

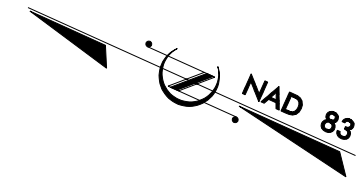
STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	000532601	1	9

STATE OF NORTH CAROLINA
ECOSYSTEM ENHANCEMENT PROGRAM

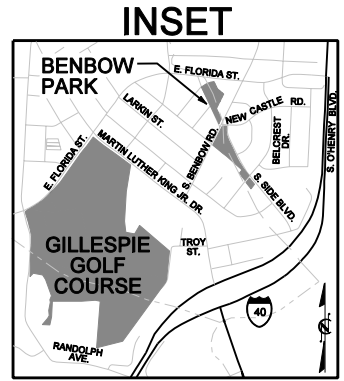
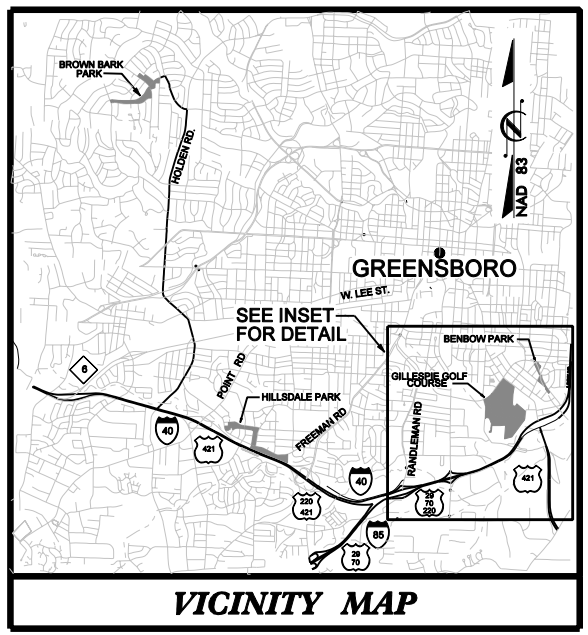
GUILFORD COUNTY

**LOCATION: BENBOW PARK
UNNAMED TRIBUTARY
TO SOUTH BUFFALO CREEK
GREENSBORO, NORTH CAROLINA**

TYPE OF WORK: AS-BUILT

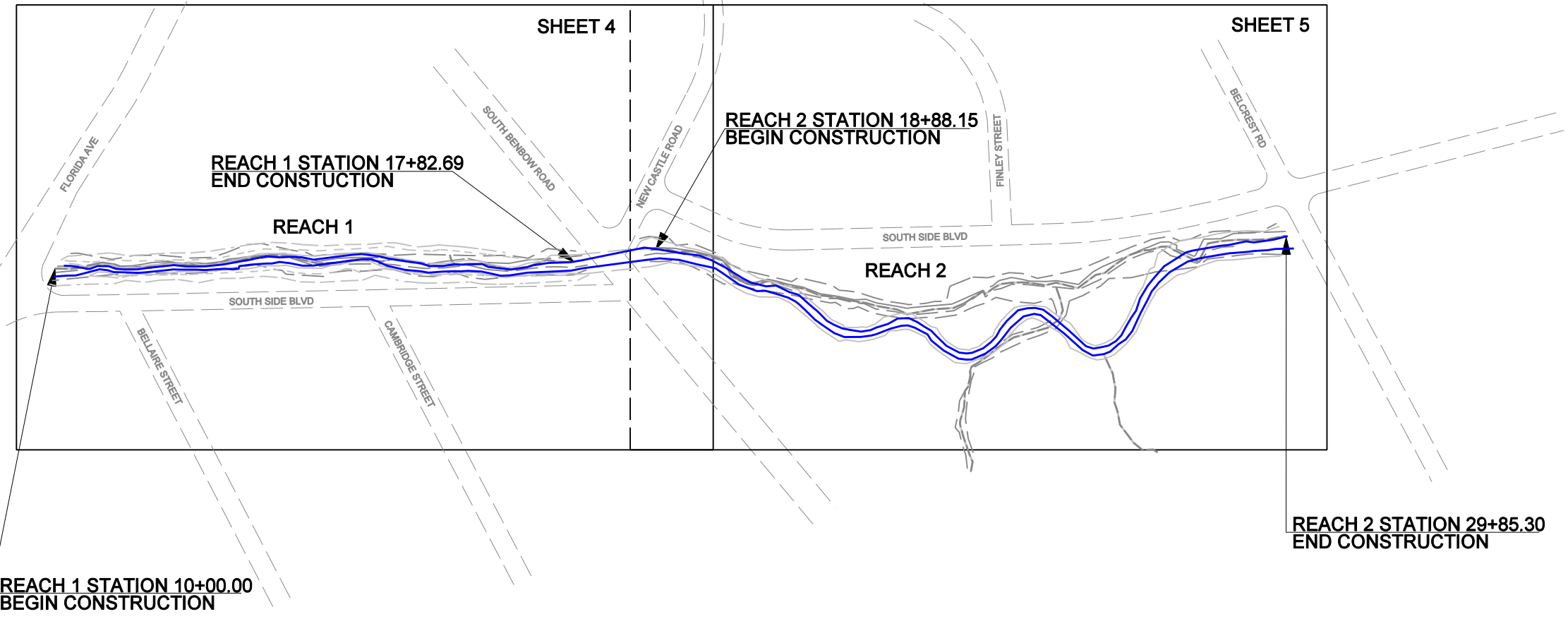


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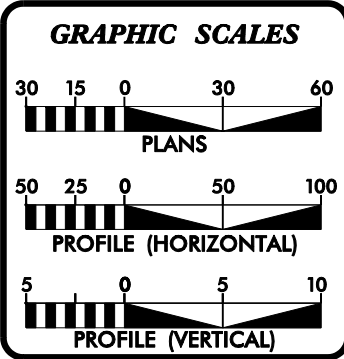


INDEX OF SHEETS:

1	TITLE SHEET
1-A	SYMBOLGY - BUCK ENGINEERING, GENERAL NOTES AND SPECIFICATIONS WETLAND CODES
1-B	SYMBOLGY - NCDOT
1-C	PLANTING SPECIFICATIONS
2 TO 2-C	TYPICAL POOL AND RIFFLE CROSS SECTIONS STRUCTURE DETAILS
4-5	PLAN VIEW AS-BUILT



PROJECT: 000532601



	DESIGN DATA	
	REACH 1	REACH 2
DESIGN STREAM TYPE	E5	E5
DESIGN LENGTH(FT)	760	1122
BANKFULL XSEC AREA(F ²)	25	45
BANKFULL WIDTH(FT)	16	21
BANKFULL DEPTH(FT)	2.3	2.8
WD RATIO	10	10

PROJECT LENGTH	
EXISTING STREAM LENGTH	= 1752 FEET
CONSTRUCTED STREAM LENGTH	= 1879 FEET
CONTACT:	JIM STANFILL REP PROJECT MANAGER

PREPARED IN THE OFFICE OF:

BUCK ENGINEERING
8000 Regency Parkway Suite 200
Cary, North Carolina 27511
Phone: 919-463-5488
Fax: 919-463-5490

MAY 4, 2005
COMPLETION DATE:

WILL HARMAN, PG
PROJECT MANAGER

C. HEATH WADSWORTH, PE
PROJECT ENGINEER

PROJECT ENGINEER

THIS DOCUMENT
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SEALED BY:
C. HEATH WADSWORTH
028421
DECEMBER 13, 2005

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SIGNATURE: _____ P.E.


