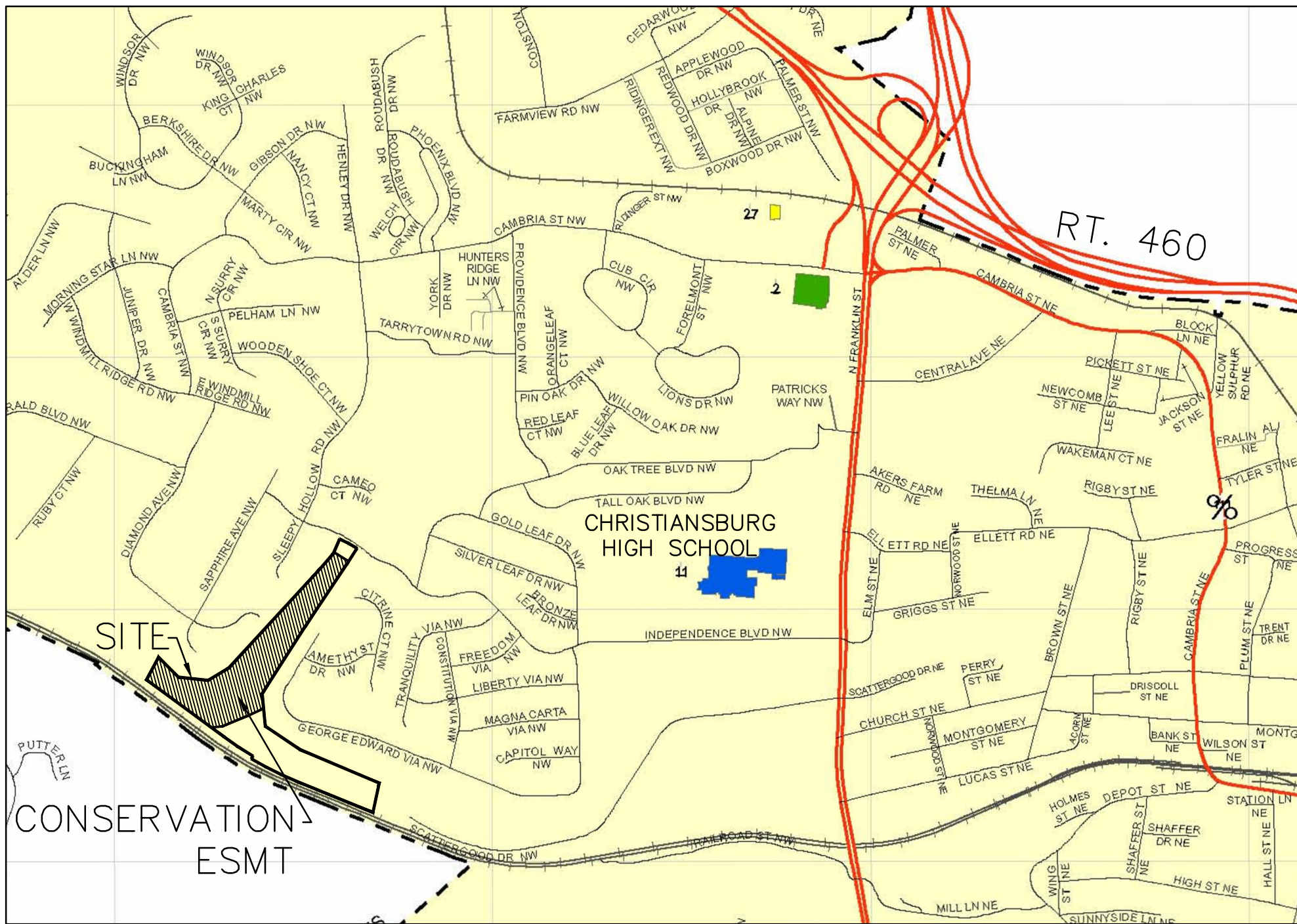


# DIAMOND HILLS PARK STREAM RESTORATION

## TOWN OF CHRISTIANSBURG, VIRGINIA

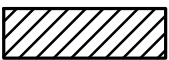

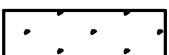




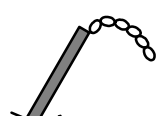



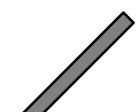



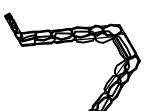
















VICINITY MAP  
SCALE: 1"=1000'

### PROJECT INFORMATION

- CLIENT: BRANCH HIGHWAYS, INC.  
442 RUTHERFORD AVENUE  
P.O. BOX 40004  
ROANOKE, VA 24022  
PH: (540) 982-1678  
CONTACT: MIKE HIGGINS
- CONSULTANT: BALZER & ASSOCIATES, INC.  
15871 CITY VIEW DRIVE, SUITE 200  
MIDLOTHIAN, VA 23113  
PH: (804) 794-0571  
CONTACT: WILLIAM KIPLING MUMAW  
TAYLOR GOODMAN  
BRIAN WAGNER
- PROJECT DESCRIPTION: THE PURPOSE OF THIS PROJECT IS TO RESTORE 2322 LINEAR FEET OF STREAM AS COMPENSATORY MITIGATION FOR UNAVOIDABLE IMPACTS ASSOCIATED WITH THE WYTHE COUNTY INDUSTRIAL PARK, PROGRESS PARK. RESTORATION ACTIVITIES WILL INCLUDE PRIORITY 1 RESTORATION BY CREATING A NEW PATTERN, PROFILE, AND DIMENSION; ROCK AND LOG STRUCTURES FOR HABITAT AND STABILITY; NATIVE RIPARIAN BUFFER PLANTING; REMOVAL OF THE EDMONT STORMWATER MANAGEMENT FACILITY; AND CREATION OF OFF-LINE STORMWATER MANAGEMENT WATER QUANTITY AND QUALITY CONTROL AREAS AS PART OF AN ANABRANCHED STREAM SYSTEM THAT WILL IMPROVE WATER QUALITY AND REDUCE STORM PEAK FLOWRATES. THIS PROJECT IS PART OF A LARGER WATERSHED APPROACH TO IMPROVING STORMWATER MANAGEMENT FOR THE DIAMOND HILLS PARK DRAINAGE AREA, WHICH WILL INCLUDE UPSTREAM RETROFITS IN THE FORM OF WATER QUANTITY CONTROLS AND STRUCTURAL UPGRADES.
- PROJECT LOCATION: DIAMOND HILLS PARK  
INDEPENDENCE BOULEVARD  
CHRISTIANSBURG, VA
- HYDROLOGIC UNIT CODE: UPPER NEW RIVER WATERSHED (05050001)
- STREAM CREDITS CREATED: 3,228
- PROPERTY OWNER: TOWN OF CHRISTIANSBURG
- PROPERTY ACREAGE: ±20.47
- DISTURBED ACREAGE: ±9.7
- CONSERVATION EASEMENT ACREAGE: 12.45
- CUT/FILL ANALYSIS: 8,500 C.Y. CUT (SURPLUS MATERIAL)
- RESTORED STREAM LENGTH: 2,322'
- 100' BUFFER ACREAGE: 9.66
- 200' BUFFER ACREAGE: 2.22

### LEGEND

	PROPOSED BUFFER		BRUSH MATRESS (BM)
	PROPOSED WETLAND		TOE-WOOD (TW)
	PROPERTY LINE		LOG VANE J-HOOK (LJ)
	PROP. CONSERVATION EASEMENT		LOG VANE J-HOOK W/ ROOTWAD (LJ-R)
	EXIST. OVERHEAD POWER		LOG SILL (LS)
	EXIST. OVERHEAD CABLE		LOG VANE (LV)
	EXIST. CENTERLINE OF ROAD		LOG CROSS VANE (LCV)
	EXIST. STORM SEWER		ROCK CROSS VANE (RCV)
	EXIST. TREELINE		DOUBLE-STEP ROCK CROSS VANE (DRCV)
	EXIST. TREE		
	EXIST. EDGE OF PAVEMENT		
	EXIST. WETLAND BOUNDARY		
	EXIST. 1' CONTOURS		
	EXIST. 5' CONTOURS		
	EXIST. STREAM BANKS		
			PROP. CENTERLINE/THALWEG
			PROP. LIMITS OF DISTURBANCE
			PROP. FLOODPLAIN
			PROP. CONTOURS (AT 1/2 INTERVALS)
			PROP. CONTOURS (AT 1/4 INTERVALS)
			PROP. BANKFULL STAGE CHANNEL

### SHEET INDEX

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- 02 OVERALL PLAN
- 03 GEOMETRY PLAN
- 04 GEOMETRY PLAN
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- 18 EROSION AND SEDIMENT CONTROL NOTES & NARRATIVE
- 19 EROSION AND SEDIMENT CONTROL DETAILS
- 20 STRUCTURE DETAILS
- 21 STRUCTURE DETAILS
- 22 PLANTING SCHEDULE AND DETAILS
- 23 PLANTING PLAN

### GENERAL NOTES

- UTILITY LOCATIONS ARE BASED ON FIELD LOCATED SURVEY DATA AND INFORMATION PROVIDED BY THE TOWN OF CHRISTIANSBURG. CONTRACTOR SHOULD VERIFY LOCATIONS AND ELEVATIONS PRIOR TO EXCAVATION.
- ALL SURVEY MAPPING HAS THE FOLLOWING DATUM:  
VERTICAL DATUM: NAVD 88  
HORIZONTAL DATUM: NAD 83
- CONTRACTOR SHALL COORDINATE WITH MISS UTILITY AND TOWN OF CHRISTIANSBURG TO LOCATE SITE UTILITIES.
- ALL PROPOSED UTILITY AND RECREATIONAL EASEMENTS SUPERSEDE THE PROPOSED MITIGATION EASEMENT.
- SUB-BASE OF FUTURE TRAIL TO BE INSTALLED DURING STREAM CONSTRUCTION. TO COINCIDE WITH CONSTRUCTION ROAD ACCESS WHERE POSSIBLE.
- TRAIL EASEMENT IS PRELIMINARILY SHOWN ON PLANS AT THIS TIME. TRAIL EASEMENT SHALL BE RECORDED AFTER STREAM CONSTRUCTION AND PLAT SHALL USE AS-BUILT PLANS FOR EASEMENT ALIGNMENT.
- GRADING SHOULD BE FIELD ADJUSTED IN CONSULTATION WITH PROJECT INSPECTOR TO PROTECT TREES. AVOID COMPACTING FILL AROUND TREES.
- INSTALLATION OF ALL STRUCTURES SHALL BE OVERSEEN BY SITE INSPECTOR.
- IF ROCK IS ENCOUNTERED WITHIN THE PROPOSED STREAM, THE SITE INSPECTOR SHALL MAKE FIELD ADJUSTMENTS AS NECESSARY. ALL FIELD ADJUSTMENTS SHALL BE RECORDED AND DOCUMENTED WITH PHOTOS AND/OR SITE SKETCHES.
- STRUCTURE LOCATION AND ORIENTATION IS APPROXIMATE IN PLAN VIEW. STRUCTURE DETAILS AND SPECIFICATIONS SHOULD TAKE PRECEDENCE OVER PLAN VIEW DEPICTIONS.
- ACCESS TO WORK AREAS SHALL BE COORDINATED WITH THE TOWN OF CHRISTIANSBURG AND SITE INSPECTOR TO DEFINE ACCESS PATHS THAT LIMIT DISTURBANCE WITHIN BUFFER AREA.
- ALL STRUCTURE DROPS ARE TO BE A MAXIMUM OF 4".
- ALL CROSS-SECTIONS ARE ORIENTED TO FACE THE DOWNSTREAM DIRECTION.
- "STREAM RIGHT" AND "STREAM LEFT" REFER TO THE RIGHT OR LEFT LOOKING DOWNSTREAM.



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Midlothian, VA 23113  
804-794-0571  
FAX 804-794-2635



DIAMOND HILLS PARK

STREAM RESTORATION

COVER

TOWN OF CHRISTIANSBURG, VIRGINIA

DRAWN BY STG  
DESIGNED BY WKM  
CHECKED BY STG/BW  
DATE 6-17-2011  
SCALE AS NOTED

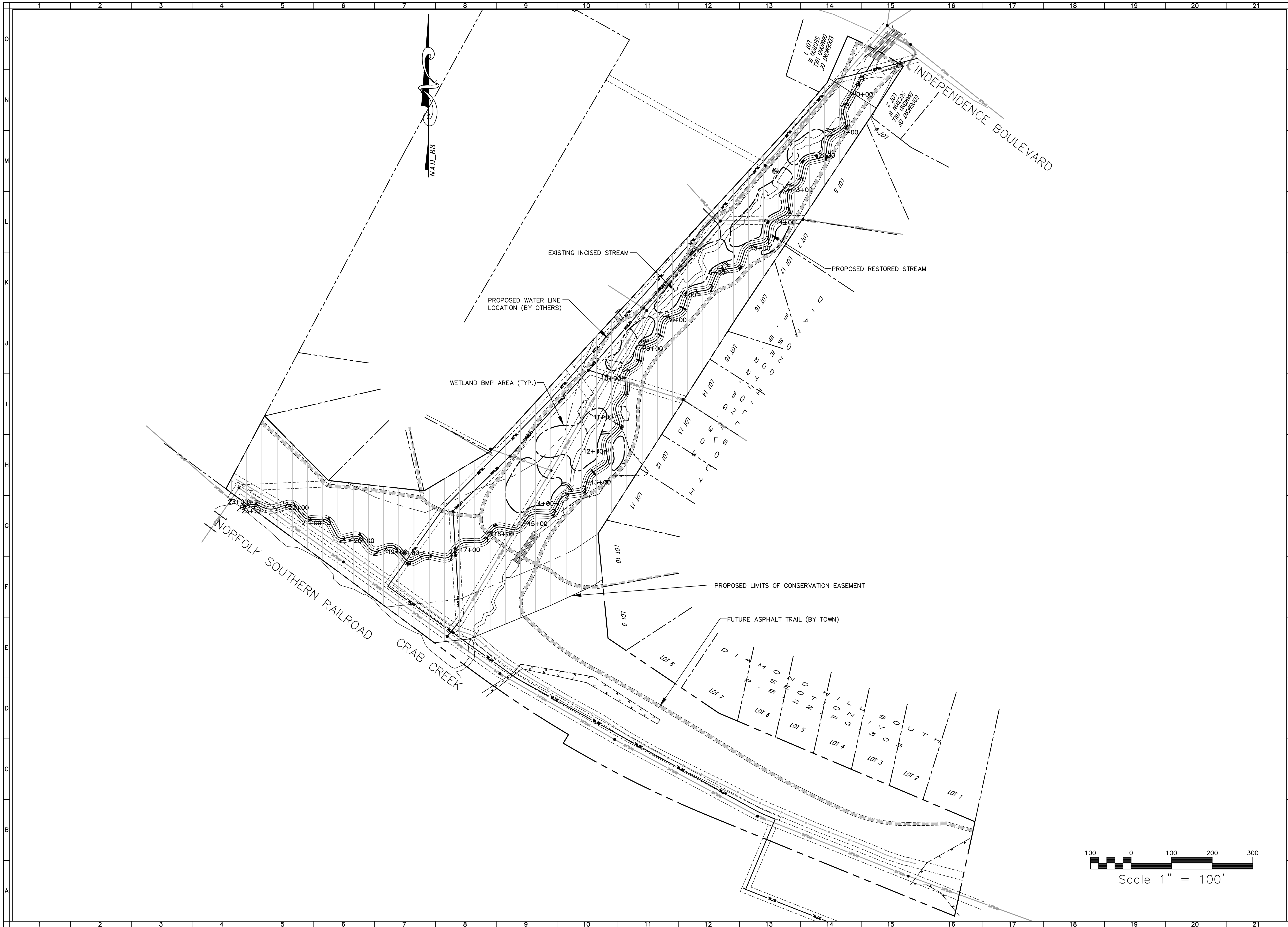
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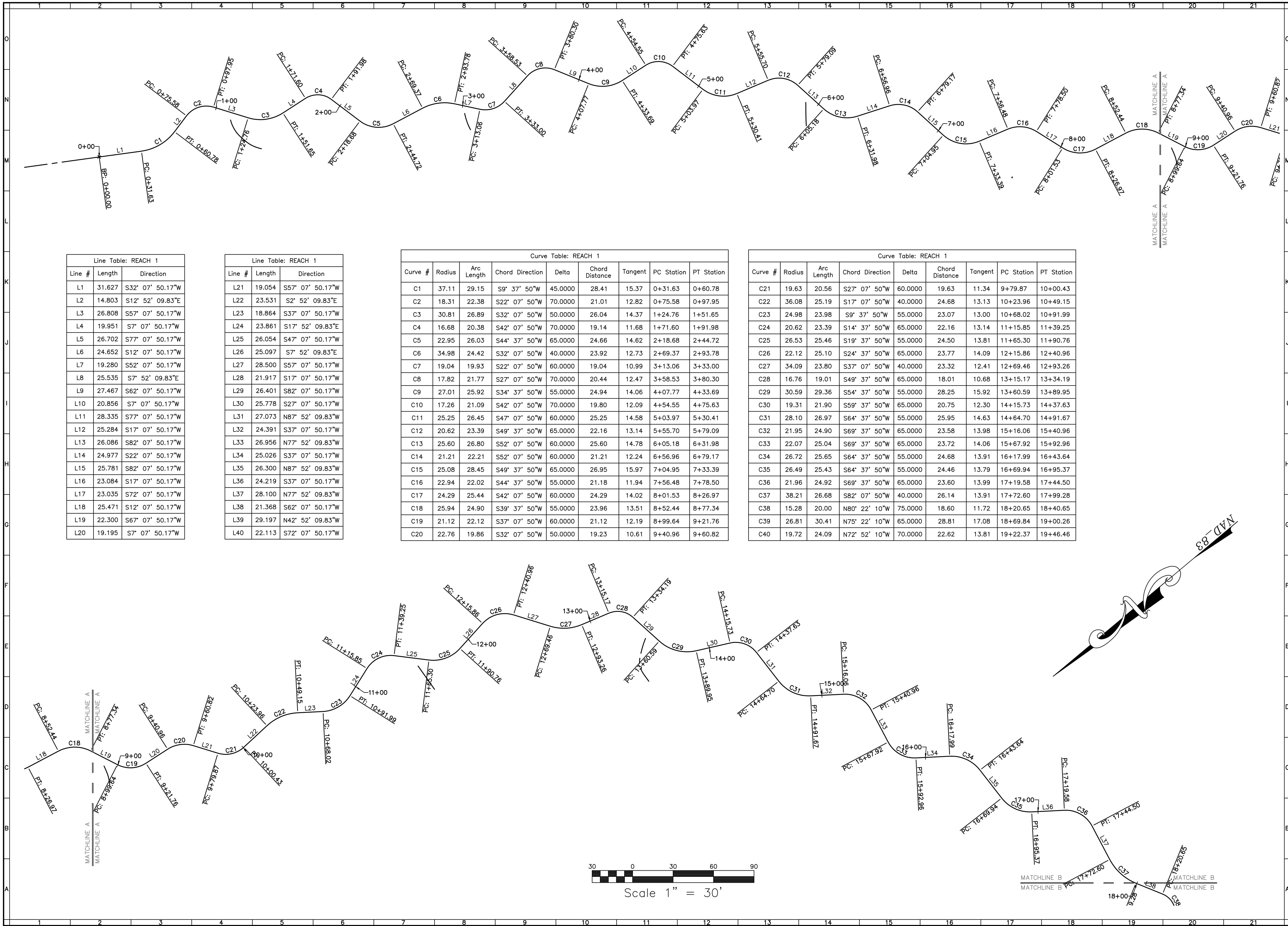
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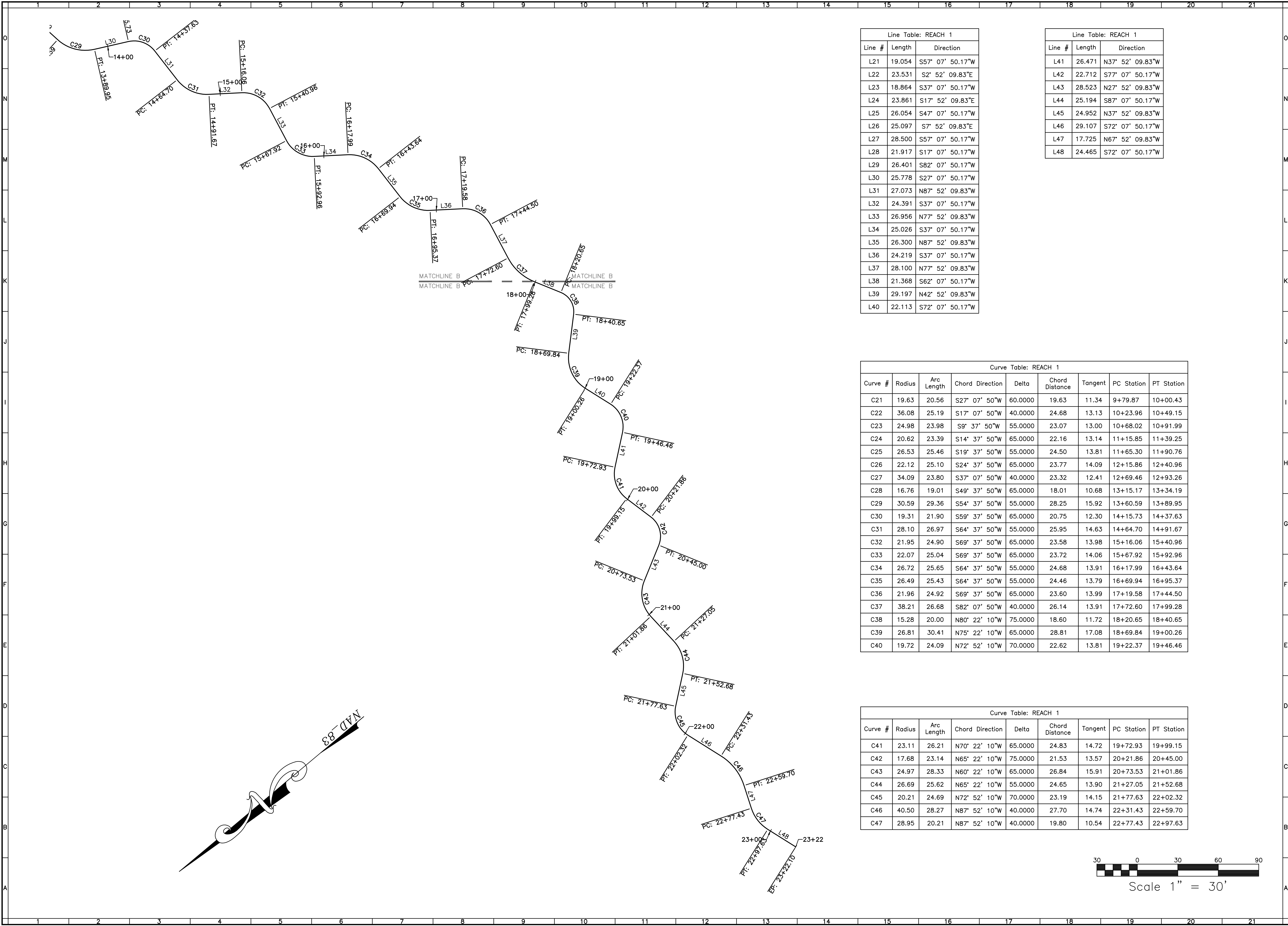
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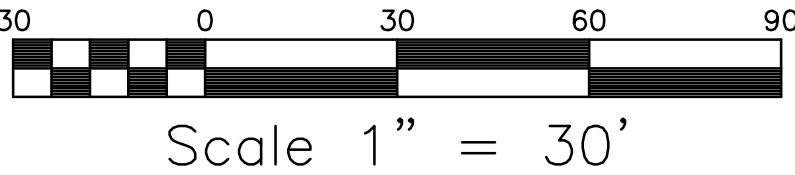


Line Table: REACH 1		
Line #	Length	Direction
L21	19.054	S57° 07' 50.17"W
L22	23.531	S2° 52' 09.83"E
L23	18.864	S37° 07' 50.17"W
L24	23.861	S17° 52' 09.83"E
L25	26.054	S47° 07' 50.17"W
L26	25.097	S7° 52' 09.83"E
L27	28.500	S57° 07' 50.17"W
L28	21.917	S17° 07' 50.17"W
L29	26.401	S82° 07' 50.17"W
L30	25.778	S27° 07' 50.17"W
L31	27.073	N87° 52' 09.83"W
L32	24.391	S37° 07' 50.17"W
L33	26.956	N77° 52' 09.83"W
L34	25.026	S37° 07' 50.17"W
L35	26.300	N87° 52' 09.83"W
L36	24.219	S37° 07' 50.17"W
L37	28.100	N77° 52' 09.83"W
L38	21.368	S62° 07' 50.17"W
L39	29.197	N42° 52' 09.83"W
L40	22.113	S72° 07' 50.17"W

Line Table: REACH 1		
Line #	Length	Direction
L41	26.471	N37° 52' 09.83"W
L42	22.712	S77° 07' 50.17"W
L43	28.523	N27° 52' 09.83"W
L44	25.194	S87° 07' 50.17"W
L45	24.952	N37° 52' 09.83"W
L46	29.107	S72° 07' 50.17"W
L47	17.725	N67° 52' 09.83"W
L48	24.465	S72° 07' 50.17"W

Curve Table: REACH 1								
Curve #	Radius	Arc Length	Chord Direction	Delta	Chord Distance	Tangent	PC Station	PT Station
C21	19.63	20.56	S27° 07' 50"W	60.0000	19.63	11.34	9+79.87	10+00.43
C22	36.08	25.19	S17° 07' 50"W	40.0000	24.68	13.13	10+23.96	10+49.15
C23	24.98	23.98	S9° 37' 50"W	55.0000	23.07	13.00	10+68.02	10+91.99
C24	20.62	23.39	S14° 37' 50"W	65.0000	22.16	13.14	11+15.85	11+39.25
C25	26.53	25.46	S19° 37' 50"W	55.0000	24.50	13.81	11+65.30	11+90.76
C26	22.12	25.10	S24° 37' 50"W	65.0000	23.77	14.09	12+15.86	12+40.96
C27	34.09	23.80	S37° 07' 50"W	40.0000	23.32	12.41	12+69.46	12+93.26
C28	16.76	19.01	S49° 37' 50"W	65.0000	18.01	10.68	13+15.17	13+34.19
C29	30.59	29.36	S54° 37' 50"W	55.0000	28.25	15.92	13+60.59	13+89.95
C30	19.31	21.90	S59° 37' 50"W	65.0000	20.75	12.30	14+15.73	14+37.63
C31	28.10	26.97	S64° 37' 50"W	55.0000	25.95	14.63	14+64.70	14+91.67
C32	21.95	24.90	S69° 37' 50"W	65.0000	23.58	13.98	15+16.06	15+40.96
C33	22.07	25.04	S69° 37' 50"W	65.0000	23.72	14.06	15+67.92	15+92.96
C34	26.72	25.65	S64° 37' 50"W	55.0000	24.68	13.91	16+17.99	16+43.64
C35	26.49	25.43	S64° 37' 50"W	55.0000	24.46	13.79	16+69.94	16+95.37
C36	21.96	24.92	S69° 37' 50"W	65.0000	23.60	13.99	17+19.58	17+44.50
C37	38.21	26.68	S82° 07' 50"W	40.0000	26.14	13.91	17+72.60	17+99.28
C38	15.28	20.00	N80° 22' 10"W	75.0000	18.60	11.72	18+20.65	18+40.65
C39	26.81	30.41	N75° 22' 10"W	65.0000	28.81	17.08	18+69.84	19+00.26
C40	19.72	24.09	N72° 52' 10"W	70.0000	22.62	13.81	19+22.37	19+46.46

