

PART II

WASTEWATER COLLECTION SYSTEM STANDARD SPECIFICATIONS

Chapter 1 – General

- 1.01 **Authority.** These Specifications are promulgated by the City of Cripple Creek. The interpretation, enforcement, and revision of these Specifications are hereby delegated to the Superintendent of the Water and Sewer Department.
- 1.02 **Effective Date of Specifications.** These Specifications shall be in effect fifteen (15) calendar days after adoption by the city council and shall supersede all former standard specifications for Installation of sanitary sewer mains within the City of Cripple Creek.
- 1.03 **Revisions, Amendments or Additions.** These Specifications may be revised, amended or added to. Such revisions, amendments and additions shall be binding and in full force and effect when adopted in the manner set forth in Section 1.02.
- 1.04 **Department Control.** These Specifications will apply to the installation, operation and maintenance of all wastewater collection facilities under the control of the City of Cripple Creek Water and Sewer Department.
- 1.05 **Organization and Interpretation of Specifications.** These Specifications are composed of written Standards of Engineering Practice, Material specifications and Standard Drawings. The interpretation of any section or of differences between sections, when appropriate, shall be made by the Superintendent of the Water and Sewer Department and his/her interpretation shall be binding and controlling in its application.
- 1.06 **Definitions.** As used in these Specifications, or in any of the drawings where these Specifications govern, unless the context shall otherwise require, the following words defined shall have the meanings herein ascribed:
 - a. **Department or Water and Sewer Department.** The department of the City of Cripple Creek which is responsible for the operations and maintenance of the wastewater collection system.
 - b. **Superintendent.** The Superintendent of the Water and Sewer Department or his/her designated representative.

- c. Engineer. The Engineer or consultant of the Water and Sewer Department, acting either directly or through properly authorized agents, such agents acting within the scope of the particular duties entrusted to them.
- d. Collection System. Sewer mains, together with all appurtenant and necessary manholes, clean outs, taps, service pipes, and associated materials, property and equipment collecting sanitary sewage from individual customers.
- e. Wastewater Main or Sanitary Main. That portion of the wastewater system which collects sewage from users to the City wastewater treatment plant, excluding service lines.
- f. Service Line. The sewage collection line extending from the premises down to and including the connection to the wastewater or sanitary main.
- g. Applicant for System Extension. Any person, association, corporation, entity, or government agency desiring sanitary sewer service or premises under their control, often a subdivider, a developer or an owner.
- h. Main Extension. Extensions to the existing collection system network.
- i. Contractor. In the context of these Specifications a person or persons, co-partnership or corporation employed by an applicant for the purpose of installing wastewater system extensions or replacements.
- j. Inspector. The authorized representative of the Water and Sewer Department assigned to the project.
- k. Standard Drawings. Water and Sewer Department Standard Drawings are a part of these Specifications.
- l. City. The City of Cripple Creek including specifically the Water and Sewer Department responsible for overseeing the wastewater systems' operations.

1.07 Abbreviations. All references to documents or specifications shall be the latest edition or revision thereof:

- a. ASTM American Society for Testing and Materials
- b. ANSI American National Standards Institute
- c. NSF National Sanitation Foundation
- d. OSHA Occupational Safety and Health Act
- e. USGS United States Geological Survey

- f. CIP Cast Iron Pipe
- g. DIP Ductile Iron Pipe
- h. PVC Polyvinyl Chloride-Plastic Pipe

WASTEWATER COLLECION SYSTEM STANDARD SPECIFICATIONS

Chapter 2 – Design Provisions

- 2.01 Planning Considerations. The land use and population densities approved by the City shall be used to determine wastewater facility design parameters. Where approved master plans do not exist, the following criteria shall be used unless specific approval for other criteria has been given by the City.
- a. Design Period: The sewer systems shall be designed for the estimated ultimate tributary population. The tributary areas shall be studied to determine the area for each projected land use.
 - b. Population densities including public use lands:
 - (1) Single-family units at 3.2 persons per unit.
 - (2) Multi-family and condominiums at 2.5 persons per unit.
 - (3) Four (4) single-family units per acre.
 - (4) Sixteen (16) multi-family cluster housing or condominiums per acre.
 - c. Per capita flows: Sewer systems shall be designed on the basis of not less than the following unless other values are specifically authorized by the City:
 - (1) On hundred (100) gallons per person per day.
 - (2) Three hundred (300) gallons per capita per day peak flow for submains and laterals.
 - (3) Two hundred fifty (250) gallons per capita per day peak flow for main trunk, interceptor or outfall sewers.
 - (4) Infiltration of 100 gallons per day per inch of diameter per mile per manhole run for new systems. New system installations which will service a portion of the existing collection system will require an infiltration/bleeding allowance as established by the city.
 - (5) Commercial land uses at 1400 gallons per acre per day with a peak factor of 2.

(6) Industrial land uses at 1600 gallons per acre per day with a peak factor of 3.

(7) Public use, park and open space at 1000 gallons per day with a peak factor of 2.

