

PRE-CONSTRUCTION MEETING AND CONSTRUCTION COMMENCEMENT:

- VIRGINIA DEPARTMENT OF TRANSPORTATION

- See Sheet ____ for Stormwater Site Statistics Table.
See Sheet ____ for New BMP Information Table.

OWNER - ROANOKE COUNTY, DEPARTMENT OF DEVELOPMENT SERVICES



- Western Virginia Water Authority
Availability letter number: _____



PRIVATE UTILITIES

- | <u>PR #:</u> | <u>NOTES:</u> |
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| | |
- Revision Table

- ## Sheet Index

Horizontal and vertical control surveys were performed in year: 2023
By: Wetland Studies and Solutions, Inc.

All vertical elevations must be referenced to the National Geodetic Vertical Datum of 1988
All horizontal elevations must be referenced to the North American Datum of 1983.

Horizontal Datum: VCS, SOUTH NAD83 Vertical Datum: NAVD 88

Source of topographic mapping is dated JULY 2023

Boundary was performed by N/A dated: _____

Benchmark Information: SEE SHEET 11 - 13

The professional seal and signature certifies the boundary survey and topographic mapping to be accurate and correct.

*Easement plats provided by Roanoke County.

NOT USED

DESIGN ENGINEER / SURVEYOR
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Blacksburg, VA 24060

PHONE NO: (540) 795.6180 FAX NO: (703) 679.5601

PROJ. MANAGER: **Nathan A. Staley** EMAIL: nstaley@wetlands.com



**5235 Canter Drive
Roanoke, Virginia**

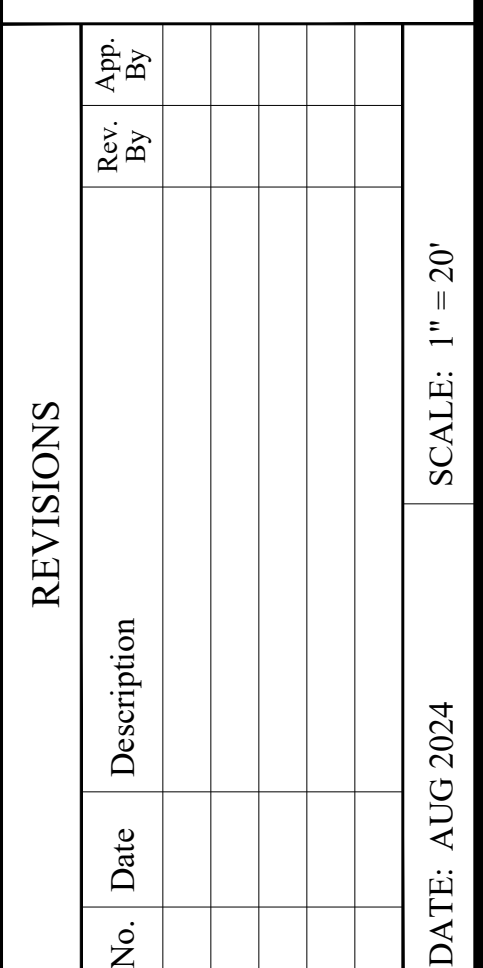
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28



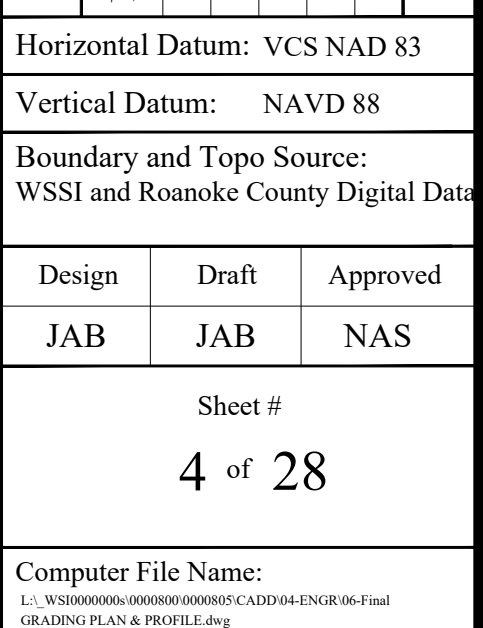
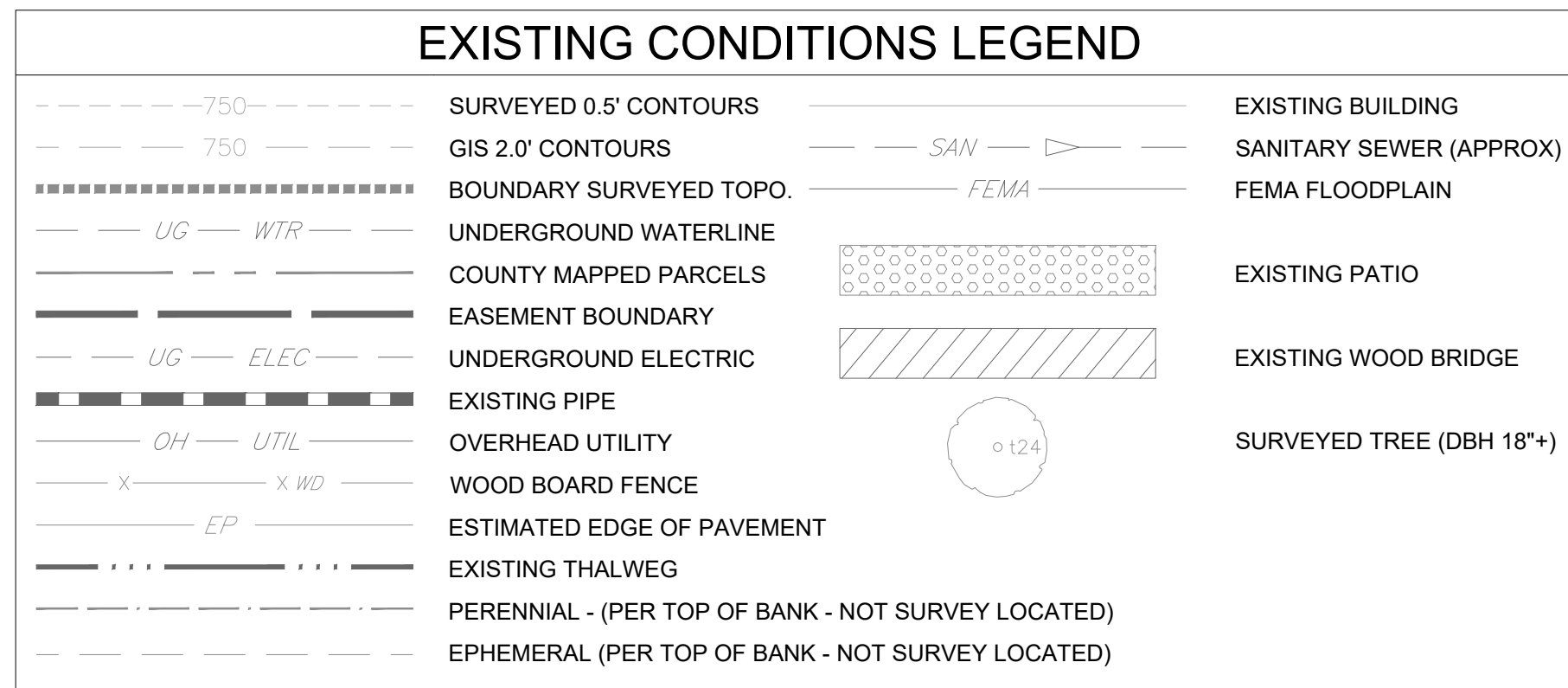
Roanoke County, Virginia

Grading Plan





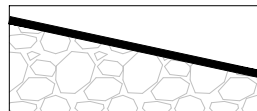

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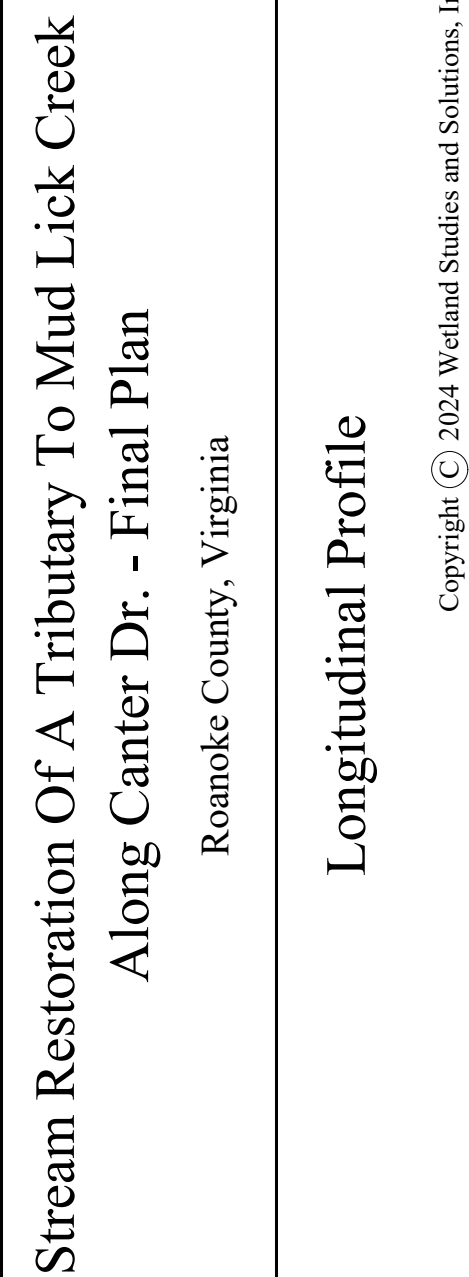


*TBR = TO BE REMOVED



PROFILE LEGEND

	EXISTING STREAM INVERT PROJECTED TO PROPOSED CENTERLINE
	PROPOSED STREAM INVERT ALONG PROPOSED CENTERLINE
	STRUCTURE ROCK
	EARTH FILL
	CLASS 1 REINFORCED BED MIX
	BOULDER RIFFLE, CLASS I REINFORCED BED MIX ARMORED WITH CLASS II



REVISIONS					
No.	Date	Description	Rev. By	App. By	
DATE: AUG 2024			SCALE: N/A		

Horizontal Datum: VCS NAD 83

Vertical Datum: NAVD 88




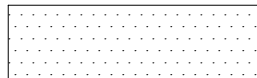
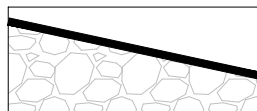

Boundary and Topo Source:
WSSI and Roanoke County Digital Data

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JAB	JAB	NAS

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PROFILE LEGEND

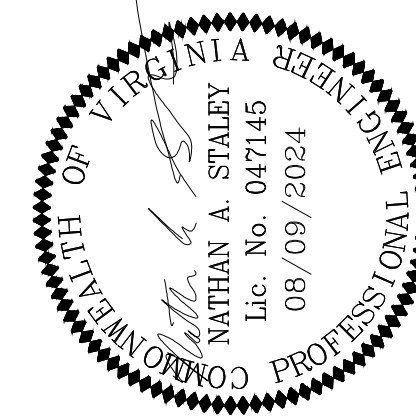
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	PROPOSED STREAM INVERT ALONG PROPOSED CENTERLINE
	STRUCTURE ROCK
	EARTH FILL
	CLASS 1 REINFORCED BED MIX
	BOULDER RIFFLE, CLASS I REINFORCED BED MIX ARMORED WITH CLASS II



Roanoke County, Virginia

Longitudinal Profile (cont'd)

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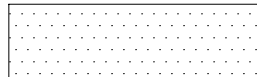
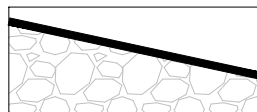

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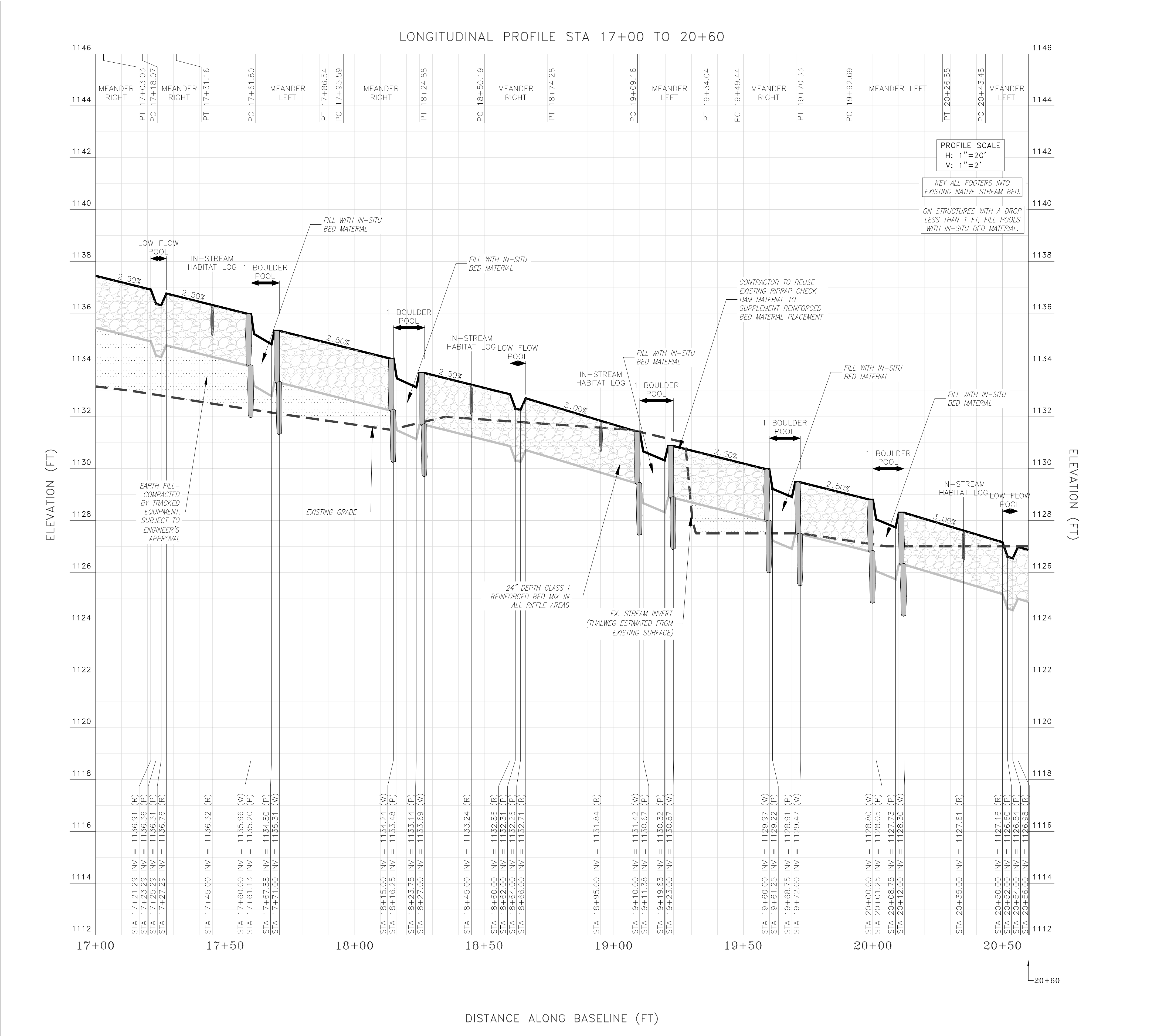
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PROFILE LEGEND

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Stream Restoration Of A Tributary To Mud Lick Creek Along Canter Dr. - Final Plan

Roanoke County, Virginia

Longitudinal Profile (cont'd)

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Vertical Datum: NAVD 88




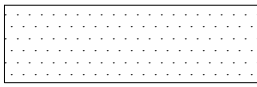
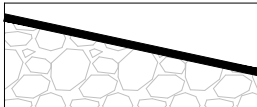

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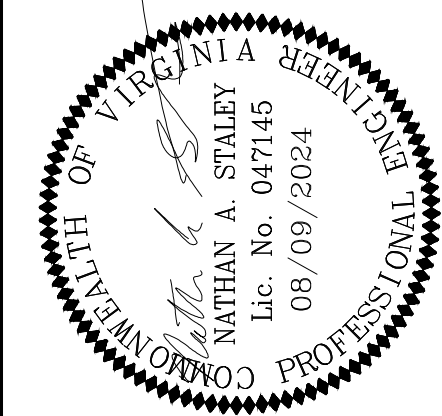
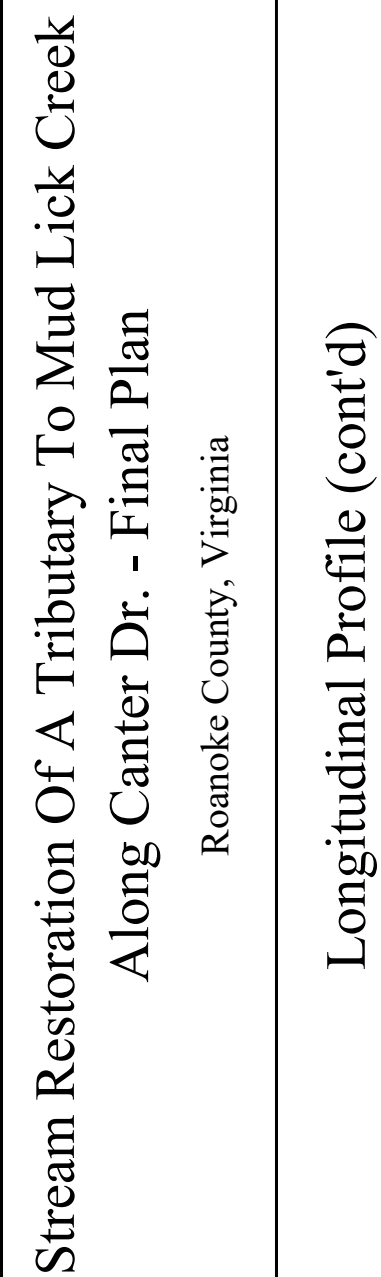
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PROFILE LEGEND