Curve Table: REACH 1								
Curve #	Radius	Arc Length	Chord Direction	Delta	Chord Distance	Tangent	PC Station	PT Station
C41	23.11	26.21	N70° 22' 10"W	65.0000	24.83	14.72	19+72.93	19+99.15
C42	17.68	23.14	N65° 22' 10"W	75.0000	21.53	13.57	20+21.86	20+45.00
C43	24.97	28.33	N60° 22' 10"W	65.0000	26.84	15.91	20+73.53	21+01.86
C44	26.89	25.62	N65° 22' 10"W	55.0000	24.65	13.90	21+27.05	21+52.68
C45	20.21	24.69	N72° 52' 10"W	70.0000	23.19	14.15	21+77.63	22+02.32
C46	40.50	28.27	N87° 52' 10"W	40.0000	27.70	14.74	22+31.43	22+59.70
C47	28.95	20.21	N87° 52' 10"W	40.0000	19.80	10.54	22+77.43	22+97.63

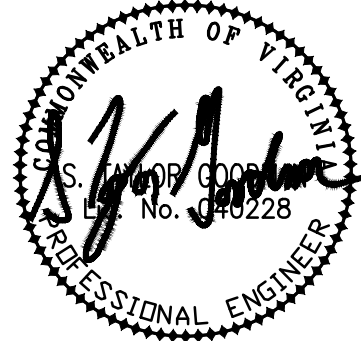


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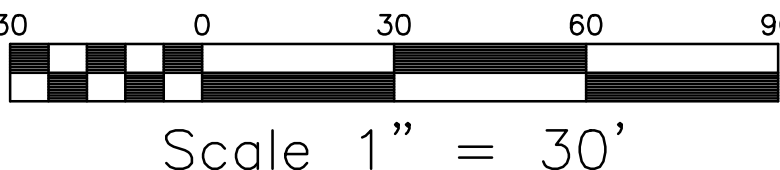
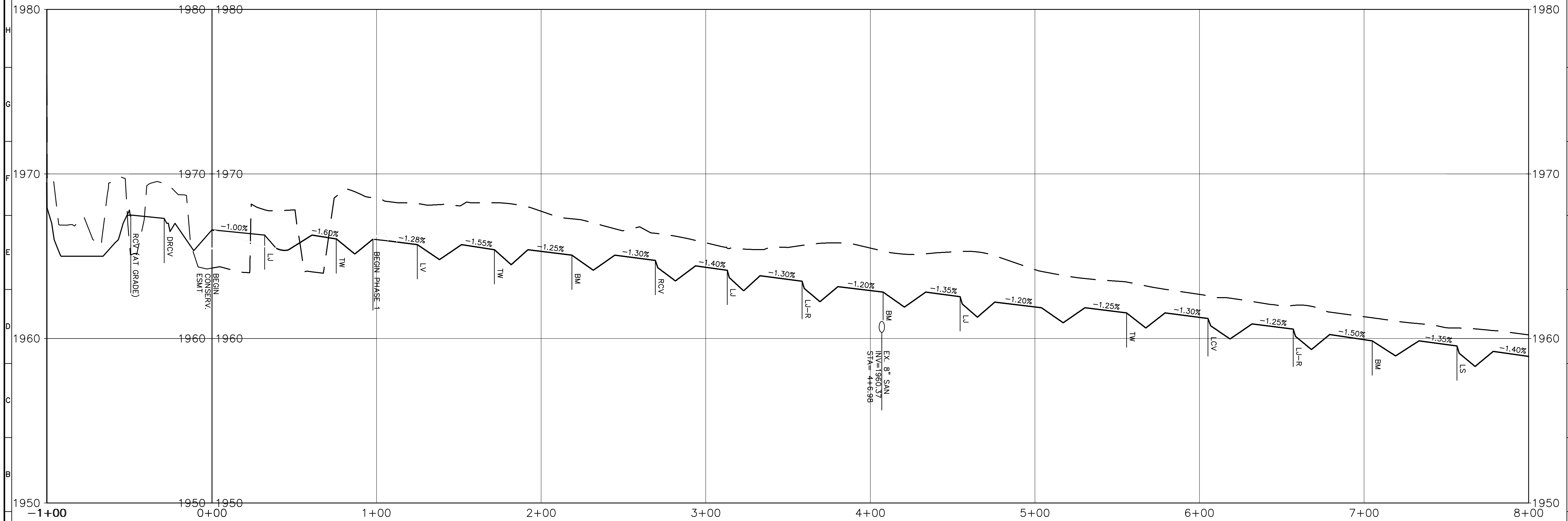
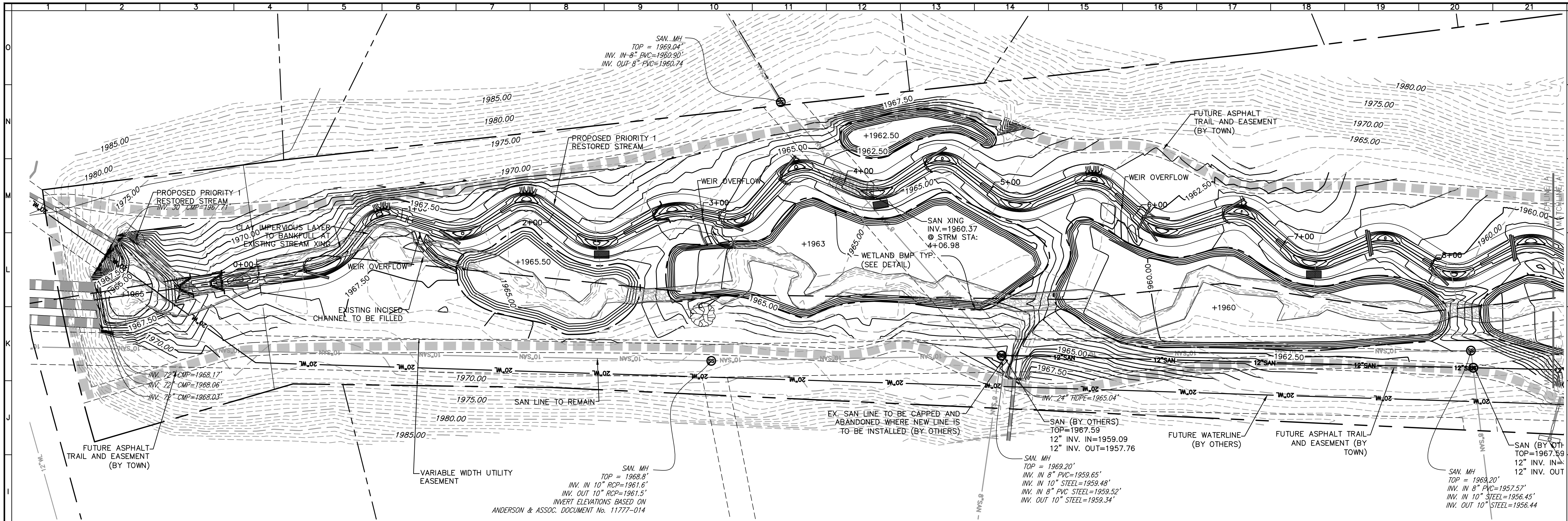
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DIAMOND HILLS PARK  
STREAM RESTORATION  
GEOMETRY PLAN  
TOWN OF CHRISTIANSBURG, VIRGINIA

DRAWN BY STG  
DESIGNED BY WKM  
CHECKED BY STG/BW  
DATE 6-17-2011  
SCALE 1"=30'  
REVISIONS:

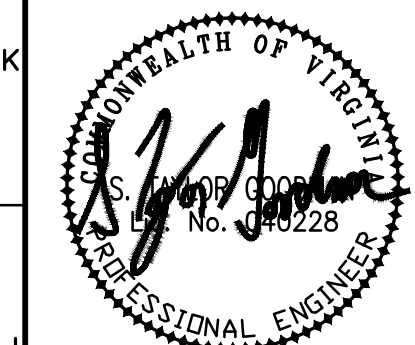




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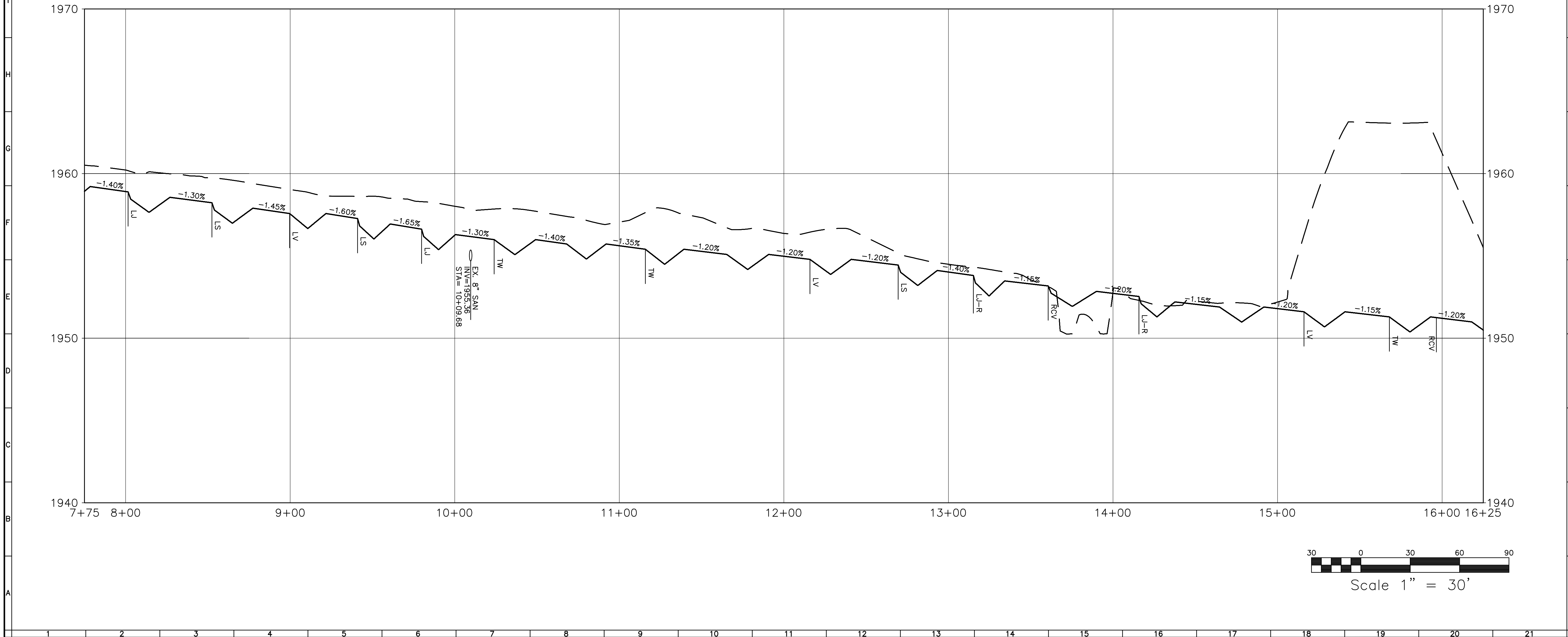
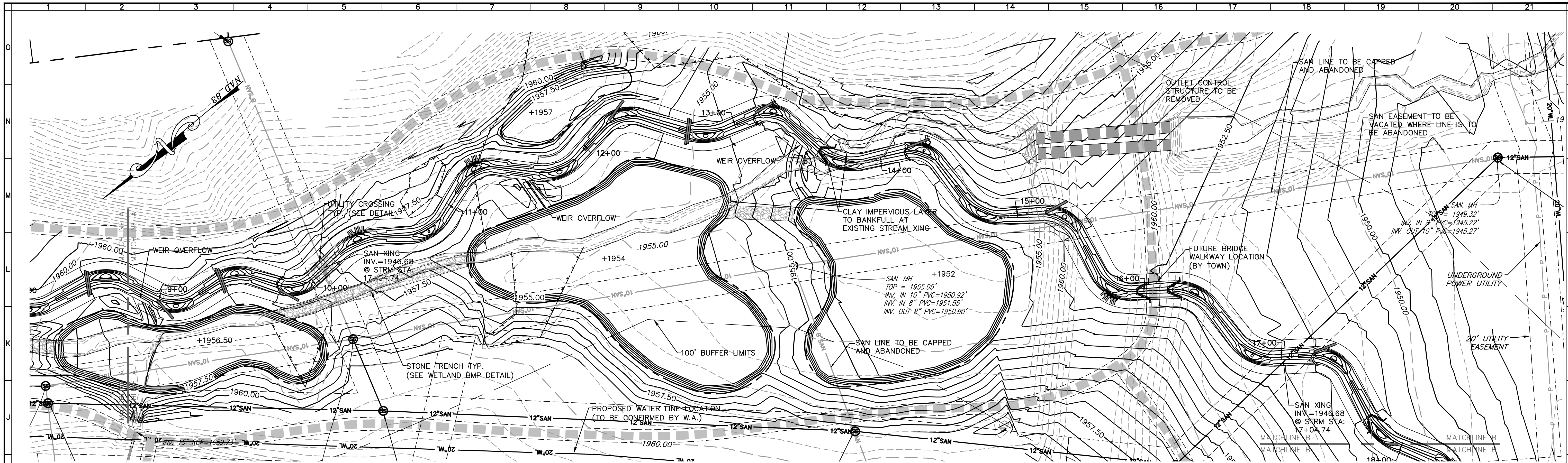
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DIAMOND HILLS PARK  
STREAM RESTORATION  
GRADING PLAN  
TOWN OF CHRISTIANBURG, VIRGINIA

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**Professional Engineer**  
No. 149228

**DIAMOND HILLS PARK**  
STREAM RESTORATION  
GRADING PLAN

TOWN OF CHRISTIANSBURG, VIRGINIA

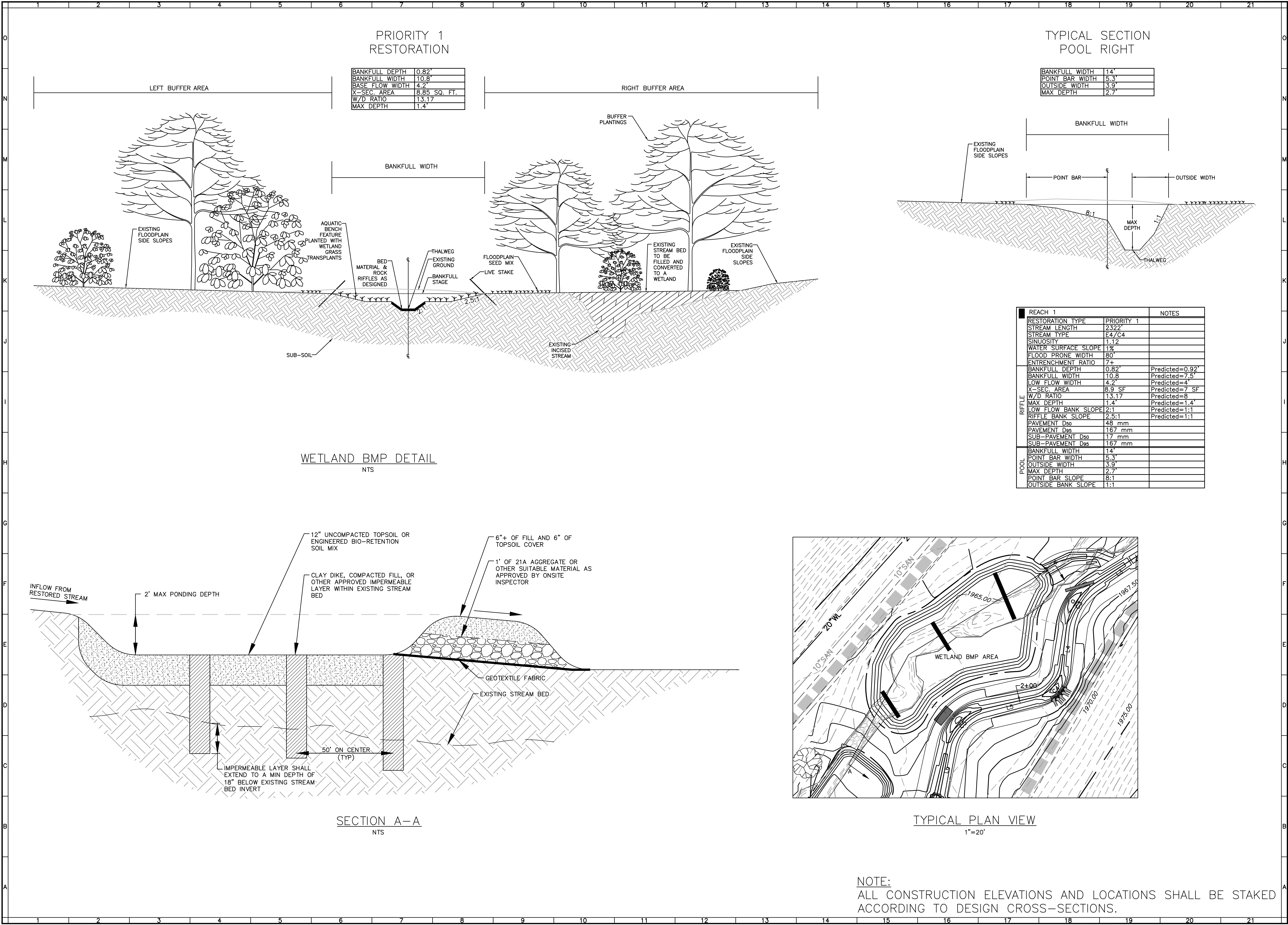
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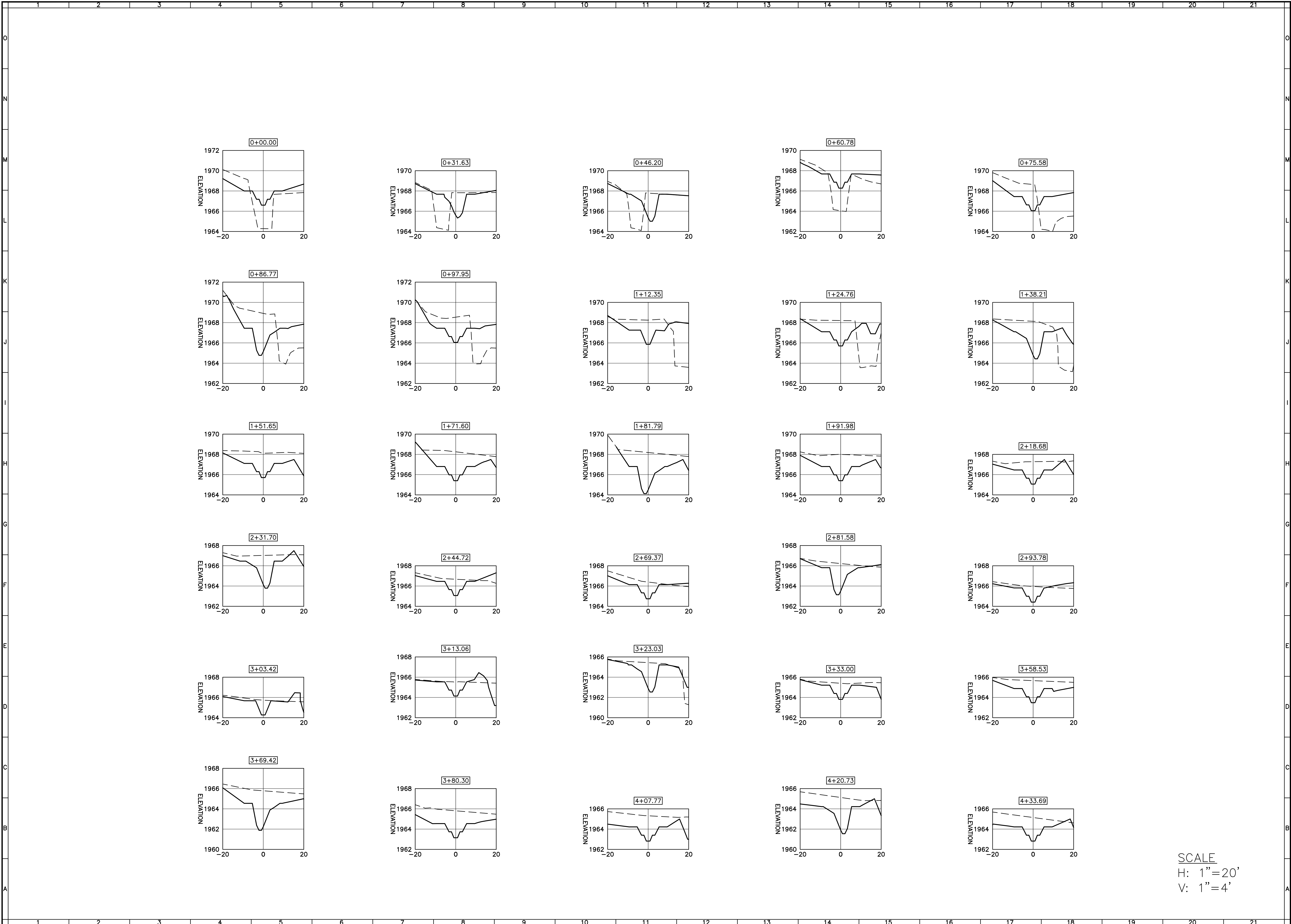
**PROFESSIONAL ENGINEER**  
No. 040228

**DIAMOND HILLS PARK**  
STREAM RESTORATION  
TYPICAL CROSS SECTION  
TOWN OF CHRISTIANSBURG, VIRGINIA

DRAWN BY STG  
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DATE 6-17-2011  
SCALE AS NOTED  
REVISIONS:

SHEET NO.  
**8 of 23**  
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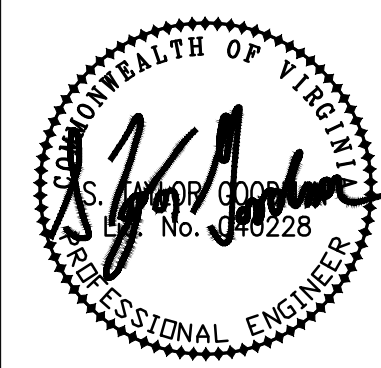
SCALE  
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V: 1"=4'



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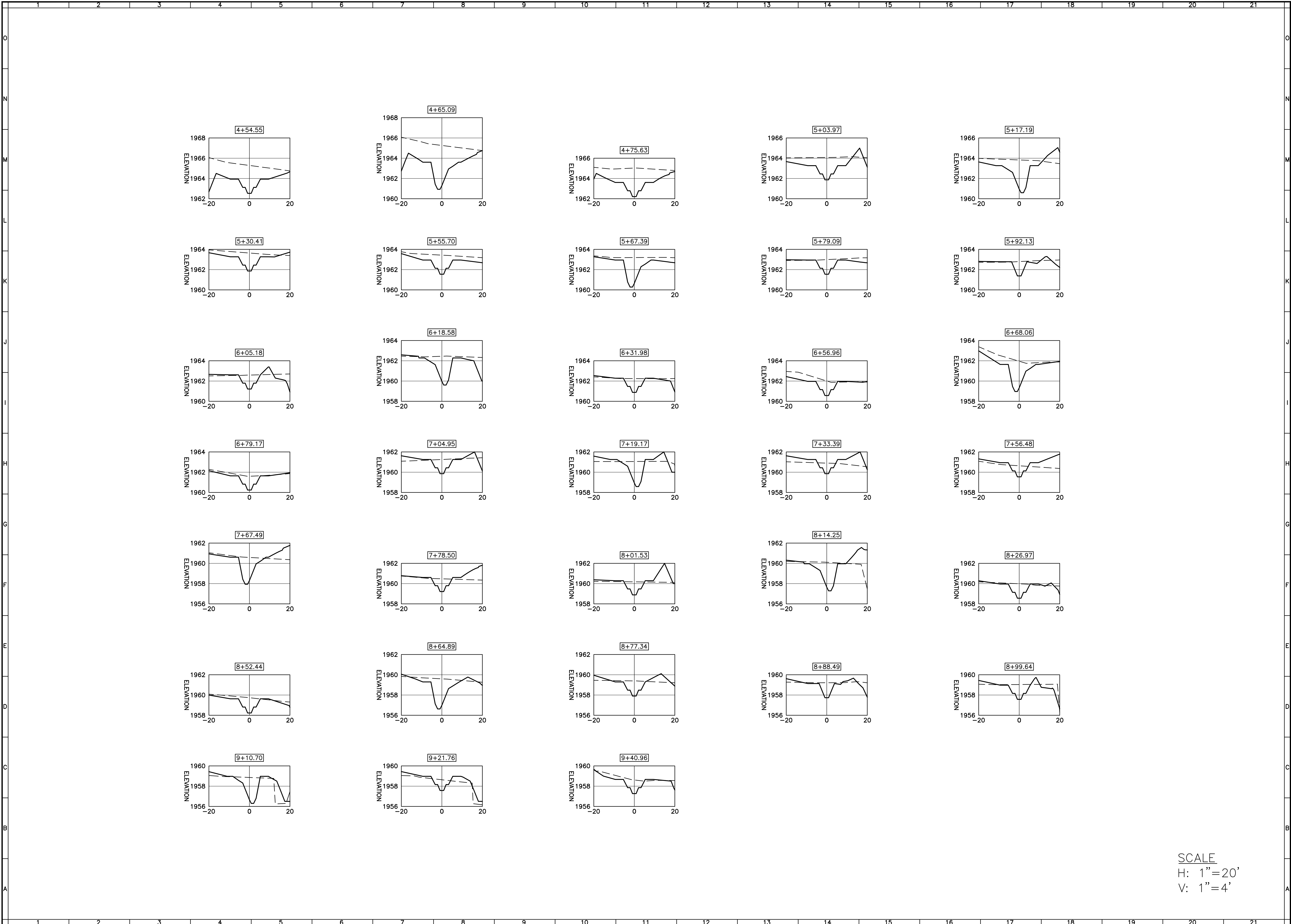
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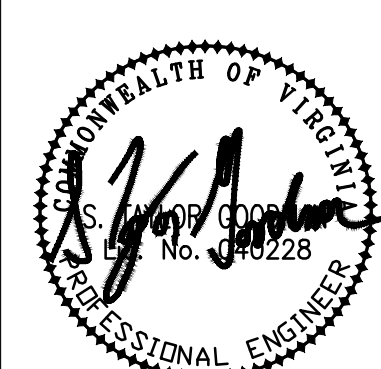


