

"AS BUILT" 30 OCTOBER 1998
DEVELOPMENT PLANS
FOR
PHASE I
"TIMBERBROOK"

SITUATED IN
AMSTERDAM MAGISTERIAL DISTRICT
BOTETOURT COUNTY, VIRGINIA

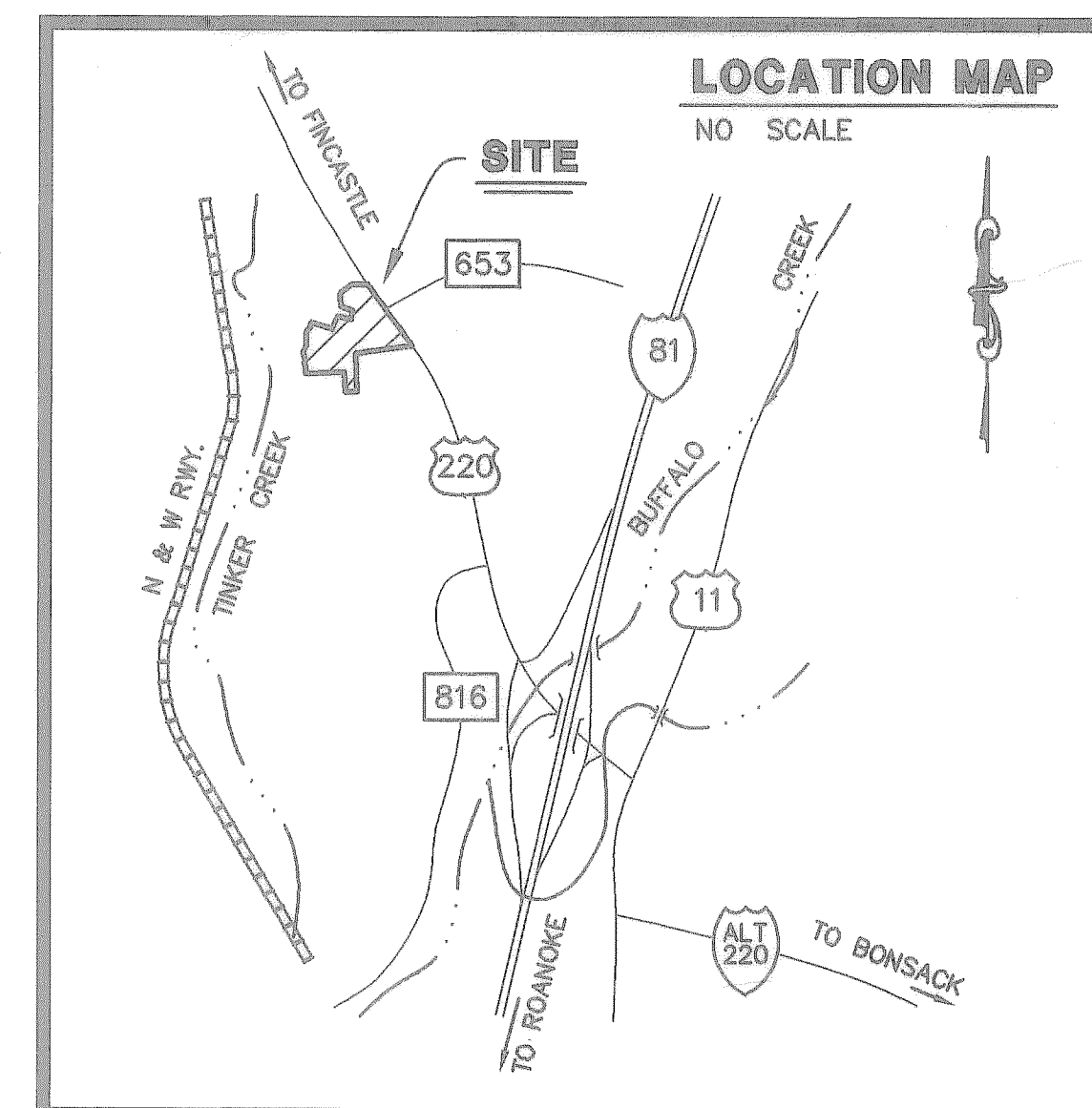
DATE: 1 JULY 1998

PROPERTY OF
TIMBERBROOK ASSOCIATES, L.L.C.

"AS-BUILT"

NOTE:

1. "AS-BUILT" INFORMATION TAKEN FROM PLANS FURNISHED BY J.P. TURNER & BROTHERS, INC., CONTRACTOR.
2. "AS-BUILT" DIMENSIONS SHOWN IN BRACKETS.



INDEX OF DRAWINGS

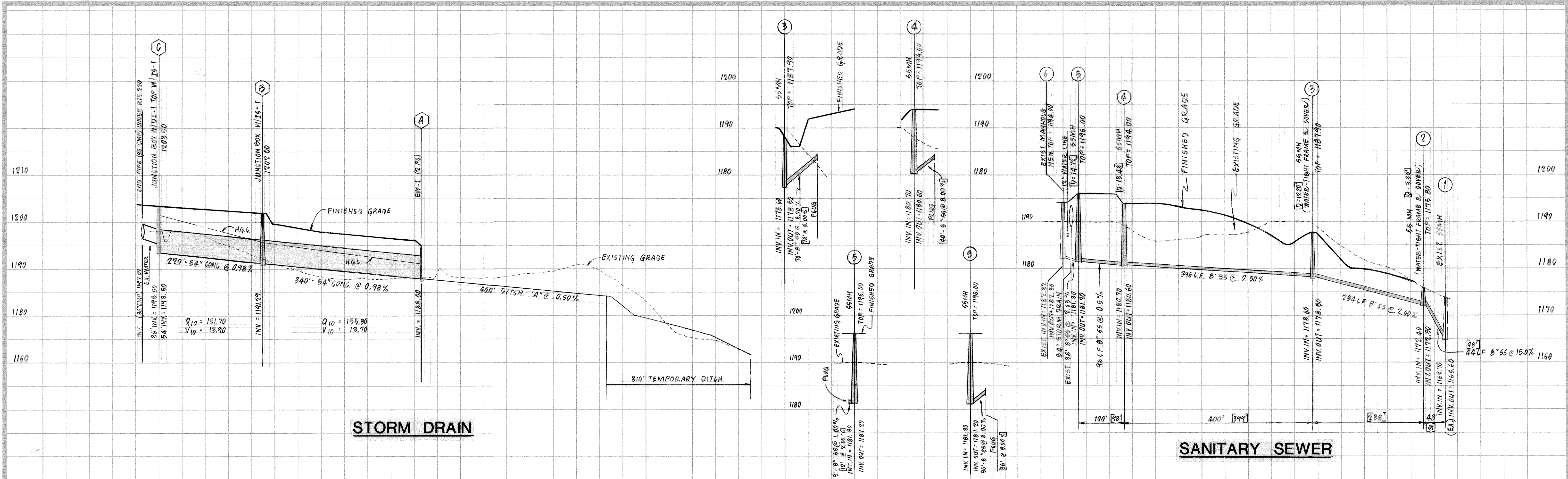
SHEET No. DESCRIPTION

1. LUMSDEN ASSOCIATES COVER SHEET
2. NOTES, DETAILS & PROFILES
3. GRADING PLAN
4. EROSION CONTROL PLAN
5. EROSION CONTROL DETAIL SHEET
6. SEDIMENT BASIN DETAILS
7. CONSTRUCTION SPECIFICATIONS
8. CONSTRUCTION DETAILS

LUMSDEN ASSOCIATES, P.C.
ENGINEERS-SURVEYORS-PLANNERS
ROANOKE, VIRGINIA

REVISIONS

DATE	SHEETS	DATE	SHEETS
15 JULY 1998	2		
21 JULY 1998	2, 3		
17 AUG. 1998	2, 3, 10, 11		



STORM DRAIN

SANITARY SEWER

GENERAL NOTES.

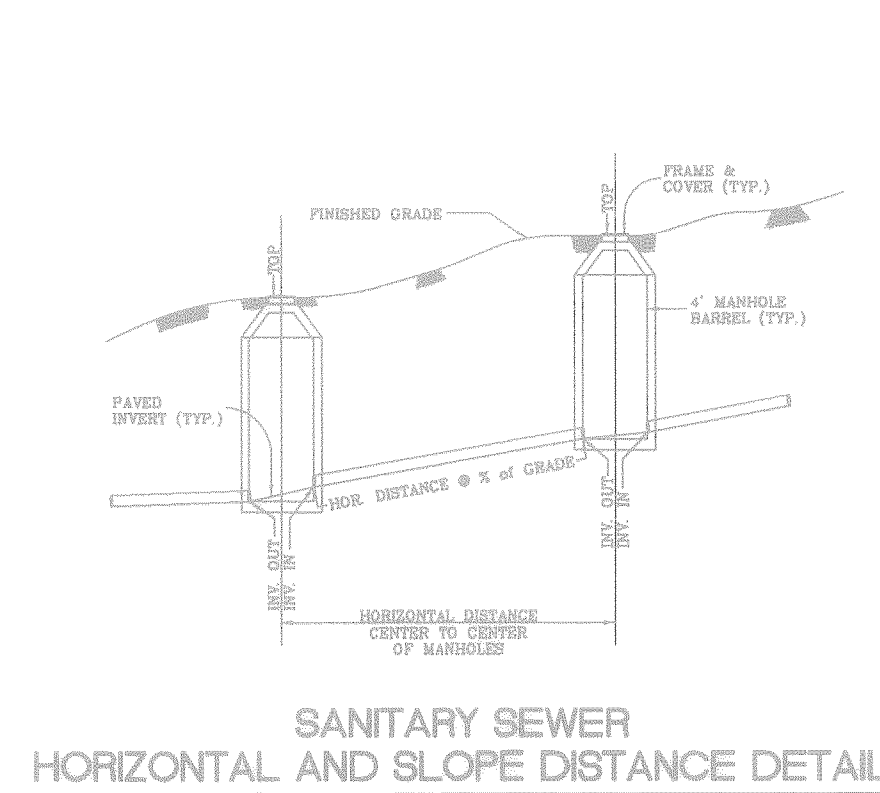
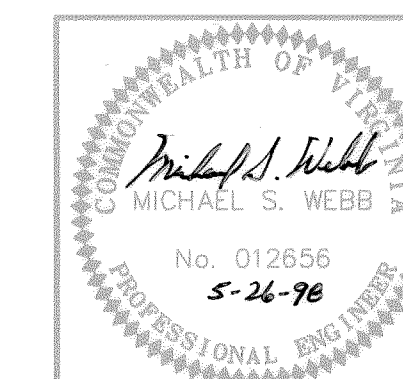
1. THE PROPERTY SHOWN ON THESE PLANS IS LOCATED AT BOTETOURT COUNTY TAX ASSESSMENT NUMBER (PART OF) 101-44B.
2. DEVELOPER: STRAUSS CONSTRUCTION COMPANY
5100 BERNARD DRIVE SW
ROANOKE, VIRGINIA 24018
3. THE ASSESSED AREA IS APPROXIMATELY 66 AC.
4. NO TITLE REPORT FURNISHED FOR THIS PROPERTY.
5. THE PROPERTY SHOWN ON THESE PLANS IS TO BE SERVED BY COUNTY WATER AND SEWER.
6. THE DEVELOPMENT SHOWN ON THESE PLANS SHALL BE ACCESSED BY PUBLIC ROAD.
7. TOPOGRAPHIC INFORMATION TAKEN FROM AERIAL PHOTOGRAPHY PERFORMED BY P.D.S.

CONSTRUCTION NOTES.

