Town of Blacksburg
Sanitary Sewer System
Standards & Specifications

Adopted By Town Council: August 25, 2009

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TOWN OF BLACKSBURG

Specifications and Standards
Sanitary Sewer System

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1.10 GENERAL

a. The following "SPECIFICATIONS AND STANDARDS FOR SANITARY SEWERS" shall be followed for the design and construction of all public sanitary sewer systems unless otherwise amended in accordance with the provisions for the variance section defined herein.

b. Sanitary sewer system shall consist of gravity pipes and force mains of all types, classes, and sizes shown on the plans, together with the required fittings, valves, manholes, cleanouts, STEP/STEG tanks, pumping stations, STEG lift stations and other appurtenances shown on the plans and profiles, or as authorized by the Engineering and GIS Department. All sanitary sewer systems and appurtenances shall be installed in accordance with these specifications and standards, and shall conform to locations and grades specified in the plans.

c. These specifications are intended to supplement the Blacksburg Town Code.

d. The Virginia Department of Health and Department of Environmental Quality enables the Town to review and approve sanitary sewer projects that are not deemed exceptions. Projects that are deemed exceptions must be submitted by the designer to the Department of Environmental Quality (DEQ) for review and approval. Projects that are deemed exceptions and must be reviewed by the DEQ include: (1) conventional pump stations and STEG lift stations, (2) force mains, (3) siphons, (4) gravity pipes with an inside diameter exceeding twelve inches, and (5.)EPA grants. The designer shall obtain a letter from the DEQ indicating that the plans have been approved by the DEQ before final approval shall be granted by the Town.

1.11 REGISTERED DESIGN PROFESSIONALS

a. A designer of plans for sanitary sewer facilities shall be, or under the supervision of, a registered professional engineer legally qualified to practice in Virginia who shall affix a signed imprint of his/her seal to each plan or plan-profile sheet and to engineer's reports.

b. In addition, in accordance with Section 54.1-408 and Section 54.1-409 of the Code of Virginia, a licensed land surveyor B or a certified landscape architect may prepare plans for gravity sanitary sewer line extensions as a part of subdivisions, site plans, and plans of development. An imprint of a signed land surveyor B or certified landscape architect seal shall be affixed to the plans and/or plan-profile sheet.

1.12 PROVISIONS FOR VARIANCE

a. Variances to these specifications shall be granted only when all of the following provisions apply:

   1. The requested variance is not detrimental to the public health safety and welfare.

   2. There is no reasonable design solution to avoid the need for the requested variance, and the variance could not have been anticipated during the preliminary subdivision or preliminary planning phases of a project.

   3. The requested variance is beneficial for operation and maintenance of the public utility system.

   4. The variance decision shall be applicable to similarly situated properties and conditions.

b. Any variance to the provisions of these specifications shall be requested in writing and the above listed findings shall be documented and approved by the Director of Public Works and the Director of Engineering & GIS.

1.13 FINAL PLANS

a. At a minimum three (3) sets of plans, design calculations, and specifications shall be submitted to the Director of Engineering and GIS for each sanitary sewer project. These shall be reviewed and one set returned to the Engineer with recommended changes and/or approval.

b. A final set of Mylar plans, design calculations and specifications shall be delivered to the Director of Engineering and GIS who shall sign each mylar sheet with his/her approval.

1.14 REQUIRED CONSTRUCTION DOCUMENTS

a. No construction work shall commence on any public sanitary sewer system until the contractor has in his possession a copy of the Town of Blacksburg "SPECIFICATIONS AND STANDARDS FOR SANITARY SEWERS" a complete set of approved plans and specifications prepared by a registered designer, whose signed seal shall appear on each plan sheet and on the specifications.

b. Each set of plans shall also be approved and signed by the Director of Engineering and GIS. Any significant change from the original approved plans shall require an additional approval from the Director of Engineering and GIS. Verbal approval from the Town Inspector may be sufficient for minor changes. The Town Inspector shall decide whether a change is a minor change or a significant change.

1.15 CONSTRUCTION SECURITY AND WARRANTY PERIOD

a. An acceptable security or performance guarantee will be required to cover the construction of all public sanitary sewer projects to be constructed by developers. Prior to approval of the plans the amount of security will be determined by the Director of Engineering and GIS. The plans shall be approved only after receipt of a security in the amount determined by the Director of Engineering and GIS.

b. After acceptance of the constructed sanitary sewer facilities by the Town and a complete set of as-built plans have been received by the Town, the project will be officially accepted by the Engineering and GIS Department.

c. The contractor/developer will be held responsible for a period of one year from the date of acceptance to cover any defects in construction. Date of acceptance is defined as the date that final completion is issued, approved as-built drawings are received by the Town, and securities are released by the Town.

d. Twenty (20%) percent of the public improvement construction security from the developer or a performance bond from the contractor will be held by the Town for the one-year warranty period. At the end of the one year warranty period the security will be returned to the contractor/developer.

1.20 CONVENTIONAL SANITARY SEWER SYSTEM DESIGN

1.21 GENERAL STANDARD

a. Public sanitary sewer systems shall be designed and constructed to achieve total containment of wastewater flows contributed from existing service areas and any new proposed developments.

b. All designs shall meet the minimum requirements established in these "SPECIFICATIONS AND STANDARDS FOR SANITARY SEWERS" and Article 1 "Collection and Conveyance Sewers" of the Virginia Sewerage Collection and Treatment Regulations (VSCAT), latest edition.

c. The wastewater system must be designed to serve by gravity the lowest floor elevation of proposed structures on all lots.

d. The developer is required to pay the portion of the upgrade attributable to the development project if it is a Town project. If it is not a Town project then the developer is required to pay for the upgrade in full to support their development project. A security will be posted as described herein prior to final approval.

e. Private laterals may only cross the property that they serve from the right of way or easement.

1.22 CAPACITY ANALYSIS

a. Plans and design calculations shall include an analysis of the downstream system to determine its adequacy for receiving additional flow. The downstream analysis shall be performed to the point in the public sanitary sewer system where the additional contributing flow is less than 1% of the total flow.

b. Projected flows for new developments shall be estimated based upon an average daily per capita flow of wastewater not less than that set forth in the VSCAT regulations.

c. At a minimum the peaking factor for new laterals, sub mains, trunk lines, and interceptor lines shall be as stipulated in the VSCAT requirements.

d. A peaking factor of no less than 2.5 times shall be applied to the estimated average daily flow projections. In certain areas of Town the Engineering and GIS department may require that a higher peaking factor be applied to the estimated average daily flows. Higher peaking factors shall be based on historical flow data provided by the Town.

e. The capacity of a pipe shall be deemed adequate when the calculated or measured depth of flow in the gravity pipe is less than 90% of the pipe diameter.

f. The capacity of a pump station shall be deemed adequate when the calculated or measured average daily peak influent flow into the pump station is less than the rated pump station capacity as defined herein.

g. The rated Pump station capacity shall be equal to 80% of the maximum pumping rate divided by the pump station peaking factor. The pump station peaking factor shall be 2.5 or greater as determined by historical flow data obtained by the Engineering and GIS Department.

1.23 DESIGN SUBMITTALS

a. The following information shall be included in the submittal for review:

1. Map showing area to be served, including the tributary area.

2. Calculations showing number or connections, estimated average flow from each, an estimate of future tributary flow and design peak flow for which the system is designed.

3. Calculations supporting the capacity of the downstream system to support the additional flows from the project; this analysis should identify the "critical section" and its capacity.

4. If industrial flow is anticipated, the Town's short form survey should be submitted indicating anticipated flow from the facility with the minimum and maximum rates of flow, the presence of any contaminants, estimated BOD quantities, suspended solids, and any abnormal pH levels.

b. Plans shall be submitted on a 24" x 36" plan/profile sheets. Profiles shall have a horizontal scale of not more than fifty (50) feet to the inch and a vertical scale of not more than ten (10) feet to the inch. Plan and profiles shall have a consistent scale and shall show:

1. Proposed facilities including pipe size, type, slope, distance between manholes, invert and ground elevation at each manhole, crossing separations, minimum cover, type of manhole, etc. All manholes should be assigned numbers that correspond on the plan and profile sheets.

2. Property lines, easements (existing and proposed) with their widths, and right-of-way with their widths.

3. Existing utilities with their widths and separation distances on the profile.

4. Lowest floor elevations

5. Streets and other paved areas.

6. Existing and proposed ground elevations (2'contours).

7. Permanent benchmarks (USGS Datum).

8. All existing structures both above and below ground.

9. One hundred (100) year flood zones.

10. North arrow (true north, or grid north if State Plane Coordinate System is used), scale, date, project name and engineer's name.

11. Any associated STEP/STEG design elements.

1.24 CONVENTIONAL GRAVITY SEWER MAINS

a. Minimum allowable inside pipe diameter for a gravity sewer main pipe is eight inches (8").

b. Standard service connections installed in the Town right of way or public utility easements shall be a minimum inside diameter pipe of six (6") inches.

c. New mains shall be designed for peak hour flow plus infiltration. The minimum design shall be 100 gallons per person per day, 2.7 people per dwelling unit, multiplied by a factor of 4.0 to reflect peak flow conditions. Higher peak flow rates may be warranted on smaller systems. The infiltration rate to be allowed in the design shall be at least 500 gpd per inch diameter per mile of pipe.

d. The Manning Equation roughness coefficient shall be 0.013 unless otherwise approved by the Town.

e. Slope should be great enough to provide a velocity of at least 2.0 fps for average flow conditions based on Manning's equation. Where velocities exceed 15 fps, the pipe shall conform to the appropriate ASTM and/or AWWA specifications relating to protections against internal erosion. (Generally, cement-lined ductile iron pipe is allowable when the flow velocity will exceed 15 fps). Concrete encasement, anchoring, or other approved mechanism shall also be provided to protect against displacement due to shock. Pipes laid at a slope exceeding 20 percent shall be anchored. Gravity pipe slopes shall be designed in accordance with VSCAT regulations.

f. Alignment: Pipes shall be designed with a straight alignment and with a uniform slope between manholes.

1.25 MANHOLES AND CLEANOUTS

a. Manholes shall be precast concrete with cast in place flexible pipe-to-manhole connector boots for all pipe connections.

b. Manholes shall be located at all changes in alignment or grade.

c. Inverts shall be shaped and formed to minimize head losses.

d. Manholes are required at the end of each line and at all intersections of laterals larger than six (6) inches and at the intersection of all mains.

e. Drop-type manholes are required when the influent pipe invert is greater than 1.9 feet above the invert effluent channel invert.

f. Manhole spacing shall not exceed 400 feet.

g. All manhole joints shall conform to the material specifications listed herein.

h. Proposed connections to existing manholes that are not precast concrete will not be allowed without the replacement of the existing manhole with a precast manhole structure.

i. New pipe connections into existing manholes shall be core-drilled and a flexible pipe-to manhole connector boot installed for each connection.

j. Ventilation of gravity sewer systems shall be provided where continuous watertight sections greater than 1,000 feet in length are incurred. The vent detail shown in the Appendix must be provided if other means of ventilation (i.e., building stack vent, manhole lids, etc.) are not provided.

k. Manholes shall be designed to provide a maximum depth of 12 feet.

l. A 0.1 foot drop shall be designed across each manhole.

m. A cleanout shall be installed at each property line or public utility easement where a private lateral connects into the Town main gravity sewer line.

1.26 MINIMUM AND MAXIMUM COVER

a. The minimum depth of cover for sanitary sewer systems shall be 36 inches, measured from the top of the pipe to the established finished grade.

b. The maximum cover shall be 15 feet.

1.27 EASEMENTS

a. Permanent easements of 15 feet width, minimum, shall be provided on all private property for sanitary sewer lines.

b. Prior to considering an easement as permanent, all surface conditions must be restored to original or better conditions. The easement shall be stabilized within 30 calendar days of the completion of construction.

c. Easement plats and deeds suitable for recordation, and recordation fees, shall be provided to the Engineering and GIS Department.

d. No building or permanent structures shall be constructed within easements.

e. No trees, shrubs, structures, fences or obstacles shall be placed within an easement which would render the easement inaccessible by equipment.

1.28 AS-BUILT PLANS

a. A complete set of as-built plans (on Mylar) shall be submitted to the Engineering and GIS Department upon completion of the sewer system. As-built plans shall show the location of easements, lines, appurtenances, service connections, and other data necessary to operate and maintain the system.

b. As-built plans shall be delivered within 30 days of the final inspection and prior to the Town's acceptance of the installation.

c. If an additional set of approved final plans are required by the VDEQ then the designer shall be responsible for submitting additional plans to the Virginia Department of Environmental Quality.

d. The developer/owner shall formally dedicate the sanitary sewer system, easements and/or property to the Town of Blacksburg.

1.29 CONSTRUCTION NOTES

a. The following standard notes shall be included on all sanitary sewer system plans:

1. A pre-construction meeting shall be held prior to construction.

2. Tie-ins to existing manholes will be core drilled and a flexible pipe-to-manhole boot installed.

3. All construction shall be in accordance with Town standards and specifications.

4. All utilities shall be visually inspected by the Town's Inspector prior to backfilling of trenches.

5. The contractor shall plug with an angle wing nut test plug the connection to the existing sanitary sewer prior to extending the sanitary sewer. The plug shall be maintained in place until such time as the sewer is completed, inspected and accepted by the Town. Failure of the contractor to appropriately install and maintain this plug shall cause him to be liable for any resulting blockages or repairs to the existing downstream sewer.

1.30 GRAVITY SEWER COLLECTION SYSTEM COMPONENTS

1.31 APPROVED EQUAL

a. Any request for use of an "approved equal" component shall be made in writing to the Director of the Engineering and GIS Department during the plan review process.

b. The determination of the approval or the use of the "approved equal" component shall be made by the appropriate Town Departments including Engineering and GIS and Public Works Departments.

c. Criteria used for determination of use shall be if the component meets the appropriate AWWA and/or ANSI Standard, maintenance requirements, and conformance with existing Town operations, equipment, and materials.

1.32 PIPES AND FITTINGS

a. Pipe Material: Sanitary sewer and lateral pipe shall be one of the following materials, as specified on the plans. When alternates are proposed, the contractor shall indicate at time of bidding the type of pipe to be installed.

1. PVC Pipe:

i. PVC pipe shall meet the requirements of ASTM D 3034-73 Polyvinyl Chloride (PVC) Plastic Gravity extra strength minimum requirements of SDR 35.

ii. Fittings and couplings shall be compatible with the pipe and shall be supplied by the same pipe manufacturer.

2. Ductile Iron Pipe:

i. Ductile iron pipe of Grade 60-24-10 centrifugally cast in accordance with ASA A21.51, shall be used for force mains and where called for on the plans. Pipe class shall be as indicated on the drawings and minimum wall thickness shall be .28", class 350 or Class 50.

ii. Pipe shall be in nominal 10', 16', or 18' lengths. Pipe and fittings shall be cement lined in accordance with ASA A21.4, except that the lining shall be half thickness, commonly referred to as "enameling," followed by an interior coat of coal tar enamel. Underground pipe, fittings, and accessories and piping in the casings shall have an exterior coat of coal tar enamel. Maximum depth shall be 15'.

b. Pipe Joints: should meet the following minimum standards:

1. PVC Joints:

Pipe shall have integral bell and spigot joints for PVC pipe with a rubber o-ring to provide from contraction and expansion to ensure water tightness. All fittings and accessories shall have identical bell and spigot configurations as the pipe.

2. Ductile Iron Joints:

Jointing materials for mechanical or slip-on joints in ductile iron pipe shall conform to the requirements of ASA A21.11. Fittings for ductile iron pipe shall be in accordance with AWWA C110/ANSI A21.10. Fittings shall have a minimum pressure rating of 250 psi. All fittings shall be cement mortar lined in accordance with AWWA C104/ANSI 21.4.

c. Plugs or Caps:

Plugs or caps used shall be those manufactured specifically for the type of pipe used. They shall be secured such that they will be water-tight and will withstand the internal pressure applied by air or exfiltration testing.

d. Casing Pipe:

The following table 1.32 lists acceptable casing sizes and maximum allowable skid support spacing. Minimum casing diameter to be installed within Town of Blacksburg

Table1.32 - Casing Sizes

Nominal Pipe Size (Diameter in Inches)	Casing Size (Inside Diameter in Inches)	Maximum Skid Support Spacing in Feet
< 8	Minimum = 8	As required by manufacturer
8	14 - 16	7.4
10	16 - 18	8.5
12	18 - 20	9.6

1.33 MANHOLES AND CLEANOUTS

a. Whenever possible manholes bases, risers, and leveling rings shall be of the precast type conforming to ASTM C 478. Minimum inside diameter shall be forty-eight (48) inches with a minimum of five (5) inch thick walls. Joints shall be of the mastic type joint conforming to ASTM C 443 which meets vacuum testing requirements. Manhole steps shall be provided on a maximum of sixteen (16) inch centers. All steps shall be protected by the use of rubber coated steps or other approved anti-corrosive coating. All manholes shall have monolithic bases. Brick manholes shall not be installed. The eccentric design manhole may be used.

b. Frames and covers shall have a minimum clear opening of twenty-four (24) inches and shall be of cast iron conforming to ASTM A-48 for Class 30 Gray Iron. Covers shall be inscribed with "SEWER" as shown on the Standard Detail Sheet.

c. Concrete used for shaping of manhole channels shall meet requirements of Virginia Department of Highways Type A3 or C. Manhole bottom sections shall be precast concrete conforming to ASTM C478. Inverts shall be formed as an integral part of the precast bottom and constructed as shown on the Contract drawings.

d. Manhole pipe joints shall be the flexible type in accordance with ASTM Standard C923-79. All pipe connections shall have flexible pipe-to-manhole connector boots and associated connecting bands.

e. Joints between precast manhole bases, risers, leveling rings, and cover frames shall be self-centering and make a uniform watertight joint conforming to ASTM C 443.

The joint shall also be sealed with a bituminous mastic joint sealing compound such as Concrete Sealants, Inc. "Con Seal", or equal.

1.40 GRAVITY SEWER CONSTRUCTION METHODS

a. The following specifications and standards shall govern all construction and installation of gravity sewer lines and appurtenances except as altered by the provisions for variance section described in these specifications.

b. It shall be the contractor's responsibility to comply with all local, State, and Federal regulations as well as good construction and management practices.

c. There shall be present and in responsible charge, whenever sewer line installation is in progress, a superintendent/foreman who, in the opinion of the inspector, is reasonably qualified and familiar with means and methods of water line installation.

1.41 CONTROL PLANS AND EMERGENCY ACCESS

a. Traffic Control Plan and Road Closure Permit – It shall be the responsibility of the contractor to take any measures as may be necessary or as directed by the Virginia Department of Highways and Transportation and/or the Town of Blacksburg. The owner/developer is required to obtain a Road Closure Permit from the Town and pay the required fee. A traffic control plan prepared in accordance with the latest edition of the Virginia Work Area Protection Manual shall be submitted to the Town for approval prior to commencing work. The owner/developer may not begin work until the Road Closure Permit is obtained and the traffic control plan is approved by the Engineering and GIS Department.

b. Erosion and Sediment Control Plan – It shall be the responsibility of the developer or contractor to submit an Erosion and Sediment Control Plan for review and approval by the Engineering and GIS Department.

c. Emergency Utilities Access – Emergency utilities such as fire hydrants and traffic signal control boxes shall not be obstructed at any time.

1.42 EXCAVATION

a. The contractor shall perform all excavation to dimensions and depths shown on the approved plans or as directed by the Engineering and GIS Department. Excavations shall be open cut except where approved by the Director of Engineering and GIS.
b. Existing utilities, structures and fencing shall be protected during construction, and if damaged or removed by the contractor, shall be repaired by him/her at no additional costs to the Town.

c. Trench Width – The following table 1.42 will serve as a guide for ordinary trench width (depths not exceeding six feet).

Table1.42 – Trench Width

Nominal Pipe Diameter	Minimum Trench Width	Maximum Trench Width
4 – 6"	3 times nominal pipe diameter	30"
8"	3 times nominal pipe diameter	32"
10"	Pipe diameter plus 2 feet	34"
12"	Pipe diameter plus 2 feet	36"
16"	Pipe diameter plus 2 feet	38"
18"	Pipe diameter plus 2 feet	42"
30"	Pipe diameter plus 2 feet	54"
42"	Pipe diameter plus 2 feet	66"

d. Rock Excavation – All rock within 6 inches of the finished pipe shall be removed. Rock is generally defined as any material which cannot be excavated by usual hand or machine methods and is more specifically defined as materials which cannot be excavated without drilling, blasting, or boring, or boulders more than one cubic yard in volume. Contractor is responsible for informing the Department of Engineering and GIS in writing about blasting activities and obtaining all necessary permits and insurance for blasting activities

e. Safety – All excavations shall conform to the latest regulations and safety practices specified by the Occupational Safety and Health Administration. The contractor shall, at his expense, protect from direct or indirect injury, all pipes, tracks, walls, buildings, and other structures of property in the vicinity of his work, whether above or below the ground or that may appear in the trench.

f. Permits – No excavations shall be made until proper permits have been obtained from the Town of Blacksburg.

g. Length of Open Trench – On any day, no trench shall be opened to a length greater than 500 feet, and any such trench shall be backfilled on that day.

h. Dewatering – Trenches shall be kept free of water during construction. Pumps, dams and/or under drains shall be maintained by the contractor. Dewatering of trenches shall be in accordance with E&S best management practices. No excavation, installation, or backfilling shall be permitted as long as water remains in a trench.

i. Trenching – Pipe trenches shall be excavated to a depth that will insure a minimum of 36 inches of cover for gravity sewer lines or as indicated in Minimum Cover section of these specifications. Excavation shall be made for bells of all pipes, and shall be of sufficiently depth to permit access to the joint for construction and inspection. In no case shall the bells be used to support the body of pipe.

j. Sheeting, Shoring and Bracing – The contractor shall support the sides and ends of all excavations, wherever necessary.

1.43 BEDDING

The class of bedding shall be determined by the engineer to provide the required support for the soil and load condition encountered. Class A, B, or C bedding as described below and as shown on system plans shall be used as required.

a. Class A

1. Concrete Cradle – The pipe shall be bedded in a monolithic cradle of plain or reinforced concrete having a minimum thickness of one-fourth the inside pipe diameter or a minimum of four inches under the barrel and extending up the sides for a height equal to one-fourth the outside diameter. The cradle shall have a width at least equal to the outside diameter of the pipe barrel plus 8 inches. Backfill above the cradle and extending to 12 inches above the crown of the pipe shall be compacted carefully.

2. Concrete Arch – The pipe shall be embedded in carefully compacted granular material having a minimum thickness of four inches and shall extend halfway up the sides of the pipe. The top half of the pipe shall be covered with a monolithic concrete arch having a minimum thickness of one-fourth the inside diameter at the crown and a minimum width equal to the outside pipe diameter plus eight inches.

b. Class B

Compacted Granular Bedding – The pipe shall be bedded in compacted material placed on a flat trench bottom. The granular bedding shall have a minimum thickness of four inches and shall extend halfway up the pipe barrel at the sides. The remainder of the sides/fills and a minimum depth of 12 inches over the top of the pipe shall be filled with carefully compacted material. (See "Backfilling" section)

c. Class C

Compacted Granular Bedding – The pipe shall be bedded in compacted granular material placed on a flat trench bottom. The granular bedding shall have a minimum thickness of four inches under the barrel and shall extend 1/10 to 1/6 of the outside diameter up the pipe barrel at the sides.

1.44 INSTALLATION

a. The installation of gravity sanitary sewer lines and appurtenances shall conform to the most current ASTM and ANSI/AWWA standards, the manufacturer's recommendations, the recommendation of the design engineer and Director of Engineering and GIS.

b. All construction within State maintained right-of-way requires approval of the Virginia Department of Transportation (VDOT). Pipe shall be placed where it will not interfere with traffic, and shall be subject to VDOT policies when placed within the right-of-way.

c. Pipe delivered to the site shall be carefully inspected for defects. Any pipe found to be broken or defective prior to or after installation shall be removed and replaced at the contractor's expense. Pipe and fittings may be strung out along the route of construction with the bells facing in the direction in which the work is to proceed.

d. Horizontal Separation - A minimum of four (4) feet of horizontal separation shall be maintained between the sewer utility and any aboveground or underground structure or pipe not associated with the sewer utility. If this minimum clearance cannot be attained then engineering controls shall be designed and installed to allow safe maintenance of the sewer utility by Town employees and protect the sewer line from damage that might result from the proximity of the other pipe or structure.

e. Gravity Pipe:

1. Pipe shall be placed in a trench in such a manner as to prevent damage to the pipe. Under no circumstances shall pipe be dropped or bumped into the trench. Any damaged pipe discovered during delivery or installation shall be immediately removed from the project site.

2. Every reasonable precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. Spigot and bell ends of pipe and gaskets shall be cleaned and lubricated according to the manufacturer's instructions. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a water-tight plug.

3. Pipe shall be laid upgrade, with bell ends facing in the direction of down slope unless directed otherwise by the Director of Engineering and GIS. Each piece of pipe shall be laid true to line and grade. The bottom of the trench shall be smoothly graded and bell holes provided so that the aggregate bedding gives uniform support to the barrel of the pipe when in final position. Adjustments to the line or grade shall be made by removing or adding granular material under the barrel. In no case shall wedges or blocks be used under the bottom of the pipe. The pipe shall be pushed fully "home" by hand, with a bar and block of wood to cushion the bell, or other methods for large diameter pipes.

4. Bedding shall consist of Virginia Department of Highways #68 or #57 or #8 aggregate. Depth of bedding shall be ¼ of the pipe's outside diameter but not less than four (4) inches. Minimum depth of aggregate in rock excavation shall be six (6) inches. Bedding must be either classes A, B, C (ASCE and WPCF) (See Town standard details).

5. Angle wing nut plug shall be installed and anchored in the new line at the existing manhole as soon as the first joint is laid. This plug shall remain in the pipe until the new sewer system is completed and tested and approved by the Town inspector.

6. Pipe being installed into existing precast manholes shall be core-drilled and flexible type pipe joint installed.

f. Fittings

1. Wyes and laterals shall be fully installed with a slope of 2% unless otherwise approved by the Town inspector.

2. Diameter of laterals shall be at least six (6) inches and shall be the same material as the sewer main. Laterals shall be installed from the main to the property lines unless otherwise indicated on the plans. Laterals shall be properly capped and suitably sealed to prevent infiltration of water into connections. Caps or plugs shall withstand pressure testing.

g. Manholes and Cleanouts

1. The sub grade and bedding for precast manhole bases shall be prepared the same as for a pipe. Poured concrete footing shall be on a well-compacted sub grade.

2. Inverts shall be channeled by running formed concrete (see Town standard detail) and shall be smooth and semi-circular in shape, conforming to the adjacent sewer section.

3. Changes in flow direction within a manhole shall be made with a smooth curve of as large radius as possible.

4. Manhole frame covers and risers shall be set level on top of Manhole base and a full bead of mastic at the proper grade.

5. Manhole stub-outs shall extend a minimum of twelve (12) inches from the manhole, be 8" minimum diameter, and the same material as the sewer main unless otherwise indicated on the drawings.

6. Stub-outs shall be sealed, braced, and marked.

7. Cleanouts are to be provided on all service laterals at the customer's property line unless the lateral connects directly into a manhole rather than the sewer main.

8. Manholes shall be vacuum tested in accordance with the testing and inspection section of these specifications

h. Separation between Sewer Lines, Water Mains and Storm Pipes

The following factors shall be considered in providing adequate separation of sanitary sewer from water mains: materials and types of joints for water and sanitary sewer mains, soil conditions, service branch connections into the water and sanitary sewer mains, compensating variations in the horizontal and vertical separations, space for repairs and alterations of water and sanitary sewer mains, offsetting of pipes around manholes, and identification of physical restraints preventing normal separation

1. Parallel – Sewer lines and manholes shall have a minimum horizontal separation of 10 feet from any existing or proposed water line or storm drain line, measured edge-to-edge. When local conditions prevent a horizontal separation of 10 feet a water main may, (with the approval of the Director of Engineering and GIS) be laid closer to the sanitary sewer or storm drain line provided that it is in a separate trench and that the bottom (invert) of the water main is as least 18 inches above the top (crown) of sanitary sewer or storm drain line. Where this vertical or horizontal separation cannot be obtained the sanitary sewer or storm drain line shall be constructed of AWWA approved water pipe, pressure tested in place with no leakage prior to backfilling. Sanitary sewer manhole shall be of watertight construction and vacuum tested in place.

2. Crossing Water lines – Sewer lines crossing water lines shall be laid to provide 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 separation, the following construction shall be used:

    i. Sewer passing over or under the waterlines shall be constructed of AWWA approved water pipe, pressure-tested in place without leakage prior to backfilling. Transition shall be made with mechanical couplings. The minimum length of the approved water pipe shall be one joint length center over the crossing point.

    ii. Water lines passing under sewers shall, in addition, be protected by providing: A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line; adequate structural support for the sewers to prevent excessive deflection of the joints and settling on and breaking water line; and the length of both the water line and sewer line shall be centered at the point of the crossing so that joints will be equidistant and as far as possible from the sewer.

3. Manholes– No water pipes shall pass through or come in contact with any part

of a sewer manhole.

4. Stormwater Conveyance Channels – Sewer mains shall not be installed under stormwater conveyance channels extending parallel with the channel. Perpendicular crossings are permitted.

i. Special Crossings – When a crossing is to be installed beneath a highway, railroad, stream, petroleum or gas pipeline or other major obstruction, all of the design, construction, and materials shall conform to the requirements of the Owner(s) or agencies having jurisdiction over said crossing. The contractor shall obtain approval of all materials and methods to be employed before such work is started, and obtain any required permits.

j. Construction in Stream Beds and Channels

1. The tops of all sewers entering or crossing streams or channels shall be at a sufficient depth below the natural bottom of the stream bed to protect the sewer line. In general, one foot of suitable cover shall be provided where the stream is located in rock and three feet of suitable cover in other materials. Less cover may be considered if the proposed sewer crossing is encased in concrete and will not interfere with future improvements to stream channel. Reasons for requesting less cover shall be given in the application.

2. Sewer and their appurtenances located along streams shall be protected against the normal range of high and low water conditions, up to at least the 100-year flood elevation. The one hundred year flood elevation shall be determined from the Floodway Boundary and Floodway Map prepared by the National Flood Insurance Program or an owner may have an engineer calculate the actual 100-year floodplain elevation using the proper methods and submit the results to the Engineering and GIS Department for review. Sewers located along streams shall be located outside of the stream bed wherever possible, with sufficient distance from the channel to account for natural conditions or future widening. Any manhole within the 100-year flood plain or within ditches or swales shall have a watertight cover.

3. Sewers entering or crossing a stream shall be constructed of water pressure pipe. The pipe and joints shall be tested in place, shall exhibit zero infiltration, and shall be designed, constructed and protected against anticipated hydraulic and physical, longitudinal, vertical and horizontal loads, erosion, and potential debris impact.

4. Aerial sewers built on piers across ravines or streams shall not be allowed, except when no other practical alternative exists. Sewers built on piers shall be constructed in accordance with the requirements of sewer entering or crossing streams. Construction methods and materials of construction shall be such that sewers will remain water-tight and free from change in alignment or grade.

1.45 BACKFILLING

a. After visual inspection of the sewer installation by the Town Inspector, all trenches and excavation shall be backfilled on the same day that the trench or excavation was opened.

b. Backfill requirements are as follows:

1. Backfill material placed in excavation running perpendicularly across existing public streets shall be only flowable fill that meets the Virginia Department of Transportation Special Provision for Flowable Backfill.

2. Backfill material placed in excavation under or within two feet of existing or proposed pavement, curb and gutter, sidewalk or other asphalt and/or concrete structures shall only be VDOT 21-B stone or flowable fill. Compaction must be in accordance with the specifications herein.

3. Backfill material for excavation located within a Public Utility Easement but not under or within two feet of existing or proposed pavement or concrete may be backfilled with VDOT 21-B stone or with suitable onsite backfill material specified herein. Compaction must be in accordance with the specifications herein.

4. Suitable onsite backfill material may be used as backfill in the predefined case in a Public Utility Easement if a written request to use soil backfill material is approved by the Director of the Engineering and GIS Department and additional testing requirements are met. Failure to comply with the following procedures shall result in revocation of the use of soil as suitable backfill material. The following requirements shall be met for suitable backfill material:

i. Standard Proctor tests shall be performed on the various soil types to be used as suitable backfill material and the results of the maximum dry density and the optimum moisture content of the various soil or soils to be used are documented and submitted to the Director of Engineering and GIS Department.

ii. No rocks larger than 3-inches in any dimension shall be included in the fill material.

iii. Field density tests shall be performed every 50 feet of length of trench on each lift of material placed and compacted. A qualified geotechnical technician shall be on site during all backfill operations to ensure that each lift is placed with the proper moisture content and the compaction standard is achieved.

iv. Any backfill areas that exhibit excessive pumping, weaving or rutting shall be excavated and replaced with material at the proper moisture content and re-compacted to meet the compaction standard.

v. Field density testing results shall be submitted to the Engineering and GIS Department on a weekly basis. These results shall include the elevation of the lift or depth below grade, the percent compaction achieved on each lift, and the Standard Proctor test used to determine the results.

vi. Any density tests that show that the lift has failed to meet the compaction requirement shall be recompacted, sacrificed, or allowed to dry if the moisture content is too high. Any lift that fails compaction testing shall be retested until the compaction standard is met. Field density test results shall be recorded and designated as a re-test for failed lift sections.

vii. Upon completion of the project, a certification letter signed and sealed by a professional engineer licensed to practice in the Commonwealth of Virginia shall be provided to the Engineering and GIS Department that states that a qualified compaction technician was on-site during all backfilling operations and witnessed the placement of each lift and that each lift was tested and met the compaction requirements. The Town will not accept the sewer line until this certification letter is accepted by the Engineering and GIS Department.

1.46 COMPACTION

All backfill shall be placed in horizontal, loose lifts not exceeding 8-inches in thickness and shall be thoroughly and carefully compacted by mechanical tampers to at least 95 percent of maximum dry density per ASTM D-698, Standard Proctor.

1.47 CLEANING AND SITE RESTORATION

a. All areas utilized during the construction activities of the contractor shall be cleaned to the satisfaction of the Town. Undesirable materials shall be disposed of off-site by the contractor at no expense to the Town.

b. All areas shall be restored to a condition equal to or better than that existing prior to construction. This work shall be included in the cost of the various applicable items.

c. Restoration shall include, but not be limited to, replacing shrubbery, sod, or topsoil, including lime, fertilizer, seed, and mulch; replacing paved or finished surfaces with similar materials; and performing work in accordance with the requirements of these specifications.

1.48 EROSION AND SEDIMENT CONTROL

a. All disturbed areas not designated for pavement and sidewalk replacement, structural use, and the like shall be stabilized.

b. All stabilization measures and materials shall be in accordance with the specifications contained with the Virginia Erosion and Sediment Control Handbook, 1992 Edition, and/or any subsequent revisions or editions.

1.49 DEMOLITION AND ABANDONDED SANITARY SEWERS

a. Sanitary sewer manholes, pipes, and appurtenances that are taken out of service shall be abandoned to eliminate the migration of ground water through the remaining structures.

b. Abandon underground piping in the following manner:

1. Concrete shall be poured into abandoned manholes above the crown of the pipe going into the manhole.

2. Abandoned piping shall be physically severed from active manholes or structures.

3. Close open ends of abandoned underground piping. Closures shall be at least eight (8) inch think brick masonry bulkheads or eight inches of non-shrink grout.

c. Abandon underground manholes in the following manner:

1. Remove manhole risers and covers and return to the Town Public Works Department.

2. Remove the upper concrete section of manhole risers to allow a minimum of five (5) feet of cover above the abandoned structure. Fill the underground abandoned structure with suitable backfill material and compact in accordance with these specifications.

1.50 TESTING AND INSPECTION

a. All sewer lines shall be tested for both displacement of structural faults and for tightness by the Town Inspector. All tests must be passed prior to acceptance of the sewer by the Town.

b. The Contractor shall make all preparations and shall supply the labor for all tests.

c. Video Recording: A television camera shall be used to check for defects, displacement, and structural integrity in the pipe. Any defects shall be remedied by the Contractor at his expense. The initial television test will be performed by the Town of Blacksburg at no cost to the Contractor. If failures are found and re-tests are required, there will be a charge to the Contractor for these re-tests.

d. Tightness Testing: Sewer lines and manholes shall be tested for tightness to meet the following requirements:

1. Sanitary Sewer Pipe: All sanitary sewer pipes will be tested with low pressure air performed in accordance with the procedures set forth in ASTM C-828 (See Appendix) and in the presence of the Town Inspector. All equipment to be used shall be approved by the Town Inspector.

2. Sanitary Sewer Manholes: All sanitary sewer manholes shall be tested for infiltration by vacuum testing as per Division of Water Programs Working Memo #550, dated November 4, 1987 (see attached Appendix).

e. Final Inspection: A final inspection shall be made when all items of work are complete. If any items of work remain incomplete at the time of final inspection, such as cleanup and minor stabilization, a "punch" list will be prepared and a date set for completion of punch list items. All items of work must be completed by the contractor.

1.60 SIDEWALK, CURB AND GUTTER, DRAINAGE STRUCTURES

The contractor shall remove and replace only those portions of sidewalk, curb and gutter and drainage structures as is absolutely necessary to complete work under the contract.

1.70 CONSTRUCTION ON HIGHWAYS, STREETS AND ADJACENT AREAS

1.71 CONTRACTORS RESPONSIBILITIES

a. The contractor shall be responsible for the removal and replacement of any and all types of pavement disturbed or damaged during the course of, and as a result of, his construction activities.

b. In all cases the area shall be restored to as good as, or better than, that which existed prior to construction in both appearance and function, and to the satisfaction of the engineer and/or governing authority.

c. Pavement replaced shall be the thickness of existing pavement, or four inches, whichever is greater, removed. In addition, the contractor shall provide a one-year warranty against pavement deflection.

d. In all cases all private driveways shall be transitioned in accordance with VDOT standard entrances with existing driveway material and areas immediately adjacent to the Town Right of Way shall be restored to as good as, or better than, that which existed prior to construction in both appearance and function for a minimum of ten feet off of the right of way.

1.72 PATCHING PORTLAND CEMENT CONCRETE PAVEMENT

a. Existing concrete shall be removed from areas shown on the plans or designated by the engineer. Undisturbed portions of the existing pavement adjacent to areas to be patched shall be left with neatly trimmed or sawn edges, having a vertical face, intersecting the surface, of not less than 1 ½ inches and shall be free from foreign substances. In areas from which concrete has been removed, the sub grade shall be dressed, brought to grade, and compacted. Unsuitable sub base material shall be removed, disposed of and replaced with material in accordance with the Backfill Section of these Specifications.

b. Concrete shall be deposited on the sub grade spaded, tamped, or vibrated so that it completely fills the area of the patch and all irregularities in the edges of the adjacent pavement.

c. Joints shall be placed to coincide with joints in the existing pavement, unless otherwise directed. All concrete shall be finished to conform to the cross-section of existing pavement.

d. The patch and existing pavement for a distance of 8 feet shall be tested by means of a 10-foot straightedge laid parallel to the centerline of the road, and irregularities in the patch in excess of ¼-inch shall be corrected, except that this tolerance will be ½-inch in the 10 feet where the patch is to receive overlay.

e. Portland cement concrete patching shall not be subjected to vehicular traffic until the compressive strength of the patching material has attained 2,000 psi.

1.73 PATCHING BITUMINOUS CONCRETE PAVEMENT

a. Existing surface and base courses shall be removed from areas shown on the plans or designated by the engineer. Edges of pavement to be removed shall be neatly cut, using suitable power equipment, for a depth equal to the combined depth of existing base and surface courses of bituminous materials. In areas from which bituminous concrete has been removed, the sub grade shall be dressed, brought to grade and compacted. Unsuitable sub base material s hall be removed, disposed of, and replaced with material accordance with Section 2.10 of these Specifications.

b. Unless otherwise specified, a tack or prime coat of bituminous material shall be applied between the sub grade surface and the bituminous paving mixture and between courses of bituminous paving mixtures.

c. Contact surfaces of curbing, gutters, manholes and other structures shall be painted with a thin uniform coating of bituminous material prior to the bituminous paving mixture being placed against them.

d. Bituminous concrete paving mixtures, of the type and thickness shown on the plans, shall be deposited, tamped or rolled to achieve breakdown. If the air temperature is such that the minimum lay down temperature cannot be maintained during the breakdown rolling, a temporary surface shall be applied and final surface course shall be installed at a later time.

e. Surface course shall be finished to conform to the cross section of existing pavement.

f. The patch and existing pavement for a distance of 8 feet shall be tested by means of a 10-foot straightedge laid parallel to the centerline of the road, and irregularities in the patch in excess of ¼-inch shall be corrected, except that this tolerance will be ½-inch in the 10 feet where the patch is to receive overlay.

g. The surface of the compacted course shall be protected until the material has cooled sufficiently to carry normal traffic without marring.

1.74 LIMITS ON STREET PATCHES

a. On streets not yet accepted by the Town, no patches shall be allowed and full lane repairs are required.

b. On existing Town streets, patches shall be at least fifteen (15) horizontal feet. A repair patch shall extend 1 foot on each side of the trench.

c. At a minimum the repair patch must be installed from the center line of the road to the shoulder edge of the pavement on the side of the street where the trench construction occurred. In the event that the repair patch area extends past the center line of the road then an overlay must be installed from the shoulder edge of pavement on the side of the street where the construction occurred to the edge of pavement on the opposite side of the road. If repair patches are within 30 horizontal feet of one another then a continuous overlay shall be installed across and in between the repair areas.

d. Milling will be required adjacent to curb or gutter at patch limits to provide a smooth transition.

e. The asphalt pavement and base stone shall be replaced to the original thickness of the existing street. If more than six (6) inches of asphalt is required to meet this, the asphalt shall be placed and compacted in multiple lifts.

