

## SECTION II

<b><u>SANITARY SEWER SYSTEM SPECIFICATIONS</u></b>	<b><u>PAGE</u></b>
1. Purpose and General Requirements	2
2. Location of Lines	3
3. Pipe	3
4. Manholes	7
5. Cleanouts	9
6. Encasements and Casings	10
7. Vinyl Plastic Liner Plate	10
8. Installation of Sewer Pipe	10
9. Protection of Water Supplies	19
10. Test and Inspections	20
11. Responsibility of the Contractor	27
12. Sewer Services	29
13. Oil and Sand Interceptor	29

**SANITARY SEWER SYSTEM SPECIFICATIONS**1. PURPOSE AND GENERAL REQUIREMENTS1.1 Purpose

This publication is to provide information to all Engineers, Contractors, Builders, Developers and other interested persons or firms, on the District requirements with respect to design and construction of sanitary sewer systems within the District. This publication presents technical specifications for the design and installation of the sewers and should be used in conjunction with the District Rules and Regulations by any firm or individual planning to design or construct sewer systems within the District. In all cases in these specifications where reference is made to "District Engineer" or "Engineer," the "District Engineer" or "Engineer" shall mean any individual designated by the District to provide inspection of the sewer system construction.

1.2 General Requirements

1.2.1 All contractors must notify the District Engineer at least 48 hours prior to start of construction.

1.2.2 A pre-construction meeting must be arranged by the CONTRACTOR and held prior to the start of any work. The District Engineer, CONTRACTOR, and OWNER or Owner's Engineer must be represented at this meeting, which shall be held either on the construction site or at the office of the District Engineer.

1.2.3 Approved plans must be kept on the job site by the CONTRACTOR at all times.

1.2.4 All work shall comply with Acceptable Industry Standards.

1.2.5 Sanitary sewer lines are to be a minimum distance of 5.0' from lip of gutter pan.

1.2.6 Squeegee bedding to be used only. On-site is material not acceptable without approval of District Engineer.

## 2. LOCATION OF LINES

### 2.1 Sewers in Streets

When the sewers are placed in streets, they shall be placed as follows:

2.1.1 On streets running north and south, the sewer line shall be placed 5' (Five Feet) west of the centerline of the street.

2.1.2 On streets running east and west, the sewer line shall be placed 5' (Five Feet) south of the centerline of the street.

2.1.3 On streets shaped as a "U" or on streets having unusually sharp turns, the sewer line will conform to the above specification as near as practical, but the final location shall be as determined by the ENGINEER or his representatives. Curve sewer mains shall not be allowed without prior approval of the ENGINEER. Design must attempt to minimize the use of manholes.

### 2.2 Sewers in Easements

In areas where sewer lines are placed in easements, all sewer lines shall be located within the easements shown on the Contract Drawings. All sewer easements must be a minimum of 30' (Thirty Feet) in width for exclusive easements and 50' (Fifty Feet) in width for non-exclusive easements, and must be prepared in accordance with the District Rules and Regulations. No trees or structures of any kind will be allowed within the easements. No sewer shall be located less than 10' (Ten Feet) from the edge of the easement. District Engineer reserves the right to require additional easement and/or more than 10' to the edge of the easement, depending on the depth of the sewer.

#### 2.2.1 Markers

In areas where sewer lines are placed in easements, all manholes and force main valves shall be identified with a 4" steel marker post, offset as directed by the District Engineer and painted yellow, with the distance to the manhole or valve and the appropriate identifying initials stenciled in black.

## 3. PIPE

### 3.1 General

No public sewer main shall be less than 8 inches in diameter. Private sewer services may be 4 or 6 inches in diameter. No sewer line shall be less than 4 inches in diameter. The minimum and maximum slopes for sewer lines shall be as shown in Table I below. The slope between manholes must be uniform.

<b>Size of Sewer (Inches)</b>	<b>Minimum Slope Feet Per Hundred</b>	<b>Maximum Slope Feet Per Hundred</b>
4	2.0	25
6	0.5	20
8	0.4	15
10	0.28	12
12	0.20	11
15	0.15	8.5
18	0.12	6.5
21	0.092	5.0
24	0.08	4.5
27	0.065	3.5
30	0.06	3.2

3.2 Concrete Pipe

Concrete pipe shall be specified by pipe diameter, class or strength, the methods of jointing and any special lining or concrete requirements such as the method of manufacture. The pipe should conform, insofar as appropriate, to the following standard specifications. All concrete pipe shall be epoxy-lined, shall be manufactured with calcareous aggregates and shall be used only with prior written approval of the District Engineer. In general, however, concrete pipe shall not be allowed for sanitary sewer mains.

3.2.1 Non-Reinforced Concrete Pipe - All non-reinforced concrete pipe from 4" to 24" diameter shall be manufactured in strict accordance with "Concrete Sewer, Storm Drain and Culvert Pipe," ASTM C14 or C76 and "Pipe, Concrete (Non-reinforced, Sewer)", Federal Specification SS-P-371c and as modified herein.

3.2.2 Reinforced Concrete Pipe - All reinforced concrete pipe shall be manufactured in strict accordance with "Reinforced Concrete Culvert, Storm Drain and Sewer Pipe," ASTM C76 and "Pipe, Concrete (Reinforced, Sewer)," Federal Specification SS-P-375b and as modified herein.

3.2.3 Joint Material - All joint material shall be manufactured in strict accordance with "Joints for Circular Concrete Sewer and Culvert Pipe, Using Flexible,

Watertight, Rubber Gaskets," ASTM C443.

3.2.4 Physical Properties - Crushing strength requirements for non-reinforced and reinforced concrete pipe and fittings shall equal or exceed the minimum strength, as set forth in ASTM C14-70 (or latest revision thereof) when tested for "Three Edge Bearing" in accordance with ASTM C497-70A (or latest revision thereof) or "Determining Physical Properties of Concrete Pipe and Tile," ASTM C497.

3.2.5 Identification Markings - In addition to any special markings specified in the Contract or order, marking for shipment shall be in accordance with Federal Standard No. 123.

3.2.6 Pipe Lining - All concrete pipe used for sanitary sewers, either reinforced or non-reinforced, shall have an interior PVC lining or a protective epoxy coating to preserve the pipe from corrosive condition. Coatings shall cover the entire internal circumference of the pipe; the method and application shall be approved by the ENGINEER prior to acceptance.

### 3.3 Plastic Pipe

3.3.1 General - All Polyvinyl Chloride (PVC) Sewer Pipe and Fittings shall be in accordance with ASTM D-3034.

3.3.2 Material - All Polyvinyl Chloride shall meet the requirements for ASTM D-3034, "Standard Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings."

3.3.3 Test - CONTRACTOR shall submit certified copies of all reports of tests conducted by an independent laboratory before installation of PVC Plastic Pipe. The tests shall conform to the following tests and Standards: The Quick Burst Test, ASTM D-1599, the Flattening Test, Extrusion Test ASTM D-2152, and Pipe Impact Test ASTM D-2444.

3.3.4 Straightness - Maximum allowable ordinate as measured from the concave side of the pipe shall not exceed 1/16" per foot of length. Pipe lengths shall be limited to 20 foot maximum to insure compliance with this requirement.