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PROFILE LEGEND

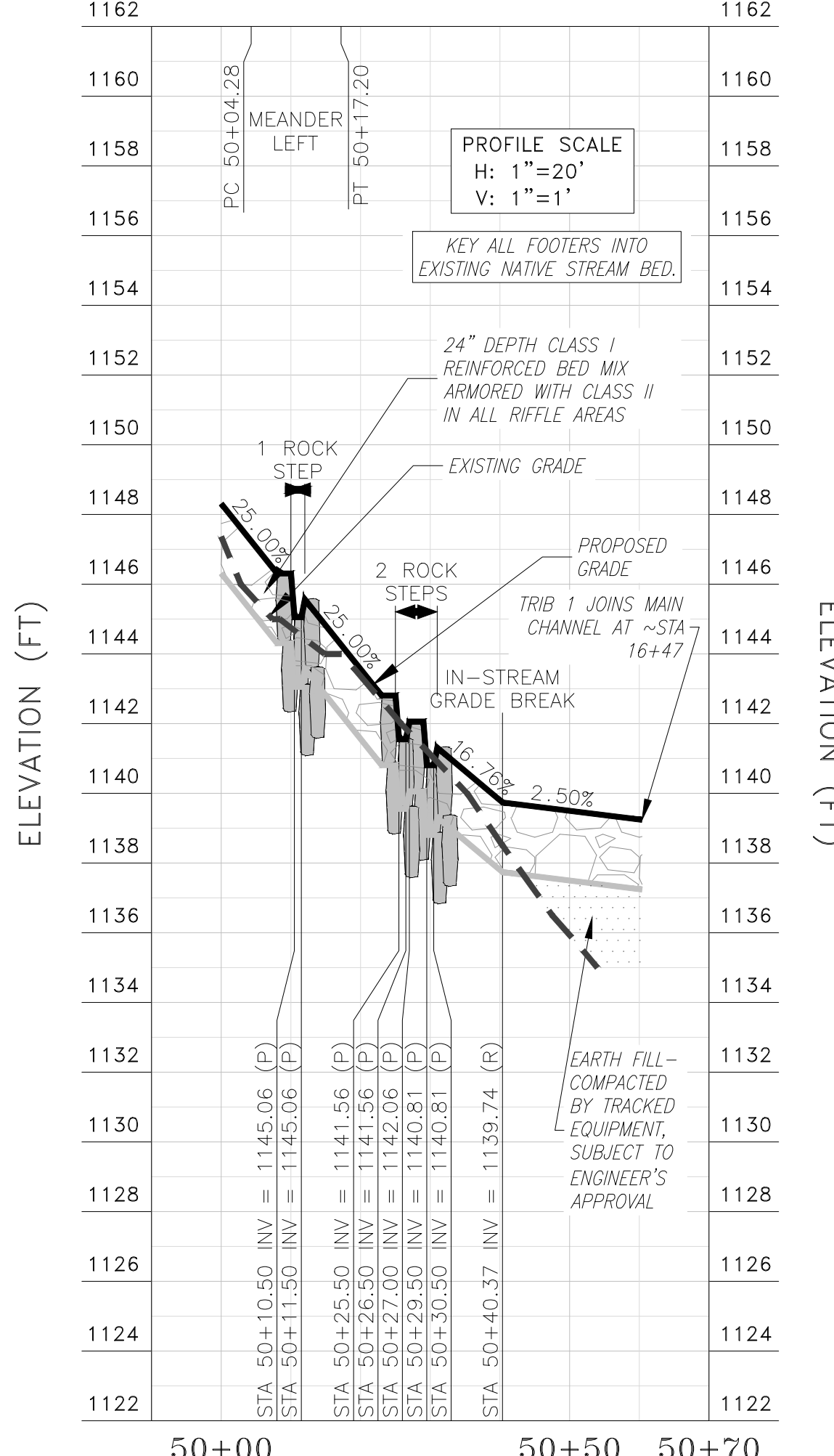
STRUCTURE ROCK

EARTH FILM

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BOULDER RIFFLE, CLASS I
REINFORCED BED MIX ARMORED
WITH CLASS II

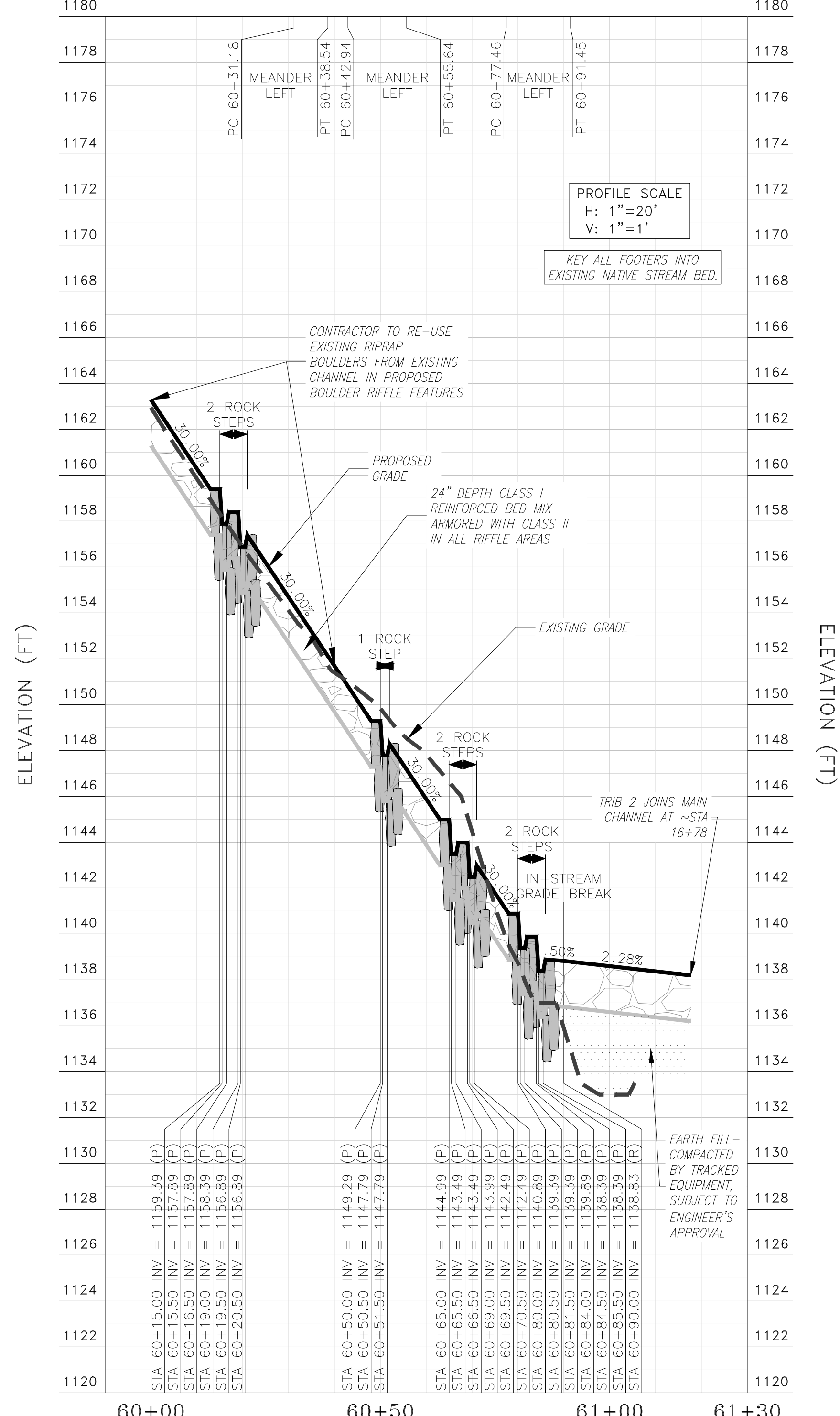
LONGITUDINAL PROFILE STA 49+90 TO STA 50+70



49+90

DISTANCE ALONG BASELINE (FT)

LONGITUDINAL PROFILE STA 59+90 TO STA 62+30



59+90

DISTANCE ALONG BASELINE (FT)

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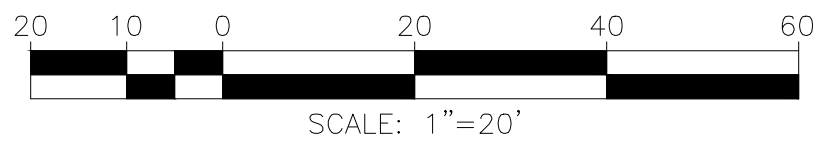
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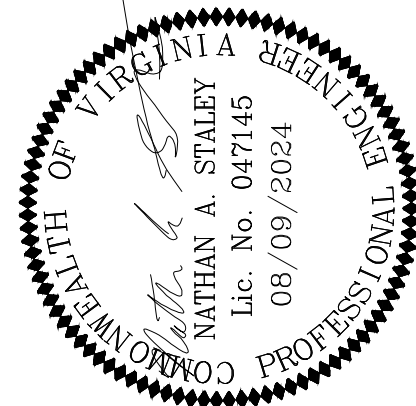
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SEE EXISTING CONDITIONS PLAN
FOR EXISTING LEGEND,
GRADING PLAN FOR PROPOSED
LEGEND (SHEETS 2 AND 4).

Roanoke County, Virginia

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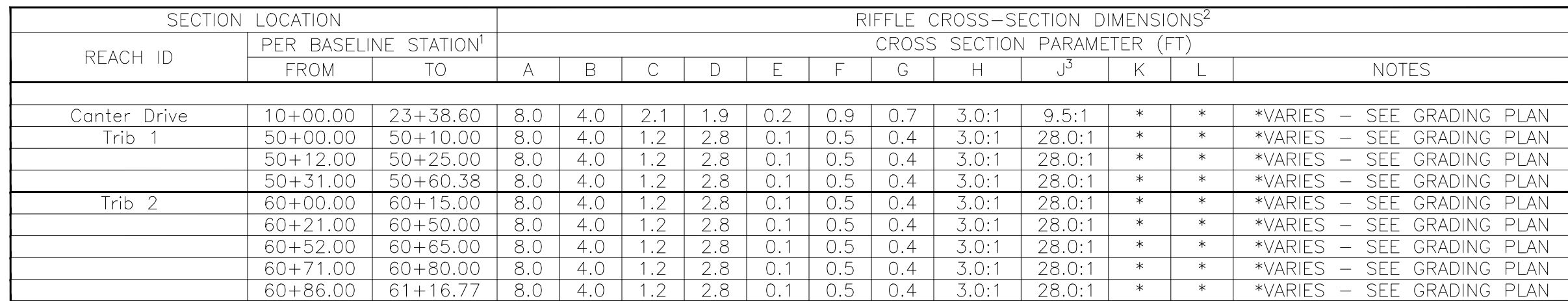
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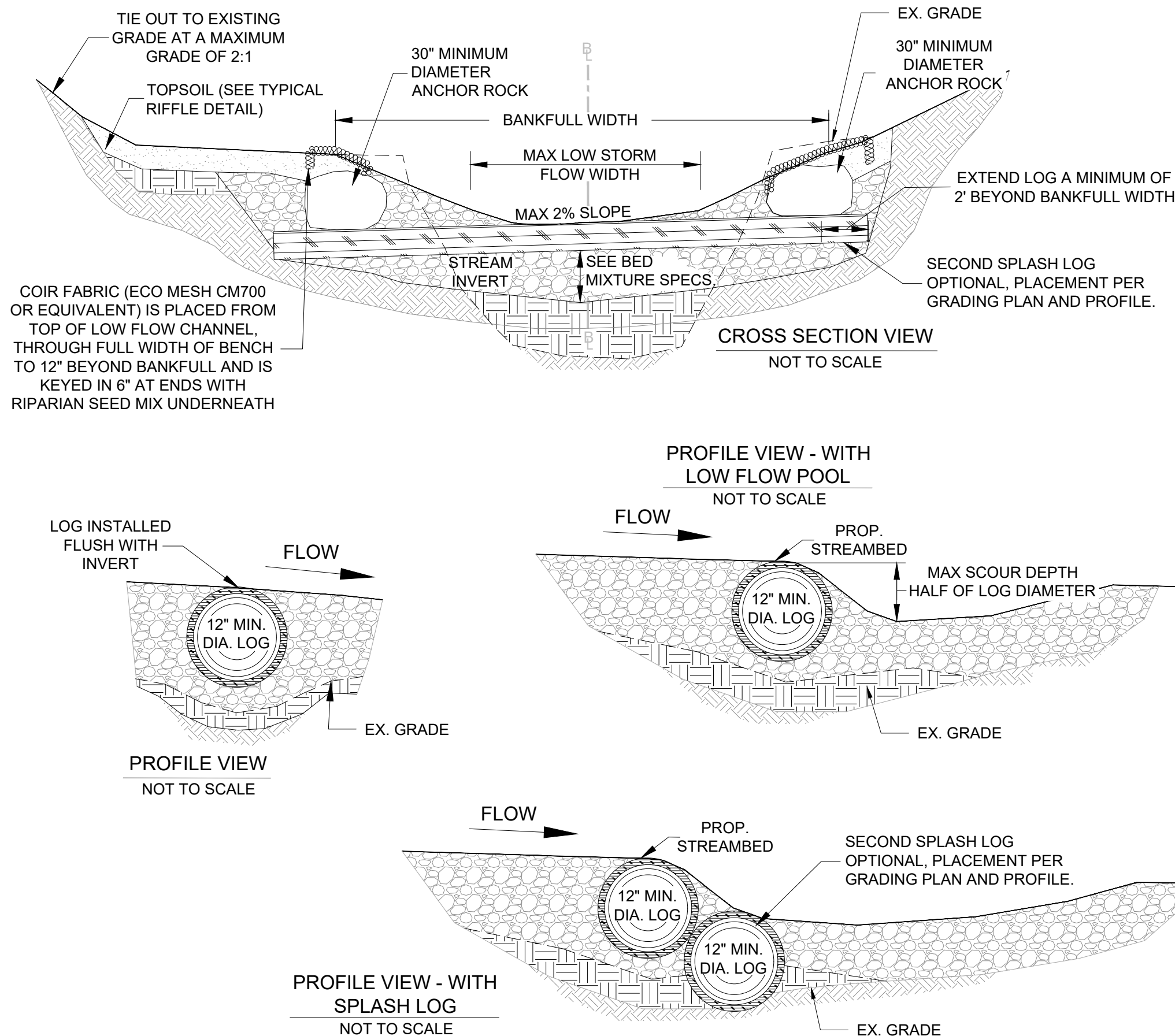
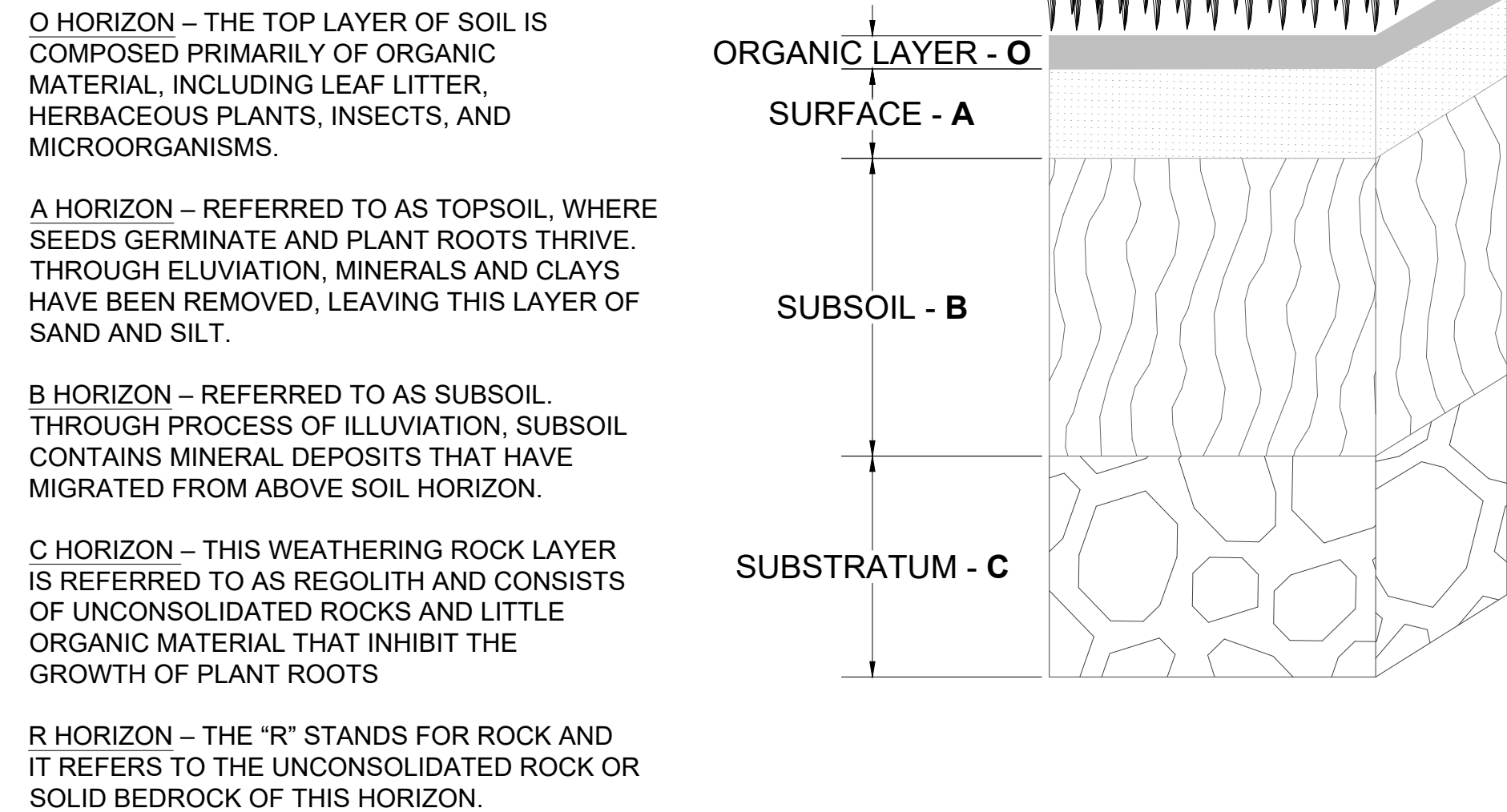
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GEOMETRY PLAN.dwg



1. TOPSOIL SHALL BE PLACED ON DESIGNATED AREAS WITHIN THE LOD TO A MINIMUM DEPTH OF 4 INCHES, ON TOP OF 3" (MINIMUM) OF LOOSENEED SUBGRADE.
2. ALL SALVAGED SOIL SHALL BE FROM THE "O" OR "A" HORIZONS (SEE TYPICAL SOIL HORIZON DETAIL - THIS SHEET). HORIZONS "B" AND "C" SHALL ONLY BE USED FOR FILL MATERIAL.
3. SALVAGED SOIL SHALL ONLY BE HARVESTED FROM AREAS DESIGNATED TO BE GRADED. NO TOPSOIL SHALL BE REMOVED FROM THE SITE AND A SOIL HARVEST CAN HAPPEN AT ANY GIVEN TIME DURING CONSTRUCTION.
4. ALL HARVESTED SOIL MUST BE PROPERLY STORED IN A DESIGNATED STOCKPILE/STAGING AREA WITH APPROPRIATE E&S CONTROLS IN ACCORDANCE WITH THE CONSTRUCTION PLANS AND THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK (VESCH).
5. THE TOPSOIL MIXTURE SHALL BE WELL MIXED AND SEEDED PER THE PLANTING PLAN IMMEDIATELY FOLLOWING INSTALLATION AND PRIOR TO STRAW AND MATTING PLACEMENT.
6. IMPORTED TOPSOIL SHALL MEET THE REQUIREMENTS SPECIFIED IN THE CONSTRUCTION SPECIFICATIONS.














