Washington County Service Authority
Standard Specifications
For
The Design and Construction
Of
Sanitary Sewerage Facilities
March 13, 2001

DWE-2

Virginia Department of Health
Office of Environmental Health Services
Division of Wastewater Engineering

Area Office: South West Date: APR 11 2001

- ☐ Operation and Maintenance Manual
- ☐ Sludge Management Plan
- ☐ Operational Plan
- ☐ Closure Plan
- ☒ Reports
- ☐ Other:

- ☒ Approved
- ☐ Conditionally Approved
- ☐ Disapproved

Area Engineer

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INTRODUCTION

USE OF THESE SPECIFICATIONS

These standard technical specifications are intended to be used for the design and construction of sanitary sewers to be owned by the Washington County Service Authority (WCSA). The use of these specifications in conjunction with engineering plans, which address the specifics of individual projects, will result in standardized construction of sewer lines in the WCSA sewage collection system.

These specifications shall be adhered to in the design & construction of all new sanitary sewers of 8, 10, and 12 inch diameter, installed to collect sewage and deliver it to WCSA sewerage systems. All projects shall be formally approved by WCSA **prior** to starting construction. The use of these specifications will facilitate expansion of our existing sewerage systems at minimum cost to the Owner developing the sewer lines.

WCSA has attempted to organize these specifications in a way that promotes access and understanding. The Owner, Engineer and Contractor should become very thoroughly familiar with these specifications prior to use. The specifications are targeted at experienced professionals who design and install gravity sewer lines. It should also be noted sewer line installation requires specialized techniques of installation such as rock mitigation, and specialized equipment for insuring proper alignment of the sewer lines during construction.

WCSA will not accept the ownership of, or the flow of sewage from improperly construction sewer lines. While WCSA will have inspector(s) observing the construction of the sewer line, the ultimate responsibility for proper installation of sewer lines lies with the owner of the project.

These specifications have been prepared by WCSA and meet or exceed the minimum requirements of the "*Commonwealth of Virginia Sewage Collection and Treatment (SCAT) Regulations*. The technical aspects of these specifications have been approved by the Virginia Department of Health - Office of Environmental Health Services (OEHS) and the Virginia Department of Environmental Quality (DEQ) for use by WCSA and others (with WCSA approval) for designing and constructing gravity sewer lines. These specifications shall be used for the construction of gravity sewer lines whose ultimate ownership will be held by WCSA unless the use of other specifications are specifically approved by WCSA, OEHS and DEQ.

Finally, WCSA believes that the development of these specifications will significantly streamline the project review process. This should mean a shorter processing time for approvals of sewer line projects by WCSA and the regulatory agencies involved. As those who work with these standards become familiar with them, design time and construction time should also be reduced resulting in a significant cost savings for all involved.

DEFINITIONS

Unless the context specifically indicates otherwise, the meaning of terms used in the rules and regulations shall be as follows:

1) Collection System means the mains, laterals, service connections, manholes and pumping facilities used for the collection of sewage from its source (property line of the owner) to the Washington County Service Authority (WCSA) sewage treatment facilities or alternatively the Town of Abingdon or City of Bristol, Virginia mains.
2) Customer means any person, firm, corporation, company association, governmental unit or owner of property furnished sanitary sewer service by the Washington County Service Authority.
3) General Manager means the General Manager of the Washington County Service Authority or his authorized deputy agent or representative.
4) Main means a sewer pipe owned, operated and maintained by WCSA which is used for the purpose of transmission or collection of sanitary sewage but is not a sewer service lateral.
5) Owner as used herein as it applies to the owner of property which the proposed sewer extensions will serve. Owner as it applies to applications for sewer services and payments for treatment shall mean the owner of real property and dwellings or structures thereon, or the owner of dwellings or structures on leased land.
6) Premises as used herein shall include but is not restricted to the following:
   a) A building or combination of buildings owned by one family as a residence.
   b) Each unit of multiple building separated by a solid vertical partition wall owned as a residence or owned or leased by one firm as a place of business.
   c) A building owned by one customer and having a number of apartments, offices or lofts using in common one hall and one or more means of entrance.
   d) A building two or more stories high under one roof owned by one customer and having an individual entrance for the ground floor occupants and one for the occupants of the upper floor.
   e) A combination of buildings owned by one customer, in one common enclosure, none of the buildings of which is adapted to separate ownership.
   f) A public building.
   g) A single plat used as a park or recreational area.

7) Property Line shall mean the edge or limit of the street, highway, public way, or right-of-way as may be shown or platted on maps of record before entering on private property of the premises.
8) Service Lateral shall mean the pipe that runs between the main and the customer's property line or utility easement. That portion from the main to the property line is the City's service
a) lateral; that portion from the property line to the premises is the owner's service lateral.
9) County shall mean Washington County, Virginia.
10) WCSA shall mean the Washington County Service Authority.
11) Equivalent Residential Unit For the purposes of establishing connection fees an Equivalent Residential Unit is defined as the average consumption of 5000 gallons of water per month. A single family dwelling unit shall be considered one equivalent unit. When computing the "equivalent" of buildings or structures other than dwelling units, the average water consumption rate of 5000 gallons per month day shall be used as the basis for determining the equivalency. For the purposes of design, the design basis required by these specifications shall be an average daily water use of 400 gallons per residential unit in accordance with the regulations of the Virginia Department of Health prevailing at the time. Deviation from this design basis will be considered on a case by case basis upon written request by the Owner or his designated agent. Approval for an alternate design basis will be made in writing by WCSA after consultation with the Virginia Department of Health and or Department of Environmental Quality.
12) Shall means a mandatory requirement. Plans not conforming to criteria or limits introduced by "shall" may be approved by the Utility when submitted with adequate justification.
13) Should means a recommendation. However, WCSA reserves the right to change a recommendation to a requirement when in the opinion of WCSA, it is appropriate to do so from a public health standpoint or when it is in the best interest of WCSA .
14) May generally means an item left to the discretion of the owner or his designated agent. However, WCSA reserves the right to change a recommendation to a requirement when in the opinion of WCSA, it is appropriate to do so from a public health standpoint or when it is in the best interest of WCSA .

Review and Approval

Review and approval of plans and design notes for all sewerage facilities shall be submitted to and approved by the following agencies prior to construction:

1) The Virginia Department of Health - Office of Environmental Health Services
2) Virginia Department of Environmental Quality (unless a waiver for formal approval for the proposed project is granted by those agencies.)
3) The Washington County Service Authority (WCSA

Processing of Plans and Design Notes

These General Specifications cover many aspects of sewer line design and construction. Specifically the following sections of the Sewage Collection and Treatment Regulations (SCAT) are covered by the WCSA Standard Specifications (The numbers in bold refer to the same numbered section in the SCAT regulations.)

i) **12 VAC 5-581-390** Construction Details
   (1) Minimum Size
   (2) Pipe Joints and Infiltration
   (3) Building Sewers and connections
   (4) Leakage Testing
   (5) Trench Construction and Pipe Bedding
   (6) Backfill and Tamping

ii) **12 VAC 5-581-410** Manholes
   (1) Materials
   (2) Measurements
   (3) Foundations
   (4) Flow Channel
   (5) Watertightness
   (6) Connections
   (7) Frames, Covers and Steps
   (8) Drop Pipe (Standard Detail Only)

iii) **12 VAC 5-581-420** Water Quality and Public Health Protection
   (1) Design Integrity
   (2) Water Supply Interconnections

Project Specific Data Required to be submitted with each proposed project includes the following.

iv) **12 VAC 5-581-370** Design Factors
  (1) Basis
  (2) Factors
  (3) Capacity

v) **12 VAC 5-581-380** Design Details
  (1) Collection Lines
    (a) Depth
    (b) Slope
    (c) Alignment
    (d) Increasing Size
    (e) High Velocity Protection
    (f) Property Access
  (2) Manholes
    (a) Location
    (b) Ventilation
    (c) Drop Pipes - if needed
  (3) Special considerations for Sewers and Manholes in Relation to Streams, Estuaries, Lakes, Reservoirs
  (4) Special considerations for Relationship to Water Works Structures

Materials Approval - These general specifications are very specific with respect to the materials which are acceptable for sanitary sewer lines and associated appurtenances. To that end:

vi) Only materials and equipment allowed by these specifications or approved specifically in writing by the WCSA Utilities shall be utilized in sewerage facilities.

vii) Deviations - There shall be no deviations from the standard specifications except in unusual circumstances. All deviation requests must be submitted to WCSA in writing for the review and approval prior to construction.

PART II

SANITARY SEWER SPECIFICATIONS

DESIGN OF SEWERAGE SYSTEMS

2.1 General:

Plans and specifications for sanitary sewer systems shall be prepared by or under the supervision of a registered professional engineer who shall affix his seal to each plan-profile sheet, accompanying sheets showing details, and to the specifications. A land surveyor who has passed Part 3 (b) of the Land Surveyor's exam given by the Board for the Examination and Certification of Architects, Professional Engineers and Land Surveyors may, for subdivisions only, prepare plans and profiles for sanitary sewer extensions where such work involves the use and application of standards prescribed by local or state authorities.

2.2 Approvals:

Two sets of plans and design notes shall be submitted to the General Manager of WCSA for each sewerage project. The plans and design notes will be reviewed and one set returned to the design professional with recommended changes and/or approval. Four sets of plans, specifications and design data shall be submitted concurrently to the Virginia Department of Health Department (VDH) for review and/or approval. If appropriate, WCSA will support a request from the owner to VDH for waiver of formal review and approval by that agency. WCSA will consider such a request if the proposed sewer line will serve less than 400 persons or less, consists entirely of gravity slow sewers, is not technically challenging with respect to design or construction and when adequate capacity of downstream facilities sewers is not an issue. After all changes required by VDH and WCSA have been made, (4) sets of plans bearing the appropriate seal shall besubmitted to the Health Department for final approval. If appropriate WCSA will inform VDH of its' intention to accept the wastewater from and the ownership of the sewer lines after successful construction

2.3 Detailed Plans:

Detail plans shall be submitted on 24" x 36" plan-profile sheets. Profiles should have a horizontal scale of not more than 100 feet to the inch and a vertical scale of not more than10 feet to the inch. A horizontal scale of 1" = 50' shall be preferred. Plan view should be drawn to a corresponding horizontal scale. Plans and profiles shall show:

d) Location of streets and sewers. Show recorded lots and other property lines. Show names of property owners when appropriate.

e) Permanent elevation benchmarks shall be set on NGS datum at approximately 1000 feet intervals. These benchmarks shall be shown graphically on the plan with the description and elevations shown on the profile.

f) Line of ground surface and proposed ground surface, size, material, and type of pipe, length between manholes, invert and surface elevation on NGS datum at each manhole, and grade of sewer between each two adjacent manholes. All manholes shall be numbered on the plan and correspondingly numbered on the profile. Where there is any question of the sewer being sufficiently deep to serve any residence, the elevation and location of the basement floor shall be plotted on the profile of the sewer which is to serve the house in question.

g) Locations of all special features such as inverted siphons, concrete encasements, elevated sewers, etc.

h) All known existing structures both above and below ground which might interfere with the proposed construction particularly water mains, gas mains, storm drains, etc.

i) Special detail drawings, made to scale to clearly show the nature of the design, shall be furnished to show the following particulars:
   i) All stream crossings, with elevations of the stream bed and water levels.
   ii) Details of all special sewer joints and cross sections
   iii) Details of all sewer appurtenances not shown on the standard detail sheet.

j) A statement that sewer lines shall be installed in accordance with WCSA General Sewer Line Specifications.

k) Plans shall have a title block and shall show the owner, the design engineer, and the date of the drawing and all revision dates.

2.4 - Design Data:

The following information shall be included with submittal of plans and specifications for approval:

a. Map showing area to be served directly and also tributary design population. Show method of calculation of tributary population.
b. Number of persons to be served directly and estimate of tributary design population. Show method of calculation of tributary populations.
c. Show any industrial, commercial, or institutional flow contribution with statement as to probability of increase or decrease of present flow. Indicate maximum or minimum rates of flow from these contributors and the presence of any flow that would be detrimental to the sewerage system.

2.5 Design Period:

In general sewer systems should be designed for the estimated ultimate tributary population, except in considering parts of the systems that can be readily increased in capacity. Similarly, consideration should be given to land use plans, zoning maps and to other planning docents and to the maximum anticipated capacity of institutions, industrial parks, apartment developments, etc.

2.6 Design Factors:

In determining the required capacities of sanitary sewers, the following factors should be considered:

a. Maximum hourly sewage flow.
b. Additional maximum sewage or waste flow from industrial plants.
c. Ground water infiltration and extraneous inflow
d. Topography of area.
e. Actual or anticipated zoning.
f. Location of waste treatment plant.
g. Depth of excavation.
h. Pumping requirements

2.7 Design Basis:

a. Per Capita Flow: New sewer systems shall be designed on the basis of an average daily per capita flow of sewage of not less than 100 gallons per day. This figure is assumed to cover normal infiltration, but an additional allowance should be made where conditions are unfavorable. Generally, the sewers should be designed to carry when running full, not less

than the following daily per capita contributions of sewage, exclusive of sewage or other waste flow from industrial plants.

i. Laterals and Sub-Main Sewer

1. Lateral - A sewer that has no other common sewers discharging into it,and shall be installed according to standard Detail Sheet 5.7 and 5.8.
2. Sub-Main - A sewer that receives sewage flow from one or more lateral sewers. Minimum peak design flow = 400% of average design flow.

ii. Main. Trunk, and Interceptor Sewers:

1. Main or Trunk - A sewer that receives sewage flow from one or more sub-main sewers.
2. Interceptor - A sewer that receives sewage flow from a number of gravity main or trunk sewers, sewage force main, etc. Minimum peak design flow = 250% of average design flow from main, trunk or interceptor.

iii. Alternate Method:

1. When deviations from the foregoing per capita rates are demonstrated, a description of the procedure used for sewer design shall be included.

