from erosion is needed.

END OF SECTION 31 25 00

SECTION 32 90 00 - PLANTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Trees.
2. Shrubs.
3. Seeded lawns, sod and “no-mow” areas.
4. Topsoil and soil amendments.
5. Planter Soil
6. Fertilizers and mulches.
7. Stakes and guys.
8. Landscape edging.
9. Maintenance, guarantees and warranties.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 31, Section "Site Clearing" for protection of existing trees and planting, topsoil stripping and stockpiling, and site clearing.
2. Division 31, Section "Earth Moving" for excavation, filling, rough grading, and subsurface aggregate drainage and drainage backfill.
3. Division 31 Section “Erosion Controls” soil erosion and sedimentation control.

1.3 INDUSTRY STANDARDS

A. References: Some products and execution are specified in this Section by reference to published specifications or standards of the following:

The American Society for Testing and Materials (ASTM)
American Association of Nurserymen (AAN)
US Department of Agriculture (USDA)
NC Department of Agriculture (NCDA)
NC Composting Council (NCCC)

B. Landscape Contractor shall mean a registered “Landscape Contractor” as defined by the NC General Statute 89D (www.nclclb.com). Unless proper credentials and evidence of experience can be supplied to prove equal capabilities, only a Landscape Contractor licensed in the State of NC shall be permitted to perform the work.

1. The Landscape Contractor’s performance shall conform to the requirements in the most current edition of the NC Landscape Contractors Manual (NCLCM) as approved by the NC Board of Landscape Contractors. In the event the Landscape Contractor feels there is discrepancy between the NCLCM and the requirements of this Contract that could affect the quality of work; it is the Contractor’s responsibility to apprise the Owner and Landscape Architect of the issue.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.

B. Product certificates signed by manufacturers certifying that their products comply with specified requirements.

1. Manufacturer's certified analysis for standard products.
2. Label data substantiating that plants, trees, shrubs, and planting materials comply with specified requirements.

C. Certification of grass seed from seed vendor for each grass-seed mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

D. Samples of each of the following:

1 Sample of imported mulch (1) 1-gal. sized bag.
2 Topsoil (1) 1-gal sized bag.

E. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, at least fifteen names and address of architects and owners, total years of experience and landscape contractor's license number. If the landscape contractor hires a sub-contractor for seeding operations, the same references shall be required from them also.

F. Material test reports from qualified independent testing agency indicating and interpreting test results relative to compliance of the following materials with requirements indicated.

1. Analysis of existing topsoil and suitability as a medium for growing specified lawn. Include recommendations of amendments required to make existing topsoil suitable as a growing medium for specified lawn, if required.
2. Analysis of imported topsoil, if required due to unacceptability of existing topsoil to meet acceptable growing medium requirements for lawn.

G. Planting schedule indicating anticipated dates and locations for each type of planting.

H. Maintenance instructions recommending procedures to be established by Owner for maintenance of landscaping during an entire year. Submit before expiration of required maintenance periods.

I. Landscape plant schedule, per Article 1.4, A, C, indicating quantity, botanical name, common name, specified size and vendor source for each individual plant species; including any substitutions. Include all cultivars and varieties for substitutions. Provide vendor source contact information as attachment to schedule.

CLH Design and the Owner reserve the right to reject any substitution requests and may request that the landscape contractor provide additional vendor search information and/or complete documentation to prove a hardship, to confirm reason(s) for substitution or to prove that the material is not available from local and national nurseries.

Refer to section 1.6, C for information regarding the appropriate time to dig trees. It is the Contractor's responsibility to plan ahead of time rather than waiting and checking availability at the time of installation.

J. All sod shall be from a certified sod producer and be blue tag certified in accordance with NCCIA and AOSCA.

K. Planting invoice from nursery or supplier indicating quantity, size and species for all plantings required for Stormwater Control Measures (SCMs); including but not limited to wetlands, bio-retention ponds, wet ponds, etc.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site during times that landscaping is in progress.

B. Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

C. Provide quality, size, genus, species, and variety of trees and shrubs indicated, complying with applicable requirements of ANSI Z60.1 "American Standard for Nursery Stock."

1. Contractor shall show proof of cultivar authenticity to Landscape Architect. When cultivars are specified, standard species will not be acceptable.

D. Topsoil Analysis: Furnish a soil analysis made by a qualified independent soil-testing agency stating percentages of organic matter, inorganic matter (silt, clay, and sand), deleterious material, pH, and mineral and plant-nutrient content of topsoil.

