

CONSTRUCT BERMS WHERE NECESSARY TO ACCOMMODATE HEAVY ROCK RIPRAP. TOP OF FILL TO BE 300 mm MINIMUM ABOVE TOP OF ROCK (MAY OR MAY NOT APPLY AT BOTH ENDS)

*NOTE REFER TO DESIGN GUIDELINES FOR EROSION AND SEDIMENT CONTROL FOR HIGHWAYS, FOR EROSION PROTECTION MEASURES AND FOR DITCH DRAINAGE ADJACENT TO THE STRUCTURE

*NOTE STEEPER SLOPE MAY BE PROVIDED TO ENSURE CLAY SEAL DOES NOT EXTEND BELOW ROAD TOP

COMPACT THE UPPER 300 mm OF EMBANKMENT OR BASE COURSE TO MINIMUM OF 100% OF STANDARD PROCTOR DENSITY AT OPTIMUM MOISTURE CONTENT

*NOTE ADJUST BACKFILL ENVELOPE, BACKFILL MATERIAL, AND COMPACTION WHERE WARRANTED DUE TO SIZE OF PIPE, HEIGHT OF COVER, OR AS REQUIRED BY HEAVIER LOADS

PLACE, SPREAD AND BLADE SMOOTH IN SUCCESSIVE LAYERS NOT TO EXCEED 150 mm WHEN COMPACTED TO THE FULL WIDTH OF THE CROSS SECTION. COMPACT TO A MINIMUM OF 95% OF STANDARD PROCTOR DENSITY AT OPTIMUM MOISTURE CONTENT. PLACE BACKFILL SUCH THAT THE DIFFERENCE IN ELEVATION OF THE COMPACTED LAYERS ON OPPOSITE SIDES OF THE PIPE IS NOT MORE THAN 150 mm

OBTAIN CONSULTANT'S REVIEW AND ACCEPTANCE BEFORE USING EQUIPMENT ABOVE OR ADJACENT TO THE PIPE. PLACE AND COMPACT THE FILL OVER THE PIPE BY MOVING EQUIPMENT PERPENDICULAR TO THE LONGITUDINAL AXIS OF THE PIPE. SUBMIT DETAILS FOR SPECIFIC CONSTRUCTION EQUIPMENT WITH AXLE LOADING, AND CONFIRM ASSOCIATED MINIMUM COVER REQUIREMENTS

COMPACT THE 300 mm LAYER OF GRANULAR MATERIAL DIRECTLY ABOVE THE PIPE WITHOUT VIBRATION

EXCAVATE AS REQUIRED TO REMOVE EXISTING STRUCTURES AS APPLICABLE AND TO INSTALL THE NEW PIPE. REMOVE OR STABILIZE SOFT OR YIELDING MATERIAL. FLATTEN AND/OR BENCH SLOPES AS REQUIRED TO PROVIDE A STABLE, SAFE EXCAVATION.