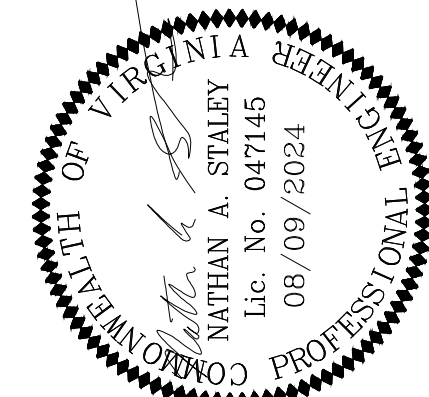
MATERIAL	SIZE	PORTION	PERCENT (%)
ROCK ² VDOT CL I RIPRAP	8.0 - 16.0 in (203 - 406 mm) (D ₅₀ = 13.2 in) ³	2 BUCKETS	35 - 40%
BANK RUN ⁴ GRAVEL	0.08 - 2.5 in (2 - 64 mm) (D ₅₀ = 1.3 in)	2 BUCKETS	35 - 40%
COARSE SAND ⁵	0.04 - 0.08 in (1 - 2 mm)	0.75 BUCKET	12 - 17%
TOPSOIL ⁶	LOAM OR SILT LOAM WITH 3-5% ORGANIC CONTENT	0.5 BUCKET	7 - 12%

- 1 THE REINFORCED BED SHALL BE A MINIMUM OF 24" IN DEPTH. SEE LONGITUDINAL PROFILE FOR LOCATIONS AND THICKNESS.
- 2 THE ROCK PORTION OF THE MIXTURE SHALL CONSIST OF RIVER WASHED COBBLE (TAN, YELLOW, OR BROWN) WITH THE SPECIFIED D_{50} . THE VOIDS FILLED WITH A MIXTURE OF SAND, GRAVEL, AND TOPSOIL. THE COMBINATION OF PARTICLE SIZES SPECIFIED IN CONJUNCTION WITH THE FILLING OF THE VOIDS, WILL RESULT IN A VERY RESISTANT, ARMORED SUBSTRATE THAT WILL BE CAPABLE OF WITHSTANDING MUCH GREATER SHEAR STRESS THAN THE COMPUTATION OF THE REQUIRED D_{50} WOULD SUGGEST.
- 3 CONTRACTOR TO REUSE EXISTING ROCK CHECK DAM STONE TO SUPPLEMENT IMPRESSED REINFORCED BED MATERIAL, WHILE ADHERING TO GENERAL MATERIAL SIZE REQUIREMENTS.
- 4 BANK RUN GRAVEL MAY INCLUDE UP TO 5% CLAY, SILT, AND/OR SAND, AND UP TO 25% COBBLE ($D_{50} = 3"$ TO 8"). GRAVEL MUST HAVE NATURAL COLOR (TAN, YELLOW, OR BROWN).
- 5 THE SAND PORTION OF THE MIXTURE SHALL CONSIST OF A WELL MIXED SAND PREDOMINANTLY 1.0 MILLIMETERS TO 2.0 MILLIMETERS IN SIZE, SUBJECT TO ENGINEER APPROVAL. (I.E. WASHED CONCRETE SAND IS NOT REQUIRED). SAND MUST BE WHITE, TAN, YELLOW, OR BROWN IN COLOR.
- 6 THE TOPSOIL PORTION OF THE MIXTURE SHALL CONSIST OF 50% SIFTED, UNWASHED COARSE SAND (WITH FINES ALLOWED), 25% COMPOSTED LEAF/BARK MULCH, 25% MINERAL SILT OR FINER MATERIAL (STONE DUST FROM ROCK CRUSHING OPERATIONS OR ANY SILT/CLAY).

1. SEE LONGITUDINAL PROFILE AND STAKEOUT SHEETS FOR ADDITIONAL INFORMATION INCLUDING ELEVATIONS AND SPECIFICS REGARDING POOL ARMORING AND BED MATERIAL THICKNESS. (ANY PORTIONS OF THE CHANNEL WITH SLOPES GREATER THAN 2.0% SHALL HAVE A MINIMUM REINFORCED BED MATERIAL THICKNESS OF 1.5x THE BED MATERIAL ROCK FRACTION D50, UNLESS OTHERWISE SPECIFIED IN THE PROFILE.)
2. REPRODUCE THE TYPICAL RIFFLE CROSS-SECTION FOR PLACEMENT OF COIR FABRIC ALONG THE STREAM.
3. STRUCTURES SHALL BE UNDERLAIN BY WOVEN OR NON-WOVEN POLYPROPYLENE GEOTEXTILE AS NOTED IN TECHNICAL SPECIFICATIONS.
4. BACKFILL BETWEEN VANES AND BANKS WITH REINFORCED BED USED IN CHANNEL.
5. ALL STRUCTURES SHALL BE KEYED INTO THE BANK, VIA SILL OR STRUCTURE ROCK PLACEMENT. A MINIMUM OF 3 FT BEYOND BANKFULL AND COMPLETELY ACROSS ANY PLACED FILL (SEE PLAN VIEW FOR DETAILS).
6. THE PLAN VIEWS OF ALL STRUCTURES LOCATED IN MEANDER BENDS ARE SHOWN AS LEFT MEANDERS (THE OUTER BANK SITUATED ON THE RIGHT LOOKING DOWNSTREAM). FOR A RIGHT MEANDER STRUCTURE (THE OUTER BANK SITUATED ON THE LEFT), THE PLAN VIEW SHOWN IS A MIRROR IMAGE OF WHAT SHOULD BE CONSTRUCTED. SEE STRUCTURE STAKEOUT SHEETS FOR STAKEOUT POINT INFORMATION.

1. ALL HEADER AND FOOTER ROCKS USED IN THE MAIN CHANNEL SHALL HAVE AN INTERMEDIATE DIMENSION OF AT LEAST **30 INCHES**.
2. SILL ROCKS SHALL HAVE AN INTERMEDIATE DIMENSION OF AT LEAST 12 INCHES.
3. THE BOTTOM OF ALL FOOTER ROCKS SHALL BE A MINIMUM OF 18 INCHES BELOW MAX POOL ELEVATION.
4. FOR NARROW STREAMS, THE VANE HEADER ROCKS MAY BE CONFIGURED TO TAKE THE PLACE OF THE CENTER HEADER ROCK AS LONG AS ALL DIMENSIONS OF THE STRUCTURE ARE MAINTAINED.
5. MORE THAN 2 ROWS OF ROCKS MAY BE NECESSARY TO ACHIEVE PROPER DIMENSIONS.
6. STRUCTURE ROCKS SHOULD BE PLACED SO AS TO MINIMIZE GAPS BETWEEN ROCKS. (THIS MAY REQUIRE REVERSING ROCKS OR SETTING SIDES OR USING ELSEWHERE.) PRIORITY SHOULD BE GIVEN TO FORMING TIGHT JOINTS AT THE TOP OF ROCKS. ANY GAPS LARGER THAN FIST-SIZED MUST BE CHINKED ON THE UPSTREAM (BACK SIDE) OF THE STRUCTURE PRIOR TO PLACING FILTER FABRIC AND BACKFILLING.

- | | |
|---|-----------------------|
|  | REINFORCED BED |
|  | IN-SITU MATERIAL |
|  | FILL MATERIAL |
|  | TOPSOIL (4 INCH MIN.) |
|  | FILTER FABRIC |
|  | COIR MATTING |
|  | STAKEOUT/WEIR POINT |
|  | HEADOUT (TOP) ROCK |
|  | WEIR ROCK |
|  | FOOTER ROCK |
|  | SPLASH ROCK |



REVISIONS			
No.	Date	Description	Rev. By
DATE: AUG 2024		SCALE: As Noted	

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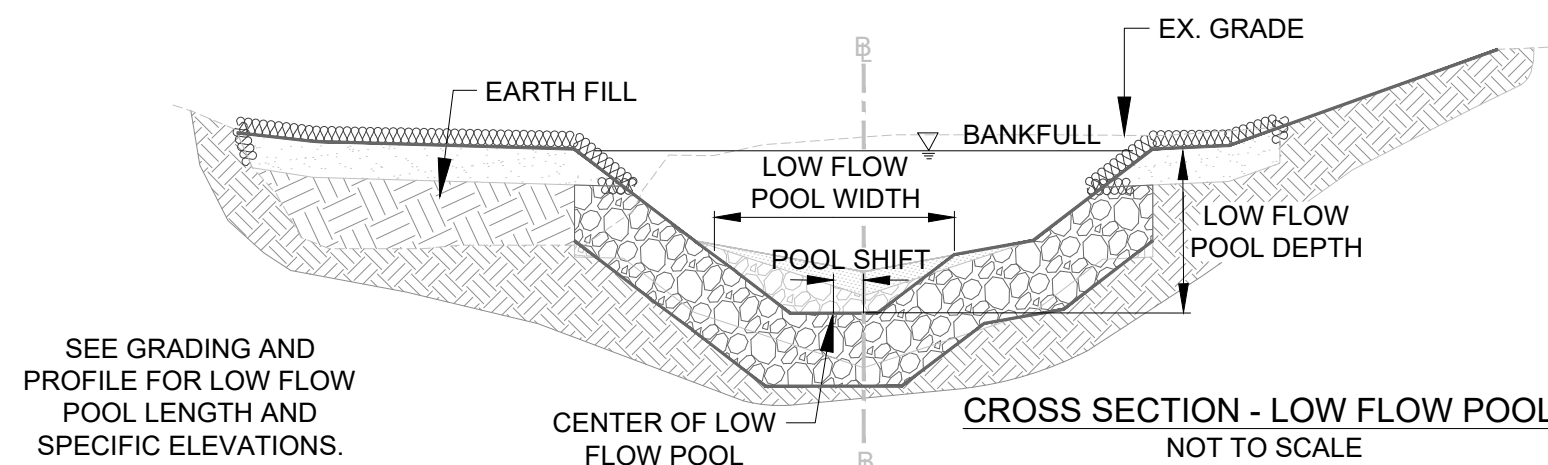
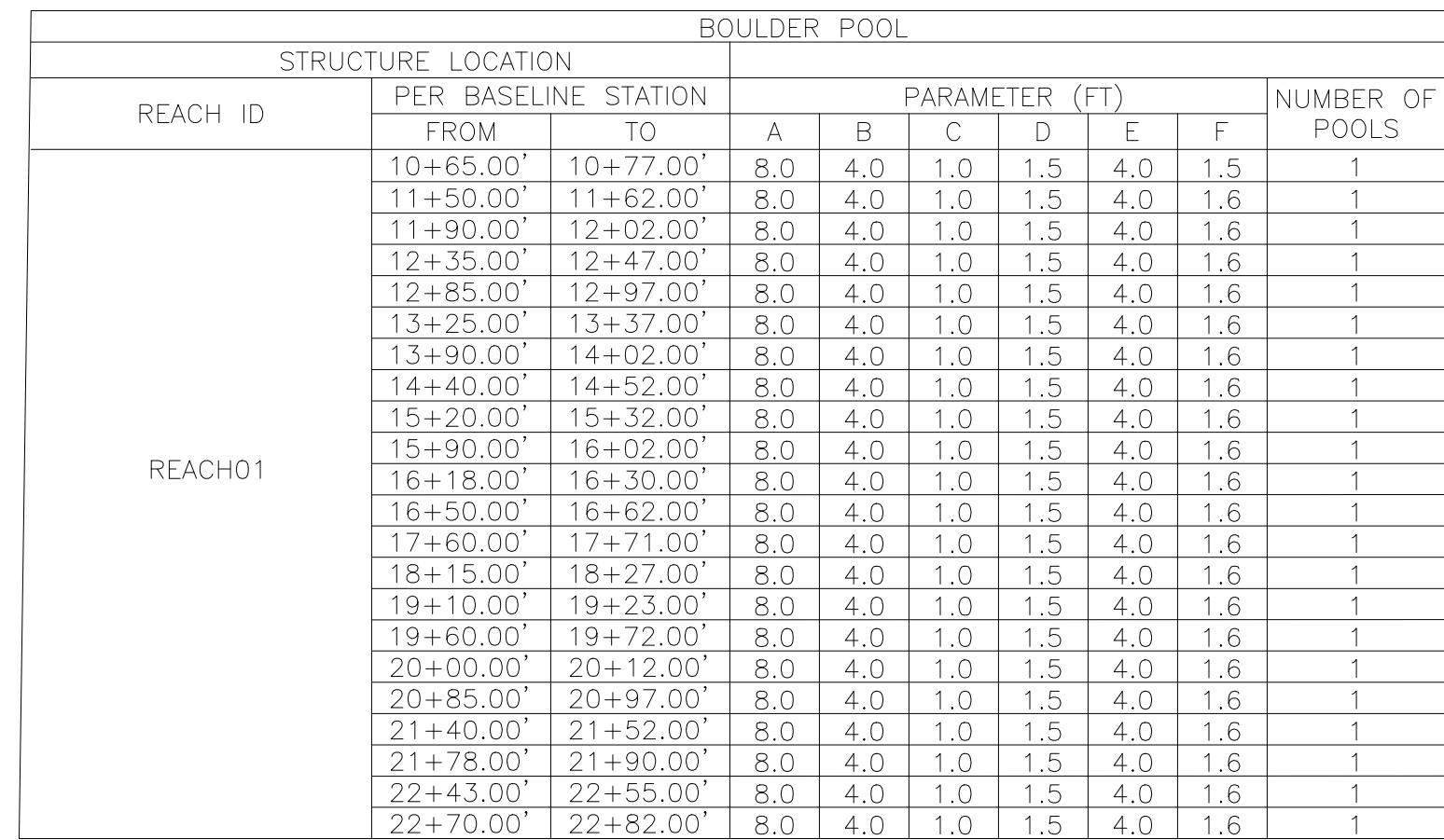
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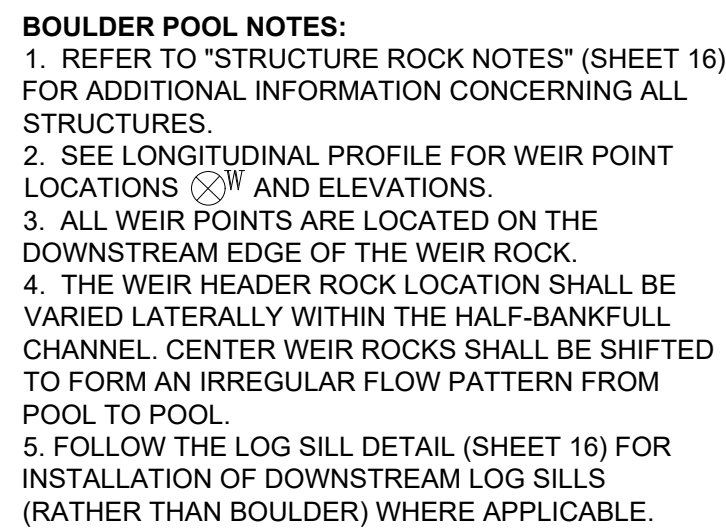
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LOW FLOW POOL (ALL OCCURRENCES)		
CROSS SECTION PARAMETER (FT)		
LF POOL WIDTH	LF POOL DEPTH	LF POOL SHIFT
3.0	1.4	0.3



A cross-sectional diagram of a filter fabric. The top part shows a horizontal layer with a wavy surface. An arrow labeled "FLOW" points from left to right above this layer. A vertical line segment labeled "B - DROP OVER FEATURE" indicates the height of a bump on the surface. A horizontal double-headed arrow labeled "LENGTH VARIES (SEE GENERAL NOTE #2)" spans the width of the top layer. The bottom part of the diagram shows a cross-section of the filter fabric, with a stippled area labeled "FILTER FABRIC" and a hatched area labeled "STREAMBED". The top surface of the filter fabric is labeled with W_N , W_{N+1} , and W_{END} . The bottom surface is labeled "STREAMBED".

ROCK STEP DIMENSIONS					
REACH ID	WEIR STATION	WEIR POINT #	WEIR ELEVATION	PARAMETER (FT)	
				A	B
CANTER DRIVE	23+18.0		1114.67	----	----
	23+22.0	2	1113.92	0.5	0.75
	23+24.0	END	1113.17	0.5	0.75
TRIB 1	50+10.0	1	1146.31	----	----
	50+12.0	END	1145.56	0.5	0.75
	50+25.0	1	1142.81	----	----
	50+29.0	2	1142.06	0.5	0.75
	50+31.0	END	1141.31	0.5	0.75
TRIB 2	60+15.0	1	1159.39	----	----
	60+19.0	2	1158.39	0.5	1.00
	60+21.0	END	1157.39	0.5	1.00
	60+50.0	1	1149.29	----	----
	60+52.0	END	1148.29	0.5	1.00
	60+65.0	1	1144.99	----	----
	60+69.0	2	1143.99	0.5	1.00
	60+71.0	END	1142.99	0.5	1.00
	60+80.0	1	1140.89	----	----
60+84.0	2	1139.89	0.5	1.00	
	60+86.0	END	1138.89	0.5	1.00

PLAN VIEW
NOT TO SCALE

TIE INTO EXISTING GRADE

PLACE ROCKS SO THAT JOINTS DO NOT ALIGN WITH JOINTS BELOW.

TOE OF BANK

ADAPTED FROM MARYLAND'S WATERWAY CONSTRUCTION GUIDELINES

6-IN. SETBACK BETWEEN ALL ROCK ROWS

FLOW

SECTION XS1
NOT TO SCALE

EXISTING GRADE

STABLE CUT FACE

GEOTEXTILE TO PREVENT PIPING OF FINES

MINIMUM 6" OVERLAP

MINIMUM 6" SETBACK

ROCKS SHALL BE ANGULAR AND HAVE A MINIMUM WIDTH EQUAL TO 1/3 THE VERTICAL HEIGHT OF THE WALL

STREAM BED

TOE TRENCH AND FOOTER ROCK (SET BELOW SCOUR DEPTH)

GENERAL ROCK WALL NOTES:

1. REFER TO "GENERAL STRUCTURE NOTES" FOR ADDITIONAL INFORMATION CONCERNING ALL STRUCTURES.
2. STONE BLOCKS SHALL BE RATED INTO THE BANK DURING PLACEMENT SUCH THAT THE UPSTREAM BLOCKS OVERLAP THE DOWNSTREAM BLOCKS BY A MINIMUM OF 6 INCHES.

