



## Public Works Standards & Specifications

### **DIVISION III – SANITARY & STORM SEWER FACILITIES**

#### **301 TRENCH EXCAVATION, BEDDING AND BACKFILL**

##### **301.1.00 DESCRIPTION**

Minimum general standards for sewer facilities shall conform to the *Oregon Standard Specifications for Construction*, latest edition. This section covers trench excavation, trench foundation, pipe bedding, pipe zone, trench backfill.

##### **301.1.01 TRENCH EXCAVATION, BEDDING, AND BACKFILL**

See Division I Trenches

##### **301.3.00 CONSTRUCTION**

##### **301.3.01 TRENCH EXCAVATION**

##### **301.3.01A General**

The Contractor shall secure and comply with applicable State, County, or City street cutting permits. The Contractor shall comply with all City, County, State and Federal Highway Construction Safety and Health Standards. Prior to installing a sewer facility in an unimproved street, the street shall be brought to subgrade to assure that adequate bury, depth of cover, and utility separation is achieved.

##### **301.3.02 TRENCH BACKFILL**

See Division I Trenches

##### **301.4.00 MEASUREMENT AND PAYMENT**

##### **301.4.01 LINEAR FOOT BASIS**

The length of trench shall be measured horizontally from centerline to centerline of manholes or to the end of the pipe, whichever is applicable. Measurement of the various depth classes, as stated in the Schedule of Bid Items, will be from the pipe invert elevation as constructed to the design subgrade elevation at the point of measurement.

Payment for TRENCH EXCAVATION will be at the unit price bid per lineal foot at the specified diameter for the depth class as measured. Payment shall include all materials, tools, labor, equipment, bedding, backfill and incidentals required to excavate and backfill the trench as specified. There will be no separate payment for rock excavation unless specifically called for in the Schedule of Bid Items.

##### **301.4.02 INCIDENTAL BASIS**

When not listed in the Schedule of Bid Items as a separate pay item, TRENCH EXCAVATION shall be considered incidental to the price bid for pipe.

#### **303 PIPE AND FITTINGS (SANITARY SEWER)**

##### **303.1.00 DESCRIPTION**

This section covers all work necessary for the installation of sanitary sewer pipe and fittings.

## **303.2.00 MATERIALS**

### **303.2.01 GENERAL**

Sanitary sewer pipe shall be designated as either gravity main or pressure main for purposes of this specification. Unless otherwise specified, all gravity sewer and pressure pipe in the project shall be polyvinyl chloride (PVC) of the size and pressure class called for on the plans. Where more than one type of material is considered appropriate, the type required will be designated on the plans.

At the sole discretion of the City, the Contractor and/or material supplier shall provide certified manufacture date of any PVC pipe with visible cracking, discoloration, or fading due to ultraviolet light exposure. Pipe which is one year or older from the date of manufacture may be rejected. The City reserves the right to reject pipe material for cause regardless of the age of pipe.

### **303.2.02 POLYVINYL CHLORIDE PIPE**

#### **303.2.02A Gravity Sewer Pipe**

1. Rigid PVC pipe compounds used in gravity sewer pipe shall conform to ASTM D1784, Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (PVC) Compounds.
2. PVC pipe shall conform to ASTM D3034, standard dimensions ratio not to exceed 35, or to ASTM F679, minimum pipe stiffness ( $F/\Delta y$ ) at 5% deflection of 46 psi or 115 psi for all sizes when tested in accordance with ASTM D2412. Provide manufacturer's certification, including test results, for all materials supplied under these Specifications.
3. All piping system components of a pipe class shall be the products of one manufacturer.
4. Where minimum cover cannot be maintained, or where directed by the Engineer, pipe shall be PVC water pipe meeting the requirements of AWWA C900 specifications, *Polyvinyl Chloride (PVC) Pressure Pipe*.

#### **303.2.02B Pressure Sewer Pipe**

1. Pipe shall be Class 150- PVC C900 and have a minimum DR of 18 unless otherwise specified.
2. All piping system components of a class shall be the products of one manufacturer.
3. Where minimum cover cannot be maintained, or where directed by the Engineer, Pipe shall be PVC water pipe meeting the requirements of AWWA C900 specifications, *Polyvinyl Chloride (PVC) Pressure Pipe*.
4. Purple non-metallic tape shall be laid 12inches above the pipe when using white or blue plastic pipe in pressure sewer installation.

### **303.2.03 JOINTING MATERIALS**

#### **303.2.03A Polyvinyl Chloride Pipe**

##### **1. GRAVITY SEWER PIPE**

Joints shall be rubber gasketed conforming to ASTM D3212 for gravity sewers. Gaskets shall conform to ASTM F477. All bells shall be formed integrally with the pipe and shall contain a factory installed elastomeric gasket. Lubricant for jointing shall be as recommended by the pipe manufacturer.

##### **2. PRESSURE SEWER PIPE**

Joints shall be rubber gasketed conforming to the manufacturers recommendations for the pressure class specified. Gaskets shall conform to ASTM F477. Lubricant for jointing shall be as recommended by the pipe manufacturer.

## 303.2.04 FITTINGS

### 303.2.04A Poly Vinyl Chloride Pipe

#### 1. GRAVITY SERVICE FITTINGS

- a. PVC pipe fittings shall conform to ASTM D3034, standard dimensions ratio not to exceed 35 or to ASTM F679. Provide manufacturer's certification, including test results, for all materials supplied under this Specification.
- b. All fittings shall be the same as the joints used on the sewer pipe. Caps or plugs shall be furnished with each tee outlet or stub with the same type gasket and joint as furnished with the service connection pipe specified for future service connections. The plug or cap shall be banded or otherwise secured to withstand all test pressures involved without leakage.
- c. Lateral connections to the main shall be made with Tee-Wyes.

#### 2. PRESSURE SEWER FITTINGS

##### a. Gate Valves (Isolation Valves)

Gate valves shall be iron-body, resilient-seated gate valves conforming to AWWA C515, "Ken-seal" valves as manufactured by Kennedy Valve Co. or equal. Gate valves shall be polymer coated inside and out, have flanged or threaded ends, and a non-rising stem. Unless otherwise specified, gate valves shall be supplied with a 2-inch operating nut and O-ring joints. Gate valves installed in vaults or above ground shall be supplied with hand wheels.

##### b. Check Valves

Check valves on pressure sewers, except for service lines, shall be spring loaded, external lever actuated, iron-body, flanged end, resilient seat check valves, Kennedy model 106 ALS or equal. APCO model 104P3 with backflow device may be used in certain applications as approved by the Engineer. Commercially available PVC check valves may be used for individual 3" diameter service lines where the total head at the check valve does not exceed 25 feet.

##### c. Valve Enclosures

Valve enclosures for check valves and gate valves shall be concrete in traffic areas and may be plastic elsewhere. Covers shall have the word "SEWER" in raised letters. Top section and base section shall have minimum overlap of 4 inches.

##### d. Pressure Pipe Cleanouts

Cleanouts shall be constructed as indicated on the Standard Drawings. Box shall be a standard valve box.

##### e. Pressure Pipe Air-release Valves

Air-release valves shall be installed as indicated on the Standard Drawings, complete with 2" shut-off valve, 1" blow-off valve, quick disconnect coupling and backflushing apparatus, ARI D-040, or approved equal. Valve shall provide for an operating pressure range of 0-50 psi.

##### f. Saddles

Saddles shall be epoxy coated, ductile iron body saddles with double stainless-steel straps equivalent to Romac 101S or 202S service saddles as manufactured by Romac Industries.

##### g. Valve Boxes

Valve boxes subject to traffic loading shall be a two-piece grade adjustable box. The valve box shall be 5" I.D. with a slip top section without a dirt flange on the bottom as shown in the Standard Drawing. Valve boxes shall be Tyler 6855 or equal. The extension piece shall be of the proper length for depth of cover. The word "SEWER" shall be cast into the top of the lid, and lid shall be filled with concrete.

##### h. Bends, Tees and Other Fittings

Pressure sewer fittings shall be ductile iron meeting the requirements of AWWA C110 or AWWA C153 and shall have a minimum working pressure of 250 psi. Fittings shall be restrained to meet the anticipated loading using grip ring gaskets or mechanical joint restraint.

### **303.2.05 Detection Tape and Detection Wire**

Detection tape shall be installed on all non-metallic sewer mains. Detection tape shall be 6" wide and be manufactured by Allen Systems or an approved equal. One course of detection tape is required at the top of the pipe zone. Detection wire shall be installed on all gravity sewer mains and all service connections. The wire shall be a green-clad, 14 gauge, UF bury, solid copper wire. The wire shall be attached to the top of the pipe. Where a splice is necessary, the wire shall be joined with a King KWC 100 tan watertight connector, or equivalent as approved by the Engineer. For service connections, detection wire shall be brought to the ground surface within the cleanout access box, allowing for adequate length (approximately 6 inches) for locator connection.

### **303.2.06 Insulation**

Pipe insulation when required shall be a minimum of 2-inch thickness, CPR Upjohn-Trymer bun material, Manville Micro-Lok, or equivalent, covered with an aluminum roll jacketing, 0.016-inch minimum thickness, PABCO Surefit Aluminum Jacketing, Manville Micro-Lok, or equivalent. Insulation shall have a maximum conductivity ("K") of 0.40. Insulation at pipe supports shall be calcium silicate or other approved rigid insulation adequate to support the pipe. Jacketing joints shall be sealed within silicone caulk. Pipe supports and hangers shall be plated or hot dipped galvanized after fabrication.

### **303.2.07 Concrete**

Concrete for thrust blocking and support structures shall conform to ASTM C 94, Alternate 2, and shall be proportioned to obtain a 28-day compressive strength of 2500 pounds per square inch or approved equal. Sacrete mix type products are not allowed.

## **303.3.00 CONSTRUCTION**

### **303.3.01 LINE AND GRADE**

Project shall be staked according to General Specifications and City Standards for street construction.

Line and grade may not vary more than 1/32 inch per inch of pipe diameter subject to the following limitations:

- a) Variance may not exceed ½ inch regardless of pipe diameter
- b) Variance must not result in level or adverse slope

### **303.3.02 PIPE DISTRIBUTION AND HANDLING**

#### **303.3.02A Pipe and Fitting Storage**

Material shall be stored on the job from cars, trucks, or storage yard no sooner than can be used to good advantage. Pipe and fittings shall be stored and covered in such a manner as to prevent damage or contamination.

#### **303.3.02B Handling Material**

Proper implements, tools, and facilities shall be provided by the Contractor for the safe and convenient prosecution of the work. The Contractor shall protect pipe and fittings from contamination or damage at all times. All pipe, fittings, and valves shall be transported and handled in a manner to prevent damage to the pipeline materials and protective coatings and linings. Under no circumstances shall pipeline materials be dropped or dumped off trucks or into the trench. No more pipe shall be laid out along open ditch prior to installation than can be installed and backfilled in one work shift. Pipeline materials shall be removed from storage area as needed for installation,

#### **303.3.02C Cleaning Pipe and Fittings**

All foreign material shall be removed from the bell-and-spigot ends of each pipe as installation proceeds. When deemed necessary by the City Inspector, the outside of the spigot and the inside of

the bell shall be wiped clean, dry, and free from oil, grease, or ice before the pipe is laid. The ends of solvent weld pipe and fittings, and of rubber gasket joint pipe and fittings, shall be wiped clean of all dirt, grease and foreign matter.

### **303.3.03 LAYING PIPE ON CURVES**

The Contractor shall lay pipe on horizontal or vertical curves in accordance with the manufacturer's recommendations. Pipelines intended to be aligned straight between manholes shall be so laid, and in no case shall the deviation from the straight line at any joint exceed 1/2-inch.

### **303.3.05 PIPE PLACING AND JOINTING**

Trench excavation, bedding, and backfill shall be in accordance with Division I - Trenches.

#### **303.3.05A Placing Pipe in the Trench**

Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed into the trench. If the pipe laying crew cannot place the pipe in the trench and install it without getting dirt in the pipe, the Inspector may require that, before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe. Between each shift, pipe end shall be plugged to prevent any objects or animals from entering.

#### **303.3.05B Unsuitable Conditions for Installing Pipe**

Pipe shall not be installed when there is water in the trench bottom, or when, in the opinion of the Inspector, trench conditions are otherwise unsuitable.

#### **303.3.05C Pipe Cutting**

Pipe shall be cut in a neat and professional manner with proper tools intended for that purpose and without damaging the ends of the pipe. The pipe shall be cut so as to leave a smooth end at right angles to the axis of the pipe. The cut end shall be dressed in conformance with the pipe manufacturer's recommendation.

#### **303.3.05D Solvent Welded Joints**

After a length of Solvent Weld pipe is placed in the trench, both the spigot end and the receiving bell shall receive a thorough application of primer and glue as per the manufacturer's specifications. Precaution shall be taken to prevent dirt from entering the joint space. The pipe (spigot end) shall be centered, inserted, seated, and rotated at least 90 degrees. The pipe shall be brought to correct line and grade along its length and secured in place with approved backfill material. Pipe and fittings which do not allow a sufficient and uniform space for jointing shall be removed and replaced with pipe and fittings of proper dimensions to assure such uniform space.

#### **303.3.05E Number of Pipes Laid before Jointing**

Solvent weld and rubber gasket joint pipe shall be connected immediately as they are placed in the trench.

#### **303.3.05F Prevention of Trench Water from Entering Pipe**

When pipe installation is not immediately progressing, the open ends of pipe in the trench shall be sealed with a watertight plug, or other means approved by the Inspector, and no trench water shall be permitted to enter the pipe. These provisions shall apply during midday breaks and at the end of each shift. If water is present in the trench, the seal shall remain in place until the trench is pumped completely dry.

#### **303.3.05G Bell End Direction**

Pipe shall be laid with bell ends facing upgrade/upstream unless otherwise directed by Engineer.

### **303.3.05H Seating Rubber Gasket Joint**

After a length of pipe with rubber gasket joint is placed in the trench, the plain end shall be centered in the bell, and the pipe properly seated and brought to correct line and grade along the entire length. Pipe and fittings which do not allow a sufficient and uniform space for jointing shall be removed and replaced with pipe and fittings of proper dimensions to provide for such space. Precautions shall be taken to prevent dirt or contaminants from entering the joint space.

### **303.3.05I Jointing Rubber Gasket Fittings**

PVC fittings with rubber gasket type joint shall be laid and jointed in strict accordance with the manufacturer's recommendations as approved by the Inspector and in accordance with the requirements of the Special Specifications (if applicable). The Contractor shall provide all special tools and devices such as special reamers, rasps, and similar items required for the installation. Lubricant for the pipe gaskets shall be of the type recommended by the pipe manufacturer, and no substitutions will be permitted under any circumstances.

Fittings, plugs, and caps shall be set and jointed to pipe in the manner prescribed by these specifications, or as otherwise approved by the City Engineer or City Representative. MJ Style couplings, such as Romac RC501 or XR501, shall be used for dissimilar pipe materials. Special conditions encountered for which suitable adapter couplings are not available, such as rare or discontinued pipe materials, shall be referred to the City Engineer for consideration of an approved method.

### **303.3.05J Joints for Dissimilar Pipe**

Adaptors for transitioning between ASTM D3034 PVC sewer pipe and AWWA C900 pressure pipe shall meet the requirements of AWWA C907. Concrete pipe to PVC pipe shall be joined with properly sized transition couplings meeting the requirements of AWWA C219. For 8" to 24" pipe, use Romac RC501 Reducing Coupling or approved equal. For pipe larger than 24", use Romac RC400 Steel Reducing Coupling or approved equal.

### **303.3.05K Pressure Service Connections and Fittings**

Service connections shall be designed and approved on an individual basis. Materials required will be specified and designated on approved plans. Pressure service pipe shall be no larger than 3" diameter and shall be connected to the City system by City crews with a gate valve and check valve assembly.

### **303.3.05L Bridge Crossing Pipe**

Pipe for bridge crossing shall be ductile iron as specified herein, except that restrained joint pipe may be used and deflected within the limits of the manufacturer's recommendations to facilitate wingwall penetration and overall alignment. Flanged fittings may be used for the wing wall penetrations. Bridge crossing pipe shall be insulated with a urethane or fiberglass pipe wrap system specifically designed for pipe insulation purposes.

### **303.3.06 DEFLECTION AT JOINTS**

Wherever it is necessary to deflect pipe from a straight line, either in a vertical or horizontal plane, a manhole shall be required. Where long-radius curves are permitted by the Engineer, the amount of deflection allowed at each joint shall be uniform and not exceed that indicated in the manufacturer's specifications.

Variation in invert elevations between ends of jointed pipes must not exceed 1/64 inch per inch of pipe diameter to a maximum of 1/2 inch regardless of pipe diameter.

### **303.3.07 REQUIREMENTS PRIOR TO TESTS**

#### **303.3.07A General**

All gravity systems and appurtenances shall successfully pass a hydrostatic or air test prior to acceptance and shall be free of visible leakage. All underground utilities proposed in the project shall be installed prior to testing. Information regarding air testing may be obtained from the Engineer.

On pipe 54" diameter and larger, individual joints may be tested by an approved joint testing device. All details of testing procedure shall be subject to approval of the Engineer.

#### **303.3.07B Plugging of Wyes, Stubs and Service Connections**

The Contractor shall plug all wyes, stubs, and service connections with gasketed caps or plugs securely fastened or blocked to withstand the internal test pressure. Such plugs or caps shall be removable, and their removal shall provide a socket suitable for making a flexible jointed lateral connection or extension.

#### **303.3.07D Time of Test**

The Contractor shall perform system testing during the normal workday, scheduling the plugging, capping and other preparatory work so as to complete the testing during daylight hours.

#### **303.3.07E Lines Not Passing Requiring Testing and Inspection**

The Contractor shall repair or replace any portion of the system not passing the air or hydrostatic test in a manner conforming to these specifications. Infiltration of ground water in an amount greater than allowed by specifications following a successful hydrostatic or air test shall be considered as evidence that the original test was in error or that partial failure of the system has occurred. The Contractor shall correct such failures occurring within the warranty period in a manner approved by the Engineer, and at no additional expense to the Owner.

### **303.3.08 REPAIRS**

All repair or replacement of existing sewer pipe must conform to City Standards and Specifications. The City's Wastewater Division must be notified of any damage to existing sewer pipe. The pipe must remain exposed until it is inspected by a City representative. Repair method must be approved by the City and repairs must be inspected prior to backfill. After trench backfill is placed and compacted, the City will conduct a video inspection and any work not meeting City standards will be corrected by the Contractor. Video inspection fees will be charged to the party that damaged the line in accordance with the fee schedule in effect at the time.

### **303.3.09 HYDROSTATIC TESTING (PRESSURE PIPE)**

#### **303.3.09A General**

Pressure sewer lines shall be tested by hydrostatic methods. The Contractor shall furnish all necessary equipment and material and make all taps in the pipe as required for testing purposes. The City Engineer or City Inspector will monitor the tests. The test pressure shall be two times the calculated operating pressure, but not less than 50 psi for the low end of the pipe. For high pressure lines, the test pressure shall not exceed the manufacturer's maximum operating pressure recommendation.

#### **303.3.09B Equipment**

Furnish the following equipment and materials for the tests:

Amount	Description
2	Approved Graduated Containers
2	Pressure Gauges
1	Hydraulic Force Pump Approved by the Engineer Suitable Hose and Suction Pipe as Required

**303.3.09C Backfilling and Thrust Blocks**

Perform the testing after the trench has been completely backfilled. The Contractor may conduct an initial test, if field conditions permit as determined by the Engineer, by partially backfilling the trench and leaving the joints open for inspection. The acceptance test shall not, however, be performed until all backfilling to subgrade has been completed. Where any section of pipe is provided with concrete thrust blocking, the pressure test shall not be conducted until five days after the concrete blocking was placed. If high-early strength cement is used for the concrete thrust blocking, the curing time may be reduced to two days.

**303.3.09D Procedure**

After backfilling the trench, fill pipe with water. Expel all air from pipe prior to test. Make up any water lost by absorption, and then apply test pressure with suitable pump. Valve offline when test pressure is determined to be stabilized, and conduct pressure test for two hours. At the end of the test period, add water with the pump to raise system back up to test pressure. Measure the quantity of water required to restore test pressure. The pipe shall be deemed to have passed if this makeup water is less than that calculated for allowable leakage.

Allowable leakage shall be determined by the formula -

$$L = \frac{ND(P)^{0.5}}{7400}$$

- L= Allowable leakage (gal./hr.)
- N = Number of joints in the section tested (pipe and fittings)  
In 1000' there are 50 pipe joints. Each fitting has 2 joints
- D = Nominal diameter of pipe (in.)
- P = Average test pressure. Equal to gage pressure less ½ static head where gage is located at the low point of the line. Where gage is located at the high point, add 1/2 static head.

**Allowable Leakage per 1,000 feet for Mechanical Joint or Push-On Joint Pipe in 20 Foot Nominal Lengths Not Including Fittings (gallons per hour)**

Nominal Pipe Size	Average Test Pressure in Line (psi)				
Inches	50	100	150	200	250
4	0.19	0.27	0.33	0.38	0.43
6	0.29	0.41	0.50	0.57	0.64
8	0.38	0.54	0.66	0.76	0.85



10	0.48	0.68	0.83	0.96	1.07
12	0.57	0.81	0.99	1.15	1.28
14	0.67	0.95	1.16	1.34	1.50
16	0.76	1.08	1.32	1.53	1.71
18	0.86	1.22	1.49	1.72	1.92
20	0.96	1.35	1.66	1.91	2.14
24	1.15	1.62	1.99	2.29	2.56
30	1.43	2.03	2.48	2.87	3.20
36	1.72	2.43	2.98	3.44	3.85

### **303.3.10 AIR TESTING (GRAVITY PIPE)**

#### **303.3.10A General**

The Contractor has the option after completing installation of the system, including all service connections, backfilling and compaction, of conducting a low-pressure air test in lieu of the hydrostatic test. The Owner may require testing of manhole to manhole sections as they are completed for the purpose of expediting acceptance of the system and to allow connections to be made before the entire system is complete.

The test shall be performed at no additional expense to the City. The Contractor shall provide all equipment and personnel for the test. The method, equipment, and personnel shall be subject to the approval of the Engineer. The Engineer may, at any time, require a calibration check of the instrumentation used. The pressure gauge shall have minimum divisions of 0.10 psi and have an accuracy of 0.0625 psi (one ounce per square inch). All air used shall pass through a single control panel.

The Air Test described in this section shall be used for plastic pipe. The Air Test indicated in the APWA Standard Specifications shall be used for all other materials. Where a question exists as to the appropriateness of the method to be used, the method resulting in the longest test period shall be used.

#### **303.3.10B Safety Precautions**

All plugs used to close the sewer for the air test must be capable of resisting the internal pressures and must be securely braced as necessary.

All air testing equipment must be placed above ground, and no person shall be permitted to enter a manhole or trench where a plugged line is under pressure. All pressure must be released before plugs are removed. The testing equipment used must include a pressure relief device designed to relieve pressure in the line under test at 10 psi or less and must allow continuous monitoring of the test pressures in order to avoid excessive pressure. The Contractor shall use care to avoid flooding of the air inlet by ground water. The Contractor shall inject the air at the upper plug if possible. Only qualified personnel shall be permitted to conduct the test.

### 303.3.10C Ground Water

The presence of ground water will affect results of the test. The average height of ground water over the pipelines must be determined immediately before starting the test. The method of checking the ground water height shall be as approved by the Engineer.

### 303.3.10D Method

All air testing shall be by the Time Pressure Drop Method. The test procedures are described as follows:

1. Clean the lines to be tested and remove all debris where noted.
2. The Contractor has the option of wetting the lines prior to testing.
3. Plug all open ends with suitable test plugs. Brace each plug securely.
4. Check the average height of the ground water over the pipe. The test pressures required below shall be increased 0.433 psi for each foot of average water depth over the line.
5. Add air slowly to the section of system being tested until the internal air pressure is raised to 4.0 psig greater than the average back pressure of any ground water that may submerge the pipe.
6. After the internal test pressure is reached, allow at least 2 minutes for the air temperature to stabilize adding only the amount of air required to maintain pressure.
7. After the temperature stabilization period disconnect the air supply.
8. At any convenient observed pressure reading between 3.5 and 4.0 psig greater than the average external pressure of any groundwater above the pipe, begin timing the pressure loss. If the time shown in the table below for the designated pipe size and length elapses before the air pressure drops 0.5 psig, the section is considered to have passed the test. The test may be discontinued once the prescribed time has elapsed, even though 0.5 psig loss has not occurred.
9. Technical data
  - a. Allowable air loss rate (Q) - The value for Q is 0.0015 cubic feet per minute per square foot of internal surface.
  - b. Testing main sewers with services - If lateral sewers such as services are included in the test because of the difficulty in isolating such lateral sewer, their lengths may be ignored for computing test times. Ignoring the laterals results in a slightly more severe test.
  - c. Rounding off pipe lengths - Rounding off pipe lengths shall always be to the next higher length value shown, i.e., the test time for 201' shall be the times shown for 250'. At the discretion of the Inspector, test times for a unique pipe length may be linearly interpolated from the next higher and lower times indicated.

Specification Time for Length (L) Shown  
(min:sec)

Pipe Dia. (in)	Min. Time Min: Sec	Length For Min. Time (ft)	Time For Longer Length (sec)	100ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	500 ft
6	2:50	398	0.427L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12	3:33
8	3:47	298	0.760L	3:47	3:47	3:47	3:47	3:47	4:26	5:04	5:42	6:20
10	4:43	239	1.187L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54	9:54
12	5:40	199	1.709L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50	14:16

15	7:05	159	2.671L	7:05	7:05	8:54	11:0 8	13:2 1	15:3 5	17:4 8	20:0 2	22:1 6
18	8:30	133	3.846L	8:30	9:37	12:4 9	16:0 1	19:1 4	22:2 6	25:3 8	28:5 1	32:0 4
21	9:55	114	5.235L	9:55	13:05	17:2 7	21:4 9	26:1 1	30:3 2	34:5 4	39:1 6	43:3 8
24	11:20	996	837L	11:2 4	17:57	22:4 8	28:3 0	34:1 1	39:5 3	45:3 5	51:1 7	56:5 9

**303.3.11 CLOSED CIRCUIT TELEVISION INSPECTION OF SANITARY AND STORM SEWERS**

The City shall televise all lines before the placement of street base material and paving. Charge for this service is listed in the Master Fee schedule.

Prior to CCTV inspection the following conditions need to be met:

- 1) All sewer trenches are to be completely backfilled and compacted as specified in Division 1 Trenches.
- 2) All manholes to be in place with covers exposed.
- 3) All grouting of pipes and channels in manholes are to be finished.
- 4) All curbs in place.
- 5) Streets clear of materials and debris to allow inspection equipment access to point(s) of inspection.
- 6) Manholes are to be constructed to grade. If manhole is more than one foot above surrounding grade, ramping is required.
- 7) The Contractor must remove all large, construction debris from the line prior to inspection. The City will clean and flush sediment from all pipelines just prior to CCTV Inspection.
- 8) CCTV inspection should be performed prior to base rock placement.

Findings will be recorded, and the Contractor will be required to correct all deficiencies at no additional expense to the City. Deficiencies include, but are not limited to;

- 1) Horizontal offsets at joints or fittings in excess of 1/32 inch per inch of pipe diameter (Ex. ¼” for 8” pipe)
- 2) Vertical offsets at joints or fittings in excess of 1/32 inch per inch of pipe diameter (Ex. ¼” for 8” pipe) if drop is in direction of flow. No offset is allowed if it will create a step up in the direction of flow.
- 3) Standing water in excess of 3/8 inch
- 4) Fittings protruding into pipe in excess of ½ inch if above spring line. No protrusion permitted below spring line.
- 5) Damage to pipe or fittings

Upon correction of deficiencies revealed by television inspections, the Contractor shall notify the Engineer. If the pipe has been cut and repaired or opened in any way, the pressure test must be repeated along with mandrel testing and CCTV inspection. If the corrective work is limited to exposing the pipe and making minor changes to the grade, only mandrel testing and CCTV inspection are required. Additional CCTV inspection testing services will be conducted by the City with cost for inspection charged to the Contractor or developer in accordance with the current fee schedule.

If at any time during the one-year warranty period an examination of the sewer line discloses a deficiency from construction, that deficiency shall be corrected by the Contractor, Developer, Property Owner or other responsible party at no additional expense to the City. Pavement, sidewalk, landscaping or other incidental repairs are the responsibility of the Contractor Developer or Property Owner. The City will consider trenchless repair methods provided they can be shown to provide acceptable corrective action. A CCTV inspection will be completed by the City following all repairs.

### **303.3.12 MANDREL TESTING**

PVC sanitary sewer mains shall be deflection tested by pulling an approved mandrel 95 percent of the inside pipe diameter having at least 6 vanes through the pipe from manhole to manhole. Conduct test after pipe has been flushed and cleaned and no less than 30 days after trench has been backfilled and compacted, but prior to paving.

### **303.3.13 SERVICE CONNECTION INSPECTION**

All connections for service lines shall be inspected by the City Inspector prior to backfilling.

## **303.4.00 MEASUREMENT AND PAYMENT**

### **303.4.01 SEWER PIPE**

Payment for stormwater and sanitary sewer pipelines will be made on a lineal foot basis for the various classes, types, and size of pipe listed and installed. The pipeline will be measured horizontally from center-to-center of manholes, or to the end of the pipe, whichever is applicable.

No final payment for sewer pipe in place will be made until the pipeline has successfully passed the air or hydrostatic test and video inspection.

### **303.4.02 WYE FITTINGS**

Payment for tee and wye fittings will be made at the unit price for each size and type as listed and installed. Payment for tee and wye fittings will be in addition to payment for sewer from manhole to manhole.

### **303.4.03 CONCRETE WYE ENCASUREMENT**

Payment for concrete tee and wye encasement will be made at the unit price each for the various sizes of pipe as listed and installed.

### **303.4.04 INCIDENTAL BASIS**

When neither specified nor listed in the proposal for separate payment, Pipe and Fittings (Sanitary Sewer) shall be considered incidental work for which no separate payment will be made.

## **304 SERVICE LINE SEWERS**

### **304.1.00 DESCRIPTION**

This section covers the work necessary for the installation of sewer service lines, service taps, and connections. In general, service lines will extend from the sewer main to the street or alley right of way line.

At the sole discretion of the City, the Contractor and/or material supplier shall provide certified manufacture date for any PVC pipe with visible cracking, discoloration and/or fading due to ultraviolet light exposure. Pipe which is one year or older may be rejected. The City also reserves the right to reject pipe material for cause regardless of age of pipe.

### **304.2.00 MATERIAL**

#### **304.2.03 PIPE AND FITTINGS FOR SERVICE LINES**

Sewer service connection lines shall conform to the same specifications as sanitary sewer lines unless otherwise modified by these specifications.

#### **304.2.04 SEWER SERVICE MARKERS**

Service connection markers shall be new, one-piece Douglas Fir or cedar, 2x4's, utility grade or better, or 2" PVC Schedule 40 pipe. All markers shall be painted green.

#### **304.2.05 SERVICE SADDLES**

12" diameter or smaller shall use a rigid gasketed wye fitting and gasketed couplers for the new sewer service(s). Service saddles shall be used only on 15" diameter or larger and be Romac "CB" type saddles or equivalent. The type shall conform to style 101S with painted saddle and stainless-steel strap.

#### **304.2.06 SWING CHECK VALVES**

Swing valves shall be APCO series 100 or equivalent. The check valve shall be capable of passing a 3" diameter solid.

#### **304.2.07 GATE VALVES**

Iron body, resilient seated gate valves shall be "Kennedy Ken-Seal" or equal. Gate valves will meet AWWA standards (C-515), have non-rising stems, be rated at 200 lbs. working pressure and 350 lbs. hydrostatic pressure, open left with 2" square operating nuts, with brass fittings, "O" ring stem pressure seals, non-directional, mechanical joints; as manufactured by Kennedy, Mueller, Waterous, or American Darling.

### **304.3.00 CONSTRUCTION**

Sewer service lines shall not have less than 3.0 feet of cover under roadway area and shall not have less than 3.0 feet of cover to natural ground in the right-of-way. Services shall be extended at minimum grade or as required to provide gravity services to each property or building.

Each property shall be connected to the sewer main or lateral by an independent sewer service. Sewer services to adjacent properties may share the same trench.

Where a sewer service is to be connected to an existing sewer main and no connection fitting is available, the actual connection must be made by a licensed and bonded contractor with a City of Sisters business license. Inspection by the Public Works Department is required for work in the public right-of-way. Sewer services in new construction areas shall extend to the property line and be marked with material described in 304.2.04 extending a minimum of 6" above the natural ground surface. The distance from natural ground surface to the top of the service connection in feet and inches shall be neatly written in permanent ink on the sewer service marker.

#### **304.3.01 SEWER TAPS**

All taps on existing sewer mains shall be inspected by City of Sisters Wastewater Division personnel. Contractor shall provide 72-hour advance notice to the City for all taps (Hot Tap permit is required prior to installation).

### **304.3.02 CITY SEWER TAP PREPARATION REQUIREMENTS**

The Contractor shall provide a finished trench with appropriate safety shoring meeting OSHA requirements to allow City staff to tap active or existing main lines for service laterals. The full circumference of sewer main shall be exposed and accessible and wiped free of dirt and foreign material prior to the scheduled arrival of the City tapping crew. When crossing streets, or when required by the City, traffic control shall be provided and maintained by the Contractor. Damage to existing pipe or other utilities in the ground is the responsibility of the excavator.

### **304.4.00 MEASUREMENT AND PAYMENT**

#### **304.4.01 TRENCH EXCAVATION AND BACKFILL**

Trench excavation and backfill shall be paid for under the provisions of Sec. 301.4.01.

Where no separate item exists in the Schedule of Bid Items, work for sewer service trench excavation and backfill shall be considered incidental to the work required to provide and install sewer services.

#### **304.4.02 SEWER SERVICE LINE PIPE**

Payment for sewer service line pipe will be made on a lineal foot basis for the size and type of pipe shown. Measurement will be made horizontally along the centerline of the service pipe from the main line fitting to the cap or termination of the service line.

No final payment for sewer service line pipe will be made until the section of sewer to which the services are connected has successfully passed the applicable internal pressure test as described in Section 303.

#### **304.4.03 SEWER TAPS**

Payment for sewer taps will be made on a per each basis for the type, kind, and size specified, and shall constitute full compensation for constructing the sewer tap complete and in place.

#### **304.4.04 INCIDENTAL BASIS**

When neither specified nor listed in the proposal for separate payment, sewer service lines shall be considered incidental work for which no separate payment will be made.

## **305 PIPE AND FITTINGS (STORM SEWERS)**

### **305.1.00 DESCRIPTION**

This section covers the work necessary for the construction of storm sewers. Except as amended or modified herein, the provisions of Section 303 shall apply.

At the sole discretion of the City, the Contractor and/or material supplier shall provide certified manufacture date of any PVC pipe with visible cracking, discoloration and/or fading due to ultraviolet light exposure. Pipe which is one year or older may be rejected. City also reserves the right to reject pipe material for cause regardless of age of pipe.

### **305.2.00 MATERIALS**

#### **305.2.01 GENERAL**

Unless otherwise specified, all storm sewer pipe with less than 24 inches of cover to finish grade shall be AWWA C900, 8" thru 12", or AWWA C905, 14" through 24", DR 25 water pipe meeting the requirements of AWWA specifications for *Poly Vinyl Chloride (PVC) Water Transmission and Distribution Pipe*. Pipes with more than 24 inches of cover to finish grade may be PVC meeting the requirements of ASTM D3034 SDR 35 for diameters up to and including 15 inches. Pipes larger than 15 inches with more than 24 inches of cover shall meet the requirements of ASTM F679 PS46.

## **305.3.00 CONSTRUCTION**

### **305.3.01 TRENCH BACKFILL**

Trench backfill shall be placed in accordance with the requirements of Division I – TRENCHES, except that the finished backfill shall be water jetted under the direction of the Engineer to demonstrate that all rock crevices that may have been opened up during excavation are sealed.

### **305.3.02 INSTALLATION**

All storm sewer not located under paved roadway shall be provided with one layer of detection tape.

### **305.3.03 CLOSED CIRCUIT TELEVISION INSPECTION**

All storm sewers shall be inspected in accordance with Section 303.3.11.

## **305.4.00 MEASUREMENT AND PAYMENT**

### **305.4.01 TRENCH EXCAVATION AND BACKFILL**

Trench excavation and backfill shall be paid for under the provisions of Sec. 301.4.01. Where no separate item exists in the Schedule of Bid Items, work for storm sewer trench excavation and backfill shall be considered incidental to the work required to construct storm sewers.

### **305.4.02 STORM SEWERS**

Payment for storm sewers will be made on a lineal foot basis. Measurement will be made horizontally along the pipe centerline from the finished end to end of the pipe.

### **305.4.03 INCIDENTAL BASIS**

When neither specified nor listed in the proposal for separate payment, storm drains shall be considered incidental work for which no separate payment will be made.

## **306 MANHOLES**

### **306.1.00 DESCRIPTION**

This section covers the work necessary for the construction of sanitary and stormwater sewer manholes. Except as modified or supplemented herein, the provisions of Section 00470 of the *APWA Oregon Standard Specifications for Construction*, current edition shall apply.

Manholes shall be located as shown on the Plans or as directed by the City Engineer, or City representative.

### **306.2.00 MATERIALS**

#### **306.2.01 CONCRETE**

Concrete shall conform to the requirements of ASTM C94 Alternate 2. Compressive strength for manhole bases and miscellaneous concrete structures shall be not less than 3000 psi at 28 days. Maximum size of aggregate shall be 1 1/2 ". Slump shall be between 2" and 4".

#### **306.2.02 METAL CASTINGS**

Covers for sanitary sewer manholes and storm sewer manholes shall comply with the Standard Drawings. Locking and sealed manhole covers may be required in some locations.

### **306.2.03 RIM ADJUSTMENT**

An adjustment system such as East Jordan Iron Works Infra-Riser or approved equal, shall be used to adjust manhole frame and cover to finish grade.

### **306.2.04 MANHOLES**

#### **306.2.04A Pre-cast Manhole Sections**

Materials shall conform to the requirements of ASTM C478. Minimum wall thickness shall be 4 inches. Cones shall have the same wall thickness and reinforcement as riser sections. Joints shall be tongue-and-groove or keylock type. Cone shall be eccentric unless otherwise specified. Flat top manholes shall be used where depth is less than 6 feet.

Minimum manhole diameter shall be as 48" unless otherwise approved by the Engineer.

#### **306.2.04B Pre-cast Bases**

At the option of the Contractor, pre-cast base sections or manhole bases maybe used provided all details of construction are approved by the City Engineer prior to construction.

#### **306.2.04C Cast in Place Bases**

Cast-in-place bases shall be formed prior to setting wall sections, i.e. blocking up walls and casting base beneath will not be acceptable. Options include using block outs in first wall section (over pipe) to use as form or casting base with form ring.

#### **306.2.04D Mortar**

Mortar shall conform to the requirements of ASTM C387, or be proportioned 1-part Portland cement to 2 parts clean, well graded sand passing a 1/8-inch screen. Admixtures may be used not exceeding the following percentages by weight of cement: hydrated lime, 10 percent; diatomaceous earth, or other inert materials, 5 percent. Consistency of the mortar shall be such that it will readily adhere to the pre-cast concrete.

#### **306.2.04E Coatings**

When required due to corrosion concerns, manholes shall be spray lined with Polyshield HT Elastomeric Polyurea or approved equal.

### **306.2.05 PIPE FITTINGS**

Pipe and fittings shall conform to the applicable portions of Section 303. Tees, ells, and other fittings for drop manholes shall be of the same material as the pipe in the adjacent mains unless specified otherwise.

### **306.2.06 PIPE STUB-OUTS FOR FUTURE SEWER CONNECTIONS**

Pipe stub-outs shall be the same type as approved for use in the lateral, main, or trunk sewer construction. Strength classifications shall be the same class as specified for adjacent pipelines. Where there are two different classes of pipe at a manhole, the higher strength pipe shall govern strength classification. Rubber-gasketed watertight plugs shall be furnished with each stub-out and shall be adequately braced for hydrostatic or air test pressure.

## **306.3.00 CONSTRUCTION**

### **306.3.01 GENERAL**



### **306.1.01A Foundation Stabilization**

If in the opinion of the Engineer, unstable material exists that will not support the manhole or other structure, the Contractor shall excavate to suitable supporting material and backfill with compacted foundation stabilization material to the design grade as directed by the Engineer.

### **306.3.01B Pipe Connections**

All pipes entering or leaving the manhole or vault shall be provided with flexible joints within 18 inches of the manhole structure and shall be placed on firmly compacted bedding. Special care shall be taken to see that the openings through which the pipes enter the structure are completely watertight. Flexible joints shall be constructed with rigid PVC repair couplings or the bell end of a PVC pipe section. Flexible rubber couplings are not an acceptable flexible joint.

## **306.3.02 PRECAST CONCRETE MANHOLES**

### **306.3.02A Bases**

If bases are cast-in-place, the concrete shall be consolidated by mechanical vibration. The concrete shall be screed off so that the first manhole section to be placed has a level uniform bearing for the full circumference.

Pre-cast base sections shall be carefully placed on the prepared bedding so as to be fully and uniformly supported in true alignment and assuring that all entering pipes can be inserted on the proper grade.

The minimum open channel length thru the manhole shall not be less than the diameter of the manhole less 12", i.e., 48" manhole requires a 36" minimum channel length. All pipes entering or leaving shall be provided with flexible mechanical joints (Calder type couplings are not permissible) within 18" of the exterior wall of the manhole structure.

### **306.3.02B Frames and Covers**

The final elevation for each manhole shall be 1/4" below the finished street grade. It is permissible to adjust the manhole frame to final grade after street paving provided that the structure is low enough so as not to interfere with the street paving operation. Patching material shall be asphalt concrete or Portland Cement Concrete with a maximum patch diameter of 6 feet.

Manhole cover shall have two holes. A cut out at the rim should be provided for raising the lid.

### **306.3.02C Cleanouts**

Cleanouts are not acceptable on gravity sanitary or storm sewer lines in lieu of a manhole except at the upper end of lateral sewers 250 feet or less in length. Sanitary sewer cleanouts on pressure systems shall be located as shown on the plans.

### **306.3.03 MANHOLE TESTING**

Manholes shall be tested using either hydrostatic or vacuum methods as specified by APWA Oregon Standard Specifications Section 00470.71.

## **306.4.00 MEASUREMENT AND PAYMENT**

### **306.4.01 MANHOLES**

Payment for manholes will be made on a per each basis as listed in the Bid Schedule for the type and size shown. Payment shall include all materials, labor, equipment, and incidentals necessary to construct and test manholes complete and in place as shown.

### **306.4.02 INCIDENTAL BASIS**

When neither specified nor listed in the proposal for separate payment, Manholes shall be considered incidental work for which no separate payment will be made.

## **307 CATCH BASINS AND INLETS**

### **307.1.00 DESCRIPTION**

This section covers the work necessary to construct catch basins at the locations shown on the plans and Standard Drawings. Except as modified or supplemented herein, the provisions of Section 00470 of the *APWA Oregon Standard Specifications for Construction*, current edition shall apply.

Construction of City standard double and single or curb inlet catch basins, frames and grates shall conform to the Standard Drawings.

### **307.2.00 MATERIALS**

#### **307.2.01 EXCAVATION AND BACKFILL**

Excavation and backfill shall conform to the requirements of Section 301.

#### **307.2.02 WELDED FRAMES AND GRATES**

The Contractor shall furnish grates conforming to Standard Drawings. The Owner has the option to supply grates, which will be listed in the Special Provisions. Ductile iron grates matching the dimensions in the Standard Drawings may be substituted for steel grates.

### **307.3.00 CONSTRUCTION**

#### **307.3.01 EXCAVATION AND BACKFILL**

After backfilling and mechanical compaction is complete, the backfill around catch basins shall be water jetted if directed by the Engineer. Water jetting shall continue until all evidence of subsidence disappears. When dry, subsided areas shall be backfilled with appropriate material. The Engineer may then require water jetting of the entire backfill to be repeated. Other techniques include mechanical compaction.

#### **307.3.02 FORMING, POURING, AND CURING**

Pipe connections shall be grouted on the interior and exterior of all stormwater structures.

#### **307.3.03 FRAMES AND GRATES**

The grate frame shall be set into the concrete structure. The dimensions of the various grate frames are shown on the standard drawings.

Catch basin grates shall be placed after street paving has been completed. In the interim, 2" wood planking shall be substituted to protect the structure during street construction.

### **307.4.00 MEASUREMENT AND PAYMENT**

#### **307.4.01 CATCH BASINS AND INLETS**

Measurement and payment for catch basins will be made on a per each basis for the number and type constructed. Payment shall constitute full compensation for all tools, materials, work and incidentals required to complete the work.

### **307.4.02 EXCAVATION**

Where not listed as a separate item, excavation for any drainage structure will be considered incidental to the price bid to construct the structure. Where listed as a separate item, excavation will be measured by the cubic yard to the nearest 1 cubic yard. The dimensions for measuring excavation will be the exterior dimensions of the drainage structure as designed and specified by the Engineer. Payment for excavation will be at the contract unit price bid for excavation.

### **307.4.03 INCIDENTAL BASIS**

When neither specified nor listed in the proposal for separate payment, Catch Basins and Inlets shall be considered incidental work for which no separate payment will be made.

## **308 DRYWELLS, SWALES AND PONDS**

### **308.1.00 DESCRIPTION**

This section covers the work necessary to construct drywells, swales, ponds and other storm water disposal facilities at the locations shown on the plans and in accordance with the Standard Drawings. Except as modified or supplemented herein, the provisions of the Central Oregon Stormwater Manual and Section 00470 of the *APWA Oregon Standard Specifications for Construction*, current edition shall apply.

### **308.1.01 DRYWELL LOCATION**

No portion of a drywell shall be located within 10 feet of a waterline. Drywells shall be located no closer than 25 feet from a fire hydrant. Drywells and infiltration swales must be located at least 50 feet from a sewer wet well. Drywells shall be spaced at least 40 feet center to center, or twice the depth of the drywell, whichever is greater.

### **308.2.00 MATERIALS**

#### **308.2.01 EXCAVATION AND BACKFILL**

Excavation and backfill shall conform to the requirements of Section 301.

#### **308.2.02 DRYWELL FRAME AND COVER**

The Contractor shall furnish frame and cover conforming to Standard Drawings. The Owner has the option to supply grates, which will be listed in the Special Provisions.

#### **308.2.03 DRAIN ROCK**

Drain rock shall consist of clean 6"-2" river rock containing little or no fines.

#### **308.2.04 DRYWELL FABRIC LINER**

A fabric liner is specified for the inside of the drywell barrel. This fabric shall have a smooth finish surface to promote cleaning by washing down. Felted materials are not acceptable. Fabric liner shall have sufficient tensile strength to be hung without undue sagging, and to resist tearing and raveling.

Fullflow Vinyl screen (a0706) or approved equal, available locally, is an acceptable fabric liner.

#### **308.2.05 GEOTEXTILE**

When required to protect the drain rock from contamination, geotextile fabric shall be placed against, and to 24" beyond gravel or soil at the limits of the excavation for drain rock, to prevent fine soil particles from migrating into the drain rock. Material shall be equivalent to a Type 1 or Type 2 riprap geotextile fabric per ODOT Spec 02320-1 (8-10 oz. nonwoven).

### **308.2.06 SWALE SOIL LAYER**

The treatment zone soil layer in swales and ponds shall meet the requirements of Section 6.5.1.2 of the Central Oregon Stormwater Manual with a minimum infiltration rate of 0.25 inches per hour and at least 2 percent organic content.

### **308.3.00 CONSTRUCTION**

#### **308.3.01 FORMING, POURING, AND CURING**

The concrete cap required by the Standard Drawings need not be formed. It may be placed directly on the moisture barrier. In earth or granular material, the outside two feet (2') of the concrete cap shall be placed over undisturbed earth. In rock excavation, the cap may be placed directly to the rock sidewall, provided that the rock wall is stable.

Pipe connections shall be grouted on the interior and exterior of all stormwater structures.

#### **308.3.02 DRYWELL FRAMES AND GRATES**

The grate frame shall be set into the concrete structure. The dimensions of the various grate frames are shown on the standard drawings.

#### **308.3.04 DRYWELLS**

Drywells construction details are shown in the Standard Drawings. Drywells are subject to DEQ regulations. Drywells shall comply with standards and facility requirements as specified in the Central Oregon Stormwater Manual, current edition with City amendments.

Drywells shall be protected from and not used for sediment collection during construction. Drywells installed prior to final site stabilization shall be protected from construction site runoff by routing storm runoff to an appropriate sediment control facility and erosion control measures.

#### **308.3.05 DRYWELL TESTING AND ACCEPTANCE CRITERIA**

Prior to acceptance and certification, all drywells shall pass a performance test conducted by a City Representative if they are in the right of way and observed by a City Representative if they are on private property. Drywell testing consists of three components; confirmation of storage volume, verification of infiltration rate and ability to drain within 72 hours.

1. The testing process starts during construction. Track the quantity of drain rock placed using load tickets. Record on the testing form and calculate the volume of drain rock storage.
2. Measure the diameter and depth of the drywell. Calculate interior volume of the drywell from the base to the bottom of the lowest pipe and record on the testing form. Verify that total volume exceeds design volume shown on the construction plans.
3. Inspect the drywell for compliance with construction drawings and City Standard Drawings and Specifications.
4. Field check the accuracy of the flow meter to be used for the test.
5. Introduce clean water into the drywell. Monitor flow using an in-line flowmeter.
6. If possible, raise the water level in the structure until it reaches the top of the active barrel section. In the case of structures interconnected by pipes, raise the water level to the invert elevation of the connecting pipe, or use an expandable plug to seal the connecting pipe.
7. Monitor and record the flow rate required to maintain the constant head level in the drywell at 10-minute intervals.

8. If a hydrant is available, it shall be used for the test. Fill the drywell with water from a metered source and adjust the flow rate to maintain the level of water at the top of the barrel section or the base of the inlet pipes (whichever is lower). Measure and record the flow rate at 10-minute intervals.
  - a. For drywells in the right of way, maintain the flow rate necessary to keep the water level at the top of the barrel section or pipe invert for one hour. After the one-hour period, turn off the water supply and record the depth to the water surface every 10 minutes for one hour. If the drywell cannot be filled, measure the depth to the water surface and record depth and flow rate at 10-minute intervals. Stop filling after 60 minutes and measure and record the depth to the water surface every 10 minutes for one hour.
  - b. For drywells on private property, maintain the flow rate necessary to keep the water level at the top of the barrel section or pipe invert for one hour or until the design volume has been reached. At this time, turn off the water supply and record the depth to the water surface every 10 minutes for one hour. If the drywell cannot be filled, measure the depth to the water surface and record depth and flow rate at 10-minute intervals. Stop filling after 60 minutes or when the design volume is reached and measure and record the depth to the water surface every 10 minutes for one hour.
9. If a hydrant is not readily available, a water truck may be used. Place four water truck loads (3,500 to 4,000 gallons) in the drywell within a 2-hour period. After the water has been placed, let the drywell drain and record the depth to the water surface every 10 minutes for one hour.
10. Fill out all of the information on the drywell testing form including a sketch of the installation. Take photos of the installation during construction and after completion. Note any other pertinent data in the comments section

### **308.3.06 SWALE, POND AND INFILTRATION GALLERY TESTING AND ACCEPTANCE CRITERIA**

Prior to acceptance and certification, the storage volume, infiltration rate and ability to drain within 72 hours shall be confirmed.

**308.3.06A Storage Volume:** For ponds, swales and other surface facilities, confirm the storage volume with as-built measurements and calculations provided by the project surveyor. For infiltration galleries, track the quantity of drain rock used with load tickets. Calculate the storage volume in the drain rock using a void ratio of 35 percent unless a different void ratio is provided by a material testing lab.

**308.3.06B Infiltration Rate:** For infiltration swales and ponds in general and for infiltration galleries constructed with filter soil placed above the drain rock, measure the infiltration rate at the surface after the filter soil is placed. If the infiltration gallery is designed so that runoff enters directly into the drain rock with filter soil below, measure the infiltration rate of the soil prior to placing the drain rock. Use the single ring infiltrometer test (Appendix D of the Central Oregon Stormwater Manual) or other test recommended by a Geotechnical Engineer.

**308.3.06C 72-hour Drainage:** Use the Swale Flood Test described in Appendix 4E of the Central Oregon Stormwater Manual. For sloped swales and swales with check dams, introduce flow at the high end and allow it to overtop each check dam until it pools to a depth of 6 inches in the low end. Check 72 hours after stopping the flow to see if the facility has emptied. Use standpipe for infiltration galleries.

### **308.4.00 MEASUREMENT AND PAYMENT**

### **308.8.01 DRY WELLS**

Measurement and payment for dry wells will be made on a per each basis for the number and type constructed. Payment shall constitute full compensation for all tools, materials, work and incidentals required to complete the work.

### **308.4.02 EXCAVATION**

Where not listed as a separate item, excavation for any drainage structure will be considered incidental to the price bid to construct the structure. Where listed as a separate item, excavation will be measured by the cubic yard to the nearest 1 cubic yard. The dimensions for measuring excavation will be the exterior dimensions of the drainage structure as designed and specified by the Engineer. Payment for excavation will be at the contract unit price bid for excavation.

### **308.4.03 INCIDENTAL BASIS**

When neither specified nor listed in the proposal for separate payment, drainage facilities shall be considered incidental work for which no separate payment will be made.

## **310 SEWAGE PUMP STATION**

### **310.1.00 DESCRIPTION**

This section shall provide for the furnishing and installation of one new factory-built automatic pump station, service and monitoring equipment and control equipment, complete and ready for operation as shown on the Plans and specified herein. General items of equipment include furnishing of one complete, automatic two pump sewage pumping station for installation on concrete wet wells.

The station manufacturer shall be required to affix an UNDERWRITER'S LABORATORIES (UL) LABEL attesting to the compliance of that assembled equipment under the PACKAGED PUMP SYSTEMS (QCZJ) UL Listing Category. This label shall be inclusive of the entire station with enclosure so as to demonstrate compliance with the National Electrical Code requirements for working clearances and wiring procedures. Equipment manufactured without this third party certification label or equipment manufactured by an outside source or brokered equipment defined as systems not assembled on the premises of the named manufacturer by that company's employees WILL NOT be considered as equal and will not be accepted by the City of Sisters. All lift station designs are subject to submittal to D.E.Q. for approval.

City maintained lift stations shall be located in dedicated tracts of land owned by the City. All lift stations not on City owned land will remain the responsibility of the homeowner or homeowner group. Developed subdivisions utilizing pressure systems shall discharge at a single manhole location approved by the City of Sisters Engineer.

### **310.1.01 INTENT**

It is the intent of these specifications that the pump station shall be a unit complete and ready for connection to pressure line, influent line and suction lines.

### **310.1.02 EQUIPMENT**

- a. Principal items of equipment for each station shall include two vertical, close coupled, motor driven, vacuum primed, non-clog sewage pumps, valves, internal piping; central control panel with circuit breakers; motor starters and automatic pumping level controllers, heater, ventilating blower, priming pumps and appurtenances; pump running and alarm light; all internal wiring; and an exterior high and low water alarm light. All valves, motors, pumps, and controls shall be accessible from the top of the

base plates. Access to the wetwell through the pump station base plate shall be required for wetwell maintenance.

- b. Pump station shall be a standard item of the manufacturer. Pump station shall be as manufactured by the Smith & Loveless Division of the Ecodyne Corporation, Lenexa, Kansas; or equal, approved by the Engineer ten days prior to bid date.
- c. Connection of gravity and pressure piping. Contractor shall verify required connections before ordering materials and shall be responsible for same. Plans should indicate approximate location and requirements.
- d. Operating Conditions.

(01) Pump Station. Each pump shall be designed for 20-year demand and required total dynamic head, when one pump is in operation. The pumps shall be non-overloading during design conditions with both pumps in operation. Lower than 1750 rpm pump speeds will be used wherever possible. Pumps shall be Smith & Loveless Model 4B2A or approved equal. Motors shall be 240/480-volt, three phase, four wire, 60 cycle rated. Station shall be provided with interior piping.

(02) All openings and passages shall be large enough to permit passages of spheres three inches in diameter and any trash or stringy materials which can pass through a 4" house collection system.

- e. Pump Station.

(01) The pump station shall be shown on the plan view of the Drawings. The floor plate shall be minimum 3/8-inch-thick mild steel plate.

(02) Pump station shall be enclosed by a hinged fiberglass cover. The cover shall have a suitable drip-lip around the edge and shall be provided with a hasp and staple connection to the floor plate to allow the pump chamber to be locked with a padlock.

(03) The cover shall have a latch mechanism to keep the cover open under load. Adjustable ventilating louvers shall be provided on each end of the fiberglass cover which are capable of being closed during cold weather operation.

(04) A steel manway cover located exterior to the fiberglass pump chamber shall be provided, complete with padlocking provisions. The manway shall be an integral part of the station floor plate and provide access to the wetwell.

(05) A stanchion with lifting arm shall be provided to lift each pump. The lifting arm shall have a hook over the center of the motor to support a hoist (provided by others) to facilitate easy removal of the motors, impellers and pumps from the station.

(06) All steel structural members shall be joined by electric arc welding with welds of adequate section for the joint involved.

(07) In valve vaults 5 feet or more deep, provide an OSHA approved round rung ladder with "Ladder Up" safety extension.

- f. Control Panel

(1) The Controller will be housed in two 30"x30"x12" NEMA4 enclosures mounted side-by-side with one enclosure containing the equipment required for 3-phase motor operation and voltages above 24 volts nominal control (Motor Panel), and the other

containing the equipment required to provide for operator interface, 24VDC input/output control circuitry and for executing control sequencing (24VDC Panel). In addition, a Federal Signal Model# TERRA 3 SCADA RTU unit shall be mounted on the back of the Controller (SCADA panel).

(2) Each panel will be lockable, dead front with intrusion detection alarms and swing-out internal panels for mounting of control operators and indicators. The enclosure motor panel will be fitted with a separate, external, weatherproof, lockable housing for a convenience outlet and light switch. Panel exteriors will be painted bright white using UTEK SIKKENS Polyurethane paint specification number WA5111 in order to minimize component heat rise due to direct sunlight exposure. Enclosures will be Hoffman or approved equivalent. All exterior penetrations shall be gasketed and made rain tight, or in bottom of enclosures, or both.

- g. Transfer Switch. Station shall be equipped with a NEMA 3R, fused transfer switch with high visibility handle and nameplate with on/off/on indication, clear line terminal shields, generous wiring room that meets or exceeds NEC wire bending space requirements, side hinges and rated for 60/700 C wire connection through 200 amps.
- h. Generator Receptacle. Stations equipped with a transfer switch will also come equipped with a user specified heavy duty circuit breaking receptacle. Receptacle shall be mounted on the outside of the pump station and will be equipped with a weatherproof spring door. It shall be placed at a 45deg angle. Appleton part number ADR1034P4RS.
- i. Emergency Generator. An appropriately sized emergency generator shall be provided for lift stations with a designed flow rate exceeding 400gpm or as determined by the City Engineer as critical infrastructure needing back-up power supply. Generator specifications shall be obtained from the City. An automatic transfer switch integrated with the City's SCADA system is required.

### **310.1.03 PROTECTION AGAINST CORROSION**

- a. After welding, all inside and outside surfaces of the structure shall be blasted with steel grit to remove rust, mill scale, weld slag, etc. All weld spatter and surface roughness shall be removed by grinding. Immediately following the cleaning, Versapox single heavy inert coating shall be factory-applied to all inside and outside surfaces prior to shipment. This coating shall be Versapox Epoxy Resin especially formulated by Smith & Loveless for abrasion and corrosion resistance. The dry coating shall contain a minimum of 85% epoxy resin with the balance being pigments and thixotropic agents.
- b. A touch-up kit shall be provided for repair of any mars or scratches occurring during installation. This kit shall contain detailed instructions for use and shall be a material which is compatible with the original coating.

### **310.1.04 PUMPS**

- a. Pumps shall be vertical close mounted, non-clog sewage pumps of heavy cast iron construction especially designed with double mechanical seals for filtered lubrication and vacuum priming.
- b. Pump impeller and volutes shall be Meehanite or equal.



- c. Motors shall be of current NEMA design B for 40 degree C temperature rise, vertical solid shaft close coupled pump motors with oversized one-piece stainless-steel shafts extending through the pump and motor.
- d. Pump impeller shall be of enclosed type and balanced.

### 310.1.05 CONTROLS

- a. Control equipment shall be mounted on a NEMA Type 1 steel enclosure with a removable access cover. The circuit breakers overload reset buttons and control switches shall be operable without removing the access cover.
- b. Each panel will be lockable, dead front with intrusion detection alarms and swing-out internal panels for mounting of control operators and indicators. The enclosure motor panel will be fitted with a separate, external, weatherproof, lockable housing for a convenience outlet and light switch. Panel exteriors will be painted bright white using UTEK SIKKENS Polyurethane paint specification number WA5111 in order to minimize component heat rise due to direct sunlight exposure. Enclosures will be Hoffman or approved equivalent. All exterior penetrations shall be gasketed and made rain tight, or in bottom of enclosures, or both.
- c. Control operators and indicators mounted to the swing-out panel doors will be corrosion resistant and rated for heavy-duty industrial application. Operators will be 30MM Cutler-Hammer 10250T series or approved equivalent. Internal condensation and corrosion control will be accomplished by the inclusion (at a minimum) of a 200Watt/120VAC space heater (mounted in both the 24VDC and SCADA panels) and corrosion inhibitors (mounted in both the Motor and 24VDC panels).
- d. All serial communication, analog and/or frequency signal wiring inside the control panel will be 18AWG UL508A twisted, shielded-pair cabling unless otherwise specified on the schematic diagram(s). All analog signal loops will be routed through centrally located terminal groups to allow for easy access and modification(s) as necessary. All discrete control wiring inside the control panel will be 16AWG MTW UL508A approved hook-up wire and sized according to NEC unless otherwise specified on the schematic diagram(s). Color-coding of panel wiring should be as follows:

AC Power (Unswitched)	Black
AC Neutral	White
AC Control (Switched)	Red
Ground	Green/Yellow
Foreign (External) Power	Yellow
DC Power	Blue
DC Common	Blue/White
DC Control	Blue

- e. The operation of the control system will be field-configurable based around a Programmable Logic Controller (PLC) (model ELC-PA10AADR processor with ELC-EXO8NNDR expansion module) and Human Machine Interface (HMI) (model ELC-GPO4). The controller will operate a pair of 4860 VAC 3-phase 60Hz appropriately sized motors in an alternating-duplex configuration. The operational mode of each pump will be field-selectable between "Hand", "Off" and "Auto" using a pair of illuminated H-O-A switches mounted on the swing-out panel door of the 24VDC panel. In "Auto" mode, the pumps will be field-selectable to operate as "Lead" pump, or "Lag" pump, and "Alternate" at the completion of each pumping cycle. In addition they will

both run when a high float condition exists and can be individually selected through the SCADA system.

- f. The pump motors will be protected against short-circuit by Cutler Hammer type HMCP circuit breakers sized appropriately for the HP rating of the motors with individual disconnect mechanisms mounted through the swing-out panel door of the Motor Panel. The pump motors are also protected by a contactor/overload relay assembly
- g. Cutler Hammer style IT type E04N (contactor) and E05N (O.L.) sized for motor HP with overload reset operators mounted on the swing-out panel door of the 24VDC panel.
- h. Three-phase power, seal failure and thermal protection connections from the control system to the pump motors will be made using pin and sleeve type quick disconnect plugs and sockets. The current draw of each pump will be monitored by passing one leg of the 3-phase power output to the motor through a current transformer (CT) and will be continuously displayed locally by digital ammeters mounted on the swing-out panel of the 24VDC panel, and transmitted remotely via analog (4-20mA) signal to the SCADA unit mounted on the back of the control system. The operational run-time of each pump will be tracked by hour meters mounted on the swing-out panel of the 24VDC panel.
- i. Control circuitry will be protected against short circuit by (at a minimum) the following small-frame circuit breakers: Panel Heater, 1P/5A/UL1077, Control Power Transformer (Primary) 2P/15A/UL489, Control Power Transformer (Secondary), 1P/15A/UL489, 24VDC/5A Power Supply, 1P/5A/UL1077, External Station Lighting, 1P/15A/UL1077, SCADA RTU, 1P1A/UL1077, Convenience Outlet, 1P/15A/UL489. In addition, the power circuitry in the system will be protected (at a minimum) by the following devices: Motor Saver / Phase Monitor, model MS-201-A and Transient Voltage Surge Suppressor Square D model SDSA3650.
- j. Thermal magnetic air circuit breakers shall be provided for branch disconnect service and short circuit protection of all motor control and auxiliary circuits.
- k. Magnetic across-the-line starters with undervoltage release and overload coils for each pump motor to give positive protection. Each auxiliary motor shall be equipped with an over-current protection device in addition to each branch circuit breaker or shall be impedance protected. All switches shall be labeled, and a color-coded wiring diagram shall be provided.
- l. To control the operation of the pumps with variations of sewage and level in the wetwell, and to provide an effective alarm system, five mercury displacement switches shall be provided for the station. A green running light and red alarm light shall be provided on the pump station panel for each pump. Float switches shall be 120 volts.
- m. An automatic alternator with manual on-off switch shall be provided to change the sequence of operation of the pumps on the completion of an 8-hour cycle.
- n. A 120-volt duplex service outlet shall be mounted on control panel.
- o. An elapsed time meter shall be furnished for each pump to indicate total cumulative pump operating hours.

- p. Provisions shall also be made for the pumps to operate in parallel should the level in the wetwell continue to rise above the starting level for the low-level pump.
- q. To provide a warning system for pump failure a pedestal mounted high water and low water light with reset push button shall be provided for each station. Light shall remain lit until problem causing alarm is repaired.
- r. All push button, selector switches and trouble lights shall be industrial oil tight construction. No wobble stick switches will be allowed.
- s. Each pump shall have an adjustable time delay relay for motor starting, adjustable from 0-60 seconds. Initial setting shall be at 20 seconds to allow time for closing of motorized valve.
- t. Terminal test strip and test light. The manufacturer shall provide a terminal test strip and 120-volt neon test light within the control panel for the operator's use in determining a malfunction in the various control components. All test points shall be wired to the terminal test strip. A step by step troubleshooting guide shall be furnished to assist the operator in testing each component. This test system shall have the capability of testing at least the following components: control circuit breaker, HOA switches, alternator, float switches, electrode relays, vacuum pump relays, vacuum pumps, capacitors, resistors and diodes.
- u. Instrumentation, Control, SCADA System and Radio Telemetry shall be provided as specified in other sections of this specification. Mount in Pedestal Mounted Panel.

#### **310.1.06 VACUUM PRIMING SYSTEM**

- a. A separate and independent priming system shall be furnished for each pump, providing standby operation. Each priming system shall include a separate vacuum pump. Vacuum pumps shall have corrosion resistant internal components. They shall each be capable of priming the sewage pump and suction piping in not greater than 60 seconds, under rated static suction lift conditions of 20' at mean sea level.
- b. Each priming system shall be complete with vacuum pump, vacuum control solenoid valve, prime level sensing probe, and a float operating check valve installed in the system ahead of the vacuum pump to prevent liquid from entering the vacuum pump. The float operated check valve shall have a transparent body for visual inspection of the liquid level and shall be automatically drained when the vacuum pump shuts off.
- c. The priming system shall automatically provide positive lubrication of the mechanical seal each time the sewage pump is primed. To prevent excessive stoppage due to grease accumulation, no passageway in the priming system through which sewage must pass shall be smaller than the equivalent of a 2-1/2" opening.

#### **310.1.07 ENVIRONMENTAL EQUIPMENT**

A ventilating blower shall be provided, capable of delivering 250 cfm at 0.1" static water pressure, in order to remove the heat generated by continuous motor operation. The ventilating blower shall be turned on and off automatically by a pre-set thermostat. The ventilating blower shall be rigidly mounted from the station floor. The discharge outlet shall have a thick resilient gasket which will match with a louvered opening in the fiberglass cover to seal the discharge to the cover when the cover is closed. An electric heater controlled by a pre-set thermostat shall be furnished. The heater shall be rigidly mounted in the station to prevent removal.

### **310.1.08 SUCTION AND DISCHARGE PIPING**

- a. Suction piping shall be Schedule 80 steel of sufficient length to suit the wetwell and as detailed on Plans.
- b. Discharge riser piping shall be Schedule 80 steel or PVC pipe, flanged for compression coupling connection to cast iron pipe on interior of pump station. Connection to force main line shall be made with cast iron piping and fittings as shown on the plans.
- c. Discharge line from each pump shall be fitted with a swing type check valve and an eccentric full port plug valve. The check valve shall be of the spring-loaded type with external lever arm and a resilient seal to insure drip tight seating. Construction of station shall provide for all valving to be located above floor plate.