2.02 Minimum Size. No public sewer shall be less than 8 inches diameter. No building sewer shall be less than 4 inches in diameter.

2.03 Minimum Depth. In general, sewers shall be designed deep enough to drain basements and to prevent freezing. No public mains shall be less than 5 feet deep measured from the top of pipe unless special protection is require. Special protection shall consist of:

(a) Less than 5 feet but more than 3 feet of cover requires ductile iron, cast iron, reinforced concrete encasement or arch.

(b) Less than 3 feet of cover requires ductile iron or cast iron with reinforced concrete encasement.

No building sewer shall be less than 5 feet deep in traffic areas without similar special protection listed above except that concrete driveways may be substituted for protection of service lines.

2.04 Minimum Slopes. All sewers shall be designed to transport average sewage flows at mean velocities of 2 feet per second based on a Manning's roughness factor of 0.013. The slope between manholes shall be uniform. In no case shall the slope be less than the following for sewer mains and services:

MINIMUM GRADE TABLE

Services

Pipe Diameter

Slope

4 inches	2% or 1/4 inch per foot
4 inches	Ductile iron or cast iron pipe – 1% or 1/8 inch per foot
6 inches	1% or 1/8 inch per foot

Mains and Service

<u>Pipe Diameter</u>	<u>Slope</u>
8 inches	.40%
10 inches	.35%
12 Inches	.26%
15 inches	.20%
18 inches	.15%

- 2.05 High Velocity Protection. In the case of sewers where the slopes are such that over 15 percent grades are attained, special provisions as determined by the City shall be made to prevent excessive erosion of material surfaces or displacement by impact. Such high velocity protection shall be shown on detail drawings and approved by the City on a case-by-case basis.
- 2.06 Alignment. Standard location for sewers, unless some major interference prevents, is along the centerline of the street, easement or right-of-way. In streets less than 36 feet wide and alleys, the standard location shall be parallel to but removed 2 feet from the centerline. Manholes shall be located so as to prevent storm water entrance. Proposed sewer lines which may conflict with the placement of other underground facilities will require prior approval of the sewer placement location by the controlling agencies whose facilities are affected. Locations other than those specified will require specific approval of the City.
- 2.07 Pipe Alignment in Manholes.
- a. Intersections. All pipes shall have free discharge into the collection system. Where possible, the flow line of the intersecting pipe shall be the spring line (horizontal center of pipeline) of the collection sewer. All manhole inverts shall be designed with a 0.1-foot drop except for changes in alignment in excess of 30° shall have a 0.3-foot drop in the invert through the manhole. Locations other than those specified will require specific approval of the City.
 - b. Increasing Size. When sewers are increased in size with no intersecting sewers, the invert of the larger sewer shall be lowered sufficiently to maintain the same energy gradient.
- 2.08 Manhole Location. Manholes shall be installed at the end of each line, at all pipeline intersections, changes in grade, size, alignment and at distance not greater than 400 feet. Manholes must be located to allow unassisted and unrestricted access by City maintenance vehicles. Lines and manholes located in areas where access, in the opinion of the City, is not possible, will not be approved for construction.

2.09 Manhole Details.

- a. Manhole Sizes. The inside diameter of the manhole shall not be less than 4 feet on lines 8 inches through 12 inches in diameter; not less than 5 feet on line 15 inches through 36 inches in diameter; not less than 6 feet on lines in excess of 36 inches in diameter for standard design manholes (see Drawing No. 3 for standard manhole design).
- b. Drop Manholes. External drop manholes will be permitted only in extreme and special conditions where approval has been granted by the City. As a general criteria, a minimum difference in elevation of 4 feet between the inlet and outlet is required before considering use of external drop manhole design. The external drop sections must be totally encased in reinforced concrete and place on an adequate foundation (see Drawing No. 2 for standard drop manhole design).
- c. Manhole Channels. The flow channel shall be made to conform to the slope and shape of the sewer pipe for the invert of the open flow channel. At intersections with other lines, channels shall be formed with a curve to minimize turbulence. The flow channel shall be constructed to have a depth equal to the pipe diameter. Refer to Drawing Nos. 2 & 3.
- d. Rings and Covers. The ring and cover shall be constructed of cast iron for traffic bearing conditions and cast aluminum or cast iron for non-traffic bearing conditions. All manholes located outside of dedicated street or alley right-of-way will be designed and constructed with a locking type cover and the ring bolted to the concrete cone. Grade adjustment rings or blocks between the ring and cover and the concrete cone cap shall not exceed 6 inches.
- e. Watertightness. Precast concrete manhole joints shall be made watertight with a rubber 'O' ring, Ram-Nek, Con-Seal or similar approved material. Manholes of brick or segmented block shall not be used in the sanitary sewer system.
- f. Stub Outs from Manholes. Stub outs from manholes shall not exceed 40 feet except for line which will be extended in the future. Whenever practical, designs to complete the manhole run shall be submitted to the City superintendent for review to insure proper grade and alignment for future construction. Future extension of stub outs shall be of like material using the same grade and alignment.