DEFINITION SKETCH
NOT TO SCALE

4 ft

MAX. HEIGHT

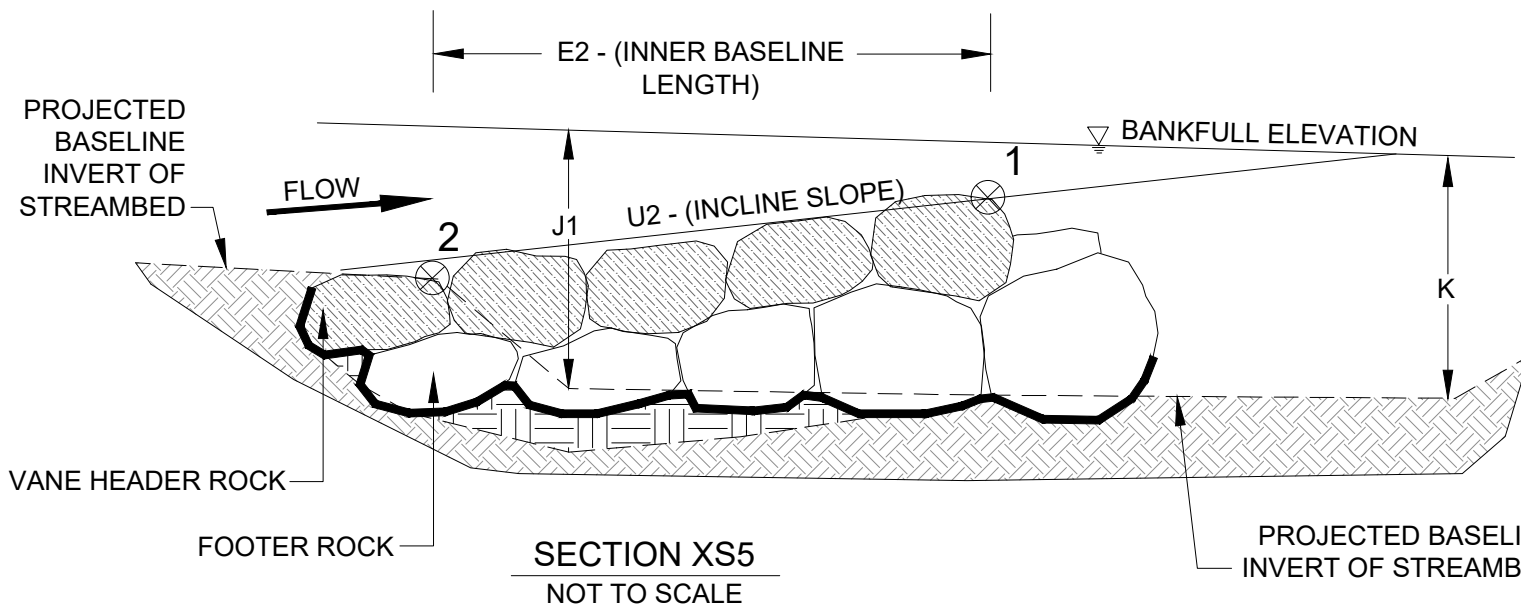
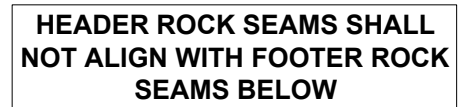
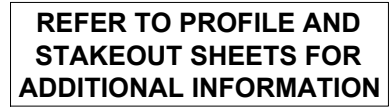
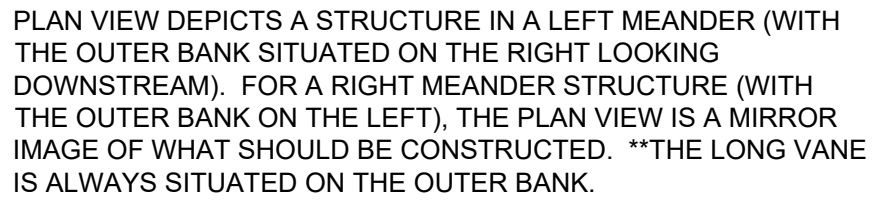
β = BACKFILL SLOPE ANGLE (2H:1V OR FLATTER BUT GREATER THAN 5.0%)

α = INCLINATION OF WALL FROM HORIZONTAL (1H:1V)

REVISIONS				
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MODIFIED CROSS VANE NOTES:

1 VARIABLE "A1" IS THE BANKFULL WIDTH AT SECTION XS1, VARIABLE "A2" IS THE BANKFULL WIDTH AT SECTION XS2, AND "A3" IS BANKFULL WIDTH AT XS3. THE BANKFULL WIDTH CHANGES CONTINUOUSLY THROUGHOUT THE STRUCTURE BASED ON GRADING OF THE BAR.

2 VARIABLE "F" IS IN UNITS OF DEGREES AND VARIABLES "U1" AND "U2" ARE SLOPES EXPRESSED AS VERTICAL:HORIZONTAL (V:H) AND IN UNITS OF FT/FT.

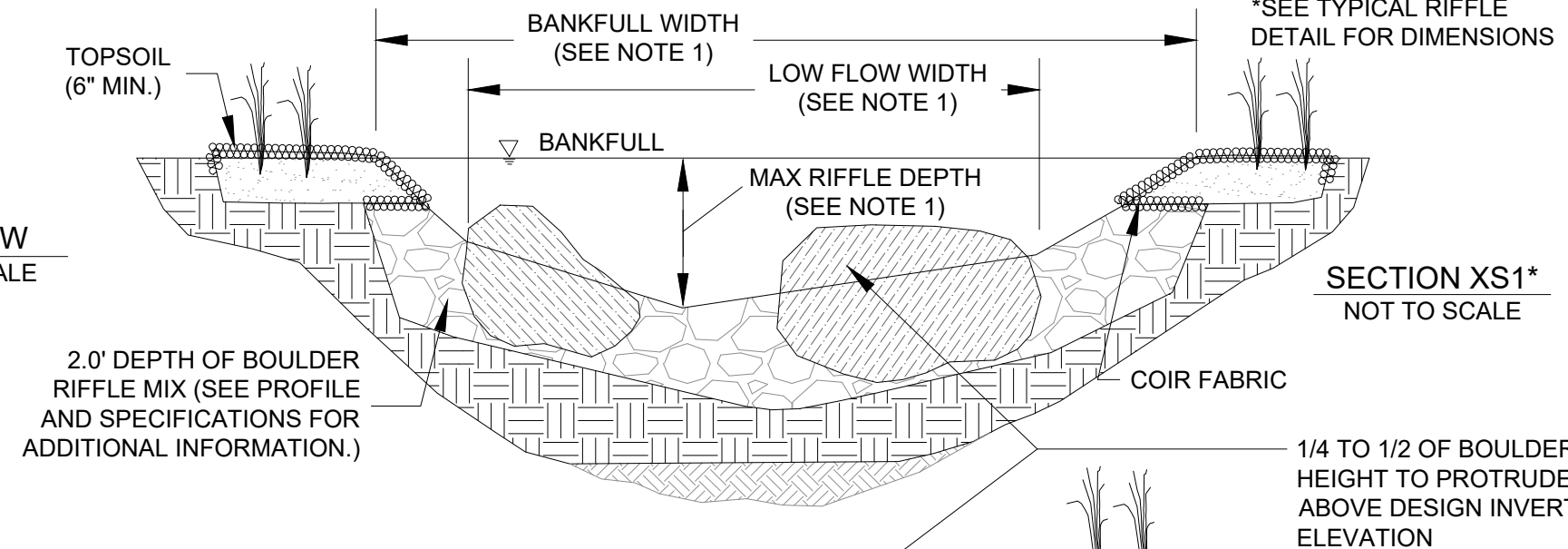
3 VARIABLES "J1", "J2", "K", "M1", & "M2" ARE DEPTHS RELATIVE TO BANKFULL.

4 SEE PLAN VIEW FOR VARIABLE "H" (SILL LENGTH AND PLACEMENT).

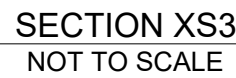
5 VARIABLES "N" AND "R" ARE SLOPES EXPRESSED AS HORIZONTAL:VERTICAL (H:V).

BOULDER RIFFLE NOTES:

1. REFER TO TYPICAL RIFFLE SECTION FOR CROSS SECTION DIMENSIONS.
2. WEIR ELEVATIONS AND LOCATIONS SHALL ADHERE TO PLAN SPECIFICATIONS. BETWEEN THESE POINTS INVERT LOCATION IS EXPECTED TO VARY WIDELY THROUGH THE FULL WIDTH OF THE LOW FLOW CHANNEL. SEE TYPICAL RIFFLE DETAIL FOR ADDITIONAL INFORMATION.
3. 40% OF RIFFLE AREA SHALL CONSIST OF PROTRUDING RANDOM BOULDERS (STRUCTURE ROCK). BOULDERS SHALL BE PLACED SO AS TO MAXIMIZE CHANNEL ROUGHNESS (NOT FLAT), LEAVING A UTILIZED SCOUR HOLES BETWEEN PROTRUDING BOULDERS. BOULDERS SHALL BE PLACED WITH 1/4 TO 1/2 OF THE ROCK HEIGHT BURIED BELOW THE INVERT AND THE REMAINDER PROTRUDING FROM THE SURROUNDING BED. PROTRUSION HEIGHTS SHALL VARY.
4. SPECIFIC LOCATIONS FOR RANDOM BOULDER PLACEMENT SHALL BE MARKED AND REVIEWED BY DESIGN ENGINEER OR ENGINEER'S REPRESENTATIVE PRIOR TO PLACEMENT.
5. RANDOM BOULDERS SHOULD BE PLACED AT THE DESIGNATED LOCATIONS AND THE FEATURE BACKFILLED WITH MATERIAL AS SPECIFIED IN THE PROFILE AND BOULDER RIFFLE MIXTURE SPECIFICATIONS.



REFER TO PROFILE SHEETS
FOR ADDITIONAL INFORMATION



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Stream Restoration Of A Tributary To Mud Lick Creek Along Canter Dr. - Final Plan

Roanoke County, Virginia

Construction Details (cont'd)

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Boundary and Topo Source:
N/A

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CONSTRUCTION DETAILS.dwg

EROSION AND SEDIMENT CONTROL NARRATIVE

A. PROJECT DESCRIPTION

THIS STREAM RESTORATION PROJECT BEGINS NEAR THE MORE UPSTREAM EXISTING WOODEN FOOTBRIDGE BEHIND 5367 CANTER DRIVE AND FLOWS SOUTHWEST FOR APPROXIMATELY 1,300 FEET BEFORE ENTERING THE EXISTING 36-INCH CULVERT NEAR THE STREAM'S CONFLUENCE WITH MUDLICK CREEK. THE PROJECT AREA INCLUDES APPROXIMATELY 59,210 SF (1.36 AC) OF LAND DISTURBANCE. NATURAL CHANNEL DESIGN (NCD) TECHNIQUES WERE UTILIZED TO DEVELOP A STABLE CHANNEL, CROSS SECTION, LONGITUDINAL PROFILE, AND PLANFORM GEOMETRY FOR THE DEGRADED STREAM CHANNEL THAT IS PROPOSED TO BE RESTORED. NCD RESTORES A DEGRADED STREAM BY MIMICKING, TO THE EXTENT PRACTICABLE, THE CHARACTERISTICS OF A STABLE, "NATURAL" STREAM. THROUGH THE USE OF GEOMORPHIC PRINCIPLES, NCD SEEKS TO ACHIEVE LONG-TERM STABILITY GIVEN CURRENT AS WELL AS FUTURE FLOW RATES.

B. EXISTING SITE CONDITIONS

THE PROJECT AREA ENCOMPASSES MUCH OF THE CONFINED FLOODPLAIN AREA, BOUNDED TIGHTLY BY STEEP SLOPES LEADING TO RESIDENTIAL PROPERTIES ALONG CANTER DRIVE TO THE SOUTHWEST AND HIDDEN VALLEY HIGH SCHOOL PROPERTY ON TITAN TRAIL TO THE NORTHEAST. THE DRAINAGE AREA FOR THE REACH IS 77 ACRES WITH APPROXIMATELY 22% IMPERVIOUSNESS. THE CHANNEL SLOPE IN THE AREA VARIES WIDELY, FROM 2% TO 4.5% WITHIN THE PROJECT REACH.

C. ADJACENT AREAS

THE SUBJECT SITE IS BOUNDED BY SINGLE FAMILY HOMES AND PUBLIC SCHOOL PROPERTY. WORK IS BEING DONE WITHIN EASEMENTS OBTAINED FROM ADJACENT LANDOWNERS.

D. OFF-SITE AREAS

NO OFF-SITE LAND DISTURBING ACTIVITIES ARE PROPOSED.

E. CRITICAL AREAS

THIS PROJECT IS LOCATED ENTIRELY WITHIN A STREAM CHANNEL; HOWEVER, THE DESIGN PRESENTED HEREIN PROPOSES TO RESTORE THIS DEGRADED STREAM CHANNEL THUS IMPROVING THE WATER QUALITY OF THE DOWNSTREAM RECEIVING WATERS.

F. SOILS

THE SOIL LOCATED ON THE PROJECT SITE IS COMPRISED OF HAYESVILLE CHANNERR FINE SANDY LOAM (28E) AND CHISWELL-LITZ COMPLEX (5D AND 5E). HAYESVILLE (28E) IS NOT A HYDRIC SOIL AND THE WATER TABLE IS TYPICALLY MORE THAN 6 FEET FROM THE SURFACE. THIS SOIL DRAINS WELL (HYDROLOGIC SOIL GROUP B) AND HAS LOW EROSION POTENTIAL (K = 0.17). CHISWELL-LITZ COMPLEX IS NOT A HYDRIC SOIL AND THE WATER TABLE IS TYPICALLY MORE THAN 6 FEET FROM THE SURFACE. THIS SOIL DRAINS POORLY (HYDROLOGIC SOIL GROUPS C AND D) AND HAS MODERATE EROSION POTENTIAL (K = 0.37-0.43).

G. EROSION AND SEDIMENT CONTROL MEASURES

- BEFORE ANY WORK IN THE STREAM AREA COMMENCES, AN ON-SITE PRE-CONSTRUCTION MEETING SHALL BE HELD TO ENSURE THAT ALL AFFECTED PARTIES (DESIGN ENGINEER, CONTRACTOR, STATE OFFICIALS, OWNER, AND PROJECT MANAGER) FULLY UNDERSTAND THE CONSTRUCTION SEQUENCING.
- MATERIALS AND METHODS USED IN CONSTRUCTION AND MAINTENANCE OF THE EROSION AND SEDIMENT CONTROL MEASURES REQUIRED SHALL CONFORM TO THE CONSTRUCTION STANDARDS AND SPECIFICATIONS IN CHAPTER 3 OF THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK (VESCH), THIRD EDITION, 1992, AS WELL AS ANY OTHER APPLICABLE LOCAL, STATE, AND FEDERAL REGULATIONS.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ANY ADDITIONAL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES THAT MAY BE REQUIRED BY THE CITY INSPECTOR, OR COMMENSURATE WITH THEIR SEQUENCE OF CONSTRUCTION, TO PREVENT EROSION AND SEDIMENT CONTROL RELATED DAMAGE TO PROPERTY OF OTHERS, ADJACENT AND/OR DOWNSTREAM WATERWAYS, OR TO THE PROJECT, DURING CONSTRUCTION AND PRIOR TO PERMANENT STABILIZATION OF ALL DISTURBED AREAS.
- PRIOR TO ANY OTHER CONSTRUCTION ACTIVITIES, PERIMETER EROSION CONTROL MEASURES ARE TO BE INSTALLED (I.E. SILT FENCE, STONE CONSTRUCTION ENTRANCE) AROUND THE LIMITS OF CLEARING.
- WORK WITHIN THE STREAM AREA SHALL NOT COMMENCE UNTIL AFTER PERIMETER EROSION CONTROL MEASURES ARE APPROVED BY THE COUNTY INSPECTOR.
- FOR ANY CLEARING OR GRADING ON THE SITE, THE LIMITS OF CLEARING AND GRADING (LOC) SHALL BE MARKED WITH FLAGGING.
- THE LOC SHALL BE REVIEWED ON-SITE WITH THE CONTRACTOR, THE OWNER OR OWNER'S REPRESENTATIVE(S), AND A COUNTY URBAN FORESTER, AND A DETERMINATION MADE AT THAT TIME REGARDING WHICH TREES WILL BE REMOVED BASED ON THE APPROVED GRADING AND STREAM RESTORATION ACTIVITIES.
- ADJUSTMENTS WILL BE MADE TO FLAGGING MARKING THE LOC TO ADEQUATELY PROTECT TREES TO BE PRESERVED AND ALLOW REMOVAL OF TREES TO BE REMOVED. TREE PROTECTION FENCING SHALL BE ERECTED ALONG THESE ADJUSTED LIMITS OF CLEARING AND GRADING PRIOR TO THE COMMENCEMENT OF ANY OTHER CONSTRUCTION ACTIVITIES.
- TREES TO BE REMOVED THAT ARE LOCATED ON THE LOC OR IMMEDIATELY ADJACENT TO THE LOC WITHIN THE PROTECTED AREA SHALL BE REMOVED USING CHAIN SAWS TO MINIMIZE ROOT ZONE DISTURBANCE OR TREES TO BE PRESERVED. (PFM 12-0603.1B(1))
- THE CONTRACTOR SHALL AVOID WETLAND AREAS WHEN POSSIBLE DURING CONSTRUCTION. ALL ACCESS AND STOCKPILE AREAS TO BE RETURNED TO PRE-CONSTRUCTION CONDITIONS AT THE COMPLETION OF CONSTRUCTION.
- STOCKPILE AREAS HAVE BEEN DESIGNATED PRIMARILY FOR STOCKPILING SOIL AND ROCK. SILT FENCE SHALL BE PLACED ALONG THE DOWNSTREAM SIDE OF ANY STOCKPILE OF SOIL THAT WILL REMAIN STOCKPILED AT THE END OF ANY WORK DAY. ADDITIONAL AREAS MAY BE UTILIZED AS STOCKPILE AREAS IF APPROVED BY ENGINEER AND THE CITY SITE INSPECTOR.
- STABILIZATION MEASURES SHALL BE APPLIED TO EARTHEN STRUCTURES SUCH AS DAMS, DIKES, AND DIVERSIONS IMMEDIATELY AFTER INSTALLATION.
- ONLY DISTURB AS MUCH AREA AS CAN BE STABILIZED IN ONE DAY.
- STABILIZE ALL DISTURBED AREAS, INCLUDING ACCESS AREAS AT THE END OF EACH DAY.
- ALL STREAM WORK SHALL BE CONDUCTED IN THE DRY, AND NO WORK SHALL BE PERFORMED IN THE RAIN. IF THERE IS A THREAT OF RAIN, WORK IS TO STOP AND WORK AREA SHALL BE STABILIZED.
- A "PUMP AROUND" SYSTEM SHALL BE USED TO DIVERT THE STREAM DURING CONSTRUCTION. SANDBAG DIKES SHALL BE INSTALLED WITHIN THE STREAM AROUND THE AREA TO BE DISTURBED THAT DAY (LARGER REACHES ARE ALLOWED IF APPROVED BY THE SITE ENGINEER); ONE AT THE UPSTREAM LIMIT OF DISTURBANCE AND ONE AT THE DOWNSTREAM LIMIT OF DISTURBANCE. IF BASEFLOW IS PRESENT, AN ADEQUATELY SIZED PUMP SYSTEM SHALL BE USED TO PUMP BASEFLOW AROUND THE AREA OF CONSTRUCTION AND BACK INTO THE STREAM AT A POINT DOWNSTREAM OF THE SECOND SANDBAG DIKE. WORK SHALL NOT PROCEED DURING RAIN EVENTS. IF SEDIMENT LADEN WATER ACCUMULATES AT THE DOWNSTREAM SANDBAG DIKE, SUCH WATER SHALL BE PUMPED INTO A FILTER BAG PRIOR TO BEING RELEASED BACK INTO THE STREAM.
- ACCESS ACROSS AND IN THE STREAM SHALL BE ALLOWED WITHIN THE STREAM REACH PROTECTED BY THE "PUMP AROUND" SYSTEM AS DESCRIBED ABOVE.
- SITE WORK ACTIVITIES SHALL BE COMPLETED, IF POSSIBLE, AT LEAST EIGHT WEEKS EARLIER THAN THE RECOMMENDED PLANTING WINDOW (I.E. AUGUST 30). DURING THIS TIME, THE EROSION CONTROL COVER CROP SHALL BE PERMITTED TO MATURE.
- ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES SHALL BE REMOVED WITHIN 30 DAYS AFTER FINAL SITE STABILIZATION OR AFTER THE TEMPORARY MEASURES ARE NO LONGER NEEDED, UNLESS OTHERWISE AUTHORIZED BY THE COUNTY INSPECTOR. TRAPPED SEDIMENT AND THE DISTURBED SOIL AREA RESULTING FROM THE DEPOSITION OF TEMPORARY MEASURES SHALL BE PERMANENTLY STABILIZED TO PREVENT FURTHER EROSION AND SEDIMENTATION.

H. PERMANENT STABILIZATION

- PLANTING OF ALL SPECIFIED CONTAINERIZED STREAMSIDE AND RIPARIAN VEGETATION SHALL BE LIMITED TO THE PERIOD BETWEEN NOVEMBER 30 AND MARCH 30, UNLESS APPROVED BY WSSI WITH SPECIAL WARRANTY CONDITIONS. NO PLANTING SHALL OCCUR WHEN THE SOIL IS FROZEN.
- PLANT ALL SPECIFIED PLANT MATERIAL ON THE NEW STREAM BANKS AND RIPARIAN AREAS - SUBJECT TO TIME OF YEAR RESTRICTIONS IN PLANTING SPECIFICATIONS, CUTTING HOLES AS REQUIRED IN THE EROSION CONTROL FABRIC. SEE VEGETATION NOTES AND THE SCHEDULE FOR SPECIFICATIONS REGARDING PLANTS AND PLANTING MATERIAL. PLANTING CONTRACTOR SHALL USE SAME ACCESS POINTS TO MINIMIZE DISTURBANCE.
- FOR ALL PLANTING TYPES, QUANTITIES, SPECIFICATIONS AND DETAILS PLEASE REFER TO THE PLANTING PLAN.

I. GENERAL LAND CONSERVATION NOTES

- PERMANENT OR TEMPORARY STABILIZATION MUST BE APPLIED TO DENUDED AREAS WITHIN 7 DAYS AFTER FINAL GRADE IS REACHED OR WITHIN 7 DAYS TO DENUDED AREAS TO REMAIN DORMANT FOR LONGER THAN 14 DAYS.
- ANY DISTURBED AREA NOT COVERED BY GENERAL CONSERVATION NOTE 1 AND NOT PAVED, SODDED OR BUILT UPON BY NOVEMBER 1, OR DISTURBED AFTER THAT DATE, SHALL BE MULCHED IMMEDIATELY WITH HAY OR STRAW MULCH AT THE RATE OF 2 TONS/ACRE (4483 KG/HA) AND OVERSEEDDED BY APRIL 15.
- AT THE COMPLETION OF THE PROJECT CONSTRUCTION AND PRIOR TO BOND RELEASE ALL TEMPORARY SEDIMENT CONTROLS SHALL BE REMOVED AND ALL DENUDED AREAS SHALL BE STABILIZED.

J. MAINTENANCE PROGRAM.

THE CONTRACTOR SHALL INSPECT ALL EROSION AND SEDIMENT CONTROL MEASURES IMMEDIATELY (WITHIN 24 HOURS) AFTER EACH RUNOFF PRODUCING RAINFALL EVENT, AT LEAST DAILY DURING PROLONGED RAINFALL, AND AT LEAST ONCE EVERY FOURTEEN DAYS. DAMAGED OR DEFICIENT MEASURES SHALL BE REPAIRED BY THE CLOSE OF EACH DAY AND ANY ADDITIONAL MEASURES REQUIRED SHALL BE IMMEDIATELY INSTALLED. FURTHER, THE CONTRACTOR SHALL MAKE A DAILY REVIEW OF AREAS OF CONSTRUCTION ACTIVITY TO INSURE THAT EROSION AND SEDIMENT CONTROL DEVICES ARE PROPERLY LOCATED FOR EFFECTIVENESS. WHERE DEFICIENCIES EXIST, ADDITIONAL MEASURES SHALL BE PROMPTLY INSTALLED. THE CONTRACTOR SHALL ALSO BE RESPONSIBLE FOR PROVIDING ANY ADDITIONAL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES THAT MAY BE REQUIRED. COMMENSURATE WITH HIS SCHEDULING SEQUENCE OF CONSTRUCTION, TO PREVENT EROSION AND SEDIMENT RELATED DAMAGE TO THE PROPERTY OF OTHERS, TO ADJACENT AND/OR DOWNSTREAM WATERWAYS, OR TO THE PROJECT, DURING CONSTRUCTION AND PRIOR TO PERMANENT STABILIZATION OF ALL DISTURBED AREAS.

THE CONTRACTOR SHALL INSTALL ANY AND ALL EROSION AND SEDIMENT CONTROLS DEEMED NECESSARY TO ACCOUNT FOR SITE AND ACTIVITY SPECIFIC ISSUES DETERMINED BY EITHER THE CITY INSPECTOR OR THE ENGINEER'S REPRESENTATIVE.

K. TWO-PHASE E&S CONTROLS

DUE TO THE NATURE OF THIS PROJECT, ONLY A PHASE I EROSION AND SEDIMENT CONTROL PLAN IS REQUIRED. NO STORMWATER INFRASTRUCTURE WILL BE CONSTRUCTED (I.E. CURB, GUTTER, INLETS, ETC.), MAKING INCLUSION OF A PHASE II EROSION AND SEDIMENT CONTROL PLAN UNNECESSARY. SITE DISTURBANCE SHALL BE LIMITED TO THE SECTION OF WORK AREA UNDER ACTIVE CONSTRUCTION, AS WELL AS THE AREA IMMEDIATELY ADJACENT. NO SECTION OF STREAM WILL BE LEFT UNSTABILIZED OVERNIGHT. THIS WORK AREA WILL BE ISOLATED FROM THE ACTIVE STREAM CHANNEL THROUGH THE USE OF A PUMP AROUND DIVERSION. IN ADDITION, THIS DIVERSION WILL NOT BE REMOVED UNTIL THE STREAM CHANNEL IS STABILIZED AND THE ADJACENT AREA IS COVERED WITH STRAW.

MINIMUM STANDARDS NARRATIVE

MS-1 (SOIL STABILIZATION): SOIL SHALL BE STABILIZED PURSUANT TO THE EROSION AND SEDIMENT CONTROL NARRATIVE, SECTIONS H AND I.

MS-2 (SOIL STOCKPILE STABILIZATION): PURSUANT TO THE EROSION AND SEDIMENT CONTROL NARRATIVE, SECTION G, NOTE 11 (THIS SHEET); SILT FENCE WILL BE PLACED AROUND ANY SOIL THAT WILL BE STOCKPILED FOR LONGER THAN ONE DAY.

MS-3 (PERMANENT STABILIZATION): PERMANENT STABILIZATION SHALL BE APPLIED PURSUANT TO THE EROSION AND SEDIMENT CONTROL NARRATIVE, SECTION H (THIS SHEET). SPECIFICS REGARDING THE PLANTINGS ARE PROVIDED ON THE PLANTING PLAN, VEGETATION SCHEDULE, AND PLANTING NOTES & DETAILS SHEETS.

MS-4 (SEDIMENT BASINS & TRAPS): NOT APPLICABLE, NO SEDIMENT BASINS OR TRAPS ARE PROPOSED TO BE CONSTRUCTED AS PART OF THIS PROJECT.

MS-5 (STABILIZATION OF EARTHEN STRUCTURES): PURSUANT TO THE EROSION AND SEDIMENT CONTROL NARRATIVE, SECTION G, NOTE 12 (THIS SHEET); ALL EARTHEN STRUCTURES SHALL BE STABILIZED IMMEDIATELY AFTER INSTALLATION.

MS-6 (SEDIMENT TRAPS & SEDIMENT BASINS): NOT APPLICABLE, NO SEDIMENT BASINS OR TRAPS ARE PROPOSED TO BE CONSTRUCTED AS PART OF THIS PROJECT.

MS-7 (CUT/FILL SLOPES DESIGN & CONSTRUCTION): CUT/FILL SLOPES DESIGNED TO MINIMIZE EROSION AND CONFIRMED WITH MODELING. FURTHERMORE, DETAILED PLANTING PLAN WILL YIELD LONG TERM STABILITY.

MS-8 (CONCENTRATED RUNOFF DOWN SLOPES): NO CONCENTRATED RUNOFF SHALL BE ROUTED DOWN PROPOSED FILL/CUT SLOPES.

MS-9 (SLOPE MAINTENANCE): NOT APPLICABLE, NO SLOPES ARE PROPOSED TO BE DISTURBED AS PART OF THIS PROJECT.

MS-10 (STORM SEWER INLET PROTECTION): NOT APPLICABLE, NO STORMWATER INLETS ARE PROPOSED TO BE CONSTRUCTED AS PART OF THIS PROJECT.

MS-11 (STORMWATER CONVEYANCE PROTECTION): NOT APPLICABLE, NO STORMWATER CONVEYANCES ARE PROPOSED TO BE CONSTRUCTED AS PART OF THIS PROJECT.

MS-12 (WORK IN LIVE WATERCOURSE): PURSUANT TO THE EROSION AND SEDIMENT CONTROL NARRATIVE, SECTION G, NOTE 17 (THIS SHEET); A "PUMP AROUND" SYSTEM WILL BE USED TO ISOLATE THE WORK AREA AND PROTECT DOWNSTREAM RECEIVING WATERS.

MS-13 (CROSSING LIVE WATERCOURSE): PURSUANT TO THE EROSION AND SEDIMENT CONTROL NARRATIVE, SECTION G, NOTE 17 (THIS SHEET); "ACCESS ACROSS AND IN THE STREAM SHALL BE ALLOWED WITHIN THE STREAM REACH PROTECTED BY THE "PUMP AROUND" SYSTEM DESCRIBED ABOVE"

MS-14 (REGULATION OF WATERCOURSE CROSSING): THE PROPOSED PROJECT IS BEING REGULATED BY NATIONWIDE PERMIT 27.

MS-15 (STABILIZATION OF WATERCOURSE): THIS MINIMUM STANDARD IS ADDRESSED IN THE EROSION AND SEDIMENT CONTROL NARRATIVE, SECTION G, NOTES 13, 14, & 15 (THIS SHEET).

MS-16 (UNDERGROUND UTILITY LINE CONSTRUCTION): NOT APPLICABLE, NO UNDERGROUND UTILITIES ARE PROPOSED TO BE CONSTRUCTED AS PART OF THIS PROJECT.

MS-17 (VEHICULAR SEDIMENT TRAPPING): A STONE CONSTRUCTION ENTRANCE WITH A WASH RACK AND TEMPORARY SEDIMENT TRAP (IF NECESSARY) SHALL BE PLACED AT THE ENTRANCE TO THE PROJECT SITE. DETAILS ARE PROVIDED ON THIS SHEET AND THE LOCATION OF THE CONSTRUCTION ENTRANCE WITH APPURTENANCES ARE SHOWN ON THE ACCESS PLAN.

MS-18 (REMOVAL OF TEMPORARY MEASURES): THIS MINIMUM STANDARD IS ADDRESSED IN THE EROSION AND SEDIMENT CONTROL NARRATIVE, SECTION G, NOTE 19 (THIS SHEET).

MS-19 (STORMWATER MANAGEMENT): THE PROPOSED STREAM RESTORATION DESIGN EMPLOYS NATURAL CHANNEL DESIGN TECHNIQUES. THEREFORE PURSUANT TO §10.1-561.A OF THE VIRGINIA LEGISLATIVE CODE; "STREAM RESTORATION AND RELOCATION PROJECTS THAT INCORPORATE NATURAL CHANNEL DESIGN CONCEPTS ARE NOT MAN-MADE CHANNELS AND SHALL BE EXEMPT FROM ANY FLOW RATE CAPACITY AND VELOCITY REQUIREMENTS FOR NATURAL OR MAN-MADE CHANNELS AS DEFINED IN ANY REGULATIONS PROMULGATED PURSUANT TO THIS SECTION. § 10.1-562. OR 10.1-570."

SEQUENCE OF CONSTRUCTION

- NO IN-STREAM WORK SHALL BEGIN UNTIL ALL E&S CONTROLS HAVE BEEN PROPERLY INSTALLED (PERIMETER SILT FENCE AND CONSTRUCTION ENTRANCES, ETC.) AND THE SPECIFIED STABILIZATION SEED MIXES AND NATURAL FIBER EROSION CONTROL MATTING ARE ON SITE. ADDITIONALLY, STREAM CENTERLINE AND AREAS IMMEDIATELY ADJACENT TO THE EASEMENT BOUNDARIES SHALL BE SURVEYED AND STAKED-OUT PRIOR TO BEGINNING OF WORK. **IN ADHERENCE TO PERMIT CONDITIONS, NO TREE CLEARING MAY OCCUR PRIOR TO NOVEMBER 15TH OR AFTER MARCH 31ST.**
- SITE ACCESS AND MOBILIZATION SHALL BE FROM CANTER DRIVE. CONTRACTOR SHALL PLACE ORANGE SAFETY FENCE AS INDICATED IN PLAN AND POST SIGNAGE TO RESTRICT ACCESS DURING PERIODS OF ACTIVE CONSTRUCTION.
- ACCESS WITHIN THE STREAM CORRIDOR SHALL BE VIA THE SOUTHWEST SIDE OF THE STREAM (RIGHT BANK) EXCEPT FOR ~STA19+20' TO 20+60', WHERE THE ACCESS IS SHIFTED TO THE NORTHEAST SIDE OF THE STREAM (LEFT BANK). WORK SHALL BE PERFORMED FROM TOP OF BANK OR IN CHANNEL (PROVIDED A PUMP AROUND DIVERSION IS INSTALLED DURING THE EVENT OF FLOW).
- WORK SHALL PROGRESS FROM UPSTREAM TO DOWNSTREAM (UNLESS OTHERWISE AUTHORIZED BY COUNTY STAFF).
- ALL WORK SHALL OCCUR IN THE DRY. IF FLOW IS PRESENT THE CONTRACTOR SHALL SHALL CONSTRUCT A PUMP AROUND DIVERSION AS SPECIFIED IN THE EROSION AND SEDIMENT CONTROL DETAILS.
- TREES PROPOSED TO BE REMOVED SHALL BE CUT AS NECESSITATED BY PROPOSED GRADING. TREES SHOULD BE FELLED SUCH THAT DAMAGE TO SURROUNDING TREES IS MINIMIZED. IN AREAS WHERE GRADING IS NOT REQUIRED BUT TREES ARE SIGNIFICANTLY IMPACTED TREES SHOULD BE FLUSH CUT AND THE ROOT BALL LEFT IN PLACE TO PRESERVE ROOTMASS AND ASSOCIATED SOIL STABILITY. **DISTURBANCE TO TREES (NOT PROPOSED TO BE REMOVED) ADJACENT TO ACCESS AREAS SHALL BE MINIMIZED VIA PLACEMENT OF DECK MATS.**
- FINAL GRADES OUTSIDE OF THE CHANNEL SHALL BE ACHIEVED THROUGH THE PLACEMENT OF 6 INCHES (MIN.) OF TOPSOIL (SALVAGED OR IMPORTED, SEE SPECIFICATIONS FOR TOPSOIL SALVAGING AND STOCKPILING PROCEDURE). THE CONTRACTOR SHALL ONLY CLEAR AND GRUB AS MUCH OF THE PROPOSED CHANNEL AND GRADING AREAS THAT THE CONTRACTOR CAN COMPLETE THE CONSTRUCTION ON AND HAVE STABILIZED IN THE SAME DAY. IF COMPACTED BY CONSTRUCTION TRAFFIC, THE CONTRACTOR SHALL SCARIFY SUBGRADE PRIOR TO TOPSOIL PLACEMENT TO PROMOTE GOOD VEGETATIVE ESTABLISHMENT.
- CONTRACTOR SHALL WORK PROGRESSIVELY, FINISHING GRADING, SPREADING NATIVE SEED, AND INSTALLING MATTING ALONG PROPOSED CHANNEL AREAS IMMEDIATELY UPON ACHIEVING FINAL GRADE. THIS WILL MINIMIZE THE AMOUNT OF DISTURBED AREA IN THE EVENT OF A HIGH FLOW EVENT.
- ALL DISTURBED AREAS SHALL BE SEEDED WITH RIPARIAN SEED MIX UNLESS OTHERWISE SPECIFIED IN THE PLANTING PLAN. NATURAL FIBER MATTING SHALL BE PLACED PER THE TYPICAL RIFFLE DETAIL AND AS OTHERWISE INDICATED IN THE PLAN, STAKED TO MANUFACTURERS SPECIFICATIONS USING BIODEGRADABLE STAKES. (NOTE: SEED MUST BE SOWN IMMEDIATELY PRIOR TO MATTING PLACEMENT.)
- ONCE ALL PROPOSED GRADING IS COMPLETE THE CONTRACTOR SHALL RESTORE ALL STAGING/STOCKPILE AND ACCESS AREAS TO PRE-EXISTING CONDITIONS USING THE APPROPRIATE SEED MIX WHERE INDICATED AS WELL AS STRAW MULCH OR MATTING PER LOCAL REQUIREMENTS AND THE VIRGINIA E&S HANDBOOK. PLANTINGS SHALL BE INSTALLED PER THE PLANTING PLAN AND SPECIFICATIONS AND ADHERING TO THE SPECIFIED TIME OF YEAR PLANTING WINDOWS.
- THE CONTRACTOR SHALL ASSESS THE POST-CONSTRUCTION CONDITIONS OF EXISTING INFRASTRUCTURE, REPAIRING ANY DAMAGE NOT OTHERWISE SPECIFIED IN THESE PLANS TO PRE-EXISTING CONDITIONS OR BETTER.
- CONTRACTOR SHALL REMOVE E&S MEASURES AND RETURN ANY REMAINING DISTURBED AREAS TO A PRE-CONSTRUCTION CONDITION.
- CONTRACTOR TO FOLLOW ALL APPLICABLE OSHA REQUIREMENTS.



