
GLOBAL WATER RESOURCES (GWR)**CODE OF PRACTICE**
GWR-CP-EX-008**CONSTRUCTION AND ACCEPTANCE OF UNDERGROUND FACILITIES****BACKGROUND**

This code of practice details the requirements for each of Global Water Resources Utilities for the construction and acceptance of infrastructure into the Utility's inventory. The code of practice is for both Owner/Developer deployed infrastructure and the Utility's Capital Improvement Projects. There are some items in the code of practice that applies only to the Owner/Developer. Those items will reference Owner/Developer-deployed infrastructure. All other items in the code of practice apply to both the Owner/Developer and the Utility's infrastructure improvements.

GENERAL

No new utility will be installed or a preconstruction meeting scheduled until the Developing Entity has executed a Line Extension Agreement with the Utility through Global Water Growth Services and paid all required fees to the Utility.

No new utility improvements shall serve a customer until Global Water is satisfied that all of the facilities have been properly installed, constructed, disinfected, inspected, tested and the requirements of all Governmental Agencies have been met and the "Letter of Provisional Completion" has been issued by Global Water. Any utility that is to be owned and maintained by Global Water shall have approved plans and specifications prior to start of construction. The plans and specification shall be approved by Global Water and all appropriate Governmental Agencies; including, Arizona Department of Environmental Quality (ADEQ) or Maricopa County Environmental Services Department (MCESD). Plan approval is limited to time stated on the approved plans.

Water meters will not be installed until the "Letter of Provisional Completion" has been issued.

No untreated sewage or inadequately treated wastes shall be discharged to a ditch, stream or lake without a written permit from the applicable regulatory agencies prior to the time of discharge.

No other utility lines or systems are to be placed in the same trench as gravity flow sanitary sewer lines or sewer force mains, recycled water lines, raw water lines or potable water lines without the prior written authorization from Global Water.

No person shall install, permit to be installed or maintain an interconnection or other connection between any part of the sewerage system and a potable water supply or a public water supply in such manner that sewage or waste may find its way into or otherwise contaminate any potable or public water supply. An air gap between the potable water supply and any water or wastes on site shall be maintained at all times. The Contractor shall install a Global Water provided metered backflow prevention device for any in line water connection for new water lines being connected to the potable water system and Global Water will provide and install all hydrant metered backflow prevention devices that will be used for any construction purposes, including elevated tanks. The Contractor is responsible for supporting the backflow prevention devices per Global Water Standard Details 344-1 and 344-2. The Contractor is also responsible for having the backflow prevention devices tested, immediately after each installation, by a Company licensed to certify backflow devices. No more than five (5) days after the installation of the device a copy of the certification that the backflow prevention device is operating correctly will be given to the Global Water Inspector. All costs associated with both types of backflow prevention devices shall be borne by the Contractor.

TRENCH SAFETY

The Contractor is solely responsible for trench safety. The Contractor is responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. The safety program shall comply with all applicable requirements of the Occupational Safety and Health Act (OSHA) of 1970 and all other applicable federal, state and local laws and regulations and with the requirements of an Owner controlled insurance program, if any, and with Owner's safety program. The Contractor shall have a competent safety person on site at all times per the requirements of OSHA. The Global Water Inspector is not the competent safety person on site; and therefore, is not responsible for and not necessarily qualified to inspect the trench for the trench safety. For this reason Global Water will not direct the Contractor on means or methods to comply with trench safety requirements or remedy trench safety violations.

PROVISIONAL COMPLETION OF UTILITIES (Owner/Developer-Deployed Infrastructure)

No new utilities will receive a "Letter of Provisional Completion" from Global Water until the following has occurred:

1. All installed facilities have been inspected, tested, and approved.
2. A video survey of all sewer infrastructures has been completed and the video survey is acceptable to Global Water.
3. A copy of all test reports, including trench compaction tests, and inspections has been provided to Global Water; and, a signed and sealed certification from the "Engineer of Record" that the utilities were installed per the plans and specifications.
4. Final walk through and all punch list items required by the Global Water have been addressed.
5. A signed ADEQ or MCESD "Approval of Construction / 4.01 Authorization to Discharge" has been provided to Global Water.
6. Two black line sets of as-built drawings reduced to 11 X 17 and one electronic (compatible with AutoCAD and ESRI) as-built set on CD-R disk, signed and sealed by a Registered Land Surveyor.
7. A listing of all addresses for all lots within each parcel of the development has been provided for use by Engineering and GIS.