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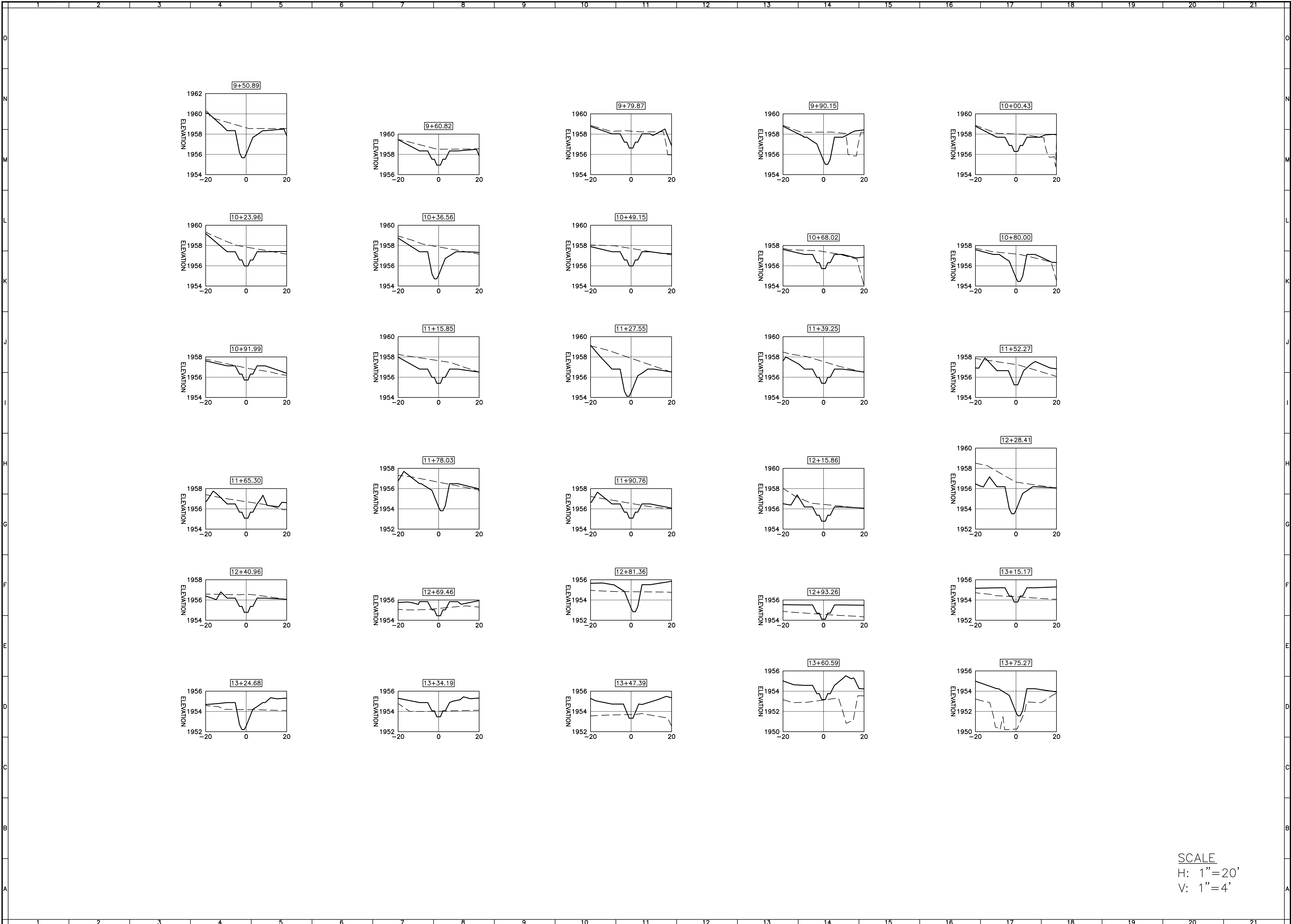
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REVISIONS:

SCALE  
H: 1"=20'  
V: 1"=4'

SHEET NO.  
**10 of 23**  
JOB NO. B1000031.00



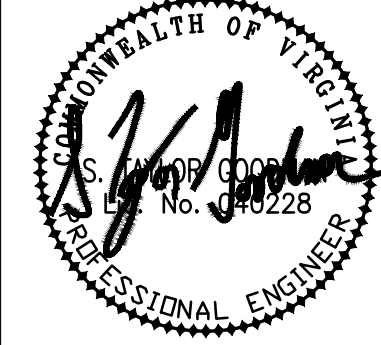


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DIAMOND HILLS PARK  
STREAM RESTORATION  
DESIGN CROSS SECTIONS

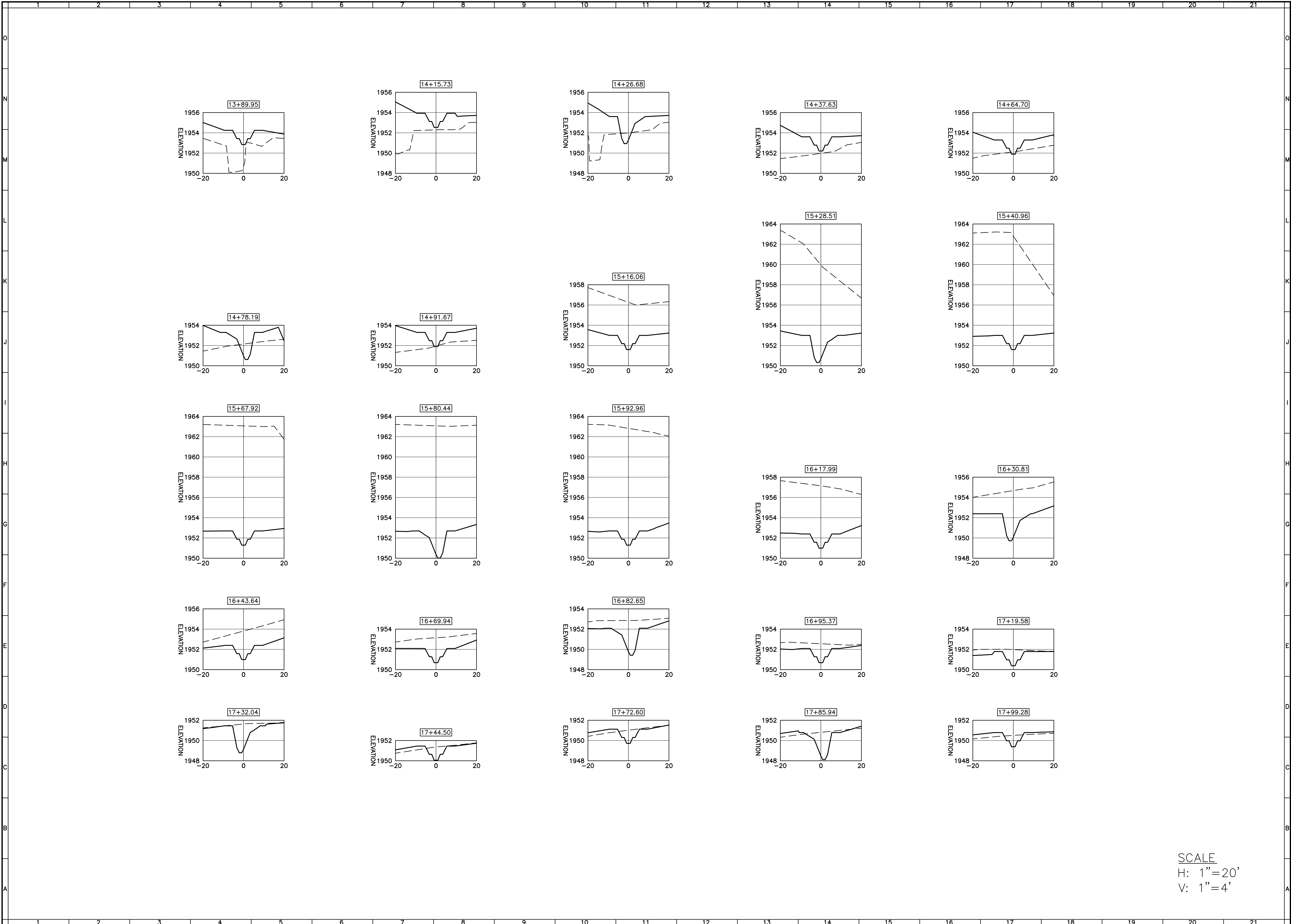
TOWN OF CHRISTIANSBURG, VIRGINIA

DRAWN BY STG  
DESIGNED BY WKM  
CHECKED BY STG/BW  
DATE 6-17-2011  
SCALE 1"=20'  
REVISIONS:

SHEET NO.  
**11 of 23**

JOB NO. B1000031.00

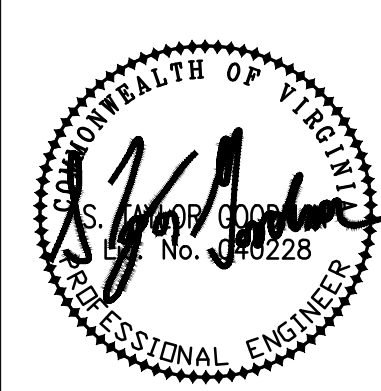
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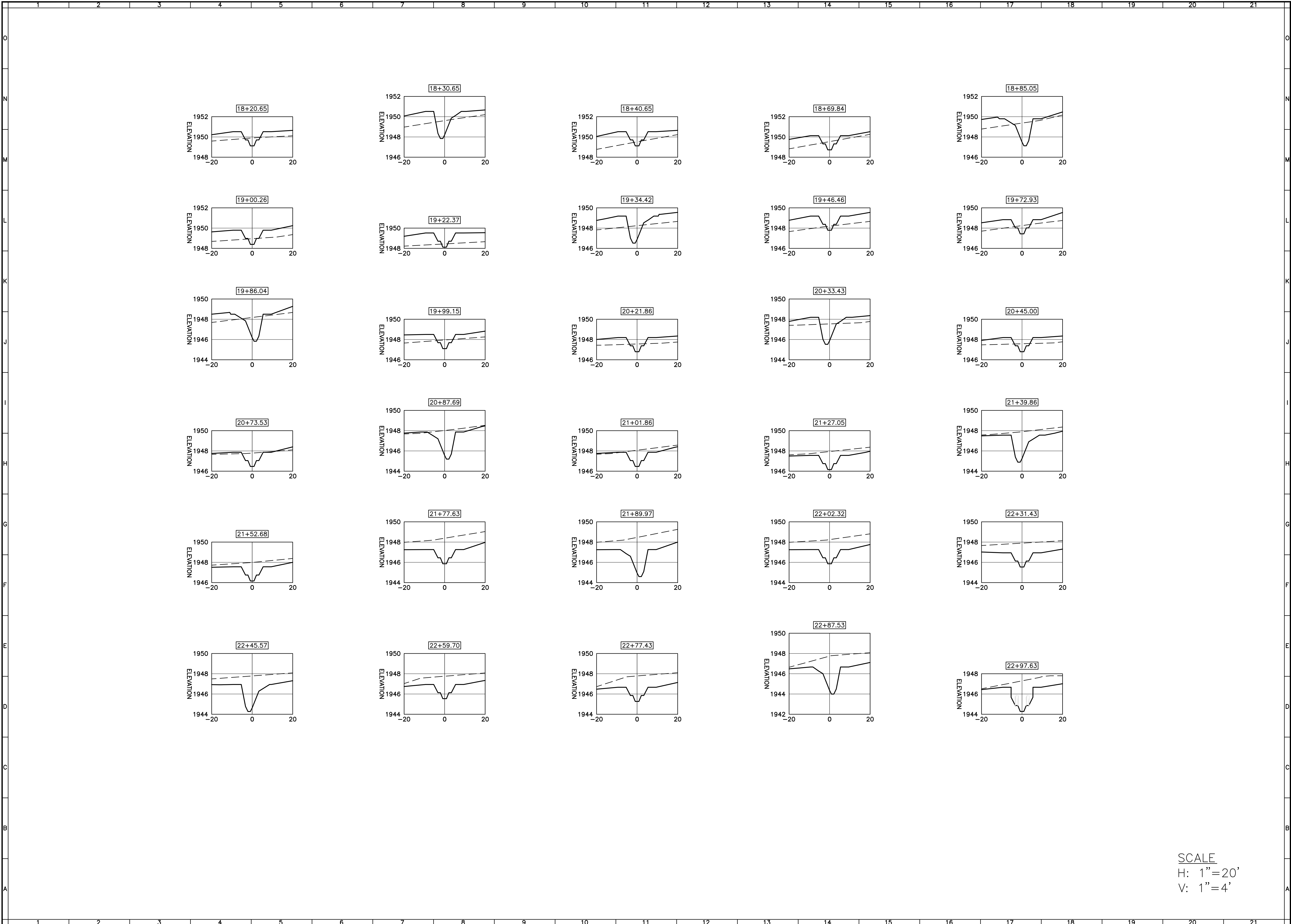


DIAMOND HILLS PARK  
STREAM RESTORATION  
DESIGN CROSS SECTIONS  
TOWN OF CHRISTIANSBURG, VIRGINIA

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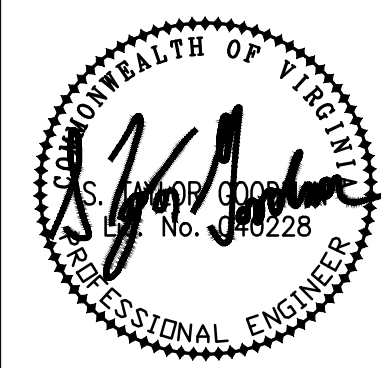




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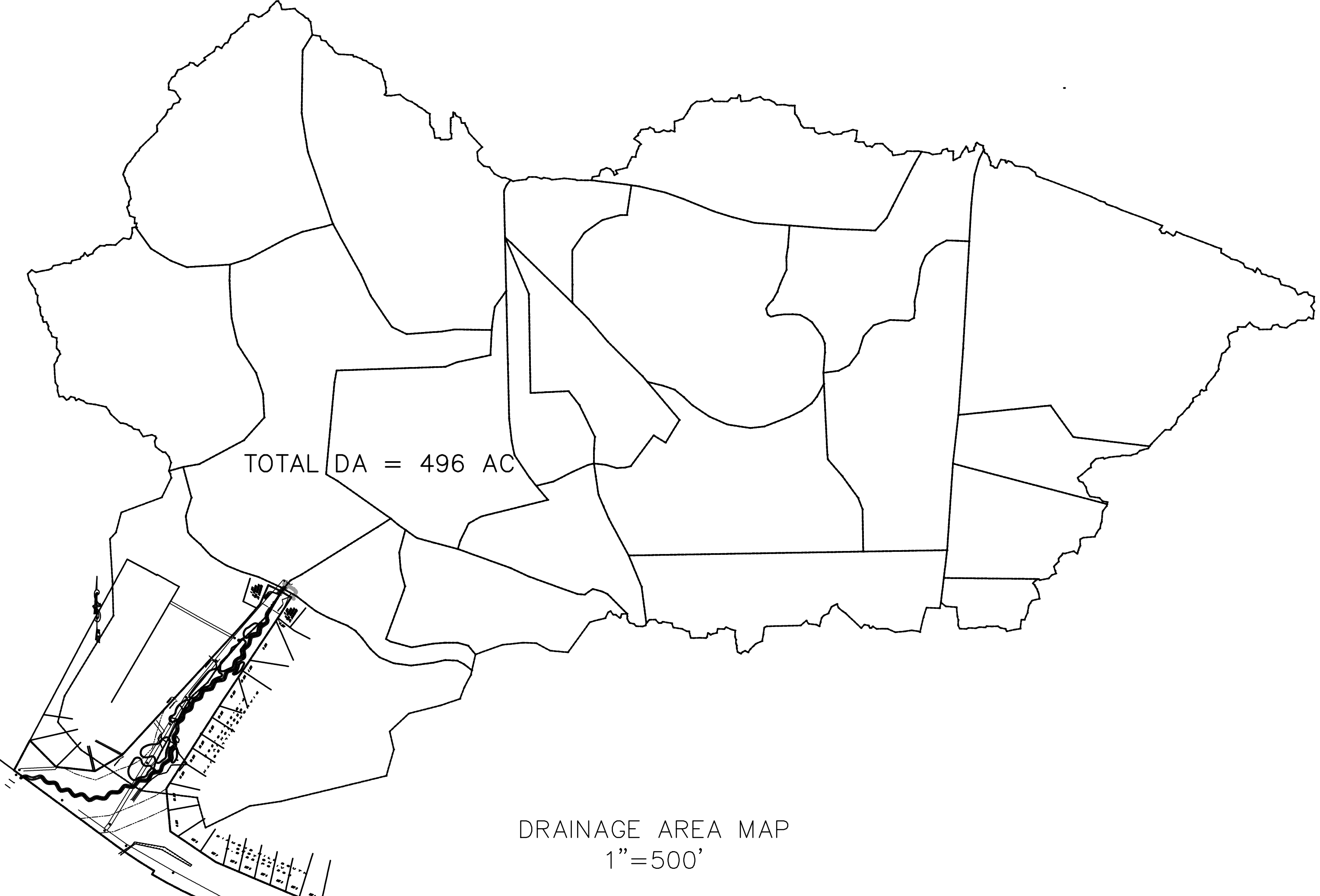
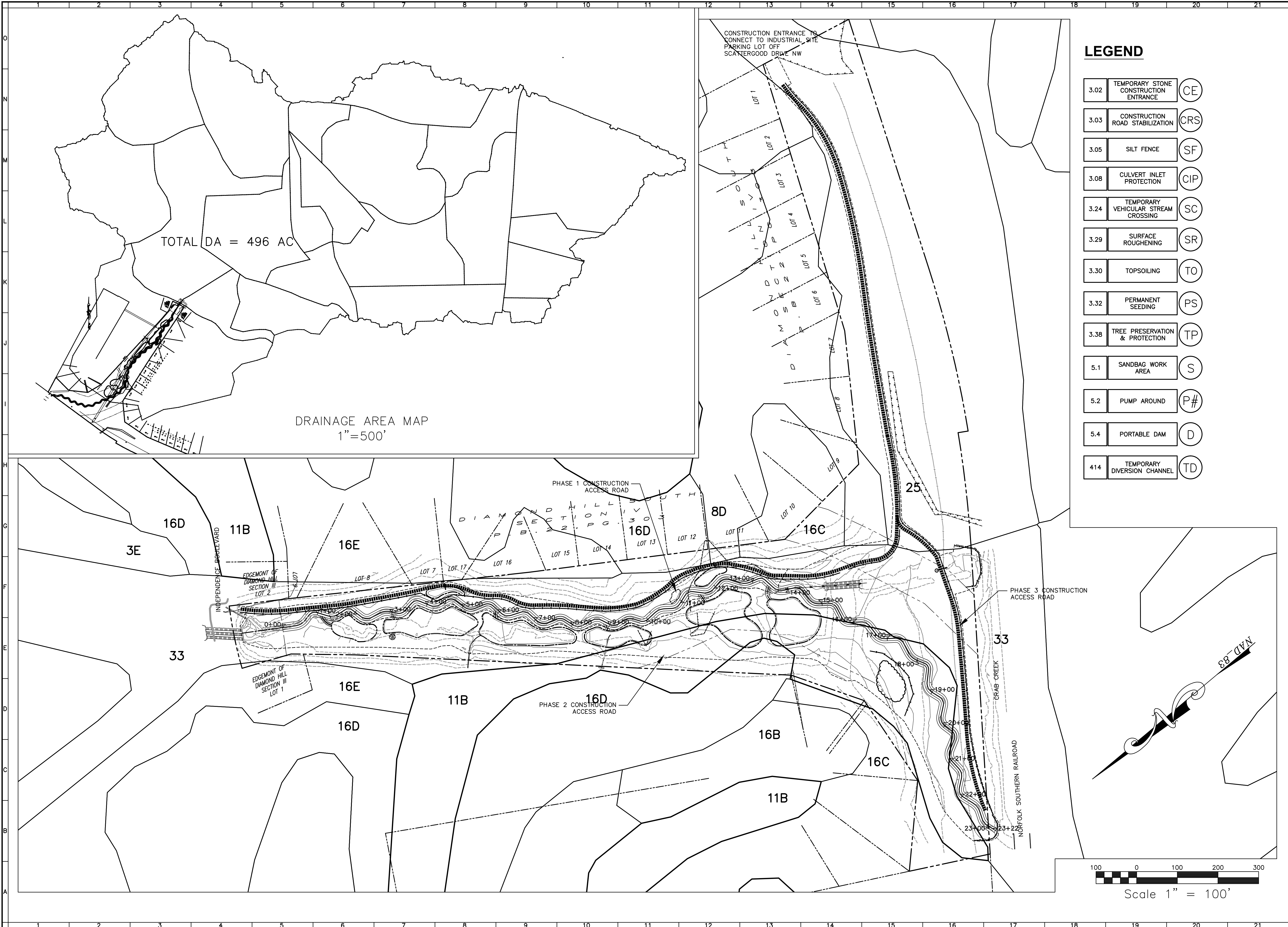
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**DIAMOND HILLS PARK**  
STREAM RESTORATION  
DESIGN CROSS SECTIONS  
TOWN OF CHRISTIANSBURG, VIRGINIA

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DATE 6-17-2011  
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REVISIONS:

SCALE  
H: 1"=20'  
V: 1"=4'



LEGEND		
3.02	TEMPORARY STONE CONSTRUCTION ENTRANCE	CE
3.03	CONSTRUCTION ROAD STABILIZATION	CRS
3.05	SILT FENCE	SF
3.08	CULVERT INLET PROTECTION	CIP
3.24	TEMPORARY VEHICULAR STREAM CROSSING	SC
3.29	SURFACE ROUGHENING	SR
3.30	TOPSOILING	TO
3.32	PERMANENT SEEDING	PS
3.38	TREE PRESERVATION & PROTECTION	TP
5.1	SANDBAG WORK AREA	S
5.2	PUMP AROUND	P#
5.4	PORTABLE DAM	D
414	TEMPORARY DIVERSION CHANNEL	TD

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No. 49228

DIAMOND HILLS PARK  
STREAM RESTORATION  
EROSION CONTROL PLAN

TOWN OF CHRISTIANBURG, VIRGINIA

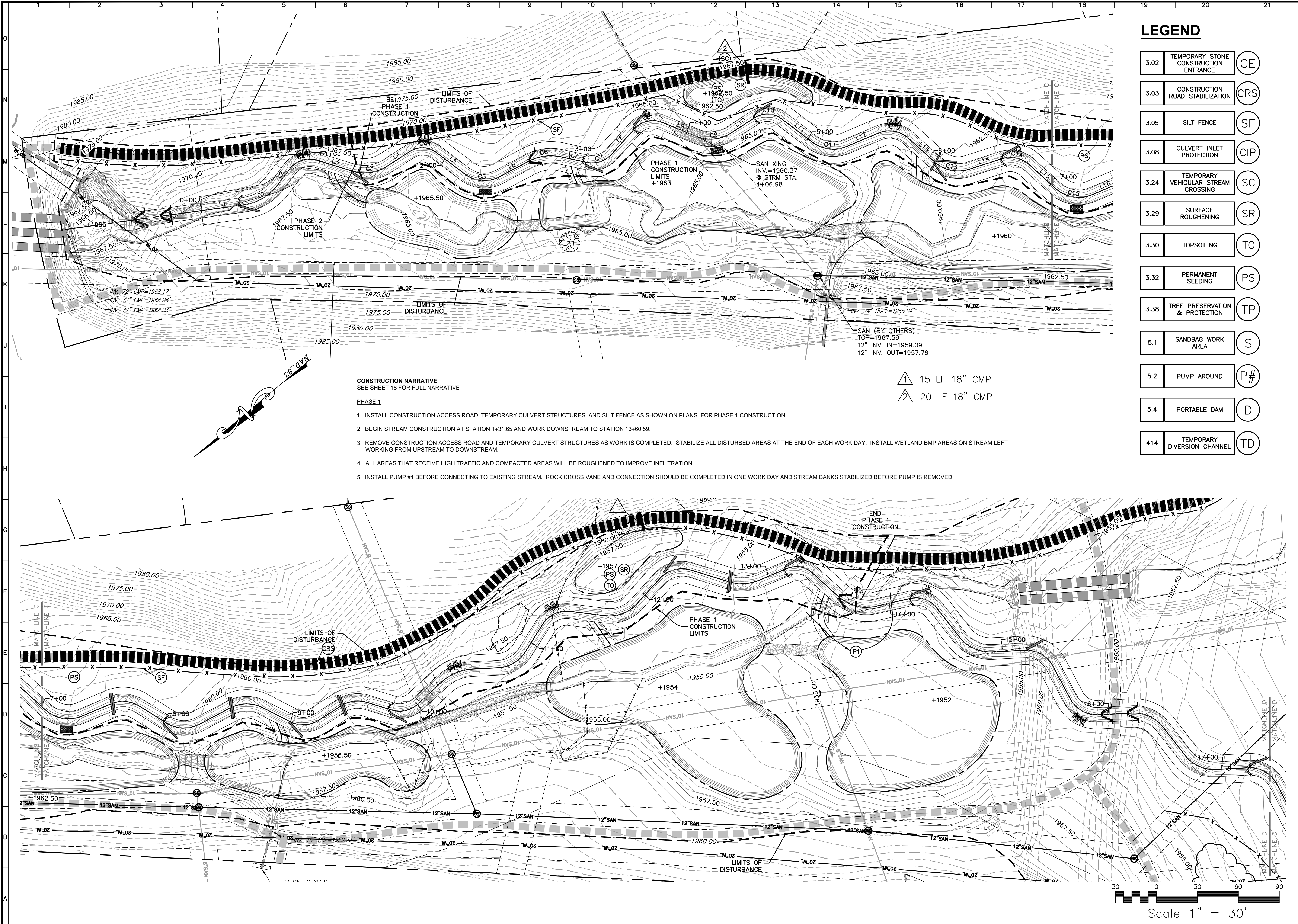
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DATE 6-17-2011  
SCALE 1"=100'

REVISIONS:

SHEET NO.  
14 of 23

JOB NO. B1000031.00





LEGEND

3.02	TEMPORARY STONE CONSTRUCTION ENTRANCE	(CE)
3.03	CONSTRUCTION ROAD STABILIZATION	(CRS)
3.05	SILT FENCE	(SF)
3.08	CULVERT INLET PROTECTION	(CIP)
3.24	TEMPORARY VEHICULAR STREAM CROSSING	(SC)
3.29	SURFACE ROUGHENING	(SR)
3.30	TOPSOILING	(TO)
3.32	PERMANENT SEEDING	(PS)
3.38	TREE PRESERVATION & PROTECTION	(TP)
5.1	SANDBAG WORK AREA	(S)
5.2	PUMP AROUND	(P#)
5.4	PORTABLE DAM	(D)
414	TEMPORARY DIVERSION CHANNEL	(TD)

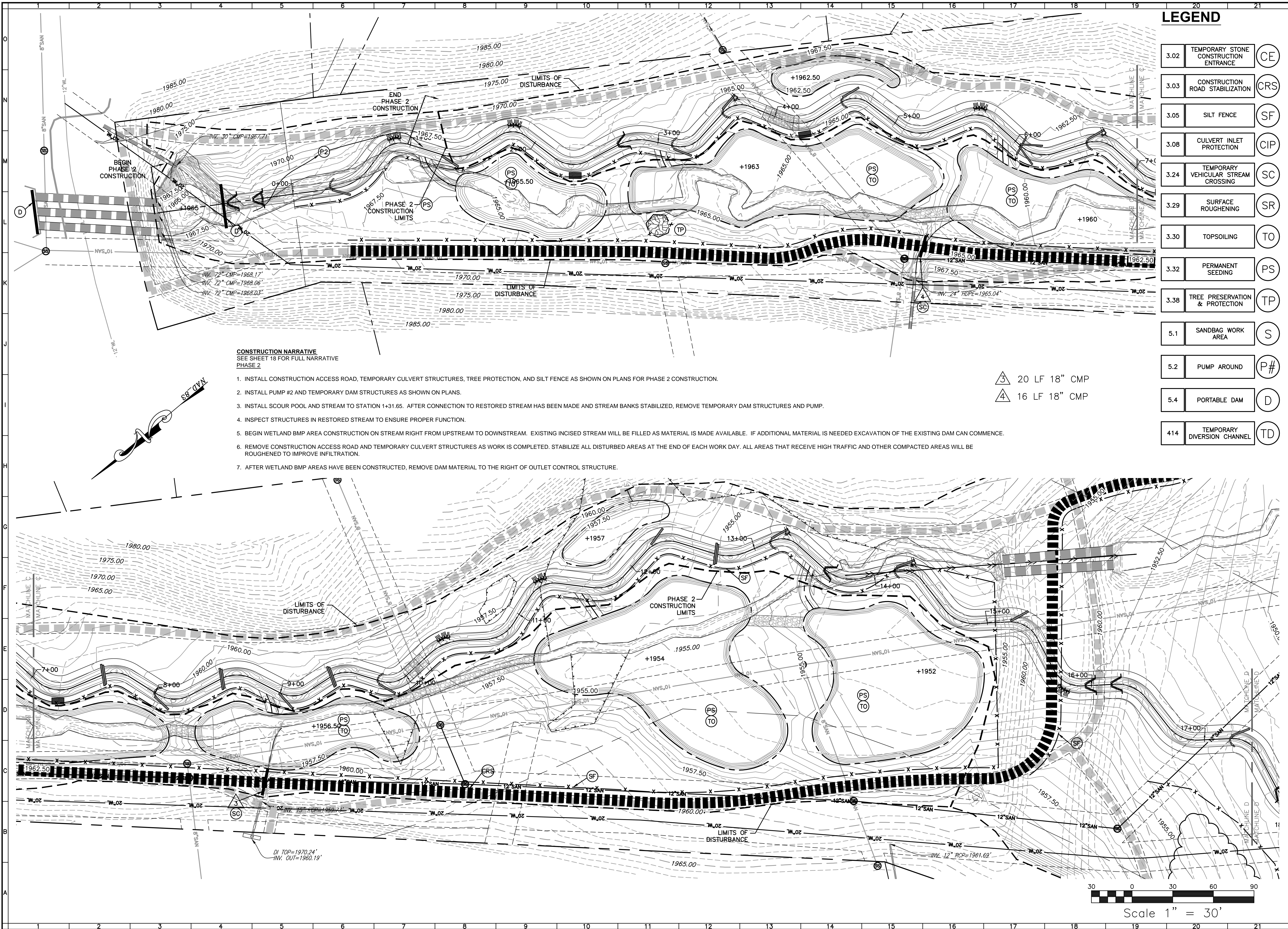
CONSTRUCTION NARRATIVE  
SEE SHEET 18 FOR FULL NARRATIVE

PHASE 1

1. INSTALL CONSTRUCTION ACCESS ROAD, TEMPORARY CULVERT STRUCTURES, AND SILT FENCE AS SHOWN ON PLANS FOR PHASE 1 CONSTRUCTION.
2. BEGIN STREAM CONSTRUCTION AT STATION 1+31.65 AND WORK DOWNSTREAM TO STATION 13+60.59.
3. REMOVE CONSTRUCTION ACCESS ROAD AND TEMPORARY CULVERT STRUCTURES AS WORK IS COMPLETED. STABILIZE ALL DISTURBED AREAS AT THE END OF EACH WORK DAY. INSTALL WETLAND BMP AREAS ON STREAM LEFT WORKING FROM UPSTREAM TO DOWNSTREAM.
4. ALL AREAS THAT RECEIVE HIGH TRAFFIC AND COMPACTED AREAS WILL BE ROUGHENED TO IMPROVE INFILTRATION.
5. INSTALL PUMP #1 BEFORE CONNECTING TO EXISTING STREAM. ROCK CROSS VANE AND CONNECTION SHOULD BE COMPLETED IN ONE WORK DAY AND STREAM BANKS STABILIZED BEFORE PUMP IS REMOVED.