1.75 UNSTABLE SUBGRADE

a. In the event that unsuitable materials are encountered at or below the level of the pipe bed, such material shall be removed and replaced with suitable sub grade material as directed in writing by the Director of Engineering and GIS .

b. Approved sub grade material for replacement shall be loose earth, sand, gravel, or crushed rock.

1.76 BORING AND JACKING

Pipelines shall be installed by conventional boring and jacking methods at such locations as are shown on the plans (or authorized in writing) in accordance with the standard details. Casing pipe shall meet the requirements of the specifications, herein. The casing shall be so installed as to prevent the formation or accumulation of water within the casing and shall be constructed with even bearing throughout its length with pipe supports as shown in the Town Standard detail. Casing pipe supports shall be The ends of the casing shall be suitably protected against the entrance of foreign material and sealed.

2.00 CONVENTIONAL SEWER PUMP STATIONS AND FORCE MAINS

The majority of the Town's sewer pump stations are Conventional closed-coupled suction lift centrifugal pump stations that convey wastewater through force mains and discharge into the gravity sewer system. All Conventional sewer pump stations and appurtenances shall be in accordance with the following specifications sections.

2.01 PLAN SUBMITTAL, REVIEW AND APPROVAL

a. A Preliminary Engineering Report is required to be submitted to the Health Department.

b. Final plans shall be submitted simultaneously for review by the State Health Department, the Department of Environmental Quality, and the Director of Engineering and GIS. Once plans are acceptable to all three parties, the Virginia Department of Health will issue a "Certification to Construct".

2.02 DESIGN CRITERIA

a. All pump stations and force mains shall be designed in accordance with Article 2 Section 3.11-3.13 Sewage Collection and Treatment Regulations of the State Health Department and additional specifications contained herein.

b. A downstream analysis must be performed on all new development flows that exceed existing flow rates which are submitted to the Health Department for review.

c. A developer is responsible for performing the analysis and installing any upgrades necessary to the system for adequate flow handling downstream. Any partial upgrades to existing pump stations are at the developer's cost including any drawdown tests that need to be performed.

2.03 PUMP STATION STRUCTURE

a. All pump stations shall be housed in an above ground, weather-tight building, unless otherwise approved by the Director of Engineering and GIS, which must be designed in accordance with the Uniform Statewide Building Code (BOCA Basic Building Code, BOCA Basic Plumbing Code, BOCA Basic Mechanical Code, and the National Electric Code).

b. Details of Design and Construction

1. Exterior: The exterior motif shall be similar to surrounding residential/commercial structures

2. Roof: A truss roof system shall be used with a slope similar to the surrounding residential/commercial structures.

3. Property: Developer is responsible for dedicating the property in which the pump station is located to the Town of Blacksburg, fee simple.

4. Access: Access to the pump station shall be by a paved asphalt drive with adequate turn around space for maintenance vehicles. The drive shall be a public easement or publicly owned adjacent to a right of way.

5. Screening: Proper screening and fencing is required to preserve the visual integrity of the surrounding neighborhood and will be evaluated on a site by site basis.

6. Orientation of Building to Site: Each structure shall meet the local zoning standards and be oriented to facilitate loading/unloading of materials and for general maintenance. All doors shall be located on the parking area/driveway side of the structure.

7. Plumbing: All plumbing lines, including suction and pressure lines, shall be installed in floor channels routed to area served. Each channel shall be covered with steel grates. Floor drains shall either be installed in each channel or, if the channels are connected, a common drain shall be installed. A nozzle complete with the proper backflow preventer and water sample tap should be installed inside the station.

8. Electrical: All electrical wiring shall be installed in conduit and routed under slab or in the floor or vertically rise form the floor channels as close as possible to the unit/area served. Electrical designs shall be certified and stamped by an electrical engineer.

9. Utilities: All utilities shall be set up by the developer and shall reside in his name until the station begins operation. It is the developer's responsibility to transfer power, phone, and any other utility in the station over to the Town upon operation

of the station. Power to the station shall be 3-phase unless waived by the Planning and Engineering Director. The station shall have water service in the building; developer is responsible for running a lateral or main to the station as required by the subdivision ordinance.

10. Generator: Where a generator is required by the Health Department or the Town, it shall be designed inside the building, to carry the load of the station. It shall contain a diesel storage volume to run the station for 48 hours.

11. Lighting: Overhead lighting is required. All overhead lighting shall be installed so as not to interfere with the operation of the overhead hoist.

12. Working Clearance: A minimum of three (3) feet clearing work area shall be maintained between equipment and walls.

13. Generator Room: The generator room shall be separated from the pump room by eight (8) inch cement block wall or equivalent. One 3'0" x 6'8" steel door shall be installed for access to the generator room.

14. Hoist: A three rail; single hoist system shall be installed to facilitate maintenance in the pump room (see attached design).

15. Insulation: Insulation shall be installed in or on all exterior walls and overhead. Types and thickness of insulation shall be the responsibility of the design engineer/architect.

16. Heat: The size and type of heater to be installed in the pump room shall be adequate to prevent freezing. A residential type thermostat shall be connected to the heater to control the heat.

17. Electrical Surge Protection: Power and telephone surge protection shall be installed to protect electrical components associated with the pump station controls, data logging system, and telecommunications system, in accordance with minimum International Society of Automation (ISA) standards.

    a. All field analog instruments shall be protected by surge suppression on the instrument.
    b. All analog signals coming from instrumentation to the main panel box shall be protected with surge suppression.
    c. All digital input/out signals and instruments shall be protected by inline fuses.
    d. Transient voltage surge suppression (TVSS) shall be installed at the main power feed and in the main control panel.
    e. Surge suppression shall be tested and rated for 50 occurrences of 2000 amp peak test wave form.
    f. DC clamping voltage shall be 20 to 40% above operation voltage for the circuit.

g. DC clamping voltage tolerance shall be ± 10%.
h. Maximum loop resistance shall be 18 ohms per conductor.
i. Test wave form shall be a linear 8 microsecond rise in current from 0 amps to a peak current value followed by an exponential decay of current reaching ½ the peak in 20 microseconds.
j. installation and grounding of suppressors shall be in conformance with manufactures recommendations.

18. Influent Grinder: A sewer grinder system shall be installed to grind all influent solids being conveyed into the pump station wet well. Grinder shall be installed so that it can be removed for maintenance and replacement. The Structure shall be designed to allow influent flow to passively by pass the grinder in the event of a mechanical failure and not overflow the pump station structure. The grinder shall be in accordance with the Town's standards specified herein or approved equal.

19. Odor Control: Plans submitted for evaluation shall identify the land use and access controls proposed for a 100-foot radius around the pump station. Proposed building locations and uses shall be clearly identified. The Engineer shall require a easement that prevents structures from being built within the 100-foot radius around the station or provide necessary odor and pathogenic vector controls based upon the proximity of structures within the 100-foot radius. Odor and vector controls shall be equal to standardized systems that are currently employed by the public works department.

2.04 FORCE MAINS

a. All force mains shall be tested at a minimum pressure of at least 50 percent above the design operating pressure, for at least thirty (30) minutes. Design operating pressure should be shown on the plans.

b. Leakage shall not exceed the amount given by:

$$L=\frac{ND\,(P)^{\frac{1}{2}}}{1850},$$

where

L= allowable leakage in gallons per hour;
N = the number of pipe joints;
D = the pipe diameter in inches;
P = is the test pressure in psi.

c. A plug valve shall be installed on the force main outside of the building such that the work can be performed on the pumps without draining the force main back into the wet well.

d. If the force main passes through the wet well, it must be anchored at 90 degrees.

e. Air/Vacuum Valves:

1. Air and or/vacuum release valves are prone to long term O&M issues and susceptible to failure, therefore the number of valves installed in a force main shall be minimized and shall be installed only in the event that the force main can not be installed in an alternative manner to eliminate the high point and therefore eliminate the need for the air and/or vacuum release valve system.

2. Air release valves and air/vacuum valves shall be located at the high points of the line. Profiles for each pipe run shall be submitted with the hydraulic grade line for both static and dynamic flow conditions to show where the critical points are for air release valves. Vehicular access to air/vacuum valves is required for maintenance.

3. Because the air released by these valves may contain hydrogen sulfide, the valves and their enclosures shall be constructed of corrosion-resistant materials. The valve vaults shall have insulated lids to prevent freezing. The air released from the valve may be odiferous; thus, each vent shall be equipped with an odor-control carbon filter.

4. Air/vacuum relief valves shall be of equal to the make and model shown in the standard Town detail and shall be housed within a precast manhole cone section as identified on the Standard Town of Blacksburg Detail sheet.

2.05 PUMPS/APPURTENANCES

a. Pumps: Shall be Smith and Loveless brand suction lift pumps unless otherwise approved by the Planning and Engineering Director. Pumping rates shall be a minimum of 80 gpm for a 4" force main and 140 gpm for a 6" force main. Pump design must meet Virginia Department of Health Requirements.

b. Generator: The generator shall provide enough energy for the pump station to run for 2 days and should contain a storage tank with enough storage for 2 days of fuel.

c. Flow Meter: A flow meter shall be installed on the downstream side of the pumps at the force main to determine the flows from the station.

d. Emergency Pump Connection: An emergency bypass pump connection, with plug valve and blind flange, shall be installed to allow an emergency pumping system to connect to the pumps suction line. The Emergency Pump Connection shall be installed down stream of the pump check valves so that emergency bypass pumping can occur while the pump station pumps are removed or out of service.

e. Floats: Floats will consist of mercury switches suspended from the wet well through looped guides, one guide per switch separated to reduce tangling of floats.

f. Surge Valve: The design engineer must perform an analysis to determine if a surge valve is necessary to protect the pumps from back surge. This must be designed to fit on the downstream pump end of the force main inside of the building.

g. Auto dialer: An auto dialer communications must be installed in the pump station which can be programmed to send alarms to the Publics Works Department via a telephone land line. Auto dialer shall be surge protected. The Auto dialer shall be a SENSAPHONE – Express auto dialer system manufactured by Phonetics, Inc. or approved equal.

h. Data Logging system: A data logger system shall be installed inside the station to record at a minimum the following data points: (1) amperage of pumps, (2) pressure transducer in wet well, (3) analog output from the flow monitor, (4) output from rain gauge and (5) pump system vacuum and/or discharge pressure. The logging system shall be able to communicate with the most current data warehousing software on the Town server. The logger shall have a telephone modem that can call into the Town Hall server once every 24 hours to down load data. The logger modem shall be able to connect to the telecommunications dialer via a line seizure relay to utilize the same land telephone line installed for the telecommunications unit. The logger system shall be a Telog R3300 Multi-channel record or approved equal.

2.06 WET WELL

a. Structure shall be concrete cast with ventilation per Virginia Department of Health Regulations.

b. Only one gravity inlet into the wet well from a manhole is permitted; the connection must be installed with a flexible water-tight sleeve or gasket.

2.07 OWNERSHIP, OPERATION, AND MAINTENANCE WARRANTY PERIOD

a. The pump station and access drive shall be dedicated by the owner/developer to the Town Of Blacksburg. The Director of Engineering and GIS may determine when easements are preferable over land ownership.

b. The developer's engineer is responsible for developing an operation and maintenance manual to be reviewed by and in accordance with the Virginia Department of Health. The Developer shall provide a final O&M the Town Of Blacksburg in an electronic format, such that the O&M data can be store in the Town's data warehouse for future reference as needed.

c. The Town will maintain and operate the pump station and force main upon acceptance.

d. The developer shall warranty the utilities for one-year past the date of acceptance. Should any replacements or repairs be needed during this time, the Town may perform the work and bill the developer for materials, labor, equipment, and any other repair costs incurred.

3.00 SEPTIC TANK EFFLUENT GRAVITY (STEG) & PUMPED (STEP) SYSTEMS

3.01 GENERAL

a. The word "Director" shall mean the Town of Blacksburg Director of the Engineering and GIS Department.

b. The following Standards and Specifications are for the Design of Septic Tank Effluent Gravity (STEG) and Septic Tank Effluent Pump (STEP) sewer collection systems identified in Chapter 18 (Sewers) and Appendix B (Subdivision Ordinance) of the Town code. To the extent that these Standard Specifications conflict with any specifications and standard contained in other sections, these standards and specifications shall control.

c. In a STEP or STEG system, sewage from a residential premise flows by gravity through a private lateral into a Town owned interceptor tank where solids and grease are held back. A "clear" effluent from the mid-depth of the tank is conveyed to a common sewer. The effluent is either pumped from the septic tank under pressure (STEP) to a small-diameter pressurized collector sewer or effluent may also flow by gravity (STEG) to small-diameter gravity collector lines. A project that employs both types of effluent conveyance methods is referred to as a STEP/STEG system. These Standards and Specifications apply to all systems.

d. The public STEP/STEG system includes all of its components beginning with the interceptor tank, and ending at the point(s) of discharge into a Town owned sewer system. Maintenance of the tank and associated components is critical to the reliability of STEP or STEG systems. Upon successful construction of a STEP/STEG system in accordance with the standards herein, the Town shall take ownership of all tanks, pumps, and other components and maintain as required.

e. STEG (gravity rather than pumped tank discharges) shall be used to the greatest extent possible. The design must limit the number of pumps and pump locations. Where all lots cannot be served with a STEG system, a lift station which serves the maximum number STEG tanks possible will be required to minimize the number of individual STEP systems.

f. STEP/STEG systems may be installed to serve residential locations in accordance with the standards herein. Only sanitary wastewater will be discharged into the

interceptor tank. Roof drains and other stormwater sources will be strictly excluded.

g. Any development with STEP/STEG sewers will include an easement on the face of the plat for access to all lots.

h. All STEP/STEG components shall be under warranty by the Developer to the Town for a period of one (1) year after the acceptance of the STEP/STEG system by the Town.

i. Operation and maintenance of the tank, pump, and pump controls will be the responsibility of the Town only after the system has been inspected and approved and an easement is granted to the Town.

j. It is required by the Town that the easements for a new development be granted on the plat and in the Deed of Easement. On individual lots a Deed of Easement for each lot shall be granted at the time of connection. The contractor will submit as-built drawings for review and acceptance by the Town. Service will not be provided to the customer until as-built drawings are accepted by the Town. Once the drawings are accepted, the Town will retain them and revise them as needed.

k. Power (when applicable) with STEP systems will be provided and paid for by the customer. Property owners will be responsible for notifying the Town when the control panel audible alarm buzzer is activated. The customer will be responsible for curtailing water usage until Town forces respond to the customer's notification. The Town will accept no responsibility for damages resulting from a plumbing backup, such as may occur if water usage is not curtailed during an alarm condition or if the alarm is disabled prior to the response of Town forces. The audible alarm may be silenced after Town forces have been properly notified of the alarm condition.

l. The STEP/STEG tank and/or controls may not be made inaccessible by the installation of fences or other impediments. A note to this effect shall be provided on all subdivision plats which lots are served by STEP/STEG.

m. All private sewer laterals, sewer pipe, drains, and plumbing between the tank and the premises will be the responsibility of the property owner.

n. Property owners are prohibited from making modification, repairing, or tampering with Town owned STEP/STEG systems.

3.02 DESIGN STANDARDS

a. The collection STEP/STEG main must be extended adjacent to each proposed lot or property to be served.

b. STEP/STEG interceptor tanks shall be installed in one of the following locations:

1. The lowest topographical point to maximize gravity flow on the lot it serves or immediately adjacent to the lot and no more than twenty-five (25) feet from the lot line in a publicly or privately owned open space.

2. Where a tank can not be placed on the lot it serves or within twenty-five (25) feet from the lot line and meet the depth of bury standards herein, it may be installed adjacent to and no more than 100 feet from the lot in a publicly owned open space or commonly owned open space, or

3. Where the depth of bury cannot be obtained on the lot or in an adjacent open space, it may be installed in the public right of way if all below conditions are met:

   i. The tank shall be traffic bearing per VDOT specifications.

   ii. The tank shall not be installed under the travel way or between the travel way and adjacent lot due to future utility or sidewalk conflicts.

   iii. The tank shall be installed in a grassed median. The grassed area of the median shall be large enough so that the tank can be centered in the median and the grassed area of the median extend at least six (6) feet horizontally past each edge of the tank.

c. No tank shall be installed in or under a private travel way.

d. The layout of extensions will provide for the future continuation of the existing system as determined by the Town.

e. Public service laterals may not cross individually owned private properties between the interceptor tank and the property it serves.

f. The Town shall possess a recorded general easement or deed restriction to enter the private property being served, and to access the system and its components. Access must be guaranteed to operate, maintain, repair, restore service, and remove sludge.

g. Vehicular access shall be provided to within 50 feet horizontally and 20 feet vertically of each interceptor tank and allow sufficient access for the Department of Public Works to remove solids, maintain, and operate each system. An improved travel surface is not required to access individual tanks.

h. The following Notes shall be included on any plans dealing with STEP/STEG systems:

1. "The Town holds a deed of easement over all STEP/STEG tanks located on private property to operate, maintain, repair, restore service, and remove sludge from STEP/STEG tanks. Easements over tanks are sanitary sewer easements only and no other public utilities shall be installed within the easement area."

2. "Vehicular access shall be provided to within 50 feet horizontal and 20 feet vertical of each STEP/STEG tank for maintenance by the Department of Public Works."

3. "No trees shall be installed within twenty-five (25) feet of a STEP/STEG interceptor tank."

4. *"On a periodic basis The Home Owner Association or other appropriate entity in development where STEP/STEG systems are installed, shall instruct lot owners and their assigned on the use of STEP/STEG systems. Publications that describe the operations of STEP/STEG systems, such as "Your Alternative Wastewater Collection System", can be obtained from the Department of Engineering/GIS."*

3.03 ENGINEERING DESIGN CALCULATIONS AND SUBMITALLS

a. Engineering calculations shall be submitted to demonstrate adequate design for the hydraulics and the sizing of STEP/STEG tanks, pumps, and lines. In general, system design shall conform to the following Design Documents:

   1. Manual of Practice FD-12, Alternative sewer systems, Water Pollution Control Federation (1986).

   2. Small and Decentralized Wastewater Management Systems, McGraw-Hill (Chapter 6 – Alternative Wastewater Collection Systems, and other pertinent chapters pertaining to STEP and STEG Sewers, (1998)).

   3. Commonwealth of Virginia State Board of Health (CVSBH) Sewage Handling and Disposal Regulations, latest edition.

b. At a minimum the following design information shall be submitted to the Town for review. All design calculations and references shall be included in the submittal.

c. An overall project map showing all proposed phases of development and surrounding areas that may be served by the proposed public sewer system.

d. Map showing contributing structures for each pipe.

e. Projected wastewater flow shall be per criteria published in the Virginia Sewage

Collection and Treatment Regulations (VSCAT) latest edition. An alternative industry approved design standard may be used in lieu of VSCAT at the discretion of the Director.

f. Flow generation assumptions, including:

1. Units per acre
2. Gallons per capita per day
3. Population per unit
4. Average Flow
5. Design Flow
6. Peaking factor associated with the use
7. Flow Velocity
8. Slope of Hydraulic Grade Line (ft. /ft.)
9. Total Head Loss (ft.)
10. Site-Specific Calculations

g. Interceptor Tank Components, Site Location, and Sizing:

1. Single tanks serving multiple lots under separate ownership will not normally be allowed. Each residence or site should have a separate tank. The rare exception will be considered on a case-by-case basis and must be approved by the Director.

2. All tanks shall feature inlet and outlet risers with lockable covers. Covers shall be designed for H-20 loading in traffic areas. Inlet riser shall be minimum 15" diameter. Outlet risers shall be sized to accommodate and access the equipment installed, with 24" diameter as a minimum.

3. Interceptor Tanks shall have pored in place gaskets for inlet and outlet piping.

4. Tanks shall be designed for all anticipated structural loads, including soil backfill. Where vehicle access is allowed, the tank shall be protected with an appropriate structural slab. All designs shall be stamped by a structural engineer licensed to do practice in the Commonwealth of Virginia.

5. To assure retention of solids and grease in the tank, all tanks shall feature a plastic effluent screen. Screens shall meet minimum standards herein. No unscreened discharge will be allowed.

6. Flotation of tanks in areas of high groundwater shall be anticipated in system design. Structural design features and operational procedures shall be employed to prevent flotation. Equalization of buoyancy through hydrostatic pressure-relief valves installed in a tank will not be allowed.

7. Existing septic tanks should be removed or abandoned in place. Existing tanks

which fully meet the requirements, including structural design and leakage testing, may be considered for use as an Interceptor Tank. However, to retrofit existing septic tanks with effluent screens, flow control, access risers, and other specified features is usually impractical and the Town reserves the right to reject tanks that do not meet specifications identified herein.

8. Tanks placed in series to provide the required storage capacity will be prohibited.

9. Tanks placed in parallel will be allowed when approved by the Town.

10. Pipe connections to tanks shall be made with an approved commercial water stop or poured in place gasket manufactured for the intended purpose. Field improvised water stops or adapters will not be approved.

h. Single Residential Developments:

1. Single Residential development means a two family dwelling, a single-family attached dwelling, Townhouse, or Single-Family detached dwelling.

2. Tank volumes shall be based upon the maximum number of bedrooms that may be possible in an existing or proposed structure on the premise.

3. Minimum tank volumes for single residential developments that have three bedrooms or less shall be 1000 gallons.

4. Minimum tank volumes for single residential developments with more than 3 bedrooms shall be in accordance with the Commonwealth of Virginia State Board of Health Sewage Handling and disposal Regulations:

i. Five Bedrooms or less: Minimum tank volumes shall be in accordance with Septic tank design capacity for dwelling units Table 5.2

Table 5.2 - Septic Tank Capacity for Dwelling Units

No. of Bedrooms	Approximate Tank Volume (gallons)
1	1000 TOB SPEC
2	1000 TOB SPEC
3	1000 TOB SPEC
4	1200
5	1500

** TOB SPEC = Town of Blacksburg minimum tank volume requirement.*

ii. More than five Bedrooms: Calculated Volumes shall be in accordance with CVSBH Sewage Handling and Disposal Regulations or if not specifically identified in the CVSBH it should be based upon a solids pump-out interval of

at least six (6) years and take into account the accumulation of scum and sludge based upon an average daily flow and a peaking factor of at least 1.5. Based upon the aforementioned criteria the minimum calculated volume shall be based upon the following equation (page 321 Small and Decentralized Wastewater Management Systems, 1998):

Equation-3.40.g.3b: $Volume_{Tank} = (4.0) \times (Q_{AVE}) \times 1.5$

5. The tank shall be pumped when 35% of the capacity is filled with solids.

6. Total STEP/STEG system mains shall be designed to convey a flow rate based upon the following equation:

Equation-3.40.g.5 Q (total) = [0.5 (gpm) x (number of customers) + 20 (gpm)]

i. Commercial/Multifamily Developments:

1. All commercial/multifamily systems must meet or exceed all criteria set forth for Single Residential Developments.

2. Tank volumes shall be based upon the highest average daily flows for the specific waste stream generated for the most intensive use allowable by the zoning code for the proposed development site.

3. Design document shall be in accordance with standard design guidelines identified in Section 3.0 (Engineering Design Submittals) of the specifications herein.

4. Tank volume shall be determined based on a six-year sludge pumping cycle, a peaking factor that is justified by actual flow records or industry accepted design data and multiplied by a safety factor of 1.5, defined as the "calculated volume" in the preceding section.

j. Pump Operation Criteria and Sizing Calculations shall at a minimum include the following:

1. Pumping time per 24 cycle
2. Elevation for Pump-on, Pump-off, and High water alarm.
3. Total volume per cycle.
4. Pumping cycles per day
5. Total pumping time per day
6. Total dynamic head size
7. System Head vs. Pump Curve analysis
8. Hydraulic Grade lines.

k. Design Considerations for Odor and Corrosion Controls

1. The designer shall determine the detention time of the collection system from the most remote service connection to the discharge point of the STEP/STEG system.

2. The designer shall include odor and corrosion control alternatives as part of the design project if the projected detention time is greater than 6 hours.

3. At a minimum odor controls shall include provisions for passive carbon filters to be installed on the discharge manhole.

3.04 BUILDING GRAVITY SERVICE LINE

a. The sewer lateral between a private building and the interceptor tank shall be installed in accordance with the Town Building Code Requirements, and no less than four (4) inches in diameter.

b. If an interceptor tank is installed off of a property line in accordance with the permissible Design Standards herein, then a cleanout shall be located at the property line and shall be no less than four (4) inches in diameter. Cleanouts shall also be installed when there is a change in the horizontal alignment that exceeds the allowable pipe deflection defined by the pipe manufacturer. Cleanouts shall not be used for any vertical drops in the service lateral line. Additional cleanouts may be required between the property line and the interceptor tank if deemed necessary for operation and maintenance by the Director of Public Works.

c. The building sewer lateral from an interceptor tank or clean out on the property to a building is a private sewer lateral and it is the responsibility of the property owner to operate and maintain accordingly.

3.05 INTERCEPTOR (STEP/STEG) TANK

a. Minimum acceptable tank volumes will be based upon the type and size of development as defined in the Calculations and Submittals section of the specifications herein.

b. All tanks will be manufactured for acceptance of STEG Effluent filter assemblies and STEP pump assemblies. Concrete manufacturers not yet approved or approved manufacturers seeking approval for a new tank design are subject to an independent structural analysis as required by the specifications herein. The manufacturer will bear the expense of this analysis. The design or analysis will be in accordance with accepted engineering practice.

c. Walls, bottom, and top of reinforced concrete tanks will be designed across the shortest dimension using one-way slab analysis. Stresses in each face of monolithically constructed tanks may be determined by analyzing the tank cross

section as a continuous fixed frame. The walls and bottom slab shall be poured monolithically.

d. Tank Manufacturing Requirements:

1. Interceptor tanks shall be precast concrete tanks meet ASTM C1227 (Standard Specification for Precast Concrete Septic Tanks). The tank design shall be sealed by a professional structural engineer licensed in the Commonwealth of Virginia. The manufacture shall certify that each tank model # has been constructed in accordance with the structural design stamped by the professional structural engineer and in accordance with ASTM C1227 (Standard Specification for Precast Concrete Septic Tanks).

2. All tanks shall be manufactured for acceptance of risers and STEP pump assemblies as defined in this section and have a cast in place riser section to allow for positive attachment of riser assemblies.

3. The manufacture shall provide the structural design and certification for each model # of tanks manufactured to the Town of Blacksburg for review, in accordance with accepted engineering practices.

4. Tank shall be designed for bury up to 4.5 feet depth in typical soils. The maximum installation depth allowed by the Town of Blacksburg shall be 4.5 feet. The Tank manufacture shall contact the Town of Blacksburg if additional soil characteristics are needed to design tanks.

5. Modification of completed or existing tanks will not be permitted for structural, warranty, and liability reasons.

6. Tanks shall be designed for a maximum depth of bury of 4.5 feet and in accordance with ASTM C1227 Structural Design Requirements. Deeper installations, if required by local conditions, will require special consideration. Tanks approved as traffic-bearing tanks will be designed to withstand an H-20 live load with a minimum soil cover of 18 inches.

7. The tank manufacture shall submit QA/QC data to substantiate Quality Control and Sampling in accordance with ASTM C 1227.

8. Tanks shall not be moved from the manufacturing site to the job site until the tank has cured for seven days and has reached two-thirds of the design strength.

e. Tank Installation Requirements:

1. The depth of bury over any tank shall not be greater than 4.5 feet, measured from the final surface grade elevation to the top of the buried tank.

2. Tanks shall be bedded and backfilled along the walls with 6 inches of #57 stone.

3. Sides shall be backfilled with no. 57 stone or compacted in 2 foot lifts for 95% standard proctor.

4. Where exterior piping protrudes from the tank, #57 stone shall be used to backfill around, with a minimum of 1 foot below plumbing components to reduce likelihood of damage to piping from differential settlement.

5. Tanks shall be located a maximum of 50 horizontal feet and 20 vertical feet of vehicular access so that it can be maintained by the Public Works Department. The maximum vertical elevation separation shall be the difference between the inside floor elevation of the tank and the grade elevation of the vehicular access point. Tanks shall be accessible at all times. Enclosing tanks with fencing, shrubbery, or other obstructions is not permitted. A variance to this standard may be granted through the specified variance process herein.

f. Risers and Lids:

1. General Riser Specifications:

i. Inlet, and effluent or pump risers shall be installed on all interceptor tanks to allow access to inlet piping, effluent filters, pumps, electrical connections, removal of solids and maintenance of the tank as required.

ii. All risers shall be constructed watertight. The risers shall be attached to the tank such that a watertight seal is provided and tested to confirm proper water tight construction. Risers shall extend three inches above the final grade to allow for future settlement and ensure positive drainage away from the lids.

iii. Risers shall be ribbed PVC as manufactured by Orenco Systems®, Inc. or engineer-approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89.

2. Inlet and Inspection: Risers shall be a minimum of 24 inches in diameter and have an accompanying water tight lid.

3. Pump Chamber Riser Specifications:

i. Risers that contain pump assemblies and electrical boxes shall be a minimum of twenty-four (24) inches in diameter and may be required by the Town to be a greater diameter to allow removal of internal mechanical and electrical parts without removing splice boxes, etc.

ii. Risers shall be installed so that all mechanical equipment can be retrieved from grade. Pump disconnect unions or any other device that needs to be disconnected to remove associated mechanical or electrical equipment for repair or maintenance shall not be more than 18 inches from the top of the riser. Pump chamber risers will be 30-inch-diameter fiberglass or ribbed PVC as manufactured by Orenco Systems, Inc., or approved equal.

iii. All penetrations for pump and electrical equipment in risers shall be sealed using compression threaded grommets that must pass hydrostatic testing requirements. Two 1-inch diameter (IPS) neoprene grommets, one for the pump discharge, installed between 8 to 12 inches from the top of the riser, and one for the splice box conduit shall be installed.

iv. A PVC splice box with 4 cord grips and 1-inch outlet fitting, Orenco Model No. SB4i or approved equal shall be installed.

4. Riser Lids:

i. One lid shall be furnished with each riser.

ii. Lids shall be fiberglass with green non-skid finish, provided with stainless steel bolts as supplied by Orenco™ Models FL18G, FL21, FI24-4B or FL30G or approved equal.

iii. The riser and lid combination shall have gaskets and able to support a 2500 lb load. (Note: this is not to imply that the PVC risers and lids are intended for traffic areas.

3.06 INSTALLATION AND LEAK TESTING

a. Inlet and Pump risers shall be installed according to manufacturer's instructions.

b. The system shall be checked for leakage in accordance with Performance Test Methods outlined in ASTM C 1227 with all parts of the system properly installed, such as the tank, inlet riser, pump riser, lids, electrical wires, pumps, and force main.

C Tanks installed where groundwater levels may rise above the tank bottom require precautions to prevent flotation.

D. Tank excavation shall be backfilled with #57 stone or select material free of boulders and compacted to a dry density equal to or greater than that of the adjacent, undisturbed soil. Finish grading, cleanup, and restoration will be completed prior to final acceptance by the Town.

3.07 INTERCEPTOR TANK DISCHARGE PIPE

a. Interceptor Tank Discharge lines will be either a STEP discharge force main or a STEG small diameter gravity pipe.

   1. The pipe will be Schedule 80 PVC water pipe, solvent weld joint located at 90 degrees to the main line when possible.

   2. Solvent cements and primer for joining PVC pipe and fittings to SDR-21 Mainline pipe will comply with ASTM D 2564 and will be used as recommended by the pipe and fitting manufacturers.

b. STEP Discharge force main pipe will have a minimum nominal diameter size of 1.25 inches. Discharge lines will have a minimum of 18 inches of cover over the top of pipe as it penetrates through the riser. The force main shall be installed with at least 36 inches of cover as soon as it exits the riser structure to protect the force main from freezing.

c. STEG small diameter gravity discharge pipe shall have a minimum diameter of two (2) inches. The discharge pipe shall be laid to a uniform grade with no high points.

3.08 FORCE MAIN

a. The smallest pipe size diameter shall be 2 inches in nominal diameter. This is based on maintenance requirements rather than flow.

b. Pipe will be PVC, ASTM D2241, SDR 21 (200) with rubber gasket joints. Gaskets will comply with ASTM D 1869. STEP mains will have a minimum 36 inches of cover to top of pipe.

c. Minimum force main diameters to convey wastewater shall be determined by the design engineer as identified in the design section of the specifications. To minimize the number of different diameters and standardize fittings the following diameters will be allowed for mainline force main pipe: 2, 3, and 4 inches.

d. Service connection pipe will be minimum 1.25-inches in diameter, Schedule 80 PVC water pipe, solvent weld joint located at 90 degrees to the main line when possible.

   1. Solvent cements and primer for joining PVC pipe and fittings to SDR-21 Mainline pipe will comply with ASTM D 2564 and will be used as recommended by the pipe and fitting manufacturers.

   2. Services lines will have a minimum 18 inches of cover to the top of pipe.

3.09 SMALL DIAMETER GRAVITY SEWERS

Gravity sewers shall be a minimum of 2" in diameter and installed with tracer tape and toning wire.

3.10 TRACER TAPE, TONING WIRE, AND ACCESS BOXES

a. Tracer Tape: All plastic pipes shall be installed with continuous tracer tape installed 12 to 18 inches under the proposed finished grade. The marker tape shall be marked "sewer" and be plastic, nonbiodegradable metal core or backing that can be detected by a standard metal detector. Tape shall be Terra Tape "D" or approved equal.

b. Toning Wire: In addition to tracer tape, 14-gauge-coated copper toning wire shall be installed.

   1. Wrap the toning wire around the pipe or secure it to the bottom of the pipe with non-biodegradable plastic ties at a minimum interval of 10 feet.

   2. Toning wire is to be brought up and tied off at the valve boxes and in Toning wire access boxes.

c. Access Boxes: Toning wire access boxes shall be USAbluebook.com #Ma-22408 or approved equal. Boxes shall contain leads for the underground toning wire and shall be installed at a maximum horizontal separation of 500 feet directly over the pipe.

d. Cathodic Protection: A 1-pound magnesium anode shall be buried with the sewer toning wire every 1,000 linear feet for cathodic protection of the wire. Toning wire splices and connections to anodes shall join wires both mechanically and electrically and shall employ epoxy resin or heat shrink tape insulation.

3.11 FITTINGS

a. All pipe fittings shall have a minimum working pressure rating equal to 200 psi.

b. Fittings shall be PVC schedule 80, or SDR-21 to be compatible with the same material of pipe to which it is being fitted.

c. Solvent weld fittings for 1.25-inch pipe shall be socket-type Schedule 80 PVC and shall comply with ASTM D-1784 and ASTM D-2466.

3.12 VALVES

a. Ball Valves:

   1. All valves shall be True Union Fitting PVC ball valves with preloaded EPDM stem seals and o-rings and self-adjusting polyethylene ball seat to compensate for wear and prevent over tightening.

   2. The valve body shall come with both slip socket and FPT ends so that the valve

body can be removed with out having to cut out a glued valve body.

3. A ball valve shall be installed at the following locations in the system: (1) at every pipe intersection, (2) on both ends of casings, (3) at any point in the mainline where the head differential is greater than 40 feet, (4) at a dead-end for future planned continuation of the system and (5) at a minimum every 2000 feet.

b. Air/Vacuum Valves:

1. Air and or/vacuum release valves are prone to long term O&M issues and susceptible to failure, therefore the number of valves installed in a force main shall be minimized and shall be installed only in the event that the force main can not be installed in an alternative manner to eliminate the high point and therefore eliminate the need for the air and/or vacuum release valve system.

2. Air release valves and air/vacuum valves shall be located at the high points of the line. Profiles for each pipe run shall be submitted with the hydraulic grade line for both static and dynamic flow conditions to show where the critical points are for air release valves. Vehicular access to air/vacuum valves is required for maintenance.

3. Because the air released by these valves may contain hydrogen sulfide, the valves and their enclosures shall be constructed of corrosion-resistant materials. The valve vaults shall have insulated lids to prevent freezing. The air released from the valve may be odiferous; thus, each vent shall be equipped with an odor-control carbon filter.

4. Air/vacuum relief valves shall be ARB15 by Orenco Systems, Inc. or equal. The carbon filters shall be model CF3 by Orenco Systems, Inc. or equal. Air/Vacuum relief assembly shall be housed within a precast manhole cone section as identified on the Standard Town of Blacksburg Detail sheet.

c. Check Valves:

1. Check valves used on service lines shall be a tee or wye pattern swing check.

2. The body of the valve shall be made of clear PVC schedule 80 material so that the performance of the check valve can be confirmed while in operation. It shall have a working pressure of 150 psi. Valves shall be designed for use with corrosive fluids. A check valve shall be installed at the end of the service stub-out at the property line.

3.13 VALVE BOXES

a. All service connection and main line valves shall be installed in a valve box.

Valve boxes shall not be installed in ditch lines, drainage swales, storm water structures, or low lying areas that are prone to pooling water.

c. The boxes shall be adjustable for elevation and shall be set to allow equal movement above and below finished grade. The base shall be centered over the valve and shall rest on solid concrete block.

d. Backfill shall be compacted around the valve box. The top of the base section shall be aligned with the center of the valve body and operational handle. The entire assembly shall be plumb. Valve boxes shall be adjusted flush with the finished grade unless specified otherwise.

e. Different types of valve boxes shall be specified for traffic and non-traffic areas. Valve box configuration shall allow unobstructed access to the valve with a standard valve tool employed by the Town of Blacksburg Public Works Department.

f. Traffic Bearing Valve Boxes:

1. All service connection and main line valve boxes in traffic areas shall be three-piece screw type, cast iron construction with covers rated for proposed traffic areas in accordance with ASHTO standards. Where valve boxes are located in the road shoulder they shall be set a maximum of two inches below finished grade to preclude damage from road maintenance equipment.

2. Valves 2-inches and smaller shall have a gray iron valve box with 5.25 inch shafts and a base of 14.25 inches in diameter and manufactured by East Jordan Iron Works, Inc., Product Series Number 8560 or equal, meeting ASTM A48 CL35B and AASHTO M306 specifications.

3. Valves greater than 2inches shall be installed in a custom valve box made of concrete with a traffic bearing ring and cover as approved by the Director of Public Works.

g. Non Traffic Bearing Valve Boxes:

1. Valve boxes in non-traffic areas shall be SDR-35 PVC pipe with a solid SDR-35 cap.

2. The valve box shall consist of an exterior split sleeve base and shaft pipe. The split sleeve base shall have a notch that is 0.5 inch larger than the O.D. of the service or mainline pipe. The shaft pipe shall have a notch that is 6 inches high and 0.5 inch wider than the O.D. of the service or mainline pipe. The notch in the shaft pipe shall allow potential settlement of the shaft pipe from coming into contact with service or mainline pipe. The split sleeve base shall be installed around the outside of the shaft pipe to prevent soil from entering into the valve box.

3. The top of the solid cap shall be installed flushed to finished grade.

4. Valves 2-inches and smaller shall be installed in an 8 inch diameter SDR-35 pipe.

5. Valves greater than 2 inches shall be installed in a 12 inch diameter SDR-35 pipe.

h. Valve Box Lids: Valve box lids shall be cast with the word "sewer" so they can be distinguished from valves in the water system.

3.14 PUMPING TANK EQUIPMENT, ALARMS, AND CONTROLS

a. Pump and Assemblies shall be stainless steel, thermoplastic, or coated inside and out with baked-on epoxy paint, UL listed for use in effluent.

b. All pumping systems shall be Orenco Systems model series PI00511 High Head pumping assemblies or approved equal comprised of the following:

1. Standard Vault: 12-inch by 54-inch Biotube pump vault with external flow inducer manufactured by Orenco with eight 1 3/8-inch-diameter inlet holes; 19 inches from base; with an 18-inch tall Biotube filter cartridge or approved equal.

2. Hose and Valve Assembly: Includes 1-inch-diameter flexible PVC hose with quick-disconnect fittings and PVC ball valve manufactured by Orenco or approved equal.

3. Mercury Switch Float Assembly: Model MF-ABR, or approved equal, with three mercury floats mounted on a PVC stem that attaches to vault and shall be wired to the control panel.

4. Pump: OSI High Head pumps, 115-volt, single-phase, with 8-foot cord and 1/8-inch bypass orifice for effluent application, or approved equivalent. Higher head or discharge pumps may be allowed under certain circumstances with prior approval and shall be wired to the control panel using #12 AWG THHN Standard wire as a minimum and follows the manufacturer's color coding.

5. All pumping systems shall be installed in accordance with the manufacturer's recommendations. Pumps shall be accessible for operation and maintenance from ground level.

c. Control Panel and Alarms:

1. All residential STEP systems shall be wired to a dedicated 25-amp breaker that supplies power to the STEP system control box only. This is required to avoid damage or overload to system and appliances.

2. The developer shall be responsible for the operation and maintenance of the

breaker and feeder wires that serve the STEP system. All buried power shall be installed with continuous tracer tape installed 12 inches above the buried power. The marker tape shall be plastic nonbiodegradable metal core backing marked "power."

3. Positions on the PVC 3-float assembly are to be set at the following levels: High tank level alarm is to be set 9 inches below underside of tank top, "on" at 32 inches below alarm and "off" in same float as "on" set 32 inches below "on" and redundant "off" with low-level alarm set 4 inches below "off."