1. Report suitability of on-site topsoil for growth of applicable planting material. State recommended quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to produce a satisfactory topsoil at no additional cost to owner.

E. Measurements: Measure trees and shrubs according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches (150 mm) above ground for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

When size ranges are given, 50 % of plant material shall be at the larger size.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 01 Section "Project Meetings."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

B. Seed: Deliver seed in original sealed, labeled, and undamaged containers.

C. Trees and Shrubs: Deliver freshly dug trees and shrubs. Do not prune before delivery, except as approved by Landscape Architect. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy natural shape. Provide protective covering during delivery. Do not drop trees and shrubs during delivery. For trees which cannot be dug in the summer, Contractor shall have trees pre-dug and heeled-in at the nursery where they are grown until planting. Contractor shall be responsible for ensuring that the trees have been adequately watered and cared for at the nursery prior to delivery. No substitutions will be allowed for trees which cannot be “summer-dug”.

D. Handle balled and burlap stock by the root ball.

E. Deliver trees, shrubs, and ground covers after preparations for planting have been completed and install immediately. If planting is delayed more than 6 hours after delivery, set planting materials in shade, protect from weather and mechanical damage, and keep roots moist.

PLANT MATERIAL SHALL NOT BE DELIVERED TO THE SITE MORE THAN 72 HOURS BEFORE PLANTING TAKES PLACE. THE LANDSCAPE ARCHITECT RESERVES THE RIGHT TO REJECT ALL MATERIAL NOT PLANTED WITHIN THAT TIME PERIOD UNLESS THE LANDSCAPE CONTRACTOR MAKES HEELING-IN AND IRRIGATION PROVISIONS WITHIN 24 HOURS OF PLANT DELIVERY.

1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
2. Do not remove container-grown stock from containers before time of planting.
3. Water root systems of trees and shrubs stored on site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.7 PROJECT CONDITIONS

A. Utilities: Determine location of above grade and underground utilities and perform work in a manner which will avoid damage. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.

B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Landscape Architect before planting.

1.8 COORDINATION AND SCHEDULING

A. Coordinate installation of planting materials during normal planting seasons for each type of plant material required.

Planting Season: The normal season for planting balled and burlap material is November 15 through March 15. The normal season for planting container grown material is September 15 through April 15. After notification to proceed, planting operations shall be conducted under favorable weather conditions during the normal planting season. The Landscape Contractor shall make provisions for watering the material on an as-needed basis and as frequently as is required to ensure that plant material thrives.

The General Contractor shall coordinate the planting schedule with the Landscape Contractor to avoid any summer digging and planting.

The Landscape Architect shall be notified and must approve of any schedule changes which may require summer planting. THE CONTRACTOR SHALL NOT BE COMPENSATED FOR ADDITIONAL WATERING COSTS FOR PLANTINGS WHICH ARE INSTALLED IN THE SUMMER.

B. Temporary Seeding: In accordance with the schedule as detailed on the drawings.

1. In the event the Landscape Contractor is required to establish a temporary seeding cover due to the construction schedule, the Landscape Contractor is not relieved from providing the specified permanent seed mixture.
2. The Landscape Contractor is responsible for eradicating any temporary seed cover by means of mowing, thatching and using an herbicide approved by the Owner’s representative at the manufacturer’s recommended rate.

1.9 GRASS ESTABLISHMENT SCHEDULE

A. Refer to the Supplementary Conditions for Final Completion dates of grassed areas of the site.

B. Definitions:

1. Final Complete seeded or sprigged grass: A healthy, dense, weed free stand of the specified species of grass with 95% grass coverage as evaluated on a per square yard sample basis.
2. Final Complete sodded grass: An installed and rolled healthy sod, free of weeds and dead spots.

D. Complete Site: A complete installation of grass sod and/or stand of grass, germinated from seed or sprigs, on the complete site shall be established by the following date:

1. Complete Site (Seed, Sprig or Sod) Final Completion: *See Final Completion Date noted in contract documents.* Due to seasonal restrictions the specified date shall not be extended. Extension to the Contract Time will not change this date.

1.10 WARRANTY

A. General Warranty: The 12-month warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. 12-Month Warranty: Contractor is responsible for general maintenance and care for trees, shrubs, ground covers and ornamental grasses during 12-month warranty period, in addition to general maintenance specified in this Article. Additional maintenance during 12-month warranty period for lawn, grass and sod is not required once areas have met 95% coverage, have met final acceptance and the Owner has assumed mowing/maintenance of these areas. Contractor agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth; except for defects resulting from abuse or incidents that are beyond Contractor's control.
b. Structural failures including plantings falling or blowing over.

