

SECTION 3000 - SANITARY SEWER PIPES

- 3001 SCOPE.** This section covers all labor and materials for the construction of sanitary sewer mains including all manholes, pipe encasements, service connections and appurtenances.
- 3002 GENERAL.** When reference is made to a standard specification (ASTM, AWWA, etc.), the specification referred to shall be understood to mean the latest revision of said specification except as otherwise noted in the contract documents.
- 3003 MATERIALS.** Contractor shall be required to use the materials shown on the City of Gardner Approved Materials List unless otherwise specified or approved by the City Engineer. The Approved Materials List is available on the City of Gardner public website at www.gardnerkansas.gov

A. Polyvinyl Chloride (PVC) Pipe

Pipe	Pipe shall be seamless. Pipe material shall conform to ASTM D1784 and shall have a minimum cell classification of 12454C, 12364A, or 13364B. Pipe diameters less than eighteen (18) inches shall be SDR 26 and conform to ASTM D3034. Pipe diameters eighteen (18) inches and larger shall be PS115 (Pipe Stiffness of 115 psi) and conform to ASTM F679 or F794.
Joints	All gasketed joints shall be compression, bell and spigot push-on conforming to ASTM D3212 and ASTM F477. Lubricant shall be as recommended by the pipe manufacturer.
Fittings	Molded fittings defined as tee connections suitable for assembly to six (6) inch diameter house or building sewers shall be fittings molded of PVC materials conforming to ASTM D1784. All fittings shall utilize elastomeric seals and shall be suitable for use with PVC pipe specified.

*When PVC is used on force mains, a tracer wire shall be installed allowing accurate locates of the main.

B. High Density Polyethylene (HDPE) Pipe

Pipe	Pipe shall be manufactured from a PE 3408 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material will meet the specifications of ASTM D3350 with a cell classification of PE 345464C. Pipe shall have a manufacturing standard of ASTM F714. Pipe shall be DPS DR 13.5 unless otherwise specified on the plans.
Fittings	Butt Fusion: Fittings shall be PE3408 HDPE, cell classification of 345464C as determined by ASTM D3350. Butt fusion fittings shall have a manufacturing standard of ASTM D3261. Fabricated fittings are to be factory manufactured. All fused joints shall be de-beaded and debris removed from the main.

Electrofusion Couplings and Restrains: Couplings shall be PE3408 HDPE, cell classification of 345464C as determined by ASTM D3350. Electrofusion couplings shall have a manufactured standard of ASTM F1055.

All fittings and couplings shall have the same pressure rating as the pipe unless otherwise specified on the plans. HDPE butt fusion installers must be qualified with training from the pipe distributor or manufacturers' representatives.

C. Cured In Place Pipe (CIPP) Cured in place pipe (CIPP) shall only be allowed as an alternative to pipe replacement at locations by the City Engineer.

Fabric CIPP lining material shall consist of one or more layers of absorbent non-woven felt fabric capable of absorbing the resin and withstanding the installation pressures and curing temperatures. The tube should be compatible with the resin system used. Any plastic film applied to the tube on what will become the interior wall of the finished CIPP shall be an impermeable, flexible membrane which is compatible with and contain the resin system used.

Resin The resin system shall be a corrosion resistant polyester, or vinyl ester, or epoxy and catalyst system.

Minimum lining thickness is outlined in Table 3003-1.

Table 3003-1 - Minimum CIPP Lining Thickness

Original Pipe Diameter (inch)	Minimum CIPP Thickness (mm)	Design Criteria (inch)
8-12	6.0	0.236
15	9.0	0.354
18	12.0	0.472
24	15.0	0.591
30	18.0	0.709

The cured liner shall conform to ASTM D790 for the minimum structural standards. Liner tube and resin shall also meet the requirements of ASTM F1216, ASTM D5813, ASTM F1743 and any project specific criteria.

All force mains shall be installed with granular embedment per the Technical Specifications. All force mains shall be laid to continuous slope when not shown on the Drawings.

Approved air relief valves shall be installed at all locations shown on the Drawings where required by the Engineer.

The Contractor shall restrain the pipeline to accommodate thrust and testing forces at pipe deflections, bends, tees, and plugs in accordance with the project Contract Documents. All damage caused by the Contractor's failure to provide adequate restraint shall be corrected by the Contractor at no additional cost of the Owner.

