

"AS BUILT" MARCH 29, 2002
SITE PLAN
FOR
PARCEL A, PHASE III
"BOTETOURT COMMONS"

SITUATED IN
AMSTERDAM MAGISTERIAL DISTRICT
BOTETOURT COUNTY, VIRGINIA

DATE: 11 JANUARY 2002

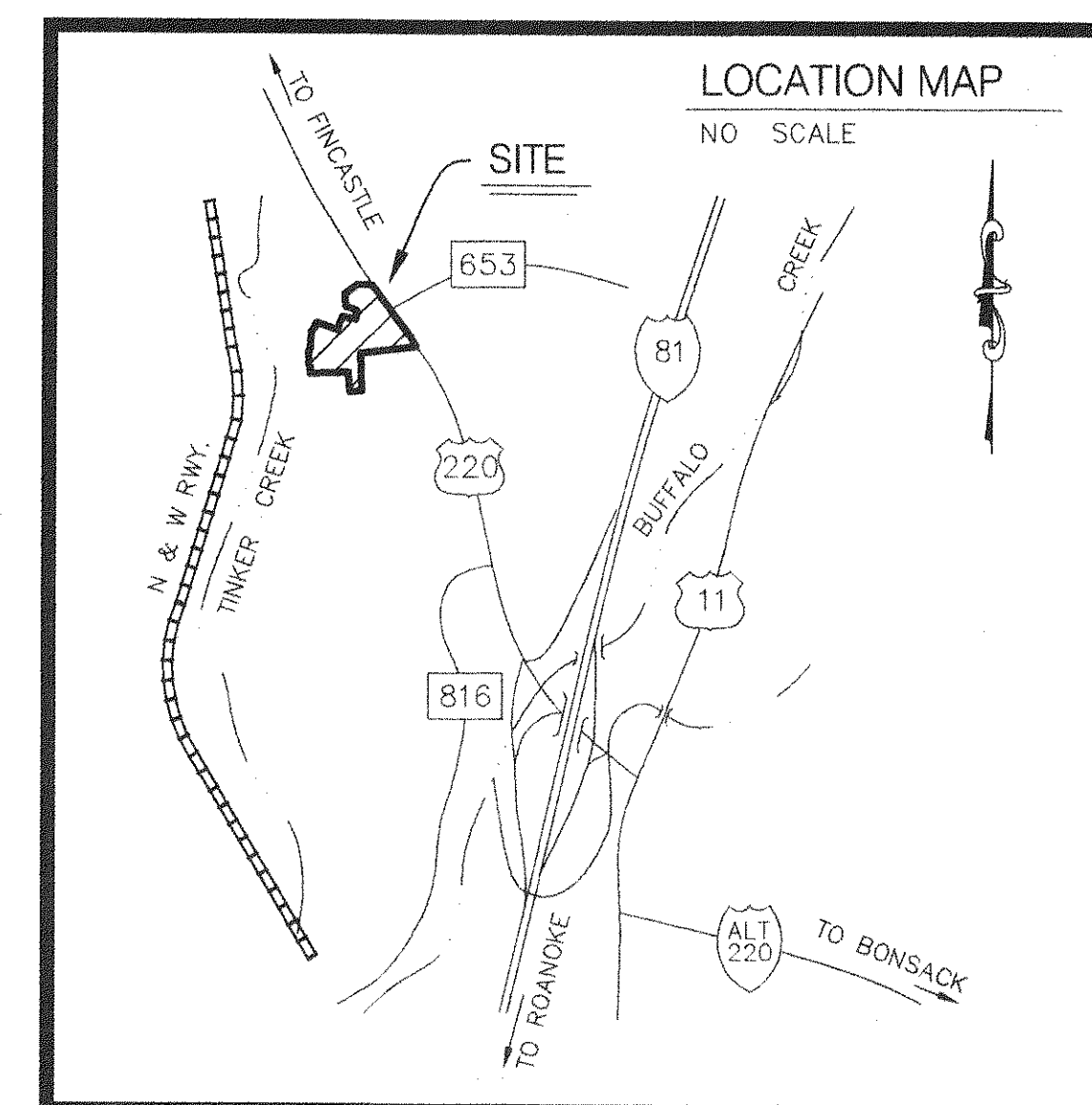
OWNER / DEVELOPER
TIMBERBROOK ASSOCIATES, L.C.
P.O. BOX 20287, ROANOKE, VIRGINIA 24018
(540) 989-7060

"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.

*SCHEDULE
FINAL 11/20/02
TESTING RESULTS
SUBMIT AS BUILTS 2 COPIES*



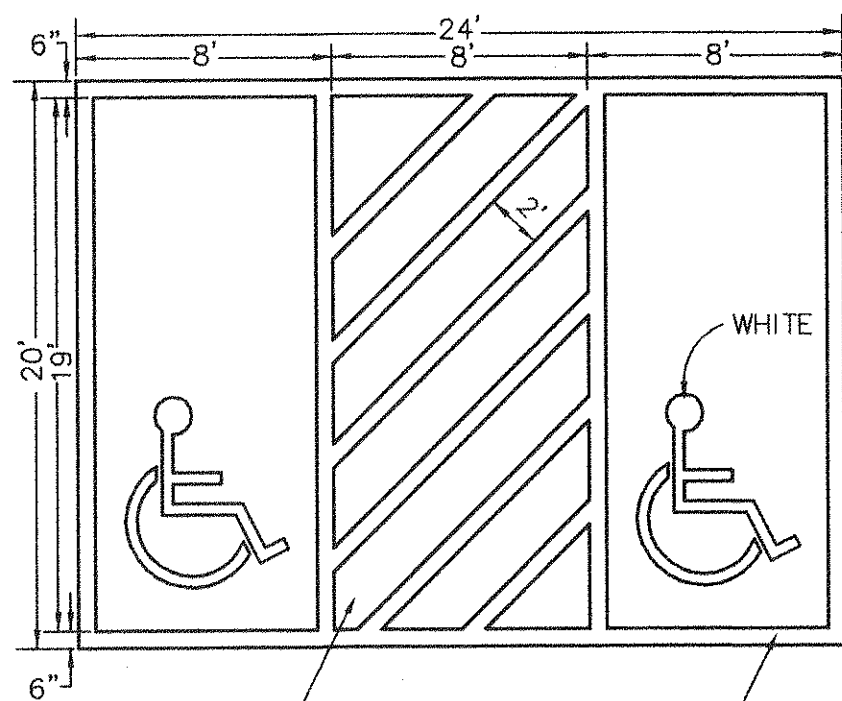
INDEX OF DRAWINGS

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

P.O. BOX 20669, ROANOKE, VIRGINIA 24018 - (540) 774-4411

REVISIONS			
DATE	SHEETS	DATE	SHEETS



TWO HANDICAPPED SYMBOLS REQUIRED IF APPROACHED FROM BOTH ENDS

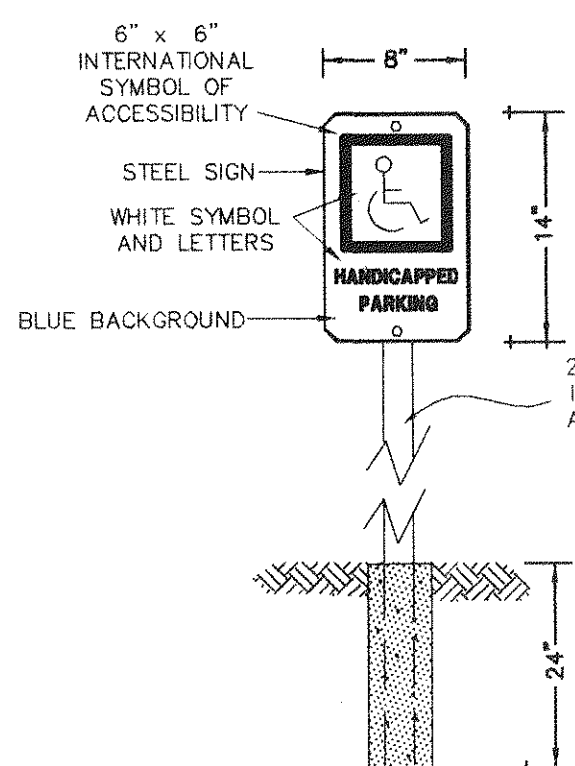
6" STRIPES AT 45° 2' APART

WHITE OUTLINE

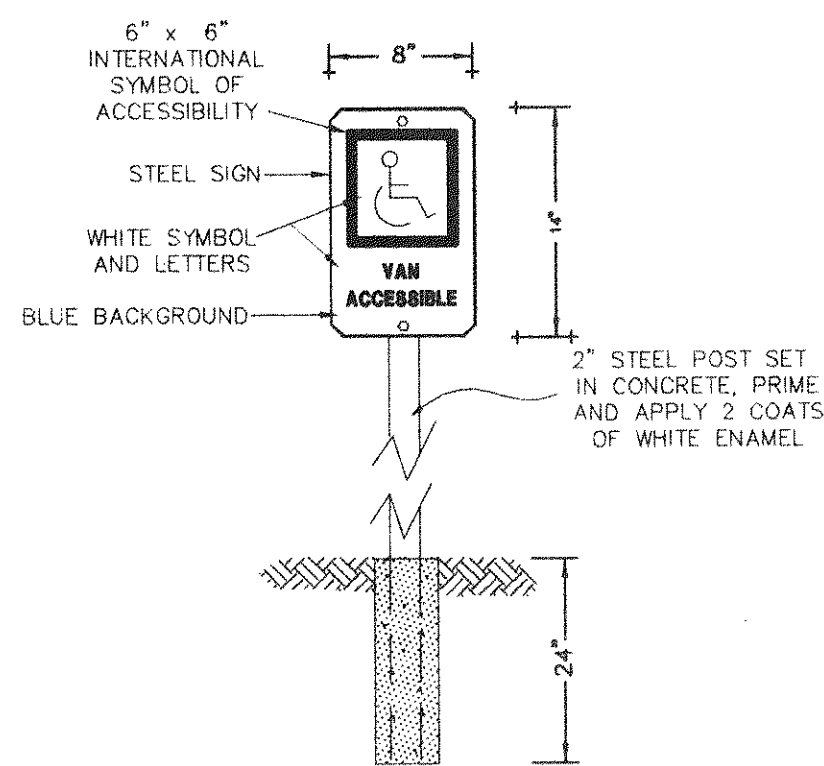
PAINT: DURO KOTE ACRYLIC LATEX WHITE

NOTE: THIS DESIGN IS TO BE USED FOR MULTIPLE SPACES ONLY.

HANDICAP PARKING SPACE

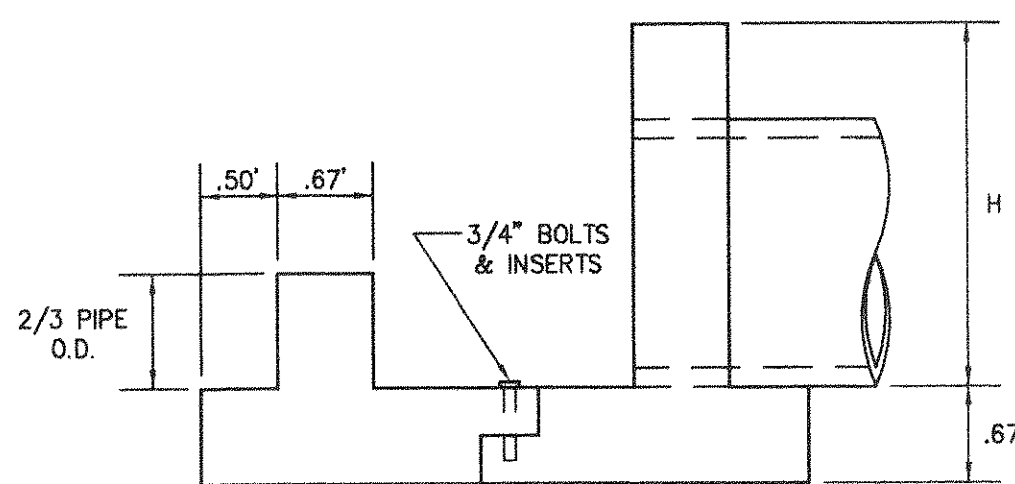
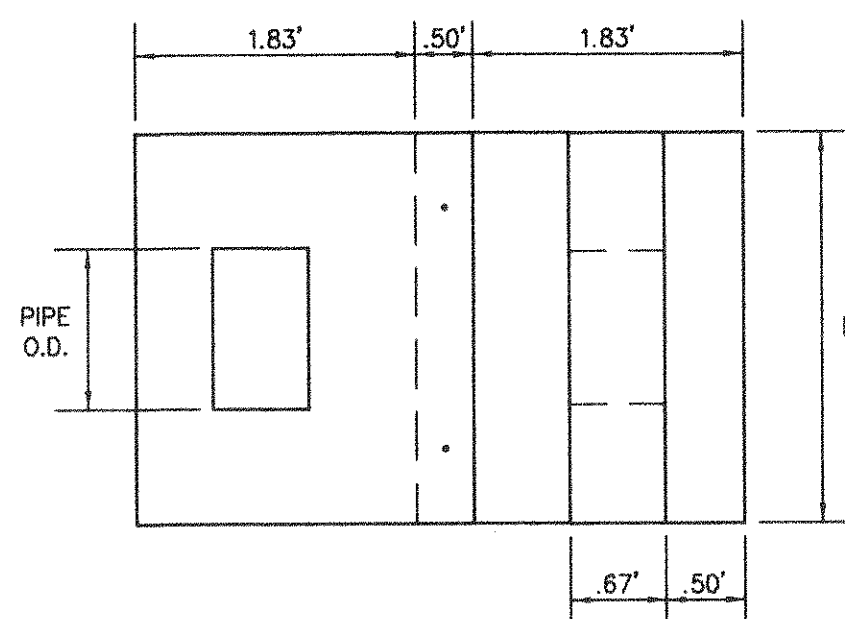


HANDICAP PARKING SIGN (S1)



VAN ACCESSIBLE HANDICAP PARKING SIGN (S2)

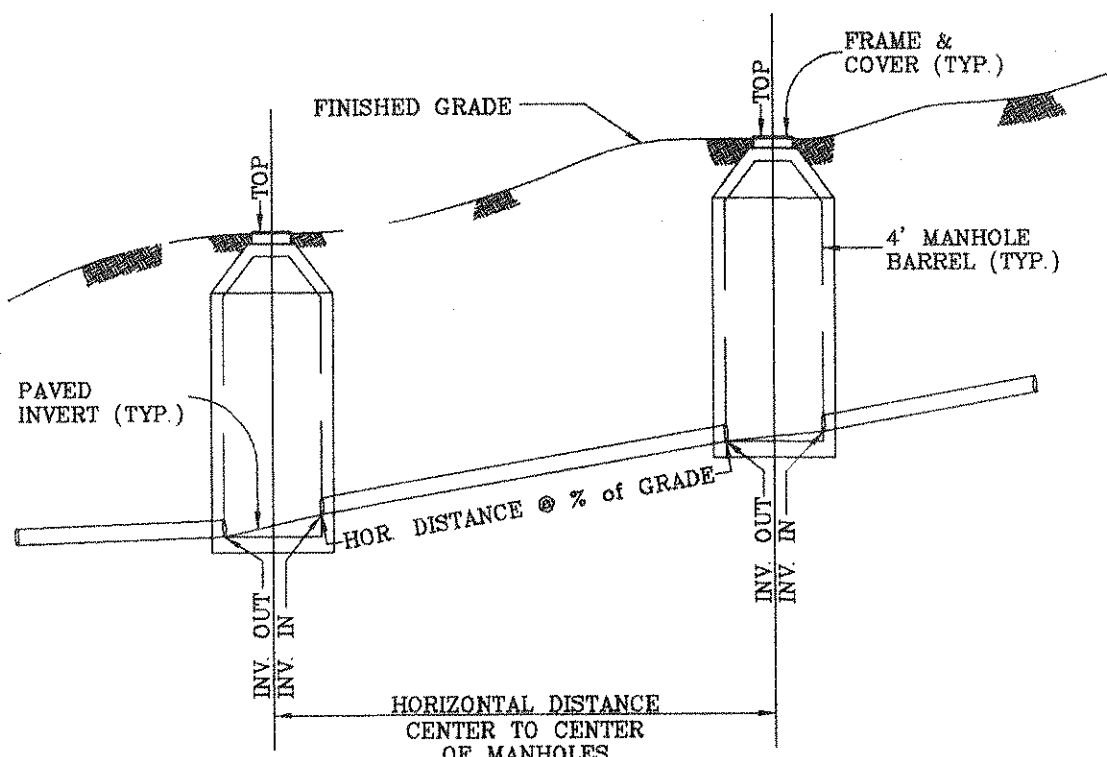
PIPE I.D.	H	L
12"	2.00'	4.00'
15"	2.25'	5.00'
18"	2.50'	6.00'
24"	3.17'	8.00'
30"	3.83'	10.00'
36"	4.50'	12.00'



NOTES:

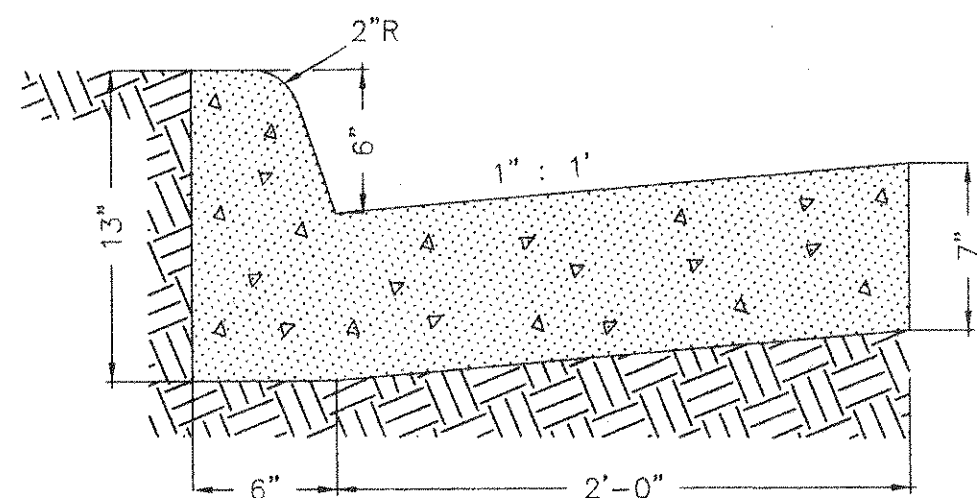
- CONCRETE 4,000 P.S.I.
- REINFORCING #4 @ 8" C.C. E.W. DOUBLE ROW THROUGHOUT.

