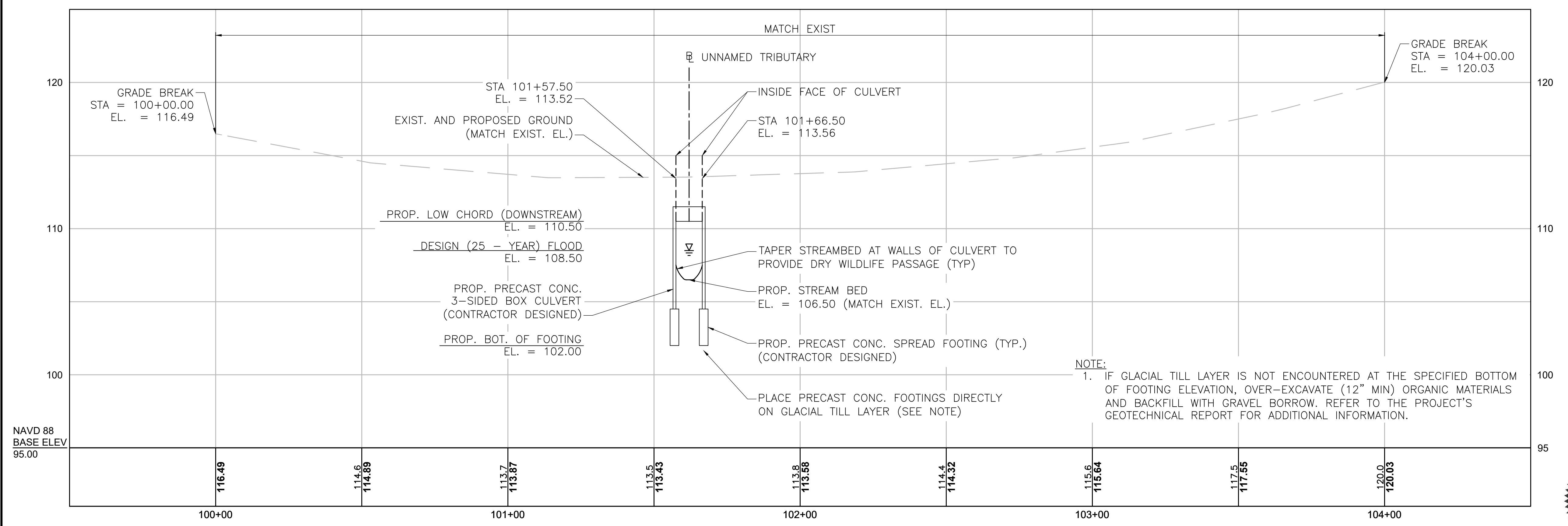


- NOTES:**
- A-SERIES AND B-SERIES BORDERING VEGETATIVE WETLANDS FLAGGING ARE SHOWN BASED ON FIELD SURVEY PERFORMED BY BAY COLONY GROUP ON AUGUST 12, 2020.
  - ENTIRE PROJECT LIMITS IS WITHIN THE 100-FOOT BUFFER ZONE TO BVW/INLAND BANK.

**INDEX**

SHEET NO.	DESCRIPTION
1	KEY PLAN AND PROFILE
2	BORING LOGS
3	GRADING PLAN
4	PLAN & ELEVATION
5 - 7	CONSTRUCTION DETAILS
8	CONTROL OF WATER PLAN
9 - 10	TEMPORARY TRAFFIC CONTROL PLAN



DATE	DESCRIPTION	REV #
10/5/20	DEP COMMENTS	
8/12/20	UPDATED WETLAND FLAGS	
8/6/20	NOI SUBMITTAL	-
7/31/20	100% DESIGN SUBMITTAL	-

**TEC**  
The Engineering Corp

146 Dascomb Road  
Andover, MA 01810  
978-794-1792

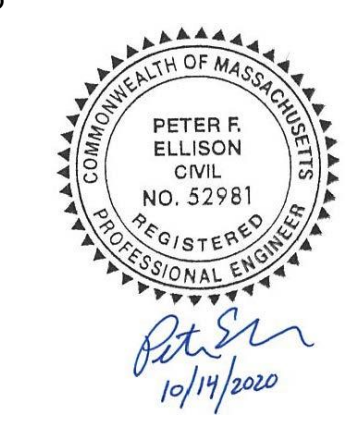
311 Main Street  
2nd Floor  
Worcester, MA 01608  
508-868-5104

169 Ocean Blvd, Unit 3  
PO Box 249  
Hampton, NH 03842  
603-601-8154

www.TheEngineeringCorp.com


**RECOMMENDED FOR APPROVAL**

CHIEF ENGINEER	DATE
APPROVED	
HIGHWAY ADMINISTRATOR	DATE



BORING B-1

TEST BORING LOG

 <b>MILLER ENGINEERING &amp; TESTING, INC.</b> 100 Sheffield Road - Manchester, NH 03103 Ph. (603) 668-6016 - Fax: (603) 668-8641		Project: Willow Rd. Culvert Replacement Boxford, MA		Sheet 1 of 1 Boring No: B-1						
		Project No: 20.097.NH Date Start: 06-17-20 Date End: 06-17-20		Location: See Plan Approx. Surface Elev:						
GROUNDWATER OBSERVATIONS										
	CASING	SAMPLER	Date	Depth	Casing At	Stabilization Period				
Type	HSA	SS	06-17-20	7'	26'	Upon Completion				
Size	2-1/4" ID	1-3/8" ID								
Hammer	140 lbs.									
Fall	30"									
Depth/ Elev.	Cas bl/ft	SAMPLE		BLOWS				Strata Change	Sample Description	Notes
		Sample No.	Depth Range	Pen.	Rec.	0-6"	6-12"	12-18"	18-24"	
0		-	0.0-1.2	14						-: 14" Asphalt
		S-1	1.2-2.5	16	9	7/4"	13	13		S-1: Brown, fine to coarse sand, some gravel, little silt
		S-1A	2.5-3.0	6	4				12	S-1A: Brown, fine to coarse sand, some silt, some gravel (FILL)
		S-2	4.0-6.0	24	14	7	4	3	2	S-2: Brown, fine to coarse sand, some silt, little gravel (FILL)
5		S-3	6.0-8.0	24	9	2	4	4	2	S-3: Brown, fine to coarse sand, some silt, little gravel (organic roots in sample) (FILL)
		S-4	8.0-10.0	24	4	2	2	2	3	S-4: Brown, fine to coarse sand, some silt, little gravel (FILL)
10		S-5	10.0-11.0	12	10	6	12			S-5: Dark brown/black, peat, wet
		S-5A	11.0-12.0	12	8			11	11	S-5A: Brown, fine sand, little silt, trace gravel, wet (1)
15		S-6	14.0-16.0	24	14	10	17	15	21	S-6: Olive/Orange, fine to coarse sand, some silt and gravel
20		S-7	19.0-20.5	18	13	22	34	54		S-7: Gray, silt, little clay
25		S-8	24.0-25.3	16	13	31	47	50/4"		S-8: Gray, fine to coarse sand, some silt and angular gravel (2)
										Auger Refusal at 26' BORING TERMINATED AT 26 ft
30										
Driller: R. Marcoux Helper: J. Donahue Inspector: T. Young		COHESIVE CONSISTENCY (Blows/Foot) 0-2 VERY SOFT 2-4 SOFT 4-8 MEDIUM STIFF 8-15 STIFF 15-30 HARD		COHESIONLESS (Blows/Foot) 0-4 VERY LOOSE 4-10 LOOSE 10-30 MEDIUM DENSE 30-50 DENSE 50+ VERY DENSE		PROPORTIONS USED TRACE: 0-10% LITTLE: 10-20% SOME: 20-35% AND: 35-50%				
NOTES: (1) A large piece of gravel was at the transition from peat to naturally occurring sand. (2) Rock in tip of split-spoon.										
REMARKS: THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITION MAY BE GRADUAL. WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF THE GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.										


EXIST GROUND SURFACE  
EL = 113.0±

GROUNDWATER (6/17/20)  
EL = 106.0±

PROP. BOT. OF FOOTING  
EL = 101.20

BORING B-2

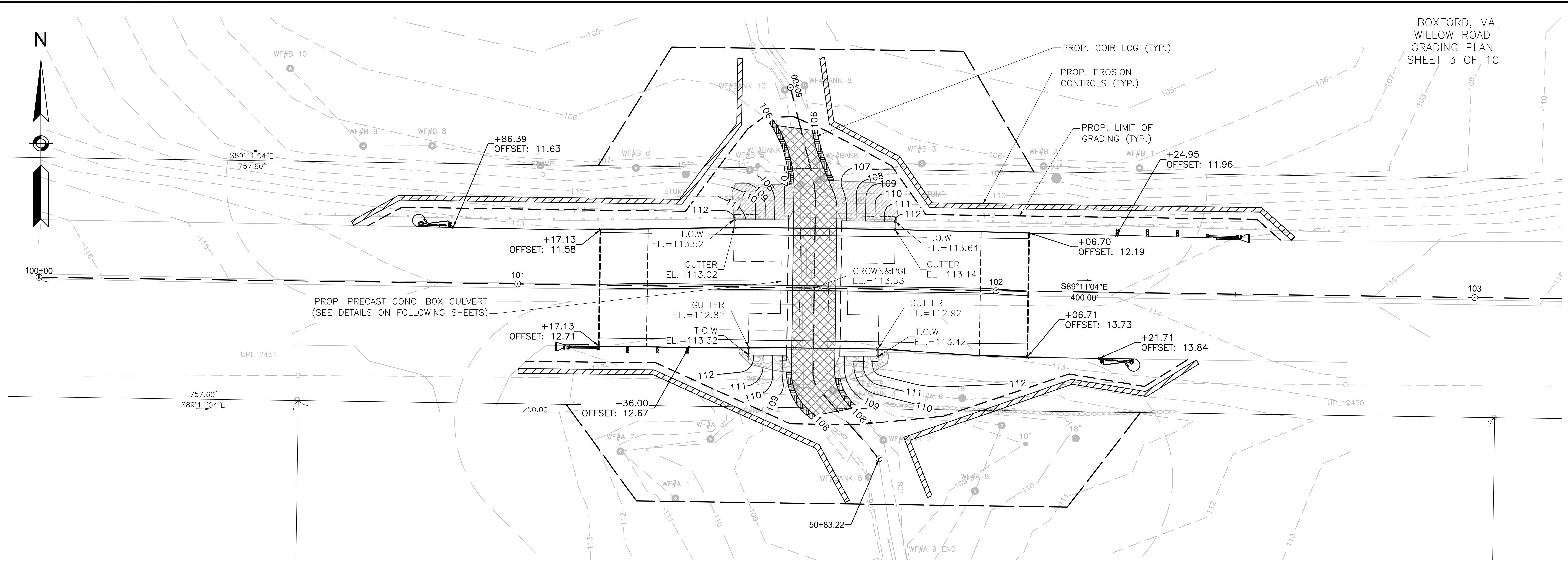
TEST BORING LOG

 <b>MILLER ENGINEERING &amp; TESTING, INC.</b> 100 Sheffield Road - Manchester, NH 03103 Ph. (603) 668-6016 - Fax: (603) 668-8641		Project: Willow Rd. Culvert Replacement Boxford, MA		Sheet 1 of 1 Boring No: B-2						
		Project No: 20.097.NH Date Start: 06-17-20 Date End: 06-17-20		Location: See Plan Approx. Surface Elev:						
GROUNDWATER OBSERVATIONS										
	CASING	SAMPLER	Date	Depth	Casing At	Stabilization Period				
Type	HSA	SS	06-17-20	5.5'	27.5'	Upon Completion				
Size	2-1/4" ID	1-3/8" ID								
Hammer	140 lbs.									
Fall	30"									
Depth/ Elev.	Cas bl/ft	SAMPLE		BLOWS				Strata Change	Sample Description	Notes
		Sample No.	Depth Range	Pen.	Rec.	0-6"	6-12"	12-18"	18-24"	
0		-	0.0-1.2	14						-: 14" Asphalt
		S-1	1.2-3.0	22	8	21/4"	31	17	30	S-1: Brown/Orange, fine to medium sand, some silt and gravel (FILL)
		S-2	4.0-6.0	24	10	7	17	13	6	S-2: Brown/Orange, fine to medium sand, some silt and gravel (FILL)
5		S-3	6.0-7.0	12	7	7	11			S-3: Brown/Orange, fine to medium sand, some silt and gravel, wet (FILL)
		S-3A	7.0-8.0	12	8			14	5	S-3A: Dark brown/black, peat, wet
		S-4	8.0-9.5	18	9	1	2	10		S-4: Dark brown/black, peat, wet
10		S-4A	9.5-10.0	6	2			15	15	S-4A: Olive/Orange (mottled), fine sand, little silt, little gravel, wet
		S-5	10.0-12.0	24	13	21	25	31	29	S-5: Olive/Orange (mottled), fine sand, little silt, little gravel, wet
15		S-6	14.0-16.0	24	2	27	25	23	25	S-6: Brown, fine sand, little silt, wet
20		S-7	19.0-21.0	24	14	22	26	21	37	S-7: Gray, fine to coarse sand, some silt and angular gravel
25		S-8	24.0-26.0	24	12	15	15	16	26	S-8: Gray, fine to coarse sand, some silt and angular gravel
										Auger Refusal at 27.5' BORING TERMINATED AT 27.5 ft
30										
Driller: R. Marcoux Helper: J. Donahue Inspector: T. Young		COHESIVE CONSISTENCY (Blows/Foot) 0-2 VERY SOFT 2-4 SOFT 4-8 MEDIUM STIFF 8-15 STIFF 15-30 HARD		COHESIONLESS (Blows/Foot) 0-4 VERY LOOSE 4-10 LOOSE 10-30 MEDIUM DENSE 30-50 DENSE 50+ VERY DENSE		PROPORTIONS USED TRACE: 0-10% LITTLE: 10-20% SOME: 20-35% AND: 35-50%				
NOTES:										
REMARKS: THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITION MAY BE GRADUAL. WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF THE GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.										

EXIST GROUND SURFACE  
EL = 113.1±

GROUNDWATER (6/17/20)  
EL = 107.6±

PROP. BOT. OF FOOTING  
EL = 102.80



**GRADING PLAN**  
SCALE: 1" = 10'

**GENERAL NOTES**

**DESIGN:**  
IN ACCORDANCE WITH THE 2017 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS LRFD BRIDGE DESIGN SPECIFICATIONS WITH CURRENT INTERIM SPECIFICATIONS THROUGH 2019 FOR HL-93 LOADING.

**BENCHMARKS:**

MAG NAIL SET 1' UP IN POLE 180/82	500 N: 3084761.976 E: 780674.338 EL: 112.470	501 N: 3084804.870 E: 780247.102 EL: 122.830	502 N: 3084792.046 E: 780914.956 EL: 117.958
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ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988.

**SCALES:**  
SCALES NOTED ON THE PLANS ARE NOT APPLICABLE TO REDUCED SIZE PRINTS. DIVIDE SCALES BY TWO FOR HALF-SIZE PRINTS (A3).

**UNSUITABLE MATERIAL:**  
ALL UNSUITABLE MATERIAL SHALL BE REMOVED WITHIN THE LIMITS OF THE FOUNDATIONS OF THE STRUCTURE, AS DIRECTED BY THE ENGINEER.

**REINFORCEMENT:**  
REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M 31 GRADE 60 EPOXY COATED. UNLESS OTHERWISE NOTED ON THE CONSTRUCTION DRAWINGS, ALL BARS SHALL BE LAPPED AS FOLLOWS:

MODIFICATION CONDITION	#4 BARS	#5 BARS
1. NONE	21"	26"
2. 12" OF CONCRETE BELOW BARS	29"	36"
3. COATED BARS, COVER<3db, OR CLEAR SPACING<6db	31"	39"
4. COATED BARS, ALL OTHER CASES	25"	31"
5. CONDITION 2. AND 3.	35"	44"
6. CONDITION 2. AND 4.	34"	43"

IF THE ABOVE BARS ARE SPACED 6" OR MORE ON CENTER, THE LAP LENGTH SHALL BE 80% OF THE LAP LENGTH GIVEN ABOVE. ALL OTHER BARS SHALL BE LAPPED AS SHOWN ON THE CONSTRUCTION DRAWINGS.

**PRECAST ELEMENTS:**  
THE FABRICATOR IS RESPONSIBLE FOR THE DESIGN AND INSTALLATION OF LIFT HOOKS FOR ALL PRECAST ELEMENTS. UNDER NO CIRCUMSTANCES WILL THE REBAR ELEMENTS SHOWN ON THE PLANS BE USED TO LIFT THE PRECAST ELEMENTS. FOR ADDITIONAL REQUIREMENTS, REFER TO THE "PRECAST CONCRETE ELEMENTS" PORTION OF ITEM 995.1 IN THE SPECIAL PROVISIONS.

**PRECAST CONCRETE:**  
5000 PSI, 3/4 IN, 685 HP: CULVERT, HEADWALL, AND FOOTINGS.

**TRAFFIC:**  
THE BRIDGE WILL BE CLOSED TO VEHICULAR TRAFFIC DURING ALL PHASES OF DEMOLITION AND CONSTRUCTION. VEHICULAR TRAFFIC WILL BE DETOURED AS SHOWN ON THE PLANS.

**UTILITIES:**  
DURING CONSTRUCTION, THE CONTRACTOR SHALL LOCATE AND PROTECT FROM DAMAGE ALL UTILITIES THAT ARE TO REMAIN. ALL EXISTING UTILITY POLES AND OVERHEAD WIRES SHALL BE LEFT IN PLACE DURING CONSTRUCTION.

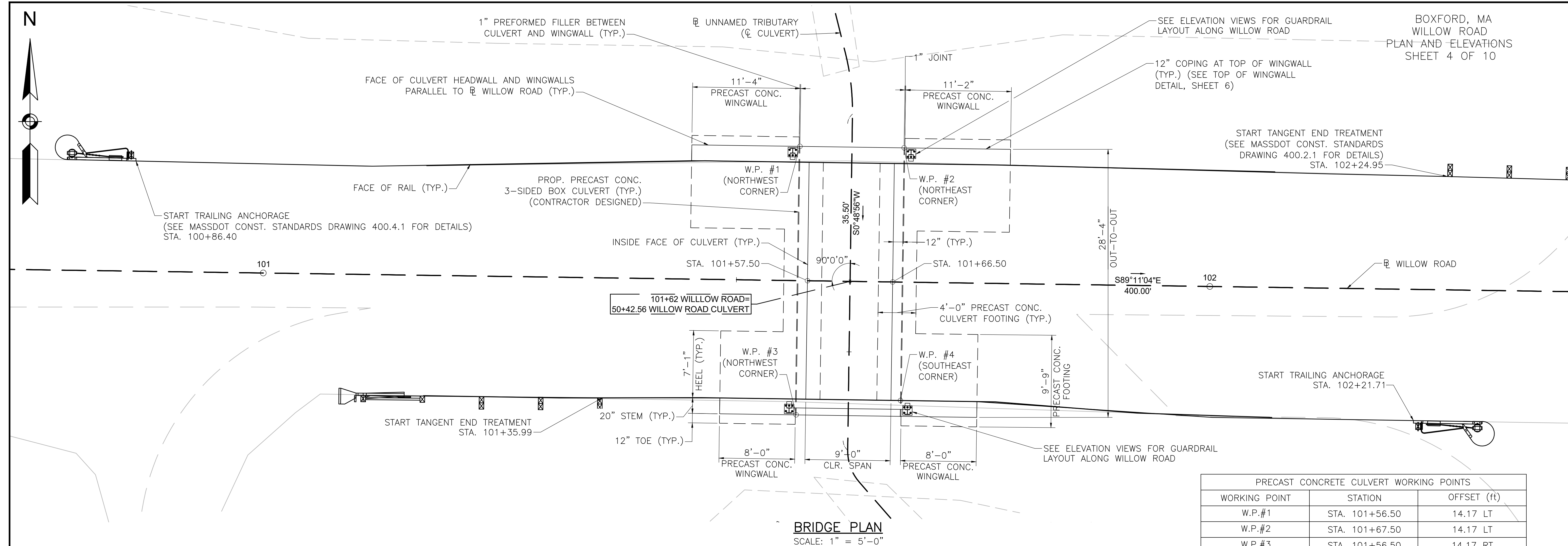
**COIR LOGS:**  
WHILE GRADING IS TAKING PLACE, NO COIR LOGS WILL BE PLACED. UPON COMPLETION OF GRADING, COIR LOGS SHALL BE PLACED AS SHOWN.