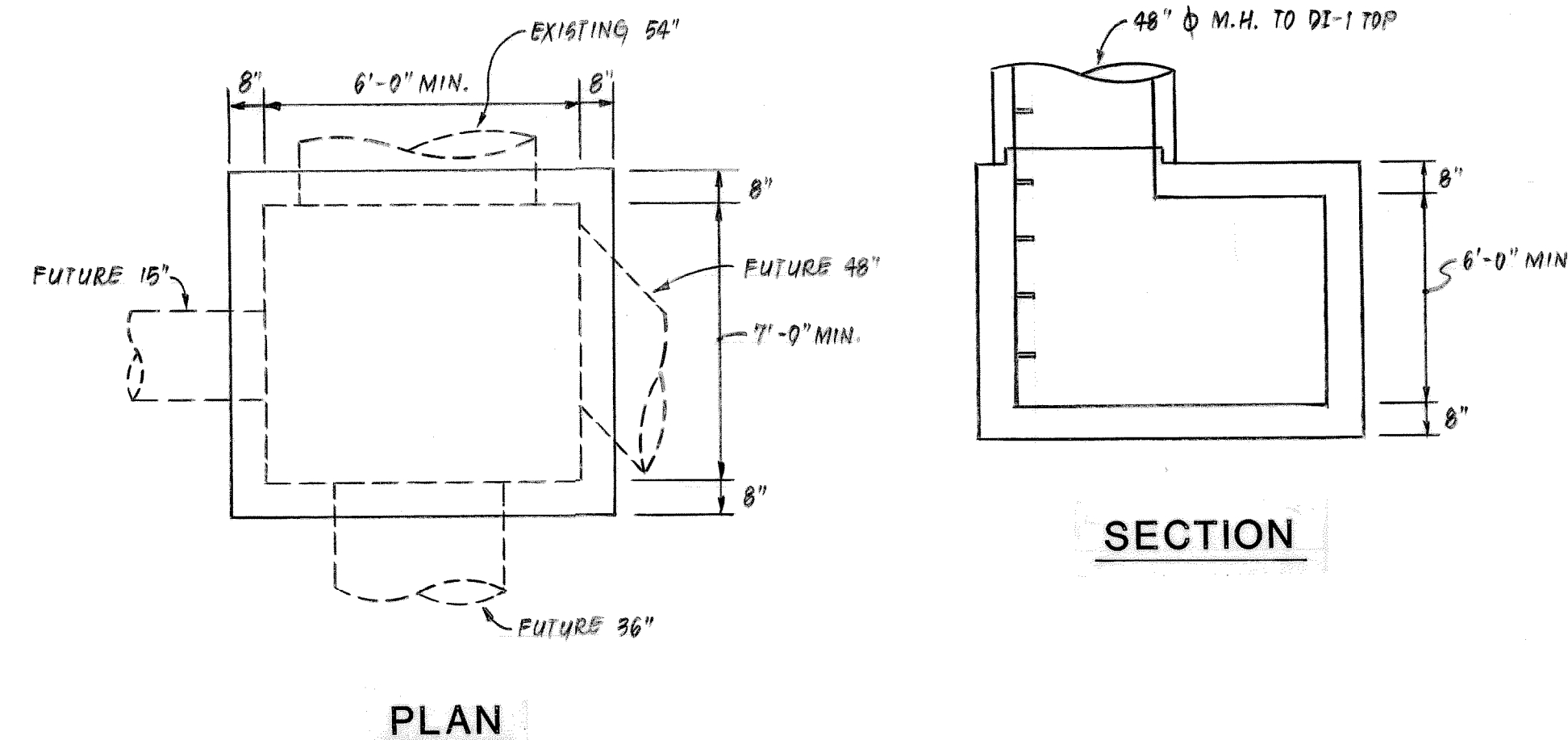
1. ALL CONSTRUCTION SHALL CONFORM TO THE CURRENT COUNTY OF BOTETOURT STANDARDS AND SPECIFICATIONS.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING THE OWNER AND THE ENGINEER OF ANY CHANGES OR CONDITIONS ATTACHED TO PERMITS OBTAINED FROM ANY AUTHORITY ISSUING PERMITS.
3. NO SUBSOIL INVESTIGATIONS HAVE BEEN MADE BY THE DESIGNING ENGINEER.
4. THE CONTRACTOR SHALL VISIT THE SITE AND VERIFY EXISTING CONDITIONS PRIOR TO STARTING CONSTRUCTION.
5. LUMSDEN ASSOCIATES, P.C. DOES NOT CERTIFY TO THE LOCATION OF OR THE EXISTENCE OF ANY EXISTING UNDERGROUND UTILITIES. THE CONTRACTOR SHALL VERIFY THE LOCATIONS OF ALL EXISTING UTILITIES PRIOR TO STARTING CONSTRUCTION.
6. AREAS TO BE GRADED SHALL BE CLEARED & GRUBBED OF ALL VEGETATION, STRUCTURES AND OTHER PHYSICAL FEATURES IN PREPARATION OF GRADING.
7. TOPSOIL SHALL BE REMOVED FROM THE CLEARED AREA AND STOCKPILED FOR FUTURE USE.
8. FILL MATERIAL SHALL BE FREE OF ORGANIC MATTER AND ROCKS LARGER THAN 6 INCHES IN DIAMETER. FILL MATERIAL SHALL BE PLACED AND COMPACTED IN 8 INCH LIFTS TO 95% MINIMUM DENSITY, STANDARD PROCTOR.

"AS BUILT"

REVISION	DATE	DESCRIPTION
30 OCT. 1998		"AS-BUILT"
3	7 AUG. 1998	ADDED PROFILE OF STUBOUTS FROM MANHOLE 5.
2	21 JULY 1998	REVISED SAN SEWER & STUBOUTS.
1	15 JULY 1998	ADDED DIMENSIONS & SECTION FOR JUNCTION BOX "C"
NOTES, DETAILS & PROFILES		
FOR		
PHASE I		
"TIMBERBROOK"		
PREPARED FOR		
TIMBERBROOK ASSOCIATES, L.L.C.		
AMSTERDAM MAGISTERIAL DISTRICT		
BOTETOURT COUNTY, VIRGINIA		
DESIGNED: CAM	VERT: 1"=10'	COMM: 97-452
DRAWN: CAM, VNB	SCALE: HOR: 1"=100'	
CHECKED: MSW	DATE: 1 JULY 1998	SHEET 2 of 8



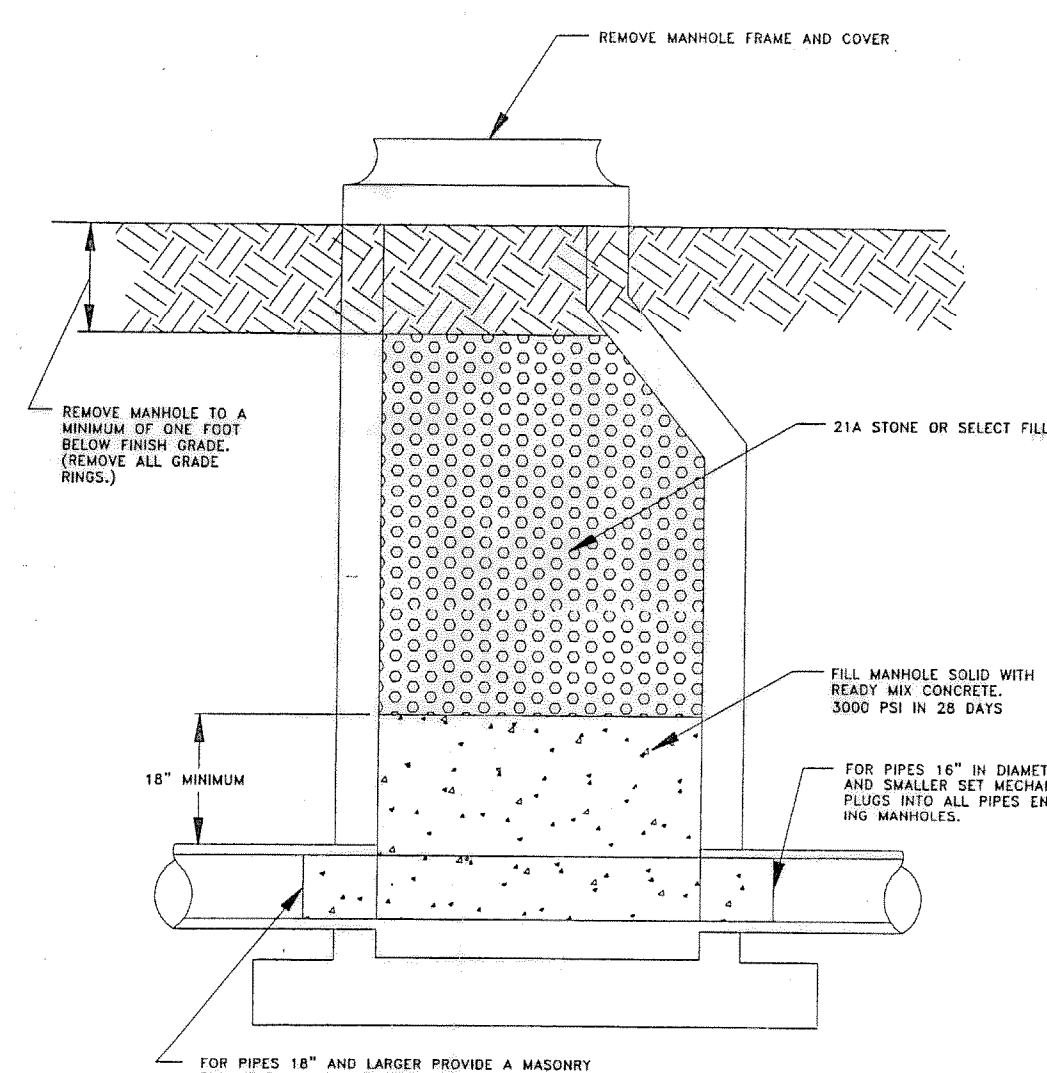
SANITARY SEWER
HORIZONTAL AND SLOPE DISTANCE DETAIL



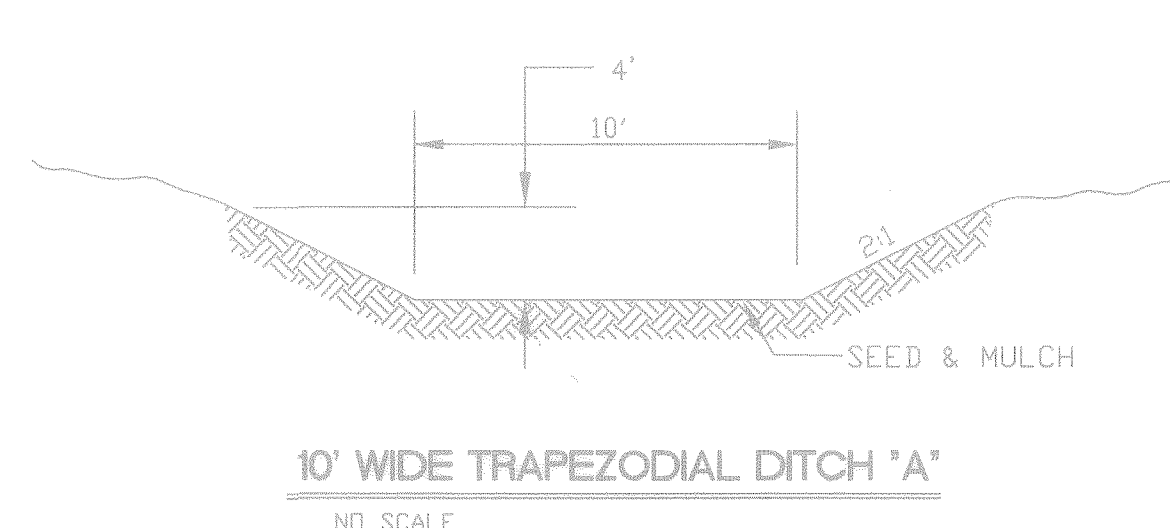
PLAN

JUNCTION BOX "C"

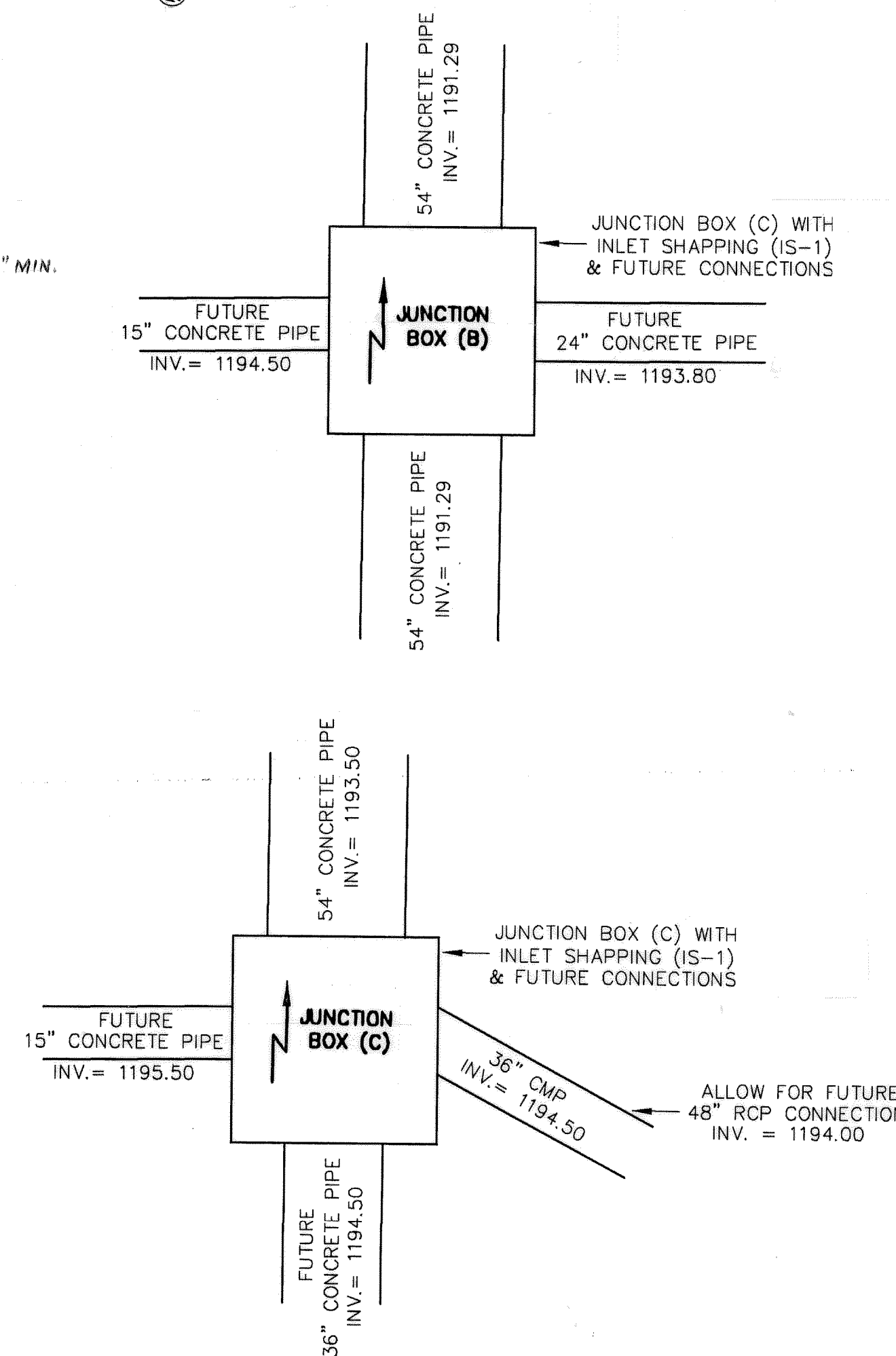
NOT TO SCALE



SANITARY SEWER
MANHOLE
ABANDONMENT



10' WIDE TRAPEZODIAL DITCH "A"