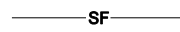

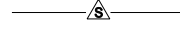





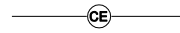







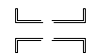












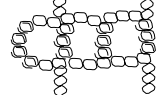
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STREAM CONVENTIONAL SYMBOLS SUPERCEDES SHEET 1B

	ROCK J-HOOK		SILT FENCE
	ROCK VANE		SAFETY FENCE
	OUTLET PROTECTION		TAPE FENCE
	ROCK CROSS VANE		100 YEAR FLOOD PLAIN
	MODIFIED ROCK CROSS VANE		CONSERVATION EASEMENT
	SINGLE WING DEFLECTOR		EXISTING MAJOR CONTOUR
	DOUBLE WING DEFLECTOR		EXISTING MINOR CONTOUR
	TEMPORARY SILT CHECK		FOOT BRIDGE
	ROOT WAD		TEMPORARY STREAM CROSSING
	LOG J-HOOK		PERMANENT STREAM CROSSING
	LOG VANE		TRANSPLANTED VEGETATION
	LOG WEIR		TREE REMOVAL
	LOG CROSS VANE		TREE PROTECTION
	CONSTRUCTED RIFFLE		NON-DEDICATED TREE
	BOULDER CLUSTER		'MEMORY' TREE
	ROCK STEP POOL		

****NOTE: ALL ITEMS ABOVE MAY NOT BE USED ON THIS PROJECT**

GENERAL NOTES

WETLAND CODES

STANDARD SPECIFICATIONS

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

*S.U.E = SUBSURFACE UTILITY ENGINEER

CONVENTIONAL SYMBOLS

ROADS & RELATED ITEMS

Edge of Pavement	----
Curb	----
Prop. Slope Stakes Cut	-----C-----
Prop. Slope Stakes Fill	-----F-----
Prop. Woven Wire Fence	○-----○
Prop. Chain Link Fence	□-----□
Prop. Barbed Wire Fence	◇-----◇
Prop. Wheelchair Ramp	WCR
Curb Cut for Future Wheelchair Ramp	CCFR
Exist. Guardrail	-----
Prop. Guardrail	-----
Equality Symbol	⊕
Pavement Removal	XXXXXX

RIGHT OF WAY

Baseline Control Point	◆
Existing Right of Way Marker	△
Exist. Right of Way Line w/Marker	-----△-----
Prop. Right of Way Line with Proposed	-----▲-----
R/W Marker (Iron Pin & Cap)	▲
Prop. Right of Way Line with Proposed	-----▲-----
(Concrete or Granite) R/W Marker	⊙
Exist. Control of Access Line	⊙
Prop. Control of Access Line	⊙
Exist. Easement Line	-----E-----
Prop. Temp. Construction Easement Line	-----E-----
Prop. Temp. Drainage Easement Line	-----TDE-----
Prop. Perm. Drainage Easement Line	-----PDE-----

HYDROLOGY

Stream or Body of Water	-----
River Basin Buffer	-----RBB-----
Flow Arrow	→
Disappearing Stream	-----
Spring	○
Swamp Marsh	-----
Shoreline	-----
Falls, Rapids	-----
Prop Lateral, Tail, Head Ditches	-----

STRUCTURES

MAJOR	
Bridge, Tunnel, or Box Culvert	-----CONC-----
Bridge Wing Wall, Head Wall and End Wall	-----CONC WW-----

MINOR	
Head & End Wall	-----CONC HW-----
Pipe Culvert	=====
Footbridge	----->-----<-----
Drainage Boxes	□ CB
Paved Ditch Gutter	-----

UTILITIES

Exist. Pole	•
Exist. Power Pole	•
Prop. Power Pole	•
Exist. Telephone Pole	•
Prop. Telephone Pole	•
Exist. Joint Use Pole	•
Prop. Joint Use Pole	•
Telephone Pedestal	⊕
UG Telephone Cable Hand Hold	⊕
Cable TV Pedestal	⊕
UG TV Cable Hand Hold	⊕
UG Power Cable Hand Hold	⊕
Hydrant	⊕
Satellite Dish	⊕
Exist. Water Valve	⊕
Sewer Clean Out	⊕
Power Manhole	⊕
Telephone Booth	⊕
Cellular Telephone Tower	⊕
Water Manhole	⊕
Light Pole	⊕
H-Frame Pole	⊕
Power Line Tower	⊕
Pole with Base	⊕
Gas Valve	⊕
Gas Meter	⊕
Telephone Manhole	⊕
Power Transformer	⊕
Sanitary Sewer Manhole	⊕
Storm Sewer Manhole	⊕
Tank; Water, Gas, Oil	⊕
Water Tank With Legs	⊕
Traffic Signal Junction Box	⊕
Fiber Optic Splice Box	⊕
Television or Radio Tower	⊕
Utility Power Line Connects to Traffic Signal Lines Cut Into the Pavement	-----TS-----

Recorded Water Line	-----
Designated Water Line (S.U.E.*)	-----
Sanitary Sewer	-----SS-----
Recorded Sanitary Sewer Force Main	-----FSS-----
Designated Sanitary Sewer Force Main(S.U.E.*)	-----FSS-----
Recorded Gas Line	-----G-----
Designated Gas Line (S.U.E.*)	-----G-----
Storm Sewer	-----S-----
Recorded Power Line	-----P-----
Designated Power Line (S.U.E.*)	-----P-----
Recorded Telephone Cable	-----T-----
Designated Telephone Cable (S.U.E.*)	-----T-----
Recorded U/G Telephone Conduit	-----TC-----
Designated U/G Telephone Conduit (S.U.E.*)	-----TC-----
Unknown Utility (S.U.E.*)	-----TUTL-----
Recorded Television Cable	-----TV-----
Designated Television Cable (S.U.E.*)	-----TV-----
Recorded Fiber Optics Cable	-----FO-----
Designated Fiber Optics Cable (S.U.E.*)	-----FO-----
Exist. Water Meter	⊕
UG Test Hole (S.U.E.*)	⊕
Abandoned According to U/G Record	ATTUR
End of Information	E.O.I.

BOUNDARIES & PROPERTIES

State Line	-----
County Line	-----
Township Line	-----
City Line	-----
Reservation Line	-----
Property Line	-----
Property Line Symbol	PL
Exist. Iron Pin	⊕
Property Corner	⊕
Property Monument	⊕
Property Number	123
Parcel Number	6
Fence Line	-----X-----
Existing Wetland Boundaries	-----WW & ISBW-----
High Quality Wetland Boundary	-----WLB-----
Medium Quality Wetland Boundaries	-----HO WLB-----
Low Quality Wetland Boundaries	-----MO WLB-----
Proposed Wetland Boundaries	-----LO WLB-----
Existing Endangered Animal Boundaries	-----EAB-----
Existing Endangered Plant Boundaries	-----EPB-----

BUILDINGS & OTHER CULTURE

Buildings	-----
Foundations	-----
Area Outline	-----
Gate	-----
Gas Pump Vent or UG Tank Cap	-----
Church	-----
School	-----
Park	-----
Cemetery	-----
Dam	-----
Sign	-----
Well	-----
Small Mine	-----
Swimming Pool	-----

TOPOGRAPHY

Loose Surface	-----
Hard Surface	-----
Change in Road Surface	-----
Curb	-----
Right of Way Symbol	R/W
Guard Post	⊕ GP
Paved Walk	-----
Bridge	-----
Box Culvert or Tunnel	-----
Ferry	-----
Culvert	-----
Footbridge	-----
Trail, Footpath	-----
Light House	-----

VEGETATION

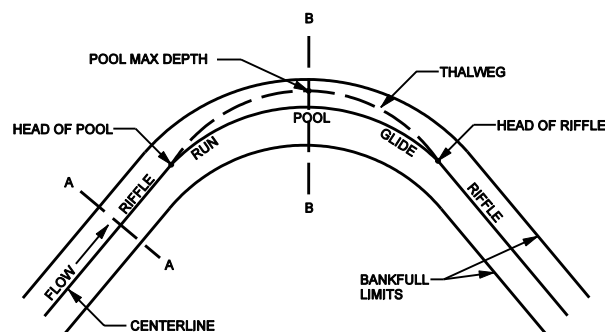
Single Tree	-----
Single Shrub	-----
Hedge	-----
Woods Line	-----
Orchard	-----
Vineyard	-----