3.3.5 Joint Type - The pipe joints shall be bell and spigot type with an elastomeric gasket conforming to ASTM D-3212 and F-477. Solvent welded joints are not acceptable.

3.3.6 Pipe Diameter - The pipe diameters shall be per Parker Water & Sanitation District Specifications.

3.3.7 Fittings and Specials - The fittings and specials shall be in accordance with ASTM D-3034.

3.3.8 Pipe Installation and Field Testing - Pipe shall be installed in full compliance with the recommended practice for "Underground Installation of Flexible Thermoplastic Sewer Pipe," ASTM Designation D-2321. Specifically, the bedding shall be Class "B" as shown in Section 13, Standard Details. The bedding trench shall be brought to proper grade and elevation prior to installation of pipe and assembly joints. The pipe shall be placed and joints made in a dry trench and bedding shall be placed in the trench up to one-half the diameter of the pipe (haunch) without lifting or laterally mis-aligning the pipe.

In addition to the construction and testing procedures outlined in other sections of these specifications, the CONTRACTOR shall be required to install the pipe in such a manner so that the maximum ring deflection of the pipeline under load shall be limited to 5% of the vertical internal pipe diameter. The District reserves the right to request deflectometer tests to assure that the pipe meets this requirement. Equipment used in the tests shall be direct reading, producing an immediate, continuous record of pipe deflection and shall consist of the following units: a non-rotating sensing element, a remote readout instrument and a strip chart recorder providing a permanent record of the measurements. The District Engineer shall determine the footage to be tested but in no case shall the test section be less than 400 feet or between manholes, whichever is less. Testing shall be performed at the expense of the OWNER or Developer. All pipe exceeding 5% deflection shall be considered to have reached the limit of its serviceability and shall be re-laid or replaced prior to final acceptance at the expense of the CONTRACTOR.

Infiltration-exfiltration tests shall be conducted as detailed in Section 10, Tests and Inspections, of these specifications.

3.4 Cast Iron Pipe

Cast iron pipe shall be used in all areas designated by the District Engineer and as indicated in these specifications.

3.4.1 Material - Cast iron pipe shall be bell and spigot soil pipe, centrifugally cast and shall conform to Federal Specification WW-P-421 and AWWA Specification C-106. Class of pipe shall be as shown in Table II.

<b>TABLE 3 - II</b>	
<b>Size</b>	<b>Class</b>
3" to 12"	22
14" to 24"	21

3.4.2 Joints - All cast iron pipe joints shall be made using elastomeric rubber gaskets. Where cast iron pipe is jointed to a pipe of another material, an approved collar or coupling utilizing a rubber seal shall be used. All couplings shall be

encased in a concrete collar in accordance with the details in Section 13.

#### 4. MANHOLES

##### 4.1 General

All manholes shall be a minimum of 48" in diameter and shall be installed at the end of each sewer line, at all changes in grade, size or alignment and at all intersections. Manholes shall be installed at distances not greater than 400' for sewers 15" inside diameter and less, and 500' for sewers 18" to 30" inside diameter. Longer spacing may be permitted, with prior approval of the District Engineer, in sewer lines of larger diameter. All manholes in excess of 20' in depth, measured from cover to invert, shall have an intermediate platform located at the center of the depth, in accordance with the details in Section II.

##### 4.2 Standard Manholes

Manholes may be either precast concrete or poured-in-place concrete. All concrete shall be mixed using Type II cement. For poured-in-place manholes, design details and analysis, along with construction procedure, must be submitted to and approved by the District Engineer prior to start of construction. All manholes shall have an inside diameter at least 2' greater than the outside diameter of the sewer pipe or pipes entering and leaving the manhole but in no case shall any manhole have an inside diameter less than 4'. Where a second sanitary sewer line enters a manhole, the invert on the second sewer line shall enter the manhole at least 0.2' higher than the invert of the main sewer line and shall enter the line of flow of the main sewer line with as near a full sweep 90 degree bend as possible. In no case shall a second line be allowed to intersect with this main line at an angle less than 90 degrees, with the outlet portion of the main line. If alignment and slope allow, the sewer main should be laid through the manhole. A drop of 0.1' will be required from invert to outlet where the sewer main cannot be laid through the manhole. A drop of 0.2' shall be required on all angle manholes. All manholes subject to turbulent flows shall be epoxy-coated (E.G. outside/inside drops, interceptors, outfalls, and 90 degree manholes).

4.2.1 Base - The base on all manholes shall be a minimum of 8" thick, and the overall outside dimensions shall be one (1') foot greater than the outside dimensions of the manhole constructed thereon. The base shall be constructed of premixed concrete composed of a mix of well-graded, well washed, calcareous aggregate ranging from sand to gravel one and one-half (1-1/2") inches in maximum diameter. The mix shall contain six (6) sacks of Type II cement to the cubic yard and only enough water shall be used in the mix to give it a slump test of 2". Air entrained in the mix when placed shall be between 3% and 5%. Cylinders taken from the mix shall in 28 days have not less than 3,000 pounds crushing strength per square inch. Base reinforced steel or wire mesh shall be in accordance with the detail Sheet 13. The CONTRACTOR shall be responsible for taking and testing cylinders as required by the District Engineer.

4.2.2 Concrete Manholes - Concrete manholes shall be constructed of pre-cast

concrete rings composed of concrete meeting ASTM C33-54T, or latest revision thereof. Cement used shall meet ASTM C150. The concrete mix shall be made with Type II cement with a cement factor of six (6) sacks per cubic yard. The coarse aggregate shall be no less than 40% of the combined mix. The minimum core strength in 28 days shall be 4,000 psi. Concrete manholes shall consist of one or more concentric rings according to the depth of the manhole. The top cone shall be eccentric and shall be approximately one (1) foot below finished grade on the street in order that the manhole can be brought to the finished grade with concrete rings by the CONTRACTOR when final grade on the street is established.

Aluminum or plastic steps shall be firmly embedded in the walls of all manholes. They shall be placed in a straight line 12" O.C. vertical on the straight side of the manhole. Steps must be positioned to allow no more than 18" spacing from the rim to the first step, and 12" spacing thereafter. Steps shall conform to the details shown in detail section. Manhole covers shall be of close-grained gray iron semi-steel in the solid cover of a design conforming to the details shown in Section 13. They shall be equal to the City of Denver Standard Traffic Pattern and weigh approximately 400 pounds. Covers shall be solid, and shall be machined so that they will not rock under traffic. Aluminum manhole rings and covers shall generally not be allowed. Any requirement to use aluminum rings and covers must be submitted to and approved by the District Engineer prior to start of this work. If aluminum manhole rings and covers are allowed, they must be bolted down.

Where manholes must be raised up to finished street grade, no more than 12" of rings shall be used. If greater than twelve inches (12") is necessary to bring the manhole to finished grade, additional barrel sections should be added. All manhole rings shall be embedded in bituminous mastic (Ram-Neck or equal) and shall be watertight. Mortar mixed with Type II cement shall be used on the inside of ring joints. The word "Sewer" shall be boldly cast in a readily visible location on the cover. The bench shall slope at 2" per foot toward the sewer line in the manhole. The total chimney length shall not exceed 20".

#### 4.3 Drop Manholes

Drop manholes shall be constructed exactly the same as regular manholes except the manhole base shall be extended upstream far enough to form a base for the concrete encasing the sewer pipe drop entering the bottom of the manhole. The drop entering the manhole shall be completely encased in concrete up to the spring line of the pipe of the main sewer line.