FINAL APPROVAL AND ACCEPTANCE OF UTILITIES (Owner/Developer-Deployed Infrastructure)

The warranty period begins once the improvements are *legally conveyed to the utility through a bill of sale as further described within the Owner/Developer's Line Extension Agreement*. Various items must be provided to Global Water Growth Services prior to conveyance and to begin warranty period. The items to be provided prior to conveyance are detailed in the Bill of Sale Code of Practice GWR-CP-EX-040.

Prior to the expiration of the warranty period a warranty walk through will be conducted on the utilities installed. All punch list items required by the Global Water Inspector must be completed prior to final acceptance of the utilities by Global Water. The Global Water Inspector will check sewer manholes to insure the ring and manhole grout are acceptable; that water meters, fire hydrants and valves are at proper height, undamaged, unobstructed and that valves nuts are accessible (free of dirt and debris).

CRITERIA

The code of practice is divided into four Appendices:

- A. Construction, Inspection, Testing, Approval and Acceptance of Gravity Flow Sanitary Sewers
- B. Construction, Inspection, Testing, Approval and Acceptance of Sewer Force Mains
- C. Construction, Inspection, Testing, Approval and Acceptance of Water Mains (Potable and Raw Water Mains)
- D. Construction, Inspection, Testing, Approval and Acceptance of Recycled Water Mains

Appendix A**CONSTRUCTION, INSPECTION, TESTING, APPROVAL AND ACCEPTANCE OF GRAVITY FLOW SANITARY SEWERS****INTRODUCTION**

This section applies to the construction, inspection, testing, approval and acceptance of gravity flow sanitary sewers, including appurtenances normally installed as part of the system. The installation of the utility is to conform to the requirements of Global Water, the approved plans and specifications, MAG specifications and the requirements of all Governmental Agencies, including but not limited to, ADEQ or MCESD, and the Local Governing Authority.

MATERIALS

The utility is to be constructed with materials that meet the requirements of Global Water, the approved plans and specifications, MAG specification and the requirements of all Governmental Agencies, including but not limited to ADEQ or MCESD, and the Local Governing Authority.

INSPECTION

Global Water's Inspector or authorized representative shall inspect and approve all the work per plans and specifications signed and sealed by a Registered (Civil) Engineer and approved by Global Water. These plans and specification will require re-approval if any substantial change to the scope of work is made during the construction process. Plan approval is limited to the time stated on plans.

Prior to construction of any utility that is to be owned and maintained by Global Water a preconstruction meeting is to be scheduled. The preconstruction meeting is to be scheduled a minimum of 48 hours in advance. Prior to scheduling the preconstruction meeting two (2) reduced copies, 11 X 17, of the approved plans, list of material to be installed with the date of manufacture, copies of all permits, including City and/or County building permits, ADEQ or MCESD permits, and County dust control permit, are to be given to the Global Water Inspector. The required attendees for the preconstruction meeting are representative of: entity installing the utility, Contractor, City Inspector if work within City jurisdiction, County Inspector if work is in County Right-of-Way and Global Water Inspector. Other suggested attendees for the preconstruction meeting are representatives of Engineer of Record, Geotechnical Engineer and Registered Land Surveyor.

Any construction performed without a preconstruction meeting or without the knowledge of the Global Water Inspector is considered at risk. The Contractor is responsible for all costs and any corrective action required by Global Water to bring the utility into compliance with the approved plans & specifications, including removal and replacement, if required.