RAILROADS

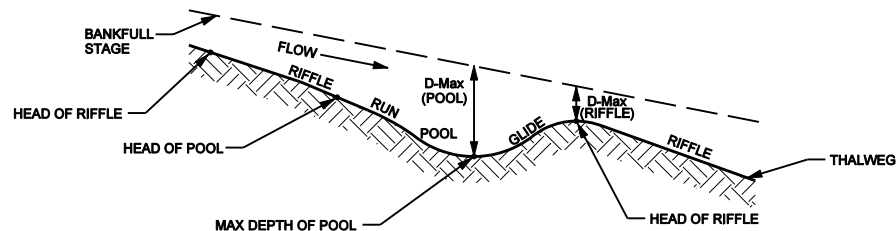
Standard Gauge	-----
RR Signal Milepost	-----
Switch	-----

TYPICAL PLAN VIEW AND PROFILE

PLAN VIEW



PROFILE VIEW

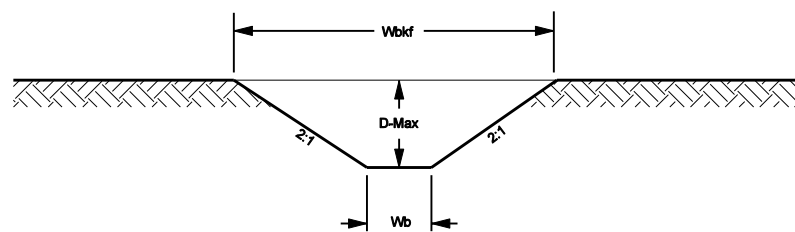


NOTES:

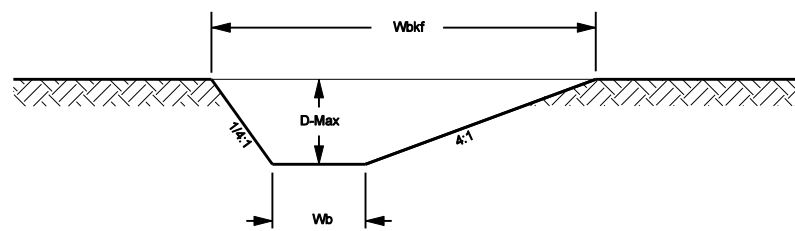
1. THE POINTS SHOWN, e.g. HEAD OF RIFFLE, HEAD OF POOL AND MAX DEPTH OF POOL ARE THE CONTROL POINTS USED TO CUT THE PROFILE; HOWEVER, THE CONTRACTOR SHOULD CREATE SMOOTH TRANSITIONS BETWEEN CONTROL POINTS AS SHOWN ABOVE.
2. USE THE FACET SLOPES IN THE TABLE AS A GUIDE TO ENSURE THAT THE FEATURES ARE APPROPRIATELY GRADED.
3. THE HEAD OF RIFFLE ELEVATION SHOULD NOT EXCEED THE HEAD OF POOL ELEVATION.
4. THE CHANGE IN WIDTH BETWEEN THE RIFFLES AND POOLS SHOULD OCCUR GRADUALLY OVER THE ENTIRE LENGTH OF THE BEND.

FACET	SLOPE RANGE
RIFFLE	.0019 - .0089
RUN	.018 - .030
POOL	.0007 - .002
GLIDE	.013 - .028

TYPICAL RIFFLE, POOL AND BANKFULL BENCH



RIFFLE A-A

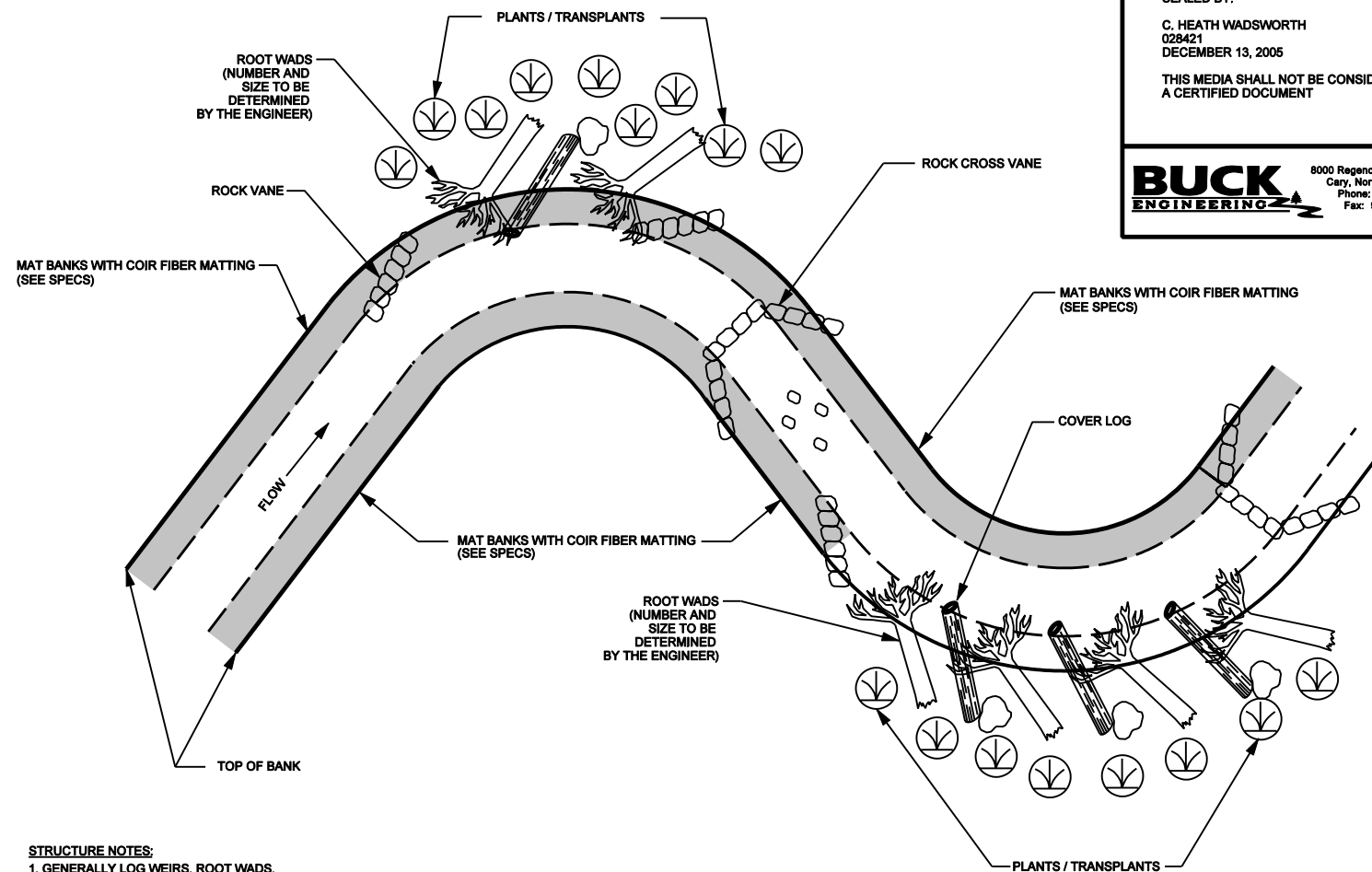


POOL B-B

NOTES:

1. DURING CONSTRUCTION CORNERS OF DESIGN CHANNEL WILL BE ROUNDED AND A THALWEG WILL BE SHAPED PER DIRECTION OF ENGINEER.
2. POOLS SHOWN ABOVE ARE LEFT POOLS ONLY.