2.10 Relation to Water Mains. Sewer lines shall be located a minimum of 10 feet horizontally from existing or proposed water mains and the sewer lines shall be a minimum of 18 inches clear distance vertically below the water main. If this clear distance is not feasible, the crossing must be designed and constructed so as to protect

the water main from potential cross connections and minimize the potential for structural damage to either pipeline. Minimum protection shall consist of the installation of an impervious and structural sewer as follows:

- a. Where the sewer pipe is above the water main, regardless of separation, one length of ductile iron pipe at least 18 feet long centered over the water main and jointed to the sanitary sewer pipe with a manufactured adapter specifically for such jointing shall be installed. It shall include rubber gasketed fittings with stainless steel tightening bands. The joints shall be enclosed in a concrete collar at least 6 inches thick and extending at least 6 inches either side of the joint.
- b. Where the sewer is beneath the water main but less than 18 inches clear distance vertically, the sewer pipe of any material shall be encased in reinforced concrete. Encasement shall be at least 6 inches thick and extend a distance of 10 feet on either side of the water main crossing. Reinforcing shall consist of a minimum of four No. 4 bars placed at quarter points around the pipe being encased.

The above-described protection from potential cross connections shall apply to service lines as well as sanitary sewer mains where the above described protection and special installation is required.

2.11 Stream and Drainage Channel Crossings.

- a. All stream and drainage channel crossings shall be ductile iron pipe encase in reinforced concrete where the installation is below the flow line of the stream or drainage channel.
- b. Crossings less than 4 feet fellow existing or proposed channel bottoms shall be supported by reinforced concrete caissons constructed in accordance with the approved special design.
- c. Where the pipeline crossing will be above the stream or drainage channel flow line, special approval and design will be required by the City. All details of the design shall be submitted to the City for review and approval.

2.12 Railroad and Highway Crossing.

- a. All work shall be accomplished in accordance with the appropriate permit issued by the responsible agency having jurisdiction over the work.
- b. Crossings under railroads and highways shall consist of polyvinyl chloride (PVC), ductile iron or coal tar enamel lined steel pipe (carrier pipe) laid inside a steel pipe conduit (casing pipe), which is placed beneath the track or roadway. The steel conduit pipe (casing pipe) shall be jacked horizontally through the ground on

substantially the grade of the sewer, with due allowance for the bells or joints of the carrier pipe. As the pipe is jacked along, the earth shall be excavated from the face and removed so that it will not be necessary to force the pipe through solid ground. Specifications for materials and installation of the railroad or highway agency shall govern.

- c. The casing pipe diameter for 16-inch and smaller carrier pipes shall be a minimum of 8 inches larger than the carrier pipe and the casing pipe diameter for larger than 16-inch diameter carrier pipe shall be a minimum of 12 inches larger than the carrier pipe.
- d. After the conduit has been completed, the carrier pipe shall be placed inside and blocked in exact position and grade with a support at least every 8 feet and behind each bell or coupling. A minimum of three blocks or other points of support shall be installed to prevent displacement by floating.
- e. Each end of the casing pipe shall then be plugged tight around the carrier pipe and inside the casing pipe. The plug may consist of an 8-inch brick wall laid up with Portland cement mortar or a prefabricated rubber boot with stainless steel tightening bands specifically for sealing casing pipe ends.

2.13 Service Lines (Building Sewers).

- a. Service lines and stub outs from main sewers shall be extended to each property at a point 5 feet inside the property line and generally 5 feet above the low lot corner. Service stubs for flag lots shall be extended through the flag stem to the main body of the lot except where approved otherwise by the City.
- b. Stub outs from a sewer main may be made to an unoccupied lot provided it is part of an officially platted and recorded subdivision. Such stubs shall be extended to 5 feet inside property line and plugged with a watertight and airtight cap or plug insert. Plugging or capping shall be sufficient to perform air testing of the pipeline. Records of the depths and location of the end of the service stub shall be recorded by the City for future reference.
- c. Four-inch diameter service lines shall have a maximum length of 250 feet. A 4-inch diameter cleanout shall be installed on the service lines where the total length exceeds 100 feet and at 100-foot intervals thereafter up to a maximum of 250 feet in length. The cleanout shall have a proper waterproof cap. For cleanout access, a prefabricated formed wye with a riser pipe shall be installed to the finished grade.

Service lines projected to be longer than 250 feet in length shall have pipe 6 inches in diameter or as otherwise required by the City. Provisions for cleanouts shall also apply to pipelines 6 inches in diameter.

- d. No service line within the Department's service area will serve more than one property or customer. Each house, building or business shall have an individual connection to the sewer main and service line from the main to the structure served.