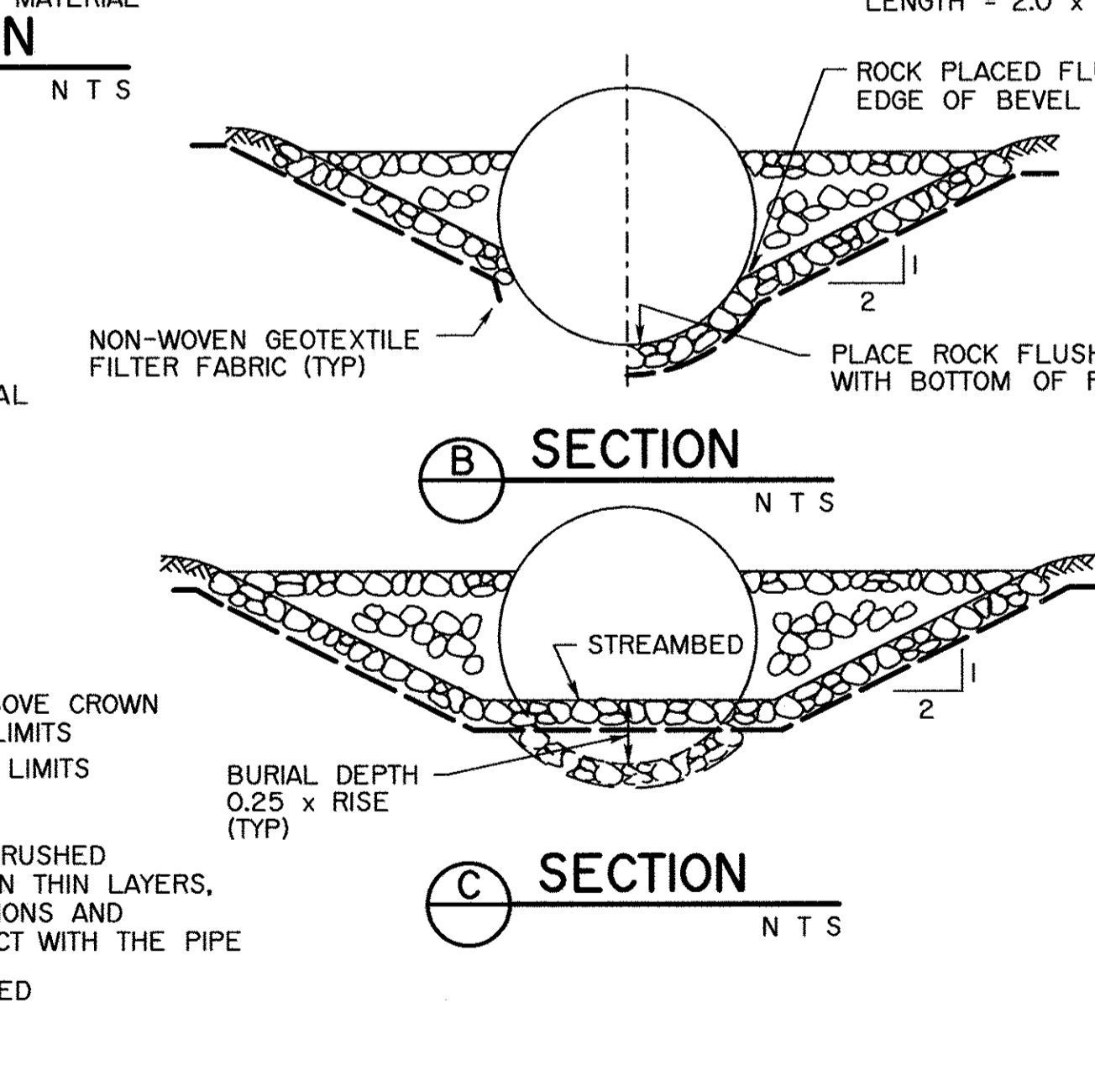
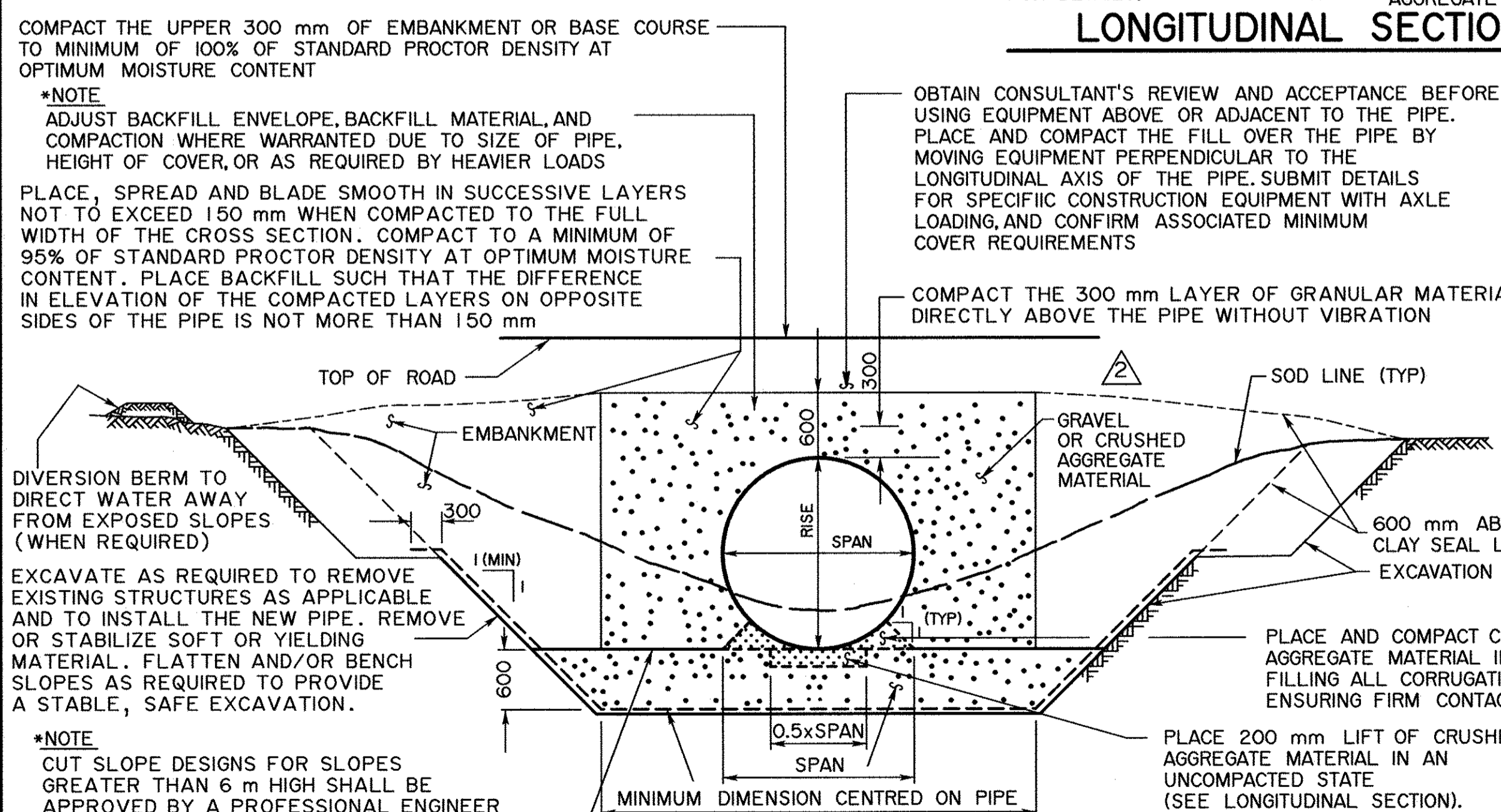