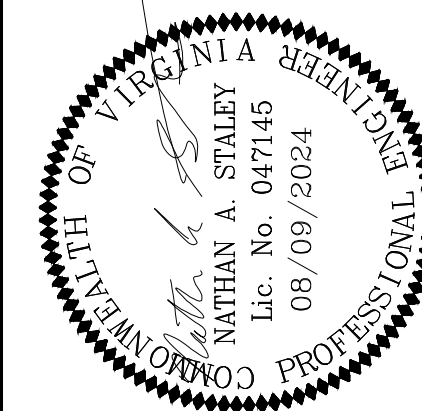
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Stream Restoration Of A Tributary To Mud Lick Creek
Along Canter Dr. - Final Plan

Roanoke County, Virginia

Erosion and Sediment Control Narrative and
Minimum Standards

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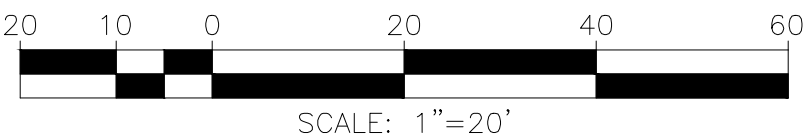
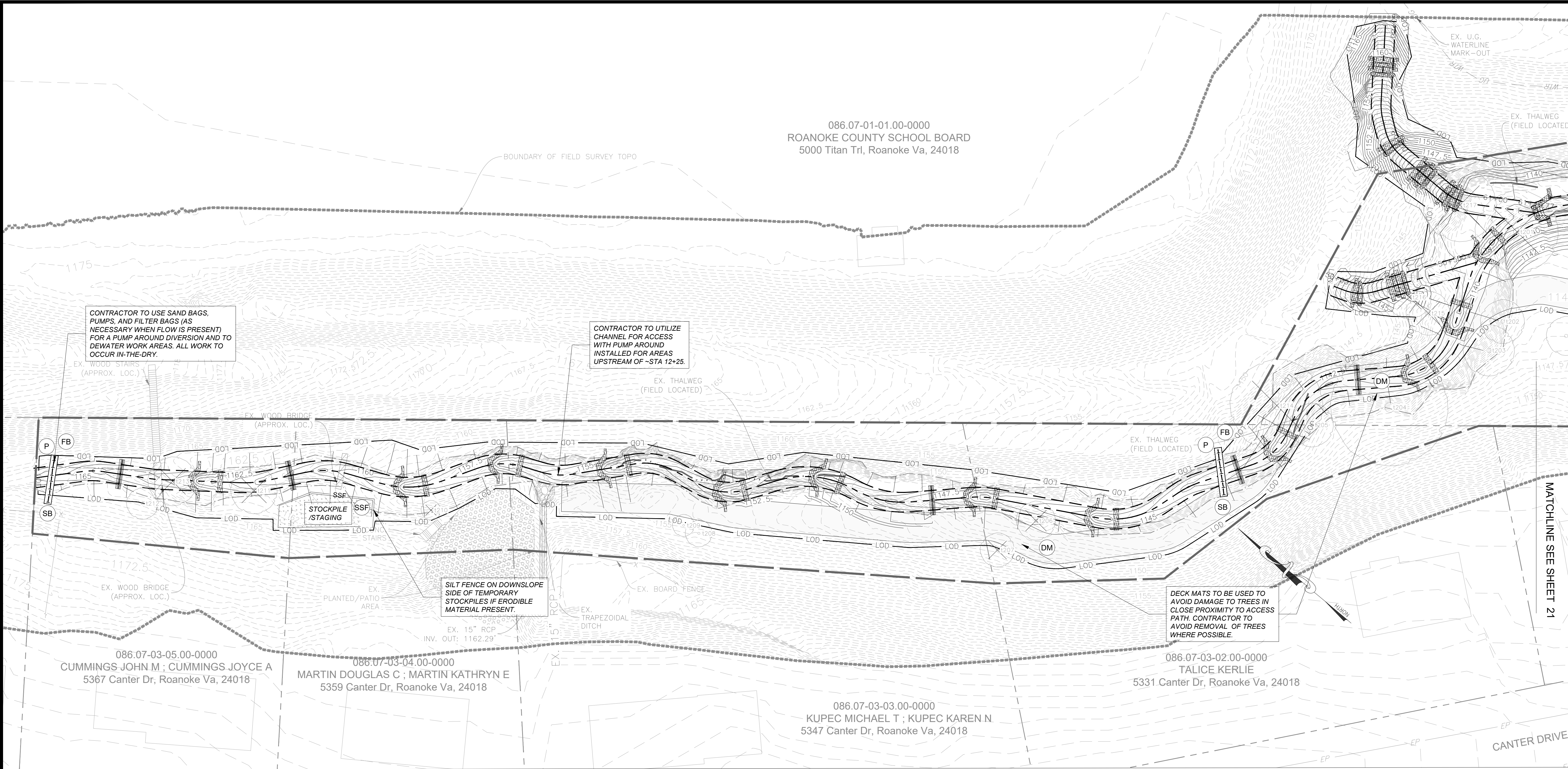
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19 of 28

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GENERAL NOTES:

- CONTRACTOR SHALL ADHERE TO OSHA REQUIREMENTS FOR DURATION OF CONSTRUCTION.
- SEE THE EROSION AND SEDIMENT CONTROL NARRATIVE FOR MORE INFORMATION. **THIS SHEET SHALL BE USED FOR EROSION AND SEDIMENT CONTROL PURPOSES ONLY.**
- MAIN STOCKPILE STAGING AREAS TO BE AS SHOWN IN PLAN. OTHER AREAS MAY BE USED TEMPORARILY.
- CONTRACTOR SHALL NOT GRUB AREAS UNTIL NECESSITATED BY GRADING ACTIVITIES, DISTURBED AREAS SHALL BE STABILIZED AT THE END OF EACH DAY OR UPON THREAT OF RAIN.
- NATURAL FIBER MATTING (CM-700 OR APPROVED EQUAL) TO BE USED ON ALL STREAM BANK AREAS, ACROSS BANKFULL BENCH, ON SLOPES 3:1 OR STEEPER, AND AS OTHERWISE NOTED IN PLANS/ DETAILS. ALL OTHER AREAS TO BE SEEDED PER THE PLANTING PLAN AND MULCHED WITH STRAW AT 2 TONS/AC (MIN.).
- DECK MATS SHALL BE USED ALONG ACCESS PATH AREAS WHERE BOUNDED BY MATURE TREES WHICH WILL BE LEFT UNDISTURBED.
- TREE PROTECTION FENCE AND HIGH VISIBILITY SAFETY FENCE SHALL BE INSTALLED UPON REQUEST OF ENGINEER OR COUNTY STAFF.
- EXCAVATORS USED FOR IN STREAM WORK SHALL DEMONSTRATE (THROUGH SUBMITTAL IMMEDIATELY UPON MOBILIZATION) THAT AN ORGANIC HYDRAULIC FLUID SUBSTITUTE IS BEING UTILIZED (BIODEGRADABILITY PER EPA 560/6-82-003, NON-TOXIC PER OECD 203, OR EQUIVALENT).**

EROSION/SEDIMENT CONTROL LEGEND					
NO.	TITLE	KEY	SYMBOL	UNITS	QUANTITY
MGWC 1.2	PUMP AROUND DIVERSION*	P	(P)	EA	1
MGWC 1.2	SANDBAG DIKE	SB	(SB)	EA	2
3.01; PPM PLATE 6-12	WELDED WIRE TREE PROTECTION FENCE	TP	LOD-TP	LF	AS NEEDED
3.02	WASH RACK	WR	(WR)	EA	AS NEEDED
3.02	TEMP. STONE CONSTRUCTION ENTRANCE	CE	(CE)	EA	1
3.05	SILT FENCE	SF	(SF)	LF	AS NEEDED
3.05 B	SILT FENCE WITH WIRE SUPPORT (SUPER SILT FENCE)	SSF	(SSF)	LF	430
N/A	FILTER BAG	FB	(FB)	EA	1
N/A	TEMPORARY DECK MATS	DM	(DM)	LF	AS NEEDED

*PUMP AROUND SHALL MOVE AS CONTRACTOR STARTS NEW AREAS.

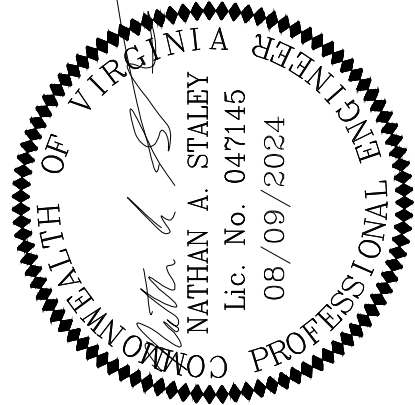
THIS SHEET TO BE USED FOR
EROSION AND SEDIMENT
CONTROL PURPOSES ONLY.

SEE PLANTING PLAN AND
VEGETATION SCHEDULE
SHEETS FOR VEGETATIVE
STABILIZATION MEASURES.

SEE EXISTING CONDITIONS PLAN
FOR EXISTING LEGEND,
GRADING PLAN FOR PROPOSED
LEGEND (SHEETS 2 AND 4).

Stream Restoration Of A Tributary To Mud Lick Creek
Along Canter Dr. - Final Plan

Roanoke County, Virginia
Erosion and Sediment Control Plan



REVISIONS		App. By	
No.	Description	By	By

Horizontal Datum: VCS NAD 83

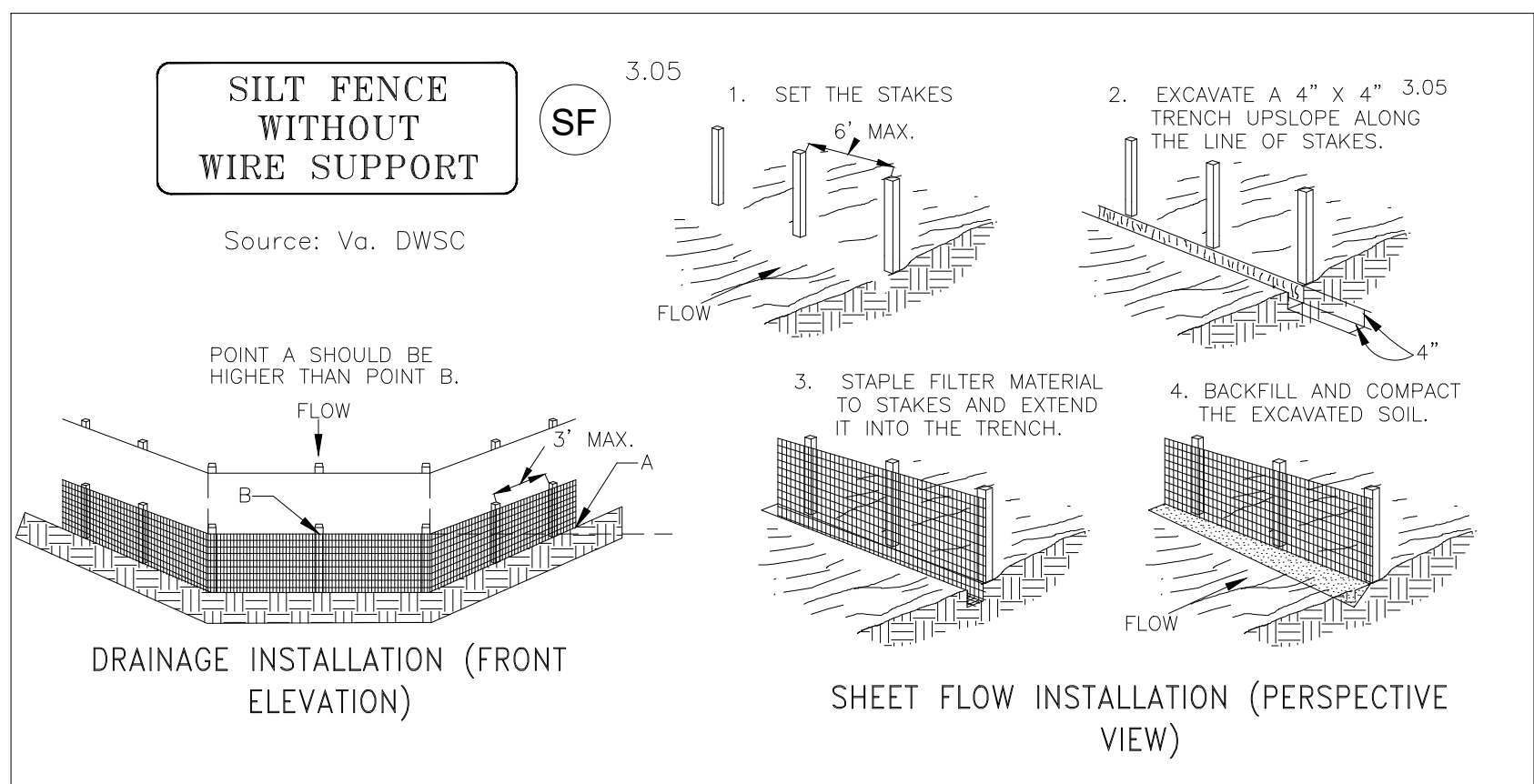
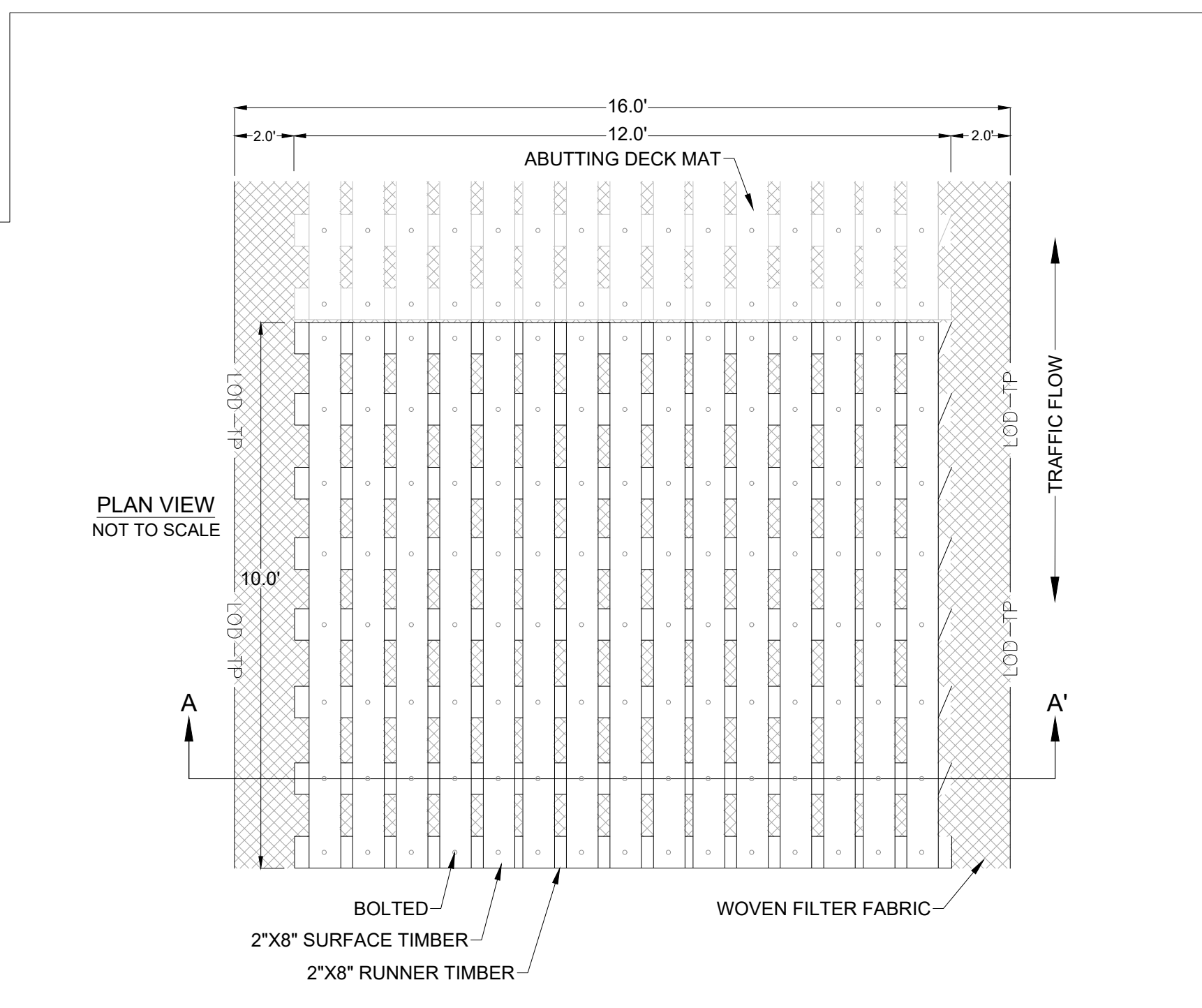
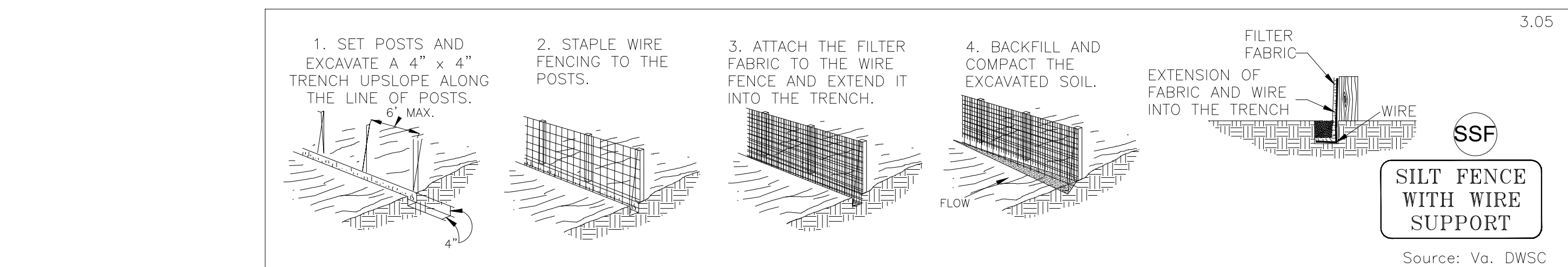
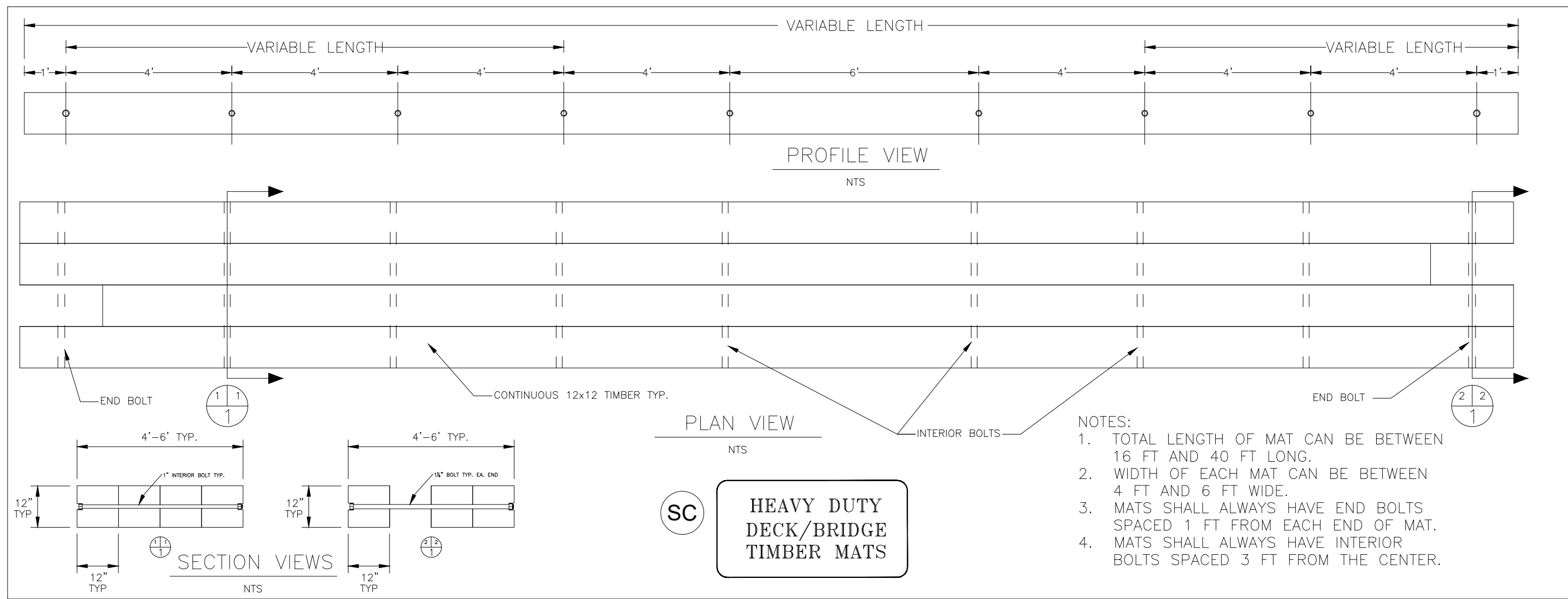
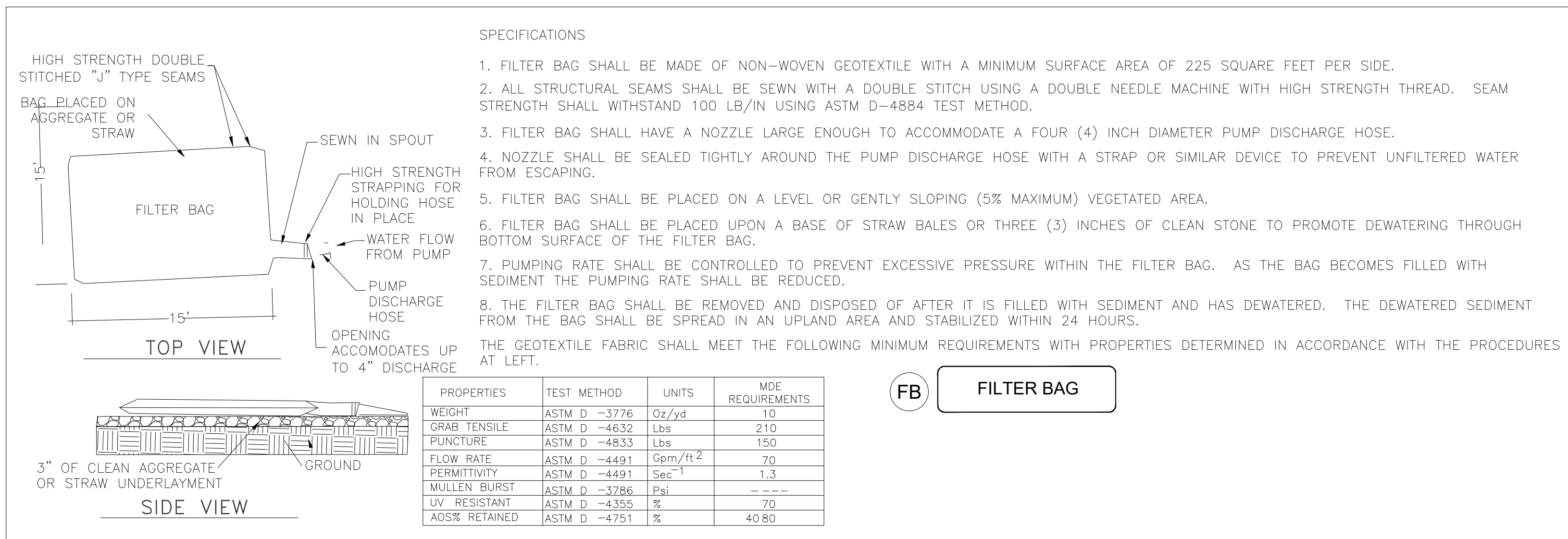
Vertical Datum: NAVD 88