Prior to construction of any gravity flow sanitary sewer line the Contractor to verify existing inverts at existing manhole and/or verify invert, slope and direction when connecting to an existing stub. The Contractor is to notify the Global Water Inspector whether or not the existing inverts and slope are per plan. If there is a discrepancy between the plan grades and existing conditions, the Global Water Inspector will decide how to correct the discrepancy or refer the decision to Global Water Engineering and Construction Department. Any corrective action required will be the responsibility of the installing entity.

The Contractor will be required to install sewer plugs at all points of connection to Global Water's existing sewer system. These plugs will remain in place until removal is required by the Global Water Inspector just prior to issuance of the "Letter of Provisional Completion". Global Water will require cut stakes to the flow line when constructing gravity flow sanitary sewer line. The interval of the cut stakes will be approved by the Global Water Inspector.

Ceramic epoxy lined ductile iron pipe used in gravity flow sanitary sewer pipe will be wrapped in a green polyethylene wrap for the entire length of the ductile iron pipe in accordance with MAG 610.5. Installation of polyethylene wrapped ductile iron pipe will be performed using a strap to prevent damage to the polyethylene wrap.

A Geotechnical Engineer or his authorized representative shall be present during bedding and backfill operation, as required by the Global Water or the Local Governmental Inspector, to test bedding and backfill to insure required compaction densities are met. The Geotechnical Engineer or his authorized representative will keep a record of these tests and give copies of the test results to both the Global Water Inspector and the Engineer of Record. All costs associated with the Geotechnical Engineer are the responsibility of the entity installing the utility.

An Engineer of Record or his authorized representative is required to be present during installation and all testing of the utility. The Engineer of Record is responsible for the required documentation of the utility testing and submittals required by Global Water and all Governmental Agencies; including, ADEQ or MCESD. The Engineer of Record is responsible for accuracy of the as-built of the utility. All cost associated with the Engineer of Record are the responsibility of the entity installing the utility.

CLEANING

Prior to testing any section of sewer, the Contractor shall remove all foreign matter from the interior of the system. The Contractor shall clean the system by flushing a cleaning ball, pressure jetting or other appropriate method approved by Global Water's Inspector. The Contractor is to install watertight plugs or other methods approved by Global Water's Inspector to prevent dirt or debris from entering Global Water's existing sewer systems. Water and foreign matter washed downstream is to be cleaned from manholes by means approved by Global Water's Inspector; this includes the use of a hydro-vac truck, if required.

Debris shields shall be installed within all manholes prior to the removal of manhole ring and/or grade rings when lowering manholes to plate prior to concrete or paving/grading operations. The debris shields are to be removed after final adjustments to manhole ring and cover are made to finished grade at the direction of the Global Water Inspector.

TESTING

Testing shall be conducted by the Contractor. All expenses associated with testing, including equipment, labor and material are the responsibility of the Contractor. Equipment necessary to perform testing shall be the type, quality and capacity to perform the operations required to execute the test specified. Testing shall be conducted after the dry utilities have been installed and prior to concrete or paving operations. The bedding and backfill density test (compaction) must pass prior to the following required tests:

1. Deflection Test
2. Watertight Integrity Test
3. Video Survey

All testing shall be accomplished in the presence of the Engineer of Record or his authorized representative and witnessed by the Global Water Inspector or his authorized representative.

The total length of the sewer lines must tested for uniform slope, in accordance with A.A.C. R18-9-E301(D)(2)(k).

Global Water shall be notified 48 hours in advance of the testing.

Testing shall not commence on any portion of the pipeline, until all field placed concrete in contact with the pipe, fittings or appurtenances is adequately cured.

DEFLECTION TEST

A deflection test shall be done on all sewer pipe made of flexible materials to ensure the installation meets or exceeds manufacturer's recommendations, in accordance with A.A.C. R18-9-E301(D)(2)(i).

WATERTIGHT INTEGRITY

The Contractor shall test 100% of the sewer line for leakage using low-pressure air-test (ASTM Method F 1417-92, Reapproved 1998), in accordance with A.A.C. R18-9-E301(D)(2)(j)(i).

All sewer manholes must pass an exfiltration or vacuum test.