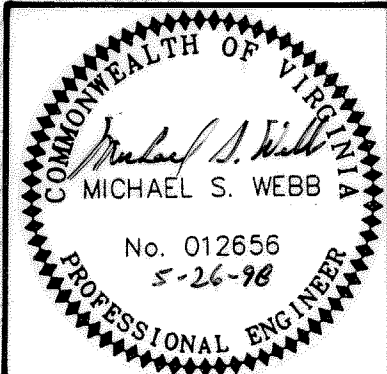


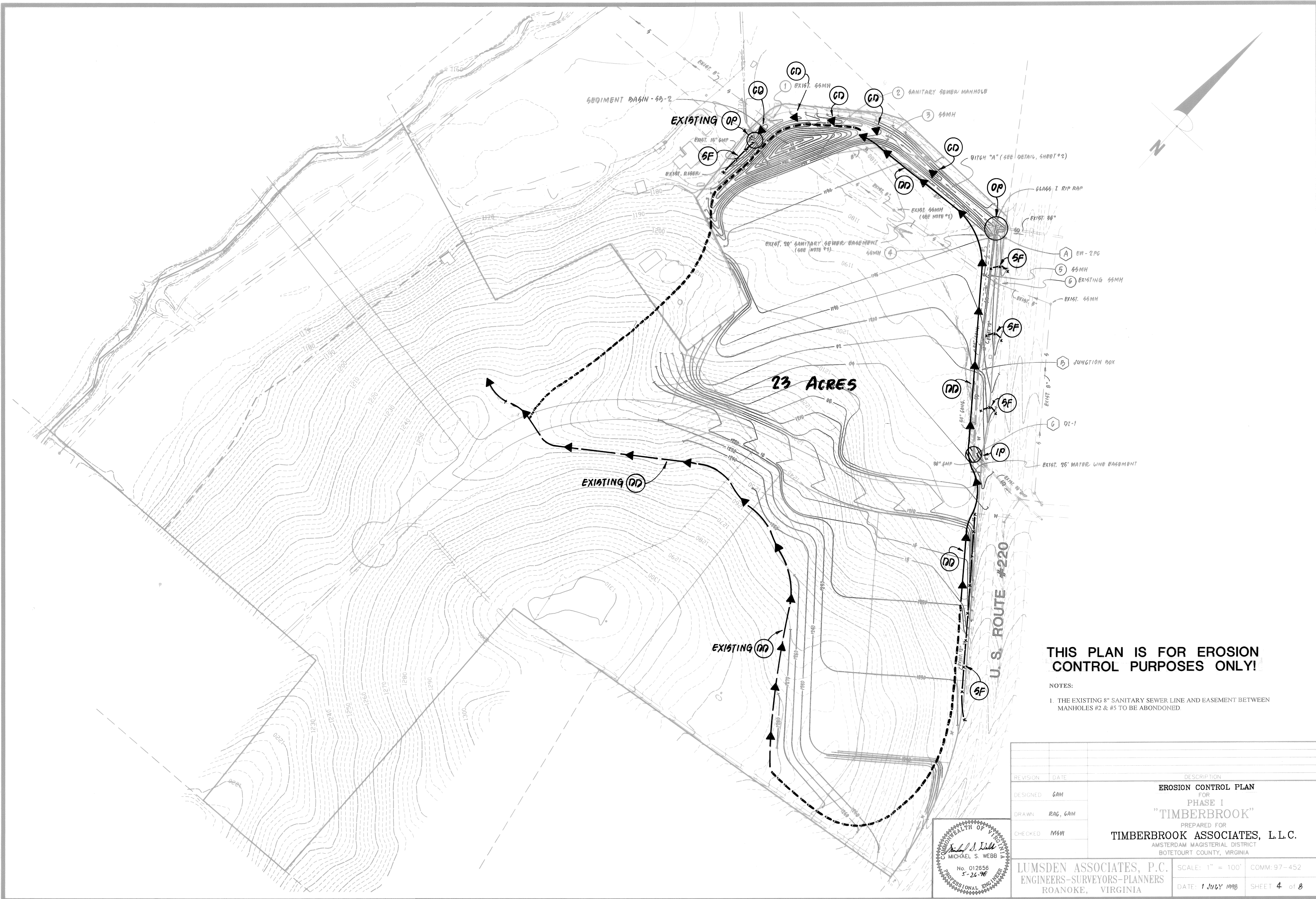
The diagram shows a circular manhole with several lines connected to it. At the top, a vertical line is labeled "SAN. SEWER LINE OUT". On the left, a horizontal line is labeled "SAN. SEWER MANHOLE". At the bottom-left, a line labeled "SAN. SEWER LINE IN" enters the manhole at an angle. This line is shown in two positions: a solid line and a dashed line, with an arc between them labeled "DEFLECTION ANGLE". On the right, a line labeled "SAN. SEWER SERVICE LATERAL" exits the manhole at an angle. To the right of the diagram, a note states: "NOTE: ALL SANITARY SEWER SERVICE LATERAL ANGLES ARE CLOCK-WISE ANGLES MEASURED FROM THE SANITARY SEWER LINE OUT".

1. THE EXISTING 8" SANITARY SEWER LINE BETWEEN MANHOLES #1 & #5 TO BE ABANDONED AFTER THE NEW SEWER LINE HAS BEEN PLACED IN SERVICE. THE EXISTING SEWER LINE SHALL BE CUT AND PLUGGED OUTSIDE OF THE MANHOLE. MANHOLE INVERTS SHALL BE RESHAPED TO DIRECT FLOW.

	30 OCT. 1998	"A5-BUILT"
	27 OCT. 1998	REVISED GRADING.
	7 AUG. 1998	ADDED RIP RAP & VALVE BOX NOTES AND REVISE ABANDONMENT PROCEDURE NOTE #1.
	21 JULY 1998	ADDED NEW DEFLECTION ANGLES TO CHART & MOVED SEWER LINE
REVISION	DATE	DESCRIPTION
DESIGNED	GAM	GRADING PLAN FOR PHASE I
DRAWN	RAG, GAM	"TIMBERBROOK"
CHECKED	MBW	PREPARED FOR TIMBERBROOK ASSOCIATES, L.L.C.
		AMSTERDAM MAGISTERIAL DISTRICT BOTETOURT COUNTY, VIRGINIA