All manholes in which the drop is 18" or greater must be constructed with an outside drop as specified above. A cleanout must be placed in the manhole at the level of the main sewer line. All drop manholes shall be constructed in accordance with the details in Section II with the specific variation of the detail determined in advance by the District Engineer. All drop manholes must be completely lined with coal tar epoxy.

#### 4.4 Underdrain

No Underdrain system will be allowed to be placed in mainline or sewer service trenches.

#### 4.5 Service Connection to Manholes

In general, sewer service lines will not be allowed to connect to manholes. Certain exceptions, however, may be made by the District Engineer. Two service lines will be allowed to connect to a manhole located on the end of a sewer main in a cul-de-sac. The service line must be installed prior to placing the manhole base. No sewer service shall connect to the main line closer than 7' to the centerline of the uphill manhole.

#### 4.6 Plastic Pipe Connections to Manholes

Where plastic pipe is used, all connections to manholes shall be sealed by approved methods. Placing the concrete manhole base directly around the plastic pipe will not be satisfactory. Approved rubber gaskets, bonding material, or other sealants must be used in accordance with the details in Section II.

### 5. CLEANOUTS

Cleanouts shall not be used in public streets, unless so directed by the District Engineer. All cleanouts shall be constructed in accordance with the details in Section 13. Cleanouts shall be installed on private sewer services under the following guidelines:

5.1 At all changes in direction requiring bends on commercial services.

5.2 Not more than 100' of continuous sewer line shall be installed without at least one cleanout.

5.3 Cleanouts shall be located such that all portions of the line can be cleaned by rodding.

## 6. ENCASEMENTS AND CASINGS

### 6.1 Concrete Encasements

Concrete encasements shall be installed under the following conditions:

6.1.1 Where sewer lines are at a depth too shallow to sustain traffic load or any other load to which they are subjected. The depth may range from 0 to 4 feet, depending on the loading conditions.

6.1.2 At all locations where infiltration is likely to be high.

6.1.3 At locations where horizontal movement of the sewer mains may be experienced, i.e., below streambeds.

6.1.4 At all crossings under gulches, channels, creeks, and streambeds. These encasements shall be reinforced.

6.1.5 At potable water supply crossings. See Section 9.

6.1.6 At any location designated by the District Engineer.

All concrete encasements shall be reinforced in accordance with the details in Section 13 and shall be of a length to completely span the condition encountered.

### 6.2 Pipe Casings

Pipe casings shall be used where bores are required under rights-of-way by the using agency. All pipe casings shall be constructed to conform to the details in Section 13.

## 7. SECTION INTENTIONALLY LEFT BLANK

## 8. INSTALLATION OF SEWER PIPE

### 8.1 Excavation

Excavation for pipelines, fittings, and appurtenances shall be open trench to the depth and in the direction necessary for the proper installation of the same as shown on the approved drawings or as otherwise approved by the District Engineer. Any water, which may be encountered or may accumulate in the excavation shall be pumped out or otherwise removed as necessary to keep the bottom of the excavation free and clear of water during the progress of the work.

Tunneling may be permitted as indicated by economy of construction or necessity of preserving existing improvements. If the earth in the tunnel sloughs off, the roof of the tunnel shall be broken down, and the trench excavated as an open trench.

## 8.2 Limit of Excavation

Except by expressed written permission of the District Engineer, the maximum length of open trench shall be 600 feet or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is smaller. The distance is the collective length at any location, including open excavation, pipe laying and appurtenances, construction and backfill that has not been temporarily resurfaced. No trench shall be left open at any time that the CONTRACTOR is not on the job site engaged in construction operations.

## 8.3 Trench Width

The overall trench width shall not be more than 16" or less than 12" wider than the largest outside diameter of the pipe to be laid therein, measured at a point 12" above the top of the pipe, exclusive of branches. Excavating and trenching shall be true to line so that a clear space of not more than 12" or less than 6" in width is provided on each side of the largest outside diameter of the pipe in place. For the purpose of this section, the largest outside diameter shall be the outside diameter of the bell, on bell and spigot pipe. All trenching sizes shall be in accordance with the Bedding Details in Section II.

Where the trench width, measured at a point 12" above the top of the bell of the pipe, is wider than the maximum set forth above, the trench area around the pipe shall be backfilled with 2,500 psi concrete to form a cradle for the pipe as shown in the Bedding Details in Section II. Special care shall be used when pouring the concrete cradle around the pipe so no displacement will occur. In the event of movement, the CONTRACTOR shall remove and replace all pipe and cradle affected.

## 8.4 Excavation Below Grade

Before the pipe is laid, the subgrade shall be made by backfilling with an approved material in 3" uncompacted layers. The layers shall be thoroughly tamped as directed by the District Engineer so as to provide a continuous bearing and support for the pipe at every point between coupling holes, except that it will be permissible to disturb and otherwise damage the finished surface over a maximum length of 18" near the middle of each length of pipe by the withdrawal of pipe slings or other lifting tackle. The finished subgrade shall be prepared accurately by means of hand tools.

The subgrade beneath the centerline of the pipe shall be finished to within 0.03 feet of a straight line between pipe joints or batter boards; all tolerances shall be above the specified grade.

#### 8.5 Correction of Faulty Grades

Where excavation is inadvertently carried below subgrade and/or foundation elevations, suitable provision shall be made at the expense of the CONTRACTOR for adjustment of same, as directed by the District Engineer to meet requirements incurred by the deeper excavation beneath pipe or structures. Over-depth excavation in such location shall be rectified by backfilling with approved sand and/or graded gravel, and shall be compacted to provide a firm and unyielding subgrade and/or foundation, as directed by the District Engineer.

#### 8.6 Trenching by Hand or Machine

Hand methods for excavation shall be employed in locations directed by the District Engineer. In other locations, the CONTRACTOR may use trench digging machinery or employ hand methods.

#### 8.7 Bracing Excavations

All excavations shall be properly supported in the manner as required by OSHA Federal Register Vol. 37 No. 243, Sub-part P, Section 1926.652 or as required by state laws and municipal ordinances and as may be necessary to protect life, property, and the work or as ordered by the District Engineer. Excavations shall be braced, sheeted and supported so that they will be safe, and the ground alongside the excavation will not slide or settle. Excavations shall be so braced or sheeted so as to provide conditions under which workmen may work safely and efficiently at all times. The sheeting, shoring and bracing shall be so arranged as not to place any stress on portions of the completed work until the general construction thereof has proceeded far enough to provide ample strength.

Care shall be exercised in the drawing or removing of sheeting, shoring, bracing and timbering to prevent the caving or collapsing of the excavation faces that are being supported.

#### 8.8 Grading and Stockpiling

The CONTRACTOR shall control grading in a manner to prevent water from running into excavations. Obstruction of surface drainage shall be avoided and means shall be provided whereby storm and wastewater can be uninterrupted in existing gutters, other surface drains, or temporary drains.

#### 8.9 Dewatering

The CONTRACTOR shall provide and maintain at all times during construction, ample means and devices with which to promptly remove and properly dispose of all water from any source entering the excavations or other parts of the work. Dewatering shall be accomplished by methods that will ensure a dry excavation and preservation of the final lines and grades of the bottoms of excavations. Said methods may include well points, sump

pumps, suitable rock or gravel placed below the required bedding for drainage and pumping purposes, temporary pipelines and other means, all subject to the approval of the District Engineer.