2.14 Pump Station Design Parameters. Design of pump stations within the City's collection system shall be accomplished on a case-by-case basis. Pump stations shall not be used wherever gravity sewer service is available. Preliminary considerations and a rationale for the need of the pump station shall be reviewed in detail with the City's Superintendent of the Water and Sewer Department prior to proceeding with preliminary and final design. As general guidelines for planning purposes, any pump station considered by the City must include, but is not necessarily limited to the following design features:

- a. Dry pit or wet well mounted pumping equipment.
- b. Multiple pumps.
- c. Standby power generation or dual source of power supply.
- d. Ventilation, heating and dehumidification equipment.
- e. Automatic controls.
- f. Remote alarm system for operating functions.

2.15 Sanitary Sewerage Plan Submittal Requirements.

- a. Plans and Specifications. Three (3) copies of all plans and specifications for facilities to be installed under these rules and regulations shall be furnished to the City. One (1) copy will be returned to the applicant when approved by the City and bear evidence of such approval or comments requiring correction.
- b. Plan Content. As a minimum, the following information shall be required on all plans.

(1) Plan View: The plan view shall show streets, alleys, rights-of-way and utility easements with the location and size of the sewers, locations and distance between manholes, the slope and other appurtenances indicated. It is desirable for plans to show the proposed size and location of service stubs and the location of all existing or proposed underground utilities and structures located within 20 feet horizontally or vertically, of the centerline of the proposed sewer extension. (The scale is optional, however, 1"=50' is commonly used.)

- (2) Profile View: The profile view with vertical and horizontal grids shall show the existing ground surface (dotted) and proposed surface (solid). Also, show the proposed sewer with elevations of manhole rims and inverts, the distance and grade between manholes and elevations of utility crossings.
- (3) Detail drawings: Special detail drawings, made to scale, shall clearly show the nature of design and construction of the following:
 - (a) Special sewer appurtenances such as non-standard manholes, inverted siphons and elevated sewers.
 - (b) Special joints and utility or storm sewer crossings.
 - (c) Stream and drainage channel crossings with elevations of normal high and low water levels.
- c. Supporting Data: Submit with the plans and specifications all necessary supporting data to fully describe the proposed installation. This data shall include but not necessarily be limited to a copy of the recorded plat of the subdivision in which the improvements are proposed to be installed, copies of dedicated rights-of-way and easements in which improvements are proposed to be installed. Submit copies of necessary permits from other governmental or private agencies having jurisdiction in the area of the proposed work.

Should a site application for a collection system extension be required by the Colorado Department of Health, the individual party responsible for construction of the facility shall also be responsible for obtaining this site approval.

- d. Upon completion of construction and prior to acceptance by the City, two (2) copies of “as-constructed” plans shall be submitted to the City for record. The two (2) copies shall be complete with all “as-constructed” information together with a certification by the party responsible for construction that all data thereon is accurate and represents actual “as-constructed” conditions. One (1) copy shall be a transparency suitable for blueprint reproduction.
- e. All plans, specifications and supporting documents shall be prepared by or under the direct supervision of a professional engineer registered to practice in the State of Colorado. All plans and specifications shall bear the seal and registration number and name of said registered professional engineer.

WASTEWATER COLLECTION SYSTEM STANDARD SPECIFICATIONS

Chapter 3 – Pipe and Manhole Materials

3.01 Vitrified Clay Pipe and Fittings

a. Conformance

ASTM C 700; vitrified clay pipe, extra strength

b. Joints

Compression joint for vitrified clay pipe and fittings per ASTM C425

PVC collar with rubber gasketed spigot end; PVC in conformance with ASTM D1784, Class B

Special pipe connections – Specially manufactured rubber connection with stainless steel tightening bands (Mission Rubber Co., Fernco or equivalent).

c. Criteria for Acceptance. In addition to any deficiencies covered by ASTM C700, clay pipe, which has any of the following visual defects, will not be accepted.

- (1) Improperly formed pipe such that pipe intended to be straight has an ordinate, measured from the concave side of the pipe exceeding 1/16 inch per foot of length.
- (2) Pipe that is out-of-round to prohibit proper jointing.
- (3) Improperly formed bell and spigot ends.
- (4) Pipe that is fractured, cracked, chipped or damaged in any manner.
- (5) Pipe that has been damaged during shipment or handling.
- (6) Pipe or fittings not properly marked as required by the following specifications.

d. Marking of Material. The following shall be clearly marked by indentations of the exterior of the pipe near the bell or collar:

- (1) "Extra Strength" or "ES".
- (2) Name or trademark of manufacturer.
- (3) ASTM specification.

e. Material Handling and Storage. Exercise proper precaution in unloading, handling, stockpiling and installation in order to prevent damage to material. Remove any broken or damaged materials from the construction site and do not use in any portion of the construction. Any broken, damaged or otherwise defective materials, which are included in the construction, shall be removed and replaced at no additional expense to the City.

Maintain all pipes and fittings on their shipping pallets and in the bundles assembled by the manufacturer until ready for installation in the trench.

3.02 PVC Pipe and Fittings (Polyvinyl Chloride).

a. Conformance

ASTM 3034; Standard Dimension Ration (SDR) shall be maximum of 35.

b. Joints.