**CONTROL OF WATER SYSTEM:**  
CONTROL OF WATER SYSTEM SHALL BE DESIGNED BY THE CONTRACTOR AND SUBMITTED TO THE ENGINEER FOR APPROVAL, PER ITEM 991.1. CONTROL OF WATER SYSTEM SHALL BE DESIGNED USING THE 2-YEAR DESIGN FLOOD EVENT ELEVATION OF 108.0. APPROXIMATE LIMITS SHOWN ON THIS PLAN ARE CONCEPTUAL AND THE FINAL LOCATION SHALL BE DETERMINED BY THE CONTRACTOR.

**PAVEMENT MARKINGS:**  
ALL PAVEMENT MARKINGS SHALL BE THERMOPLASTIC AND SHALL SMOOTHLY TRANSITION INTO THE EXISTING PAVEMENT MARKINGS AT THE PROJECT LIMITS. A MINOR (NEGLECTIBLE) VARIATION IN THE SPECIFIED LANE WIDTHS IS PERMISSIBLE IN ORDER TO MAKE A SMOOTH TRANSITION FROM PROPOSED TO EXISTING PAVEMENT MARKINGS.

**HYDRAULIC DESIGN DATA**

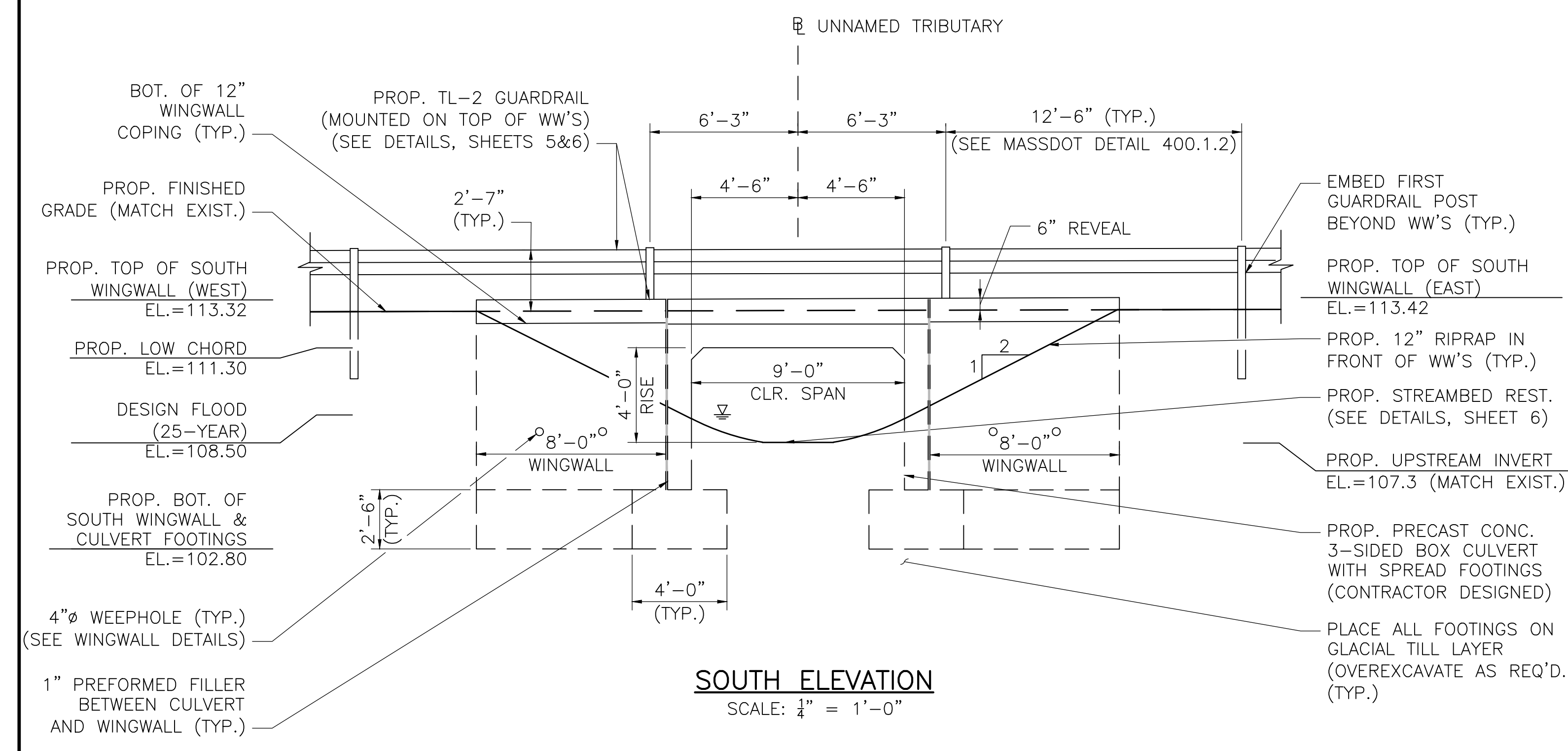
DRAINAGE AREA:	0.19 SQUARE MILES
DESIGN FLOOD DISCHARGE:	31 CUBIC FEET PER SECOND
DESIGN FLOOD FREQUENCY:	25 YEARS
DESIGN FLOOD VELOCITY:	4.8 FEET PER SECOND
DESIGN FLOOD ELEVATION:	108.50 FEET
LOWER CHORD ELEVATION:	109.70 FEET



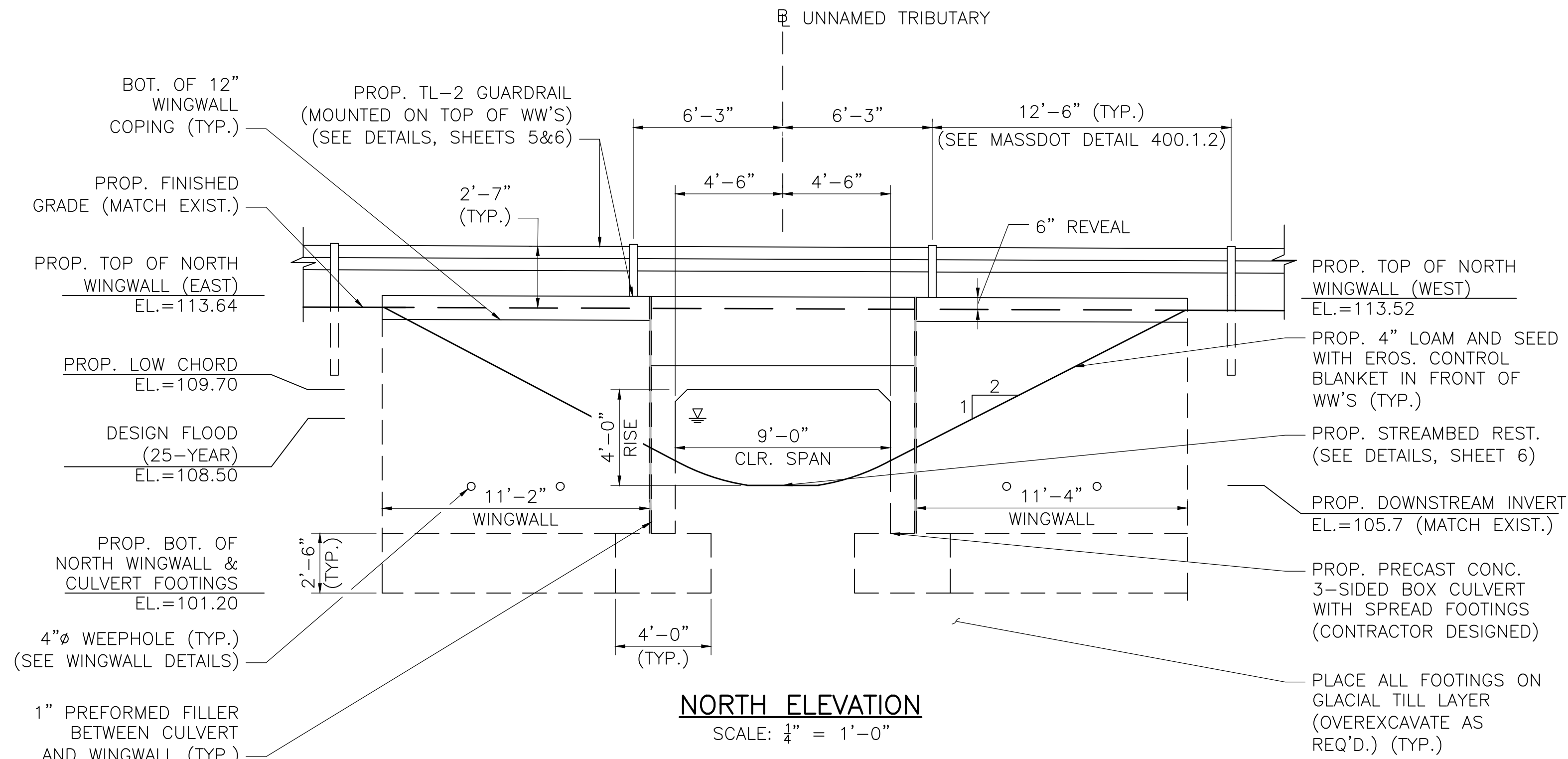
PRECAST CONCRETE CULVERT WORKING POINTS		
WORKING POINT	STATION	OFFSET (ft)
W.P.#1	STA. 101+56.50	14.17 LT
W.P.#2	STA. 101+67.50	14.17 LT
W.P.#3	STA. 101+56.50	14.17 RT
W.P.#4	STA. 101+67.50	14.17 RT

**BRIDGE PLAN**  
SCALE: 1" = 5'-0"

**NOTE:**  
CULVERT FOOTING DIMENSIONS SHOWN ON THIS SHEET ARE CONCEPTUAL AND SHALL BE DESIGNED BY THE CONTRACTOR. REFER TO "PRECAST CONCRETE CULVERT NOTES" ON SHEET 5 FOR ADDITIONAL INFORMATION



**SOUTH ELEVATION**  
SCALE: 1/4" = 1'-0"



**NORTH ELEVATION**  
SCALE: 1/4" = 1'-0"

**TRANSVERSE SECTION NOTES:**

- EXISTING CULVERT AND HEADWALLS NOT SHOWN FOR CLARITY. CONTRACTOR IS RESPONSIBLE FOR DEMOLITION OF ALL EXISTING CULVERT INFRASTRUCTURE.
- THE PROPOSED ROADWAY ELEVATIONS AND CROSS SLOPES ARE INTENDED TO MATCH THE EXISTING CONDITIONS. CONTRACTOR SHALL SMOOTHLY TRANSITION ALL PROPOSED ELEMENTS INTO THE EXISTING APPROACHES AND EMBANKMENT SLOPES.

**PAVEMENT NOTES:**

**PROPOSED FULL DEPTH RECONSTRUCTION:**

SURFACE: 1 1/2" SUPERPAVE SURFACE COURSE 12.5 (SSC - 12.5) OVER 2 1/2" SUPERPAVE INTERMEDIATE COURSE 19.0 (SIC - 19.0)