EW-1 MODIFIED WITH ENERGY DISSIPATOR



SANITARY SEWER HORIZONTAL AND SLOPE DISTANCE DETAIL

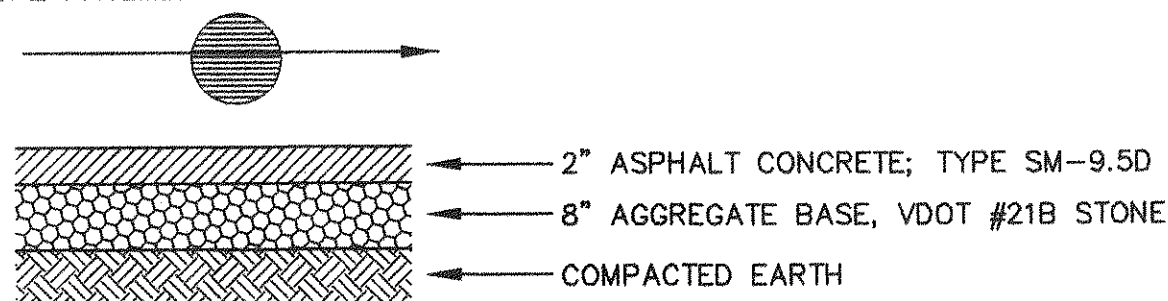
NO SCALE



CONCRETE CURB AND GUTTER (CG-6)

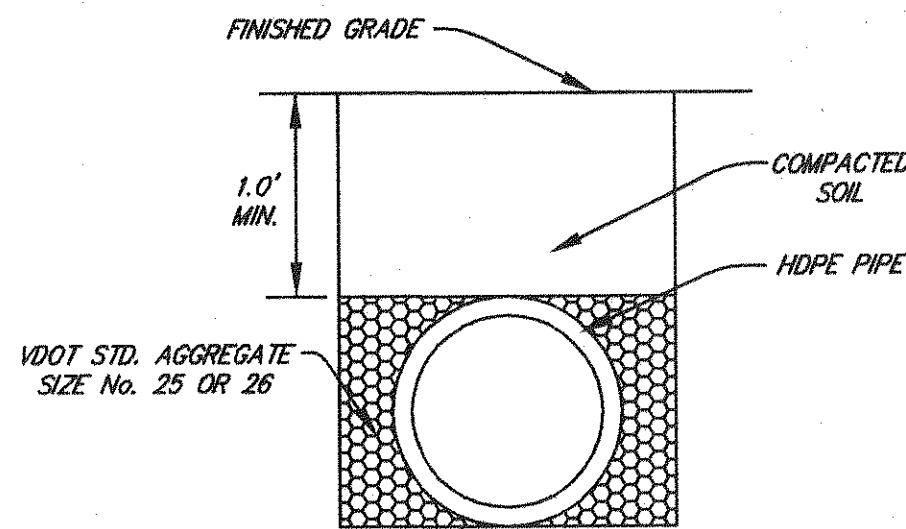
NO SCALE

SLOPE PAVEMENT IN ACCORDANCE WITH GRADING PLAN



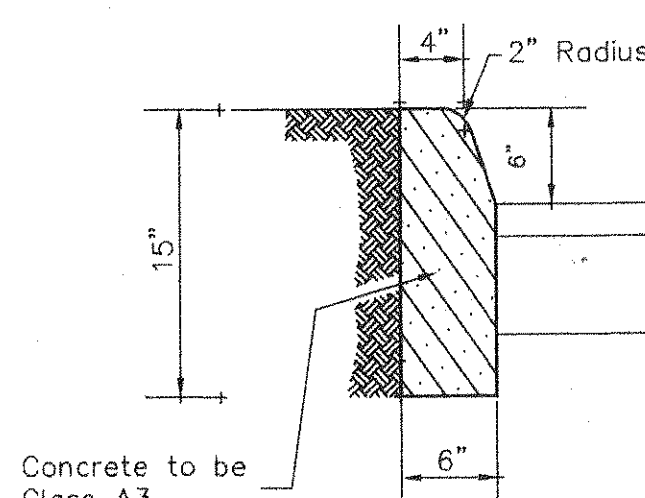
STANDARD PAVEMENT DETAIL

NO SCALE



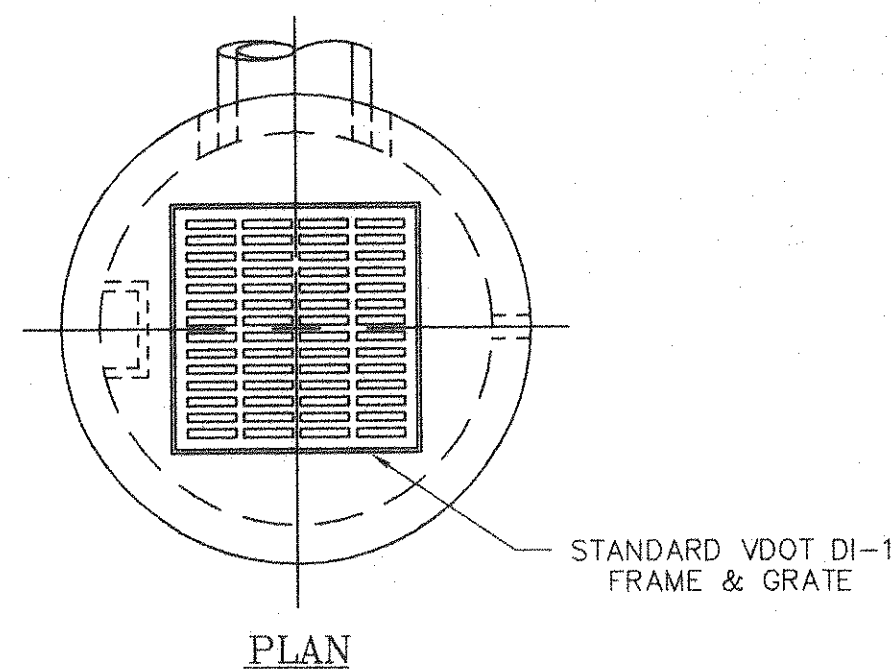
PLASTIC PIPE BEDDING

NO SCALE

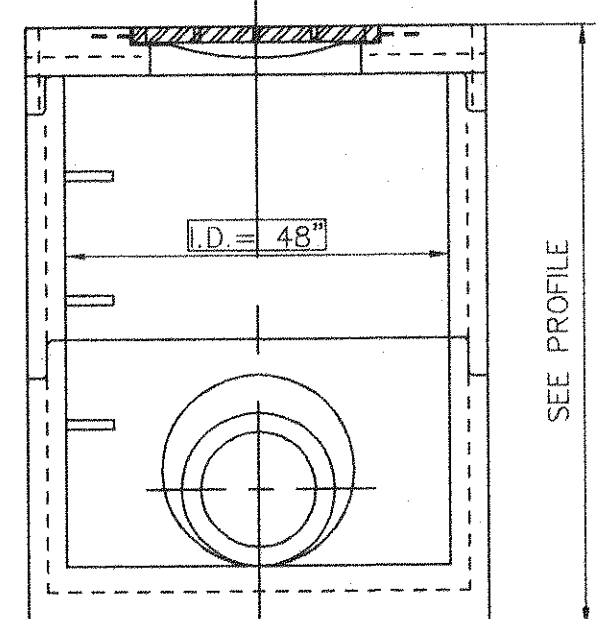


CONCRETE CURB (CG-2)

NO SCALE



PLAN



SECTION

DI-1 DROP INLET DETAIL

GENERAL NOTES

- THE PROPERTY SHOWN ON THESE PLANS IS LOCATED AT BOTETOURT COUNTY TAX ASSESSMENT NUMBER (PART OF) 101-44B.
- DEVELOPER: TIMBERBROOK ASSOCIATES, L.C. 5100 BERNARD DRIVE SW. ROANOKE, VIRGINIA 24018
- CURRENT ZONING: B-1
- SITE ACREAGE: 3.35 ACRES
- NO TITLE REPORT FURNISHED FOR THIS PROPERTY.
- THE PROPERTY SHOWN ON THESE PLANS IS TO BE SERVED BY COUNTY WATER AND SEWER.
- THE DEVELOPMENT SHOWN ON THESE PLANS WILL BE ACCESSED BY PUBLIC ROADS.
- TOPOGRAPHIC INFORMATION IS THE DIRECT RESULT OF A FIELD SURVEY BY LUMSDEN ASSOCIATES, P.C. IN MARCH, 2000.

CONSTRUCTION NOTES

- ALL WORK SHALL BE SUBJECT TO INSPECTION BY BOTETOURT COUNTY INSPECTORS. THE CONTRACTOR SHALL NOTIFY THE PROPER COUNTY OFFICIALS PRIOR TO THE START OF THE WORK.
- ALL CONSTRUCTION SHALL CONFORM TO THE CURRENT COUNTY OF BOTETOURT STANDARDS AND SPECIFICATIONS.
- 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.
- NO SUBSOIL INVESTIGATIONS HAVE BEEN MADE BY THE DESIGNING ENGINEER.
- THE CONTRACTOR SHALL VERIFY THE LOCATIONS OF ALL EXISTING UTILITIES PRIOR TO STARTING CONSTRUCTION.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING "MISS UTILITY" AND COMPLY WITH VIRGINIA'S UNDERGROUND UTILITY DAMAGE PREVENTION ACT.
- UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS FOR CURBING ARE TO THE TOP FACE OF CURB.
- COORDINATE BUILDING CONNECTIONS WITH ARCHITECTURAL PLANS.
- ALL WATER AND SANITARY SEWER MATERIALS AND CONSTRUCTION SHALL COMPLY WITH THE MOST CURRENT VERSION OF THE WATER AND SEWER REGULATIONS OF BOTETOURT COUNTY AS ADOPTED BY THE BOTETOURT COUNTY BOARD OF SUPERVISORS.
- ALL WATER AND SEWER PIPES SHALL HAVE A MINIMUM OF THREE AND A HALF (3.5) FEET OF COVER MEASURED FROM THE TOP OF PIPE, OVER THE CENTERLINE OF THE PIPE.
- ALL WATER AND SANITARY SEWER CONNECTIONS TO EXISTING LINES SHALL BE PERFORMED BY THE CONTRACTOR WITH THE BOTETOURT COUNTY INSPECTOR ON SITE.
- ALL WATER MAINS SHALL BE CLASS 52 DUCTILE CAST IRON PRESSURE PIPE AS SPECIFIED IN THE MOST CURRENT VERSION OF THE WATER AND SEWER REGULATIONS OF BOTETOURT COUNTY AS ADOPTED BY THE BOTETOURT COUNTY BOARD OF SUPERVISORS.
- ALL SANITARY SEWER LINES SHALL BE DUCTILE IRON OR POLYVINYL CHLORIDE (PVC) AS SPECIFIED IN THE MOST CURRENT VERSION OF THE WATER AND SEWER REGULATIONS OF BOTETOURT COUNTY AS ADOPTED BY THE BOTETOURT COUNTY BOARD OF SUPERVISORS.
- PRESSURE REDUCING VALVES SHALL BE INSTALLED IN EACH METER BOX.
- SEE VDOT ROAD AND BRIDGE STANDARDS FOR CONCRETE CURB AND STORM DRAINAGE DETAILS.

GRADING NOTES

- ALL AREAS TO BE GRADED SHALL BE STRIPPED OF PAVEMENT AND ORGANIC MATTER. ALL MATERIAL NOT SUITED FOR USE AS FILL MATERIAL SHALL BE REMOVED FROM THE SITE AND DISPOSED OF PROPERLY.
- ANY BORROW OR WASTE SITE MUST HAVE AN APPROVED EROSION AND SEDIMENT CONTROL PLAN PRIOR TO CONSTRUCTION.
- 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.

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

4664 BRAMBLETON AVENUE
P.O. BOX 20669
ROANOKE, VIRGINIA 24018

PROFESSIONAL ENGINEER
No. 012656
1-2-02

NOTES & DETAILS

PARCEL A, PHASE III
BOTETOURT COMMONS
PREPARED FOR
TIMBERBROOK ASSOCIATES, L.C.
AMSTERDAM MAGISTERIAL DISTRICT
BOTETOURT COUNTY, VIRGINIA

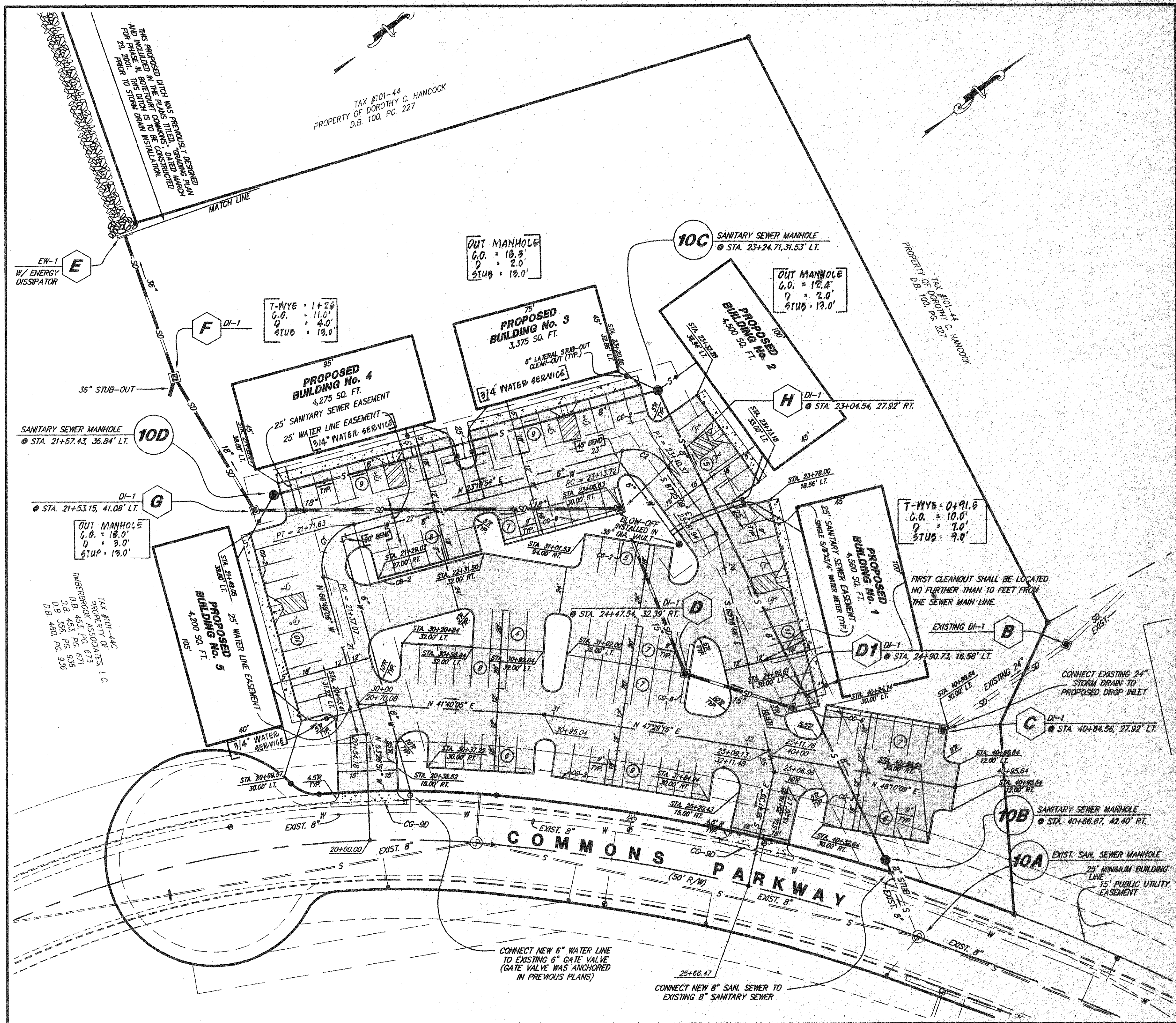
REVISIONS					
NO.	DATE	DESCRIPTION			
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3					
4					

DATE: 11 JANUARY 2002

SCALE: NONE

COMMISSION NO: 00-336A

CADD FILE: 00336A-ENG-PARCEL A-338A.dwg



PARKING SUMMARY

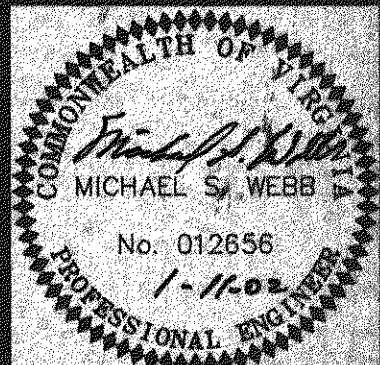
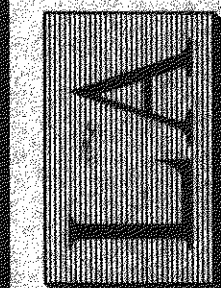
TOTAL BUILDING AREA: 20,850 SQ. FT.

PARKING REQUIRED: 105 SPACES @ 1 SPACE/200 SQ.FT.