2.8 Details of Sewer Design and Construction

a. Minimum Size:

i. No sewer shall be less than eight (8) inches in diameter except that service laterals for individual house connections and single apartment buildings of 6 units or less shall be a minimum of 6 inches in diameter. The 6" minimum diameter shall only apply to that portion of the lateral from the sewer main to the clean out at the property line or easement boundary.

b. Depth: - In general, sewers shall be sufficiently deep so as to receive sewage from basements and to prevent freezing. The absolute minimum shall be two (2) feet.

c. Slope: - All sewers shall be so designed and constructed to give mean velocities, when flowing full, or not less than 2.0 feet per second, based on the Manning equation using an "n" value of 0.013. Use of other practical "n" values may be permitted if deemed justifiable on the basis of research or field data presented. The following are the minimum slopes which should be provided; however, slopes greater than these are desirable:

Sewer Size	Minimum slope in feet per 100 Feet
6 inch	1.0
8 inch	0.40
10 inch	0.28
12 inch	0.22

Sewers shall be laid with uniform slope between manholes. Sewers on 20 per cent slope or greater shall be anchored securely with concrete anchors or equal, spaced as follows:

a. Not over 36 feet center to center on grades 20 percent and up to 35 percent.
b. Not over 24 feet center to center on grades 35 percent and up to 50 percent.
c. Not over 16 feet center to center on grades 50 percent and over.

d) Alignments: Sewers 24 inches or less shall be laid with straight alignment between manholes.

e) Increasing Size: When a smaller sewer joins a larger one, the invert of the larger sewer should be lowered sufficiently to maintain the same energy gradient. An approximate method for securing these results is to match the crowns of the pipe. Changes in the diameter of the sewer shall only be accomplished at manholes unless specifically approved in writing by WCSA.

f) High Velocity Protection: Where velocities greater than 15 feet per second are attainted, special provision shall be made to protect against displacement by erosion and shock.

g) Materials: Any material permitted by the technical specifications for sewers will be given consideration, but the material selected should be adapted to local conditions such as character of industrial wastes, possibility of septicity, soil characteristics, exceptionally heavy external loadings, abrasion and similar problems. Also the sewer material shall be kept uniform between sewer manholes, unless otherwise approved in writing by WCSA.

(1) Encasement: All sewers shall be designed to prevent damage from superimposed loads. Proper allowance for loads on the sewer shall be made because of the width and depth of trench. This may be accomplished by encasement in concrete (standard detail 5.10) or by placement in an approved conduit.

2.9 Details of Manhole Design and Construction

a) Location: Manholes shall be installed at the end of each line; at all changes in grade, size, or alignment; at all intersections; and at distances not greater than 400 feet for sewers 15 inches or less and 500 feet for sewers greater than 15 inches. Cleanouts may be used only

for special conditions and shall not be substituted for manholes nor installed at the end of laterals greater than 150 feet in length. A 20' off- set- hub shall be required at each manhole.

b) Drop Type: A drop pipe should be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches, the invert should be filleted to prevent solids deposition. A drop manhole shall also be provided when the there is less than a 90 degree angle between the entering influent line and the exiting effluent line.

c) Diameter - The minimum diameter of manholes shall be 48 inches.

d) Elevation drop through manhole - a minimum drop of 0.1 foot shall be provided between the influent invert elevation and the effluent invert elevation.

2.10 Protection of Water Supplies:

a) Water Supply Interconnections: There shall be no physical connection between public or private potable water supply system and a sewer, or appurtenance thereto which would permit the passage of any sewage or polluted water into the potable supply.

b) Relation to Water Works Structures: The horizontal distances from a well to any pipe carrying sewage or pipe in which sewage can bask up shall be at least 50 feet.

c) Relation to Water Mains:

i) Parallel Installation of Water and Sewer Lines:

(1) Normal Conditions

(a) Whenever possible, sewers and sewer manholes should be laid at least 10 feet, horizontally, from any existing or proposed water main.

(2) Unusual Conditions as follows must be approved in advance by WCSA and will only be considered on a case by case basis.

(a) Should local conditions prevent a lateral separation of 10 feet, a sewer or sewer manhole may be laid closer than 10 feet to a water main if:

(i) It is laid in a separate trench

(ii) It is laid in the same trench with the water mains located at one side on a bench of undisturbed earth.

(iii) In either case, the elevation of the crown of the sewer is at least 18 inches below the invert of the water main.

ii) Water and Sewer Lines Crossing

(1) Normal Conditions

(a) Whenever sewers must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water main.

(2) Unusual Conditions as follows must be approved in advance by WCSA and will only be considered on a case by case basis.

(a) When the elevation of the sewer cannot be buried to meet the above requirement, the water main shall be relocated to provide this separation the sewer line must be constructed of AWWA approved water pipe for a distance of 10 feet on each side of the sewer and be pressure tested in place and demonstrate no leakage.

2.11 Location of Sewers in Relation to Streams, Estuaries, Lakes, & Reservoirs

a) The tops of all sewers entering or crossing streams 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 material. Less cover will 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.

b) In paved channels, the top of the sewer lines should be placed below the bottom of channel pavement.

c) Sewers shall remain fully operational during 25-year flood/wave action.

d) Sewers and their appurtenances located along streams shall be protected against the normal range of high and low water conditions, including the 100-year flood/wave action.

e) Sewers located along streams shall be located outside of the stream bed wherever possible and sufficiently removed therefrom to provide for future possible channel widening.

f) Justification for requesting sewer lines to be located within stream beds shall be submitted for review with the plans specifications and design notes.

g) Sewers entering or crossing the streams shall be constructed of watertight pipe.

h) The pipe and joints shall be tested in place, shall exhibit "0" infiltration.

i) The sewers shall be designed, constructed and protected against anticipated hydraulic and physical, longitudinal, vertical and horizontal loads and erosion and impact.

j) Sewers laid on piers across ravines or streams shall be allowed only when it can be demonstrated that no other practical alternative exists. Such sewers on piers shall be constructed in accordance with requirements for sewers entering or crossing under streams. Construction methods and materials of construction shall be such that sewers will remain watertight and free from change in alignment or grade.

2.12 Force Mains:

These specifications do not cover force mains or pump stations.

2.13 As-Built Plans:

Upon completion of the project As-Built plans shall be provided to WCSA. WCSA will not accept ownership of the sewer line extension until these are provided. The As-Built plans shall show the location of all laterals, tees and other appurtenances. The As-Built plans must show the measurements to all appurtenances from a minimum of two permanent landmarks. Only then will acceptance of the facilities be considered.

PART III

SANITARY SEWER SPECIFICATIONS

TECHNICAL SPECIFICATIONS

GENERAL REQUIREMENTS

3.1 Statement of Work:

The requirements herein are intended to apply to those items of labor, tools, materials, and equipment necessary for the construction of the sanitary sewer lines and appurtenances as shown on the plans and described in these specifications.

3.2 Preconstruction Conference:

Prior to the start of any construction the Contractor (and developer if the project is in a subdivision and the work is being done for the developer to be turned over to WCSA at completion of construction) shall attend a conference at the project site with WCSA's Inspector and General Manager or his designated agent. At this meeting a general construction schedule will be developed so the WCSA's inspection services can be planned. The Contractor's contact person will be designated at this meeting, and communication at the job site between WCSA's representative and the contractor shall be through this individual.

3.3 Inspection:

All construction work for WCSA or work done for or by an Owner on sewer lines that will connect to the WCSAs' sewer shall be subject to inspection and approval by WCSAs' personnel. (This does not relieve the Owner of his responsibility to provide the professional inspection services necessary for a licensed professional engineer to certify the work as being "completed in accordance with approved plans and specifications") No sewer line shall be installed and covered without approval of the WCSA Inspector. Sufficient notice (preferably 3 WCSA working days) shall be given prior to the need for inspection by the WCSA Inspector. Inspections by the WCSA Inspector will not relieve the Contractor of maintenance responsibility of the sewer system during the maintenance period.

3.4 Plans. Construction Staking, and Cut Sheets:

The Contractor shall have on the job site at all times at least one individual who is competent to read and understand the plans, cut sheets, and grade stakes. Prior to any construction the sewer line shall be staked by or under the supervision of a registered engineer or surveyor and cut sheets shall be prepared and supplied to the WCSA Inspector and the Contractor. If laser alignment equipment is used, extra care shall be taken to assure that grades and alignment are in accordance with plans. If batter boards are used, at least three batter boards will be in place at all times in order to maintain proper grade and alignment.

3.5 Safety

The Contractor will
provide adequate protection to safe guard and protect the public and workmen when working on public right-of-ways and property. The Contractor shall be subject to inspection by the WCSA designated Safety Inspector, and will be required to abide by the Safety Inspector's recommendations and will be subject to work stoppage if compliance is not made.

3.6 Caution in Excavation:

The contractor shall proceed with caution *in the* excavation and preparation of the trench so that the exact location of underground structures, both known and unknowns, may be determined. The location of existing underground structures should be determined by the Contractor enough in advance of the pipe laying to provide far a change of design alignment by the Design Engineer if required. Any loss or damage to the site or to the underground or surface utilities within the site area due to construction activities shall be borne by the Contractor.

3.7 Approved Plans:

No work shall commence on any sewer system until the Contractor has in his possession a complete set of approved plans prepared by the registered engineer or a properly licensed land surveyor whose signed seal shall appear on each plan sheet. Each set of plans shall also be approved and signed by the General Manager of WCSA or his designated agent. Any significant change from the original approved plans shall require an additional approval from the Director. Verbal approval from the WCSA Inspector shall

be sufficient for minor changes. The WCSA shall decide whether a change is a minor change or a significant change.

3.8 As-Built Plans:

The Contractor shall keep at the job site at all times two sets of approved plans and one set of project specifications. Within five days after completion of the project, the Contractor shall return to the Design Engineer one set of marked plans showing the sewer line in an "As-Built" condition. This shall include the location of all laterals, tees and other appurtenances. The information contained on these "As-Built" prints will then be transferred to the original tracings by the design engineer and prints delivered to WCSA prior to acceptance and use of the sewer line.

3.9 Maintenance Period:

After a professional engineer has certified the sewer line to be completed in accordance with the approved plans and specifications, a final inspection by the appropriate regulatory agencies including the Virginia Department of Health, the delivery of a complete set of "As-Built" plans to WCSA, WCSA will send a letter of provisional acceptance to the Owner. At this time the sewer line may be put into service. The Owner shall be responsible for the maintenance of the new facilities for a period of not less than twelve (12) months commencing on the date of the provisional acceptance letter issued by WCSA. The Owner shall repair any and all defects in the facilities that occur during the prescribed period prior to final acceptance of the new facilities into the WCSA sanitary sewer system.

3.10 Exceptions:

Exceptions may be made to these specifications in cases where engineering data are presented to the WCSA and the Virginia, Department of Health by a Virginia licensed professional engineer or properly licensed land surveyor which shows the suitability of some alternate method or material. Such request for approval of an exception shall be made in writing, properly documented, to WCSA. WCSA will not grant an exception to these specifications until the Virginia Department of Health and the Department of Environmental Quality have concurred with granting the proposed exception, when the exception is within the purview of both departments.

3.11 Pumping Stations:

All pumping stations shall be designed in accordance with the Commonwealth of Virginia's SCAT Regulations. The owners and/or his engineer must abide by all

requirements of these regulations including formal review and approval of plans, specifications, and design notes by the Virginia Department of Health, Department of Environmental Quality, and WCSA. Upon approval of plans, specifications and design notes, WCSA will inform the owner in writing of the conditions under which WCSA will accept the pump station and the wastewater generated. The owner is responsible for obtaining any required construction permits from the regulatory agencies involved including the Department of Environmental Quality as well as other local permits which are required.

PART IV

SANITARY SPECIFICATIONS

TECHNICAL SPECIFICATIONS

EXCAVATION, INSTALLATION AND BACKFILLING

4.1 Classification: Excavation shall be unclassified regardless of material encountered unless otherwise specified.

4.2 Clearing:

Only that portion of the right-of-way or easement actually needed for construction shall be cleared unless directed otherwise by the inspector. In no case shall clearing or debris from clearing operations he taken past right-of-way or easement lines into private property. Areas disturbed by construction operations shall be protected from erosion by suitable methods outlined by WCSA.

4.3 Excavation and Preparation of Trench:

a) Depth - Depth of trenches shall be as shown on plans and cut-sheets except that the trench shall be excavated to allow for a depth of 1/4 of the pipe outside diameter or a minimum of 4" of Virginia Department of Highways #7 or #8 aggregate bedding in earth, 6 inches of aggregate bedding in rock.

b) Width - Width shall be sufficient to allow laying without walking or standing on the pipe and shall not be less than 6 inches on each side of the pipes largest diameter.

c) Unsuitable Material - Wet or otherwise unsuitable soil at the subgrade shall be removed and replaced with approved sound materials. Excess or unsuitable materials shall be disposed of by the Contractor.

d) Rock Excavation - Ledge rock. boulders, and large stones shall be removed to provide a clearance of at least 6" below and on each side of all pipe or manholes.

e) Trench Protection - The Contractor shall furnish and erect such sheathing, bracing and shoring, and shall furnish necessary signs, barricades and temporary lighting as may be pertinent for the protection of his work, employees, the public, adjacent strictures, and to guard against contingencies which might give rise to delays in the work. Sheathing left in place shall be at the Contractor's expense. Where trench wall sloping is necessary for safety or other reasons, the Engineer shall be notified to determine if additional strength pipe will be required. Responsibility for preservation of trench banks and other excavated spaces and the prevention of injury to any persons or property shall rest entirely with the contractor. Normally a maximum of 200 feet of trench will be allowed open at any time. If in the opinion of the owner, a safety hazard exists and the Contractor has not made a reasonable effort for correction, the owner will take appropriate action at the expense of the Contractor.

f) Pumping, Bailing & Draining - The Contractor shall remove by pumping, bailing, or other appropriate means any water which may accumulate or be found in the trenches or other excavations and shall form dams, flumes or affect other means to keep the excavations clear of water while pipe is being installed.

g) Blasting - If explosives have to be used in the execution of the work, only experienced powder men shall be employed and the work shall be performed in compliance with the "Rules and Regulations Governing Manufacture, Storage, Handling, Use and Sale of Explosives" as adopted by the Safety Codes Commission of the Commonwealth of Virginia in 1964 and all amendments or revisions thereof. An explosives permit shall be obtained from Washington County, Virginia and other regulating authorities as appropriate, prior to any blasting. Damage of any nature resulting from blasting operations shall be satisfactorily corrected by the Contractor at no cost to WCSA.

h) Excavation in Pavement - All work done within the Virginia Department of Transportation (VDOT) right of way shall be done in accordance VDOT specifications and directives and this work shall also be acceptable to WCSA. This includes cutting of pavement, pavement restoration, jacking or boring and encasing sewer line under VDOT roads.

i) When pavement must be cut, the cut shall be made in a straight line, parallel to the pipe and 6 inches wider than the trench, on each side, so that an undisturbed shoulder will be provided under the new work.

ii) Sidewalks or curb and gutter disturbed by the construction shall be removed and replaced at existing joints.

iii) Cutting shall be done neatly so that a uniform, straight joint will result to provide a bond with the original concrete or pavement.

iv) When trenches cross streets, not more than one-half of the street width shall be disturbed at one time, and the first trench opening shall be restored to satisfactory travelable condition before the second half is excavated.

v) Placement of excavated material on existing pavement shall be avoided whenever possible, and when so placed the pavement shall be satisfactorily cleaned by an approved method.

vi) No cleated equipment shall be used on pavements.

vii) Street drainage shall not be clogged, and shoulders and ditches affected by trenching operations shall be maintained in satisfactory condition.

viii) Entrances shall not be blocked except for short periods and ingress and egress to adjacent property shall be maintained at all times.

ix) Traffic shall not be blocked or re-routed on public streets without permission from WCSA.