The Contractor shall obtain Kansas State Plane coordinates on the force main using survey-grade GPS equipment. The coordinates shall be obtained at 100-foot intervals on straight runs of pipe, at 25-foot intervals on curved runs of pipe, and at all fittings. The Contractor shall provide the coordinates to the City Engineer in an electronic format such as a comma delimited text file, a shape file, or a Microsoft Excel spreadsheet. The electronic file shall identify the fittings with their corresponding coordinate pair.

All force mains shall be installed with underground tracer wire and electronic locate markers and shall be installed in accordance with the Design Criteria.

3004 ALIGNMENT. Piping shall be installed to the grades indicated on the drawings using laser beam equipment and surveying instruments.

The following sag tolerances will be acceptable on sanitary sewer installations:

- For 8-inch and 12-inch diameter pipe with slopes below one and a half percent, a maximum sag of ten (10) percent of the pipe area and no more than two sags of ten (10) percent of the pipe area between structures.
- For all pipes with a diameter larger than 12-inches, sags shall be evaluated by the Engineer on a case-by-case basis. The City Engineer shall have final determination if the sag will be acceptable.
- For any sags not meeting acceptable criteria as outline above, backfall slope is not allowed at any point in the pipe installation. Remove and replace, otherwise repair, any sections of non-conforming pipe at no additional cost to the City.

All flexible pipelines shall be tested for deflection by pulling a mandrel through the entire length thereof.

- The mandrel (go/no-go) device shall be cylindrical in shape and constructed with nine (9) evenly spaced arms or prongs. Mandrels with fewer arms will be rejected as not sufficiently accurate. The rigid mandrel shall have an outside diameter (O.D.) equal to 95 percent of the inside diameter (I.D.) of the pipe. The inside diameter of the pipe, for the purpose of determining the outside diameter of the mandrel, shall be the average outside diameter minus two minimum wall thicknesses for O.D. controlled pipe and the average inside diameter for I.D. controlled pipe, dimensions per appropriate standard. Statistical or other “tolerance packages” shall not be considered in mandrel sizing. The dimensions of the mandrel for PVC pipe shall be listed in the table below. The “D” mandrel dimension shall carry a tolerance of ± 0.01 inch. Contact length (L) shall be measured between points of contact on the mandrel arm. The length shall not be less than as shown in the accompanying table.

Nominal Diameter (Inches)	“L” Mandrel Length (Inches)	“D” Mandrel Diameter (Inches)
ASTM D3034 SDR26		
8	8	7.37
10	10	9.21
12	10	10.96
15	12	13.42
ASTM F679 PS115		
18	18	16.49
21	21	19.44
24	24	21.87
27	27	24.65
30	24	28.21
36	24	33.78
42	24	39.24
48	24	44.80

- Mandrel outside diameters for HDPE and Fiberglass Wastewater Pipe shall be calculated as described in the above paragraph. For Fiberglass Wastewater pipe, the outside diameter for the mandrel shall be 97% of the inside diameter of the pipe.
- The Engineer shall be responsible for approving the mandrel. The Contractor shall provide proving rings to verify.
- The mandrel shall be hand-pulled by the Contractor through all flexible sewer lines. Any sections of sewer not passing the mandrel test shall be uncovered and the Contractor, at no additional cost to the Owner, shall re-round or replace the sewer to the satisfaction of the Engineer. These repaired sections shall be retested.
- The testing shall be conducted after final trench backfill.

Vertical Tolerance Table Based on Slope and Length

Slope	MH to MH Length (Feet)	Max. Tolerance @ Upstrm. MH (Feet)	Slope	MH to MH Length (Feet)	Max. Tolerance @ Upstrm. MH (Feet)	Slope	MH to MH Length (Feet)	Max. Tolerance @ Upstrm. MH (Feet)
0.10%	50	0.01	0.35%	50	0.02	0.95%	50	0.05
0.10%	100	0.01	0.35%	100	0.04	0.95%	100+	0.10
0.10%	150	0.02	0.35%	150	0.05	1.00%	50	0.05
0.10%	200	0.02	0.35%	200	0.07	1.00%	100+	0.10
0.10%	250	0.03	0.35%	250	0.09	1.05%	50	0.05
0.10%	300	0.03	0.35%	300+	0.10	1.05%	100+	0.10
0.10%	350	0.04	0.40%	50	0.02	1.10%	50	0.06
0.10%	400	0.04	0.40%	100	0.04	1.10%	100+	0.10
0.10%	450	0.05	0.40%	150	0.06	1.15%	50	0.06
0.10%	500	0.05	0.40%	200	0.08	1.15%	100+	0.10
0.15%	50	0.01	0.40%	250+	0.10	1.20%	50	0.06
0.15%	100	0.02	0.45%	50	0.02	1.20%	100+	0.10
0.15%	150	0.02	0.45%	100	0.05	1.25%	50	0.06
0.15%	200	0.03	0.45%	150	0.07	1.25%	100+	0.10
0.15%	250	0.04	0.45%	200	0.09	1.30%	50	0.07
0.15%	300	0.05	0.45%	250+	0.10	1.30%	100+	0.10
0.15%	350	0.05	0.50%	50	0.03	1.35%	50	0.07
0.15%	400	0.06	0.50%	100	0.05	1.35%	100+	0.10
0.15%	450	0.07	0.50%	150	0.08	1.40%	50	0.07