- 15 LF 18" CMP  
20 LF 18" CMP





- CONSTRUCTION NARRATIVE**  
SEE SHEET 18 FOR FULL NARRATIVE  
**PHASE 2**
1. INSTALL CONSTRUCTION ACCESS ROAD, TEMPORARY CULVERT STRUCTURES, TREE PROTECTION, AND SILT FENCE AS SHOWN ON PLANS FOR PHASE 2 CONSTRUCTION.
  2. INSTALL PUMP #2 AND TEMPORARY DAM STRUCTURES AS SHOWN ON PLANS.
  3. INSTALL SCOUR POOL AND STREAM TO STATION 1+31.65. AFTER CONNECTION TO RESTORED STREAM HAS BEEN MADE AND STREAM BANKS STABILIZED, REMOVE TEMPORARY DAM STRUCTURES AND PUMP.
  4. INSPECT STRUCTURES IN RESTORED STREAM TO ENSURE PROPER FUNCTION.
  5. BEGIN WETLAND BMP AREA CONSTRUCTION ON STREAM RIGHT FROM UPSTREAM TO DOWNSTREAM. EXISTING INCISED STREAM WILL BE FILLED AS MATERIAL IS MADE AVAILABLE. IF ADDITIONAL MATERIAL IS NEEDED EXCAVATION OF THE EXISTING DAM CAN COMMENCE.
  6. REMOVE CONSTRUCTION ACCESS ROAD AND TEMPORARY CULVERT STRUCTURES AS WORK IS COMPLETED. STABILIZE ALL DISTURBED AREAS AT THE END OF EACH WORK DAY. ALL AREAS THAT RECEIVE HIGH TRAFFIC AND OTHER COMPACTED AREAS WILL BE ROUGHENED TO IMPROVE INFILTRATION.
  7. AFTER WETLAND BMP AREAS HAVE BEEN CONSTRUCTED, REMOVE DAM MATERIAL TO THE RIGHT OF OUTLET CONTROL STRUCTURE.

LEGEND		
3.02	TEMPORARY STONE CONSTRUCTION ENTRANCE	CE
3.03	CONSTRUCTION ROAD STABILIZATION	CRS
3.05	SILT FENCE	SF
3.08	CULVERT INLET PROTECTION	CIP
3.24	TEMPORARY VEHICULAR STREAM CROSSING	SC
3.29	SURFACE ROUGHENING	SR
3.30	TOPSOILING	TO
3.32	PERMANENT SEEDING	PS
3.38	TREE PRESERVATION & PROTECTION	TP
5.1	SANDBAG WORK AREA	S
5.2	PUMP AROUND	P#
5.4	PORTABLE DAM	D
414	TEMPORARY DIVERSION CHANNEL	TD

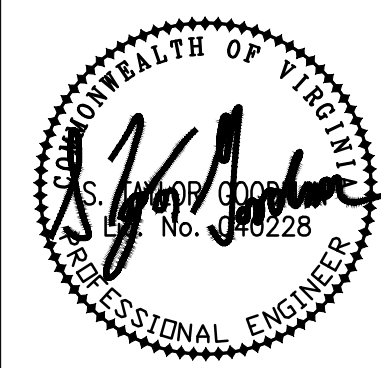
3 20 LF 18" CMP  
4 16 LF 18" CMP



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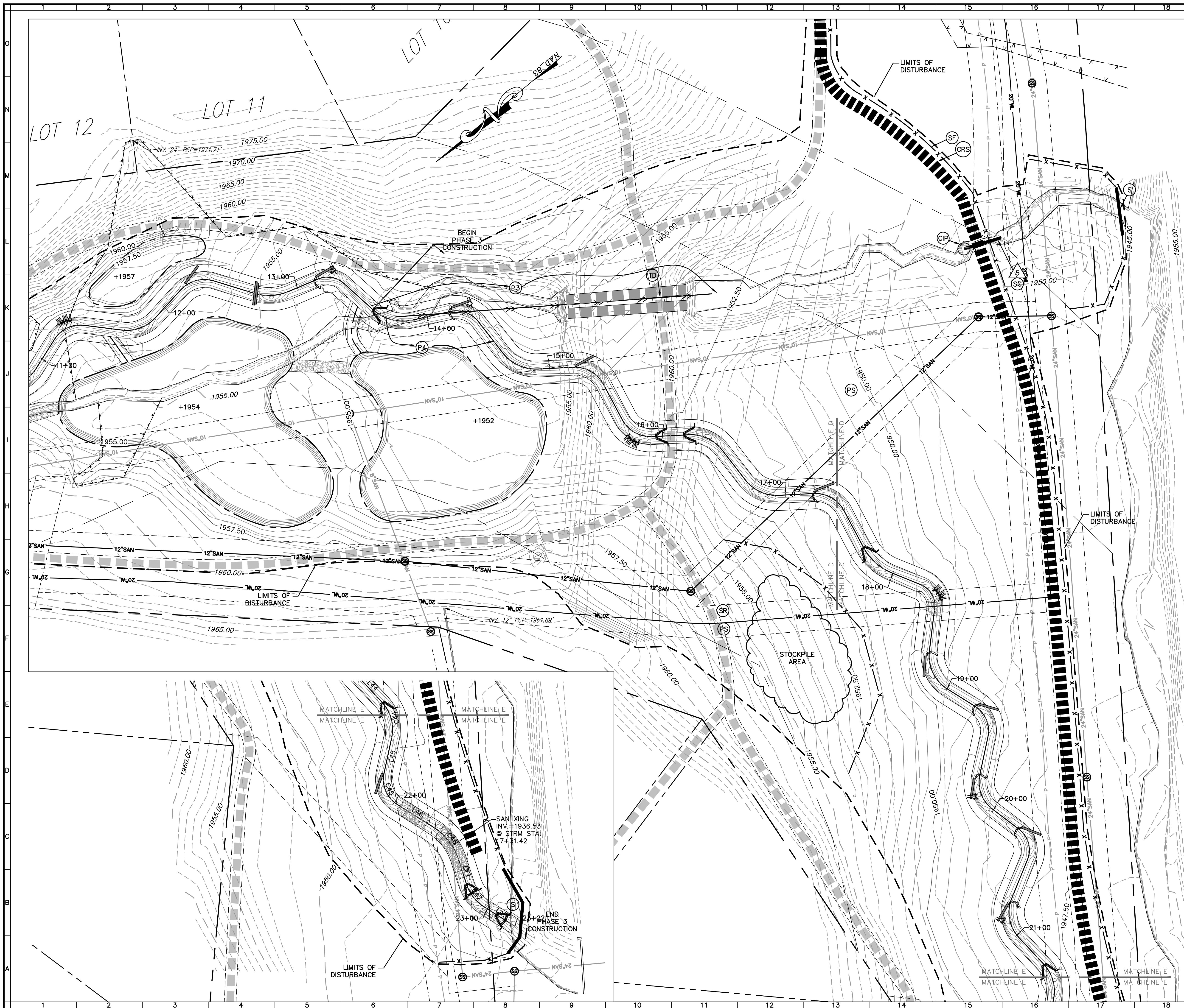
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**DIAMOND HILLS PARK**  
STREAM RESTORATION  
**PHASE 2 EROSION CONTROL PLAN**  
TOWN OF CHRISTIANSBURG, VIRGINIA

DRAWN BY STG  
DESIGNED BY WKM  
CHECKED BY STG/BW  
DATE 6-17-2011  
SCALE 1"=30'  
REVISIONS:



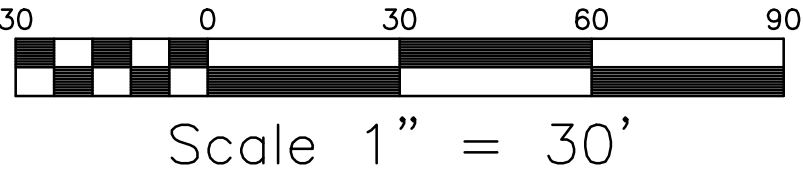


LEGEND

3.02	TEMPORARY STONE CONSTRUCTION ENTRANCE	CE
3.03	CONSTRUCTION ROAD STABILIZATION	CRS
3.05	SILT FENCE	SF
3.08	CULVERT INLET PROTECTION	CIP
3.24	TEMPORARY VEHICULAR STREAM CROSSING	SC
3.29	SURFACE ROUGHENING	SR
3.30	TOPSOILING	TO
3.32	PERMANENT SEEDING	PS
3.38	TREE PRESERVATION & PROTECTION	TP
5.1	SANDBAG WORK AREA	S
5.2	PUMP AROUND	P#
5.4	PORTABLE DAM	D
414	TEMPORARY DIVERSION CHANNEL	TD

- CONSTRUCTION NARRATIVE**  
SEE SHEET 18 FOR FULL NARRATIVE  
PHASE 3
1. INSTALL CONSTRUCTION ACCESS ROAD, TEMPORARY CULVERT STRUCTURES, CULVERT INLET PROTECTION, AND SILT FENCE AS SHOWN ON PLANS FOR PHASE 3 CONSTRUCTION.
  2. INSTALL PUMP #3 AND REMOVE OUTLET CONTROL STRUCTURE AND REMAINING DAM MATERIAL.
  3. INSTALL DIVERSION AND REMOVE PUMP #3 AFTER AREA IS STABILIZED.
  4. BEGIN STREAM CONSTRUCTION FROM STATION 13+89.95 TO CONFLUENCE WITH CRAB CREEK WORKING FROM UPSTREAM TO DOWNSTREAM. INSTALL TEMPORARY DAM, DIVERSION, AND DEWATERING PUMP AS NECESSARY TO CONNECT TO EXISTING CRAB CREEK.
  5. INSTALL PUMP #4 AND BEGIN STREAM CONSTRUCTION FROM STATION 13+60.59 TO 13+89.95.
  6. REMOVE PUMP #4 AND DIVERSION AFTER RESTORED STREAM IS STABILIZED AND UPSTREAM AND DOWNSTREAM CONNECTIONS ARE COMPLETE.
  7. FILL IN EXISTING STREAM BELOW CONNECTION POINT AND COMPLETE GRADING.
  8. REMOVE CONSTRUCTION ACCESS ROAD AND TEMPORARY EC MEASURES UPON PERMANENT STABILIZATION OF SITE.
  9. INSTALL STREAM BUFFER PLANTINGS AS SHOWN ON PLANS.
  10. UPON COMPLETION OF THE PROJECT AND APPROVAL BY THE PROJECT ENGINEER AND REGULATORY OFFICIALS THE AREA MUST BE RESTORED TO ITS ORIGINAL CONDITION. ALL SILT FENCES ARE TO BE REMOVED FROM THE SITE, UNLESS OTHERWISE DIRECTED BY THE PROJECT ENGINEER OR LOCAL COUNTY OFFICIAL.

EX. 30" CMP TO BE REPLACED IF NECESSARY



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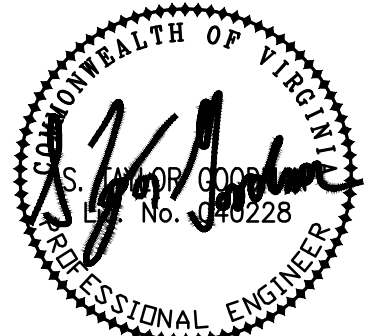
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DIAMOND HILLS PARK

STREAM RESTORATION

PHASE 3 EROSION CONTROL PLAN

TOWN OF CHRISTIANSBURG, VIRGINIA

DRAWN BY STG

DESIGNED BY WKM

CHECKED BY STG/BW

DATE 6-17-2011

SCALE 1"=30'

REVISIONS:

SHEET NO.

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JOB NO. B1000031.00



## Construction Narrative

- \*CONSTRUCTION SHALL FOLLOW THE ORDER OF CONSTRUCTION PHASES AS SHOWN ON THE PLAN.
- \*ALL GRADING AND DISTURBED AREAS SHALL BE STABILIZED PRIOR TO THE END OF CONSTRUCTION EACH DAY.
- \*VEGETATION AND STABILIZATION SHALL BE STABLE BEFORE RELEASE OF STREAM FLOW INTO THE RESTORED CHANNEL.
- \*ALL CONSTRUCTION SHALL BE IN THE DRY WHEREVER POSSIBLE.
- \*ALL STREAM CONSTRUCTION SHALL COMMENCE FROM THE UPSTREAM TO DOWNSTREAM DIRECTION UNLESS SPECIFICALLY ADDRESSED.
- \*NEW CHANNEL SECTIONS SHALL BE CONNECTED TO DOWNSTREAM EXISTING CHANNEL PRIOR TO RELEASE OF STREAM FLOW TO THE NEW CHANNEL. AN IMPERVIOUS DIKE SHALL BE IN PLACE AT THE UPSTREAM CONNECTION TO RESTORED OR EXISTING CHANNEL TO PREVENT STREAM FLOW UNTIL DOWNSTREAM CONNECTION IS MADE.
- \*STREAM BANK PLANTINGS SHALL BE INSTALLED AS RESTORED STREAM IS CONSTRUCTED UNLESS OTHERWISE SPECIFIED.
- \*CONTACT "MISS UTILITY" AT LEAST 3 DAYS PRIOR TO BEGINNING WORK.
- \*COORDINATE WORK WITHIN SANITARY SEWER EASEMENTS WITH THE TOWN OF CHRISTIANSBURG DEPARTMENT OF PUBLIC WORKS.
- \*EQUIPMENT WORK SHALL BE DONE FROM TOP OF BANK WHEREVER POSSIBLE.
- \*ALL ELEVATIONS ARE FINISHED GRADES; CONTRACTOR SHOULD EXCAVATE BELOW FINISHED GRADE ELEVATIONS TO PLACE BASE MATERIAL OR RIFFLE MATERIAL AS APPROPRIATE.
- PRIOR TO BEGINNING CONSTRUCTION, AN ONSITE PRE-CONSTRUCTION MEETING SHALL BE HELD. TOWN OFFICIALS, THE ENGINEER, AND CONTRACTOR MUST ATTEND. APPROPRIATE OFFICIALS MUST RECEIVE 48 HOURS NOTICE PRIOR TO SCHEDULING.
  - THE CONTRACTOR IS TO NOTIFY THE TOWN OFFICE OR APPROPRIATE REGULATORY OFFICIAL 48 HOURS PRIOR TO COMMENCING WITH LAND DISTURBANCE ACTIVITIES.
  - CLEAR ENTRANCE AND INSTALL GRAVEL CONSTRUCTION ENTRANCE AS SHOWN. ALL CONSTRUCTION TRAFFIC SHALL ENTER AND EXIT THE SITE VIA SITE CONSTRUCTION ENTRANCE ONLY. DURING WET WEATHER CONDITIONS, DRIVERS OF CONSTRUCTION VEHICLES SHALL BE REQUIRED TO WASH THEIR WHEELS BEFORE ENTERING HIGHWAY.
  - CLEAR / GRUB STREAM REACH CORRIDOR AS MINIMALLY AS NEEDED FOR THE DAY'S ACCESS AND CONSTRUCTION. STUMPS AND OTHER WOODY MATERIAL GRUBBED ON SITE SHALL BE USED FOR STRUCTURES IF APPROPRIATE, GROUND INTO MULCH FOR LATER USE, USED AS RIPARIAN WOODY MATERIAL, OR REMOVED TO AN APPROVED DISPOSAL SITE AS DIRECTED BY SITE INSPECTOR
  - STOCKPILE SOIL AT LOCATIONS SHOWN ON THE PLAN. SEPARATE TOPSOIL, SUITABLE FILL MATERIAL AND UNSUITABLE FILL MATERIAL.
  - ALL VEGETATIVE AND STRUCTURAL EROSION AND SEDIMENT CONTROL PRACTICES SHALL BE CONSTRUCTED AND MAINTAINED ACCORDING TO MINIMUM STANDARDS AND SPECIFICATIONS OF THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK AND VIRGINIA REGULATION VR 625-02-00 OR THE VIRGINIA STREAM RESTORATION AND STABILIZATION BEST MANAGEMENT PRACTICES GUIDE.
  - ALL DISTURBED AREAS ARE TO DRAIN TO APPROVED SEDIMENT CONTROL MEASURES AT ALL TIMES DURING LAND DISTURBING ACTIVITIES UNTIL FINAL STABILIZATION IS ACHIEVED.
  - THOSE AREAS BROUGHT TO FINISHED GRADE SHALL BE STABILIZED BY TOPSOILING, MATTING, PERMANENT SEEDING AND MULCHING.
  - THE CONTRACTOR SHALL INSPECT ALL EROSION CONTROL MEASURES PERIODICALLY AND AFTER EACH RUNOFF PRODUCING RAINFALL EVENT. ANY NECESSARY REPAIRS OR CLEANUP TO MAINTAIN THE EFFECTIVENESS OF THE EROSION CONTROL DEVICES SHALL BE MADE IMMEDIATELY.
  - THE CONTRACTOR IS RESPONSIBLE FOR THE INSTALLATION OF ADDITIONAL EROSION CONTROL MEASURES NECESSARY TO PREVENT EROSION AND SEDIMENTATION AS DETERMINED BY THE ENVIRONMENTAL ENGINEERING DEPARTMENT.

### PHASE 1

- INSTALL CONSTRUCTION ACCESS ROAD, TEMPORARY CULVERT STRUCTURES, AND SILT FENCE AS SHOWN ON PLANS FOR PHASE 1 CONSTRUCTION.
- BEGIN STREAM CONSTRUCTION AT STATION 1+31.65 AND WORK DOWNSTREAM TO STATION 13+60.59.
- REMOVE CONSTRUCTION ACCESS ROAD AND TEMPORARY CULVERT STRUCTURES AS WORK IS COMPLETED. STABILIZE ALL DISTURBED AREAS AT THE END OF EACH WORK DAY. INSTALL WETLAND BMP AREAS ON STREAM LEFT WORKING FROM UPSTREAM TO DOWNSTREAM.
- ALL AREAS THAT RECEIVE HIGH TRAFFIC AND COMPACTED AREAS WILL BE ROUGHENED TO IMPROVE INFILTRATION.
- INSTALL PUMP #1 BEFORE CONNECTING TO EXISTING STREAM. ROCK CROSS VANE AND CONNECTION SHOULD BE COMPLETED IN ONE WORK DAY AND STREAM BANKS STABILIZED BEFORE PUMP IS REMOVED.

### PHASE 2

- INSTALL CONSTRUCTION ACCESS ROAD, TEMPORARY CULVERT STRUCTURES, TREE PROTECTION, AND SILT FENCE AS SHOWN ON PLANS FOR PHASE 2 CONSTRUCTION.
- INSTALL PUMP #2 AND TEMPORARY DAM STRUCTURES AS SHOWN ON PLANS.
- INSTALL SCOUR POOL AND STREAM TO STATION 1+31.65. AFTER CONNECTION TO RESTORED STREAM HAS BEEN MADE AND STREAM BANKS STABILIZED, REMOVE TEMPORARY DAM STRUCTURES AND PUMP.
- INSPECT STRUCTURES IN RESTORED STREAM TO ENSURE PROPER FUNCTION.
- BEGIN WETLAND BMP AREA CONSTRUCTION ON STREAM RIGHT FROM UPSTREAM TO DOWNSTREAM. EXISTING INCISED STREAM WILL BE FILLED AS MATERIAL IS MADE AVAILABLE. IF ADDITIONAL MATERIAL IS NEEDED EXCAVATION OF THE EXISTING DAM CAN COMMENCE.
- REMOVE CONSTRUCTION ACCESS ROAD AND TEMPORARY CULVERT STRUCTURES AS WORK IS COMPLETED. STABILIZE ALL DISTURBED AREAS AT THE END OF EACH WORK DAY. ALL AREAS THAT RECEIVE HIGH TRAFFIC AND OTHER COMPACTED AREAS WILL BE ROUGHENED TO IMPROVE INFILTRATION.
- AFTER WETLAND BMP AREAS HAVE BEEN CONSTRUCTED, REMOVE DAM MATERIAL TO THE RIGHT OF OUTLET CONTROL STRUCTURE.

### PHASE 3

- INSTALL CONSTRUCTION ACCESS ROAD, TEMPORARY CULVERT STRUCTURES, CULVERT INLET PROTECTION, AND SILT FENCE AS SHOWN ON PLANS FOR PHASE 3 CONSTRUCTION.
- INSTALL PUMP #3 AND REMOVE OUTLET CONTROL STRUCTURE AND REMAINING DAM MATERIAL.
- INSTALL DIVERSION AND REMOVE PUMP #3 AFTER AREA IS STABILIZED.
- BEGIN STREAM CONSTRUCTION FROM STATION 13+89.95 TO CONFLUENCE WITH CRAB CREEK WORKING FROM UPSTREAM TO DOWNSTREAM. INSTALL TEMPORARY DAM, DIVERSION, AND DEWATERING PUMP AS NECESSARY TO CONNECT TO EXISTING CRAB CREEK.
- INSTALL PUMP #4 AND BEGIN STREAM CONSTRUCTION FROM STATION 13+60.59 TO 13+89.95.
- REMOVE PUMP #4 AND DIVERSION AFTER RESTORED STREAM IS STABILIZED AND UPSTREAM AND DOWNSTREAM CONNECTIONS ARE COMPLETE.
- FILL IN EXISTING STREAM BELOW CONNECTION POINT AND COMPLETE GRADING.
- REMOVE CONSTRUCTION ACCESS ROAD AND TEMPORARY EC MEASURES UPON PERMANENT STABILIZATION OF SITE.
- INSTALL STREAM BUFFER PLANTINGS AS SHOWN ON PLANS.
- UPON COMPLETION OF THE PROJECT AND APPROVAL BY THE PROJECT ENGINEER AND REGULATORY OFFICIALS THE AREA MUST BE RESTORED TO ITS ORIGINAL CONDITION. ALL SILT FENCES ARE TO BE REMOVED FROM THE SITE, UNLESS OTHERWISE DIRECTED BY THE PROJECT ENGINEER OR LOCAL COUNTY OFFICIAL.

## Erosion Control Narrative

- Project Description:** The purpose of this project is to restore the stream within Diamond Hills Park in the Town of Christiansburg. The stream restoration is functioning as offsite mitigation for Progress Park in Wytheville, VA. A total of 9.70 acres is to be disturbed with the construction of this project. The estimated project start date is October, 2011 and the estimated project completion is April, 2012.
- Existing Site Conditions:** The site is currently used as open space. The property is known as Diamond Hills Park and is currently owned by the Town of Christiansburg. Site topography is moderate to steep sloping with valley grades ranging from 1% to 5% and side slopes outside the floodplain ranging from 5% to 30%. All wetlands trees and buffers not scheduled to be disturbed shall be left in their natural state. 2' buffer tape shall be used to mark wetlands and buffer areas to remain undisturbed.  
The site ultimately drains to the southwest to Crab Creek. Existing channel instabilities are systemwide and include channel incision, lateral erosion, degradation, and actively migrating headcuts. No untreated discharges will occur on this site.
- Adjacent Areas:** To the north, east, and west, the project property is bounded by residential properties that are part of Edgemont of Diamond Hill or Diamond Hill subdivisions. To the south, the project property is bordered by the railroad.
- Off-site Areas:** No offsite areas shall be disturbed for this project. All surplus material shall be stored on-site for use in future phases of construction.
- Soils:**  
Soil types as designated from the NCRS SSURGO database are described below:
  - Weaver soils
  - Duffield - Ernest complex
- Critical Areas:** Critical areas include the area of wetlands that are within the site which are proposed to be impacted with this plan. When disturbance occurs in these areas during the construction phase, specific erosion control measures and planting that have been specified on this plan must be in working order at all times to protect these areas from soil erosion and contamination. All unimpacted downstream areas and Crab Creek shall be protected from sedimentation with erosion control measures as specified on the plan.
- Erosion and Sediment Control Measures:** Unless otherwise indicated, all vegetative and structural erosion and sediment control practices shall be constructed and maintained according to minimum standards and specifications of the Virginia Erosion & Sediment Control Handbook (VESCH). The minimum standards of the VESCH shall be adhered to unless otherwise waived or approved by a variance. The following measures are proposed:

### 3.02 - Temporary Construction Entrance

A stone pad, located at points of vehicular ingress and egress on a construction site, to reduce the soil transported onto public roads and other paved areas. Temporary construction entrance(s) shall be installed as indicated on the plans.

### 3.05 - Silt Fence Barrier

Silt fence sediment barriers will be installed downslope of disturbed areas to filter sediment-laden runoff from sheet flow as indicated on this sheet.

### 3.31 Temporary Seeding

Establishment of temporary vegetative cover on disturbed areas that will not be brought to final grade for 30 days to a year. Temporary seeding shall be as follows:

Date	Species	Lbs. per ac.
Sept. 1 - Feb. 15	50/50 mix winter rye & winter wheat	90-100
Feb. 16 - Apr. 30	oats (avena sativa)	90-100
May 1 - Aug. 31	german millet	50

Note: Alternate seeding per VESCH, Table 3.31-C.

### 3.32 - Permanent Seeding

All permanent seeding shall be as specified in the planting plan.

### Permanent Stabilization:

All areas disturbed by construction shall be stabilized with permanent seeding immediately following finish grading. Seeding shall be done according to VESCH Standards & Specifications 3.32. Permanent Seeding and the planting plan. Erosion control blankets will be installed over fill slopes 2H:1V or steeper which have been brought to final grade and have been seeded to protect the slopes from rill and gully erosion and to allow seed to germinate properly. Mulch (straw or fiber) will be used on relatively flat areas. In all seeding operations, seed, fertilizer and lime (if required per soils report) will be applied prior to mulching.