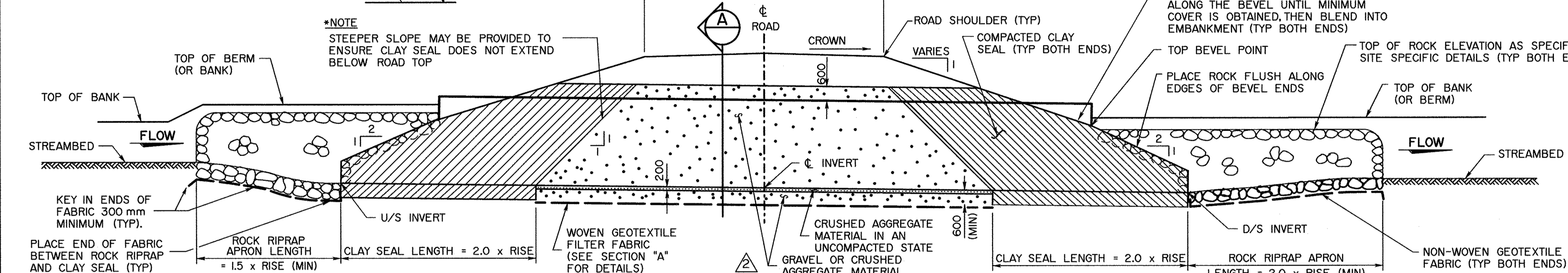
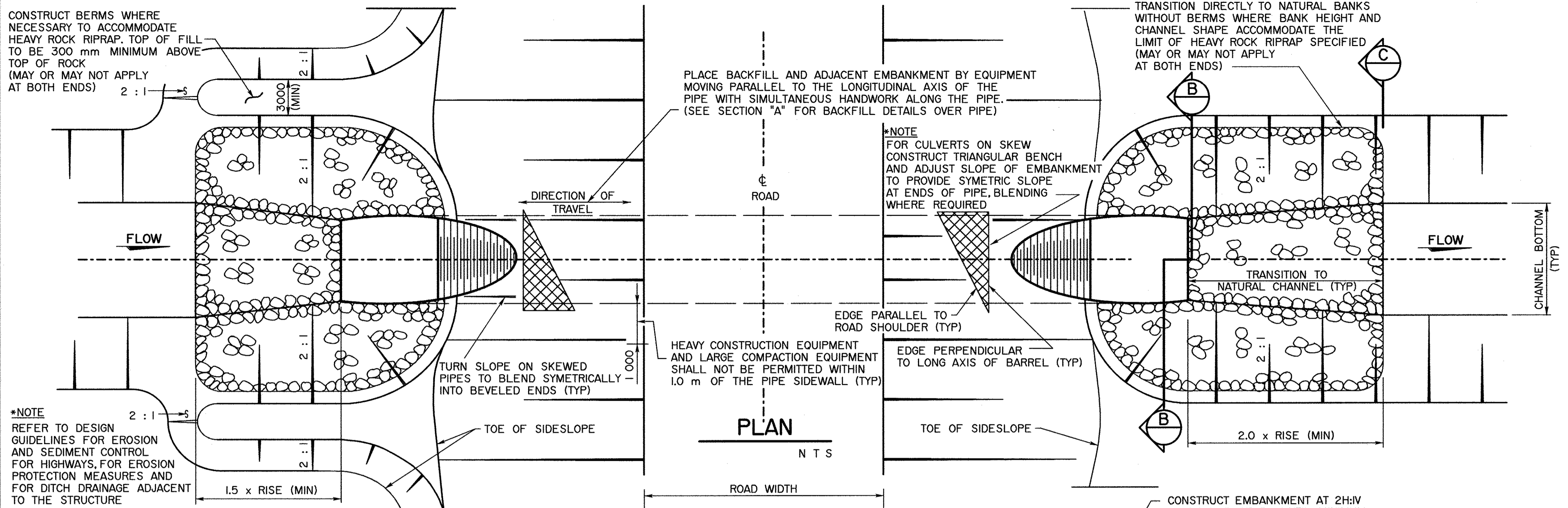
*NOTE CUT SLOPE DESIGNS FOR SLOPES GREATER THAN 6 m HIGH SHALL BE APPROVED BY A PROFESSIONAL ENGINEER