Boundary and Topo Source:
WSSI and Roanoke County Digital Data

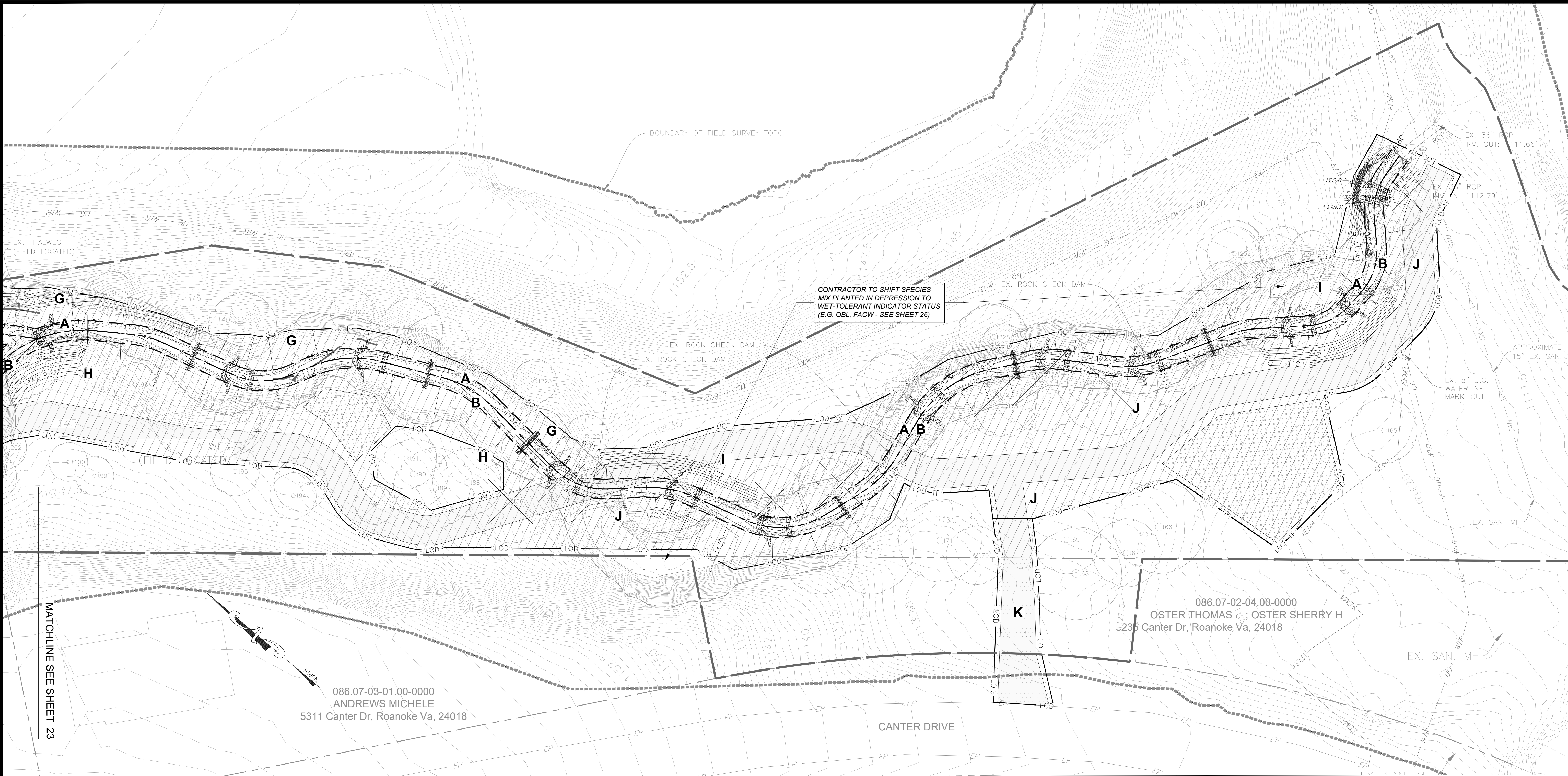
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JAB	JAB	NAS

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20 of 28

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DATE: AUG 2024			SCALE: N/A		



SEE PLANTING DETAILS, SHEET 25.

SEE EXISTING CONDITIONS PLAN FOR EXISTING
LEGEND, GRADING PLAN FOR PROPOSED
LEGEND (SHEETS 2 AND 4).

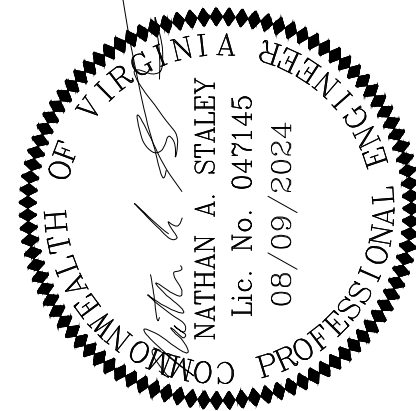
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PLANTING PURPOSES ONLY

PLANTING AREAS		SYMBOL
UPLAND ZONE	STREAMSIDE* STREAM BANK - 6,000 SF = 0.14 AC STREAM EDGE - 2,999 LF	A, B, C, D
	RIPARIAN FOREST SEED AND PLANTING* 46,384 SF = 1.06 AC	E, F, G, H, I, J
	TURF SEED* 778 SF = 0.02 AC	K
*SEED MIX SHALL BE DISTRIBUTED EVENLY THROUGHOUT ALL DISTURBED AREAS IN THE AMOUNT SPECIFIED ON THE SEEDING SCHEDULE SHEET.		

Stream Restoration Of A Tributary To Mud Lick Creek
Along Canter Dr. - Final Plan

Roanoke County, Virginia

Planting Plan (cont'd)



REVISIONS		DATE: AUG 2024		SCALE: 1" = 20'	
No.	Date	Description	Rev. By	App. By	

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Vertical Datum: NAVD 88		
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24 of 28		
Computer File Name: L:\WSS\000000\0000000000\CA2D\44-ENG\06-Final PLANTING PLAN.dwg		

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RIPARIAN FOREST VEGETATION SCHEDULE FOR SHADY & VARIABLE HYDROLOGY CONDITIONS																								
PLANTING SCHEDULE													PLANTING QUANTITIES (BASED ON ONE-GALLON SIZE) ⁴											
CONTAINER PLANTING ZONE		SPECIES GROUP ^{1,2}	SPECIES ²	INDICATOR STATUS (AGCP)	INDICATOR STATUS (EMP)	WILDLIFE VALUE				PLANT SPACING ³	CONTAINER SIZE, RATE, AND QUANTITY ⁴		AREA (SF): AREA (AC): LENGTH (LF):	A 2,769 0.06 1,319	B 2,833 0.07 1,349	C 133 0.003 111	D 265 0.01 221	E 3,439 0.08 -	F 6,710 0.15 -	G 5,843 0.13	H 9,918 0.23	I 5,748 0.13 -	J 14,726 0.34 -	
						FUNCTIONS	PRIMARY SPECIES	PLANT PART	SEASON		PLANTS PER ACRE	# OF PLANTS												
RIPARIAN FOREST (VARIABLE, SHADY)	OVERSTORY LAYER	1	QUERCUS FALCATA (SOUTHERN RED OAK)	FACU	FACU	Food	Woodpeckers, turkey, deer, squirrels, raccoons, other small mammals	Nuts, trees	All	12' O.C. ³	300 ONE GAL -- or -- 600 TUBELINGS -- or -- MIX AT 1:2 RATIO*	318 (BASED ON ONE-GALLON)	0	0	0	24	45	39	69	39	102			
			QUERCUS ALBA (WHITE OAK)	FACU	FACW	Food	Woodpeckers, turkey, deer, squirrels, raccoons, other small mammals	Nuts, trees	All															
			QUERCUS PALUSTRIS (PIN OAK)	FACW	FACW	Food	Woodpeckers, turkey, deer, squirrels, raccoons, other small mammals	Nuts, trees	All															
			QUERCUS PHELLOS (WILLOW OAK)	FACW	FAC	Food	Woodpeckers, turkey, deer, squirrels, raccoons, other small mammals	Nuts, trees	All															
			QUERCUS RUBRA (NORTHERN RED OAK)	FACU	FACU	Food	Woodpeckers, turkey, deer, squirrels, raccoons, other small mammals	Nuts, trees	All															
	OVERSTORY LAYER	2	ACER NEGUNDO (BOX ELDER) ⁸	FAC	FAC	Food	Finches, chickadees, squirrels, robins, goldfinches, other birds	Seeds, buds, flowers, tree	Spring, summer	21' O.C. ³	100 ONE-GALLON -- or -- 400 TUBELINGS -- or -- MIX AT 1:2 RATIO ⁴	106 (BASED ON ONE-GALLON)	0	0	0	8	15	13	23	13	34			
			CARYA CORDIFORMIS (BITTERNUT HICKORY)	FAC	FACU	Food	Squirrels, small mammals	Seed, tree	Spring, summer, fall															
			DIOSPYROS VIRGINIANA (COMMON PERSIMMON)	FAC	FAC	Food	Bees, large and small mammals, song birds including cedar waxwing, game birds	Fruits, flowers, leaves, twigs	All															
			LIQUIDAMBAR STYRACIFLUA (SWEET GUM)	FAC	FAC	Food	Finches, cardinals, chickadees, sparrows, squirrels	Seed	Summer, fall, winter															
			NYSSA SYLVATICA (BLACK GUM)	FAC	FACW	Food, cover	Song birds, waterfowl, small mammals	Fruit, tree	All															
			PLATANUS OCCIDENTALIS (AMERICAN SYCAMORE)	FACW	FACW	Food	Raccoons, opossum, wood duck, pileated and other woodpeckers	Hollow trunks	All															
	UNDERSTORY LAYER	3	ACER RUBRUM (RED MAPLE) ⁹	FAC	FAC	Food	Finches, chickadees, squirrels, robins, goldfinches, other birds	Seeds, buds, flowers, tree	Spring, summer	15' O.C. ³	200 ONE-GALLON -- or -- 400 TUBELINGS -- or -- MIX AT 1:2 RATIO ⁴	212 (BASED ON ONE-GALLON)	0	0	0	16	30	26	46	26	68			
			AMELANCHIER CANADENSIS (CANADIAN SERVICEBERRY)	FAC	FAC	Food, cover	Song birds, small mammals	Fruit, tree	All															
			ASIMINA TRILOBA (PAWPAW)	FAC	FAC	Food	Catbird, thrasher, thrushes, woodpeckers, zebra swallowtail butterfly larval food	Fruit, leaves	Spring, summer, fall															
			CERCIS CANADENSIS (EASTERN REDBUD)	UPL	FACU	Food	Honeybees, butterfly caterpillars	Flowers, leaves	Spring, summer															
			JUNIPERUS VIRGINIANA (EASTERN RED CEDAR)	FACU	FACU	Food, cover, reproduction	Birds, small mammals	Fruit, needles, twigs	All															
MAGNOLIA VIRGINIANA (SWEETBAY MAGNOLIA)	FACW	FACW	Food	Birds, small mammals, pollinators	Flower, fruit, leaves	Spring, summer, fall																		
SHRUB LAYER	4	CORYLUS AMERICANA (AMERICAN HAZELNUT)	FACU	FACU	Food, cover	Songbirds, small mammals	Fruit	Summer, fall	15' O.C. ³	200 ONE-GALLON -- or -- 400 TUBELINGS ⁴	212 (BASED ON ONE-GALLON)	0	0	0	16	30	26	46	26	68				
		LINDERA BENZOIN (NORTHERN SPICEBUSH)	FACW	FAC	Food	Thrushes vireos, catbird, bluebird, butterfly caterpillars	Fruit, leaves	Spring, summer, fall																
		VIBURNUM DENTATUM (SOUTHERN ARROWWOOD)	FAC	FAC	Food	Robins, bluebirds, other thrushes, thrashers, catbirds, vireos	Fruit	Fall																
			VIBURNUM PRUNIFOLIUM (BLACK-HAW)	FACU	FACU	Food, cover	Catbirds, thrashers, thrushes, cover and nest sites for songbirds	Fruit, tree	Spring, fall															
RIPARIAN FOREST QUANTITY SUBTOTALS											800	848		-	-	-	-	64	120	104	184	104	272	
STREAMSIDE PLANTING ZONES	STREAM BANK	SHRUB LAYER	5	ALNUS SERRULATA (BROOKSIDE ALDER)	FACW	OBL	Food, reproductive areas	Finches, sparrows, doves, yellow warbler, song sparrow, other songbirds	Seeds, buds, stems	Summer, fall, winter	3' O.C. ⁶	4800 ONE-GALLON -- or -- 9600 TUBELINGS -- or -- MIX AT 1:2 RATIO ⁴	687 (BASED ON ONE-GALLON)	288	336	15	48	-	-	-	-	-	-	
				ARONIA ARBUTIFOLIA (RED CHOKEBERRY)	FACW	FACW	Food, cover, reproductive areas	Finches, sparrows, doves, yellow warbler, song sparrow, other songbirds	Flower, fruit	Summer, fall, winter														
				CEPHALANTHUS OCCIDENTALIS (BUTTONBUSH)	OBL	OBL	Food, cover, reproductive areas	Catbird, thrasher, thrushes, cedar waxwings, rabbits	Flower, fruit	Summer, fall, winter														
				ILEX VERTICILLATA (COMMON WINTERBERRY)	FACW	FACW	Food, cover, reproductive areas	Bluebird, catbird, brown thrasher, robin, yellow bellied sapsucker, mockingbird	Flower, seed, leaves	All														
				VIBURNUM DENTATUM (SOUTHERN ARROWWOOD)	FACU	FAC	Food, cover, reproductive areas	Purple finch, goldfinch, robin, junco, bluebird, hermit thrush	Flower, fruit	Spring, summer, fall														
	STREAM BANK QUANTITY SUBTOTALS											4800	687		288	336	15	48	-	-	-	-	-	-
	STREAM EDGE	SHRUB LAYER	6	ALNUS SERRULATA (SMOOTH ALDER)	FACW	OBL	Food, reproductive areas	Finches, sparrows, doves, yellow warbler, song sparrow, other songbirds	Seeds, buds, stems	Summer, fall, winter	1 PER L.F. STAGGERED ⁶	N/A	2,999 (TUBELINGS OR LIVESTAKES ONLY) ⁷	1319	1349	111	221	0	0	0	0	0	0	
CEPHALANTHUS OCCIDENTALIS (BUTTONBUSH)				OBL	OBL	Food, cover, reproductive areas	Catbird, thrasher, thrushes, cedar waxwings, rabbits	Flower, fruit	Summer, fall, winter															
CORNUS AMOMUM (SILKY DOGWOOD)				FACW	FACW	Food, cover, reproductive areas	Catbird, thrasher, thrushes, cedar waxwings, rabbits	Flower, fruit	Summer, fall, winter															
SAMBUCUS NIGRA spp. CANADENSIS (ELDERBERRY/BLACK ELDER)				FACW	FAC	Food, cover	Brown thrasher, catbird, woodpeckers, thrushers	Seed	Spring, fall, winter															
STREAM EDGE QUANTITY SUBTOTALS											---	2,999		1,319	1,349	111	221	-	-	-	-	-	-	
LIVE STAKE		7	SALIX NIGRA (BLACK WILLOW)	OBL	OBL	Food, cover, reproductive areas	Beaver, porcupine, deer, muskrat, ducks, fish	Buds, foliage, bark	All	1 PER L.F. STAGGERED ⁶	N/A	2,999 LIVE STAKES		1319	1349	111	221	0	0	0	0	0	0	
LIVE STAKE QUANTITY SUBTOTALS											---	2,999		1,319	1,349	111	221	-	-	-	-	-	-	

