

ADDENDUM #2

ITB 4321 - Windemere Park Tennis Court Renovations City of Ann Arbor

Due: Thursday, February 20, 2014 by 10:30 a.m.

The following changes, additions, and/or deletions shall be made to the Invitation to Bid for the Windemere Park Tennis Court Renovations, for which bids will be received on or before 10:30 A.M. Thursday, February 20, 2014.

The information contained herein shall take precedence over the original documents and is appended thereto. This Addendum includes **29 pages**. The changes listed below are identified by page number within the bid document.

The Contractor is to acknowledge receipt of this Addendum No. 1 on page P-1 of the Bid Documents prior to submitting its Bid.

1. Replace the bid form, pages BF-4 and BF-5 with the one included in this addendum
2. A Grading/Soil Erosion and Sedimentation Control Permit is required. A pdf of the application can be found at this link:

http://www.a2gov.org/government/communityservices/planninganddevelopment/building/Documents/Revised%20Building%20Apps%20and%20Forms%20Address%20Updates%2002.28.12/Grading_Application.pdf

Link to the fees for the permit – which will be \$220 for this project:

http://www.a2gov.org/government/communityservices/planninganddevelopment/building/Documents/Revised%20Fee%20Sheets%20Addresses%20Updated%2003.23.12/Environmental_Permit_Fees.pdf

3. A ROW permit shall be required for working at the street, however, the fee will be waived as it is a public project. Inspection fees for the reconstruction and tap into the curb inlet will also be waived for the contractor.
4. A testing firm will be hired independently by the City of Ann Arbor.
5. Bids are to be delivered to the first floor Customer Service area of City Hall. The bids will be time stamped by Customer Service staff.
6. Soil boring reports are posted on the City of Ann Arbor website and MITN site.
7. The sign in sheet is posted on the City of Ann Arbor website and MITN site.
8. Topsoil may be imported instead of screening existing soil for the top 3” of restored turf area. All imported topsoil must be friable sandy loam capable of supporting optimal plant growth and development and be clean of roots, plants, invasive weeds, sod, stones, clay lumps and other extraneous materials.
9. Care needs to be taken not to disturb tree roots to the extent possible where the 12” storm line approaches the curb inlet through the berm.
10. The timeframe for construction of the courts shall be as early in the construction season as weather permits.

11. The fence fabric at the backstop may need to be removed and reattached to accommodate the storm pipe trench. If the fabric is damaged, it will need to be replaced by the contractor.
12. Clarification for asphalt mix – shall be **36 A** for leveling and wearing course.
13. All City of Ann Arbor Standard Specifications are part of this document. Refer to the following City of Ann Arbor Standard Specifications for piping, manholes, and utility testing:
http://www.a2gov.org/government/publicservices/project_management/privatedev/Pages/StandardSpecificationsBook.aspx

(On Division III and IV, Use updated portion of specification included with this addendum)

Division III, Material Standards, Pipe materials

Division IV, Testing and installation, and including televising of pipe by the contractor.

Division X, Standard Details:

SD-TD-5 Utility Trench – Type V

SD-S-1 Standard Manhole Type I for 8” to 30” sewers

SD-GU-5 Standard Casting Schedule

Addendum #2

REPLACEMENT BID FORM

Section 1 – Schedule of Prices

Windemere Park

<u>Item Description</u>	<u>Estimated Quantity</u>	<u>Unit Price</u>	<u>Total Price</u>
1. Remove existing asphalt and base, fencing, tennis net posts, footings, and dispose of properly.	LS		\$ _____
2. All grading, including restoration of existing tennis court area. Stockpile existing topsoil for reuse. Screen prior to reuse	LS		\$ _____
3. 21AA crushed limestone base 8" depth	332 CY	\$ _____	\$ _____
4. Bituminous pavement, 36A, 3" depth total: 1.5" leveling course, 1.5" wearing course	1462 SY	\$ _____	\$ _____
5. Supply and install Tensar TX140 triaxial Geogrid or approved equal	1462 SY	\$ _____	\$ _____
6. Supply and install Tencate/Mirfi 140N Geotextile or approved equal, include overlap	1462 SY	\$ _____	\$ _____
7. Supply and install tennis net posts (4) and nets (2), ground sockets and center tie downs (2)	LS	\$ _____	\$ _____
8. Supply and install black vinyl clad chainlink fencing, 10 feet tall, including one pedestrian gate	456 LF	\$ _____	\$ _____
9. Color coat and stripe	1462 SY	\$ _____	\$ _____
10. Supply and install drain tile, 6" perforated in geotextile with pea gravel	272 LF	\$ _____	\$ _____
11. Supply and install drain tile, 12" solid N12 pipe on 2" 6A setting bed and backfill with 6-8" 6A washed limestone	193 LF	\$ _____	\$ _____
12. Reconstruct existing storm drain at curb. Replace with 3' diameter structure, tap 12" pipe into structure. Includes repair to disturbance to the site, including the curb, asphalt etc.	LS		\$ _____
13. Supply and install 2' diameter field drains with concrete riser pipes per spec. 1040 East Jordan. 1040, Type M1 grate and 1040, Type O2 grate	2 EA		\$ _____ \$ _____
14. Supply and install 3' diameter concrete inlet structures with concrete riser pipes			

2' diameter flat grates	2	EA	\$_____	\$_____
15. Supply and install detention outlet structure as shown in detail, including Type 02 beehive grate.		LS		\$_____
16. Supply and install flared end section for 6" pipe to rain garden with stone bedding and geotextile		LS		\$_____
17. Allowance for subgrade undercutting, includes replacing soils with approved backfill	250	CY	\$_____	\$_____
18. Provide and install White Spruce, Picea glauca, b&b 5-6'	5	EA	\$_____	\$_____
19. Provide and install River Birch, Betula nigra, multistem, b&b, 10-12'	5	EA	\$_____	\$_____
20. Provide and install Tulip Tree Liriodendron tulipifera 2.5-3" b&b	5	EA	\$_____	\$_____
21. Restoration - fine grade, seed, mulch blanket for all areas disturbed areas exceeding 5% slope		LS		\$_____
22. Rain garden area – provide and install cover crop of annual rye or oats	1890	SF	\$_____	\$_____
23. Provide and install silt fence	287	LF	\$_____	\$_____
24. Allowance to provide and install 3" topsoil for area at removed tennis court.	1672	SY	\$_____	\$_____
25. General Conditions – bonds, soil erosion control permit, overhead		LS		\$_____
TOTAL FOR WINDEMERE PARK				\$_____

Alternate #1

Provide and install woven geotextile Tencate Mirafi
PET70/70 for area where Tennis court is being
removed to stabilize soils

1440 SY \$_____ \$_____

Alternate #2

Relocate existing 4" diameter Maple tree

2 EA \$_____ \$_____

Alternate #3

Eliminate rain garden - Delete items 15, 16 and 22.
Decrease 6" drain pipe by 30' and increase 12" solid
N12 drain pipe to 290 LF. (write in amount that the
base bid would either increase
or decrease with this change)

LS \$_____

Alternate #4

Replaces item #11: Provide an alternate price for 12"
solid wall SDR including 4" class II sand bedding
(eliminate 6A washed limestone).

193 LF \$_____ \$_____

**REVISED DIVISION III AND IV OF SPECIFICATIONS FOR
STANDARD CITY OF ANN ARBOR SPECIFICATIONS**

2. UTILITIES

2A. Concrete Pipe and Fittings

Reinforced concrete pipe shall conform to the requirements for reinforced concrete pipe of ASTM Designation C 76, Class IV, unless otherwise designated on the Plans. For diameters larger than listed in ASTM Specifications, wall thickness and reinforcing steel shall be as shown in detail on the Plans.

