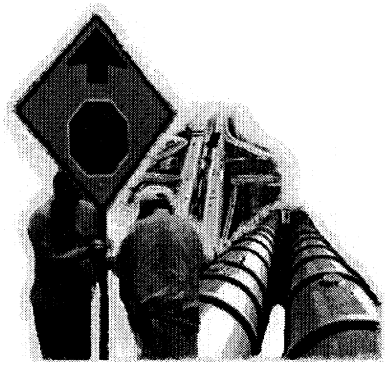
STANDARD DETAILS AND SPECIFICATIONS



Chandler • Arizona

January 2007

CITY OF CHANDLER

STANDARD SPECIFICATIONS

JANUARY 2007 EDITION

TABLE OF CONTENTS

SPECIFICATION NO. 1: DUCTILE IRON PIPE - SANITARY SEWER LINE 3

1. Lining System No. 1 3
   - A. Materials 3
   - B. Application 3
   - C. Lining Thickness 4
   - D. Production Date Marking 5
   - E. Testing 5
   - F. Damage Repair 5

2. Lining System No. 2 5
   - A. Material 5
   - B. Application 5
   - C. Lining Thickness 6
   - D. Testing 6

SPECIFICATION NO. 2: SEWER MANHOLE 7

1. Sewer Manhole 7
2. Trunk Sewer Manhole 7
3. Pesticide Coating 7
4. Testing 7

SPECIFICATION NO. 3: STREET CUT BACKFILL AND PAVEMENT REPLACEMENT 8

SPECIFICATION NO. 4: UTILITY TRENCHING - BRACING, SHORING, AND SHEETING 10

SPECIFICATION NO. 5: BORE STANDARDS 11

SPECIFICATION NO. 6: SUBGRADE COMPACTION - CONCRETE 12

SPECIFICATION NO. 7: FIRE HYDRANT LOCK 13

SPECIFICATION NO. 8: FIBER OPTIC CABLE 14

1. Cable Installation 14
2. Cable Locating 14

SPECIFICATION NO. 9: RECLAIMED WATER LINE CONSTRUCTION 15

SPECIFICATION NO.10: WATER PIPE AND FITTINGS - 4" THROUGH 16" DIAMETER 16

1. General 16
2. Workmanship 16
3. Material 16
4. Applied Load Calculations 17
5. Bedding 17
6. Fittings 18
7. Storage 18
8. Thrust Blocks 18
9. Modification to MAG Specifications 18

SPECIFICATION NO. 11: UNDERGROUND FACILITIES INSTALLED IN ANY REAL PROPERTY OUTSIDE THE CITY'S RIGHT-OF-WAY 23

SPECIFICATION NO. 12: ROADWAY STRIPING OBLITERATION 24

APPENDIX A: PROCEDURE P-222 25

SPECIFICATION NO. 1:

DUCTILE IRON PIPE - SANITARY SEWER LINE

All ductile iron pipe used for sanitary sewer line construction shall be minimum class 50 conforming to MAG Specification Section 750.

All ductile iron pipe shall be fully lined with either of the following lining systems.

1. LINING SYSTEM NO. 1

A. MATERIALS

The material shall be a catalyzed coal tar epoxy supplied by a reputable manufacturer having a proven history in water and waste service.

All materials shall be delivered to the application plant in the original unopened containers. Handling and storage shall be in accordance with manufacturer's recommendations and adequate to prevent damage or deterioration.

The material supplier shall supply test results and certification that the delivered materials meet the manufacturer's specifications.

Any material found to be non-conforming, damaged or deteriorated shall be immediately removed from the application plant.

The manufacturer's recommendations and specifications for this material shall be furnished to the City Engineer by the contractor.

B. APPLICATION

All interior barrel and joint surfaces which will be exposed to the sewer liquids and gases shall be prepared for lining so as to remove all loose foreign materials which would adversely affect the bond of the compound to the pipe surface. Since some oxides present after the manufacture of the ductile iron pipe are tightly adhering to the surface and thus become an integral part of the surface, the intent of this specification is that these tightly adhering oxides be left on the surface and only loose oxides be sand blasted away. Specifically, surface preparation shall consist of sand blasting to the extent that the entire surface is struck by the blast media. All prepared surfaces shall receive at least one coat of the specified protective compound prior to any deterioration of the prepared surface.

The lining compound shall be applied by a competent firm with a demonstrated ability of lining ductile iron. The workmen employed by the applicator shall be experienced and competent in the application of pipe lining and shall have been trained in the application and inspection of the lining compound.

All application equipment, including a special high-speed centrifugal airless device, shall be as recommended by the supplier of the lining compound. Suitable spray equipment or brushes shall be utilized to coat the joint surfaces and the exterior of the pipe. All equipment used shall be maintained in good working condition. Materials and brushes shall be delivered to the job site for field application of lining sections, which may be damaged during installation.

The pipe surface areas to be lined shall be blown off with air to remove all abrasives, dust or other contaminants. Any grease or oil shall be removed by solvent cleaning. The lining shall not be applied under adverse atmospheric conditions that would cause loss of integrity of the applied coating, and in no event when the ambient temperature is less than 40 degrees F.

C. LINING THICKNESS

The lining compound shall be thoroughly mixed in accordance with the manufacturer's instructions. After blasting and cleaning, the lining compound shall be applied to all barrel surface areas, which will be exposed to sewer liquids and gases. The lining compound shall be applied to the barrel of the pipe utilizing a suitable application device so as to obtain a continuous and relatively uniform and smooth integral lining in two or more coats. The first coat shall consist of (20 mils wet) 16 mils minimum dry film thickness and the finish coat(s) shall be applied to yield a total minimum dry film thickness of 40 mils for the complete system. The material supplier's re-coat instructions shall be strictly followed. After coating the barrel surfaces, special care shall be given to assure that all joint surfaces exposed to sewer liquids and gases are given a prime and finish coat resulting in a minimum dry film thickness of 30 mils. Because of the extremely rough profile of ductile iron pipe and to insure adequate protection, the amount of material required to achieve the desired film thickness shall be calculated and that amount shall be applied to the surface. When measured with a properly calibrated magnetic film thickness gauge, the cured coating shall not read less than 36 mils for the barrel and joint surfaces.