Water used for watertight integrity tests shall be potable water, reclaimed or raw water or as otherwise approved by the Global Water Inspector.

VIDEO INSPECTION

All sewer lines, including sewer services, shall be inspected by video camera after installation of dry utilities and prior to curb and gutter operations. The costs of the video camera inspection shall be borne by the Contractor. The Global Water Inspector shall be notified 24 hours in advance of video inspection. Global Water reserves the right to randomly video sewer lines after pavement. The cost will be the responsibility of Global Water.

Video equipment expressly designed for pipeline inspection purposes and operated by experienced and qualified personnel shall be operated through the entire pipeline, including sewer services. The video operator shall maintain a log noting location of all sewer services, type and extent of any deficiencies, including photographing all deficiencies. The log will include a detail showing all marks on the mechanical gauge, including the upper and lower marks described in the next paragraph.

Inspector shall monitor the placing of water throughout the system one hour in advance of video camera. The video shall verify the uniform slope of the entire system length, including any sewer services. The picture shall be clear and concise to provide a view that is acceptable. A mechanical gauge will be mounted in front of the camera to show the depth of any standing water. The gauge shall clearly indicate a minimum of two (2) marks on the gauge with the lower markings of .05 (5/8") for pipe 8" through 15" and .10 (1 1/4") for pipe 15" and larger. The upper marking on the gauge will be double the lower marking or as directed by the Global Water Inspector. Ponding water in excess of the allowable tolerance will be cause for rejection.

All costs incurred in correcting deficiencies found during the video inspection, including cost of additional video inspection required to verify correction of deficiencies, are the responsibility of the Contractor.

A copy of the completed video in DVD format compatible with windows based program and a report log with a key map of the entire videoed system that is reviewed, approved, sealed and signed by the Engineer of Record, shall be submitted to the Global Inspector for review and approval. Excessive dirt or debris in pipe shall be cause for rejection of the video tape and log. The system will have to be recleaned, revideoed and recertified by the Engineer of Record.

The City will require a "Compliance Letter" from Global Water prior to allowing the concrete/paving to begin. The Engineer of Record shall prepare a submittal package to Global Water indicating that all test data has been reviewed and approved for compliance of the plans and specifications. The submittal package is to be sealed and signed by the Engineer of Record. The following items are to be included in the submittal package: test results for density for all sewer lines and manholes, low pressure air test, deflection test, manhole exfiltration or vacuum test, video inspection logs and DVD disc of sewer mains and service, and a copy of the ECC submittal to ADEQ or MCESD. Global Water's Inspector will review submittal

package within seven (7) days. Incomplete submittal packages will be rejected without any review. The debris shields shall be installed prior to issuance of the Compliance Letter.

PROVISIONAL ACCEPTANCE

A PRE-FINAL walk through will be conducted when the utilities, paving and parkway grading are complete. A copy of the as-built plans will be given to the Global Water Inspector prior to pre-final walk through. During the walk through a punch list will be generated noting any deficiencies in workmanship or materials. A copy of the punch list will be provided to the entity installing the utility and the Contractor. The Contractor shall remedy, at his own expense, any deficiencies noted on the punch list.

Manholes and sewer lines will be cleaned by flushing and hydro-vac prior to scheduling a walk through. During walk through, to check for dirt and debris, a video inspection will be conducted of manholes and adjoining sewer lines. If video inspection reveals dirt or debris that is unacceptable to the Global Water Inspector, the sewer line/lines shall be hydro-vac and video inspected, at Contractor's expense.

All sewer services are required to have an 'S' stamped in the concrete at the top of curb location.

Provisional acceptance will be granted after all punch list items are corrected to the satisfaction of the Global Water Inspector and all other provisional acceptance requirements are met.

Flow of any kind into the existing sewage system shall not be allowed until the sewer has been approved and accepted for use by Global Water.

Portions of the work completed may be placed in operation after all cleaning, testing and inspection requirements have been fulfilled. Such partial use or partial acceptance shall be subject to the approval of Global Water Resources.