TYPICAL STRUCTURE PLACEMENT



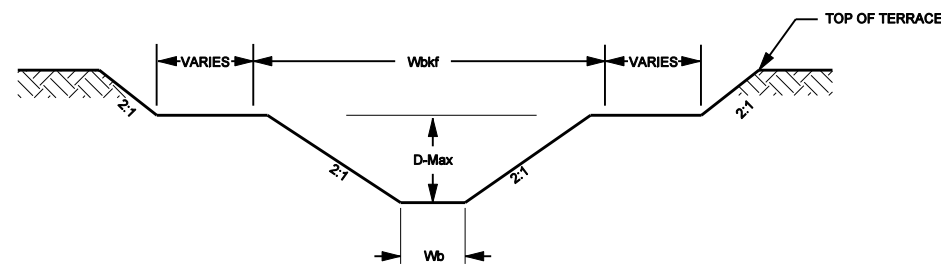
STRUCTURE NOTES:

1. GENERALLY LOG WEIRS, ROOT WADS, LOG VANES AND COIR FIBER MATTING WILL BE INSTALLED IN THE LOCATION AND SEQUENCE AS SHOWN.
2. ADDITIONAL STRUCTURES OR CHANGES TO STRUCTURE LOCATIONS MAY BE MADE BY THE ENGINEER DURING CONSTRUCTION.

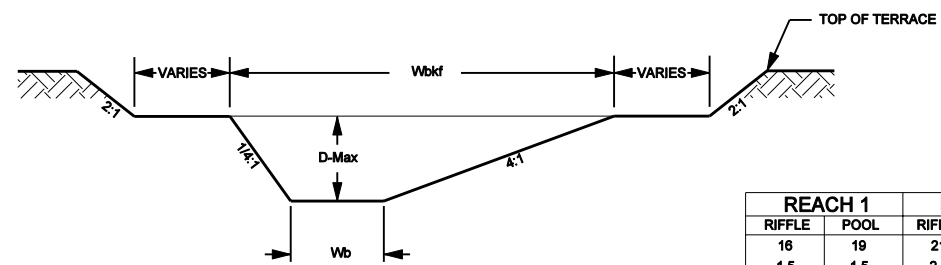
NOTES:

1. COIR FIBER MATTING TO BE INSTALLED ON RIFFLE/RUN SECTIONS BETWEEN BENDS.
2. IF ROOT WADS DO NOT COVER ENTIRE SLOPE ON OUTSIDE OF MEANDER BENDS, COIR FIBER MATTING IS NEEDED.

PROJECT REFERENCE NO. 000532601	SHEET NO. 2
PROJECT ENGINEER	
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BUCK ENGINEERING	
8000 Regency Parkway Suite 200 Cary, North Carolina 27511 Phone: 919-483-5488 Fax: 919-483-5490	



RIFFLE WITH BANKFULL BENCH

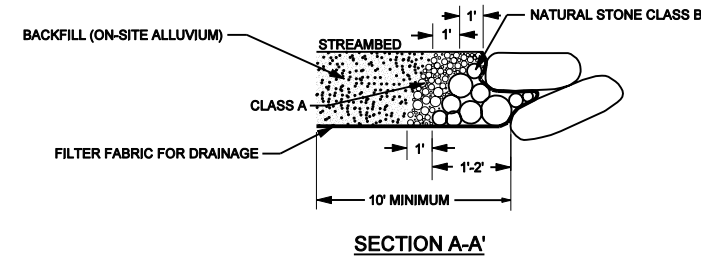
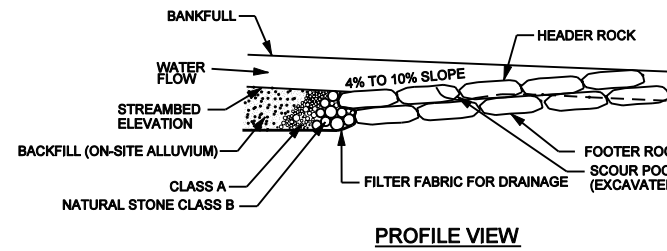
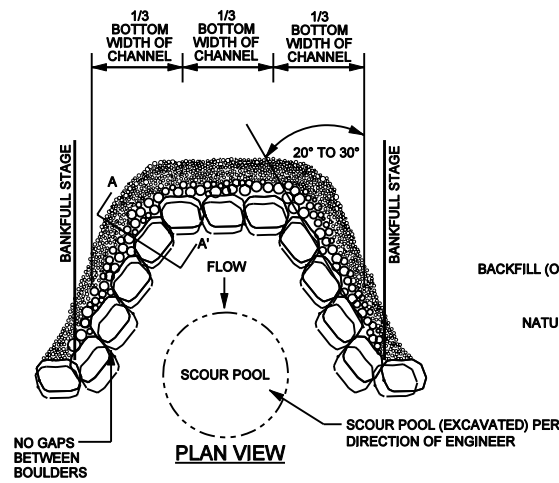


POOL WITH BANKFULL BENCH

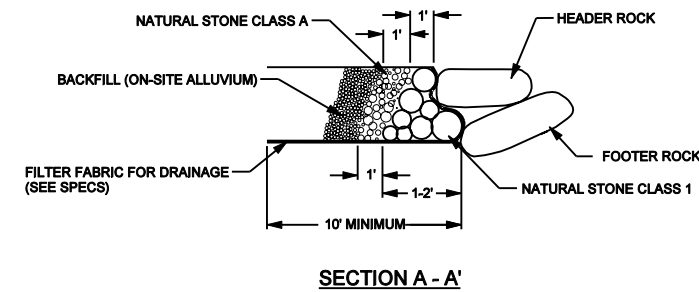
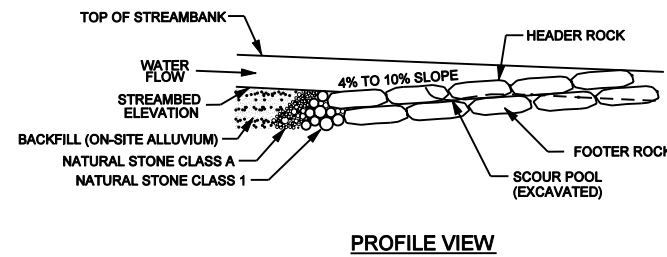
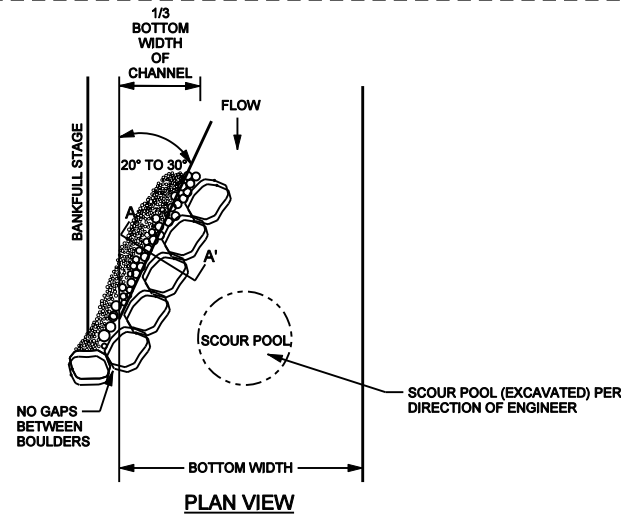
REACH 1		REACH 2	
RIFFLE	POOL	RIFFLE	POOL
16	19	21	25
1.5	1.5	2.1	2.0
2.3	2.4	2.8	3.2
10	12	10	12
25	29	45	51
7	5	12	7

- WIDTH OF BANKFULL (Wbkf)
- AVERAGE DEPTH (D)
- MAXIMUM DEPTH (D-Max)
- WIDTH TO DEPTH RATIO (Wbkf / D)
- BANKFULL AREA (Abkf)
- BOTTOM WIDTH (Wb)