Reinforced elliptical concrete pipe shall conform to the requirements for reinforced concrete elliptical pipe of ASTM Designation C 507, Class as designated on the Plans. For diameters larger than listed in ASTM Specifications, wall thickness and reinforced steel shall be as shown in detail on the Plans.

Non-reinforced concrete pipe shall conform to the requirements for concrete pipe of ASTM Designation C 14, Class as designated on the Plans.

Concrete water main pipe shall be Prestressed Concrete Cylinder Pipe, Lined Cylinder Type, or, where concrete river crossing pipe is specified, it shall be Prestressed Concrete Cylinder Pipe, Lined Cylinder Type with Subaqueous Lugs. All concrete water main pipe shall meet the requirements of AWWA C301, and shall be designed for sustained internal working water pressure of 150 psi unless specified otherwise on the Plans or Detailed Specifications. The design calculations and a tabulated pipe laying schedule shall be submitted to the Public Services Director for review. The laying schedule shall show, as a minimum, the centerline and invert elevations, as well as the station, of each end of each pipe. Identification marks will be required for fittings and special length pieces. Cement shall conform to standard specifications for Portland Cement ASTM C 150, Types I or II. Steel cylinders for pipes, fittings, and specials shall be tested for tightness. Concrete water main fittings shall be standard fittings conforming to the requirements of Section 4 of AWWA C 301.

Joints

Joints for reinforced concrete pipe shall meet ASTM C 443 and shall be rubber gasket for tongue and groove, full bell and spigot rubber O-ring gasket, or modified grooved tongue with rubber gasket. Joints for sewers over 36 inches in diameter shall have inside joints cement mortar pointed to their full depth and shall have the outside joints provided with a cement mortar collar.

Joints for non-reinforced concrete pipe shall be rubber gasket for tongue and groove, or modified grooved tongue with rubber gasket.

Joints for prestressed concrete cylinder pipe used for water mains shall be bell and spigot with O-ring gasket meeting Sections 2.9, 2.11, 3.3, and 3.4 of AWWA C-301 specifications.

Joints for reinforced concrete water mains 30 inches in diameter and larger shall have inside joints cement mortar pointed to their full depth. All reinforced concrete water mains shall have the outside joints provided with a cement mortar collar.

Joints for reinforced concrete elliptical pipe shall be mastic compound with inside cement mortar pointing to full depth and outside cement mortar collar.

Lubricants used in making up joints shall be supplied by the pipe manufacturer and the joints shall be coupled in accordance with the manufacturer's requirements.

Pipe Marking

The following information shall be clearly marked on each length of pipe:

- a) The pipe designation and class (e.g., C 76, Class IV).
- b) The name or trademark of the manufacturer.
- c) Identification of the manufacturing plant.
- d) The date of manufacture.
- e) Testing lot number or testing lab stamp.
- f) Reinforced concrete pipe with elliptical reinforcement shall be clearly marked on the inside and the outside opposite walls along the minor axes of the elliptical reinforcing.
- g) Water main pipe and fittings shall have special marks of identification to show proper location in the line by reference to layout drawings.
- h) Beveled pipe shall be marked with the amount of bevel and the point of maximum length shall be marked on the beveled end.

Manufacturer's Certification

All pipe furnished shall be accompanied by the manufacturer's certificate of test showing conformity with the Specifications. Each certificate shall identify a specific lot number, quantity of pipe, and show actual test results for the lot furnished. These certificates shall be submitted to the Inspector at the time of unloading.

Inspection

All pipe furnished shall be subject to inspection on arrival at the job site by the Public Services Director. The purpose of the inspection shall be to cull and reject pipe or fittings that, independent of physical tests specified under the standard specifications designated herein, fail to conform to the requirements of these Specifications.

The Contractor shall notify the Public Services Director sufficiently in advance so that an Inspector may be on the job during the unloading of materials. A minimum notice of 24 hours is required for such unloading and inspection.

All reinforced concrete water main pipe shall be stacked on pallets off of the existing grade.

Concreted pipe of any type shall be subject to rejection on account of any of the following:

- a) Variation in any dimension exceeding the permissible variations given in the material specifications.
- b) Fractures or cracks passing through the wall.
- c) Defects that indicate imperfect proportioning, mixing, or molding.
- d) Surface defects indicating honeycombed or open texture.
- e) Variation of more than 1/16 inch per lineal foot in alignment of pipe intended to be straight.
- f) Insecure attachment of branches or spurs.
- g) Damaged ends, where in the judgment of the Public Services Director such damage would prevent making a satisfactory joint.

Rejected pipe shall be plainly marked by the Inspector and immediately removed from the site of the work by the Contractor, without cost to the City.

2B. High Density Polyethylene Smooth Interior Pipe

High density polyethylene (HDP) pipe shall be ADS N-12 pipe or Hancor Sure-Lok, or Hancor Blue Seal pipe meeting the requirements of AASHTO M294 or ASTM F2306. The pipe shall be corrugated with an integrally formed smooth interior. The maximum diameter approved shall be per the MDOT Standard Specifications for construction unless otherwise approved by the Public Services Director.

Joints

Joints for Smooth Lined Corrugated Plastic pipe shall be either bell and spigot watertight, or bell and spigot soil tight. Bells shall cover at least two full corrugations on each section of pipe. Watertight joints must be in conformance with ASTM D3212. The bell and spigot joint shall have an "O"-ring rubber gasket meeting ASTM F477 with the gasket factory installed and placed on the spigot end of the pipe. Lubricant used in making up joints shall be supplied by the pipe manufacturer and the joints shall be coupled in accordance with the manufacturer's requirements.

Field repair connections must be made using split coupling bands and geotextile fabric. The coupling band shall engage a minimum of four corrugations, two on each side of the pipe joint. The joints shall be coupled in accordance with the manufacturer's requirements. A continuous geotextile filter fabric sock shall be placed over the coupling band, extending a minimum of one foot past each end of the coupling band. The ends of this filter fabric sock shall be secured with coupling band tie straps placed in the bottom of the corrugations.

Pipe Marking

The following information shall be clearly marked on each length of pipe:

- a) Specification designation (e.g. AASHTO M294).

- b) The name or trademark of the manufacturer.
- c) Nominal size.
- d) The plant designation code.
- e) The date of manufacturer.

Manufacturer's Certification

All pipe furnished shall be accompanied by the manufacturer's certificate of test showing conformity with the Specifications. Each certificate shall identify a specific lot number, quantity of pipe, and show actual test results for the lot furnished. These certificates shall be submitted to the Inspector at the time of unloading.

Inspection

All pipe furnished shall be subject to inspection on arrival at the job site by the Public Services Director. The purpose of the inspection shall be to cull and reject pipe or fittings that, independent of physical tests specified under the standard specifications designated herein, fail to conform to the requirements of these Specifications.

The Contractor shall notify the Public Services Director sufficiently in advance so that an Inspector may on the job during the unloading of materials. A minimum notice of 24 hours is required for such unloading and inspection.

HDP pipe shall be subject to rejection on account of any of the following:

- a) Cracked pipe.
- b) Creased pipe.
- c) Unpigmented or non-uniformly pigmented pipe.

Rejected pipe shall be plainly marked by the Inspector and immediately removed from the site of the work by the Contractor, without cost to the City.

2C. Vitrified Clay Pipe and Fittings

Vitrified clay sewer pipe shall be the bell and spigot type, glazed or non-glazed, and shall be of full internal diameter from 4 through 18 inches inclusive. Clay pipe shall conform to the material and testing requirements of ASTM C 700, extra strength.