4. Control panels shall be Quality Manufacturing or approved equal with the following features:

   i. Rating: 1 HP/115 VAC, 2 HP/230 VAC, single-phase, 60 Hz. Motor start contact shall be rated for 25 FLA, single-phase, 60 Hz.

   ii. Audible alarm and light panel mounted with a minimum of 80 db sound pressure at 24 inches continuous sound. Alarm shall be located to maximize visibility to ensure that an alarm condition is recognizable to anyone in the vicinity of the tank.

   iii. Oil-tight visual alarm, red lens, with push-to-silence feature.

   iv. Automatic audio alarm reset.

   v. 15-amp motor rated toggle switch, single pole, double throw

   vi. NEMA 4X-rated fiberglass enclosure with gasket, hinged cover and locking latch. Padlock shall be furnished and installed by the Town at the time of Town's acceptance of the completed installation and shall signify final acceptance.

   vii. Alarm circuit shall be wired separately from the pump so that if the internal pump overload switch is tripped, the alarm shall still function.

   viii. A 25-amp power disconnects assembly toggle switch to de-energize entire control panel to permit servicing panel without access to the customer's breaker switches. The pump control panel shall be mounted on a treated 4" x 4" pedestal next to the tank in the public utility easement. The panel shall be between 4 feet and 5 feet above finished grade.

   ix. There shall be a dedicated 25-amp circuit breaker serving the pump control panel.

   x. Control panel shall contain hour meter and event counter.

xi. In cases where an exterior power disconnect switch is required, it shall be installed in a lockable, weatherproof enclosure.

3.15 GRAVITY (STEG) DISCHARGE TANK FILTER EQUIPMENT

a. Gravity discharge tanks shall be equipped with effluent filters manufactured by Orenco or approved equal, installed in conformance with the standard plans.

b. All effluent filter systems shall be supplied by a reputable manufacturer with at least five years of experience in supplying equipment for effluent sewers.

c. Gravity system tanks for single residential developments shall be equipped with an Orenco Systems®, Inc. Biotube® Effluent Filter (FT04 Model Series) or engineer-approved equal, installed in conformance with the engineer's plans. The filter shall have an effective flow area of no less than 228 square inches.

d. The effluent filter shall consist of either a PVC vault with eight holes evenly spaced around the perimeter, located appropriately to allow for maximum sludge and scum accumulation before requiring pumping (approximately 70% of minimum liquid level).

e. The Biotube® cartridge shall be made with 1/8" mesh polypropylene and with a solid base (to prevent solids from entering through the bottom). The Biotube® cartridge shall be housed inside the PVC vault.

f. The direct-coupled outlet for the filter shall contain two (2) flow modulating orifices and one (1) vent hole.

g. Commercial and multiple-family tanks shall require larger effluent filters, the sizes of which must be individually determined and spelled out in the specifications. Commercial applications should be sized according to the document titled "Biotube® effluent filter sizing" published by Orenco Inc.

3.16 COMMERCIAL/MULTIFAMILY INSTALLATIONS

a. All commercial/multifamily installations shall be evaluated on a case by case basis to determine what additional design components may need to be included to provide a reliable STEP/STEG system based on the specific waste water characteristics for the proposed development.

b. The following additional items may be added to a Commercial or multifamily development:

1. Telecommunications as defined in the Centralized Pump Station and force main sections of this specification.

2. An approved alternate source of power. If the building being served has emergency power generators, they shall be able to power the STEP system.

3.17 STEG LIFT STATIONS

a. Lift stations shall be in a location that maximizes the STEG service area.

b. Details for Design and Construction:

1. Public Utility Easement: Developer is responsible for dedicating a public easement to the Town for the property in which the lift station lies and any other access that is required for the Town to maintain the lift station.

2. Duplex Lift Station Pumps: Pumps shall be single phase, 60 Hz, 120 volt. Two pumps shall be installed in parallel and each pump shall be able to pump the projected peak flow rate. An alternator shall switch operation between pumps after each pump cycle. Pumps shall be UL and CSA listed effluent pumps as manufactured by Orenco Systems, Inc or approved equal.

3. Tanks and Pumping Systems: The lift station shall have no more than two interceptor tanks in parallel and no tanks shall be installed in series. Tanks shall meet minimum standards specified for interceptor tanks.

4. Control Panel Shelter: The lift station control panel shall be affixed to a covered kiosk in accordance with the Town standard detail. The structure shall be constructed of all weather materials. Shop drawings shall be submitted for approval prior to construction. The lift station control panel, power drop, transfer switch, and auxiliary power connection sockets shall be installed under the kiosk cover. Controls, data logger, autodialer, and other control components shall be in a single Nema 4x enclosure that can be locked.

5. Access Road: Access roads to the pump station shall be paved and allow vehicular access by the Public Works Department to operate and maintain the pump station. Adequate turn around space for maintenance vehicles must be provided. The drive shall be in a public easement.

6. Screening: Proper screening and fencing is required to preserve the visual integrity of the surrounding neighborhood and will be evaluated on a site by site basis.

7. Electrical: All electrical wiring shall be installed in conduit and routed to the control kiosk pad. Electrical designs shall be certified and stamped by an electrical engineer with adequate surge protection.

8. Utilities: All utilities shall be set up by the developer and shall reside in his name until the station begins operation. It is the developer's responsibility to transfer

power, phone, and any other utility in the station over to the Town upon operation of the station.

9. Storage Volume: The designer shall demonstrate through the design calculations that the STEP/STEG system can contain the average daily design volume for a 24 hour period in the event of a power loss or pump failures at the lift station.

10. Auxiliary Power Connector: An exterior transfer switch and auxiliary power connection socket that is compatible with the Town portable auxiliary power generator shall be installed.

11. Exterior Lighting and Outlets: Exterior lighting shall be installed with dusk to dawn sensing units to illuminate the control panel kiosk. A manual on-off light switch and 120 volt outlet shall be installed in a water tight locked and protective cover to allow manual over ride of the dusk to dawn sensor and electrical service for Town to plug in power tools for maintenance.

12. Auto dialer: An auto dialer telecommunications unit must be installed in the pump station control panel which can be programmed to send alarms to the Public Works Department via a telephone land line. Auto dialer shall be surge protected. The auto dialer shall be a SENSAPHONE – Express auto dialer system manufactured by Phonetics, Inc. or approved equal.

13. Amperage Readings:
Each lift station shall have a clamp-on current transformer with integral contact closure output to measure amperage draw through the main power feed at a minimum of (1) minute intervals and is connected to the data logger system. The closure switch shall activate when detecting AC currents in the range of ¼ to 200 amps. The current transformer shall be a Telog IS-200 current transformer as manufactured by Telog Instruments or approved equal. Contractor shall supply all wiring to connect the current transformer to data logging system.

14. Pressure Transducer:
Each lift station shall have a pressure transducer in the main pump chamber that measures the tank level at a minimum of one (1) minute intervals and is connected to the data logger system. The pressure transducer shall be a Telog water level system PR-31 pressure recorder, Pt-30b 10 psi pressure sensor, manufactured by Telog instruments or approved equal. The pressure sensor shall be provided a minimum of twenty-five (25) feet of cable and the contractor shall connect to data logging system. The pressure transducer shall be installed in a pvc conduit that protects the pressure transducer from solids inside the main pump tank as depicted in the standard Town detail.

15. Data Logger: A data logger shall be installed inside a NEMA 4 enclosure to record at a minimum the following data points: (1) amperage of pumps, (2) pressure transducer in tanks, and (3) output from a rain gauge. The logging

system shall be able to communicate with the most current data warehousing software on the Town server. The logger shall have a telephone modem that can call into the Town Hall server once every 24 hours to down load data. The logger modem shall be able to connect to the telecommunications dialer via a line seizure relay to utilize the same land telephone line installed for the telecommunications unit. Data logger shall be surged protected. The logger system shall be a Telog R3300 Multi-channel record or approved equal.

16. Electrical Surge Protection: Power and telephone surge protection shall be installed to protect electrical components associated with the pump station controls, data logging system, and telecommunications system as outlined in conventional sewer pump station specification section .

Appendices

Appendix A – Low Pressure Air Test ASTM C828

Appendix B – Example Practice of ASTM C828

Appendix C – Local Standards and Review Program

Appendix D – Precast Concrete Tank Specification ASTM C1227

Appendix E – TOB Pump station Submittal Form

Appendix F – TOB Projected sewer loadings and Capacity worksheet

Appendix G – Sewer Details

Sewer General Details (SGD)

SGD-001 Force Main Buttresses and Anchorage for Vertical Bends
SGD-002 Trench Bedding
SGD-003 Concrete Encasement of Sanitary Lines
SGD-004 Sealed Casing Installation
SGD-005 Utility Cut Repair - Perpendicular crossing in Street
SGD-006 Utility Cut Repair – Within town Right of Way
SGD-007 Standard Service Connections
SGD-008 Standard Sewer Cleanout
SGD-009 Sanitary Cleanout in Pavement
SGD-010 Cleanout & Valve Box Lids
SGD-011 Force Main Buttresses for Horizontal Bends
SGD-012 Typical Cleanout Cover
SGD-013 Typical Cleanout Frame

Sewer Manhole Details (SMH)

SMH-001 Precast Concrete Manhole
SMH-002 Manhole Step
SMH-003 Standard Manhole Cover
SMH-004 Manhole Frame
SMH-005 Watertight Manhole Cover

SMH-006 Drop Manhole Connection
SMH-007 Manhole Ventilation

Sewer Pump Station Details (SPS)

SPS-001 Pressure Transducer Conduit
SPS-002 Wooden Fence and Gate
SPS-003 Chain Link Fence and Gate
SPS-004 Emergency Pump Connection
SPS-005 Combination Air/Vacuum Release Valve
SPS-100 Typical Pump Station Exterior
SPS-101 Typical Pump Station Cross Section
SPS-102 Typical Pump Station Plan View
SPS-103 Typical Pump Station Grinder
SPS-104 Typical Pump Station Building Materials

STEP/STEG General Details (SSGD)

SSGD-200 STEP Interceptor Tank
SSGD-201 STEG Interceptor Tank
SSGD-202 STEP/STEG Interceptor Tank Installation Detail
SSGD-203 STEP/STEG Typical Trench Section Detail
SSGD-204 STEP/STEG Pipe Locator Wire Detail
SSGD-205 STEP/STEG Valve Box Service Connections
SSGD-206 STEP/STEG Service Termination

STEP/STEG Lift Station Details (SSLS)

SSLS-001 Centralized STEP/STEG Lift Station Section
SSLS-002 Single Tank Centralized Lift Station Site Layout
SSLS-003 Dual Tanks Centralized Lift Station Site Layout
SSLS-004 Fail Safe Valve Centralized Lift Station
SSLS-005 Control Panel Shelter Centralized Lift Station

Appendix H – Standard Cut Sheets

Collection System

Press-Seal Gasket Corp. Press-Boot™ Manhole Connector

Romac Industries Inc. Style "CB"™ Sewer Saddle
Spider® Supports and Spacers

STEP/STEG System

Hayward® True Union PVC Ball Valves

Pump & Lift Stations

Red Valve® Series 42/742 Diaphragm Pressure Gauge Seal
Telog® R-3300 Series Multi-Channel Recorders

Appendix I – Handouts

Do's and Don't for Your Wastewater Collection System

Appendices

Appendix A

APPENDIX A

LOW PRESSURE AIR TEST
FOR SANITARY SEWER (ASTM C828)

Summary of Method

The section of the sewer line to be treated is plugged. Low pressure air is introduced into the plugged line. The amount and rate of air loss is used to determine the accessibility of the section tested.

Preparation of the Sewer Line

Flush and clean the sewer line prior to testing, thus serving to wet the pipe surface as well as clean out any drebris. A wetted interior pipe surface will produce more consistant results. Plug all pipe outlets to resist the test pressure. Give special attention to stoppers and laterals.

Procedure

Determine the test duration for the section under test by computation from the applicable equations shown in ASTA C 828, or from prepared air test tables. The pressure holding time is based on an average holding pressure of 3 psi or a drop from 3.5 psi to 2.5 psi.

Add air until the internal air pressure of the sewer line is raised to approximately 4.0 psi. After an internal pressure of approximately 4.0 psi is obtained, allow time for the air pressure to stabilize. The pressure will normally show some drop until the temperature of the air in the section stabilizes.

When the pressure has stabilized and is at or above the starting test pressure of 3.5 psi, commence the test. Before starting the test, the pressure may be allowed to drop to 3.4 psi. Record the drop in pressure for the test period. If the pressure has dropped more than 1.0 psi during the test period, the line is presumed to have failed. The test may be discontinued when the prescribed test time has been completed even though the 1.0 psi drop has not occurred.

The test procedure may be used as a presumptive test which enables the installer to determine the acceptability of the line prior to backfill and subsequent construction activities.

If the pipe to be tested is submerged in ground water, a water infiltration test should be used.

Safety

The air test may be dangerous if, because of lack of understanding or carelessness, a line is improperly prepared.

It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. Inasmuch as a force of 250 lbf is exerted on an eight-inch plug by an internal pipe pressure of 5psi, it should be realized that sudden explosion of a poorly installed plug or of a plug that is partially deflated before the pipe pressure is released can be dangerous.

As a safety precaution, pressurizing equipment may include a regulator or relief valve set at perhaps 10 psi to avoid over-pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.

Tables

The air test table on the following page has been prepared utilizing applicable equations from ASTM C 828. It is based on an allowable air loss of 0.003 ft^3/min and a maximum air loss per test section of 3.5 ft^3/min and a minimum significant air loss per test section of 2.0 ft^3/min. (Test sections of such length that an air loss of 3.5 ft^3/min would be exceeded using the allowable loss of six per square foot of internal pipe surface may be tested in segments where the total air loss would be between 2.0 and 3.5 ft^3/min.)

The following table applies when testing one pipe diameter only. If the section of the line to be tested includes more than one pipe size, calculate the test time for each size and add the test times to arrive at the total test time for the section.

In order to demonstrate the technique the technique of applying of applying this recommended practice, an example calculation has been prepared (see next page). It utilizes various pipe sizes, lengths, and conditions which may be encountered in the field.

AIR TEST TABLE

Based on Equation from ASTM C 828

SPECIFICATION TIME (min:sec) REQUIRED FOR PRESSURE DROP FROM 31/2 TO 21/2 PSIG
WHEN TESTING ONE PIPE DIAMETER ONLY

PIPE DIAMETER, INCHES

	4	6	8	10	12	15	18	21	24
25	0:04	0:10	0:18	0:28	0:40	1:02	1:29	2:01	2:38
50	0:09	0:20	0:35	0:55	1:19	2:04	2:58	4:03	5:17
75	0:13	0:30	0:53	1:23	1:59	3:06	4:27	6:04	7:55
100	0:18	0:40	0:10	1:50	2:38	4:08	5:56	8:05	10:34
125	0:22	0:50	1:28	2:18	3:18	5:09	7:26	9:55	11:20
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				12:06
225	0:40	1:29	2:38	4:08	5:40			10:25	13:36
250	0:44	1:39	2:56	4:35			8:31	11:35	15:07
275	0:48	1:49	3:14	4:43			9:21	12:44	16:38
300	0:53	1:59	3:31				10:12	13:53	18:09
350	1:02	2:19	3.47			8:16	11:54	16:12	21:10
400	1:10	2:38			6:03	9:27	13:36	18:31	24:12
450	1:19	2:50			6:48	10:38	15:19	20:50	27:13
500	1:38			5:14	7:34	11:49	17:01	23:09	30:14

AIR TEST TABLE

Based on Equations from ASTM C 828

SPECIFICATION TIME (min:sec) REQUIRED FOR PRESSURE DROP FROM 3½ TO 2½ PSIG
WHEN TESTING ONE PIPE DIAMETER ONLY

PIPE DIAMETER, INCHES

LENGTH OF LINE, FEET	4	6	8	10	12	15	18	21	24
25	0:04	0:10	0:18	0:28	0:40	1:02	1:29	2:01	2:38
50	0:09	0:20	0:35	0:55	1:19	2:04	2:58	4:03	5:17
75	0:13	0:30	0:53	1:23	1:59	3:06	4:27	6:04	7:55
100	0:18	0:40	1:10	1:50	2:38	4:08	5:56	8:05	10:34
125	0:22	0:50	1:28	2:18	3:18	5:09	7:26	9:55	11:20
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	↓	↓	↓	12:06
225	0:40	1:29	2:38	4:08	5:40	↓	↓	10:25	13:36
250	0:44	1:39	2:56	4:35	↓	↓	8:31	11:35	15:07
275	0:48	1:49	3:14	4:43	↓	↓	9:21	12:44	16:38
300	0:53	1:59	3:31	↓	↓	↓	10:12	13:53	18:09
350	1:02	2:19	3:47	↓	↓	8:16	11:54	16:12	21:10
400	1:10	2:38	↓	↓	6:03	9:27	13:36	18:31	24:12
450	1:19	2:50	↓	↓	6:48	10:38	15:19	20:50	27:13
500	1:28	↓	↓	5:14	7:34	11:49	17:01	23:09	30:14

Appendix B

APPENDIX B

EXAMPLE OF: APPLICATION OF RECOMMENDED PRACTICE C 828

Symbols

d = nominal pipe diameter, in. (m)
K = constant, 0.085 when U.S. customary units are used; 1.02 when SI units are used; and includes the reduction of all constants and unit conversion factors.
K' = constant, 0.022 when U.S. customary units are used; 3.2 when SI units are used; and includes the reduction of all constants and unit conversion factors.
L = length of line of one pipe size, ft (m)
q = allowable air loss rate per unit area, 0.003 $ft^3/min \times ft^2$ ($0.0009\ m^3/min \times m^2$)
Q = allowable air loss rate in any test section. For the determination of test time, t, the maximum allowable value of Q is 3.5 ft^3/min ($0.098\ m^3/min$); the minimum required value of Q is 2.0 ft^3/min ($0.056\ m^3/min$)
t = test time,s; the minimum required time calculated for a pressure drop from 3.5 to 2.5 psi (24 to 17 kPa) gage.

Calculation of Test Time

Test times are determined by three criteria, as follows:

An allowable air loss rate per unit area, of 0.003 $ft^3/min \cdot ft^2$ ($0.0009\ m^3/min \cdot m^2$) applied over the interior surface, determined from the nominal diameter;

A maximum air loss rate of 3.5 ft^3/min ($0.098\ m^3/min$) in any section tested; and

The minimum air loss rate to be used in the determination of test time is 2.0 ft^3/min ($0.056\ m^3/min$) in any section tested.

Equations for determining test times are as follows (Note):

For a single pipe size in a test section, air loss rate per unit area being the criterion:

$$t = K(d/q)$$

For more than one pipe size in a test section, air loss rate per unit area being the criterion:

$$t = (K/q) \times \frac{d_1^2L_1 + d_2^2L_2 \ldots d_n^2L_n}{d_1L_1 + d_2L_2 \ldots d_nL_n}$$

For a single pipe size in a test section, air loss rate being the criterion:

$$Q = (K'/t) \times (d_1^2 L_1 + d_2^2 L_2 \ldots d_n^2 L_n)$$

NOTE - Equations are based on air stablization at 68°F(20°C). Air temperatures stabilized between 43 and 96°F(6 and 36°C) will introduce errors of less than 5%.

Test sections, that are of such a length that the air loss rate based on $q = 0.003$ ft^3/min $\cdot$ ft^2 exceeds the 3.5 ft^3/min criterion, may be tested in segments.

In order to demonstrate the technique of applying this recommended practice, the example has been prepared utilizing various pipe sizes, lengths, and conditions which may be encountered in the field.

EXAMPLE: An installation (see Fig. X1.1) has been made which consists of 600 ft (183 m) of 12-inch (0.30 m) diameter pipe between two manholes. From one manhole extends a short length of pipe, 35 ft (10.7 m) of 12-inch pipe; and from the same manhole extends a network consisting of 300 ft (91 m) of 8-inch (0.20 m) diameter pipe and 240 ft (73 m) of 4-inch (0.10 m) diameter pipe.

Solution I: Considering the line of 600 ft of 12-inch pipe, based on $q = 0.003$ ft^3/min x ft^2, what is the test time, t?

$$t = K(d/q) = 0.085 \times (12/0.003) = 340 \text{ s}$$

If we test the line using this test time, will the air loss rate meet the test criteria?

$$Q = K'(d^2 L/t) = 0.022 \times (12^2 \times 600/340) = 5.6 \text{ ft}^3/\text{min}$$

Conclusion: The entire length of line cannot be tested using the air loss rate of $Q = 5.6$ ft^3/min because this exceeds the 3.5 ft^3/min and test accordingly, or we may test the line in shorter segments of length, L, determined by using $Q = 3.5$ ft^3/min and $t = 340$ s.

$$Q = K'(d^2 L/t)$$

Solving for L:

$$L = (Qt/K'd^2) = 3.5 \times 340/0.022 \times 12^2 = 375 \text{ ft}$$

Conclusion: We can test 375 ft segments of line and meet the $q = 0.003$ ft^3/min x ft^2 and $Q = 3.5$ ft^3/min criteria.

Our line is 600 ft of 12-inch pipe. Can we test the line in two test segments of 300 ft each?

$$Q = K'(d^2 L/t) = 0.022 \times (12^2 \times 300/340) = 2.8 \text{ ft}^3/\text{min}$$

Conclusion: Yes, we can test the line using 300 ft segments and meet all three criteria.

Solution II: Considering the line of 35 ft of 12-inch pipe, what is the test time? In the previous example, we established a t for 12-inch pipe, t = 340 s.

Is the test time, t = 340 s, appropriate to test the 35 ft of 12-inch vitrified clay pipe?

$$Q = K'(d^2L/t) = 0.022 \times (12^2 \times 35/340) = 0.33 \text{ ft}^3/\text{min}$$

Conclusion: It is inappropriate to test the line on this basis because the air loss rate, based on q = 0.003 ft^3/min x ft^2, is less than the 2.0 ft^3/min air loss rate criterion.

What is the appropriate test time for this 35 ft segment of 12-inch pipe?

Using the minimum required value, Q = 2.0 ft^3/min criterion:

$$Q = K'(d^2L/t)$$

Solving for t:

$$t = K'(d^2L/Q) = 0.022 \times (12^2 \times 35/2.0) = 55 \text{ s}$$

Solution III: What is the appropriate test time for a network consisting of 300 ft of 8-inch and 240 ft of 4-inch pipe?

Considering the q criterion:

$$t = (K/q) \times d_1^2L_1 + d_2^2L_2/d_1L_1 + d_2L_2 = (0.085/0.003) \times [(8^2 \times 300) + (4^2 \times 240)/(8 \times 300) + (4 \times 240)]$$

$$t = 194 \text{ s}$$

Will the air loss rate of this net work meet the Q criteria?
X1.5.2.1 Using t = 194 s:

$$Q = (K'/t)(d_1^2L_1 + d_2^2L_2) = (0.022/192)\ [(8^2 \times 300) - (4^2 \times 240)$$

$$Q = 2.6 \text{ ft}^3/\text{min}$$

Conclusion: Test the network for t_3 = 194 s. The q = 0.003 ft^3/min x ft^2, Q < 3.5 ft^3/min and Q > 2.0 ft^3/min criteria are satisfied.

Appendix C

APPENDIX C

LOCAL STANDARDS AND REVIEW PROGRAM

A. Introduction

The State Water Control Law requires submission of plans, specifications, and other pertinent data for all sewerage system projects designed to serve more than four hundred persons. In the past, the State Water Control Board (**Board**) and State Department of Health (**Department**) reviewed all gravity sewer systems serving less than four hundred persons when received.

Since February 1, 1977, when the Virginia Sewerage Regulations became effective, waiver of State review of certain plans have been incorporated into the Regulations and include: (1) gravity sewage collection systems with a design capacity to serve less than four hundred persons; and (2) individual home discharges (although a NPDES permit is required). However, as before, this waiver does not limit the power of the **Board** and the **Department** in the control of these systems, nor does this waiver allow the design and construction of these systems which do not meet the requirements of the Manual of Practice of the Sewerage Regulations.

For projects requiring submission of plans and specifications, the **Department** and the **Board** conduct their full review. They will approve construction of the project if the submissions are determined to be in substantial compliance with the minimum requirements of the Manual of Practice.

Recently, the **Board** and the **Department** established the Local Standards and Review Program. Municipalities participating in this program will perform the routine design review of plans for gravity collection systems rather than the **Department** and the **Board**. It is important to note, however, that the **Department** and the **Board** must, by law, retain their respective approval authority. Only the review of the plans may be delegated to the locality and under certain conditions.

The following pages outline the purpose, benefits, requirements for participation, and operation of the Local Standards and Review Program. A final section clarifies the meaning of gravity collection system when used with reference to the Local Standards and Review Program.

B. Purpose

1. Encourage and promote design review of gravity collection systems serving under four hundred persons.

2. Expedite review process for gravity collection systems serving over four hundred persons.

C. Benefits

1. Expand local control over gravity collection systems.

2. Reduce the amount of infiltration/inflow due to properly designed and constructed gravity collection system.

3. Increase the likelihood that gravity collection systems serving less than four hundred persons will meet the requirements of the Sewerage Regulations.

4. Reduce average review period for all sewerage plans since the **Department** and the **Board** will have less projects requiring full review.

D. Requirement for Participation

The **Department** and the **Board** must approve the participation of any municipality in the program. Although the program is directed towards municipalities, private owners will be considered for participation. Those municipalities wishing to participate in the Local Review Program must submit the following items to the **Department** and the **Board** for their review and approval:

1. Design criteria and construction specifications used in the locality. These must meet the minimum requirements of the Sewerage Regulations.

2. Information to show that the municipality employs personnel with the training and experience to review plans and insure compliance with requirements.

3. A master plan for each sewer shed in the municipality's sewerage system which should generally include:
   a) size and capacity of interceptor and truck sewer;
   b) points at which contributory sewer connect to the trunks and interceptors along with the contributory populations and flows;
   c) routing of sewage after leaving the sewer shed; and
   d) capacities of downstream conveyance and treatment facilities as well as connected loads.

   This plan shall be updated at least annually. Also, periodic notification of all new connections to each sewer shed will be made.

   In lieu of initially submitting the master plan for its entire sewerage system, a municipality may delay submission of any individual sewer shed plan until a project located in that sewer shed is proposed.

4. A certificate to be used to certify projects to the SHD/SWCB for collection systems serving more than four hundred persons.

   This certification shall include the following information:

   a) project name
   b) sewer shed
   c) linear feet of pipe
   d) pipe size, type
   e) manholes
   f) design flow
   g) project population
   h) space to note any substantial deviations from "shall" criteria contained in Sewerage Regulations and justification for the deviations
   i) space for signature of municipal official who has authority to certify projects
   j) other information, as required, such as a design review sheet (with reviewer's name and date of review) and sketches (to show sewer lines or pump station immediately downstream of project)

   Discovery by the **Department** and the **Board** that a project has been certified which is not in conformance with the Sewerage Regulations shall be grounds for termination of the municipality's program.

E. Program Operation

1. For all gravity collection systems serving under four hundred persons, the municipality shall review the plans for conformance with local design criteria. The municipality's approval allows construction to begin.

   For all eligible systems (see Section VI below) serving over four hundred persons, the municipality certifies to the **Department** and the **Board** that plans are in substantial compliance with their approved local design criteria.

2. The **Department** and the **Board** then review the municipality's certification and other information. If acceptable, the **Board** would then issue a Certificate to Construct. This allows construction to begin on these projects.

3. The municipality must retain a copy of the approved plans in their permanent files for future reference by either the **Department** or the Board. Periodically, the State

Agencies will conduct spot checks on the locality's program by requiring submission of plans for a full review.

4. As required by the Sewerage Regulations, upon completion of construction the owner shall submit to the **Department** a statement that construction was completed substantially in accordance with approved documents. The **Board** shall then take prompt action to issue the Certificate to Operate.

5. If it is determined that part or all of a gravity collection system is not eligible under this program the municipality should still review the plans for that project. The plans will then be submitted to the **Department** and the **Board** for review. However, any design review information that accompanies the plans will expedite the **Department** and the **Board**'s review and final approval.

F. Gravity Collection Systems

The following criteria will be used to determine whether a project can be reviewed under an approved Local Standards and Review Program:

1. Only gravity collection systems are eligible. Plans for pumping stations, force mains, or any special structures, such as siphons, must be submitted to the **Department** and the **Board** for their full review. Gravity mains, trunks, and interceptors (as defined in Section 21.04 of the Virginia Sewerage Regulations) downstream of a gravity collection system project may be eligible if they do not exceed the size criteria discussed in number 3 below.

2. All EPA grant projects are ineligible.

3. Size criteria - all 8", 10", and 12" gravity sewers are eligible.

4. Regardless of the size criteria outlined above, the **Department** and the **Board** may condition a Local Review Program approval so that only certain types or sizes of sewers are eligible.

Appendix D

Designation: C 1227 – 08

Standard Specification for Precast Concrete Septic Tanks[1]

This standard is issued under the fixed designation C 1227; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers design requirements, manufacturing practices, and performance requirements for monolithic or sectional precast concrete septic tanks.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:* [2]

A 82/A 82M Specification for Steel Wire, Plain, for Concrete Reinforcement

A 185/A 185M Specification for Steel Welded Wire Reinforcement, Plain, for Concrete

A 496/A 496M Specification for Steel Wire, Deformed, for Concrete Reinforcement

A 497/A 497M Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete

A 615/A 615M Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

A 706/A 706M Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement

A 996/A 996M Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement

C 33 Specification for Concrete Aggregates

C 39/C 39M Test Method for Compressive Strength of Cylindrical Concrete Specimens

C 94/C 94M Specification for Ready-Mixed Concrete

C 125 Terminology Relating to Concrete and Concrete Aggregates

C 150 Specification for Portland Cement

C 231 Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

C 260 Specification for Air-Entraining Admixtures for Concrete

C 330 Specification for Lightweight Aggregates for Structural Concrete

C 494/C 494M Specification for Chemical Admixtures for Concrete

C 595 Specification for Blended Hydraulic Cements

C 618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

C 685/C 685M Specification for Concrete Made by Volumetric Batching and Continuous Mixing

C 890 Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures

C 990 Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

C 1116/C 1116M Specification for Fiber-Reinforced Concrete

2.2 *ACI Standard:*[3]

ACI 318 Building Code Requirements for Reinforced Concrete

2.3 *NSF/ANSI Standard:*[4]

NSF/ANSI 46–2005 Evaluation of Components and Devices used in Wastewater Treatment Systems

3. Terminology

3.1 For definitions of terms relating to concrete, see Terminology C 125.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *access opening, n*—hole in the top slab used to gain access to the inside of the tank for the purpose of cleaning and removing sludge without a person actually having to enter the tank.

3.2.2 *air scum volume, n*—number of cubic inches (centimetres) in the space between the liquid surface and the underside of the top slab.

[1] This specification is under the jurisdiction of ASTM Committee C27 on Precast Concrete Products and is the direct responsibility of Subcommittee C27.30 on Water and Wastewater Containers.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American Concrete Institute (ACI), P.O. Box 9094, Farmington Hills, MI 48333-9094, http://www.aci-int.org.

[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

3.2.3 *baffle, n*—device placed in a tank to dissipate energy, direct flow, retain solids, and/or draw liquid off at a specific depth.

3.2.4 *baffle, inlet, n*—tee or wall segment at or near the inlet pipe of a tank designed to direct flow below the liquid surface.

3.2.5 *baffle, outlet, n*—tee or wall segment at or near the outlet pipe of a tank designed to collect flow from the liquid effluent layer.

3.2.6 *cement, n*—powdered substance of lime and clay mixed with water to make concrete.

3.2.7 *connector, n*—device that provides a flexible seal between a pipe and the precast concrete tank.

3.2.8 *corrosion-resistant, adj*—materials that are resistant to deterioration when in contact with the corrosive materials found in a septic tank.

3.2.9 *dead load, n*—mass of a structure and all permanent loads imposed on the structure (that is, soil).

3.2.10 *detention time, n*—average length of time a unit volume of liquid or a suspended particle remains in a tank; mathematically, it is the volume of liquid in the tank divided by the flow rate through the tank.

3.2.11 *effective volume, n*—maximum amount of liquid and solids that can be contained in a tank under normal operating conditions.

3.2.12 *effluent filter device, n*—device, made from corrosion-resistant materials, that separates solid material from tank liquid before the liquid exits the tank.

3.2.13 *grinder, n*—device for grinding and flushing cooking wastes; also known as a garbage disposal.

3.2.14 *inspection opening, n*—hole in the top slab used for the purpose of observing conditions inside the tank.

3.2.15 *joint, n*—physical separation where two pieces of precast concrete are in contact.

3.2.16 *liquid effluent layer, n*—area in a tank made up of liquids and semibuoyant waste particles after the sludge and scum waste have separated and settled.

3.2.17 *live load, n*—loads exerted on or above a structure when the source of the load is dynamic and transient.

3.2.18 *non-sealed joint, n*—joint in which sealant is not used but in which a machined fit will minimize the movement of liquid from one side of a precast concrete wall to the opposite side.

3.2.19 *owner, n*—is by definition, end user, customer, or purchaser.

3.2.20 *rated volume, n*—depth from the bottom of a septic tank to the invert of the outlet pipe.

3.2.21 *scum layer, n*—buoyant waste floating near the surface of liquid, consisting of lighter-than-water materials, such as greases and soaps.

3.2.22 *sealed joint, n*—joint that is sealed to prevent liquid passing from one side of a precast concrete wall to the opposite side.

3.2.23 *septic tank system, n*—anaerobic digestion chamber in which domestic sewage is received and retained, and from which the liquid effluent, which is comparatively free from settleable and floating solids, is then discharged.

3.2.24 *sludge layer, n*—heavier waste solids that separate and settle at the bottom of a tank.

3.2.25 *tee, n*—"T"-shaped pipe fitting made of corrosion-resistant materials used to connect horizontal piping with vertical piping and used to provide access for cleaning piping.

4. Ordering Information

4.1 The purchaser shall include the following information in bidding documents and on the purchase order, as applicable to the units being ordered:

4.1.1 Reference to this specification and date of issue.

4.1.2 Quantity, that is, number of units ordered.

4.1.3 Capacity of tank in gallons or litres.

4.1.4 Special cement requirements including moderate sulfate-resisting cement, Specification C 150 Type II, or highly sulfate-resisting cement, Specification C 150, Type V. If the purchaser does not stipulate, the manufacturer shall use any cement meeting the requirements of Specification C 150 or C 595.

4.1.5 Acceptance will be based on a review of the calculations or on proof tests.

4.1.6 Design requirements such as depth of earth cover, live load applied at the surface, and ground water level.

4.1.7 Testing for water leakage shall not be required at the job site unless specifically required by the purchaser.

4.1.8 Manufacturer is permitted to require testing on site prior to backfill.

5. Materials and Manufacture

5.1 *Cement*—Portland cement shall conform to the requirements of Specification C 150 or shall be portland blast-furnace slag cement or portland-pozzolan cement conforming to the requirements of Specification C 595.

5.2 *Aggregates*—Aggregates shall conform to Specification C 33 and lightweight aggregates shall conform to Specification C 330, except that the requirements for grading shall not apply.

5.3 *Water*—Water used in mixing concrete shall be clean and free of injurious amounts of oils, acids, alkalies, salts, organic materials, or other substances that will be incompatible with concrete or steel.

5.4 *Admixtures*—Admixtures, when used, shall conform to Specification C 494/C 494M or Specification C 618 and shall not be injurious to other products used in the concrete.

5.4.1 *Air-Entraining Admixtures*—Air-entraining admixtures conforming to Specification C 260 shall be used when there is a risk that the concrete will be exposed to freezing and thawing. Then the concrete mixture shall contain 5.5 ± 1.5 % air by volume as determined by Test Method C 231.

5.5 *Steel Reinforcement*—Steel reinforcement shall conform to Specification A 82/A 82M or A 496/A 496M for wire, Specification A 185/A 185M or A 497/A 497M for wire fabric, or Specifications A 615/A 615M, A 706/A 706M, or A 996/A 996M for steel reinforcement bars.

5.5.1 *Locating Reinforcement*—Reinforcement shall be placed in the forms as required by the design.

5.5.2 *Holding Reinforcement in Position During Pouring Placement*—Reinforcement must be securely tied in place to maintain position during concrete placing operations. Chairs, bolsters, braces, and spacers in contact with forms shall have a corrosion-resistant surface.

5.6 *Concrete Mixtures*—The aggregates, cement, and water shall be proportioned and mixed to produce a homogeneous concrete meeting the requirements of this specification, and in accordance with Specification C 94/C 94M or Specification C 685/C 685M.

5.7 *Forms*—The forms used in manufacture shall be sufficiently rigid and accurate to maintain the dimensions of the structure within the stated tolerances. All casting surfaces shall be of smooth nonporous material. Form releasing agents used shall not be injurious to the concrete.

5.8 *Concrete Placement*—Concrete shall be placed in the forms at a rate to allow the concrete to consolidate in all parts of the form, and around all reinforcement steel and embedded fixtures without segregation of materials.

5.9 *Curing*—The precast concrete sections shall be cured by any method or combination of methods that will develop the specified compressive strength at 28 days or less.

5.10 *Concrete Quality*—The quality of the concrete shall be in accordance with the chapter on concrete quality in ACI 318, except for frequency of tests, which shall be specified by the purchaser. Concrete compressive strength tests shall be conducted in accordance with Test Method C 39/C 39M.

5.11 *Fibers*—Polypropylene or polyolefin fibers are only permitted as a secondary reinforcing material, at the manufacturer's option, in precast concrete septic tanks. For the purposes of this specification, secondary reinforcing material is only used to resist temperature and shrinkage effects. Only Type III conforming to the requirements of Specification C 1116/C 1116M shall be accepted.

5.12 *Sealants*—Flexible sealants used in the manufacture and installation of tanks shall conform to Specification C 990. Rigid (mortar) sealing of tank sections is not permitted.

6. Structural Design Requirements

6.1 Structural design of septic tanks shall be by calculation or by performance.

6.1.1 Design by calculation shall be completed using the Strength Design Method (ultimate strength theory) or the Alternate Design Method (working stress theory) outlined in ACI 318. The Strength Design Method is outlined in Chapter 9 and the Alternate Design Method is in Appendix A.

6.1.2 Design by performance requires the manufacturer to demonstrate that failure will not occur by physically applying loads to the product. The load applied shall be 1.5 times the anticipated actual loads.

6.1.3 Tanks shall be designed so that they will not collapse or rupture when subjected to anticipated earth and hydrostatic pressures when the tanks are either full or empty.

6.1.4 After conditions are established, loads from Practice C 890 shall be used for design. Unless heavier live loads are expected, the minimum live load at the surface for design shall be 300 lbf/ft^2 (14 kPa).

6.1.5 The live loads imposed at lifting points shall be considered in the design of the structure.

6.1.6 Inserts embedded in the concrete shall be designed for an ultimate load that is four times the working load (Factor of Safety = 4).

6.2 *Concrete Strength*—The minimum compressive strength (f'c) for designs shall be 4000 psi (28 MPa) at 28 days of age.

6.3 *Reinforcing Steel Placement*—The concrete cover for reinforcing bars, mats, or fabric shall not be less than 1 in. (25 mm).

6.4 *Openings*—The structural design shall take into consideration the number, placement, and size of all openings.

6.5 Lift equipment shall be designed for an ultimate load that is five times the working load (Factor of Safety = 5).

7. Physical Design Requirements

7.1 *Capacity*—Sizes are generally specified by local regulations and they shall supersede the following guidelines. When local regulations are not available, the following minimum sizes will be required:

1-bedroom residence	750 gal (2800 L)
2 and 3-bedroom residence	1000 gal (3800 L)
4-bedroom residence	1200 gal (4500 L)
5-bedroom residence	1400 gal (5300 L)
Motels	100 gpd/unit (380 Lpd/unit)
Restaurant	70 gpd/seat (265 Lpd/seat)
Office building	20 gpd/seat (75 Lpd/seat)

Additional capacity is required when grinders are available

7.2 *Shape*:

7.2.1 There shall be a total of no less than 25 ft^2 (2.3 m^2) of surface liquid area and a total inside length of at least 6 ft (2 m) between inlet and outlet of the tank.

7.2.2 The air scum volume above the liquid shall be at least 12½ % of the volume of liquid but not less than 9 in. (230 mm) high for entire surface above liquid.

7.2.3 Minimum water depth shall be 36 in. (900 mm) unless otherwise approved by local code or jurisdiction.

7.2.4 Maximum liquid depth shall be 72 in. (1800 mm) unless otherwise approved or required by local codes or jurisdiction.

7.3 *Compartments*:

7.3.1 The septic tank system shall include two compartments unless otherwise approved by local codes or jurisdiction. The two-compartment dividing wall is to be monolithically cast or placed secondarily utilizing a non-sealed joint with the tank body.

7.3.2 One double unit or two single compartment units in series are acceptable.

7.3.3 The first compartment shall have a liquid volume of approximately two thirds of the liquid volume of the entire contents of the system.

7.3.4 The transfer port between compartments shall be sized to maintain a low velocity as liquid moves between compartments. A minimum of 50 in.^{2} (320 cm^2) shall be used where local codes do not specify otherwise.

7.3.5 The transfer port shall be in the middle 25 % of the distance from the bottom of the tank to the water line.

7.3.6 No baffle, tee, outlet filter unit, or compartment wall shall extend to the interior roof without providing for venting. The cross-sectional area of a vent shall be at least equivalent to a 4-in. (100-mm) diameter pipe.

7.4 *Influent and Effluent Pipes*:

7.4.1 The influent pipe shall be no less than 4 in. (100 mm) in diameter.

7.4.2 The difference between the invert of the influent pipe and the invert of the effluent pipe shall be a minimum of 2 in. (50 mm) and a maximum of 4 in. (100 mm).

7.4.3 Inlet and outlet pipes shall be connected to the tank with a sealed flexible joint connector to accommodate tank movement.