DATE: 1 JULY 1998 SHEET 3 of 8

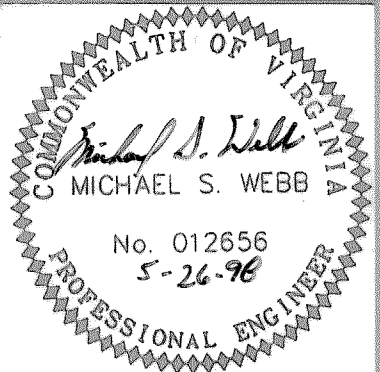


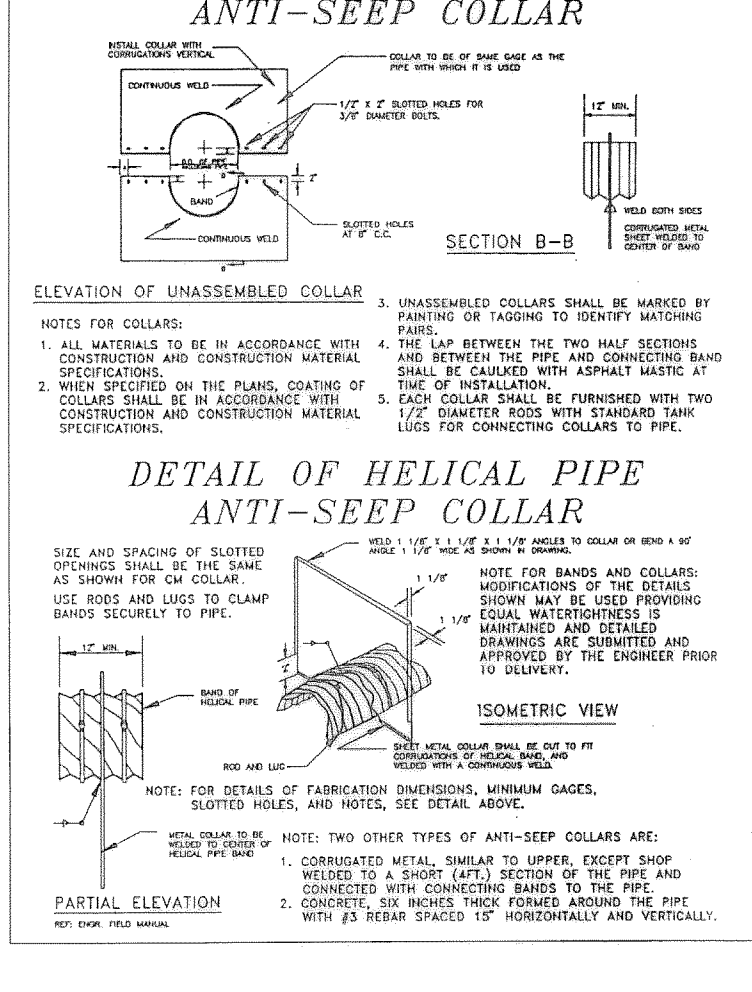
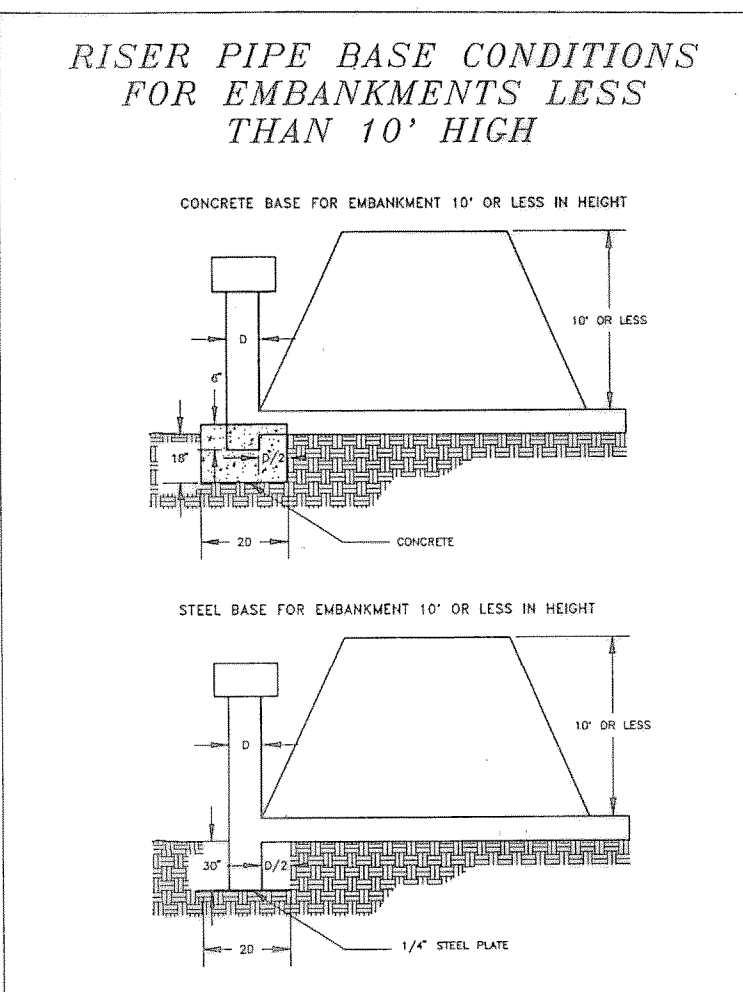
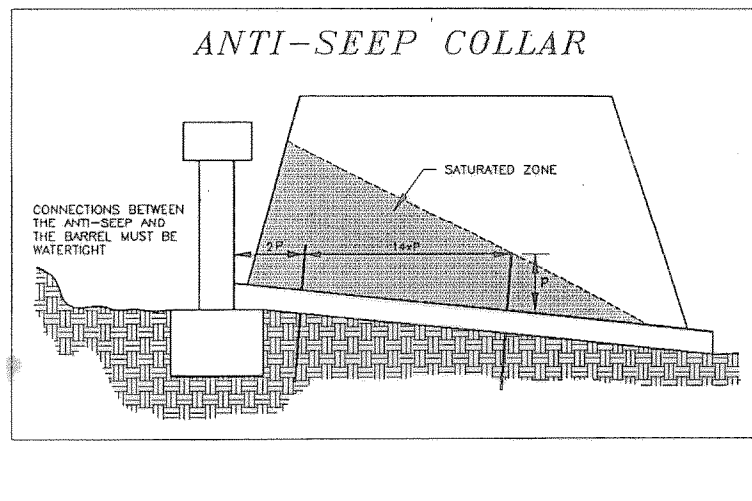
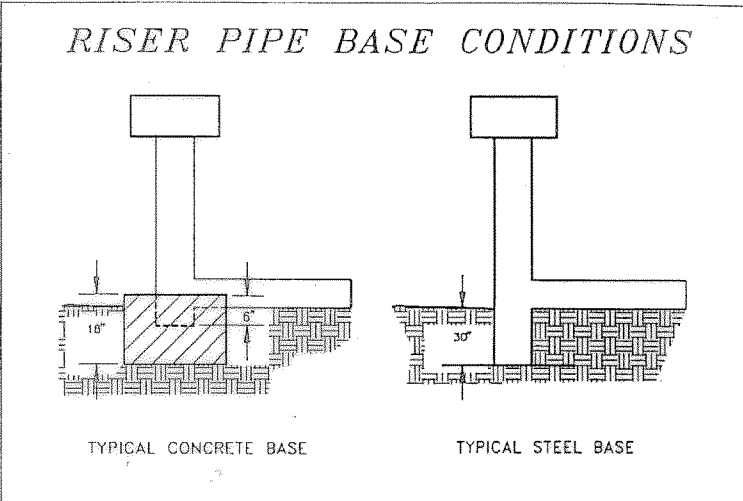
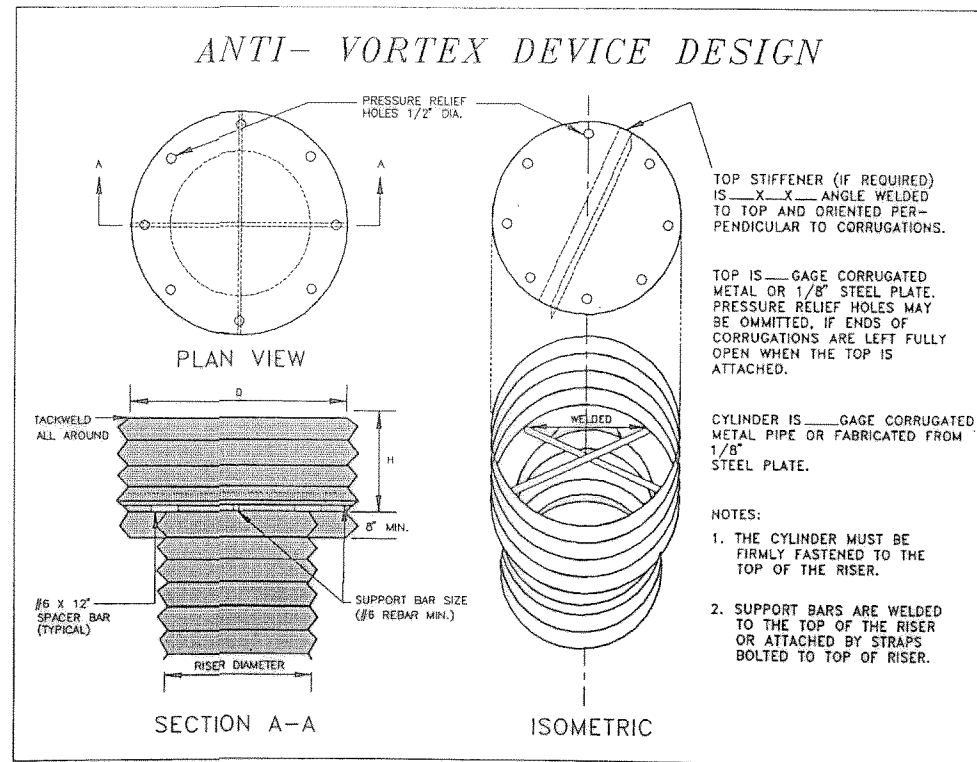
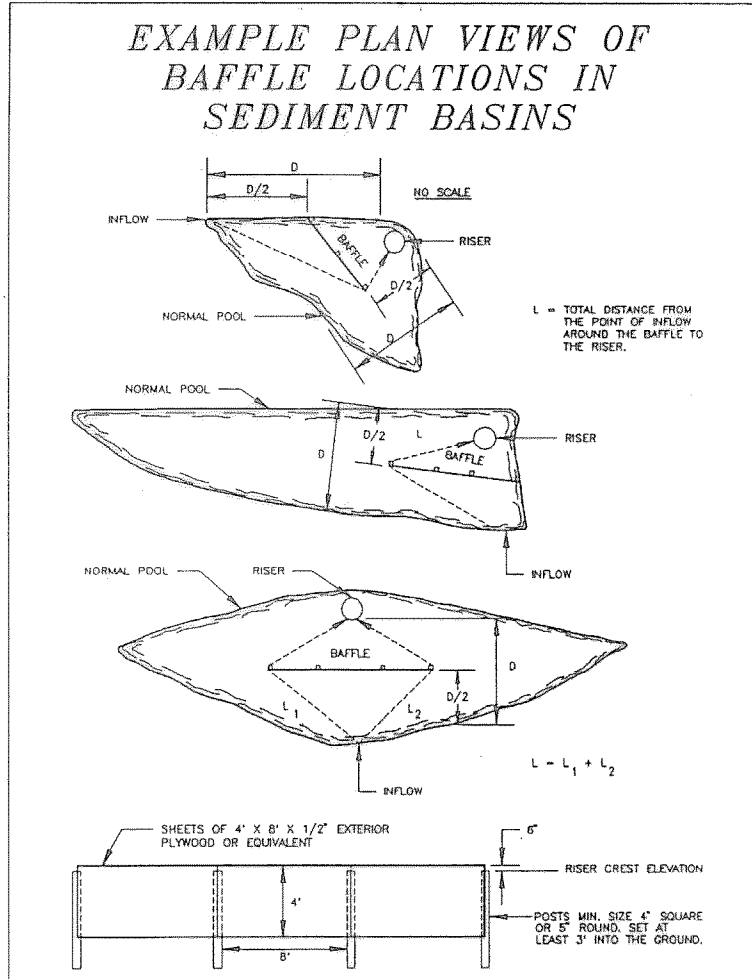
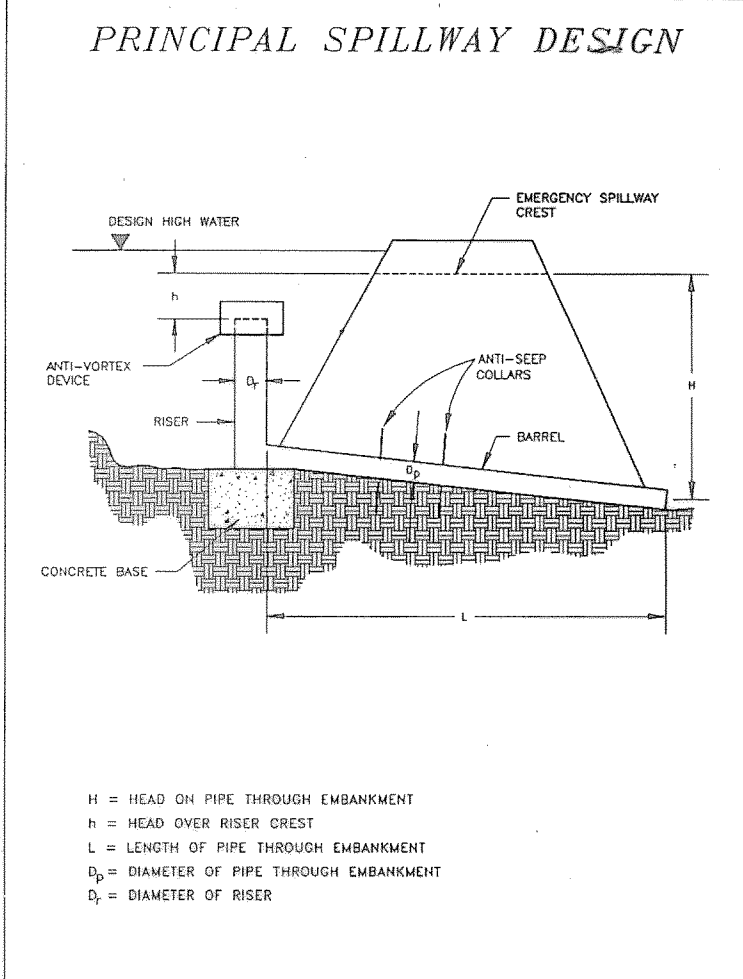
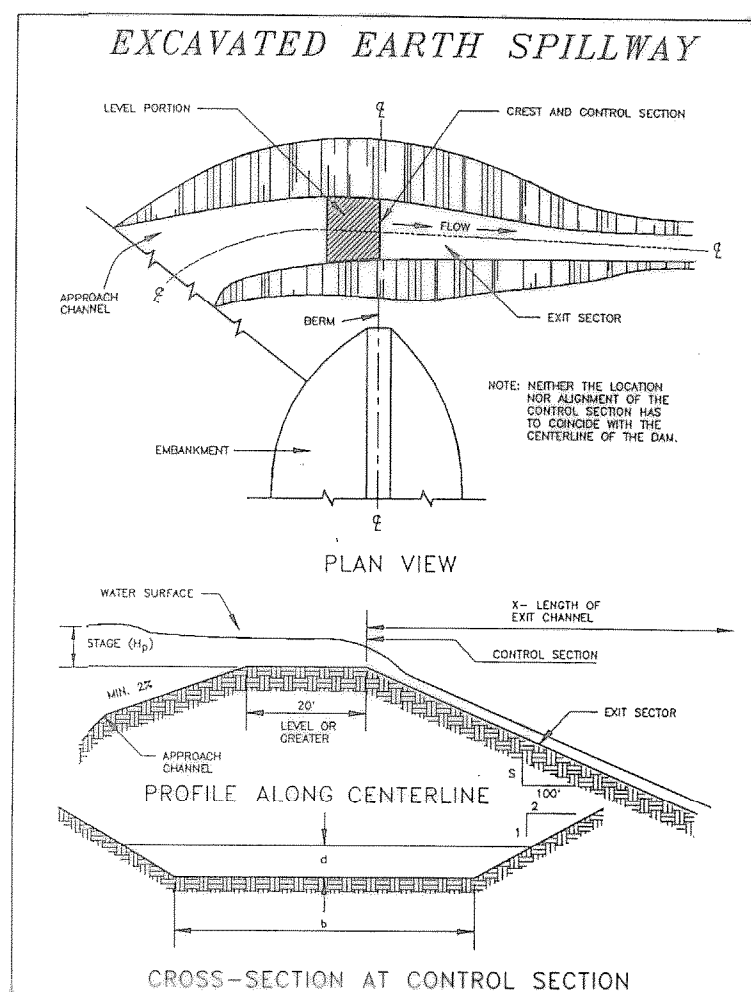
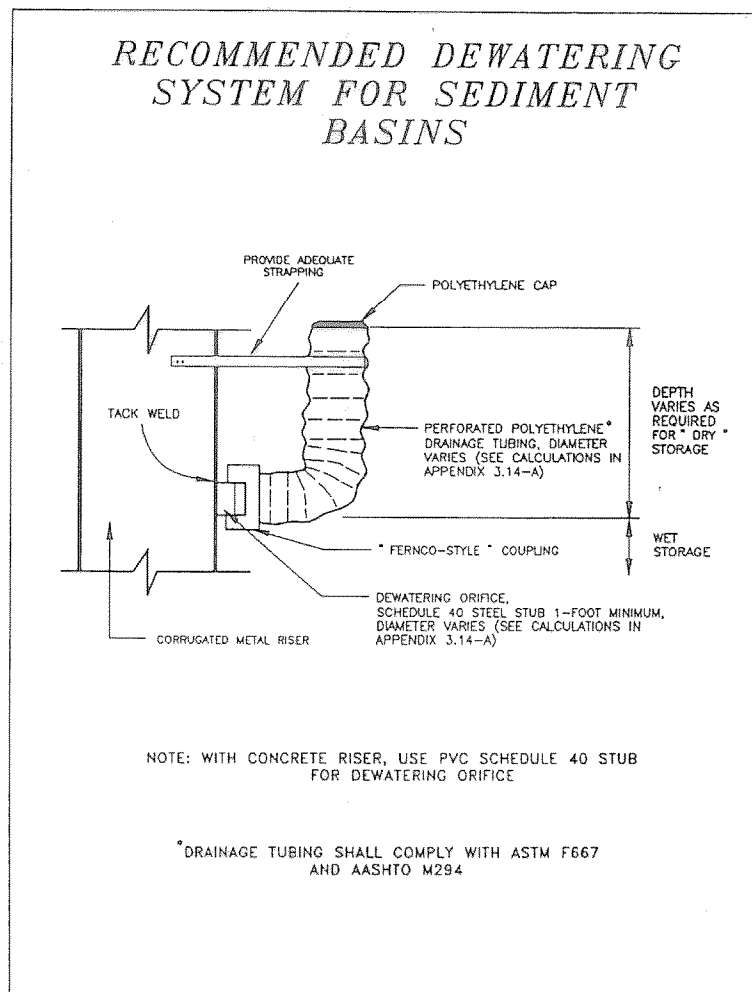
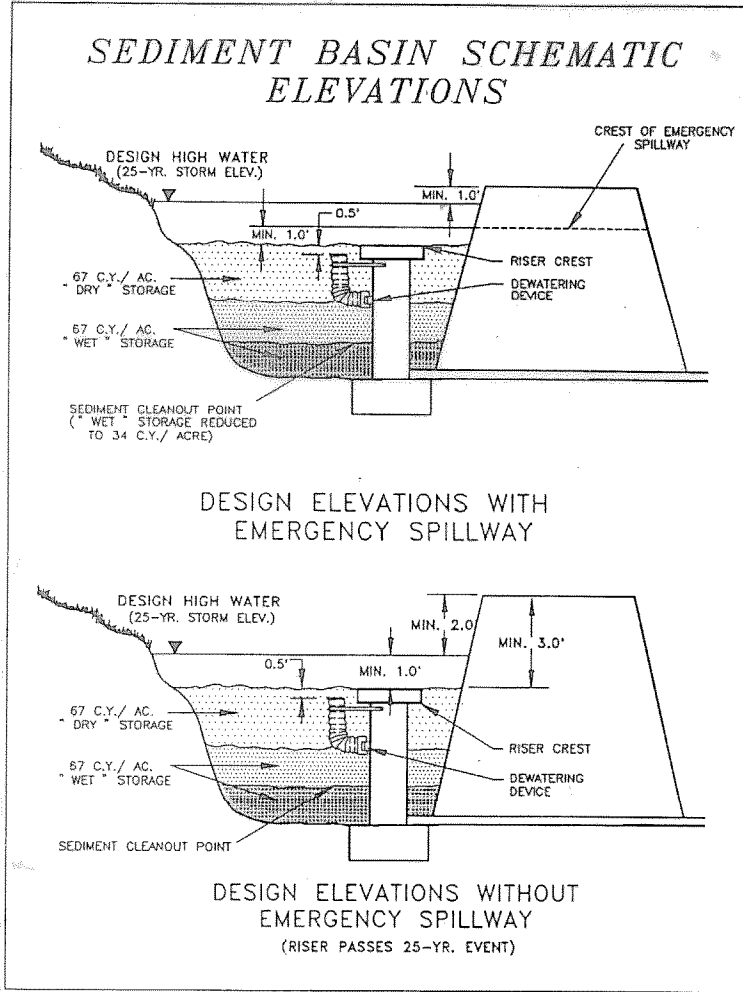


THIS PLAN IS FOR EROSION
CONTROL PURPOSES ONLY!