2. Warranty Periods from Date of Final Completion:

a. Trees, Shrubs, Ground Covers, Ornamental Grasses, and Wetland, Detention Pond, and Bio-Retention Plants: 12 months.
b. Lawn, grass and sod (herbicide and fertilizer): 12 months

3. Include the following remedial actions as a minimum:

a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
c. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

4. Areas seeded or sodded that are bare and not established at the end of the warranty period shall be re-seeded or re-sodded at no additional cost to the Owner.

5. Contractor is responsible for applying weed control herbicide and fertilizers during warranty period.

1.11 TREE AND SHRUB MAINTENANCE

A. Maintain trees and shrubs by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free

of insects and disease. The presence of significant insects or disease at the end of the 12-month warranty period shall be grounds for rejection of material. Restore or replace damaged tree wrappings. Maintain trees and shrubs until end of the 12-month warranty period.

1.12 LAWN/GRASS MAINTENANCE

A. Begin maintenance of lawns and other grassed/sodded areas immediately after each area is planted and continue until acceptable lawn is established and accepted by the Owner, but for not less than the following periods:

1. Seeded Lawns/Grass and Naturalized Seed Areas: **Final Completion**.

a. When full maintenance period has not elapsed before end of planting/growing season, or if lawn is not fully established at that time (95% coverage as established on a per square yard sample basis), continue maintenance during next planting season until 95% coverage is established.

2. Sodded Lawns/Grass: **Final Completion.**

a. Sodded areas will be accepted at final inspection if –

1. Sodded areas are properly established.
2. Sod is free of bare and dead spots and without weeds.
3. Sodded areas have been mowed a minimum of twice.

B. Maintain and establish lawns by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth lawn.

C. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawns uniformly moist to a depth of 4 inches (100 mm). Following the date of project Final Completion, water shall be provided by contractor own water source (water truck, gator bag, etc.).

1. Supplement natural precipitation to provide a net rate of one inch of water per week or as required to maintain lawn in a thriving condition.
2. Watering shall conform to the time, volume and frequency recommendations of applicable governmental water conservation regulations.
3. Irrigate at minimum rate of once per day for two full weeks following date of seeding or sod installation.
4. Irrigate at minimum of once per week for remainder of maintenance period.

D. Mow lawns as soon as there is enough top growth to cut with mower set at specified height for principal species planted. Repeat mowing as required to maintain specified height without cutting more than 40 percent of the grass height at any mowing. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet.

E. Postfertilization: Apply fertilizer to lawn after first mowing and when grass is dry. Apply only from August through October.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb per 1000 sq. ft. (0.5 kg per 100 sq. m) of lawn area or as required to maintain lawn in a thriving condition. A minimum of 50% of the nitrogen shall be in a slow release form.

1.13 STORMWATER CONTROL MEASURE, WETLAND AND DETENTION POND MAINTENANCE

A. Begin maintenance of stormwater control measures (stormwater wetlands, detention ponds and bioretention cells) immediately after each area is planted and continue until completion of the 12-month warranty period.

B. The area to be maintained shall include the wet and dry surfaces of the facility and perimeter areas within 15-ft of the water quality pool elevation, along with the inlet and outlet structures, embankments, emergency spillway, turf and plants.

1. Maintenance shall include all items listed in the Operation & Maintenance Plan listed on the drawings. Maintenance shall include, but not limited to, the following:

   a. Keep dry and wet areas clean of trash and debris.
   b. Repair of erosion. Re-seed any bare areas including top and slopes of embankments.
   c. Keep inlet and outlet pipes, weirs, orifices, under-drains, and swales clear of blockages.
   d. Remove accumulated sediment from riprap aprons.
   e. Remove accumulated sediment forebay of wetlands and ponds if greater than 12-in of accumulation.
   f. Prune shelf plants.
   g. Remove invasive plants and algae.
   h. Replace dead plants.
   i. Replace/replenish mulch.
   j. Other requirements of the Operation and Maintenance Plan on the drawings.

2. Perform inspections at least every two months and after every storm of greater than 1.5-in of rainfall. Perform maintenance as needed.
3. Final maintenance shall be performed immediately prior to the 11-month inspection.
4. Perform additional maintenance and repair resulting from the 11-month inspection.
5. Records of inspections and maintenance performed shall documented and supplied to the Owner at the completion of the warranty and maintenance period.