7.5 *Baffles and Outlet Devices*:

7.5.1 Baffles or tees shall be placed at the influent pipe. Outlet filter devices shall be placed at the effluent pipe.

7.5.2 Baffles or tees are permitted to be precast monolithically with the tank. If baffles, tees, or outlet filters are added, they shall be made of noncorrosive materials and be permanently connected with noncorrosive fasteners to either the inside of the tank or the outlet pipe.

7.5.3 The inlet baffle or tee shall extend at least 8 in. (200 mm) below the liquid level and at least 5 in. (125 mm) above the liquid level.

7.5.4 The outlet filter shall extend below the liquid line at least 10 in. (250 mm) but not more than 40 % of the depth of the liquid. It shall extend a minimum of 5 in. (125 mm) above the liquid level line. The filter device shall be constructed to prevent the discharge of floating solids in the event the liquid level in the tank overflows the top of the filter with the filter element in place. All filter devices must meet the performance criteria of NSF/ANSI Standard 46–2005 or most current revision.

7.5.5 Outlet filter device shall be maintained in accordance with manufacturer's recommendations or requirements of regulating agencies, or both.

7.5.6 Outlet filter devices shall be sized upon the estimated daily water use and the rated capacity of the filter per the manufacturer's specifications.

7.5.7 Specifications for baffles, tees, and outlet filter devices are for normal, low-flow conditions. High-flow conditions, created when liquid is pumped from another tank, will require consideration for other dimensions. Design by a qualified engineer is required for these cases.

7.5.8 Outlet solids deflectors may be used in conjunction with outlet filter devices to deflect suspended solids away from the outlet filter device and shall be installed per the manufacturer's instructions.

7.6 *Openings in Top Slab*:

7.6.1 An access opening shall be located over the influent pipe and the effluent pipe. Where an opening has any dimension greater than 12 in. (300 mm), the lid shall weigh a minimum of 59 lb (27 kg) or be provided with a lock system to prevent unauthorized entrance.

7.6.2 An access opening or openings shall be provided to permit pumping of all compartments.

7.6.3 An inspection hole, at least 4 in. (100 mm) in diameter, shall be located over an interior divider in a two-compartment tank.

7.6.4 Handles shall be provided when the top of a cover is flush with the top of the top slab. Handles shall be made of corrosion-resistant material and be capable of supporting the weight of the cover.

7.6.5 Handles are not required when the cover sits on top of the slab. The cover shall be prevented from moving laterally if sitting on top of the slab.

7.6.6 Where covers are flush with or above ground, they shall be provided with a lock system to prevent unauthorized entrance.

7.6.7 If cover is below grade, it shall have a minimum of 6 in. (150 mm) and a maximum of 12 in. (300 mm) of earth above.

7.6.8 If top slab is more than 12 in. (300 mm) below grade, risers will be required to make the top of the cover meet the requirements of 7.6.7.

8. Quality Control and Sampling

8.1 The manufacturer shall certify that the product meets three criteria: (*1*) water tightness, (*2*) physical dimensions, and (*3*) strength of structure.

NOTE 1—Installation to be in accordance with manufacturer's instructions.

8.2 When the purchaser specifies in the bidding documents and the purchase order, the manufacturer shall select at random 1 of every 20 septic tanks to determine compliance with the provisions of this specification.

9. Performance Test Methods

9.1 Proof testing is used to demonstrate the strength of the tank to resist anticipated external and internal loads.

9.1.1 Proof testing, when required by the purchaser, shall be performed in such a way as to simulate the actual anticipated loads.

9.2 Testing for leakage is performed using either vacuum testing or water-pressure testing.

9.2.1 *Vacuum Testing*—Seal the empty tank and apply a vacuum to 4 in. (100 mm) of mercury. The tank is approved if 90 % of vacuum is held for 2 min.

9.2.2 *Water-Pressure Testing*—Seal the tank, fill with water, and let stand for 24 h. Refill the tank. The tank is approved if water level is held for 1 h.

10. Dimensions and Permissible Variations

10.1 *Dimensional Tolerances*—The length, width, height, or diameter measurements of the structure when measured on the inside surface shall not deviate from the design dimensions more than the following:

Dimension	Tolerance
0 to 5 ft (0 to 1.5 m)	±¼ in. (±6 mm)
5 to 10 ft (1.5 to 3.0 m)	±⅜ in. (±10 mm)
10 to 20 ft (3.0 to 6.1 m)	±½ in. (±13 mm)
20 ft (6.1 m) and over	as agreed upon between the manufacturer and the purchaser

10.2 *Squareness Tolerance*—The inside of the rectangular precast concrete component shall be square as determined by diagonal measurements. The difference between such measurements shall not exceed:

Measured Length	Allowance Difference
0 to 10 ft (0 to 3.0 m)	½ in. (13 mm)
10 to 20 ft (3.0 to 6.1 m)	¾ in. (19 mm)
20 ft (6.1 m) and over	as agreed upon between the manufacturer and the purchaser

10.3 *Joint Surfaces*—The following joint tolerances for water-retaining structures shall apply:

10.3.1 *Flexible Joint*—The sealed joint gap between two mating joint surfaces shall not exceed ⅜ in. (10 mm) before the joint sealant is applied.

10.4 *Reinforcement Location*—With reference to thickness of wall or slab, reinforcement shall be within ±¼ in. (6 mm) of the design location, but in no case shall the cover be less than 1 in. (25 mm). The variation in reinforcement spacing shall not be more than one tenth of the designed bar spacing nor exceed 1½ in. (38 mm). The total number of bars shall not be less than that computed using the design spacing.

11. Repairs

11.1 Repairs of precast concrete structures, when required, shall be performed by the manufacturer in a manner ensuring that the repaired structure will conform to the requirements of this specification.

12. Rejection

12.1 Precast concrete structures or sections of structures shall be subject to rejection because of failure to conform to any of the requirements contained in this specification.

13. Product Marking

13.1 Each septic tank shall be clearly marked within 2 ft (0.6 m) of the inlet to the tank by indentation or other approved means with (*1*) date manufactured, (*2*) name or trademark of the manufacturer, and (*3*) tank capacity. The tank or tank cover shall also be marked within 2 ft (0.6 m) of the inlet either on the cover or on the tank with an indication of external loads for which the septic tank is designed to resist, including the number of feet of earth cover above top slab and surface load from Practice C 890, that is, A-03, A-8, A-12, or A-16, unless required otherwise by local codes.

13.2 Each septic tank shall be clearly marked by indentation, or other approved means with (*1*) date of manufacture, (2) name or trademark of the manufacturer, and (*3*) indication of external loads for which the septic tank is designed to resist, including the number of feet of earth cover above top slab and surface load from Practice C 890, that is, A-03, A-8, A-12, or A-16, unless required otherwise by local codes.

13.2.1 When all the requirements of this specification are met, the product shall be so stamped.

13.3 Where an access opening or an inspection opening has a dimension greater than 8 in. (200 mm), a label of noncorrosive material shall be placed in a prominent place to warn everyone that "Entrance into the tank could be fatal."

14. Keywords

14.1 anaerobic digestion; on-site wastewater treatment; sanitary waste; septic tank; sewer; sewer treatment

Appendix E

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SEWER PUMP STATION DESIGN SUBMITTAL FORM

I. The following items must be submitted with the plans and/or specifications.

A._____Preliminary Engineering Report – A Preliminary Engineering Report (PER) that gives an narrative describing the pump station service area, projected flows, environmental concerns, and design considerations for the proposed pump station shall be submitted to the Director of Engineering and GIS for consideration. Pump station design shall consider buildout of the proposed sewer service area based upon current TOB zoning over a 30 year period. At a minimum the PER shall be a bound report that includes the following sections in the Table of Contents:

1. Purpose and Scope
2. Existing and Proposed Service Area
3. Existing and Proposed Sewer Loadings
4. Down Stream System Capacity Issues
5. Project Alternatives
6. Opinion of Probable Costs
7. Recommendations and Conclusions
8. Appendices
    a. Sewer Loading Calculations
    b. Down Stream Sewer Capacity Analysis
    c. Environmental Assessments
    d. DEQ Submittal Form
    e. Current zoning of service area
    f. Standard TOB PS specifications
9. Tables & Figures
    a. Figure 1: Service area map
    b. Figure 2: Site Map and Force main routing to discharge point.
    c. TOB projected loadings

B. _____Project costs - The project cost is an estimate of the design and construction costs of the sewerage portion of the project. For example, if a subdivision project is being submitted for review of the sewer lines, the cost will only include the sewer lines.

C. _____Design calculations - One set of design calculations for a sewer pump station project must be submitted. The calculations are the engineer's calculations for sizing pipes, pumps, etc. Basis of design includes flow projections. All applicable calculations, including buoyancy calculations, should be submitted, and will usually be acceptable for our review to begin. A **pump curve** for each type of pump used must be submitted. If a pump station is connecting to a force main, provide the residual pressure at the point of hook up. If the force main at the point of hook up.

II. The following items must be on the plans or in the specifications.

D. _____Original P.E. seal, signature, and date on each cover sheet - This is a requirement of the Department of Professional and Occupational Regulation §12.8.B. The signature and date should be across or below the seal. The date is the date that the seal is signed.

E. _____Facsimile P.E. seal, signature, and date on each subsequent plan sheet - This is also a requirement of the Department of Professional and Occupational Regulation §12.8.B. The signature should be across or below the seal.

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F. _____**Date on plans and specifications** - The title page of plans and specifications needs to be dated in order to give the project a time reference. This date is usually when the design is complete.

G. _____**Adequate title** - The plans and specifications need to have an adequate title to identify the project. If there are several phases to a project, that should be noted in the title.

H. _____**Legible plans** - The plans which are submitted need to be on 24 " x 36 " size plan sheets and must be dark enough to see all of the details. Half size plans may be acceptable for large projects.

I. _____**Owner of the sewerage project with an address** - The owner of the project (and developer if different) need to be on the plans in order to give the project ownership.

J. _____**Engineer with an address** - The engineer's (or company) name needs to be on the plans and specifications to identify who designed the project.

K. _____**Project location (site plan)** - The project location needs to be specific enough so if someone wanted to visit the site based on this location map, it would be possible.

L. _____**Site plan with topography** - The topography needs to be on the plans to identify the elevation(s) at the project site. If a sewer line project is submitted, the plan and profile views will have the elevations, which will satisfy this requirement.

M. _____**Plan and profile views** - Both views are needed for clarity of the project. Both views for a sewer line are needed to identify elevations of other utilities in the area.

N. _____**Construction Specifications** – The Town of Blacksburg has standard construction specifications for gravity sewer lines and force mains. Additional specifications for the Pump Station construction shall be submitted to the Town of review prior to bid of the project.

O. _____**Method of continuous operation** - Continuous operation must be provided for pump stations and treatment facilities in the event that power or equipment fails. The Town of Blacksburg requires an onsite generator with automatic switchover. In the case of smaller pump stations 24 hours of onsite storage may allowed in lieu of a back up generator. Pump shall be equipped with a portable pump connection, even if another method of continuous operation is provided.

P. _____**Alarm system** – All pump stations shall have a class I reliability rating, and the alarm system must monitor at least the high water level, the power failure, and each pump failure; must be equipped with a test function (button to activate the alarm) and a back up power supply (such as a battery pack); and must transmit the alarm signal to a 24 hour per day manned location. As specified in the Town of

Q. _____**Electrical specifications** - electrical specifications need to be included on the plans and in the specifications. The electrical items that must be provided include breaker settings or fuse ratings, compliance with NEC or UL, moisture resistant underground conduits, protection of concrete, metal, and safety devices against corrosion, adequate protection from short circuits and overloads for three phase motors, and adequate electrical and equipment testing performed by the contractor.

R. _____**Standard Equipment and Details:** Standard details and design documents shall be included in the specifications and plan sheets to construct a pump station that meets the most current Town of Blacksburg Sewer Specifications Pump Station specifications and associated details.

DEQ SUBMITTAL FORM

SEWERAGE PLANS AND/OR SPECIFICATIONS

County/City: _____

Project: _____

I. The following items must be submitted with the plans and/or specifications.

_____ project cost = _____
_____ one set of design calculations
_____ pump curve
_____ buoyancy calculations
_____ flow certificate (requested or enclosed)
_____ flow acceptance letter
_____ portable equipment form
_____ correct number of plans and/or specifications*

* four sets of plans and/or specifications are required for approval, but one set can be submitted initially

II. The following items must be on the plans or in the specifications.

_____ **original** P.E. seal, signature, and date on each cover sheet (plans and specifications)
_____ facsimile P.E. seal and signature on each subsequent plan sheet
_____ date on plans and specifications
_____ adequate title
_____ legible plans
_____ owner of the sewerage project with an address and phone number
_____ engineer with an address and phone number
_____ project location (1:2000 map)
_____ site plan with topography
_____ plan and profile views
_____ City/County specifications identified (if used)
_____ manhole stationing and sewer slopes
_____ method of continuous operation = _____
_____ alarm system
_____ electrical specifications
_____ available power to the site = _____ volts and _____ phase

All gravity sewer and force main projects must be submitted to the Department of Environmental Quality (DEQ) for review. All pump stations with > 25 gpm pump rate (at 100 feet TDH) must be submitted to DEQ for review. Review of all other pump stations may be waived, as determined by the area engineer. DEQ reviews all VPDES discharge sewage treatment facilities projects and vacuum sewerage systems.

Appendix F

Worksheet No. 1: TOB Projected Sewer Loadings and Capacity Worksheet

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Name of Development Project:

A.) Calculate the Projected Average Daily Flows from the Development:

TOB Design Loadings			Total Project Loadings		
Use	gallons per day	Typical Sewer	Total Number	units	Average GPD Flow
Family Dwelling	170	per dwelling		dwellings	0
Town Home	170	per home		homes	0
Multifamily	125	per unit		units	0
Car Wash	450	450 ea		each	0
Retail Store	40	per 1000 sf		square feet	0
Office Spaces	40	per 1000 sf		square feet	0
Industrial Facilities	350	per acre		acres	0
Hotel/Motel	150	per 1000 sf		square feet	0
Restaurants	150	per 1000 sf		square feet	0
Medical Office	150	per 100 sf		square feet	0
Other Flows (See VSCAT Table 3.)					
			(A.) Total Average Daily Flow =		0

B.) Calculate the average infiltration rate from new sewer pipe:

Total Length of new sewer pipe for project (B1)=		ft
Infiltration factor (B2)=	1.5	gpd/ft
(B.) Total Average Infiltration (B1 x B2) =	0	gpd

C.) Total projected average daily develoment sewer flow (A+B) = 0 gpd

D.) TOB Sewer shed where development is located:

E.) Point of down stream analysis (100 x item C) = GPD

F.) Is there a downstream pump station? Xyes no
(if no skip items F & G and go to item H)

F1: Name of receiving pump station: Windsor Hills
F2: TOB rated dapacity of PS = GPD

G.) Determine if there is Capacity in Pump Station:

G1:	Current average daily flow into PS (TOB flow data)=		GPD
G2:	Total projected average daily development sewer flow (item C)=	0	GPD
G3:	Total project flow to pump station (G1+G2)=	0	GPD

G4: Capacity in pump station? ___x___Yes (if G2 >G3) _____No (if G2<G3)

H.) Is down stream analysis at gravity interceptor? yes X No
(if no skip items F & G and go to item H)

H1:	Name of TOB sewershed where interceptor point is located:		
H2:	Current average daily flows at interceptor point =		GPD
H3:	Total Projected Average Daily Development Sewer Flow (item C)=		GPD
H4:	TOB peaking factor at interceptor point (10 yr storm historic data) =		
H5:	Total projected flow to interceptor point (H2+H3)x(H4)=	0	GPD

I.) Determine if there is capacity at gravity interceptor :

I1:	Diameter or limiting inteceptor pipe =		inches
I2:	Minimum slope of limiting interceptor =		%
I3:	Capacity of interceptor (see Figure 1: Manning pipe chart) =		gpm

I4: Capacity in Interceptor? _____Yes (if I3 >H5) _____No (if I3<H5)

I.) Other capacity Issues or items that will be addressed with this project:

Figure 1:
Manning Pipe Flow Chart

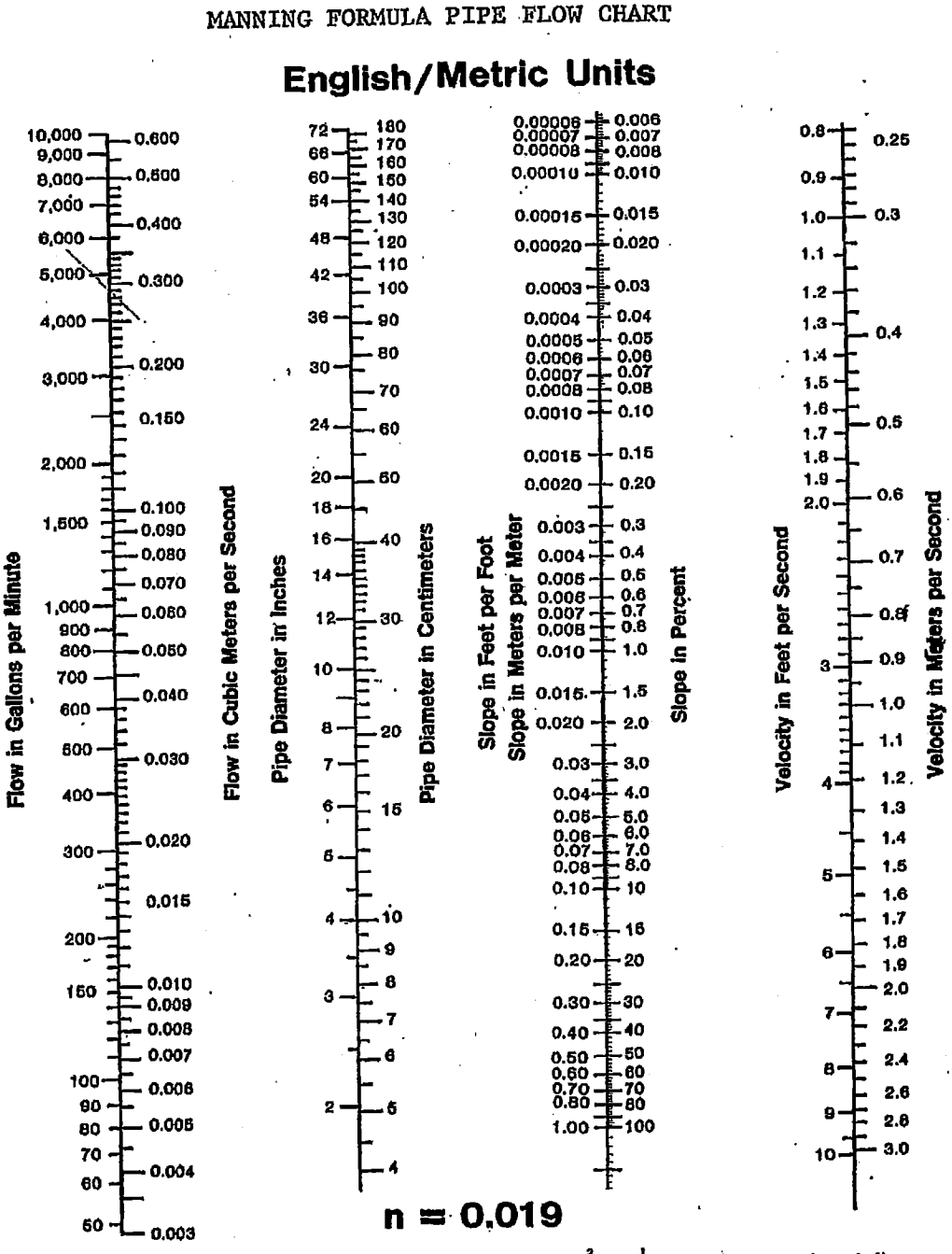
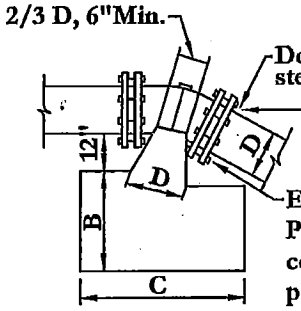


Chart based on the formula $Q = \frac{1.486}{n} \times AR^{\frac{2}{3}} \times S^{\frac{1}{2}}$ for pipe flowing full.

Reprinted with permission from the April 30, 1978 reference issue of Water & Sewage Works magazine. Prepared by Frank Reid and Harold Stone, Water & Sewage Works staff.

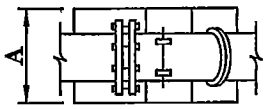
Appendix G



ELEVATION

REINFORCING BARS

Size	5 5/8°	11 1/4°	22 1/2°	45°
6"		3-#6	3-#6	3-#6
8"		3-#6	3-#6	3-#6
10"		3-#6	3-#6	3-#6
12"		3-#6	3-#6	3-#6
16"		3-#6	3-#6	3-#6
20"	3-#6	3-#6	3-#6	4-#6
24"	3-#6	3-#6	3-#6	5-#6
30"	3-#6	3-#6	5-#6	5-#7
36"	3-#6	4-#6	5-#7	6-#7

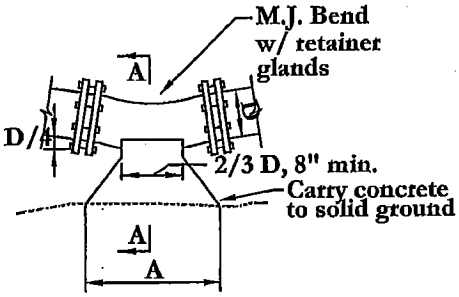


PLAN

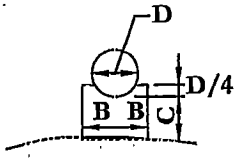
Anchorage for vertical bends

ANCHORAGE FOR VERTICAL BENDS

Bend		6"	8"	10"	12"	16"	20"	24"	30"
5 5/8°	A						2'-2"	2'-6"	3'-6"
	B						2'-0"	2'-6"	2'-6"
	C						4'-6"	4'-6"	5'-0"
11 1/4°	A	1'-6"	1'-6"	1'-5"	3'-0"	3'-6"	4'-0"	4'-3"	4'-6"
	B	1'-3"	1'-9"	1'-3"	2'-0"	2'-0"	2'-6"	2'-6"	2'-8"
	C	2'-0"	2'-6"	2'-9"	3'-0"	4'-0"	5'-0"	5'-9"	6'-6"
22 1/2°	A	2'-0"	3'-4"	3'-8"	4'-0"	4'-4"	4'-8"	5'-0"	5'-4"
	B	1'-9"	2'-3"	2'-6"	2'-6"	2'-6"	2'-8"	3'-8"	4'-6"
	C	2'-6"	2'-8"	3'-10"	4'-0"	5'-6"	7'-6"	8'-6"	8'-6"
45°	A	2'-6"	3'-0"	4'-0"	4'-6"	5'-2"	5'-6"	6'-0"	6'-6"
	B	2'-6"	2'-9"	3'-0"	3'-6"	4'-0"	4'-6"	5'-6"	6'-0"
	C	3'-0"	4'-0"	4'-6"	4'-9"	6'-6"	8'-6"	9'-6"	11'-0"



ELEVATION



SECTION A-A

Buttress for vertical bends

BUTTRESS FOR VERTICAL BENDS

Bend		6"	8"	10"	12"	16"	20"	24"	30"
5 5/8°	A						1'-8"	2'-0"	2'-6"
	B						10"	1'-0"	1'-3"
	C						10"	1'-0"	1'-1"
11 1/4°	A	6"	8"	10"	1'-0"	1'-4"	1'-8"	2'-0"	2'-6"
	B	7"	8"	9"	10"	1'-0"	1'-2"	1'-4"	1'-7"
	C	7"	7"	8"	8"	9"	10"	1'-0"	1'-1"
22 1/2°	A	9"	1'-0"	1'-6"	1'-9"	2'-3"	3'-0"	3'-6"	4'-2"
	B	7"	7"	8"	10"	1'-0"	1'-2"	1'-4"	1'-7"
	C	7"	7"	8"	8"	9"	10"	1'-0"	1'-1"
45°	A	1'-3"	1'-8"	2'-1"	2'-6"	3'-4"	4'-2"	5'-0"	6'-3"
	B	7"	8"	9"	11"	1'-3"	1'-6"	1'-9"	2'-3"
	C	7"	8"	10"	11"	1'-3"	1'-6"	1'-9"	2'-3"

Notes:

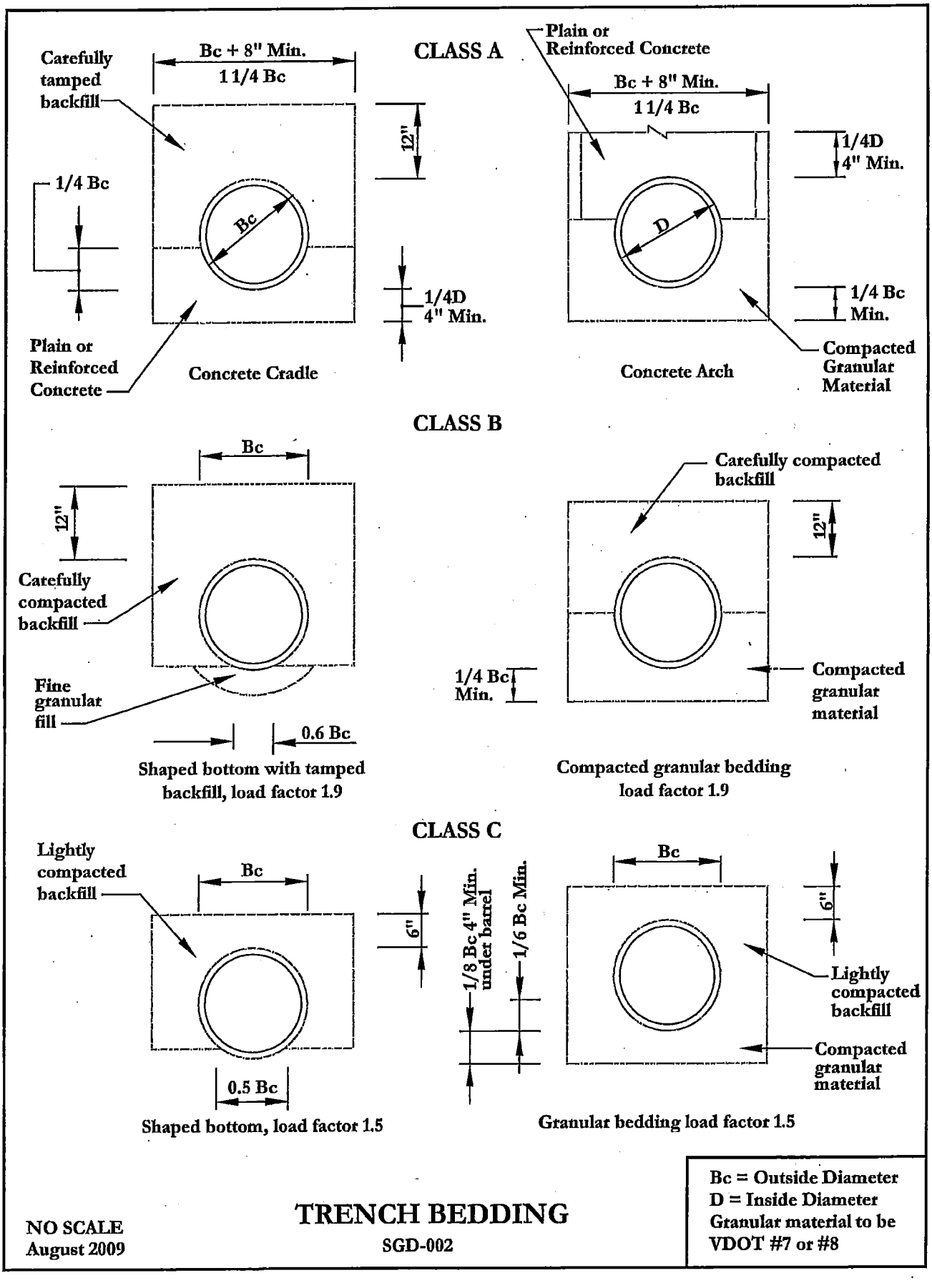
1. All concrete to be 3000 P.S.I.
2. Buttress dimensions shown are minimum.
   Dimensions are based upon soil bearing pressure of 3000 P.S.F. and static water pressure of 150 P.S.I.

FORCE MAIN BUTTRESSES AND ANCHORAGE FOR VERTICAL BENDS

August 2009

NO SCALE

SGD-001



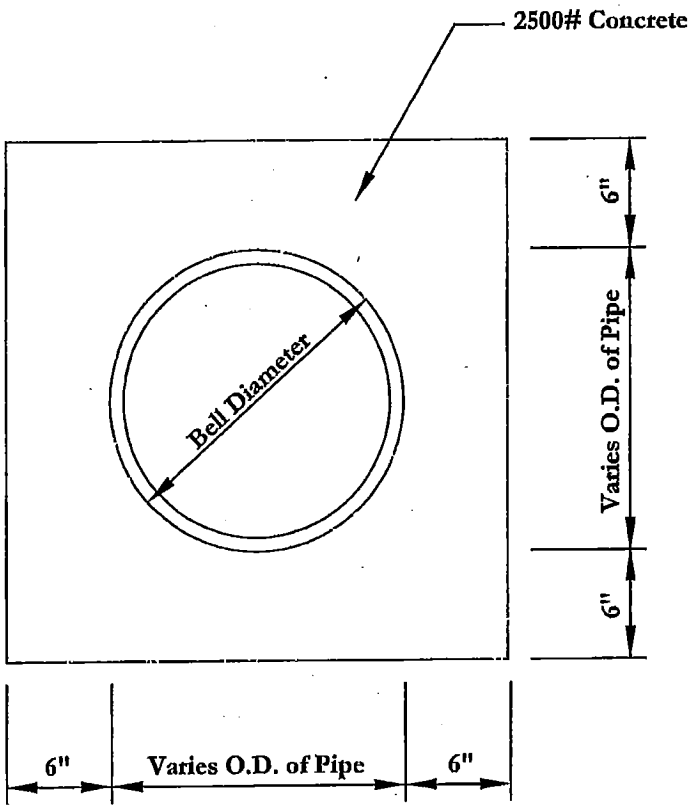
TRENCH BEDDING

SGD-002

NO SCALE
August 2009

Bc = Outside Diameter
D = Inside Diameter
Granular material to be VDOT #7 or #8

NOTE:
1. Length to depend on field conditions.



CONCRETE ENCASEMENT OF SANITARY LINES

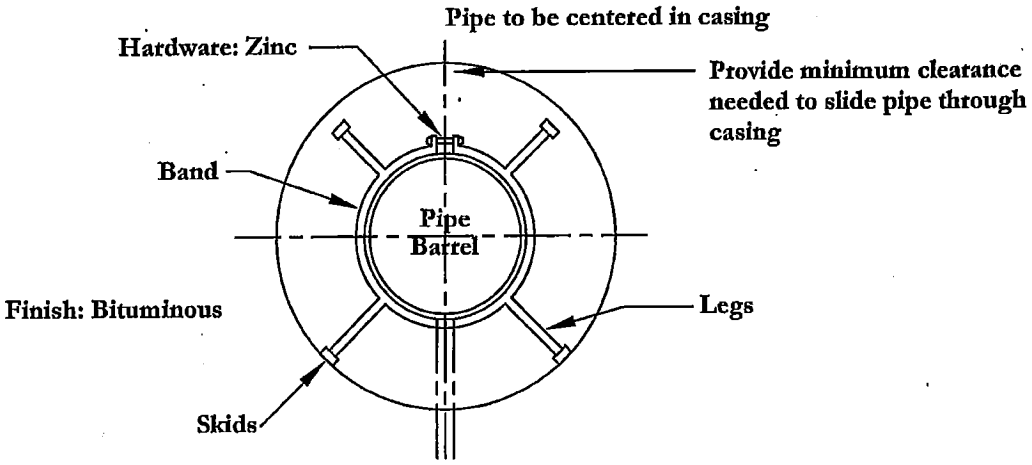
SGD-003

August 2009

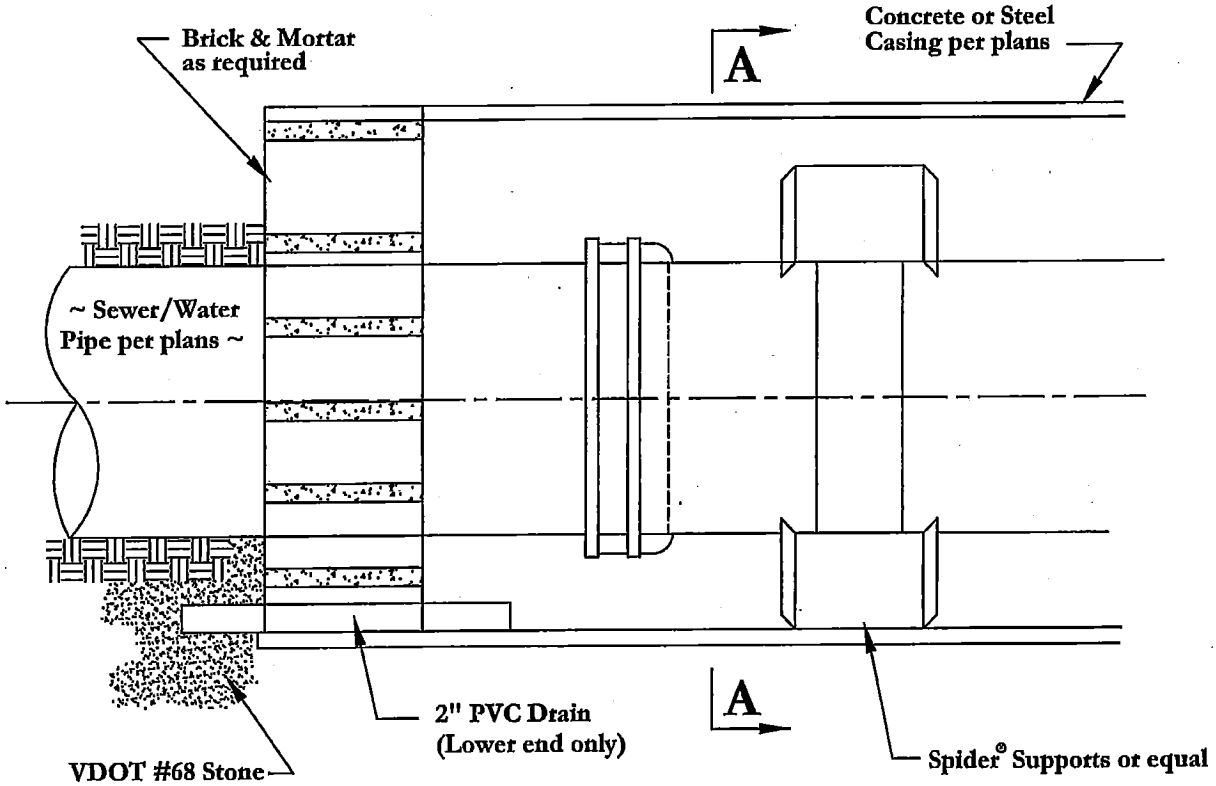
NO SCALE

NOTES:

1. Provide skid midway between bell and spigot end for PVC pipe. Top block not required at this location. Provide shim to protect pipe against strap.
2. Pad pipe at bulkhead with two (2) layers of 15 lb. builders felt.
3. * With PVC pipe, DO NOT use petroleum products (oil and grease) or creosote treated wood.



SECTION A-A

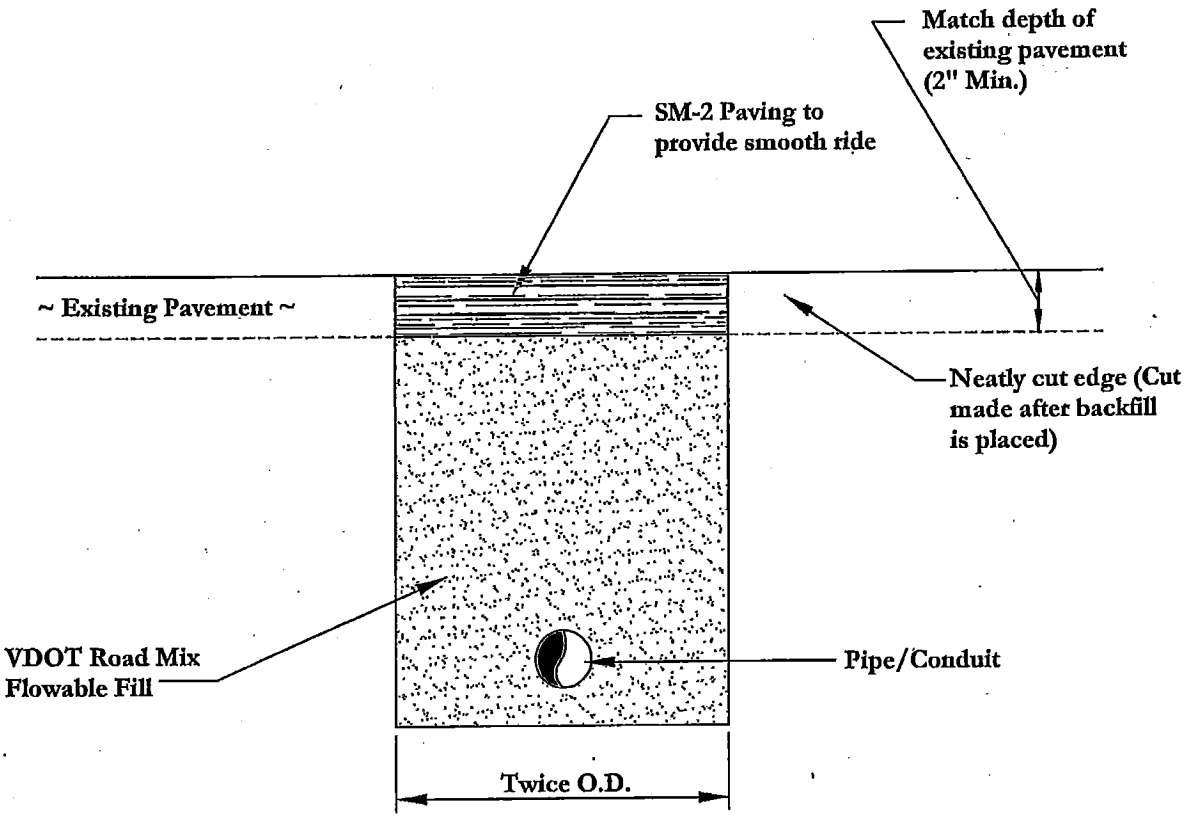


SEALED CASING INSTALLATION

August 2009 SGD-004 NO SCALE

SGD-005

TOWN OF BLACKSBIRG
STANDARD UTILITY CUT REPAIR
(PERPENDICULAR CROSSINGS WITHIN STREETS)



NOTES:

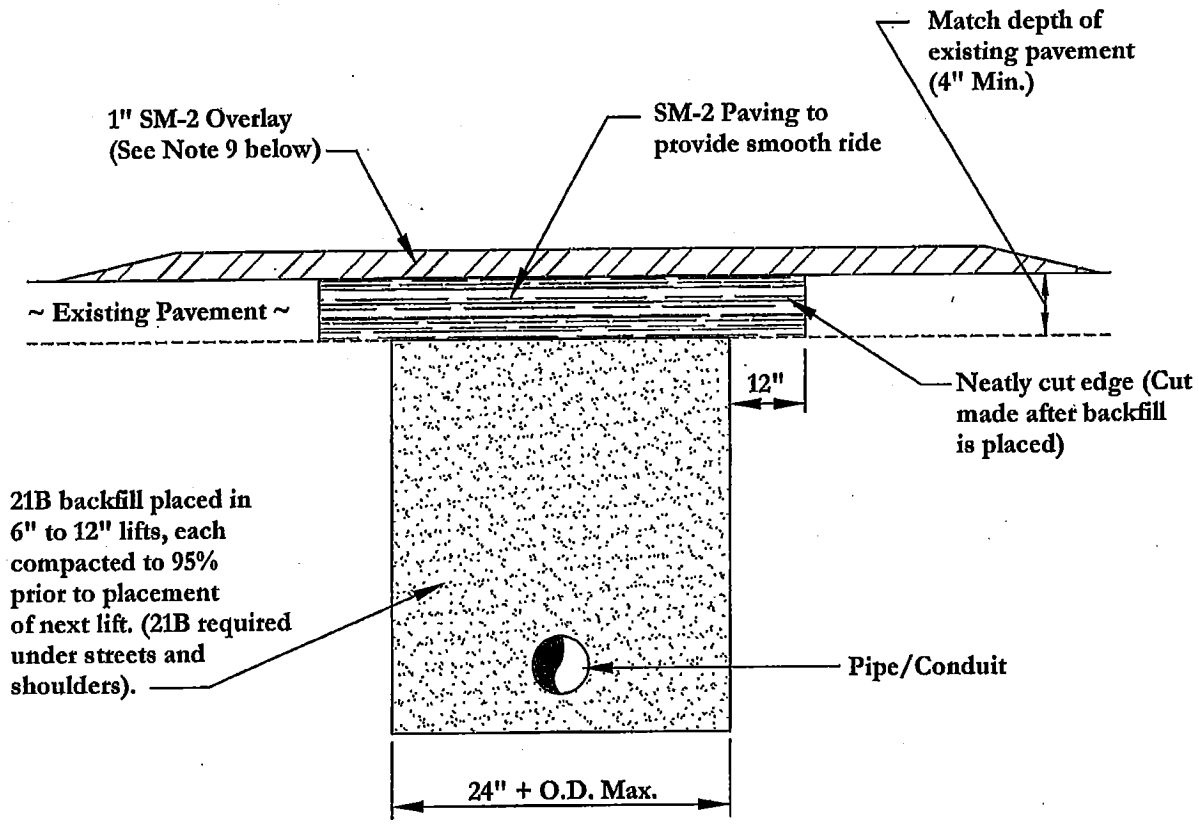
1. Repaired surface to be at least as good as original surface.
2. Paving to be placed within 5 working days of utility repair.
   Flowable fill to be brought up to bottom of asphalt with 7/8" cold rolled steel plates to cover trench.
3. During cold weather, cold mix to be used as temporary measure on primary streets (for determination of primary street call Utility Inspector), 21B on other streets. Permanent SM-2 paving to be placed within 3 weeks of start up of hot mix plants. Check stone or plates at least daily until resurfaced.
4. Safety measures are required: for example: flag men at all times the street is obstructed, barricades at night, bracing etc.
5. Excavation permits are required for all cuts in the Town right-of-way.
6. Contact the Town Utility Inspector (961-1126) prior to starting work (non-emergency) and prior to finishing work.
7. Excavated material may be used as temporary backfill in an emergency street cut, but is to be removed and replaced with flowable fill not later than the next day.
8. The minimum pavement patch width for perpendicular installations shall be equal to the width of the sheet or fifteen (15) feet, whichever is greater.