D. **PRODUCTION DATE MARKING**

Each day's production shall be marked with the date that the lining system is completed and inspected using a suitable, permanent marker.

E. **TESTING**

Holiday detection on the cured coating shall be performed using a low voltage, wet sponge detector similar to Tinker and Rasor Model M-1 for each pipe section and fitting.

F. **DAMAGE REPAIR**

All damaged areas, holidays and insufficient milling shall be repaired in accordance with the manufacturer's recommendation so that the repaired area is equal to the undamaged areas in all respects.

Equipment used to handle and transport the lined pipe shall be suitably designed and operated so as to not damage the coating. Should damage occur, the damaged areas shall be repaired so that the repaired area is equal to the undamaged areas in all respects.

Lined surfaces of the pipe shall be permitted as long a drying time as practical, but in any event until the finished coating has dried at least five days at 70 degrees F. All phases of the lining process and repair procedure shall conform to the manufacturer's recommendations.

2. **LINING SYSTEM NO. 2**

A. **MATERIALS**

The lining material for pipe and fittings shall be polyethylene complying with ANSI/ASTM D1248, compounded with an inert filler and with sufficient carbon black to resist ultraviolet rays during above ground storage of the pipe and fittings. Prior to preheating, the high temperature oxide film shall be removed by sandblasting through proper preparation of pipe interior surfaces. Fittings shall be preheated to a temperature adequate to provide uniform fusing of the polyethylene powders and proper bonding to the pipe and fittings.

B. **APPLICATION**

Polyethylene linings shall cover the inner surface of the pipe or fitting from the plain or beveled end to the rear of the gasket socket.

C. LINING THICKNESS

Lining in pipe and in fittings shall be 40 mils nominal thickness. Minimum lining thickness shall be 30 mils, except for areas not to exceed 12 inches in any direction, minimum thickness shall be 25 mils. At ends of pipe and fittings, lining thickness may taper for a distance of 4 inches to a minimum of 10 mils thickness.

D. TESTING

The lining at the ends shall be hermetically sealed and every pipe and fitting shall be subjected to and pass a 400 volt wet sponge, or equivalent, spark test.

For either lining system, the pipe joints shall be caulked utilizing a single component, polyurethane base sealant, "Grove International, Inc. Mono-caulk 100", or approved equal.

The pipe shall be coated by encasement, in a polyethylene protective wrapping in conformance with MAG Specification Section 610.5.

A sealant material that can be brush applied in the field shall be provided and applied in the field for lining damage caused during pipe installation.

Measurement will be made horizontally from centerline to centerline of manholes and/or fittings for the various sizes of pipe called out in the plans and in the bidding schedule.

On City of Chandler projects only, the payment for the various sizes of ductile iron sewer pipe will be made at the unit price bid per linear foot. This price shall be full compensation for furnishing and installing new pipe and fittings complete in place, as specified, including all excavation, backfilling, bedding, compacting, sheeting and bracing, testing, and all incidental work not specifically covered in other pay items.

SPECIFICATION NO. 2:

SEWER MANHOLE

1. **Sewer Manhole:** Precast concrete sewer manholes which are constructed as a separate project prior to surface improvements shall be required to have a minimum of 12 inches and a maximum of 24 inches of reinforced concrete adjusting rings. Manholes constructed in conjunction with, or after roadway paving improvements shall be constructed in accordance with MAG Standard Detail 420.

2. **Trunk Sewer Manhole:** Manholes located in major or minor arterial streets or serving 18 inches in diameter and larger pipe shall have installed 360 degree, white T-lock PVC lining in conformance with MAG Standard Specification 741 and installed per manufacturer's specifications using type P-1 joints.

3. **Pesticide Coating:** Manholes shall be painted with a latex pesticide paint such as Insecta Insecticide Coating, or approved equal. Application rates shall be in accordance with the manufacturer's recommendations. Application shall be in compliance with E.P.A. recommendations and applied starting from the top of the bench to eight feet above the bench.

4. **Testing:** Testing of PVC lining materials shall be accomplished in accordance with MAG Standard Specification 741.

SPECIFICATION NO. 3:

STREET CUT BACKFILL AND PAVEMENT REPLACEMENT

1. All street cuts require a separate application and approval by the City Engineer/designee. Street cuts will generally not be approved unless: (a) the street is scheduled for near term replacement, or (b) there is no feasible alternative to cutting the street.

2. Trenches and cuts shall be backfilled, as approved by the City Engineer, in accordance with the requirements as shown in Detail No. C-110 of these City of Chandler Standard Details and Specifications.

3. Excavated material shall be immediately removed from the site. Backfilling shall begin immediately following completion of utility work. Immediately after backfilling is completed, steel plates shall be placed over the trench that are secured to prevent movement and for roadways with City posted speeds of 35 mph or greater, recessed flush with the roadway surface and for roadways with City posted speeds less than 35 mph, gradually ramped from plate edges with EPA approved material and the street opened to traffic. A permanent asphalt patch, which conforms to MAG Specifications and City of Chandler Standard Details, shall be placed within two working days of completion of backfill.

4. The final pavement replacement shall be placed flush with the existing pavement edges. The grade from one end of the trench to the other shall be smooth and straight with no more than one quarter inch plus or minus deviation (but not both), in all directions within and 2 foot minimum beyond the edge of the pavement replacement as measured with a 10 foot straightedge.