PARKING PROVIDED: 116 SPACES, INCLUDING 10 HANDICAP

**ASSOCIATES, P.C.
SURVEYORS-PLANNERS
VIRGINIA**

PHONE: (540) 774-4411
FAX: (540) 772-9445
E-MAIL: MAIL@LUMSDENPC.COM

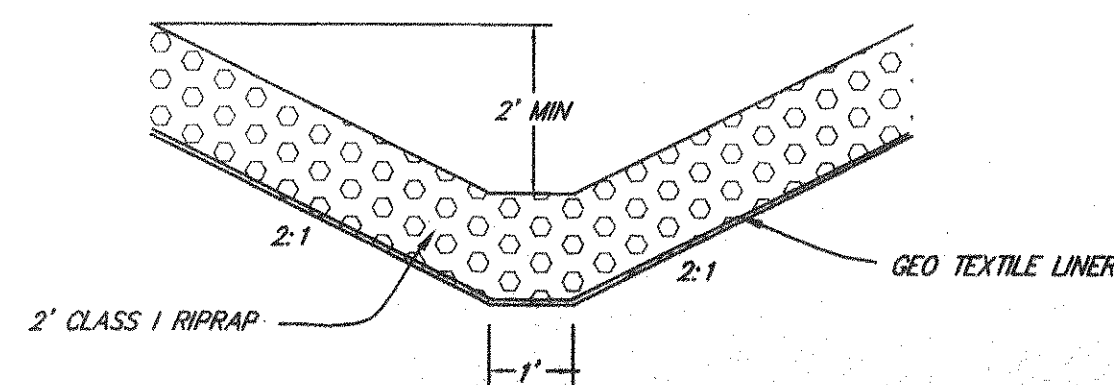
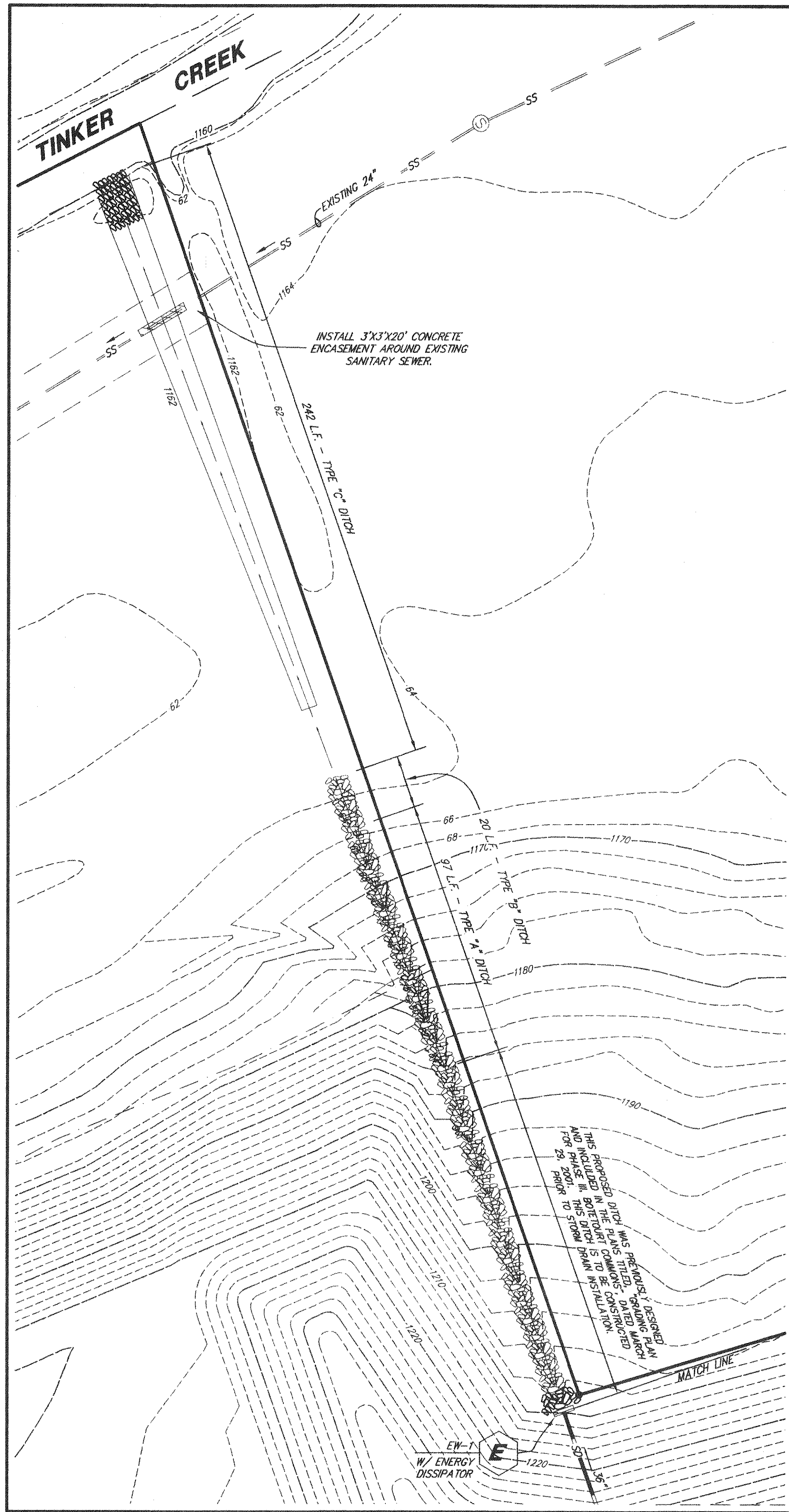


DIMENSIONAL LAYOUT & UTILITIES

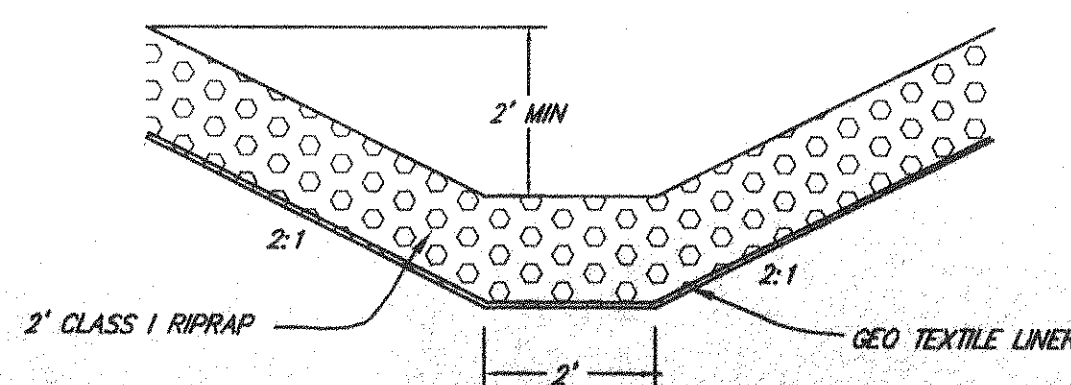
PARCEL A, PHASE III
BOTETOURT COMMONS
PREPARED FOR
TIMBERBROOK ASSOCIATES, L.C.
AMSTERDAM MAGISTERIAL DISTRICT
BOTETOURT COUNTY, VIRGINIA

REVISIONS		
NO.	DATE	DESCRIPTION
1	9/12/02	"AS-BUILT" IN BRACKETS
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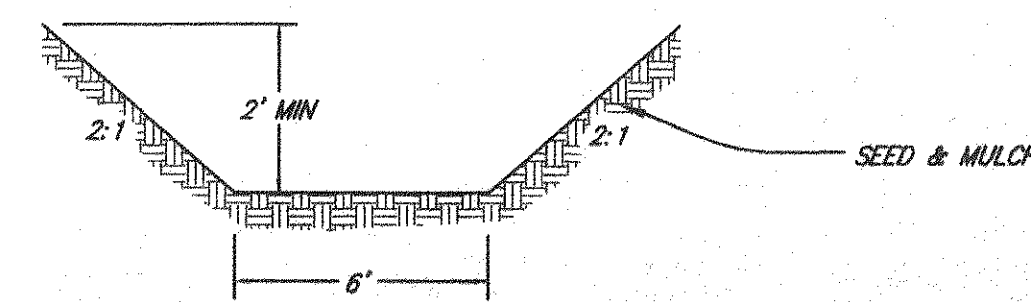
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SCALE:	1" = 30'
COMMISSION NO:	00-336A
CADD FILE:	00336A\ENG\PARCELA\336A\COMP
SHEET 3 OF 11	



TYPE 'A' DITCH
NOT TO SCALE

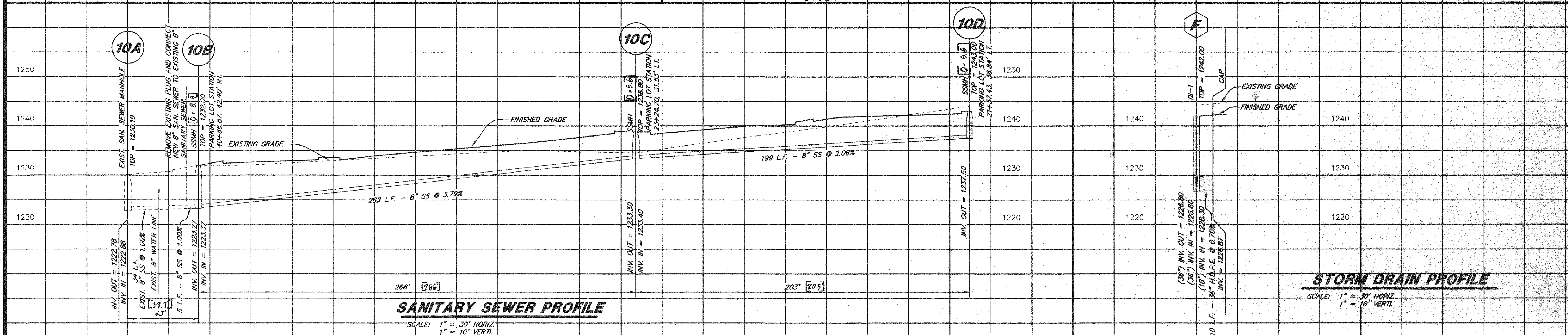
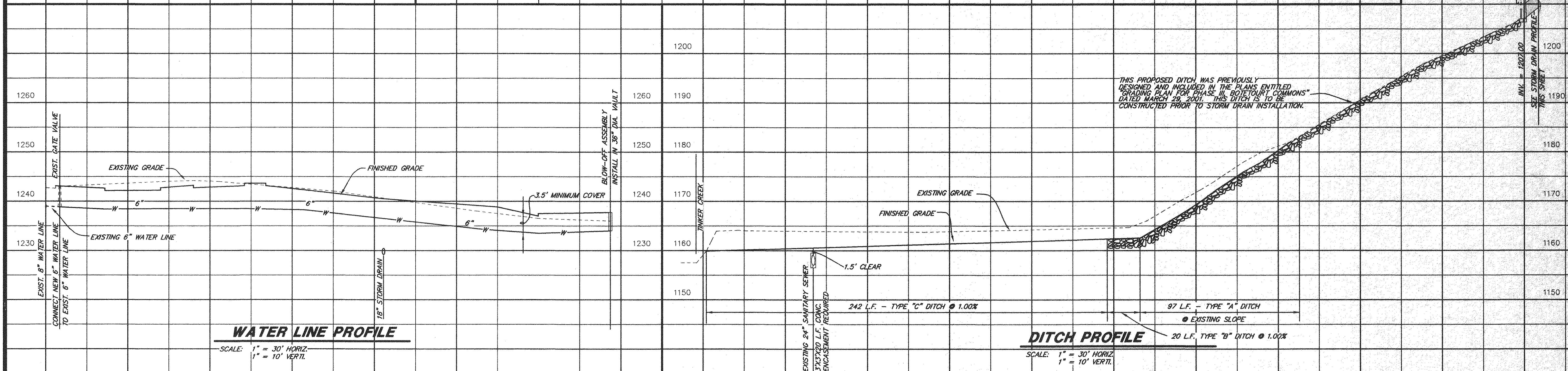
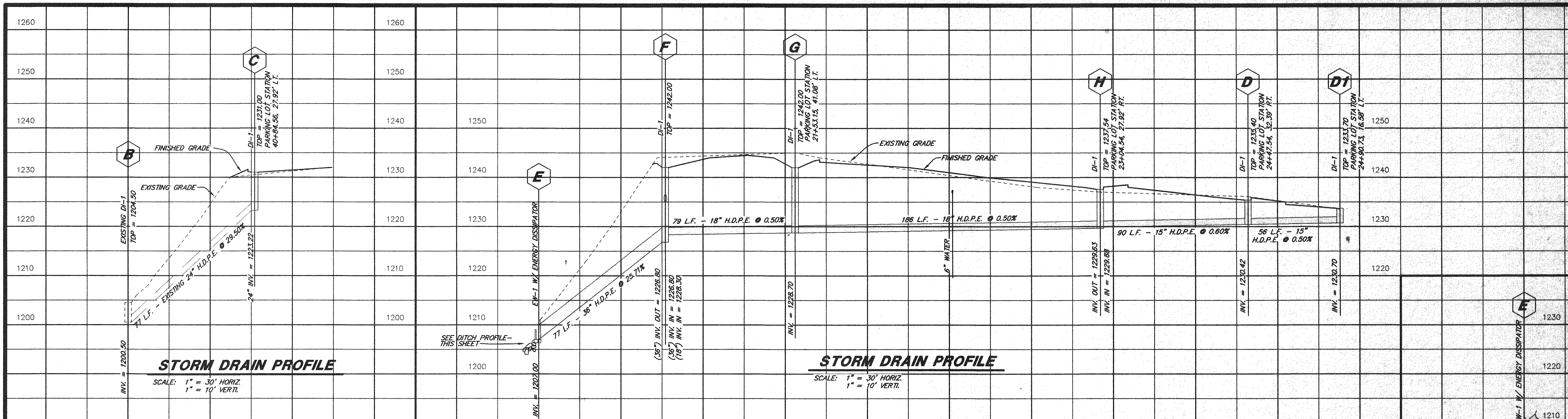


TYPE 'B' DITCH
NOT TO SCALE



TYPE 'C' DITCH
NOT TO SCALE

LEGEND		
ITEM	EXISTING	PROPOSED
Pavement	---	---
Curb & Gutter	---	---
Concrete Curb	---	---
Sanitary Sewer Manhole	⊙	⊙
Sanitary Sewer Line	---	---
Sanitary Sewer Cleanout	---	---
Waterline	---	---
Blow-Off	---	---
Fire Hydrant	---	---
Single Water Service Meter	---	---
Storm Drain Line	---	---
Storm Drain Drop Inlet	---	---
Contours	---	---



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

LA

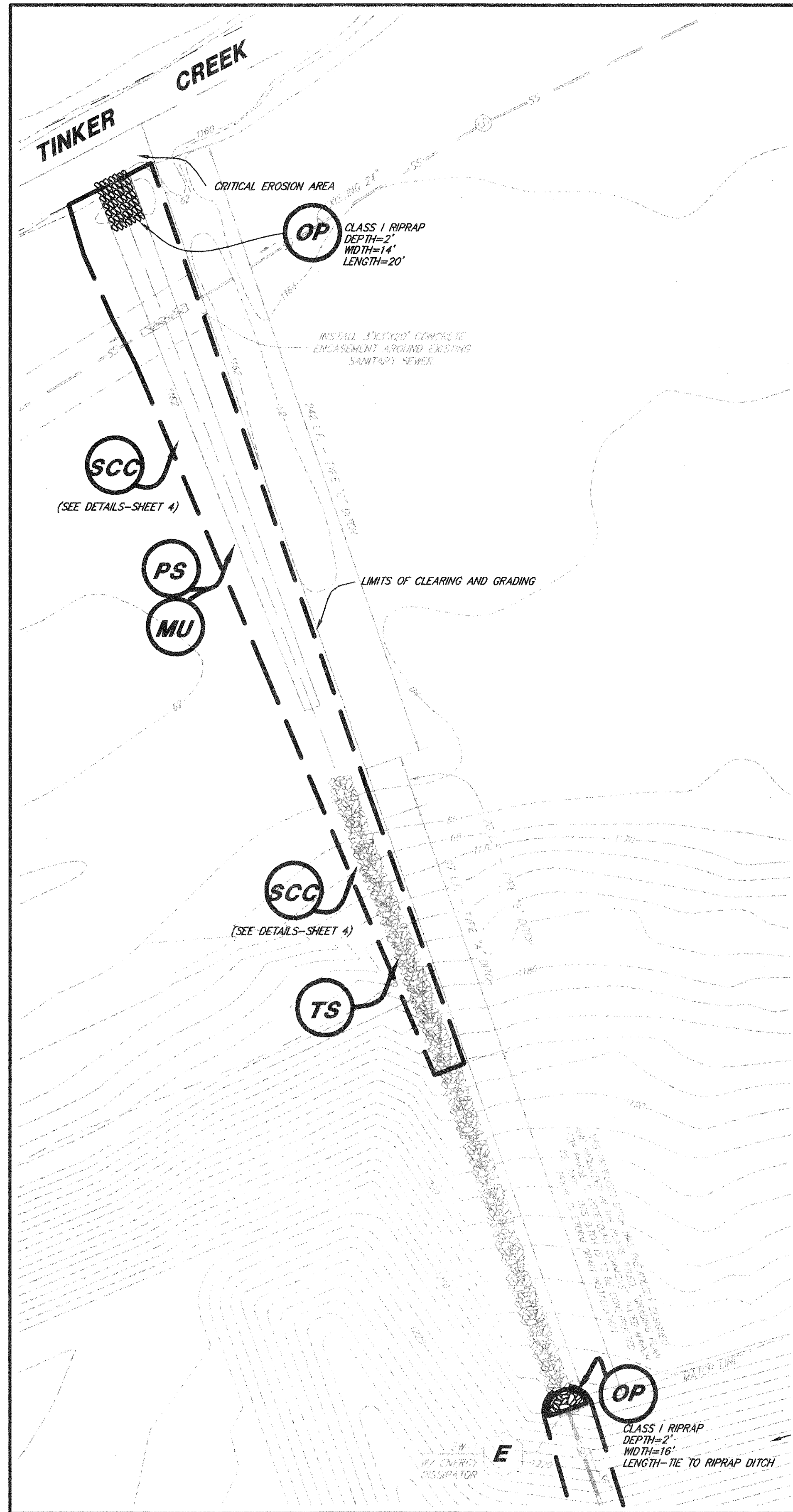
COMMONWEALTH OF VIRGINIA
MICHAEL S. WEBB
No. 012656
11-26-00
PROFESSIONAL ENGINEER

PROFILES

PARGEL A, PHASE III
BOTETOURT COMMONS
PREPARED FOR
TIMBERBROOK ASSOCIATES, L.C.
AMSTERDAM MAGISTERIAL DISTRICT
BOTETOURT COUNTY, VIRGINIA

NO.	DATE	REVISIONS	DESCRIPTION
1	9/24/02	1	As-built in plan
2			
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DATE: 11 JANUARY 2002
SCALE: AS SHOWN
COMMISSION NO. 00-336A
SHEET 5 OF 11