Under no circumstances shall any portion of the sewer collection system be placed in operations unless the pipeline is able to discharge directly to the Utility's backbone system. Upstream collection, hauling or pumping of raw wastewater will not be allowed.

Appendix B**CONSTRUCTION, INSPECTION, TESTING, APPROVAL AND ACCEPTANCE OF SEWER FORCE MAINS****INTRODUCTION**

This section applies to the construction, inspection, testing, approval and acceptance of sewer force mains, including appurtenances normally installed as part of the system. The installation of the utility is to conform to the requirements of Global Water, the approved plans and specifications, MAG specifications and the requirements of all Governmental Agencies, including but not limited to, ADEQ or MCESD, and the Local Governing Authority.

MATERIALS

The utility is to be constructed with materials that meet the requirements of Global Water, the approved plans and specifications, MAG specification and the requirements of all Governmental Agencies, including but not limited to ADEQ or MCESD, and the Local Governing Authority.

INSPECTION

Global Water's Inspector or authorized representative shall inspect and approve all the work per plans and specifications signed and sealed by a Registered (Civil) Engineer and approved by Global Water. These plans and specifications will require re-approval if any substantial change to the scope of work is made during the construction process. Plan approval is limited to the time stated on plans.

Prior to construction of any utility that is to be owned and maintained by Global Water a preconstruction meeting is to be scheduled. The preconstruction meeting is to be scheduled a minimum of 48 hours in advance. Prior to scheduling the preconstruction meeting two (2) reduced copies, 11 X 17, of the approved plans, list of material to be installed with the date of manufacture, copies of all permits, including City and/or County building permits, ADEQ or MCESD permits, and County dust control permit, are to be given to the Global Water Inspector. The required attendees for the preconstruction meeting are representative of: entity installing the utility, Contractor, City Inspector if work within City jurisdiction, County Inspector if work is in County Right-of-Way and Global Water Inspector. Other suggested attendees for the preconstruction meeting are representatives of Engineer of Record, Geotechnical Engineer and Registered Land Surveyor.

Any construction performed without a preconstruction meeting or without the knowledge of the Global Water Inspector is considered at risk. The Contractor is responsible for all costs and any corrective action required by Global Water to bring the utility into compliance with the approved plans & specifications, including removal and replacement, if required.

Prior to the construction of any sewer force main, the Contractor is to verify existing inverts at existing manholes and/or verify invert, slope and direction when connecting to an existing stub. Global Water will require cut stakes when constructing a sewer force main. The interval of the cut stakes will be approved by the Global Water Inspector.

All sewer force mains are to be marked with green locator tape placed one (1) foot above the pipe.

Ceramic epoxy lined ductile iron pipe used in sewer force mains will be wrapped in green polyethylene for the entire length of the pipe in accordance with MAG 610.5. Installation of the polyethylene wrapped ductile iron pipe will be performed using a strap to prevent damage to the polyethylene wrap.

A Geotechnical Engineer or his authorized representative shall be present during bedding and backfill operation, as required by the Global Water or the Local Governmental Inspector, to test bedding and backfill to insure required compaction densities are met. The Geotechnical Engineer or his authorized representative will keep a record of these tests and give copies of the test results to both the Global Water Inspector and the Engineer of Record. All costs associated with the Geotechnical Engineer are the responsibility of the entity installing the utility.

An Engineer of Record or his authorized representative is required to be present during installation and all testing of the utility. The Engineer of Record is responsible for the required documentation of the utility testing and submittals required by Global Water and all Governmental Agencies; including, ADEQ or MCESD. The Engineer of Record is responsible for accuracy of the as-builts of the utility. All cost associated with the Engineer of Record are the responsibility of the entity installing the utility.

CLEANING

Prior to testing any section of sewer force main, the Contractor shall remove all foreign matter from the interior of the system. The Contractor shall clean the system by flushing a cleaning ball, pig, pressure jetting or other appropriate method approved by Global Water's Inspector. The Contractor is to install watertight plugs, use isolation valves or other methods approved by Global Water's Inspector to prevent dirt or debris from entering Global Water's existing sewer system; including lift stations and receiving manholes. Water and foreign matter washed downstream is to be intercepted and removed by means approved by Global Water Inspector; this includes the use of a hydro-vac truck, if required.