Dewatering for the sewer lines shall commence when groundwater is first encountered, and shall be continuous until such time as water can be allowed to rise in accordance with the provisions of this section.

The CONTRACTOR shall dispose of the water from the work in a suitable manner without damage to adjacent property. No water shall be drained into work, built or under construction, without prior consent of the District Manager.

#### 8.10 Foundations in Poor Soil

If excessively wet, soft, spongy, unstable or similarly unsuitable materials are encountered at the surface upon which the bedding material is to be placed, the unsuitable material shall be removed to a depth as determined in the field by the District Engineer and in accordance with the Bedding Details.

#### 8.11 Foundations in Rock

Where rock is encountered, it shall be removed below grade and the trench backfilled with clean imported sand, squeegee, or 3/4" rock to provide a compacted foundation cushion with minimum allowable thicknesses of 3" under the outside diameter of the pipe bell and 6" under the pipe barrel. Whether or not the foundation material will be considered as rock will be at the discretion of the District Engineer.

#### 8.12 Pipe Clearance in Rocks

Ledge rock, boulders, and large stones shall be removed to provide a clearance of at least 6" below the pipe and fittings.

#### 8.13 Bedding Procedure

The pipe shall be carefully bedded as shown in the Bedding Details in Section II. The CONTRACTOR shall be responsible for accurately shaping the pipe subgrade to fit the bottom of the pipe for the width shown on the Bedding Details. Use of a drag template shaped to conform to the outer surface of the pipe will be required if other methods do not give satisfactory results.

Each joint shall be recessed in bedding material as required by the Bedding Detail in such a manner as to relieve the bell of the pipe of all load and to ensure continuous bearing along the pipe barrel upon the pipe subgrade.

8.13.1 Class A Bedding (Concrete Arch or Cradle) - Class A Bedding shall be used when additional supporting strength of the pipe is required. The lower portion of the

pipe shall be supported by means of a concrete arch or cradle. Class A bedding will not be allowed for flexible pipe such as steel, corrugated steel, plastic and ductile iron pipe. Class A Bedding shall comply with the details in Section II.

8.13.2 Class B Bedding (Granular) - Class B Bedding material shall consist of a well graded mixture of mineral aggregate. The aggregate shall be squeegee with the maximum amount of fines passing a No. 200 screen not to exceed 5% by weight. The aggregate shall comply with ASTM C-33 or ASTM D-448, gradation #6 or #67. If the excavation for bedding is below the water table, the sub-bedding material shall consist of 3/4-inch to 1-1/2 inch rock. Class B Bedding shall comply with the details in Section II.

#### 8.14 Installation of the Sanitary Sewer Line

8.14.1 General - All pipe shall be laid without break from structure to structure, with the socket ends of the pipe upgrade. Pipe shall be laid to the line and grade shown on the approved plans and in such a manner as to form a close concentric joint with the adjoining pipe and prevent sudden offsets of the flow line. The interior of the sewer pipe shall be cleaned of all dirt and superfluous material of all descriptions as the work progresses.

At all times when pipe laying is not in progress, the open end of the pipe shall be closed with a tight fitting cap or plug to prevent the entrance of foreign matter into the pipe. These provisions shall apply during the noon hour as well as overnight. In no event shall the sewers be used as drains for removing water that has infiltrated into the trenches.

8.14.2 Alignment and Grade - The sewer line shall be laid and maintained to the required lines and grades as shown on the Plans.

Whenever obstructions not shown on the Plans are encountered during the progress of the work and interfere to such an extent that an alteration in the approved Plans is required, the District Engineer shall have the authority to change the Plans and order a deviation from the line and grade.

#### 8.14.3 Placing of Sewer Pipe in the Trench

8.14.3.1 When placing the sanitary sewer pipe in the ditch, the recommended practice for installing sewer pipe ASTM C12-77 or latest revision thereof shall be used. Pipe shall be laid true to line and grade as shown on Plans approved by the District Engineer.

All pipe shall be protected during handling against impact shocks and free fall and no pipe shall be placed in the sewer line that has been damaged while lowering into the ditch. Bell holes shall be dug under the bells of all pipe, regardless of the type of bedding used in the ditch and the entire length of

barrel of all sewer pipe shall rest firmly on the bedding material used in the ditch and the weight of the sewer pipe in no case shall be supported by the bells of the pipe.

After lowering into the ditch, both the bell and spigot shall be thoroughly cleaned and free from any foreign material.

8.14.3.2 When manufacturer's prefabricated joints are used in the laying of clay or other sanitary sewer lines, such lines shall be joined using lubricants, primers, adhesives, solvents, etc., recommended by the manufacturers of said manufactured joints. All factory fabricated joints shall be placed, fitted, joined and adjusted in such a workmanlike manner as to obtain the degree of water tightness required and in compliance with recommended methods of the manufacturer, and as approved by the District Engineer.

8.14.3.3 Where cast iron sewer pipe is used in a sanitary sewer line, it shall be as designated under sewer pipe in these specifications. The method of placing and joining cast iron sanitary sewer pipe in the trench shall be in accordance with specifications of the pipe manufacturer on this operation, and as approved by the District Engineer.

#### 8.14.4 Pipe Fittings

8.14.4.1 General - Pipe fittings shall include branches of every type and stoppers. Fittings shall be furnished and installed at the locations, to the grades and of type and size shown on the Plans and in conformance with these specifications. Branches shall be installed in accordance with the details in Section II.

8.14.4.2 Branches - Branches of type shown on the Plans shall be furnished with connections of the sizes specified and shall be securely and completely fastened to the barrel of the pipe in the process of manufacture. In the case of pipe 15" or greater in diameter, in addition to other fastening material of approved quality, there shall be a reinforcing collar of cement mortar around the outside of the joint, and there shall be no exposure of cement mortar on the interior surface of the pipe. Wye branches shall have their axis approximately 45 degrees (unless otherwise specified on the Plans) to the longitudinal axis of the pipe, measured from the socket end. All branches shall terminate in sockets and the barrel of the branch shall be of sufficient length to permit making a proper joint when the connecting pipe is inserted in the branch socket.

The quality of pipe fittings shall conform to the applicable provisions of these specifications, and Section 3. Joints for fittings shall conform to applicable pipe material.

8.14.4.2.1 Installation of Branches - Pipe wyes, and other types of branches shall be furnished and installed along with the sewer. Wyes of size specified on the Plans shall be installed for all sewer house connections and for future sewer house connections as shown on the Plans, or specified in the detailed specifications. The longitudinal barrel of branch fittings to be placed in line and grade with the sanitary sewer mains shall be of the same diameter, quality and type as said sewer. Installation, earthwork and bedding for branches shall conform to the applicable provisions set forth for said sewer pipe. Unless otherwise specified, the branch of wye fittings shall be inclined upward at an angle not greater than 45 degrees from a horizontal line. No wye for sewer house connection branches shall be placed closer than 7 feet, in the downstream side, to the centerline of any structure or manhole.

The CONTRACTOR shall hand tamp the backfill under every wye branch when installed.

8.14.4.3 Stoppers - Pipe stoppers shall be 3/4" in thickness and shall have a factory-made plasticized polyvinyl chloride compound joint material cast and bonded to the pipe. The material shall be molded and cured to a uniform hardness and compressibility and form a tight compression coupling when assembled. The material used for the compression joint shall conform to the type of pipe material specified.

Neoprene (synthetic rubber) stoppers shall be equal to those manufactured by Pacific Clay Products, Gladding McBean and Company or approved equal. The joint formed by the stopper and pipe shall be a tight compression coupling when assembled.

All joints for stoppers shall be adequate to withstand the internal pressure of the leakage and/or infiltration test; however, joints shall be made in such a manner that they may be removed without injury to the socket.

8.14.5 Pipe at Manholes or Structures - Pipe joint of the same inside diameter as the adjoining pipe shall be placed at the inlet and outlet to each manhole or structure as shown on the details.

Pipe bells shall not be cast into manholes or structures. The bell shall be cut off so that no recess or offset appears on the exposed face from the inside wall of the pipe to the outside wall of the pipe (to be a plain end, flush with the inside wall of the manhole or structure, or as shown on the details.)

8.14.6 Underdrain - No underdrain system will be allowed to be placed in mainline or sewer service trenches.

## 8.15 Backfilling

8.15.1 General - All trenches shall be backfilled after pipe, fittings and appurtenances have been installed, inspected and approved by the District Engineer. All, if any, frozen material must be removed prior to backfill. Bedding and "pipe zone" backfill shall be installed in accordance with Section 8.13.

Whenever a relative compaction requirement value is specified herein, the optimum moisture content and relative density shall be determined in accordance with AASHTO T-180 and ASTM D1557 for 90% and AASHTO T-99 and ASTM D698 for 95%.

8.15.2 Density Requirements in Trench - The CONTRACTOR shall obtain a Standard Proctor Density of 90% for the total depth of all trenches in open fields and **95% in dedicated rights-of-way**. Backfilling shall be done with good sound earth, sand or gravel, and no oil cake, bituminous pavement, concrete, rock or other lumpy material shall be used in the backfill unless these materials are scattered and do not exceed 6" in any dimension and are not placed within 1 foot of the 1-1/2 foot limit. Material of perishable, spongy or otherwise improper nature shall not be used in backfilling and no material greater than 4" in any dimension shall be placed within 1 foot of any pipe, manhole or structure. All backfill material shall be subject to the approval of the District Engineer.

8.15.3 Compacted Fill - Compaction shall be done by use of vibratory equipment, tamping rollers, pneumatic tire rollers or other mechanical tampers of the type and size approved by the Engineer. The backfill shall be placed in horizontal layers of such depths as are considered proper for the type of compacting equipment being used in relation to the backfill material being placed. Each layer shall be evenly spread, properly moistened and compacted to the density specified in Section 8.15.2. Any damage to the pipe as a result of CONTRACTOR'S operation shall be repaired and/or replaced.

8.15.4 Consolidated Fill - Consolidated fill shall be performed by flooding, pooling or jetting so as to obtain a density of the fill material at least equal to that specified in Section 8.15.2. When flooding, pooling or jetting methods are used, material for use as backfill shall be placed and compacted in layers not exceeding 3 feet in thickness. Flooding, pooling or jetting methods shall be supplemented by the use of vibratory or other compaction equipment when necessary to obtain the required density. Care shall be taken in all consolidating operations to prevent the movement or floating of the pipe. In the event there is movement or floating, the CONTRACTOR shall re-excavate, relay and backfill all pipe so affected. Consolidation methods shall not be used when the backfill material is not sufficiently granular in nature to be self-draining during and after consolidation and foundation materials may be softened or otherwise damaged by applied water.

8.15.5 Procedure at Street Zone - The top 2-1/2 feet from finish street grade or

ground surface, as the case may be, shall be compacted in horizontal layers not exceeding 6" in thickness, using approved hand pneumatic or mechanical type tampers to obtain a Standard Proctor Density of 95%. From existing street grade to 2-1/2 feet below street grade, the material for backfill may contain stones up to 2" in diameter, in quantity not exceeding 20% of the volume, where said coarse materials are well distributed throughout the finer material and the specified compaction can be obtained.

#### 8.16 Compaction Tests

When required by the District Engineer, compaction tests will be taken by an approved testing laboratory at locations designated by the District Engineer. All expenses involved in these tests will be borne by the Developer/Owner. Test results must be made available to the District Engineer immediately and copies of results submitted once a week. In all cases where the tests indicate compaction less than that required in these specifications, additional compaction and tests will be required until these specifications are met. Probationary acceptance of the lines by the District will be contingent upon satisfactory compaction results. All compaction tests and acceptance of test results must be taken and reviewed prior to testing for infiltration and/or exfiltration. Frequency of testing will be as follows:

- 1 test at every above ground appurtenance (manholes)
- 1 test every 200 LF of mainline trench with 50% of the tests at subgrade elevation and 50% below subgrade
- test at every sewer service at various depths with 50% of test in lower half of the trench backfill.

#### 8.17 Final Clean Up

After backfill has been completed, the right-of-way shall be dressed smooth and left in a neat and presentable condition and as close to its original condition as possible, and to the satisfaction of the District Engineer.

### 8.18 Safety Precautions

All excavations shall be performed, protected and supported as required for safety and in the manner set forth in the operation rules, orders and regulations prescribed by the OSHA Federal Register.

Barriers shall be placed at each end of all excavations and at such places as may be necessary along excavations to warn all pedestrian and vehicular traffic of such excavations. Lights shall also be placed along excavations from sunset each day to sunrise of the next day until such excavation is entirely refilled.

## 9. PROTECTION OF WATER SUPPLIES

### 9.1 Water Supply Inter-Connections

There shall be no physical connection between a 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.

### 9.2 Relation to Water Works Structures

While no general statement can be made to cover all conditions, it is generally recognized that sewers must be kept remote from public water supply wells or other water supply sources and structures.

### 9.3 Relation to Water Mains

Sewers shall be located a minimum of 10 feet horizontally from existing or proposed water mains (centerline distance). Where sewer lines cross water mains, the sewer pipe shall be a minimum of 18" clear distance vertically below the water main. If this clear distance is not feasible, the crossing must be designated and constructed so as to protect the water main. Minimum protection shall consist of the installation of an impervious and structural sewer. For example:

9.3.1 One length of ductile iron water pipe at least 18 feet long centered under the water main. Joints between the sewer pipe and the cast iron pipe shall be encased in a concrete collar at least 6" thick and extending at least 6" either side of the joint.

9.3.2 Concrete, PVC, or vitrified clay sewer pipe with reinforced concrete encasement. Encasement shall be in accordance with the details in Section 13 and extend a distance of 10 feet either side of the water main.

In all cases, suitable backfill or other structural protection shall be provided to preclude settling and/or failure of the higher pipe.

## 10. TESTS AND INSPECTION

## 10.1 Pipe Testing Prior to Construction

10.1.1 General - Before being used in any work under these specifications, pipe shall be subjected to and shall meet the requirements of the following hydrostatic pressure tests and loading test. These tests shall be made by the CONTRACTOR and shall be witnessed by a reputable testing laboratory. The CONTRACTOR shall deliver the pipe selected for testing to the place and at the time designated by the testing laboratory. Written test reports will be furnished to the District Engineer upon request.