5. No street cut shall be made without a Street Cut Permit. A permit to work in the right-of-way is not authorization to cut a street unless the approval to cut the street is specified on the permit. Street cuts made without approval are subject to be overlaid with asphalt to a length and width specified by the City Engineer at the contractor's expense, in addition to penalty charges.

6. Permission to excavate in new streets will not be granted for two years after completion of street construction, reconstruction or renovation (major rehabilitation). Utilities shall determine alternate methods of making necessary repairs to avoid excavating in new streets. Exceptions to the above are as follows:

   A. Emergency which endangers life or property.
   B. Interruption of essential utility service.
   C. Work that is mandated by city, county, state or federal legislation.
   D. Service for buildings where no other feasible means of providing service exists.

   In addition to the payment of the Pavement Restoration Fee, a condition of any such street cut permit for cutting the pavement of a street within one year of construction,

reconstruction or renovation, shall be that the permittee renovate such street by mill and overlay/ inlay, for a minimum of the full width of all lanes impacted by the cut(s) (outside lane includes to the curb) and for arterial streets, extending a minimum length of fifty (50) feet in both directions from the area of the cut(s) and for collector streets extending a minimum length of twenty five (25) feet in both directions from the area of the cut(s), all as more specifically directed by the City Engineer/designee. Provided, however, for pavement cuts smaller than two square feet, the requirement to reconstruct or renovate the street by mill and overlay/inlay shall not apply.

7. These requirements do not preclude emergency street cuts by utility companies to restore service or eliminate hazardous conditions. In such cases, immediate notification, in writing, will be provided to Off-site Inspection (782-3320) during working hours, or Police Dispatch (782-4132) for work after normal working hours.

8. For an exemption from the pavement restoration fees or reconstruction requirements, a single pothole/cut shall be spaced no less than the following requirements, and as shown in Detail No. C-111.

   A. Collector Streets

      1. Neither fees nor reconstruction will be required for one pothole of less than two square feet per traffic lane and/or turn lane at any one location. Potholes shall be spaced greater than 12.0 feet from the edge-of-pothole to the edge-of-pothole as measured perpendicular to the roadway. Any one location is defined as 5.0 feet either side of the centerline of a utility in the roadway.

      2. Neither fees nor reconstruction will be required for multiple potholes of less than two square feet in one lane or adjacent lane of the roadway that are spaced greater than 25.0 feet from the edge-of-pothole to the edge-of-pothole as measured parallel to the roadway.

   B. Arterial Streets

      1. Neither fees nor reconstruction will be required for one pothole of less than two square feet per traffic lane and/or turn lane at any one location. Potholes shall be spaced greater than 12.0 feet from the edge-of-pothole to the edge-of-pothole as measured perpendicular to the roadway. Any one location is defined as 5.0 feet either side of the centerline of a utility in the roadway.

2. Neither fees nor reconstruction will be required for multiple potholes of less than two square feet in one lane or adjacent lane of the roadway that are spaced greater than 50.0 feet from the edge-of-pothole to the edge-of-pothole as measured parallel to the roadway.

For roadways with a flush median, the flush median shall be considered a traffic lane or turn lane for the determination of pavement restoration fees. For roadways with a raised median, each side of the median can be considered separately for the determination of fees. Potholes should not be located in the wheel path of any traffic lane unless approved in writing by the City inspector.

For potholes that are spaced closer than as specified above, the pavement reconstruction, or the pavement restoration fee and mill and overlay requirements as established by the City Code will apply. The area of the pavement cut will be the sum of the area of all the potholes at any crossing location or along any utility line. The area to be milled and overlaid will be all lanes that are potholed, by 50' on arterials and 25' on collectors beyond the outside edges of all potholes at any crossing locations or along any utility line.

SPECIFICATION NO. 4:

UTILITY TRENCHING - BRACING, SHORING, AND SHEETING

When vertical side walls are to be excavated and trench boxes are not used, the contractor shall do such trench bracing, sheathing, or shoring necessary to perform and protect the excavation as required for safety and conformance to governing laws. Shoring, sheeting, or other protective procedures reviewed by the Engineer or his designee for conformance to standards shall be required when the trench depth exceeds five feet. The contractor shall provide a shoring and bracing plan designed by his engineer for review for adherence to OSHA requirements. Spacing of shoring braces shall not exceed ten feet center to center. The bracing, sheathing, or shoring shall not be removed in one operation, but shall be done in successive stages as determined by the Engineer to prevent overloading the pipe during backfilling operations.

On City of Chandler projects only, the cost to brace, sheath, or shore, and removal of same, shall be included in the unit bid price per foot of the pipe.

SPECIFICATION NO. 5:

BORE STANDARDS

Only approved slurry boring methods shall be allowed. Water jetting shall not be substituted for slurry boring. All pneumatic boring shall be at a minimum depth of 36 inches below pavement surface.

Uncased guided bore holes shall be at a depth below finish grade no less than four times the diameter of the hole. Uncased guided bore holes shall be limited to a maximum of 12 inches. Bore holes in excess of 12 inches in diameter shall be cased, unless otherwise approved by the Engineer. Contractor shall stipulate the size of bore on the permit application.

Over drilling or final reaming of uncased guided bores should be limited to no more than one inch over the maximum cross section of the conduit bank, casing, or pipe. Annular spaces exceeding this requirement shall be pressure grouted.

Guided bore methods shall minimize over-reaming or over-drilling of holes. Fluids shall not cause scour of the bore hole beyond the previously noted tolerance. Controlled fluid boring is preferred and should utilize fluids to remove cuttings, stabilize and lubricate bore holes, soften soils for advancing bores, provide directional control of guided bores, and for cooling of drilling equipment. Uncontrolled jetting, where the primary purpose is to use fluid pressure to erode soil for creation of the final bore hole diameter, is prohibited. Methods which vary from these requirements shall require demonstration and shall have a history of successful use prior to acceptance. Any method utilized shall not disturb the soils outside the final bore hole diameter.

