CONSTRUCTION STANDARD SPECIFICATION

SECTION 02730

SANITARY SEWER SYSTEMS

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CONSTRUCTION STANDARD SPECIFICATION

SECTION 02730

SANITARY SEWER SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. This section shall apply to the materials and operations required for the installation of exterior sanitary sewer systems.

B. The extent of the work is indicated on the contract drawings.

C. Related Sections: Refer to the following sections for related work:

1. Section 02200, "Earthwork".
2. Section 02725, "Sewer Manholes".
3. Section 03300, "Cast-in-Place Concrete".

1.02 SUBMITTALS

Submit Material Safety Data Sheets (MSDS) for joint compounds as required.

1.03 QUALITY ASSURANCE

A. The materials and practices comprising the work shall conform to this and other referenced standard specifications and codes.

B. All materials used shall not contain any asbestos fibers.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

Pipe and fitting materials shall be polyvinyl chloride (PVC), unless otherwise indicated as ductile iron or vitrified clay on the contract drawings. Each pipe and fitting shall be

marked with a permanent label which allows identification of class and type of material. In addition, pipe shall conform to the following requirements:

A. Sanitary sewer pipe and fittings of nominal pipe diameters 8" and larger and all sanitary sewer main lines shall be constructed of PVC, vitrified clay, or ductile iron pipe. Building sewer branch lines and other service lines of nominal pipe diameters 6" and smaller shall be constructed of PVC or ductile iron pipe or as indicated on the contract drawings.

B. Vitrified clay pipe (VCP) and fittings shall be integrally cast bell and spigot type conforming to the extra strength provisions of ASTM C 700.

C. Cast-iron pipe and fittings, when specified, shall be hub and spigot type conforming to ASTM A 74.

D. Ductile iron (DI) pipe and fittings for sewer shall conform to ASTM A 746. Ductile iron pipe shall have an asphaltic lining unless otherwise specified.

E. Polyvinyl chloride (PVC) pipe shall meet the requirements of ASTM D 3034 for pipe sizes 6" through 15" diameter. Minimum wall classification shall be SDR 35 or SDR 26, as required. Only solid wall pipe will be acceptable.

F. PVC pipe which will be used only for sanitary sewer service lines shall conform to ASTM D 2665 for Schedule 40 pipe. Pipe for this purpose shall be solvent-welded joined, per manufacturer's recommendations.

2.02 JOINTS

Joint materials shall be furnished with the sewer pipe. Gaskets shall be stored in accordance with ASTM C 443. In addition, the joints shall conform to the following requirements:

A. Vitrified clay pipe bell and spigot joints shall conform to ASTM C 425. Each joint shall receive an application of furan-based cement mortar according to manufacturers instructions.

B. Cast-iron pipe hub and spigot joints shall have neoprene compression gaskets and shall conform to ASTM 564.

C. Ductile iron pipe for sewer shall have push-on rubber gasket joints and shall conform to AWWA C111.

D. For PVC, refer to ASTM D 2321 and ASTM F 794 for pipe laying and joining of pipe guidelines.

1. All joints will be assembled in accordance with manufacturer's published recommendations. If a lubricant is required to facilitate assembly, it shall have no detrimental effect on the gasket or on the pipe when subjected to prolonged exposure. Proper jointing may be verified by rotation of the spigot by hand or with a strap wrench. If unusual joining resistance is encountered or if the insertion mark does not reach the flush position, disassemble the joint components and repeat the assembly steps. Note that fitting bells may permit

less insertion depth than pipe bells. When mechanical equipment is used to assemble joints, care should be taken to prevent over insertion.

2. Solvent cement joints shall be limited to 4" and 6" diameter sanitary sewer service lines. The solvent cement shall be compatible to the pipe manufacturer's product and shall conform to the requirements as specified in ASTM D 2564 for PVC pipe and ASTM D 2235 for ABS pipe.

2.03 CLEANOUTS

Cleanouts shall be constructed according to the standard details and conform to the following materials requirements:

A. Top: Iron ferrule with countersunk brass screw plug.

B. Riser: Cast-iron, service weight, hub and spigot pipe and fittings for DI and VCP sewer lines.

C. Riser for PVC lines shall be PVC Schedule 40 pipe conforming to ASTM D 2665 cast-iron soil pipe (service weight), or ABS Schedule 40 sewer pipe conforming to ASTM D 2661. Only PVC or ABS shall be used when connecting to flexible pipe.