The testing laboratory shall select at random for testing as herein specified up to 2% of the number of pipe in each size of pipe furnished, except that in no case shall less than five (5) specimens be tested.

The specimens selected for testing purposes shall be sound pipe having dimensions consistent with these specifications. The lot or lots from which the test samples are taken shall be sufficient to fill the entire order for that size of pipe used in the work under the Contract if they pass the tests, and shall be so designated and marked.

All pipe shall be subject to inspection by the District Engineer at the factory, trench or other point of delivery. The purpose of the inspection shall be to cull and reject any pipe that, independent of the physical tests herein specified, fails to conform to the requirements of these specifications, or that may have been damaged during transportation and/or in subsequent handling.

<b>Thickness of Barrel</b>	<b>Minimum Testing Time</b>
Up to and including 1"	7 minutes
Over 1" and including 1-1/2"	9 minutes
Over 1-1/2" and including 2"	12 minutes
Over 2" and including 2-1/2"	15 minutes
Over 2-1/2" and including 3"	18 minutes
Over 3"	21 minutes

10.1.2 Hydrostatic Test - In lieu of the standard ASTM absorption test, the following hydrostatic pressure test shall be substituted:

The hydrostatic pressure test shall precede the loading test by not less than one (1) hour or more than three (3) hours and shall be applied to all the specimens received for test in each size of the pipe. When subjected to an internal hydrostatic pressure

of 10 pounds per square inch for the time specified in Table II, the accumulated moisture on the exterior surface of the pipe shall not run down the side in such quantity that it will exceed 10 milliliters.

10.1.3 Loading Test - The loading test shall be the three-edge bearing. The loading test shall conform to the applicable provisions of the ASTM for each type and class of pipe specimens selected for testing, except that loading to test ultimate strength will not be required.

The net inside length of the pipe from the bottom of the socket to the spigot end of the pipe shall be used as the divisor to calculate the load per linear foot.

10.1.4 Acceptance or Rejection on Result of Test - If all, or the minimum, designated percentage or number of the specimens tested meet the requirements of the test, then all of the pipe in the lot, shipment or delivery corresponding to the sizes and classes so tested shall be considered as complying with the test. If, however, 10% or more of the specimens tested fail to meet the requirements of the test, or if more than one specimen fails to meet the requirements of the test when the number to be tested is less than ten, then a second selection of pipe shall be made for the test. The number of specimens to be tested in the second selection of pipe shall be five (5) for each specimen of the first selection that failed to meet the requirements.

If 90% or more of the specimens tested, including those first tested, meet the requirements of the test, all of the pipe in the lot, shipment or delivery corresponding to the sizes and classes so tested shall be considered as complying with that test; otherwise, all pipe of these sizes and classes shall be rejected.

10.1.5 Inspection Independent of Tests - The following imperfections in a pipe or special fitting will be considered injurious and cause for rejection without consideration of the test results herein above specified:

A single crack in the barrel of the pipe, extending through the entire thickness, regardless of the length of such crack.

A single crack which extends through one-fifth of the barrel thickness and is over 3" long.

Any surface fire crack which is more than 1/32" wide at its widest point.

Lumps, blisters, pits or flakes on the interior surface of a pipe or fittings.

When the bore or socket of the pipe varies from a true circle more than 3% of its nominal diameter.

When a pipe or fitting, designated to be straight, deviates from a straight line more than 1/16" per linear foot. The deviation shall be measured from a

straight edge at a point midway between the ends of the pipe.

A piece broken from either the socket or spigot end.

Tramp clays, grog or other foreign matter that have fused permanently to the exterior or interior surface of the pipe or fitting.

If, when placed in a vertical position, the pipes do not give a metallic ring when struck with a hammer.

## 10.2 Test for Leakage and Infiltration After Construction

10.2.1 General - It is the intent of the sewer specifications that the completed sewer pipes of all types, along the manholes and other appurtenances, shall be watertight.

At the option of the District Engineer, each section of sewer between two successive manholes shall be tested for leakage and/or infiltration. These tests shall be performed subsequent to acceptance of compaction test results by the District Engineer.

Even though a section may have previously passed the leakage or infiltration test, each section of sewer may be tested subsequent to the last backfill compacting operation in connection therewith, where, in the opinion of the District Engineer, heavy compaction equipment or any of the operations of the CONTRACTOR or others may have damaged or affected the required watertight integrity of the pipe, structure and appurtenances. The CONTRACTOR shall furnish all materials required for the tests. Tests shall be made in the presence of the District Engineer.

If the leakage and/or infiltration rate as shown by the tests specified herein is greater than the amount specified, the pipe joints shall be repaired or, if necessary, the pipe shall be removed and re-laid by the CONTRACTOR. The sewer will not be considered acceptable until the leakage and/or infiltration rate, as determined by test, is less than the allowable.

The CONTRACTOR may at his option air test or water test for leakage except where (a) in the opinion of the District Engineer excessive groundwater is encountered, then the infiltration test shall be made, or (b) where the difference in elevation between the invert of the upper structure and the invert of the lower structure is more than 10 feet, then the air test shall be made.

10.2.2. Water Test - Each section of sanitary sewer between two successive structures may, at the direction of the District Engineer, be tested by closing the lower end of the sewer to be tested and the inlet sewer of the upper structure with plugs or stoppers and filling the pipe and structure with

water to a point 4 feet above the invert of the open sewer in the upper structure, or to a height of 10 feet above the invert of the sewer in the lower structure, whichever gives the least hydrostatic pressure on the lower structure.

The total leakage shall be the decrease in volume of water in the upper structure. The leakage shall not exceed 0.23 gallons per hour per inch of nominal diameter of pipe per 100 feet of sewer pipe being tested or as indicated in Table III. The length of house connection shall not be used in computing the length of sewer main being tested.

If the leakage, as shown by the test, is greater than allowed, the pipe shall be overhauled and, if necessary, replaced and re-laid until the joints and pipe shall hold satisfactorily under this test. All tests must be completed before street or trench is resurfaced, unless otherwise directed by the District Engineer. The CONTRACTOR shall furnish all labor and materials for making the tests required.

<b>TABLE 10 - II</b>	
<b>ALLOWABLE LIMITS OF EXFILTRATION (LEAKAGE)</b>	
<b>295 GAL/INCH DIA/MI/DAY (AT 10' HEAD)</b>	
<b>OR 0.23 GAL/INCH DIA/100'/HR</b>	
<b>Pipe Diameter (Inches)</b>	<b>Maximum Allowable Loss In Gals/Hr/100' of Pipe</b>
8	1.9
10	2.3
12	2.6
15	3.5
18	4.2
21	4.9
24	5.6
27	6.3
30	7.0
33	7.6
36	8.3

10.2.2.1 Air Test Procedure - Each section of sanitary sewer between two successive manholes may, at the direction of the District Engineer, be tested by plugging all pipe outlets with suitable test plugs. Air shall be slowly added until the internal pressure is raised to 4.0 psi. The compressor used to add air to the pipe shall have a blow-off valve set at 5 psi to assure that at no time the internal pressure in the pipe exceeds 5 psi. The internal pressure of 4 psi shall be maintained for at least two minutes to allow the air temperature

to stabilize after which the air supply shall be disconnected and the pressure allowed to decrease to 3.5 psi. The time in minutes that is required for the internal air pressure to drop from 3.5 psi to 2.5 psi shall be measured and the results compared with the values listed in Table IV.