Unless site specific soil information is available indicating otherwise, caving of soils around bore holes should be assumed. Pipe, case, or conduit banks should be advanced during final reaming.

Guided bores through unstable granular soils and granular utility backfill should be stabilized with a pressurized bentonite slurry drilling fluid having a consistency of at least one pound of bentonite to five gallons of water, or an approved equal. The flow rate and applied pressure shall be monitored. A sudden loss of pressure indicates that slurry may be intruding excessively into the backfill. Cased bores may be used in lieu of stabilization.

Equipment operators shall observe the bore hole and monitor cuttings for excessive soil removal. When evidence of excessive voids are found, bore holes shall be pressure grouted after placement of pipe, casing, or conduit banks.

SPECIFICATION NO. 6:

SUBGRADE COMPACTION - CONCRETE

Compaction of subgrade soils under concrete such as sidewalks, curbs, gutters, valley gutters and aprons shall be within the range of 80 to 90 percent of standard proctor density.

The City Engineer may accept a waiver of this requirement if it can be shown through proper engineering testing, including, but not limited to, sieve analysis, plasticity index, soil type, and swell potential of the soil in question, that it is unnecessary. The testing and Waiver Request must be made under the direction, seal and signature of a Registered Professional Engineer licensed by the State of Arizona who has established proficiency in Geotechnical Engineering. The Geotechnical Engineer's Recommendation for Waiver from this specification shall include a minimum and maximum range of compaction of the soil type being waived, but will not exceed a range of 10%. The Waiver Request shall be submitted with the plans for first review.

SPECIFICATION NO. 7

FIRE HYDRANT LOCK

An effective vandal-proof device to prevent unauthorized opening of fire hydrants shall be provided with each hydrant. Operating nuts shall be drilled and tapped per City of Chandler Standard Detail No. C-304. The device shall readily attach to the existing fire hydrant housing or opening mechanism. Materials shall be strong enough to withstand acts of vandalism and weather extremes and still provide smooth hydrant operation. The device shall be unique in that only a special magnetic wrench can open or close the hydrant.

An inner barrel construction of high tensile manganese bronze shall be designed to fit over the existing fire hydrant operating nut. An outer housing constructed of stainless steel shall be installed over the inner barrel so as to swivel freely until a special key wrench is used. Attachment of the outer housing shall be by a special snap ring groove designed to withstand repeated blows by sledge hammers without shearing.

A mating collar shall be installed between the outer housing hydrant top for a weather seal and to prevent removal of the swivel housing by pry bars or other tools available to vandals. The mating collar shall extend up the sides of the swivel housing and to a height sufficient to provide added protection for the hydrant operating nut and to resist repeated blows by sledge hammers.

A special key wrench shall be constructed of an aluminum-magnesium alloy. The wrench shall incorporate a unique permanent magnet, which will engage an activator located inside the outer housing. Performance must not be affected by local environmental temperature ranges or weather conditions. The special key wrench will be the only means of opening or closing the hydrant. As an added convenience, the opposite side of the key wrench shall contain a conventional pentagon recess that will work on a standard hydrant. The hydrant lock shall be a Hydrashield Custodian.

SPECIFICATION NO. 8:

FIBER OPTIC CABLE INSTALLATION INSTRUCTIONS

1. **CABLE INSTALLATION:**

A. "Trunk Lines" Cable, cables providing telecommunications service by connecting regions or states, or by connecting central offices within a metropolitan area, shall be installed as described below:

1) If the cable is to be installed within an open trench, the cable shall be placed within Schedule 40 PVC Pipe Conduit or equal with a minimum inside diameter of 4 inches. The conduit shall be buried at a minimum depth of 48 inches below finished grade measured to the top of the conduit. A color coded plastic warning tape with a minimum thickness of 5 mil and a minimum width of 3 inches shall be installed in the trench and centered over the PVC conduit at a depth of from 18 to 30 inches below finished grade.

2) Cable crossings under existing paved streets shall be accomplished by jacking or boring unless open trenching is authorized by the City Engineer. The cable shall be placed within a steel casing at a minimum depth of 48 inches.

B. Telecommunications Cable, cables other than "trunk lines" shall be installed as described below:

1) If a cable is to be installed within the right-of-way of an arterial street, or is determined to be a trunk line, it shall be placed at a minimum depth of 48 inches below finished grade. A color coded plastic warning tape as described in "A" (above) shall be placed 18 inches below the surface.

2) If a cable is to be installed within the right-of-way of a local/residential street, it shall be placed at a minimum depth of 24 inches below finished grade. In a collector street, or a street within an industrial area, the minimum depth shall be 36 inches below finished grade.

3) Cable crossings under existing paved streets shall be accomplished by jacking or boring unless open trenching is authorized by the City Engineer. The cable shall be placed within a steel casing at a minimum depth of 24 inches.

2. **CABLE LOCATING (FIBER OPTIC):**

A. If a cable which is to be installed is fiber optic, a tracing or locating wire shall be installed with the cable.

SPECIFICATION NO. 9:

RECLAIMED WATER LINE CONSTRUCTION

MAG Specifications Section 616 will apply to Reclaimed Water Line Construction with the following exceptions and modifications:

1) The color "red" as stated in the MAG Specifications will be changed to purple, which is standard color "Pantone 512".

2) Marking tape shall be purple (Pantone 512) in color with the following message printed thereon: "WARNING – RECLAIMED WATER – DO NOT DRINK".

3) The exterior of PVC or other plastic type pipes will be Pantone 512 in color. Pipe that cannot be purple in color will be marked as per MAG Standard Specification 616.3.

4) For Small and Large Water User Reclaimed Water Turn-Outs, see City of Chandler Standard Details Number C-404 and C-405.