**FOR EROSION AND SEDIMENT CONTROL OF
SITE GRADING, SEE GRADING PLAN FOR PHASE III,
BOTETOURT COMMONS, DATED MARCH 29, 2001.**

**THIS PLAN IS FOR EROSION &
SEDIMENT CONTROL PURPOSES ONLY!**

LUMSDEN ASSOCIATES, P.C.
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466 BRIMBLETON AVENUE
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EMAIL: LAM@LUMSDENPC.COM

COMMONWEALTH OF VIRGINIA
MICHAEL S. WEBB
No. 012656
1-2-02
PROFESSIONAL ENGINEER

**EROSION & SEDIMENT
CONTROL PLAN**

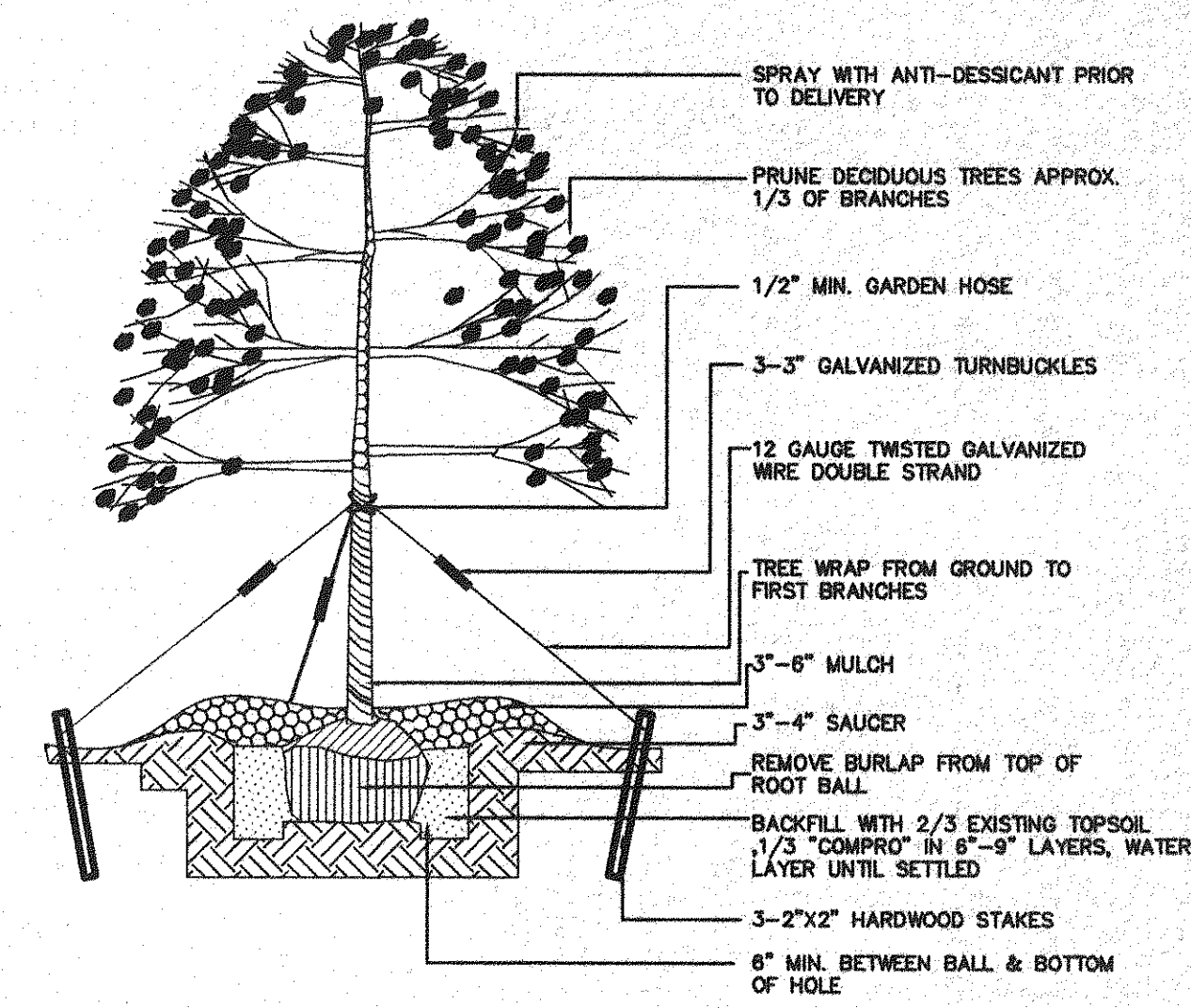
**PARCEL A, PHASE III
BOTETOURT COMMONS
PREPARED FOR
TIMBERBROOK ASSOCIATES, L.C.
AMSTERDAM MAGISTERIAL DISTRICT
BOTETOURT COUNTY, VIRGINIA**

NO.	DATE	REVISIONS	DESCRIPTION
1	11 JANUARY 2002		
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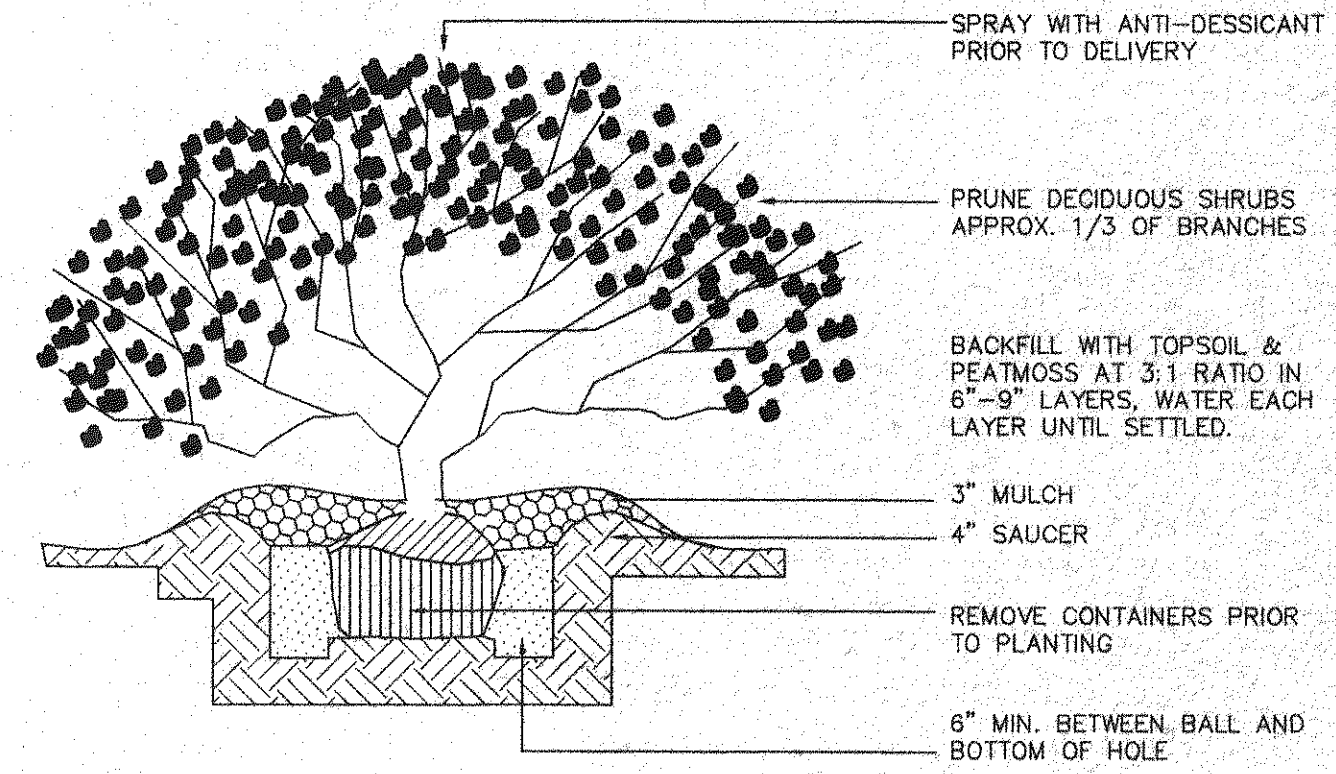
DATE: 11 JANUARY 2002
SCALE: 1" = 30'
COMMISSION NO. 00-336A
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SHEET 6 OF 1



LANDSCAPE SCHEDULE				
SYMBOL	QUAN.	COMMON NAME	BOTANICAL NAME	SIZE
A	7	RED OAK	QUERCUS RUBRA	2.5" CALIPER
B	3	YOSHINO CHERRY	PRUNUS YEDOENSIS	2" CALIPER
C	36	"BIG BLUE" LIRIOPE	LIRIOPE MUSCARI	18" - 24"
D	17	"LITTLE RICHARD" ABELIA COMPACT	ABELIA GRANDIFLORA	3 GALLON
E	24	CHINESE JUNIPER "SARGENTII"	JUNIPERUS CHINENSIS "SARGENTII"	1 GALLON
F	15	CREEPING JUNIPER	JUNIPERUS HORIZONTALIS	1 GALLON
G	27	INKBERRY HOLLY	ILEX GLABRA "COMPACTA"	3 GALLON



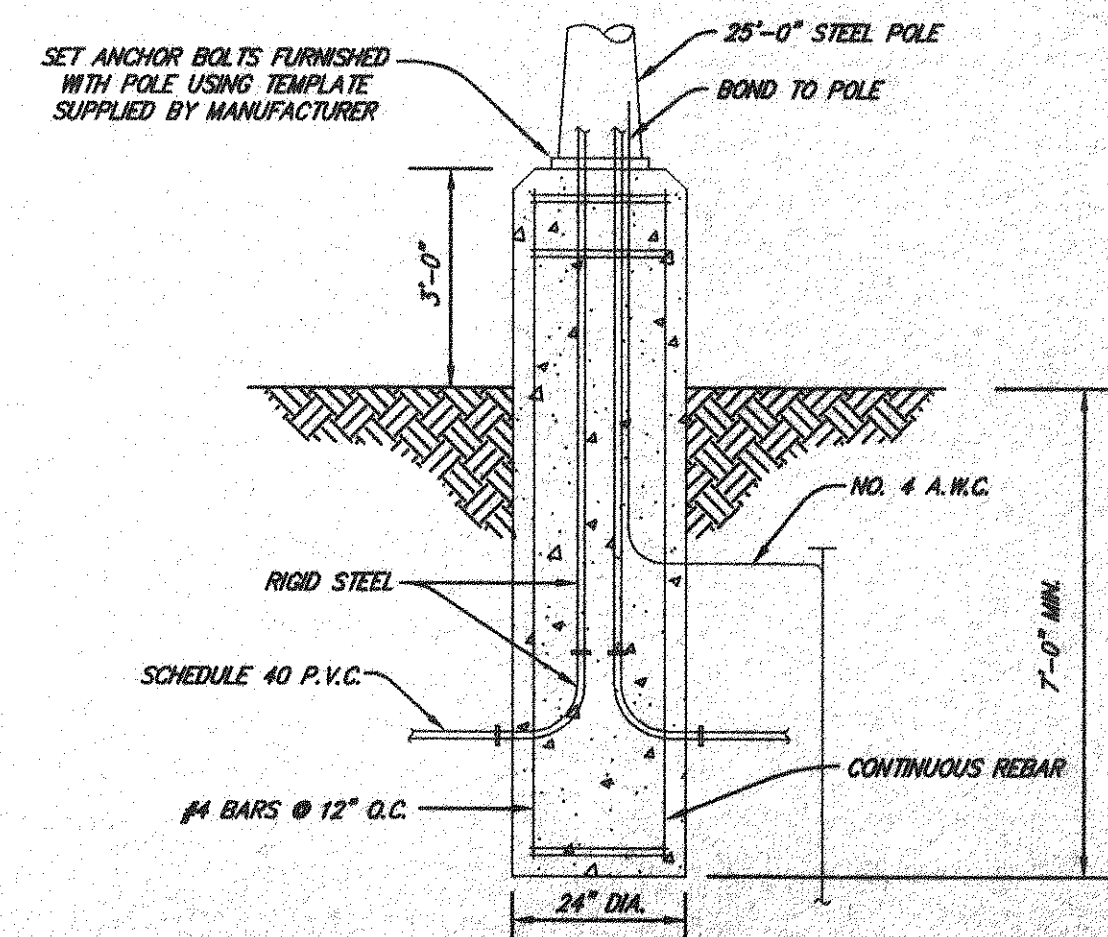
TREE PLANTING DETAIL



SHRUB PLANTING DETAIL

LIGHTING CHART		
SYMBOL	NO. OF HEADS	QUANTITY
■	2	4
●	1	1

NOTE:
1. LIGHTS SHALL MATCH EXISTING LIGHTS INSTALLED IN PREVIOUS PHASES OF BOTETOURT COMMONS.
2. ALL ELECTRICAL WORK SHALL MEET NEC AND BOTETOURT COUNTY CODES.



LIGHT POLE BASE DETAIL

LUMSDEN ASSOCIATES, P.C.
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ROANOKE, VIRGINIA
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COMMONWEALTH OF VIRGINIA
MICHAEL S. WEBB
No. 012856
11-26-01
PROFESSIONAL ENGINEER

LANDSCAPE & LIGHTING PLAN

PARCEL A, PHASE III
BOTETOURT COMMONS
PREPARED FOR
TIMBERBROOK ASSOCIATES, L.C.
AUSTERDAM MAGISTERIAL DISTRICT
BOTETOURT COUNTY, VIRGINIA

REVISIONS		DESCRIPTION	
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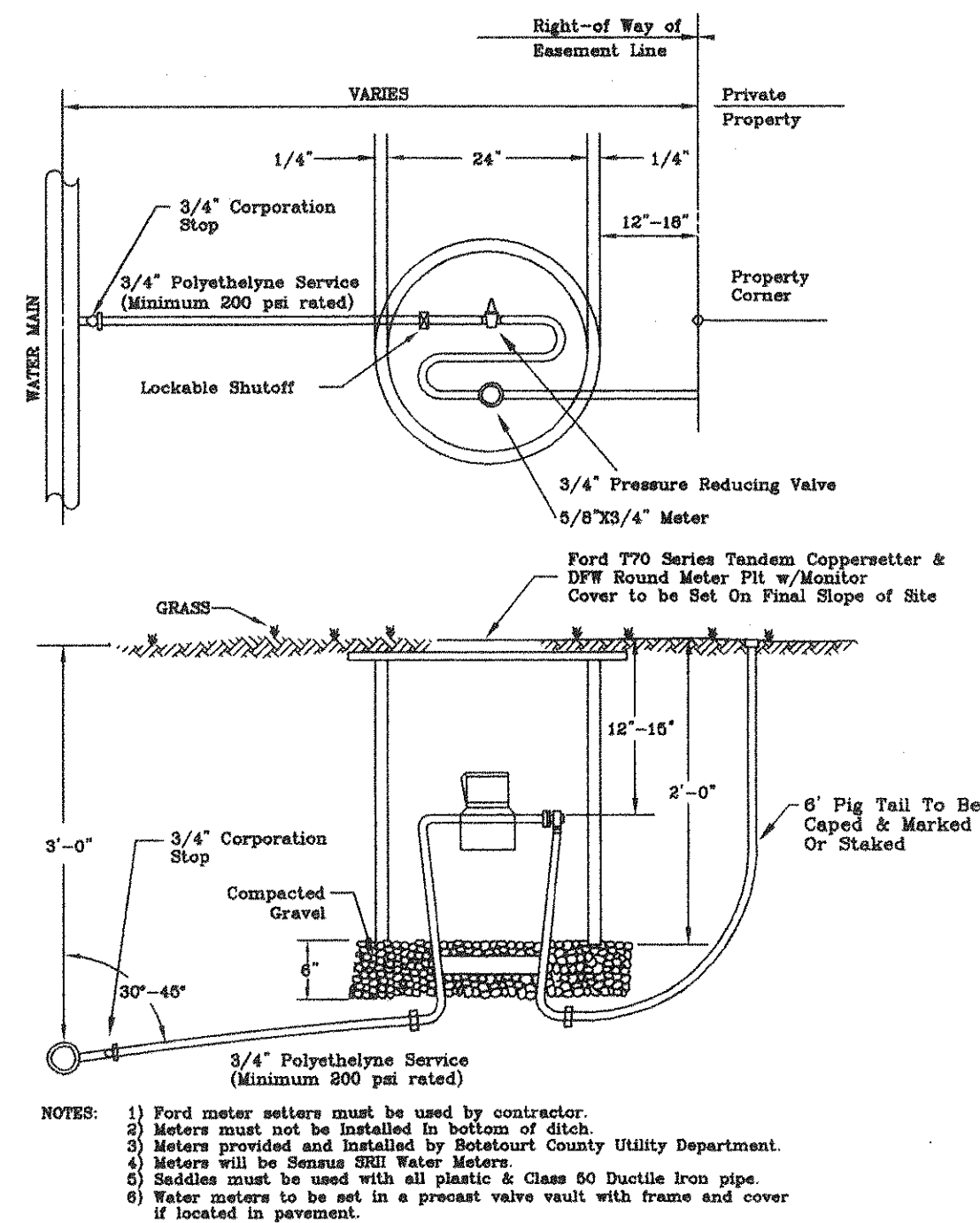
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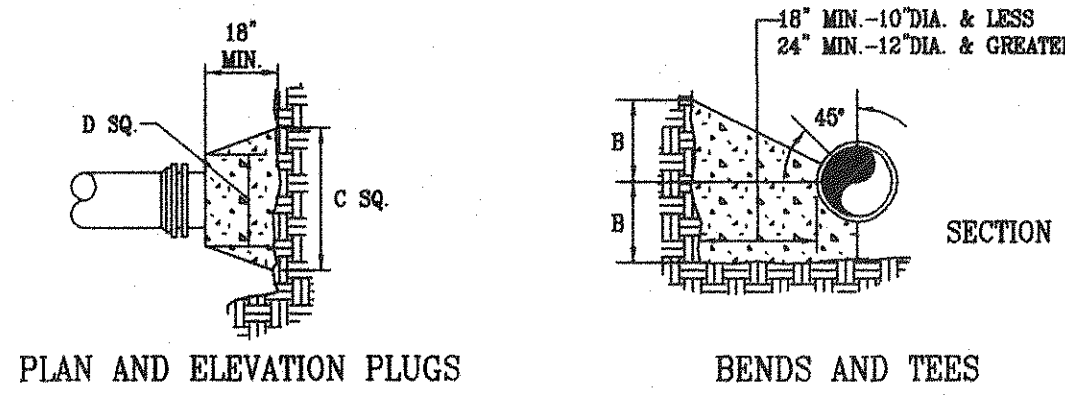
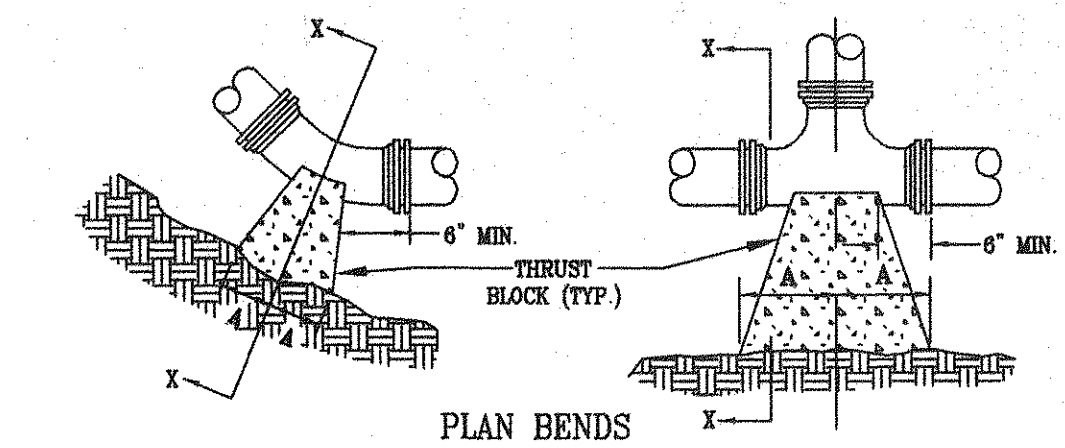
COMMISSION NO. 00-336A