D. Wye or double-wye fitting on building sewer shall be of the same material as the building sewer.

E. Collar: Cast-in-place reinforced concrete shall conform to the requirements of Section 03300, "Cast-in-Place Concrete".

2.04 SERVICES

A. Sanitary sewer service lines shall be installed at all locations shown on the plans.

B. All fittings shall be compatible with the service line material.

PART 3 - EXECUTION

3.01 PIPE LAYING

A. The depth of sewer pipe mains shall be a minimum of 3 feet from top of finished grade to the top of sewer pipe, unless otherwise indicated on the contract drawings.

B. Pipe shall be laid on a smoothly graded, prepared subgrade soil foundation true to alignment and grade as indicated on the applicable contract drawings. Bell holes shall be hand-excavated so that the bottom of the pipe is in continuous contact with the surface of the prepared subgrade material. When joined in the trench, the pipe invert shall form a true and straight line.

C. Sewer pipe shall be laid according to the pipe manufacturer's written recommendations or installation handbooks. If conflicts occur between these specifications and the manufacturer's instructions, these specifications shall govern.

Vitrified clay pipe shall also be laid in accordance with ASTM C 12 for Class C bedding.

D. Vitrified clay pipe joints shall be made up using furan-based cement mortar. Before joining, the mortar shall be applied in the base of the bell so that when the pipe sections are joined, the joint will be completely filled with mortar, and the excess mortar will be pushed out into the bore of the pipe. A burlap bag, stuffed so that it fits tightly into the bore of the pipe, shall be drawn past the joint to wipe the excess mortar away, leaving a smooth interior surface at the joint.

E. For PVC, the reference mark (a distinct circumferential line) is placed on the pipe's spigot by the manufacturer to indicate the correct depth of spigot penetration into the pipe gasket joint. If the pipe is seated too deeply or too shallowly, the pipe may buckle or separate due to thermal expansion/contraction. Spigot penetration shall be within 1/4" of the manufacturer's recommended mark.

F. PVC pipe connection to manholes: The Contractor shall install an appropriately sized press seal gasket, such as PS-10 by Press Seal Gasket Corporation, Large Diameter Waterstops for Concrete Manhole Adapters by Fernco, or approved equal. The gasket shall be installed per manufacturer's directions.

G. Approved backfill material shall be spaded and tamped into the "haunch" area under each side of the pipe so that all void spaces underneath the pipe are filled with compacted backfill material.

H. Pipe laying shall proceed upstream with the spigot ends pointing in the direction of flow. Pipe shall not be laid in standing water or when trench or weather conditions are deemed unsuitable by the Sandia Delegated Representative (SDR).

I. Approved backfill material shall be placed in the trench along the side of the pipe and compacted by hand up to the top of the pipe. Approved backfill material shall be placed and compacted a minimum of 12" above the top of the pipe.

J. Pipe coupons shall not be left inside the sewer main when the direct-tapping method is used. All pipe coupons shall be returned to the SDR.

3.02 CLEANOUTS

Single and two-way cleanouts shall be constructed at the locations indicated and as detailed on the contract drawings. Cleanouts and extensions to grade shall be constructed on 6" and smaller lines at the minimum spacing and at the locations required by the Uniform Plumbing Code (UPC), Section 406, unless otherwise specified on the contract drawings.

3.03 SEPTIC SYSTEMS

A. Septic systems, including septic tank, distribution box, drain field (or seepage pit), shall comply with UPC requirements. In addition, the following requirements shall be met:

1. Access holes (with covers) shall be extended to grade and furnished with manhole covers.

2. Septic tanks shall be placed on a sand bed (with a minimum thickness of 1") 90% compacted earth per ASTM D 1557.

3. A minimum of six guard posts shall be installed above grade around the septic tank perimeter.

B. The Contractor shall also be required to:

1. Complete the Liquid Waste Disposal (LWD) permit application and pay the application fee.

2. Obtain all necessary State of New Mexico Construction Industries Division (CID) inspections relating to the LWD permit.

3. Complete, as a contract deliverable, the LWD permit application, including the CID endorsement indicating completion of required inspections.

4. Submit the completed LWD permit to the SDR, who will then transmit the documents to the Construction Management Engineer.

5. Have an MS-1, MS-3, MM-1, or MM-98 New Mexico plumbing license.

3.04 CLEANING

A. Prior to laying pipe, each interior pipe section shall be cleaned of all soil and debris.

B. After laying backfill, all interior pipes shall be free of all foreign material such as soil, cement mortar, joint compounds, etc. If large amounts of material have accumulated, the SDR may require flushing of the pipe. If flushing is required, any outlets into existing lines shall be blocked so that no foreign material is discharged into existing lines.

3.05 LOCATION OF WATER AND SEWER LINES

A. Mains: Water and sewer mains running parallel shall be laid at least 10 feet apart horizontally with the water main at a higher elevation than the top of the sewer line. Water and sewer mains shall be laid in separate trenches in all cases. Where water and sewer mains are laid closer than 10 feet or where they are crossing, the bottom of the water main shall be at least 18" higher than the top of the sewer line, otherwise the sewer line shall be of pressure class pipe, or shall be encased in concrete as indicated on the contract drawings, within 10 feet either side of the water main.

B. Service Lines: Water and sewer service lines shall not be laid in the same trench, unless the bottom of the water line, at all points, is at least 12" above the top of the sewer line, and the water line shall be laid on a solid shelf excavated at one side of the common trench. Where water and sewer service lines cross, the water line shall be at least 12" higher than the sewer.

3.06 INSPECTION

A. Upon arrival at the job site, all materials may be inspected for conformance with the requirements of Part 2 of this specification. Any rejected material shall immediately be removed from the job site.

B. When PVC pipe is stored outside and exposed to prolonged periods of sunlight, an obvious discoloration of the pipe can occur. This is an indication of reduced pipe impact strength, and any particular length of pipe that is discolored shall be rejected. All pipe rejected by the SDR shall be removed from the job site.

C. Immediately prior to laying, each pipe section shall be visually inspected for defects or damage. Any damaged or defective pipe section shall not be used. Each pipe section shall be cleaned so that the interior and joining surfaces of the pipe are free of soil and debris.

Vitrified clay pipe shall be inspected for straightness, true circular cross-section, cracks, blister, lumps, pits, broken bell and spigot, and general soundness according to ASTM C 700.

D. After the trench has been backfilled, the DI and VCP pipe shall be inspected for displacement, poor alignment or other defects by illuminating the interior of the pipe using a lamp or mirror. The pipeline shall be deemed to be in poor alignment if less than three quarters of the opening at the opposite end of the pipe can be seen by the SDR. Allowable deviations from vertical grade shown on the drawings shall be no more than 3/8" below or above the true grade line. In addition, vertical sags and crowns in the pipe joints shall be no more than 1/4" across any 16 feet of pipe length. Horizontal alignment, as shown on the contract drawings, shall be within 1" of the true line and shall not vary more than 1/2" across any single joint of pipe, unless otherwise shown on the contract drawings. Any sections of pipe found to be defective, damaged or in poor alignment shall be taken up and relaid or replaced at the Contractor's expense.

E. Not less than 30 days after the installation and backfilling of PVC sewers, including any service connections, the Contractor shall, in the presence of the SDR, test deflection of the pipe with a mandrel (GO-NOGO device). The mandrel shall be hand-pulled. All pipe with deflections in excess of 5% of the base internal diameter, as determined by ASTM D 3034, ASTM F 679, or ASTM F 794, shall be excavated, rerounded, backfilled and retested after an additional period of at least 30 days. Mandrels shall have 9 ribs and be only hand-pulled through the test section. The Contractor shall furnish the mandrels. The length of the minimum radius portion of the mandrel shall not be less than one-third of the nominal diameter of the pipe tested. The pipe shall be flushed and cleaned by the Contractor prior to testing. No flow will be permitted in the pipe while testing for deflections.

1. All expense for trenching, backfill, compaction, paving, and related work that is required because of failure to meet deflection test requirements shall be borne by the Contractor.