5) All Reclaimed Water Valve boxes will be 8 1/4" square. See City of Chandler Standard Details Number C-406.

6) Lake Boundaries – City of Chandler Standard Details Number C-407.

SPECIFICATION NO. 10

STANDARDS FOR

WATER PIPE AND FITTINGS

4" THROUGH 16" DIAMETER

1. GENERAL:

These specifications apply to Polyvinyl Chloride (PVC) pressure pipe intended for use as potable water distribution pipelines, which carry water under pressure.

2. WORKMANSHIP:

Pipe shall be homogeneous throughout. It shall be free of voids, cracks, inclusions, or other defects. It shall be as uniform as commercially practical in color, density, and other physical properties. Pipe surfaces shall be free from nicks and scratches. Joining surfaces of spigots and other joints shall be free from gouges and imperfections that could cause leakage. The contractor shall supply the Engineer with certified third party test data establishing both the long-term compressive strength and the long-term modulus of elasticity of the PVC material.

3. MATERIAL:

4 inch through 12 inch PVC pressure pipe shall be designed, manufactured and tested in accordance with AWWA C-900, latest edition. The barrel of furnished pipe shall conform to the outside dimensions of steel pipe (IPS) or cast-iron-pipe-equivalent (CI), and with the wall thickness of dimension-ratio (DR) Series 14. All approved PVC pipe shall carry a NSF rating.

The pressure rating for C-900 pipe shall be 200 psi minimum.

16 inch PVC pressure pipe shall be designed, manufactured, and tested in accordance with AWWA C-905, latest edition. The barrel of furnished pipe shall have an iron-pipe-size-equivalent (IPS) outside diameter and wall thickness equal to the dimension-ratio (DR) Series 18.

The pressure rating for C-905 pipe shall be 235 psi.

All PVC pipe furnished shall be integral bell with elastomeric gaskets. Plain ends with elastomeric gasket couplings will be allowed only for intermediate pipe lengths. PVC joints using elastimeric gaskets to achieve the pressure seal shall be tested as assembled joints and shall meet the laboratory performance requirements specified in ASTM D3139.

A Manufacturer's Affidavit for compliance to AWWA C-900 and AWWA C-905 shall be furnished. The manufacturer shall provide documentation of the long-

term compressive strength of the pipe material, or the long-term hydrostatic design strength, which shall be certified by an independent third party.

All required manufacturing quality control inspection and testing shall be performed in the United States of America at the pipe manufacturer's plant or at an approved testing laboratory in the United States. The seal of the testing agency that verified the suitability of the pipe material for potable water service shall be marked on the pipe. In addition, markings on the pipe shall include the following:

A. Nominal size and OD base
B. Material code designation
C. Dimension ratio number
D. AWWA pressure class
E. AWWA designation number for this standard
F. Manufacturer's name or trademark and production record code.

Pipe shall be supplied within 270 days of its manufacture. A Manufacturer's written Verification of date of manufacture shall be provided.

4. APPLIED LOAD CALCULATIONS:

Assumption of soil arching shall not be used in calculation embankment loads over PVC pipe. The prism earth load formula shall be used to determine earth loads.

$$W_c = HwB_c$$

Where:

W_c = Embankment Load, lbs/ft
H = Depth of soil cover, ft
w = Soil Density, lbs/ft
B_c = Pipe outside diameter, ft

5. BEDDING:

Pipe bedding shall be in conformance with MAG Standards Section 601.4.2 and as further specified by the City of Chandler Standard Detail C-308. Sand, gravel, or crushed rock material of a single graduation shall not be used for bedding within the pipe zone. The design engineer shall determine the suitability of native *insitu* soils as bedding material using the H20 Highway Loading curve, the soil type, plasticity index, and sieve analysis to ensure proper structural stability of the pipe/trench system. The *insitu* soil shall be shown to provide structural stability as a side wall support system for the pipe, and shall contain no more than 12 percent by weight passing the No. 200 sieve. The *insitu* soil shall conform to Section 702, Table 702-1 of the *Maricopa Association of Governments Uniform Standard Specifications for Public Works Construction.*

6. **FITTINGS:**

Fittings shall be ductile iron and conform to AWWA C-110 or C-153 for 250 psi minimum working pressure rating.

All fittings shall be cement lined in accordance with AWWA C-104.

Fittings which require transition gaskets to ductile iron pipe sizes may be furnished only in sizes 6 inch through 8 inch.

PVC connections to asbestos cement or ductile iron pipe shall be ductile or gray iron adapters.

7. **STORAGE:**

Storage of PVC pipe shall be in accordance with the manufacturer's recommendation and guidelines. PVC pipe and fittings shall be stored in a dry, ventilated area that protects the pipe form UV radiation and the elements. Pipe stockpiled at the construction site shall not remain exposed to the elements and weather in excess of 24 hours, or as approved by the Engineer.

PVC pipe shall be delivered to the site and stored and handled in accordance with the manufacturer's instructions. During shipment and storage, the pipe ends shall be securely covered. PVC pipe shall be stored in a manner such that it is protected from exposure to sunlight and/or extreme heat.

8. **THRUST BLOCKS:**

Thrust blocks shall be installed per MAG 610.13.

9. **MODIFICATION TO MAG SPECIFICATIONS:**

A. **610.3 MATERIALS**

All pipe for water lines shall be of the classes shown on the plans or as specified below.

(A) 4 inch through 12 inch pipe may be ductile iron or polyvinyl chloride, except where otherwise specified.

(B) 14 inch through 16 inch pipe may be ductile iron, concrete cylinder pipe, or polyvinyl chloride pipe as specified in the standards for 14 inch to 16 inch diameter transmission pipe, and in accordance with AWWA C-905 standards.

(C) Pipe sizes greater than 16 inches may be either ductile iron or concrete pressure pipe - steel cylinder type.