ROCK CROSS VANE

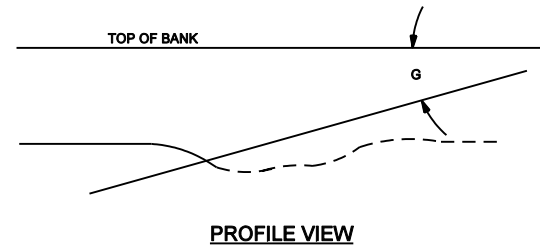
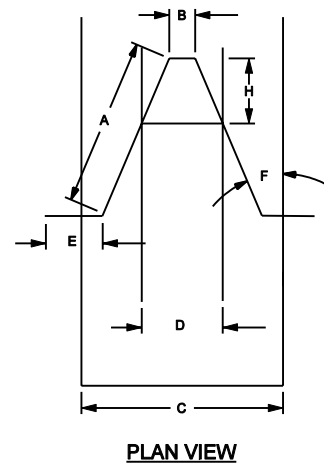


ROCK VANE

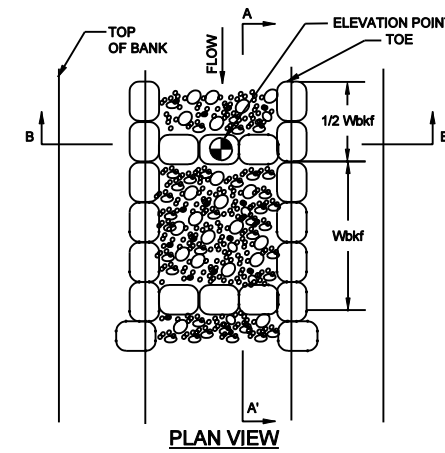


- BOULDERS MUST BE AT LEAST 4' x 3' x 2'.
- INSTALL FILTER FABRIC FOR DRAINAGE BEGINNING AT THE MIDDLE OF THE HEADER ROCKS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF TEN FEET.
- DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS AND PLACE FILL ON UPSTREAM SIDE OF VANE ARM, BETWEEN THE ARM AND STREAM BANK.
- START AT BANKFULL AND PLACE FOOTER ROCKS FIRST AND THEN HEADER (TOP) ROCK.
- CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
- AN EXTRA BOULDER CAN BE PLACED IN SCOUR POOL FOR HABITAT IMPROVEMENT.
- USE CLASS 1 RIP RAP TO FILL GAPS ON UPSTREAM SIDE OF BOULDERS, AND CLASS A RIP RAP TO FILL GAPS ON UPSTREAM SIDE OF CLASS 1 RIP RAP.
- AFTER ALL STONE HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF THE TOP OF THE HEADER ROCK.

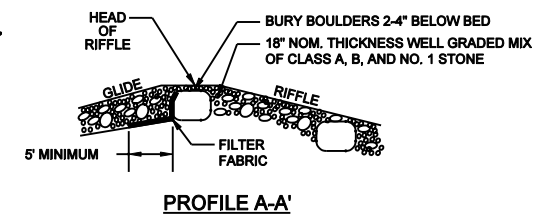
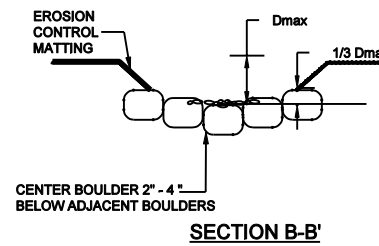
CROSS VANE TYPICAL



	REACH 1	REACH 2
A VANE ARM LENGTH	17.0 FT	21.0 FT
B INVERT LENGTH	4.0 FT	8.0 FT
C BANKFULL WIDTH	16.0 FT	21.0 FT
D BOTTOM WIDTH	5.9 FT	11.5 FT
E SILL LENGTH	4.0 FT	4.0 FT
F ARM ANGLE	20°	20°
G ARM SLOPE	10 %	10 %
H BEGIN STEP	11.0 FT	12.0 FT

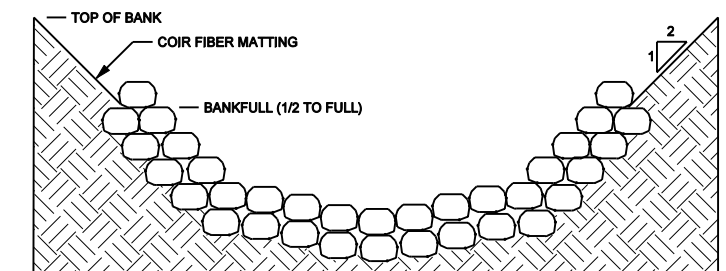
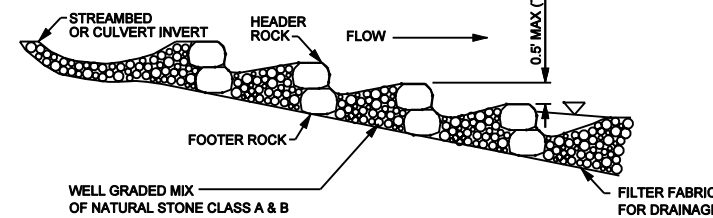
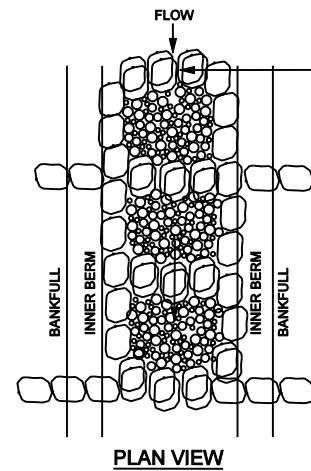


CONSTRUCTED RIFFLE



REACH	1	2
Wbkf (ft)	16.0	21.0
Dmax (ft)	2.3	2.8

STEP POOL

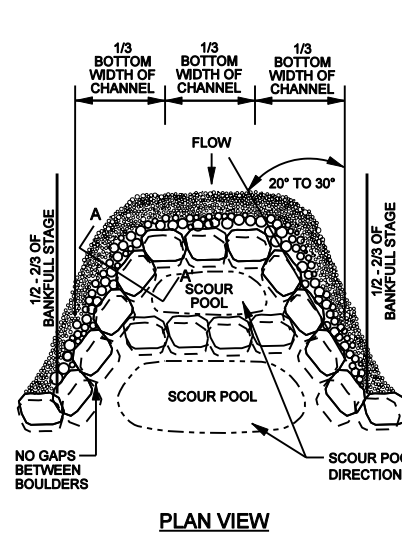


CROSS SECTION

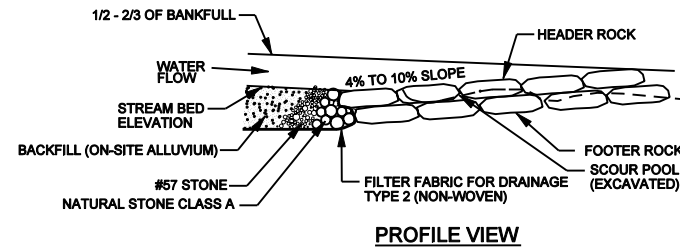
PROFILE VIEW

PLAN VIEW

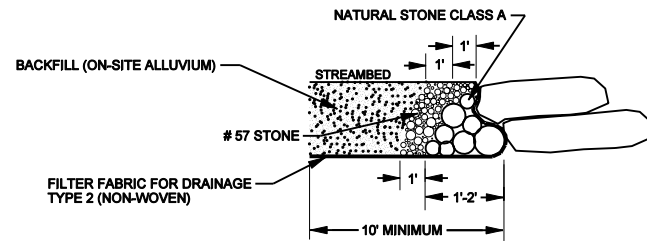
MODIFIED ROCK CROSS VANE



PLAN VIEW

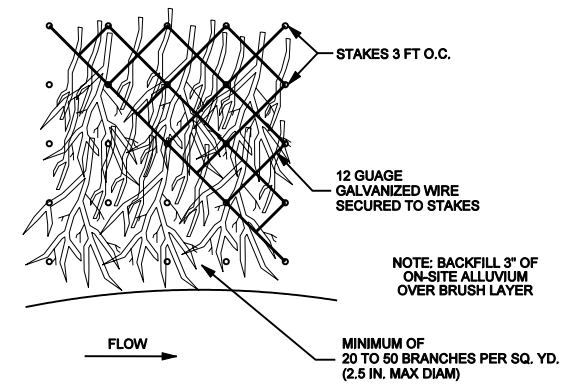


PROFILE VIEW

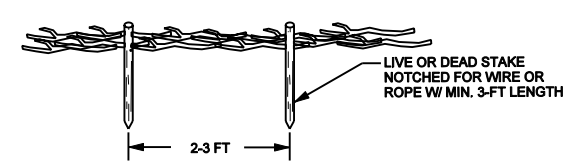


SECTION A-A'