4.4 Installation of Pipe, Fittings and Manholes

a) Placement:

i) Pipe shall be placed in a trench in such a manner as to prevent damage to pipe.

ii) Under no circumstances shall pipe be dropped or dumped into the trench.

iii) Any damaged pipe discovered during delivery or installation shall be immediately removed from the project.

b) Cleaning:

i) Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line.

ii) Spigot and bell ends of pipe and gaskets shall be cleaned and lubricated according to the manufacturer's instructions.

iii) At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug.

c) Direction of Laying

i) Pipe shall be laid upgrade with bell ends facing in the direction of laying, unless directed otherwise by the engineer.

ii) Each piece of pipe shall be laid true to line and grade.

iii) 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.

iv) Adjustments to 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 body of the pipe.

v) 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 pipe.

d) Bedding:

i) Bedding shall consist of materials listed in Part V..

ii) Depth of bedding shall not be less than 4 inches.

iii) Minimum depth of aggregate in rock excavation shall be 6 inches.

iv) For PVC pipe the bedding shall be Class A or B as shown on standard detail sheet SD13. For ductile iron pipe bedding may be Class A, B, or C unless otherwise stated.

v)

e) Installation of Tees and Laterals:

i) Tees and laterals shall be installed with the same care that main line sewers are laid.

ii) Slopes shall be in accordance with the uniform state wide building code.

iii) Laterals shall be of 6" pipe of the same material as the main sewer pipe and shall run to property lines unless otherwise indicated on the plans.

iv) Laterals shall be properly capped and suitable sealed to prevent infiltration of water into connections.

v) Caps or plugs shall be placed to prevent blow-off during exfiltration or air-testing.

vi) Ends of laterals shall be marked by a steel marker driven hush with the ground and in such a manner as to brace the plug on the lateral.

f) Clean Outs:

i) All service laterals shall include a clean out. (Detail Sheet No. SD8)

g) Installation of Manholes:

i) The sub-grade and bedding for the monolithic base for the precast manhole shall be prepared similar to that for pipe.

ii) The invert channels shall be formed with concrete as shown on the Standard Detail Sheet and shall be smooth and semicircular in shape, conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. The floor of the manhole outside of the channels shall be smooth and shall slope toward the channels not less than 2 inches per foot nor more than 4 inches per foot.

iii) All connections to the manholes shall require doughnuts to provide flexible joints between the pipe and manholes.

iv) Manhole frames shall be set level on a full bed of mortar to the proper grade. O-ring seals will be used in placement of manhole sections.

v) Under no circumstance shall manholes be left in an incomplete condition such that surface water could enter into the sewer line in any significant amount.

vi) Where new manholes are installed on existing sewer lines, the base may be constructed separately from the first vertical section of the manhole.

vii) When required by WCSA, water tight covers will be used where ever the manhole tops maybe flooded. As a minimum water tight manhole covers are to be used to the elevation of the 25 year flood/wave action.

h) Installation of Manhole Stub-outs:

i) Manhole stub-outs shall be provided where indicated or directed.

ii) Stub-out pipes shall be 8 inches in diameter unless otherwise indicated on the drawings and shall be the same pipe material as the sewer pipe.

iii) Manhole stub-outs shall be extended from the manhole a minimum of 6 feet. Stub-outs shall be sealed, braced and marked in the same manner as the ends of laterals as stated in Section "e" above.

iv) In-flow and out-flow pipe should be cut and placed so that there will be a bell joint at least 12" but not more than 16" from the manhole to prevent sheering of pipe in the event of shock or movement of manhole during completion or construction.

i) Ventilation:

i) Ventilation of gravity sewer systems shall be provided where continuous watertight sections greater than 1,000 feet in length are incurred. Ventilation through service connection plumbing will be considered when such plumbing exists.

j) Testing - All sewer lines shall be tested by any or all of the following methods for both displacement or structural faults and for water tightness as directed by the WCSA Inspector. The testing methods shall be at the option of WCSA. The Contractor shall make all preparations and shall supply the labor for all tests. No charge will be made for initial witnessing of tests by the WCSA representatives, but the cost of each succeeding test required on the same section of line caused by failure of the tests shall be charged to the Contractor.

i) Displacement and Structural Testing - T.V.:

(1) If this test is required the TV equipment must be supplied by the Contractor at his expense to be used to locate defects in the pipe line. These shall then be remedied by the Contractor at his expense.

ii) Water Tight Testing - Infiltration:

(1) When, in the opinion of the WCSA Inspector, the trench or excavation is sufficiently saturated as a result of ground water or rain, such that the hydrostatic head is equal to or greater than four (4) feet above the crown of the sewer pipe, tests may be made on the basis of infiltration.

(2) The Contractor shall carefully measure the flow of water at the nearest downgrade manhole.

(3) The necessary supply of water, plugs, labor and equipment shall be furnished by the Contractor at his expense.

(4) Three series of measurements shall be made at not less than one hour intervals, and the results shall be reduced to an average. This average shall then be computed so as to apply for the 24-hour period. All such tests shall be made only during observation of the Inspector or other representatives that WCSA shall designate.

(5) Infiltration shall not exceed a rate of 100 gallons per inch of pipe diameter per mile per day for any section of the system. All defective work shall be immediately repaired and re-tested until proven to be satisfactory.

iii) Water Tight Testing-Exfiltration:

(1) The line to be tested shall be subjected to a minimum of 4 feet of head, or head to the top of the manhole, whichever is lesser, above the crown of the pipe.

(2) the leakage outward or inward shall not exceed 100gallons per inch of nominal pipe diameter per mile per day (2400 gpd/mi maximum) for any section of the system.

(3) Manholes should be tested prior to pipeline testing.

iv) Water Tight Testing - Air: The following procedure shall be followed for the air testing:

(1) Clean pipe to be tested by propelling snug fitting inflated rubber ball through the pipe with water if necessary.

(2) Plug all pipe outlets with suitable test plugs. Brace each plug securely.

(3) If the pipe to be tested is submersed in ground water. Insert a pipe probe by boring or jetting, into the backfill material adjacent to the center of the pipe, and determine the pressure in the probe when air passes slowly through it. This is the back pressure due to ground water submergence over the end of the probe. All gauge pressures in the test shall be increased by this amount.

(4) Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 psig.

(5) After an internal pressure of 4.0 psig., start stop watch. Determine the time in seconds that is required for the internal air pressure to reach 2.5 psig minimum permissible pressure holding time for runs of single pipe diameter and for systems of 4" , 6" or 8" laterals in combination with trunk lines are indicated in the attached tables in seconds.

NOTE: The air test (using vacuum or positive pressure) may be dangerous if, because of ignorance 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 blow outs. In as much as a force of 250 lbs. is exerted on an 8" plug by an internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or of a plug that is partially deflated before the pressure is released can be dangerous. As a safety precaution, pressurized equipment should include a regulator 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.

v) Water Tight Testing Hydrostatic- Manholes

(1) All Lines in the manhole will be sealed with inflatable plugs.

(2) The manhole shall then be filled with water to the top. A 12 hour soak shall be allowed.

(3) Leakage shall not exceed 1/4 gallon per hour per foot of depth.

vi) Water Tight Testing Vacuum - Manholes - As an alternate, manholes may be tested by vacuum test, after assembly but prior to backfilling.

(1) The manhole vacuum Test shall comply with ASTM standards or the Virginia Department of Health, Office of Water Programs Working Memo #550 dated November 4, 1987.

(2) This test method is only applicable to precast concrete manholes. Testing shall include the joint between the concrete cone or spacer rings and the manhole frame.

(3) Stub-outs, manhole boots and pipe plugs shall be secured to prevent movement while the vacuum is drawn.

(4) Installation and operation of vacuum equipment and indicating devices shall be in accordance with equipment specifications for which performance information has been provided by the manufacturer and approved by the Virginia Department of Health.

(5) A measured vacuum of 10 inches of mercury shall be established in the manhole. The time for the vacuum to drop to nine inches of mercury shall be recorded.

(6) Acceptance standards for leakage shall be established from the elapsed time for a negative pressure change from 10 inches to nine inches of mercury. The maximum allowable leakage rate for a four-foot diameter manhole shall be in accordance with the following:

Manhole Depth	Minimum Elapsed Time for a Pressure Change of 1 Inch Hg
10 ft. or less	60 seconds
> 10 ft. but < 15 ft.	75 seconds
> 15 ft. but < 25 ft.	90 seconds

(7) For manholes five feet in diameter, add an additional 15 seconds and for manholes six feet in diameter, add an additional 30 seconds to the time requirements for four-foot diameter manholes.

(8) If the manhole fails the test,necessary repairs shall be made and the vacuum test and repairs shall be repeated until the manhole passes the test or the manhole shall be tested in accordance with the standard exfiltration test and rated accordingly.

(9) If a manhole joint mastic is completely pulled out during the vacuum test, the manhole shall be disassembled and the mastic replaced.

4.5 Backfilling (See Part V of the specifications for the specific material requirements bedding, haunching, initial, and final backfill material and compaction required for each)

a) Haunching - the soil placed at the sides of the pipe from the bedding up to the spring line is the haunching. The care with which this material is placed has a significant influence on the performance of the sewer pipe. Care must be taken to carefully and completely tamp under the haunches of the pipe. Special care shall be taken to avoid damaging or displacing the pipe during this operation.

i) PVC pipe - for flexible pipe compaction of the haunchng material is essential. The spring line is defined as 1/2 the pipe diameter. Only Class A or Class B bedding is acceptable.

ii) Ductile iron pipe - Class A, B or C bedding is acceptable unless otherwise stated on the plans. If Class C bedding is used the pipe shall be haunched to 1/4 the pipe diameter.

b) Initial Backfill:

i) All trenches shall be backfilled by hand or other approved method with approved material in layers not exceeding 6 inches, from the top of the haunching material to a depth of 1 foot above the pipe.

ii) Material shall be deposited on both sides of the pipe simultaneously and compacted into place by tamping.

c) Backfilling to Grade:

i) From the point one foot above the pipe, the remainder of backfilling shall be carried up evenly on both sides of the pipe in increments of not more than two feet

ii) Each layer of earth shall be compacted into place by tamping, before the next layer is applied. Damage to pipe lines or other structures resulting from compaction shall be corrected by the Contractor at his expense, before acceptance and before any service is connected.

iii) In areas where settlement is not critical, and where approved. by the Engineer. alternate methods of backfilling may be employed, with written approval from the Utilities' Inspector.

d) Backfill Under Pavement:

i) Backfilling of trenches under existing pavement or proposed pavement shall be layers of not more than 12 inches thickness and shall be compacted to a minimum of 95% density as compared to density of the same material when tested in accordance with AASHO Specification T-99.

ii) Compaction shall be by pneumatic tampers or other approved methods.

iii) Compaction by water will not be permitted under pavement.

iv) All fill material under the pavement shall consist of aggregate base material meeting the requirements of the Virginia Department of Highways Specification 210 Type I.

v) This material shall be thoroughly and uniformly tamped with pneumatic tampers or other approved methods.

vi) Moisture content shall be within 20% of optimum.

vii) The Contractor will be responsible for and shall repair any settlement in the backfill or pavement for a period of one year after completion of the work.

4.6 Restoration

a) Finished Surfaces:

i) Uniformly smooth grading of disturbed areas shall be required after backfill and compaction.

ii) Finished surfaces shall not be more than 0.10 feet above or below the original grade or cross section.

iii) Ditches and gutters shall be finished to drain readily.

iv) In grass or lawn areas the last four inches of compaction fill will consist of topsoil or an approved soil which will support a turf growth after fertilization and seeding.

v) Settlement or other damage that occurs prior to acceptance of this work shall be repaired and grades satisfactorily reestablished.

b) Seeding

i) The seeding, fertilizing and mulching of the areas prepared for seeding shall be in accordance with these specifications and Section 529, *Seeding of the Virginia Department of Highways Road and Bridge Specifications*, using the following quantities of seed, fertilizer, lime and mulch:

(1) Seed:

(a) Mixture shall be sown at a rate of 2.5 pounds per 1000 square feet in the following proportion:

(i) Certified Merian Kentucky Bluegrass :40°%

(ii) Certified Kenblue Kentucky Bluegrass Or Certified South Dakota Kentucky Bluegrass 30°%

(iii) Certified Pennlawn Red Fescue 30%

(2) Fertilizer:

(a) Shall be 10-20-10 fade produced by an approved manufacturer.

(b) Fertilizers shall be spread at a rate of 24 pounds per 1000 square feet.

(3) Lime:

(a) Shall be ground agricultural limestone spread at a rate of 50 pounds square foot,

(4) Mulch:

(a) Shall be applied to the seeded area at a rate of 100 pounds per 1000 square feet. and maintained until growth is obtained.

(5) Application:

(a) Seed fertilizer and lime shall be uniform and at the rate specified.

(b) Seed bed shall be loosened to a depth of 4 inches and fertilizer and lime thoroughly mixed in by discing, harrowing, or railing.

(c) Seed shall be uniformly spread and worked into the soil bed toa depth of at least half an inch.

(d) Mulch consisting of straw or a similar material shall be spread to a depth of one and one-half inches over the entire area disturbed.

ii) Planting Season - Shall be between March 15 and May 15 or between August 15 and November 1 unless otherwise authorized.

iii) Maintenance - Of the seeded area until establishment of an acceptable stand of grass is obtained shall be the responsibility of the Contractor. Such maintenance shall include reseeding, where necessary, and the replacement of all mulch destroyed or removed by any cause.

iv) Alternate Methods - Alternate methods of obtaining an acceptable stand of grass will be considered upon request to WCSA detailing methods and materials proposed.

c) Replacement of Pavement and Structures: - The Contractor shall restore all pavement, sidewalks, curbing, gutters, shrubbery fences. poles, or other property and surface structures removed or disturbed as a part of the work to a condition equal to that before the work began, as directed by the WCSA Inspector.

d) Cleanup: Cleanup of surplus materials, tools, temporary structures, dirt, rubbish, and excess earth from the excavation shall be maintained during construction progress as directed by the WCSA Inspector. At the completion of construction the sites will be left in a safe and clean condition.

4.7 Sewers Crossing Streams, Estuaries. Lakes, & Reservoirs

a) Sewers entering or crossing the streams shall be constructed of watertight pipe.

b) The pipe and joints shall be tested in place, shall exhibit no infiltration.