ASTM D3212; Bell and spigot, push-on with single rubber gasket.

Jointing of dissimilar pipe materials shall be accomplished with a specially manufactured rubber connection with stainless steel tightening bands (Mission Rubber Company, Fernco or equivalent).

Solvent Cement Joints may be used for 4-inch and 6-inch pipe.

c. Length of Joints.

The length of joints for flexible conduits shall not exceed 12-1/2 feet for grades less than one percent.

d. Criteria for Acceptance. Pipe that has any of the following visual defects will not be accepted.

- (1) Improperly formed pipe such that pipe intended to be straight has an ordinate, measured from the concave side of the pipe exceeding 1/16 inch per foot of length.

- (2) Pipe that is out-of-round to prohibit proper jointing.
 - (3) Improperly formed bell and spigot ends or bells that are less than 1-1/2 inches in length.
 - (4) Pipe that is fractured, cracked, chipped or damaged in any manner.
 - (5) Pipe that has been damaged during shipment or handling.
 - (6) Pipe or fittings not properly marked as required by the following specifications.
- e. Marking of Material. The following shall be clearly shown on the exterior of the pipe:
- (1) Manufacturer's name.
 - (2) Appropriate ASTM designation.
 - (3) Appropriate SDR number of 4-inch and 6-inch pipe.
 - (4) Homemark.
- f. Material Handling and Storage. Avoid damage to pipe from impact, bending, compression or abrasion during handling and storage.

Store pipe on flat surface which provides even support for the pipe barrel with bell end overhanging. Do not stack pipe higher than 5 feet. Do not store pipe and fittings in direct sunlight for extended periods (greater than two to three weeks). Any discoloration of the pipe material shall be evidence of ultraviolet damage and shall be reason for rejection and the removal from the project.

Ship rubber gaskets in cartons and store in a clean area away from grease, oil, ozone producing electric motors, heat and the direct rays of the sun.

Use only nylon-protected sling to handle pipe. The use of hooks, bare cables or chains will not be permitted.

For pipe slopes less than one percent, the maximum pipe joint length shall be 13 feet.

3.03 Ductile Iron Pipe

a. Conformance

ANSI 21.51; Thickness Class 50, unless otherwise required for internal or external loading.

Fittings shall conform to ANSI 21.10 for flanged, mechanical joints and push-on joints (AWWA C110).

b. Joints

- (1) Mechanical Joint: ANSI A21.11
- (2) Push-On: ANSI A21.11
- (3) Flanged: ANSI B16.1, 125 lb. drilling
- (4) Rubber Gaskets: AWWA C111 (AMSO A21.11)

c. Protective Coatings

- (1) Exterior Coating: Manufacturer's standard coating approximately 1 mil thick.
- (2) Interior Lining: Interior lining shall consist of standard thickness, cement mortar in conformance with ANSI A21.4 standards.

d. Criteria for Acceptance. In addition to any deficiencies covered by the reference specifications above, any of the following visual defects will not be accepted.

- (1) Improperly formed pipe such that pipe intended to be straight has an ordinate, measured from the concave side of the pipe exceeding 1/16 inch per foot of length.
- (2) Pipe that is out-of-round to prohibit proper jointing.
- (3) Pipe that is fractured, cracked, chipped or damaged in any manner.
- (4) Pipe that has been damaged during shipment or handling.
- (5) Pipe that has lining that is fractured, cracked, chipped or damaged in any manner and would not provide satisfactory service under the conditions intended.

e. Marking of Material & Certification of Manufacturer. All materials shall be marked with the name of the manufacturer of origin. Manufacturer will provide a certification to the City that all products supplied to the project site are in conformance with these specifications.

f. Material Handling and Storage. Handle pipefittings and accessories using lifting hoist or skidding to avoid shock or damage. Do not drop such materials. Do not allow pipe unloaded on skidways to be skidded or rolled into pipe previously unloaded. Protect the pipe coatings and linings from damage during delivery and handling.

3.04 Manholes. Except as otherwise specifically approved by the City, manholes shall be precast concrete and manufactured in accordance with the referenced specifications.

a. Conformance

Precast concrete in conformance with ASTM C478.

b. Size of Manholes

<u>Size of Sewer Main</u>	<u>Inside Diameter of Manhole</u>
Up to 12 inches	4'
15 through 36 inches	5'
42 inches and above	6'

c. Cement

All cement used in manhole construction shall be Type II or Type IIIA. All concrete shall have a 28-day compressive strength of at least 3,000 pounds per square inch (psi).

Rubber gasketed joints for pre-cast manhole sections shall be an R-4 joint and designed in accordance with ASTM C443.

Manhole joints may be joined with flexible plastic/rubber gaskets constructed of Ram-Nek, Rubber-Nek or equivalent.

3.05 Cast-in-Place Concrete. All cast in place concrete utilized in sanitary sewer construction shall have a minimum compressive strength of 3000 psi at 28 days unless specifically required otherwise by the project.

a. Aggregates

Conform to ASTM C33; maximum size shall be 3/4-inch nominal diameter.

b. Cements.

Portland Cement in accordance with ASTM C150, Type II or IILA will be used for all concrete incorporated.

c. Admixtures

Air entraining admixtures will be permitted in conformance to ASTM C260. Maximum entrained air shall be 6.5% and minimum shall be 5.0%. Water reducing and retarding admixtures may be utilized with the specific approval of the City. Such admixtures shall be in conformance with ASTM C493. Flyash or calcium chloride are not permitted for use.

d. Water/Cement Ratio

Maximum water cement ratio shall be 0.45.

e. Slump

Maintain within the following limits:

1" minimum, 3" maximum for all concrete to be incorporated in sanitary sewerage facilities.

3.06 Casting

a. Cast Iron

(1) Conformance: ASTM A48

(2) Applicable Items: Manhole rings and covers with non-slip surface with "SEWER" cast in the cover. Combined weight will not be less than 300 pounds. Ring shall be a minimum of 4 inches in height.

b. Aluminum

(1) Conformance: ASTM Alloy B0179, Alloy SN122A and CN42A

Ring and cover in non-traffic area; non-slip surface with the word "SEWER" cast in the top. Combined weight not less than 250 pounds. Include lock nut on all aluminum manhole covers.

3.07 Steps. All manholes shall have steps at a maximum of 16 inches vertical spacing unless otherwise specifically directed by the City.

- a. Conformance: Federal Spec. QQ-A-200/8.
- b. Material: Aluminum with drop front design or safety nosing and non-skid grooves.
- c. Width: 12 inches.
- d. Capacity: 1000 pounds at 6 inches from wall.
1500 pounds at 4 inches from wall.

OR

- a. Material: Plastic (co-polymer polypropylene) with 1/2" diameter Grade 60 steel reinforcement as manufactured by M.A. Industries, Inc.
- b. Design Equipment: PS-2-PFS Manhole Step with non-skid grooves and safety nosings or drop front design.

3.08 Cement Mortar

Conformance: ASTM A270, Type M.

3.09 Non-Shrink Grout

Approved commercial factory mix product made especially for intended use. Utilize non-metallic chemical grout for non-shrink applications.

WASTEWATER COLLECTION SYSTEM STANDARD SPECIFICATIONS

Chapter 4 – Pipe Installation

4.01 Subgrade Preparation

See Part III of these regulations.

4.02 Pipe Laying

- a. Begin pipe laying at the lowest point, unless directed otherwise by the City, and install the pipe with the spigot ends pointing in the direction of flow.
- b. Unless required or directed otherwise by the City, lay all pipe straight between changes in alignment and at uniform grade between changes in grade or slope.
- c. As each length of pipe is placed in the trench, the joint shall be completed in accordance with the pipe manufacturer's recommendations and the pipe shall be brought to the correct line and grade. The offset at the invert shall be less than 1% of the inside pipe diameter.
- d. The length of joints for curvilinear sewer shall be determined by the radius using joint deflection not exceeding the manufacturer's recommendations, three degree couplings or a combination of both. Bending of the pipe material to achieve the curvature shown on the plans shall not be permitted.
- e. Secure the pipe in place with the specified bedding material tamped under and around the pipe. Do not walk on small diameter conduit or otherwise disturb any conduit after jointing has been completed.
- f. All foreign matter or soil shall be removed from the inside of the pipe before it is lowered into its position in the trench and shall be kept clean at all times during and after laying. All openings along the line of the sewer shall be securely closed and during suspension of work at any time, suitable pipe plugs or closures shall be placed to prevent water, soil or other materials from entering the pipeline.

4.03 Fittings, Couplings, Wyes and Saddles

- a. Fittings, couplings, wyes and saddles shall be the same material as the pipeline or as specifically manufactured for a particular installation.

- b. Jointing of dissimilar materials shall be permitted only with approval of the city representative. Jointing of such dissimilar materials shall be through the use of fittings, couplings, wyes, saddles, adapters or adhesives specifically manufactured for such transitions.

4.04 Service Lines.

- a. Prepare Subgrade in accordance with Part III of these regulations.
- b. Connect all service lines to mains with a wye or wye saddle in the top one-half of the sewer main. Connections made in the lower half or at mid-point of the main shall have prior approval of the City and may require the installation of a backflow prevention device.
- c. Connection of service lines to mains shall only be accomplished with the use of an acceptable tapping machine or hole saw. Wye saddles will be installed with holes cut using the appropriate hole template. The cuts shall be no larger than 1/4 inch larger than the template outline.
- d. Service line connections shall be separated by a minimum of 3 feet measured center to center along the main.
- e. Plug all service line stubs with water and airtight cap or plug unless the service line will be immediately connected to a building sewer.

Where new street construction is proposed immediately following construction of sanitary sewer facilities, extend the service line to 5 feet inside the property line, install the appropriate plug and mark with a vertical wood marker extending above the surface and having dimensions of 2" x 4".

- f. The Contractor and/or Developer shall provide complete as-built information on each service line connection installed within his/her work. As a minimum this information shall include the location of the connection to the main referenced to the nearest manhole or other permanent improvement, the location of the end of the service line stub, the direction of the service line as it relates to surrounding permanent surface improvements, the size, the material of construction and the date and name of the installer. All such information shall be provided to the City's representatives for incorporation into the City's permanent records.
- g. Connection of service lines and service line construction shall be accomplished by experienced, qualified personnel with adequate equipment. The City's representative shall have authority to reject work and may not permit work to be accomplished unless done by qualified personnel.

4.05 Manholes

- a. Where cast-in-place concrete bases are proposed for construction, prepare the subgrade and excavation in accordance with Chapter 2 of these specifications. Place the concrete against undisturbed soil to the depth thickness and other dimensions shown on the detail drawings.
- b. Provide segmental precast concrete barrel sections a maximum of 4 feet in length with preformed flexible gasket material between each barrel section as jointing material or install rubber gaskets in precast R-4 joint grooves per manufacturer's recommendations.
- c. Provide one, one (1) foot high barrel section beneath a reducing ring or cone cap to bring the manhole ring and cover to within 6 inches of desired grade.
- d. Provide precast concrete 2-inch-high grade adjustment rings to bring the ring and cover to desired grade. A maximum of three grade adjustment rings are permitted.
- e. Where the pipeline passes through a manhole in straight alignment without changing directions, the sanitary sewer pipe may be laid through the manhole base and the top of the pipe cut out after a cast-in-place concrete base has been installed. The bottom of the manhole shall be smoothly shaped to conform to the pipe as shown on the detail drawings. Concrete floors in the manhole shall have a light broom finish.
- f. Where intersecting pipelines or pipelines requiring deflections at manholes require that the invert on the manhole be shaped to match the pipe cross sections, such construction shall be accomplished in accordance with the detail drawings of these specifications. Form the flow line configuration of intersecting pipes to allow for free uninterrupted flow of sanitary sewage through and out of the manhole. All channel inverts shall be finished smooth by steel troweling. All inverts shall be placed and finished with a single pour of cast-in-place concrete. Placement of grout and/or other material to repair and /or reshape the manhole invert shall not be permitted unless specifically approved by the City's representative.
- g. Cast-in-place bases for manholes shall be constructed in a manner to provide for a smooth level surface on which vertical barrel sections shall be placed. Completely watertight joints shall be made utilizing preformed flexible gasket material or a precast concrete base section may be utilized. The manhole shall be constructed such that no single section varies from true vertical by more than two percent.

- h. All manholes constructed in the city shall have the ring and cover elevations set at final street grades or at a point not more than 6 inches above the existing ground in non-traffic areas unless directed otherwise by the City. The Developer/Contractor shall be responsible for adjusting the manhole rings and covers to the final elevations.
- i. In areas where street paving will be placed, the manhole ring adjustment shall be accomplished in a two-step process prior to placement of pavement. The manhole ring shall be constructed 0.5 feet below finished pavement surface elevation. Pavement shall then be placed in accordance with the applicable rules, regulations and specifications. Following completion of paving, the sanitary sewer manhole rings will be raised by the Developer/Contractor to finished grade in accordance with the specifications of the City.
- j. The ring shall be adjusted with precast concrete rings a maximum of 0.5 feet in height. Cement grout shall be placed to adjust the ring to conform to the surface. A concrete collar shall be placed around the adjusting rings and the ring of the manhole up to a point 2 inches below finished grade. Paving material shall then be placed over the concrete and match the surrounding pavement surface. Tack coat material shall be placed between new and existing asphaltic concrete surfaces, the manhole setting and the concrete collar.

WASTEWATER COLLECTION SYSTEM STANDARD SPECIFICATIONS

Chapter 5 – Testing of Pipelines and Appurtenances

- 5.01 Infiltration. Use where ground water may be above the pipeline invert.
- a. Infiltration tests shall be conducted on each segment of the sanitary sewer system where it could be anticipated that ground water may rise above the flow line of the pipeline. Tests shall be conducted by placing an approved calibrated V-notch weir in the line just above the next lower manhole and plugging the line just above the next higher manhole. Sufficient time will be allowed to permit the water level behind the weir to stabilize before reading. Any foreign material hanging to the weir will be dislodged before reading. Successive readings shall be taken until consistent results are obtained.
 - b. The maximum allowable infiltration shall be 100 gallons per day per inch of pipe diameter per mile of pipe.
 - c. Each segment of pipeline between manholes or other major appurtenances must satisfy and pass the infiltration tests.
 - d. Should it be determined that the infiltration rate is in excess of that permitted by these regulations, any repair and/or replacement of pipelines, manholes or other appurtenances shall be at the Contractor's and/or Developer's expense. Satisfactory repair and replacement shall be accomplished prior to the consideration of acceptance of any facility by the City.
 - e. The Contractor and/or Developer will furnish all labor, equipment and materials required to accomplish such testing.
- 5.02 Exfiltration. Exfiltration testing may be required where existing ground water levels are below the invert of the pipeline to be tested.
- a. Exfiltration shall be limited to 100 gallons per day per inch of diameter per mile of pipeline.
 - b. Each segment of pipeline between manholes must pass the exfiltration test.
 - c. Each test section between successive manholes shall be prepared by plugging the pipe just above each manhole. Fill the upper manhole and pipe with water to a point 4 feet above the invert of the sewer at the center of the upper manhole.