COMPACT MATERIAL AT THIS LEVEL TO A MINIMUM OF 95% OF STANDARD PROCTOR DENSITY AT OPTIMUM MOISTURE CONTENT

PLACE WOVEN GEOTEXTILE FILTER FABRIC BEFORE PLACING GRAVEL OR CRUSHED AGGREGATE MATERIAL. GEOTEXTILE IS NOT CONTINUOUS THROUGH THE CLAY SEALS. FABRIC TO BE CONTINUOUS IN THE TRANSVERSE DIRECTION AND LAPPED IN THE LONGITUDINAL DIRECTION ACCORDING TO MANUFACTURER'S DIRECTIONS

EXCAVATE 600 mm MINIMUM BELOW THE PIPE INVERT AND REPLACE WITH GRAVEL OR CRUSHED AGGREGATE MATERIAL. REMOVE OR STABILIZE SOFT OR YIELDING MATERIAL BELOW THIS ELEVATION TO THE SATISFACTION OF THE CONSULTANT

*NOTE PRE-SHAPE BED IF PIPE IS HORIZONTALLY ELLIPSED OR IF DIAMETER EXCEEDS 3000 mm



TRANSITION DIRECTLY TO NATURAL BANKS WITHOUT BERMS WHERE BANK HEIGHT AND CHANNEL SHAPE ACCOMMODATE THE LIMIT OF HEAVY ROCK RIPRAP SPECIFIED (MAY OR MAY NOT APPLY AT BOTH ENDS)

*NOTE FOR CULVERTS ON SKEW CONSTRUCT TRIANGULAR BENCH AND ADJUST SLOPE OF EMBANKMENT TO PROVIDE SYMETRIC SLOPE AT ENDS OF PIPE, BLENDING WHERE REQUIRED

HEAVY CONSTRUCTION EQUIPMENT AND LARGE COMPACTION EQUIPMENT SHALL NOT BE PERMITTED WITHIN 1.0 m OF THE PIPE SIDEWALL (TYP)

CONSTRUCT EMBANKMENT AT 2H:1V ALONG THE BEVEL UNTIL MINIMUM COVER IS OBTAINED, THEN BLEND INTO EMBANKMENT (TYP BOTH ENDS)

*GEOTEXTILE FILTER FABRIC SHOWN SHALL MEET THE FOLLOWING REQUIREMENTS.

WOVEN GEOTEXTILE FILTER FABRIC SPECIFICATIONS AND PHYSICAL PROPERTIES	
GRAB STRENGTH	1275 N
ELONGATION (FAILURE)	15%
PUNCTURE STRENGTH	275 N
BURST STRENGTH	3.6 MPa
TRAPEZOIDAL TEAR	475 N
MINIMUM FABRIC LAP TO BE 1000 mm	

NON-WOVEN GEOTEXTILE FILTER FABRIC SPECIFICATIONS AND PHYSICAL PROPERTIES		
	CLASS 1M, 1, 2	CLASS 3
GRAB STRENGTH	650 N	875 N
ELONGATION (FAILURE)	50%	50%
PUNCTURE STRENGTH	275 N	550 N
BURST STRENGTH	2.1 MPa	2.7 MPa
TRAPEZOIDAL TEAR	250 N	350 N
MINIMUM FABRIC LAP TO BE 300 mm		

GENERAL NOTES

GENERAL

- DIMENSIONS ARE GIVEN IN MILLIMETRES UNLESS NOTED OTHERWISE.
- THIS DRAWING PROVIDES GENERAL INFORMATION ONLY AND IS APPLICABLE TO CULVERTS WITH A DIAMETER OF 3.0 METRES OR LESS. SITE SPECIFIC DETAILS ARE REQUIRED FOR CULVERTS WITH A DIAMETER GREATER THAN 3.0 METRES
- THIS DRAWING WILL BE SUPPLEMENTED OR SUPERSEDED BY THE SITE SPECIFIC DESIGN DRAWING(S), ASSEMBLY DRAWINGS, SPECIAL PROVISIONS, AND ENVIRONMENTAL REQUIREMENTS WHERE APPLICABLE.
- ADDITIONAL "NON-STANDARD" NOTES (*NOTES) HAVE ALSO BEEN PROVIDED ON THE DRAWING TO SERVE AS REMINDERS WHERE A SPECIFIC DETAIL MAY NEED TO BE DEVELOPED FOR THE DESIGN DRAWINGS.