- BOULDERS MUST BE AT LEAST 4' x 3' x 2'.
- INSTALL FILTER FABRIC FOR DRAINAGE BEGINNING AT THE MIDDLE OF THE HEADER ROCKS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF TEN FEET.
- DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS AND PLACE FILL ON UPSTREAM SIDE OF VANE ARM, BETWEEN THE ARM AND STREAM BANK.
- START AT BANKFULL AND PLACE FOOTER ROCKS FIRST AND THEN HEADER (TOP) ROCK.
- CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
- AN EXTRA BOULDER CAN BE PLACED IN SCOUR POOL FOR HABITAT IMPROVEMENT.
- USE CLASS 1 RIP RAP TO FILL GAPS ON UPSTREAM SIDE OF BOULDERS, AND CLASS A RIP RAP TO FILL GAPS ON UPSTREAM SIDE OF CLASS 1 RIP RAP.
- AFTER ALL STONE HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF THE TOP OF THE HEADER ROCK.

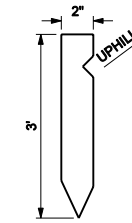


PLAN VIEW



DETAIL

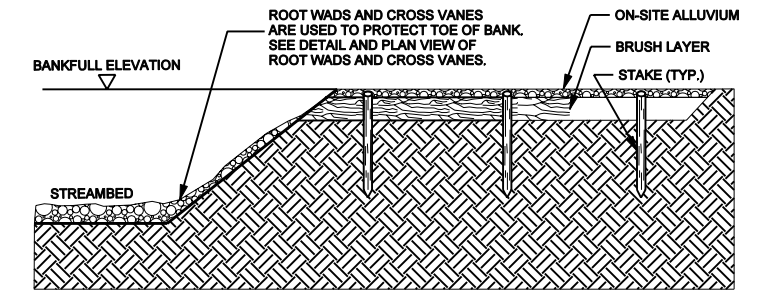
BRUSH LAYER



TYPICAL STAKE

NOTES:

- BOARD FOR STAKE SHOULD BE 2" X 4" X 12"

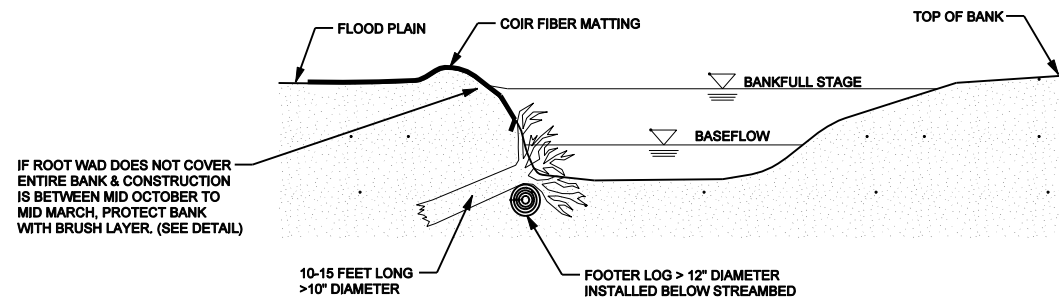


NOTES:

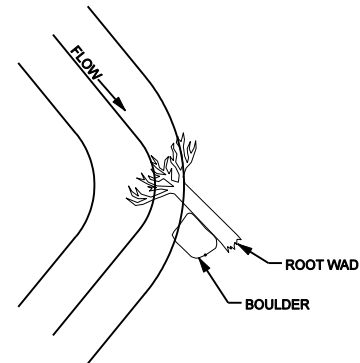
- CREATE 12" DEEP TRENCH
- STAKE AND WIRE BRUSH LAYER INTO TRENCH.
- BACK FILL 3" OF ON-SITE ALLUVIUM OVER BRUSH LAYER.

CROSS SECTION

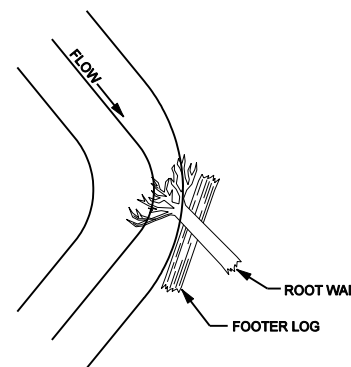
ROOT WADS



CROSS SECTION VIEW



PLAN VIEW
DRIVE POINT METHOD



PLAN VIEW
TRENCHING METHOD

NOTE:

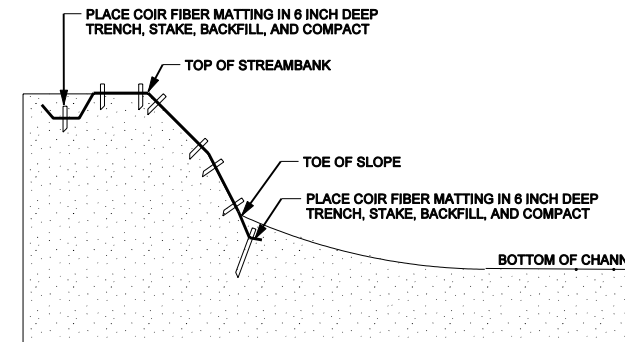
DRIVE POINT METHOD:

SHARPEN THE END OF THE LOG WITH A CHAINSAW BEFORE "DRIVING" IT INTO THE BANK. ORIENT ROOT WADS UPSTREAM SO THAT THE STREAM FLOW MEETS THE ROOT WAD AT A 90-DEGREE ANGLE, DEFLECTING THE WATER AWAY FROM THE BANK. A TRANSPLANT OR BOULDER SHOULD BE PLACED ON THE DOWNSTREAM SIDE OF THE ROOT WAD IF A BACK EDDY IS FORMED BY THE ROOT WAD. THE BOULDER SHALL BE APPROXIMATELY 4' X 3' X 2'.

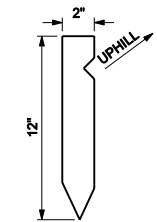
TRENCHING METHOD:

IF THE ROOT WAD CANNOT BE DRIVEN INTO THE BANK OR THE BANK NEEDS TO BE RECONSTRUCTED, THE TRENCHING METHOD SHOULD BE USED. THIS METHOD REQUIRES THAT A TRENCH BE EXCAVATED FOR THE LOG PORTION OF THE ROOT WAD. IN THIS CASE, A FOOTER LOG SHOULD BE INSTALLED UNDERNEATH THE ROOT WAD IN A TRENCH EXCAVATED PARALLEL TO THE BANK AND WELL BELOW THE STREAMBED. ONE-THIRD OF THE ROOT WAD SHOULD REMAIN BELOW NORMAL BASE FLOW CONDITIONS.