0.15%	500	0.08		0.50%	200+	0.10		1.40%	100+	0.10
0.20%	50	0.01		0.55%	50	0.03		1.45%	50	0.07
0.20%	100	0.02		0.55%	100	0.06		1.45%	100+	0.10
0.20%	150	0.03		0.55%	150	0.08		1.50%	50	0.08
0.20%	200	0.04		0.55%	200+	0.10		1.50%	100+	0.10
0.20%	250	0.05		0.60%	50	0.03		1.55%	50	0.08
0.20%	300	0.06		0.60%	100	0.06		1.55%	100+	0.10
0.20%	350	0.07		0.60%	150	0.09		1.60%	50	0.08
0.20%	400	0.08		0.60%	200+	0.10		1.60%	100+	0.10
0.20%	450	0.09		0.65%	50	0.03		1.65%	50	0.08
0.20%	500	0.10		0.65%	100	0.07		1.65%	100+	0.10
0.25%	50	0.01		0.65%	150+	0.10		1.70%	50	0.09
0.25%	100	0.03		0.70%	50	0.04		1.70%	100+	0.10
0.25%	150	0.04		0.70%	100	0.07		1.75%	50	0.09
0.25%	200	0.05		0.70%	150+	0.10		1.75%	100+	0.10
0.25%	250	0.06		0.75%	50	0.04		1.80%	50	0.09
0.25%	300	0.08		0.75%	100	0.08		1.80%	100+	0.10
0.25%	350	0.09		0.75%	150+	0.10		1.85%	50	0.09
0.25%	400+	0.10		0.80%	50	0.04		1.85%	100+	0.10
0.30%	50	0.02		0.80%	100	0.08		All lengths of pipe with slopes of 1.9% and greater shall have no more than 0.1 feet of tolerance.		
0.30%	100	0.03		0.80%	150+	0.10				
0.30%	150	0.05		0.85%	50	0.04				
0.30%	200	0.06		0.85%	100	0.09				
0.30%	250	0.08		0.85%	150+	0.10				
0.30%	300	0.09		0.90%	50	0.05				
0.30%	350+	0.10		0.90%	100	0.09				
				0.90%	150+	0.10				

3005 HANDLING. The Pipe and fittings shall be handled in a manner which prevents damage and ensures the delivery and installation in a sound and acceptable condition. Hooks shall not be permitted to contact joint surfaces. Damaged pipe shall be removed from the site.

3006 CLEANING. The interior of all pipe and fittings shall be thoroughly cleaned before installation and shall be kept clean until the work has been accepted. All joint contact surfaces shall be kept clean until the joint is completed.

Whenever pipe installation has stopped, the open end of the pipe must be closed by using a pipe plug to prevent trench water, gravel, earth, or any other foreign object from entering the pipe. In no case will removal of sewer plug be permitted and water allowed to enter the sewer. Contractor may be required by the City Engineer to remove all water from the trench before continuing installation.

3007 LAYING PIPE. Lateral displacement of the pipe is not acceptable. Pipe shall not be installed with water in the trench or under unsuitable weather.

Pipe installation shall begin at the lowest elevation with bell ends facing the upstream, unless otherwise approved by the City Engineer.

3008 JOINTING. All joint preparation and jointing operations shall comply with the instructions and recommendations of the pipe manufacturer. Immediately before joints are pushed together, all joint surfaces shall be coated with the lubricant furnished with the pipe.

3009 TEMPORARY PLUGS. Provide and install watertight plugs as manufactured by pipe supplier. Secure plugs in place in a manner to facilitate removal when required to connect pipe.