2. Acceptance of plastic pipe sewers shall be made only after these deflection test requirements have been met.

3. Minimum Diameters of Mandrels:

Nominal Pipe Size	Minimum Mandrel Diameter
8"	7.28"
10"	9.03"
12"	10.80"
15"	13.20"

3.07 TESTING FOR LEAKAGE

A. All sanitary sewer pipes shall be tested for leakage by the low pressure air method or other method submitted by the Contractor and approved by the SDR. The Contractor, at his option, may air test the sanitary sewer line before backfilling to aid the Contractor in checking for any defects. The testing for acceptance and compliance with the contract specifications will be performed after backfilling has been completed. If the line does not meet or exceed the test requirements, the Contractor shall make repairs to the line as necessary, and shall retest the line at no additional cost to Sandia National Laboratories (SNL). All manholes shall be tested separately.

The procedure for conducting an air test shall be as follows:

1. Clean the pipe section (manhole to manhole reach of sewer) being tested by propelling a snug-fitting inflated ball, or other adequate method, through the pipe with water. It is important that the pipe be thoroughly wetted if consistent results are to be expected.

2. Plug all pipe outlets with pneumatic plugs. The pneumatic plugs shall be able to resist internal testing pressures without requiring external bracing. Give special attention to laterals.

3. Introduce air slowly to the section of pipe under evaluation until the internal air pressure is raised to 4.0 psig plus any increase required by a high groundwater level.

4. Allow the air pressure to stabilize. Air may be added slowly to maintain a pressure between 3.5 and 4.0 psig for two minutes.

5. After the stabilization period, when the pressure reaches exactly 3.5 psig, the stopwatch is started, and when the pressure reaches exactly 2.5 psig the stopwatch is stopped.

6. If the time required for a one pound pressure drop is not less than the allowable time for the pipe section under test to lose air, the section shall pass the leakage test.

7. All persons conducting an air test must be made aware of the fact that an air test may be dangerous if improperly conducted.

8. Air Testing Table: Table 1 will be used to determine the required test duration for the section of line being tested.

B. Tables

1. Explanation of Tables

   a. Column A: Nominal diameter of pipe (any pipe material).

   b. Column B: Minimum duration of air test regardless of length of line segment being tested. (e.g., 250 feet of 8" PVC: test duration 3 min. 47 sec.)

   c. Column C: Length of line associated with minimum duration of air test (Column B).

   d. Column D: L=Length of line in feet; product of computation yields duration of air test (e.g., 250 feet of 12" PVC where ground water is not present (Table 1): test duration -- 1.709 (250) = 427.25 sec. = 7 min. 8 sec.)

   e. Column E: Duration of air test for given incremental lengths of line.

2. Use of Tables: Table 1 is based on an air loss rate of 0.003 cfm/sf of internal surface area. Use for line installations where ground water and subsequent infiltration is not present. In the event that ground water and infiltration is present, Table 2 shall be used.

TABLE 02730-1

SPECIFICATION TIME REQUIRED FOR LOSS OF PRESSURE
FROM 3.5 PSIG TO 2.5 FOR SIZE AND
LENGTH OF PIPE INDICATED FOR 1=0.003

(A) Pipe Diam-eter (in.)	(B) Mini-mum Time (Min: sec)	(C) Length for Mini-mum Time (ft)	(D) Time for length (sec)	(E) Specification Time for Length (L) Shown (min:sec)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	1:53	597	.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:48	11:24	12:49
15	7:05	159	2.671 L	7:04	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	23:38	28:51
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926 L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23
39	18:25	61	18.054 L	30:57	45:09	60:11	75:14	90:16	105.19	120:22	135:24
42	19:50	57	20.039 L	34:54	52:21	69:48	87:15	104:42	122:09	139:36	157:05

Table from: WPCF Journal, Vol. 44, No. 4, April 1972; Ramseier, "Testing New Sewer Pipe Installations"; pp. 557-564.

TABLE 02730-2

SPECIFICATION TIME REQUIRED FOR 1.0 PSIG PRESSURE DROP FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q=0.0015

(A) Pipe Diam-eter (in.)	(B) Mini-mum Time (Min: sec)	(C) Length for Mini-mum Time (ft)	(D) Time for length (sec)	(E) Specification Time for Length (L) Shown (min:sec)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102.34	128:12	153:50	179:29	205:07	230:46

Table from: UNI-B-6-79, *Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe"; Uni-Bell Plastic Pipe Assoc.