<b>Pipe Diameter (Inches)</b>	<b>Minimum Distance Test Time in Minutes</b>	<b>Between Manholes (Feet)</b>
8	4	340
10	5	260
12	6	230
15	7	170
18	9	150
21	10	120
24	11	110
27	13	100
30	14	90
33	16	80
36	17	70

The above tabulated values shall be used for the respective diameter pipes except where the distance between successive manholes is less than the above tabulated values, in which case the following formula will be used to determine the test time:

$$T = .000183 d^2L$$

T = Test time in minutes

d = Inside diameter of pipe in inches

L = Distance between successive manholes in feet

If the pressure drop from 3.5 psi to 2.5 psi occurs in less time than the above tabulated or calculated values, the pipe shall be overhauled and, if necessary, replaced and re-laid until the joints and pipe shall hold satisfactorily under this test.

#### 10.2.2 Test for Infiltration - If, in the construction of a section of the sewer between

structures, excessive groundwater is encountered, the test for leakage described in Section 10.2.2 shall not be used, but instead, the end of the sewer at the upper structure shall be closed sufficiently to prevent the entrance of water, and pumping of groundwater shall be discontinued for at least three days after which the section shall be tested for infiltration. The infiltration shall not exceed 0.16 gallons per hour, per inch of diameter, per 100 feet of main-line sewer being tested or as indicated in Table V and does not include the length of house laterals entering that section. Where any infiltration in excess of this amount is discovered before completion and acceptance of the sewer, the sewer shall be immediately uncovered and the amount of infiltration reduced to a quantity within the specified amount of infiltration before the sewer is accepted, at the expense of the CONTRACTOR. Should, however, the infiltration be less than the specified amount, the CONTRACTOR shall stop any individual leaks that may be observed when ordered to do so by the District Engineer. The CONTRACTOR shall furnish all labor and materials for making the tests required. All tests must be completed before street or trench is resurfaced, unless otherwise directed by the District Engineer.

See following sheet for Table 10-IV:

**TABLE 10 - IV**

**ALLOWABLE LIMITS OF INFILTRATION  
200 GAL/INCH DIA/MI/DAY  
OR 0.16 GAL/INCH DIA/100' HR**

<b>Diameter of Sewer (Inches)</b>	<b>Infiltration Gal/Hr/100' (Gallons)</b>
8	1.3
10	1.6
12	1.9
15	2.4
18	2.8
21	3.3
24	3.8
27	4.3
30	4.8
36	5.7

**ALLOWABLE LIMITS OF INFILTRATION  
FOR MANHOLE STRUCTURES**

<b>Diameter of Manhole (Inches)</b>	<b>Infiltration Gal/Vertical Ft/Hr</b>
41	0.07
48	0.08
60	0.10
72	0.12

10.3 Tests for Alignment and Grade, and Damaged or Defective Pipe in Place

Pipe Deflection Testing: At least thirty (30) days after construction and flushing, all sanitary sewer systems constructed of PVC pipe shall be tested for vertical ring deflection using a deflectometer, properly sized “go, No-Go” Mandrel, or sewer ball. Maximum allowable vertical ring deflection is five percent (5%) of the pipe’s diameter. The following Table 10-V outlines the acceptable Mandrel diameter for different sizes of PVC pipe.

<b>Pipe Diameter (Inches)</b>	<b>Base Inside Diameter (Inches)</b>	<b>5% Deflection Mandrel</b>
8	7.665	7.28
10	9.563	9.08
12	11.361	10.79
15	13.898	13.20
18	16.976	16.13
21	20.004	19.00
24	22.480	21.35
27	25.327	24.06

In areas where there are still some questions as to the condition of the sewer line, the District Engineer may require that pictures be taken of the interior of that part of the sewer line under question. After the pictures have been interpreted by the CONTRACTOR and the District Engineer, should the sewer line be interpreted to be defective, the cost of taking the pictures shall be borne by the CONTRACTOR. Should the sewer line be interpreted as being a good sewer line, the cost of taking the pictures shall be borne by the District. However, the District reserves the right to require pictures be taken of any curved line approved for installation. In all such cases, the pictures will be taken at the expense of the CONTRACTOR and will become the property of the District after interpretation. Final acceptance of the lines will not be granted until all tests are successful and all items listed for correction by the District Engineer have been accomplished.

- 10.4 All sanitary sewer mains must be televised. One VHS tape or standard format DVD must be sent to the District Engineer.

11. RESPONSIBILITY OF THE CONTRACTOR

Prior to the start of any work where sewer mains to be installed tie into existing District sewer systems, the nearest manhole to the point of tie-in shall be plugged with a plumber's plug on the outlet side by the CONTRACTOR. This plug shall remain in place until the main has been deemed acceptable for service by the District Engineer. Its purpose is to prevent any mud, water, or other materials from entering the existing line during construction. The CONTRACTOR shall be responsible for pumping and cleaning these manholes and removing the plug when so instructed by the District Engineer.

The CONTRACTOR is responsible also for maintaining As-Recorded drawings complete with a kinematic GPS survey to include all distances between manholes and locations of wyes or service tees. These as-builts and survey shall be transmitted to the District as AUTOCAD files in either floppy disk or CD format.

The following shall be layered as follows:

1. Gravity: Mains, size, material, manholes, length and stations.
2. Force Mains: Mains, size, material, lift stations, valves, blow offs, air vacuums, length and stations.
3. Invert elevations, top of rim, percent, size of manhole, flow arrows, ID numbers, and concentric or eccentric cones.
4. Subdivision.
5. Street Address.
6. Taps, service laterals, underdrain, and cleanouts.
7. Parcels.

These drawings will be turned over to the District Engineer and final acceptance of the line by the District will be contingent upon receipt of formal As-Recorded drawings in 24" x 36" size (scale :1" = 100' and submitted in reproducible and print form. Once the sanitary sewer construction has been completed and all tests performed and the mains deemed operational by the District, a walk through inspection will be performed. Once all corrections to the system are made and approved, the District will issue a probationary acceptance of the system. Final acceptance will be issued as outlined in the Rules and Regulations of the District.

The CONTRACTOR will be held responsible for the proper functioning of the lines for up to two (2) years from the date of probationary acceptance of the lines by the District. Any malfunction during this period of guarantee shall be remedied by the CONTRACTOR to the satisfaction of the District Engineer and at no expense to the District.

## 12. SEWER SERVICES

Installation of any and all service lines, whether from the main line to the property line or from property line to the building must be inspected by the District, who shall be notified by the CONTRACTOR at least 48 hours prior to installation.

Concrete, cast iron, or plastic sewer services will be acceptable if they conform to the specifications previously mentioned. All methods of joining the sewer service to the existing wye or tie at the main line, or to the ground iron stack at the building must be approved by the District in advance. In all cases where existing wyes or ties cannot be met, or are not available, mechanical methods must be used to tap the main line.

No sewer service taps shall be made prior to the acceptance of the completed main-line by the District Engineer. Where all taps are made, the CONTRACTOR must keep accurate records indicating the exact location of the tap. Installation of service pipe must conform to the specifications previously mentioned.