B. **610.4 CONSTRUCTION METHODS**

Polyvinyl Chloride pipe shall be installed in accordance with the AWWA Manual 23.

When polyvinyl chloride is used, a locator tape shall be buried 18 inches below the ground surface on top of the approved bedding material. The backfill shall be sufficiently leveled so that the tape is installed on a flat surface. The tape shall be entered in the trench with the printed side up. Care shall be taken to avoid displacement of the tape and to ensure its integrity. (A) Locator Tape: Detectable pipe locating tape shall be a minimum 4.0 mils thick, inert polyethylene plastic that is impervious to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the soil, with a minimum 1/3 mil thick metallic foil or two embedded copper wires. The tape shall be a minimum three inches in width. Locating tape shall be solid blue in color with the following message printed thereon: **'CAUTION WATERLINE.'** The tape message shall be legible and imprinted continuously over the entire length in permanent black lettering with the message length 18 inch maximum. The lettering shall be a minimum 1-1/2 inches high. The spacing between the individual words of the message shall be three inches maximum. The locator tape ends shall be placed at the top of the valve boxes to encourage easy pipe location.

Locator wire shall be run continuous along and attached to the PVC pipe. The wire leads shall be run into each valve box. Embedded copper wire shall be tested with a conductive locator for continuity over the full length of the pipe run prior to placement of backfill material.

C. **610.6 VALVES**

Valves shall be installed in accordance with AWWA C-600 or AWWA Manual 23, modified as follows.

D. **610.10 METER SERVICE CONNECTIONS**

(E) Service taps shall be installed using an all bronze double-strap tapping saddle or a tapped tee. Any tapping saddle for use on PVC pipe shall provide full support around the circumference of the pipe and a bearing area for 2 inches minimum along the axis of the pipe.

E. **610.14 TESTING**

The Contractor shall test water lines for water tightness, including all fittings and connections to the water lines. Each pipe shall be tested for leakage and pressure in accordance with applicable provisions of AWWA standards and/or Manuals, except as modified below.

The Contractor shall provide all vents, piping, plugs, bulkheads, valves, bracing, blocking, pump, including measuring devices and all other equipment necessary for making the tests, except pressure gauges.

The pipe shall be tested between each valve or between a valve and the closed end of the pipe. Pipe test sections shall be limited to ½ linear mile or less, unless otherwise approved in writing by the Engineer.

All connections, blow-offs, hydrants and valves shall be tested with the main, where practical.

The test section shall be slowly filled with potable water and all air shall be vented from the line. The rate of filling shall be as approved by the Off-site Inspector, with at least 24 hour notice required before filling is scheduled.

(A) Pressure Tests: Water lines, including all fittings and connections, shall be tested for water tightness by subjecting each test section to a pressure test. The test pressure shall be measured at the lowest end of the test section. The test pressure shall be 188 psi unless otherwise specified. The furation of each pressure test shall be at least 2 hours.

The pressure test shall begin after the pipe has been filled with water for at least 24 hours to allow for absorption.

(B) Leakage Tests: Leakage tests shall be made after the pressure test has been completed, pressure test results are satisfactory, and all backfilling and compaction is completed.

The duration of each leakage test shall be at least 2 hours. Leakage test pressure shall be at least 150 psi and not vary more than 5 psi during the test.

The maximum allowable leakage from the pipe line shall be determined by the applicable formula:

$$L = ND\frac{\sqrt{P}}{7400}$$

in which:

L = allowable leakage in gallons per hour

N = number of joints in the pipe line being tested, with no allowance for joints at branches, blow-offs, fittings, and similar appurtenances. "N" is calculated using the standard length of pipe installed divided into the length being tested.

D = nominal inside diameter of pipe in inches

P = average test pressure, in psi gage, as measured at the lowest point in the test section.

Should the test on any section of the pipe line show leakage greater than that specified above, the Contractor shall locate and correct the deficiency and retest until the leakage is within the specified allowance for a 2 hour duration. All repairs and retests shall be the contractor's responsibility and expense.

Leakage is defined as the quantity of make-up water necessary for the test section to maintain the specified leakage test pressure after the pipe line has been filled with water and all air expelled.

F. **630.3 GATE VALVES: Subsection (A)**

Change the sixth paragraph to read:

The connecting ends of valves may be flange, mechanical joint, push-on, or an appropriate combination. Valves which require transition gaskets to ductile iron pipe sizes may be furnished only in sizes 4 inches through 8 inches.

G. **630.4.2 TAPPING SLEEVES AND VALVES: Subsection (A) (2) (a)**

Following the word CAST-IRON, add
(Not allowed for use on PVC pipe).

H. **630.5 BUTTERFLY VALVES: Subsection (B)**

Fourth paragraph, change (1) to read:

"(1) Valve ends may be the thin type or wafer type to be installed between the flanges and drilled in conformance with the ASA B 16.1-25, or may have flanges at both ends, or the valves may have bell ends with the rubber gaskets which conform to the type of pipe being used."

SPECIFICATION NO. 11:

Underground Facilities Installed in Any Real Property Outside the City's Right-of-Way

The following marking standards are require to comply with House Bill 2256 and shall apply to any utilities installed after December 31, 2005:

- A yellow insulated copper wire or other approved conductor shall be installed adjacent to underground utilities for fire line piping, potable water distribution piping, sanitary sewer lines, stormwater piping, reclaimed water piping, gravity flow irrigation piping and pressurized irrigation piping larger than two (2) inches in diameter unless these facilities can be detected from above ground with an electronic locating device. Access shall be provided to the tracer wire or the tracer wire shall terminate above ground at each end of the piping. The tracer wire shall not be less than 18 AWG and the insulation type shall be suitable for direct burial.

SPECIFICATION NO. 12:

Roadway Striping Obliteration

At areas where striping obliteration has occurred, the roadway surface must be sealed with a slurry seal product approved by the City of Chandler Street Division. The sealant product is required to be 4" sandrock and asphalt emulsion mixture to allow for replacement of lost aggregate, fill voids, and permanently seal the damaged surface. Aggregate size is required to exceed the #2 type sandrock mixture per MAG specifications. Striping obliteration by grinding is not permitted.

APPENDIX A

Procedure P-222

1. Permits are required for any work within the public right-of-way, including public utility easements.

2. Distribution mains for irrigation, reclaimed water, and water.

   Distribution mains (generally four inches [4"] or greater in diameter) which serve large areas and/or multiple parcels will require the following:

   A. An agreement with the City.

   B. The granting of an easement by the City for the purpose of installing the irrigation main where the owner of the main has prior ownership rights. (This requires Council approval.)

   C. Approval of plans by the City Engineer.

   D. In the case of reclaimed water lines, compliance with City of Chandler Standard Specification No. 9.

3. Service lines for irrigation, reclaimed water, and water.

   Service lines to individual parcels or properties (generally those less than a four inch [4"] diameter) will not require plan approval but must meet the following requirements:

   A. Lines may be installed in rights-of-way or public utility easements outside of paved areas.

   B. Street crossings shall be sleeved and shall be a minimum of Type "K" Hard Copper per MAG Spec. No. 754, or other material approved by the City Engineer.

   C. In cases where service is required to all lots or other situations which would require crossings at other intersections, mains will be required on both sides of the street.

   D. Irrigation lines shall be constructed at least two feet (2') below finished grade.

   E. For reclaimed water lines, a minimum separation of six feet (6') from potable water mains and service lines must be maintained and Maricopa Association of Governments (MAG) Standard Specification and Detail requirements for sewer and water separation or encasement shall apply to all crossings of potable lines.

F. Valves located on reclaimed water lines shall be in accordance with City of Chandler Standard Specification No. 9.

4. The City Engineer will determine the classification of irrigation lines as distribution mains or service lines.

SERIES C-100 GENERAL INFORMATION (C-100 TO C-110)

This No.	Replaces	
C-100	62	Hazard Marker Placement
C-101	63	Hazard Marker
C-102	64	Hazard Marker, Soil Anchor
C-103		Fiber Optic Cable Splicing Vault - Pg. 1 of 2
		Fiber Optic Cable Splicing Vault - Pg. 2 of 2
C-104	120	Fiber Optic Cable Ducts
C-105	94	Guard Post for Backflow Prevention Assemblies
* C-106		Standard Trench Plating
C-107		Galvanized Handrail
C-108	95	Air Gap Backflow Protection for Water Tanks
C-109		Shallow Pit Percolation Test Requirements
C-110		Pavement Cut and Patch and Joint/Cut Sealant
C-111		Minimum Pothole Spacing for Pavement Restoration Fee Exemption

SERIES C-200 STREETS (C-200 TO C-254)

This No.	Replaces	
* C-200	10	Standard Utility Locations - Arterial Streets
* C-201	11	Standard Utility Locations - Collector Streets
* C-202	12	Standard Utility Locations - Local Streets
C-203	20	Major Arterial Street - Typical Cross Section
C-204	21	Phased Major Arterial Street - Typical Cross Section
C-205	22	Minor Arterial Street - Typical Cross Section
* C-206	23A	Collector Street with Median - Typical Cross Section
C-207		Unassigned
* C-208	24	Industrial Collector Street - Typical Cross Section
* C-209	25A	Residential Collector Boulevard - Typical Cross Section
* C-210	25B	Residential Collector Street - Typical Cross Section
* C-211	26	Local Street with Median - Typical Cross Section
* C-212	27A	Local Boulevard with Frontages Less Than 65' - Typical Cross Section

* Revised / Deleted January 2007.

SERIES C-200 STREETS (C-200 TO C-254)

This No.	Replaces	
* C-213	27B	Local Street - Typical Cross Section
* C-214	28	Agrarian Collector Street - Typical Cross Section
* C-215	29	Agrarian Local Street - Typical Cross Section
C-216	105	Ocotillo Major Arterial
C-217	106	Ocotillo Minor Arterial
* C-218	108	Ocotillo Collector Street
C-219	109	Ocotillo Entry Road
C-220		Unassigned
* C-221		Local Boulevard with Frontages of 65' to 90' - Typical Cross Section
* C-222		Local Boulevard - Typical Cross Section
* C-223		Standard Major Arterial/Major Arterial Intersection Right-Of-Way, and Street Dimensions - pg. 1 of 2
* C-223	18A	Ultimate Major Arterial/Major Arterial Intersection Right-Of-Way, and Street Dimensions - pg. 2 of 2

SERIES C-200 STREETS (C-200 TO C-254)

This No.	Replaces	
* C-224	18B	Major Arterial Deceleration Lane
C-225	37	General Median Design
* C-226		"Left In Only" Median Design 16' Wide Median
* C-227		"Left In Only" Median Design 40' Wide Median
C-228		Typical Driveway Access to Private Gated Community
C-229		Left Turn Bay on Two-Lane Roadway (Temporary Widening, Cross Street on One Side Only)
* C-230	118	Concrete Bus Bays
* C-231	38	Right Turn/Deceleration Lane for Driveways
C-232	41	Cul-De-Sac
C-233	42	Valley Gutter
* C-234		Speed Hump
* C-235		Deleted

* Revised / Deleted January 2007.