SUBBASE: 4" DENSE GRADED CRUSHED STONE OVER 8" GRAVEL BORROW, TYPE B

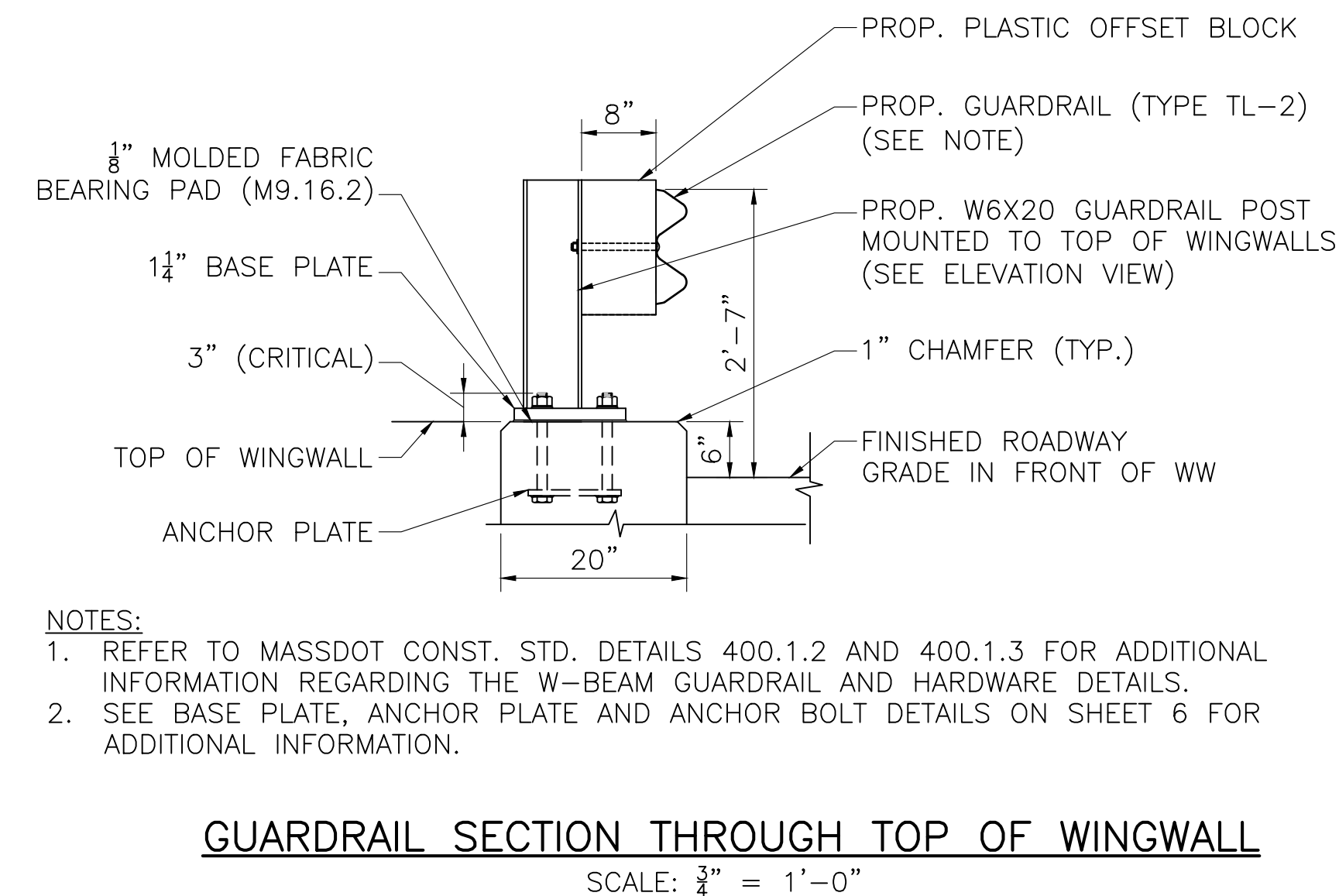
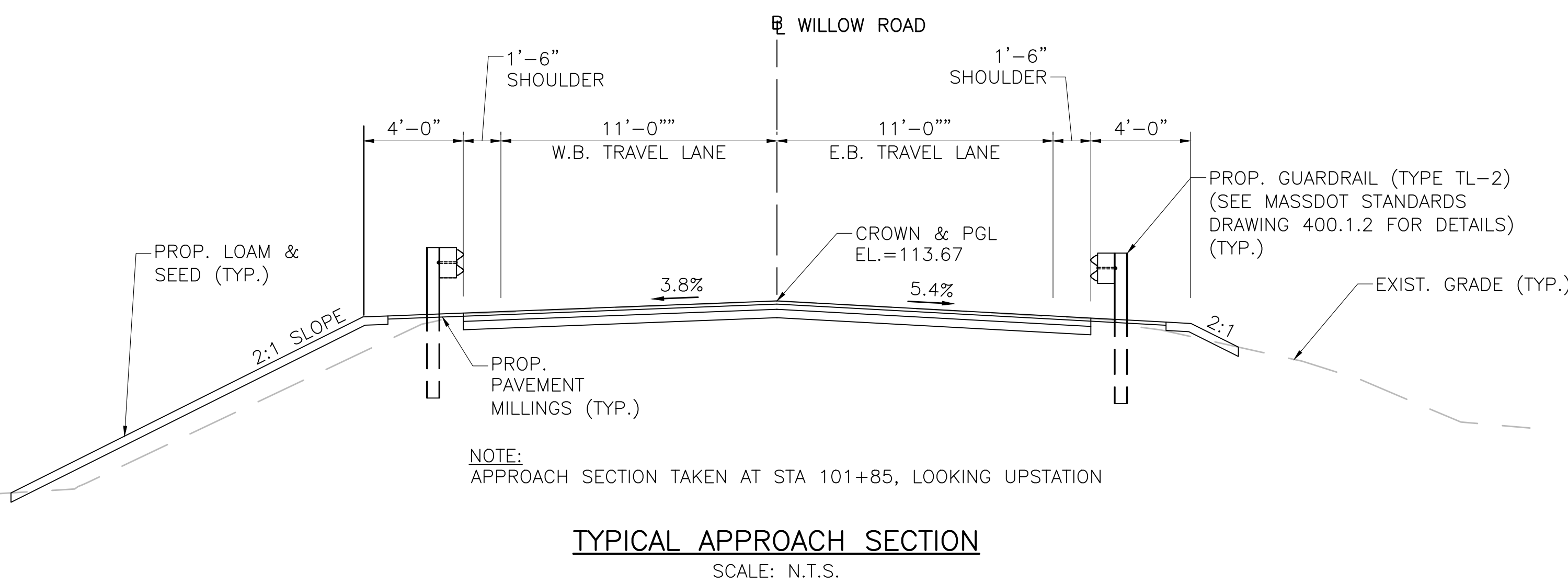
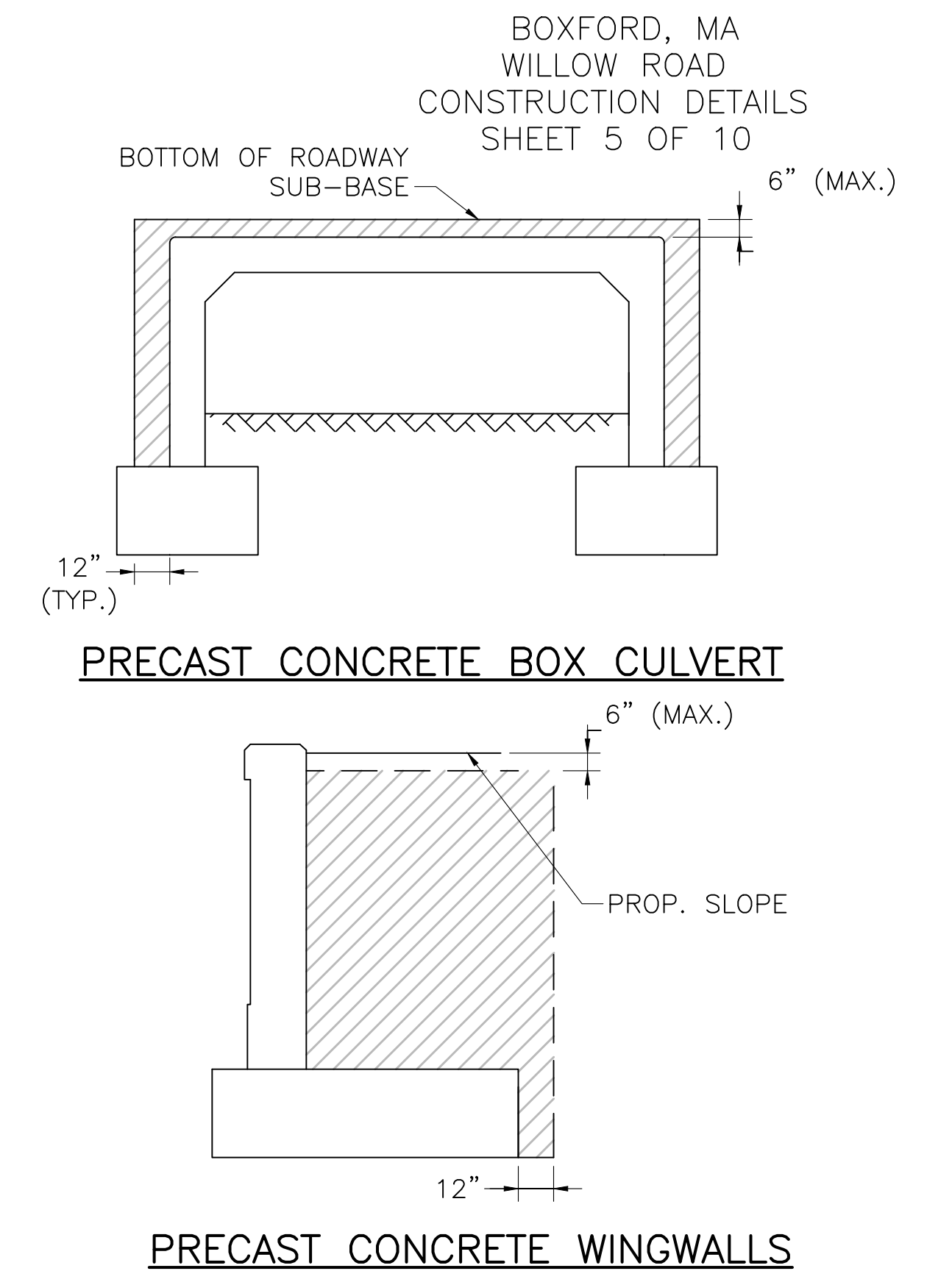
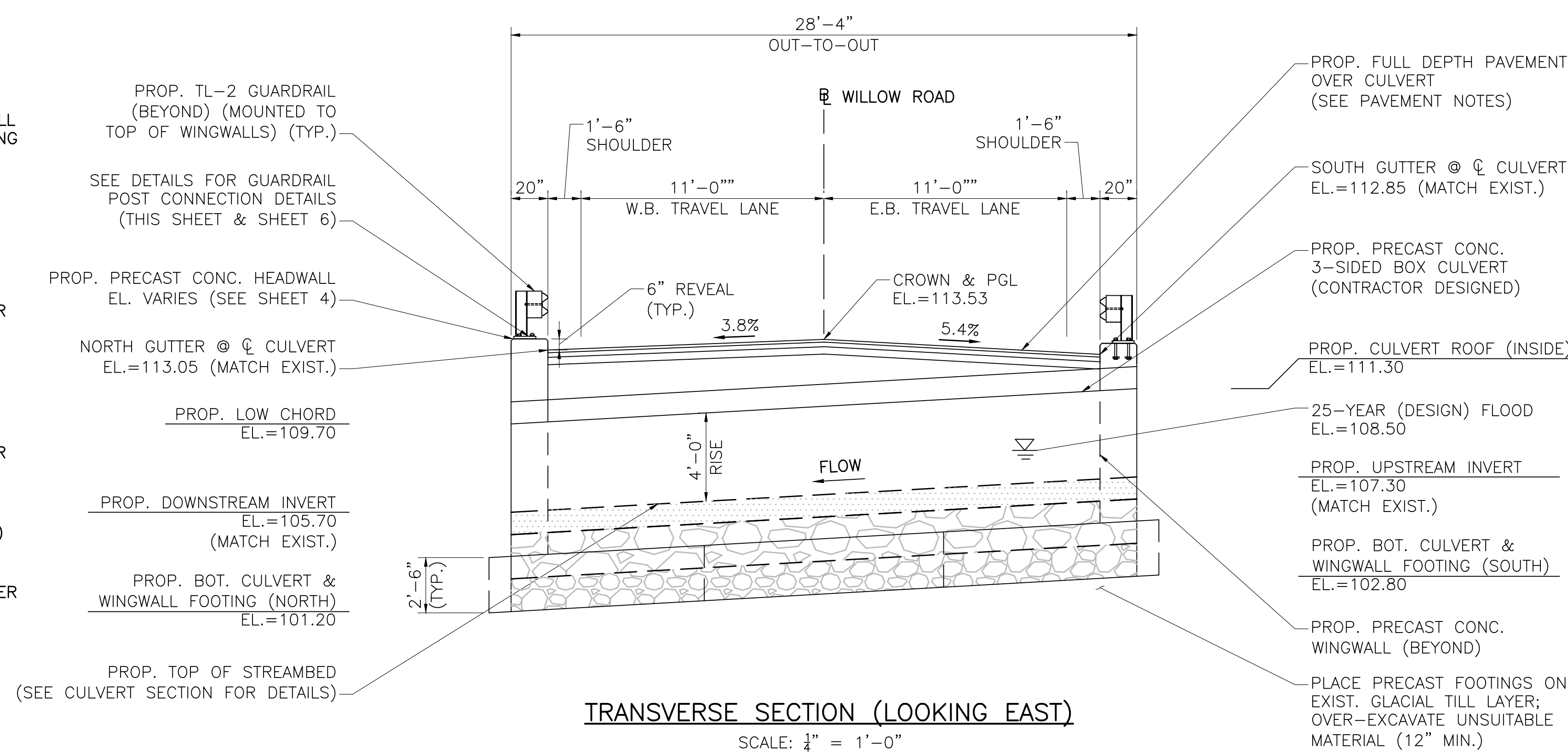
**PROPOSED FULL DEPTH RECONSTRUCTION (OVER CULVERT):**

SURFACE: 1 1/2" SUPERPAVE SURFACE COURSE 12.5 (SSC - 12.5) OVER 2 1/2" SUPERPAVE INTERMEDIATE COURSE 19.0 (SIC - 19.0)

SUBBASE: 4" DENSE GRADED CRUSHED STONE OVER VARIABLE DEPTH GRAVEL BORROW, TYPE B (UP TO 1'-7"±)

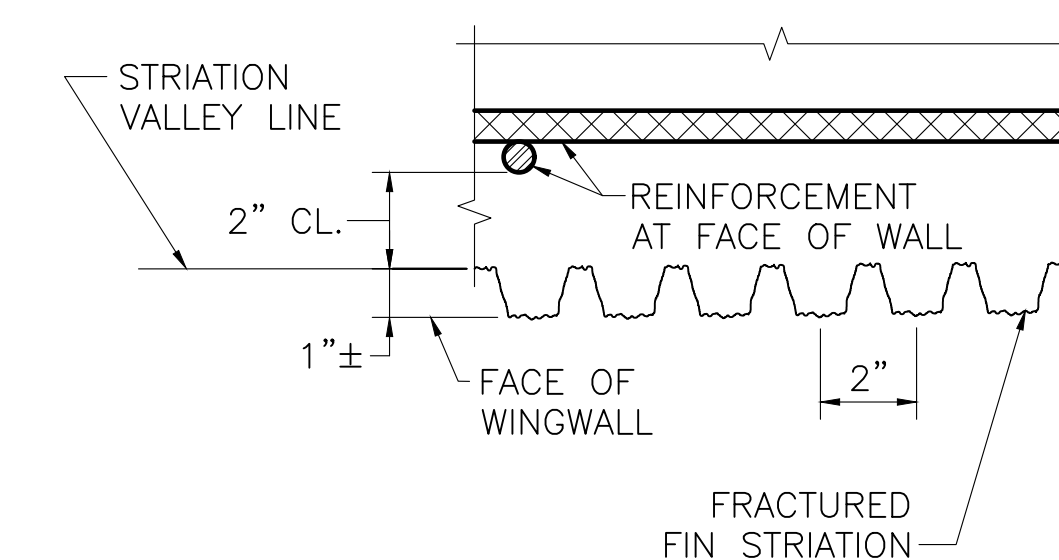
**PROPOSED PAVEMENT MILLING TRANSITION:**

SURFACE: 1 1/2" SUPERPAVE SURFACE COURSE 12.5 (SSC - 12.5) OVER 2 1/2" SUPERPAVE INTERMEDIATE COURSE 19.0 (SIC - 19.0)



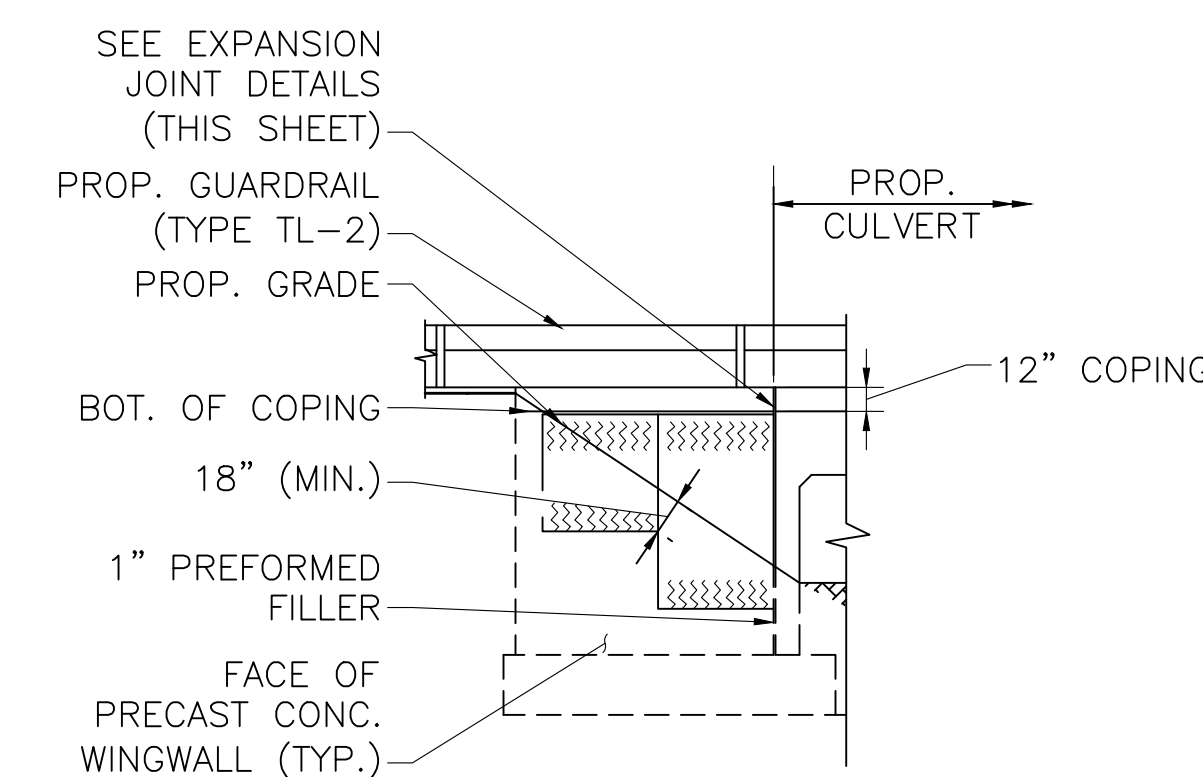
**PRECAST CONCRETE CULVERT NOTES:**

- CONTRACTOR SHALL SUBMIT PRECAST CONCRETE 3-SIDED BOX CULVERT AND FOOTING DESIGN CALCULATIONS AND SHOP DRAWINGS SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF MASSACHUSETTS FOR APPROVAL PRIOR TO FABRICATION. PRESCRIBED HYDRAULIC OPENING (4'X9') SHALL BE MAINTAINED.
- IF CLOSURE POURS ARE REQUIRED AS PART OF THE FOOTING OR CULVERT DESIGN, HIGH EARLY STRENGTH CONCRETE SHALL BE UTILIZED IN ORDER TO EXPEDITE BACKFILLING OPERATIONS. ACTUAL FOOTING DIMENSIONS SHALL BE DETERMINED BY THE CONTRACTOR. ALL OTHER CULVERT AND FOOTING CONCRETE SHALL BE 5000PSI, 3/4", 685 HP CEMENT CONCRETE.
- THE CONTRACTOR SHALL APPROVE ALL ELEVATIONS AND DIMENSIONS OF THE SHOP DRAWINGS PRIOR TO FABRICATION. SHOP DRAWINGS AND CALCULATIONS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW AND APPROVAL PRIOR TO FABRICATION.
- REINFORCEMENT SHALL BE PLACED WITH A MINIMUM OF 1 1/2" COVER. TRANSVERSE REINFORCEMENT SHALL BE PLACED NORMAL TO THE CULVERT CENTERLINE.
- ALL CULVERT REINFORCEMENT SHOWN IS CONCEPTUAL FOR BIDDING PURPOSES. THE CONTRACTOR SHALL SUBMIT DESIGN CALCULATIONS AS PART OF THE SHOP DRAWINGS.
- DESIGN SHALL BE IN ACCORDANCE WITH THE 2017 AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS WITH CURRENT INTERIM SPECIFICATIONS THROUGH 2019 AND THE MASSDOT LRFD BRIDGE MANUAL PART 1 CHAPTER 3 FOR HL-93 LOADING.
- A FACTORED BEARING RESISTANCE OF 5.0 KSF SHALL BE USED IN THE DESIGN OF THE CULVERT (IF PLACED DIRECTLY ON THE GLACIAL TILL LAYER, AS SPECIFIED IN THE GEOTECHNICAL REPORT). THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE SUBGRADE PREPARATION SUCH THAT THE DESIGN BEARING CAPACITY SHALL BE ACHIEVED. THE CONTRACTOR SHALL NOTIFY THE ENGINEER IF THIS BEARING CAPACITY CANNOT BE MET.
- THE CONTRACTOR SHALL BE MADE AWARE OF THE OVERHEAD WIRES ABOVE THE SOUTH GUTTERLINE. CONTRACTOR SHALL UTILIZE CONSTRUCTION TECHNIQUES TO WORK BENEATH THESE WIRES.

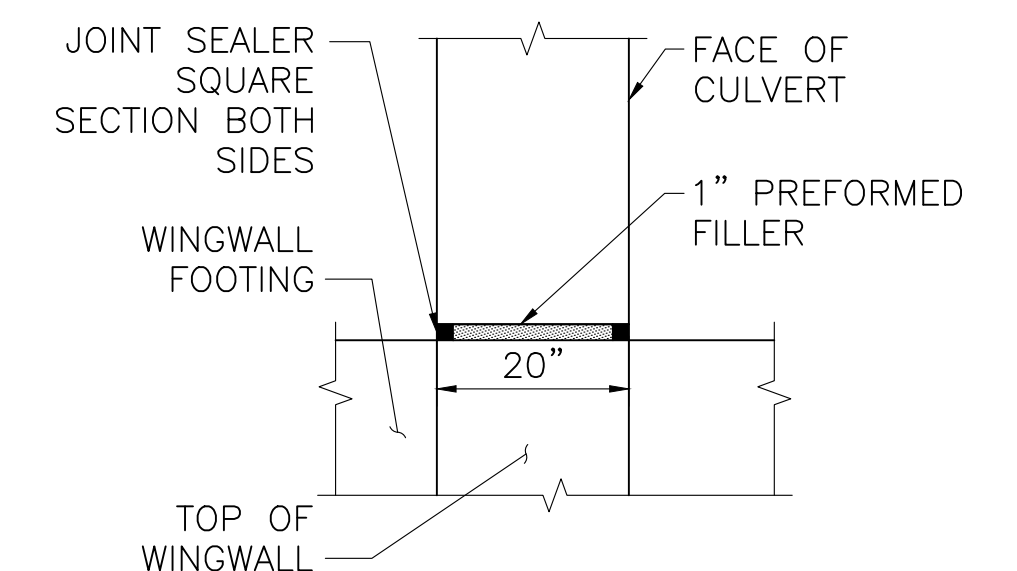


- NOTES:**
- THE CONTRACTOR SHALL MAKE SURE THAT THE STRIATION FINS ARE PLUMB AND LINED UP VERTICALLY FROM PANEL TO PANEL FOR THE FULL HEIGHT OF THE WALL.
  - THE HORIZONTAL JOINT MAY BE OMITTED IF THE CONTRACTOR CAN DEMONSTRATE THAT THE FORM LINER PANELS CAN BE INSTALLED END TO END WITHOUT CREATING A VISIBLE SEAM IN THE FINAL CAST CONCRETE.
  - STRIATION DETAILS SHALL ONLY BE INCORPORATED ON THE WINGWALLS.