PART 2 - PRODUCTS

2.1 TREE AND SHRUB MATERIAL

A. General: Furnish nursery-grown trees and shrubs conforming to ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement, including trunks which are not straight on single stem trees.

B. The natural stem/root collar of balled and burlap materials shall be found within two inches of the nursery maintained soil line. Trees shall not be accepted which have been grown too deeply or too high in the soil profile.

C. Grade: Provide trees and shrubs of sizes and grades conforming to ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Landscape Architect, with a proportionate increase in size of roots or balls.

D. Label one tree and shrub in each plant grouping with securely attached, waterproof tag bearing legible designation of botanical and common name. Proof of cultivar shall be required on all species for which a cultivar is designated.

E. Label at least 1 tree and 1 shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.

F. Imported Fire Ant Control: All plants shall be accompanied by a certificate stating: “certified under all applicable state and federal quarantine.” Contact Landscape Architect for inspection of all plant materials for the presence of imported fire ants. The presence of fire ants shall be cause for rejection of plant material.

2.2 SHADE AND FLOWERING TREES

A. Shade Trees: Single-stem trees with straight trunk, free of basal sprouts, well-balanced crown, and intact leader, of height and caliper indicated, conforming to ANSI Z60.1 for type of trees required. Grounds for rejection may include, but not limited to: improper branch density or distribution, "v" crotches, including bark, undesirable multiple leaders, leaders that have been topped or headed back, prevalent suckering or epicormic sprouting. Trees which have evidence of unevenly distributed, girdling or suckering roots may be rejected.

1. Branching Height: 1/2 of tree height.

B. Small Trees: Small upright or spreading type, branched or pruned naturally according to species and type, and with relationship of caliper, height, and branching recommended by ANSI Z60.1, and stem form as specified in the Plant List on the drawings. Good structure shall be especially critical for trees. Grounds for rejection may include, but not limited to: improper branch density or distribution, "v" crotches, including bark, undesirable multiple leaders, leaders that have been topped or headed back, prevalent suckering or epicormic sprouting. Trees which have evidence of unevenly distributed, girdling or suckering roots may be rejected.

C. Provide balled and burlap trees unless noted otherwise on the drawings. Plants designated "B&B" in the plant list shall be balled and burlap. They shall be nursery grown and freshly dug. They shall be dug with firm, natural balls of earth of sufficient diameter and depth to encompass the fibrous and feeding root system necessary for full recovery of the plant. Balls shall be firmly wrapped with untreated biodegradable burlap and bound with twine, cord, or wire mesh basket. Plants shall not be accepted if the ball is dry, deformed or broken before or during the planting operations.

2.3 DECIDUOUS SHRUBS

A. Form and Size: Deciduous shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub.

B. Provide container grown shrubs unless noted otherwise on the drawings.

2.4 CONIFEROUS EVERGREENS

A. Form and Size: Specimen-quality, exceptionally heavy, tightly knit, symmetrically shaped coniferous evergreens.

B. Provide balled and burlap coniferous evergreens.

1. Container-grown coniferous evergreens will be acceptable in lieu of balled and burlap coniferous evergreens subject to meeting ANSI Z60.1 limitations for container stock and provided they are equal in quality and size to balled and burlap material.

2.5 BROADLEAF EVERGREENS

A. Form and Size: Normal-quality, well-balanced, broadleaf evergreens, of type, height, spread, and shape required, conforming to ANSI Z60.1.

B. Provide balled and burlap broadleaf evergreens.

1. Container-grown broadleaf evergreens will be acceptable in lieu of balled and burlap broadleaf evergreens subject to meeting ANSI Z60.1 limitations for container stock and provided they are equal in quality and size to balled and burlap material.

2.6 GRASS/LAWN MATERIALS

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with the Association of Official Seed Analysts' "Rules for Testing Seeds" for purity and germination tolerances.

1. Seed Mixture: Provide seed of grass species and varieties as specified in the plans and/or specifications.

2. Sod shall be as indicated on the plans and detail drawings. Provide machine cut, strongly rooted, certified turf grass sod, not less than two years old, free from weeds and undesirable native grasses and stripped not more than 24 hours before laying. Sod pad size shall be uniform thickness of 5/8", plus or minus ¼", measured at the time of cutting and excluding top growth and thatch.

2.7 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, 4 percent organic material minimum, free of stones 1 inch (25 mm) or larger in any dimension, and other extraneous materials harmful to plant growth. Sticks, roots, and clay clumps shall be removed from topsoil prior to spreading.