Mechanical plugs, braced with a 4x4 timber wedged against the opposite wall of the manhole, shall be installed at the downstream end (connection with existing line) on all sanitary sewer extension projects under construction, and shall be verified by the Contractor at the completion of each working day. Also, the open end of the sewer shall be plugged at the end of the work day with a suitable mechanical plug to prevent entry of ground water or foreign material until work is resumed.

3010 WYE BRANCHES. Wye branches shall all be pitched at 45° and installed at locations designated on the plans. The contractor shall verify that wye branch locations have been marked in advance of the construction of sewers serving any property which will require sewer service and, if the locations have not been designated, shall stop the sewer construction until the necessary tee branch or saddle locations have been obtained. Wye branches shall be installed with the lower lip not more than two inches (2") below the outside top of the pipe. Wye branches not be covered until each location has been recorded.

Each wye branch shall be marked with a wooden strip extending from the wye vertically to within one foot (1') of the ground surface. **All service line branches shall be extended to within 8 feet of the minimum sewerable floor elevation at the time of the main construction.** Markers shall be securely anchored and maintained vertical until backfilling has been completed. Wye branches shall be closed with a suitable plug held in place by an approved joint sealing compound.

Service connections made to the sewer prior to backfilling shall not be installed as vertical risers but shall be laid on a slope not to exceed one foot vertical to one foot horizontal. A 45° bend shall be used to join the wye branch to the service connection. The service pipe shall make such a horizontal angle with the sewer line that a proper connection to the 45° bend is obtained without trimming the pipe and with no danger to jute or jointing material being forced into the sewer. Each service connection pipe shall have a solid bearing on rock backfill.

3011 CONCRETE ENCASEMENT. See the City of Gardner *Design Criteria for Public Improvement Projects* and applicable Standard Details.

3012 WATER LINE CLEARANCES. See the City of Gardner *Design Criteria for Public Improvement Projects* and applicable Standard Details.

3013 SEWER MANHOLES. Manhole construction shall comply with all the applicable requirements of the City of Gardner *Technical Specifications for Public Improvement Projects*.

3014 ACCEPTANCE TEST. Each reach of sewer shall meet the requirements of the following acceptance tests. All defects shall be repaired to the satisfaction of the Engineer by and at the expense of the contractor.

- A. Air Test.** Contractor shall perform a low pressure air test for pipe between successive manholes. The pipe between manholes shall be sealed with suitable plugs. One of the plugs shall have a positive on-off valve and suitable means for readily disconnecting it at the control panel. A second orifice in the plug shall be used for constantly reading the internal pressure of the pipe. This orifice shall be continuously connected to a pressure gauge capable of measuring up to 10 psi. The gauge shall have minimum divisions of 0.10 psi and shall have an accuracy of ± 0.04 psi.

The testing methods and air leakage rates shall conform to the requirements of ASTM F-1417-92 or the latest revision thereof, except as modified herein. Each reach of sewer pipe between manholes shall be tested after completion of the installation of the pipe, appurtenances and the backfill of the sewer trench. Internal air pressure shall be monitored so that it will not exceed 9.0 psig.

Determine the rate of air loss using the time-pressure drop method. Slowly introduce air into the section of pipe to be tested until the air pressure is raised to approximately 4.0 psig and the section of pipe is stabilized. As discussed previously, disconnect the air supply and decrease the pressure to 3.5 psi before starting the test. Determine the time required for the pressure to drop from 3.5 psi to 2.5 psi and compare this interval to the required time to decide if the rate of air loss is within the allowable minimum times required by pipe diameter as shown in Table 3015-1.

If the pressure drops 1.0 psi before the appropriate time shown in Table 3015-1, the air loss rate shall be considered excessive and the test section fails. If the test section fails, leaks shall be repaired and the line shall be retested to the requirements of this test method. Rubber clamp-on type repair couplers will not be an acceptable method of repair. Solid repair sleeves shall be used on all new construction. Prior to acceptance, all constructed sewer lines shall satisfactorily pass the low pressure air test.

The air test may be stopped if no pressure loss has occurred during the first fifty (50) percent of the calculated testing time. If any pressure loss or leakage has occurred during the first fifty (50) percent of the testing period, the test shall continue for the entire test duration as outlined below, or until failure.

Plugs should not be removed until all air pressure has been released.

Example of how to use Table 3015-1: What should be the required test time for a 1.0 psig pressure drop in 327 feet of 8-inch diameter pipe between manholes?