- Maintenance:**  
See Mitigation maintenance schedule

### 3.02 - Construction Entrance

The entrance shall be maintained in a condition which will prevent tracking or flow of mud onto public rights-of-way. This may require periodic top dressing with additional stone or the washing and reworking of existing stone as conditions demand and repair and/or clean out of any structures used to trap sediment. All materials spilled, dropped, washed or traced from vehicles onto roadways or into storm drains must be removed immediately. The use of water trucks to remove materials dropped, washed, or tracked onto roadways will not be permitted under any circumstances.

### 3.05 - Silt Fence

- Silt fences shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs shall be made immediately.
- Close attention shall be paid to the repair of damaged silt fence resulting from end runs and undercutting.
- Should the fabric on a silt fence decompose or become ineffective prior to the end of the expected usable life and the barrier still be necessary, the fabric shall be replaced promptly.
- Sediment deposits should be removed after each storm event. They must be removed when deposits reach approximately one-half the height of the barrier.
- Any sediment deposits remaining in place after the silt fence is no longer required shall be dressed to conform with the existing grade, prepared and seeded.

### 3.09 - Temporary Diversion Dike

The measure shall be inspected after every storm and repairs made to the dike, flow channel, outlet or sediment trapping facility, as necessary. Once every two weeks, whether a storm event has occurred or not, the measure shall be inspected and repairs made if needed. Damages caused by construction traffic or other activity must be repaired before the end of each working day. Seeded areas which fail to establish a vegetative cover shall be reseeded as necessary.

### 3.32 - Permanent Seeding

In general, a stand of vegetation cannot be determined to be fully established until it has been maintained for one full year after planting.

**Irrigation:** New seedlings should be supplied with adequate moisture. Supply water as needed, especially late in the season, in abnormally hot or dry weather, or on adverse sites. Water application rates should be controlled to prevent excessive runoff. Inadequate amounts of water may be more harmful than no water.

**Re-seeding:** Inspect seeded areas for failure and make necessary repairs and reseedings within the same season, if possible.

- If vegetative cover is inadequate to prevent rill erosion, over-seed and fertilize in accordance with soil test results.
- If a stand has less than 40% cover, re-evaluate choice of plant materials and quantities of lime and fertilizer. The soil must be tested to determine if acidity or nutrient imbalances are responsible. Re-establish the stand following seedbed preparation and seeding recommendations.

**Fertilization:** Cool season grasses should begin to be fertilized 90 days after planting to ensure proper stand and density. Warm season fertilization should begin at 30 days after planting. Apply maintenance levels of fertilizer as determined by soil test. In the absence of a soil test, fertilization should be as follows:

**Cool Season Grasses:** 4 lbs. Nitrogen (N), 1 lb. Phosphorus (P), 2 lbs. Potash (K) per 1000 ft.<sup>2</sup> per year

75% of the total requirements should be applied between Sept. 1 and Dec. 31st. The balance should be applied during the remainder of the year. **More than 1 lb. of soluble nitrogen per 1000 ft.<sup>2</sup> should not be applied at any one time.**

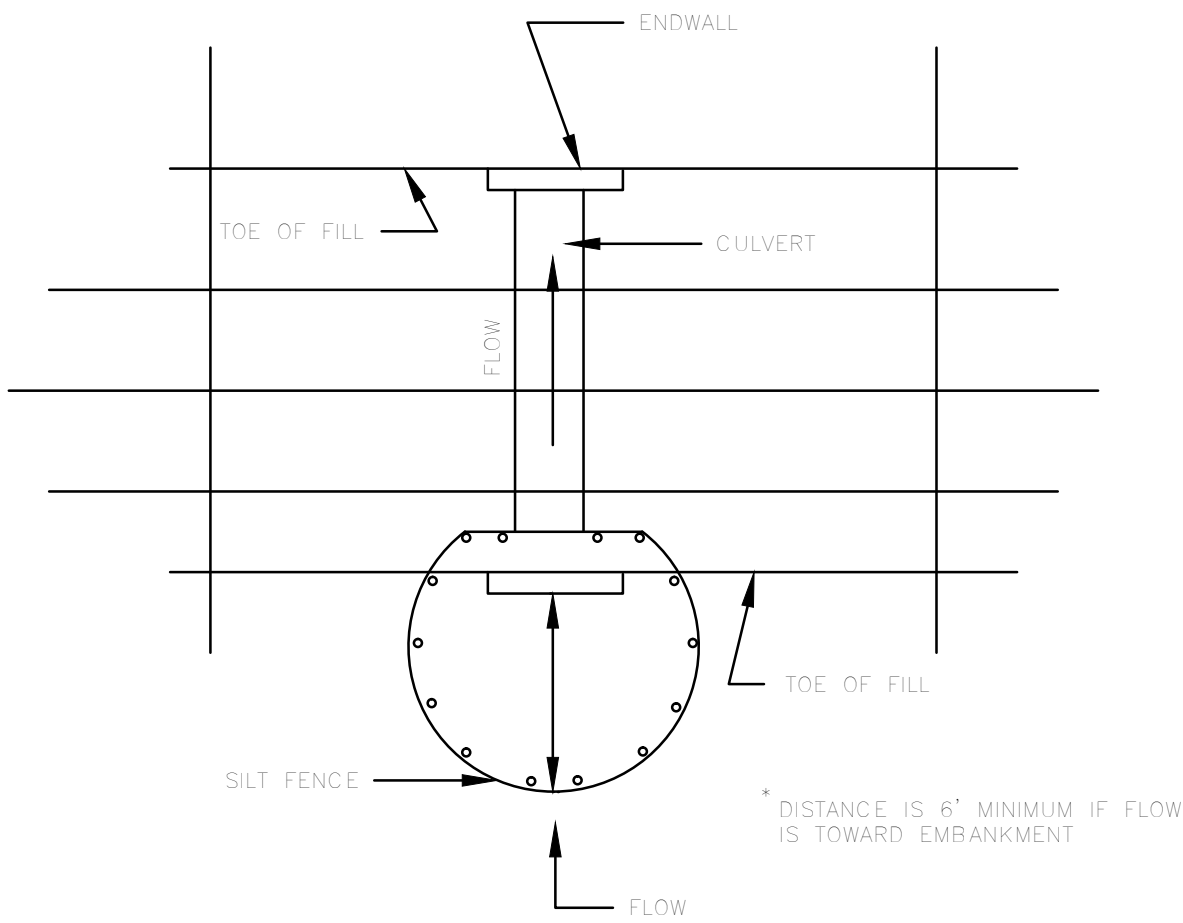
**Warm Season Grasses:** Apply 4-5 lbs. Nitrogen (N) between May 1 and August 15th per 1000 ft.<sup>2</sup> per year. Phosphorus (P) and Potash (K) should only be applied according to soil test.

NOTE: The use of slow-release fertilizer formulations for maintenance of turf is encouraged to reduce the number of applications and the impact on groundwater.

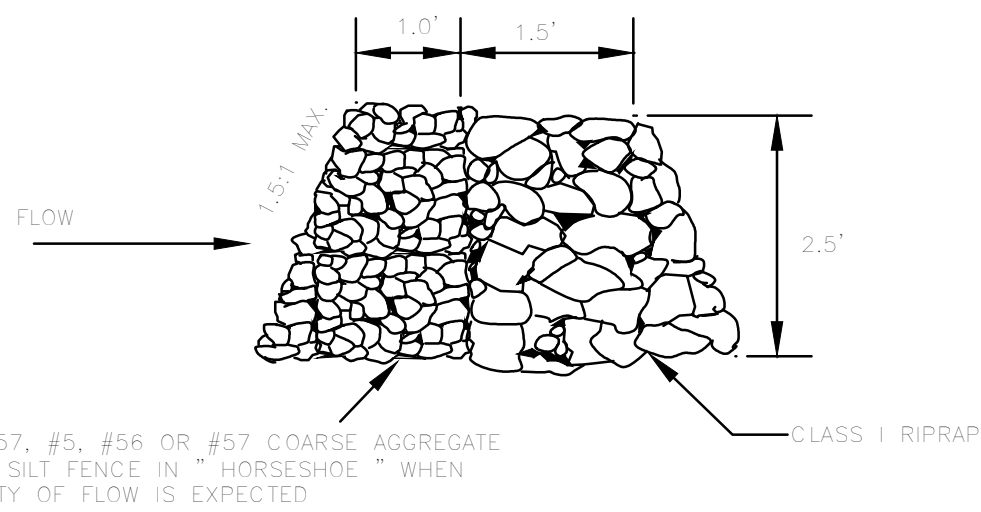
### 12. Management Strategies

- Construction will be sequenced so that grading operations can begin and end as quickly as possible.
- Sediment trapping measures will be installed as a first step in grading and will be seeded and mulched immediately following installation.
- Temporary seeding or other stabilization will follow immediately after grading.
- Areas which are not to be disturbed will be clearly marked by flags, signs, etc.
- The job superintendent shall be responsible for the installation and maintenance of all erosion and sediment control practices.
- After achieving adequate stabilization, the temporary erosion controls will be cleaned up and removed.

## SILT FENCE CULVERT INLET PROTECTION



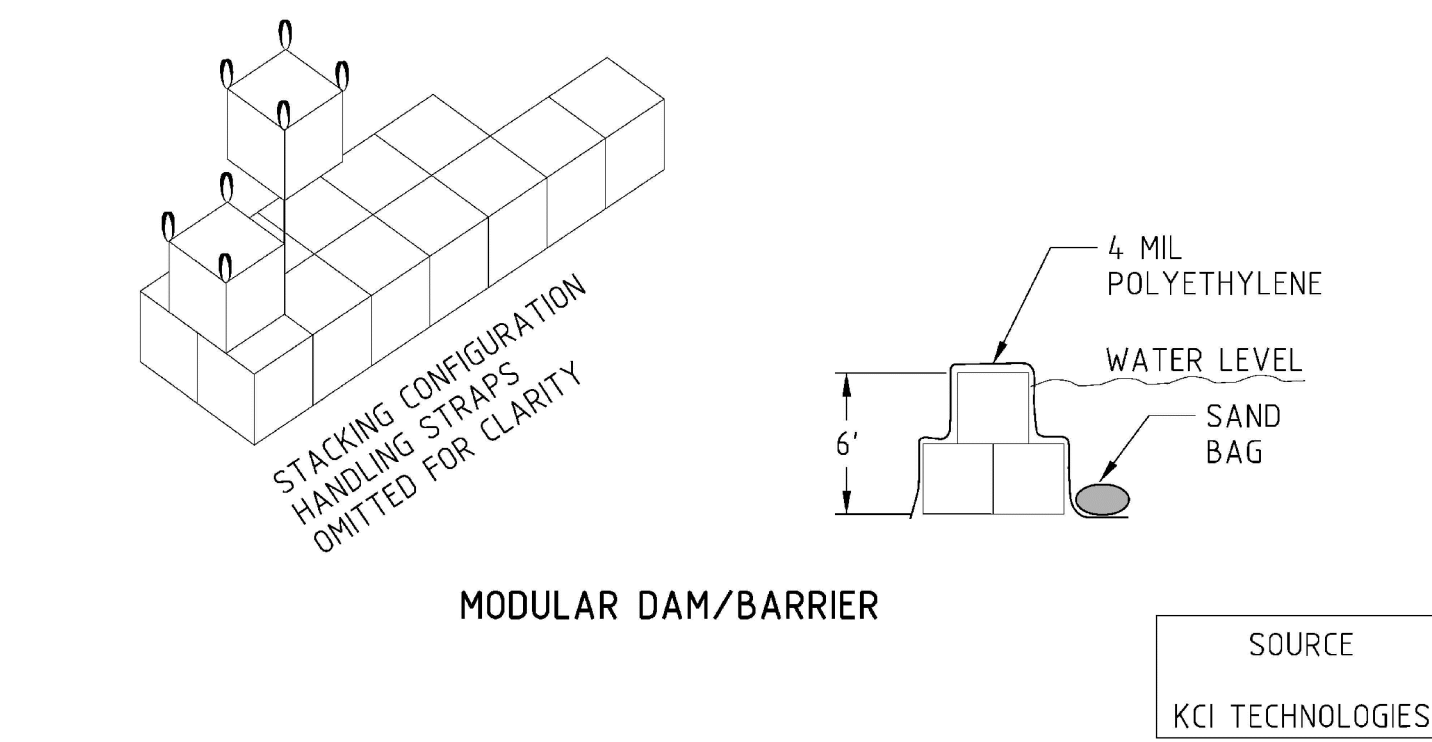
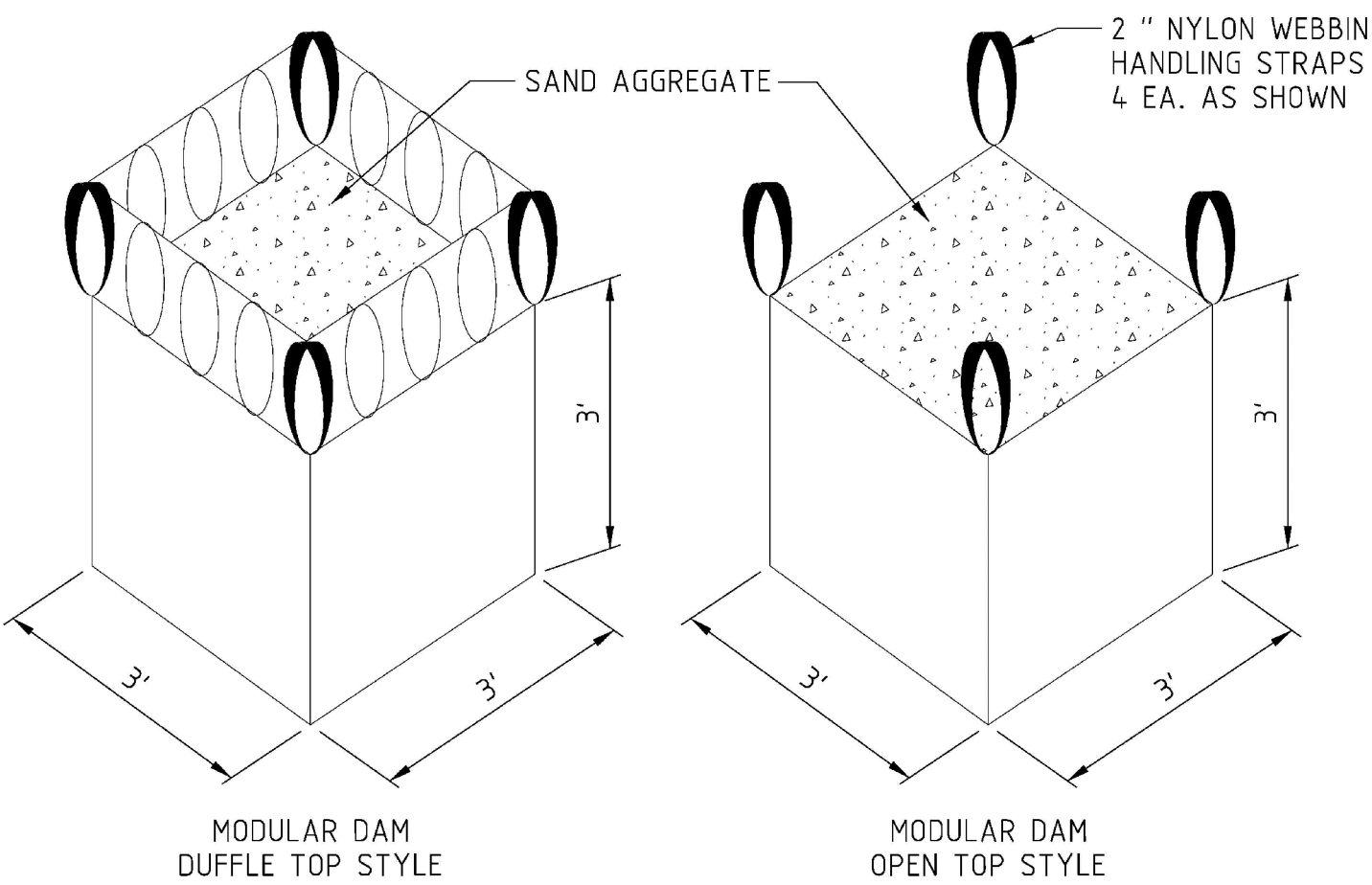
## \* OPTIONAL STONE COMBINATION



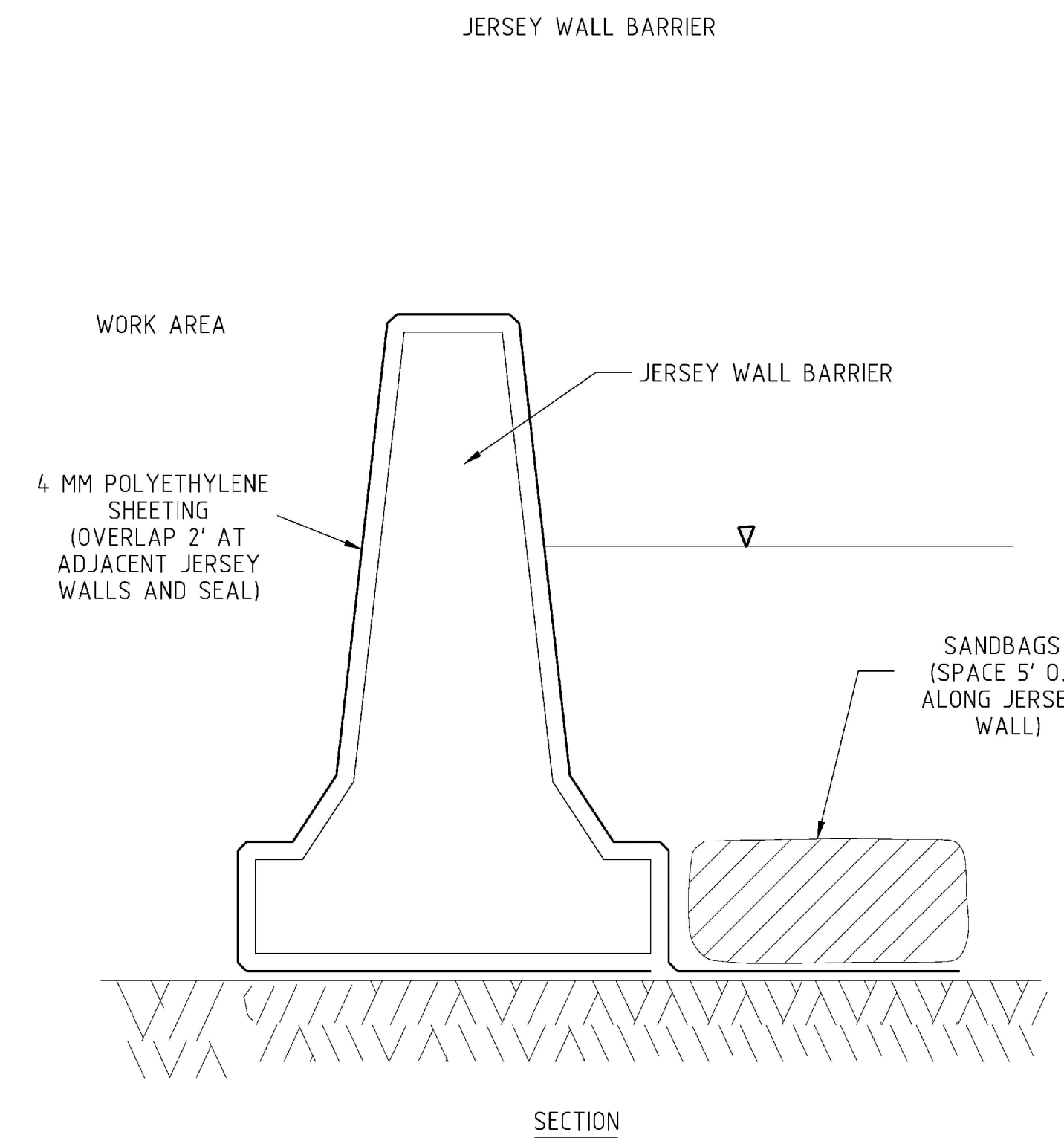
SOURCE: ADAPTED from VDOT Standard Sheets and Va. DSWC

PLATE. 3.08-1

## The Virginia Stream Restoration & Stabilization Best Management Practices Guide DETAIL 5.4(a): PORTABLE DAMS/BARRIERS



## The Virginia Stream Restoration & Stabilization Best Management Practices Guide DETAIL 5.4(b): PORTABLE DAMS/BARRIERS



SOURCE  
KCI TECHNOLOGIES

TEMPORARY INSTREAM CONSTRUCTION MEASURES

DECEMBER 2003

VIRGINIA DEPARTMENT OF CONSERVATION RECREATION



www.balzer.cc

Chesterfield  
Henrico  
New River Valley  
Roanoke  
Shenandoah Valley

RESIDENTIAL LAND DEVELOPMENT ENGINEERING  
SITE DEVELOPMENT ENGINEERING  
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TRANSPORTATION ENGINEERING  
ENVIRONMENTAL & SOIL SCIENCE  
WETLAND DELINEATIONS & STREAM EVALUATIONS

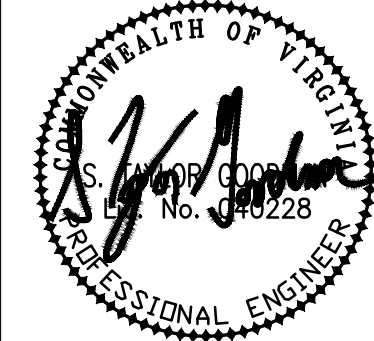
Balzer and Associates, Inc.

15871 City View Drive, Suite 200

Midlothian, VA 23113

804-794-0571

FAX 804-794-2635



DIAMOND HILLS PARK

STREAM RESTORATION

EROSION CONTROL NOTES

TOWN OF CHRISTIANSBURG, VIRGINIA

DRAWN BY STG

DESIGNED BY WKM

CHECKED BY STG/BW

DATE 6-17-2011

SCALE AS NOTED

REVISIONS:

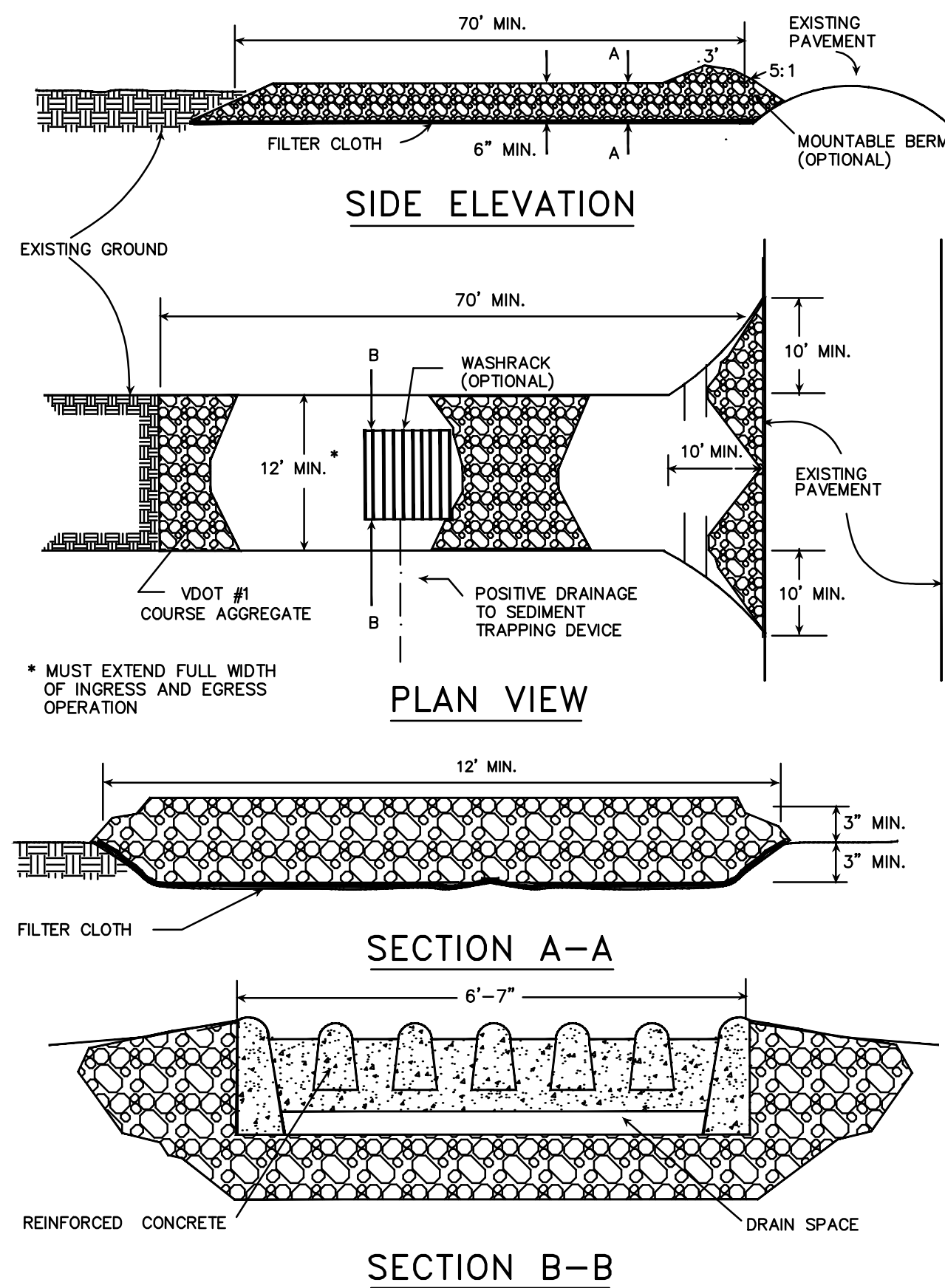
SHEET NO.