1. Topsoil Source: Reuse surface soil stripped and stockpiled on the site if adequate quantities exist. Verify suitability of surface soil to produce topsoil meeting requirements and amend when necessary. Screen topsoil of roots, plants, sods, stones greater than 1/2" diameter in general lawn areas and planting beds, clay lumps, and other extraneous materials harmful to plant growth. Screen topsoil prior to planting. If inadequate quantities of topsoil exist on-site contractor will be required to import pre-screened topsoil. A minimum depth of 3 inches shall be required.

2.8 SOIL AMENDMENTS

A. Lime: ASTM C 602, Class T, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent, with a minimum 99 percent passing a No. 8 (2.36 mm) sieve and a minimum 75 percent passing a No. 60 (250 micrometer) sieve.

1. Provide lime in the form of dolomitic limestone.

B. Organic Compost: Organic compost of neutral character, decomposed, stable and weed-free meeting the US Composting Council standards.

C. Perlite: Horticultural perlite, soil amendment grade.

D. Peat Humus: Finely divided or granular texture, with a pH range of 6 to 7.5, composed of partially decomposed moss peat (other than sphagnum), peat humus, or reed-sedge peat.

E. Peat Humus: For acid-tolerant trees and shrubs, provide moss peat, with a pH range of 3.2 to 4.5, coarse fibrous texture, medium-divided sphagnum moss peat or reed-sedge peat.

F. Sawdust or Ground-Bark Humus: Decomposed, nitrogen-treated, of uniform texture, free of chips, stones, sticks, soil, or toxic materials.

1. When site treated, mix with at least 0.15 lb (2.4 kg) of ammonium nitrate or 0.25 lb (4 kg) of ammonium sulfate per cu. ft. (cu. m) of loose sawdust or ground bark.

G. Manure: Well-rotted, un-leached stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

H. Herbicides: EPA registered and approved, of type recommended by manufacturer.

I. Water: Potable.

J. Mycorrhizae: Applied to planting hole backfill or planting bed solid. Product shall be formulated for the moisture regime of the particular planting location (low, medium, high) contain a broad spectrum of mycorrhizae species, an organic bi-stimulant (2-2-2 preferred) and a water holding gel (low moisture locations only). Apply per manufacturer's recommendations.

2.9 FERTILIZER

A. Bonemeal: Commercial, raw, finely ground; minimum of 4 percent nitrogen and 20 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea-form, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency and as needed to maintain plant material and lawns in a thriving condition.

D. Slow-Release Fertilizer: Granular fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency and as needed to maintain plant material and lawns in thriving condition.

2.10 MULCHES

A. Organic Mulch: Organic mulch, free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of the following:

1. Triple Shredded Hardwood Mulch: At least 80% hardwoods with moisture content of 30% or less, that can pass through a maximum screen size of 1 5/8". Raw material shall contain no yard waste, construction debris, or any other extraneous material.

a. Depth: 3" (after compaction)
b. Refer to plans for location.

2.11 EROSION-CONTROL MATERIALS

A. Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

B. Fiber Mesh: Biodegradable twisted jute or spun-coir mesh, 0.92 lb per sq. yd. (0.5 kg per sq. m) minimum, with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

2.12 STAKES AND GUYS

A. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, redwood, or pressure-preservative-treated softwood, free of knots, holes, cross grain, and other defects, 2 by 2 inches (50 by 50 mm) by length indicated, pointed at one end.

B. Use flexible Arbor tape or equivalent ¾" woven belt synthetic fabric strap installed per manufacturer's specifications. Color: Green.

C. Flags: Standard surveyor's plastic flagging tape, pink, 6 inches (150 mm) long.
NOTE: Clearly mark all guy wires with flagging for visibility, especially near recreation and pedestrian areas.

2.13 LANDSCAPE EDGINGS

A. “V” Ditch: A 4-inch deep trench by 6 inches width around all planting beds. Except where beds are adjacent to naturally wooded areas due to the possible damage to existing tree roots. Use care around existing tree roots in and around all planting beds. Do not cut existing tree roots to form the "V" ditch, work around them wherever possible.

2.14 MISCELLANEOUS MATERIALS

A. Anti-desiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's instructions. Apply as per nursery’s recommendations. It should be applied prior to plant transport from the nursery where it is dug, if in full leaf.

2.15 TACKIFIER

A. Non-asphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

B. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors. (9 gals/1,000 SF).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive landscaping for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected. Do not seed the site until the Landscape Architect has reviewed the final grades.