- NOTES:
1. THE EXISTING 8" SANITARY SEWER LINE AND EASEMENT BETWEEN MANHOLES #2 & #5 TO BE ABANDONED.

REVISION	DATE	DESCRIPTION
DESIGNED	GAM	EROSION CONTROL PLAN FOR PHASE I "TIMBERBROOK"
DRAWN	RAG, GAM	PREPARED FOR TIMBERBROOK ASSOCIATES, L.L.C.
CHECKED	MGM	AMSTERDAM MAGISTERIAL DISTRICT BOTETOURT COUNTY, VIRGINIA
LUMSDEN ASSOCIATES, P.C. ENGINEERS-SURVEYORS-PLANNERS ROANOKE, VIRGINIA		SCALE: 1" = 100' DATE: 1 JULY 1998 COMM: 97-452 SHEET 4 of 8





Riser Diam., in.	Cylinder Diameter, inches	Thickness, gage	Height, inches	Minimum Size Support Bar	Minimum Top Thickness	Stiffener
12	18	16	6	#6 Rebar or 1/4" x 3/16" angle	16 ga. (FAC)	-
15	21	16	7	"	"	"
18	27	16	8	"	"	"
21	30	16	11	"	16 ga.(C), 14 ga.(F)	-
24	36	16	13	"	"	"
27	42	16	15	"	"	"
30	54	14	17	#8 Rebar	14 ga.(C), 12 ga.(F)	-
42	60	16	19	"	"	"
48	72	16	21	1/4" pipe or 1/4" x 3/16" angle	14 ga.(C), 12 ga.(F)	-
54	78	16	25	"	"	"
60	90	14	29	1/4" pipe or 1/4" x 3/16" angle	12 ga.(C), 8 ga.(F)	-
66	96	14	33	7" pipe or 2 x 2 x 3/16 angle	12 ga.(C), 8 ga.(F) w/stiffener	2 x 2 x 1/4 angle
72	102	14	36	"	"	2 1/2 x 2 1/4 angle
78	114	14	39	2 1/2" pipe or 2 x 2 x 3/16 angle	"	"
84	120	12	42	2 1/2" pipe or 2 1/2 x 2 1/4 x 3/16 angle	"	2 1/2 x 2 1/4 x 3/16 angle

CONSTRUCTION SPECIFICATIONS

SITE PREPARATION

AREAS UNDER THE EMBANKMENT OR ANY STRUCTURAL WORKS RELATED TO THE BASIN SHALL BE CLEARED, GRUBBED, AND STRIPPED OF TOPSOIL TO REMOVE TREES, VEGETATION, ROOTS OR OTHER OBJECTIONABLE MATERIAL. IN ORDER TO FACILITATE CLEANOUT AND RESTORATION, THE AREA OF MOST FREQUENT INFUNDATION (MEASURED FROM THE TOP OF THE PRINCIPAL SPILLWAY) WILL BE CLEARED OF ALL BRUSH AND TREES.

CUTOFF TRENCH

FOR EARTH-FILL EMBANKMENTS, A CUTOFF TRENCH SHALL BE EXCAVATED ALONG THE CENTERLINE OF THE DAM. THE TRENCH MUST EXTEND AT LEAST 1 FOOT INTO A STABLE, IMPERVIOUS LAYER OF SOIL AND HAVE A MINIMUM DEPTH OF 2 FEET. THE CUTOFF TRENCH SHALL EXTEND UP BOTH ABUTMENTS TO THE RISER CREST ELEVATION. THE MINIMUM BOTTOM WIDTH SHALL BE 4 FEET, BUT ALSO MUST BE WIDE ENOUGH TO PERMIT OPERATION OF COMPACTION EQUIPMENT. THE SIDE SLOPES SHALL BE NO STEEPER THAN 1:1.

COMPACTION REQUIREMENTS SHALL BE THE SAME AS THOSE FOR THE EMBANKMENT. THE TRENCH SHALL BE DRAINED DURING THE BACKFILLING/COMPACTION OPERATIONS.

EMBANKMENT

THE FILL MATERIAL SHALL BE TAKEN FROM APPROVED BORROW AREAS. IT SHALL BE CLEAN MINERAL SOIL, FREE OF ROOTS, WOODY VEGETATION, STUMPS, SOIL, OVERSIZED STONES, ROCKS, OR OTHER PERISHABLE OR OBJECTIONABLE MATERIAL. THE MATERIAL SELECTED MUST HAVE ENOUGH STRENGTH FOR THE DAM TO REMAIN STABLE AND BE TIGHT ENOUGH, WHEN PROPERLY COMPACTED, TO PREVENT EXCESSIVE PERCOLATION OF WATER THROUGH THE DAM. FILL CONTAINING PARTICLES RANGING FROM SMALL GRAVEL OR COARSE SAND TO FINE SAND AND CLAY IN DESIRED PROPORTION IS APPROPRIATE. ANY EMBANKMENT MATERIAL SHOULD CONTAIN APPROXIMATELY 20% CLAY PARTICLES BY WEIGHT. USING THE UNIFIED SOIL CLASSIFICATION SYSTEM, SC (CLAYEY SAND), GC (CLAYEY GRAVEL) AND CL ("LOW LIQUID LIMIT" CLAY) ARE AMONG THE PREFERRED TYPES OF EMBANKMENT SOILS. AREA ON WHICH FILL IS TO BE PLACED SHALL BE SCARIFIED PRIOR TO PLACEMENT OF FILL. THE MATERIAL SHOULD CONTAIN THE PROPER AMOUNT OF MOISTURE TO ENSURE THAT 95% COMPACTION WILL BE ACHIEVED. FILL MATERIAL WILL BE PLACED IN 6-INCH CONTINUOUS LAYERS OVER THE ENTIRE LENGTH OF THE FILL. COMPACTION SHALL BE OBTAINED BY ROUTING THE HAULING EQUIPMENT OVER THE FILL SO THAT THE ENTIRE SURFACE OF THE FILL IS TRANSVERSED BY AT LEAST ONE WHEEL OR TREAD TRACK OF THE EQUIPMENT, OR BY USING A COMPACTOR. SPECIAL CARE SHALL BE TAKEN IN COMPACTION AROUND THE ANTI-SEEP COLLARS (COMPACT BY HAND, IF NECESSARY) TO AVOID DAMAGE AND ACHIEVE DESIRED COMPACTION. THE EMBANKMENT SHALL BE CONSTRUCTED TO AN ELEVATION 10% HIGHER THAN THE DESIGN HEIGHT TO ALLOW FOR SETTLEMENT IF COMPACTION IS OBTAINED WITH HAULING EQUIPMENT. IF COMPACTORS ARE USED FOR COMPACTION, THE OVERBUILD MAY BE REDUCED TO NOT LESS THAN 5%.

PRINCIPAL SPILLWAY

THE RISER OF THE PRINCIPAL SPILLWAY SHALL BE SECURELY ATTACHED TO THE BARREL BY A WATERTIGHT CONNECTION. THE BARREL AND RISER SHALL BE PLACED ON A FIRMLY COMPACTED SOIL FOUNDATION. THE BASE OF THE RISER SHALL BE FIRMLY ANCHORED ACCORDING TO DESIGN CRITERIA TO PREVENT ITS FLOATING. PVIOUS MATERIALS SUCH AS SAND, GRAVEL, OR CRUSHED STONE SHALL NOT BE USED AS BACKFILL AROUND THE BARREL OR ANTI-SEEP COLLARS. SPECIAL CARE SHALL BE TAKEN IN COMPACTION AROUND THE ANTI-SEEP COLLARS (COMPACT BY HAND, IF NECESSARY). FILL MATERIAL SHALL BE PLACED AROUND THE PIPE IN 4-INCH LAYERS AND COMPACTION UNTIL 95% COMPACTION IS ACHIEVED. A MINIMUM OF TWO FEET OF FILL SHALL BE HAND-COMPACTED OVER THE BARREL BEFORE CROSSING IT WITH CONSTRUCTION EQUIPMENT.

EMERGENCY SPILLWAY

VEGETATION EMERGENCY SPILLWAYS SHALL NOT BE CONSTRUCTED OVER FILL MATERIAL. DESIGN ELEVATIONS, WIDTH, ENTRANCE AND EXIT CHANNEL SLOPES ARE CRITICAL TO THE SUCCESSFUL OPERATION OF THE SPILLWAY AND SHOULD BE ADHERED TO CLOSELY DURING CONSTRUCTION.

VEGETATION STABILIZATION

THE EMBANKMENT AND EMERGENCY SPILLWAY OF THE SEDIMENT BASIN SHALL BE STABILIZED WITH TEMPORARY OR PERMANENT VEGETATION IMMEDIATELY AFTER INSTALLATION OF THE BASIN SEE TEMPORARY SEEDING, STD. & SPEC. 3.31 OR PERMANENT SEEDING, STD. & SPEC. 3.32).

EROSION AND SEDIMENT CONTROL

THE CONSTRUCTION OF THE SEDIMENT BASIN SHALL BE CARRIED OUT IN A MANNER SUCH THAT IT DOES NOT RESULT IN SEDIMENT PROBLEMS DOWNSTREAM.

SAFETY

ALL STATE AND LOCAL REQUIREMENTS SHALL BE MET CONCERNING FENCING AND SIGNS WARNING THE PUBLIC OF THE HAZARDS OF SOFT, SATURATED SEDIMENT AND FLOOD WATERS (REFER TO STD. & SPEC. 3.01, SAFETY FENCE).

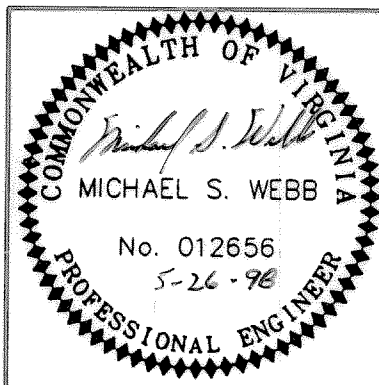
MAINTENANCE

THE BASIN EMBANKMENT SHOULD BE CHECKED REGULARLY TO ENSURE THAT IT IS STRUCTURALLY SOUND AND HAS NOT BEEN DAMAGED BY EROSION OR CONSTRUCTION EQUIPMENT.

THE EMERGENCY SPILLWAY SHOULD BE CHECKED REGULARLY TO ENSURE THAT ITS LINING IS WELL ESTABLISHED AND EROSION-RESISTANT.

THE BASIN SHOULD BE CHECKED AFTER EACH RUNOFF-PRODUCING RAINFALL FOR SEDIMENT CLEANOUT. WHEN THE SEDIMENT REACHES THE CLEAN-OUT LEVEL, IT SHALL BE REMOVED AND PROPERLY DISPOSED OF.