18 of 23

JOB NO. B1000031.00



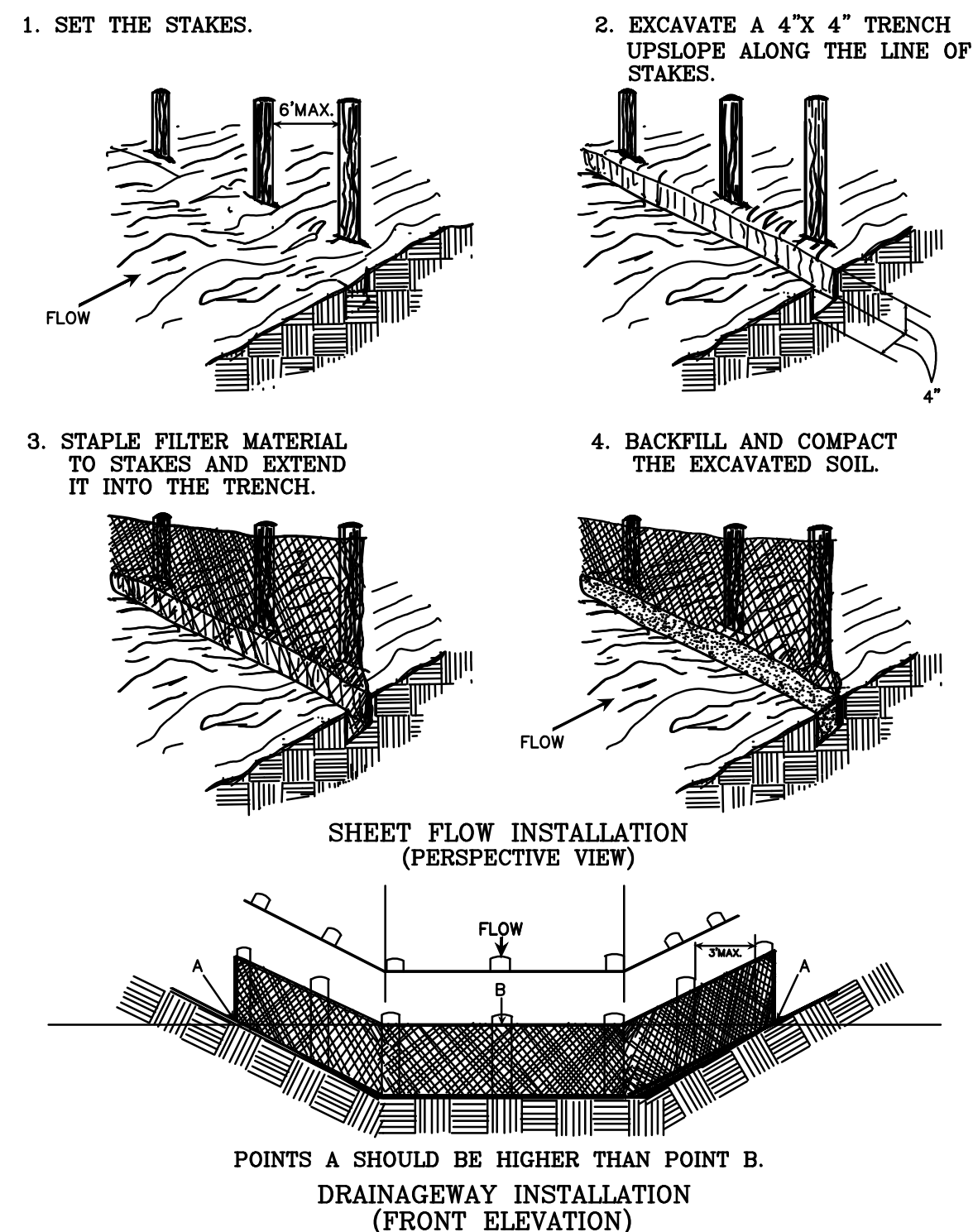
## STONE CONSTRUCTION ENTRANCE



SOURCE: ADAPTED FROM 1983 Maryland Standards for Soil Erosion and Sediment Control, and Va. DSWC

Plate 3.02-1

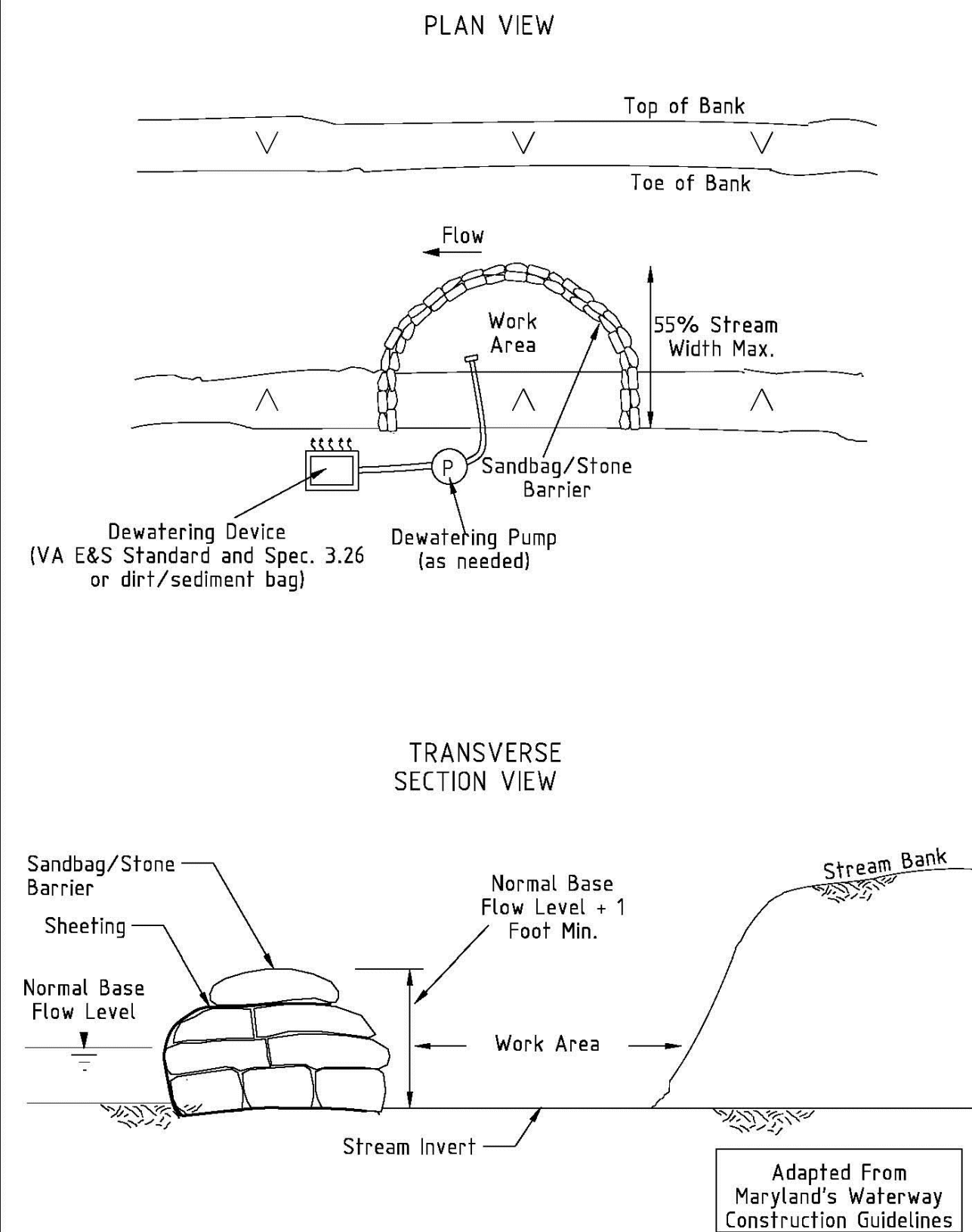
## CONSTRUCTION OF A SILT FENCE (WITHOUT WIRE SUPPORT)



SOURCE: Adapted from Installation of Straw and Fabric Filter Barriers for Sediment Control, VA DSWC Sherwood and Wyant

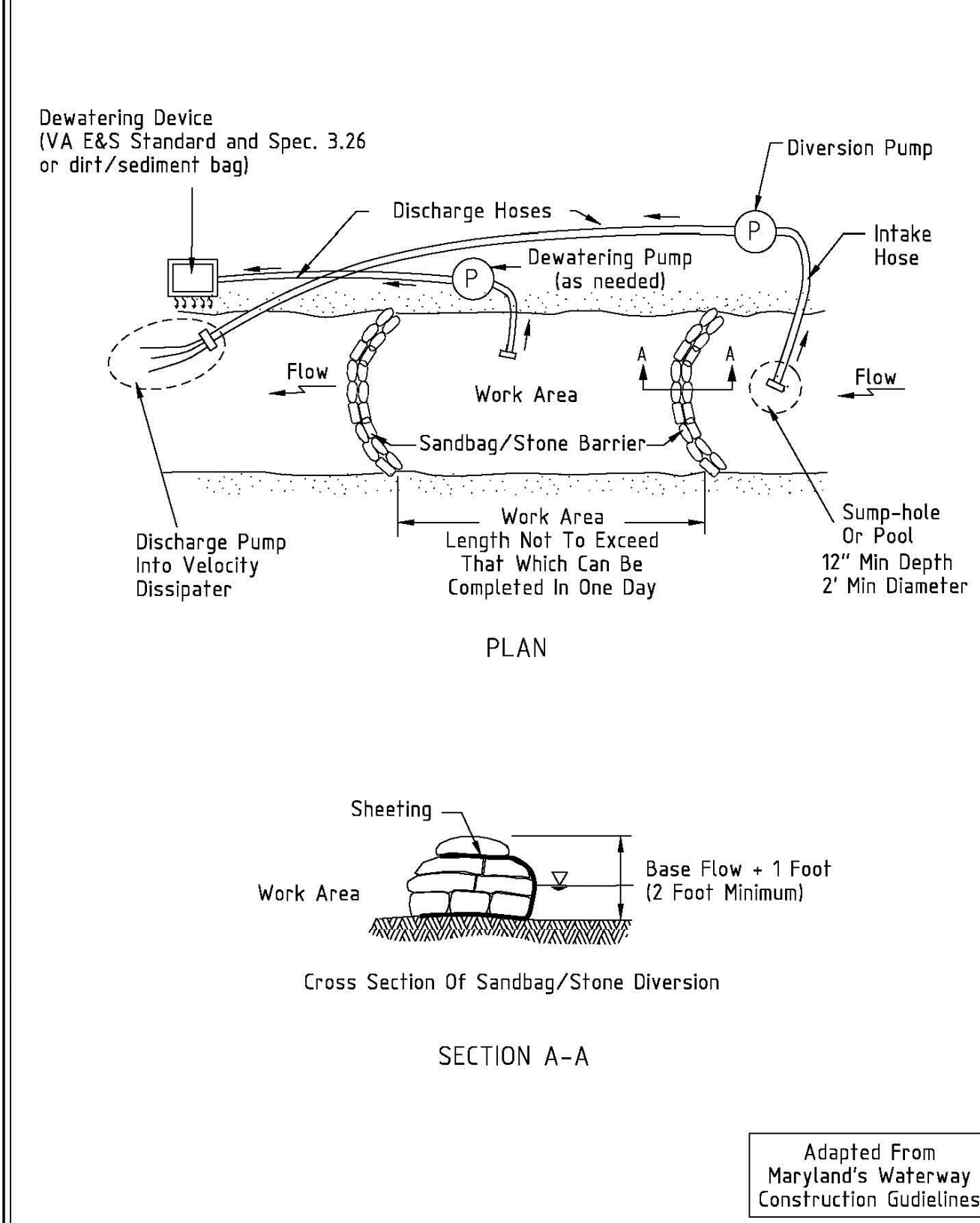
PLATE 3.05-2

## The Virginia Stream Restoration & Stabilization Best Management Practices Guide DETAIL 5.2: SANDBAG/STONE DIVERSION



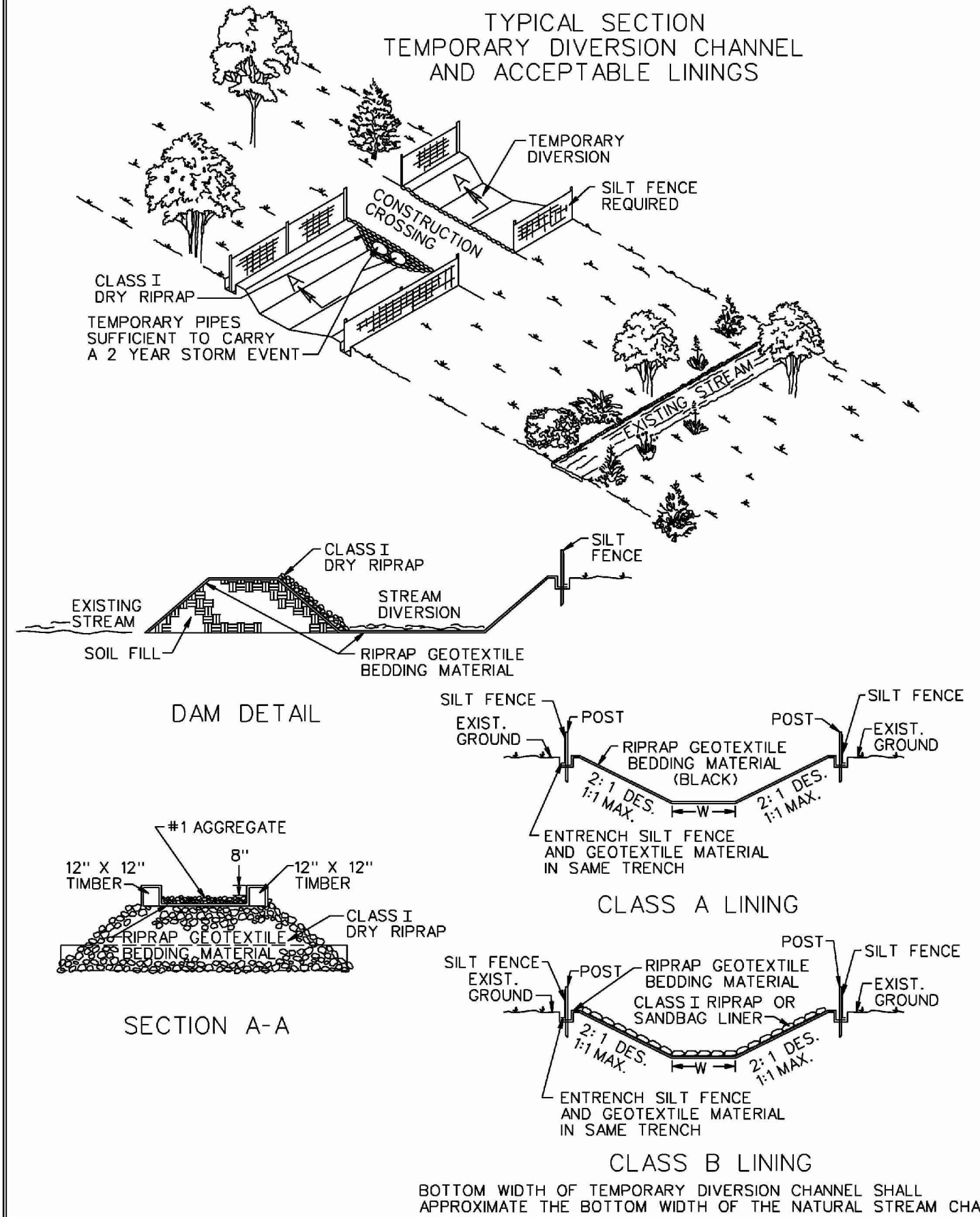
TEMPORARY INSTREAM CONSTRUCTION MEASURES DECEMBER 2003 VIRGINIA DEPARTMENT OF CONSERVATION RECREATION

## The Virginia Stream Restoration & Stabilization Best Management Practices Guide DETAIL 5.1: PUMP-AROUND PRACTICE



TEMPORARY INSTREAM CONSTRUCTION MEASURES DECEMBER 2003 VIRGINIA DEPARTMENT OF CONSERVATION RECREATION

## TYPICAL SECTION TEMPORARY DIVERSION CHANNEL AND ACCEPTABLE LININGS



SPECIFICATION REFERENCE  
302  
303  
414

TEMPORARY DIVERSION CHANNEL & ACCEPTABLE LININGS

VIRGINIA DEPARTMENT OF TRANSPORTATION

## STREAM DIVERSION GENERAL NOTES

**SLOPES**  
MAXIMUM STEEPNESS OF SIDE SLOPES SHALL BE 1:1. DEPTH AND GRADE MAY BE VARIABLE, DEPENDENT ON SITE CONDITIONS, BUT SHALL BE SUFFICIENT TO ENSURE CONTINUOUS FLOW OF WATER IN THE DIVERSION.

**EXCAVATION**  
NO EXCAVATED MATERIAL SHALL BE STORED OR STOCKPILED NEXT TO THE DIVERSION OR IN SUCH A MANNER THAT SILTATION OF THE STREAM COULD OCCUR.

**PIPE CULVERTS**  
PIPE CULVERT(S) MAY BE USED TO DIVERT A STREAM PROVIDED THEY ARE PROPERLY SIZED TO SAFELY CARRY THE FLOW OF A TWO YEAR STORM EVENT. UNDERSIZED PIPES SHALL BE USED FOR NO LONGER THAN 72 HOURS PROVIDED LESS THAN 50% THREAT OF RAIN CAN BE REASONABLY EXPECTED WITHIN THAT TIME PERIOD AND THEY ARE APPROVED BY THE ENGINEER.

**LINING**  
WHEN THE CONTRACTOR USES PIPE CULVERTS IN LIEU OF THE DIVERSION CHANNEL OR A PORTION OF THE CHANNEL, PAYMENT WILL BE MADE BASED ON THE PRICE BID FOR THE QUANTITIES SHOWN ON THE PLANS FOR TEMPORARY DIVERSION CHANNEL EXCAVATION AND TEMPORARY DIVERSION CHANNEL LINING CLASS SPECIFIED.

THE CONTRACTOR SHALL HAVE THE OPTION OF USING A HIGHER CLASS OF LINING THAN THAT SPECIFIED ON THE PLANS. NO ADDITIONAL COMPENSATION WILL BE ALLOWED FOR USING THE HIGHER CLASS.

STREAM DIVERSION LINERS SHALL BE SECURED AT THE UPSTREAM AND DOWNSTREAM SIDES WITH NON-ERODIBLE WEIGHTS SUCH AS EROSION CONTROL STONE. THESE WEIGHTS SHALL ALLOW NORMAL FLOW OF THE STREAM. SOIL SHALL NOT BE MIXED IN WITH STREAM DIVERSION WEIGHTS. WEIGHTS MAY ALSO BE NEEDED ALONG THE STREAM DIVERSION WEIGHTS. STREAM DIVERSION LINERS SHALL BE ENTRENCHED AT THE TOP OF THE DIVERSION SLOPES (SLOPE BREAKS) WITH A LINE OF SILT FENCE.

PROTECTIVE COVERING (EC-2) STAPLES OR NON-ERODIBLE WEIGHTS SHALL BE USED AS NECESSARY TO ANCHOR STREAM DIVERSION LINERS TO THE SIDE SLOPES OF THE DIVERSION. WOODEN STAKES SHALL NOT BE USED ON THE DIVERSION'S BOTTOM OR SIDE SLOPES.

STREAM DIVERSION LINERS SHALL BE OVERLAPPED WHEN A SINGLE OR CONTINUOUS LINER IS NOT AVAILABLE OR IS IMPRACTICAL. OVERLAPS SHALL BE PLACED SUCH THAT CONTINUOUS FLOW OF THE STREAM IS MAINTAINED. AN UPSTREAM SECTION SHALL OVERLAP A DOWNSTREAM SECTION BY A MINIMUM OF 18". OVERLAPS ALONG THE CROSS-SECTION SHALL BE MADE SUCH THAT A LINER IS PLACED IN THE STREAM DIVERSION BOTTOM FIRST AND ADDITIONAL PIECES OF LINER ON THE SLOPES OVERLAP THE BOTTOM PIECE BY A MINIMUM OF 18".

**GENERAL**  
THE DOWNSTREAM PLUG SHALL BE REMOVED PRIOR TO THE UPSTREAM PLUG WHEN A STREAM DIVERSION IS USED FOR THE TRANSPORT OF WATER.

NON-ERODIBLE MATERIALS, INCLUDING BUT NOT LIMITED TO, EROSION CONTROL STONE, CONCRETE BARRIERS, SANDBAGS, PLYWOOD, OR SHEET PILING SHALL BE USED BOTH TO DIVERT THE STREAMS AWAY FROM THEIR ORIGINAL CHANNELS AND TO PREVENT OR REDUCE WATER BACKUP INTO A CONSTRUCTION AREA.

STREAMS MAY BE DIVERTED THROUGH AN EXISTING OR INCOMPLETE STRUCTURE PROVIDED THEY WILL NOT RE-ENTER A DISTURBED AREA, COME INTO CONTACT WITH WET CONCRETE, AND/OR BECOME PARTIALLY OR WHOLLY IMPROUNDED, SILENT, OR OTHERWISE CONTAMINATED.

STREAMS MAY BE REDIRECTED UPON COMPLETION OF THE DRAINAGE STRUCTURE(S) FOR WHICH THE DIVERSION WAS BUILT. PRIOR TO REDIRECTION, ANY MATERIALS USED TO PREVENT WATER BACKUP INTO THE DOWNSTREAM END OF THE DRAINAGE STRUCTURE(S) SHALL BE REMOVED. THIS MATERIAL SHALL NOT BE PLACED IN THE DOWNSTREAM END OF THE DIVERSION UNTIL AFTER WATER HAS BEEN REDIRECTED TO THE DRAINAGE STRUCTURE(S). THE DIVERSION SHALL BE REDIRECTED BY REMOVING ALL OF THE MATERIALS DAMMING THE UPSTREAM END OF THE DRAINAGE STRUCTURE(S) BEFORE PLACING IT IN THE UPSTREAM END OFF THE STREAM DIVERSION. THE DIVERSION SHALL BE SEALED OFF AT THE DOWNSTREAM END AND THEN BACKFILLED.

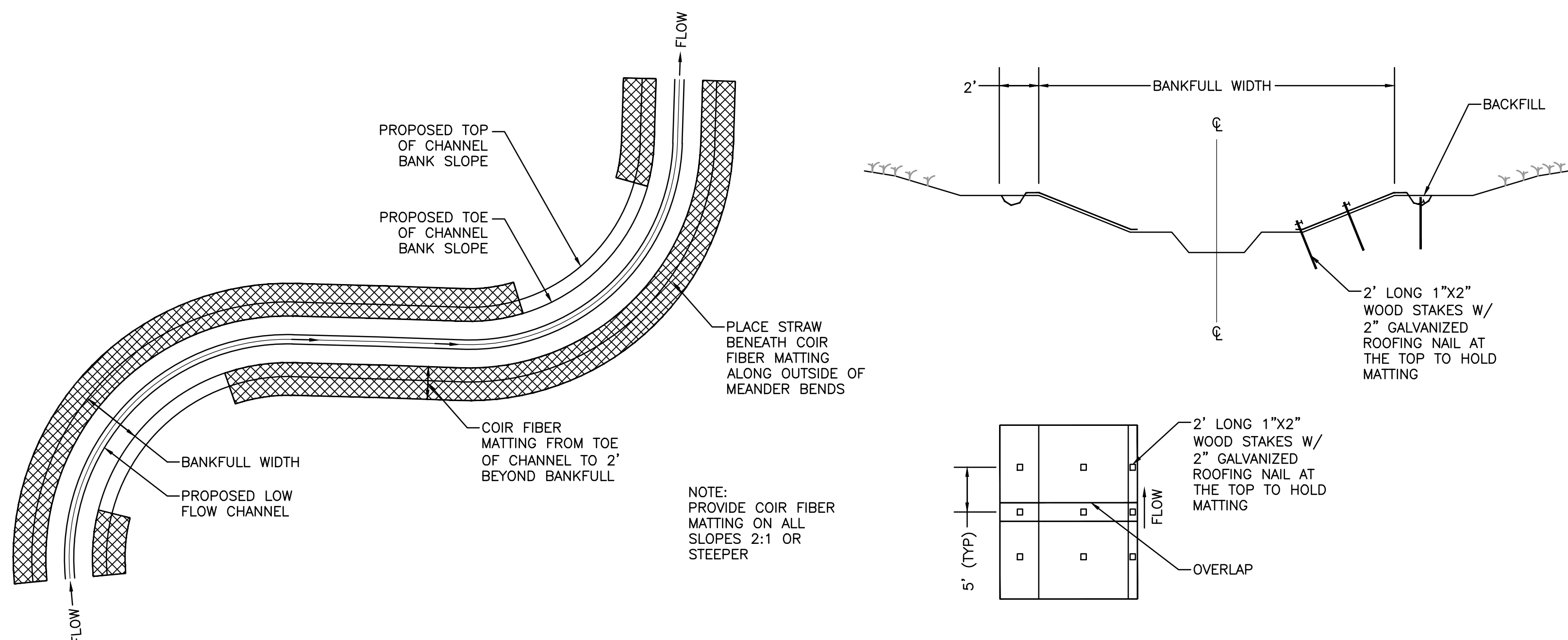
ONCE STARTED, ANY WORK TO RELOCATE A STREAM (PLUGS) SHALL NOT BE DISCONTINUED UNTIL IT IS COMPLETED.

ANY DEVIATIONS TO THE ABOVE NOTED STREAM DIVERSION DESIGN, INSTALLATION, OR MAINTENANCE SHALL BE APPROVED BY THE ENGINEER.

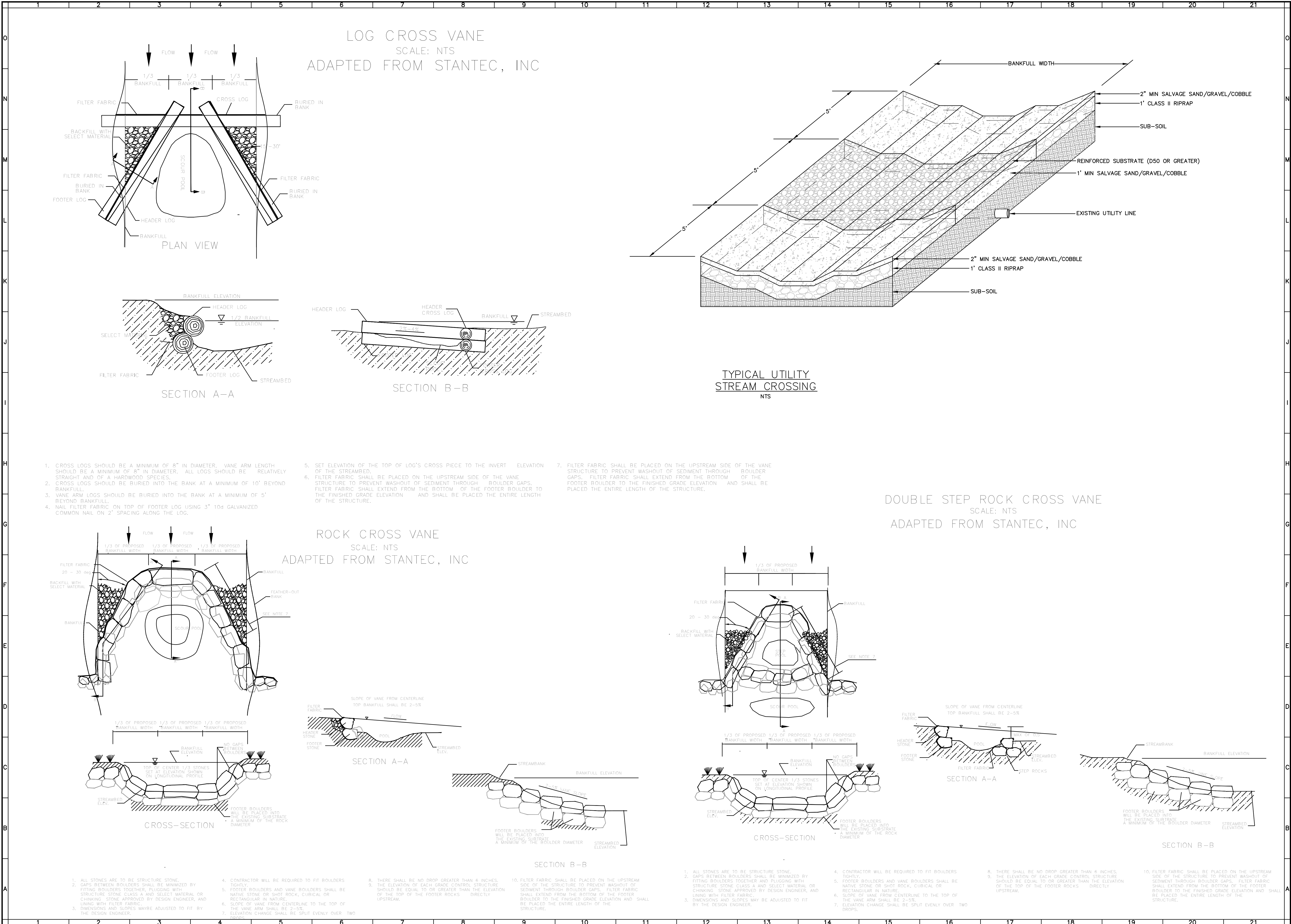
TO-CL

## TYPICAL MATTING DETAIL

NTS

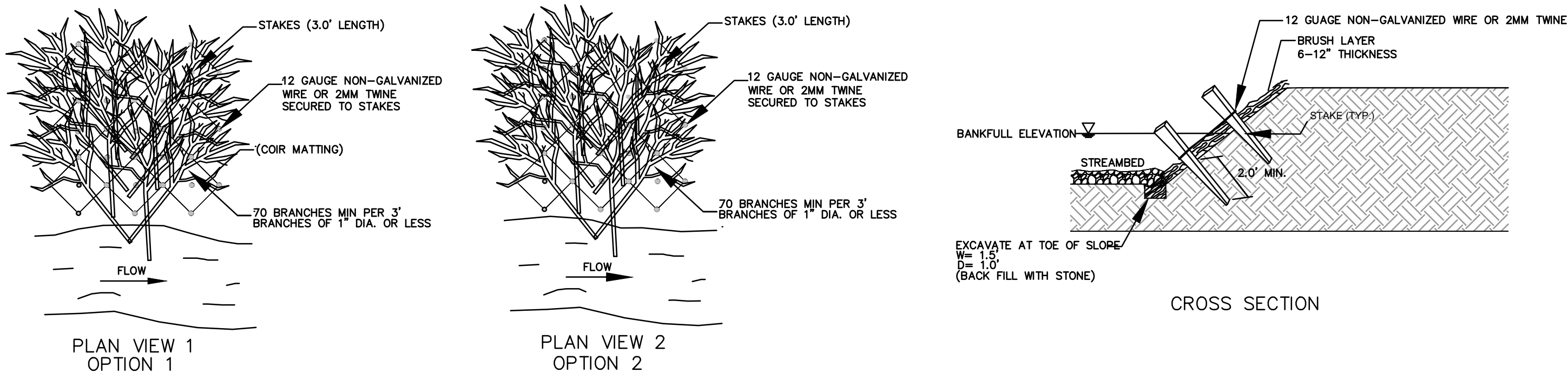






BRUSH MATTRESS

SCALE: NTS  
ADAPTED FROM STANTEC



BRUSH MATTRESS - THIS METHOD USES HARDWOOD BRUSH LAYERED ALONG A STREAMBANK AS A MATTRESS AND ANCHORED IN PLACE WITH GRID OF STAKES AND WIRE OR TWINE. THE TOE BELOW THE WATERLINE IS ANCHORED BY ROCK. THE LIVING BLANKET ACTS AS MULCH FOR SEEDING AND PLANTING ESTABLISHED IN THE BANK. IT ALSO PREVENTS EROSION OF SLOPED SURFACES.