Joints

Joints for vitrified clay sewer pipe shall be compression type joints conforming to the material and testing requirements of ASTM C 425. Lubricant used in making up joints shall be supplied by the pipe manufacturer and the joints shall be coupled in accordance with the manufacturer's requirements.

Pipe Marking

The following information shall be clearly marked on each length of pipe:

- a) The pipe designation and class (e.g., C 700, ES).
- b) The name or trademark of the manufacturer.
- c) Identification of the manufacturing plant.
- d) Testing lot number or testing lab stamp.

Manufacturer's Certification

All pipe furnished shall be accompanied by the manufacturer's certificate of test showing conformity with the Specifications. Each certificate shall identify a specific lot number, quantity of pipe, and show actual test results for the lot furnished. These certificates shall be submitted to the Inspector at the time of unloading.

Inspection

All pipe furnished shall be subject to inspection on arrival at the job site by the Public Services Director. The purpose of the inspection shall be to cull and reject pipe or fittings that, independent of physical tests specified under the standard specifications designated herein, fail to conform to the requirements of these Specifications.

The Contractor shall notify the Public Services Director sufficiently in advance so that an Inspector may be on the job during the unloading of materials. A minimum notice of 24 hours is required for such unloading and inspection.

Vitrified clay pipe shall be subject to rejection on account of any of the following:

- a) Variation in any dimension exceeding the permissible variations given in the material specifications. Pipe in all cases shall be full diameter.
- b) Fractures or cracks passing through the barrel or socket.
- c) Chips or fractures on the interior of the pipe exceeding two inches in length, one inch in width, or depth more than 1/4 of the thickness of the wall.
- d) Blisters that are either broken, exceed three inches in diameter, or project more than 1/8 inch above the surrounding surface of the pipe.
- e) Variation of more than 1/16 inch per lineal foot in alignment of pipe intended to be straight.
- f) Insecure attachment of branches or spurs.

Rejected pipe shall be plainly marked by the Inspector and immediately removed from the site of the work by the Contractor, without cost to the City.

2D. Polyvinyl Chloride Pipe and Fittings

Polyvinyl chloride (PVC) pipe shall have an integral wall bell and spigot. PVC pipe shall conform to the material and testing requirements of ASTM D 3034-83. Minimum wall thickness shall be SDR 35.

Joints

Joints for PVC pipe shall be elastomeric gasketed push-on joints conforming to the requirements of ASTM D3212-81. Lubricant used in making up joints shall be supplied by the pipe manufacturer and the joints shall be coupled in accordance with the manufacturer's requirements.

Pipe Marking

The following information shall be clearly marked on each length of pipe at intervals of five feet or less:

- a) Manufacturer's name or trademark and code.
- b) Nominal pipe size.
- c) The PVC cell classification (e.g. "12454-B").
- d) The legend "Type PSM SDR-35 PVC Sewer Pipe".
- e) The designation "Specification D 3034".

The following information shall be clearly marked on each fitting:

- a) Manufacturer's name or trademark.
- b) Nominal size.
- c) The material designation "PVC".
- d) "PSM"
- e) The designation "Specificalton D 3034".

Manufacturer's Certification

All pipe furnished shall be accompanied by the manufacturer's certificate of test showing conformity with the Specifications. Each certificate shall identify a specific lot number, quantity of pipe, and show actual test results for the lot furnished. These certificates shall be submitted to the Inspector at the time of unloading.

Inspection

All pipe furnished shall be subject to inspection on arrival at the job site by the Public Services Director. The purpose of the inspection shall be to cull and reject pipe or fittings that, independent of physical tests specified under the standard specifications designated herein, fail to conform to the requirements of these Specifications.

The Contractor shall notify the Public Services Director sufficiently in advance so that an Inspector may be on the job during the unloading of materials. A minimum notice of 24 hours is required for such unloading and inspection.

Pipe shall be subject to rejection on account of any of the following:

- a) Variation in any dimension exceeding the permissible variations given in the material specifications. Pipe in all cases shall be full diameter.
- b) Fractures or cracks passing through the barrel or socket. c) Chips or fractures on the interior of the pipe exceeding two inches in length, one inch in width, or depth more than 1/4 of the thickness of the wall.
- d) Blisters that are either broken, exceed three inches in diameter, or project more than 1/8 inch above the surrounding surface of the pipe.
- e) Variation of more than 1/16 inch per lineal foot in alignment of pipe intended to be straight.

Rejected pipe shall be plainly marked by the Inspector and immediately removed from the site of the work by the Contractor, without cost to the City.

2E. Sewer Service Leads, Risers and Fittings

Sewer service leads, risers and fittings shall meet the requirements of the current City of Ann Arbor Building Code (Chapter 98 of the City Code). Allowable pipe materials are; SDR 35 polyvinyl chloride (PVC) plastic conforming to the material and testing requirements of ASTM D3034; vitrified clay pipe conforming to the material and testing requirements of ASTM C700; and cast iron pipe conforming to the material and testing requirements of ASTM A74.

Whenever adapters are required to properly connect the pipe with pipe of other material or manufacturer, the nominal I.D. of adapters shall be manufactured for that specific purpose and shall be the same size as the nominal diameter of pipe connected thereto. Adapters shall also be furnished and used as required by the manufacturer. The adaptor shall be a style "CB" gasketed sewer saddle manufactured by Romac Industries, Inc. or approved equal, or a flexible neoprene rubber boot.

Joints

Joints for SDR 35 PVC pipe shall be bell and spigot rubber o-ring gasket joints conforming to the requirements of ASTM D-3212. Lubricant supplied by the pipe manufacturer shall be used, and the joints shall be coupled in accordance with the manufacturer's requirements.

Joints for vitrified clay pipe shall be compression type joints conforming to the material and testing requirements of ASTM C425. Lubricant used in making up joints shall be supplied by the pipe manufacturer and the joints shall be coupled in accordance with the manufacturer's requirements.

Joints for cast iron pipe shall be mechanical compression joints conforming to the material and testing requirements of ASTM C564.

Pipe Marking

The following information shall be clearly marked on each length of pipe:

- a) The pipe designation and class (e.g., SDR 35, ASTM D3034).
- b) The name or trademark of the manufacturer.
- c) Identification of the manufacturing plant.
- d) Testing lot number.

Manufacturer's Certification

All pipe furnished shall be accompanied by the manufacturer's certificate of test showing conformity with the Specifications. Each certificate shall identify a specific lot number, quantity of pipe, and show actual test results for the lot furnished. These certificates shall be submitted to the Inspector at the time of unloading.

Inspection

All pipe furnished shall be subject to inspection on arrival at the job site by the Public Services Director. The purpose of the inspection shall be to cull and reject pipe or fittings that, independent of physical tests specified under the standard specifications designated herein, fail to conform to the requirements of these Specifications.

The Contractor shall notify the Public Services Director sufficiently in advance so that an Inspector may be on the job during the unloading of materials. A minimum notice of 24 hours is required for such unloading and inspection.

Pipe for sewer service leads and risers shall be subject to rejection on account of any of the following:

- a) Variation in any dimension exceeding the permissible variations given in the material specifications. Pipe in all cases shall be full diameter.
- b) Fractures or cracks passing through the barrel or socket.
- c) Chips or fractures on the interior of the pipe exceeding two inches in length, one inch in width, or depth more than 1/4 of the thickness of the wall.
- d) Blisters that are either broken, exceed three inches in diameter, or project more than 1/8 inch above the surrounding surface of the pipe.
- e) Variation of more than 1/16 inch per lineal foot in alignment of pipe intended to be straight.

Rejected pipe shall be plainly marked by the Inspector and immediately removed from the site of the work by the Contractor, without cost to the City.

2F. Cast Ductile Iron Pipe & Fittings

Cast ductile iron pipe shall be Iron Grade 60-42-10 and meet the requirements of ANSI/AWWA C151/A21.51 in all respects; with standard thickness cement mortar lining and asphaltic seal coat in accordance with ANSI/AWWA C104/A21.4; and coated outside with an asphaltic coating in accordance with ANSI/AWWA C151/A21.51. 100% of the ferrous metals used in the manufacture of cast ductile iron pipe shall be recycled from scrap and other sources. All pipe shall be Pressure Class 350 (Table 50.5 ANSI/AWWA C150/A21.50), or Thickness Class 50 (Table 50.15, ANSI/AWWA C150/A21.50). Ductile iron pipe crossing under a railroad shall be thickness Class 56.

Cast ductile iron river crossing pipe shall be Clow Corp. "F-141 River Crossing Pipe", U.S. Pipe "USIFLEX Boltless Flexible Joint Pipe" or equal approved by the Public Services Director, and shall be thicknesses Class 56 minimum. It shall have a boltless flexible joint of the ball and socket type, and be designed for, and rated at, a minimum interior working water pressure of 250 psi.

Restrained joint pipe, where called out on the Plans, shall be factory manufactured by the installation of retainer weldment and ductile iron locking segments or rings. Restrained joint pipe shall be TR-Flex restrained joint pipe manufactured by U.S. Pipe, Lok-Ring joint pipe manufactured by American Ductile Iron Pipe, or equal as approved by the Public Services Director.

Cast or ductile iron fittings shall be push-on joint, unless otherwise specified (with the exception of solid sleeves and fire hydrants which shall be mechanical joint), meeting the requirements of ANSI/AWWA C110/A21.10 for short body cast iron fittings. Fittings shall have a cement mortar lining and asphaltic seal coat in accordance with ANSI/AWWA C104/A21.4 and ANSI/AWWA C110/A21.10. The outside of all fittings shall have an asphaltic coating in accordance with ANSI/AWWA C110/A21.10.

Solid sleeves shall be long sleeves.

Pipe Wrapping

All Cast Ductile Iron Pipe & Fittings (except river, railroad and highway crossing pipe) shall be polyethylenewrapped per ANSI/AWWA C105/A21.5.

Joints

Push-on joints shall be single gasket joint meeting the requirements of ANSI/AWWA C111/A21.11.

Mechanical joints for fire hydrants and solid sleeves shall be in accordance with ANSI/AWWA C111/A21.11 and shall include the Mega lug joint restraint system manufactured by EBAA Iron Sales, Inc. Bolts for mechanical joints shall be high strength, low alloy steel bolts only, meeting the requirements of ANSI/AWWA C111/A21.11.

Cast ductile iron river crossing pipe joints shall be a push-on type ball and socket joint utilizing a first grade rubber gasket. The joint shall be capable of 15-degree full turning deflection without separation, leakage, or restriction of the pipe waterway. Joint restraint shall be provided by a boltless means which is locked against accidental disengagement of the restraining component. Pipe shall be furnished with the necessary gaskets, lubricant, and retainer locking accessories.

Joints for restrained joint pipe shall be in accordance with ANSI/AWWA C111/A21.11. Bolts and nuts for the retainer assembly shall be stainless steel.

Restrained, push-on joint pipe shall be American Pipe's "Fast-Grip" gasket system or U.S. Pipe's "Field-Lok" gasket system.

The use of retainer glands and set screws shall not be acceptable.

Lubricants used in making up joints shall be supplied by the pipe manufacturer and the joints shall be coupled in accordance with the manufacturer's requirements.

Pipe Marking

The following information shall be clearly marked and/or cast on each length of pipe:

- a) The pipe designation and class (e.g., D.I., Class 50).
- b) The name or trademark of the manufacturer.
- c) Country where cast.
- d) The year in which the pipe was produced.

The following shall be distinctly cast on each fitting:

- a) The pressure rating of the fitting.
- b) Nominal diameters of openings.
- c) The name or trademark of the manufacturer.
- d) Country where cast.
- e) The number of degrees or fraction of the circle on all bends.
- f) Ductile iron fittings shall have the letters "DI" or "Ductile" cast on them.

Manufacturer's Certification

All pipe furnished shall be accompanied by the manufacturer's certificate of test showing conformity with the Specifications. Each certificate shall identify a specific lot number, quantity of pipe, and show actual test results for the lot furnished. These certificates shall be submitted to the Inspector at the time of unloading.

All materials that will potentially be in contact with the City water supply must be certified by Underwriters Laboratory (UL) or the National Sanitation Foundation (NSF) for use in a potable water system. These materials shall include pipe coatings, pipe metals, cement linings, and joint lubricants and gaskets.

Inspection

All pipe furnished shall be subject to inspection on arrival at the job site by the Public Services Director. The purpose of the inspection shall be to cull and reject pipe or fittings that, independent of physical tests specified under the standard specifications designated herein, fail to conform to the requirements of these Specifications.

The Contractor shall notify the Public Services Director sufficiently in advance so that an Inspector may be on the job during the unloading of materials. A minimum notice of 24 hours is required for such unloading and inspection. The Contractor shall also notify the Public Services Director when the material has arrived at the site.

All ductile iron water main pipe shall be stacked on pallets off of the existing grade, with each end plugged or bagged so as to keep the pipe interior clean until final installation.

Cast ductile iron pipe and fittings shall be subject to rejection on account of any of the following:

- a) Variation in any dimension exceeding the permissible variations given in the material specifications.
- b) Any crack or defect in the cement mortar lining which, in the opinion of the Public Services Director, is non-repairable, including but not limited to loose or "hollow" lining.
- c) Any signs of physical damage or poor manufacturing which might render the material unsuitable for its intended use.
- d) Variation of more than 1/16 inch per lineal foot in alignment of pipe intended to be straight.
- e) Damaged ends, where in the judgment of the Public Services Director such damage would prevent making a satisfactory joint.
- f) Improper handling during delivery, unloading or installation.

Rejected pipe shall be plainly marked by the Inspector and immediately removed from the site of the work by the Contractor, without cost to the City.

2G. Valves

Gate valves shall be Waterous Series 300 and T300 NRS Double Disc Gate Valve, Mueller A-2380 Series, East Jordan Series A, or Kennedy AWWA 571X, NRS with two inch square operating nut, opening right. Joints shall be push-on joint meeting the requirements of ANSI/AWWA C111/A21.11. Sixteen inch and larger gate valves shall be furnished with a three inch valved by-pass, opening right. Twenty inch and larger gate valves shall be List 14 AWWA Gate Valves: Eddy - Iowa Division, James B. Clow & Sons, Inc., and shall be furnished with bronze rollers, tracks and scrapers, having enclosed bevel gearing, and shall be installed horizontally. Gearing shall consist of cut tooth cast steel gears with rolled bronze pinion shafts having a minimum mechanical advantage ratio of 2 to 1.

Butterfly valves and operators for sizes twelve inch and larger shall meet AWWA Specifications C504-74. Butterfly valves shall be Henry Pratt "Groundhog" or Mueller "Linesal III" with operator for buried service with two inch square operating nut, opening right. Joints as specified on the Plans or elsewhere herein shall be mechanical joint ANSI/AWWA C111/A21.11 or flanged joint ANSI B16.1 with 125# or 250# drilling and bolting.

Valve boxes shall be Buffalo type, Size D, screw type, 3-piece, 5-1/4 inch shaft with a #6 base for valves 8 inches or less, and a #8 base for valves of 10 or 12 inches. The word "Water" shall be cast in raised letters on the cover. Boxes shall be Tyler 6860 or equal approved in writing by the Public Services Director.