**TYPICAL STRIATION DETAIL**  
SCALE: 3" = 1'-0"

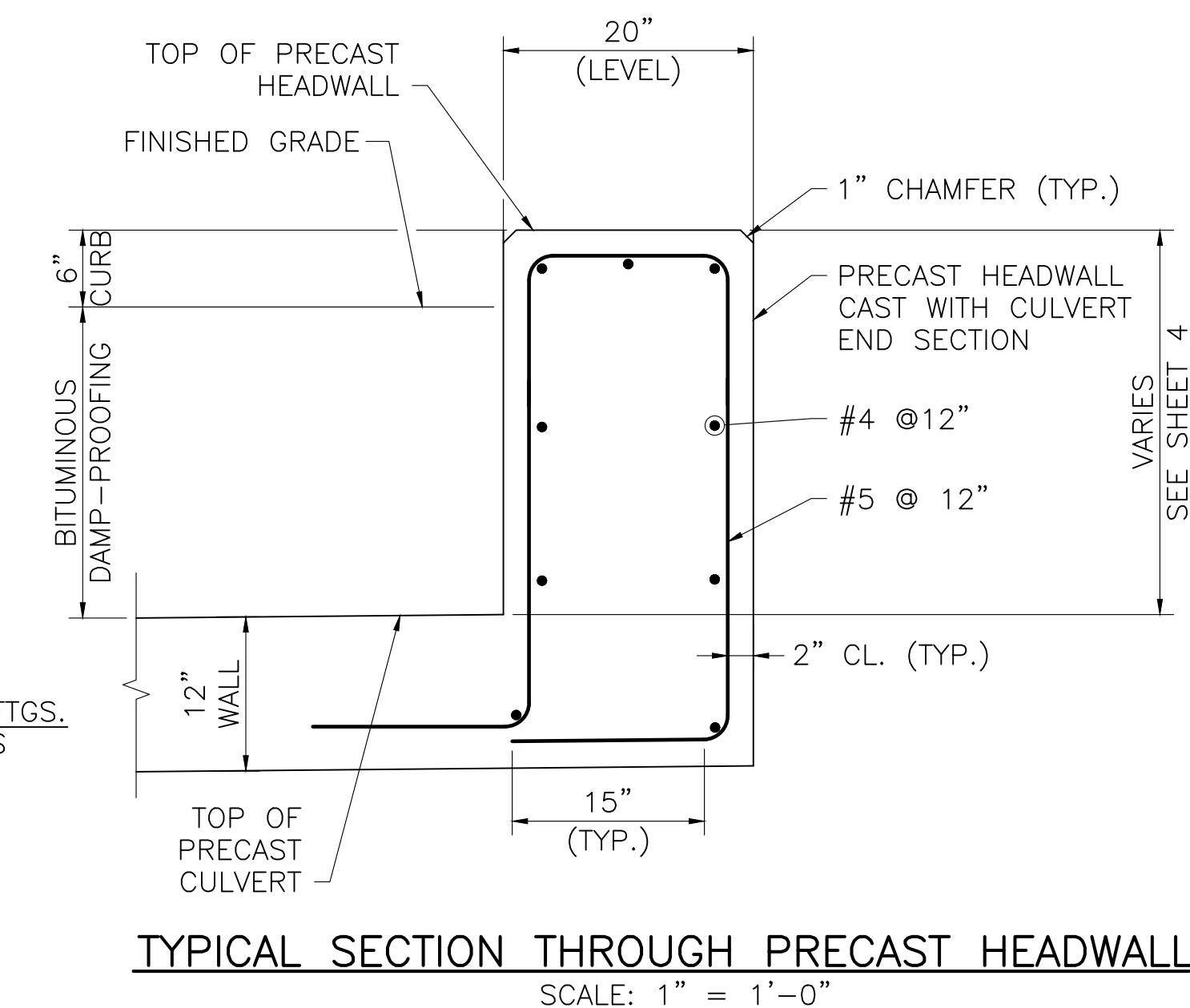
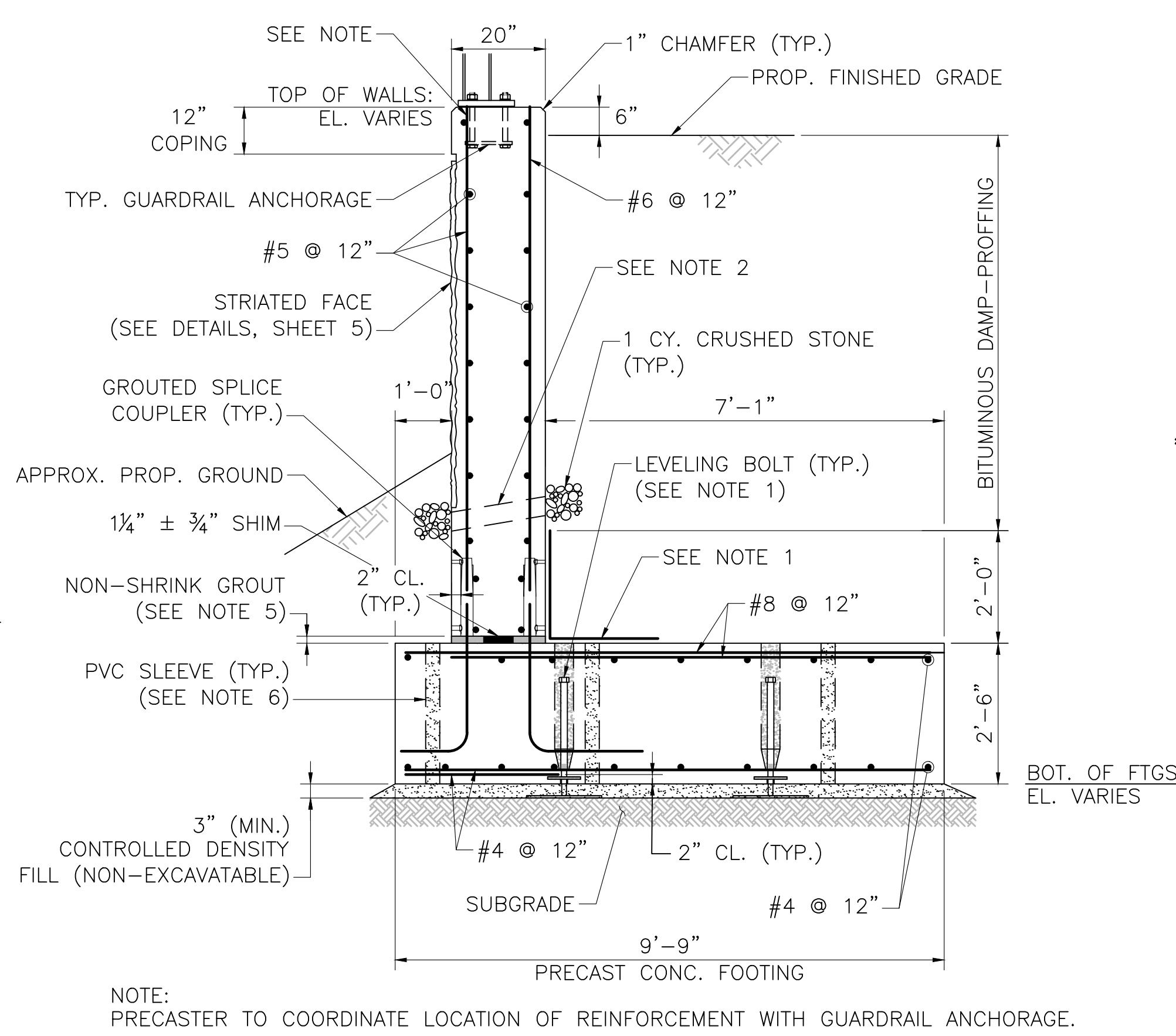
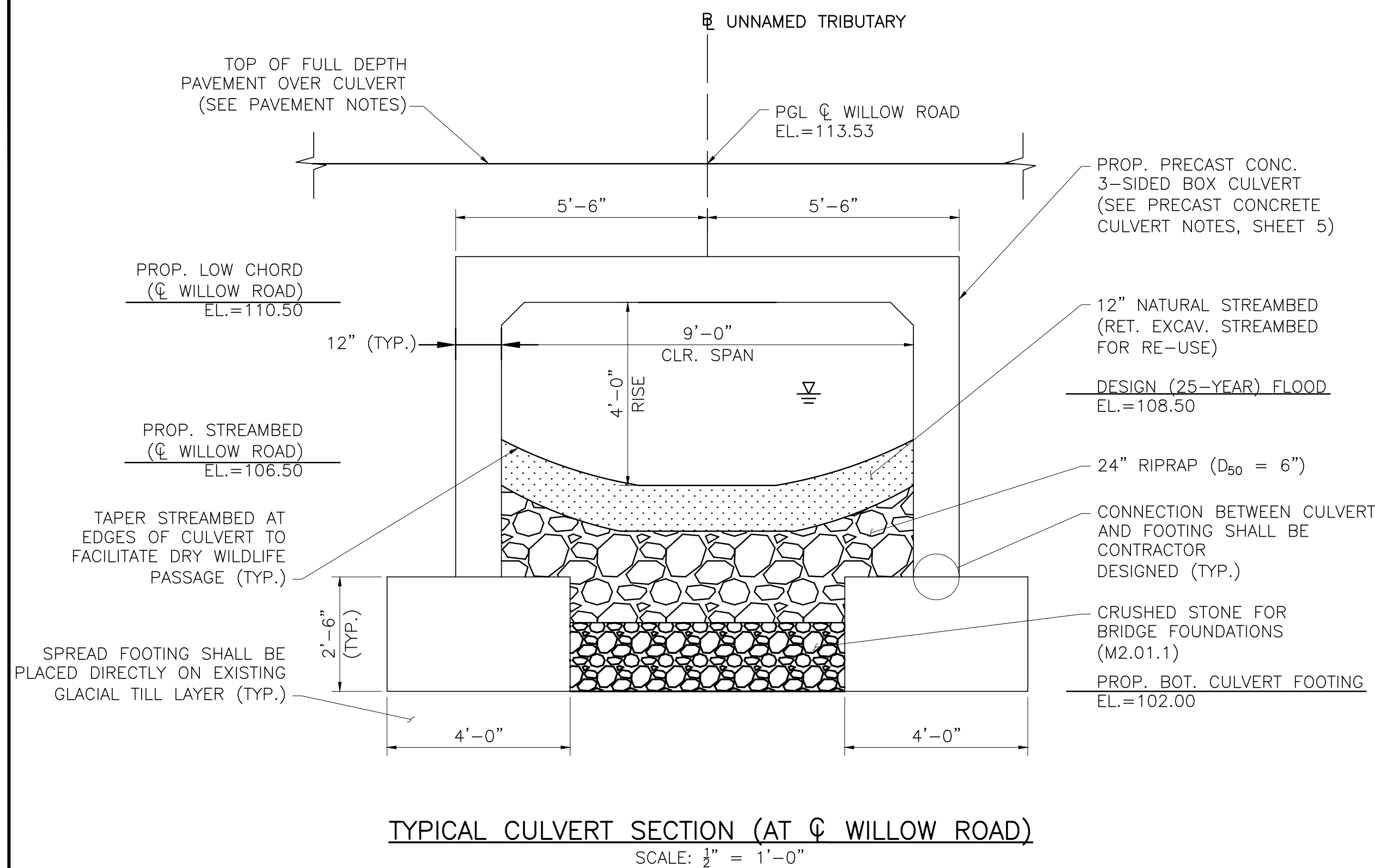


**WINGWALL STRIATION - ELEVATION**  
SCALE: N.T.S.

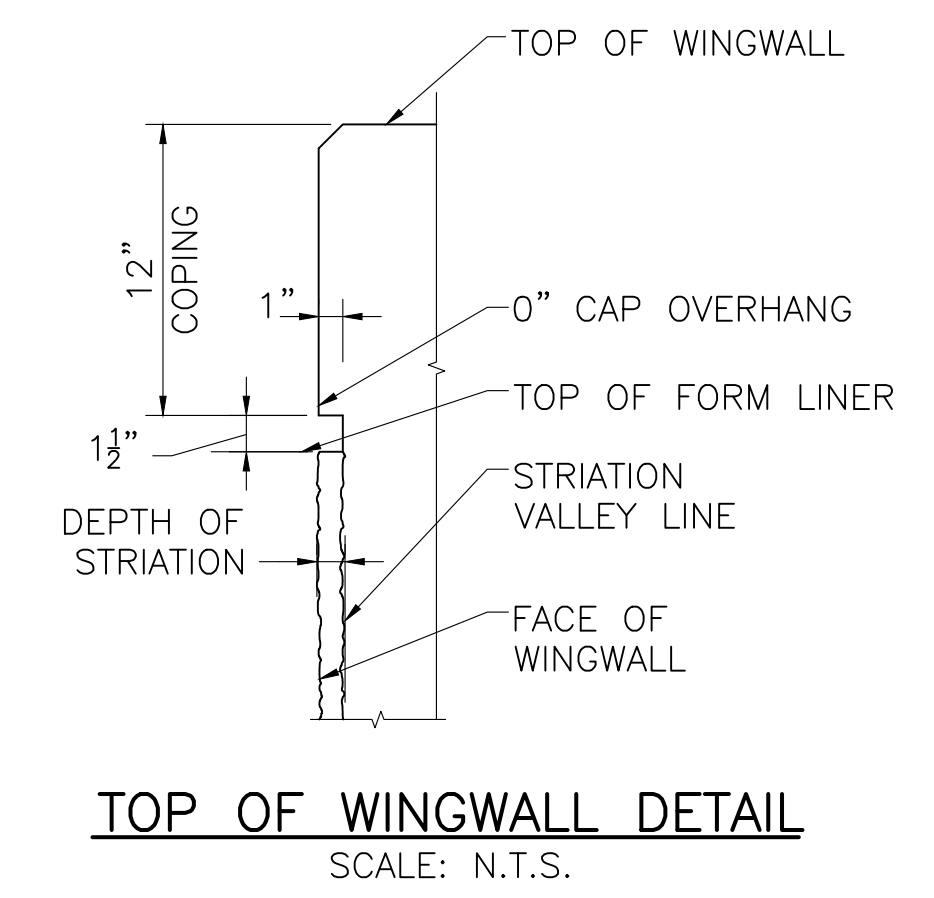
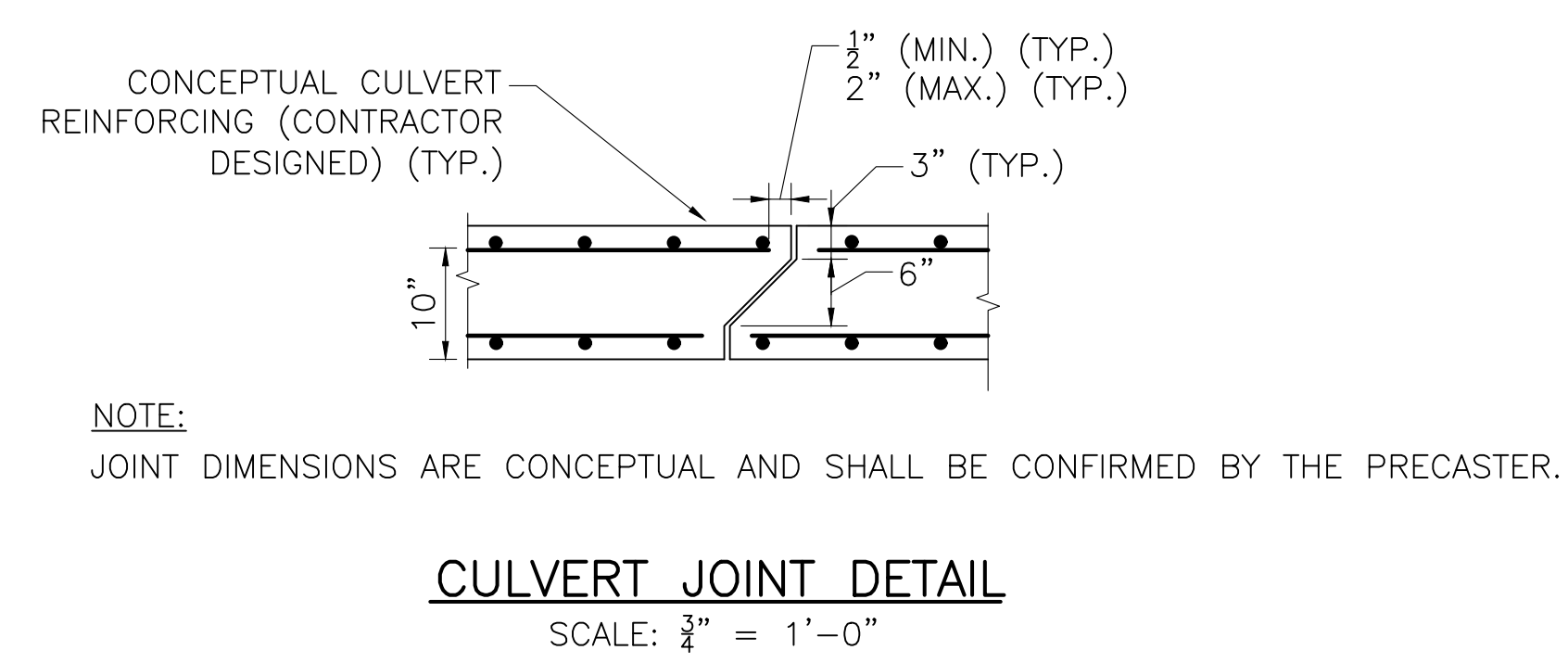
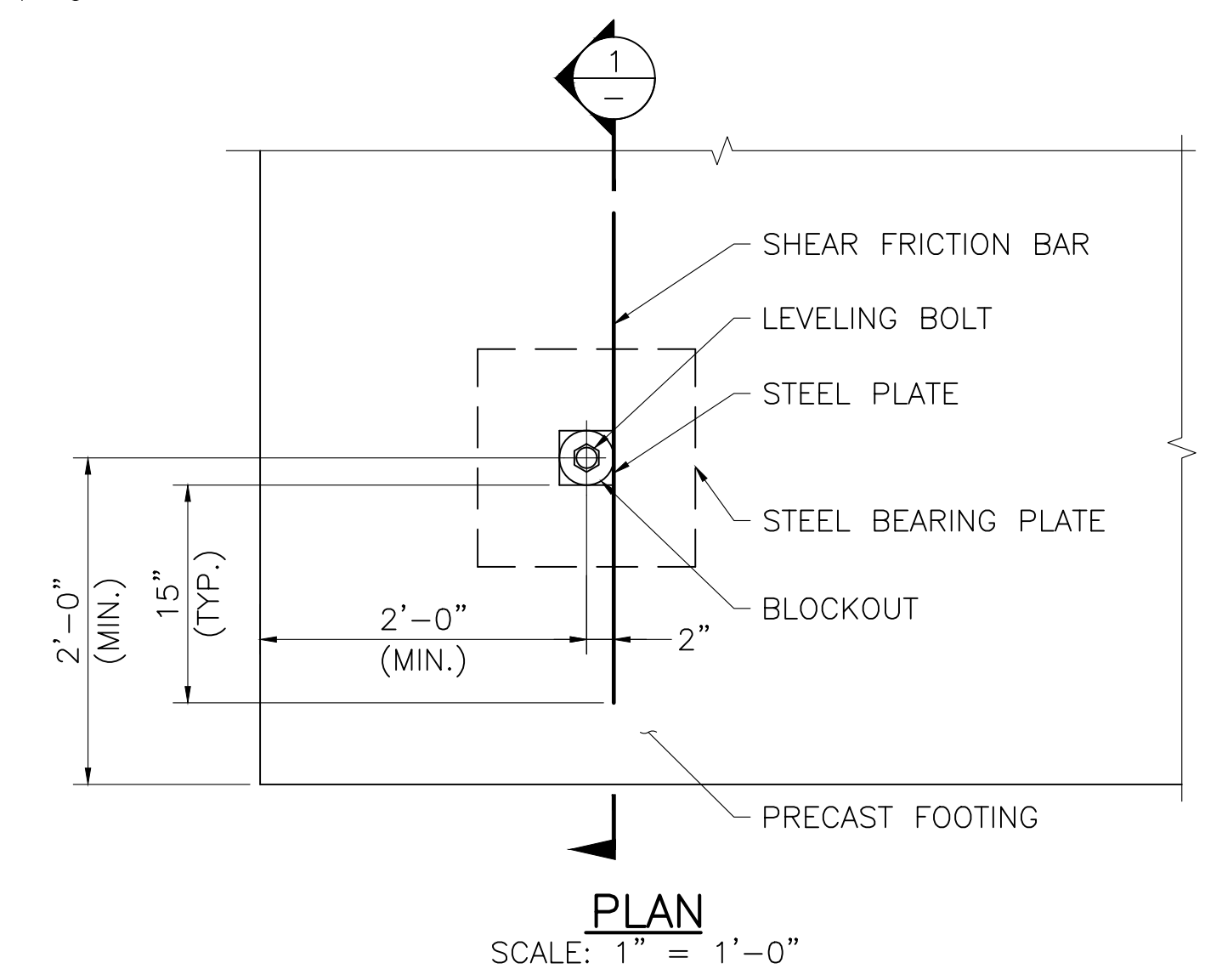