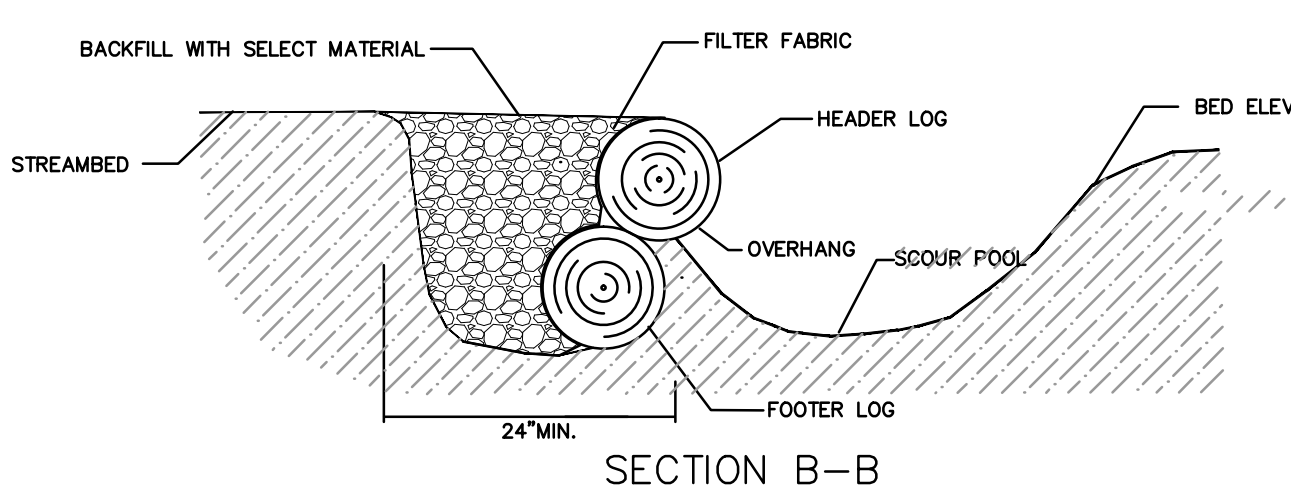
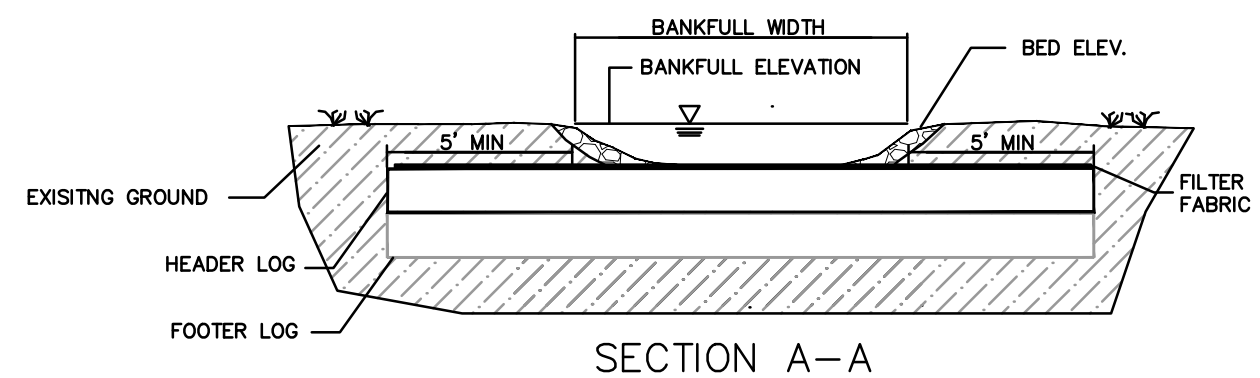
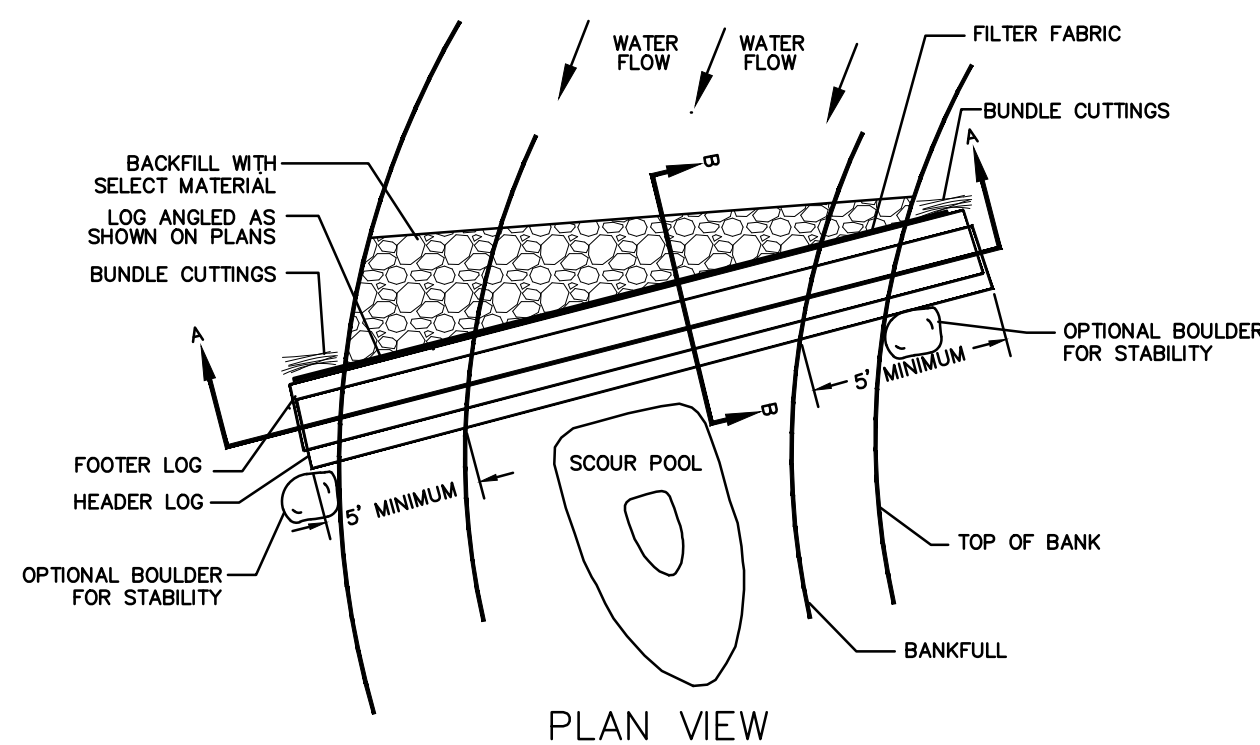
1. CUT BRANCHES OF SPECIFIED TYPE (SEE PLANTING PLAN) AT 45 DEGREE ANGLE LONG ENOUGH TO COVER BANKS PLUS 1' DEEP INTO TRENCH.
2. DIG 1' TRENCH AT BASE OF BANK, RESERVING SOIL FOR BACKFILL.
3. LAY FIRST LAYER OF CUTTINGS PERPENDICULAR TO SLOPE, MAKING SURE TO PUSH OUT END INTO TRENCH.
4. LAY SECOND LAYER AT 45 DEGREES (UPSTREAM).
5. LAY THIRD LAYER AT 45 DEGREE (DOWNSTREAM).

6. (OPTIONAL STEP IF NEEDED TO HOLD BRANCHES CLOSE TO GROUND SURFACE AT TOP OF STREAMBANK). ABOUT 1/2-2/3 OF THE WAY UP THE BANK, PLACE STAKES IN A ROW, SPACED 3' APART. HAMMER TO GET STARTED. WRAP WIRE AROUND 1ST STAKE; CONNECT TO 2ND STAKE AND WRAP; CONNECT TO 3RD STAKE AND WRAP, ETC.
7. USING SHOVELS AND BUCKETS OR TRACK HOE BUCKET, SPRINKLE SOIL THROUGH THE CUTTINGS.
8. IF USING OPTIONAL STAKES, HAMMER INTO BANK.
9. COVER WITH STRAW MULCH AT MINIMUM 75% COVERAGE.

10. WRAP WIRE OR TWINE NEAR TOP OF STAKES IN CRISSCROSS PATTERN.
11. FINISH BY HAMMERING REMAINING STAKES INTO BANK.

LOG SILL

SCALE: NTS  
ADAPTED FROM STANTEC



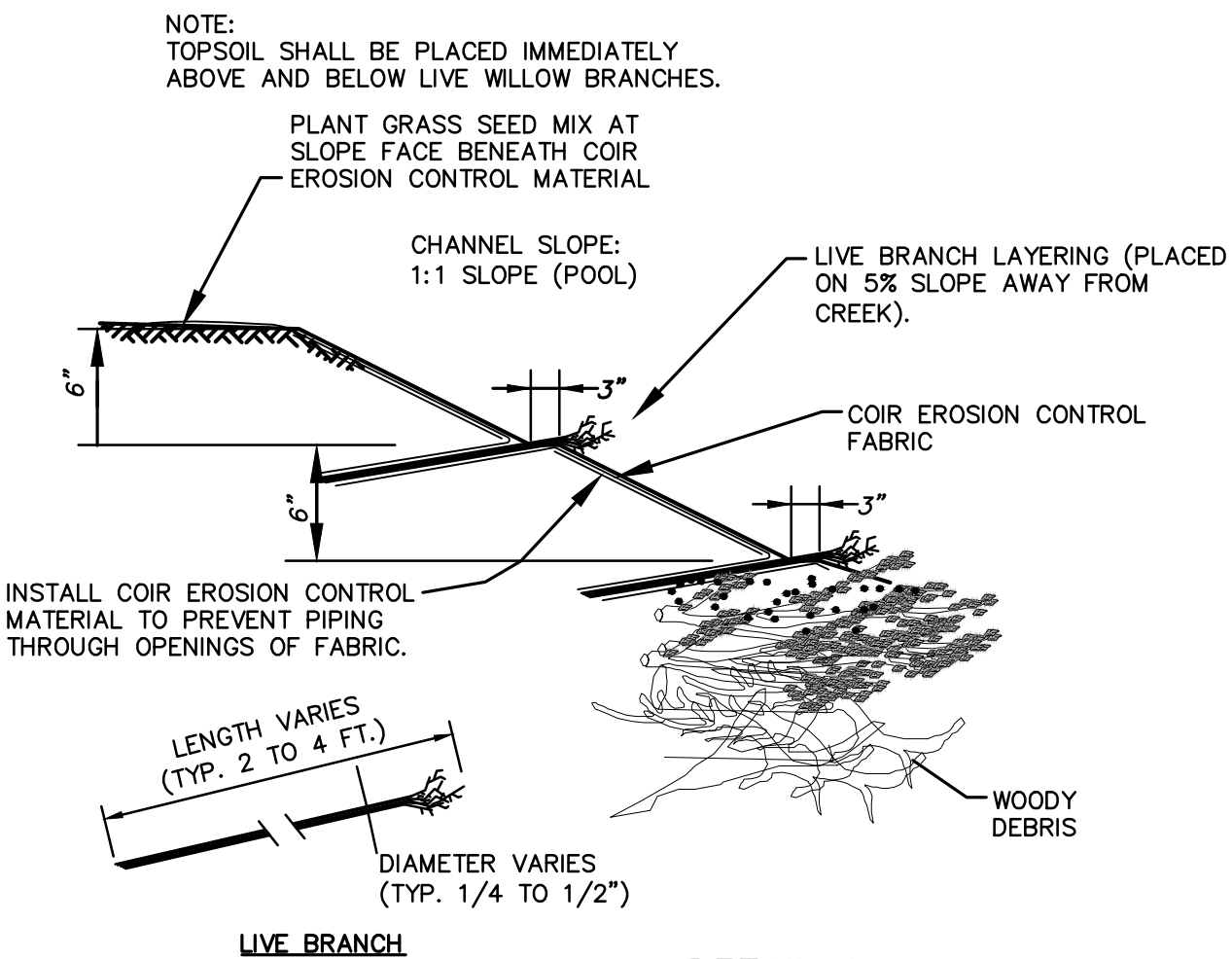
1. SILL LOGS SHALL BE OF A HARDWOOD SPECIES WITH A MINIMUM TRUNK DIAMETER OF 8".
2. LOG SILL SHALL BE CONSTRUCTED WITH 1 FOOTER LOG AND 1 HEADER LOG.
3. ANGLE OF LOGS IN CHANNEL SHALL MATCH THE ANGLE OF THE LOG AS SHOWN ON THE PLAN VIEW IN THE CONSTRUCTION PLANS.
4. NAIL FILTER FABRIC ON TOP OF FOOTER LOG USING 3" 10d GALVANIZED COMMON NAIL ON 2' SPACING ALONG THE LOG.

5. BUNDLE CUTTINGS SHALL BE PLACED AT THE CHANNEL EDGE ABOVE THE SILL ON BOTH THE LEFT AND RIGHT BANKS.
6. PLACE HEADER LOG SLIGHTLY FORWARD ON TOP OF THE FOOTER LOG ALLOWING FOR OVERHANG.
7. LENGTH OF THE LOGS SHALL BE A MINIMUM OF 5' BEYOND BANKFULL STAGE.
8. PLATE THE UPSTREAM SIDE OF THE LOGS WITH FILTER FABRIC AND SELECT MATERIAL.

9. FILTER FABRIC SHALL BE PLACED ON THE UPSTREAM SIDE OF THE VANE STRUCTURE TO PREVENT WASHOUT OF SEDIMENT THROUGH LOG GAPS. FILTER FABRIC SHALL EXTEND FROM THE BOTTOM OF THE FOOTER LOG TO THE FINISHED GRADE ELEVATION AND SHALL BE PLACED THE ENTIRE LENGTH OF THE STRUCTURE.

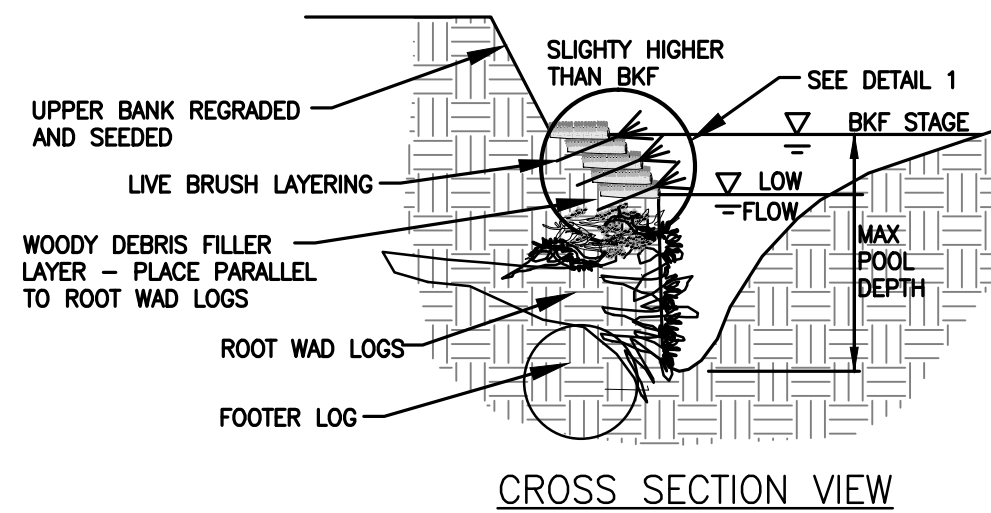
TOE WOOD STRUCTURE

SCALE: NTS  
ADAPTED FROM STANTEC



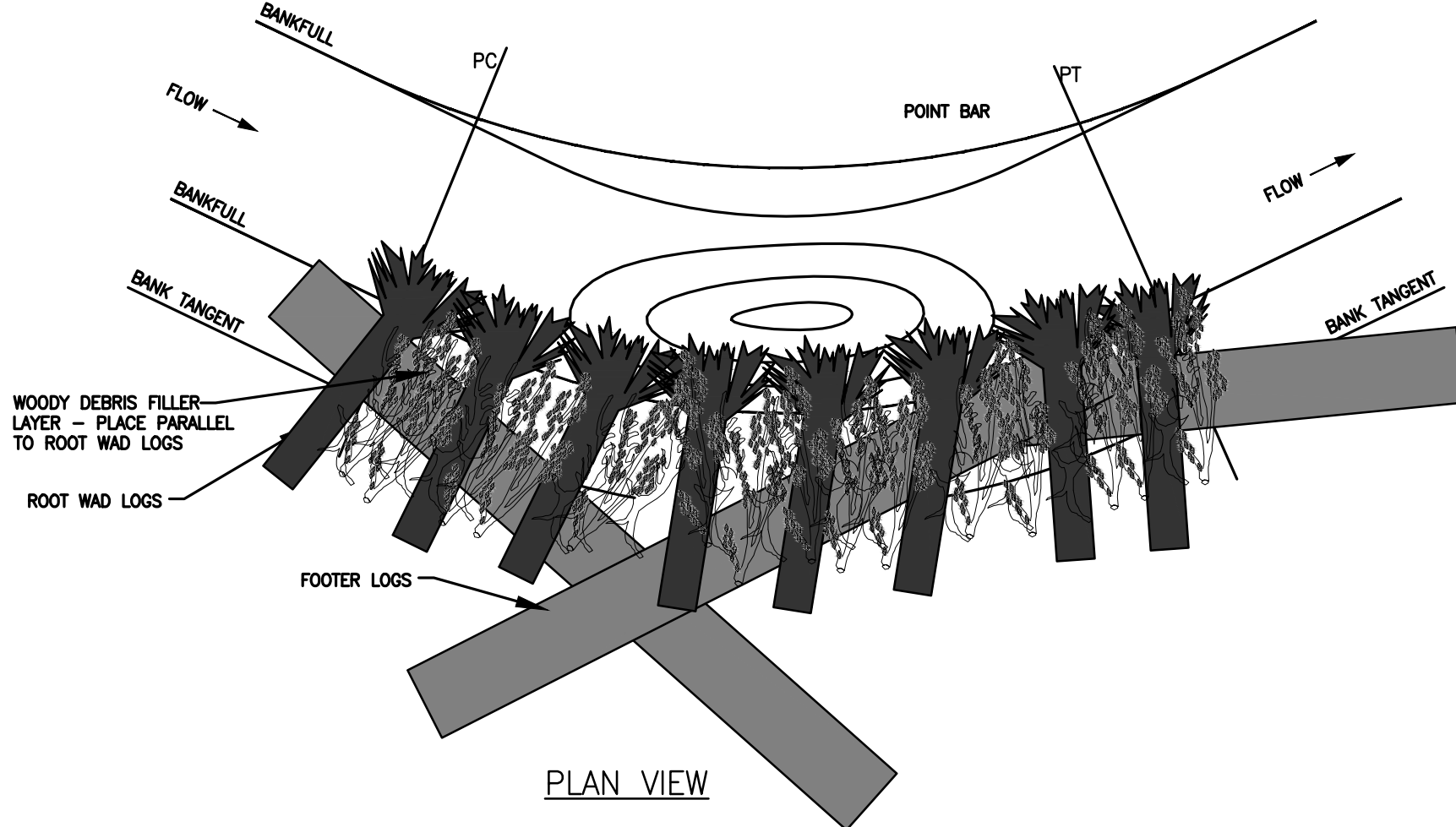
TOE WOOD NOTES:

1. FOOTER LOGS SHALL BE OF A HARDWOOD SPECIES WITH A MINIMUM TRUNK DIAMETER OF 8".
2. ROOT WAD LOGS SHALL HAVE A MINIMUM 6" TRUNK DIAMETER.
3. TOE WOOD SHALL BE CONSTRUCTED WITH A MINIMUM OF 2' BEYOND BANKFULL STAGE AND A MINIMUM OF 5' INTO THE BANK, WHICHEVER IS GREATER.
4. LENGTH OF FOOTER LOGS SHALL BE A MINIMUM OF 2' BEYOND BANKFULL STAGE AND A MINIMUM OF 5' INTO THE BANK, WHICHEVER IS GREATER.
5. PLACE FILLER MATERIAL PARALLEL TO ROOT WAD LOGS. FILLER MATERIAL CAN CONSIST OF SMALL LOGS, LIMBS, TREE TOPS AND BRUSH.
6. FILLER MATERIAL SHALL BE COMPACTED WITH TEMPORARY COUNTER WEIGHT OR OTHER METHOD PRIOR TO BACKFILLING OVER THE FILLER MATERIAL.
7. WHEN BACKFILLING OVER AND AROUND ROOT WAD LOGS PACK FILLER MATERIAL, STONE OR SOIL BETWEEN ALL WADS TO FIRMLY SECURE ALL GAPS.
8. ROOT WADS SHALL OVERLAP.
9. THERE SHALL BE NO GAP BETWEEN THE BOTTOM OF THE CHANNEL AND THE BOTTOM OF THE ROOT WAD.
10. ROOT WAD SHALL NOT BE DETERIORATED AT THE TIME OF INSTALLATION.
11. POOLS CONTAINING TOE WOOD SHALL BE OVER EXCAVATED TO MAXIMUM POOL DEPTH.



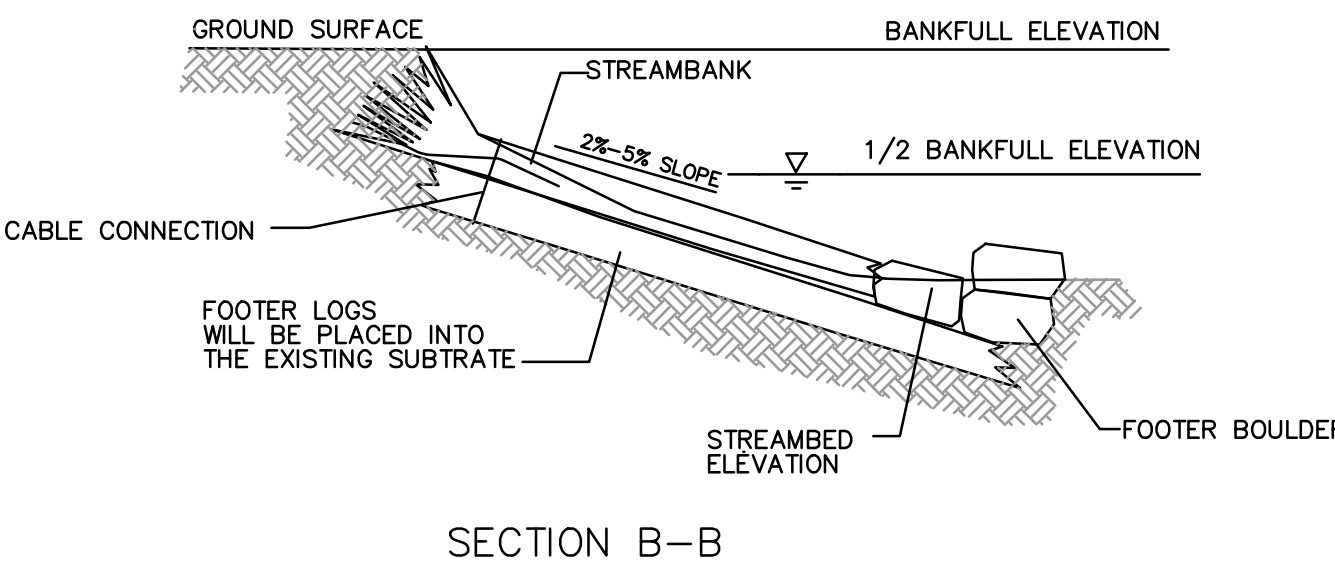
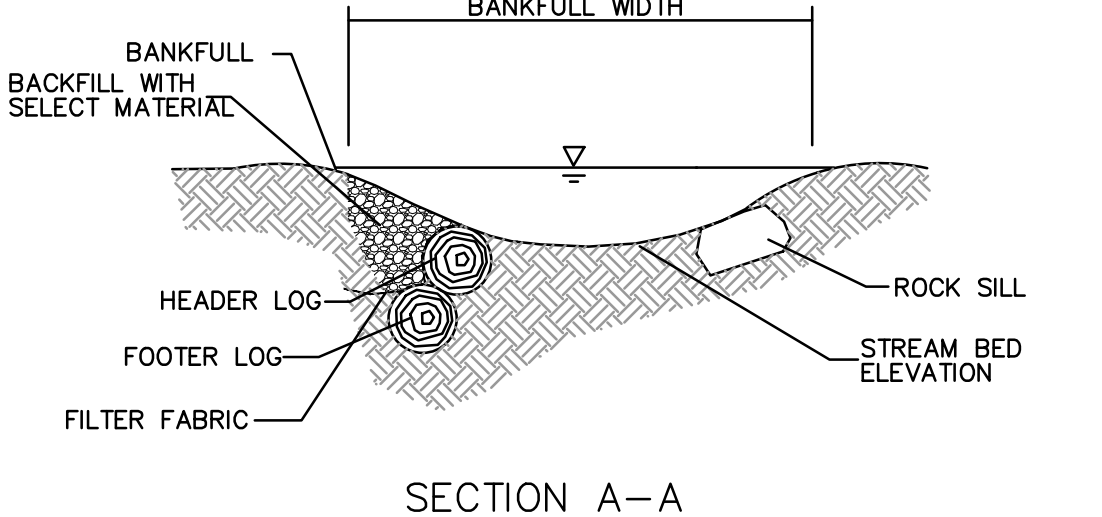
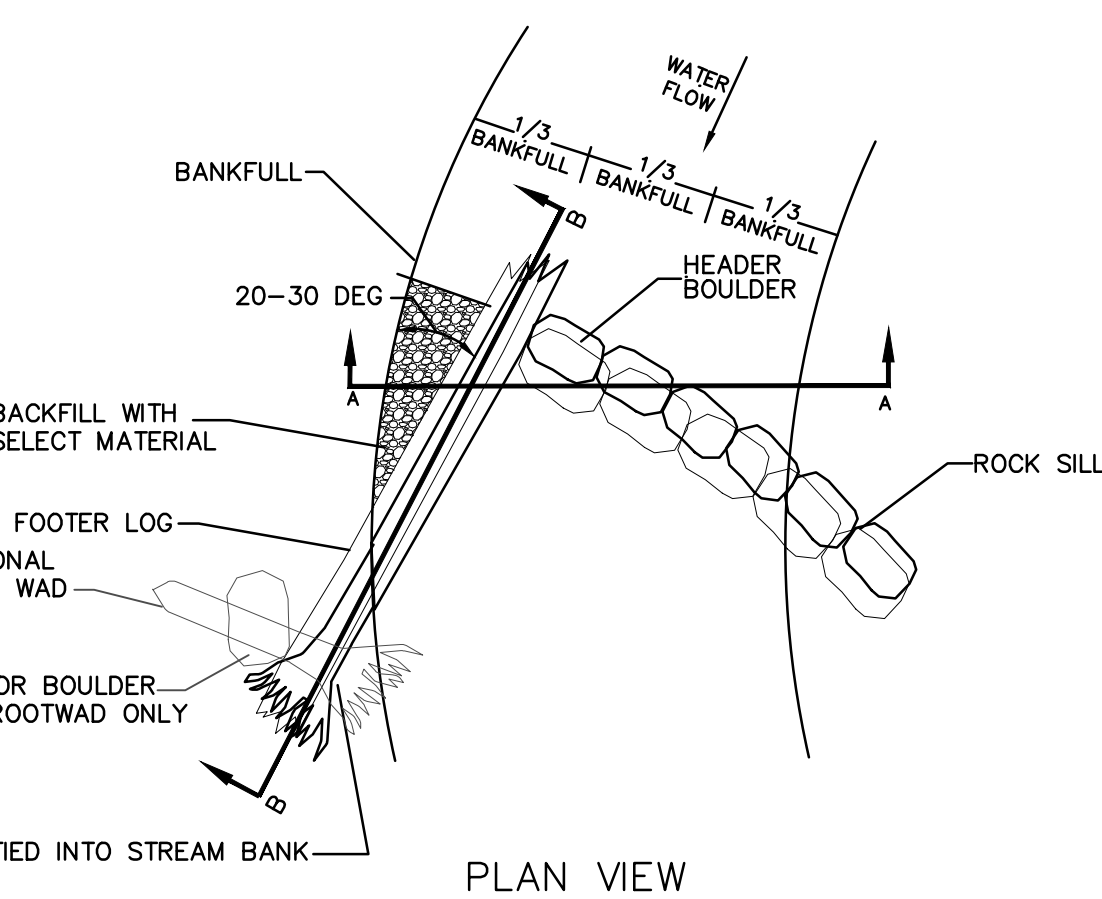
LIVE BRANCH PLANTING NOTES:

1. BACKFILL BEHIND LOGS WITH SOIL TO CREATE A PLANTING SURFACE SLOPE APPROXIMATELY 5% AWAY FROM CREEK. WIDTH OF PLANTING SURFACE SHOULD BE A MINIMUM OF 2 FEET. PLACE TOPSOIL ON PLANTING SURFACE AND PLACE LIVE BRANCHES SUCH THAT 2/3 OF THE BRANCH WILL BE COVERED WITH SOIL AND 1/3 OF THE BRANCH IS EXPOSED, EXTENDING OUT BEYOND THE FACE OF THE BANK. PLACE A MINIMUM OF 8 TO 10 STEMS PER RUNNING FOOT OF BANK IN A SLIGHT CRISS-CROSS PATTERN. BACKFILL ABOVE LIVE BRANCHES WITH A 3 INCH LAYER OF TOPSOIL.
2. USING A STRIP OF COIR MATTING, LAY THE FABRIC OVER THE LIVE BRANCH LAYERING SUCH THAT A MINIMUM OF TWO FEET OF FABRIC IS OVER THE NEWLY PLACED LIVE BRANCHES AND TOPSOIL. LAY THE FABRIC DOWN-SLOPE AND PLACE A 6-INCH-THICK LAYER OF SOIL OVER THE FABRIC. GENTLY COMPACT THIS SOIL BY USING THE EXCAVATOR BUCKET CAREFULLY SO THAT THE UNDERLYING BRANCHES AND LOGS ARE NOT DISPLACED OR DAMAGED. WHEN STARTING TO PLACE THE FILL, OFFSET THE FILL APPROXIMATELY 2 INCHES BACK FROM THE FACE OF THE SLOPE TO CREATE A SLIGHT TERRACE. ON THE OUTER FACE OF THE SLOPE, WHICH WILL BE EXPOSED TO FLOW, PLACE 2 INCHES OF TOPSOIL, SEED AND COVER WITH COIR MATERIAL SUCH THAT SOIL CANNOT PIPE THROUGH THE OPENINGS IN THE MATTING FABRIC. WRAP THE MATTING OVER THE FACE OF THE SLOPE AND CREATE A NEW PLANTING SURFACE FOR THE NEXT LAYER OF LIVE BRANCHES ON A 5% SLOPE AWAY FROM THE CREEK.
3. REPEAT STEP 3 ABOVE TO BUILD THE NEXT SOIL WRAP AND LIVE BRANCH LAYER.
4. RECONSTRUCT THE SLOPES SUCH THAT THE OVERALL SLOPE IS 1:1 FOR POOLS.
5. ABOVE THE LAST LIVE BRANCH LAYER, PLACE THE COIR FABRIC IN THE LIVE BRANCH TRENCH, SIMILAR TO STEP 3, AND ADDITIONAL COIR MATERIAL ON THE FACE OF THE SLOPE AND EXTEND THE COIR FABRIC UP ONTO THE BANKFULL BENCH AREA. SLIGHTLY BURY THE EDGE OF THE FABRIC INTO THE SOIL BY PUSHING IN WITH THE BLADE OF A DOZER OR SHOVEL. SECURE THE FABRIC WITH STAKES PER THE PLANS. IF NECESSARY, INSTALL A SECOND ROLL OF COIR FABRIC ON THE BANKFULL BENCH.



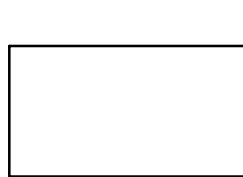
LOG VANE ROCK J-HOOK  
W/ OPTIONAL ROOTWAD

SCALE: NTS  
ADAPTED FROM STANTEC

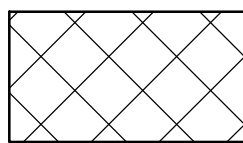


1. FILTER FABRIC SHALL BE PLACED ON THE UPSTREAM SIDE OF THE STRUCTURE 1/4 DIAMETER FROM THE TOP OF THE LOG. THE NAILS SHALL BE ON 12 INCH CENTERS. FILTER FABRIC SHALL BE BURIED IN THE BOTTOM OF THE CHANNEL AND SHALL BE PLACED THE ENTIRE LENGTH OF THE STRUCTURE.
2. A TRENCH SHALL BE DUG IN SUCH A MANNER THAT THE FOOTER BOULDERS AND LOGS AND A MINIMUM OF 2/3 OF THE HEADER BOULDER IS BURIED BENEATH THE BED SURFACE ELEVATION.
3. A HYDRAULIC EXCAVATOR WITH A BUCKET THAT CONTAINS A HYDRAULIC THUMB SHALL BE USED TO PLACE BOULDERS AND LOGS WITH THE SUPERVISION OF THE ENGINEER.
4. HEADER AND FOOTER LOGS SHALL BE A MINIMUM OF 8" IN DIAMETER. LOGS SHALL BE BURIED A MINIMUM OF 5' INTO THE BANK BEYOND BANKFULL.
5. FOOTER LOG SHALL BE PLACED FIRST WITH HEADER LOG PLACED ON TOP PRIOR TO BACKFILLING THE TRENCH.
6. THE HEADER ROCK SHALL BE PLACED AT 0.2 FT ABOVE THE CHANNEL 1/3 OF THE WAY ACROSS THE CHANNEL FROM THE OUTSIDE BANK.
7. THERE SHALL BE GAPS BETWEEN THE HEADER ROCKS OF AT LEAST 0.3 FT.
8. HEADER LOGS SHALL SLOPE FROM THE BED ELEVATION, AT THE HEAD OF THE VANE, TO 1/2 BANKFULL ELEVATION AT A SLOPE OF 2%-5%. HEADER AND FOOTER LOGS SHALL BE TIED SECURELY INTO THE BANK IN SUCH A WAY THAT IT ELIMINATES THE POSSIBILITY OF STREAMFLOW DIVERTING AROUND THEM.
9. ANY SOIL DISTURBED DURING THE PLACEMENT OF J-HOOK VANES, SHALL BE SEEDED USING TEMPORARY AND PERMANENT SEEDING METHODS.
10. FOOTER, HEADER AND ROOTWAD (IF USED) LOGS SHALL BE CABLED TOGETHER AT THE HORIZONTAL LOCATION OF BANKFULL.
11. FILTER FABRIC SHALL BE PLACED ON THE UPSTREAM SIDE OF THE VANE STRUCTURE TO PREVENT WASHOUT OF SEDIMENT THROUGH BOULDER GAPS. FILTER FABRIC SHALL EXTEND FROM THE BOTTOM OF THE FOOTER BOULDER TO THE FINISHED GRADE ELEVATION AND SHALL BE PLACED THE ENTIRE LENGTH OF THE STRUCTURE.

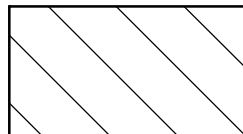




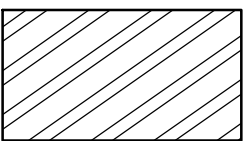
**AQUATIC BENCH**  
PLUGS OR TRANSPLANTS 2'-5' ON CENTER  
ALISMASUBCORDATUM  
JUNCUS CANADENSIS  
JUNCUS EFFUSES  
LEERSIAORYZOIDES  
LUDWIGIA ALTERNIFOLIA  
SCIRPUS CYPERINUS  
SCIRPUS VALIDUS



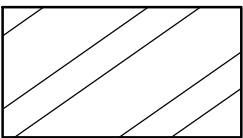
**WETLAND BMP**  
MIN. 9 lbs./AC  
ANDROPOGONGERARDII  
BROMUSCILATUS  
CALMAGROSTIS CANADENSIS  
CAREX HYSTERICINA  
CAREX STIPATA  
ELYMUSCANADENSIS  
ELYMUSVIRGINICUS  
GLYCERIAGRANDIS  
JUNCUS CANADENSIS  
PANICUM VIRGINICUS  
SCIRPUS CYPERINUS  
SCIRPUS VALIDUS  
JUNCUS EFFUSUS  
SORGHASTRUMNUTANS  
ANEMONE CANADENSIS  
ASCLEPIASINCARNATA  
ASTER NOVAE-ANGLIAE  
ASTER UMBELLATUS  
BOLTONIAASTEROIDES  
EUPATORIUM MACULATUM  
EUPATORIUM PERFOLIATUM  
HELIOPSISHELIAHIOIDES  
LIATRISPYCNOSTACHYA  
LEBELIA CARDINALIS  
LOBELIA SIPHILITTICA  
PHYSOSTEGIA VIRGINIANA  
PYCNANTHEMUM VIRGINIANUM  
RUDBECKIAHIRTA  
SILPHIUMMACINATUM  
SILPHIUMPERFOLIATUM  
VERBENA HASTATA  
VERNONIAN NOVAEBORACENSIS  
VERONICASTRUMVIRGINICUM  
ZIZIAAUREA



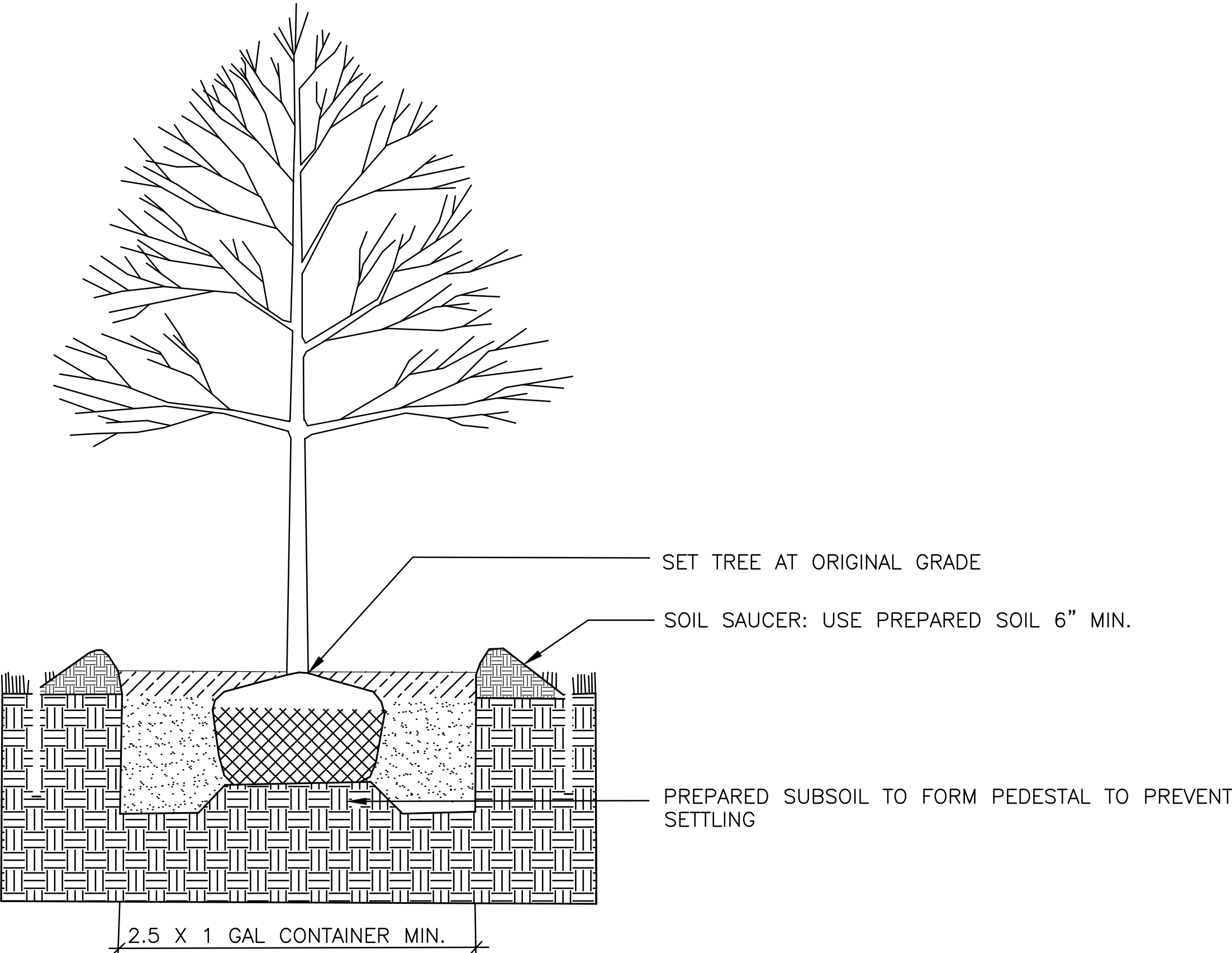
**PIEDMONT-MOUNTAIN ALLUVIAL FOREST**  
BARE ROOT/1-3 GAL. POTTED PLANTS  
ACER SACHARINUM  
BETULA NIGRA  
CARPINUSCAROLINIANUM  
CELTIS OCCIDENTALIS  
JUGLANS NIGRA  
PINUSSTROBUS  
PLATANUS OCCIDENTALIS  
VIBURNUM DENTATUM



**LIVE STAKE PLANTING**  
(INNER 5' FROM BANKFULL)  
STAKES 5' O.C.  
ALNUSSERRULATTA  
CEPHALANTHUS OCCIDENTALIS  
PHYSOCARPUSOPPUFOLIUS  
SALIX NIGRA



**STEEP SLOPES**  
BARE ROOT/1-3 GAL. POTTED PLANTS  
CELTIS OCCIDENTALIS  
JUNGLANS NIGRA  
LIRIODENDRON TULIPIFERA  
PINUSSTROBUS  
VIBURNUM PRUNIFOLIUM



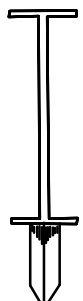
SEEDLING / LINER BARERROOT PLANTING DETAIL  
SCALE: N.T.S.

**PLANTING NOTES:**

**PLANTING BAG**  
During planting, seedlings shall be kept in a moist canvas bag or similar container to prevent the root systems from drying.

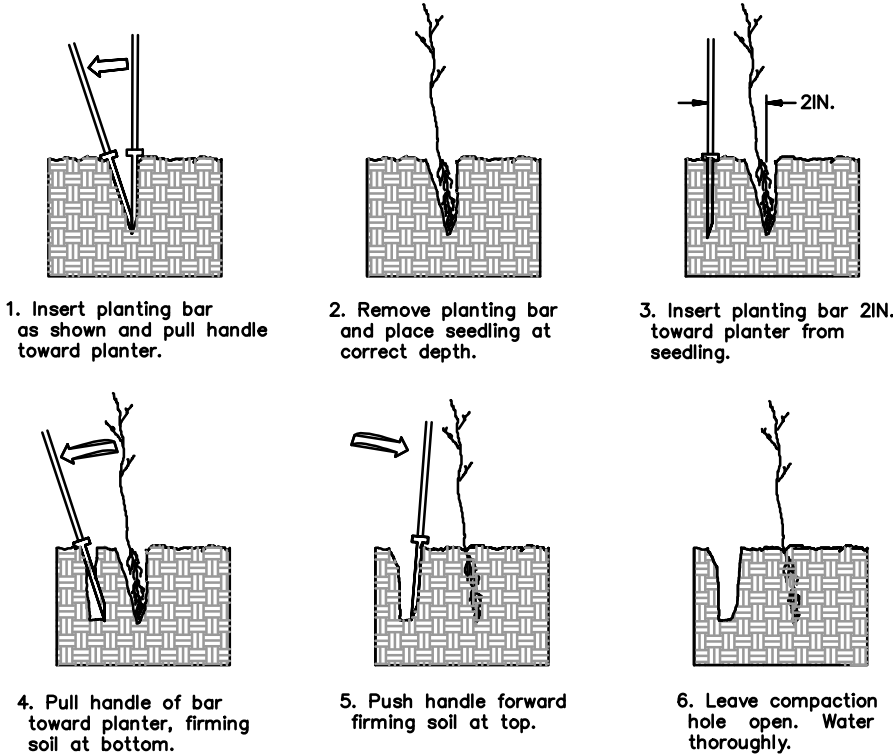


**KBC PLANTING BAR**  
Planting bar shall have a blade with a triangular cross section, and shall be 12IN. long, 4IN. wide and 1IN. thick at center.



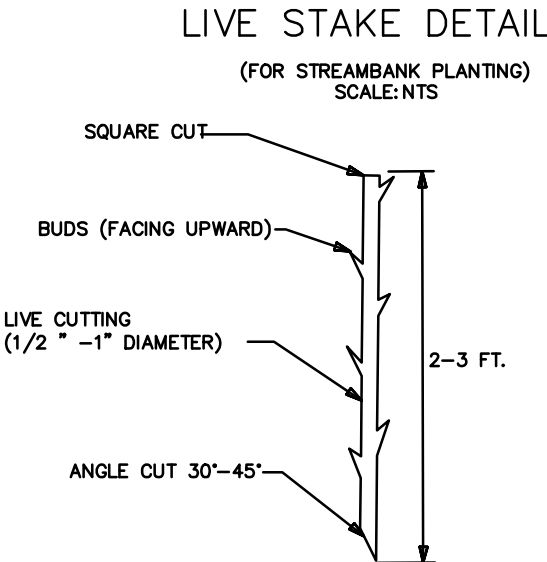
**ROOT PRUNING**  
All seedlings shall be root pruned, if necessary, so that no roots extend more than 10 inches (10IN.) below the root collar.

**DIBBLE PLANTING METHOD**  
USING THE KBC PLANTING BAR  
(FOR FLOODPLAIN BUFFER PLANTING AND UPLAND BUFFER PLANTING)

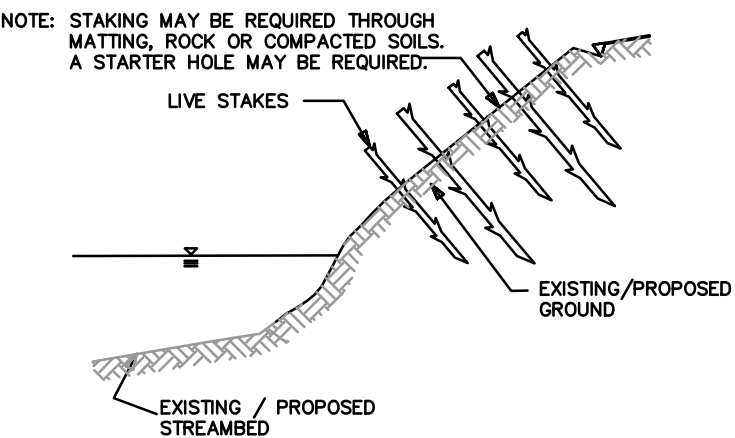


NOTE:  
1. OTHER PLANTING METHOD CAN BE USED WITH THE PERMISSION OF THE PLANTING SUPERVISOR.

**PLANTING DETAILS**  
ADAPTED FROM STANTEC

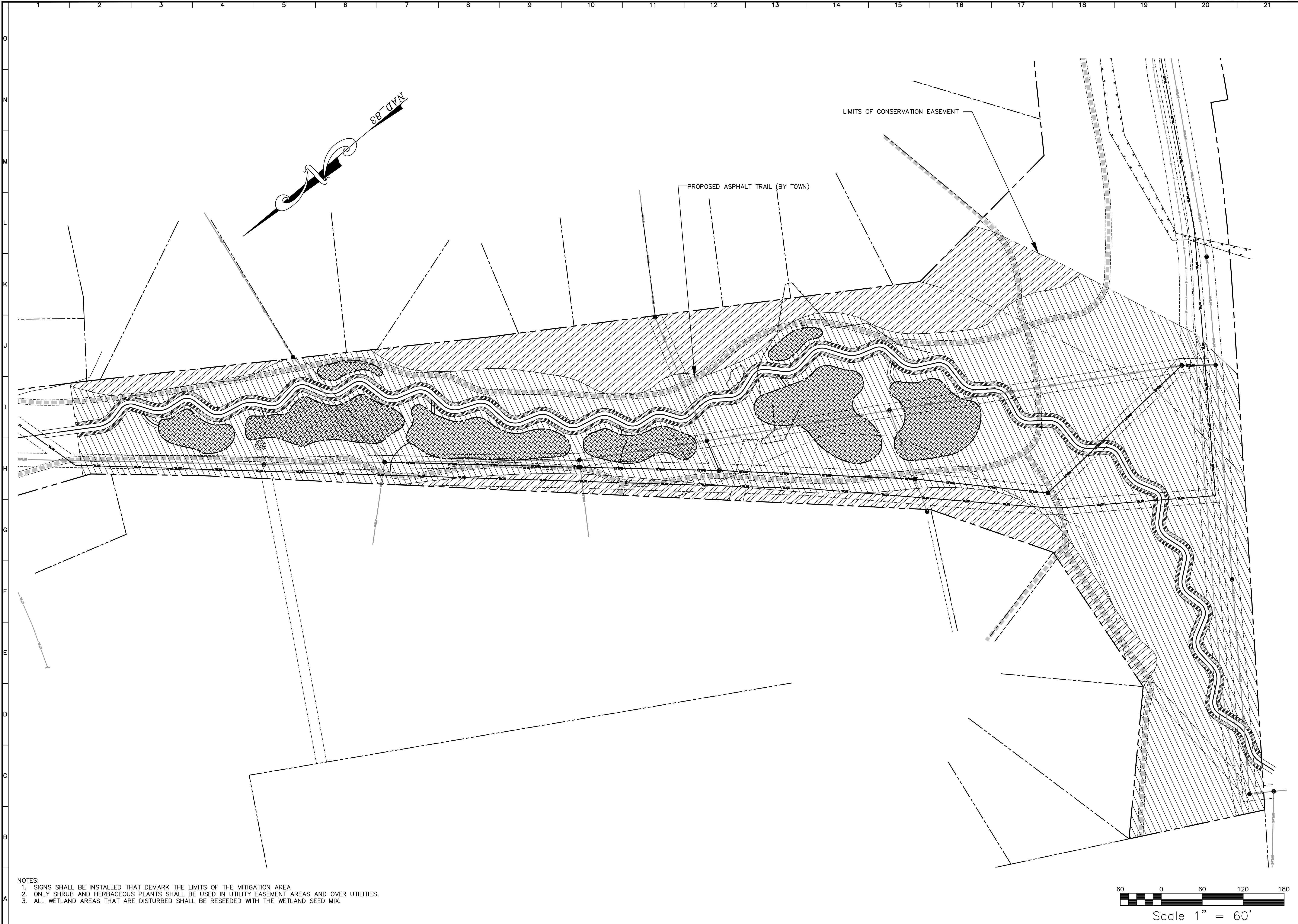


**LIVE STAKE**

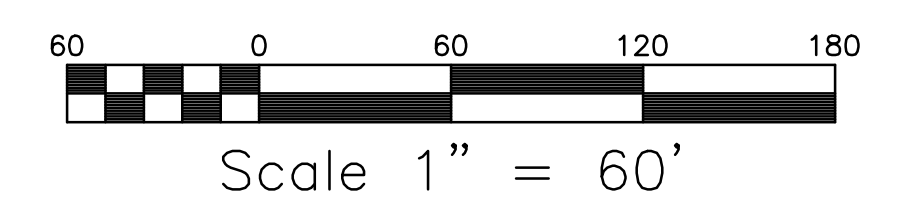


NOTE:  
1. LIVE STAKES SHALL BE EVENLY SPACED 4 FT. APART.  
2. LIVE STAKES SHALL BE DRIVEN UNTIL APPROXIMATELY 3/4 OF LIVE STAKE IS WITHIN GROUND.  
3. AFTER DRIVING INTO GROUND, REMOVE TOP OF STAKE TO 1" BELOW SPLIT WOOD (MIN. 1") WITH LOPPERS/PRUNERS AT AN ANGLE.  
4. IF STARTER HOLE IS NEEDED, MINIMIZE AIR POCKET.  
5. UTILIZE ALL ON SITE TRANSPLANT MATERIALS WHERE POSSIBLE ONCE SOURCE OF TRANSPLANT MATERIAL HAS BEEN HARVESTED, THEN UTILIZE LIVE STAKING.

**BANK STABILIZATION WITH LIVE STAKES**



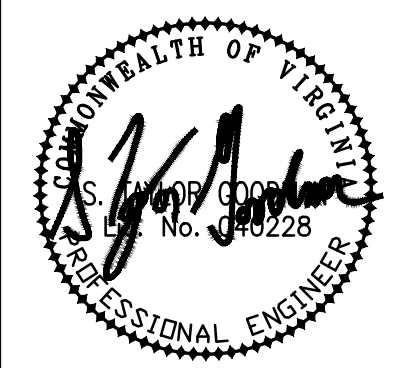
- NOTES:
1. SIGNS SHALL BE INSTALLED THAT DEMARK THE LIMITS OF THE MITIGATION AREA
  2. ONLY SHRUB AND HERBACEOUS PLANTS SHALL BE USED IN UTILITY EASEMENT AREAS AND OVER UTILITIES.
  3. ALL WETLAND AREAS THAT ARE DISTURBED SHALL BE RESEEDED WITH THE WETLAND SEED MIX.



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WETLAND DELINEATIONS & STREAM EVALUATIONS

**Balzer and Associates, Inc.**  
15871 City View Drive, Suite 200  
Midlothian, VA 23113  
804-794-0571  
FAX 804-794-2635



**DIAMOND HILLS PARK**  
STREAM RESTORATION  
PLANTING SCHEDULE  
TOWN OF CHRISTIANSBURG, VIRGINIA

DRAWN BY STG  
DESIGNED BY WKM  
CHECKED BY STG/BW  
DATE 6-17-2011  
SCALE 1"=60'

REVISIONS: