



Public Works Manual

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Sewer & Water

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AUTHORITY

The following special conditions and design criteria (Gypsum Public Works Manual) shall be used in the preparation of design plans and specifications for land development and public works projects in the Town of Gypsum, Colorado.

The applicant is responsible for complete compliance with these specifications. The Gypsum Public Works Manual will take precedence over the Town of Gypsum's review. The Town of Gypsum is not responsible for omissions that may occur during its plan review process. Variances are allowed only after approval by the Town Council.

1.0 SEWAGE COLLECTION SYSTEM DESIGN AND LAYOUT

The sewage collection system shall be designed to the capacity required for the estimated ultimate tributary population. Unless otherwise approved by the Town Council, every subdivision shall have a central sewage collection system, the design of which shall be prepared by a registered professional engineer and meet the Colorado Department of Health Standards. The use of individual systems must be approved by the local public health agency (Eagle County), who shall give written opinion concerning the suitability of the proposed subdivision for the individual systems, before they will be considered for approval by the Town Council.

1.01 PIPE SIZE

The minimum sewer main size shall be 8-inch I.D. Under special conditions, such as low tributary population, 6-inch I.D. sewer main will be considered. Sewer service lines shall be a minimum of 4-inches in diameter.

1.02 MINIMUM PIPE COVER

The minimum cover from top of pipe to finished grade shall be three and one half feet (3.5'). For depths greater than twenty feet (20'), Town approval is required. Insulation may be installed for depths less than 3.5' at the rate of 1" of blue board per foot of lacking cover; with a minimum of 2" of blue board by 24" wide.

1.03 MINIMUM SLOPES

Gravity sewers should be designed to provide a minimum velocity of 2 fps at full flow based on the Manning Equation with $n = 0.013$. Refer to Table 1.03, below, for the minimum allowable slopes.

TABLE 1.03
Minimum allowable sewer main slopes:

SEWER SIZE IN INCHES	MINIMUM SLOPE IN FEET PER 100 FEET
6	0.50
8	0.40
10	NOT ALLOWED
12	0.22
15	0.15
18	0.12
21	0.10
24	0.09

The Town of Gypsum may, at its sole discretion, require that during the course of installation of sewer main designed at a grade flatter than 125% of minimum, the designed

elevation of each pipe joint be confirmed by level measurements taken with an engineering level and certified by a registered professional land surveyor. For pipe grades with slopes flatter than .7% with sagging pipe, either SDR 26 or ductile iron pipe must be installed to avoid problems.

1.04 MATERIALS

The type and class of pipe to be used in the work will be shown on the plans and/or called for in the specifications. The following specifications will apply to pipeline and appurtenant materials.

<u>Material</u>	<u>Specification</u>
SDR35, SDR26, Green Sewer Pipe	ASTM D-3034
PS46, PS115, Big Green Sewer Pipe	ASTM F-679
Black Plumbers Pipe	ASTM D-2680
Manhole Risers, Manhole Rings, Barrel Sections, Cone Sections Precast Bases	ASTM C-478
Class 200 PVC	ASTM D-2241
Schedule 40 PVC	ASTM D-1785

When required by the Town of Gypsum, the Contractor shall furnish certification by the manufacturer(s) of the pipe and materials to be furnished on this project, certifying that they comply with the applicable specifications. All pipe and materials shall be clearly marked with type, class and/or thickness as applicable. Lettering shall be legible and permanent under normal conditions of handling and storage.

When sewage collection cannot be accomplished by gravity flow, the interested party must apply for a variance, and consult Town Engineers with regards to materials that are permissible.

1.05 SEWER MAIN EASEMENTS

Where possible all mains shall be installed in dedicated public streets. Otherwise, the installation shall be made in a right-of-way or easement. Minimum easement width shall be as shown in Table 1.05. The main shall be centered in the easement, or widen the easement to properly accommodate the depth of the pipe for future excavation. See Appendix A.1 for more information.

Sewer Pipe Depth of Bury	Minimum Easement Width
≤8'	20'
8' to 11'	25'
11' to 13'	30'
13' to 16'	35'
16' to 18'	40'
18' to 21'	45'
21' to 23'	50'

1.06 SEWER SERVICE CONNECTIONS AND SERVICE PIPES

Note: All new sewer mains must remain plugged and shall not discharge into the existing Town of Gypsum sewer collection system until it has been flushed/cleaned, pressure tested, TV inspected and approved by the Town of Gypsum.

Sewer service connections shall be constructed in accordance with the standard detail of the SANITARY SEWER SERVICE CONNECTION AT SEWER MAIN as seen in Appendix A.2. All sewer service lines shall be of sufficient length to reach the right-of-way line or a point 5 feet beyond the outermost utility or pavement, whichever is greater. Service line construction shall be complete prior to the construction of any surface infrastructure such as streets, sidewalks and curb and gutter. Sewer service pipe and fittings shall be rubber gasket, push on joint, SDR35. Services shall be plugged or capped and restrained sufficiently to withstand air pressure testing. No connection shall be made until pressure testing has been completed and accepted by the town.

Prior to backfilling the sewer services, the horizontal and vertical position of the sewer service must be field verified. At a minimum this verification must include the horizontal and vertical location of the following: the crown of the sewer main at the service wye; the crown of the sewer service at the top of the service bend (upstream of the 45° bend); and the crown of the sewer service at its termination (or connection to an existing service pipeline). This verification of the position of the sewer service shall be performed by a representative of the Town of Gypsum or shall be certified by a Registered Professional Land Surveyor in which case, the verification information shall be promptly provided to the Town of Gypsum. If at any point during the field verification process, it is discovered that the sewer service is not constructed in accordance with either the Town specifications or the plans and specifications for the project, the surveyor must immediately notify the Town's construction inspector. In any case, the sewer service may not be backfilled until its position has been verified as described above, and the town has approved the horizontal and vertical position of the service line.

The maximum length of the sewer service line shall not exceed 52 feet from the main to the right of way line. If the ultimate length of the sewer service is greater than 100 feet, then cleanouts need to be installed every 100 feet and at bends. Service line must be installed at minimum grade of 2% and enter the top of the full body wye. No saddle taps are acceptable in newly constructed mains.

1.07 MANHOLES

For all sewer pipeline installations, new construction includes manholes, and other appurtenances normally used in sewage collection systems. The work includes the furnishing of all materials, excavation of trenches, installation of materials, backfilling, construction of manholes, testing, flushing/cleaning and restoration of surface. (See Appendix A.3 and A.4)

1.07.1 Adjustment Rings

Manholes shall be constructed of precast concrete rings with frames and covers and steps in accordance with the details shown on the drawings. Adjusting rings may be used for adjusting the manhole top elevation to coincide with existing ground elevations. The total height of adjusting rings used per manhole shall not exceed 12 inches. Adjusting rings shall be reinforced to withstand traffic.

1.07.2 Manhole Steps

Manhole steps shall be non-corrosive type material such as rubber encased steel, aluminum, or nylon. Steps shall withstand vertical loads of 400 pounds and pull-out force of 1000 pounds.

1.07.3 Manhole Covers

Manhole rings and covers and the supporting rings shall be designed to withstand H-20 AASHTO loading. Manhole rings and covers shall be non-ventilated type and shall conform to the standards of the Town's system. Manhole covers shall have a side open pick slot, similar to the Deeter Type "F", unless approved in writing by the Town of Gypsum. Manhole bases shall be precast and placed on undisturbed or compacted earth.

Any manhole wherein the depth from the rim to the top of the pipe is less than 4.0 feet shall be constructed with a full 48-inch barrel section and a flat lid.

1.07.4 Invert Channels

Invert channels shall be smooth and semi-circular in cross-section conforming to the inside of the inlet/outlet sewer sections. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole and the nature of the change will permit. Changes in size and grade of the channels shall be made gradually. Additionally, changes in pipe size crowns shall match as well. The invert channels may be formed directly in the concrete of the manhole base or may be half pipe sections laid in the concrete. The floor of the manhole outside of the channel shall be smooth and shall slope toward the channel not less than one inch per foot or more than two inches per foot. Manhole inverts and channels shall be formed as shown on the detail sheets, but in no case shall the difference in inlet and outlet be less than 0.10 of a foot. (See Appendix A.5 and A.6)

1.07.5 Connective Materials

All connections between manhole rings shall be joined with "Rub-R-Nek" "LTM" or approved equal, in such a manner as to make the manhole watertight. "Rub-R-Nek" sealant/primer shall be applied to both top and bottom surfaces of manhole risers before placing the "Rub-R-Nek". Two "Rub-R-Nek" gaskets shall be placed around the manhole risers, one the inner ledge, and one on the outer ledge. The sewer pipes shall be joined to the manhole base by use of expandable water stops, special purpose-made sleeves, or a rubber gasket cemented to the manhole and connected to the pipe with a stainless-steel band clamp. Both

inner and outer joints between sewer pipe and manhole shall be grouted. Rubber "O" ring gaskets may be used, to seal and join manhole riser sections, if approved by the Town of Gypsum. When a new sewer line is connected to an existing manhole, a flow-channel shall be cut from the floor of the existing manhole and re-grouted to a smooth configuration to match the inlet characteristics of the new sewer line. New entry into an existing manhole must be covered with gasketed boots. In cold weather conditions, when the "Rub-R-Nek" gasket material becomes stiffer or hard to handle, a propane torch may be used to warm the gasket before seating the next manhole riser, so long as care is taken not to damage the gasket by overheating. No grouting shall be permitted on the interior walls of a manhole, except for that which is a part of the manhole channel.

Anchor manholes will be constructed on slopes greater than twenty percent (20%). Landscaping will not be allowed to cover manholes and must be graded to drain away from the rim.

1.07.6 Manhole Location

Manholes shall be installed:

1. At the end of each main line; except when the main line will be extended and there are not any existing services, a clean-out may be installed at the end.
2. At all changes of grade, size, or alignment.
3. At all sewer line intersections.
4. At distances no greater than 400 feet, unless approved by the Town of Gypsum.
5. Shall be located in an easement with vehicular access for service.

Sewer manholes shall be located in the pavement section where possible. Every effort should be made to locate the manhole in the center of the driving lane. The finished grade of a manhole lid in a paved surface shall be ½ inch below the finished grade of the paved surface to protect it from snowplows.

Manholes shall not be located in depressions where water may accumulate or temporarily pond, and the Town of Gypsum may, at its sole discretion, require that watertight lids be installed.

Unless otherwise approved, the elevation of all sewer manhole rims shall be located a minimum of 1.00 feet above the base flood elevation for the 100-year rainfall event for Gypsum Creek, Alkali Creek, Spring Creek and the Eagle River.

Cast-in-place manholes are to be used only when tying into an existing sewer line. Manholes shall be constructed to the dimensions shown on the plans.

1.07.7 Cleanouts

Cleanouts will be considered at the ends of sewer mains which are outside of roadway pavement sections and where future extension of the main is anticipated. Landscaping will not be allowed to cover manholes or cleanouts. (See Appendix A.7.)

1.07.8 Drop Manholes

Drop manholes shall not be constructed. When it is necessary to cause a drop in sewer flow in excess of an elevation difference equal to one half the diameter of the manhole, a second manhole shall be constructed at the required distance to cause a slope between the manholes of 50%, i.e. if a drop of 5.0 feet is required, the distance between manholes will be a minimum of 10 feet.

1.08 PROTECTION OF WATER SUPPLIES

Sewer mains and services shall be located a minimum of ten feet horizontally from existing or proposed water mains and services. **The distance will be measured pipe wall to pipe wall.** Whenever it is necessary that a sewer main cross above or within 18 inches below a water main, the sewer main shall be made impervious by one of the methods listed below, and as shown in the detail drawings. The 10-foot separation shall be required until it enters the foundation.

Method 1: The sewer pipe shall be reinforced with a concrete encasement which shall be at least six inches thick on all sides of the sewer pipe and extend for at least ten feet each way from the crossing point with the water main, measured perpendicular to the water main.

Method 2: The sewer main shall be constructed of C-900 PVC class 200 pressure pipe or Yelomine pressure pipe, or Standard Dimensional Ratio (SDR) 26 pressure pipe or polyethylene lined ductile iron, for a distance of no less than ten feet, each way from the crossing point with the water main, measured perpendicular to the water main. The crossing point itself shall be created using Harco adapter coupling.

Method 3: Sewer services crossing over water lines shall be encased within a larger pipe having both ends grouted. Pressure pipe shall be used for the encasement, and the sewer service shall be encased for a distance of no less than ten feet each way from the crossing point with the water main, measured perpendicular to the water main. All joints within the ten feet perpendicular to the water main shall be encased in a concrete collar six inches thick and extending at least six inches on either side of the joint.

See details in Appendix A.8 and A.9.

1.08.1 Sand/Oil/Water Separators

A gravity flow Sand/Oil/Water Separators shall be placed on any sewer service line, where sand/oil/water are likely to enter. Businesses that are likely to need an S/O/W separator include those that service/wash automobiles, greased, repaired or washed or where gasoline is dispensed, and others. See the Gypsum building department and IBC codes for restaurant grease traps.

S/O/W separators shall be placed at a depth of at least three and a half feet (3.5') from top of Sand/Oil/Water Separator to finish grade, or protect from freezing with insulation.

The maximum amount of discharge that shall be permitted is two times the stated flow rate in gpm. For example, a maximum anticipated discharge of 100 gallons would require a flow rate design capable of carrying 50 gpm.

S/O/W separators shall be designed to provide at least 18" of liquid seal. The capacity of oil water separators shall be designed to accommodate the following capacities

$$\begin{aligned}\text{Floor Area} \leq 100 \text{ ft}^2 &\rightarrow C = 6 \text{ ft}^3 \text{ (45 gallons)} \\ \text{Floor Area} > 100 \text{ ft}^2 &\rightarrow C = (6 + A/100) \text{ ft}^3\end{aligned}$$

Where C = Minimum capacity of separator
A = Floor area served (ft²)

S/O/W separators shall be designed to retain no less than 6 ft³ of sediment, and prevent it from flowing into waste water system.

S/O/W separators will need manhole access, to facilitate scheduled pumping (See Appendix A.10). Records and receipts shall be maintained for inspection by the Gypsum Public Works Department.

1.09 TESTS AND INSPECTION

New sewer manholes and lines will not be accepted until tests have been made to assure the Town of Gypsum that the manholes are properly constructed and grouted, and that pipe laying and jointing are satisfactory. The contractor shall provide the labor and materials to conduct the following tests in the presence of the Town of Gypsum.

- a. Lamp Test Sewer mains shall be checked by the Town of Gypsum to confirm that the alignment of the pipe has not shifted during backfilling of the trench. The Town of Gypsum will inspect lengths of sewer main between manholes by using a bright light and observing for a "full moon" circle of the opposite end of the pipe. The Town of Gypsum may elect to "lamp" the sewer main from both ends of the pipe. Any visible alignment deflection, earth, rocks or other debris, or any other defect found by the Town of Gypsum shall be remedied prior to acceptance.
- b. Flushing of Sewer Mains- all earth or rock found in the sewer main, which, in the opinion of the Town of Gypsum, is detrimental to the inspection, or function of the sewer, shall be removed prior to acceptance by the Town. All new sewer mains shall be cleaned by flushing with a quantity of water sufficient to develop a minimum velocity of 10 fps in the flattest portion of the sewer main, for a period of at least two minutes. The procedure used to flush the sewer mains shall be subject to review by the Town of Gypsum, but in all cases, it shall be the responsibility of the Contractor to install plugs at the connection to the existing sewer system and to pump out all flushing water and debris to a disposal tank or to a suitable open area. Under no circumstances shall the flushing water or the debris flushed from the sewer mains be allowed to enter the Town's sewer system or treatment plant. The Contractor shall take all steps necessary to prevent damage from erosion, deposition, or any other cause related to the disposal of flushing water or debris, and shall be responsible for all aspects of the cleaning of the sewer mains and disposal of flushing water and debris. The Town of Gypsum shall be notified in writing 24 hours prior to the flushing of the sewer mains, and shall witness the flushing process.

- c. Video Camera Inspection- All sewer mains shall be inspected by television (TV) camera on a minimum of two occasions prior to final acceptance by the Town of Gypsum. The first TV inspection must occur prior to the placement of Hot Bituminous Pavement on the road and the second TV inspection must occur within three months prior to the expiration of the warranty period.

The end-of-warranty video shall be made without flushing the line, in order for the Town's inspector to observe how well the sewer main is performing. If too much debris is present, then the sewer main must be jetted and video taped a second time. All deflections in the sewer pipe, which retain a depth of water equal to one-half inch, shall be deemed defective, and shall be repaired at the Contractor's sole expense. No pipe couplers are allowed on new pipe installation. The television camera system used shall have the ability to produce a high quality image of the interior of the pipe and its contents and also have the ability to turn and "look up" a sewer service connection. The Town of Gypsum shall receive the original videotape from the inspection. The contractor may make and keep copies of the tape.

1.10 PRESSURE TESTING OF SEWER MAINS AND SERVICE LINES

There are two main methods available to testing sewer mains and manholes. Pressure testing, which is outlined in this section, and vacuum testing with is outlined in section 1.11. Either method is acceptable.

1.10.1 Scope

The work shall consist of pressure testing sewer mains and service lines. The contractor shall furnish all facilities and equipment necessary to conduct the pressure testing of the sewer pipe, including but not limited to sewer pipe plugs and connections, air compressor, pressure gauges, bulkheads, regulator to avoid over pressurization and all miscellaneous hoses and fittings. The Town of Gypsum shall witness the test. The contractor shall at all times be responsible for the safe performance of this test, and that all relevant safety precautions are adhered to, including the requirements of OSHA regarding confined space entry procedures.

1.10.2 General

The contractor shall notify the Town of Gypsum in writing 48 hours in advance of all vacuum testing.

1.10.3 Pressure Test Equipment

- a. The pipe plug for the low-pressure air testing of the sewer line shall be equipped with two taps. One tap will be used to supply air into the line being tested with appropriate valves and fittings to regulate air flow to the test section of pipe. The second tap shall be fitted with a valve and fittings to accommodate a pressure test gauge.
- b. The system shall include a pressure relief valve to prevent the pressure in the test section from exceeding 5.0 psig for standard sewer mains, plus external pressure from ground water as per 1.10.4.e. below.

c. The pressure test gauge shall meet the following minimum specifications:

ASME Grade A

1) Diameter = 4.5 inches

2) Pressure range = 0 to 15 psi

3) Gauge increments = 0.20 psi

4) Accuracy = 1% of maximum scale reading

Calibration data shall be supplied with all pressure test gauges. Certification will be required from the gauge manufacturer. Calibration and certification data shall be available to the Town of Gypsum prior to testing.

d. Compressor for air supply.

1.10.4 Pressure Testing Standard For Sewer Mains:

After completion of installation and backfilling, each section of sewer pipe between manholes shall be tested in the following procedure:

- a. Plug ends of test section and all service taps with fittings capable of withstanding pressure up to 5.0 psig. One of the plugs provided must be equipped to connect testing system.
- b. Pressure test section up to **4.0 psig** and maintain pressure, with air supply, between 3.5 and 4.0 psig for two minutes to allow air temperature to equalize with pipe wall temperature. During this period, check all plugs to detect any leakage. Bleed off pressure and tighten any leaking plugs.
- c. After temperature is stabilized, allow pressure to decrease to 3.5 psig, begin timing to determine time for pressure to drop from 3.5 psig to 2.5 psig. If the time, in seconds, for the air pressure to decrease from 3.5 psig to 2.5 psig is greater than that shown in the table below, the pipe section shall be presumed to be free of defects that would cause leakage.

The following sections apply to both Standard SDR 35 Sewer Mains and to SDR 26 Sewer Mains.

PIPE SIZE (INCHES)	REQUIRED TIME PER 100 L.F. OF TEST SECTION (Minutes: seconds)	MAXIMUM REQUIRED TIME (Minutes: seconds)	MAXIMUM TIME APPLIES TO ALL PIPE <u>OVER</u>:
8	(1:10)	(3:47)	325 L.F.
10	(1:50)	(4:43)	258 L.F.
12	(1:38)	(5:40)	216 L.F.
15	(4:08)	(7:05)	172 L.F.
18	(5:56)	(8:30)	144 L.F.
21	(8:05)	(9:55)	123 L.F.
24	(10:34)	(11:20)	108 L.F.
27	(12:45)	(12:45)	100 L.F.
30	(14:11)	(14:11)	100 L.F.
33	(15:35)	(15:35)	100 L.F.

- d. If test fails, locate and repair leaks and repeat tests.
- e. In areas with high ground water, the air pressure shall be increased to compensate for the external pressure caused by the height of the ground water. To determine how much to increase testing air pressure, one pound per square inch (1 psig) of pressure shall be added to the test pressure for each two point three feet (2.30') of ground water above the flow line of the sewer main. The height of ground water shall be estimated by the Town of Gypsum, based on the best available information, and will be determined from the greatest depth in any given section of pipe being tested.

1.11 VACUUM TESTING OF MANHOLES

1.11.1 Scope

The work shall consist of vacuum testing sewer manholes. The contractor shall provide all required equipment, materials and labor. The Town of Gypsum shall witness the test. The contractor shall at all times be responsible for the safe performance of this test, and that all relevant safety precautions are adhered to, including the requirements of OSHA regarding confined space entry procedures.

1.11.2 General

The contractor shall notify the Town of Gypsum in writing 48 hours in advance of all vacuum testing.

1.11.3 Vacuum Test

- a. Each manhole shall be tested immediately after assembly and prior to backfilling.
- b. All lift holes shall be plugged with an approved non-shrink grout.
- c. No grout will be placed in the horizontal joints before testing.
- d. All pipes entering the manhole shall be plugged, taking care to securely brace the plugs from being drawn into the manholes.
- e. The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturer's recommendations.
- f. A vacuum of **10 inches of mercury** shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass if the time is greater than 60 seconds for a 48-inch manhole, 75 seconds for a 60-inch manhole and 90 seconds for a 72-inch manhole.
- g. If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.
- h. Sewer mains may be vacuum tested along with the manholes according to the schedule outlined in item F adding 30 seconds to the time stated. For example, if testing a 48-inch manhole with one section of pipe, 10-inches of mercury shall be drawn and time measured to drop to 9-inches of mercury in a period of no less than 90 seconds, 105 seconds for a 60-inch manhole and 120 seconds for a 72-inch manhole.

The contractor shall repair and/or replace any section of the system that fails to meet testing standards, or fails to pass visual inspection, following which the section shall be retested. The test section of sewer shall not exceed 800 feet in length.

SEWER LINE ACCEPTANCE PROCEDURE

Sewer Line will not be accepted until it has passed all tests including flushing, lamp test video inspections, vacuum and/or air pressure testing.

1.12 WASTE WATER COMPOSITION

No material may ever be discharged to the Town of Gypsum sewage collection system, which contains organic or inorganic substances that in nature or concentration would be hazardous or deleterious in any way to the operation and maintenance of the sewage collection system or the sewage treatment system. This includes but is not limited to flammable materials, paint, petroleum products, cleaning solutions, anti-freeze, excessively high concentrations of organic waste from food and beverage manufacturing/processing, animal and vegetable fat, and soaps/ detergents.

It is also prohibited to direct intermittent or continuous flows of water into the sewage system from sources other than normal plumbing fixtures and/or in quantities greater than would normally be expected from those plumbing fixtures, based on the population being served by those plumbing fixtures. This includes, but is not limited to: drainage from roof, sump pumps, hydroponic gardening, fish tanks, swimming pools, and decorative water features.

Before connecting to the Town of Gypsum sewage system, any activity which will require the disposal of waste material which has a composition that differs from the average composition of normal household domestic sewage by a factor of 25% or may potentially contain, on a regular basis, or from time to time, materials which may be hazardous and/or otherwise deleterious to the sewage collection or treatment systems, must submit a plan of mitigation, prepared by a registered professional engineer. The plan must provide for a system of pretreatment of the waste stream, prior to disposal in the Town of Gypsum system, which will render the waste stream acceptable to the Town of Gypsum System. The Town of Gypsum will review the plan, and if it is approved, it must be constructed, in place and operational before a physical connection is made to the Town of Gypsum sewage treatment system.

2.00. WATER DISTRIBUTION SYSTEM DESIGN AND LAYOUT

2.01 SIZING DISTRIBUTION MAINS

All mains shall be sized large enough to provide for domestic, irrigation, and fire protection flows to the area requesting service. The minimum size of all Town of Gypsum mains shall be eight inches (8") except for fire hydrant laterals of less than 100 feet in length, which may be six inches (6"). Fire hydrant laterals longer than 100 feet in length, as measured from the centerline of the main to the mechanical joint coupling on the hydrant, shall be eight inches (8") with an 8" x 6" reducer immediately ahead of the hydrant. All mains must be buried at a frost depth of 5.5' or greater, but not more than 9.0' from top of pipe.

Water mains shall be sized for fire protection in compliance to the current ISO recommendations and as called for by the Fire District and the Town of Gypsum. The Gypsum Fire district includes the entire Town west of Alkali Creek and the Greater Eagle Fire Protection District covers east of Alkali Creek.

The Town of Gypsum reserves the right to over-size mains to provide service for projected future needs or as outlined in the Town's Master Plan. Unless otherwise agreed to by the

Town, this over-sizing shall be at the sole expense of the developer with no reimbursements from the town, or future users, or future developers.

2.02 FIRE PROTECTION

The Town of Gypsum must approve the number and location of fire hydrants in a given area. Spacing shall be determined by depth of lot from street, type of business/use and requirements of the Town's fire authority. However, the distance between hydrants shall not exceed 500'. A fire hydrant must be installed at the end of all water mains and in cul-de-sacs. Fire hydrants must be painted red and face the street. The hydrant shall be installed a minimum of 2' behind the sidewalk. If no curb is present, hydrant shall be placed at roadside elevation on the opposite side of the roadway drainage ditch. No horizontal or vertical bends or offsets shall be used in installing fire hydrant branch lines unless approved by the Town of Gypsum.

Under no circumstances shall any size or manner of tap be made on a fire hydrant branch line between the hydrant and hydrant valve. The hydrant valves shall be located at the tee and all joints from the tee to the hydrant shall be restrained. (Please see Appendix B-2).

2.02.1 Fire Hydrants

Fire hydrants shall be Mueller "Centurion Super 250", U.S. Pipe Metropolitan Sentinel 250, conforming to AWWA Standard C502. Standard features will include:

- Minimum bury of five and one half (5.5) feet to top of pipe.
- Maximum working pressure of 250 psi
- Six-inch mechanical joint inlet
- Minimum 5-1/4" compression type main valve, which closes under pressure
- ANSI B26 nozzle threads
- Two 2-1/2" hose nozzles
- One 4-1/2" pump nozzle
- Open left with direction arrow cast in top of hydrant
- Traffic flange with breakable coupling near ground level
- Red only in color.**

Fire hydrants must be installed with guard valves and at the end of all main lines. The guard valve will be installed on a main line tee with flange fittings or mechanical joint restraining gland on the hydrant side of the valve and on the hydrant. Fire hydrants shall be installed at the relative elevation to the surrounding finished grade such that the portion of the hydrant below the breakaway flange is protected from damage by vehicle collision.

2.03 DISTRIBUTION REGULATING AND MONITORING INSTALLATIONS

When water main extension plans are submitted for review, the need for regulating installations must be approved by the Town of Gypsum based on existing and proposed pressure zones, booster pump areas and the existing distribution system piping. These installations shall conform as outlined below. All regulating installations will be reviewed and approved by the Town of Gypsum and installed by the Owner/Developer.

2.03.1 Pressure Reducing Valves (PRV)

Pressure reducing valves shall be installed such that the main line pressure shall not exceed 100 PSI. PRV valves shall be installed in vaults as described in Appendix B-3. No less than two Pressure Relief Valves are required. One for high flow conditions and one for low flow conditions. In some cases a third PRV maybe required. All pressure reducing valves shall be CLA-VAL or Golden-Anderson cushioned, single globe, pilot pattern, hydraulically operated with flanged ends. The valve body shall be cast iron ASTM - 126 with flanges conforming to the latest ANSI standards. The valve body shall be extra heavy construction throughout. The valve interior trim shall be bronze B-62 as well as the main valve operation. The valve seals shall be easily renewable. All controls and piping shall be non-corrosive construction. All PRV must have a strainer installed upstream of the valve.

2.03.2 Air Release/Vacuum Valve

At all high points in the main line distribution system, a combination air vacuum and air release valve shall be installed in a minimum four foot (4') diameter manhole in accordance with the Town of Gypsum details and specifications. See Appendix B-3. Air release/vacuum valves shall be APCO Series or Valmatic and be 1-inch diameter minimum. The valve shall have a cast iron body, cover and baffle with a stainless steel float. The seat shall be fastened into the valve cover, without distortion, and shall be easily removed, if necessary. Air release/vacuum valves shall be installed on all main line extensions at the high points in the system.

2.03.3. Main line flow meter

Main line flow meters may be required to be installed on extensions to the existing distribution system at the sole discretion of the Town of Gypsum.

2.03.4 Pumping Facilities

All proposed booster-pumping facilities shall be considered as a special feature and dealt with on a case by case basis. The size, location, and type of booster pumping facilities shall be reviewed and approved by the Town of Gypsum. Every effort shall be made to provide facilities that are consistent with the Town of Gypsum's existing booster pump stations. Pump stations shall include telemetry control equipment compatible with the Town of Gypsum. Check valves shall be: bronze mounted; AWWA C508; high strength cast iron gate with bronze gate ring; bronze, back-faced seat ring; and solid bronze Y-shaped hinge.

2.03.5 Storage Facilities

Water storage tanks are required throughout the distribution system to maintain adequate supply during peak demand period. The size, location and type of storage tanks shall be reviewed and approved by the Town of Gypsum.

2.04 LAYOUT OF THE DISTRIBUTION SYSTEM

Every subdivision shall have a central water system, designed and prepared by a registered professional engineer, in accordance with the Town of Gypsum design standards approved

by the Colorado Department of Health. The water main system shall be connected to and become part of the Town of Gypsum municipal water system. The water services are privately owned and maintained

Right-of-way width requirements for water main installations are as follows:
 All mains shall be installed in a Public Street. Every effort should be made to locate water valves outside of normal vehicle wheel paths, preferably in the center of the driving lane. Valves shall never be located on curb, gutter, pans or sidewalks. The finished grade of a lid for a water valve box in a paved surface shall be 1/2 inch below the finished grade of the paved surface. If it is not possible or feasible for an installation to be made in a dedicated street right-of-way, the installation shall be made in a dedicated utility easement. The minimum width, right-of-way or easement which will be accepted by the Town of Gypsum is twenty feet (20'), ten feet (10') each side of the main. In the case of extreme depths of bury or nearby utilities more easement may be required. Easements must be granted which will provide sufficient room for future excavation and maintenance of the line (see following table).

<u>WATER MAIN COVER DEPTH</u>	<u>MINIMUM EASEMENT WIDTH REQUIRED</u>
7' TO 8'6"	20'
8'7" to 9'	25'

Looping of the water distribution system will be required at the discretion of the Town of Gypsum. Installed pipe shall have a minimum depth of cover of 5.5 feet from finished grade to the top of the pipe, with a maximum depth of bury at 9 feet. When a pipe must be installed under a culvert or other structure wherein the cover between the pipe and open air is less than 5.5 feet, a site specific design must be prepared and construction accomplished for insulating the pipe from freezing. A general rule is 1" of blue-board insulation for each foot of missing cover; 2" minimum.

(10)-gauge insulated tracer wire shall be required on all main line installations. Tracer wire must be taped on top of all pipes, at each coupling and at the mid- point between couplings. The interval between tape points shall not exceed 10 feet. Wire shall loop to the surface at all valve boxes.

Line valves shall be installed in all water mains at a maximum interval of 750 feet or at the discretion of the Town of Gypsum. Isolation valves shall be installed on all branches of all Tees and Crosses except at fire hydrant and service isolation valves. In the event that a pipeline must be installed at a depth greater than 5.5-foot, cover a valve nut extension with centering plate shall be provided such that the depth to a valve nut shall be no more than 4.0 feet.

Warning tape shall be placed two (2) feet above all water mains. Tape shall be blue in color, to indicate water.

2.05 SERVICE LINE STUB OUT DESIGN AND LAYOUT FOR ALL NEW AND REPLACEMENT SERVICE LINES

All service line taps shall be made before the main line has been pressure tested. All direct taps to ductile iron mains must engage a minimum of three complete threads on the corporation stop. When this cannot be accomplished, a saddle must be used. The Town of Gypsum must inspect all service line taps while under test pressure before the service line is accepted.

An expansion loop (3/4" through 2" only) must be left in the service line where it is connected to the corporation stop at the water main, to allow for expansion and contraction. This loop shall be made in a vertical plane at the level of required pipe depth.

Service lines for residences shall be a minimum of three-quarter inch (3/4") in diameter. No couplings shall be allowed from the main line to the curb stop. Curb stops shall be located 12 inches inside the property line. In the case of nearby utilities, service lines must extend beyond the curb stop to the greater of; 6 feet beyond the back of walk, or the nearest utility.

Service lines for commercial, light industrial or industrial subdivisions or developments require 8 inch lines be extended between common lot lines to serve two lots. An isolation valve shall be provided at the main line tee. Cap shall be located at the right of way or the greater of 6 feet beyond the back of walk, or nearest utility. These water main extensions may be provided within utility easements on common lot lines to serve both lots. The plug at the end of the 8-inch service line shall be restrained and the service line isolation valve shall remain open during the pressure testing of the main. Domestic and fire suppression water must enter the building in separate lines. The main shall be fully retained from main to tee. The curb stop for domestic water must be located outside the building.

Service lines between the corporation and the curb stop (3/4" through 2" only) shall be constructed of type "K" copper (or Town of Gypsum approved material e.g. PureCor) 3/4 inch services shall not exceed 60 feet from corporation to curb stops. Water service lines over two inches (2") shall be ductile iron or other Town of Gypsum approved material.

Service lines (3/4" through 2" only) shall have only compression fittings. Service lines shall be installed with five and one-half feet (5.5') of cover. Depth of bury shall be determined from finished street grade or roadway ditch (which ever is greater) and finished grade of property being served. The Town of Gypsum will require an U.F. insulated ten gauge (10) copper wire to be installed with the service line and taped every three feet (3') to the pipe and extended into the meter pit for the purpose of locating the service. (Appendix B-1)

All service lines are required to have pressure-reducing valves (PRV's). The PRV's shall be installed ahead of meters.

Water mains and services shall be located a minimum of ten feet horizontally from existing or proposed sewer mains and services. The distance will be measured pipe wall to pipe wall. Whenever it is necessary that a water main cross below or within 18 inches below a sewer main, the sewer main shall be made impervious by one of the methods listed in

section: Protection of Water Supply, and as shown in the detail drawings. The 10-foot horizontal separation shall be required until it enters the foundation.

Taps shall not be made after November 15th of any year, or before April 15th, unless specific approval of the Town of Gypsum is given. Taps may be allowed during this period, with specific approval, provided the area is heated, is outside the roadway and 48 hours prior noticed has been given.

The Town of Gypsum shall perform all operation of water main valves. Absolutely no operation of water valves by contractors, developers, homeowners, or any unauthorized personnel will be allowed. All water must be metered, except for initial flushing of high chlorine.

All line stub outs shall be marked as indicated in the Standard Drawings with a metal t-post. No wooden markers shall be used. (Appendix B-1)

As-built drawings must show ties to two (2) permanent surface structures from the end of the service line.

2.06 MATERIALS FOR SERVICE CONNECTIONS, SERVICE LINES, METERS AND APPURTENANCES

2.06.1 Scope

This section covers the installation of corporation stops, service lines, meters, yokes, meter boxes and pressure reducing valves and backflow prevention devices for services.

2.06.2 Materials

- a. Saddles--Saddles shall be brass (ASTM B-62 & AWWA C-800) with flattened, silicon bronze straps and brass alloy (ASTM B-62 & AWWA C-800) nuts or stainless steel with double flat stainless steel straps and nuts. Manufactured by Ford, Mueller or approved equal.
- b. Direct taps--All direct taps to ductile iron mains must engage a minimum of three complete threads on the corporation stop. When this cannot be accomplished, a saddle must be used. Corp stops shall be Mueller 300 Ball Valve No. B-25008, AWWA 800 inlet thread shall be Mueller and discharge connection shall be Mueller 110 compression connection.
- c. Corporation Stops--Corporation stops shall be all brass construction (AWWA C-800) with threads suitable for the coupling or saddle to which the connection is being made, and shall be Mueller 300 Ball valve B-25008 compression fitting, no substitutes.
- d. Service Lines--Service lines shall be PurCor or Type K copper, soft, meeting ASTM B88-62 for service lines from 3/4 inch to 2 inch. Service connections larger than 2 inch shall be considered water mains and shall be as specified under the applicable

sections. All copper service line connections shall be compression joints. Polyethylene service lines may be installed with a trace wire from the curb stop to the meter at the discretion of the Town. Only Mueller 110 compression connections shall be acceptable.

- e. Curb Stops--Curb stops shall be Mueller 300 Ball curb valve no. B-25209 compression fitting or AWNA C-800, no substitutes.
- f. Valve Boxes for Curb Stops-- Valve boxes for curb stops shall have one inch extension rod to within **24 inches of the surface** with arch pattern and stationary rod as called for in the following table:

MANUFACTURER	MODEL NO. FOR 3/4 AND 1 INCH	MODEL NO. FOR 1-1/2 AND 2 INCH
MUELLER	H-10334	H-10310
MCDONALD	5601	5603
FORD	EA-2	EA-2

- g. Meters--The Town of Gypsum shall determine meter type and manufacture. For outside installation, the Town staff shall install the meter pit and meter yoke. For inside installation, the meter yoke shall be installed by the customer's plumber. Installation must be in a freeze-proof, accessible area and will be near floor level in a horizontal position.

The customer shall install wire from the meter location to the touch-read pad prior to meter installation. Touch-read pad will be located on the street side of building, four to five feet (4'-5') above the ground in an accessible location free from snow.

A pressure-reducing valve (PRV) shall be installed before the meter. A backflow preventer shall be installed following the meter. Isolation valves shall be located before the PRV and after the backflow preventer (i.e. isolation valve-PRV-meter-backflow preventer-isolation valve). The backflow preventer shall be provided and installed in accordance with the Town of Gypsum plumbing code.

Schedule installation with Town of Gypsum personnel 48 hours in advance. Service will be turned on and billing will commence when the meter is installed. Town of Gypsum personnel only will turn on water.

- h. Pressure Reducing Valve--Pressure reducing valves (PRV) for service lines shall be Cash-Acme Type EB-74 (1/2" through 1") or Type EB-86 (1-1/4" through 2") or approved equal with a range of adjustment of discharge pressure from 20 to 70 psi.
- i. Isolation valves of service line size shall be installed ahead of the pressure-reducing valve (PRV) and after the meter (i.e. valve, PRV, meter, backflow preventer, valve).

2.07 JOINT RESTRAINT

Unless otherwise approved by the Town of Gypsum, concrete thrust block joint restraints are not allowed. All joint restraints must be made with EBAA IRON SALES, MEGALUG fittings, or U.S. Pipe Field Loc Gaskets, only. All joint restraint calculations shall be prepared with the specific equipment manufacturers' programs and shall be certified by a registered professional engineer. These calculations shall be submitted to the Town of Gypsum during the development approval process. All tees shall be calculated as 90° bends and fully retained in all three directions.

In the course of construction of water system infrastructure, all required joint restraint installation must be observed by an authorized Town of Gypsum representative and tentatively approved, prior to backfill. Final approval of water system infrastructure will only be given after successful completion of all flushing and testing of the system.

2.08 WATER PIPELINE CONSTRUCTION

All materials shall conform to the Material Specifications and shall be furnished new and undamaged. Everything necessary to complete all installations shall be in accordance with the Specifications and all installations shall be completed as fully operable functioning parts of the Town of Gypsum's System.

Unless otherwise approved, pipe installation sequencing shall be as follows:

- a. Trench excavation shall not precede pipe installation by more than 250 feet.
- b. Pipe installation shall not precede backfill by more than 100 feet.
- c. Trench excavation shall not precede clean-up by more than 1000 feet.

Additionally, no timber, bracing, lagging, sheathing, or other lumber shall be left in any trench.

2.09 MATERIALS

The type and class of pipe to be used in the work will be shown on the plans and/or stated in the specifications. The following specifications apply to pipeline and appurtenant materials.

<u>Material</u>	<u>Specification</u>
Ductile Iron Pipe (DIP)	AWWA C-151
Polyvinyl Chloride pipe (PVC) (Limited to special circumstances when approved by the Town)	AWWA C-900
DIP Cement Mortar lining	AWWA C-104
DIP Mechanical and push on joint	AWWA C-111
DIP Compact Fittings	AWWA C-153
DIP & Gray Iron Fittings	AWWA C-110
Gate valves	AWWA C-500
Butterfly valves	AWWA C-504
Resilient Seated Gate valve	AWWA C-509
Resilient Seated Gate valve int. coating	AWWA C-550
Fire Hydrant	AWWA C-502
Loose Polyethylene Encasement	AWWA C-105

- a. **Valves**--Isolation valves shall be the same size as the main pipeline. Gate valves shall be Mueller A- 2360, U S Pipe Metroseal 250 or American Flow series 2500. Valves shall be cast iron body, 250 psi pressure rating, bronze-mounted, resilient wedge, epoxy coated interior and exterior, meeting AWWA C509. Valves shall have ring stem seal, two inch (2") square operating nut, open left. Gate valves shall be installed on all pipe sizes up to and including twelve inches (12"). Valves larger than twelve inches (12") shall be butterfly configuration and shall be Mueller 5227, Lineseal XP with buried service actuators requiring a minimum of 30 turns to open or close and shall have epoxy coating interior. Butterfly valves shall be tight closing with rubber seals attached to the valve body. Butterfly valves shall conform to AWWA C504. Valves shall be flange or MJ with Mega Lug ends. To determine the correct valve application, contact the Town of Gypsum Inspector prior to ordering material.
- b. **Valve Boxes**--All buried valves shall be provided with a six-inch (6") cast iron valve box, screw type. The valve box shall be of a design, which will not transmit shock or stress to the valve and shall have enough extension capability to be raised to final street grade. The valve box shall be cast iron, adjustable screw type, with minimum five-inch (5") diameter shaft provided with cover, marked "water".

2.10 WATER PIPE INSTALLATION

The pipe shall be installed in accordance with the manufacturer's recommendations for installing the type of pipe used unless modified or changed in the Special Provisions. The Contractor shall provide all tools and equipment including any special tools for installing each particular type of pipe used.

- a. Pipe shall be laid with the bells pointing in the direction that the work is progressing.
- b. Where pipes are installed on grades of 10% or greater, installation shall start at the bottom and proceed upslope.
- c. The joint shall be completed in accordance with the applicable pipe material specification and the pipe shall be adjusted for line and grade. Adjustments to line and grade of the pipe shall be made by adjusting the bedding along the entire length of the pipe, and not by wedging, blocking, or mounding up the pipe or bell.
- d. Secure the pipe in place with the specified bedding tamped under and around the pipe except at the last bell. The pipe bedding material shall be placed around the pipe by hand and compacted by hand tamping. For all other pipe bedding and trench backfill see Appendix A-1.
- e. Install the pipeline such that a constant positive or negative grade is maintained between high and low points. Record the location of high and low points so that they may be readily located for the installation of air-vacuum valves or blow offs.

- f. Polyethylene encasement (polywrap) shall be installed on ductile iron pipe, due to the soils found in the Town. Encasement shall be tube type, in accordance with AWWA C-105, and shall be installed by advancing a bunched length of material around each length of newly laid pipe. Overlap and tape encasement joints. Repair rips, punctures or other damage with adhesive tape or short length of encasement wrapped and secured around the damaged area.
- g. Furnish and install insulated 10 gage copper trace wire on all water pipe lines. Installation will be on the top one third of the pipe, taped at 6-foot intervals, outside polyethylene encasement when DIP is used. Connect all branch line trace wire to main trench wire with a twist splice. Bring trace wire to finished grade surface adjacent to all valve boxes. Ground trace wire at a maximum of 500 foot intervals, with grounds being located at hydrants or valves, wherever possible.
- h. All temporary (dead end) plugged ends longer than 10 feet in length **and** larger than one-inch diameter shall be provided with a temporary tap for flushing and testing.
- i. All pipe, fittings and appurtenances (poly wrap, trace wire, etc.) must be inspected by the Town of Gypsum prior to backfill.
- j. **Pipeline Insulation**- When it becomes necessary to insulate a new pipeline due to shallow depth, and when this type of installation is approved by the Town of Gypsum, the following method and materials shall be used:
 1. 36" or more to the top of pipe. For every foot of depth missing, add 1" of blue-board; 2" minimum. Place on top of pipe, at least 24" wide, or encase sides and top with Town approval.
 2. Less than 36" to top of pipe
 - i. The carrier pipe shall be installed within an encasement of ADS-N12 pipe, the inside diameter of which shall be a minimum of 4 inches greater than the maximum outside diameter of the carrier pipe (i.e. bell or fitting);
 - ii. The carrier pipe shall be mounted on Cascade spacers, as supplied by Grand Junction Pipe, or approved equal, at spacing of 2 per pipe joint of carrier pipe, but no more than 7.0 feet apart;
 - iii. The space between the outside of the carrier pipe and the inside of the ADS-N12 shall be filled with foam or dense packed fiberglass insulation.
- k. **Procedures** – Service meters shall be purchased from the Town of Gypsum.
Master Meter Vaults: All master meter vaults in the Town of Gypsum shall be equipped with a main (high flow) Invensys turbine meter of a size necessary for the function of the vault, and a Invensys, positive displacement low flow meter. The contractor will be required to submit a piping schematic to the Town of Gypsum prior to any installation, showing the meters valve location, pipe and inlet screen. Refer to Standard Drawings for additional detail, shown in Appendix B-4 and Appendix B-5.

- I. **Pipe Bedding and Trench Backfill** – All trenches shall be backfilled immediately after grade, alignment and jointing of the pipe has been inspected and accepted by the Town of Gypsum. Leakage tests, pressure tests or tests for alignment, grade and/or pipe cross-section deflection shall be performed after backfill has been accomplished. Pipe bedding material placed around and up to a point twelve inches over the pipe shall consist of select earth, sand, or fine gravel free from clods, lumps of frozen material or stones larger than 1 ½ inches in their maximum dimension. The pipe bedding material shall be placed around the pipe in layers of six inches thick or less and compacted by tamping. Water settling of this portion of the trench will not be allowed, and the addition of water shall be limited to that required for optimum compaction. After the select pipe bedding material has been placed and compacted as called for above, the remainder of the trench shall be backfilled. All backfill material shall be free from cinders, ashes, refuse, organic and frozen material, boulders, or other unsuitable material. From twelve inches over the pipe to a point 12 inches below the surface or road sub grade, stones which do not exceed 12 inches in maximum dimension may be included in the backfill. Materials used for backfill shall be placed in the trench in layers suitable to the equipment used for compaction and shall be compacted to a minimum of 95% of the maximum dry density as determined by the Standard Proctor test (ASTM D698) at a moisture content within 2% of optimum. Completion of backfill in roads, streets and sidewalks shall include the reconstruction of paving surfaces to a condition as good as or better than the original surface, and shall include replacement of all sub-base and base course gravels. Trench configuration shall be shown as in Appendix A-1.

The Contractor shall be responsible for the safe and proper storage/handling of all material intended for the until it has been incorporated in the completed and accepted work.

Every precaution shall be taken to prevent foreign material from entering the pipe while it is being handled, stored or installed. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a water-tight plug or other means approved by the Town of Gypsum.

2.11 PIPE DEFLECTION

Alignment layout shall not exceed one-half (1/2) the deflection value listed below and the actual individual joints in the field shall not exceed the deflection values listed below:

MAXIMUM DEFLECTION FULL LENGTH PIPE -- MECHANICAL JOINT PIPE APPROX. CURVE RADIUS, MAX DEFLECT. PRODUCED BY SUCCESSION

Pipe Size (inches)	Maximum Offset, (inches)		Approx. Radius of Curve – R Produced by Succession of Joints, feet.	
	L = 18 ft	L = 20 ft	L = 18 ft	L = 20 ft
3	31	35	125	140
4	31	35	125	140
6	27	30	145	160
8	20	22	195	220
10	20	22	195	220
12	20	22	195	220
14	13.5	15	285	320
16	13.5	15	285	320
18	11	12	340	380
20	11	12	340	380

MAXIMUM DEFLECTION FULL LENGTH PIPE -- PUSH-ON TYPE JOINT APPROX. CURVE RADIUS PRODUCED BY SUCCESSION

Pipe Size (inches)	Maximum Offset, (inches)		Approx. Radius of Curve – R Produced by Succession of Joints, feet.	
	L = 18 ft	L = 20 ft	L = 18 ft	L = 20 ft
3	19	21	205	230
4	19	21	205	230
6	19	21	205	230
8	19	21	205	230
10	19	21	205	230
12	19	21	205	230
14	11	12	340	380
16	11	12	340	380
18	11	12	340	380
20	11	12	340	380

The cutting of pipe as necessary in the course of the work shall be accomplished in neat workmanlike manner without damage to the pipe and any coating thereon. The cut shall result in a smooth cut at right angles to the axis of the pipe and a grinder shall be used to bevel the pipe end for jointing and smooth the rough edges of the cut end. **Flame cutting of**

pipe shall not be allowed. Cuts shall be made with a saw or abrasive wheel for ductile iron pipe.

Acceptance of materials, or the waiving of inspection thereof, shall in no way relieve the Applicant of the responsibility for furnishing materials meeting the requirements of the Specifications.

2.12 TESTING AND ACCEPTANCE

2.12.1 Scope Flushing And Disinfection Of Water Lines

The work consists of the disinfection of potable water lines. **IT SHOULD BE NOTED THAT THE ACTUAL WORK OF THIS SECTION BEGINS WITH AND CONTINUES THROUGHOUT THE CONSTRUCTION OF THE WATER LINE. CARE IN THE MANNER IN WHICH THE PIPE AND FITTINGS ARE STORED, HANDLED AND INSTALLED WILL GREATLY REDUCE THE POTENTIAL FOR DIFFICULTIES IN OBTAINING ACCEPTABLE BACTERIOLOGIC TESTS.** The wide variety of water main configurations that must be flushed and disinfected require that the Contractor and the Town of Gypsum cooperate to insure that no contamination exists which may be a hazard to public health when the water system is placed in service. The contractor is responsible for disinfection of water lines and shall furnish all materials labor and equipment necessary for the work.

2.12.2 Testing And Acceptance Of Water Lines

Acceptance of water lines is dependent upon proof by testing and inspection that the system has been constructed and prepared to transport domestic water in accordance with specifications and regulations of the Town. The order of testing is as follows:

- a. Continuity of tracer wire
- b. Disinfection (30 ppm for 24 hours, if greater than or equal to 80 ppm, flush at 3 hours with high chlorine.)
- c. Flushing--if flushing results in the discharge of an inordinate volume of dirt, rocks or other debris, the Town of Gypsum may require, at its sole discretion, an additional course of disinfection. The flushing of high chlorine content water to surface stream is prohibited.
- d. Low chlorine
- e. Bacteriological sampling
- f. Hydrostatic testing (See section 2.13)

2.12.3 Connection To Existing Water Facilities

Where connections are to be made to existing water facilities, such connections shall be made in strict conformance with the details shown on the Plans and called for in the Specifications, and shall be begun only after prior consultation with the Town of Gypsum. Connections shall not be initiated until all appropriate fittings are on hand and ready for use. Connections shall be made at such time and conditions to provide for minimum interruption of service to users. Care shall be taken to insure protection of water supplies. The Contractor shall notify the Town of Gypsum at least 48 hours prior to the time that a connection to existing facilities is planned. Disinfection of the connection shall be

accomplished in accordance with current edition of AWWA C651, "Standard for Disinfecting Water Mains".

2.13 HYDROSTATIC TESTING

2.13.1 Scope

The work shall consist of the hydrostatic testing of water distribution lines. Pressure tests and leakage tests shall be conducted concurrently. The Contractor shall provide all required equipment, materials and labor, including any special temporary taps necessary for the testing. A hydrostatic test shall not be considered valid unless the Town of Gypsum witnesses it.

2.13.2 General

- a. The Contractor shall notify the Town of Gypsum 48 hours in advance of all hydrostatic testing.
- b. No tests shall be conducted until all required pipe and joint restraint features are in place.
- c. No allowance shall be made for pressure reductions accomplished by means of pressure reducing valves or other mechanical means.
- d. Prior to tests, inspect valves within the test section to make sure they are fully open. When fire hydrants are in the test section, the test shall be conducted with the hydrant turned off and the hydrant isolation or guard valve open. The operation of all valves shall be verified by the Town of Gypsum staff.

2.13.3 Pressure Test

a. Preparation

The Town of Gypsum shall slowly fill the pipe section to be tested with water. Remove all air from the test section. The pipe filled with water shall stand a minimum of 24 hours prior to the hydrostatic pressure test, if cement mortar lined pipe is being tested.

b. Test pressure

1. The test pressure shall be 150% of the working pressure measured at the lowest elevation of the pipeline test section, or 150 psi whichever is greater.
2. Pressure shall be maintained within +/- 5 psig of the required test pressure for at least 2 hours.

2.13.4 Leakage Test

a. Definition: Leakage is the quantity of water that must be added to the pipeline to maintain pressure within 5 psig of the specified test pressure after the air has been expelled and the pipe is filled with water.

b. Maximum allowable leakage where:

L = maximum allowable leakage in gallons per hour over two hour test

S = length of pipe tested in feet

D = nominal pipe diameter in inches

P = average test pressure during the leakage test in psig

$$L = \frac{SD\sqrt{P}}{133,200}$$

2.13.5 Passing

a. The contractor shall locate and repair defective materials and joints if the tests disclose pressure or leakage greater than that specified.

b. All visible leaks shall be repaired regardless of the amount of leakage.

The contractor shall submit manufacturer's certification that the hypochlorite materials (no tablets allowed) to be used in the disinfection conform to the AWWA B300 Standard for Hypochlorites.

3.00 ROAD AND STREET DESIGN AND LAYOUT

3.01 STREETS

The street system shall be designed to provide traffic safety, allow for alternate access and routing in emergencies, be practical to construct and maintain, provide access to all lots, tracts, parcels, adjoining public lands and private lands, and coordinate with existing or planned streets, as may be shown on the master plan. Intersections shall be located and designed to provide conditions optimizing traffic safety.

a. Streets shall bear a logical relationship to the topography.

b. Where two streets intersect a common street from opposite sides, the intersections shall be directly aligned on centerline, or shall be offset not less than 150 feet, centerline to centerline. Where two streets intersect a common street from the same side, the intersections shall be separated by no less than 150 feet centerline to centerline.

c. Intersections shall be designed as nearly to right angles as possible, with no intersecting angles of less than 75 degrees.