August 2009

NO SCALE

SGD-006

TOWN OF BLACKSBIRG
STANDARD UTILITY CUT REPAIR
(WITHIN THE TOWN RIGHT OF WAY)

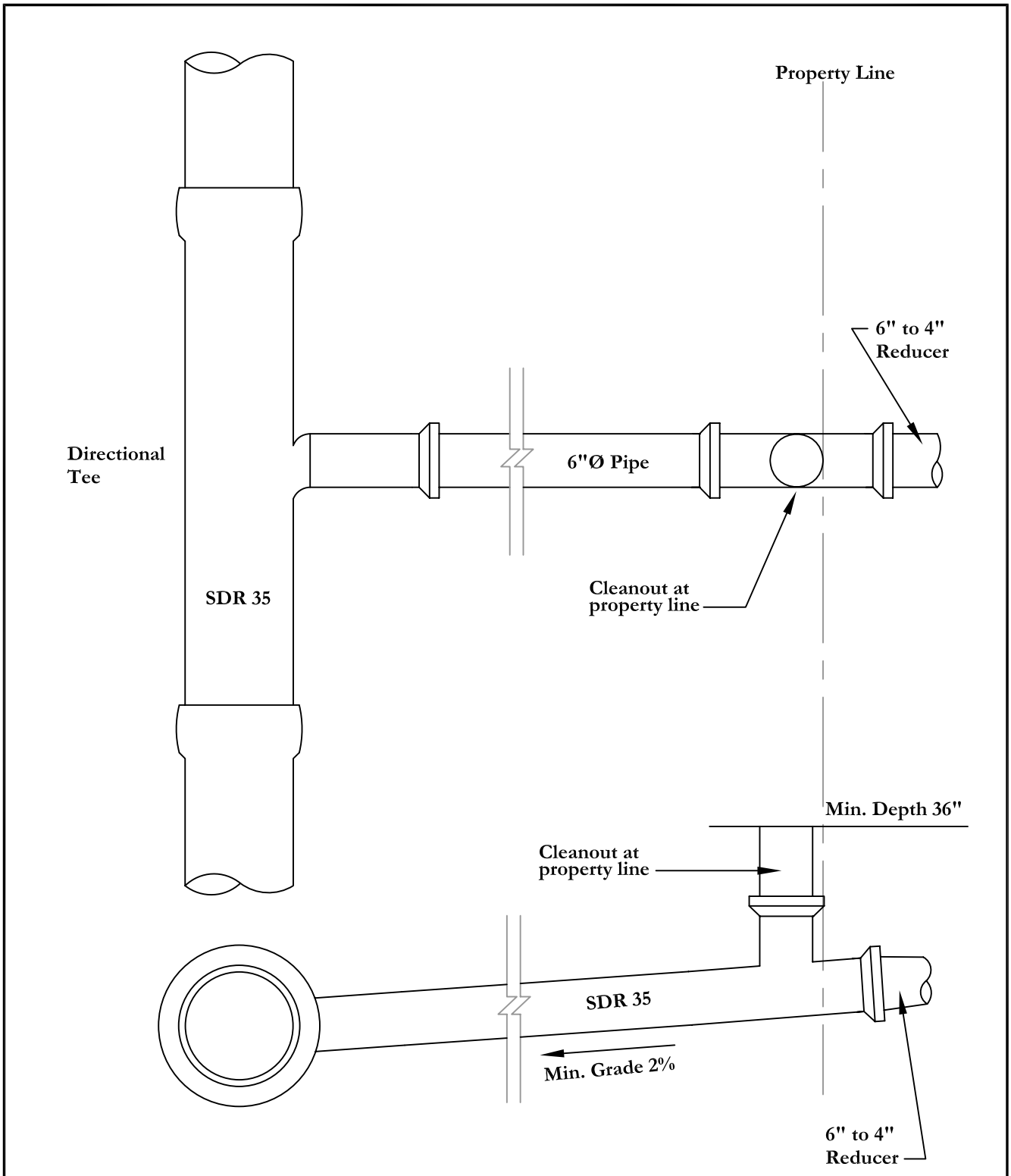


NOTES:

1. Repaired surface to be at least as good as original surface.
2. Paving to be placed within 5 working days of utility repair. (21B Stone to be brought up to street surface and maintained during 5 day interim). The same time limit and interim measures hold in repair of sidewalks.
3. During cold weather, cold mix to be used as temporary measure on primary streets (for determination of primary street call Utility Inspector), 21B on other streets. Permanent SM-2 paving to be placed within 3 weeks of start up of hot mix plants. Check stone and refill/tamp as necessary at least weekly, until resurfaced.
4. Safety measures are required: for example: flag men at all times the street is obstructed, barricades at night, bracing etc.
5. Excavation permits are required for all cuts in the Town right-of-way.
6. Contact the Town Utility Inspector (961-1126) prior to starting work (non-emergency) and prior to finishing work.
7. Rolling and compacting equipment to be suitable to obtain 95% compaction.
8. Excavated material may be used as temporary backfill in an emergency street cut, but is to be removed and replaced with 21B stone not later than the next day.
9. The minimum pavement patch width for perpendicular installations shall be equal to the width of the street. Minimum pavement patch width for parallel installations shall be one half the width of the road, or a minimum of fifteen (15) feet on existing streets, centered over the travel lane. On streets not yet accepted by the Town, the overlay shall be a minimum of thirty (30) feet in width.

August 2009

NO SCALE

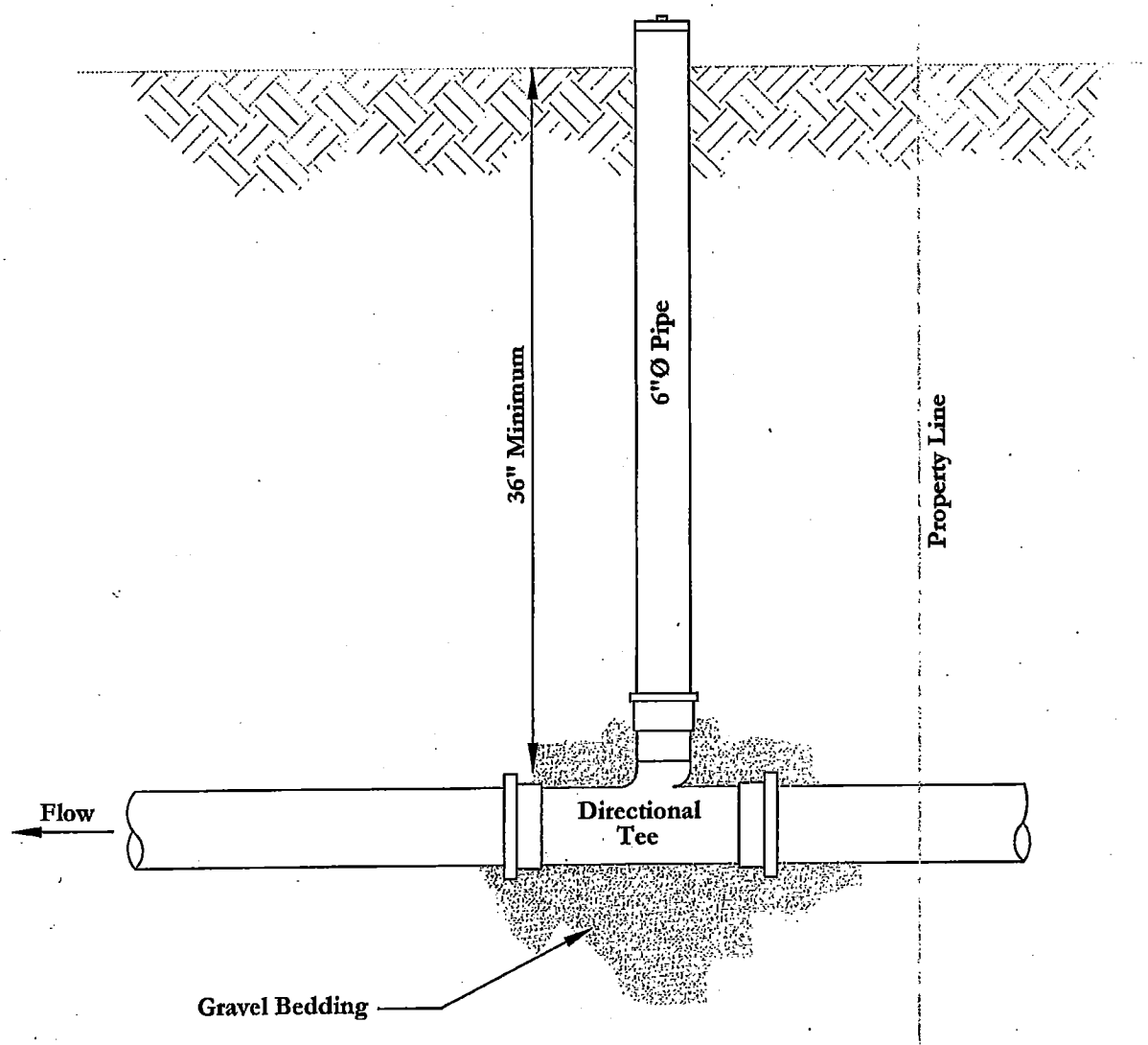


STANDARD SERVICE CONNECTIONS

SGD-007

January 2012

NO SCALE

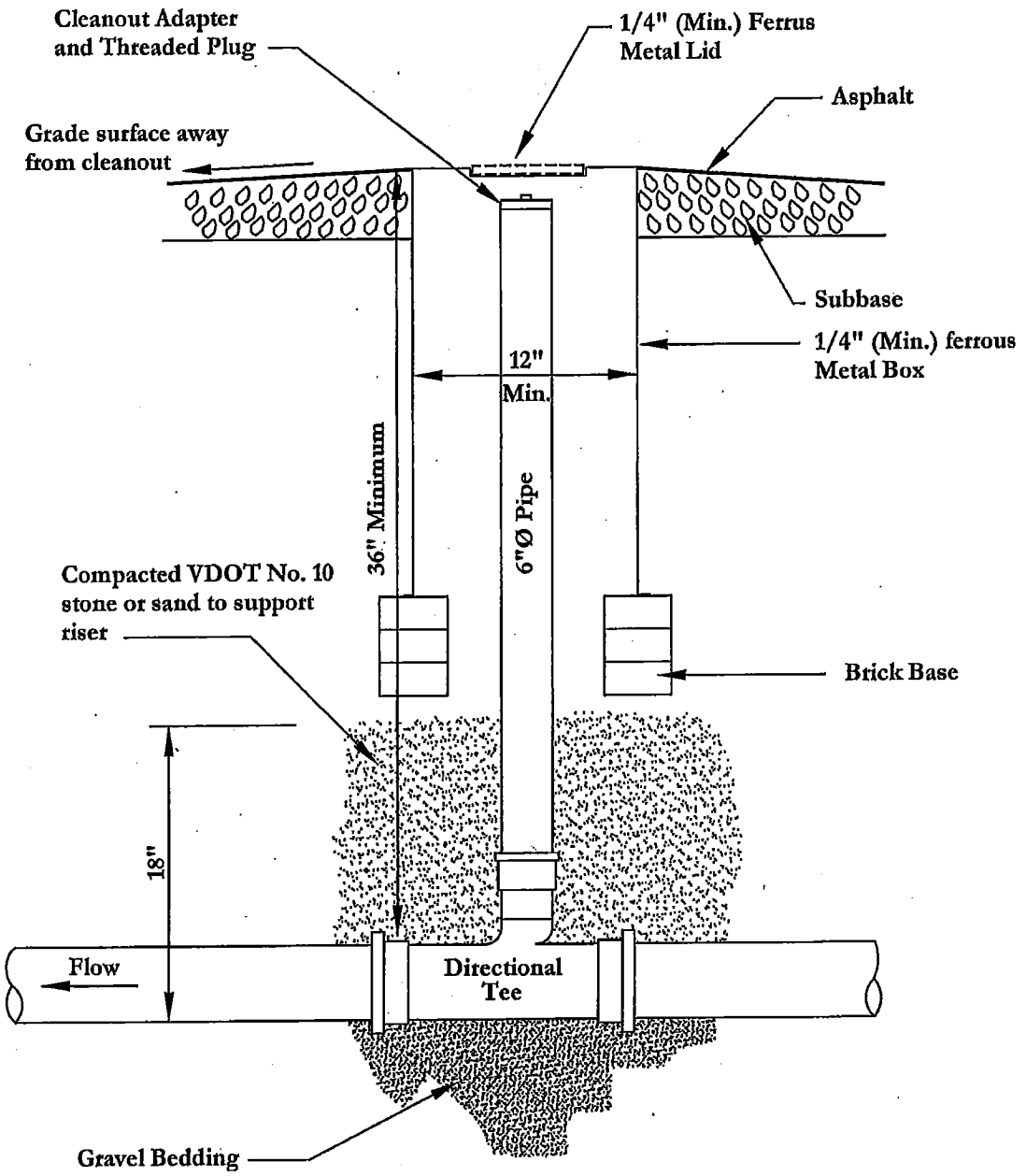


SANITARY SEWER CLEANOUT

SGD-008

August 2009

NO SCALE

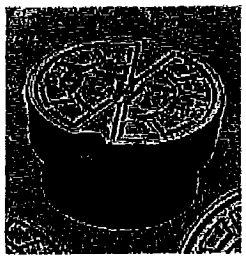


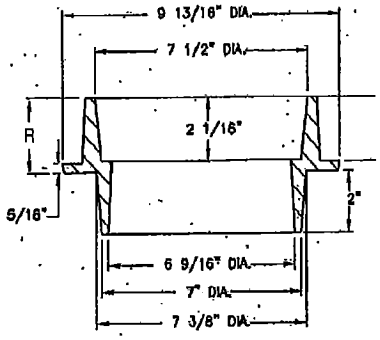
SANITARY SEWER CLEANOUT IN PAVEMENT

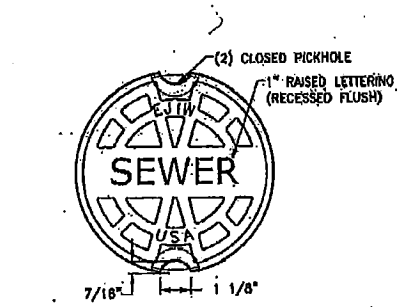
SGD-009

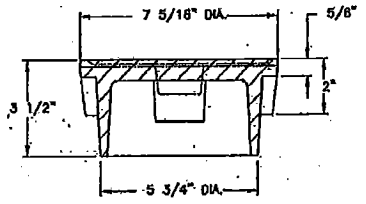
August 2009

NO SCALE



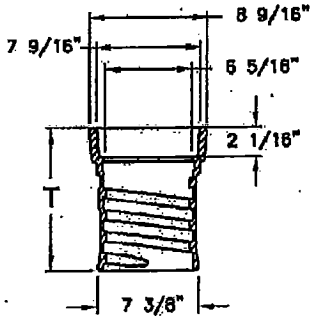




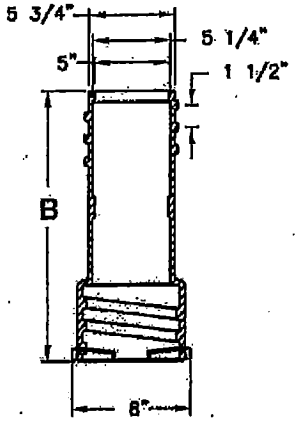


Non-Locking Lid

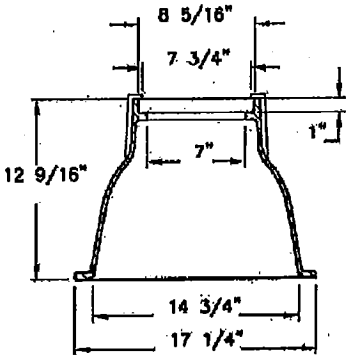
CLEANOUT AND VALVE BOX DROP LIDS



TOP



BOTTOM/EXTENSION



#6 BASE

CLEANOUT AND VALVE BOX EXTENSION PIPES TRAFFIC AREAS

SGD-010

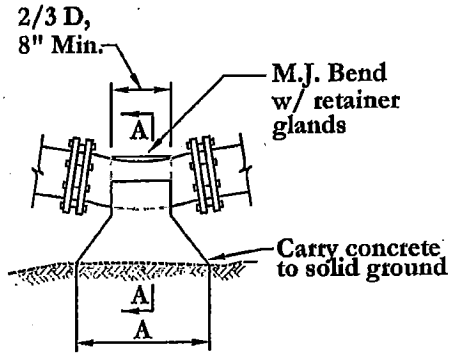
August 2009

No Scale

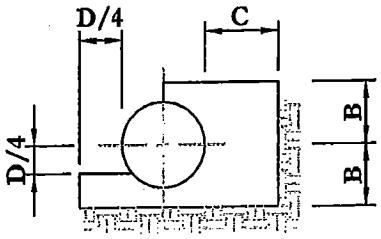
Notes:

1. All concrete to be 3000 P.S.I.
2. Buttress dimensions shown are minimum.
   Dimensions are based upon soil bearing pressure of 3000 P.S.F. and static water pressure of 150 P.S.I. Special buttress design is required when conditions encountered vary from these conditions.

Bend		6"	8"	10"	12"	16"	20"	24"	30"	36"
5 5/8°	A						1'-6"	2'-0"	2'-6"	3'-0"
	B						10"	1'-0"	1'-3"	1'-6"
	C						10"	1'-0"	1'-1"	1'-2"
11 1/4°	A	6"	8"	10"	1'-0"	1'-4"	1'-6"	2'-0"	2'-6"	3'-0"
	B	6"	8"	9"	10"	1'-0"	1'-2"	1'-4"	1'-7"	1'-11"
	C	7"	7"	8"	8"	9"	10"	1'-0"	1'-1"	1'-2"
22 1/2°	A	9"	1'-0"	1'-6"	1'-9"	2'-3"	3'-0"	3'-6"	4'-2"	5'-4"
	B	7"	8"	9"	10"	1'-0"	1'-2"	1'-4"	1'-7"	2'-0"
	C	8"	9"	10"	11"	1'-2"	1'-4"	1'-4"	1'-9"	2'-0"
45°	A	1'-3"	1'-8"	2'-1"	2'-6"	3'-4"	4'-2"	5'-0"	6'-3"	7'-6"
	B	7"	8"	9"	11"	1'-3"	1'-6"	1'-8"	2'-0"	2'-6"
	C	8"	9"	10"	11"	1'-2"	1'-4"	1'-9"	2'-3"	2'-8"
90°	A		2'-3"		3'-6"					
	B		9"		12"					
	C		9"		12"					

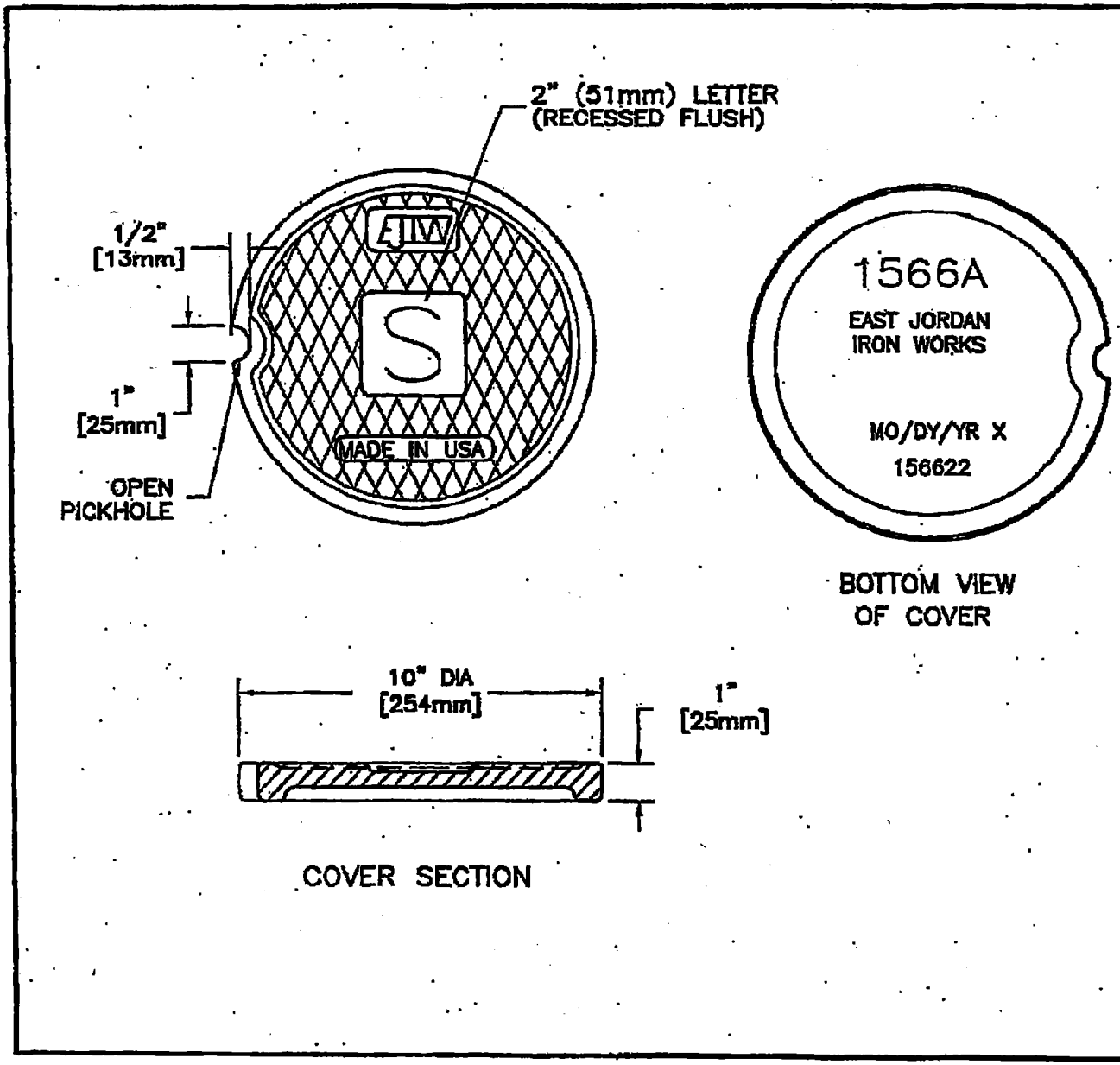


PLAN



SECTION A-A

FORCE MAIN BUTTRESSES FOR HORIZONTAL BENDS



Town of Blacksburg
Typical Cleanout Cover
Based on East Jordan
Iron Works, Inc.
or Equivalent

DRAWN	DATE
DEW	02/19/03
APPROVED	DATE

PRODUCT NO.
00156622

CATALOG NO.
1566A

REF. PRODUCT DRAWING
156622

EST. WT.
COVER: 15 LBS 7kg

OPEN AREA
N/A

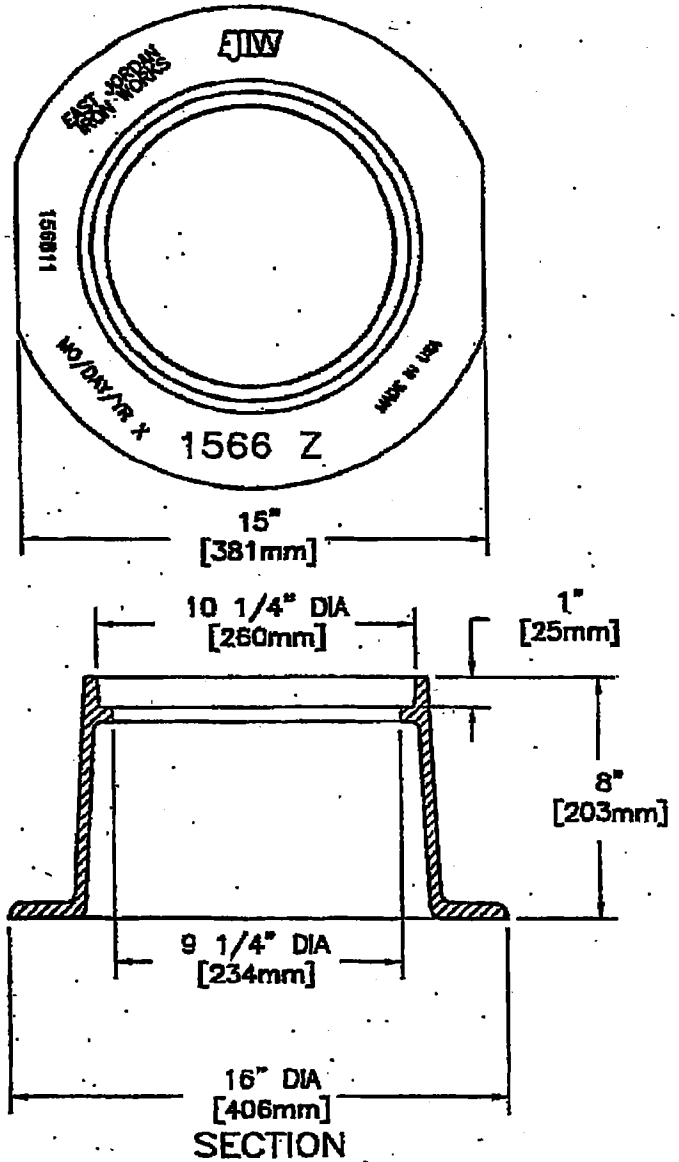
MAT'L SPEC.
COVER – GRAY IRON
ASTM A48 CL35B

LOAD RATING
HEAVY DUTY
(HS-25)

August 2009

TYPICAL CLEANOUT COVER

SGD-012



Town of Blacksburg
Typical Cleanout Frame
Based on East Jordan
Iron Works, Inc.
or Equivalent

DRAWN	DATE
DEW	12/03/04
APPROVED	DATE

PRODUCT NO.
00156611

CATALOG NO.
1566Z

REF. PRODUCT DRAWING
156611

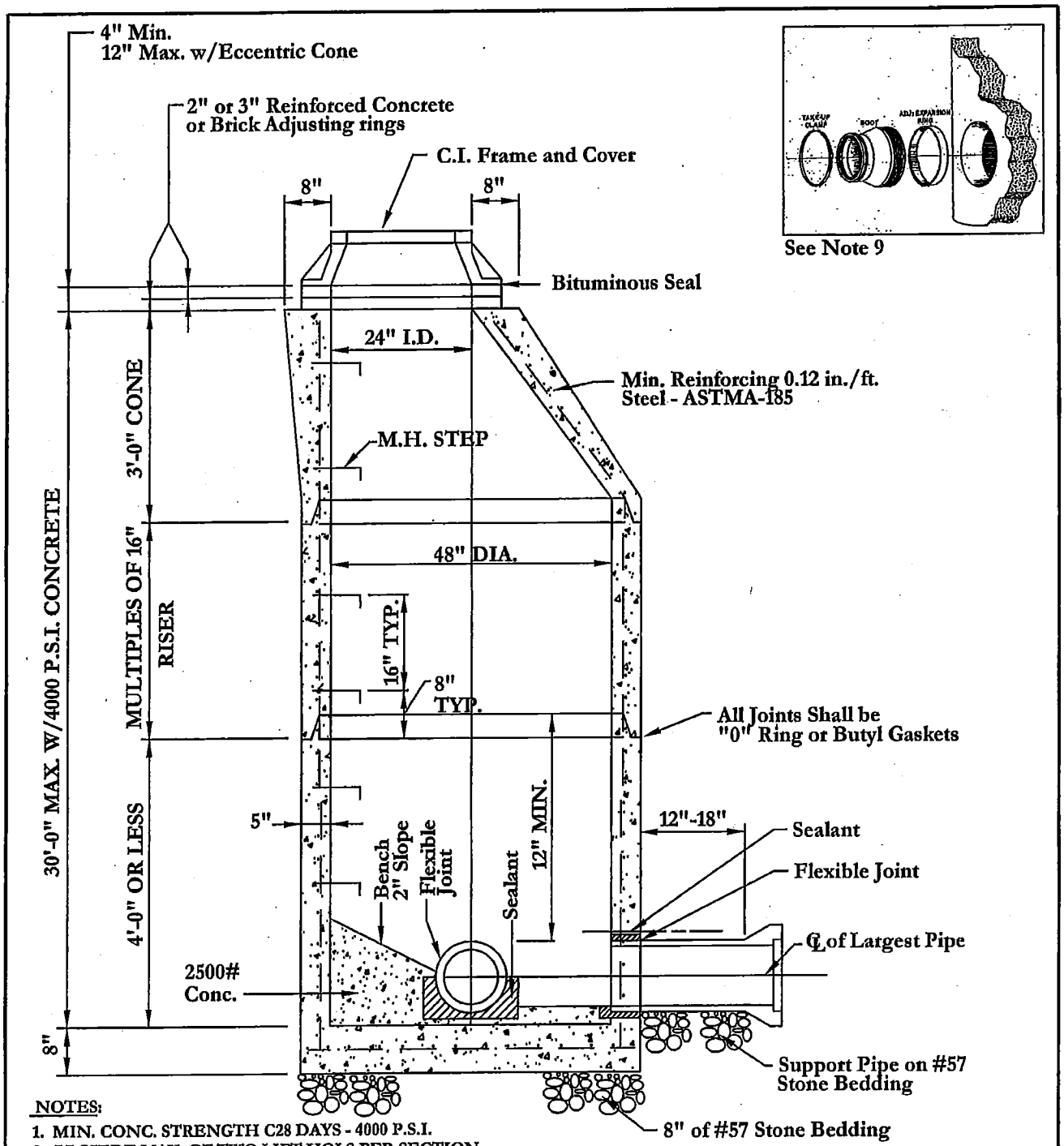
EST. WT.
FRAME: 35 LBS 16kg

OPEN AREA
N/A

MAT'L SPEC.
FRAME – GRAY IRON
ASTM A48 CL35B

LOAD RATING
HEAVY DUTY
(HS-25)

TYPICAL CLEANOUT FRAME



NOTES:

1. MIN. CONC. STRENGTH C28 DAYS - 4000 P.S.I.
2. PROVIDE MAX. OF TWO LIFT HOLS PER SECTION. PLUG WATERTIGHT AFTER INSTALLATION.
3. BELL END ON INCOMING PIPES.
4. PLAIN END ON OUTGOING PIPE
5. BENCH MAY BE CONCRETE OR BRICK AND MORTAR.
6. MANHOLE CONSTRUCTION SHALL CONFORM TO ASTM SPEC. C-478.
7. WHERE STUBS OR KNOCKOUTS ARE PROVIDED FOR FORMED.
   FUTURE CONNECTIONS BENCH SHALL BE SO
8. NO GROUT SHALL BE INSTALLED OVER INTERIOR JOINTS OR ADJUSTING RINGS INSIDE MANHOLE.
9. FOR EXISTING MANHOLES CORE HOLE AND INSTALL PRESS-BOOT AROUND NEW PIPE.

PRECAST CONCRETE MANHOLE
4' DIAMETER – STANDARD
(ECCENTRIC WITH MONOLITHIC BASE)

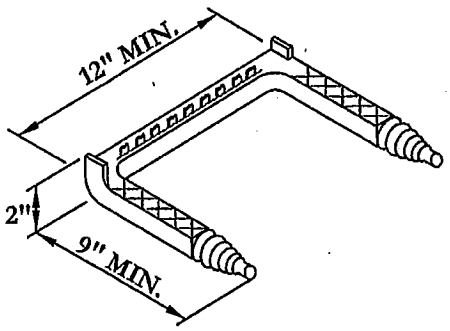
SMH-001

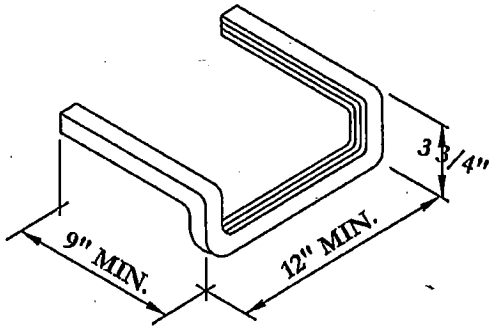
August 2009

NO SCALE

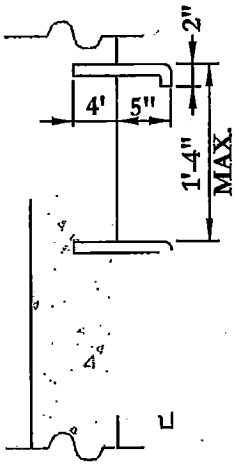
NOTES:

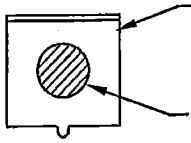
1. STEPS WILL BE REQUIRED IN ALL STRUCTURES WITH A DEPTH OF 4'-0" OR GREATER UNLESS OTHERWISE NOTED ON THE PLANS.
2. ALL STEPS SHALL PROTRUDE 5" FROM INSIDE FACE OF STRUCTURE WALL.
3. STEPS SHALL WITHSTAND A MINIMUM LOAD OF 300 POUNDS WHEN EXTENDED 5" FROM THE FACE OF THE SUPPORT.
4. MAXIMUM STEP SPACING TO BE 1'-4" C.C.
5. STEPS ARE TO BE VERTICALLY ALIGNED AND UNIFORMLY SPACED FOR THE ENTIRE DEPTH OF ANY STRUCTURE.
6. IN PRECAST UNITS STEPS MAY BE CAST IN PLACE OR MORTARED INTO HOLES PROVIDED BY THE FABRICATOR.
7. STEPS DIFFERING IN DIMENSIONS, CONFIGURATION OR MATERIALS FROM THOSE SHOWN MAY ALSO BE USED PROVIDED THEY MEET THE MINIMUM REQUIREMENTS SHOWN HERON AND THE CONTRACTOR HAS FURNISHED THE ENGINEER WITH DETAILS AND CERTIFIED TEST REPORTS OF THE PROPOSED SUBSTITUTE AND HAS RECEIVED WRITTEN APPROVAL FROM THE ENGINEER FOR THE USE OF SUCH STEPS.





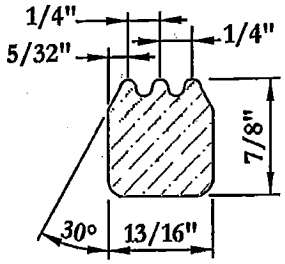
ALUMINUM STEP





TYPICAL SECTION

(DIMENSIONS MAY VARY WITH MANUFACTURER'S DESIGN)



TYPICAL SECTION

(DIMENSIONS MAY VARY WITH MANUFACTURER'S DESIGN)

INSTALLATION

Steps are to be poured integrally with the manhole section and not mortared or grouted in later.

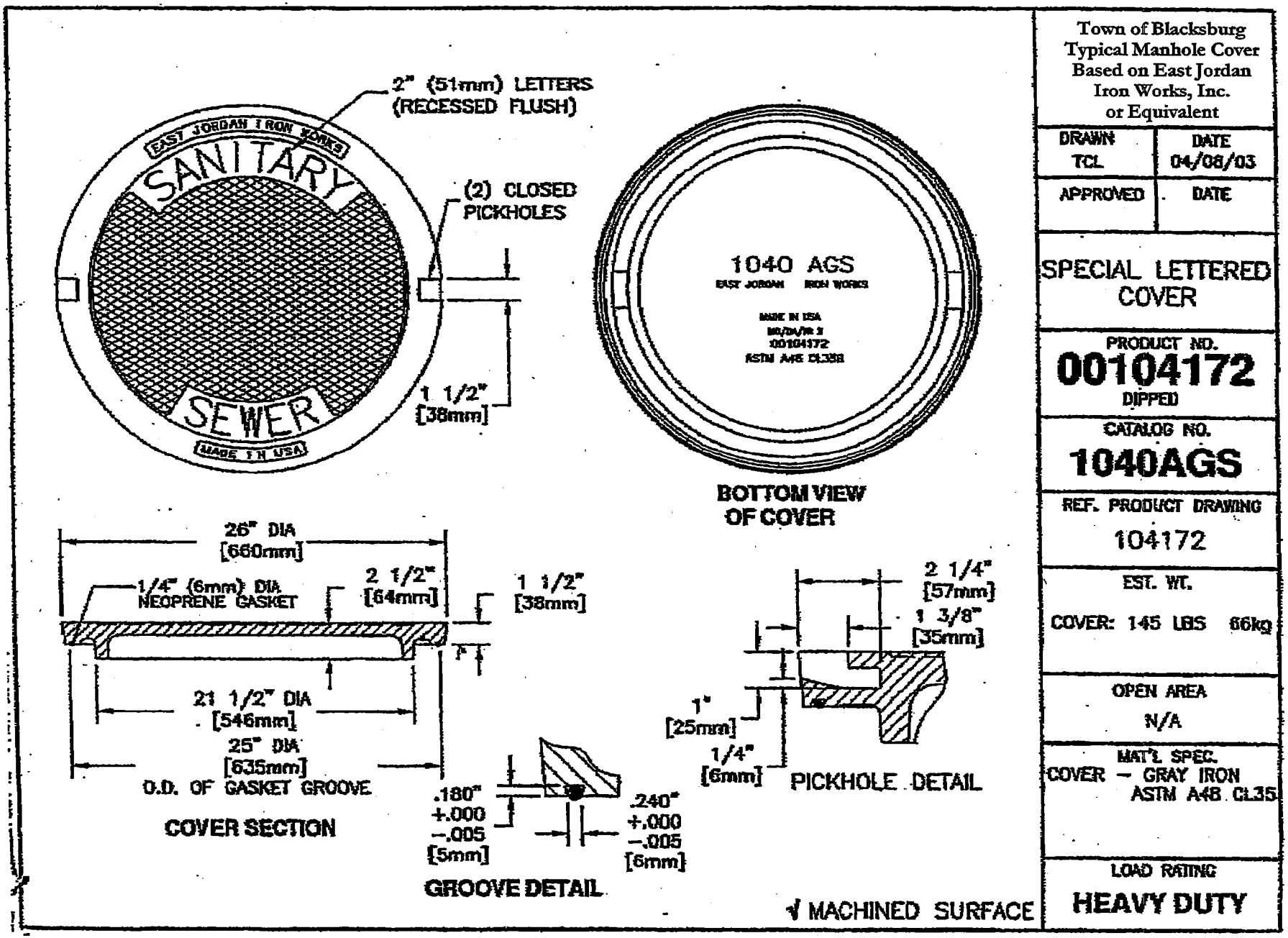
MATERIALS

Polypropylene Plastic - Grade 10-1014 "AVISUN CORP."

Steel Reinforcing Bar - conforms to ASTM St'd. A-615.

STANDARD MANHOLE STEP

August 2009 | SMH-002 | NO SCALE



Town of Blacksburg
Typical Manhole Cover
Based on East Jordan
Iron Works, Inc.
or Equivalent

DRAWN	DATE
TCL	04/08/03
APPROVED	DATE

SPECIAL LETTERED COVER

PRODUCT NO.
00104172
DIPPED

CATALOG NO.
1040AGS

REF. PRODUCT DRAWING
104172

EST. WT.
COVER: 145 LBS 66kg

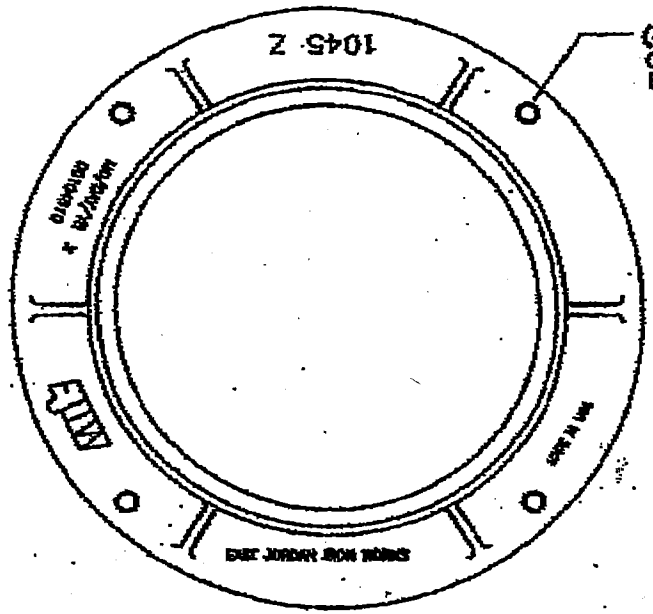
OPEN AREA
N/A

MAT'L SPEC.
COVER – GRAY IRON
ASTM A48 CL35

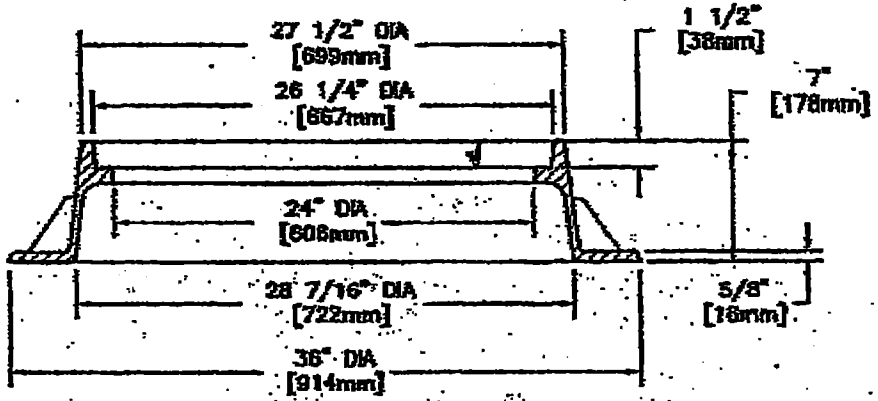
LOAD RATING
HEAVY DUTY

August 2009

TYPICAL MANHOLE COVER
SMH-003



(4) 1" (25mm) DIA HOLES ON 32 3/4" (834mm) DIA BOLT CIRCLE.