3.2 PREPARATION

A. Lay out individual tree and shrub locations and areas for multiple plantings. Entire areas for multiple plantings shall be chiseled to a depth of 12 inches and tilled and amended to a depth of 8 inches with the same soil mixture as is required for planting backfill material. Stake locations, outline areas, and secure Landscape Architect's acceptance before the start of planting work. Make minor adjustments as may be required.

3.3 PLANTING SOIL PREPARATION

A. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.

B. Mix soil amendments and fertilizers with topsoil at rates indicated. Delay mixing fertilizer if planting does not follow placing of planting soil within a few days.

C. For tree pit or trench backfill, mix planting soil before backfilling and stockpile at site.

D. For planting beds, mix planting soil prior to planting.

1. Mix lime with dry soil prior to mixing fertilizer. Prevent lime for lawn plantings from contacting roots of acid-tolerant plants.

E. Do not attempt soil preparation of plant installation when soils are frozen, wet, in poor tilth or otherwise unsuitable for planting.

3.4 LAWN PLANTING PREPARATION

A. Limit subgrade preparation to areas that will be planted in the immediate future.

B. Loosen subgrade to a minimum depth of 8 inches. Remove stones larger than 1/2 inch (19 mm) in any dimension and sticks, roots, rubbish, and other extraneous materials. Remove excess gravel which will inhibit lawn establishment and survival.

C. Spread topsoil to depth required to meet thickness, grades, and elevations shown, after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen.

1. Place approximately 1/2 the thickness of topsoil required. Work into top of loosened subgrade to create a transition layer and then place remainder of the topsoil.

D. Preparation of Unchanged Grades: Where lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare soil as follows:

1. Remove and dispose of existing grass, vegetation, and turf. Do not turn over into soil being prepared for lawns.
2. Till surface soil to a depth indicated on soil test report, but at a minimum of 6 inches (150 mm). Apply required soil amendments and initial fertilizers and mix thoroughly into top 4 inches (100 mm) of soil. Trim high areas and fill in depressions. Till soil to a homogenous mixture of fine texture.
3. Clean surface soil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.
4. Remove waste material, including grass, vegetation, and turf, and legally dispose of it off the Owner's property.

E. Grade lawn and grass areas to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future. Remove trash, debris, stones larger than 1 inch in any dimension, and other objects that may interfere with planting or maintenance operations. Remove all glass, wire or other objects of any size which may cause injury.

F. Moisten prepared lawn areas before planting when soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

G. Restore prepared areas if eroded or otherwise disturbed after fine grading and before planting.

H. Contact Owner and Landscape Architect for review and approval of seedbed preparation and seeding methods prior to and during seeding operations.

3.5 EXCAVATION FOR TREES AND SHRUBS

A. Pits and Trenches: Excavate with vertical sides and with bottom of excavation slightly raised at center to assist drainage. Loosen hard subsoil in bottom of excavation. Refer to planting details.

1. Place tree in pit by lifting and carrying the tree by its ball (never lift by branches or trunk) and then lowering it into the pit. Set the tree straight, plumb and in the center of the pit with the most desirable side of the tree facing the prominent view (sidewalk, building, street, etc.).
2. Determine the elevation of the root flare and ensure that it is planted at or slightly above finished grade. This may require that the tree be set higher than the grade in the nursery.
   If the root flare is less than 2-inches below the soil level of the root ball, plant the tree at the appropriate level above the grade, so the flare is even with the grade. If the flare is more than 2-inches at the center of the root ball above the grade, the tree shall be rejected.

B. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

C. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.

D. Fill excavations with water and allow to percolate out, before placing setting layer and positioning trees and shrubs.

3.6 PLANTING TREES AND SHRUBS

A. Set balled and burlap stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated.

1. Place stock on setting layer of compacted planting soil.
2. Remove burlap from tops of balls and partially from sides, but do not remove from under balls. Remove the top 2/3's of the wire baskets. Remove pallets, if any, before setting. Do not use planting stock if ball is cracked or broken before or during planting operation.
3. Place backfill around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately 1/2 backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.

B. Set container-grown stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated.

1. Carefully remove containers so as not to damage root balls.
2. The root ball shall be loosened to alleviate matted or encircling roots. Roots shall be spread out evenly in an outward, radial fashion.
3. Place stock on setting layer of compacted planting soil.
4. Place backfill around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately 1/2 backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.

C. Dish and tamp top of backfill to form a 3-inch- (75-mm-) high mound around the rim of the pit. Do not cover top of root ball with backfill.