Solution: The exact time is easily calculated by using Table 3015-1. Since 327 feet exceeds the 298 feet length associated with the minimum test time for an 8-inch pipeline, the fourth column in Table 3015-1 is used to calculate the required test time as follows:

$$T = 1.520 \times L = 1.520 \times 327 = 497 \text{ seconds}$$

Therefore, the required test time for a 1.0 psig pressure drop is 497 seconds, or 8 minutes and 17 seconds.

Table 3014-1 - Minimum Duration of Air Test Required for Maximum 1.0 psi Pressure Drop

Pipe Diam. In	Min. Time min:s	Length for Minimum Time, ft	Time for Longer Length, s	Specification Time for Length (L) Shown, min:s							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 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

In areas where ground water is known to exist, a one-half inch diameter capped pipe nipple approximately ten (10) inches long is to be installed through the manhole wall on top of one of the sewer lines entering the manhole. This installation is to be done at the time the sewer line is constructed. Immediately prior to the performance of the line acceptance test, the ground water level shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground to clear it, and then connecting a clear plastic tube to the pipe nipple. The tube shall then be held vertically and a measurement of height in feet of water shall be taken after the water height has stabilized in the tube. The height in feet shall be divided by 2.3 to establish the pounds of pressure to be added to all readings.

All pressure sewage force mains shall have hydrostatic pressure and leakage tests performed prior to acceptance. All tests shall conform to AWWA C600 procedures except as modified herein. The test pressure and leakage allowed shall be determined by the Design Engineer and approved by the City Engineer. The test shall be conducted after line installation and trench backfilling is complete.

The test shall be performed separately in segments between sectionalizing valves and a test plug, or between test plugs. Test segments shall be selected so that adjustable seated valves are isolated for individual checking. Contractor shall furnish and install test plugs at no additional cost to the City, including all required anchors, braces and other devices to withstand hydrostatic pressure on the lugs. Any damage to public or private property caused by failure of the plugs shall be the responsibility of the Contractor. The fill rate of the line shall be limited to the available venting capacity.

If any of the above tests fail to meet the above prescribed requirements, the test shall be repeated as necessary after all leaks and defects have been repaired.

- B. Deflection Test.** A deflection test shall be required on all installations involving flexible or semi-rigid pipe after said pipe has been laid and backfilled. The maximum allowable deflection shall not exceed five (5) percent of the pipe's actual internal diameter as measured in the field. The deflection test shall consist of guiding a device of the appropriate size for the pipe involved to accurately measure any deflection in the pipe.

The device to be used shall be approved by the City Engineer prior to its use. Attention is directed to the fact that the pipe's nominal diameter is greater than the actual internal diameter of the pipe. Lamping will not be approved as a substitution for deflection testing.

Upon completion of the testing, all piping showing a deflection greater than five (5) percent shall be excavated, replaced, backfilled and retested to the satisfaction of the City Engineer.

- C. **Video Camera Inspection.** Sewer line installations shall be inspected by closed circuit television (CCTV) at the Contractor's expense to verify alignment, deflection, and workmanship to check for a smooth, structurally sound, straight, round main. A high quality internal color video recording shall be provided by the contractor showing the pre-construction conditions of all sewer mains scheduled for replacement and the post-construction of all sewer mains involved in the work, including new sewers, replaced sewers, and any restored connections. All post-construction CCTV inspection shall take place after all testing of the sewer line is complete.

The camera shall be moved through the pipe at a uniform rate, stopping when necessary to ensure proper documentation of the pipe conditions. In no case shall the camera travel at a rate faster than thirty (30) feet per minute. The camera shall be moved through the line by means which do not obstruct camera view or interfere with proper documentation of the sewer conditions. The camera shall pause as it approaches a service so that the connection between the pipe and the service can be evaluated. The lens can then rotate to display the interior of the service. The service inspection should identify any visible roots, cracks, or capped risers.

Inspection of the sewer line segments shall be performed using a color camera specifically designed and constructed for the method of inspection performed. Units shall have either an automatic or remote focus or iris controls, and the complete systems shall be operable in conditions of one hundred (100) percent humidity. The Contractor shall have the necessary camera skids, floats, and rafts available to allow inspection of lines in a manner acceptable to the Engineer under live flow conditions and designed for the size of pipe being televised. The complete video system (camera, lens, lighting, cables, monitors, and recorders) shall be capable of producing a picture quality acceptable to the Engineer, and if unsatisfactory, the equipment shall be removed and no payment shall be made for unsatisfactory inspections.