4.8 **Boring, Jacking and Tunneling** - This section covers the installation of pipelines using horizontal earth boring and jacking. Tunneling is not covered by these specifications will only be considered when it is absolutely necessary. Tunneling will be approved on the basis of plans and specifications specifically prepared for the project by a registered professional engineer with tunneling experience.

a) Comply with all codes, laws, ordinances, regulations, and permits of governmental and other authorities having jurisdiction over this part of the work.. These may include but are not limited to

1) Virginia Department of Transportation (VDOT) Road and Bridge Specifications, latest edition.
2) American Railway Engineering Association (AREA) Specifications, latest edition.

b) The Contractor shall take every precaution to guard against any movement or settlement of existing or new construction, railways, utilities, paving, walks, light standards, piping, conduit, etc., and shall provide at his own expense, all sheet piling, bracing or shoring necessary in connection therewith. The Contractor shall be entirely responsible for the design, and adequacy of any sheet piling, bracing and shoring required.

c) Product data for steel casing pipe and associated appurtenances shall be submitted prior to installation, including evidence that pipe and mounting devices complies with the requirements of these specifications.

d) Highway Crossing

i) Pipeline crossing shall be installed in a steel casing installed by the "dry case as you go" boring and jacking method.

ii) The pipeline crossing shall be installed as shown on the Drawings.

iii) If the Contractor determines that boring and jacking of the highway crossing is not possible due to rock, the Contractor shall make application to VDOT to allow open cutting of the crossing. Contractor shall make every effort to bore and jack before abandoning this method, including use of a rock head. If the trench is allowed to be open cut, casing pipe shall be provided and the trench shall be backfilled entirely to the bottom of the pavement base course and the pavement restored in accordance with VDOT requirements.

iv) All operations of the Contractor shall be subordinate to the free and unobstructed use of the highway right of way for passage of traffic without delay or danger to life, equipment

or property. The Contractor shall provide all necessary bracing, bulkheads, and shields to ensure complete safety to all traffic at all times. The Contractor shall arrange for and pay for all flagmen, signs and other measures required by VDOT.

e) **Railroad Crossing** - Pipeline shall be installed in steel casing by the "dry case as you go" boring and jacking method, or by tunneling (not covered by these specifications). The pipeline crossing shall conform to Roadway and Ballast Section 5.2 - Specification for Pipelines Conveying Non-Flammable Substances of the American Railway Engineering Association Manual for Railway Engineering. The pipeline crossing shall be installed as shown on the Drawings.

i) The live load surcharge from the track adjacent to sheeting and bulkheads for the excavation pits and for the trench shall be taken into account in the sheeting and bulkhead design. Allowable stresses contained in the American Railway Engineering Association Specifications (Chapters 7, 8, and 15) shall be used. A safety factor of two (2) shall be used in the temporary sheeting or bulkhead design.

ii) Safety railings shall be installed when temporary sheeting or bulkheads are within fifteen (15) feet of the track.

iii) The Contractor is required to submit for approval through the Engineer to the Railroad a construction procedure for the temporary sheeting or bulkhead construction. Three copies of the detailed drawings shall be submitted, showing the following.

(1) Timber, steel, bolt and weld sizes and details.

(2) Dimensions showing distances from centerline track to temporary sheeting or bulkheads and between supporting elements.

(3) Section showing temporary sheeting or bulkhead heights and track elevation. Also, calculations covering temporary sheeting or bulkhead design shall be submitted for approval. The Contractor shall not proceed with the pipe or tunnel liner installation until he has received acceptance of the plan and schedule from the Engineer and from the Chief Engineer's Office of the Railroad.

iv) All operations for the Contractor shall be subordinate to the free and unobstructed use of the Railroad's right of way for passage of traffic without delay or danger to life, equipment or property.

v) The Contractor shall provide all necessary bracing, bulkheads, and shields to ensure complete safety to all traffic at all times.

vi) The Contractor shall furnish insurance as specified in the Supplementary Conditions. The Contractor shall arrange for and pay for all flagman, signs and other measures required by the Railroad.

vii) Dry Jacked Boring Method

(1) The jacking operation shall be performed in such a manner that settlement of the ground, railway, or the highway above the pipeline will not occur.

(2) The use of water or other fluids in connection with the boring and jacking operation shall not be allowed.

(3) Excavation shall not precede the jacking operation more than is necessary.

(4) Lengths of steel pipe shall be welded to the preceding length installed.

(5) Excavation shall be made by auger or manual methods at the Contractor's option to suit conditions encountered.

(6) The Contractor shall repair or replace, as directed by the Engineer, at his own expense, casing pipe which is damaged during the jacking operation.

f) **Carrier Pipe Installation** - After installation of the casing pipe or the tunnel liner, the carrier pipe shall be installed.

i) Each joint of the carrier pipe shall be supported by casing chocks or other devices as approved by WCSA or shown on the Drawings.

ii) The ends of the casing pipe or the tunnel shall be closed off by concrete or masonry block wall prior to backfilling. A drain line shall be provided at the lower end and shall run to a one cubic yard french drain. The drain shall be constructed of cement lined ductile iron pipe or alternative material acceptable to the Engineer.

PART V

SANITARY SEWER SPECIFICATIONS

TECHNICAL SPECIFICATIONS

MATERIALS

5.1 Pipe - Sanitary sewer and lateral pipe shall be one of the following materials, at the Contractor's option, except when otherwise indicated on the plans.

a) PVC Pipe:
   i) PVC pipe for sewers and laterals shall be in accordance with ASTM. D3034. The walls shall have a minimum thickness of DR - 35.
   ii) The pipe shall have integral bell and spigot joints.
   iii) Bell and spigot joints shall be supplied with a rubber O-ring to provide for contraction and expansion so as to insure water tightness.
   iv) All fittings shall have identical bell and spigot configurations as the pipe and shall be supplied by the same manufacturer as the pipe.
   v) Where PVC pipe is used and the line of sight is restricted between manholes, metal pipe detection tape shall be placed in the trench with the pipe in. The tape shall be installed in accordance with the tape manufacturers recommendations.

b) Ductile Iron Pipe:
   i) Ductile Iron pipe shall be in accordance with AWWA C151/ANSI A21.51.
   ii) Pipe thickness shall conform with AWWA C150/ANSI 21.50.
   iii) All pipe shall be cement mortar lined in accordance with AWWA C104/ANSI 21.4, except that the lining shall be "enameled" or 1/2 the normal thickness.
   iv) Buried ductile iron pipe shall have push-on joints, unless otherwise specified on the Drawings.
   v) The pipe shall be minimum Class 50 for nominal diameters 6-inch and larger and Class 51 for pipe diameters less than 6-inch.
   vi) Joints shall be rubber gasket joints in accordance with AWWA C111/ANSI A21.11.
   vii) Outside coating shall be asphaltic.

c) Plugs or Cans:
   i) Plugs or caps used shall be those manufactured specifically for the type of pipe used.

ii) They shall be secured such that they will be watertight and will withstand the internal pressure applied by air or exfiltration testing.

2) 5.2 Manholes:

a) Materials

i) Manholes shall be constructed of precast reinforced concrete conforming to ASTM C 478. Concrete shall be minimum compressive strength of 4000 psi at 28 days.

ii) Manholes shall be equipped with cast iron frames and covers as shown on the standard details.

iii) All reinforcing steel shall conform to ASTM A615

iv) Manholes steps shall be steel encapsulated in corrosion resistant rubber or copolymer polypropylene plastic, as manufactured by Delta Pipe Products (WEDGLOK), Model #PS1-PF as manufactured by M.A. Industries, or equal.

b) Dimensions

i) Manholes shall have an inside diameter of four (4) feet unless otherwise shown on the Drawings.

ii) Minimum wall thickness shall be five (5) inches.

c) Configuration

i) Base units shall be tub or monolithic type with walls that extend above the top of the largest inlet or outlet pipe.

ii) Joints shall be O-ring joints conforming to ASTM C443. Joints shall be sealed with flexible butyl resin sealant conforming to Federal Specification SS-S-210A and AASHTO M198

iii) Each unit shall have no more than two (2) holes for installation and/or handling. All holes shall be plugged with rubber stoppers and mortared upon completion of setting manhole.

iv) Manhole top units shall be eccentric taper type, at least three (3) feet in height, or flat top where indicated.

v) Manholes shall be constructed to the required height to insure that the top of the frame and cover will be set at finished grade, unless specified or indicated otherwise. Spacer rings or other means shall be provided to allow up to eight (8) inches adjustment to final pavement..

d) Manhole steps

i) shall be provided in all manholes

ii) shall be on 16" center maximum, vertically aligned and uniformly spaced for the entire depth of the structure.

iii) Steps shall be located in the structures so as to land upon a bench..

iv) Steps shall be in accordance with the dimensions and capable of withstanding the loads specified in ASTM C478, and shall be designed for installation in a sanitary sewer.

v) Steps shall be required in all structures with a depth greater than four (4) feet.

5.3- Manhole Connections

a) Sanitary sewer pipe connections to manholes shall be flexible connections

i) Manhole connections to gravity sewer line shall be made to maintain a flexible connection by utilizing rubber gaskets cast integrally in the manhole base at the time of manufacture.

ii) Rubber gaskets shall conform to ASTM C443 and shall meet the performance and test requirements of ASTM C425.

iii) Flexible connections shall be A-LOK Manhole Pipe Seal, manufactured by A-LOK Corp., or equal.

iv) As an alternate, and for connections to existing manholes, connections may be made utilizing field installed positive seal gasketing systems. Field installed connections shall be PSX, manufactured by Press Seal Gasket Corporation; KOR-N-SEAL, manufactured by National Pollution Control Systems, Inc.; or equal.

5.4 Manhole Frames and Covers

a) Manhole frames and covers shall be cast ductile iron in accordance with the dimensions shown on the standard details.

b) Minimum opening diameter shall be 24 inches. The words "SANITARY SEWER" shall be cast in the cover so as to be plainly visible.

c) Casting shall be manufactured true to pattern with component parts fitted together in a satisfactory manner.

d) Frames and covers shall have machined bearing surfaces to prevent rocking or rattling. Castings shall be uniform in quality, without defects.

e) Standard manhole frames and covers shall be GTS, manufactured by Quality Water Products, or equal.

f) Watertight manhole frames and covers shall be PAM-TIGHT, manufactured by Quality Water Products, or equal.

g) Anchor bolts shall be supplied by manufacturer

5.5- Manhole inverts

a) The invert channels of manholes shall be smooth and semi-circular in shape
b) The invert channels shall be sized to match the inlet and outlet pipes and sloped to provide a smooth transition between the inlet and outlet pipes.
c) Changes in direction of flow shall be made with a smooth curve channel with a radius as large as the base will permit.
d) The invert channels and benches may be formed directly in the concrete base unit of the manhole or may be constructed with brick and mortar. The benches shall slope a minimum of two (2) inches per foot toward the invert channel.
e) The surface of the channels and benches shall be concrete.
f) Modified shaping, defined as a channel two-thirds the height of the largest pipe, shall be acceptable.

5.6 Grout

a) Aggregate shall be clean, washed natural sand, free from dirt and foreign material, in accordance with ASTM C 144.
b) .Portland Cement shall be Type II, in accordance with ASTM C150.
c) Water shall be clean and free from injurious amounts of oil, acid, alkali, organic or other deleterious matter.
d) Grout used for shaping invert channels and filling connection openings shall be composed of two (2) parts aggregate and one (1) part Portland Cement, mixed in accordance with ASTM C270.

5.7 Cleanouts

a) Sewer clean-outs shall be constructed of Schedule 40 PVC pipe, unless otherwise indicated, which is the same diameter as the sewer main it is servicing.
b) Clean-outs shall be threaded to accept pipe plug.

5.8 Steel Casing Pipe

a) Steel casing pipe shall conform to ASTM A139, Grade B (No Hydro).
b) Joints shall be butt welded, watertight in accordance with the American Welding Society's recommended procedures.

c) Casing pipe diameter and wall thickness shall be as approved by the WCSA and VDOT, AREA or other authorities having jurisdiction.

d) Methods, equipment and devices used to install and mount the carrier pipe within the casing pipe shall be approved in advance by WCSA.

5.9 **Installation** Items shall be installed in accordance with manufacturer's recommendations, the Drawings, and related Specification Sections.

5.10 **Bedding and Backfill**

a.) Soil classification - For different categories of embedment materials, different construction procedures are specified. Soil classifications under the Unified Soil Classificaton System, including manufactured materials are grouped into five broad categories.

1. Class I - angular 0.25 to 1.5 inch graded stone. Class I material provides the best material for construction of a stable sewer pipe-soil system. When used as bedding, a compaction of 85% Standard Proctor Density is required. When using as haunching, or initial backfill a compaction of 80% Standard Proctor Density is required. This can be obtained with minor tamping effort.
2. Class II - Coarse sands and gravels with a maximum particle size of 1.5 inches, including variously graded sands and graves containing small percentages of fines. Soil types GW, GP, SW and SP are included. When used as haunching these shall be compacted to 85% Standard Proctor Density.
3. Class III - This class comprises fine sand and clayey gravels, including fine sands, sand clay mixtures, ang gravel clay mixtures. Soil types GM, GC, SM and SC are included. When used as haunching, 90% Standard Proctor Density is required.
4. Class IV and V - These materials require special effort for compaction and therefore are not suitable for bedding, haunching or initial backfill. Therefore they will not be allowed.

b) Bedding material - Shall be Class I material compacted to 85% Standard Density Proctor for PVC and ductile iron pipe.