FRAME SECTION

DRILLED FROM 104510 FRAME.

√ MACHINED SURFACE

Town of Blacksburg
Typical Manhole Frame
Based on East Jordan
Iron Works, Inc.
or Equivalent

DRAWN	DATE
DEW	09/30/02
APPROVED	DATE

MANHOLE FRAME

PRODUCT NO.
00104510
DIPPED

CATALOG NO.
1045Z

REF. PRODUCT DRAWING
104510

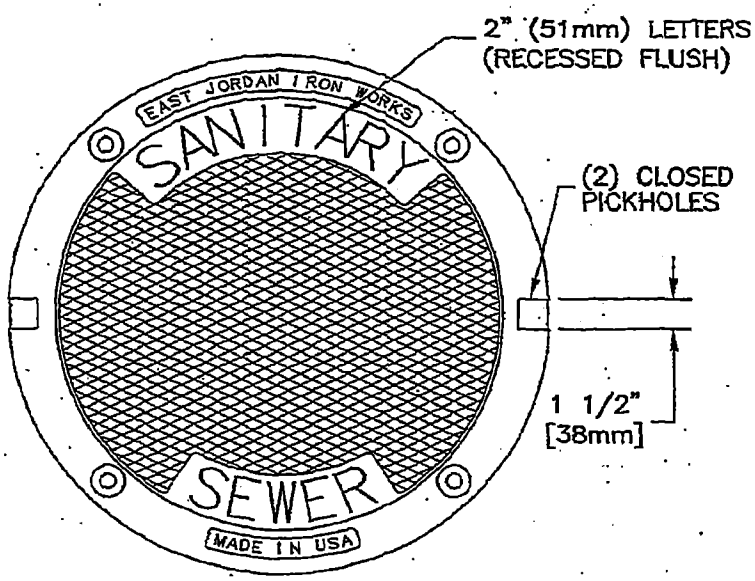
EST. WT.
FRAME: 168 LBS 76kg

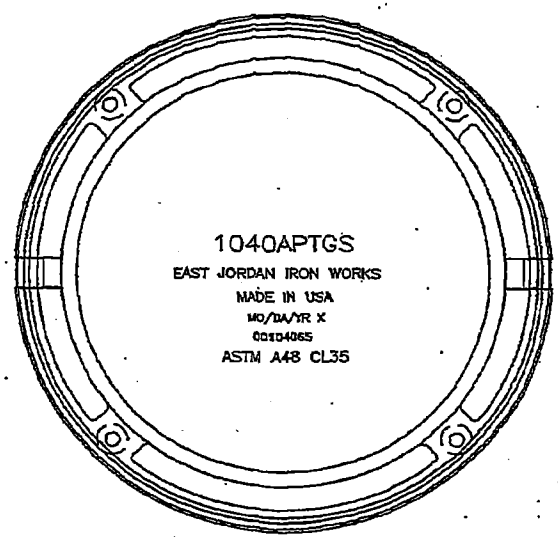
OPEN AREA
N/A

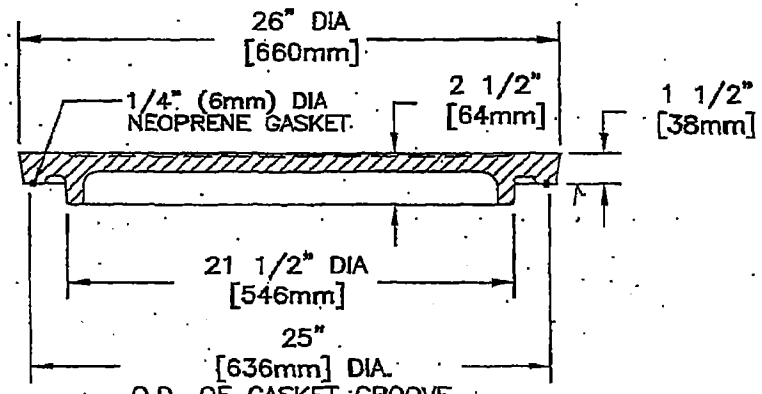
MAT'L SPEC.
FRAME — GRAY IRON
ASTM A48 CL35

LOAD RATING
HEAVY DUTY

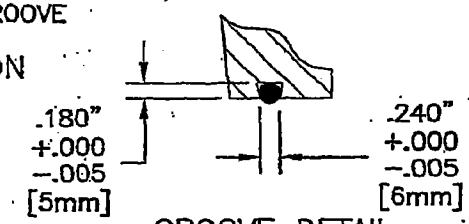
TYPICAL MANHOLE FRAME





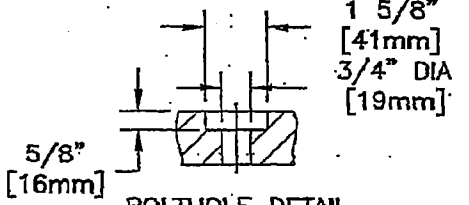


COVER SECTION

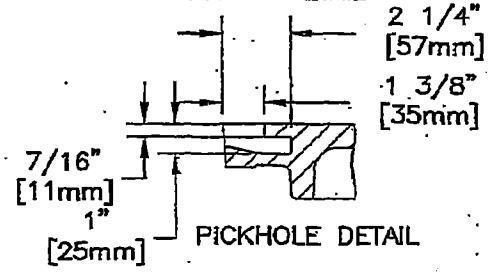


GROOVE DETAIL

BOTTOM VIEW
OF COVER



BOLTHOLE DETAIL



PICKHOLE DETAIL

√ MACHINED SURFACE

EAST JORDAN
IRON WORKS, INC.
P.O. BOX 439
EAST JORDAN, MI. 49727
1-800-874-4100
FAX 231-536-4458

DRAWN	DATE
WDB	07/26/02
APPROVED	DATE

SPECIAL LETTERED COVER

PRODUCT NO.
00104065
DIPPED

CATALOG NO.
1040APTGS

REF. PRODUCT DRAWING
104065

EST. WT.
COVER: 150 LBS. 68kg

OPEN AREA
N/A

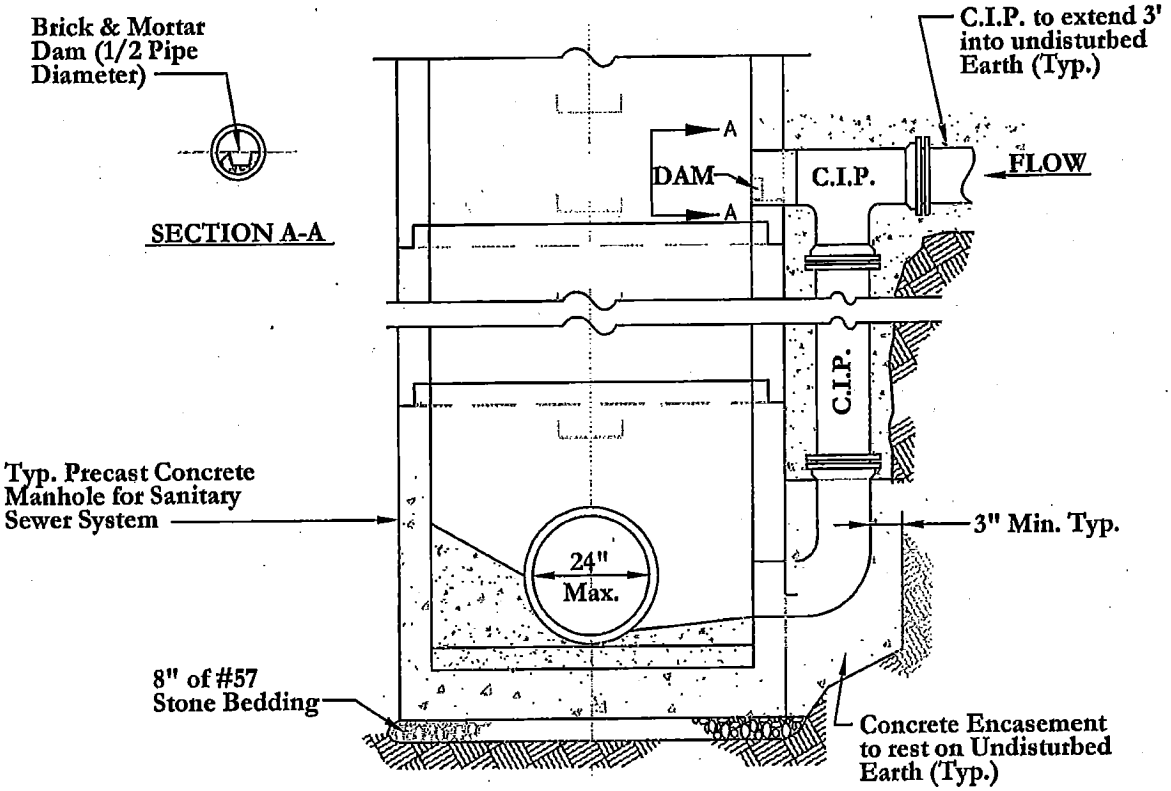
MAT'L SPEC.
COVER – GRAY IRON
ASTM A48 CL35

LOAD RATING
HEAVY DUTY

August 2009

TYPICAL WATERTIGHT MANHOLE COVER

SMH-005



DROP CONNECTIONS	
SIZE OF SEWER	MIN. DROP
8"	2'-2"
10"	2'-6"
12"	2'-8"
14"	3'-0"
16"	3'-2"
18"	3'-5"
20"	3'-8"
24"	4'-4"
30"	4'-10"
42"	6'-8"

PRECAST CONCRETE MANHOLE DROP CONNECTION

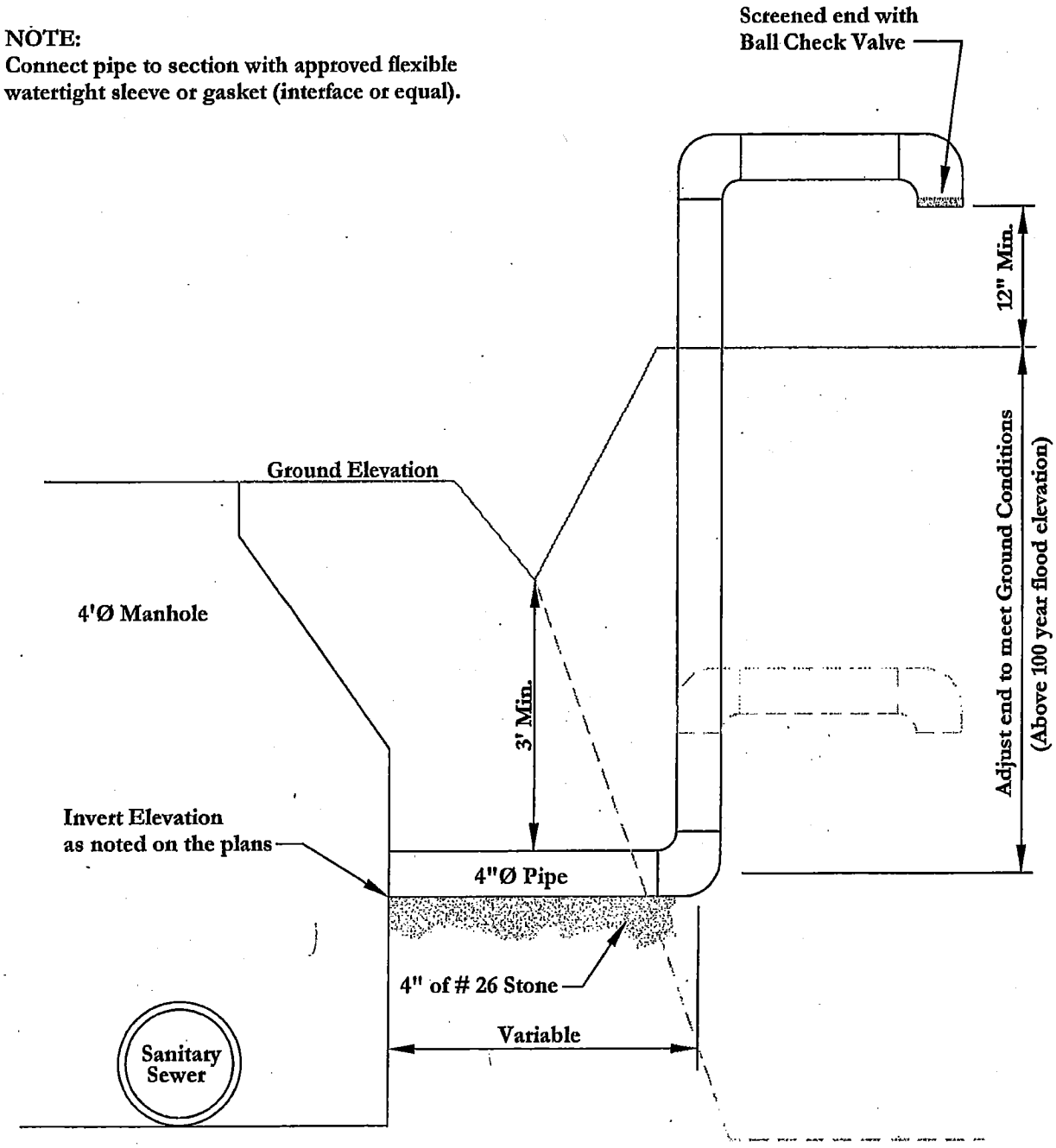
(ECCENTRIC WITH MONOLITHIC BASE)

SMH-006

August 2009

NO SCALE

NOTE:
Connect pipe to section with approved flexible watertight sleeve or gasket (interface or equal).

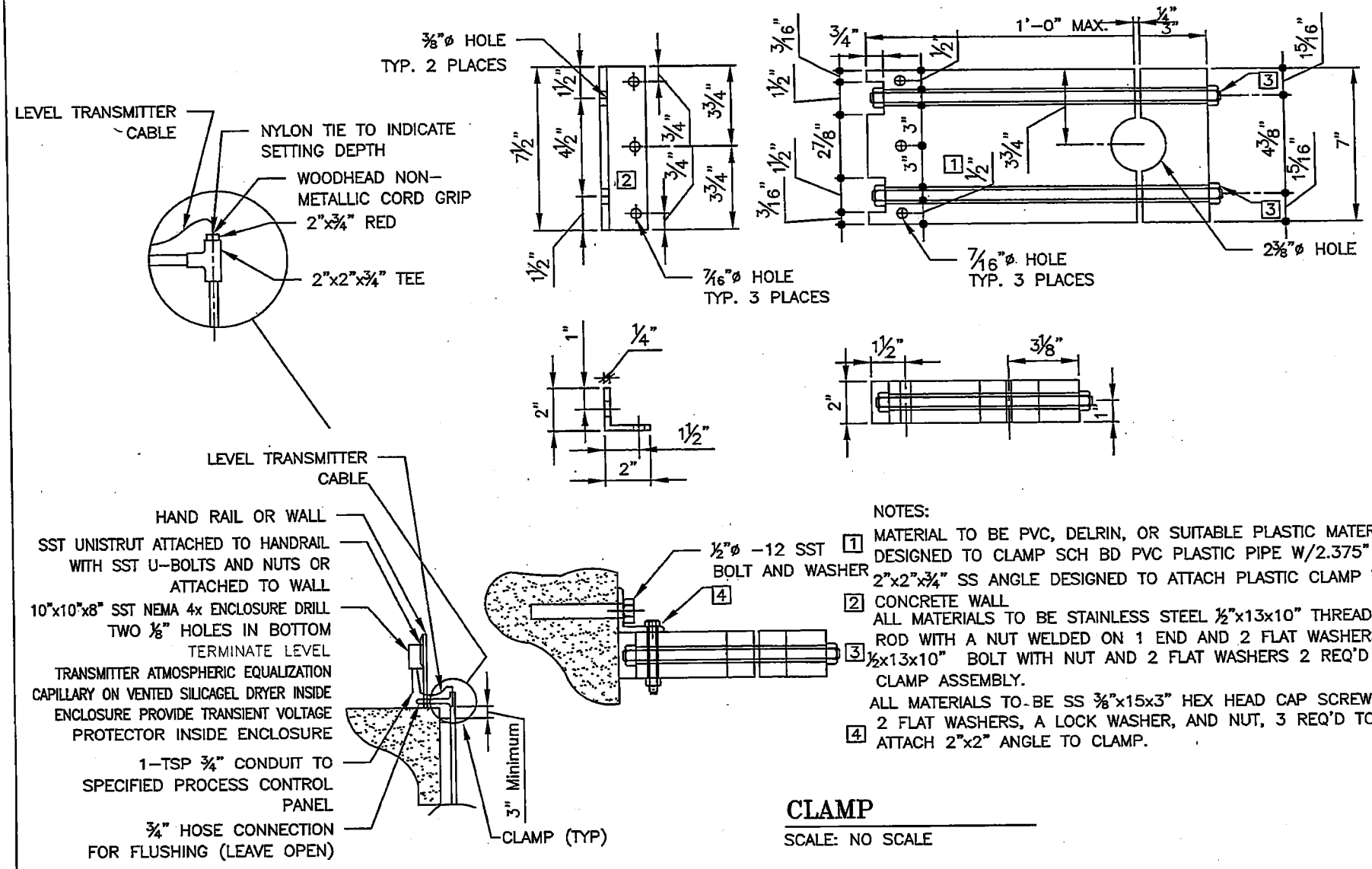


SANITARY SEWER MANHOLE VENTILATION

SMH-007

August 2009

NO SCALE



NOTES:

1. MATERIAL TO BE PVC, DELRIN, OR SUITABLE PLASTIC MATERIAL DESIGNED TO CLAMP SCH BD PVC PLASTIC PIPE W/2.375" OD.
2. 2"x2"x¾" SS ANGLE DESIGNED TO ATTACH PLASTIC CLAMP TO CONCRETE WALL
3. ALL MATERIALS TO BE STAINLESS STEEL ½"x13x10" THREADED ROD WITH A NUT WELDED ON 1 END AND 2 FLAT WASHERS OR ½x13x10" BOLT WITH NUT AND 2 FLAT WASHERS 2 REQ'D PER CLAMP ASSEMBLY.
4. ALL MATERIALS TO BE SS ⅜"x15x3" HEX HEAD CAP SCREW WITH 2 FLAT WASHERS, A LOCK WASHER, AND NUT, 3 REQ'D TO ATTACH 2"x2" ANGLE TO CLAMP.

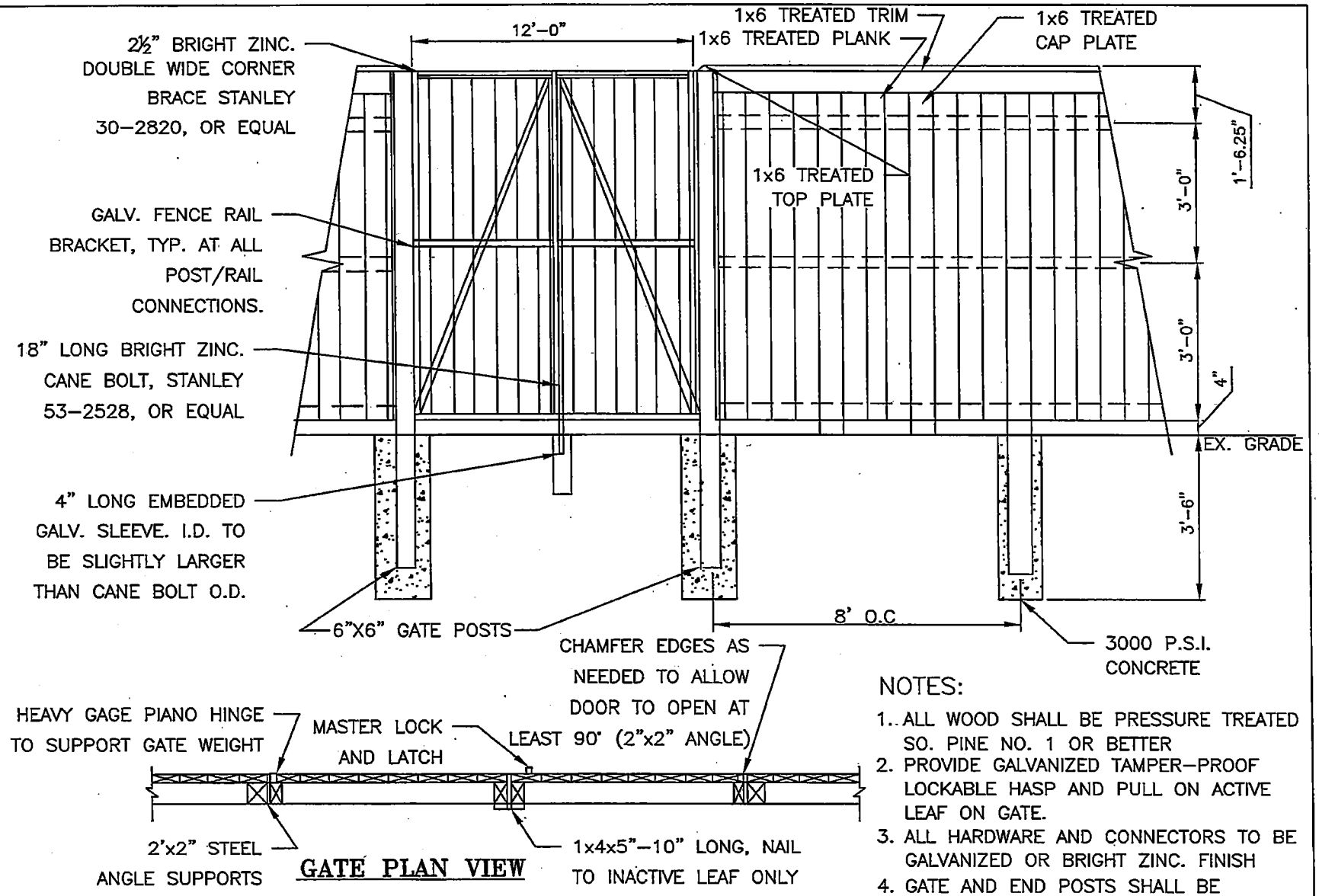
CLAMP

SCALE: NO SCALE

DETAIL-PRESSURE TRANSDUCER CONNECTION & PROTECTIVE CONDUIT

SCALE: NO SCALE

August 2009



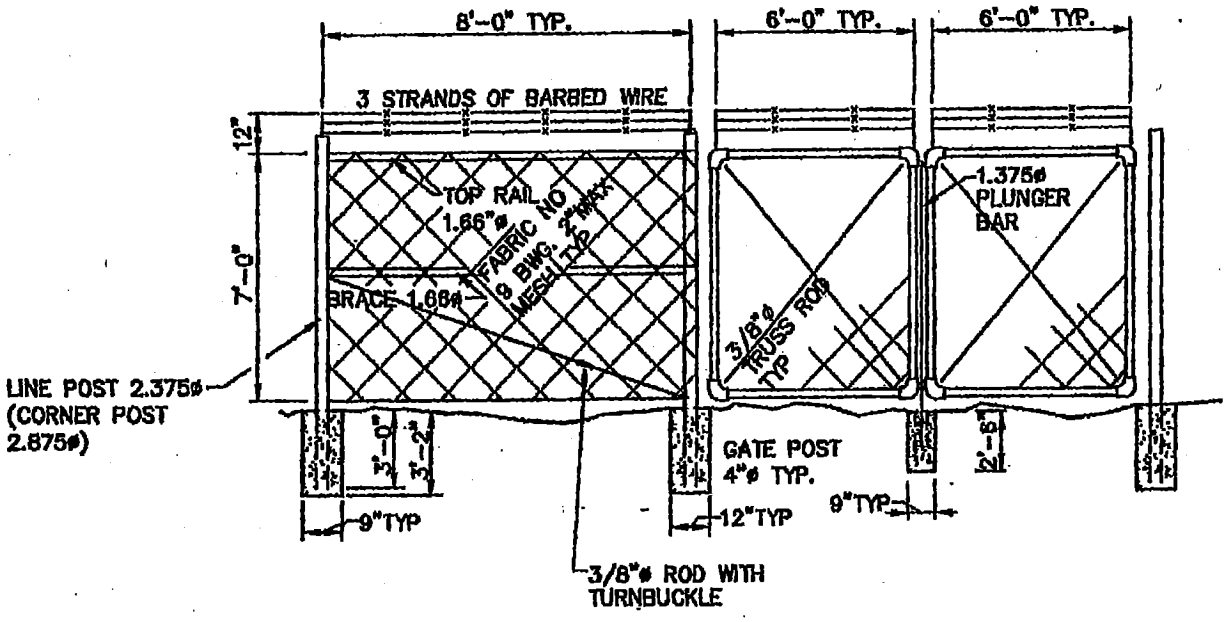
WOODEN FENCE AND GATE

NOTES:

1. ALL WOOD SHALL BE PRESSURE TREATED SO. PINE NO. 1 OR BETTER
2. PROVIDE GALVANIZED TAMPER–PROOF LOCKABLE HASP AND PULL ON ACTIVE LEAF ON GATE.
3. ALL HARDWARE AND CONNECTORS TO BE GALVANIZED OR BRIGHT ZINC. FINISH
4. GATE AND END POSTS SHALL BE 6"X6", ALL OTHER POSTS 4"X4".
5. POSTS TO BE SET ON MINIMUM 8' CENTERS.

August 2009

No Scale

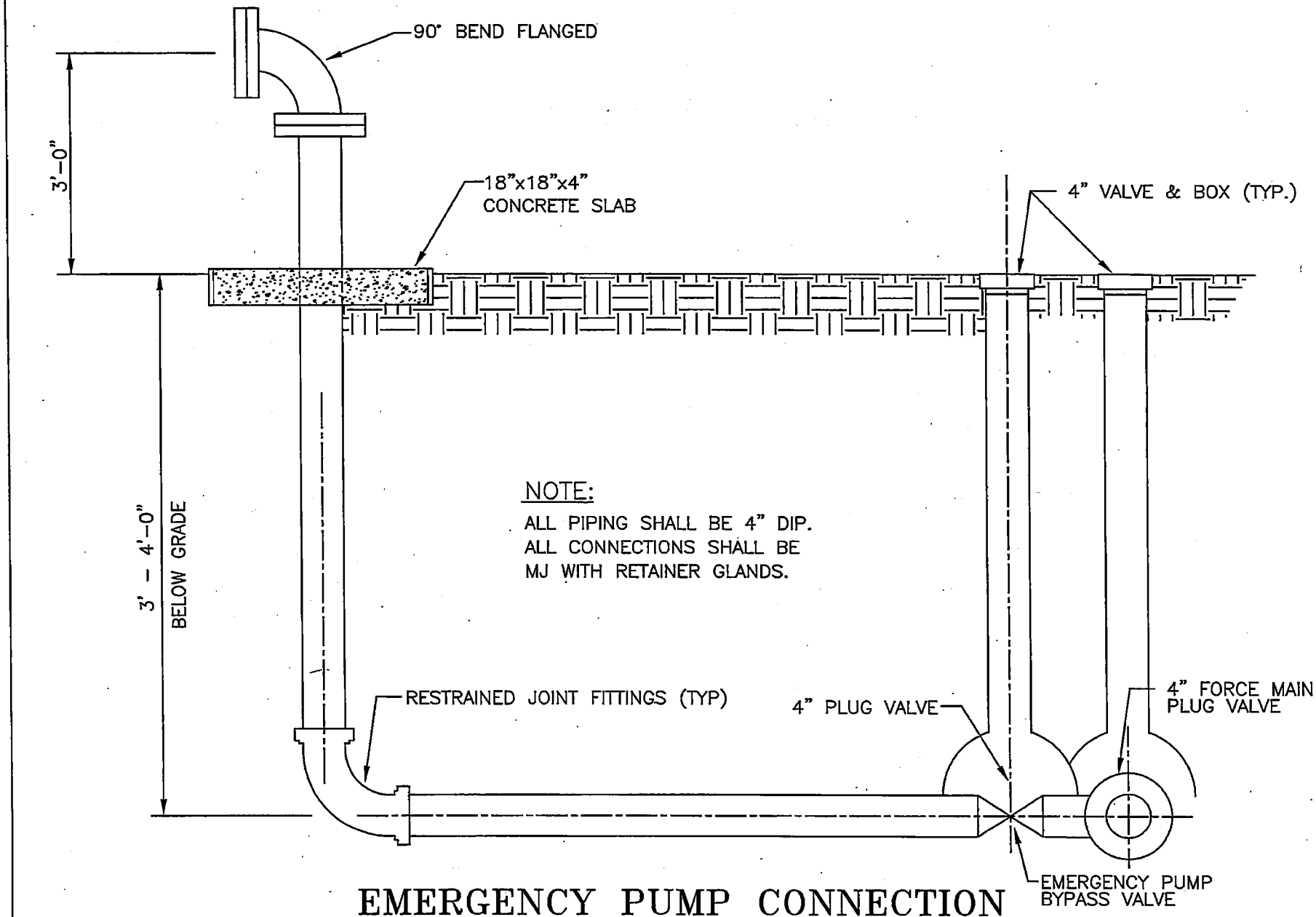


CHAIN LINK FENCE AND GATE

SPS-003

August 2009

NO SCALE

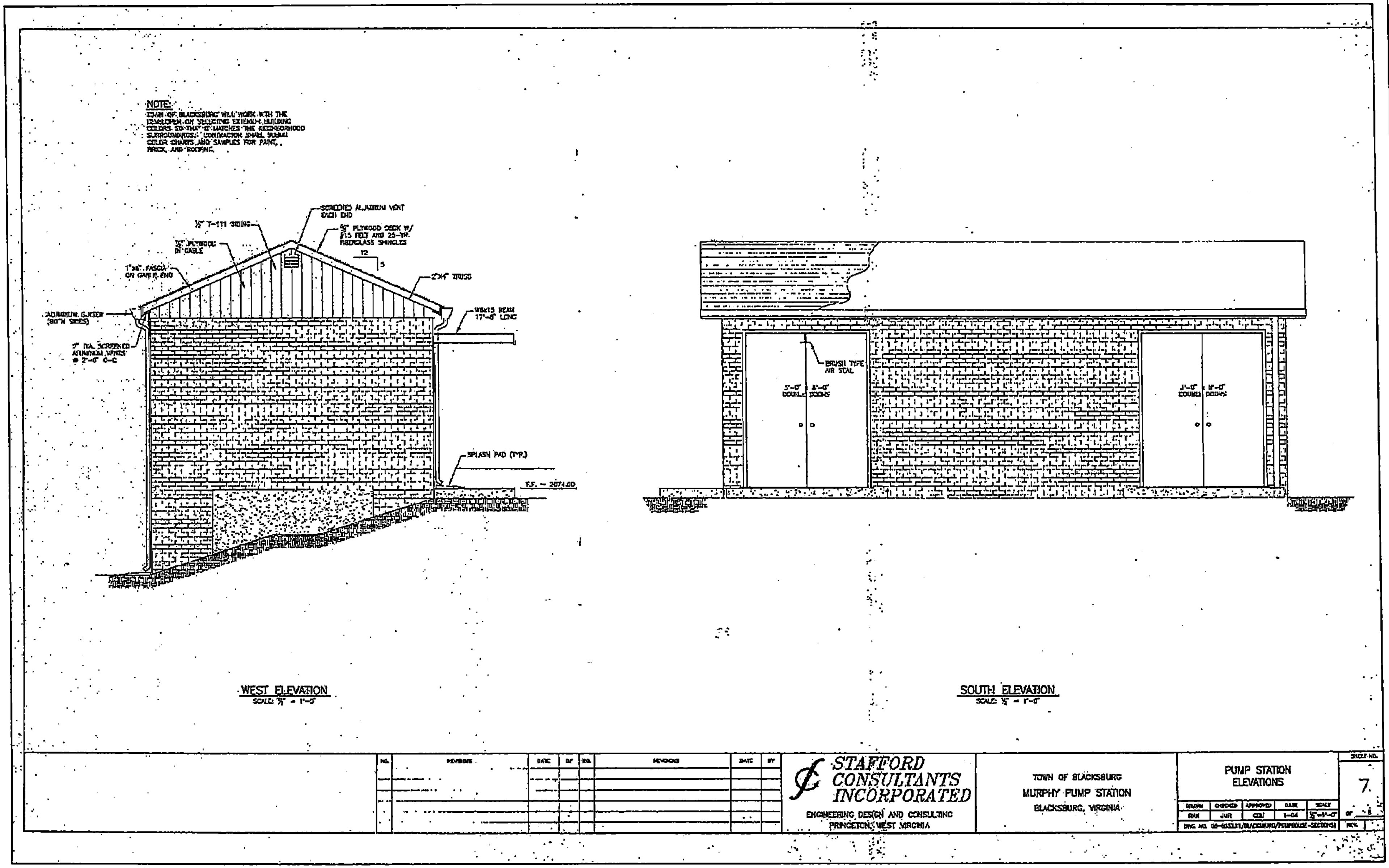


EMERGENCY PUMP CONNECTION

SPS-004

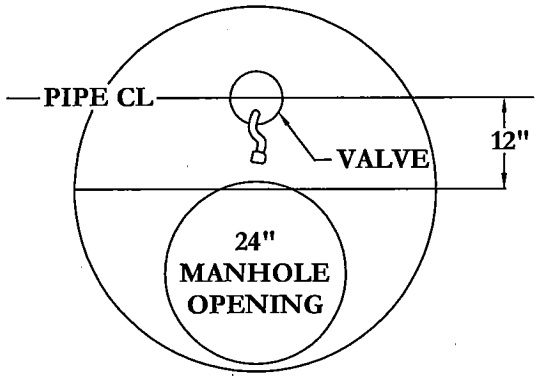
August 2009

No Scale

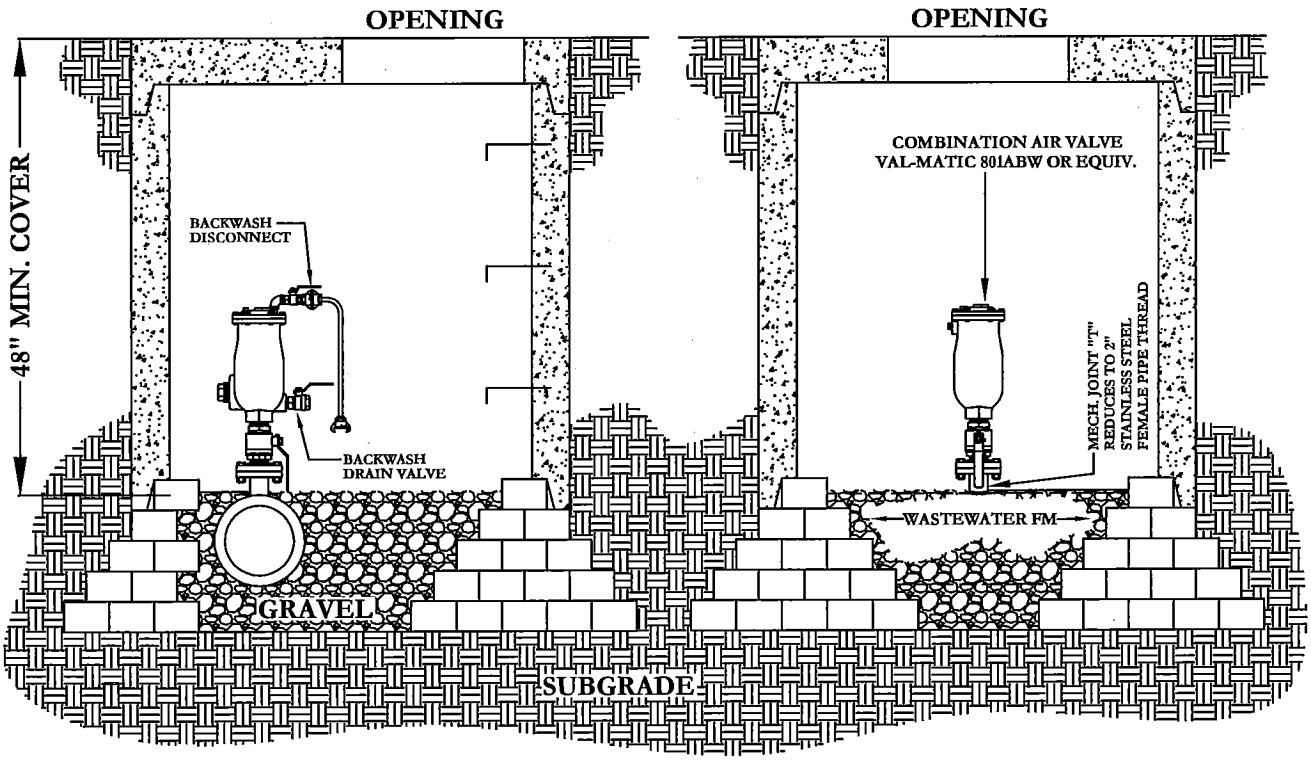


August 2009

TYPICAL PUMP STATION EXTERIOR



TOP VIEW



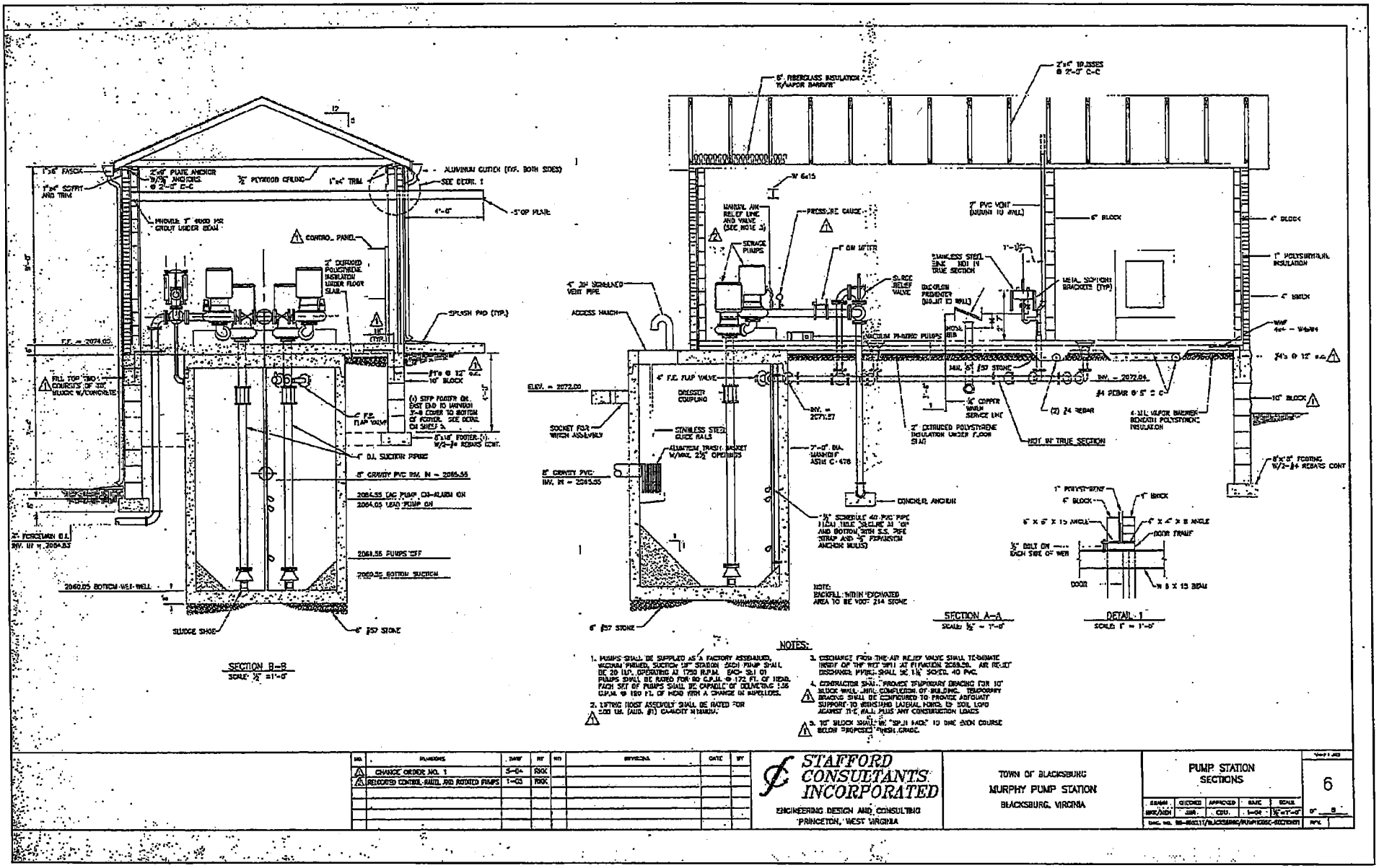
LEFT VIEW

FRONT VIEW

NOTES:

1. SEE DETAIL SMH-001 (PRECAST CONCRETE MANHOLE) FOR ADDITIONAL MANHOLE CONSTRUCTION DETAILS
2. BACKWASH ACCESSORY KITS ARE REQUIRED FOR COMBINATION AIR VALVES
3. MAINTAIN 30" CLEARANCE BETWEEN VALVE AND MANHOLE STEPS FOR MAINTENANCE AND BACKWASHING ACCESS
4. BACKWASH DISCONNECT AND DRAIN VALVE TO BE ORIENTED TOWARD MANHOLE STEPS
5. FIELD ADJUST SUPPORT BLOCKS TO MAINTAIN MINIMUM COVER

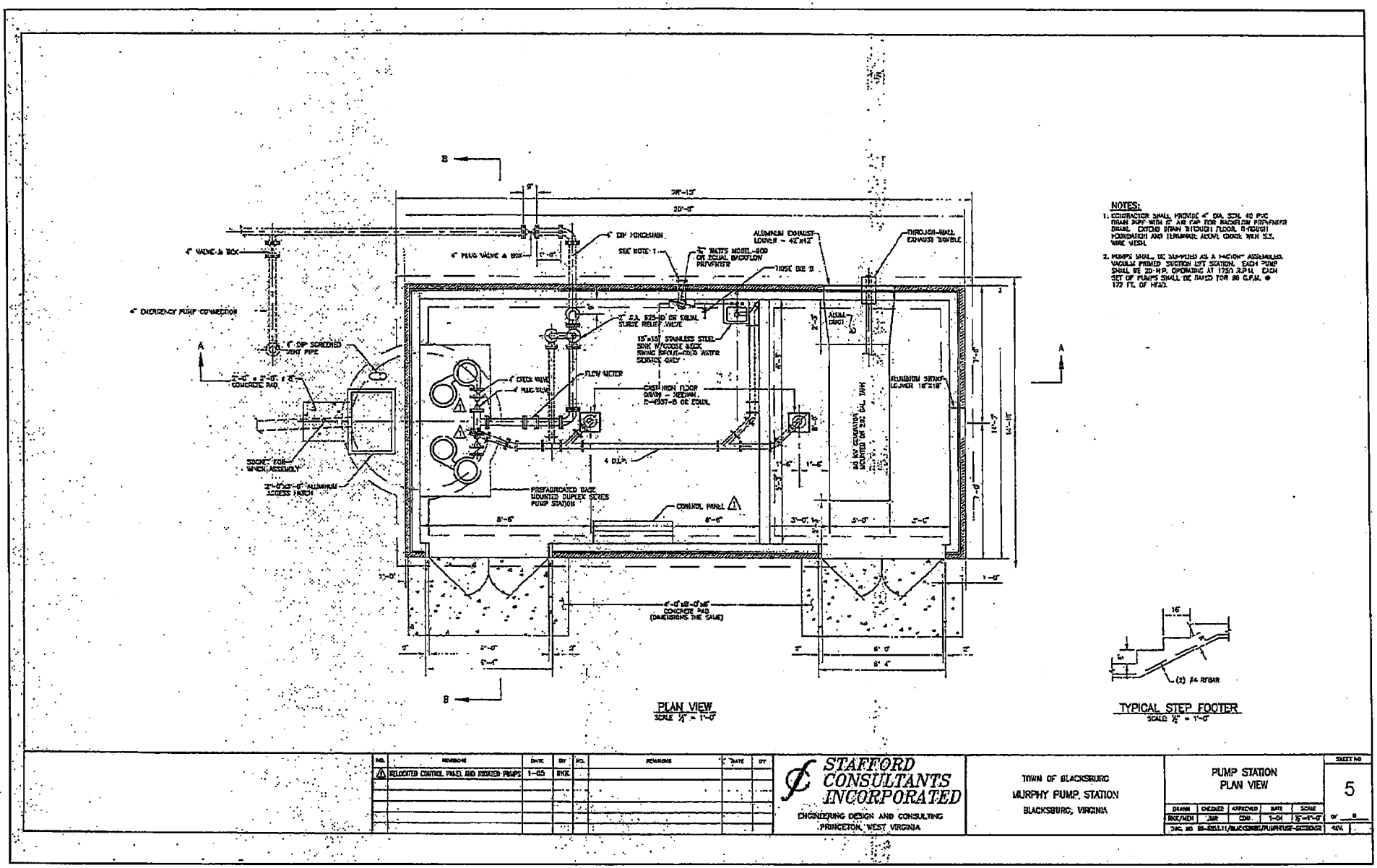
FORCE MAIN COMBINATION AIR VALVE INSTALLATION (COMBINATION AIR RELEASE AND AIR/VACUUM VALVE)



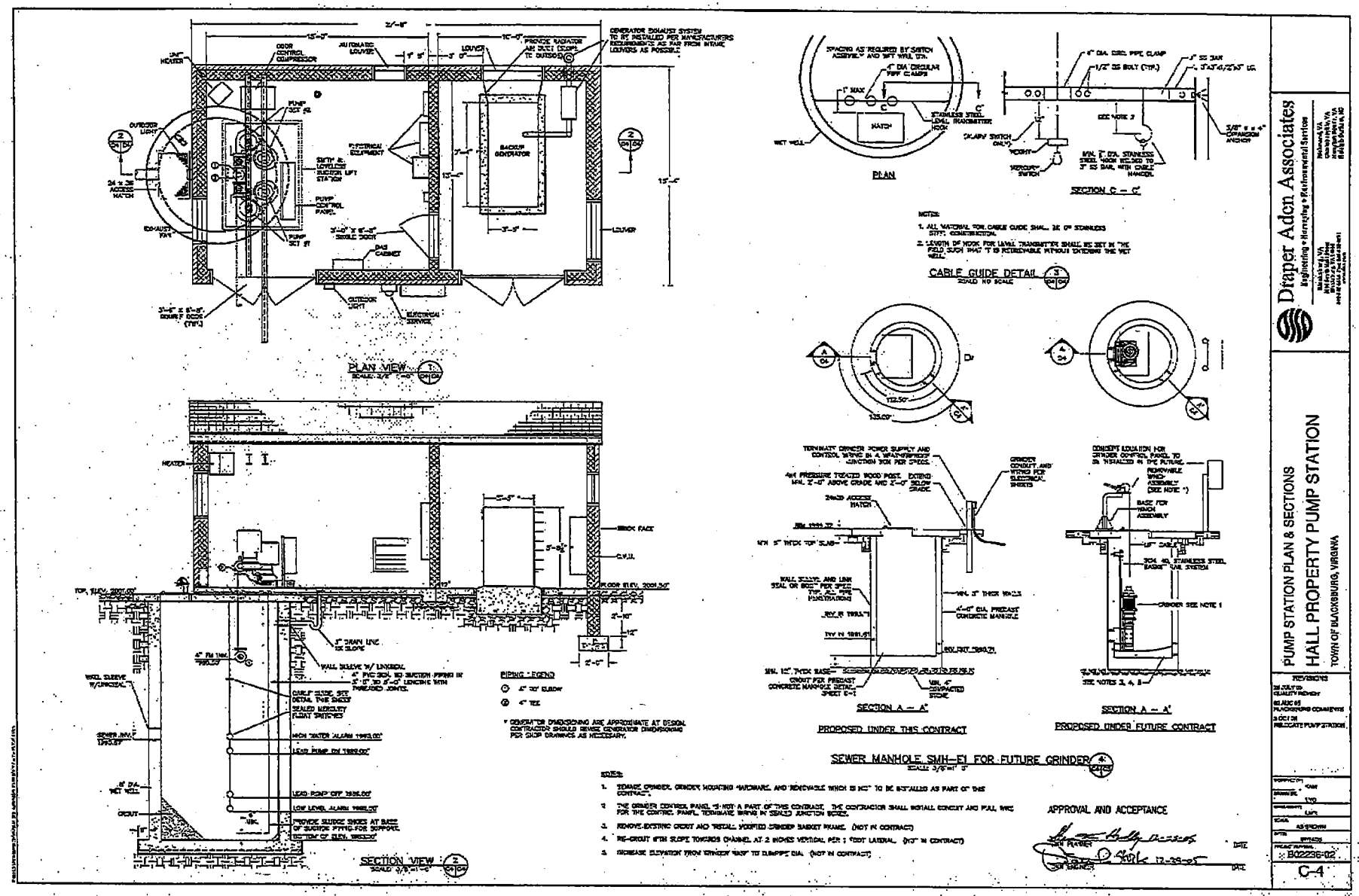
August 2009

TYPICAL PUMP STATION CROSS SECTION

SPS-101



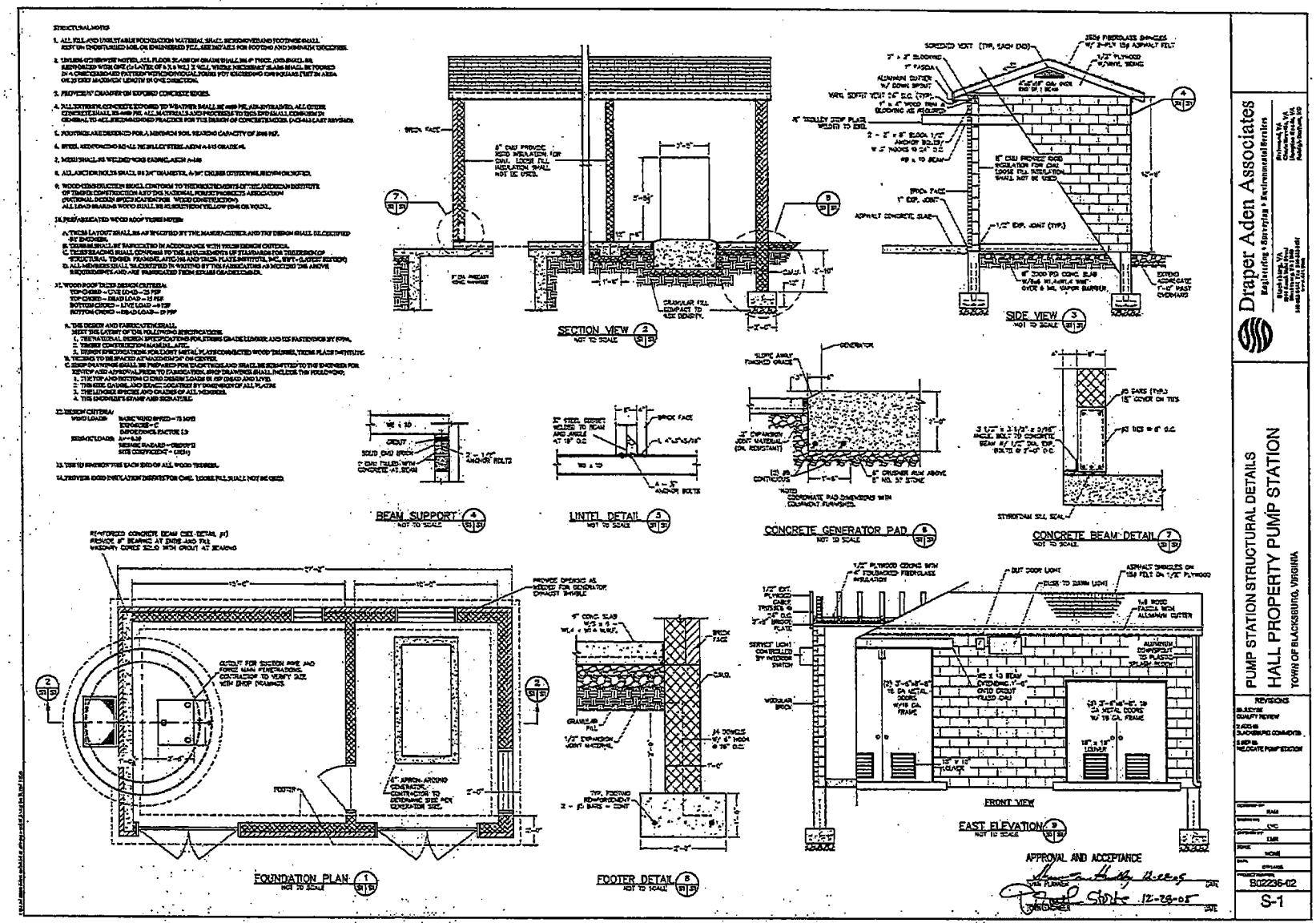
TYPICAL PUMP STATION PLAN VIEW



August 2009

TYPICAL PUMP STATION GRINDER

SPS-103

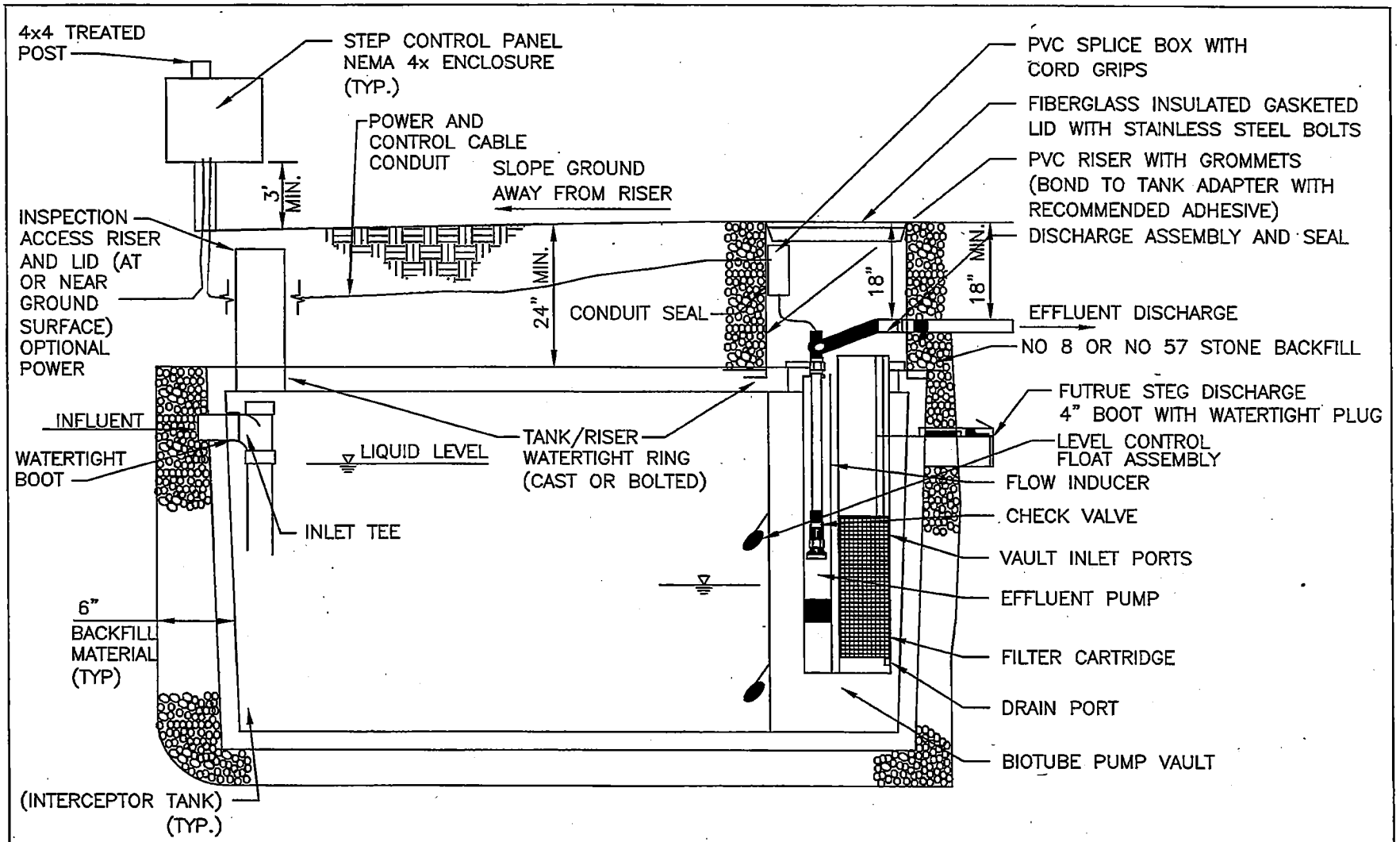


August 2009

L-1526

Typical Pump Station Building Materials

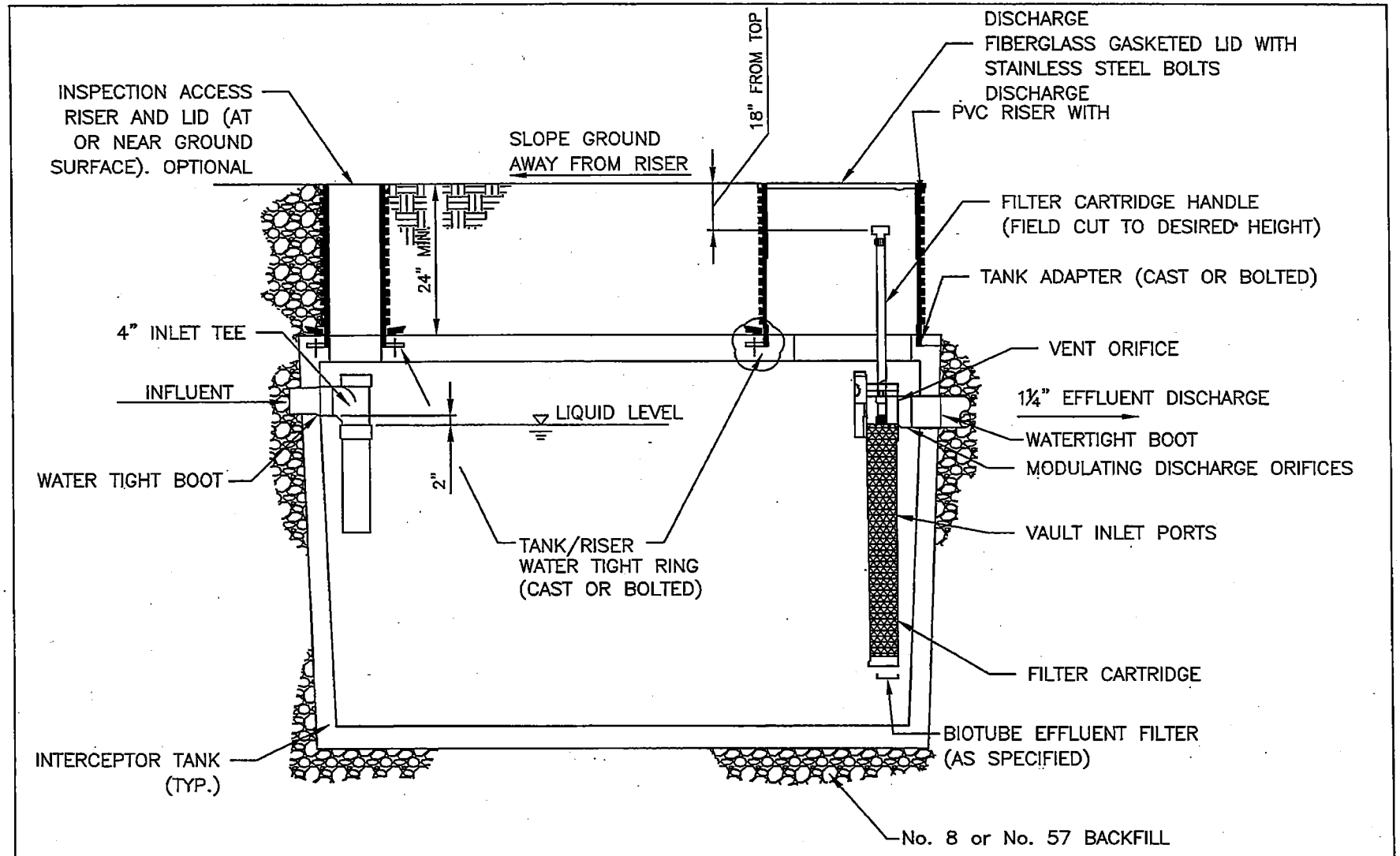
SPS-104



INDIVIDUAL SEPTIC TANK EFFLUENT PUMPING (STEP) INTERCEPTOR TANK

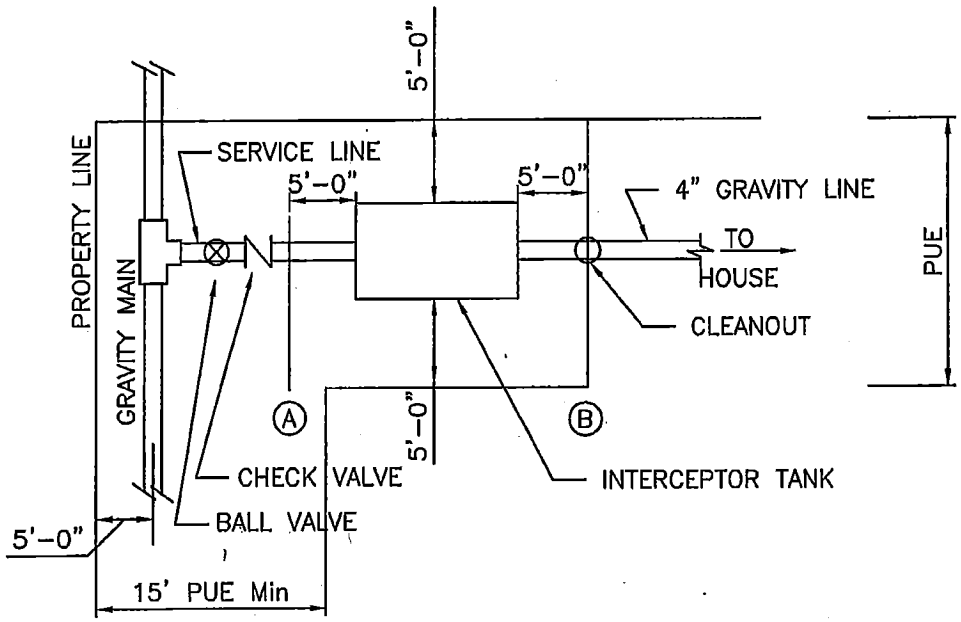
August 2009

No Scale



SEPTIC TANK EFFLUENT GRAVITY (STEG) INTERCEPTOR TANK

August 2009



(A) DEVELOPER SHALL INSTALL SERVICE CONNECTION TO 5' BEYOND CHECK VALVE. BALL VALVE SHALL BE LEFT IN THE CLOSED POSITION AND SERVICE LINE SHALL BE CAPPED WITH A SOLVENT WELD CAP, AN 8' LENGTH OF 4"x4" SHALL BE BURIED NEXT TO THE CAP, WITH 4 FEET OF THE TIMBER STICKING OUT OF THE GROUND. TIMBER SHALL BE PAINTED GREEN. AT THE TIME OF HOUSE CONSTRUCTION, OWNER SHALL REMOVE TIMBER, CUT OFF SOLVENT WELD CAP, AND TIE TO SERVICE CONNECTION WITH A SOLVENT WELD COUPLING. OWNER SHALL INSTALL SYSTEM, INCLUDING ALL WIRE, CONDUIT, AND CONTROL PANEL, FROM SOLVENT WELD CAP TO HOUSE. TOWN TO APPROVE ALL ELECTRICAL AND CONTROL WIRE SPLICES AND CONNECTIONS. PRIOR TO OPENING OF BALL VALVE AT SERVICE CONNECTION.

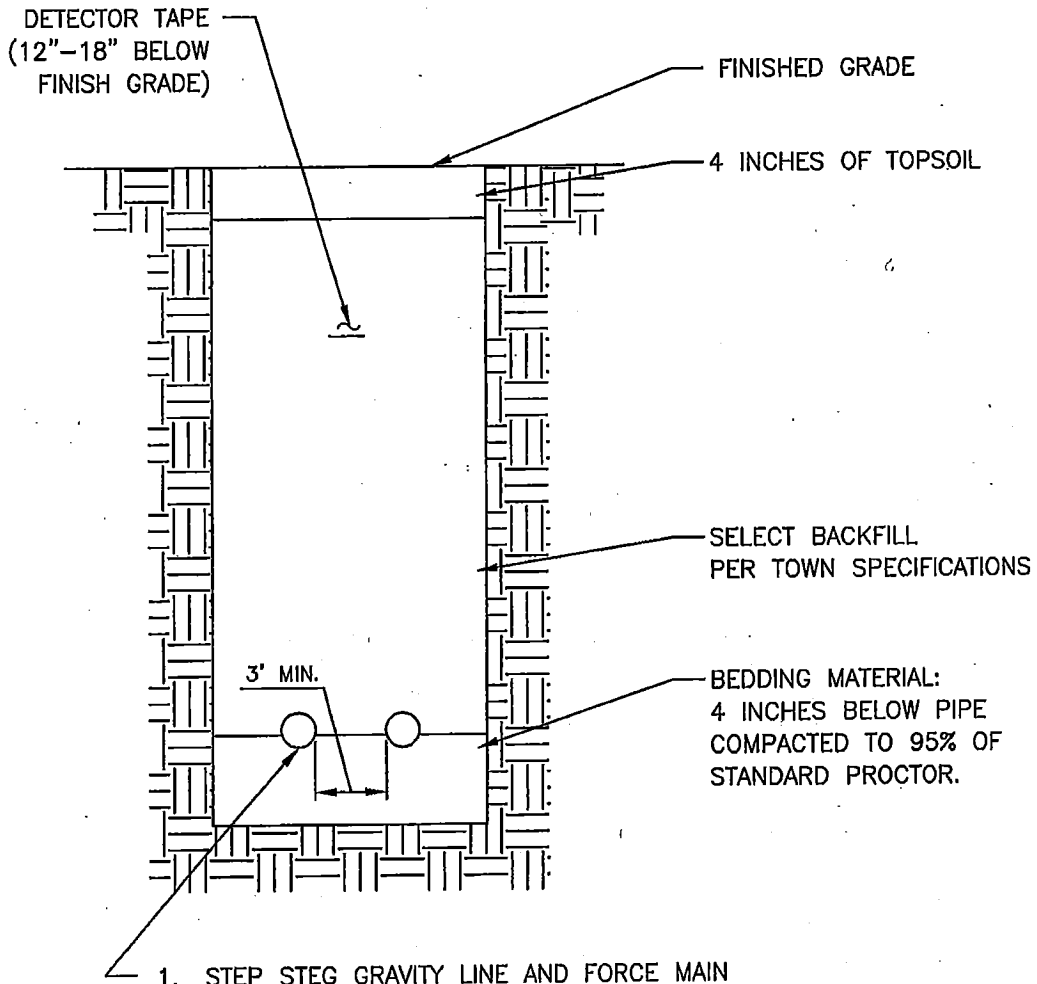
(B) TOWN OF BLACKSBURG SHALL MAINTAIN AND OWN SYSTEM UP TO 4" GRAVITY CLEANOUT. TOWN SHALL ALSO MAINTAIN AND OWN CONTROL/TELEMETRY BOX. LOCATION OF CONTROL/TELEMETRY BOX SHALL BE DETERMINED BY HOMEOWNER AND APPROVED BY THE TOWN OF BLACKSBURG.

STEP/STEG
Interceptor Tanks Installation

SSGD--202

August 2009

No Scale

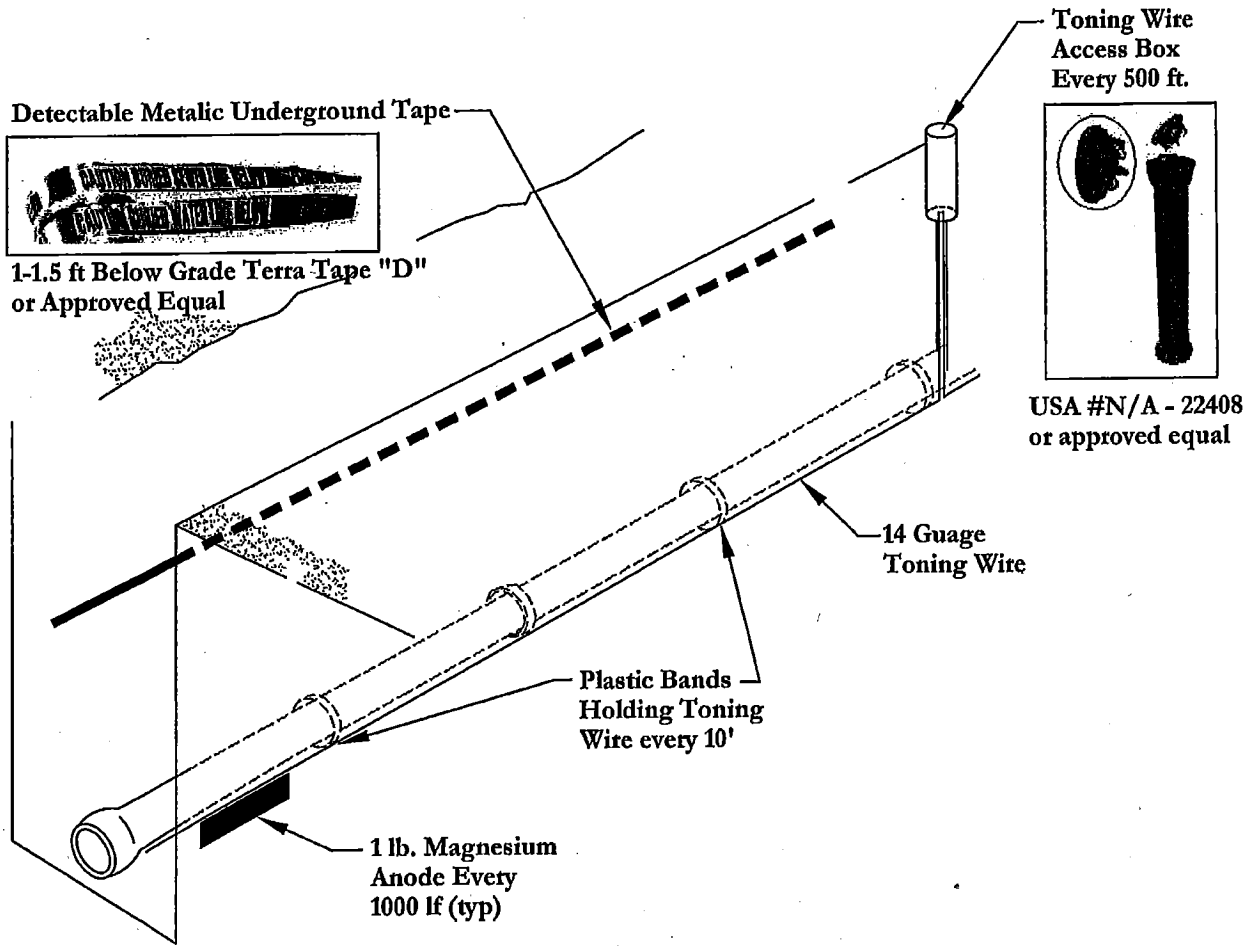


1. STEP STEG GRAVITY LINE AND FORCE MAIN SHALL BE EITHER DUCTILE IRON OR SDR21. PLASTIC PIPE SHALL BE EQUIPPED WITH TONING WIRE UNDERNEATH BANDED TO PIPE EVERY 10 FEET WITH PLASTIC TIES.
2. A 1LB MAGNESIUM ANODE BURIED EVERY 1000 LINEAR FEET FOR CATHODIC PROTECTION.
3. A TONING WIRE ACCESS BOX SHALL BE INSTALLED EVERY 500 FEET ALONG PIPE RUN.

STEP / STEG
TYPICAL TRENCH SECTION

August 2009

No Scale

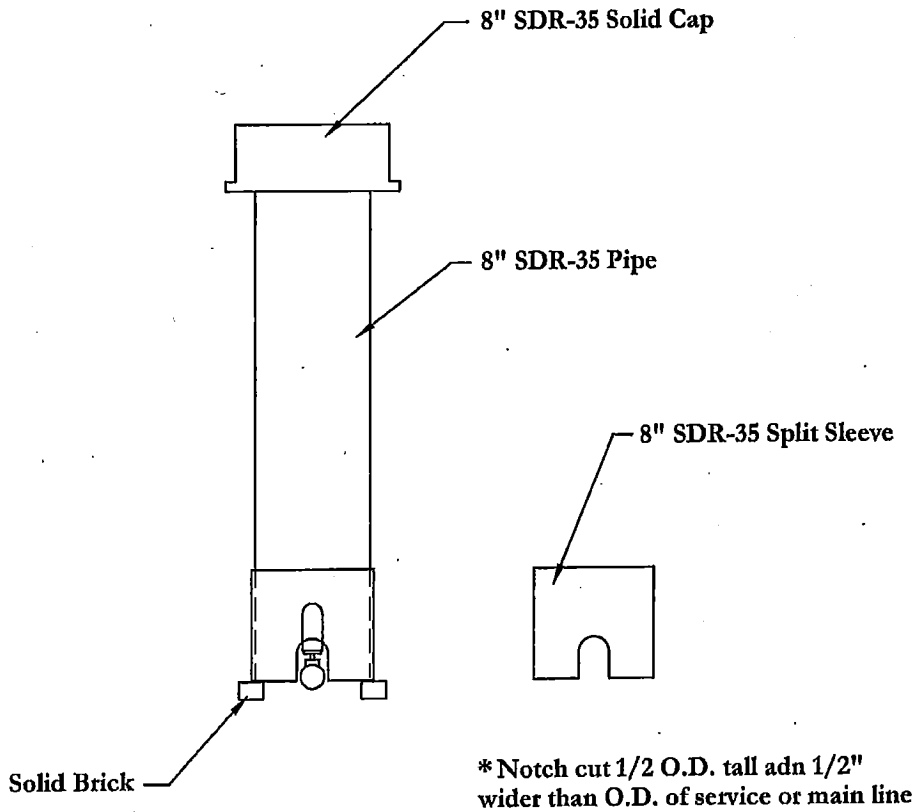


SEWER PLASTIC PIPE
ACCESS BOXES, CATHODIC PROTECTION, TRACER WIRE AND METALIC DETECTABLE TAPE

NO SCALE
August 2009

SSGD-204

VALVE BOX FOR S.T.E.P. / S.T.E.G
SERVICE CONNECTION VALVES, MAIN LINES
(NON TRAFFIC BEARING AREAS)

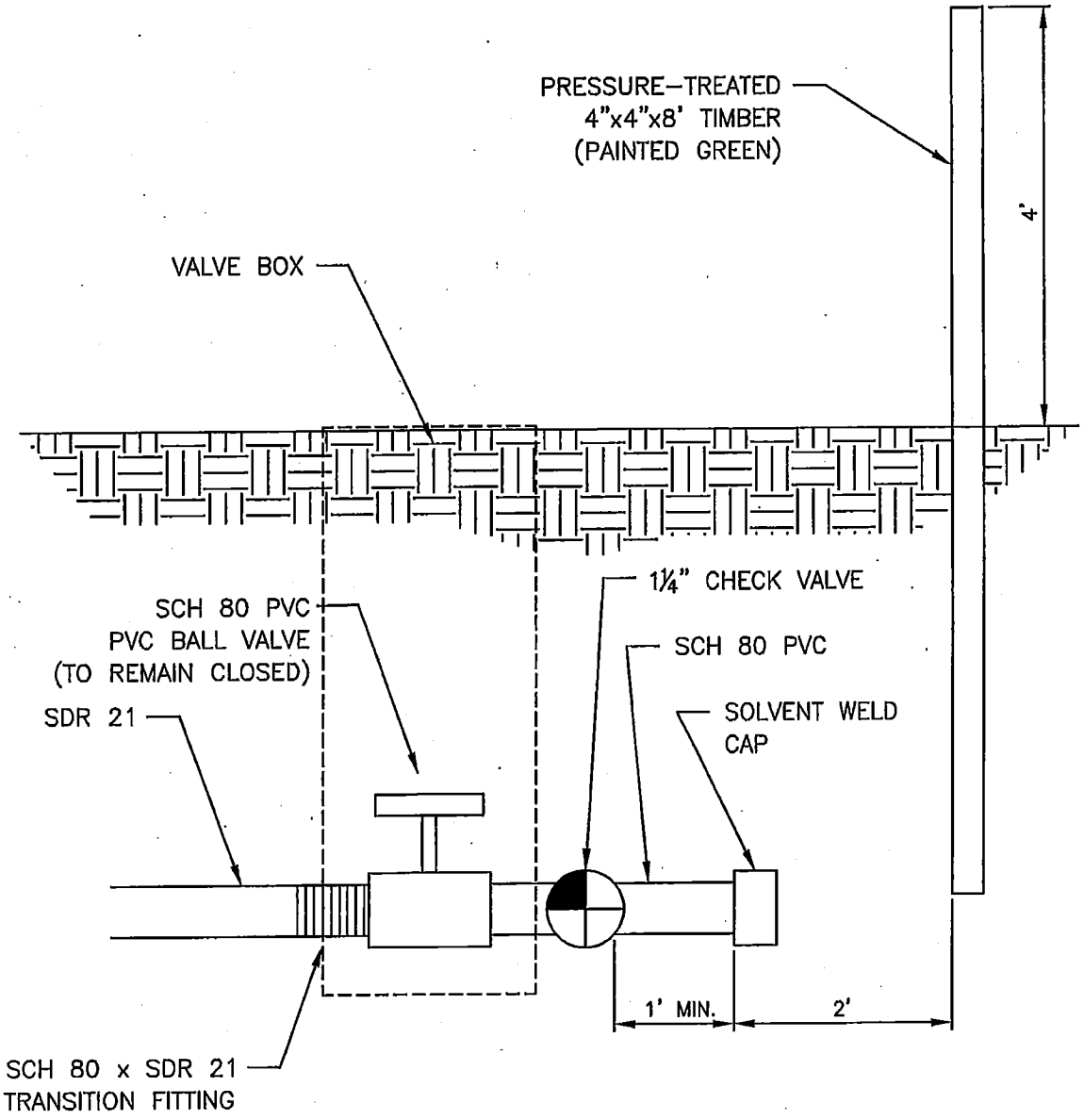


* Notch cut 6" tall and 1/2" wider than O.D. of service or main line pipe.

* Notch cut 1/2 O.D. tall adn 1/2" wider than O.D. of service or main line pipe.

August 2009

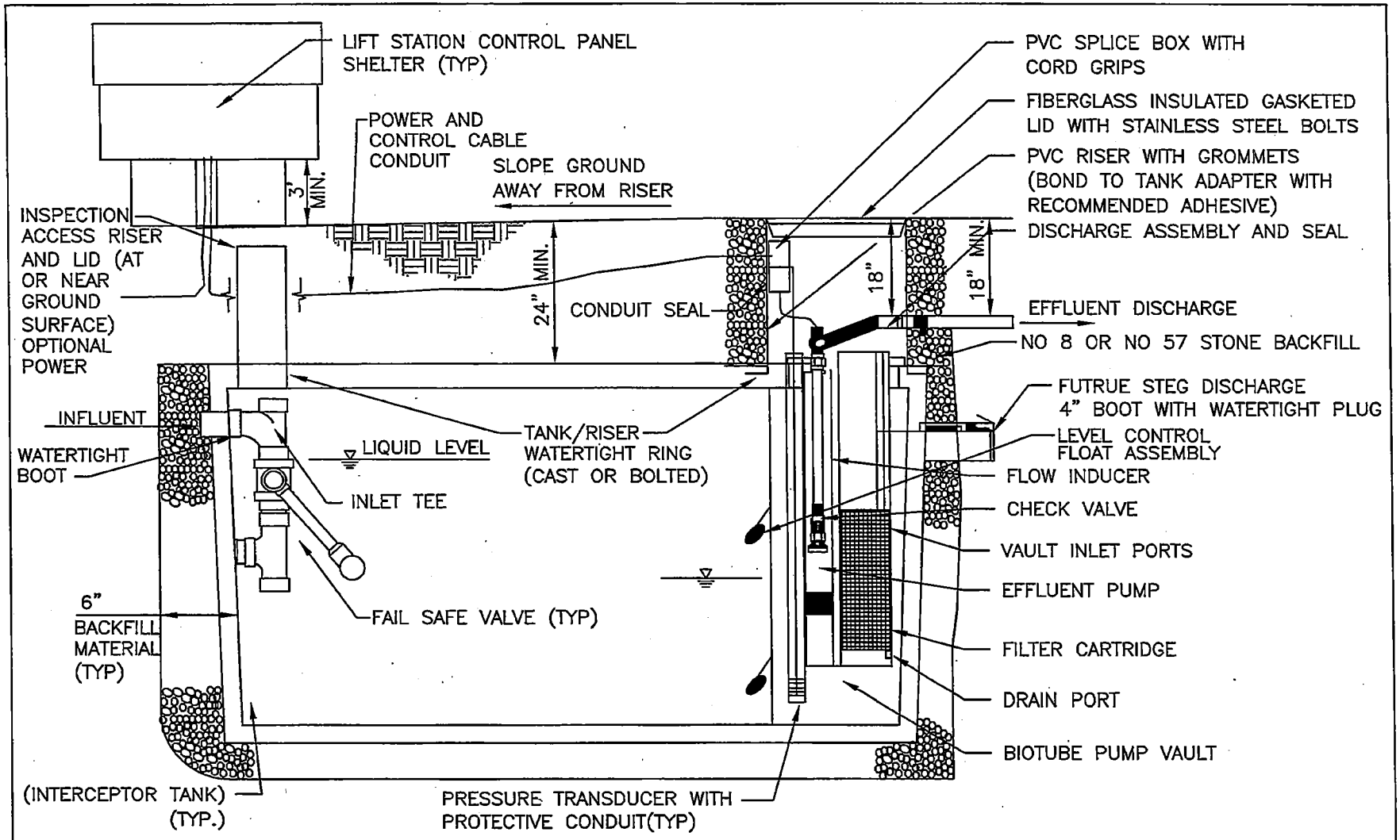
SSGD-205



NOTE:

BALL VALVE AND STUB OUT TO BE BEDED BY 6" OF NO.57 STONE ON TOP, BOTTOM AND SIDES.