**NOTE:**  
REINFORCEMENT NOT SHOWN FOR CLARITY.

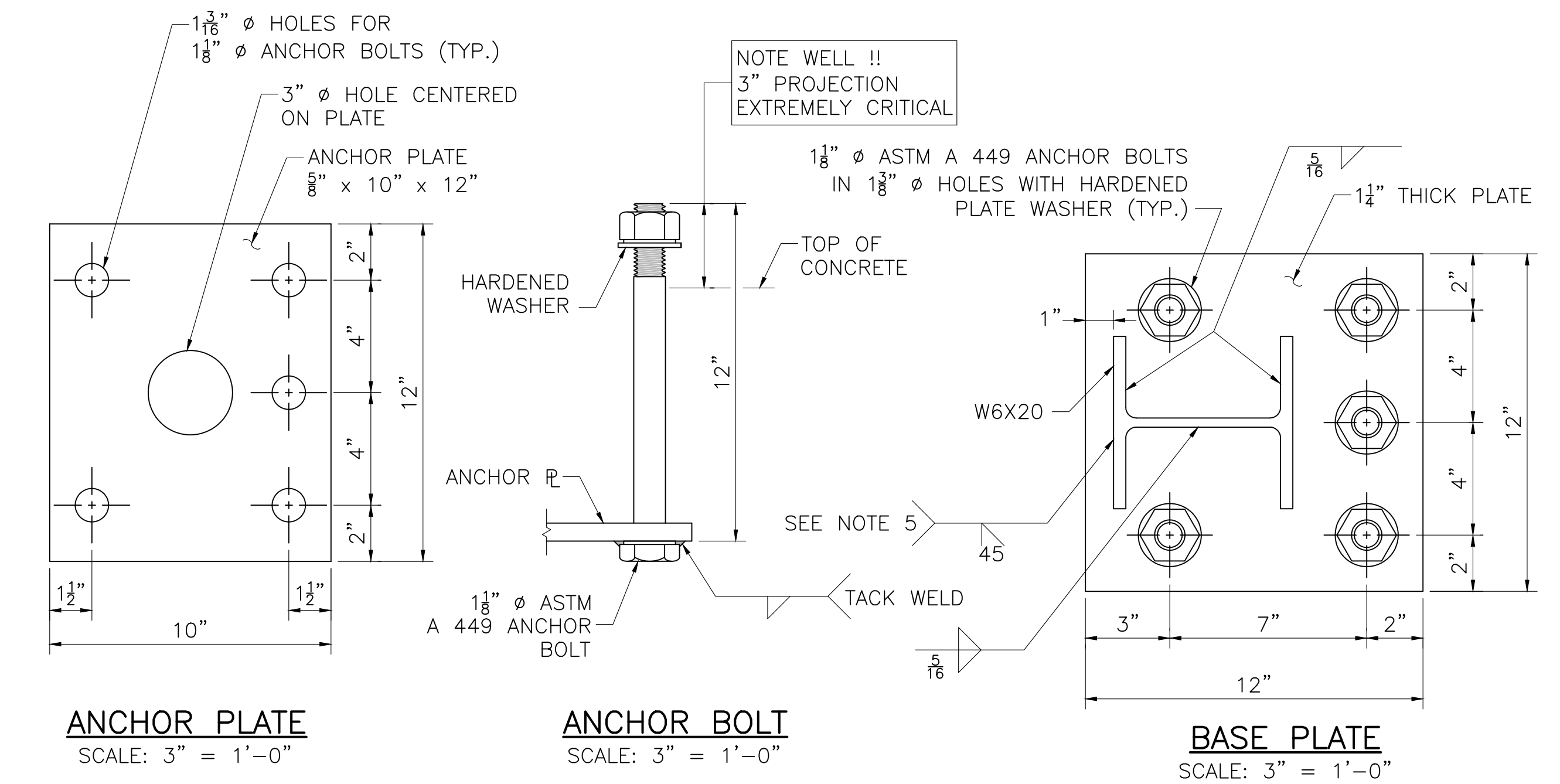
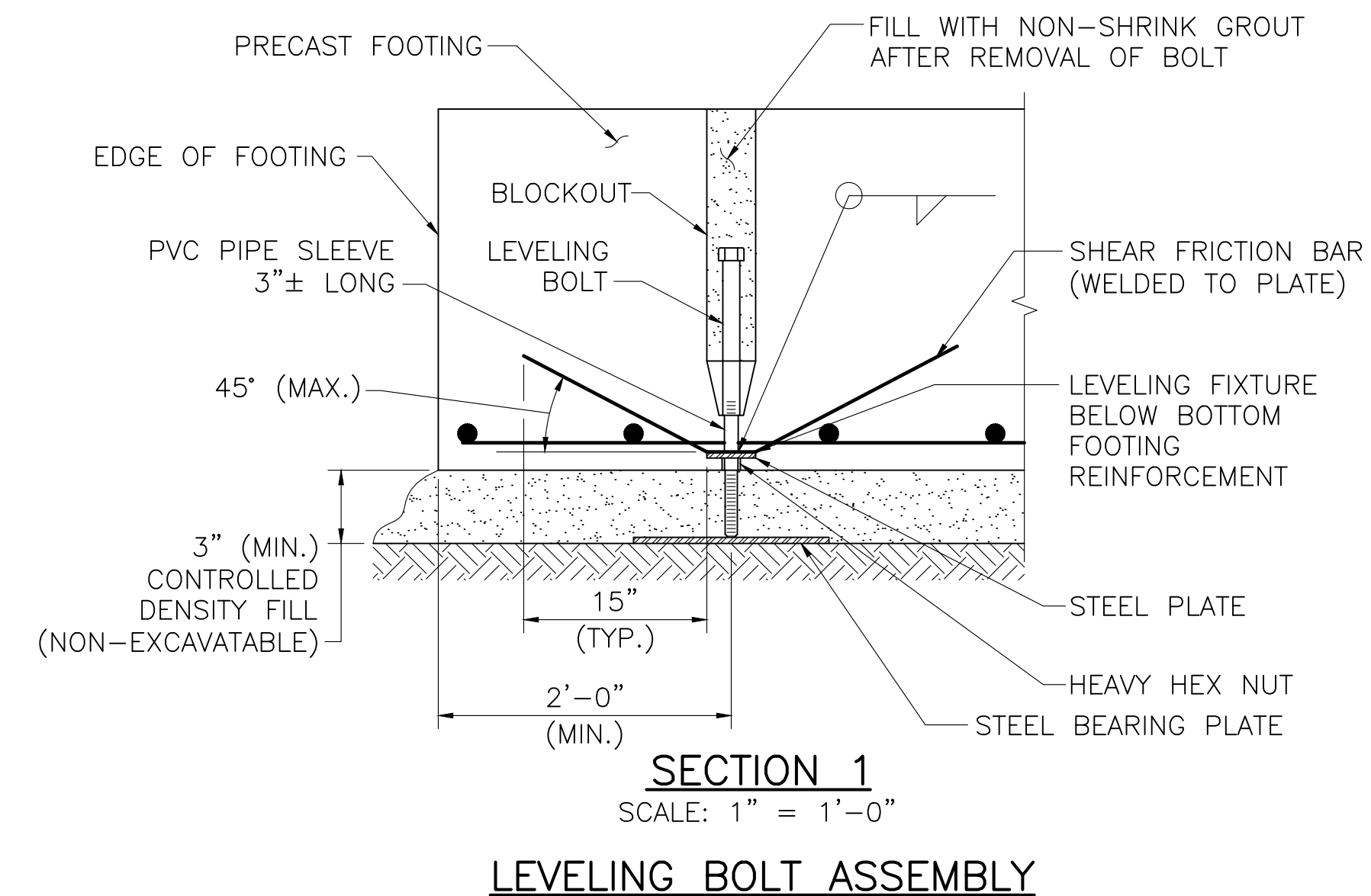
**EXPANSION JOINT DETAILS**  
SCALE: 1" = 1'-0"

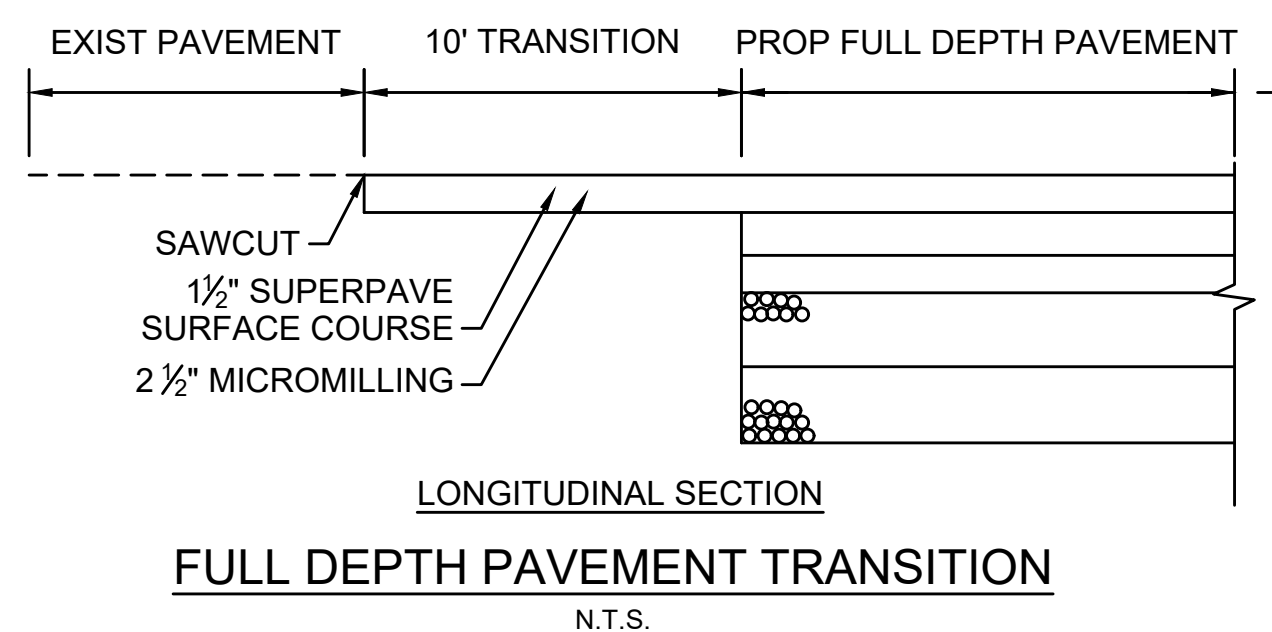


- WINGWALL CONSTRUCTION NOTES:**
- MEMBRANE WATERPROOFING OR OTHER WATERPROOFING PROTECTIVE COURSE, MIN. 2" THICK AS SPECIFIED IN MASSDOT STANDARD SPECIFICATIONS.
  - 4" Ø WEEP HOLES AT THIRD POINTS OF WALL LENGTHS (JUST ABOVE PROTECTIVE COURSE). PROVIDE 1 CUBIC YARD OF CRUSHED STONE AT EACH END OF WEEP HOLE.
  - ALL WINGWALL CONCRETE SHALL BE 5000 PSI, 3/4" IN, 685 HP CEMENT CONCRETE.
  - THE FACTORED BEARING PRESSURE = 3.75 KSF, PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH 1 LOAD COMBINATION. FACTORED BEARING RESISTANCE = 5.0 KSF. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.45.
  - PRE-BED PRECAST ELEMENT WITH NON-SHRINK GROUT WITH THICKNESS MORE THAN SHIM STACK.
  - THE CONTRACTOR SHALL DETERMINE THE SIZE AND SPACING OF THE GROUT PORTS BASED ON THE CDF'S FLOW PROPERTIES AND THE SIZE OF THE FOOTING.

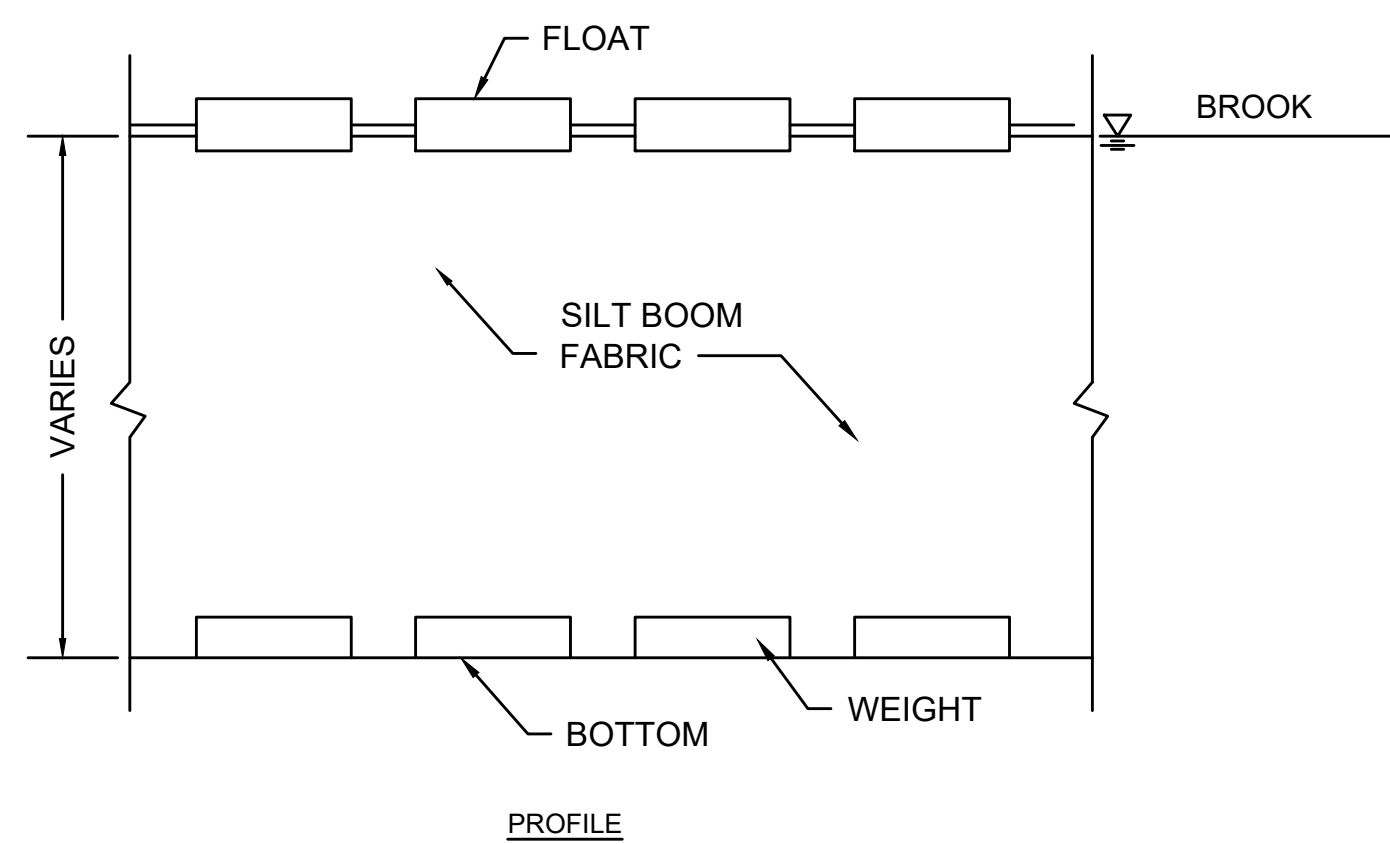
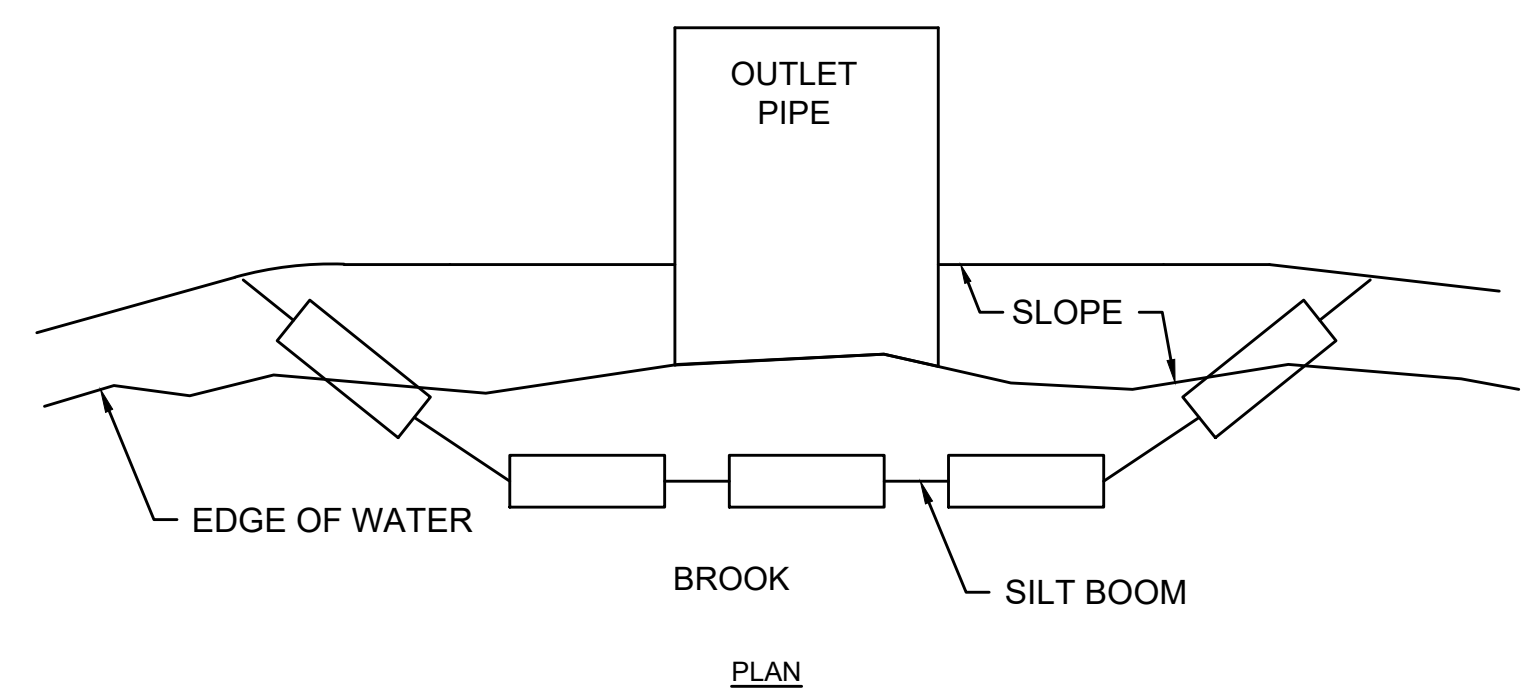


- LEVELING BOLT ASSEMBLY NOTES:**
- THE LEVELING BOLT ASSEMBLY SHOWN IS SCHEMATIC. DESIGN OF THE LEVELING BOLT ASSEMBLY SHALL BE PERFORMED BY THE CONTRACTOR AND SUBMITTED WITH THE ASSEMBLY PLAN TO THE ENGINEER FOR APPROVAL.
  - BOLT SHALL BE REMOVED AFTER THE CONTROLLED DENSITY FILL (NON-EXCAVATABLE) HAS SET.
  - STEEL PLATES SHALL BE AASHTO M 270 GRADE 36 UNCOATED STEEL.
  - BOLTS SHALL BE H.S. AASHTO M 164 AND UNCOATED.
  - REINFORCEMENT SHALL BE WELDABLE LOW-ALLOW ASTM A 706 BARS.
  - GREASE OF OIL NUT AND BOLT THREADS TO FACILITATE LEVELING AND REMOVAL.

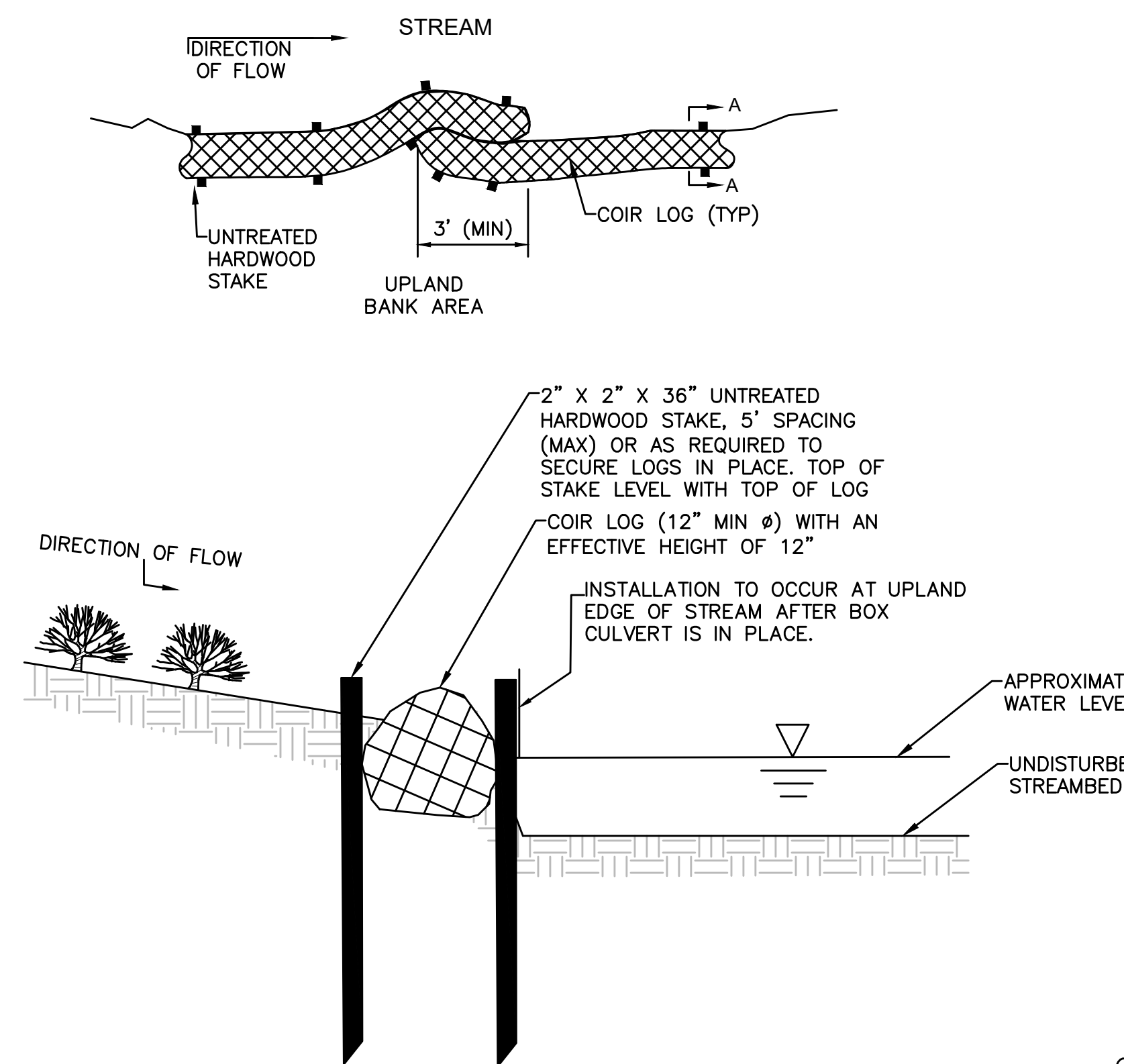




**LONGITUDINAL SECTION  
FULL DEPTH PAVEMENT TRANSITION**  
N.T.S.



**SILT BOOM FENCE**  
N.T.S.



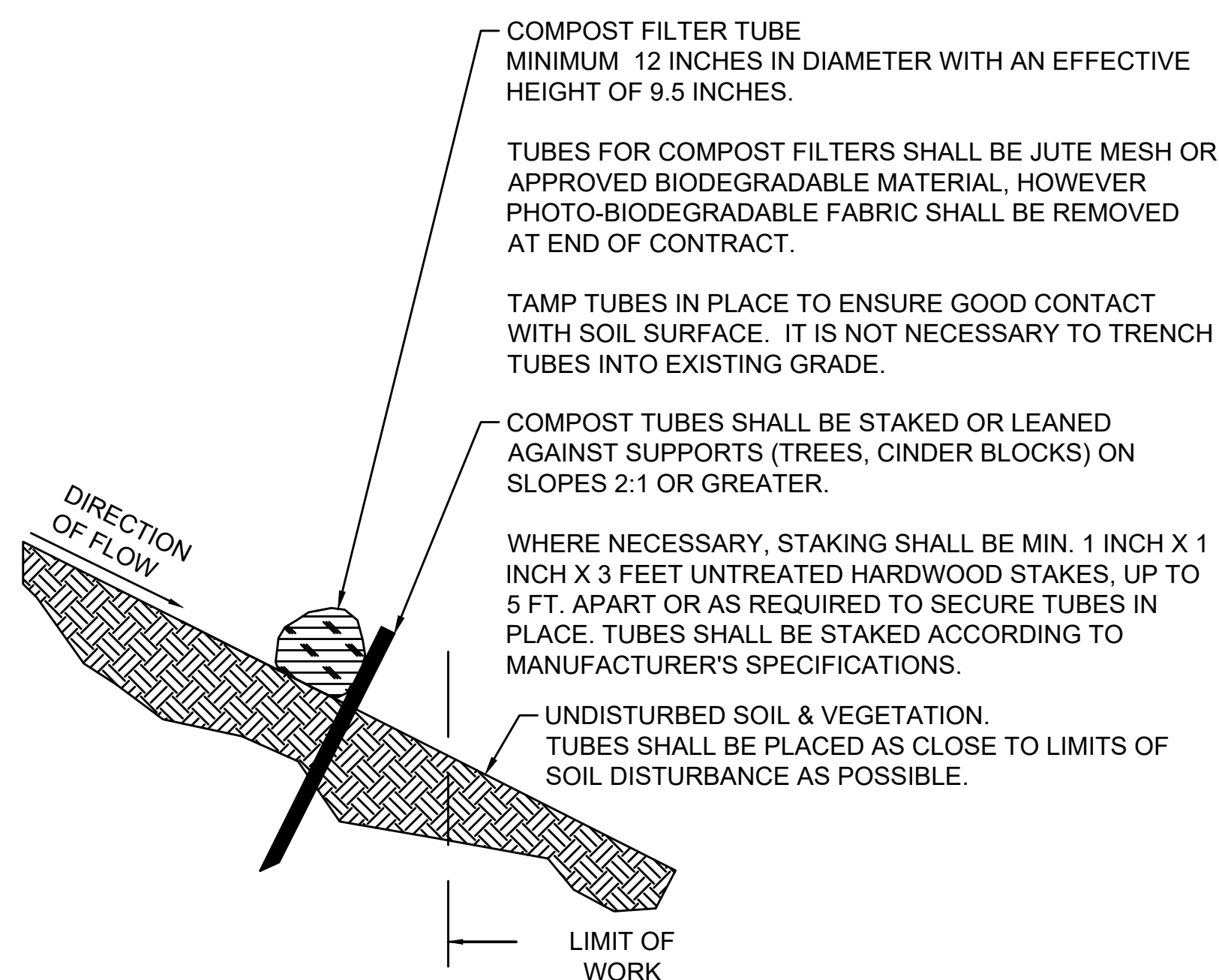
**COIR LOG**  
N.T.S.

**NOTES:**

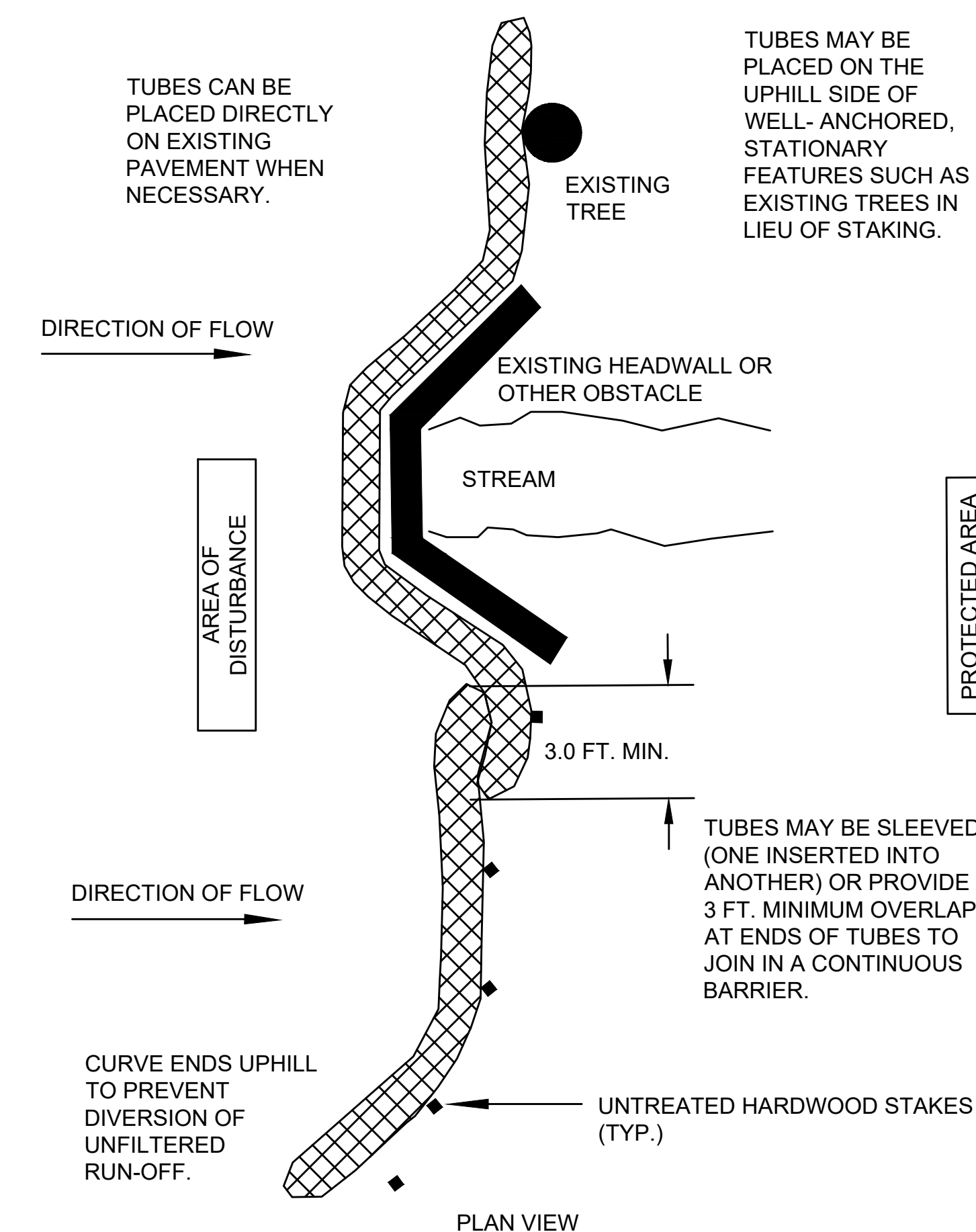
1. PROVIDE A MINIMUM TUBE DIAMETER OF 12" FOR SLOPES UP TO 50 FEET IN LENGTH WITH A SLOPE RATIO OF 3H:1V OR STEEPER. LONGER SLOPES OF 3H:1V MAY REQUIRE LARGER TUBE DIAMETER OR ADDITIONAL COURSING OF FILTER TUBES TO CREATE A FILTER BERM. REFER TO MANUFACTURER'S RECOMMENDATIONS FOR SITUATIONS WITH LONGER OR STEEPER SLOPES.
2. INSTALL LOGS ALONG CONTOURS AND AT EDGE OF STREAM.
3. CONFIGURE LOGS AROUND EXISTING SITE FEATURES TO MINIMIZE SITE DISTURBANCE AND MAXIMIZE CAPTURE AREA OF STORMWATER RUN-OFF.
4. TUBES FOR COIR LOGS SHALL BE JUTE MESH OR APPROVED BIODEGRADABLE MATERIAL. ADDITIONAL LOGS SHALL BE USED AT THE DIRECTION OF THE ENGINEER.
5. TAMP COIR LOGS IN PLACE TO ENSURE GOOD CONTACT WITH SOIL SURFACE. IT IS NOT NECESSARY TO TRENCH LOGS INTO EXISTING GRADE.
6. WHEN STAKING IS NOT POSSIBLE, SUCH AS WHEN TUBES MUST BE PLACED ON A ROCKY SURFACE, HEAVY CONCRETE OR CINDER BLOCKS CAN BE USED BEHIND LOGS UP TO 5 FT. APART OR AS REQUIRED TO SECURE TUBES IN PLACE. DO NOT PUNCTURE LOGS WITH STAKES.
7. PROVIDE A 3' MINIMUM OVERLAP AT ENDS OF LOGS TO JOIN IN A CONTINUOUS BARRIER AND MINIMIZE UNIMPEDED FLOW. STAKE JOINING LOGS SNUGLY AGAINST EACH OTHER TO PREVENT UNFILTERED FLOW BETWEEN THEM.
8. SECURE ENDS OF LOGS WITH STAKES SPACED 18" APART. DO NOT PUNCTURE LOGS WITH STAKES.
9. UPON COMPLETION OF PROJECT, ALL LOGS SHALL STAY IN PLACE AND NATURALLY BIODEGRADE OVERTIME.

**NOTES:**

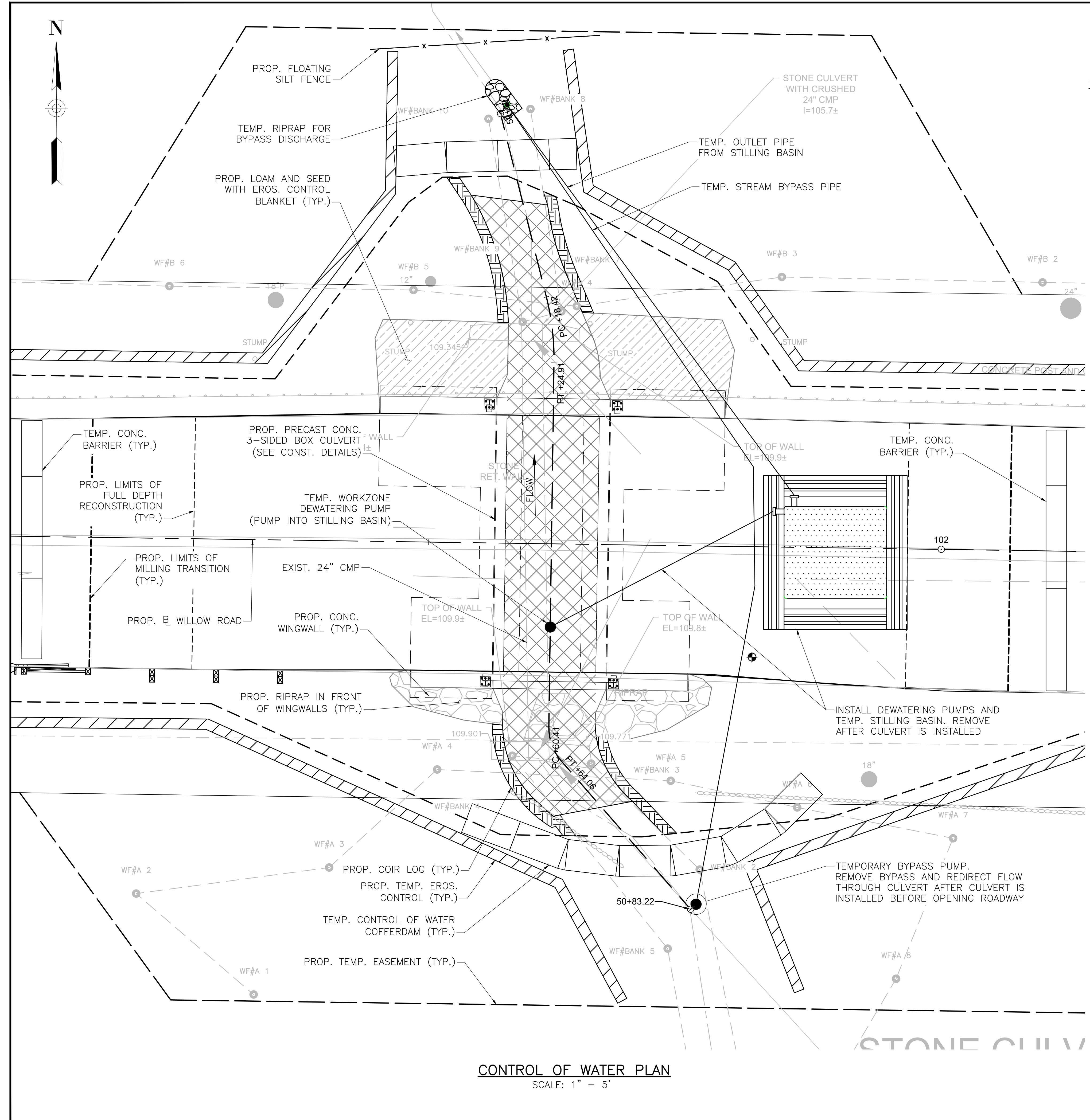
1. PROVIDE A MINIMUM TUBE DIAMETER OF 12 INCHES FOR SLOPES UP TO 50 FEET IN LENGTH WITH A SLOPE RATIO OF 3H:1V OR STEEPER. LONGER SLOPES OF 3H:1V MAY REQUIRE LARGER TUBE DIAMETER OR ADDITIONAL COURSING OF FILTER TUBES TO CREATE A FILTER BERM. REFER TO MANUFACTURER'S RECOMMENDATIONS FOR SITUATIONS WITH LONGER OR STEEPER SLOPES.
2. INSTALL TUBES ALONG CONTOURS AND PERPENDICULAR TO SHEET OR CONCENTRATED FLOW.
3. TUBE LOCATION MAY BE SHIFTED TO ADJUST TO LANDSCAPE FEATURES, BUT SHALL PROTECT UNDISTURBED AREA AND VEGETATION TO MAXIMUM EXTENT POSSIBLE.
4. DO NOT INSTALL IN PERENNIAL, EPHEMERAL OR INTERMITTENT STREAMS.
5. ADDITIONAL TUBES SHALL BE USED AT THE DIRECTION OF THE ENGINEER.
6. ADDITIONAL STAKING SHALL BE USED AT THE DIRECTION OF THE ENGINEER.



**COMPOST FILTER TUBE**  
N.T.S.



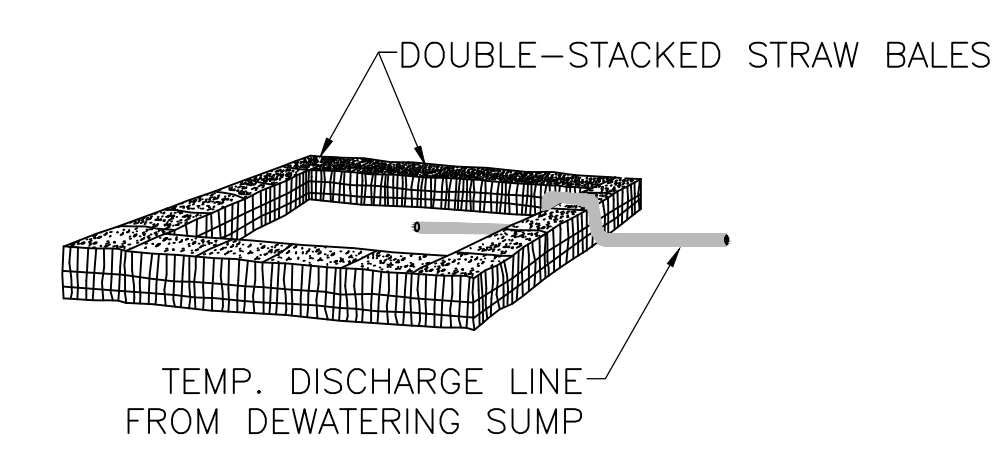
PLAN VIEW



**CONTROL OF WATER PLAN**  
SCALE: 1" = 5'

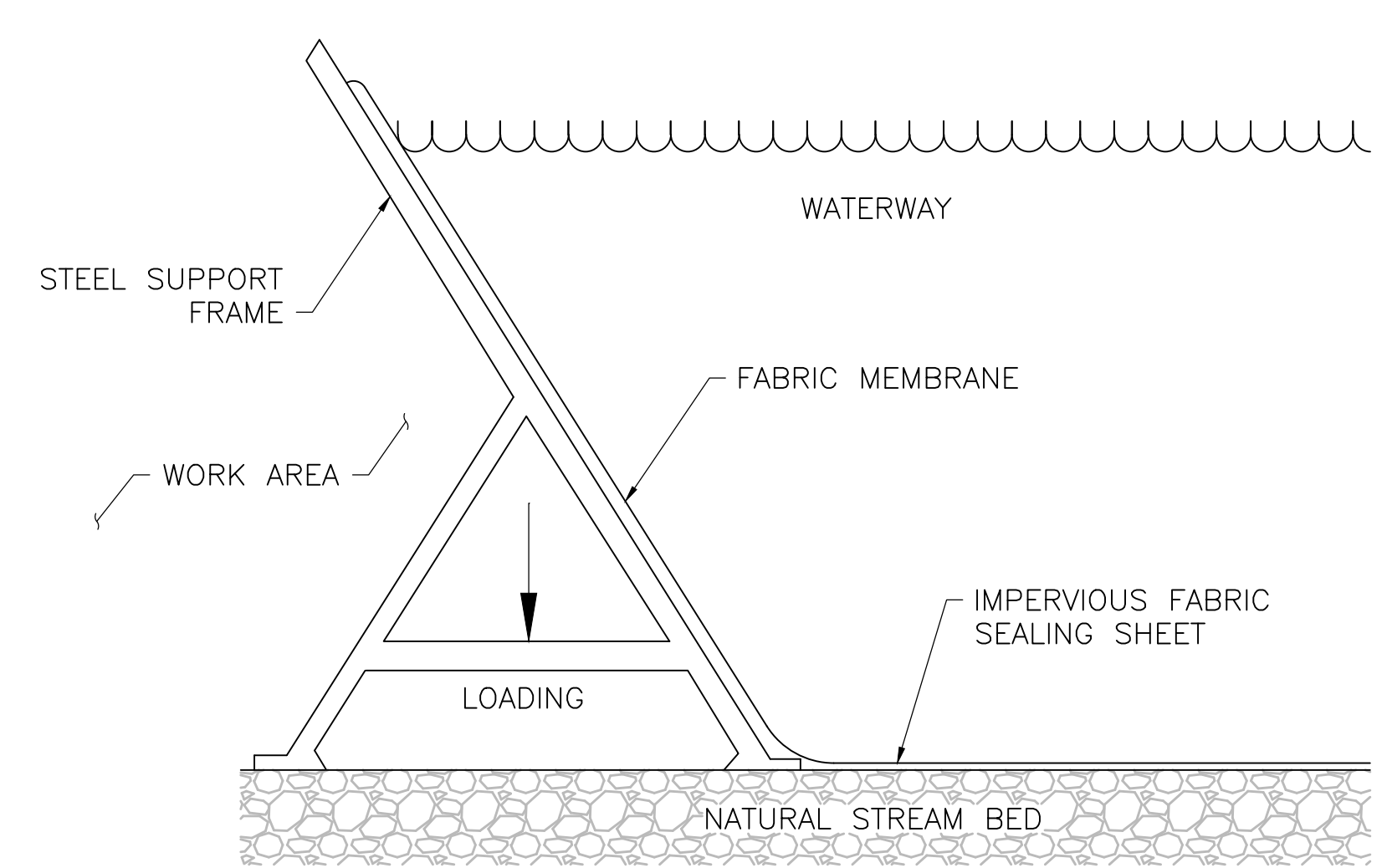
**CONTROL OF WATER NOTES**

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN OF THE CONTROL OF WATER (C.O.W.) SYSTEM AND SHALL SUBMIT A C.O.W. PLAN TO THE ENGINEER FOR APPROVAL. THE C.O.W. SYSTEM SHOWN IS CONCEPTUAL ONLY. THE C.O.W. SYSTEM SHALL BE DESIGNED TO WITHSTAND THE 2-YEAR FLOOD ELEVATION OF 108.0 (NAVD).
2. WILLOW ROAD SHALL BE CLOSED TO VEHICULAR AND PEDESTRIAN TRAFFIC AT THE BRIDGE CROSSING PRIOR TO BEGINNING EXCAVATION. DETOUR SIGNAGE WILL BE INSTALLED IN ACCORDANCE WITH THE MUTCD AND THE TEMPORARY TRAFFIC CONTROL PLANS INCLUDED IN THESE CONSTRUCTION DRAWINGS.
3. C.O.W. SYSTEM SHALL BE INSPECTED DAILY FOR WATER LEAKS OR EROSION AND REPAIRS PROCEDURES SHALL BE IMPLEMENTED ACCORDINGLY.
4. THE CONSTRUCTION SEQUENCE WITH REGARDS TO THE C.O.W. SYSTEM SHALL BE AS FOLLOWS:
  - 4.1. CLOSE THE ROADWAY TO VEHICULAR AND PEDESTRIAN TRAFFIC AT THE BRIDGE CROSSING.
  - 4.2. INSTALL EROSION CONTROLS: TEMPORARY EROSION CONTROL AROUND PROJECT LIMITS TO PROTECT THE UNNAMED TRIBUTARY FROM WORK ZONE SEDIMENT; FLOATING SILT FENCE IN THE UNNAMED TRIBUTARY DOWNSTREAM OF THE PROJECT LIMITS TO TRAP ANY FLOATING DEBRIS/SILT THAT MAY ENTER THE TRIBUTARY.
  - 4.3. INSTALL C.O.W. COFFERDAMS, BYPASS PUMPS, DEWATERING PUMPS, AND TEMPORARY STILLING BASIN.
  - 4.4. PLACE TEMPORARY RIPRAP AT OUTLET FOR BYPASS DISCHARGE.
  - 4.5. DEWATER THE WORK AREA PRIOR TO (AND THROUGHOUT) EXCAVATION TO FACILITATE INSTALLING THE CULVERT, AND WINGWALLS IN THE DRY CONDITION. ALL DEWATERING FLOW SHALL PASS THROUGH THE STILLING BASIN TO REMOVE SEDIMENT PRIOR TO DEPOSITING BACK INTO THE STREAM.
  - 4.6. INSTALL THE THREE-SIDED BOX CULVERT AND WINGWALLS. RESTORE THE STREAMBED IN ACCORDANCE WITH THESE PLANS. INSTALL RIPRAP EMBANKMENT AND LOAM AND SEED WITH EROSION CONTROL BLANKET IN FRONT OF THE WINGWALLS. INSTALL COIR LOGS ALONG UPLAND SIDES OF STREAMBED.
  - 4.7. REDIRECT STREAM FLOW THROUGH THE CULVERT.
  - 4.8. REMOVE THE C.O.W. COFFERDAMS BYPASS PUMPS AND TEMPORARY STILLING BASIN.



NOTES:  
DISCHARGE TO SEDIMENTATION BASIN (AS SHOWN) OR TO SILTATION/ DEWATERING BAG SUCH AS FLOGARD DEWATERING BAG MODEL SC-DW1215Z, OR APPROVED EQUAL BY BOXFORD CONSERVATION COMMISSION. SYSTEM SHOWN IS CONCEPTUAL ONLY AND IS TO BE DESIGNED BY CONTRACTOR.

**TEMPORARY STILLING AREA**  
SCALE: N.T.S.

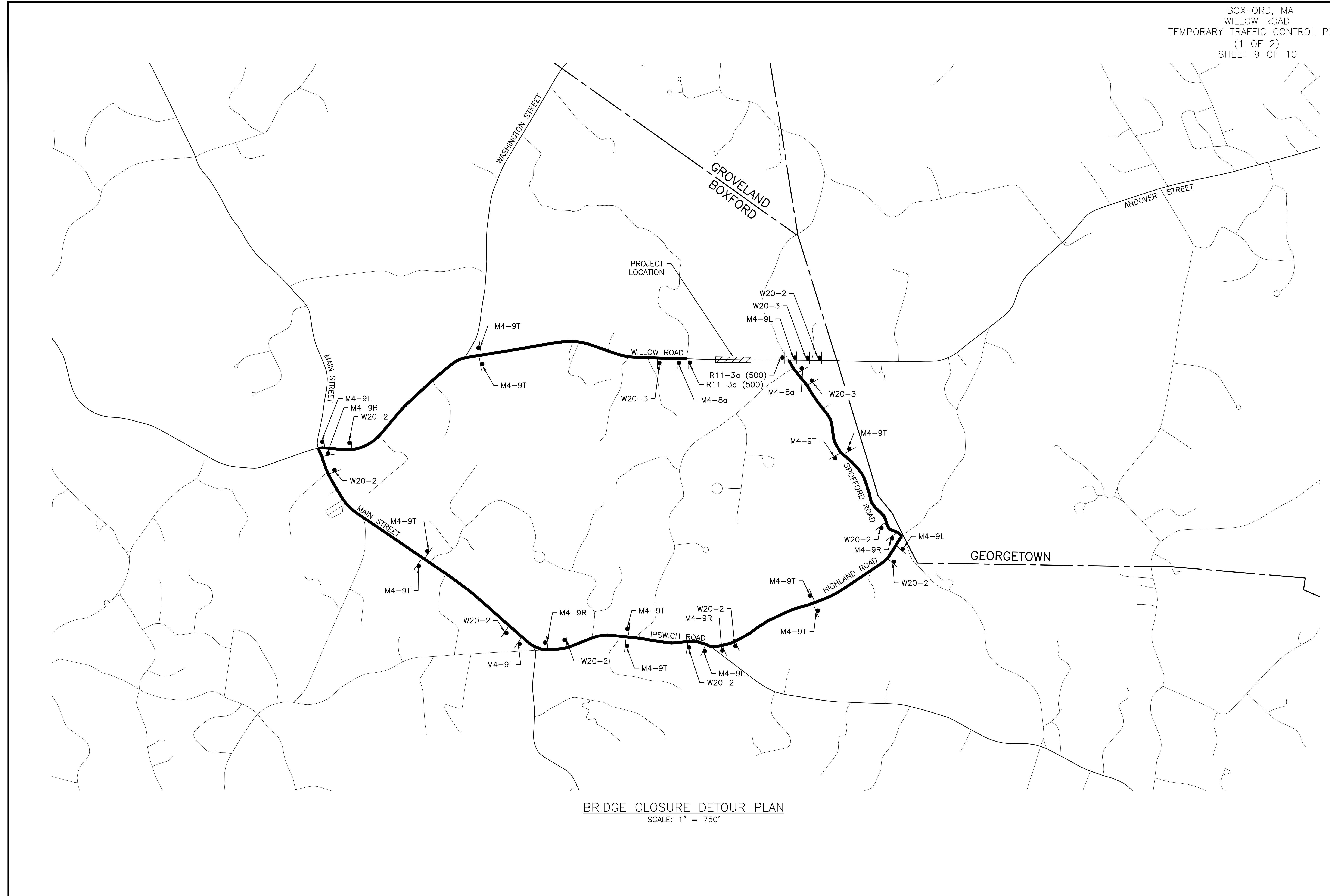


**TEMPORARY COATED FABRIC STEEL FRAME COFFERDAM**  
SCALE: N.T.S.

NOTES:  
THE STEEL FRAME COFFERDAM SHOWN ABOVE IS FOR CONCEPTUAL ONLY. THE CONTRACTOR SHALL DETERMINE THE APPROPRIATE SYSTEM FOR CONTROLLING THE WATER (I.E. BULK SANDBAGS). THE CONTRACTOR SHALL SUBMIT THEIR PROPOSED CONTROL OF WATER DESIGN TO THE ENGINEER FOR REVIEW AND APPROVAL.








2-YEAR  
(CONSTRUCTION)  
RETURN FLOOD  
EL. 108.0





BRIDGE CLOSURE DETOUR PLAN  
SCALE: 1" = 750'

### TRAFFIC SIGN SUMMARY

TEMPORARY TRAFFIC SIGN SUMMARY												
IDENTIFICATION NUMBER	SIZE OF SIGN (in)		LEGEND	TEXT DIMENSIONS (in)			NUMBER OF SIGNS REQUIRED	COLOR			UNIT AREA (SF)	TOTAL AREA (SF)
	WIDTH	HEIGHT		LETTER HEIGHT	VERTICAL SPACING	ARROW RTE. MKR		BACK-GROUND	LEGEND	BORDER		
M4-8a	24	18		SEE 2009 MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS			2	ORANGE	BLACK	BLACK	3.00	6.00
M4-9L	30	24					5	ORANGE	BLACK	BLACK	5.00	25.00
M4-9R	30	24					4	ORANGE	BLACK	BLACK	5.00	20.00
M4-9T	30	24					10	ORANGE	BLACK	BLACK	5.00	50.00
R11-3a	60	30					2	ORANGE	BLACK	BLACK	12.50	25.00
W20-2	36	36					10	ORANGE	BLACK	BLACK	9.00	90.00
W20-3	37	37					3	ORANGE	BLACK	BLACK	9.51	28.52

N



T0998\_(TITLE - SHEET 1 ENLARGED).DWG Plotted on 5-Oct-2020 10:10 AM

n/f  
WASHINGTON & WILLOW  
PRICE FAMILY LLC  
MAP ID 6-2-2.2/  
120.5 ± Acres

- EXIST. WETLAND FLAGS (TYP.)
- PROP. APPROX. LIMITS OF STREAMBED RESTORATION (TYP.)
- UNNAMED TRIBUTARY
- PROP. COIR LOG (TYP.)
- PROP. TEMP EROS. CONTROL (TYP.)
- TEMPORARY BWV IMPACTS - 228 SF  
TEMPORARY BANK IMPACTS - 31 LF
- PROP. PRECAST CONC. 3-SIDED BOX CULVERT (CONTRACTOR DESIGNED)

101+62 WILLOW ROAD=  
50+42.56 WILLOW ROAD CULVERT

PROJECT END  
STA 102+60  
N3084778.4410  
E780802.7885

PROJECT BEGIN  
STA 100+75  
N3084781.0739  
E780617.8073

PROP. SAWCUT (TYP.)

WILLOW ROAD

25-FOOT NO DISTURB ZONE

REM. EXIST STONE WALL (TYP.)