PLANTING AND SEEDING NOTES:

1. It is expected and preferred that all species in each of the Species Groups are planted. The tolerances listed in this note are intended to incorporate flexibility according to species availability. At a minimum, Contractor to provide at least:

a) 4 of the 5 species in Group 1, b) 5 of the 6 species in Group 2, c) 5 of the 6 species in Group 3, d) 3 of the 4 species in Group 4, e) 4 of the 5 species in Group 5, f) 3 of the 4 species in Group 6, g) all of the species in Group 7, h) all of the species in Group 8,	i) all of the species in Group 9, j) 3 of the 4 species in Group 10, k) 3 of the 4 species in Group 11, l) 5 of the 6 species in Group 12, m) 5 of the 7 species in Group 13, n) 4 of the 5 species in Group 14, and o) 5 of the 6 species in Group 15.
--	---
2. Substitutions for selected species based upon availability shall be requested in writing to engineer, documenting the lack of availability, If the flexibility inherent in the above schedule is still not sufficient, Engineer is under no obligation to approve substitutions.
3. The planted trees and shrubs shall be randomly spaced and species mixed throughout the planting areas.
4. Container rates and quantities shown for one gallon size. For purposes of substitution, two tubelings are the equivalent of one 1-gallon container plant in this schedule. Contractor may provide a mix of container and tubeling sizes for each species requirement, provided the ratio of tubelings to containers is not less than 2:1. Exception – Group 6 (Stream Edge) shall be planted in accordance with Note #5.
5. Group 6 (Stream Edge) zone shall be planted with tubelings, or as livestakes.
No one gallons are required to be used for any of this Group's species.
6. Stream Bank (Group 5) and Stream Edge (Group 6) zones shall be planted such that the combined mix of species is spaced approx. 3' O.C. and 1 plant per L.F. respectively. Live stake zones upstream of outer vane arm (Group 7) spaced at 1 plant per L.F. Live stake zones downstream of outer vane arm (Group 8) spaced at 4 plants per L.F.
7. All seeding rates are expressed in pounds of pure live seed (PLS).
8. If there is an abundance of existing or established maples on site, a substitution for maples may be made with an alternate species to avoid tapping into and adding to existing saturated seed bank. Final decision as to whether or not to plant maples will be made by engineer of record.

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Stream Restoration Of A Tributary To Mud Lick Creek
Along Canter Dr. - Final Plan

Roanoke County, Virginia

Vegetation Schedule

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A circular professional seal for the Commonwealth of Virginia. The outer ring contains the text "COMMONWEALTH OF VIRGINIA" at the top and "PROFESSIONAL ENGINEER" at the bottom, separated by small stars. In the center, the name "NATHAN A. STALEY" is printed above the license number "Lic. No. 047145", which is above the expiration date "08/09/2024". A handwritten signature, "N. Staley", is written over the printed name and license number.

REVISIONS			
No.	Date	Description	App. By
			Rev. By
DATE: AUG 2024		SCALE: N/A	

Horizontal Datum: VCS NAD 83		
Vertical Datum: NAVD 88		
Boundary and Topo Source: WSSI and Roanoke County Digital Data		
Design	Draft	Approved
JAB	JAB	NAS
<p style="text-align: center;">Sheet #</p> <p style="text-align: center; font-size: 2em;">26 of 28</p>		
<p>Computer File Name: L:_WSS\0000000a\000000a\00000007\CADD\04-ENG\06-1.mxd PLANTING.PLAN.dwg</p>		

RIPARIAN FOREST VEGETATION SCHEDULE FOR SHADY & VARIABLE HYDROLOGY CONDITIONS

I. Background

The overall topography for the design reach is moderate to severe slopes and severe floodplain incision. The upstream section of the reach begins connected to the floodplain with little to no erosion before the channel depth increases rapidly and the channel disconnects from the floodplain. This unstable morphology remains until the end of the reach. Channel slopes varied between 2% and 4.5% within the reach.

II. Preliminary Hydrologic Analysis

Bankfull Channel Geometry as Predicted by the Non-Urban Regional Curves.

III. Channel Sizing

IIJ. Discussion of Design Alternatives

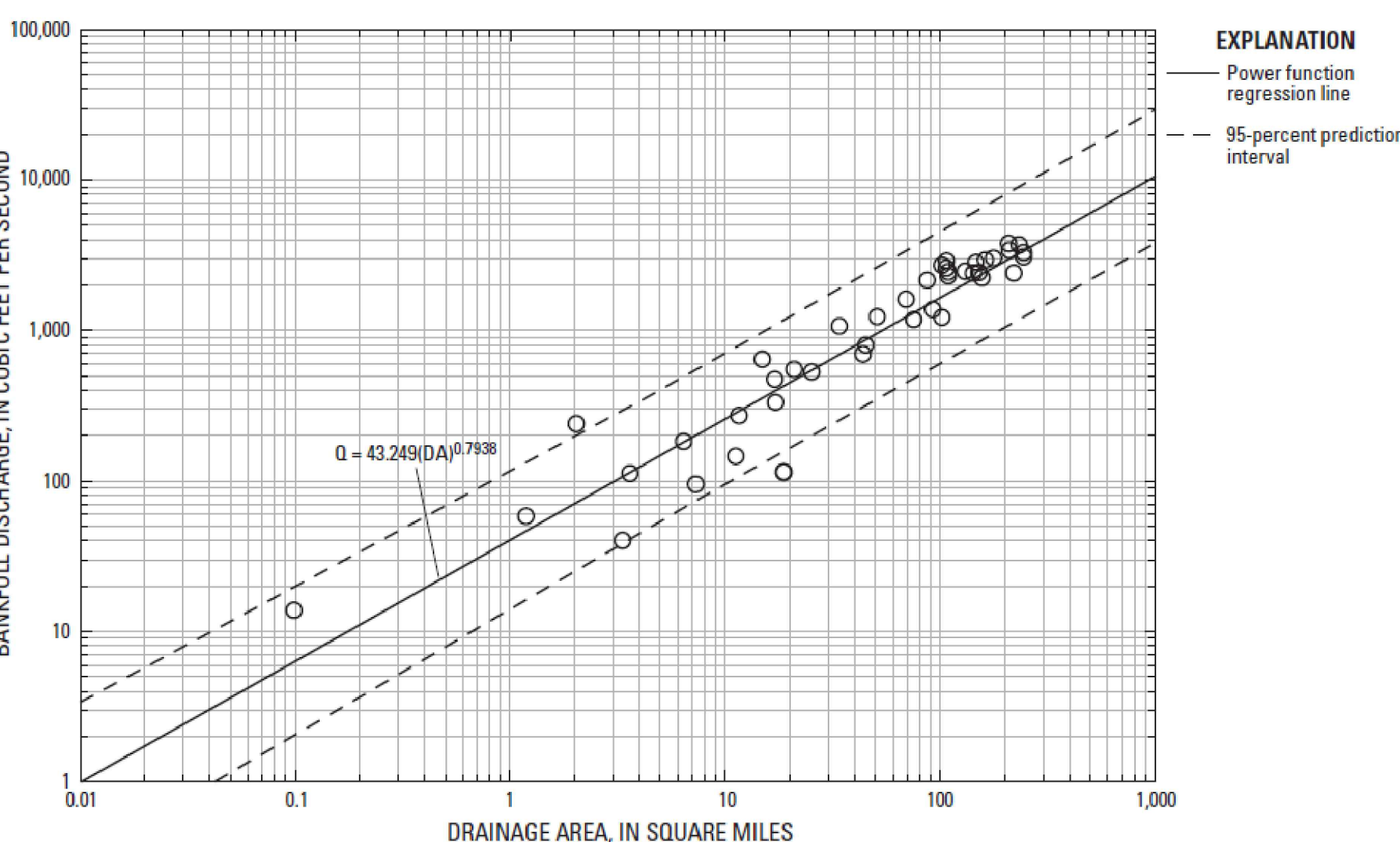
When considering the Canter Drive design reach in the context of Rosgen's channel classification system, the channel exhibits characteristics of a B-type (narrow) channel throughout the reach. Left unchecked, the design reach is likely to see continued erosion along the banks, resulting in the loss of large quantities of sediment to the downstream receiving waters and continued damage to the subject properties.

A Priority 2 (P2) restoration typically involves excavation of floodplain material in order to create a bankfull floodplain at a lower elevation where good floodplain connectivity is not otherwise seen. This approach often involves major excavation and haul off, as well as significant disturbance to the surrounding riparian vegetation/trees. Project costs for this strategy can approach those of a P1 design.

The goals of this project necessitate use of a design strategy that achieves long-term stability, improves floodplain connectivity and flood attenuation, enhances stream and wetland habitat, and works within the limits of available funding. A Priority I design is deemed to be the preferred alternative due to improved long-term stability and ecological benefits. The approach used contains elements of Priority 1 and Priority 2 design. The design channel size is based on a multi-faceted approach which considers applicable regional curves and local watershed conditions. The design largely maintains existing channel form but will raise the profile up to improve floodplain exchange which will be enhanced through bank grading and the creation of bankfull benches. This approach utilizes rock grade control structures to maintain a stable planform geometry and profile, while limiting future channel erosion.

V. Preliminary Floodplain Analysis

The majority of the proposed design reach does not lie within a FEMA-mapped floodplain except for the downstream section that is controlled by the 36" culvert (to remain). Proposed grading activities associated with this restoration are designed to maximize floodplain connectivity and promote long term stability. Due to the steep surrounding topography and the ability to largely work within the existing channel scar, the design team does not anticipate adverse floodplain impacts. The TR-55 curve number design methodology was used to model the 2-year and 10-year flow rates to assess channel stability. These flow results were then applied to a HEC-RAS 1-D hydraulic model to evaluate near channel velocities and erosion potential for the period immediately following construction. Model results indicate velocities of less than 4 ft per second, indicating coil matting and planned vegetation are sufficient to minimize future erosion.



Adapted from: Keaton, Messinger, and Doheny. 2005, Development and Analysis of Regional Curves for Streams in the Non-Urban Valley and Ridge Physiographic Province, Maryland, Virginia, and West Virginia. U.S. Geological Survey Scientific Investigations Report 2005-5076, p. 14-15.

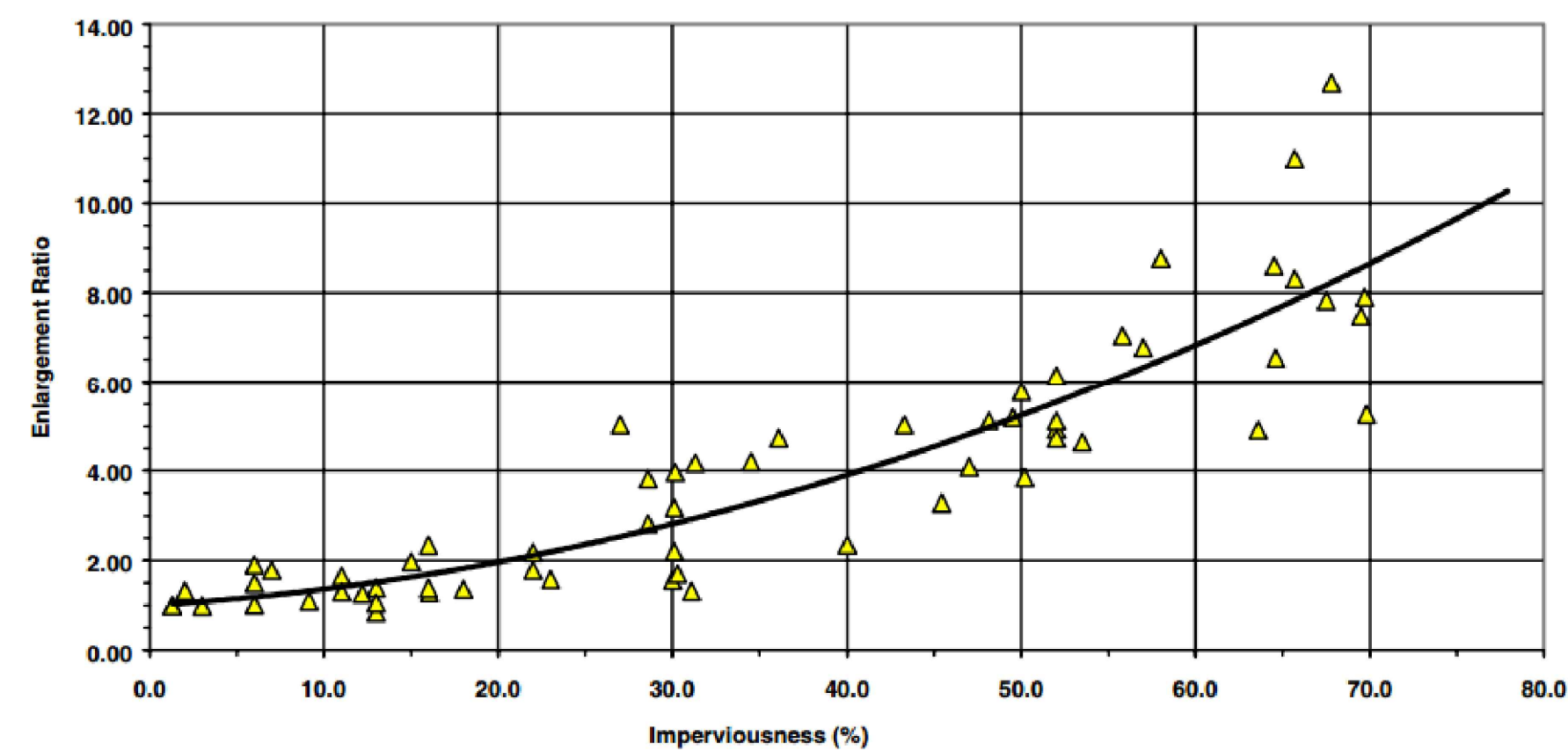
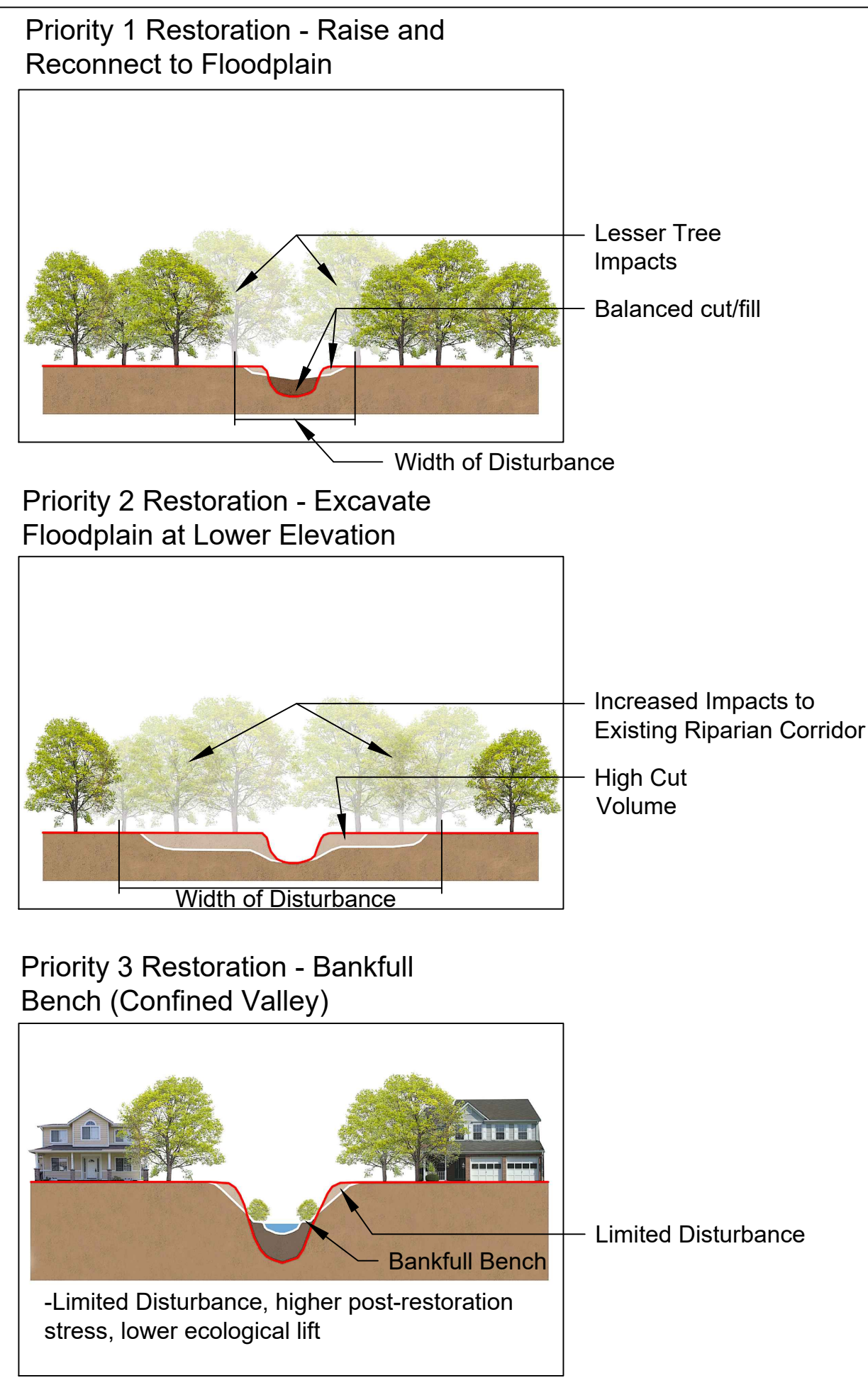


Figure 3. Stream Restoration Design Priority

Figure 4. Channel Evolution Model

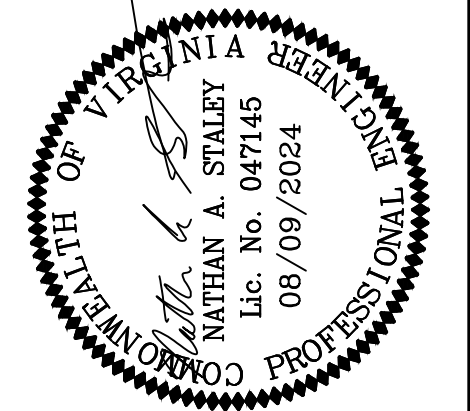


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Stream Restoration Of A Tributary To Mud Lick Creek Along Canter Dr. - Final Plan

Roanoke County, Virginia

Design Narrative, Discussion, and Regional Curves



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