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SHEET 8 OF 11

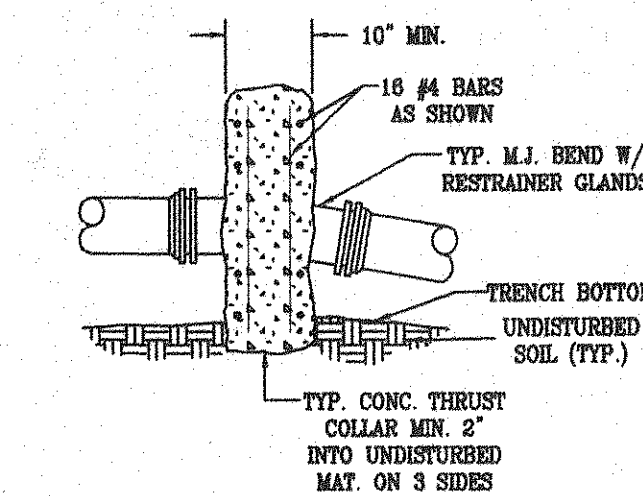


SINGLE
WATER SERVICE
WITH PRV



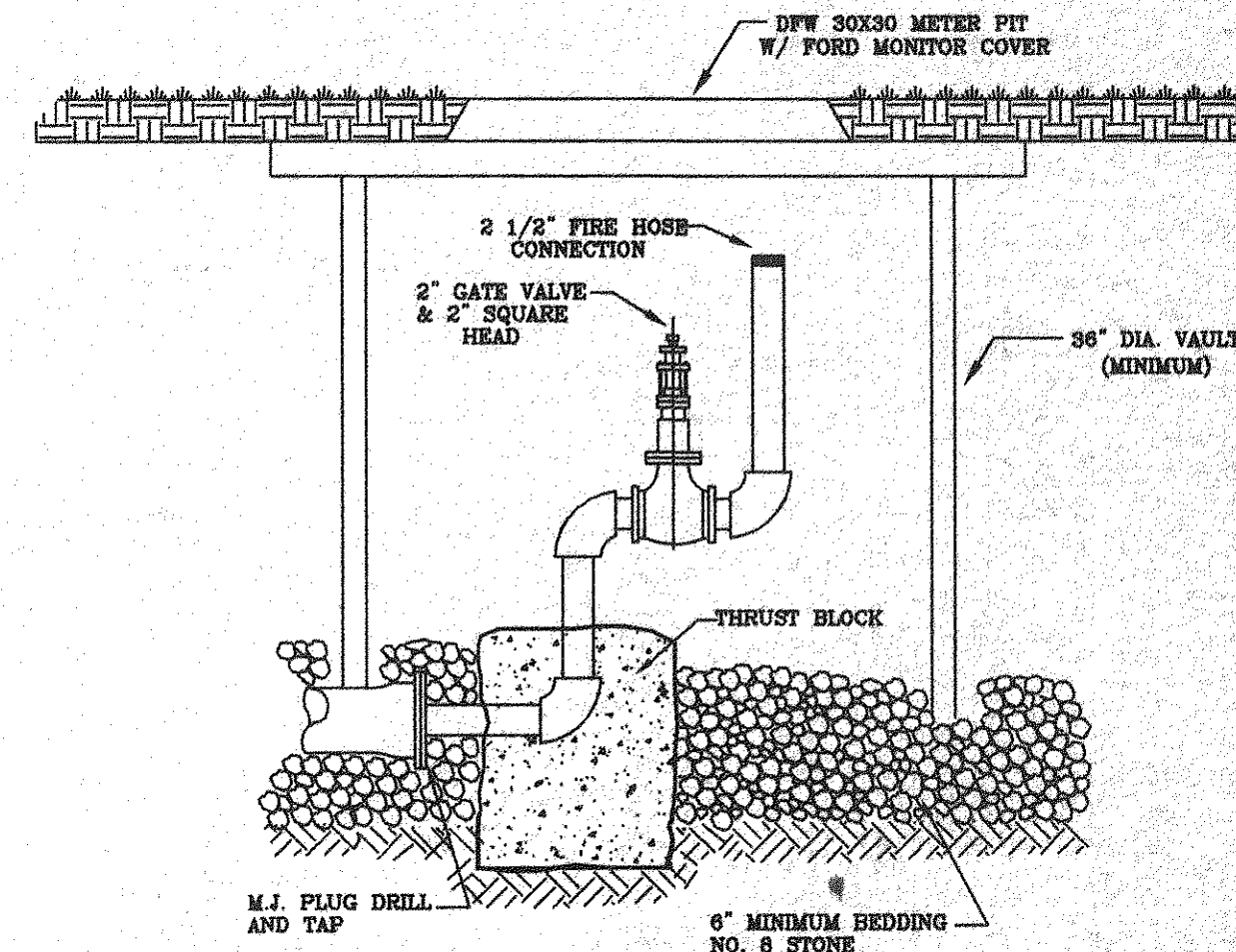
PIPE SIZE	90° BEND	45° BEND	22 1/2° BEND	11 1/4° BEND	TEE	PLUG
4"	6"	12"	8"	8"	6"	6"
6"	18"	12"	8"	8"	8"	11"
8"	18"	13"	10"	10"	8"	11"
10"	20"	16"	12"	14"	8"	12"
12"	20"	16"	12"	14"	8"	12"
16"	26"	20"	16"	18"	11"	13"
24"	82"	42"	62"	30"	44"	22"
30"	185"	42"	100"	42"	52"	42"

THRUST BLOCK CONSTRUCTION
NO SCALE



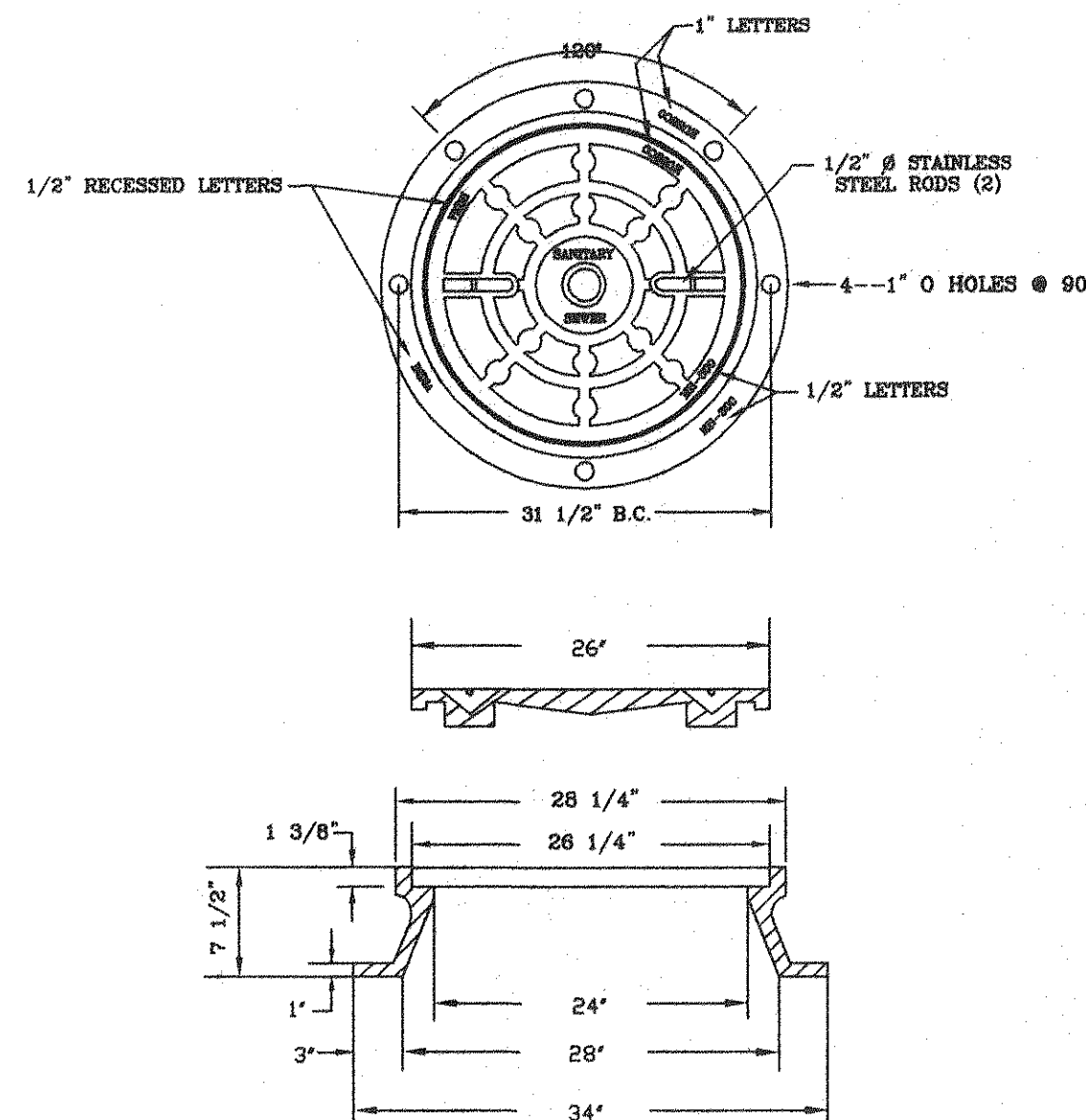
SECTION OF VERTICAL BEND

- NOTES:
- FOR VERT. BEND DOWN IN EXCESS OF 11 1/4" BEND, ANCHORAGE SHALL BE DESIGNED BY ENGINEER.
 - FOR VERT. BEND UPWARD, BLOCKING TO BE SIMILAR TO THAT FOR HORIZ. BEND.
 - GLANDS & BOLTS SHALL BE PROTECTED FROM CONC. BY PLASTIC SHEETING WHEN POURING THRUST BLOCKS.
 - ALL THRUST BLOCK & SUPPORT CONC. SHALL BE 3000 PSI READY MIX CONC.
 - THRUST BLOCKS WITH "B" DIMENSION GREATER THAN 30" SHALL HAVE THE RESTRAINED PIPE INSTALLED WITH A MINIMUM OF 4' OF COVER.
- PRESSURE = 200 psi
BEARING = 2000 psf
FACTOR OF SAFETY = 1.5

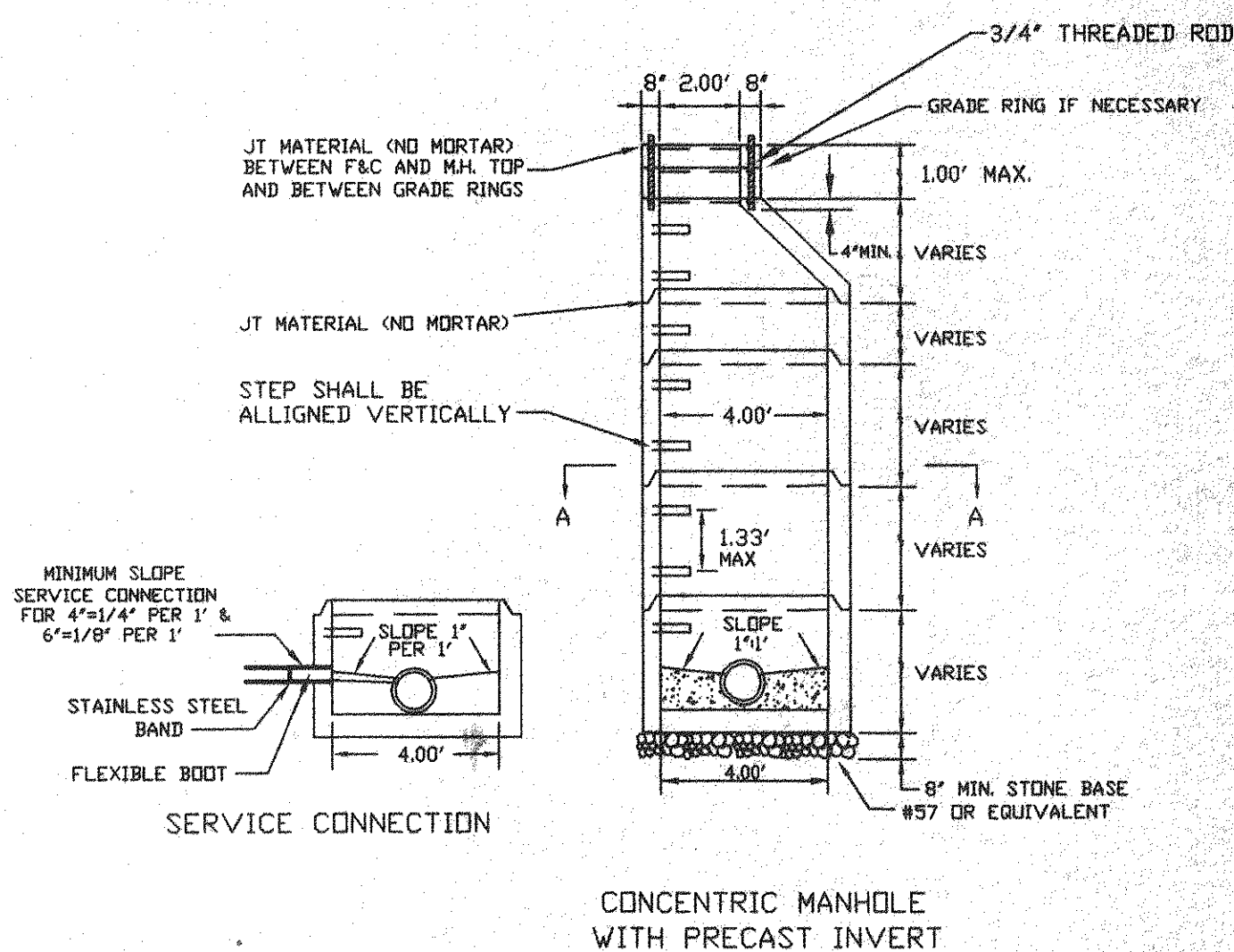
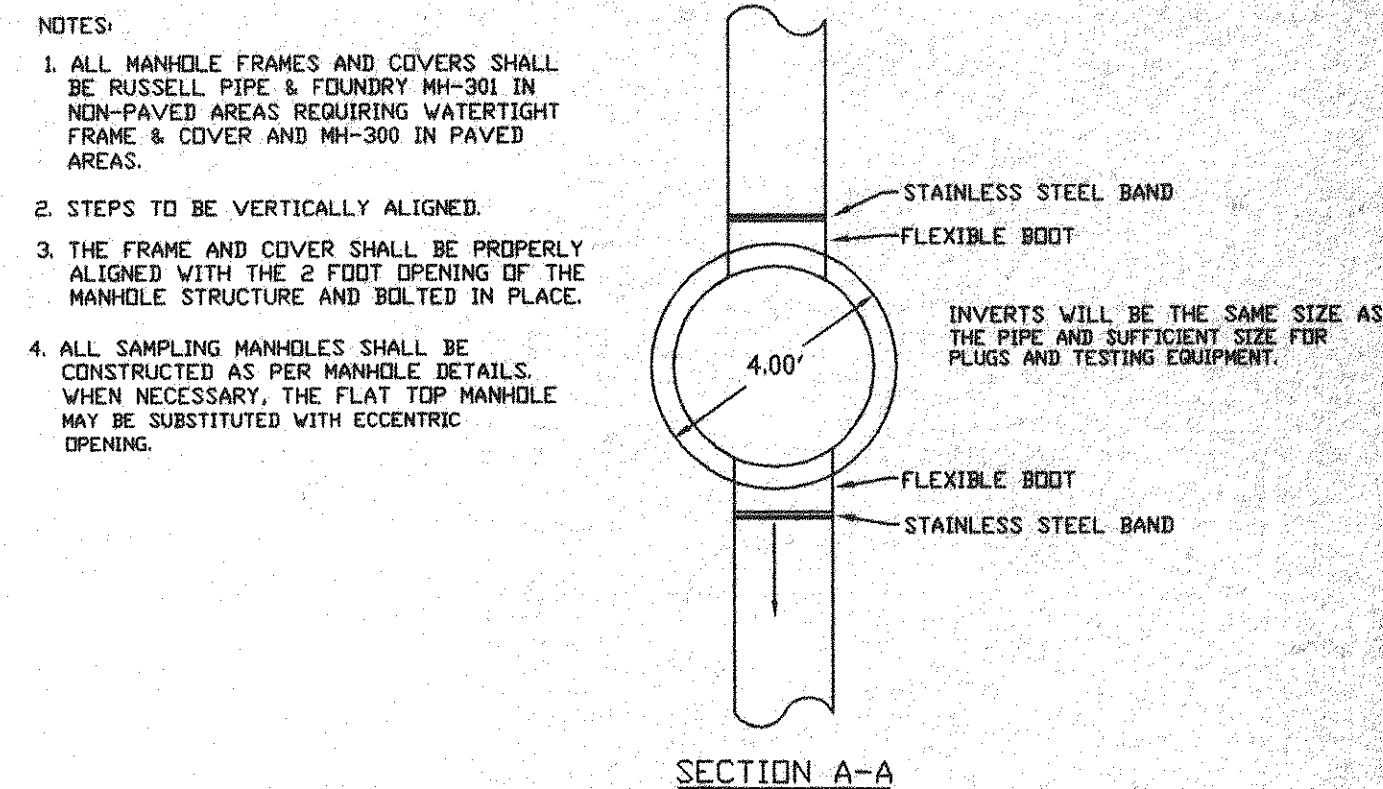