TEMPORARY BWV IMPACTS - 125 SF  
TEMPORARY BANK IMPACTS - 28 LF

**NOTES:**

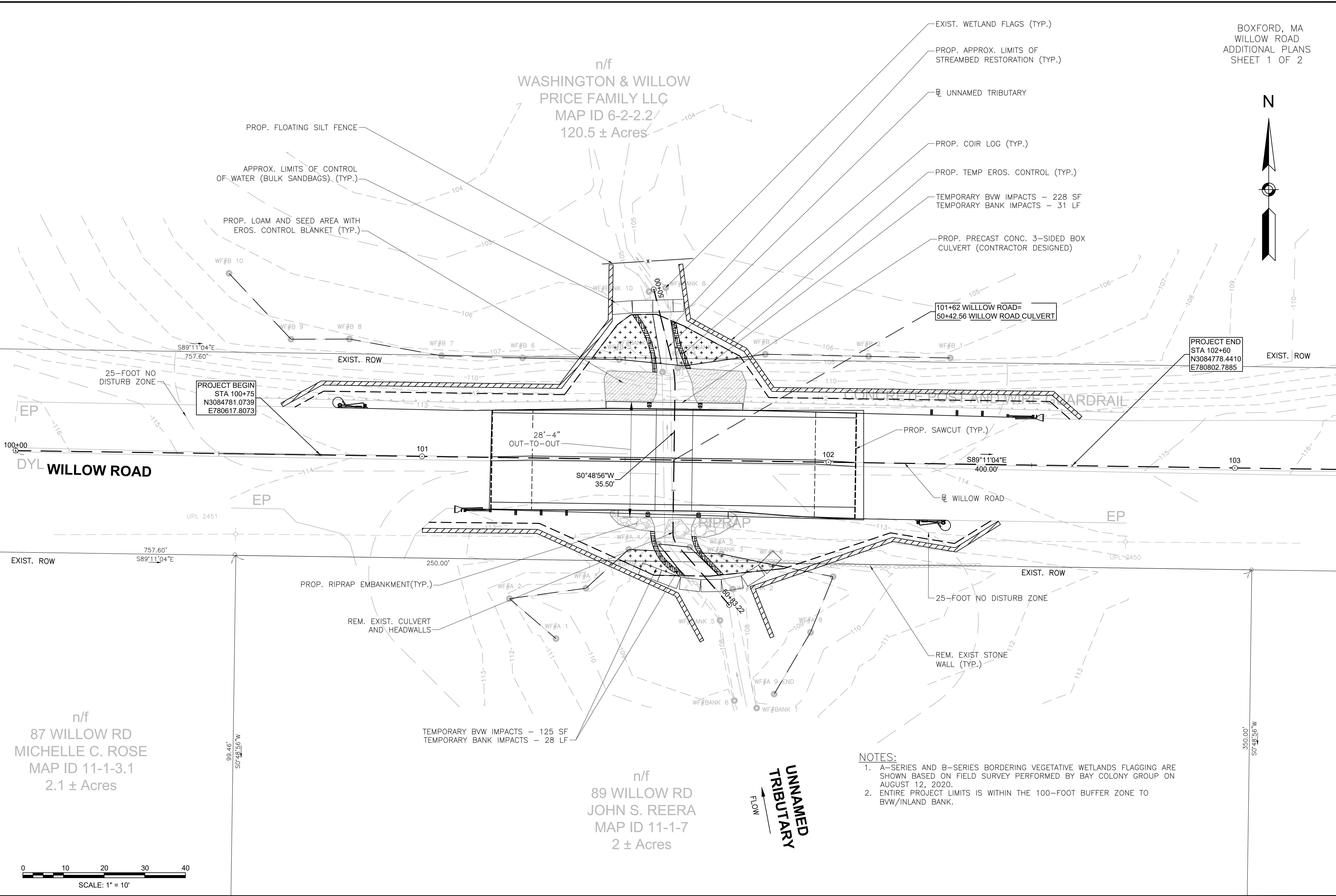
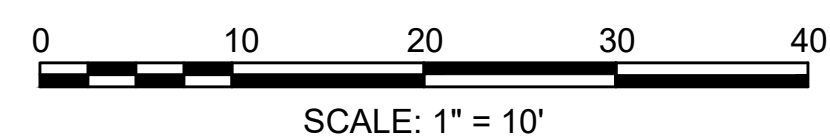
1. A-SERIES AND B-SERIES BORDERING VEGETATIVE WETLANDS FLAGGING ARE SHOWN BASED ON FIELD SURVEY PERFORMED BY BAY COLONY GROUP ON AUGUST 12, 2020.
2. ENTIRE PROJECT LIMITS IS WITHIN THE 100-FOOT BUFFER ZONE TO BWV/INLAND BANK.

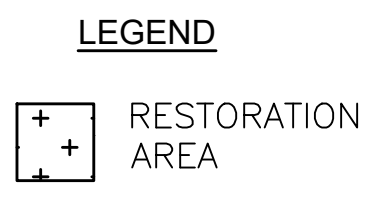
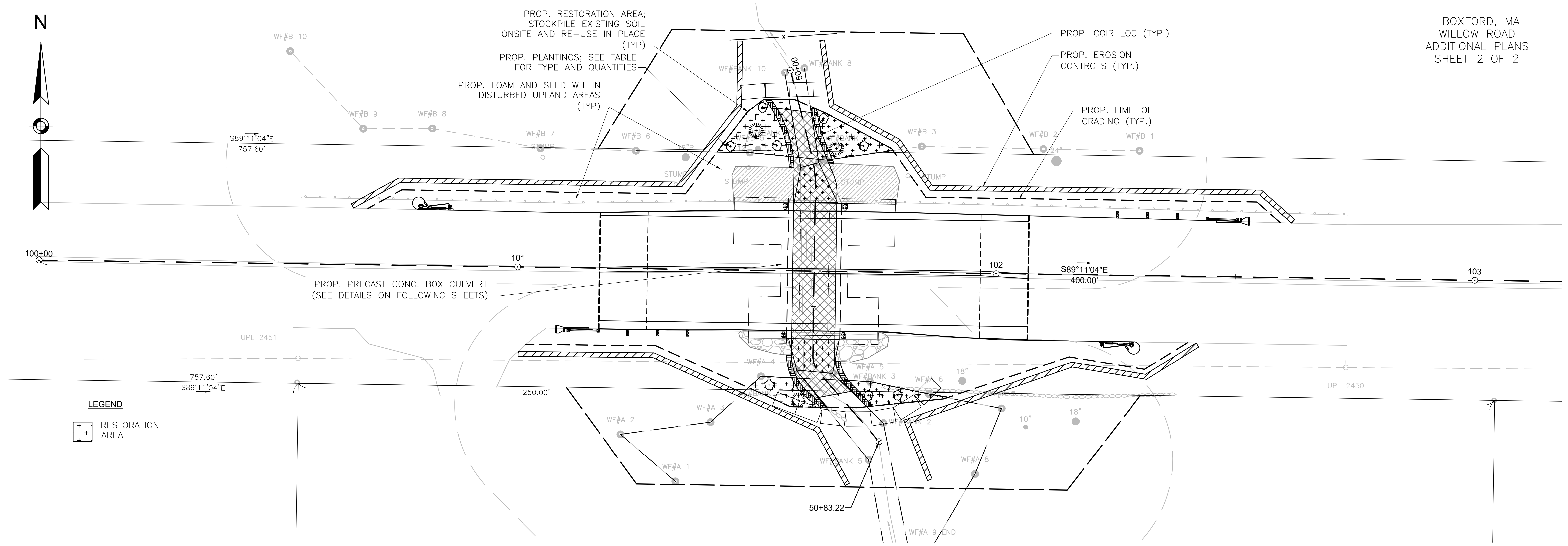
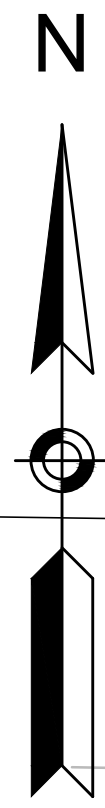
UNNAMED TRIBUTARY  
FLOW

DYL WILLOW ROAD

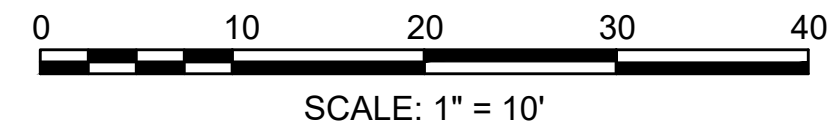
n/f  
87 WILLOW RD  
MICHELLE C. ROSE  
MAP ID 11-1-3.1  
2.1 ± Acres

n/f  
89 WILLOW RD  
JOHN S. REERA  
MAP ID 11-1-7  
2 ± Acres





**RESTORATION PLAN**  
SCALE: 1" = 10'



PROPOSED PLANTING SUMMARY TABLE					
SYMBOL	QTY	BOTANICAL NAME	COMMON NAME	SIZE	COMMENTS
	3	SYMPLOCARPUS FOETIDUS	SKUNK CABBAGE	6" - 24"	CONTAINER
	8	OSMUNDA CINNAMOMEA	CINNAMON FERN	6" - 24"	CONTAINER

- PLANTING NOTES:**
- CONTRACTOR SHALL HAVE ALL SUBSURFACE UTILITIES MARKED PRIOR TO THE START OF WORK.
  - FINAL LOCATION OF ALL PLANT MATERIAL WILL BE APPROVED BY THE RESIDENT ENGINEER PRIOR TO PLANTING.
  - ALL PLANT MATERIAL WILL HAVE TAGS INDICATING COMMON NAME, BOTANICAL NAME & SIZE.
  - ALL PLANTS WILL BE MULCHED PER THE PLANTING SPECIFICATIONS AND DETAILS.
  - WETLAND SOIL OR LOAM SHALL BE APPLIED TO ALL DISTURBED AREAS AND SEEDED WITH THE CORRESPONDING SEED MIX PER THE APPLICABLE DETAIL.
  - WETLAND SEED MIX SHALL BE IN ACCORDANCE WITH MASSDOT STANDARDS. SEED MIX SHALL BE SITE SPECIFIC THAT IS NATIVE TO THE TOWN OF BOXFORD.

**WETLAND RESTORATION SPECIFICATIONS & GENERAL NOTES:**

**RESTORATION SITE SELECTION**

THE RESTORATION AREA IS LOCATED WITHIN THE EXISTING WETLAND AREA THAT WILL BE TEMPORARILY ALTERED IN ORDER TO CONSTRUCT THE NEW CULVERT. THE RESTORATION AREA WITHIN THE WETLAND WILL CONSIST OF WETLAND SHRUBS AND WETLAND SEED MIX AS SHOWN IN THE ATTACHED TABLE. RESTORATION SHALL BE SUPERVISED BY A PROFESSIONAL WETLAND SCIENTIST. THE RESTORED WETLAND ONCE ESTABLISHED WITH NATIVE PLANTINGS WILL PROVIDE SIGNIFICANTLY IMPROVED HABITAT FUNCTION FROM THE IMPACTED WETLAND.

**HYDROLOGY**

WETLAND HYDROLOGY WITHIN THE RESTORATION AREA WILL BE ACHIEVED BY ESTABLISHING AN UNRESTRICTED HYDRAULIC CONNECTION BETWEEN THE RESTORED WETLAND AND THE EXISTING WETLAND, AND BY INTERCEPTING THE SEASONAL HIGH GROUNDWATER TABLE. FINISHED GRADES OF THE RESTORATION AREA SHALL BE CONSTRUCTED TO MATCH EXISTING GRADES PRIOR TO START OF WORK. THE HYDRAULIC CONNECTION THAT EXISTS TODAY WILL REMAIN IN PLACE POST CONSTRUCTION.

**SOILS**

SOIL TRANSLOCATION FROM THE IMPACTED WETLAND IS THE PREFERRED METHODOLOGY FOR RESTORATION SOILS. SOILS WITHIN THE RESTORATION SHALL BE EXCAVATED AND STORED ONSITE FOR RE-USE. THERE ARE FOUR DISTINCT RESTORATION AREAS AS PART OF THE PROJECT. STOCKPILES FOR EACH RESTORATION AREA SHALL BE KEPT ONSITE AND CLEARLY LABELED FOR RE-USE IN EACH AREA. SUBGRADE OF EACH RESTORATION AREA SHOULD BE ESTABLISHED AND THEN 12-INCHES (MINIMUM) OF EXISTING WETLAND SOIL SHOULD BE PLACED IN EACH RESTORATION AREA. EXISTING WETLAND SOILS SHOULD BE KEPT WET AND NOT BE ALLOWED TO DRY OUT.

IT IS ESTIMATED THAT ADDITIONAL, IMPORTED SOILS MAY BE REQUIRED IN ORDER TO ESTABLISH THE RESTORATION AREAS AND RESTORED STREAMBED. IMPORTED SOIL SHALL CONSIST OF EQUAL PARTS ORGANIC MATTER (LEAF COMPOST IS PREFERRED) AND CLEAN LOAM OR ORGANIC RICH LOAM WITH A MINIMUM 20% ORGANIC CARBON BY DRY WEIGHT. IMPORTED SOIL WILL BE APPROVED BY A WETLAND SCIENTIST PRIOR TO PLACEMENT IN THE WETLAND RESTORATION AREA AND SHALL BE INSTALLED TO A MINIMUM DEPTH OF 12 INCHES. SURVEYING OF SUBGRADES AND FINISHED ELEVATIONS SHOULD BE CONDUCTED FREQUENTLY DURING CONSTRUCTION. SOILS TO BE USED AT THE MITIGATION SITE SHOULD BE USED IMMEDIATELY IF POSSIBLE AND STOCKPILED FOR AS LITTLE TIME AS POSSIBLE. WHILE STOCKPILED THE SOILS SHOULD BE KEPT WET AND NOT BE ALLOWED TO DRY OUT. CONTAMINATION OF THESE SOILS SHOULD BE PREVENTED. THEY SHOULD BE TRANSPORTED IN VEHICLES THAT HAVE BEEN WASHED SO THAT NO EXOTIC/INVASIVE SEEDS FROM OTHER SITES GET MIXED IN WITH THEM.

**PLANTING REQUIREMENTS**

SHRUBS SHOULD BE PLANTED 4-10 FEET ON CENTER IN A RANDOM PATTERN OR IN CLUSTERS TO MIMIC NATURAL CONDITIONS.

**INVASIVE SPECIES**

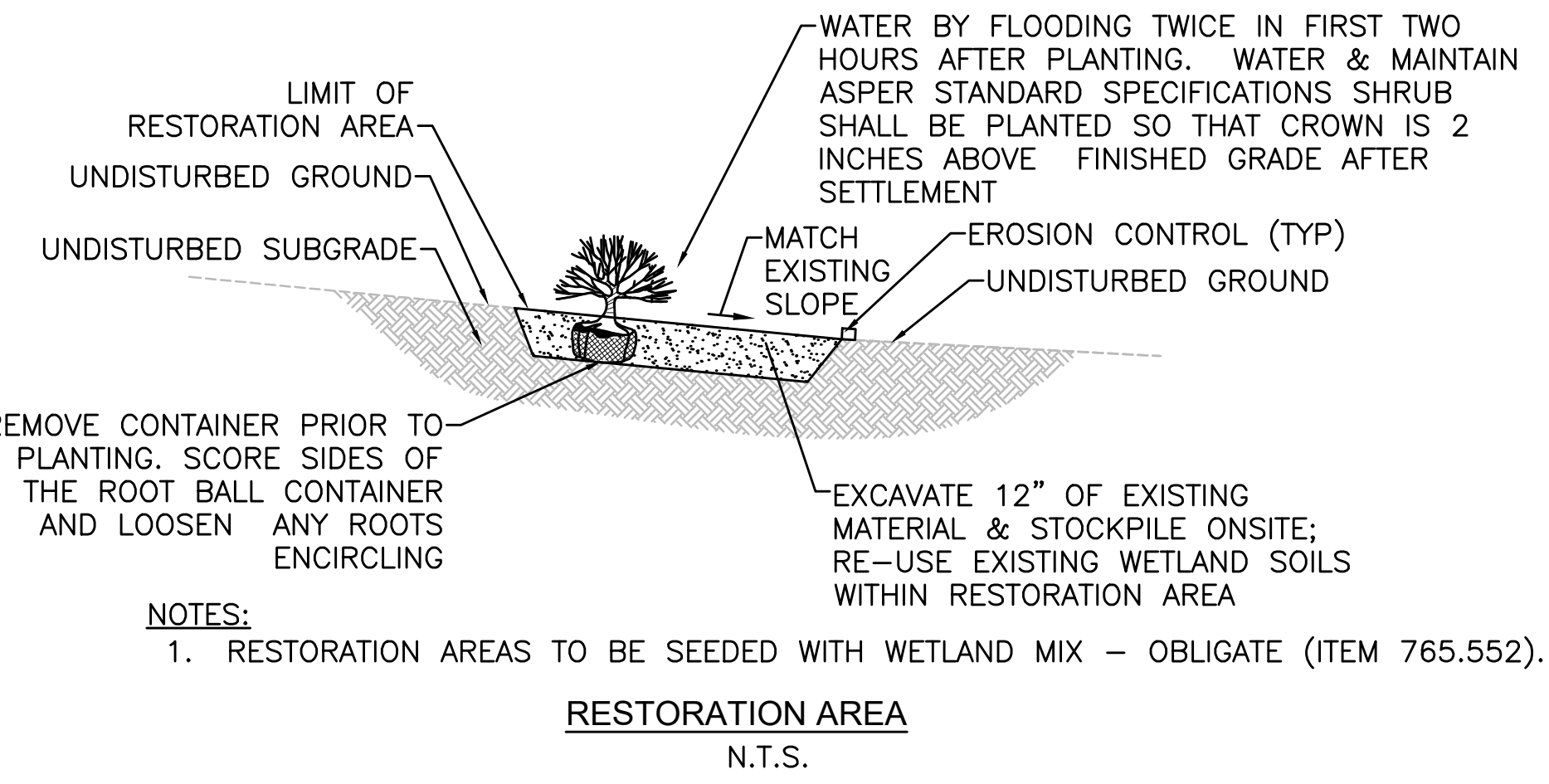
TRUCKS THAT HAVE PREVIOUSLY BEEN ON OTHER SITES SHOULD BE WASHED PRIOR TO INTRODUCTION TO THE REPLICATION SITE SO THAT MUD/DIRT WITH EXOTIC/INVASIVE SEEDS IS NOT INADVERTENTLY BROUGHT TO THE RESTORATION SITE.

**TIMING OF PLANTINGS**

ALL PLANTING SHOULD OCCUR AT THE BEGINNING OR END OF THE GROWING SEASON. FALL PLANTINGS SHOULD BE DONE BEFORE THE FIRST FROST, BUT NO LATER THAN NOVEMBER 15.

**EROSION CONTROL**

EROSION CONTROLS WILL BE PLACED ALONG THE BOUNDARY OF THE RESTORATION AREA. UPON COMPLETION OF THE RESTORATION AREA, INSTALLATION OF SILTATION FENCING AND COMPOST FILTER TUBES BETWEEN THE RESTORATION AREA AND THE ADJACENT UPLAND WILL BE PROVIDED TO PREVENT SILT FROM ENTERING THE RESTORATION AREA. PRIOR TO PERMANENT ESTABLISHMENT OF VEGETATION IN THE RESTORATION AREA, SOILS WILL BE TEMPORARILY STABILIZED TO PREVENT IMPACTS FROM EROSION BY MULCHING AND SEEDING WITH A WETLAND SEED MIXTURE UNTIL RE-ESTABLISHMENT OF WETLAND VEGETATION OCCURS. ALL EMBANKMENT SLOPES ADJACENT TO WETLAND RESTORATION AREAS SHOULD HAVE SLOPES NO GREATER THAN 2H:1V UNLESS STABILIZED BY STRUCTURAL MEANS. BIOENGINEERING STABILIZATION METHODS ARE RECOMMENDED FOR SLOPE STABILIZATION. ORGANIC SOILS AND WETLAND VEGETATION SHOULD NOT BE PLACED IN THE RESTORATION AREA UNTIL IT IS VERIFIED THAT THE FINAL EXCAVATED GRADE FOR THE RESTORATION AREA WILL ALLOW THE FINISHED GRADE OF THE RESTORATION SITE TO MEET THE DESIGN SPECIFICATIONS. FOLLOWING EXCAVATION WORK, FINAL GRADING AND LANDSCAPING SHOULD BE COMPLETED AS SOON AS POSSIBLE TO MINIMIZE EROSION. ALL EXPOSED SOIL WILL BE STABILIZED USING SEED-FREE MULCH OR OTHER APPROPRIATE EROSION CONTROL MEASURES IN THE EVENT THAT SEASONAL CONDITIONS RESULT IN A DELAY IN PLANTING. IF THE SITE IS EXCAVATED TO THE SUBGRADE IN THE FALL AND A DELAY IS INEVITABLE, CONSIDERATION SHOULD BE GIVEN TO STABILIZING THE SITE FOR WINTER, AND CONDUCTING FINAL GRADING IN THE SPRING.



- NOTES:**
- RESTORATION AREAS TO BE SEEDED WITH WETLAND MIX - OBLIGATE (ITEM 765.552).