D. Wrap trees of 2-inch (50-mm) caliper and larger with trunk-wrap tape if the species is susceptible to sun or wind scorch. Start at base of trunk and spiral cover trunk to height of first branches. Overlap wrap, exposing half the width, and securely attach without causing girdling. Inspect tree trunks for injury, improper pruning, and insect infestation and take corrective measures required before wrapping. Do not wrap the trees at the base to discourage insect infestation.

3.7 TREE AND SHRUB PRUNING

A. Prune, thin, and shape trees and shrubs as directed by Landscape Architect.

B. Only minimal pruning should be necessary at time of planting since plant material shall conform to the specified standards for quality. All pruning performed by the Contractor shall conform to the standards of the current ANSI A300, American National Standard for tree care operations. Under no circumstances shall the Contractor cut or prune leaders or remove more than 1/3 of the top without permission of the Landscape Architect. Prune to remove dead wood, crossovers, split or broken branches. Do not shorten, trim or clip branches solely for appearance purposes unless directed to by the Landscape Architect.

3.8 TREE AND SHRUB GUYING AND STAKING

A. Upright Staking and Tying: Stake trees of 2- through 5-inch (50- through 125-mm) caliper. Stake trees of less than 2-inch (50-mm) caliper only as required to prevent wind tip-out. Use a minimum of 2 stakes of length required to penetrate at least 18 inches (450 mm) below bottom of backfilled excavation and to extend at least 72 inches (1800 mm) above grade. Set vertical stakes and space to avoid penetrating balls or root masses. Support trees with 2 strands of flexible Arbor tape or equivalent ¾" woven belt synthetic fabric strap at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree. Flag heavily in recreation areas or any places where children are likely to be.

3.9 MULCHING

A. Mulch backfilled surfaces of pits, trenches, planted areas, and other areas indicated.

B. Organic Mulch: Apply the following average thickness of organic mulch and finish level with adjacent finish grades. Do not place mulch against trunks or stems. Refer to section 2.10 for additional information.

1. Thickness: 4 inches (mulch depth shall be 3" after compaction and settling).

NOTE: Mulch shall NOT be from on-site chipping operations (unless specifically indicated in plans and specifications).

3.10 SEEDING NEW LAWNS

A. Sow seed with a spreader or a seeding machine. Do not broadcast or drop seed when wind exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in 2 directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.

B. Sow seed at the rates required to achieve 95% coverage prior to Final completion as determined on a per square yard basis.

C. Rake seed lightly into top 1/8 inch (3 mm) of topsoil, roll lightly, and water with fine spray. Remove surface rocks of greater than 1" diameter.

D. Protect seeded slopes 6:1 (H:V) and steeper against erosion with erosion-control blankets installed and stapled according to manufacturer's recommendations.

E. Protect seeded areas with slopes flatter than 6:1 against erosion by spreading straw mulch after completion of seeding operations. Spread uniformly at a minimum rate of 2 tons per acre (45 kg per 100 sq. m) to form a continuous blanket 1-1/2 inches (38 mm) loose depth over seeded areas. Spread by hand, blower, or other suitable equipment. Tack with liquid asphalt tack (9 gals/1,000 SF) or non-asphaltic tackifier.

F. If seeding occurs in summer months, protect seeded areas against hot, dry weather or drying winds by applying peat mulch within 24 hours after completion of seeding operations. Soak and scatter uniformly to a depth of 3/16 inch (4.8 mm) thick and roll to a smooth surface.

3.11 HYDROSEEDING NEW LAWNS

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogenous slurry suitable for hydraulic application.

1. Mix slurry with non-asphaltic tackifier.
2. Apply slurry uniformly to all areas to be seeded in a 2-step process. Apply first slurry application at the minimum rate of 500 lb per acre (5.5 kg per 100 sq. m) dry weight but not less than the rate

required to obtain specified seed-sowing rate. Apply slurry cover coat of fiber mulch at a rate of 1000 lb per acre (11 kg per 100 sq. m).

3.12 RECONDITIONING LAWNS

A. Recondition existing lawn areas damaged by Contractor's operations, including storage of materials or equipment and movement of vehicles. Also recondition lawn areas where settlement or washouts occur or where minor regrading is required.

B. Remove sod and vegetation from diseased or unsatisfactory lawn areas; do not bury into soil. Remove topsoil containing foreign materials resulting from Contractor's operations, including oil drippings, fuel spills, stone, gravel, and other construction materials, and replace with new topsoil.