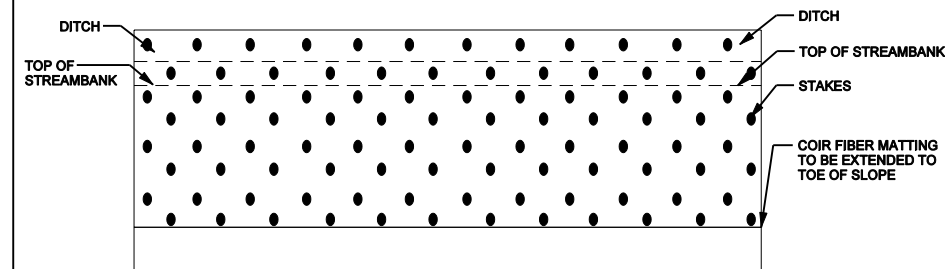
EROSION CONTROL MATTING



CROSS SECTION VIEW



TYPICAL MATTING STAKE



PLAN VIEW

NOTES:

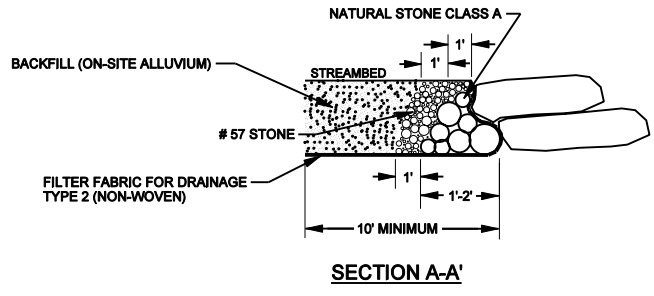
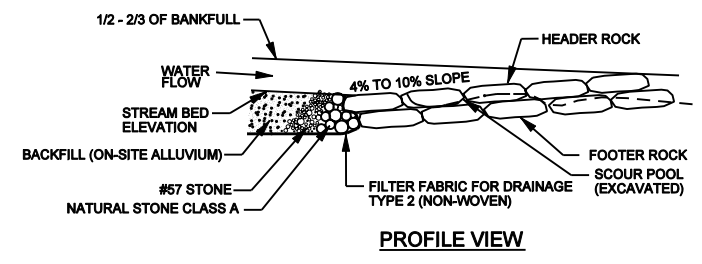
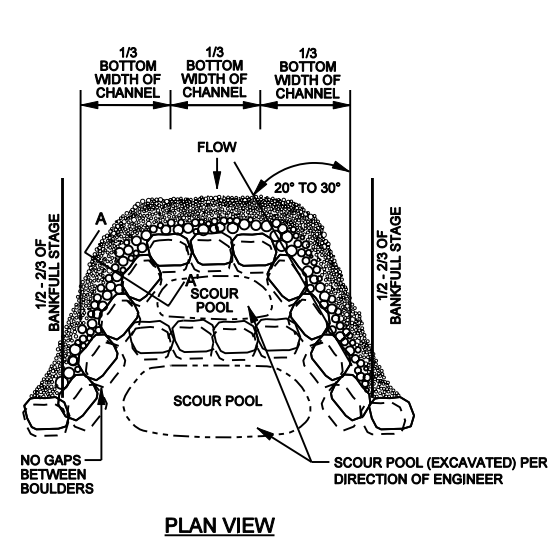
- BANKS SHOULD BE SEEDED PRIOR TO PLACEMENT OF MATTING.
- PLACE COIR FIBER MATTING ACCORDING TO MANUFACTURER RECOMMENDATIONS.
- MATting STAKES SHOULD BE PLACED IN A DIAMOND SHAPED PATTERN.
- WOODEN 3 FT. STAKES SPACED APPROXIMATELY 4 FT. APART SHALL BE USED TO SECURE THE MATTING AT THE TOE OF THE SLOPE.

THIS DOCUMENT
ORIGINALLY ISSUED AND
SEALED BY:

C. HEATH WADSWORTH
028421
DECEMBER 13, 2005

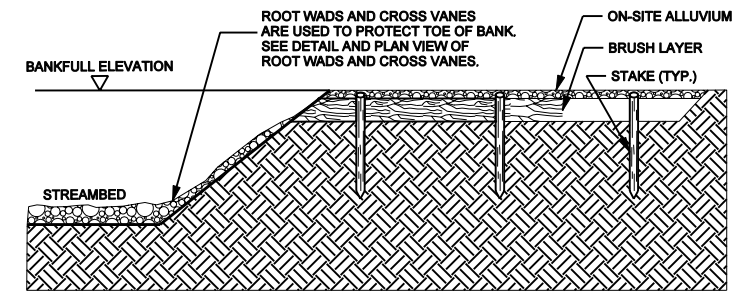
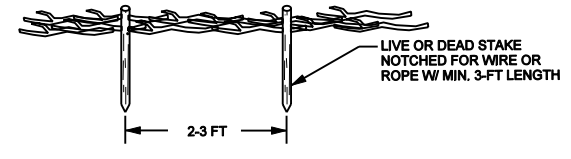
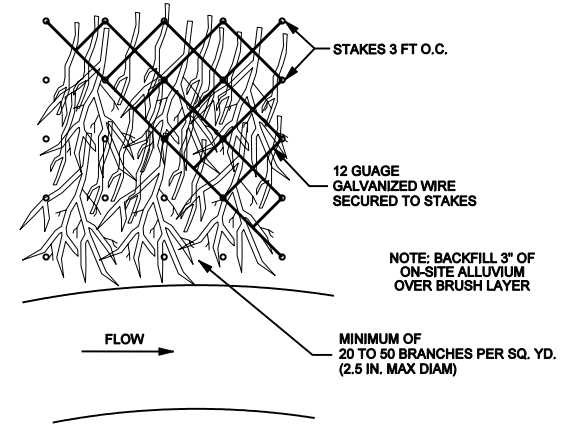
THIS MEDIA SHALL NOT BE CONSIDERED
A CERTIFIED DOCUMENT

MODIFIED ROCK CROSS VANE



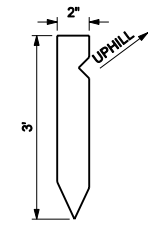
- BOULDERS MUST BE AT LEAST 4' x 3' x 2'.
- INSTALL FILTER FABRIC FOR DRAINAGE BEGINNING AT THE MIDDLE OF THE HEADER ROCKS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF TEN FEET.
- DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS AND PLACE FILL ON UPSTREAM SIDE OF VANE ARM, BETWEEN THE ARM AND STREAM BANK.
- START AT BANKFULL AND PLACE FOOTER ROCKS FIRST AND THEN HEADER (TOP) ROCK.
- CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
- AN EXTRA BOULDER CAN BE PLACED IN SCOUR POOL FOR HABITAT IMPROVEMENT.
- USE CLASS 1 RIP RAP TO FILL GAPS ON UPSTREAM SIDE OF BOULDERS, AND CLASS A RIP RAP TO FILL GAPS ON UPSTREAM SIDE OF CLASS 1 RIP RAP.
- AFTER ALL STONE HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF THE TOP OF THE HEADER ROCK.