Multiple sewer connections must be made within or under any building. Any sewer service line exiting a building must be connected directly to a District sewer main with no intermediate connections.

All sewer services must be bedded with squeegee, 4" below and 6" above the pipe. No horizontal bends will be allowed in the street. At the connection to the house service, no more than 3 bends totaling 135 degree will be allowed. Calder couplings may be used, but the pipe deflection from these couplings may not exceed 2 degrees. No 90 degree bends will be allowed. All sewer services will be installed with 6" wide wire-impregnated green or metallic-backed marker tape buried above the pipe 24" maximum below final grade.

## 13. OIL , SAND AND GREASE INTERCEPTORS

### 13.1 General

When required, Interceptors shall be provided when in the judgment of the District or its Engineer, they are necessary for the proper handling of liquid wastes containing grease or solids which may be harmful to, or cause obstruction of, the publicly owned treatment works, or interfere with the operation of the treatment works.

All drains from the kitchen, food preparation, and dishwashing areas shall be connected to the grease interceptor. Fixtures to be connected include, but are not limited to, scullery sinks, pot and pan sinks, dishwashing machines, soup kettles, and floor drains located in areas where grease containing materials may exist. Garbage disposal (Garbage Grinders) will be required to be connected to an approved interceptor.

Toilets, urinals, and similar fixtures shall not waste through the interceptor. All waste shall enter the interceptor through the inlet pipe only.

Upon approval by the District, installation of an interceptor will not be required of facilities that do not cook the food that is served, and/or do not wash equipment or utensils associated with preparation or service of cooked foods. All new commercial building within the District must have a ICPP form completed and on file with the District.

### 13.2 Approval

The size, type and location of each interceptor shall be approved and inspected by the District or its Engineer, in accordance with Parker Water and Sanitation District Standards regarding interceptors. Except where otherwise specifically permitted, no wastes other than those requiring separation shall be discharged into any interceptor. Two sets of plans, including complete mechanical and plumbing sections, shall be submitted to the District Engineer for approval prior to construction. Such plans shall include the size, type and location of each interceptor.

### 13.3 Design

All interceptors for grease and heavy solids shall be so designed and located as to be readily accessible for cleaning and shall have a water seal of not less than 6 inches. Interceptors shall be constructed in accordance with the design specifications contained herein, shall be approved by the District Engineer, and shall have a minimum of 2 compartments with fittings designed for grease retention. There shall be a minimum of 2 manholes to provide access for cleaning and inspection of all fixtures and compartments of the interceptor; a minimum of 1 per 10 feet of interceptor length. In the case of smaller, or circular interceptors, where it is not practical to install 2 manholes, a single manhole shall be located so as to permit entrance to the first compartment, and inspection of the second. All areas of the second compartment shall be accessible for cleaning. A sampling manhole must be installed immediately downstream of the grease interceptor. No connections are allowed between grease interceptor and sampling manhole.

### 13.4 Location

All interceptors shall be readily accessible for inspection, servicing, and maintaining in proper working condition. The use of ladders or the removal of bulky equipment in order to inspect or service interceptors shall constitute a violation of accessibility. All interceptors shall be located outside of the facility served. Interceptors may not be installed in any part of a building where food is handled. Location of all interceptors shall be approved by the District or its Engineer, and shall be shown on the approved building plan. No interceptors in drive-through driveways or next to main entrance ways.

### 13.5 Sizing Criteria

When determining the minimum size of interceptor required, the following will be considered:

The minimum acceptable volume shall be not less than 1,190 gallons.

The size of the interceptor shall be based on the maximum number of meals served at the maximum periods of the day (either breakfast, lunch, or dinner). Volume, in gallons, of the interceptor shall be 2-1/2 gallons multiplied by the maximum number of meals served during the busiest period of the day.

An alternate method of determining the size of the grease interceptor is to multiply seating capacity times a turnover constant of 1.6 times 2-1/2 gallons. Seating capacity can be approximated, using 10 square feet of dining area per person. (VOLUME = Seating Capacity x 1.6 x 2.5 gallons).

When the above methods are not feasible, an appropriate volume may be determined by multiplying the total rate of flow in gallons per minute from each fixture required to be connected to the interceptor times a minimum retention time of not less than 15 minutes, the resulting volume expressed in gallons.

TYPE OF FIXTURE	RATE OF FLOW (G.P.M.)
Floor drain/sink	10
Restaurant kitchen sink	15
Single compartment scullery sink	20
3 compartment sinks	35
2 single compartment sinks	25
2 double compartment sinks	35
Restaurant dishwasher:	
up to 30 gallon water capacity	15
30 to 50 gallon water capacity	25
50 to 100 gallon water capacity	40
Garbage disposal/grinder	35

### 13.6 Shoppette/Strip Mall Buildings

Each shoppette/strip mall shall have a common kitchen grease waste drain sized to collect future potential flows from fixtures that can be expected to introduce grease from food preparation and/or dishwashing into the sanitary sewer system. These fixtures shall include, but are not limited to, garbage disposals, food preparation sinks, floor sinks, dishwashers, scullery sinks, soup kettles and other fixtures of these types.

The common kitchen grease waste drain shall be routed to the exterior building to a grease interceptor. Sanitary sewage flows will not be allowed into the kitchen grease waste drain.

The grease interceptor shall be constructed in accordance with Appendix H of the

latest edition of the Uniform Plumbing Code. The grease interceptor shall be vented and access covers shall be gas tight with an opening dimension of a minimum of 24".

Section H3-C of the plumbing code, which requires a separate grease interceptor for each establishment, will not be followed.

Sizing criteria for the common grease interceptor will be as follows:

The number of potential seats in any shoppette/strip mall shall be determined by dividing 25% of the interior building square footage by the occupant load factor (15 SF/person).

$$\frac{.25 \times \text{Total Building Square Footage}}{15 \text{ SF}} = \text{Potential Restaurant Seating}$$

To size the common grease interceptor, the following formula will be used:

$$\# \text{ Seats} \times 6 \text{ (Waste Flow Rate)} \times 2.5 \text{ (Retention Time)} \times \text{Storage Factor}$$

The storage factor is as follows:

<u>Hours of Operation</u>	<u>Storage Factor</u>
8	1
16	2
24	3

In no case will any grease interceptor for a shoppette/strip mall be less than 1500 gallons.

Any establishment which will produce an overload on this design will be required to make any necessary corrections/alterations to assure compliance with Appendix H.

### 13.7 Oil and Sand Interceptor Sizing

- a. Parking Garage - Six (6) cubic feet plus one (1) cubic foot per ten (10) vehicles
- b. Repair Garage, Warehouse - Six (6) cubic feet plus one (1) cubic foot per 100 square feet
- c. Maintenance

The responsibility of cleaning and maintaining the interceptor in efficient operating

condition shall be the Owner's and/or lessee's responsibility. Oil and Sand interceptors shall be accessible and shall be inspected on a periodic basis by representatives of the District.

All sand, oil and grease interceptors must be pumped out at a maximum interval of every quarter year. Cost of pump out shall be at Owner's expense.

The District retains the right as allowed by Colorado State Statues, to review all interceptors during regular business hours, on an unscheduled basis, to determine if the unit is operating and being maintained on a regular basis. Record of maintenance shall be maintained on site. No chemicals, thermal, or bacterial agents may be used to alter the contents without written approval of the District.