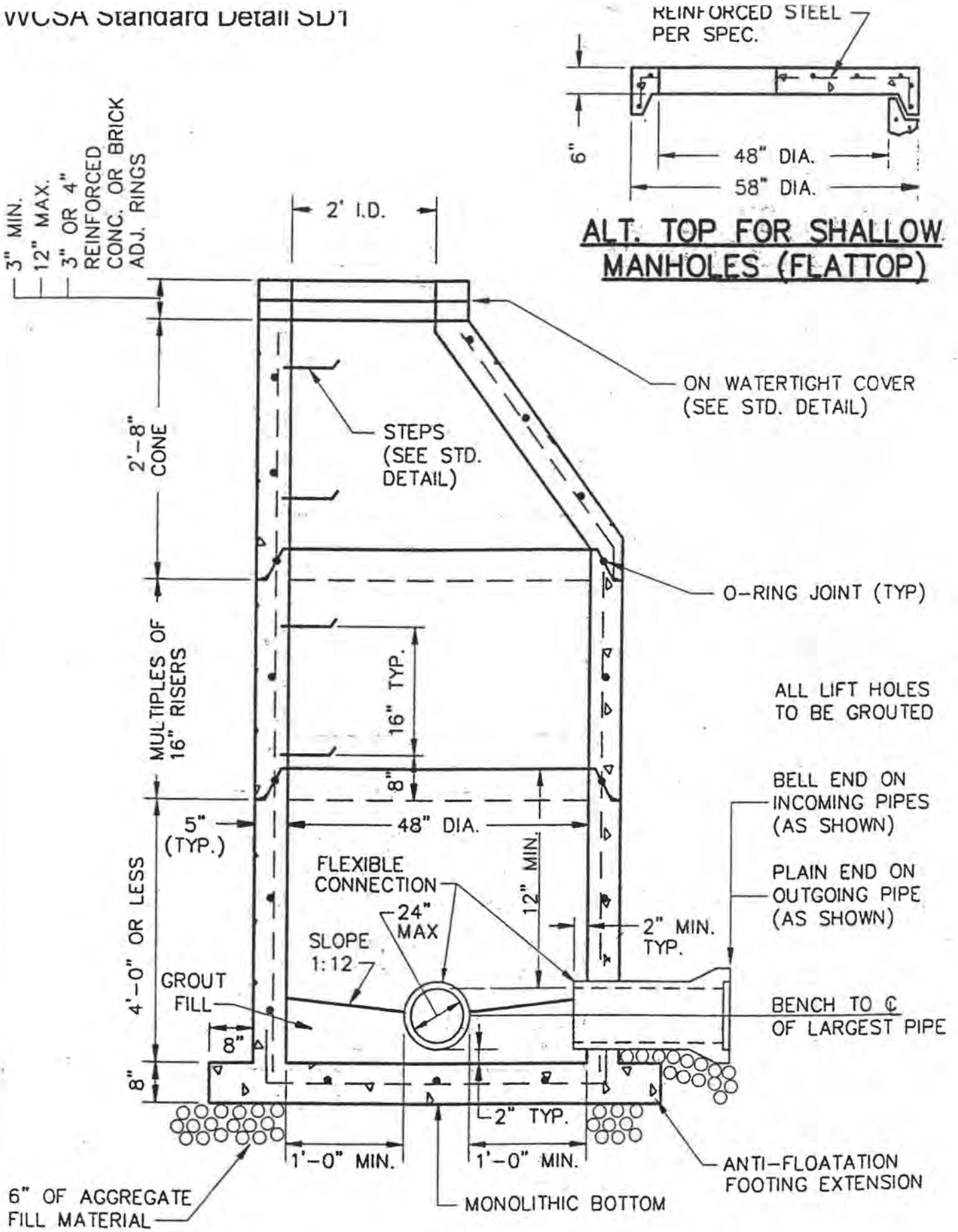
c) Haunching material - Shall be Class I, II, or III material with compaction as listed above

d) Initial backfill (from haunching to 12" above top of sewer pipe) - Shall be Class I, II or III material and shall be lightly compacted.

e) Final backfill may native material however it shall be free of mud, refuse, construction debris, organic materials, frozen materials and rocks greater than 4" in any dimension.

Section VI

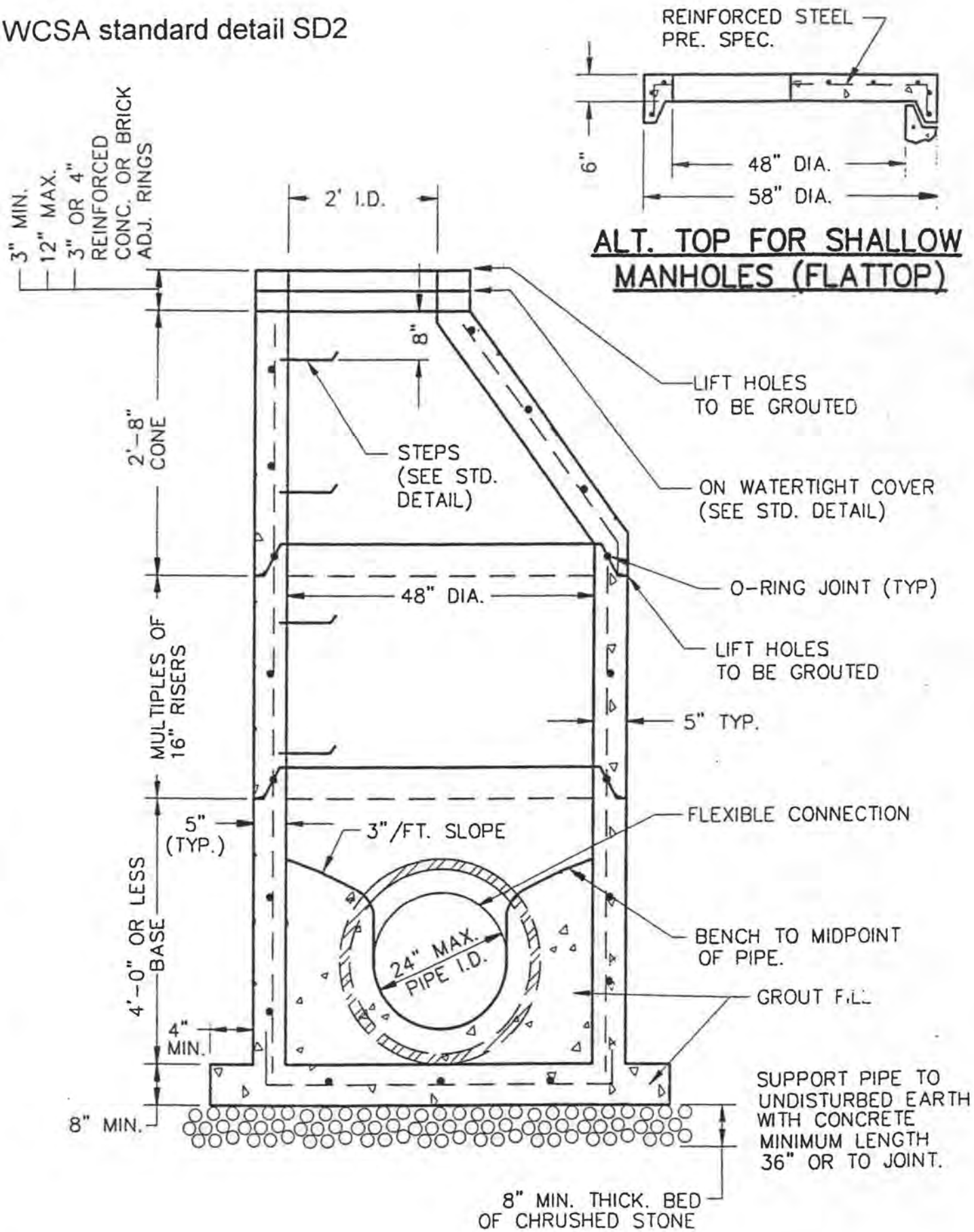
Standard Details



NOTE: MATERIALS AND FABRICATION IN ACCORDANCE WITH ASTM C478-72.

STANDARD MANHOLE NO. 1
SANITARY SEWER
PRECAST STANDARD MANHOLE
(ECCENTRIC WITH MONOLITHIC BASE)

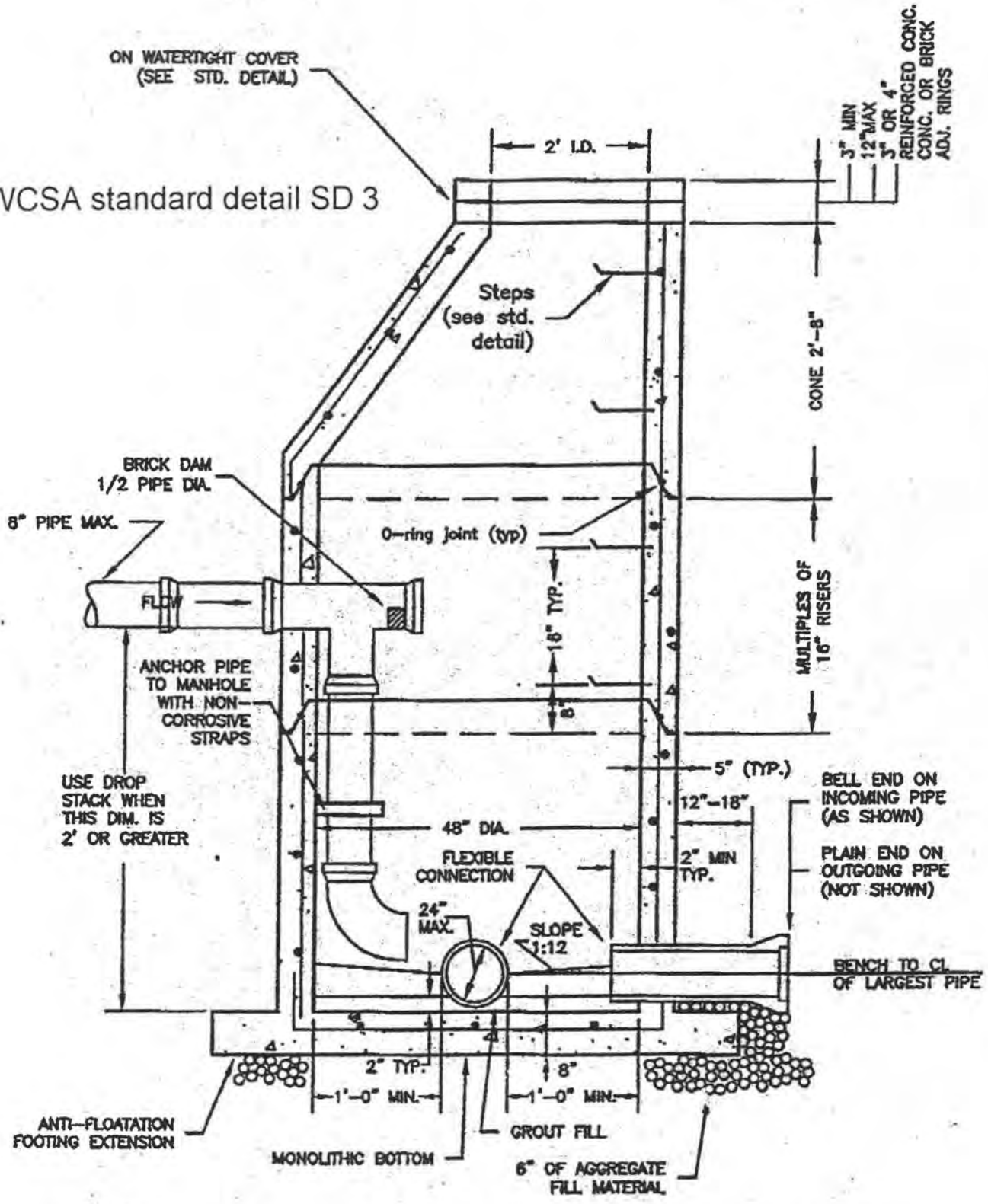
WCSA standard detail SD2



NOTE: MATERIALS AND FABRICATION IN ACCORDANCE WITH ASTM C478-72.