TESTING

All testing shall be conducted by the Contractor. All expenses associated with testing, including equipment, labor and material are the responsibility of the Contractor. Equipment necessary to perform testing shall be the type, quality and capacity to perform the operations required to execute the test specified. Testing shall be conducted after the dry utilities have been installed and prior to concrete or paving operations. The bedding and backfill density test (compaction) must pass prior to the following required tests:

1. Pressure Test
2. Leakage Test

All testing shall be accomplished in the presence of the Engineer of Record or his authorized representative and witnessed by the Global Water Inspector or his authorized representative.

Global Water shall be notified 48 hours in advance of the testing.

Testing shall not commence on any portion of the pipeline, until all field placed concrete in contact with the pipe, fittings or appurtenances is adequately cured.

PRESSURE TEST

The lines shall be tested at a pressure of 200 psi for pipes 14" and smaller, and 150 psi for pipes 16" and larger.

The duration of each pressure test shall be a minimum of two (2) hours or as directed by the Global Water Inspector.

Each valved section of pipe shall be slowly filled with water at the specified test pressure measured at the point of lowest elevation. Pressure shall be applied and maintained by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection and all necessary apparatus, except metered

backflow prevention device, shall be furnished by the Contractor, and the Contractor shall furnish all necessary labor for connecting the pump, metered backflow prevention device, and gages.

As the line is being filled and before applying the test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made, if necessary, at points of highest elevation. After the test, the taps shall be tightly plugged per the requirements of the Global Water Inspector.

During the time the test pressure is on the pipe, the line shall be carefully checked at regular intervals for breaks or leaks. Any joints showing appreciable leaks shall be repaired and any cracked or defective pipes or fittings shall be removed and replaced with sound material and the test shall be repeated until satisfactory results are obtained.

LEAKAGE TEST

After all defects have been satisfactorily repaired and all visible leaks stopped, a leakage test shall be made on each valved section of the lines to determine the quantity of water lost by leakage. The Contractor shall furnish all labor, material, and equipment required for making the test. The leakage shall be determined by measuring the quantity of water supplied to each valved section of the lines, during the test period, when the various sections of the lines are under pressure. No pipe installation will be accepted until or unless the leakage as determined by above test is less than the amount set forth below.

The allowable leakage (gallons per hour) shall not be greater than determined by the following formula:

$$L = \frac{NDP}{7400}$$

L = Gallons per Hour

D = Nominal Pipe Diameter (in.)

N = Number of Joints

P = Test Pressure (PSI)

If individual sections show leakage greater than the limits specified above, the Contractor shall, at his own expense, locate and repair the defective joints until the leakage is within the specified allowance.

The City will require a "Compliance Letter" from Global Water prior to allowing the concrete/paving to begin. The Engineer of Record shall prepare a submittal package to Global Water indicating that all test data has been reviewed and approved for compliance of the plans and specifications. The submittal package is to be sealed and signed by the Engineer of Record. The following items are to be included in the submittal package for all sewer force main: test results for density, pressure test and leak test, and a copy of the ECC submittal ADEQ or MCESD. Global Water's Inspector will review submittal package within seven (7) days. Incomplete submittal packages will be rejected without any review.

ACCEPTANCE

A PRE-FINAL walk through will be conducted when the utilities, paving and parkway grading are complete. A copy of the as-built plans will be given to the Global Water Inspector prior to pre-final walk through. During the walk through a punch list will be generated noting any deficiencies in workmanship or materials. A copy of the punch list will be provided to the entity installing the utility and the Contractor. The Contractor shall remedy, at his own expense, any deficiencies noted on the punch list.

Provisional acceptance will be granted after sewer force main punch list items are corrected to the satisfaction of the Global Water Inspector and all other provisional acceptance requirements are met.

Flow of any kind into the existing sewerage system shall not be allowed until the sewer force main has been approved and accepted for use by Global Water.