STEP / STEG
TYPICAL 1¼" SERVICE TERMINATION

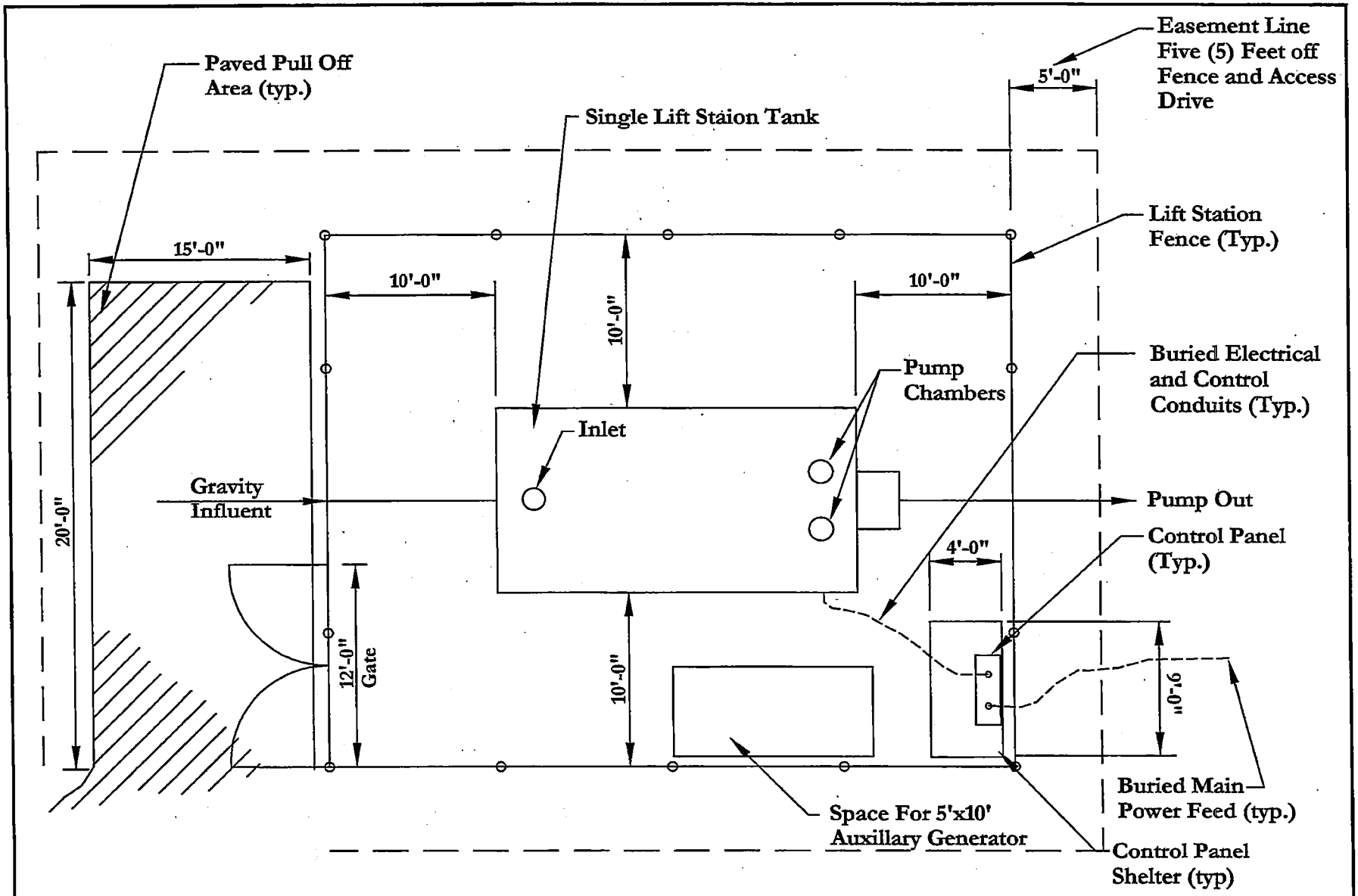


CENTRALIZED STEP/STEG LIFT STATION

August 2009

SSLS-001

No Scale

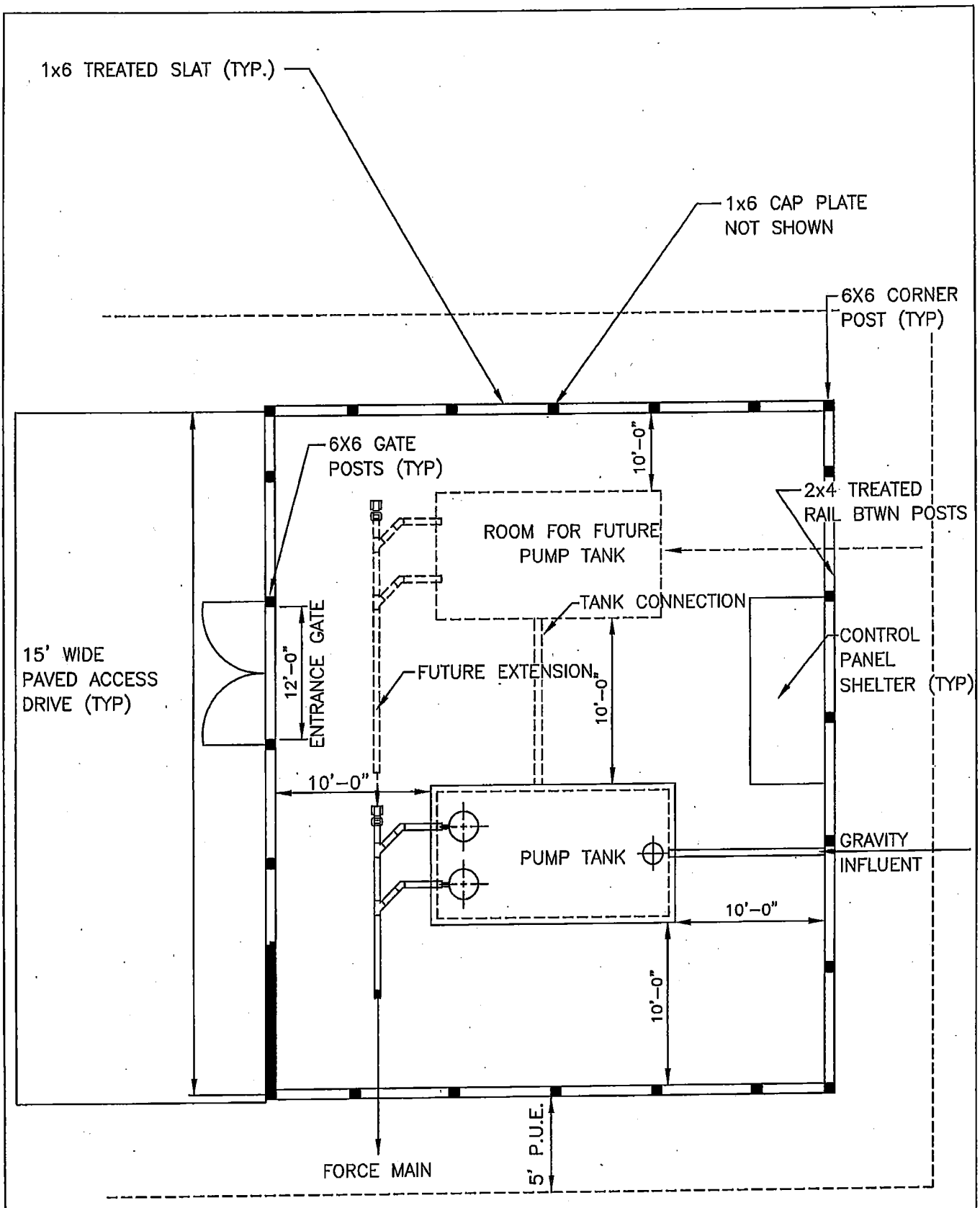


SINGLE TANK LIFT STATION SITE LAYOUT

SSLS-002

August 2009

NO SCALE

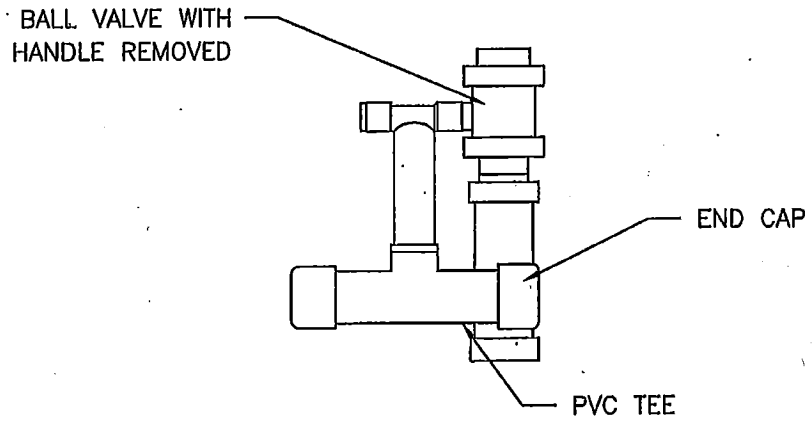


DUAL TANK CENTRALIZED STEP/STEG LIFT STATION SITE LAYOUT

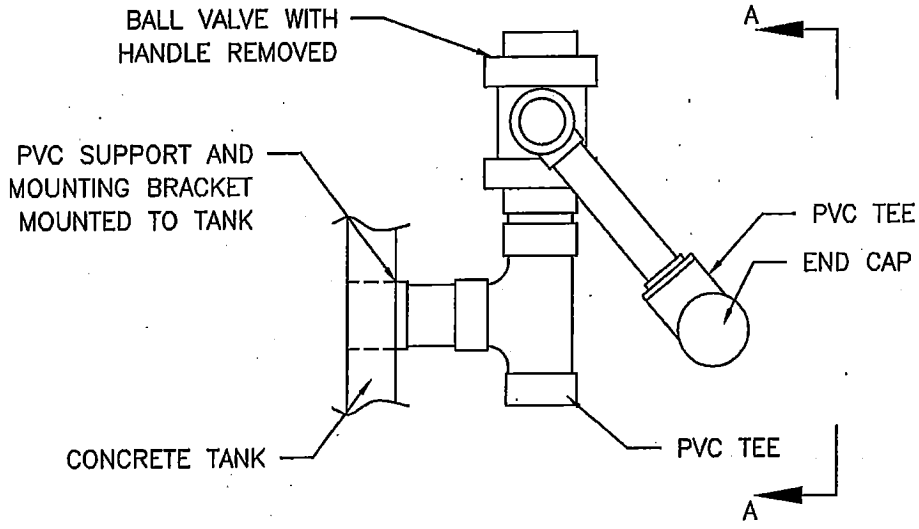
SSLS-003

August 2009

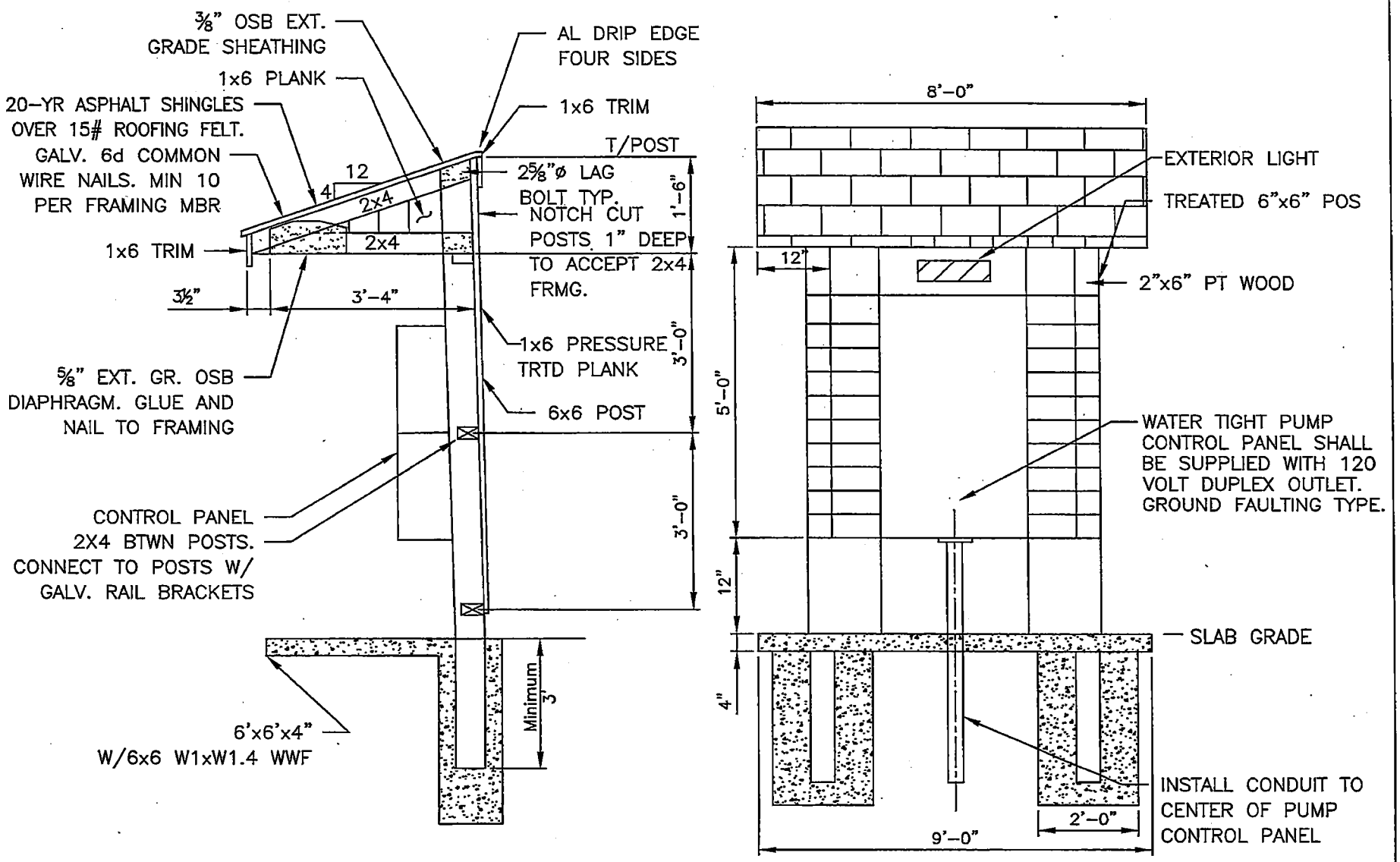
No Scale



SECTION A-A



Centralized Lift Station Fail Safe Valve



STEP / STEG LIFT STATION
CONTROL PANEL SHELTER

August 2009

No Scale

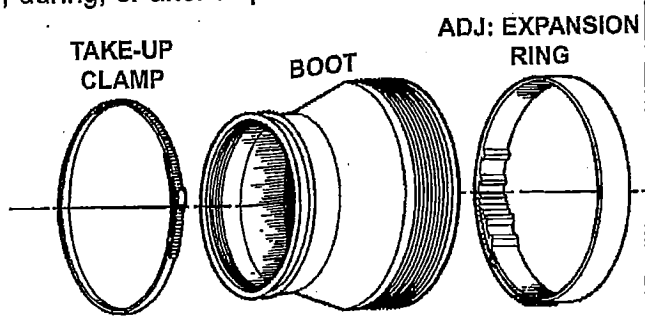
Appendix H

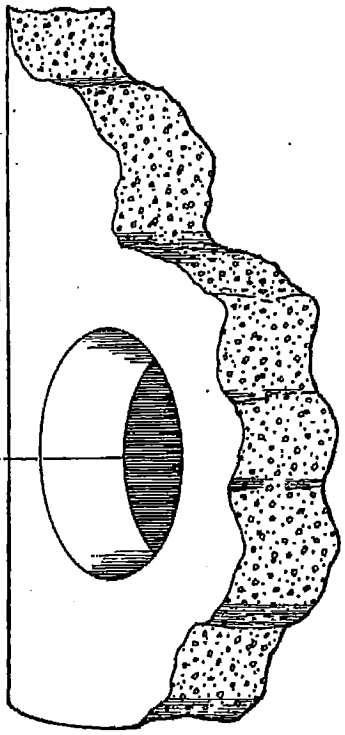
PRESS-BOOT™

DESIGNED TO EXCEED THE REQUIREMENTS OF A.S.T.M. C-923

Each **PRESS-BOOT** connector consists of three components: a **BOOT**, an **ADJ: EXPANSION RING**, and a **TAKE-UP CLAMP**. **PRESS-BOOT** connectors enable the manhole manufacturer and installation contractor to provide a flexible, watertight connection where pipe enters manhole.

The **ADJ: EXPANSION RING** is mechanically expanded to compress the **BOOT** against the receptacle hole surface in the manhole wall. After adequate compression of the **BOOT** is achieved, the self-locking design of the **ADJ: EXPANSION RING** interlocks to insure against loss of compression. This secures **PRESS-BOOT** in the manhole wall, ready to accept the desired size and type of pipe. Once **PRESS-BOOT** is installed, there is no need to re-tighten the **ADJ: EXPANSION RING** before, during, or after shipment to the jobsite.





When the contractor sets the manhole in position to grade, ditch personnel need only insert pipe through **PRESS-BOOT** and tighten **TAKE-UP CLAMP** to compress the **BOOT** against the outside wall of pipe entering manhole.

PRESS-BOOT offers the unique advantages of the **ADJ: EXPANSION RING**. This patented design provides unmatched flexibility in sealing a wide variation of hole sizes. The **ADJ: EXPANSION RING** is precision-molded of a material with corrosion resistance superior to competitive metallic expansion rings.

The **ADJ: EXPANSION RING** installs quickly and easily, and requires only minimal training of installers. If necessary, the **ADJ: EXPANSION RING** is easily removed and re-installed.

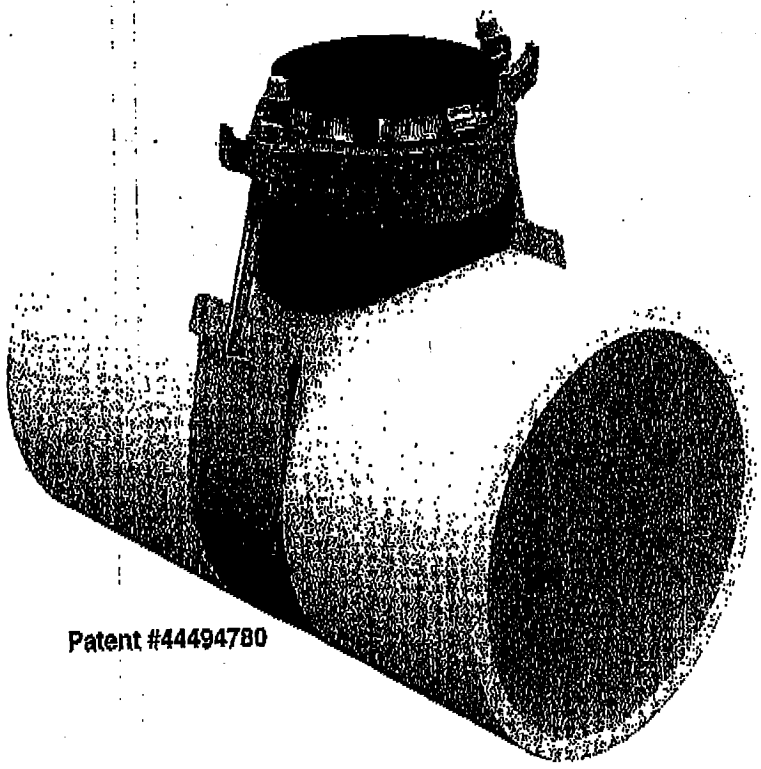
PRESS-SEAL GASKET CORPORATION
P.O. Box 10482, Fort Wayne, Indiana 46852
Phone: (260) 436-0521 (800) 348-7325 Fax: (260) 436-1908 E-mail: sales@press-seal.com Web: www.press-seal.com

ROMAC INDUSTRIES, INC.
1-800-426-9341

MADE IN U.S.A.

Style "CB"™ Sewer Saddle

A ROMAC ORIGINAL
- 1981 -



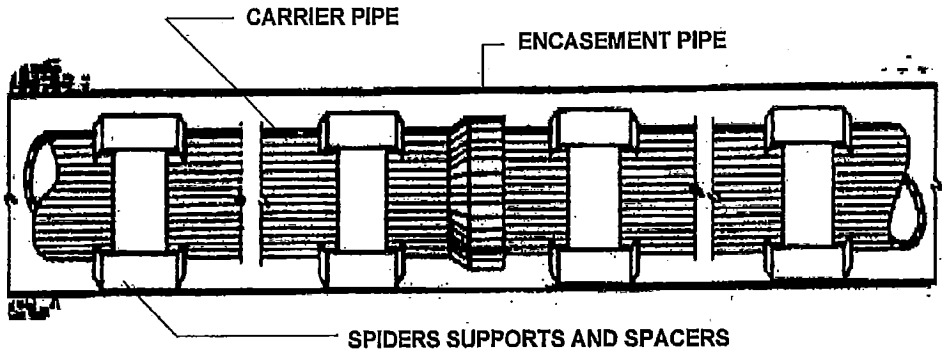
Patent #44494780

Design Advantages:

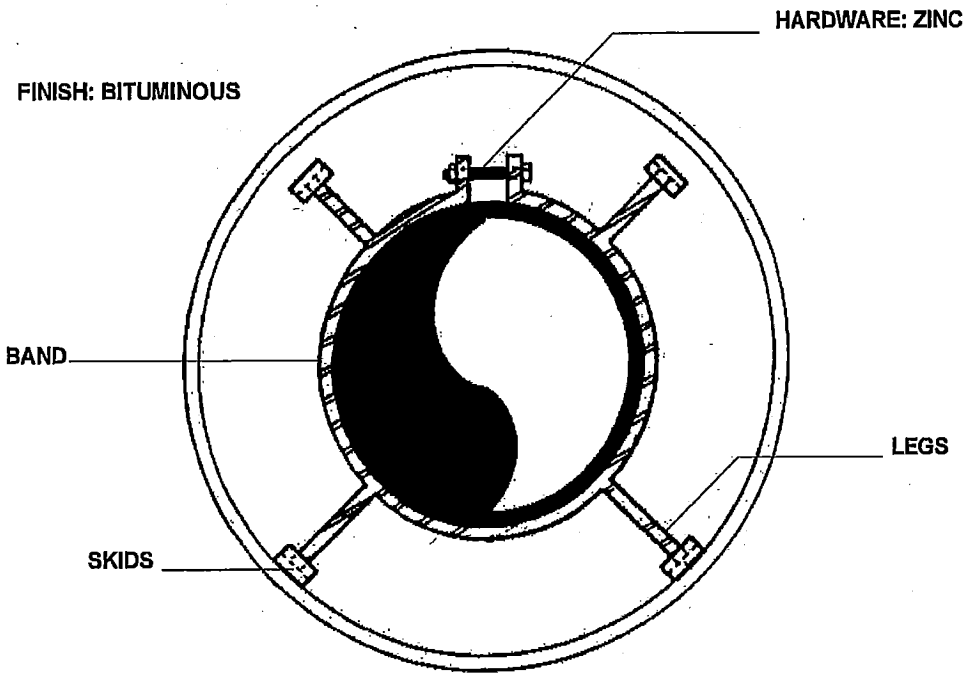
- **Inventory Reduction:** Unique gaskets fit wide range of diameters.
- **Ease of Installation:** Saddle can be installed by unskilled labor, using a socket or open end wrench. Built-in stop prevents blockages due to inadvertant insertion of branch into main.
- **Superior Strap:** Strong 304 stainless steel band GMAW & GTAW welded to roll threaded 304 stainless bolts adjusts over a wide range. Clamping force is well distributed by 3 ½" width.
- **Flexibility:** Gasket allows considerable deflection due to earth movement, while large sealing surface and wide band strongly resist displacement.
- **Reliability:** Continuous rubber connection between rim and branch eliminates potential leak spots. Saddles have been tested to pressures well in excess of typical service test requirements.

Note: *A pipe stop capable of withstanding 1000 pounds of thrust is molded into the CB saddle gasket. Care must be taken during system design and installation to assure that this thrust limit is not exceeded.*

SPIDER®
SUPPORTS AND SPACERS



CASING SECTION



NOT TO SCALE

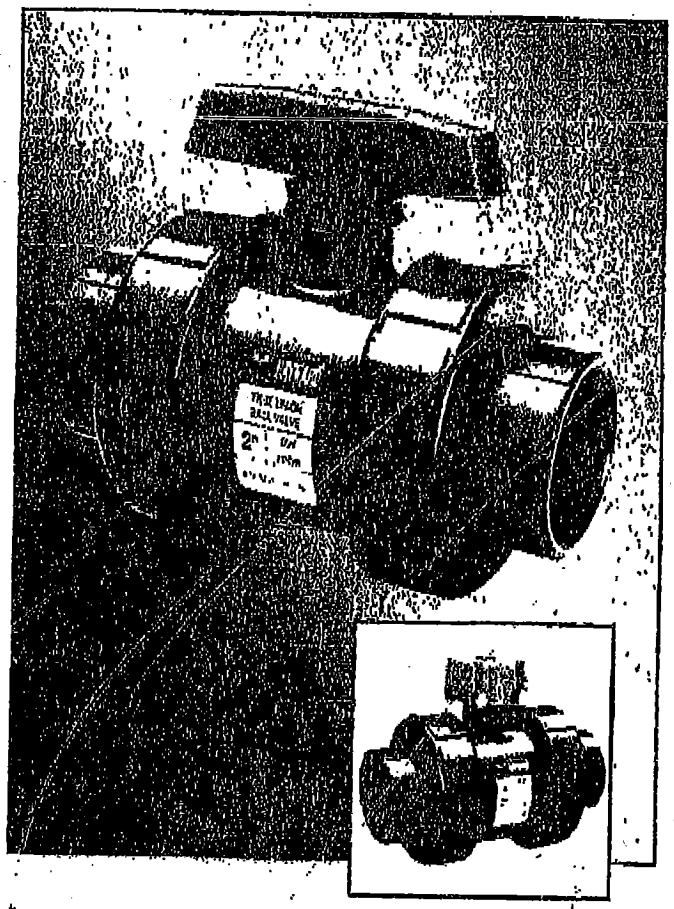
SPIDER MANUFACTURING INC.
PO BOX 15947 - DURHAM, NC 27704 - 919-575-0414 PHONE - 919-575-0420 FAX - 1-800-957-7433
www.spiderpipesupports.com

HAYWARD®

HAYWARD FlowControl

True Union Ball Valves

1/4" to 6" - PVC, Corzan® CPVC, PPL



Features

- Full Port Design
- Reversible PTFE Seats
- Easy Maintenance
- FPM or EPDM Seals
- Easily Automated
- Double O-Ring Stem Seals
- Adjustable Seat Retainer

Corzan® CPVC is a trademark of Noveon, Inc.

Options

- Stem Extensions
- Lockouts
- Spring Return Handle
- Pneumatic Actuators
- Electric Actuators
- 2"-Square Operating Nuts
- Drilled Balls For Sodium Hypochlorite Service.

Rugged, Heavy Wall Plastic Construction

Stands up to the most aggressive of applications. Hayward True Union Ball Valves can take the day to day abuse of industrial service and continue to function.

True Union Design

This makes these valves very easy to maintain by allowing for easy removal from a piping system without breaking down piping connections. Just unscrew the two assembly nuts and lift the valve body out of the line.

Advanced Design Features

Hayward True Union Ball Valves are superior performers. A fine-pitch seal retainer thread allows for accurate compensation for seat wear. Reversible seats make it easy to get a damaged valve back in service. Should the seats become damaged they only need to be removed, turned over, and reinstalled to put the valve back on line. These valves feature a double o-ring stem seal for twice the leakage protection of valves with only a single stem seal.

Solid Actuator Mounting Design

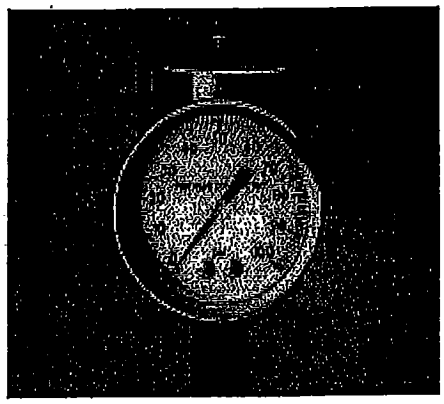
For rock-solid actuator mounting, the valve incorporates a unique design that allows the actuator mounting bracket to mount directly to the valve without the need for glued or clamped-on mounting pads. This assures proper alignment of the actuator to the valve without creating any damaging side loads to cause premature stem seal failure. With this design, the valve can be easily adapted to manual operation - should the need ever arise.

Never a Problem with Corrosion

Because of the valves' all plastic construction, they will never rust or corrode - and they can survive corrosive environments without the need for painting or expensive epoxy coating.

Series 42/742 Diaphragm Seal

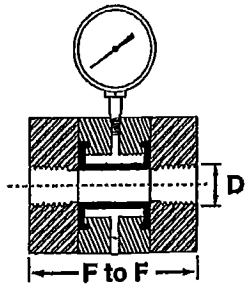
- **Series 742 can be flushed or rodded clean without removal from line or disassembly**
- **Protects and isolates instrumentation from chemical or slurry plugging**
- **Lower installation and operating costs**



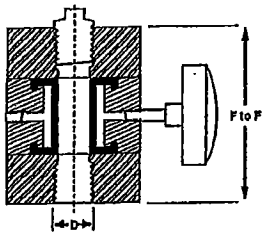
Materials of Construction

- **Body (Non-Wetted) and Upper and Lower Case (Wetted) - Carbon Steel, 316 Stainless Steel, or PVC**
- **Sleeves Available in Pure Gum Rubber, Neoprene, Hypalon®, Chlorobutyl, Buna-N, Viton®, EPDM, Food Grade Elastomers, Teflon® coated Buna-N, or Teflon® coated Viton®**
- **Fill Fluid; Ethylene Glycol & Water (200° F), Vegetable Oil (230° F), Silicone Oil (400° F)**

Series 42



Series 742



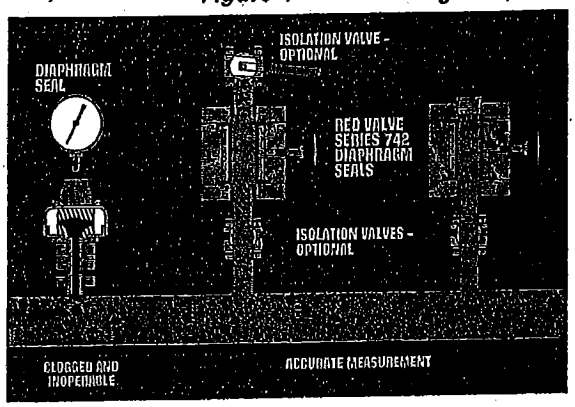
Red Valve's Series 42 Pressure Sensor and Series 742 Diaphragm Seal isolate and provide accurate instrument reading of gauges, transmitters, and pressure switches, making them ideal for use in chemical or slurry service. The Series 42 and Series 742 can be mounted in any flow direction, and have threaded ends manufactured to standard NPT pipetap dimensions for smaller pipelines. The principle of operation is simple. As process pressure is sensed by the 360° elastomer sleeve, the captive fluid transfers the process pressure to the instrument, providing a consistent, accurate reading.

The Series 742 offers a significant advantage over traditional diaphragm seals. When installed perpendicular to the pipeline, the Series 742 can be isolated so that in the event of plugging, the elastomer slurry ring area, which isolates the instrument, can be flushed (Figure 1) or rodded clean (Figure 2).

Series 42 Pressure Sensors and Series 742 Diaphragm Seals are available in sizes ½" through 2". The Series 42 features a top-mounted gauge, while the Series 742 is supplied with a standard back mounted gauge. A complete Series 742 Diaphragm Seal, including optional isolation ball valve, is available for immediate delivery.

The Only Diaphragm Seal That Can Be Flushed Without Removal From The Line

Figure 1 *Figure 2*

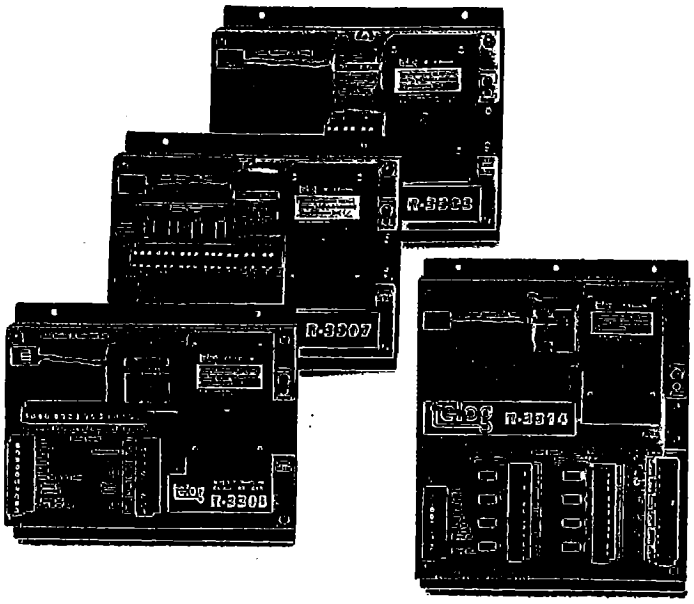


DIMENSIONS SERIES 42/742

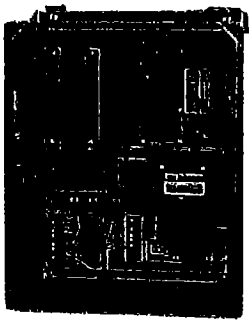
Size D	Length F to F	Working Pressure (psi)	Weight (lbs)
½"	2⅞"	720	5
1"	3⅜"	720	6
1½"	3⅜"	720	15
2"	3⅜"	720	20

** PVC Unit has Working Pressure of 200 psi; Higher Working Pressure Available.*

R-3300 Multi-Channel Recorders
Remote Data Acquisition
with Telog's R-3303, R-3307, R-3308, R-3314 Series



The R-3300 recorders become your eyes and ears in the field. The recorders accept analog and/or event inputs with a sample rate of 1 per sec up to 1 per 8 hour, storing up to 300,000 interval computations in memory. R-3300 units record output from a variety of sensors such as pressure, level, flow, pH, temperature and humidity. Combine the R-3300 recorders with a power source and communication option to easily administer a network of hundreds of remote recorders around the world.



R-3300 recorders may be packaged with power source and communication option in a NEMA 4X encosure.

Alarm notification for critical point monitoring is available. Each alarm event is time-stamped and stored in the recorder's wrap around memory. Backup battery packs ensure data integrity in the event of a power source failure.

Telog's R-3300 family of multi-channel remote recorders provide you with cost effective tools for gathering, understanding and managing information from your system. Designed for multiple applications, the R-3300 recorders can work in a network or as solo dataloggers, indoors or outdoors, battery-operated or externally powered. Support software copies the stored data for detailed analysis and professional presentations.

For more information call us at 585.742.3000, email TelogSales@telog.com, or visit us at www.telog.com.

telog®

FEATURES:

- User defined recording parameters
- Use in a network or as a solo datalogger
- Easy integration with SCADA for remote point monitoring
- Supports a variety of input types
- Alarm notification and alarm recording
- Telephone, cellular, radio & Ethernet communication options
- Low power consumption

APPLICATIONS:

- CSO/SSO monitoring and alarm notification
- Pump station run-time monitoring
- I & I studies
- Potable water distribution monitoring
- Rain fall monitoring
- Tank level monitoring
- Facilities Energy Consumption

Appendix I

Your Alternative Wastewater Collection System

Your home includes reliable, carefully engineered equipment to manage your wastewater and transport it to the Town wastewater treatment facility. Your system is called a Septic Tank Effluent Pumping (S.T.E.P)/or Gravity (S.T.E.G) System which uses a water tight septic tank, filter, and pump to deliver wastewater to a collection system. The S.T.E.P/S.T.E.G. system at your home is an innovative system that collects your sewage on-site in a tank while sending reduced amounts of wastewater solids to the treatment plant.

As wastewater leaves your home, it is stored in a septic tank on your property that does a terrific job of settling solids and decomposing them. The liquid is separated from the solids in the tank and pumped from the tank into a piping system where it is delivered to the Town's collection system. The entire system is watertight so that nothing can leak out and nothing can get into the system.

As with any engineered system, such as your car or your heat pump, your onsite wastewater system will only work if it is regularly maintained. You must maintain your system from the house to the tank and the Town of Blacksburg maintains the tank and lines downstream. If your tank contains a pump, the Town will automatically monitor your system through the control panel located near your tank. A status signal is sent via your phone line to a centralized Town database and alerts Town staff of problems.

Your system will also work better and last longer if you learn what can go into it-and what can not. Little effort is required. Just read and practice **The "Do's and Do not's"** that are listed on the backside. With preventive maintenance, along with periodic inspections, your onsite wastewater system should function for decades.

For information call the Town of Blacksburg Planning and Engineering Department: 961-1126

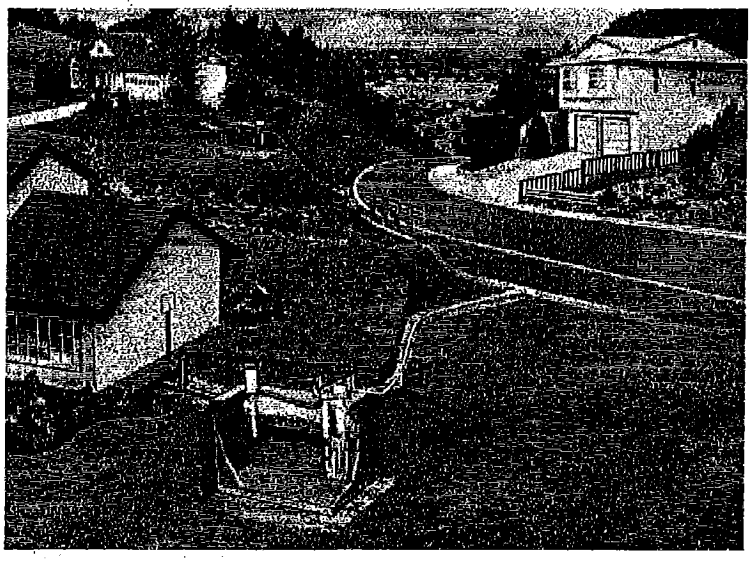


Figure 1: A typical STEP/STEG wastewater collection system tank.

Do's and Do Nots for Your Wastewater Collection System:

Do Not flush dangerous and damaging substances into your wastewater treatment system. Specifically, do not flush…

- Flammable or toxic products
- Household cleaners, especially floor wax and rug cleaners
- Chlorine bleach, chlorides, and pool or spa products
- Pesticides, herbicides, or agricultural chemicals or fertilizers
- Water softener backwash
- Excessive amounts of bath or body oils

Do Not use special additives that are touted to enhance the performance of your tank or system. Allow your system to naturally break down solids and digest nutrients in the wastewater.

DO use your trash can to dispose of substances that cause maintenance problems and/or increase the need for pumping the tank. Dispose of the following in your trash, not in the wastewater:

- Egg shells, kitty litter, coffee grounds, tea bags, cigarette butts.
- Paper towels, newspapers, sanitary napkins, diapers, condoms, etc..
- Cooking grease, collect and dispose with your trash.
- Rags, large amounts of hair.
- Avoid using garbage disposals.

YOUR RESPONSIBILITY: You are responsible for maintaining the utilities between your home and the tank clean-out, which include;

1. Home sewer lateral to the tank clean out.
2. Electric power line for STEP systems only.
3. Telephone line for STEP systems only.

YOUR TELEPHONE COMMUNICATIONS: The telephone line is required for STEP systems only so that the Town can monitor the pumps and receive alarms. If the Owner chooses to not install a telephone line or discontinue the land line telephone service, then the Town can no longer monitor the STEP and the Owner will be responsible for monitoring the system via an audible and visual alarm system on the tank control panel.

CONTACT INFORMATION: If you are planning construction around the tank, CALL MISS UTILITY and the Town Utility Supervisor and for Emergencies Call:

1. Town Utility Superintendent (8 AM to 4 PM Monday thru Friday); 961-1142
2. Police Dept. (On Weekends and After 4 PM on weekdays) 961-1150

THE TOWN'S RESPONSIBILITY: The Town will maintain your septic tank, perform inspections, and pump solids out of the tank. We own from the cleanout at the tank to the main line. There is a 30 ft x 30 ft easement over the tank, if it is on your lot. Our goal is to keep your system running seamlessly while responding to your concerns and questions in a timely manner.

Blacksburg TOWN OF
a special place

DEPARTMENT OF
ENGINEERING AND GIS

engineeringandgis@blacksburg.gov

II-F

TO: Town Council

FROM: Matt Stolte, Town Engineer

DATE: August 21, 2009

RE: Staff Report: Updates to the Town of Blacksburg Sanitary Sewer System Standards & Specifications.

The Town of Blacksurg's Sanitary Sewer System Specifications and Standards (Specs. and Standards) have been updated and are attached for Council adoption. Revisions to the Specs. and Standards include: updates since the last adoption date of May, 1987 and Section 3.00 "Septic Tank Effluent Gravity (STEG) & Pumped (STEP) Systems" which specifies the minimum design and construction requirements for STEG/STEP public sanitary sewer collection systems.

The Specs. and Standards revision process occurred in conjunction with Ordinance 1467 over a two year period. During the update process public meetings and interdepartmental meetings between the Engineering and the Public Works Departments were held to get as much input as possible. Comments from the meetings were reviewed and incorporated into the final specifications and standards update.