STANDARD MANHOLE NO. 2
SANITARY SEWER
PRECAST CONCRETE MANHOLE

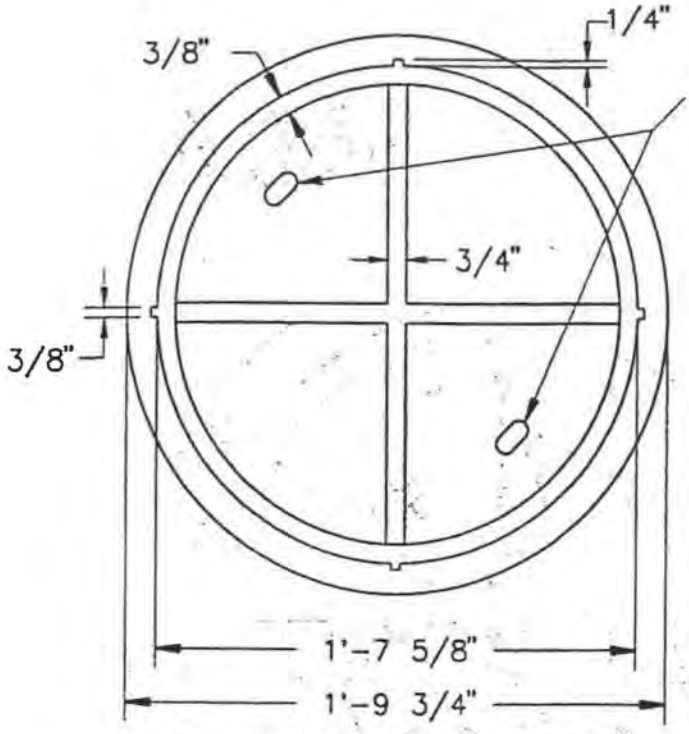
WCSA standard detail SD 3



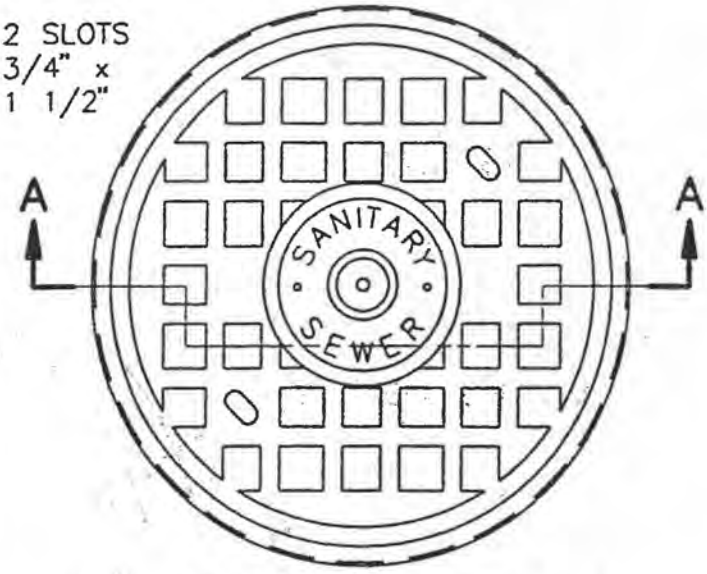
NOTE: MATERIALS FABRICATION IN ACCORDANCE WITH ASTM C478-72

STANDARD MANHOLE NO. 4
SANITARY SEWER
PRECAST DROP MANHOLE
ECCENTRIC WITH MONOLITHIC BASE

WCSA standard detail SD 3

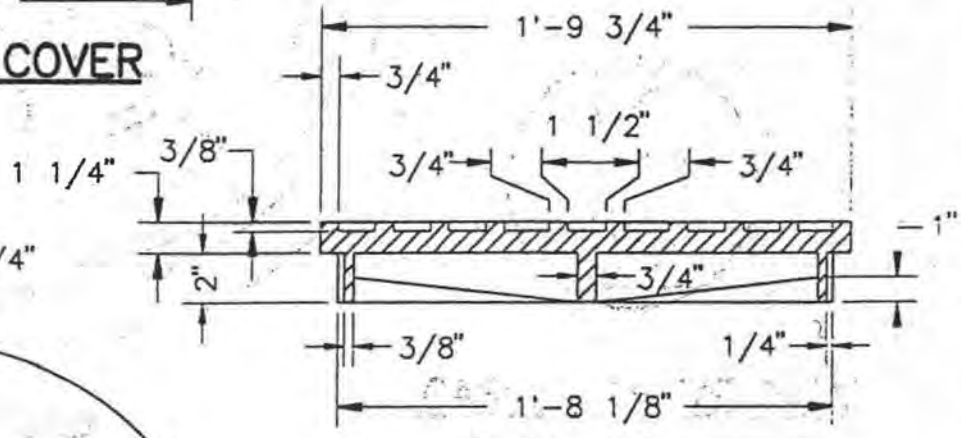


BOTTOM OF COVER

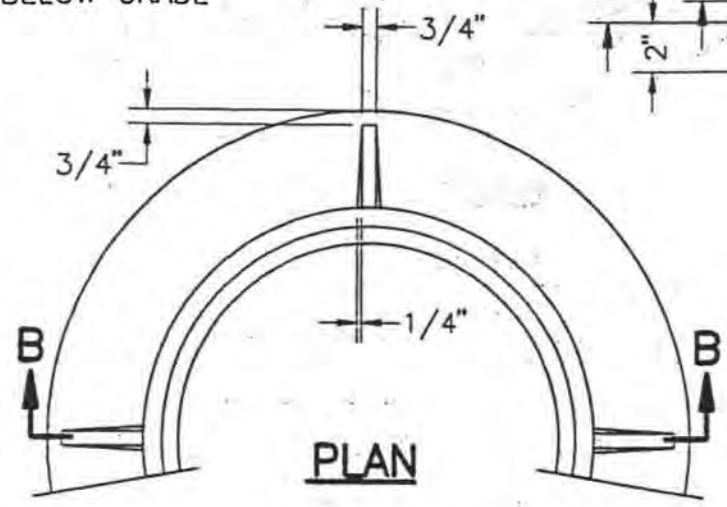


TOP OF COVER

USE SOLID COVER AND CONCEALED LIFTING HOLE WHEN TOP IS BURIED BELOW GRADE

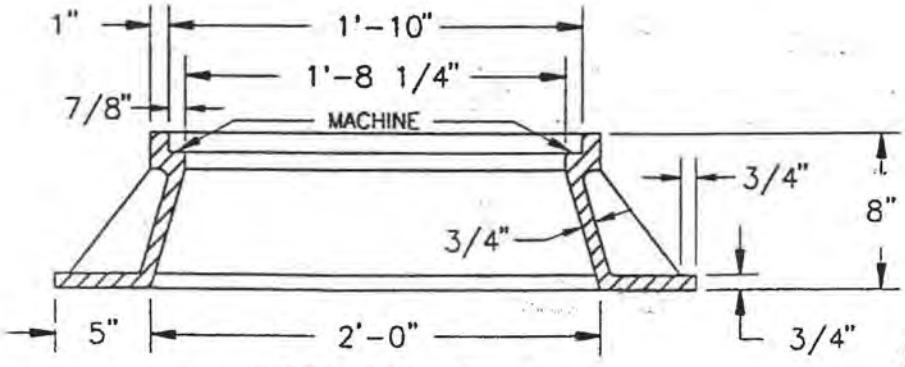


SECTION A–A



PLAN

NOTE: THE LETTERS " " ARE TO BE CAST IN THE DEPRESSION IN TOP OF COVER 1" WIDE AND RAISED 3/8" HIGH AS SHOWN



SECTION B–B

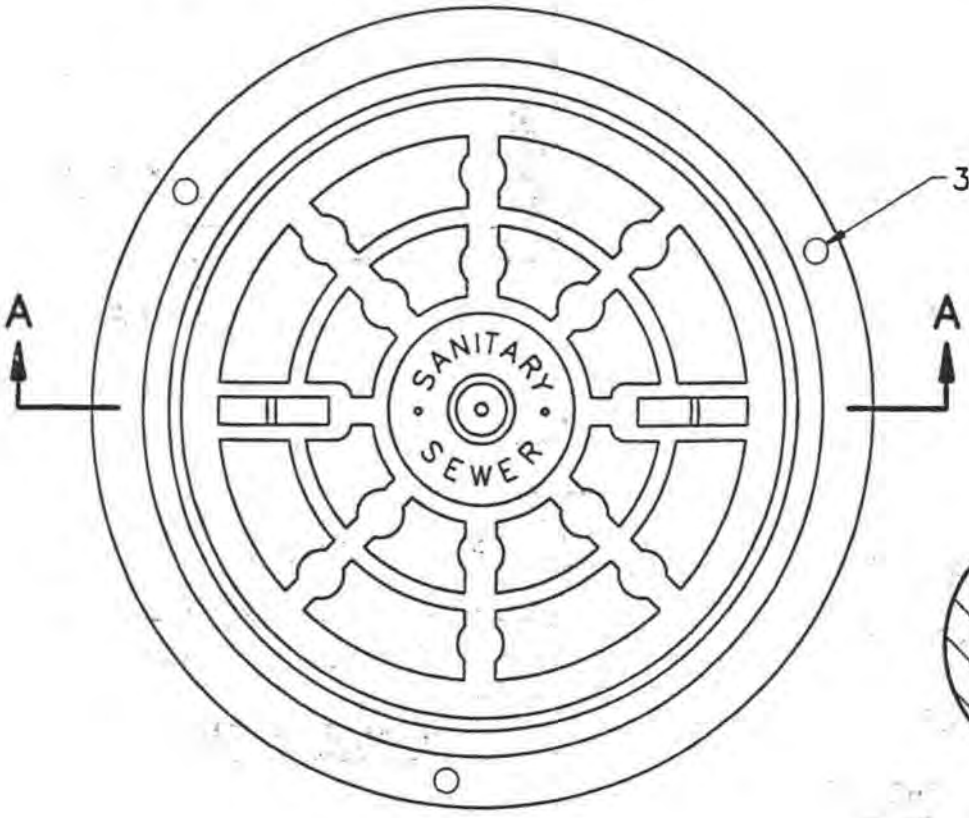
APPROXIMATE WEIGHT
CAST IRON
FRAME: 239± 12 LBS.
COVER: 137± 7 LBS.

WCSA standard detail SD4

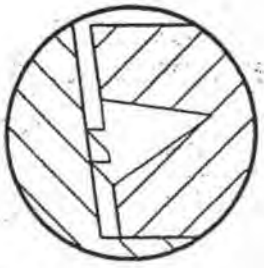
STANDARD MANHOLE FRAME & COVER

NOTE:
UNIT SIMILIAR TO
DEWEY BROTHERS INC.
RCR-3000W

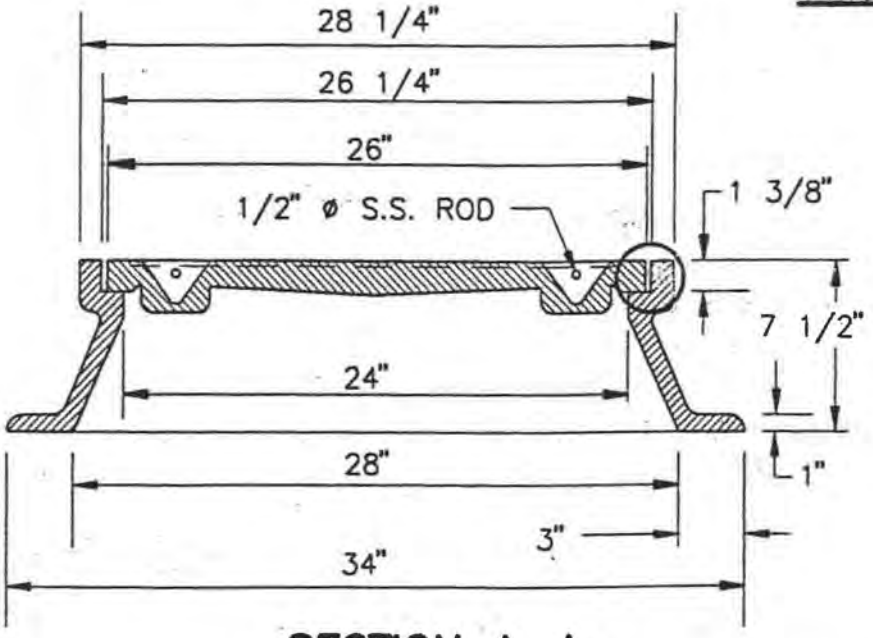
MINIMUM AVERAGE WEIGHT
FRAME: 262
COVER: 170
TOTAL: 432



PLAN



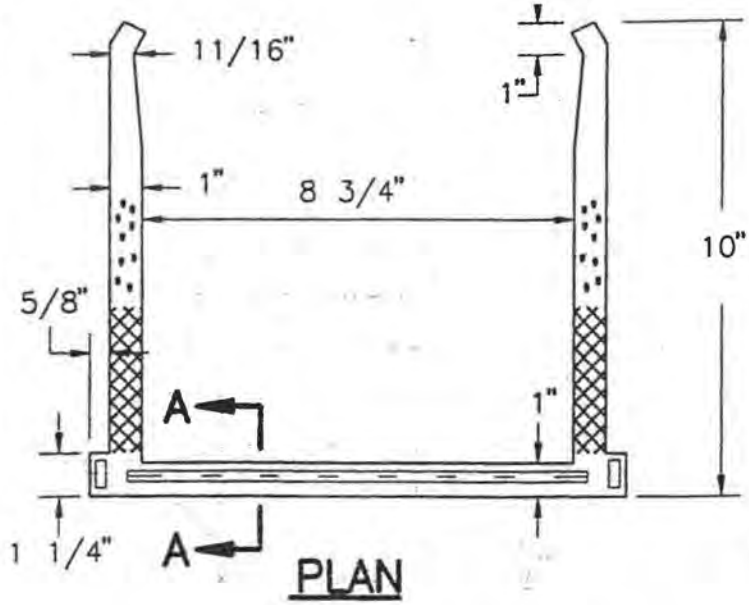
GASKET IN VERTICAL FACE OF COVER



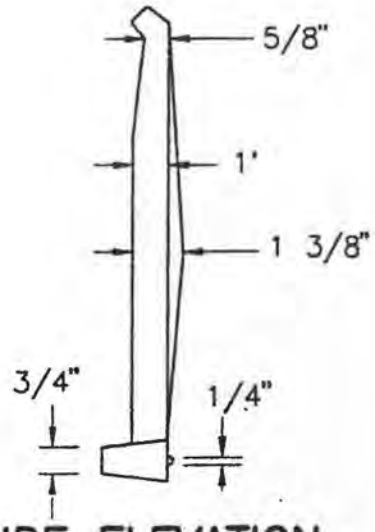
SECTION A-A

WATERTIGHT MANHOLE FRAME & COVER

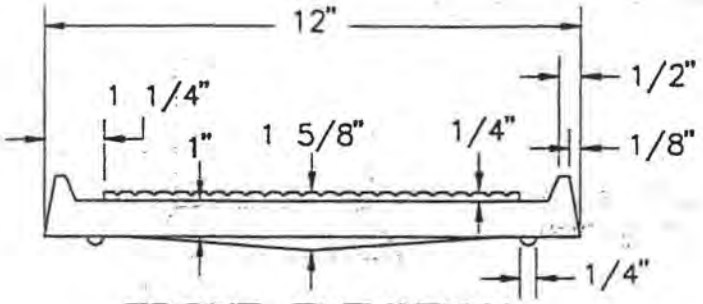
WCSA standard detail SD5



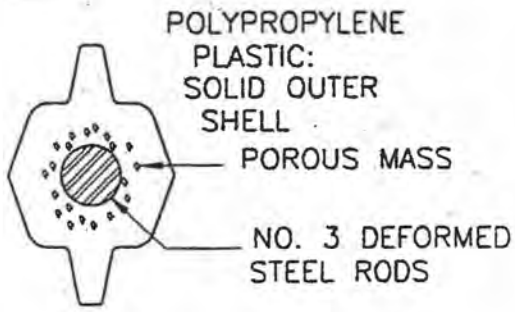
PLAN



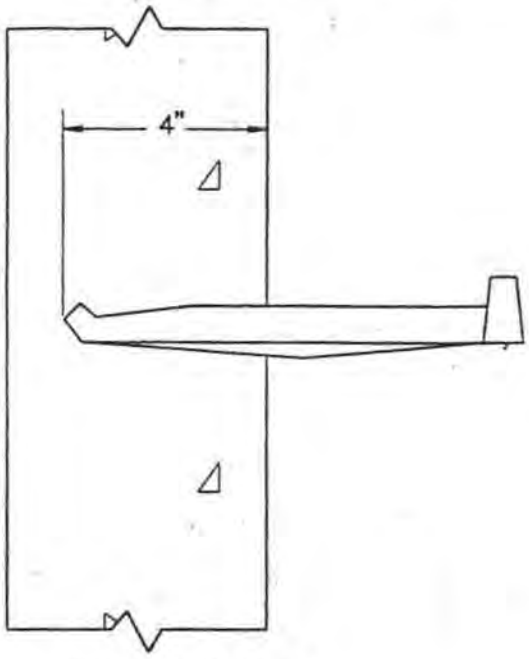
SIDE ELEVATION



FRONT ELEVATION



SECTION A–A



INSTALLATION

STEPS ARE TO BE POURED INTEGRALLY WITH THE MANHOLE SECTION AND NOT MORTARED OR GROUTED IN LATER.