SEDIMENT BASIN DATA			
	BASIN 1	BASIN 2	BASIN 3
BARREL			
Barrel Diameter		15" CMP	
Barrel Length		65'	
Barrel Outlet Invert		1170.00	
Barrel Inlet Invert		1172.00	
Barrel Slope		3%	
Riprap Class at Outlet		I	
RISER			
Riser Diameter		36"	
Riser Top Elevation		1178.80	
Barrel Inlet Invert		1172.00	
Dewatering Device Diameter		6	
Dewatering Device Invert		1175.35	
Dewatering Device Tubing Dia.		8	
Anti-Vortex Diameter (D)		54"	
Anti-Vortex Height (H)		17"	
ANTI-SEEP COLLARS			
Number			
Size			
Spacing			
BAFFLES			
Length			
EMERGENCY SPILLWAY			
Bottom Elevation		1179.50	
Bottom Width		14	
Exit Channel Slope		20%	
Exit Channel Length		33	
EMBANKMENT			
Basin Bottom Elevation		1166.00	
Embankment Top Elevation		1181.50	
Interior Slope		2:1	
Exterior Slope		2:1	
Top Width		10	
CUT-OFF TRENCH			
Depth			
Width			
Slopes			



LUMSDEN ASSOCIATES, P.C.
ENGINEERS-SURVEYORS-PLANNERS
ROANOKE, VIRGINIA

SCALE: NONE
DATE: 1 JULY 1998
COMM: # 97-452
SHEET 6 of 8

CONSTRUCTION SPECIFICATIONS

SPECIAL CONDITIONS

1. A minimum cover of three (3) feet over the proposed lines is required.
2. No work shall begin without notifying Botetourt County 24 hours in advance. The contractor is responsible for obtaining any and all necessary permits.
3. No work shall begin without written approval of construction plans.
4. Work shall be subject to inspection by the County inspectors and design engineer.
5. Contractor shall be responsible for locating and uncovering all valve boxes and adjusting boxes to final road grades, if necessary.
6. All existing utilities may be shown or may not be shown in the exact location. The contractor shall comply with the State Water Works regulations, Section 12.05.03 where lines cross.
7. The contractor shall notify the County of any field corrections to the approved plans prior to such construction.
8. All trenches within the existing or future Virginia State Department of Highways and Transportation right-of-way must be compacted in six inch layers.
9. All lines to be staked prior to construction.
10. Contractor to coordinate with the Engineer to provide as-built plans. Contractor shall maintain a set of red-line plans showing as-built location of all structures. As-built information to be submitted to design engineer for preparation of record as-built plans. Such as-built plans shall be submitted to Botetourt County prior to County acceptance.
11. All construction shall be in accordance to approved construction practices of the applicable trades.
12. Unless noted otherwise herein all construction shall be in accordance to the latest edition of AWWA standards.

EXCAVATION, STABILIZATION AND BEDDING

A. TRENCHING

1. Excavation for trenches shall include the removal of all material encountered regardless of classification in accordance with the elevations and grades at the locations and stations indicated on the plans or specified herein.
2. Excavation, unless otherwise specified, shall be open cut. The Contractor shall open no more than two hundred (200) feet of trench at one time during the laying of pipe, unless approved by the Engineer.
3. Trenches shall be excavated in straight lines and shall be accurately graded in order to establish a true elevation for the invert of the pipe.
4. The width of trenches, from existing grade to one (1) foot above the top of the pipe shall be of sufficient width to permit the proper installation of bracing, shoring or sheeting.
5. The sides of the trenches shall be as vertical as practical.
6. Excavation for structures shall allow a minimum of twelve (12) inches clear between the structure and the sides of the trench or any required bracing, shoring or sheeting.
7. Excavated materials suitable for backfill shall be stockpiled in an orderly manner at a sufficient distance from the sides of the trench in order to avoid overloading the banks of the trench and to prevent slides or cave-ins.
8. Excavated materials which are not required or approved for backfill shall be removed from the site and disposed of by the Contractor, at his expense.
9. Contractor to adhere to all local, state and federal construction laws, including OSHA Trench Safety Regulations.

B. TRENCH STABILIZATION

1. Trench stabilization material shall be coarse aggregate size number 2 and shall conform with VDOT Section 203 and/or ASTM C 33.
2. Whenever excessively wet or unstable material is encountered in the bottom of the trench, which in the opinion of the Engineer is incapable of properly supporting the pipe or structures, such material shall be removed and backfilled with trench stabilization material and shall be graded to allow for the compacted bedding material.
 3. All unauthorized overdepths of excavation shall be backfilled, at the Contractor's expense, with trench stabilization material and shall be graded to allow for the compacted bedding material.

C. COMPACTED BEDDING MATERIAL

1. Bedding material shall be coarse aggregate size Number 57 and shall conform with VDOT Section 203 and/or ASTM C 33.
2. The bottom of the pipe trench shall be excavated to a minimum overdepth of four (4) inches below the bottom of the pipe, to provide for the compacted bedding material. Bedding material shall be placed, shaped and compacted prior to placement of the pipe. After placement of the pipe, bedding material shall be placed and compacted in six (6) inch layers up to the springline of the pipe.
3. Bell holes and depressions required for the jointing of the pipe shall be dug after the compacted bedding material has been graded and shaped and shall be only of the length, depth and width required to make the joint properly.

PIPE, JOINTS AND FITTINGS

A. SCOPE OF WORK

1. All materials and appurtenances required for the work shall be new, or first class quality and shall be furnished, delivered, erected, connected and finished in every detail as specified or indicated. All materials found defective, regardless of the circumstances, shall be replaced with new material at the expense of the Contractor.
2. The materials specified for the construction shall comply with the latest revisions of the applicable American Society for Testing Materials (ASTM), American National Standards Institute (ANSI) and/or the Virginia Department of Transportation (VDOT) standards.

B. PIPE SELECTIONS

1. The Contractor shall install only one (1) type of pipe between structures. Where existing pipe is to be replaced or extended the same type of pipe shall be installed, unless specified or indicated otherwise.
2. Sanitary sewers with an inside diameter less than or equal to twelve (12) inches shall be polyvinyl chloride pipe, SDR-35. Contractor shall obtain approval of pipe material by Botetourt County Engineer prior to beginning construction.

C. TYPES OF PIPE

1. PVC sewer pipe and fittings shall be SDR 35 (ASTM D 3034).

D. JOINTS COUPLINGS AND APPURTENANCES

1. PVC pipe and fittings shall be bell and spigot type joints. The bell and spigot joint shall be sealed with elastomeric gaskets conforming to ASTM D 3212. The joints shall be made in strict accordance with the recommendation of the pipe manufacturer.
2. All valves boxes deeper than five (5) vertical feet shall be American Flow Control Adjustable Trench Box or Botetourt County approved equal. All other materials and appurtenances to be in accordance with details shown on plans.

PIPE INSTALLATION

A. GENERAL

1. The Contractor shall not lay pipe or place manholes until all water has been removed from the trench, or when in the opinion of the Engineer, the trench or the weather conditions are unsuitable for work.
2. Pipe that may require field cutting shall be done so in a neat and workmanlike manner, so as to leave a smooth end at right angles to the axis of the pipe. Care shall be taken to avoid damaging the pipe and any coatings or linings.
3. The materials shall be visually inspected for defects before lowering the pipe or placing the manholes into the trench. During the laying operation no tools, clothing or other material shall be placed in the pipe or manhole. The interior of the pipe shall be clear of all soil, debris and superfluous materials prior to and during the installation.
4. The Contractor shall exercise every precaution to prevent foreign material from entering the pipe while it is being placed in the trench. Failure by the contractor to take such precautions may result in the Engineer requiring a heavy, lightly woven canvas bag of suitable size be placed over each end of the pipe and removed only when the joint can be made properly.
5. The pipe and manholes shall be lowered carefully into the trench by suitable means and handled with care at all times to avoid damage. Under no circumstances shall the materials be dropped or dumped into the trenches.
6. When work is not in progress, the Contractor shall plug the open ends of the pipe to prevent trench water or other substances from entering the pipe. The plug shall be watertight and shall remain in place until any required dewatering has been completed.
7. Parallel Installation - Water lines shall be laid at least ten feet horizontally from a sewer or sewer manhole whenever possible. When local conditions prevent a horizontal separation of ten feet, the water line may be laid closer to a sewer or sewer manhole provided that:
 - I. The invert of the water main shall be at least 18 inches above the crown of the sewer.
 - II. Where this vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved water pipe, pressure tested in place without leakage prior to backfilling.
 - III. The sewer manhole shall be of water-tight construction and tested in place.Crossing - Water lines crossing sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water line and the top of the sewer whenever possible. When local conditions prevent this vertical separation, the following construction shall be used:
 - I. Sewers passing over or under water lines shall be constructed of AWWA approved water pipe, pressure tested in place without leakage prior to backfilling.
 - II. Water lines passing under sewers shall, in addition, be protected by providing:
 - (a) A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line,
 - (b) Adequate structural support for the sewers to prevent excessive deflection of the joints and the settling on and breaking of the waterline, and
 - (c) That the length of the water line be centered at the point of the crossing so that joints shall be equal distance and as far as possible from the sewer.
8. Before joints are made the pipe shall be well bedded on a firm foundation and no pipe shall be brought into position until the preceding length has been thoroughly embedded and secured in place. Any defects due to settlement shall be made good by the Contractor at his expense. Bell holes shall be dug sufficiently large to insure the making of proper joints.
9. Pipe shall be jointed in full accordance with manufacturer's recommendations. Push-on joints shall be thoroughly cleaned, the rubber gasket inserted in the bell socket, a thin film of approved gasket lubricant applied, the spigot end of the pipe centered into the socket and the joint completed by forcing the spigot end to the bottom of the socket by a jack-type tool or other device approved by the Engineer.

B. INSTALLING SEWER PIPE & MANHOLES

1. The installation of the sanitary sewer system shall begin at the downstream manhole and proceed upstream. The downstream sections shall be completed, tested and approved prior to allowing sanitary sewage to enter the system.

2. The pipe shall be installed in accordance with the pipe manufacturer's recommendations and as directed by the Engineer. The pipe shall be laid in true straight lines with the bell ends upstream and with the invert of the pipe being the true elevation and grade of the system.

3. The Contractor shall be responsible for establishing and maintaining the horizontal alignment and vertical elevation and grade of the system in accordance with the survey information indicated on the plans.

4. The horizontal alignment of the pipe shall be maintained by a transit or theodolite plumbed over the center of the downstream manhole. The vertical elevation and grade shall be maintained by not less than three (3) batter boards placed between manholes or by an adjustable laser level mounted at the invert of the downstream manhole with target(s) placed in the bell and of the pipe being laid.

5. Sewer pipe shall be installed in 4 inch gravel bedding extending to the springline of pipe and in accordance with manufacturers recommendations.

6. The sanitary sewer system shall be laid and joined complete-in-place so that each length and section of pipe between the manholes shall have a smooth and uniform invert.

7. The pipe shall be connected to manholes through precast openings and joined with a flexible boot adapter.

8. Detection tape to be installed 12" to 18" above all new sewer pipe mains and sewer service laterals.

E. CONNECTION TO EXISTING SYSTEMS

1. The new pipe connection to be made to an existing manhole where no stub or opening exists, shall be made through an opening of maximum diameter cut into the manhole wall at the required location and elevation.
2. The existing invert channels and benches shall be reworked as required to form a new flow channel from the new connection to the existing flow channel.
3. The new pipe connected to an existing manhole shall be secured in position and the remaining opening shall be filled and sealed with brick and mortar. The outer surface of the connection shall be given a coat of heavy bitumastic waterproofing compound.

BACKFILLING

A. JOB CONDITIONS

1. Prior to placing backfill, all organic, rubbish debris or other unsuitable or objectionable material within the trench shall be removed. All concrete forms shall be removed. All shoring or sheeting shall be removed or cut off at the depth stipulated by the Engineer.
 2. Prior to placing backfill, the trench box shall be removed. All concrete forms shall be removed. All shoring or sheeting shall be removed or cut off at the depth stipulated by the Engineer.
2. Backfill material shall be placed in uniform horizontal layers and thoroughly compacted with proper mechanical or hand operated tampers or other equipment as approved by the Engineer to perform such work.
3. Backfill material shall be placed and compacted so as to not unevenly support, damage or displace the alignment of the pipe or structures.
4. Backfill material shall not be placed or compacted against cast in place concrete until it has obtained sufficient strength to withstand the backfilled pressure placed upon it.
5. Upon the completion of backfilling, all excess soil, stones and debris shall be removed from the site and disposed of by the Contractor.

B. BACKFILL MATERIAL

1. Materials for backfill shall be approved excavated material or approved suitable material obtained from other sources.
2. Material shall consist of durable natural granular material or granular aggregates free of organic material, loam, debris, or other objectionable material which cannot be thoroughly compacted.
3. Material shall not contain stones larger in diameter than those specified herein, granite, broken concrete, masonry rubble or other material which in the opinion of the Engineer is unsuitable for backfill.
4. Excessively wet excavated material shall not be used as backfill. Frozen material shall not be placed in the trench, nor shall approved backfill be placed upon frozen material. However, backfilling may be allowed in freezing weather with prior approval of the Engineer.

C. BACKFILL

1. Backfill from the top of the pipe bedding to one (1) foot above the top of the pipe shall be free of stones larger than two (2) inches in diameter and shall be placed in layers not to exceed six (6) inches and compacted with hand operated tampers.
2. Backfill from one (1) foot above the top of the pipe to the surface shall be free of stones larger than four (4) inches in diameter and shall be placed in layers not to exceed six (6) inches and compacted with mechanical tampers.

INSPECTION AND TESTS

A. TESTING OF SANITARY SEWER

1. The Contractor shall prove the watertightness of the sewer system or portions thereof by one of the following tests, at such times as the Engineer may direct. Tests shall be made only in the presence of the Engineer. The Contractor shall furnish all labor and equipment required for the test and shall make repairs necessary until test results are satisfactory. Botetourt County Engineer shall be notified of all tests 48 hours prior to conducting such tests. All tests shall be coordinated with the Design Engineer for his attendance and observation.