### **310.1.09 ALARM DIALER AND SCADA SYSTEM**

- a. An alarm dialer shall be furnished and installed by the pump station supplier.
- b. Any alarm function from the pump station equipment controls, or motor control center shall actuate the alarm dialer.
- c. The dialer shall dial predetermined telephone numbers on a telephone line provided for access to City Hall and page notifiers, or directly to plant operators by direction of the City.
- d. Automatic alarm dialer shall be Model Chatterbox CB-4 as manufactured by Raco Manufacturing and Engineering Company or approved equal.
- e. Automatic alarm system capable of dialing up to five numbers over a shared telephone line. The system will monitor normally open contacts from two independent sets of trouble or alarm sensing devices.
- f. Upon closure of any one of the contacts, it will call a predetermined telephone number and transmit a voice recording stating the nature of the trouble. If the called number is busy, does not answer, or if an incorrect number is reached, the system will hang up and call the same number again, or up to four additional numbers. It will continue dialing the number(s) in succession until it is answered and acknowledged. Once the call is received, the person receiving it can acknowledge the call from his telephone with a touch-tone type telephone or a special adapter for a rotary dial type telephone. Upon being acknowledged, the dialer will then hang up and not place any more calls. If the other channel has been activated, the system will recycle on that channel until acknowledged.
- g. The system will include an adjustable delay (0-90 seconds) to prevent dialing out on momentary alarm conditions.
- h. Furnish one tape programmed, as specified by the Engineer, and one spare blank tape. The supplier shall provide the programming service in his plant and shall be capable of reprogramming a tape within 24 hours after receipt of same from the customer. The monitor shall connect to telephone services with an 8-pin telephone jack Model USOC#RJ-31-X. Supplier shall provide sufficient cord from the dialer to the telephone jack for connection.
- i. The unit will also include a standby battery power system capable of operating the monitor for 6 hours running time upon failure of normal power. 120VAC, 60 Hz input

power will be provided by others. If a touch-tone system is not in use, 3 remote reset devices will be furnished for the existing telephones.

- j. SCADA RTU. The control system will include a Federal Signal Model # TERRA 3 SCADA RTU in the provided NEMA 4X enclosure mounted to the back of the 24VDC panel. The RTU shall include a 12V valve-regulated sealed lead acid (SLA) battery for power backup, sized to provide more than 12 hours of uninterrupted standby operation in the event of AC power loss. The SCADA system will be used to monitor the following control signals (at a minimum):

Analog (4-20mA):

Wastewater Sump Level (AI-01),  
Pump #1 Motor Current (AI-02),  
Pump #2 Motor Current (AI-03)  
Control Circuitry Cabinet Temperature (AI-04)  
RTU Cabinet Temperature (AI-05)

Discrete:

RTU Intrusion Alarm (DI-01)  
Motor Control Cabinet Intrusion Alarm (DI-02)  
Control Circuitry Cabinet Intrusion Alarm (DI-02)  
Pump #1 Run Status (DI-03)  
Pump #2 Run Status (DI-04)  
Pump #1 Seal Fail Alarm (DI-05)  
Pump #2 Seal Fail Alarm (DI-06)  
Pump #1 Over-Temperature Alarm (DI-07)  
Pump #2 Over-Temperature Alarm (DI-08)  
High Level Float (DI-09)  
Low Level Float (DI-10)  
3 Phase Power Loss (DI-11).

- k. In addition, the SCADA system will be configured to provide remote Start/Stop control capability for each pump unit that is selected for "Auto" mode operation with the H-O-A switch mounted on the swing-out panel door of the 24VDC panel.
- l. Prior to design approval a radio frequency (RF) survey is required to be completed at the site to assure that communications with the City's server are adequate. The survey report shall be submitted to the City for approval. The pump supplier shall coordinate with the city on integration of the SCADA System with the City's existing system.
- m. RTU Communications Hardware. The RTU shall utilize a wireless licensed VHF transceiver, using the frequency provided by the City of Sisters, with modem and cables as required for a complete operating system. The transceiver shall be a Motorola CDM750. Each RTU shall utilize a properly grounded inline surge protector by Polyphaser, or approved equal, to guard against lightning intrusion. Each remote site shall utilize properly grounded, high quality antenna cable, Time Microwave LMR-400 or approved equal, for data transmission to the antenna. Each remote site shall utilize a properly grounded, omni-directional, fiberglass antenna with a minimum gain of 3dB, installed on a corrosion-resistant mast at a minimum height of ten (10) feet. The antenna for SCADA shall be an Antenex FG1563 or approved equal. The antenna is to be mounted to the mast by a certified RF specialist. The antenna and communication hardware shall be adjusted by the RF Specialist in accordance with the manufacturer's recommendations to assure optimal communications with the base

station. Optimization of the communication hardware is the responsibility of the Contractor and shall be coordinated through the City's Wastewater Department.

### **310.1.10 WIRING**

- a. Pump station shall be completely wired at factory except for the power feeder lines. All wiring in the pump station shall be color coded as indicated on the wiring diagram. Two sets of wiring diagrams matching the unit wiring shall be provided to Engineer prior to final acceptance of project.
- b. A licensed and qualified electrician shall provide service and connection to this installation.

### **310.1.11 FACTORY TESTS**

- a. All components of the pump station shall be given an operational test of all equipment at the factory to check for excessive vibration, for leaks in all piping or seals, and for correct operation of control system and all auxiliary equipment.
- b. The pump suction and discharge lines shall be coupled to a reservoir and the pump shall recirculate water under simulated service conditions.

### **310.1.12 SPARE PARTS**

A complete replacement pump shaft seal assembly shall be furnished with each pump station. The spare seal shall be packed in a suitable container and shall include complete installation instructions. A spare volute gasket shall also be provided, and a spare vacuum priming pump will be provided to Owner.

### **310.1.13 INSTALLATION OF OPERATING INSTRUCTIONS**

Installation of the pump chamber shall be done in accordance with the written instructions provided by manufacturer. These instructions shall be securely attached to and readily visible on the outside of the main chamber of the pump station.

### **310.1.14 EXPERIENCE AND WORKMANSHIP**

Pump station shall be the product of a manufacturer who shall have constructed at least one hundred similar automatic factory-built sewage pumping stations and shall have a minimum of five (5) years' experience with construction of similar pump stations. All workmanship and materials throughout shall be of the highest quality.

### **310.1.15 GUARANTEE OF PUMP STATION**

- a. Manufacturer of the lift station shall guarantee for one year from date of final station acceptance by the City of Sisters that structure and all equipment will be free from defects in design, material and workmanship.
- b. Warranties and guarantees by the suppliers of various components in lieu of a single source responsibility by the manufacturer will not be accepted. Manufacturer shall be solely responsible for the guarantee of the station and all components.
- c. In the event a component fails to perform as specified or has proven defective in service during the guarantee period, manufacturer shall provide a replacement part without cost to the Owner. He shall further, without cost, provide such labor as may

be required to replace, repair, or modify major components such as station structure, pumps, pump motors, sewage piping manifold, etc.

- d. The replacement or repair (including cost of parts and labor) of those items normally consumed in service, such as pump seals, oil, grease, etc., shall be considered as part of routine maintenance and station upkeep.

### **310.1.16 OPERATION AND MAINTENANCE BROCHURE**

Contractor shall furnish Engineer, prior to final inspection and payment, six sets of maintenance brochures, including:

- a. Operation and Maintenance Manual.
- b. Periodic maintenance requirements.
- c. Parts list with numbers.

### **310.1.17 SERVICE/METERING EQUIPMENT**

- a. Service/Metering Equipment. Contractor shall provide and install one (1) UL listed, pad-mounted circuit breaker/metering pedestal for the pump station installation. The enclosure shall be NEMA 3R, heavy gauge zinc coated steel, seam welded, with ASTM B17 durable light green finish. Enclosure shall measure 28" W x 20" D x 54" H and shall include a steel base which is to be mounted to a minimum 36"W x 30"D x 15" thick concrete pad. Equipment shall include isolated compartments for metering, line, and load sections. 8" x 8" plexiglass window for meter reading, hinged doors with padlocking provisions, bolt on frame main breaker, and provisions for SCADA and Radio Telemetry. Unit shall be factory wired to landing lugs in service pull section. Meter base shall be a safety socket type. Designed for 240/480 volt, 34w, service. Commercial Meter Pedestal, Catalog No. CMP 4924 MC with MB 2820 base as manufactured by Circle AW Products Company, or approved equal.
- b. Operation and Maintenance Brochures. Operating and Maintenance Instructions shall be securely attached to and readily visible on the inside of the pump station. Six copies to be submitted to Engineer for distribution.

### **310.10.01 SAFETY**

The Contractor shall comply with all City, County, State, and Federal construction safety and health Standards, Regulations, laws, and permits. Contractor shall be solely and completely responsible for trench and excavation safety.

### **310.10.02 TRENCHING, EXCAVATION, BEDDING and BACKFILL**

Refer to Division I TRENCHES.

### **310.10.03 BEDDING**

Bedding for Wet Well and Valve Vault shall be in accordance with the recommendations of the manufacturer and subject to review and approval by the City of Sisters Wastewater Engineering Manager and/or City Engineer. Bedding for structures shall be Class B backfill or as directed by the Engineer.

#### **310.10.04 BACKFILL**

The Contractor shall place granular backfill around Wet Well and Valve Vault above the concrete base or footings that will achieve compaction requirements without causing excessive pressures against fiberglass walls of the Wet Well or vault. Material shall be 1/2" - 1/4" clean, graded, rounded particle rock fill or "pea gravel". The fill shall be placed for at least two feet outside of wall diameter.

At the location of the inlet sewer piping, the trench zone above the pipe bedding will be lined with a geotextile filter fabric to isolate the pea-gravel structure fill from the pipe zone fill. The pipe zone will be backfilled with Class B backfill, properly compacted in lifts, or other material as approved by the Engineer.

#### **310.10.05 STATION ACCESS**

Paved access shall be provided to the station at all times. The access shall allow a vehicle to park adjacent to the wet well without blocking any traffic lanes or pedestrian walkways. Access shall be as level as possible but shaped to drain away from wet well. All paving shall be shown on construction plans and approved by the Engineering Division prior to construction. A 10-foot clear space shall be required between existing, proposed, or future equipment (including 12 foot by 20-foot designated generator area) within the fencing on all sides of the lift station.

#### **310.10.06 FENCING**

The lift station shall be enclosed with 6-foot-high vinyl coated chain link fencing with the final coating color to be determined by the City. Two 6-foot swing gates in 12-foot clear opening shall provide access to the lift station. The fence and gates will be fitted with beige privacy fence slats set in a bottom locking slat. Fencing shall be at the tract property line. The entire area within the fenced enclosure shall be paved with asphalt and sloped to drain away from the wet well.