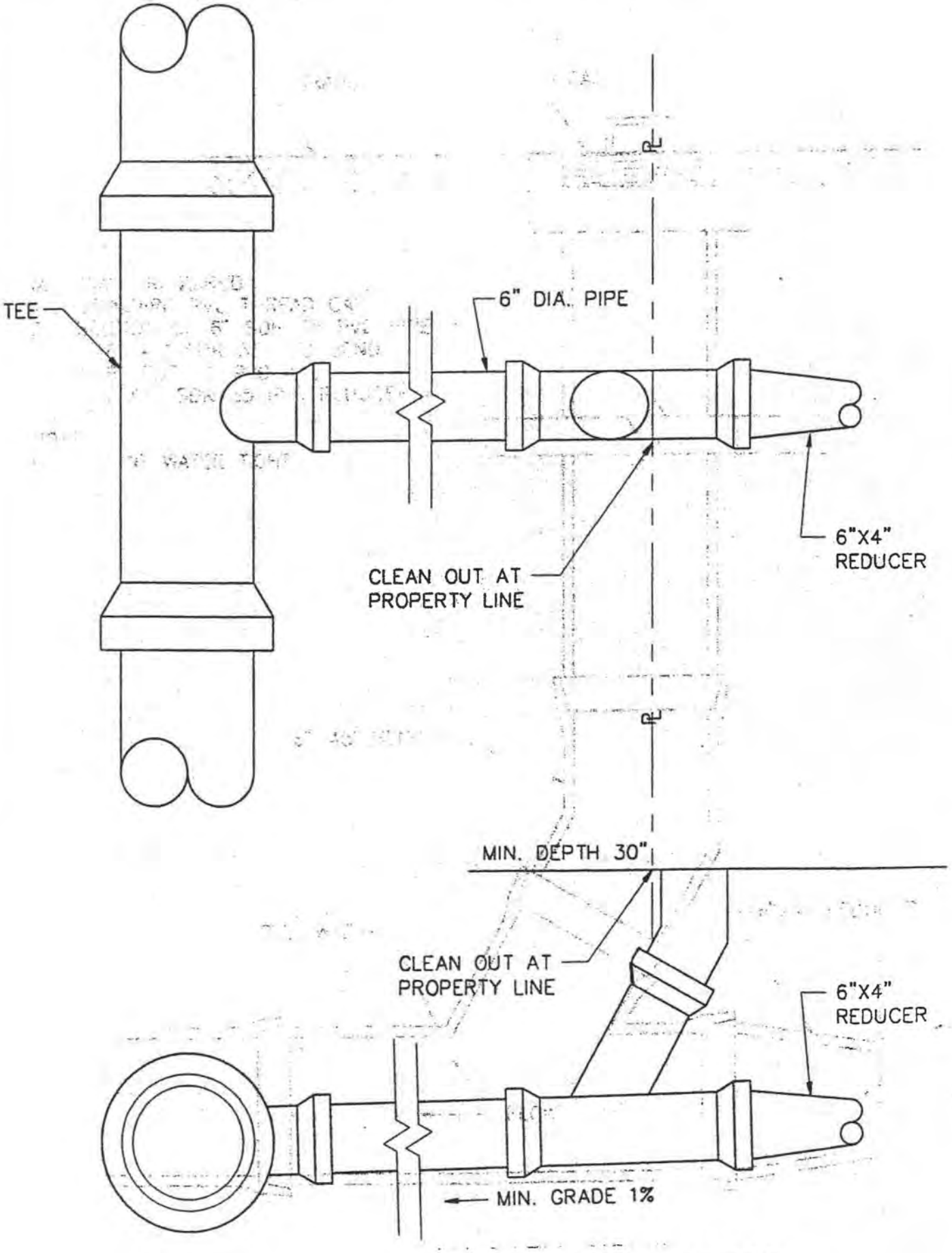
MATERIALS:

POLYPROPYLENE PLASTIC – GRADE 10–1014 "AVISUN CORP."

STEEL REINFORCING BAR – CONFORMS TO A.S.T.M. STD A–615

WCSA standard detail SD6

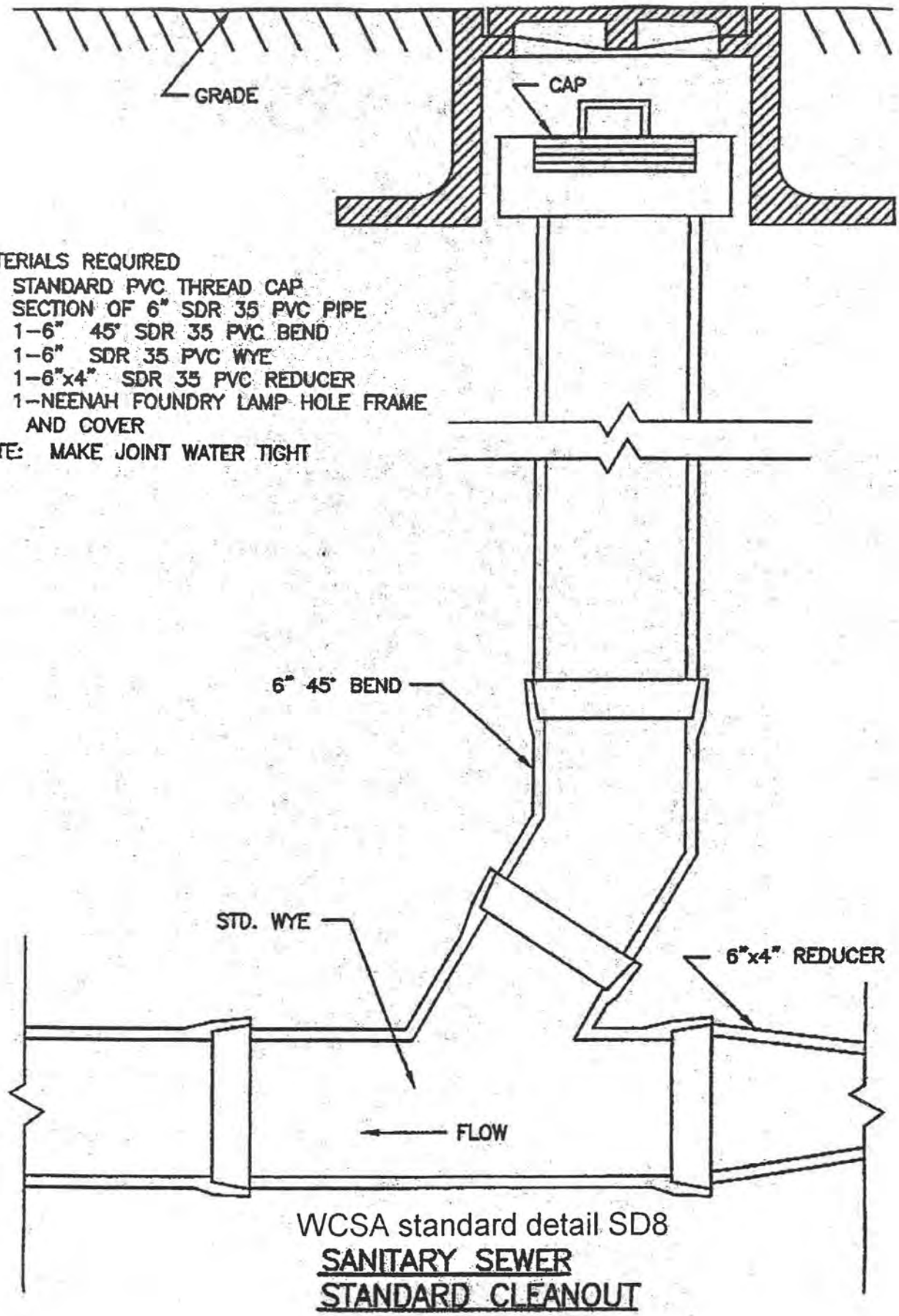
STANDARD MANHOLE STEP



WCSA standard detail SD7

STANDARD SERVICE CONNECTION

FOR USE ON ALL CONNECTIONS



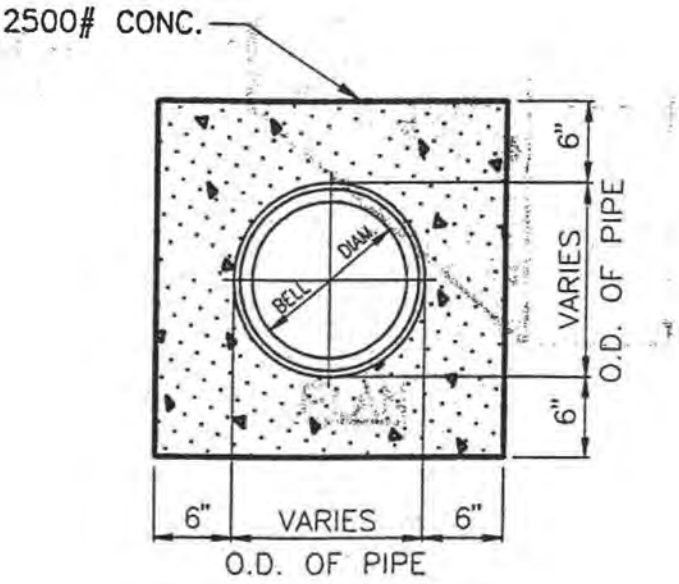
MATERIALS REQUIRED

1. STANDARD PVC THREAD CAP
2. SECTION OF 6" SDR 35 PVC PIPE
3. 1–6" 45° SDR 35 PVC BEND
4. 1–6" SDR 35 PVC WYE
5. 1–6"x4" SDR 35 PVC REDUCER
6. 1–NEENAH FOUNDRY LAMP HOLE FRAME AND COVER

NOTE: MAKE JOINT WATER TIGHT

WCSA standard detail SD8

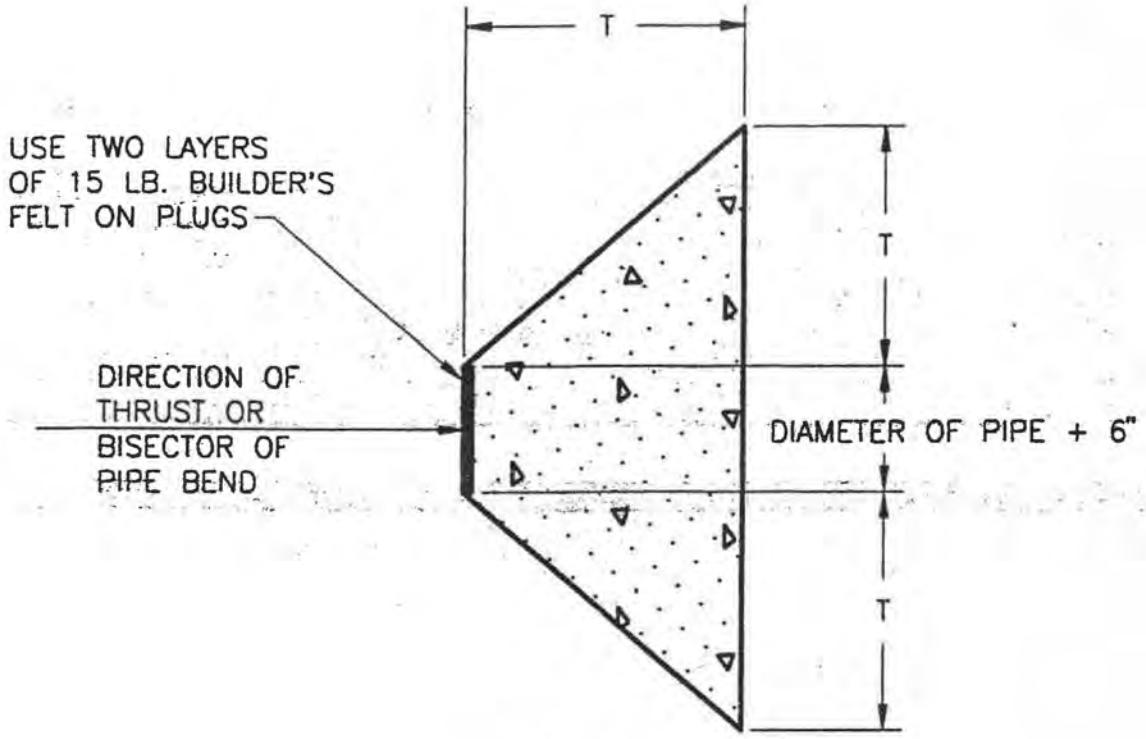
SANITARY SEWER
STANDARD CLEANOUT



NOT TO SCALE
LENGTH TO DEPEND ON FIELD CONDITIONS

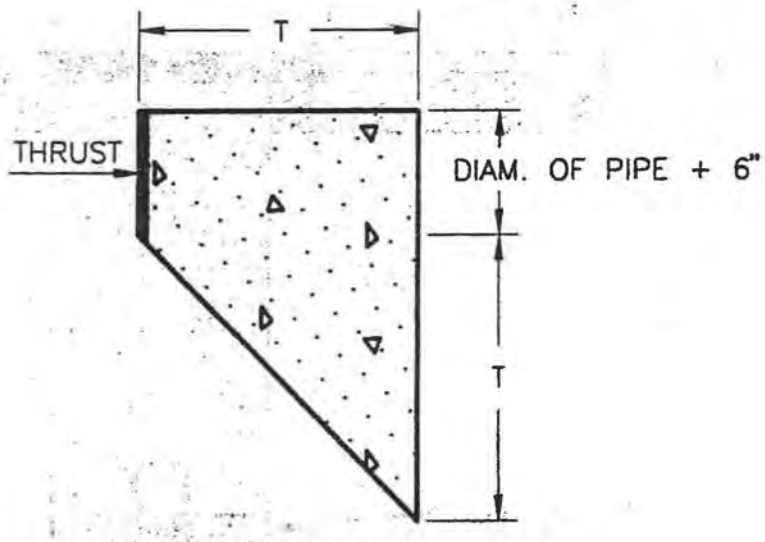
WCSA standard detail SD9

CONCRETE ENCASEMENT OF SANITARY SEWER LINES



PLAN

The value of "T" is case dependent. Please call WCSA - engineering to Obtain this value if it is not stated on Plans for the project.