SERIES C-200 STREETS (C-200 TO C-254)

This No.	Replaces	
* C-236	14A	Interlocking Paving Blocks and Decorative Concrete - Traveled Surfaces
* C-237	14B	Interlocking Paving Blocks and Decorative Concrete - Non-Traveled Surfaces
C-238	14C	Decorative Concrete at Grade - Traveled Surface
C-239	33	Depth of Base Course - Major & Minor Arterials
C-240	34	Depth of Base Course - Non Residential Collector and Local Streets
C-241	35	Depth of Base Course - Residential Collector Streets
C-242	36	Depth of Base Course - Residential Local Streets
* C-243	48	Sidewalk Ramp for Roll Curb
* C-244		Sidewalk Ramp at Intersections for Roll Curb
* C-245		Combined Sidewalk Ramp and Residential Driveway
* C-246	39	Sight Distance

This No.	Replaces	
* C-247	39A	Sight Distance for Low Speed Local or Collector Streets
C-248		Key Lot Sight Distance
C-249	47	Accessible Ramp Location
* C-250		Left Turn Bay in 40' Median Design
C-251	46	Alley Pavement Lot Drainage from Alley
C-252	45	Alley Pavement Lot Drainage to Alley
C-253	37A	Decorative Concrete
C-254		Arterial/Collector Roadway Landscape Drainage
* C-255		Typical Roundabout
* C-256		Typical Raised Crosswalk

* Revised / Deleted January 2007.

SERIES C-300 WATER (C-300 TO C-319)

This No.	Replaces	
C-300		Flushing Pipe Assembly with Ball Valve
C-301	103A	Water Service Installation
C-302	103B	Residential Backflow Prevention Assembly Installation - 1" or Under
C-303	50	Fire Hydrant
C-304	49A	Fire Hydrant Lock
C-305	102	Locations for New Fire Hydrant
* C-306	101	Fire Hydrant Reflector Locations
C-307	51	Valve Box Installation (Potable Water)
C-308		PVC Water Pipe Bedding Detail
C-309	88	Pressure Vacuum Breaker Assembly Installation - 2" and Under
C-310	89	Double-Check Valve Backflow Prevention Installation - 3" and Under
C-311	90	Reduced Pressure-Principle Backflow Prevention Assembly Installation - 3" and Under
C-312	91A	Double Check Valve Backflow Prevention Assembly 2 1/2", 4", 6", 8", 10" Private Domestic Water Main
C-313	92	Double Check Valve Backflow Prevention Assembly Vault Installation
C-314	91	Double Check Valve Backflow Prevention Assembly 3", 4", 6", 8", 10"
C-315	93	Reduced Pressure Principle Assembly 3", 4", 6", 8", 10"
C-316	100A 100B	3" and Larger Water Meter
C-317	52	Concrete Collar Detail - Water Valve Box Placement - Unpaved Areas
C-318	49	Debris and Locking Cap
C-319		2" Combination Air/Vacuum Valve Assembly

* Revised / Deleted January 2007.

SERIES C-400 WASTERWATER (C-400 TO C-410)

This No.	Replaces	
C-400	99	24" and 30" Manhole Frame and Cover - pg. 1 of 2
C-400		Manhole Cover - pg. 2 of 2
C-401	52C	Manhole Concrete Collar Detail
C-402	53	PVC Sewer Pipe Bedding Detail
C-403		Industrial Waste Sampling Manhole
C-404		Small Water User (Without Lake) Reclaimed Water Turn-Out - pg. 1 of 2
C-404		Small Water User (Without Lake) Reclaimed Water Turn Out - pg. 2 of 2
C-405		Large Water User (With Lake) Reclaimed Water Turn-Out
C-406	51A	Valve Box Installation (Reclaimed Water) - pg. 1 of 2
C-406		Valve Box and Cover (Reclaimed Water) - pg. 2 of 2
C-407		Unassigned
C-408		Pipe Locator Tape & Wire
C-409		Pipe Penetration and Manhole Frame Termination Detail
C-410		Deep Cut House Connection (Sewer Lateral)

SERIES C-500 STORM SEWER & DRAINAGE (C-500 TO C-507)

This No.	Replaces	
C-500	44	Scupper
C-501	43	Dry Well System Detail and Specifications
C-502		Dry Well System
C-503		Trash Rack/Access Barrier
C-504		Retention Basin Inlet
C-505	117	Catch Basin Access Frame and Cover
C-506		Catch Basin Grates
C-507		Below Grade Retention Basin Inlet (Bubbler Box) Pg. 1 of 3
C-507		Below Grade Retention Basin Inlet (Bubbler Box) Pg. 2 of 3
C-507		Below Grade Retention Basin Inlet (Bubbler Box) Pg. 3 of 3

* Revised / Deleted January 2007.

SERIES C-600 SIGNAGE (C-600 TO C-623)

This No.	Replaces	
* C-600	37B	Median Signage
C-601	115A	Street Name Signs (For Public Streets)
C-602		Collector Road Pavement Markings
C-603	116	Metro Street Name Sign Standard
C-604	113B	Address Identification for Cluster Developments
C-605	113A	Street Name Signs (For Private Streets)
C-606	110	Internally Illuminated Street Name Sign
C-607	110A	Internally Illuminated Street Name Sign - Bracket Assembly
C-608	110B	Internally Illuminated Street Name Sign - J/R Pole Mounting
C-609	110C	Internally Illuminated Street Name Sign - F Pole Mounting
C-610	110D	Internally Illuminated Street Name Sign - F Pole Mounting Detail
C-611	60	Handicap Parking Space Sign
C-612	61	Handicap Pavement Marking Symbol
* C-613	40	Sign Post and Base
* C-614		Pavement Marking Details
C-615		Sign Post and Base Locations For Residential Streets
* C-616		Right Turn Land Drop
C-617		Unassigned
* C-618		Typical Signs and Markings Arterial Road
* C-619		Typical Lane Widths - Arterial Road With Double Left Turns
* C-620		Major Arterial Deceleration Lane Signing and Striping
C-621		Arterial Signage
* C-622		Arterial Roadway Markings (W/O Medians)
* C-623		Intersection Markings (With Medians)

* Revised / Deleted January 2007.