BRUSH LAYER

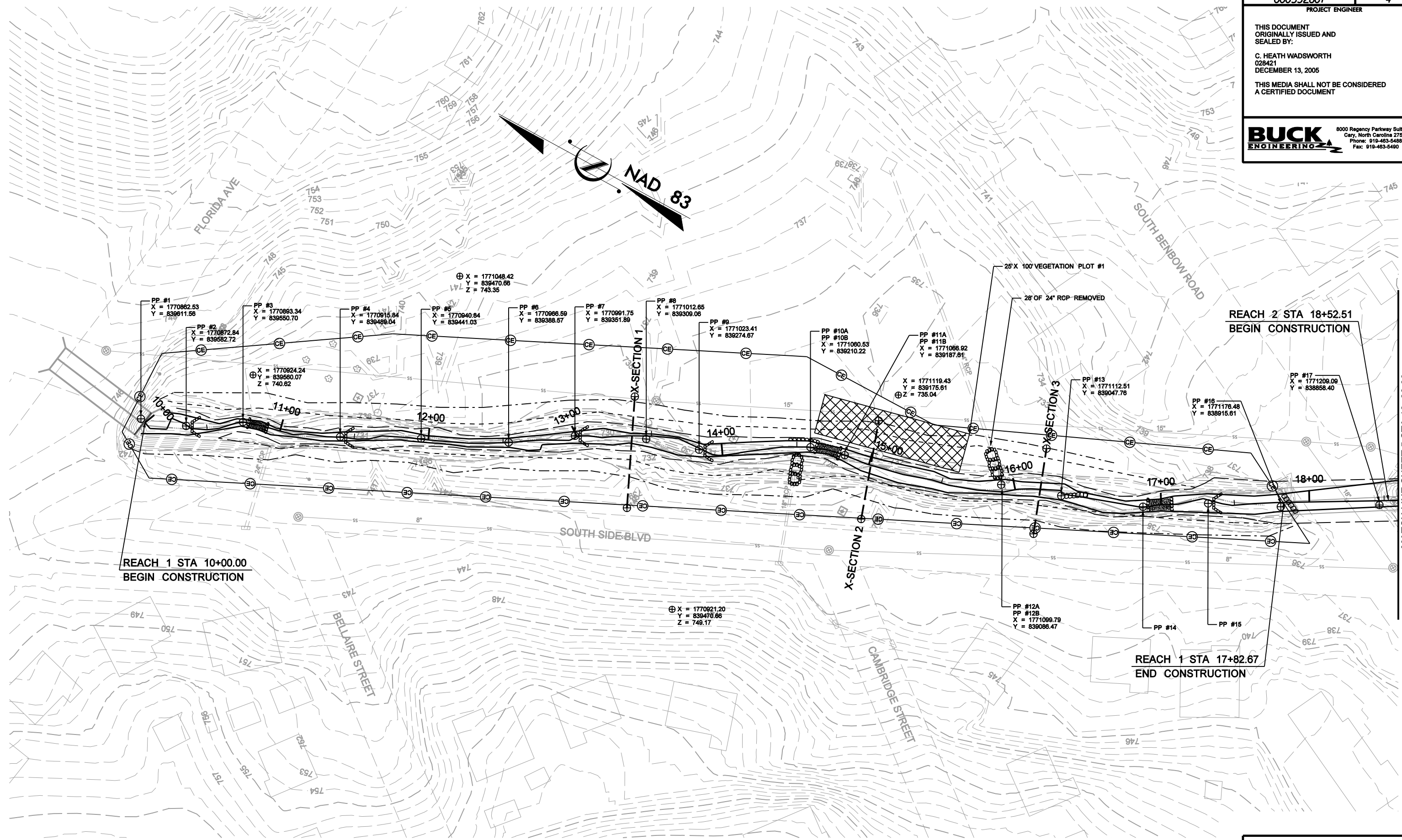


- NOTES:
- CREATE 12" DEEP TRENCH
 - STAKE AND WIRE BRUSH LAYER INTO TRENCH.
 - BACK FILL 3" OF ON-SITE ALLUVIUM OVER BRUSH LAYER.

TYPICAL STAKE



- NOTES:
- BOARD FOR STAKE SHOULD BE 2" X 4" X 12"



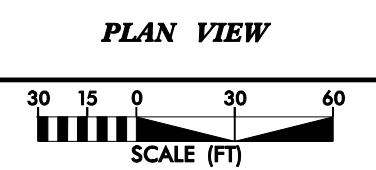
REACH 1 STA 10+00.00
 BEGIN CONSTRUCTION

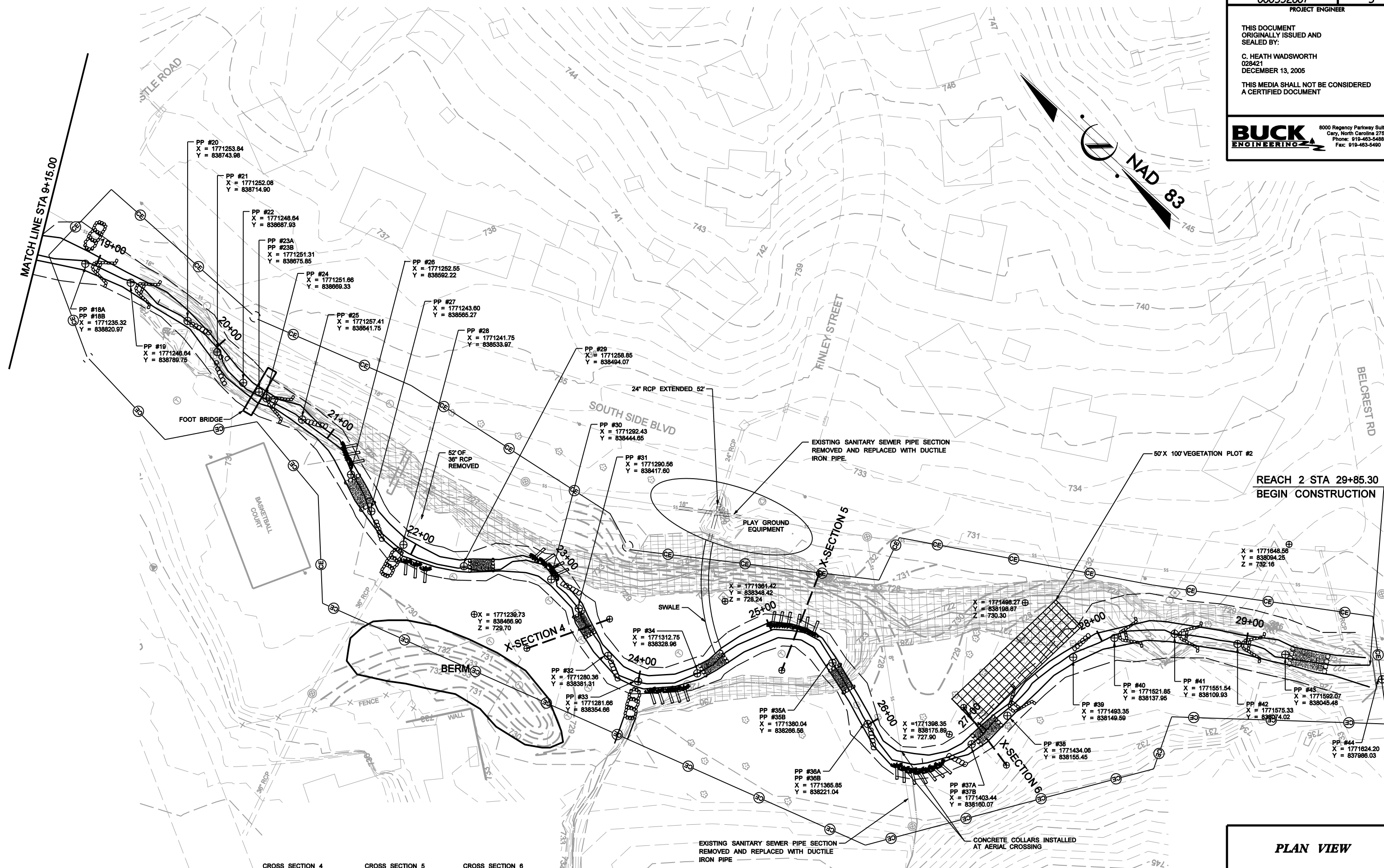
REACH 2 STA 18+52.51
 BEGIN CONSTRUCTION

REACH 1 STA 17+82.67
 END CONSTRUCTION

MATCH LINE SHEET 5 STA 18+60.00

CROSS SECTION 1	CROSS SECTION 2	CROSS SECTION 3
RIGHT PIN X = 1770968.16 Y = 839298.27	RIGHT PIN X = 1771034.75 Y = 839157.49	RIGHT PIN X = 1771135.40 Y = 839071.52
LEFT PIN X = 1771033.92 Y = 839329.35	LEFT PIN X = 1771097.96 Y = 839178.72	LEFT PIN X = 1771081.27 Y = 839051.78





REACH 2 STA 29+85.30
BEGIN CONSTRUCTION

CROSS SECTION 4 RIGHT PIN X = 1771246.95 Y = 838425.07 LEFT PIN X = 1771299.45 Y = 838397.44	CROSS SECTION 5 RIGHT PIN X = 1771353.07 Y = 838288.35 LEFT PIN X = 1771418.26 Y = 838314.09	CROSS SECTION 6 RIGHT PIN X = 1771418.13 Y = 838180.94 LEFT PIN X = 1771409.06 Y = 838133.24
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