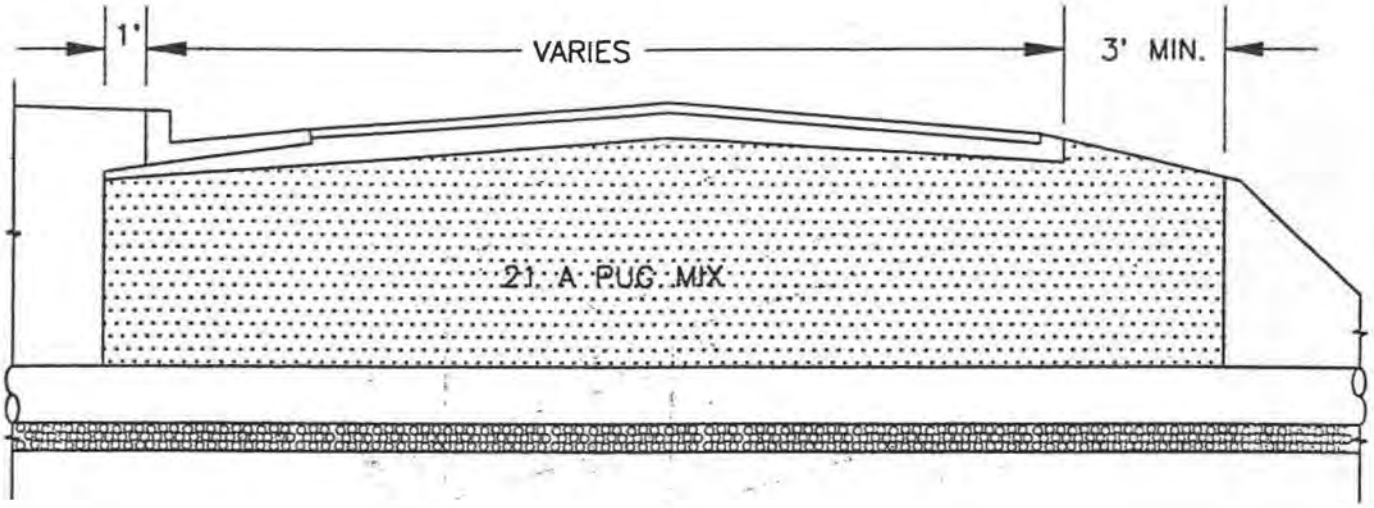


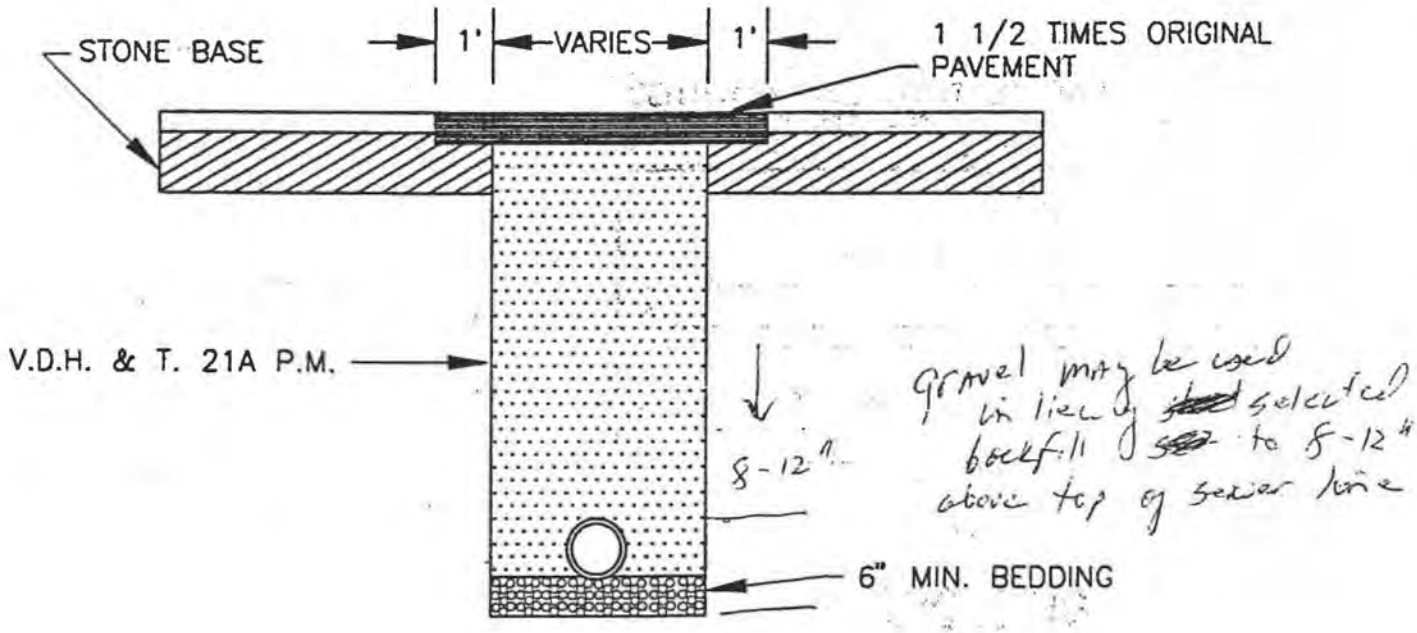
SECTION

WCSA standard detail SD10

CONCRETE ANCHOR

FOR BENDS, TEES, & PLUGS

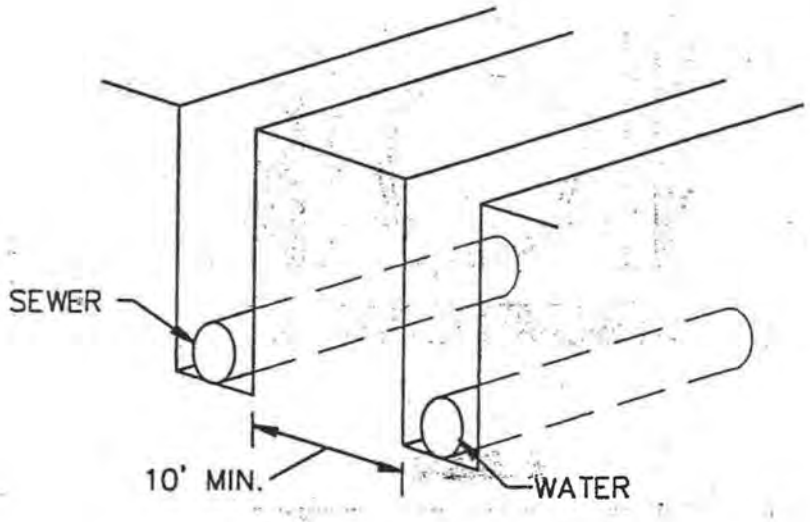




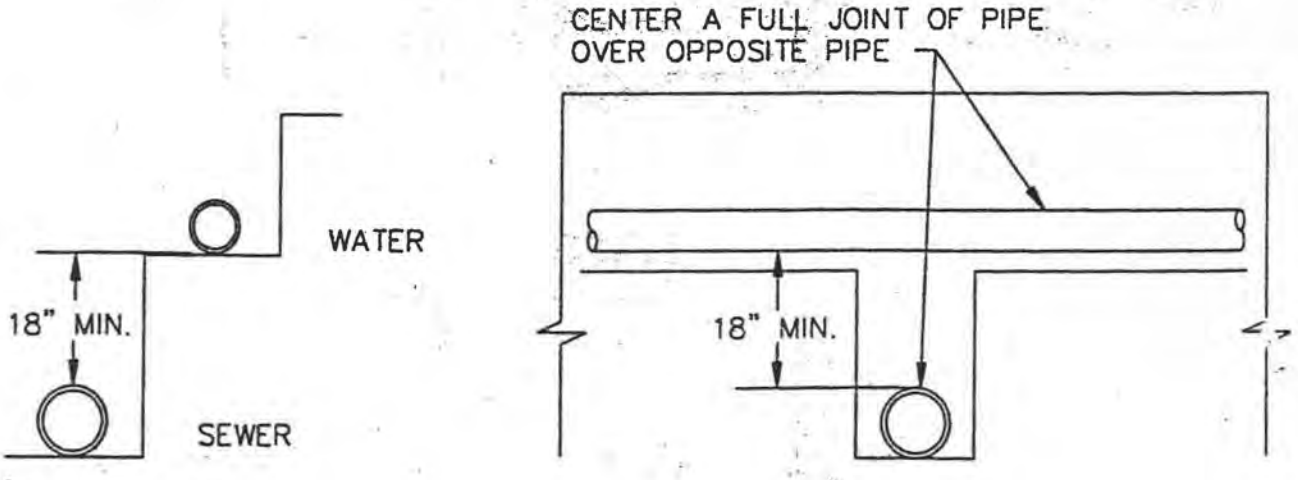
WCSA standard detail SD11

ROAD CROSSING DETAIL

This detail shows "Normal" separation. When compliance with this detail cannot be attained, contact WCSA for further instructions.



HORIZONTAL SEPARATION



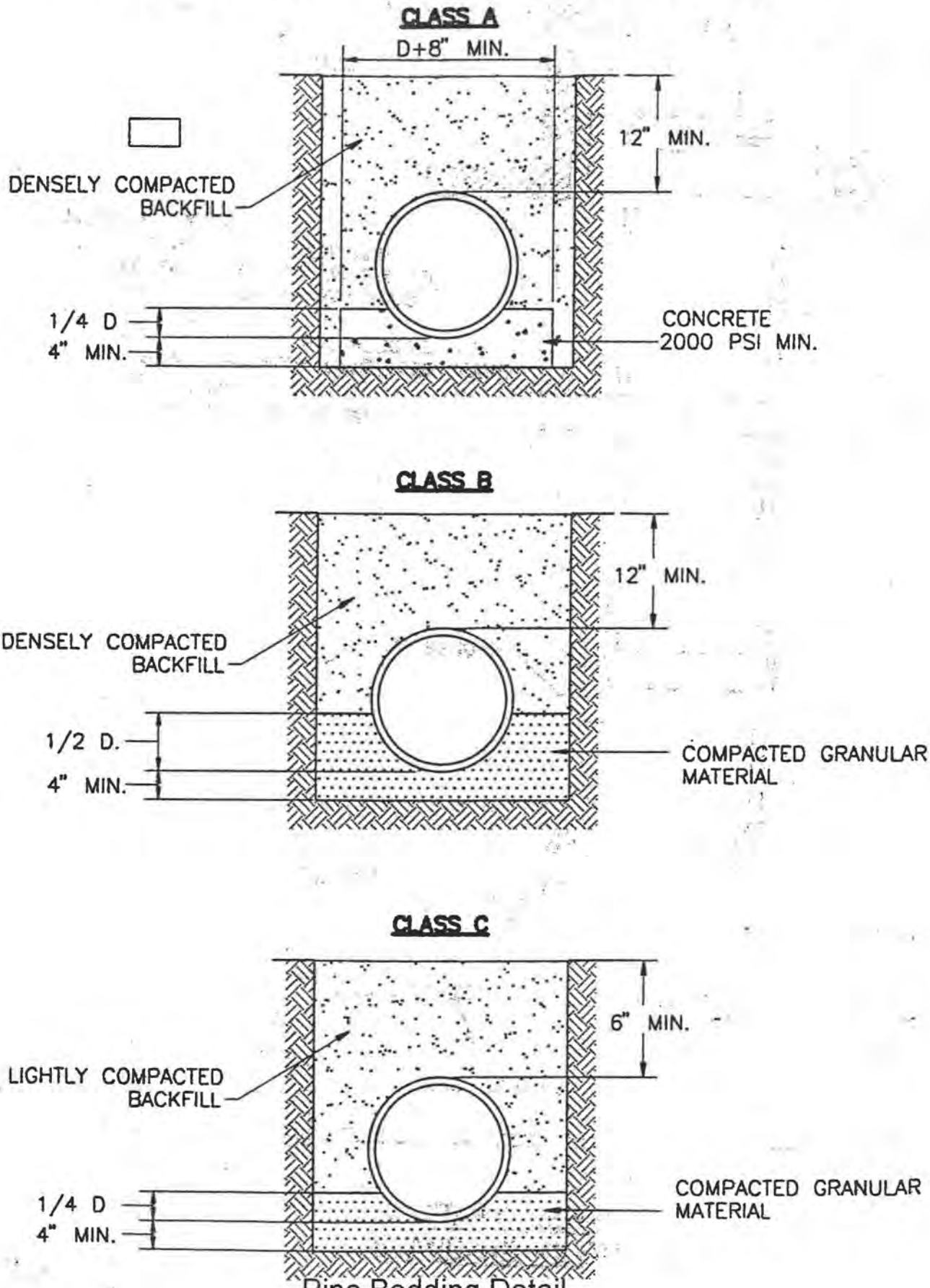
PARALLEL **CROSSING**

VERTICAL SEPARATION

WCSA standard detail SD12

WATER & SEWER SEPARATION DETAIL

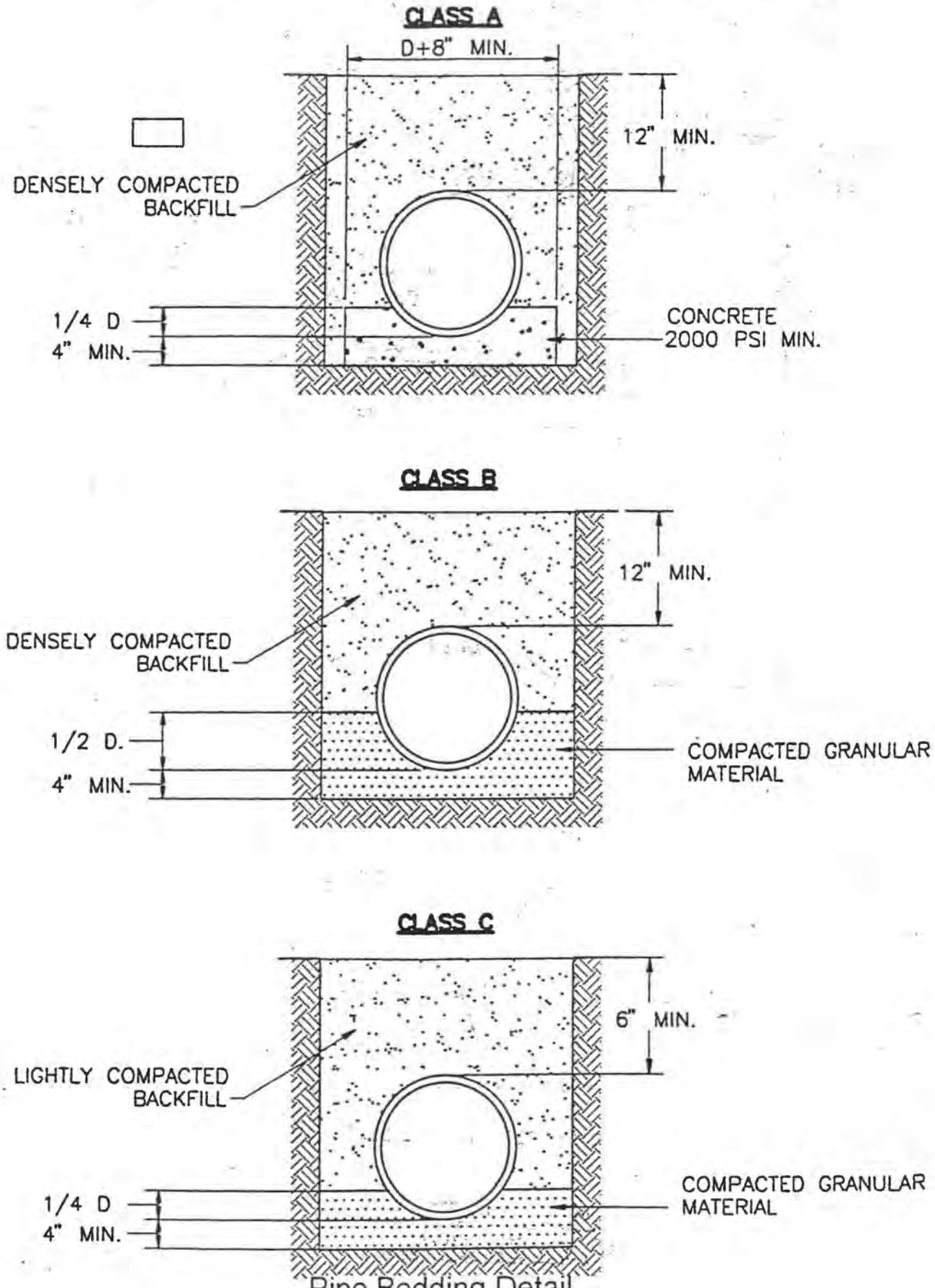
see plans or specifications for Class of bedding required



Pipe Bedding Detail

WCSA standard detail SD13

see plans or specifications for Class of bedding required



Pipe Bedding Detail

WCSA standard detail SD13