PERMANENT END OF LINE

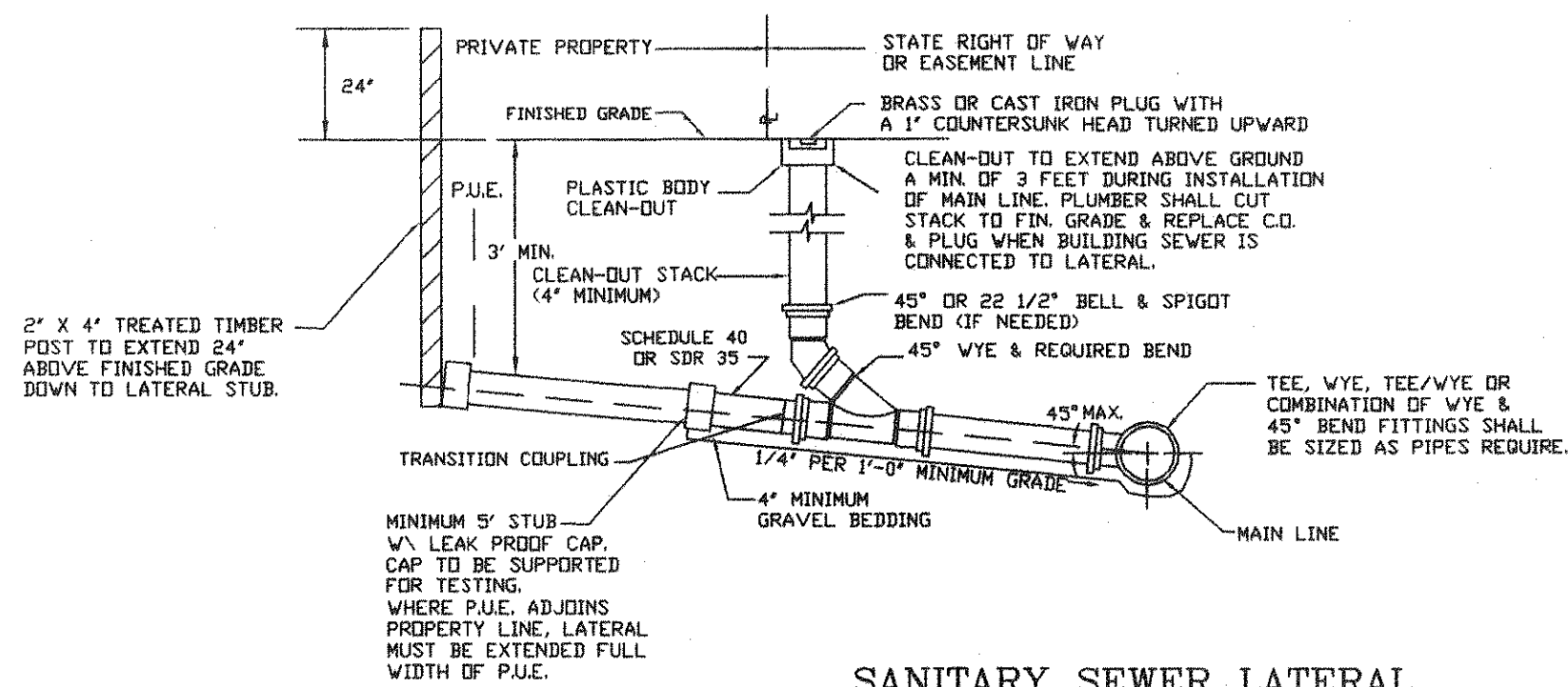
NOTES: ALL PLUMBING AND FITTINGS SHALL BE BRASS.



MANHOLE FRAME AND COVER
(RUSSELL PIPE & FOUNDRY MH-300)



4' STANDARD MANHOLE
FOR PIPE 15" OR SMALLER



SANITARY SEWER LATERAL

- GENERAL NOTES:
- TRAFFIC BEARING BOX REQUIRED IN TRAFFIC AREAS.
 - ALL PIPES AND FITTINGS SHALL BE OF SIMILAR MATERIAL.
 - ALL PIPE SHALL BE OF SAME SIZE.
 - NO BENDS ARE ALLOWED IN THE LATERAL FROM THE MAIN TO THE CLEAN-OUT STACK.
 - ALL MAIN LINE TAPS ON ACTIVE MAINS WILL BE PERFORMED BY CONTRACTOR AND INSPECTED BY BOTETOURT COUNTY UTILITY DEPARTMENT.
 - PIPING BEHIND CLEAN-OUT TO BE INSTALLED PER BOCA CODE.
 - MINIMUM LATERAL, SIZE 4" FOR RESIDENTIAL SERVICE, 6" FOR NON-RESIDENTIAL SERVICE.
 - MINIMUM COVER FOR ALL SEWER LATERALS SHALL BE THREE AND ONE HALF (3 1/2) FEET.

NO.	DATE	DESCRIPTION
1		
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WATER LINE CONSTRUCTION

A. General:

1. Except as specifically modified below, water line construction shall meet the requirements of AWWA C600, latest edition standards. Pipe, fittings, valves, hydrants, and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be dropped. Pipe shall be so handled that any coating or lining is not damaged.

2. The water main shall be laid and maintained to the required lines and grades with fittings, valves, hydrants and accessories set at the required locations indicated on the approved plans for the project. All valve and hydrant stems shall be set plumb. Whenever obstructions not shown on the plans are encountered during progress of the work and interfere to such an extent that alteration in plans is required, the County, or its authorized representative, shall be advised and their approval given before such alterations are put into effect. Any such alternative design shall be designed or approved by the Engineer of record for the original design.

3. All water shop drawings/cut sheets shall be submitted by the contractor to both the design engineer and Botetourt County for approval prior to installation. Botetourt County will require three (3) complete sets of shop drawings for review.

4. The contractor shall schedule a preconstruction meeting to be attended by the contractor's site superintendent, design engineer, the design engineer's field representative/inspector, representatives from Botetourt County Utility Department and representatives from Botetourt County Engineering Department and any materials suppliers the contractor feels necessary.

5. The contractor shall obtain a copy of the most current edition of Botetourt County Water and Sewer Construction Standards and Specifications and provide proof (a letter) that the contractor has and is familiar with the requirements therein.

6. The developer shall provide 1 year warranty for all lines prior to conveyance to Botetourt County with the warranty date beginning at the date of system acceptance by Botetourt County.

7. Water connection fees will be based upon the fee structure currently in place. Owner/developer must make applications and pay all applicable connection fees prior to issuance of any building permits.

B. Excavation, Bedding and Backfill:

1. The trench shall be dug so that the pipe can be laid to the alignment and depth required and it shall be excavated not more than five hundred (500) feet in advance of the completed pipe laying operation. The width of the trench shall be ample to permit the pipe to be placed, backfilled and thoroughly compacted in accordance with the requirements of these specifications. Trenches shall be of such extra widths as will permit the convenient placing of timber supports, sheeting and bracing and handling of special fittings or appurtenances when required.

2. The trench shall be excavated to the depth required so as to provide a uniform and continuous bearing and support for the pipe on solid and undisturbed ground at every point between bell holes; except that it will be permissible to disturb and otherwise damage the finished surface over a maximum length of eighteen (18) inches near the middle of each length of pipe by the withdrawal of pipe slings or other lifting tackle. The damaged area shall be refinished as near as possible. The part of the bottom of the trench excavated below the specified grade shall be backfilled with approved materials and be thoroughly compacted. The finished subgrade shall be prepared accurately by means of hand tools.

3. Bedding shall be placed as required by the pipe manufacturers written instructions.

4. Where excavation is made in fractured rock, boulders or other unsuitable material, the subgrade shall be made by backfilling with a minimum of four (4) inch compacted depth of gravel or clean selected soil which shall be thoroughly compacted.

5. Bell holes shall be provided at each joint to permit the jointing to be made properly and to permit maximum bedding length.

6. Ledge rock, boulders and large stones shall be removed to provide a clearance of at least six (6) inches below and on each side of the pipe and appurtenances being laid and any part, projection or joint of such rock stone.

7. No pipe shall be laid in water or when, in the opinion of the County or their authorized representative, trench conditions are unsuitable.

8. Backfill shall be placed in two (2) equal depth layers to the top of the pipe and each layer shall be thoroughly tamped to ninety five (95) percent of the maximum theoretical density as determined by ASTM D698 Standard Proctor Test. The remainder of the backfill shall be placed in a maximum of two (2) foot layers. All material tamped. Backfill material shall be free of perishable material, frozen clods, sticky masses of clay and other unsuitable matter. Rock pieces larger than two (2) inches shall not be used in the backfill which is within two (2) feet of the pipe. Backfill within existing or proposed roads shall meet the requirements established and required by the Virginia Department of Transportation.

C. Installation of Pipe and Fittings

1. When installing pipe in the trench proper implements, tools, and facilities satisfactory to the County and as recommended by the material manufacturer shall be provided and used by the contractor for the safe and convenient prosecution of the work. All pipe, valves, fittings, hydrants, and accessories shall be carefully lowered into the trench, piece by piece, by means of a derrick, ropes, slings or other suitable tools or equipment in such a manner as to prevent damage to the water main material and any protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped into the trench. The pipe and fittings shall be inspected for defects, and while suspended above grade, be rung with a light hammer to detect cracks.

2. All lumps, blisters and excess coal tar coatings shall be removed from the ends of ductile iron pipe and the outside of the spigot and the inside of the bell shall be wiped clean, dry and free from oil and greases before the pipe is laid.

3. Every precaution shall be taken to prevent foreign material including non-potable water from entering the pipe while it is being placed in the line. If the pipe-laying crew cannot put the pipe into the trench and in place without getting earth into, a heavy tightly woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe. During laying operations no debris, tools, clothing, or other materials shall be placed in the pipe. At the end of each day a watertight plug shall be placed in the end of all pipe openings.

4. After placing a length of pipe in the trench, the spigot end shall be centered in the open bell of the pipe line and the pipe pushed home so that the face of the spigot is in close contact with the shoulder of the bell. Water pipe shall be laid with the bell facing the direction of the laying.

5. No stub of any water main shall terminate with a capped or plugged valve. Where a valve is required to be installed near a stub end, one joint of pipe shall be installed after the valve. The pipe shall be plugged and a concrete kick block poured behind it.

6. The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or cement lining and so as to leave a smooth end at right angles to the axis of the pipe.

7. When machine cutting is not available for cutting metal pipe twenty (20) inches in diameter or larger, the electric-arc cutting method will be permitted using a carbon or steel rod. Only qualified and experienced workmen shall be used for this work. The flame cutting of metal pipe by means of oxyacetylene torch will not be permitted.

8. Whenever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions or plumb stems, or where long-radius curves are approved, the amount of deflection allowed shall not exceed the minimum required, for satisfactory jointing of the pipe, as specified in this manual. The maximum deflection permitted per joint shall be in accordance with AWWA C600 Table 4 for push-on joint and Table 5 for mechanical joint pipe.

9. All tees, bends, plugs, caps and fire hydrants shall be substantially braced, blocked and/or strapped to prevent any movements by providing adequate reaction backing and/or tie rods. Reaction backing shall be designed and installed as indicated in the standard details.

10. Hydrants shall be set to finished grade as follows:

a. Bottom of the four and one-half (4-1/2) inch nozzle shall be between eighteen (18) inches and twenty-four (24) inches above finish elevation of the edge of the shoulder on streets without curb and gutter and between eighteen (18) inches and twenty-four (24) inches above the elevation of the curb on streets with curb and gutter as indicated on the standard details.

b. The two and one-half (2 1/2) inch hose connections shall have a minimum of six (6) feet clearance on all sides.

c. Surface shall be approximately level within a six (6) foot radius of the hydrant.

B. Testing

1. All new water mains shall be tested, after backfilling to a hydrostatic pressure of not less than 100 psi above design water pressure for the system or 150 psi, whichever is greater. Allowable leakage shall be calculated by the following formula:

$$L = \frac{500 \cdot P \cdot L}{133,200} \text{ Where: } L = \text{allowable leakage in gallons per hour}$$

S = length of pipe tested in feet.

D = nominal diameter of pipe in inches.

P = average test pressure during leakage test in psi

Allowable leakage is shown in columnar form in Table 6.

2. No water line shall be placed in service until the leakage is less than the allowable leakage as indicated above. Testing of water mains shall only be done after installation of all valves, taps and service laterals are complete. All portions of the water system, including hydrants and service lines, shall be subject to the hydrostatic pressure during the leakage test. Testing of water mains shall be observed and documented by the design engineer. All testing shall be coordinated with Botetourt County Department of Public Works.

3. All high points and service lines in the portion of the system under test shall be vented and all air shall be expelled from the system prior to beginning the test. All fittings and hydrants shall be properly braced or blocked before applying test pressure. Where concrete thrust blocks are used, they shall have attained their final set prior to testing.

4. After the portion of the system under the test has reached the required pressure as stated herein, said pressure shall be maintained for two (2) hours. At the conclusion of the pressure test, the volume of makeup water required to refill the pipeline shall be determined by measurement with a displacement meter or by pumping from a vessel of known volume.

5. All joints or fittings at which leakage occurs shall be re-worked to insure tightness. All leaks shall be repaired regardless of amount of leakage. If the measured amount of leakage exceeds the values for the appropriate size as found in AWWA Specifications C600, Hydrostatic Testing (Table 6), the pipe-line shall be repaired and re-tested until leakage is within the limit set by the referenced specification. Methods of repair prior to re-testing will be done with the County's approval and inspection. Repairs of new construction will be by adjustment or replacement of material only. The use of repair clamps or bell clamps will not be acceptable.

Waterline Pipe, Fittings, and Accessories

A. General:

1. All pipe for water main construction shall be either ductile cast iron pressure pipe of the push-on joint or standard mechanical joint variety, conforming to AWWA C151, latest revision. Thickness class shall be Class 52 for all pipe twelve (12) inches in diameter or less. Water mains larger than twelve (12) inches diameter in size shall have thickness class as determined by thickness design of ductile-iron pipe AWWA C150.

B. Ductile Cast Iron Standard Mechanical Joint Pipe

1. All ductile cast iron standard mechanical joint water pipe shall conform to ANSI Specification A21.1, latest revision, and shall be lined with cement mortar and have an exterior coating. The linings and protective coatings equal to "Enameline" with tar coating in the exterior will be considered as a satisfactory lining for the water pipe, however, any substitution in pipe lining and/or coating from ANSI A21.4 shall be specifically approved by the County. Joints of standard mechanical joint pipe shall conform to ANSI Specifications A21.11.

2. High strength cast iron tee head bolts, hex nuts, caps or ductile iron glands and rubber gaskets shall be as furnished by the pipe manufacturer. All the bolts and nuts shall be constructed of the same size and type material as head bolts and hex nuts.

3. In making connections of ductile cast iron pipe using the standard mechanical joint gland followed by the rubber gasket shall be placed over the plain end of the pipe which shall be carefully inserted and aligned into the socket end of the pipe. Gasket shall then be pushed into position so that it is evenly seated in the socket. The gland shall then be moved into position against the face of the gasket, bolts, inserted and made finger tight. Bolts shall then be tightened in accordance with AWWA C500 Table 4 for torque for all pipe sizes 4-12". All other requirements concerning bedding, alignment, and cleaning of the pipe before making the joint shall be followed.

C. Ductile Cast Iron Pipe-Push-on Joint

1. All push-on or "slip" joint pipe shall conform to the requirements of standard mechanical joint pipe in regard to strength, class, protective coatings, etc.

D. Cast Iron Pipe Fittings

1. Fittings for all water pipes shall be ductile iron or gray cast iron in accordance with AWWA Specification C11 0, latest revision, with a minimum pressure rating of 250 psi.

E. Gate Valve

1. All gate valves shall be of superior quality thin-walled, ductile iron valves, manufactured by American Flow Control. The valves shall be resilient seat, epoxy coated bronze mount type. All gate valves shall withstand a working pressure of 200 psi and shall be in strict conformance to all applicable AWWA Standards. Wrench nut shall turn to the left (counterclockwise) to open the valve. Valves shall be so arranged to fit into pipe lines having standardized mechanical joints or slip joints. All gate valves shall be resilient seat type valves meeting AWWA C509, latest revision standards.

2. On valves fourteen (14) inches or larger, butterfly valves conforming to AWWA C504 may be used.

F. Fire Hydrants

1. All hydrants shall be traffic model, Dry-barrel type, meeting AWWA C502, latest revision standard, American Flow Control B 84 B. Hydrants shall be of the compression type with main valve openings not less than four and one-half (4-1/2) inches in diameter. Hydrants shall have a cast or ductile iron body with full bronze trim and shall withstand a hydrostatic test pressure of 300 psi. Hydrants shall have six (6) inch connection base for setting with a minimum of thirty-six (36) inch cover on connection pipe. Hydrants shall be equipped with hose connections as follows:
Two (2) each, 2-1/2" N.S.T. hose connections
One (1) each, 4-1/2" N.S.T. pumper connection

2. Hydrant shall be operated by a National Standard one and one-half (1-1/2) inch pentagon shaped operating nut, opening counterclockwise. The direction of opening shall be clearly marked by an arrow cast on the outside of the hydrant. Hydrants shall be connected to the main with a six (6) inch pipe and shall be controlled by an independent six (6) inch gate valve. The six (6) inch gate valve shall be located as near to the service main as practical and connected to the tee with tie rods.