A pan and tilt viewing camera with the ability to view into the service laterals shall be used for 8" services lines and larger. A mini-camera may be utilized where necessary if the 8" camera setup is blocked. Each service lateral or tap shall be inspected to determine operational status and condition of the piping at the mainline connection.

The Contractor shall provide and have on site, heavy cleaning and root cutting equipment for use during CCTV inspection. The Contractor shall include the cost for heavy cleaning and root cutting in their bid proposal. Blowers shall be used to clear suspended moisture or fog in pipes prior to inspection.

Lighting shall be suitable to allow a clear picture of the entire periphery of the main sewer pipe. Lighting shall operate in a manner to provide adequate light for clear

inspection and minimize glare no matter what angle of the camera lens. The lighting shall be built into the unit so the lamps remain aligned with the lens.

When possible, work should start from the upstream manhole. When an obstruction prevents the camera from passing the entire segment, document the defect(s) that do not allow the camera to pass, move to the other manhole (typically the downstream manhole), create new inspection, and inspect as much of the pipe as possible.

When the flow in the upstream manhole of the line segment being inspected is above the maximum allowable level for television inspection the flow shall be reduced. The depth of flow shall not exceed the levels show below for the respective sizes, as measured in the manhole at the time of inspection:

Pipe Diameter (in)	Max Flow Depth (% of Diameter)
≤10	20
12-24	25
≥27	30

The project internal video shall be performed by a qualified commercial or individual company who is familiar with closed circuit television (CCTV) inspection equipment and is Pipeline Assessment Certification Program (PACP) certified by the National Association of Sewer Service Companies (NASSCO). The inspection shall conform to PACP standards and the standards in this document. When PACP and this document conflict, this standard in this document shall be used.

The CCTV inspection shall be completed from manhole to manhole, and include the interior of the manhole and invert. Electronic media records shall be kept by the Contractor. Digital photographs of the pipe conditions and all defects shall be taken by Contract. Both electronic media and digital photographs shall clearly show the location, by distance in 1/10 of a foot from the manhole center, in relation to an adjacent manhole of each PACP observation and/or defect. PACP defect codes shall be recorded on the electronic media. Transparent information must appear on the viewing screen at all times. This information shall contain the site number, full date, continuous footage, and upstream and downstream manhole numbers. All pipe conditions and service connections with addresses shall be noted at the appropriate locations. Each line shall be recorded on a separate file with the upstream and downstream manhole numbers in the filename.

PACP coding standard shall be used for all observation except as expressly identified below:

- Abandoned Inspections
 - o If the length of pipe cannot be inspected, document the defect or defects that do not allow the camera to pass in addition the Miscellaneous Survey Abandoned (MSA) code. Use this method instead of documenting the reason for the abandoned inspection in the comment field. The only time it is appropriate to put the reason in the MSA comment is getting pulled off the job and when the inspection could have otherwise been continued.
- Significant and unexplained changes in turbulence:
 - o A case where flow turbulence changes significantly but there is not visual indicator why (i.e. presumably a large rock or broken/hole below the water

line). To document this, add a Miscellaneous General Observation (MGO) with “Rapids” in comments.

The Contractor shall provide deliverable with external hard drive that contains:

- PACP export database, including:
 - o Electronic media recordings, including all inspections associated with the project.
 - o Inspection logs, containing upstream and downstream manhole, street address, date, pipe diameter, direction of inspection, pipe material, line footage, lateral and observation locations, and digital photos of defects and their respective severity, PACP scoring for each line segment, and a graphic depicting the sewer line segment and showing the location and direction of lateral connections, defects, material changes, etc.

The City will review submittals for quality. Any deliverables not acceptable shall be corrected and resubmitted by the Contractor at no additional charge to the City. If additional inspections are required, the Contractor shall reschedule unacceptable inspections five days after being notified or a mutually agreed upon alternative schedule.

City will complete a second video of the sewer pipe prior to the expiration of the two (2) year maintenance bond. If any repairs are required during the two (2) year maintenance period, the Contractor will be required to video all repaired sections of pipe to verify corrections. Unacceptable defects include, but are not limited to, infiltration, displacement at joints, intrusion of foreign material, service taps entering at the wrong angle, sags outside acceptable limits as defined by these specifications, or cracked, broken, distressed or out of round pipe.

3015 BORING WITH CASING PIPE. Casing pipe shall conform to the requirements of the applicable Standard Details unless otherwise specified by the City Engineer.