B. AIR TEST

The testing equipment, procedure, and results will all be subject to the strict approval of the Engineer. Results of the air test will be reviewed for compliance with ASTM designation C-828, current revision. The air test is to be conducted between two (2) consecutive manholes. The test equipment shall consist of two (2) plugs (one tapped and equipped for air inlet connection), a shut-off valve, a pressure regulating valve, a pressure reduction valve, and a monitoring pressure gauge having a pressure range from 0 to 5 psi, graduated in 0.10 psi with an accuracy of plus/minus .04 psi. The test equipment shall be set up outside the manhole for easy access and reading. Air shall be supplied to the test slowly and shall be regulated to prevent the pressure inside the pipe from exceeding 5.0 psig. The pipeline shall be filled until a constant internal pressure of 3.5 psig is maintained. The internal pressure shall be maintained at 3.5 psig or slightly above for a five (5) minute stabilization period, after which time the internal pressure will be adjusted to 3.5 psig, the air supply shut off and the test begun. No person shall remain in the manhole while pipe is being pressurized or throughout the test for safety purposes. A pressure drop of 1.0 psi from 3.5 to 2.5 psig shall be allowed for the test times specified in the following table, based upon the designated pipe size and test segment length.

AIR TEST TABLE

BASED ON EQUATIONS FROM ASTM C-828-80 SPECIFICATIONS TIME (MIN:SEC) REQUIRED FOR PRESSURE DROP FROM 3.5 TO 2.5 PSI WHEN TESTING ONE PIPE DIAMETER ONLY.

PIPE DIAMETER, INCHES

LENGTH OF TEST SEGMENT	4	6	8	10	12	15	18
25	0:04	0:10	0:18	0:28	0:40	1:02	1:29
50	0:09	0:20	0:35	0:55	1:19	2:04	2:58
75	0:13	0:30	0:53	1:23	1:59	3:06	4:27
100	0:18	0:40	1:10	1:50	2:28	4:08	5:56
125	0:22	0:50	1:28	2:18	3:18	5:09	7:26
150	0:26	0:59	1:46	2:45	3:58	6:11	8:30
175	0:31	1:09	2:03	3:13	4:37	7:05	
200	0:35	1:19	2:21	3:40	5:17		
225	0:40	1:29	2:38	4:08	5:40		
250	0:44	1:39	2:56	4:35		8:31	
275	0:48	1:49	3:14	4:43			9:21
300	0:53	1:59	3:31			10:12	
350	1:02	2:19	3:47			8:16	11:54
400	1:10	2:38			6:03	9:27	13:36
450	1:19	2:50			6:48	10:38	15:19
500	1:28			5:14	7:34	11:49	17:01

Should the 1.0 psi drop occur in less time than that specified in the table, the sewer segment shall have failed. If the time required for the pressure to drop 1.0 psi is greater than that shown in the table, the sewer segment shall have passed.

For a more detailed description of the air test method refer to ASTM designation C-828, current revision. An air pressure correction shall be required when the prevailing ground water is above the sewer line being tested and shall be calculated as follows:

Ground Water Depth (ft) + 3.5 = Starting Test Pressure

2.31

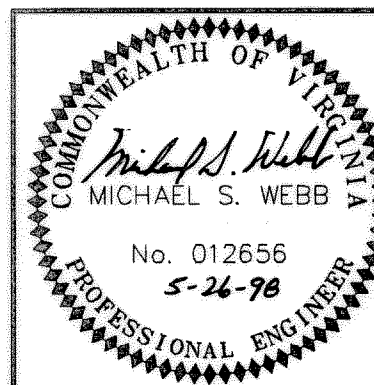
Ending Test Pressure = Starting Pressure - 1.0 psi

There is no change from time requirements established for the basic air test.

Manholes shall be tested by exfiltration by plugging lines with inflatable stoppers and filling the manhole with water for 12 hour soak period. Leakage shall not exceed one-half (1/2) gallon per hour in the two hour test period following the soak period. An approved air test for manholes will also be considered. Ex-filtration tests performed by approved vacuum tests procedures shall be acceptable.

C. MANDREL TEST

All sewer lines shall be tested by pulling a standard test mandrel between test sections.



REVISION	DATE	DESCRIPTION
1	7 AUG. 1998	REVISED SPECIFICATIONS.
DESIGNED	GAM	CONSTRUCTION SPECIFICATIONS FOR PHASE I "TIMBERBROOK" PREPARED FOR TIMBERBROOK ASSOCIATES, L.L.C. AMSTERDAM MAGISTERIAL DISTRICT BOTETOURT COUNTY, VIRGINIA
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CHECKED	MSW	