3. All hydrant barrels and caps shall be painted red.

G. Valve Boxes

1. All valve boxes, base extensions, lid and cover shall be of cast or ductile iron. Valve boxes shall be of the American Flow Control sliding type, round head marked "Water". The shaft diameter shall not be less than five (5) inches. The valve boxes shall have a minimum range of extension to fit two (2) inch to twelve (12) inch valves inclusive, placed on mains at depths of three (3) feet to five (5) feet of cover in order that the cover of the valve box is set to finished grade as shown in the Water Detail Drawing. For valves five (5) feet or deeper an American Flow Control Adjustable Trench Adapter shall be used with the cover of the valve box set to finished grade as shown in the Water Detail Drawing.

H. Special Conditions

1. The County may require that special material and/or construction be used where normal water pressure exceeds the pressure rating used in these standards and where the design will not permit reducing these pressures to acceptable levels.

Disinfection of Water Mains

A. General:

1. After testing and before final inspection of the completed systems, water mains and service laterals shall be flushed and disinfected in accordance with AWWA Specification C651 latest revisions. Flushing shall be accomplished at a flow velocity of not less than 2.5 feet per second.

2. Disinfection as described in AWWA C651-"Placing of calcium hypochlorite tab-lets" shall be used. Five (5) gram calcium hypochlorite tablets with 3.25 gram available chlorine per tablet shall be attached at the inside top of the pipe by an adhesive such as Permox No.2 or equal. The following number of tablets for

the given pipe size shall be used for an initial dose of twenty-five (25 mg/l (ppm)) chlorine:

Pipe Diameter	Number of Tablets Per 18-20 Ft. Pipe Section
6"	1
8"	2
10"	3
12"	4
16"	7

or the number of tablets equal to 0.0012 (d)2L rounded to the next higher integer, where d is the inside diameter, in inches, and L is the length of the pipe section, in feet. Use of the continuous feed or slug method of disinfecting may only be used to re-chlorinate a water pipe after the initial disinfection or in other specific cases approved by the County.

3. The disinfection solution shall remain in the pipe line for not less than twenty-four (24) hours, after which time a chlorine residual of 10 ppm at all parts of the line shall be required. All valves and appurtenances shall be operated while the chlorinated water is in the main.

4. Following chlorination piping shall be thoroughly flushed. Water in the new main shall be proven comparable in quality to the existing public water supply. The Virginia Waterworks Regulations require at least two consecutive satisfactory bacteriological samples from the distribution system before the system can be placed in service. Samples must be collected at regular intervals not exceeding 2000 feet throughout the length of the main and must be taken to an approved laboratory for testing and the Developer/Contractor shall pay all costs associated with disinfection and testing of installed facilities and bacteriological samples as required.

Separation of Water Lines and Sanitary Sewers

A. General:

1. The following factors shall be considered in providing adequate separation:
a. Materials and types of joints for water and sewer pipe
b. Soil Conditions
c. Service branch connections into the water line and sewer lines
d. Compensating variations in the horizontal and vertical separations
e. Offsetting of pipes around manholes

B. Parallel Installation

1. Normal conditions: water lines shall be laid at least ten (10) feet horizontally from a sewer line whenever possible, the distance shall be measured edge-to-edge unless determined by the County to be unusual conditions.

2. Unusual conditions: when local conditions prevent a horizontal separation described above, the following construction shall be used:

a. The bottom (invert) of the water main shall be at least eighteen (18) inches above the top (crown) of the sewer.

b. 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. Pressure test shall be 30 psi.

3. The sewer manhole shall be made 100% water-tight construction and tested in place by standard vacuum test.

C. Crossing

1. Normal Conditions: water lines crossing over sewers shall be laid to provide a separation of at least eighteen (18) inches between the bottom of the water line and the top of the sewer whenever possible.

2. Unusual conditions: when local conditions prevent a vertical separation as described above, the following construction shall be used:

a. Sewers passing over or under water lines shall be constructed of AWWA approved water pipe, pressure tested in place without leakage prior to backfill. Pressure test will be conducted at 30 psi.

b. Water lines passing under sewers shall, in addition, be protected by providing:

i. A vertical separation of at least eighteen (18) inches between the bottom of the sewer and the top of the water line. Sewer line shall be encased along its length where it is within 10' of the water line.

ii. Adequate structural support for the sewers to prevent excessive deflection of the joints and the settling and breaking of the water line.

iii. The length of the water line be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sewer.

D. Sewers or Sewer Manholes

1. No water pipes shall pass through or come in contact with any part of a sewer manhole.

E. Other Utilities

1. When other underground utilities (storm drains, gas, electrical, phone, etc.) cross within twelve (12) inches above or below water lines adequate structural support of the utilities shall be addressed.

Valve, Air Relief, and Blow-Off Chamber

A. General:

1. During construction air and sediment accumulations may be removed through a standard fire hydrant; compressed air and pumping may be used for de-aerating mains through hydrants.

2. Chambers or pits containing valves, blow-offs, meters, or other such appurtenances to a distribution system shall not be connected directly to any storm drain or sanitary sewer, nor shall blow-offs or air relief valves be connected directly to any storm drain or sanitary sewer.

3. Such chambers or pits shall be drained to the surface of the ground where they are not subject to flooding by surface water, or to absorption pits underground in areas with sufficiently water table.

4. The design engineer shall indicate the size of the air relief discharge required on the plan sheet.

As-Built Plan Submittal

A. General:

1. Prior to conveyance of the water system (main lines and associated structures) Botetourt County will require the following as built/record drawing information to be submitted:

a. One (1) complete reproducible (Mylar) set of water as-built/record drawings as prepared by the design engineer, sealed by a Professional Engineer registered in the Commonwealth of Virginia.

b. One (1) complete paper (blueprint/blueline) set of water as-built/record drawings as prepared by the design engineer, sealed by a Professional Engineer registered in the Commonwealth of Virginia.

c. One (1) complete digital (AutoCAD 2000 version) set of water as-built/record drawings as prepared by the design engineer, sealed by a Professional Engineer registered in the Commonwealth of Virginia.

d. All as-built/record drawings shall show actual field locations (horizontal and vertical) of structures (manholes, meters, vaults, meter boxes, fire hydrants etc.) and show recomputed pipe lengths and slopes based upon actual field locations.

Process of Conveyance

A. General:

1. Prior to conveyance of the water system (main lines and associated structures) Botetourt County will require the following information to be submitted:

a. One (1) letter of documentation by the design engineer, sealed by a Professional Engineer registered in the Commonwealth of Virginia, stating that the system has been built in accordance with the approved plans and specifications.

b. Deed of conveyance from the owner to Botetourt County.

c. Plat showing all water easements.

d. Warranty to Botetourt County for one (1) year following date of acceptance by the Botetourt County Board of Supervisors.

e. Two (2) complete copies of documentation prepared by the design engineer, sealed by a Professional Engineer registered in the Commonwealth of Virginia, of all requires water testing to include at least the following items.

i. Main line water line water pressure testing.

ii. Main line water line acceptable bacteriological testing results.

2. Submit all information as outlined above and provide written request that Botetourt County accept ownership and operation of the system.

3. Schedule a pre final inspection of the system.

4. Address any inspection/punch list items.

5. Schedule a final inspection of the system.

6. Botetourt County Department of Public Works makes formal recommendation to Botetourt County Board of Supervisors that the system is complete and ready for ownership and operation by Botetourt County.

7. Botetourt County Board of Supervisors takes official action to either accept or reject ownership and operation of the system.

INSTALLATION OF DUCTILE-IRON WATER MAINS

TABLE 4

Maximum Joint Deflection* Full Length Pipe-Push On Type Joint

Nominal Pipe Size (In.)	Deflection Angle 0 degrees	Maximum Offset-S in. (m)		Approx. Radius of Curve-R Produced by Succession of Joints-ft.(m)	
		18 ft. (5.5m) L	20 ft. (6.1 m) L	18 ft. (5.5m) L	20 ft. (6.1m) L
3	5	19(0.48)	21(0.53)	205(62)	230(70)
4	5	19(0.48)	21(0.53)	205(62)	230(70)
6	5	19(0.48)	21(0.53)	205(62)	230(70)
8	5	19(0.48)	21(0.53)	205(62)	230(70)
10	5	19(0.48)	21(0.53)	205(62)	230(70)
12	5	19(0.48)	21(0.53)	205(62)	230(70)
14	3*	11(0.28)	12(0.30)	340(104)	380(115)
16	3*	11(0.28)	12(0.30)	340(104)	380(115)
18	3*	11(0.28)	12(0.30)	340(104)	380(115)
20	3*	11(0.28)	12(0.30)	340(104)	380(115)
24	3*	11(0.28)	12(0.30)	340(104)	380(115)
30	3*	11(0.28)	12(0.30)	340(104)	380(115)
36	3*	11(0.28)	12(0.30)	340(104)	380(115)
42	2*	7 1/2(0.19)	8(0.20)	510(155)	570(174)
48	2*	7 1/2(0.19)	8(0.20)	510(155)	570(174)
54	1 1/2*	5 1/2(0.14)	6(0.15)	680(207)	760(232)

*For 14-in and larger push-on joints maximum deflection angle may be larger than shown above. Consult manufacturer.

INSTALLATION OF DUCTILE-IRON WATER MAINS

TABLE 5

Maximum Joint Deflection* Full Length Pipe-Mechanical Joint Pipe

Nominal Pipe Size (in.)	Deflection Angle 0 degrees	Maximum Offset-S in. (m)		Approx. Radius of Curve-R Produced by Succession of Joints- ft.(m)	
		18 ft. (5.5m)	20 ft. (6.1 m)	18 ft. (5.5m)	20 ft. (6.1m)
3	8-18	31(0.79)	31(0.89)	125(38)	140(43)
4	8-18	31(0.79)	35(0.89)	125(38)	140(43)
6	7-07	27(0.69)	30(0.76)	145(44)	160(48)
8	5-21	20(0.51)	22(0.56)	195(59)	220(67)
10	5-21	20(0.51)	22(0.56)	195(59)	220(67)
12	5-21	20(0.51)	22(0.56)	195(59)	220(67)
14	3-35	13 1/2(0.34)	15(0.38)	285(87)	320(98)
16	3-35	13 1/2(0.34)	15(0.38)	285(87)	320(98)
18	11-30	11(0.28)	12(0.30)	340(104)	380(118)
20	3-30	11(0.28)	12(0.30)	340(104)	380(118)
24	2-23	9(0.23)	10(0.25)	450(137)	500(152)
30	2-23	9(0.23)	10(0.25)	450(137)	500(152)
36	2-05	8(0.20)	9(0.23)	500(152)	550(167)
42	2-00	7 1/2(0.19)	8(0.20)	510(155)	570(174)
48	2-00	7 1/2(0.19)	8(0.20)	510(155)	570(174)

SANITARY SEWER

SANITARY SEWER PIPE MATERIALS

1. Bedding:

All pipe (PVC and ductile iron) up to and including eighteen inch (18") shall be bedded in compacted granular material and compacted granular bedding shall completely cover the pipe barrel to a depth of 6" over top of pipe. The granular material shall be well-graded, crushed stone meeting the requirements of V DOT gradation 57 or 67 stone. Bedding for pipe larger than eighteen inches (18") shall be designed on an individual basis and approved by the County. Refer to Detail Drawings.

2. Pipe Material Selection:

The pipe materials listed hereunder have been approved for use in Botetourt County. However, the acceptability of specific pipe material for use within a specific soil type or condition shall be determined by the County on an individual basis at the time of design review of the plans. The type or types of pipe allowable for use on any specific project shall be shown on the approved construction plans.

a. Ductile Iron Pipe:

Ductile iron pipe shall be centrifugally cast manufactured in accordance with ANSI Specification A21.511 latest revision, and shall be cement mortar lined in accordance with ANSI Specification A21.4-80. Slip joint or mechanical joint pipe shall be used for gravity sewers. Slip joint pipe shall be designed in accordance with ANSI standard A21-50 and specified according to ANSI standard A21-11. Class 51 pipe shall be minimum strength used in all sewer applications. May only be used upon approval of County. Gaskets shall be furnished by the manufacturer and installed in accordance with his recommendations. Ductile iron pipe shall be used in exposed pipe installations, and where approved by the County when other pipe materials are subject to crushing.

b. Polyvinyl Chloride (PVC):

PVC sewer pipe shall be manufactured in accordance with ASTM Designation 3034-77 (SDR 35). Gravity sewer pipe shall be unplasticized polyvinyl chloride with integral rubber ring wall bell and spigot joints furnished in 12.5' and 20' nominal lengths. Installation of PVC gravity sewer pipe and fittings shall be in accordance with ASTM Designation 2321 and manufacturer's recommendations.

i. PVC sewer pipe shall be stored in accordance with manufacturer's recommendations on flat, even surfaces and shall remain stacked on the pallets as delivered to the job site until such time as the trench is ready for placement of the pipe; i.e., PVC pipe shall not be strung out on the job site in excess of one day's work.

ii. The County may require additional strength PVC pipe including SDR-26, SDR-21, DR-18 or concrete encasement of SDR-35, or both where depth exceeds twelve feet (12') and where additional protection is required for the pipe.

c. PVC (Ribbed Pipe): Ultra-Rib pipe meeting ASTM F-794 with a stiffness factor of 46 may be used on County projects. Installation shall be in strict compliance with manufacturer's written instructions. All fittings used shall be designed specifically for pipe used and be approved for use by same manufacturer of pipe. Connections to manholes shall be made by manufacturer's recommended methods and approved by County.

3. Service Connections: Polyvinyl chloride (PVC) sewer pipe conforming to ASTM Designation 3034-77 (SDR-35), or Schedule 40 PVC pipe conforming to ASTM Designation 1785-76 shall be used between the sewer main and the cleanout. SDR-21 PVC pipe shall be used where additional strength pipe is required.

a. The PVC SDR 35 joints shall be made with bonded-in-bell elastomeric seal. Schedule 40 PVC joints shall be made with a solvent weld bell and spigot joint using PVC pipe cleaner and glue as supplied by the manufacturer.

b. No-hub pipe shall not be permitted.

c. There shall be no bands in service line from main to cleanout except as indicated on approved Botetourt County Sewer Detail Drawings.

4. There shall be no change in pipe size and/or material from manhole to manhole.

SANITARY SEWER CONSTRUCTION

A. General Requirements:

1. All construction of sanitary sewer mains and appurtenances in Botetourt County shall be in strict accordance with plans and specifications prepared as part of the Contract Documents and as approved by the County. All materials shall be new and unused. Prior to construction of the approved sanitary sewer, Contractor shall provide field stakeout including adequate line and grade stakes in order that sanitary sewer and appurtenances may be constructed in accordance with Contract Drawings.

2. If any deviation is contemplated in location or line grade of any sewer, structure or appurtenance as shown on the Contract Drawings, a revision of the Drawings showing the proposed deviation shall be submitted to the County for review and approval before any changes are constructed. Design Engineer of Record must concur in any revision of drawings.

3. All sewer shop drawings/cut sheets shall be submitted by the contractor to both the design engineer and Botetourt County for approval prior to installation. Botetourt County will require three (3) complete sets of shop drawings for review.

4. The contractor shall schedule a preconstruction meeting to be attended by the contractor's site superintendent, design engineer, the design engineer's field representative/inspector, representatives from Botetourt County Utility Department and representatives from Botetourt County Engineering Department and any materials suppliers the contractor feels necessary.

5. The contractor shall obtain a copy of the most current edition of Botetourt County Water and Sewer Construction Standards and Specifications and provide protection (a letter) that the contractor has and is familiar with the requirements therein.

6. The developer shall provide 1 year warranty for all lines prior to conveyance to Botetourt County with warranty date beginning at the date of system acceptance by Botetourt County.

7. Sewer connection fees will be based upon the fee structure currently in place. Owner/developer must make applications and pay all applicable connection fees prior to issuance of any building permits.

B. Excavation:

1. Excavation shall conform to the lines and grades shown on the plans. The width of excavation for trenches shall be a minimum of 24" plus the outside diameter of the pipe. Excavation shall not be carried below the established grades and any excavation below the required level shall be backfilled with suitable, thoroughly compacted granular bedding material. Contractor shall install all sheeting, bracing, and shoring necessary to perform the work, to protect existing structures and all excavations as required under Virginia OSHA Regulations. Compliance with provisions of the Overhead High Voltage Line Safety Act is required.

2. Dewatering equipment shall be sized to maintain the trench in a satisfactory de-watered condition suitable for pipe laying and backfilling. Pipe laying will be permitted only where the depth of water is maintained below the bedding material. Bedding material shall not be placed on unstable trench material.

3. Not more than one hundred fifty feet (150') of trench shall be opened in advance of the completed pipe laying. Trench walls shall be protected in accordance with current OSHA regulations at manholes and similar structures shall provide a minimum clearance of eighteen inches (18") between the outer surface of the structure and the embankment or sheeting.

4. Rock excavation: Rock excavation, when needed, shall be performed in accordance with industry standards. All blasting operations shall be in accordance with existing ordinances and regulations. Where excavation is made in fractured rock or boulders, no rock shall remain nearer than six inches (6") to any part of the sewer pipe when laid, nor shall rock project beyond the lines and grades of masonry structures. No blasting shall be performed within forty feet (40') of a tested or completed sewer. The ends of sewers adjacent to blasting shall be covered to avoid receiving debris.

5. Wherever foundation material is unsuitable, it shall be excavated until a stable foundation is achieved. Granular material, VDOT stone type 21A, shall then be placed in six inch (6") layers and compacted until the trench bottom has been stabilized. Standard granular pipe bedding material shall be placed as heretofore specified.

6. All material excavated but not used in backfill shall be properly removed and disposed of by contractor in a location approved by the County.

C. Backfill:

1. Backfill shall begin at the top of the standard granular bedding and shall be placed in six (6") layers and shall be thoroughly tamped to ninety-five percent (95%) of the maximum theoretical compaction density as determined by a standard proctor on the material until the top of the pipe has a minimum cover of one foot (1'). Remainder of the backfill shall be in two foot (2') layers and shall be thoroughly tamped to 85% of the maximum theoretical density as determined by a standard proctor on the material. Testing shall be performed by an independent laboratory at the developer's expense. The minimum testing shall be one test per job or 1000 feet. Location of test will be at the discretion of the Botetourt County field inspector. The contractor will be responsible for correcting any areas that fail, and retesting will be required. If the County representative requires additional test, the responsibility of payment for testing will be based upon the test results.