Observe the water level for a minimum period of two hours. Allowable leakage shall be as specified above.

- d. Where pipe grade does not allow filling of segment to specified depths, Contractor shall accomplish air testing as specified.

5.03 Air Test. All segments of sanitary sewer mains shall be subjected to an air pressure test.

- a. The Contractor may conduct an initial air test of the sewer main line after compaction of the backfill but prior to the installation of any service lines. Such tests shall be considered for the Contractor's convenience in quality control of the project construction. Final consideration for acceptance of the sanitary sewer by the City shall be based on satisfactory completion of testing with all service line stubs installed.
- b. Preparation of Tests: Flush and clean the sewer line prior to testing in order to wet the pipe surfaces and produce more consistent results. Plug and brace all openings in the main sewer line and the upper end of any connections. Check all pipe plugs with a soap solution to detect any air leakage. If leaks are found, release the air pressure, eliminate the leaks and start the test procedure over again.
- c. Procedure of Test: Add air until the internal pressure of the sewer line is raised to approximately 4.0-psi gage at which time the flow of air shall be reduced and the pressure maintained between 3.5 and 4.5-psi gage for a sufficient time to allow the air temperature to come to equilibrium with the temperature of the pipe.
- d. After the temperature has stabilized the pressure shall be permitted to drop to 3.5-psi gage at which time a stop watch or a sweep second hand watch shall be used to determine the time lapse required for the air pressure to drop to 2.5 psi gage.
- e. If the time lapse is less than that shown in the table, the Contractor shall make the necessary corrections to reduce the leakage to acceptable limits.

AIR TEST TABLE ⁽¹⁾
 MINIMUM HOLDING TIME IN SECONDS
 REQUIRED FOR PRESSURE TO DROP
 FROM 3.5 TO 2.5 PSIG

LENGTH OF MAIN

Main Dia.	50'	100'	150'	200'	250'	300'	350'	400'	500'+
8"	35	70	106	141	176	211	277		277
10"	55	110	165	220	275	283			283
12"	79	158	238	317	340				340
15"	124	248	371	425					425
18"	178	356	510						510

Where service lines are connected to the main line refer to additional tables published by the National Clay Pipe Institute ⁽¹⁾ and comply with the provisions thereof.

Safety: The air test may be dangerous if proper precautions are not taken. All plugs must be sufficiently braced to prevent blowouts and the pipeline must be completely vented before attempting to remove the plugs.

As a safety precaution, pressurizing equipment shall be provided with a regulator setting of 5 psi to avoid overpressurizing and damaging an otherwise acceptable line.

5.04 Alignment Testing.

- a. Each section of pipeline on a linear alignment between manholes will be subject to testing by lamping by the City's representatives to determine where proper alignment has been accomplished and whether any displacement of the pipe has occurred during construction.

The Contractor and/or Developer shall provide suitable assistance to the City's representative in accomplishing this work. The Contractor and/or Developer shall be responsible for repairing any alignment, displaced pipe or other defects discovered during this testing in accordance with these specifications.

- b. For pipelines installed at grades less than 1%, a minimum of 90% of the full pipe cross section shall be visible at the opposite end of the segment being observed.

- c. For pipelines installed at grades greater than 1%, a minimum of 75% of the full pipe cross section at the opposite end of the segment shall be observed.
- d. The determination of the acceptability of the pipeline alignment by laming shall rest solely with the City's representative and his decision shall be final.
- e. Pipelines not meeting the requirements of the alignment tests shall be completely excavated, removed and re-laid on prepared bedding material, backfilled and compacted in accordance with these specifications and then subjected to infiltration, air pressure and alignment testing.

5.05 Deflection Tests.

- a. Proper construction in accordance with these specifications and the manufacturer's recommendations should result in a vertical deflection of the pipe less than 5% of the internal diameter. At the option of the City, the Contractor and/or Developer may be required to perform testing to determine conformance with this requirement.
- b. Should the City determine that deflection testing is required, the Contractor and/or Developer shall provide all necessary equipment, labor and other facilities. Data supplied by the pipe manufacturer's representative for dimensional quality shall be utilized.
- c. Should the vertical deflection of the pipe be found to exceed 5% of the internal diameter, the Contractor will remove the pipe, install proper bedding, replace the pipeline material and properly place and compact all backfill material in accordance with these specifications. Any areas removed and replaced shall be subject to infiltration, air pressure and alignment testing.