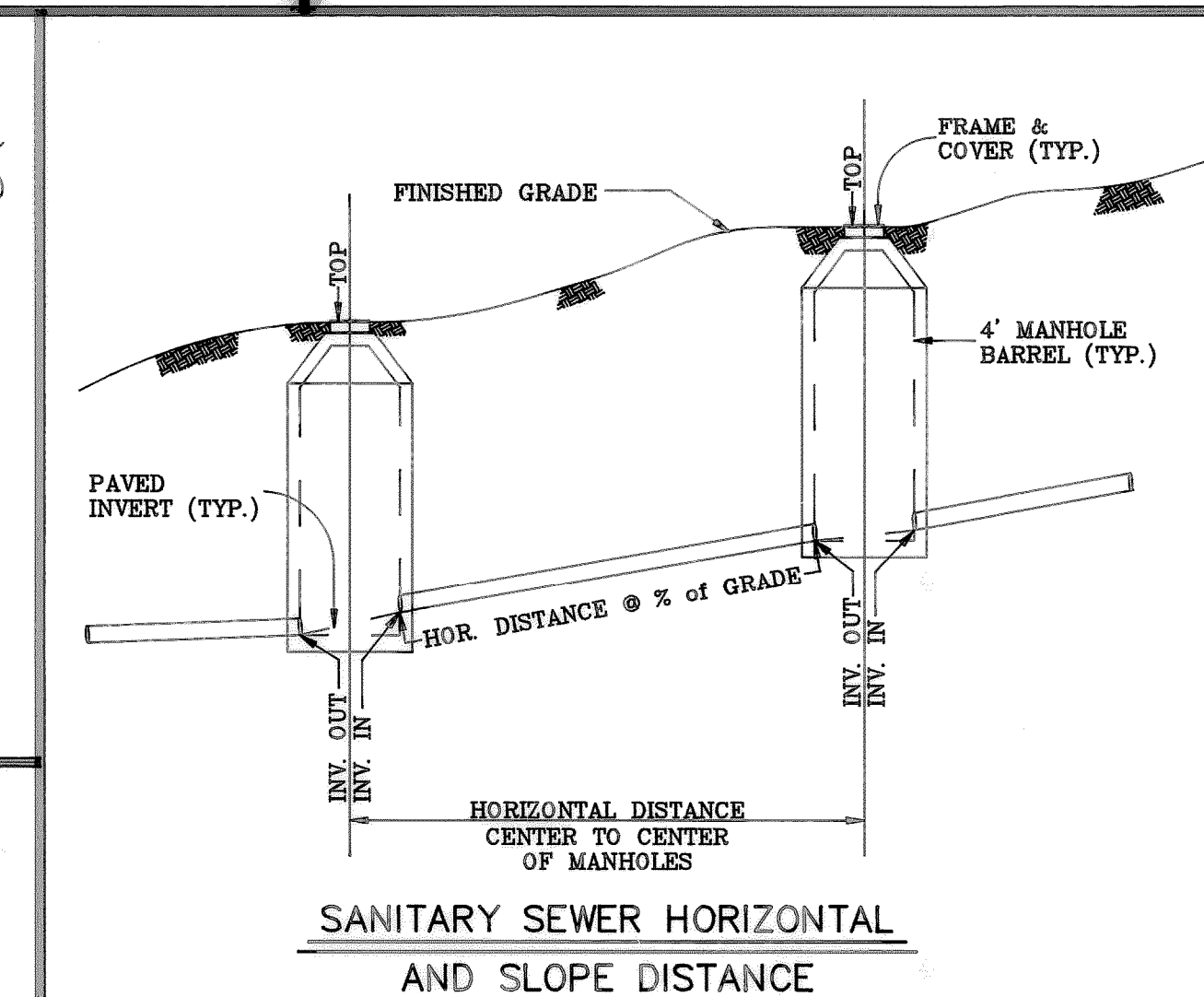
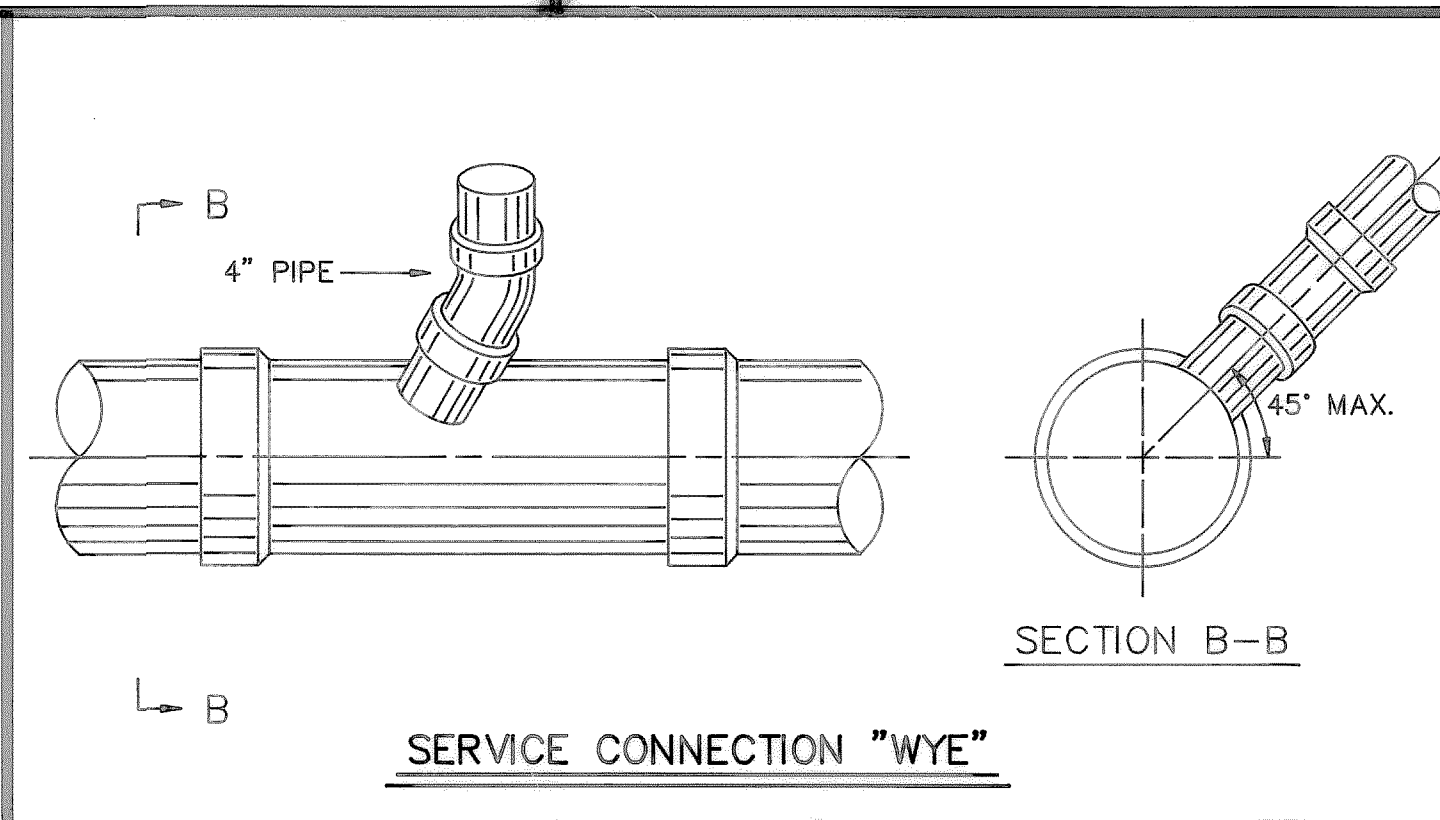
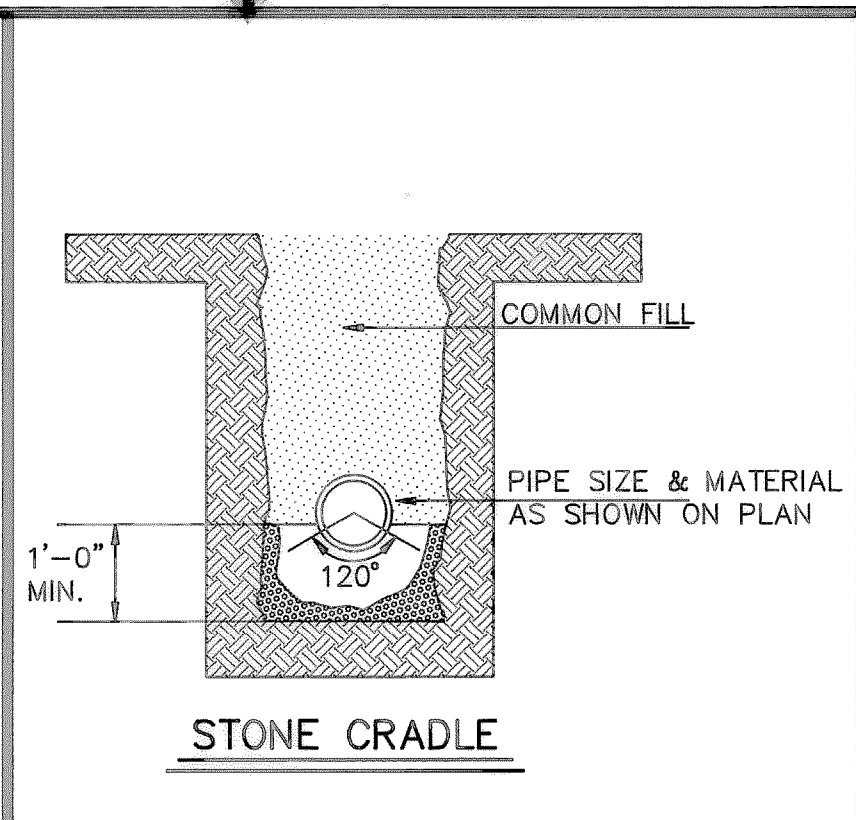
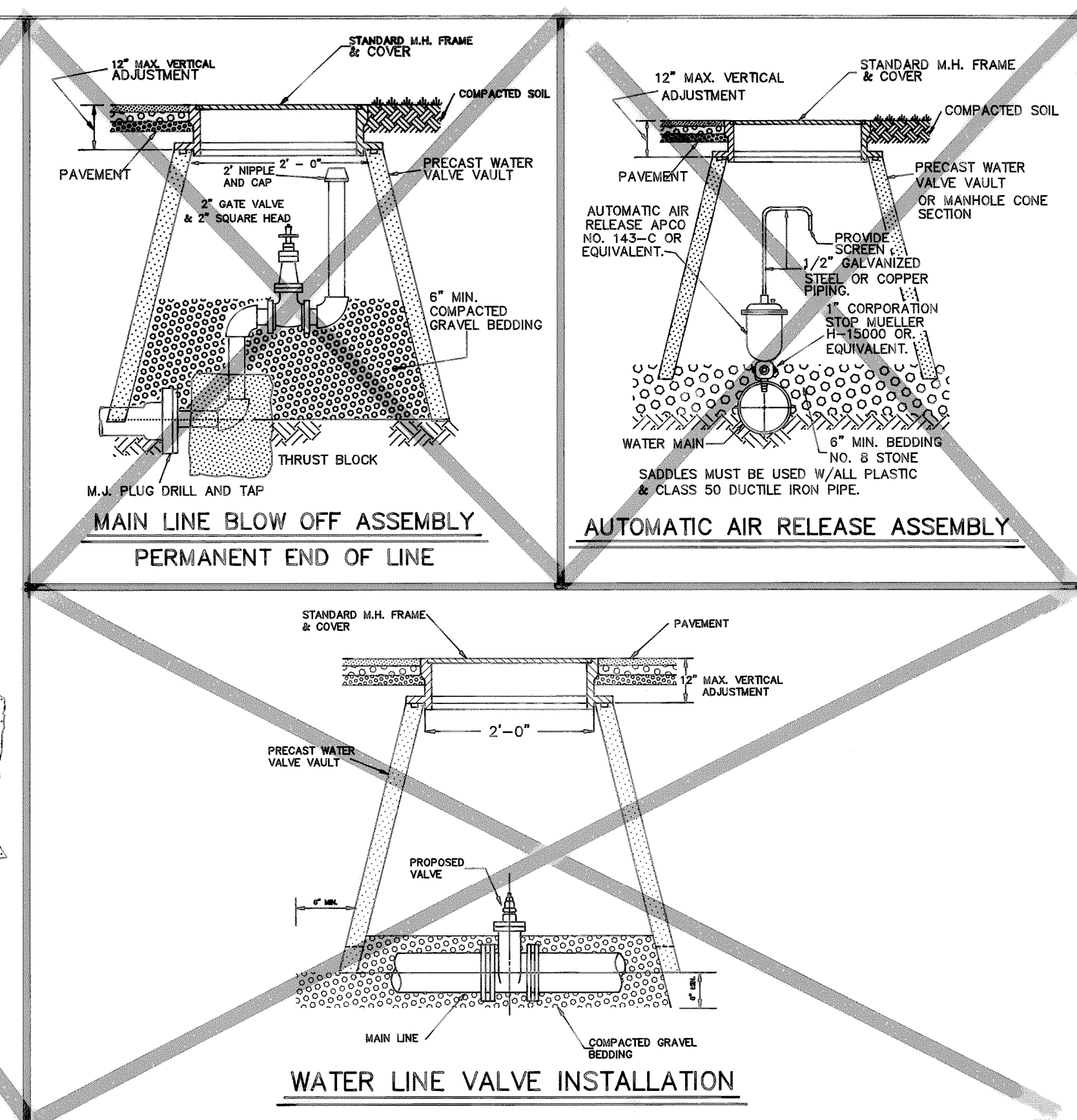
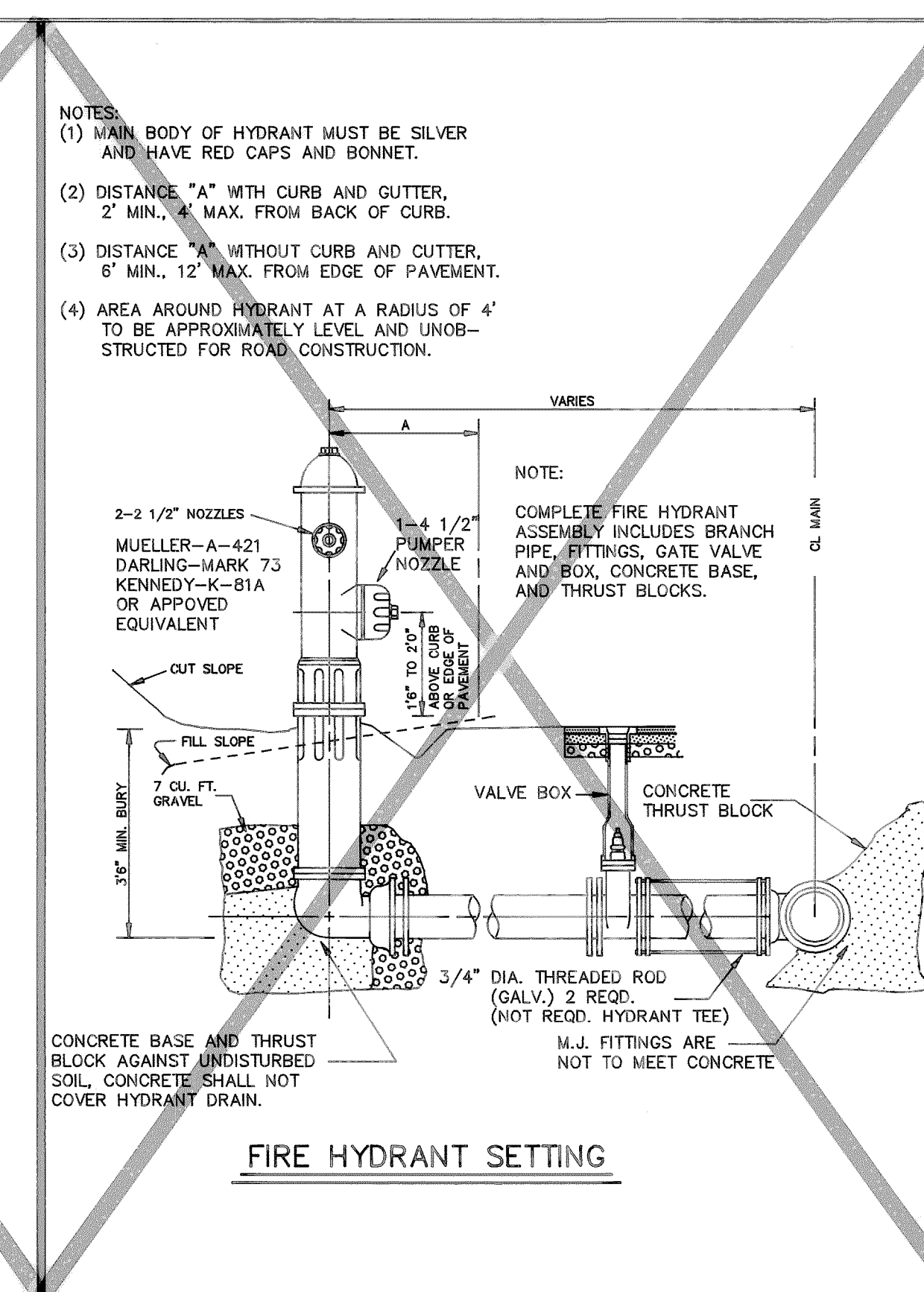
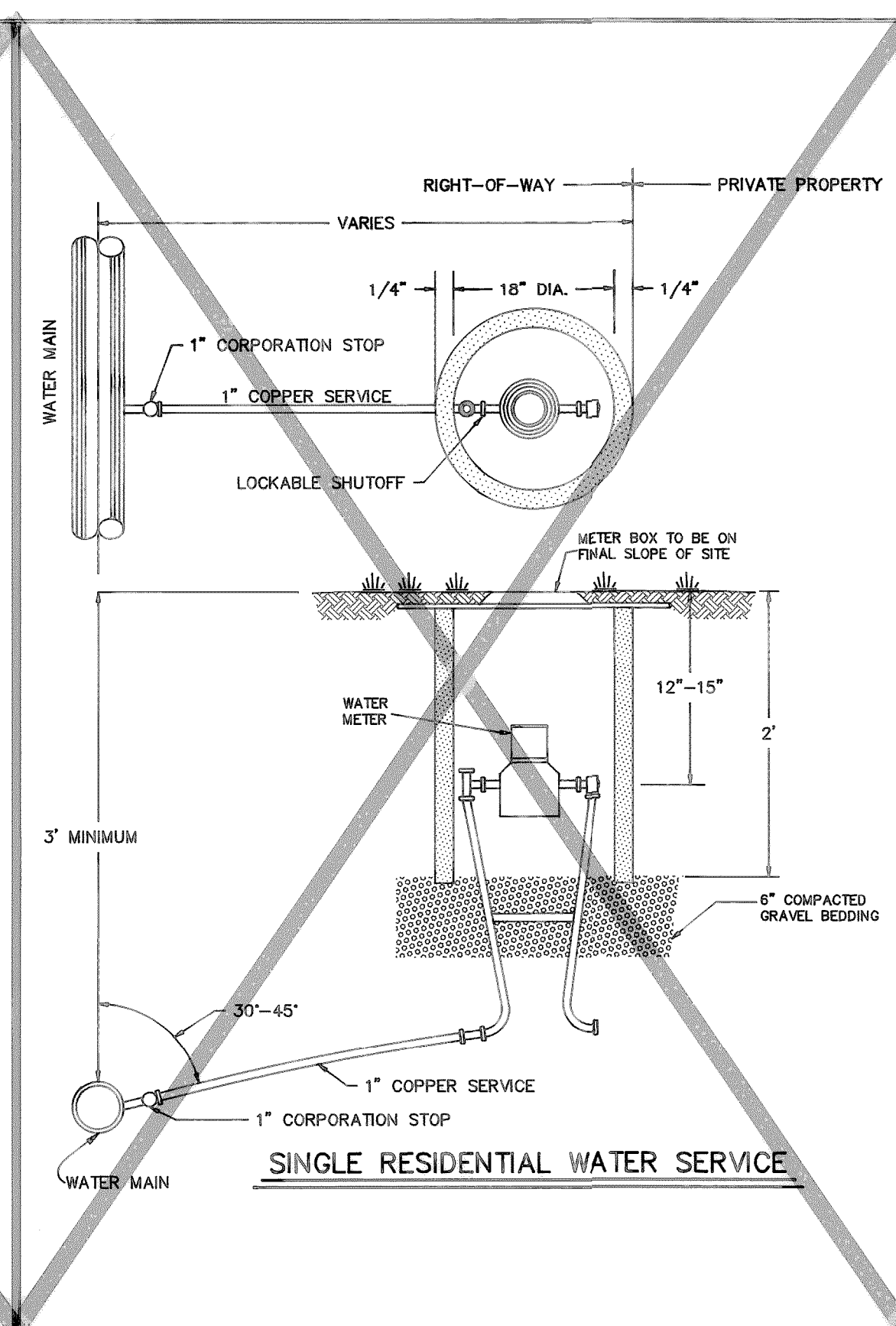
LUMSDEN ASSOCIATES, P.C.
ENGINEERS-SURVEYORS-PLANNERS
ROANOKE, VIRGINIA

SCALE: **NONE**

COMM: 97-452

DATE: 1 JULY 1998

SHEET 7 of 8



1. THE CONTRACTOR SHALL SCHEDULE A PRECONSTRUCTION MEETING WITH BOTETOURT COUNTY ENGINEER PRIOR TO CONSTRUCTION.
2. ALL DISTURBED AREAS SHALL BE REGRADED AND RESEED.
3. ALL OPEN CUT DRIVEWAYS SHALL BE PATCHED AND REPAIRED WITH MATERIAL SIMILAR TO PRECONSTRUCTION UNLESS OTHERWISE AGREED UPON, IN WRITING, BY THE CONTRACTOR WITH THE HOMEOWNER.
4. THE CONTRACTOR SHALL BE RESPONSIBLE TO CONTACT ALL UTILITIES PRIOR TO CONSTRUCTION.
5. THE CONTRACTOR SHALL PAY STRICT ATTENTION TO MUD AND DIRT ACCUMULATION ON ANY ROADWAY SURFACE AND SHALL REMOVE ANY ACCUMULATION IMMEDIATELY.
6. DETECTION TAPE TO BE INSTALLED 18"-24" ABOVE ALL MAINS AND LATERALS.