C. Where repairable lawn remains, as determined by the Owner, mow, dethatch, core aerate, and rake heavily and deeply. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

D. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of it off the Owner's property.

E. Till stripped, bare, compacted or otherwise unrepairable areas thoroughly to a depth of 8 inches.

F. Apply required soil amendments and initial fertilizers and mix thoroughly into top 4 inches (100 mm) of soil. Provide new planting soil as required to fill low spots and meet new finish grades.

G. Apply seed and protect with straw mulch as required for new lawns.

H. Water newly planted areas and keep moist until new grass is established.

3.13 SODDING NEW LAWNS

A. Lay sod to form solid, uniform mass with tightly fitted joints. “Butt” ends and sides of sod strips. Do not overlap sod strips. Stagger strips to offset joints in adjacent courses. Lay sod strips across slopes and perpendicular to drainage flow. Tamp or roll lightly to ensure contact with subgrade.

B. Secure with pegs or staples at spacing recommended by the sod grower and supplier and as approved by the Landscape Architect and Owner.

C. Water sod with fine spray immediately after planting. Water daily during first two weeks of establishment to maintain soil to depth of 4”.

D. At no time shall sodded turf be allowed to grow over 3 inches in height. Throughout this period, the target mowing height shall be 1.5 inches. At no time shall more than 50% of the turf height be removed in any three-day period by mowing or other maintenance activity.

E. Sodded turf shall be fertilized according to the monthly application rates recommended in Carolina Lawns for the utilized grass or at reduced rate if instructed by the Landscape Architect.

F. Weed control shall be provided as necessary to prevent the establishment or proliferation of a weed species and to achieve acceptable turf at time of initial Acceptance.

G. Remove all poly mesh netting prior to placement and dispose of off-site.

3.14 INSTALLATION OF EDGINGS

A. "V" Ditches: Clearly delineate planting beds, and sign locations with a 4-inch deep by 6-inch wide ditch. Lines shall be smooth. A minimum five-foot wide lawn strip shall be provided between planting beds and paved surfaces where shown on the drawings.

3.15 INSTALLATION OF MISCELLANEOUS MATERIALS

A. Apply anti-desiccant using power spray to provide an adequate film over trunks, branches, stems, twigs, and foliage.

1. When deciduous trees or shrubs are moved in full-leaf, spray with anti-desiccant at nursery before moving and again 2 weeks after planting.

3.16 INSPECTION AND ACCEPTANCE

A. When landscape work is completed, including maintenance, Architect will, upon written request, make a final inspection to determine acceptability.

B. At time of inspection for initial Acceptance, turf shall have been freshly mowed within the last 48 hours. Turf shall be healthy, of uniform color and exhibiting signs of good growth. A minimum of 95% of the specified seeding area shall be covered in established turf possessing both stolens (i.e. runners) and rhizomes. There shall be no bare areas greater than 4 sq. ft. or 1.5 ft. in any dimension. Seedling plants not having reached tiller stage (i.e. runner producing) shall be considered bare area. Turf shall be 100% free of noxious and perennial weeds and relatively free of annual weeds.

C. At time of inspection for initial Acceptance, sodded and sprigged turf shall have been freshly mowed within the last 48 hours. Turf shall be healthy, of uniform color and exhibiting good growth. A minimum of 100% of the specified turf area shall be covered in sod that has been installed for a minimum six weeks. Turf shall be 100% free of all weeds.

D. When inspected landscape work does not comply with requirements, replace rejected work and continue specified maintenance until re-inspected by Architect and found to be acceptable. Remove rejected plants and materials promptly from project site.

3.17 CLEANUP AND PROTECTION

A. During landscaping, keep pavements clean and work area in an orderly condition.

B. Protect landscaping from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of it off the Owner's property unless an agreement is made with the Owner otherwise.

3.19 FIELD QUALITY CONTROL

A. Owner's Independent Testing Agency Services: Allow testing agency to evaluate and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.

1. Pond/Wetland Imperviousness: At surface of empty pond soil surface, perform measurement of soil infiltration rate according to ASTM D 3385 at a rate of one test per each 3,000-sf of surface area.

B. Pond and Wetland Imperviousness: Following completion of new permanent detention ponds or constructed wetlands, fill pond or wetland with water, measure and record water level every 24-hrs for a period of three days with no precipitation with time/date stamped photos. Provide water level measurements to Architect. Do not proceed with final planting until imperviousness is confirmed by Architect.

END OF SECTION 329000