Curb boxes shall be Buffalo type, Size 95E, screw type, 2-piece, 2-½ inch shaft, extendable from 4-½ ft. to 6 ft. Boxes shall be Mueller Type H-10350, Tyler 6500, or Bibby Ste. Croix B-2000.

All valves must be certified by Underwriters Laboratory (UL) or the National Sanitation Foundation (NSF) for use in a potable water system.

2H. Fire Hydrants

Fire hydrants shall be either the East Jordan Iron Works Model 5-BR with traffic flange, or the Waterous Model TVC-5 with traffic flange. Only the East Jordan hydrant shall be used in areas of high density zoning (see **Division II, Section 5D.** of these Standards).

All fire hydrants shall have the following features: a 6 inch mechanical joint pipe connection, ANSI/AWWA C111/A21.11; two 2-1/2 inch National Standard hose connections; one 3-1/2 inch Ann Arbor Standard pumper connection, with 7-1/2 threads per inch and 4.05 in. O.D.; 1-3/8 inch pentagon operating and cap nuts (1-3/8 in. point-to-flat at top; 1-7/16 in. point-to-flat at base); open left; breakable flange construction; no barrel drain; and a painted red finish, unless separated from the distribution system by a check valve. Depth of bury (bottom of pipe to ground surface) is generally 6 feet but may vary depending on specific site conditions. The pumper nozzle must be 21 in. ± 3 in. above finished grade, and the breakable traffic flange must be between finished grade and 8 in. above finished grade.

Fire hydrant extensions for Waterous hydrants shall be Waterous Part #Fl-K562-6. Extensions for East Jordan Iron Works hydrants shall be hydrant model 5-BR extension kit.

All fire hydrants must be certified by Underwriters Laboratory (UL) or the National Sanitation Foundation (NSF) for use in a potable water system.

2I. Tapping Sleeves and Valves

Tapping sleeves and valves shall be manufactured of cast iron and designed for water service with a minimum working pressure of 150 psi. The sleeve shall be a full-bodied split sleeve design manufactured by Clow number F-5205; Muller Co. number H-615; Waterous Series 800 or East Jordan.

Tapping Sleeves for Prestressed Concrete Steel Cylinder Pipe shall be in accordance with AWWA M-9. The sleeves shall have a separate gland which permits installation of the sleeve prior to cutting of the prestress wires. The gland shall have a fusion epoxy coated (per AWWA C-213) waterway, and a broad gasket set in a retaining groove of a pressure plate gusseted to eliminate flexing. The gland shall be equipped with load bearing set screws to protect the cylinder. Grout under saddle is needed whether saddle is epoxy coated or not. Sleeves shall be furnished with grouting seals and grout horns to facilitate filling the space between the sleeve and the pipe. Tapping sleeves shall be a Price Brothers Company Tapping Sleeve for Prestressed Concrete Steel Cylinder Pipe or approved equal.

Tapping valves shall be double-disk type of the same manufacture as the sleeve, NRS with two inch square operating nut-opening right, with a mechanical joint outlet.

All tapping sleeves and valves must be certified by Underwriters Laboratory (UL) or the National Sanitation Foundation (NSF) for use in a potable water system.

2J. Casing Pipe

Steel casing pipe used for construction at railroad or State highway crossings shall comply with the following minimum requirements unless more stringent requirements are established by the railroad or State. Casing pipes at other locations shall comply with the following minimum requirements unless otherwise indicated on the Plans or in the Specifications.

Nominal Diameter
of Casing Pipe (inches)

Under 14
14, 16, and 18
20 and 22
24, 26, 28, and 30
32 and 34
36, 38, 40, 42, and 48

Minimum Wall
Thickness (inches)

0.250
0.312
0.375
0.500
0.563
0.625

Steel pipe shall be non-spiral pipe and have a minimum yield strength of 35,000 psi. All joints shall be made leakproof using full penetration, continuous welds. Welds shall be ground smooth outside and inside (except inside 22 in. diameter and less) to prevent conflict with the soil or pipe placement. Steel pipe shall meet the requirements of ASTM A 53, Type E or S, Grade B.

Pipe Marking

The following information shall be clearly marked on each length of pipe:

- a) The pipe designation and class (e.g., A 53, Type S, Grade B).
- b) The name or trademark of the manufacturer.
- c) Identification of the manufacturing plant.

Inspection

All pipe furnished shall be subject to inspection on arrival at the job site by the Public Services Director. The purpose of the inspection shall be to cull and reject pipe that, independent of physical tests specified under the standard specifications designated herein, fails to conform to the requirements of these Specifications.

Rejected pipe shall be plainly marked by the Inspector and immediately removed from the site of the work by the Contractor, without cost to the City.

2K. Corrugated Metal Pipe

Corrugated metal pipe shall be galvanized steel pipe conforming to the requirements for Type I and Type II pipe of AASHTO M36 and the requirements of MDOT Standard Specification Sec. 8.08 Class D pipe.

The pipe shall have a bituminous coating conforming to the requirements of AASHTO M 190 and the requirements of MDOT Standard Specifications Sec. 8.08.

Joints

Joints for corrugated metal pipe shall be made with coupling bands which conform to the material and testing requirements of AASHTO M36, and MDOT Standard Specifications Sec. 8.08.

Manufacturer's Certification

All pipe furnished shall be accompanied by the manufacturer's certificate of test showing conformity with the Specifications. Each certificate shall identify a specific lot number, quantity of pipe, and show actual test results for the lot furnished. These certificates shall be submitted to the Inspector at the time of unloading.

Inspection

All pipe furnished shall be subject to inspection on arrival at the job site by the Public Services Director. The purpose of the inspection shall be to cull and reject pipe or fittings that, independent of physical tests specified under the standard specifications designated herein, fail to conform to the requirements of these Specifications.

The Contractor shall notify the City Engineer sufficiently in advance so that an Inspector may be on the job during the unloading of materials. A minimum notice of 24 hours is required for such unloading and inspection.

Corrugated metal pipe shall be subject to rejection on account of loosening or separation of the bituminous coating from the galvanizing, or blistering of the galvanizing. Rejected pipe shall be plainly marked by the Inspector and immediately removed from the site of work by the Contractor without cost to the City.

2L. Pipe For Edge, Bank, and Foundation Drains

Smooth Plastic Pipe

Smooth plastic pipe shall be perforated with circular or slotted holes in accordance with the requirements of AASHTO M 175. Smooth plastic pipe shall be made of polyvinylchloride or acrylonitrile-butadiene-styrene plastic conforming to the material and testing requirements of ASTM D3033 or D3034, except that the pipe stiffness for 6 inch nominal diameter pipe shall not be less than 30 psi at 5% deflection, and the requirements for joint tightness shall not apply.

Corrugated Plastic Tubing

Corrugated plastic tubing shall be perforated in accordance with the requirements for the perforations of AASHTO M 36 or the tubing may be slotted. If slotted, the length of the individual slots shall not exceed 10 percent of the nominal inside circumference of the tubing and the width of the slots shall not exceed 1/8 inch. The slots shall be located in the valley of the corrugations and shall provide a minimum inlet area per unit length of pipe equal to 0.75 percent of a cylindrical surface having the same diameter as the nominal inside diameter of the tubing. The slots shall be cleanly cut so as not to restrict the inflow of water and uniformly spaced along the length of the pipe in rows. The perforation rows shall be evenly spaced around the circumference of the tubing.

Corrugated plastic tubing shall be made of polyethylene (PE) or polyvinylchloride (PVC) plastic and shall conform to the requirements for Heavy-Duty Tubing of ASTM F 405 except that the basic material for use in fabricating PVC tubing shall be a PVC plastic meeting the requirements as specified in ASTM D 3033.

Pipe Wrapping

All pipe for edge, bank, and foundation drains shall be wrapped with geotextile filter fabric. Geotextile filter fabric shall be of nylon, polypropylene, fiberglass, or polyester and shall be either woven, heat bonded, knitted, or of continuous fibers. The geotextile filter fabric shall completely cover and be secured to the pipe. In an unstretched condition, knitted polyester fabrics shall weigh at least 3.0 ounces per square yard and all other geotextiles shall weigh at least 3.5 ounces per square yard. The fabric shall be strong and tough and have a porosity such that the fabric will retain soil particles larger than 0.106 mm (no. 140 sieve) and shall pass aggregate particles finer than 0.025 mm. Geotextiles shall be stored and handled carefully and in accordance with the manufacturer's recommendations and shall not be exposed to heat or direct sunlight to such extent as to significantly affect their strength or toughness. Torn or punctured geotextiles may not be used.

Pipe Tagging

The following information shall be clearly tagged on each length of pipe.

- a) The pipe designation and class (e.g., ASTM D 3033).
- b) The name or trademark of the manufacturer.
- c) Identification of the manufacturing plant.

Manufacturer's Certification

All pipe furnished shall be accompanied by the manufacturer's certificate of test showing conformity with the Specifications. Each certificate shall identify a specific lot number, quantity of pipe, and show actual test results for the lot furnished. These certificates shall be submitted to the Inspector at the time of unloading.

Inspection

All pipe furnished shall be subject to inspection on arrival at the job site by the Public Services Director. The purpose of the inspection shall be to cull and reject pipe that, independent of physical tests specified

under the standard specifications designated herein, fails to conform to the requirements of these Specifications.

Rejected pipe shall be plainly marked by the Inspector and immediately removed from the site of the work by the Contractor, without cost to the City.

2M. Manholes and Drainage Structures

Storm sewer drainage structures shall be constructed of precast or cast in place reinforced concrete sections, or concrete masonry units. All sanitary sewer manholes and gate wells (water main valve manholes) shall be constructed of precast reinforced concrete sections.

Precast reinforced concrete bases, bottom sections, manhole risers, grade adjustment rings, concentric cones, eccentric cones, and flat slab tops shall conform to the requirements of ASTM C 478. Joints on precast manholes used on all sanitary sewers shall meet ASTM C 443, rubber O-ring gasket.

Precast manhole tees and radius pipe sections shall conform to requirements for reinforced concrete pipe, ASTM C 76, Class IV. Joints shall conform to adjacent pipe. Tees and radius pipe shall conform to details indicated on drawings offered by the Concrete Pipe Association of Michigan, Inc., or Engineer approved equal.

Concrete masonry units shall conform to the requirements for concrete masonry units for catchbasins and manholes, ASTM C 139.

Concrete brick shall conform to the requirements for concrete building brick, ASTM C 55, Grade N-I.

Cast iron frames and covers for manholes and drainage structures shall conform to the requirements for grey iron castings, ASTM A 48, Class No. 30. Specific, approved castings are listed in the Casting Schedule in the Standard Details.

Plastic coated manhole steps shall be injection molded of copolymer, polypropylene, encapsulating a 1/2 inch grade 60 steel reinforcing bar. Plastic-coated manhole steps shall meet the performance test described in ASTM C-478, Paragraph II, and shall have an impact resistance of 300 ft.-lbs., with only minor deflection and no cracking or breaking.

The steps shall resist pull out forces of 1500 lbs.

Manhole Connections

Sewer pipe to precast manhole connections shall be through: 1) a flexible neoprene rubber boot which shall be securely clamped into a core-drilled pipe port. Pipe ports shall be core-drilled at the point of manhole manufacture and shall be accurately located within 1/2-inch of proposed sewer centerline; or, 2) a self-adjusting mechanical pipe to manhole seal which provides a resilient flexible and infiltration-proof joint (Res-seal); or, 3) a flexible rubber wedge firmly rammed into a rubber gasket which is cast into the manhole (Press Wedge II), or equal approved in writing by the Public Services Director.

Neoprene rubber for manhole boots shall meet the requirements of ASTM C443 and shall have a minimum thickness of 3/8-inch. Pipe clamp bands shall be of corrosion-resistant steel.

2N. Cured-In-Place Pipe (CIPP)

The tube material shall meet the requirements of ASTM F1216. The dry tube shall consist of one or more layers of flexible needled felt, or an equivalent nonwoven material, which is compatible with the resin system used, and capable of carrying the resin, withstanding installation pressures and curing temperatures. The outside layer of the tube shall be plastic coated with a material that is compatible with the resin system used.

The tube shall be fabricated to a size that, when installed, will tightly fit the internal circumference of the sewer to be lined. The tube shall extend for the full sewer run, from manhole to manhole.

A general purpose, unsaturated, styrene-based, thermoset resin and catalyst system, or an epoxy resin and hardener which is compatible with the inversion process, shall be used. The resin must be able to cure in the presence of water, and the initiation temperature for cure shall be less than 180^o F.

The CIPP shall have a minimum flexural strength of 4,500 psi, and a modulus of elasticity of 500,000 psi.

The Contractor shall furnish to the Public Services Director written certification that the CIPP conforms to the requirements of these Standards.

2. SEWER CONSTRUCTION

2A. Drop Connections

Where shown on the Plans or directed by the Public Services Director where a branch sanitary sewer is brought into a manhole more than 24 inches above the invert elevation in the manhole, a drop connection shall be provided in accordance with the Standard Detail Drawings.

2B. Concrete Cradle and Encasement for Sewers

Where shown on the Plans, pipe shall be installed with a concrete cradle or encasement of Class X concrete as shown in the Standard Detail Drawings. Cradle or encasement shall be for the full run of the sewer, from manhole to manhole. Each pipe shall rest on a bed of Class X concrete, shaped to fit the bottom of the pipe. After setting the pipe, the space between the outside of the pipe and the undisturbed trench bank shall be completely filled with Class X concrete. Class X concrete used for this purpose shall have a slump not exceeding two inches.

2C. Cutting Pipe

Sewer pipe may not be cut when the cut end will be used in making a pipe joint. Cut ends may only occur in situations such as a manhole or headwall. Cut ends shall be carefully and neatly made with a saw, pipe cutter, or other approved means.

2D. Service Lead Connections and Fittings

Service lead connections shall be provided at such points as shown on the Plans or as directed by the Public Services Director. These shall be of the size and character indicated on the Plans. House service leads shall be a minimum of four inches in diameter. Service lead connections shall be formed by the use of standard wye or tee fittings of the same material called for use on the main sewer being constructed. Wye fittings are not to be used for connections with riser pipes. All wye and tee fittings shall be encased in Class "X"

concrete. All leads which will not have pipe connected to them immediately shall be closed by the use of a watertight plug manufactured specifically for that purpose and approved by the Public Services Director.

Branch connections to existing sewers shall be made by the Utilities Department. Scheduling of these taps shall be made with Utilities by the Contractor. All applicable tap fees must be paid in full prior to this scheduling. (See **Division I, Sections 1D. Permits and 1E. Inspections and City Departments Involvement**)

Connections for sewer service leads connecting to existing sewer mains or sewer mains of a different pipe material shall be at a core-drilled tap into the sewer pipe. The joint at this tapped connection shall be made using a Romac Industries, Inc. style "CB" gasketed sewer saddle or approved equal, or a flexible neoprene rubber boot securely clamped into the core-drilled tap. The end of the sewer service lead pipe shall be flush with the inside wall of the concrete sewer main.

In order to properly mark the location of every branch connection, the Contractor shall take accurate measurement of all branches before the sewer trench is backfilled. The measurements shall indicate the distance from each branch to the center of the nearest downstream and upstream manhole. When leads are run to the property line, they shall be perpendicular to the main sewer. The Contractor shall also report the location of the point where the lead ends, relative to the nearest property corners. The Contractor shall furnish the Public Services Director with a copy of these measurements immediately upon the completion of each section of sewer.

In addition to measurements, the Contractor shall furnish and place a minimum two inch by two inch cedar or treated lumber marking stick at the end of each lateral extension or service lead connection of such length that it will reach from the end of the pipe vertically up to a minimum of two inches above the proposed finished grade. Each marker shall be set in a vertical position. Markers will not be required on the main run of sewer at fittings. The visible end of each marker stake must be plainly painted red if sanitary or white if storm.

The service lead pipes shall also be marked for identification in order to prevent cross connection of the leads: sanitary leads - red, storm leads - white. The last two lengths of pipe shall be marked by wrapping the appropriate colored tape twice around the barrel. This wrapping shall take place at any point in the lead whenever the lead is terminated. This taping (wrapping) must be performed under the inspection of the Inspector.

2E. Riser Pipe for Service Leads

Where shown on the Plans or directed by the Public Services Director, the Contractor shall furnish and place risers extending from the branch opening of the sewer up to within eight to ten feet of the proposed finished grade. These pipes shall be laid with joints as specified above. These risers shall be laid up and held in place as required by the Standard Details. The connection fitting when a riser is to be used shall be a tee fitting. Openings in the top of the riser pipe shall be closed, marked, and staked as specified above.

2F. Abandonment of Sewer

The Contractor shall abandon sewers where shown on the Plans. This shall include either removing a minimum of five feet of the main at each manhole and placing flow fill grouting the full length and volume of the abandoned sewer, or removing the entire run of sewer. Abandonment shall also include breaking down any manholes (remove manhole ring and cover and the top 4' of manhole structure, breaking of the

manhole base, and backfill as specified in **Division IV, Section 1G. Backfilling** of these Standards) in the abandoned line, salvaging any removed manhole ring and cover and returning them to the Utilities Department, and bulkheading the abandoned pipe in manholes to remain with brick and mortar.

2G. Cured-In-Place Pipe (CIPP) for Existing Sewers

The Contractor shall remove all debris from the existing sewer line by jetting and vactoring of the line. The Contractor shall also, when required by the Public Services Director, provide bypass pumping of the flow of sewage around the section or sections of pipe designated for lining. The bypass shall be made by plugging the line at an existing upstream manhole and pumping the flow into a downstream manhole. The pump and bypass lines shall be of adequate size and capacity to handle the flow.

The existing sewer designated for lining shall be television inspected by the Contractor to determine the location of any conditions which may prevent proper installation of the CIPP tubes, and these locations shall be noted so that these conditions can be corrected. A video tape and log of these locations shall be submitted to the Public Services Director for review. The Contractor shall clear the line of obstructions such as solids and roots which will prevent the insertion of the CIPP tube. If the television inspection reveals an obstruction that will prevent the insertion of the CIPP but which cannot be removed by conventional sewer cleaning equipment, such as a protruding service connection, dropped joint, or a collapse, the Contractor shall excavate the sewer line and remove or repair the obstruction. Such excavation shall be approved in writing by the Public Services Director prior to the commencement of the work and in a City Project shall be paid for as a separate pay item.

The Contractor shall designate a location, approved by the Public Services Director, where the CIPP tube shall be vacuum impregnated prior to installation, in order to allow the Public Services Director to inspect the materials and "wet-out" procedure. A resin and catalyst system compatible with requirements of this method shall be used. The quantity of resin used shall be sufficient to fill the volume of air voids in the tube with additional allowances for polymerization shrinkage and the loss of resin through cracks and irregularities in the original pipe wall. A roller system shall be used to uniformly distribute the resin throughout the tube. The CIPP tube dimensions and quantities of the liquid thermosetting materials shall be per INA manufacturer's standards to provide the wall thickness specified.

The impregnated tube shall be inserted into a vertical inversion standpipe with the impermeable plastic membrane side out. At the lower end of the inversion standpipe, the resin impregnated tube shall be turned inside out and attached to the standpipe so that a leak proof seal is created. Water shall be added to the standpipe, and will be adjusted so as to be of a sufficient height to cause the tube to invert to the termination point, hold the tube tight to the pipe wall, produce dimples at service connections and flared ends at the manholes. The use of a lubricant is recommended, and if used it shall meet the INA manufacturer's standards. After the inversion is completed, the Contractor shall cure the CIPP by using a suitable heat source and water recirculation equipment to uniformly raise the water temperature above the temperature required to effect a cure of the resin. This temperature shall be determined by the resin/catalyst system employed. The INA manufacturer's standards shall be closely followed during the elevated curing temperature so as not to over stress the felt fiber and cause damage or failure prior to cure. The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing water supply. Another such gauge shall be placed at the remote manhole to determine the temperatures at that location during cure. Initial cure shall be deemed to be completed when inspection of the exposed portions of the pipe material appear to be hard and sound. The cure period shall continue for a duration recommended by

the resin manufacturer, during which time the recirculation of the water at the prescribed temperature shall continue.

The Contractor shall cool the CIPP to a temperature below 100° F before relieving the static head in the inversion standpipe. Cool-down may be accomplished by the introduction of cool water into the inversion standpipe to replace water being drained from a small hole made in the downstream end. Care shall be taken in the release of the static head so that a vacuum will not be developed that could damage the newly installed CIPP.

The finished CIPP shall be continuous over the entire length of an inversion run between two manholes and be free from visual defects such as foreign inclusions, dry spots, pinholes and delamination. The Contractor shall conduct a hydrostatic test on the CIPP to determine its water tightness. The test shall be conducted by using the existing hydrostatic head of 4 to 6 psi provided by the inversion standpipe. The test time shall be five minutes, during which time no makeup water shall be added to the standpipe. If at the end of the test period no water loss is observed in the standpipe, the water tightness of the CIPP will be considered satisfactory.

If due to broken or misaligned pipe at the manhole wall, the CIPP fails to make a tight seal, the Contractor shall apply a seal at that point with a material compatible with the CIPP material.

After the CIPP has cured, the Contractor shall reopen/restore all existing active service connections and branch connections. This shall be done from the interior of the pipeline by means of a remotely controlled cutting device, monitored by a close circuit television camera, re-establishing these service connections to their operational capacity.

Following the completion of the work, the Contractor shall provide to the Public Services Director a video tape and report log showing the lined sewer, including the restored connections. This television inspection shall meet the requirements of **Division IV, Section 2H. Sewer Testing** of these Standards.

2H. Sewer Testing

All sanitary sewers, including leads, 36 inches and smaller shall be air tested by the Contractor. All sanitary sewers greater than 36 inches shall be infiltration or exfiltration tested by the Contractor. The Public Services Director will decide whether infiltration or exfiltration testing is performed based upon ground water conditions. All sewers, both sanitary and storm, except 4 inch and 6 inch leads, shall be television inspected by the Contractor. All PVC sanitary sewer mains and all high density polyethylene (HDP) storm sewers shall be mandrel tested. All sewer must meet each test, in order (mandrel testing, air or infiltration/exfiltration, television inspection), before the next test is performed. The Contractor shall furnish all labor, equipment and materials necessary for testing. Only after all tests have been successfully completed, and acknowledged by the Public Services Director in writing, may the sewer be placed in service.

Mandrel Testing

All PVC sanitary sewer mains and HDP storm sewers shall be mandrel tested for deflection by the Contractor. For HDP storm sewer mains, the Public Services Director will select at least 50 percent of the installed length of each size of CPE to be tested for deformation. The mandrel shall be a commercially produced, nine fin mandrel, with the pipe diameter, percent deflection and applicable ASTM or AASHTO standard stamped on the fins. Conduct the mandrel testing between 5 and 10 working days before pavement surfacing or completion of final grade, unless otherwise approved by the Public Services Director. The

mandrel shall be pulled from structure to structure. Any portion of the pipe through which the mandrel passes freely shall be deemed to have passed the mandrel test. Sections of pipe through which the mandrel does not pass freely shall be exposed and examined. Based on this examination either the pipe zone bedding and backfill shall be improved or the pipe replaced. The pipe shall then be retested before approval is granted. An extension of contract time will not be granted for any time spent in performing repairs to the storm sewer or its appurtenances due to fulfilling these requirements.

The mandrel is to be constructed in accordance with the following table:

Pipe I.D.	HDPE	SDR 35 PVC
	Mandrel O.D.	Mandrel O.D.
8"	7.54"	7.28"
10"	9.41"	9.08"
12"	11.22"	10.79"
15"	14.04"	13.20"
18"	16.84"	N/A
24"	22.45"	N/A
30"	28.07"	N/A
36"	33.68"	N/A

Air Test

The air test can be dangerous. Lack of understanding, carelessness, or an improperly prepared line must be avoided. It is extremely important that the plugs be installed in such a way as to prevent blowouts. Sudden expulsion of a poorly installed or partially deflated plug can cause serious injury or damage. As a safety precaution, pressurizing equipment must include a relief valve set at not more than 10 psig. No one will be allowed in the manholes during testing. In areas where ground water is known to exist and the sewer is to be air tested, the Contractor shall install a 1/2-inch diameter by approximately 10 inch long pipe nipple, through the manhole wall above one of the sewer lines entering the manhole. The pipe nipple shall be capped on the inside of the manhole at the time the sewer line is installed. Immediately prior to the performance of the air test, the ground water level shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the pipe nipple. The tube shall be held vertically and a measurement of the height in feet of water above pipe centerline shall be taken after the water stops rising in this plastic tube. The height in feet shall be divided by 2.31 to establish the pressure (in psig) that will be considered to be the average ground water back pressure.

The normal sequence and time requirements for air testing are:

1. After a manhole-to-manhole section of line has been backfilled and cleaned, it shall be plugged at each manhole with pneumatic plugs. The design of the pneumatic plugs shall be such that they will hold against the line test pressure without requiring external blocking or bracing. There shall be three hose connections to the pneumatic plug. One hose shall be used only for inflation of the pneumatic plug. The second hose shall be used for continuously reading the air pressure rise in the sealed line. The third hose shall be used only for introducing low pressure air into the sealed line.
2. Low pressure air shall be introduced into the sealed line until the internal air pressure reaches 4.0 psig greater than the average back pressure of any ground water pressure that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize. After the stabilization period, the pressurization hose shall be disconnected to prevent air from entering or escaping from the line.

There shall be a pressure gauge for reading the internal pressure of the line being tested. The gauge shall be capable of showing pressure as low as 0 psig up to no greater than 20 psig. In the 0-10 psig range the gauge shall be both calibrated and accurate to one-tenth of one pound. The 0-10 psig portion of the gauge dial shall cover at least one-half of the complete dial range. This gauge shall have a tee fitting to allow simultaneous pressure reading by a City gauge.

3. The time requirement for the pressure to decrease from 3.5 to 2.5 psig (greater than the average back pressure of any ground water that may be over the pipe) shall not be less than the time given in the following table:

VCP & RCP SEWERS		PVC & DIP SEWERS	
Pipe Size	Minimum Holding Time Seconds/100 ft. Pipe	Holding Time (Seconds)	Minimum Holding Time (Minutes:Seconds)
4-6	18	0.380xLength	3:46
6-8	42	0.854xL	5:40
8-10	72	1.520xL	7:34
10-12	90	2.374xL	9:26
12-15	108	3.418xL	11:20
15-18	126	5.342xL	14:10
18-21	144	7.692xL	17:00
21-24	180	10.470xL	19:50
24-30	216	13.647xL	22:40
30-36	288	21.366xL	28:20
36-	360	30.768xL	34:00

Infiltration Test

The Contractor shall place temporary weirs for testing purposes in such manholes as necessary to measure the amount of infiltration. Test sections shall be no longer than 1,200 feet.

The allowable amount of infiltration shall not be more than 200 gallons per inch of pipe diameter per mile of sewer per 24 hours, including manholes. The Contractor shall repair all visible leaks regardless of the results of the infiltration test.

If the allowable limit of infiltration is exceeded on any test section, the Contractor shall reconstruct or repair the defective portion of the sewer, and re-test.

Exfiltration Test

The standpipe method will be used from manhole to manhole for the length of pipe to be tested. A hydrostatic head of 10 ft. to the sewer's average centerline elevation will be required, with adjustments for external submergence due to water in the trench. The Public Services Director will establish time durations and procedures for each test. The maximum allowable exfiltration rate will be 200 gallons per inch of pipe diameter per mile of sewer per 24 hours including manholes. Upon completion of this test on a sanitary sewer, the Contractor shall pump all water out of the downstream manhole to a storm sewer.

Television Inspection

A preliminary television inspection must be approved prior to the preliminary acceptance of the sewers, and prior to any building connections being made. A final television inspection will be performed by the Utilities Department within a year of the completion of sewer construction and after the completion of all paving and/or site work. This final television inspection must be approved prior to final release of the Contractor's one-year guarantee for sewer construction. The Public Services Director shall be given 24 hours notice so that an Inspector may witness the preliminary television inspection. All sewer lines are to be thoroughly cleaned prior to television inspection, by jetting of the lines or other approved methods. Television inspection shall consist of wetting the invert of the section by pouring clean water in the upstream manhole until it appears in the downstream manhole, and then, after the water has stopped flowing, passing a television camera through the section. The camera shall be connected to a monitor and video tape recorder. The tape shall indicate the date, the section tested, and the actual distance from the beginning manhole to each tee or wye, and each visible defect. The tape shall be furnished to the Public Services Director for further review.

The television inspection will be deemed satisfactory if no visible defects, including, but not limited to, dips or low spots, high spots, errors in horizontal or vertical alignment, joint offsets, leaks, cracks, or debris, are present.

2I. Sewer Repairs

If a sewer repair is required as a result of damage during construction operations, air test failure, or television inspection failure, the Contractor shall expose the sewer pipe and perform the required correction(s), as specified herein and as directed by the Public Services Director.

If the repair is required due to the pipe being out of alignment or off grade, the pipe shall be adjusted so as to be placed in proper alignment and grade. Dense-graded aggregate material shall be carefully placed under the haunches of the realigned pipe and compacted by the use of a tee-bar. From the haunches of the pipe, backfilling shall be performed in accordance with **Section 1G. Backfilling**.

If the pipe cannot be satisfactorily realigned or an open joint reset; or if the pipe is cracked, broken, or permanently deflected, the affected pipe shall be removed and replaced with the same pipe material. The pipe to be removed is to be sawed on each side of the damaged section in a neat and workmanlike manner without damage to the adjacent pipe. The replacement pipe section shall fit flush to the remaining pipe at each end. These sawed joints shall be coupled using a Fernco flexible coupling and stainless steel shear ring. These joints shall be encased to the pipe centerline with Class X concrete one foot on either side of the flexible coupling. The remaining pipe backfill shall be performed in accordance with **Section 1G.**

Backfilling