2. Backfill material shall be free of perishable material, frozen clods, sticky masses of clay and other unsuitable matter. Rock pieces larger than one inch (1") shall not be used in the backfill which is within two feet (2') of the pipe. No rock over five inches (5") in its greatest dimension shall be used in any backfill. Manholes and cleanouts shall be backfilled in same manner as the sewer pipe. Backfill material shall not be dropped directly on the pipe from a height greater than three feet (3').

3. Backfill in areas not subject to vehicular traffic shall be compacted to such a degree that any subsidence will not be objectionable or detrimental to normal use. Backfill and replacement in existing or proposed roads shall be executed in full accordance with the requirements of the Virginia Department of Transportation Standards.

D. Pipe Installation:

1. All gravity sewer mains and service laterals and force mains shall have a minimum cover of three and one half (3 1/2') measured from top of pipe to finish grade. The County may require additional cover as needed for pipe protection.

2. All pipe and fittings shall be carefully handled with non-metallic slings or other approved devices to prevent damage to protective coatings or joints. Lifting equipment shall be satisfactorily rated to handle the pipe sizes used. Pipe shall not be dumped or dropped into trench. Each section of pipe shall be thoroughly inspected for defects before being lowered into the trench.

3. Pipe shall be laid true to line and grade with bells upstream and shall be jointed together such that the completed pipe will have a smooth invert. Pipe shall be pushed home by hand. The use of equipment (i.e. blocks) shall not be permitted. Cutting of pipe shall be performed by sawing.

4. Standard bedding shall be shaped to the curvature of both the bell and barrel of the pipe. The trench shall be kept free of water while the work is in progress. The ends of the pipe shall be cleaned so that proper joints can be made. As the work progresses, the interior of the pipe shall be cleared of dirt, cement, or other deleterious material.

5. Except as required for use of a lower level, exposed end of all pipe and fittings shall be fully closed to prevent earth, water or other substances from entering pipe. Trench shall be completely backfilled at end of each workday. When new pipe is tied into an existing manhole, new pipe shall be plugged with a standard sewer plug and shall remain plugged until all new line(s) that will flow to existing manhole have been completed, tested, and accepted.

E. Service Connections:

1. SDR 35 and schedule 40 PVC pipe lateral service connections to the sewer main shall be made by means of a commercially manufactured tee, tee-wye, or wye branch. Service laterals may also be connected to the sewer system at a manhole. A sewer cleanout the same size as the service line shall be installed in accordance with the Detail Drawings. Pipe material shall be of the same type to and including the cleanout stock.

2. All taps to an existing manhole or pipe shall be made by licensed professional plumber and inspected by Botetourt County.

3. Sewer service line shall be four inches (4") minimum for residential service and six inches (6") minimum for non-residential service. Sewer cleanouts shall be same size as service line and shall be installed per Botetourt County Sewer Detail Drawing. Additional sections of pipe shall be installed behind clean out as indicated on detail drawings to prevent conflict with other utilities generally located in this area.

4. Sewer service connections from manhole or sewer main to the cleanout shall be installed with the same care as the sewer main. Proper excavation, slope of pipe and standard granular bedding shall be provided throughout. All gravity sewer mains and service laterals shall be air tested.

5. No connection shall be made to the vertical portion of a cleanout except for private force main.

6. All sewer service connections or portions of sewer service connections outside of the public right-of-way or sewer easement shall be privately owned and maintained.

7. A sampling and/or metering manhole, which conforms to Detail Drawings, shall be installed on sewer service lateral for all non-residential facilities. Manholes may be installed at property line in lieu of cleanout or between cleanout at the property line and the facility. Sampling manholes shall be tested by either vacuum method or exfiltration.

F. Manholes:

1. Only precast manhole sections shall be used. Manholes shall be constructed with manhole frames, covers and steps. Frames and covers shall be Russel Pipes & Foundry MH301, watertight in paved and non-paved areas and Russel Pipe & Foundry MH300 in areas not subject to flooding or surface drainage.

2. Casting shall be best quality tough, gray iron, free from defects, blow holes, and other imperfections and shall meet the requirements of ASTM Designation A-48, Class 20. The castings shall be sound, free to form and thickness, cleaned by means of sand blast and neatly finished. The material bearing surfaces shall be machine ground and finished to insure satisfactory seating. Covers shall have the words "Sanitary Sewer" cast into the top. Castings shall receive one coat of black asphaltum paint at the factory. Locations and type of manhole vents will be as indicated on the approved plans and as per Detail Drawings. Change in location must be approved by the County.

3. Covers shall be furnished with means of lifting. Covers that rock under normal load or will not seat will be rejected. Frames shall be bolt-down type, with butyl mastic sealer placed between frame and manhole. Mortar shall not be permitted. Frames shall have a nut and washer installed on top and bottom to facilitate minor elevation adjustments. The adjustment space between the bottom of the frame and the top of the manhole section shall be formed and filled with 3000 psi concrete.

4. Steps for manholes shall be made of steel and shall have a plastic coating. Steps shall be spaced 16 inches (16") apart. The first step shall be within 12 inches (12") of the cover. The bottom step shall be within 24 inches (24") of the bottom of the manhole.

5. Precast concrete manholes shall consist of precast reinforced concrete sections, an eccentric conical section and a standard base section with poured uniform bottom inverts. Flat top manholes can be used only with approval of the County. Where soil conditions dictate their use, expanded base section, extending a minimum of four inches (4") and a maximum of eight inches (8") beyond the outside vertical wall (riser section) of the manhole shall be used. Manhole shall be installed with steps vertically aligned over manhole bench. Access hole in flat top manhole section shall be centered over manhole steps.

6. Precast base section shall be installed on a compacted stabilized foundation of bedding material foundation prepared similar to that required for the proper installation of the adjacent sewer pipe as described elsewhere in these Specifications.

7. Precast manhole sections shall be manufactured in accordance with ASTM Designation C478, latest revision. Each section shall have not more than two (2) holes for the purpose of handling and setting. These holes shall be tapered and shall be plugged up with rubber stoppers and an approved non-shrink grout after installation.

8. A cold applied butyl mastic joint sealer manufactured specifically for the purpose shall be used to make a watertight joint between manhole sections and/or grade rings. Mortared joints are not permitted. All new manholes shall be pre-cast concrete inverts except straddle manhole. All straddle manholes and all field-constructed inverts shall be with ready mix (3000 psi) concrete and shall only be used with approval of the County.

9. Standard manhole drop connections shall be installed where indicated on the drawings. Drop connections shall conform to the Detail Drawings.

10. The invert channels of the manhole shall be smooth and semi-circular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Invert benches shall be constructed of ready mix concrete (3,000 psi) over the entire existing bench.

11. The invert channel shall be at least 0.75 times the diameter of the pipe in depth. The minimum difference in elevation of inverts of incoming and outgoing pipes shall be 0.10 feet.

12. Where grade rings are required to meet specified grade, the maximum height/thickness and minimum number of rings shall be used. Cone sections and grade rings shall be prefilled with matching holes to accept threaded rod installation. Refer to Detail Drawings.

G. Pipe Connection at Manholes:

1. All new manholes shall be supplied with an approved flexible boot connection suitable for specified pipe and manhole. All rubber boots for 8 inch (8") pipe shall have a maximum flexibility of 24" in any direction from center. Boot flexibility for pipe sizes larger than 8 inch (8") shall be per the manufacturer's recommendations. Twenty inch (20") and larger pipe connections shall have the first joint located four feet (4') from the inside face of the manhole. Flexible joint manhole connection shall be as manufactured by Pres-Seal Gasket Corporation, Fort Wayne, IN, or approved equal.

2. Manhole to pipe installation procedures shall be as follows:

a. After manhole has been set to line and grade, inspect flexible connector boot for damage and clean out inside of boot. Clean surface of pipe barrel to be installed.

b. Insert pipe into connector/boot until end of pipe breaks plane of manhole wall and flush with manhole invert. Position pipe in center of connector.

c. Install take-up clamp(s) in groove(s) at pipe receiving end of boot and tighten clamps to 60 lb./lbs. of torque prior to adjusting pipe to desired angle of deflection.

d. After desired deflection angle of pipe has been achieved, install bedding and backfill material in accordance with these Construction Standards.

3. Precast manhole sections shall be manufactured for the specified size, angle and number of pipe connections required. Field modification or abandonment of any part of a precast manhole will not be permitted without written approval of the County. Any approved field modification(s) or repairs shall be performed by a qualified person(s) approved by the manufacturer.

4. Inside of manholes (walls, steps, invert, pipe connections, benches) and frame and cover shall be kept clean and free of dirt, stone, mastic, trash and construction materials. Manholes shall be cleaned prior to testing.

5. Abandonment of manholes and sewer lines shall be performed in accordance with the Detailed Drawings.

6. A rubber water stop shall be used around pipe at manhole connection of straddle manhole. Refer to Detail Drawings.

H. Hydraulic Cement Mortar and Grout: Cement mortar and grout shall consist of a mixture of hydraulic cement, fine aggregate, water and admixture.

a. Cement shall be Portland Cement Type I or II.

b. Fine Aggregate Grade C shall be used.

c. Water used with cement or lime shall be clean, clear, and free of oil, acid, salt, alkali, organic matter or other deleterious substances.

d. Admixtures shall conform to Section 217 of VDOT Specifications.

e. Hydraulic cement mortar and grout shall contain from 3 to 7 percent entrained air. Air entrained cement may be used in lieu of plain cement and air-entraining admixture. Mortar and grout shall be mixed with a minimum amount of water necessary to obtain required consistency. Mortar and grout shall be properly cured and protected for not less than three (3) days.

i. Cement Mortar shall consist of one part hydraulic cement, 2 1/2 parts fine aggregate by weight and sufficient water to produce a stiff mix. Grade C Fine Aggregate shall be used.

ii. Non-Shrink Mortar shall consist of one part hydraulic cement, 2 1/2 parts fine aggregate by weight, a set retardant or other admixture which will reduce the amount of required mixing water and sufficient water to produce a stiff mix. Grade C Fine Aggregate shall be used.

iii. Cement Grout shall consist of one part hydraulic cement, 2 parts fine aggregate by weight and sufficient water to produce a free flowing mix. Grade A fine aggregate shall be used.

iv. High Strength Grout and Mortar shall consist of a pre-packaged, non-shrink hydraulic cement mixture with a 7-day compressive strength of at least 4,000 psi when tested in accordance with ASTM C 109 and with a 7-day bond strength of at least 1,000 psi when tested in accordance with VTM-41, except that epoxy will not be used to develop the bond.

I. Acceptance Tests:

1. General

a. Sewers will be inspected to determine if any deviation from line and grade have occurred. Pipe alignment will be checked by illuminating interior of pipe. If pipe shows poor alignment, displaced pipe, or any defect, including a visible leak, defect shall be corrected before leak testing of the pipe.

b. The developer shall provide video camera inspection documentation prior to conclusion of 1 year warranty period. Video camera inspection work to be performed no sooner than 6 months after the date of system acceptance by Botetourt County and no later than 8 months after the date of system acceptance by Botetourt County. One (1) copy of the video tape to be provided to Botetourt County. Video camera inspection work to be coordinated with Botetourt County such that County personnel can be present during video inspection operations.

c. Air testing shall be used, test methods and acceptability criteria shall be in accordance with the Uni-Ball low pressure air test. Air testing of gravity lines shall be required for all types of pipe and materials.

2. Manhole Acceptance Tests

a. Manholes, including frame, shall be tested by vacuum testing from the top of the frame. Inflatable stoppers shall be used to plug all lines into and out of the manhole being tested including any vent line. The stoppers shall be positioned in the lines far enough from the manhole to insure testing to those portions of the lines not air tested. Vacuum tests shall be made with a vacuum of 10" Hg. The time for the vacuum to drop from 10" to 8" of Hg must be greater than 60 seconds.

b. Contractor shall furnish weirs, stand pipes, pipe plugs, water, pressure gauges, stop watches, air compressor, vacuum pump, hose and assistance as required to perform these tests. All acceptance tests shall be conducted by Contractor in the presence of a County Inspector.

c. Acceptance tests shall not be made until sanitary sewer, manholes and proposed sewer service connections, as shown on the approved sewer plans, have been installed, the sewer trenches (including manholes and cleanout stocks) backfilled and compacted to finished sub-grade.

d. Contractor shall schedule all acceptance tests with the project inspector at least forty-eight (48) hours in advance. Each section of completed sewer shall be tested from manhole to manhole. No sewers or sewer service connections are to be excluded from this testing procedure.

3. Sewer Pipe Testing Procedures

a. Whenever it is necessary to construct underdrains or place gravel under pipe lines in order to dewater trench during construction of sewers, acceptance test will not be made until any pumps, which have been used in dewatering process, have been disconnected or drains have been taken out of service.

b. Contractor shall schedule all acceptance tests with the County at least forty-eight (48) hours in advance. Each section of completed sewer shall be tested. Generally, sewers will be tested from manhole to manhole. No sewer or sewer service connection is to be excluded from this testing procedure.

c. Low Pressure Air Testing Procedure -The test procedure shall be conducted in the following manner: (Vacuum test of manholes is generally inverse of low pressure air test of sewer lines)

i. Contractor shall thoroughly clean and remove all debris, silt, earth or other materials from the sewer prior to acceptance testing.

ii. Proper test plugs shall be supplied and installed by Contractor. Test gauges used in air test procedure shall have a range of 0-10 psi and shall be calibrated in divisions of 0.10 psi with an accuracy of +/- one percent. Test gauges shall be calibrated at least once a year and the date and results displayed on the equipment including date of calibration. Calibrations shall be certified by an independent testing lab. Test gauges shall be located outside of manhole during testing.

iii. If pipe to be tested is expected to be below ground water table, Contractor shall either:

-Install a small diameter perforated vertical pipe from invert elevation of the sewer to the surface prior to backfilling; or

-Insert a pipe probe by boring or driving into the backfilling material adjacent to the invert elevation of the pipe, and determine the depth of the ground water level above the pipe invert immediately prior to acceptance testing.

-All gauge pressures for test shall be increased by the amount of this back pressure due to ground water over the invert of the pipe.

-In lieu of the above water depth determination, Contractor may add three (3) psi to the gauge pressure in the test.

iv. Contractor shall add air slowly to the portion of the pipe under test until the internal air pressure is raised to 4.0 psi gauge plus the ground water pressure.

v. As a safety precaution, no one shall be allowed in manhole after air pressure is increased in the sewer line. If the inspector suspects that the test plug may be leaking, pressure shall first be relieved before any adjustments are made to eliminate air leakage at the plug.

vi. Contractor shall allow air temperature to stabilize for at least two (2) minutes with the pipe subjected to an internal pressure of 4.0 psi by adding only the amount of air required to maintain the pressure.

vii. After temperature stabilization, the test will begin. If the internal air pressure decreases, the time required for the pressure to drop from 3.5 to 2.5 psi gauge will be observed and recorded. The time interval shall be compared to the time established standards in accordance with the DD-30 or DD-31 for time and length of test section for various diameters of the sewer. All pipes 15 inches or less shall be tested for a pressure drop of 1.0 psi gauge.

viii. Pipe which fails to maintain the stipulated pressure for a period equal to or greater than the holding time shown in Table I shall be deemed to have failed the low pressure air test and is unsatisfactory for acceptance by the County. Any sewer that fails to pass this test shall be replaced by the Contractor at his expense.

As-built Plan Submittal

A. General

1. Prior to conveyance of the sewer system (main lines and associated structures) Botetourt County will require the following as built/record drawing information to be submitted:

a. One (1) complete reproducible (Mylar) set of sewer as-built/record drawings as prepared by the design engineer, sealed by a Professional Engineer registered in the Commonwealth of Virginia.

b. One (1) complete paper (blueprint/blueline) set of sewer as-built/record drawings as prepared by the design engineer, sealed by a Professional Engineer registered in the Commonwealth of Virginia.

c. One (1) complete digital (AutoCAD 2000 version) set of sewer as-built/record drawings as prepared by the design engineer, sealed by a Professional Engineer registered in the Commonwealth of Virginia.

d. All as-built/record drawings shall show actual field locations (horizontal and vertical) of structures (manholes, clean-outs, service stub-outs, etc.) and show recomputed pipe lengths and slopes based upon actual field locations.

Process of Conveyance

A. General:

1. Prior to conveyance of the sewer system (main lines and associated structures) Botetourt County will require the following information to be submitted:

a. One (1) letter of documentation by the design engineer, sealed by a Professional Engineer registered in the Commonwealth of Virginia, stating that the system has been built in accordance with the approved plans and specifications.

b. Deed of conveyance from the owner to Botetourt County.

c. Plat showing all sewer easements.

d. Warranty to Botetourt County for one (1) year following date of acceptance by the Botetourt County Board of Supervisors.

e. Two (2) complete copies of documentation prepared by the design engineer, sealed by a Professional Engineer registered in the Commonwealth of Virginia, of all required sewer testing to include at least the following items:

i. Main line sewer line air pressure testing up to and against the first clean-out on service lines.

ii. Main line sewer line deflection mandrel testing.

iii. Sewer manhole vacuum testing up to and including the manhole frame.

2. Submit all information as outlined above and provide written request that Botetourt County accept ownership and operation of the system.

3. Schedule a pre final inspection of the system.

4. Address any inspection/punch list items.

5. Schedule a final inspection of the system.

6. Botetourt County Department of Public Works makes formal recommendation to Botetourt County Board of Supervisors that the system is complete and ready for ownership and operation by Botetourt County.

7. Botetourt County Board of Supervisors takes official action to either accept or reject ownership and operation of the system.

LUMSDEN ASSOCIATES, P.C.
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SANITARY SEWER SPECIFICATIONS

PARCEL A, PHASE III FOR BOTETOURT COMMONS PREPARED FOR TIMBERBROOK ASSOCIATES, L.C. AMSTERDAM MAGISTERIAL DISTRICT BOTETOURT COUNTY, VIRGINIA

REVISIONS						
NO.	DATE					
1	11 JANUARY 2002					
2						
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DATE: 11 JANUARY 2002

SCALE: NONE

COMMISSION NO. 00-336A

CADD FILE: 00336A.DWG PARCET A 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 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