ASSEMBLY

- CSP SECTIONS SHALL BE POSITIONED SO THAT THE ENDS ARE IN CLOSE CONTACT. COUPLERS SHALL BE WELL FITTED AND EVENLY TIGHTENED ALL AROUND THE PIPE. WHERE REQUIRED JOINTS SHALL BE SEALED USING APPROVED MATERIAL SUPPLIED BY THE CONTRACTOR.
- SPCSP SHALL BE ASSEMBLED AS SHOWN ON THE ASSEMBLY DRAWINGS AND AS OUTLINED BELOW:
 - ASSEMBLY, LOOSE BOLTING AND RING CLOSURE SHALL PROGRESS FROM ONE END WITH EACH RING CHECKED AND ADJUSTED TO DESIGN GEOMETRY WITH FULLY NESTED PLATES IMMEDIATELY UPON CLOSURE OF INDIVIDUAL RINGS. WHERE TEMPORARY SUPPORTS OR TIE CABLES ARE USED, ADEQUATE MEANS SHALL BE TAKEN TO DISTRIBUTE LOADS ALONG THE PIPE WALL, TO PREVENT LOCAL DISTORTION AND MAINTAIN DESIGN SHAPE.
 - ALL BOLTED SEAMS SHALL BE PROPERLY LAPPED AND PLATES SHALL BE IN CONTACT FOR THE FULL WIDTH AND LENGTH OF THE LAP. THE BOLTS IN THE VALLEY OF EACH LONGITUDINAL SEAM SHALL BE NEAREST TO THE VISIBLE EDGE OF THE PLATE.
 - THE VERTICAL AXIS SHALL BE UPRIGHT AND THE LONGITUDINAL SEAMS SHALL BE STRAIGHT. ROTATION OF THE PIPE AND/OR SPIRALING OF THE LONGITUDINAL SEAMS SHALL NOT BE PERMITTED.
 - BOLTS SHALL BE TORQUED TO AND MAINTAINED AT NOT LESS THAN 200 N.m. AND NOT MORE THAN 340 N.m.
 - DISTORTION OF BOLT HOLES CAUSED BY OVER-TORQUING, OR POOR ASSEMBLY METHODS WILL NOT BE PERMITTED. WHERE ADDITIONAL HOLES ARE REQUIRED, THEY SHALL BE DRILLED. EXTRA HOLES AND MINOR SURFACE DAMAGE SHALL RECEIVE 2 BRUSH APPLIED COATS OF ZINC RICH PAINT.
 - BOLTS ON PEDESTRIAN OR STOCK UNDERPASSES SHALL BE INSTALLED WITH THE BOLT HEADS INSIDE THE STRUCTURE.
- USE SOFT SLINGS AND HANDLE WITH CARE TO AVOID SCRATCHING, BRUISING, AND DISTORTION OF THE PIPE. DEFORMATION DURING CONSTRUCTION SHALL NOT EXCEED A 2% UPWARD OR DOWNWARD DEFLECTION FROM THE DESIGN RISE. IF STRUTS OR CABLES ARE USED TO MAINTAIN THE PIPE'S SHAPE, THEY SHALL BE REMOVED BEFORE THEY RESTRICT DOWNWARD MOVEMENT OF THE CROWN.

BACKFILL

- BACKFILL SHALL CONSIST OF APPROVED GRANULAR MATERIAL. NON-ORGANIC CLAY SHALL BE USED FOR THE CLAY SEALS AT EACH END OF THE PIPE. BACKFILL MATERIAL SHALL BE PLACED AND COMPACTED IN AN UNFROZEN CONDITION, MEET THE SPECIFIED GRADATION, CONTAIN NO ROCKS EXCEEDING 80 mm IN DIAMETER, AND SHALL BE FREE OF LARGE OR FROZEN LUMPS, WOOD, OR OTHER UNSUITABLE MATERIAL. BACKFILLING IS NOT ALLOWED ON FROZEN SUBSTRATE OR WHEN AIR TEMPERATURE IS BELOW 0°C.
- PRE-APPROVED GRANULAR MATERIAL SHALL MEET THE FOLLOWING GRADATION SPECIFICATIONS:

GRAVEL MATERIAL DESIGNATION 6, CLASS 80			CRUSHED AGGREGATE MATERIAL DESIGNATION 2, CLASS 40		
µm	SIEVE SIZE	% BY WEIGHT PASSING	µm	SIEVE SIZE	% BY WEIGHT PASSING
80 000		100%	40 000		100%
50 000		55 - 100	25 000		70 - 94
25 000		38 - 100	16 000		55 - 85
16 000		32 - 85	10 000		44 - 74
5 000		20 - 65	5 000		32 - 62
315		6 - 30	1 250		17 - 43
80		2 - 10	630		12 - 34
			315		8 - 26
			160		5 - 18
			80		2 - 10
% FRACTURES BY WEIGHT (2 FACES)		N/A	% FRACTURES BY WEIGHT (2 FACES)		50 +
PLASTICITY INDEX		NP-8	PLASTICITY INDEX		NP-6
LA ABRASION LOSS PERCENT MAXIMUM		N/A	LA ABRASION LOSS PERCENT MAXIMUM		50

HEAVY ROCK RIPRAP

- HEAVY ROCK RIPRAP SHALL COVER THE AREA SHOWN AND SHALL BE PLACED TO THE FOLLOWING MINIMUM THICKNESS:

CLASS OF ROCK	1M	1	2	3
THICKNESS (mm)	300	450	800	1100

- REFER TO THE CURRENT VERSION OF B354 SECTION 10 "HEAVY ROCK RIPRAP" OF THE SPECIFICATIONS FOR BRIDGE CONSTRUCTION FOR ADDITIONAL INFORMATION.
- PLACE NON-WOVEN GEOTEXTILE FILTER FABRIC UNDER ALL HEAVY ROCK RIPRAP.

UNDERPASSES

- GRAVEL MATERIAL "DESIGNATION 6, CLASS 80", SHALL BE PLACED TO A THICKNESS OF 200 mm ON THE APPROACHES FROM THE PIPE TO THE EDGE OF RIGHT OF WAY. DO NOT USE HEAVY ROCK RIPRAP UNLESS SPECIFIED.
- CONCRETE FLOOR WITH ROUGH TEXTURED SURFACE OR COMPACTED GRANULAR FLOOR SHALL BE PLACED TO A DEPTH OF 150 mm AT THE INVERT. ACP FLOORS MAY BE CONSIDERED FOR PEDESTRIAN OR VEHICLE UNDERPASSES.
- CLAY SEALS ARE NOT REQUIRED FOR UNDERPASSES.
- LOCATE AND SLOPE UNDERPASSES TO PROVIDE POSITIVE DRAINAGE AND TO PREVENT PONDING OF WATER.

FILE: EDB-025002 VSHR8GLDGN DRAWN BY: MKR

PERMIT TO PRACTICE
BPTC-DNW ENGINEERING LTD.
Signature: THOMAS CHAN
Date: JUL 9, 2003
PERMIT NUMBER: P211
The Association of Professional Engineers
Geologists and Geophysicists of Alberta

DESIGNER
ORIGINAL STAMPED AND SIGNED
BY: JOHN O'BRIEN
ON: JUL 9, 2003
PROFESSIONAL ENGINEER ALBERTA

CHECKER
ORIGINAL STAMPED AND SIGNED
BY: SHANE HALL
ON: JUL 9, 2003
PROFESSIONAL ENGINEER ALBERTA

REV	DATE	REVISIONS	BY
△	2009-05-15	REVISED BACKFILL GRAVEL	CM
△	2003-07-03	REDRAWN FROM S-1418 (REV. 5) TO COMPLY WITH CAN/CSA - S6-00	

RECOMMENDED DIRECTOR BRIDGE ENGINEERING ORIGINAL SIGNED BY:
TOM LOO
APPROVED EXECUTIVE DIRECTOR TECHNICAL STANDARDS BRANCH ORIGINAL SIGNED BY:
ALLAN KWAN

Alberta TRANSPORTATION
INSTALLATION OF LARGE METAL PIPES
AI BAR CODE DATE SHEET DRAWING
2003-07-03 1 of 1 S-1418-03