Under no circumstances shall any portion of the sewer collection system be placed in operations unless the pipeline is able to discharge directly to the Utility's backbone system. Upstream collection, hauling or pumping of raw wastewater will not be allowed.

Appendix C**CONSTRUCTION, INSPECTION, TESTING, APPROVAL AND ACCEPTANCE OF WATER MAINS (POTABLE AND RAW WATER MAINS)****INTRODUCTION**

This section applies to the construction, inspection, testing, approval and acceptance of water mains, including appurtenances normally installed as part of the system. The installation of the utility is to conform to the requirements of Global Water, the approved plans and specifications, MAG specifications and the requirements of all Governmental Agencies, including but not limited to, ADEQ or MCESD, and the Local Governing Authority

Water meters will not be installed until the “Letter of Provisional Completion” has been issued by Global Water.

MATERIALS

The utility is to be constructed with materials that meet the requirements of Global Water, the approved plans and specifications, MAG specification and the requirements of all Governmental Agencies, including but not limited to ADEQ or MCESD, and the Local Governing Authority. All water lines shall be constructed per MAG. standard specifications 610.

During construction of the water line no direct connection to an existing Global Water line may be made. An air gap between the potable water supply and any water or wastes on site shall be maintained at all times. The Contractor shall install a Global Water provided metered backflow prevention device for any in line water connection for new water lines being connected to the potable water system. All costs associated with backflow prevention device shall be borne by the Contractor.

INSPECTION

Global Water’s Inspector or authorized representative shall inspect and approve all the work per approved plans and specifications signed and sealed by a Registered (Civil) Engineer and approved by Global Water. These plans and specification will require re-approval if any substantial change to the scope of work is made during the construction process. Plan approval is limited to the time stated on plans.

Prior to construction of any utility that is to be owned and maintained by Global Water a preconstruction meeting is to be scheduled. The preconstruction meeting is to be scheduled a minimum of 48 hours in advance. Prior to scheduling the preconstruction meeting two (2) reduced copies, 11 X 17, of the approved plans, list of material to be installed with the date of manufacture, copies of all permits, including City and/or County building permits, ADEQ or MCESD permits, and County dust control permit, are to be given to the Global Water Inspector. The required attendees for the preconstruction meeting are representative of: entity installing the utility, Contractor, City Inspector if work within City jurisdiction, County Inspector if work is in County Right-of-Way and Global Water Inspector. Other suggested attendees for the preconstruction meeting are representatives of Engineer of Record, Geotechnical Engineer and Registered Land Surveyor.

Any construction performed without a preconstruction meeting or without the knowledge of the Global Water Inspector is considered at risk. The Contractor is responsible for all costs and any corrective action required by Global Water to bring the utility into compliance with the approved plans & specifications, including removal and replacement, if required.

Prior to construction of any potable or raw water line the Contractor is to verify the existing lines being connected to, and the location, depth and size of pipe. Global Water will require cut stakes to the top of pipe when constructing water lines and blue tops for fire hydrants (potable water) and meter boxes (potable water) if no curb exists. The interval of the cut stakes will be approved by the Global Water Inspector.

Ductile iron pipe used in potable or raw water lines will be polyethylene wrapped for the entire length of pipe in accordance with MAG 610.5. All ductile iron potable water lines will be wrapped in blue polyethylene and all ductile iron raw water lines will be wrapped in black polyethylene. The installation of polyethylene wrapped ductile iron pipe will be performed using a strap to prevent damage to the polyethylene wrap.

All potable water lines are to be marked with blue and all raw water lines with black locator tape placed one (1) foot above the pipe.

Locator balls are to be placed in at all vertical and horizontal angle points of the potable (blue) and raw (black) water lines.

A Geotechnical Engineer or his authorized representative shall be present during bedding and backfill operation, as required by the Global Water or the Local Governmental Inspector, to test bedding and backfill to insure required compaction densities are met. The Geotechnical Engineer or his authorized representative will keep a record of these tests and give copies of the test results to both the Global Water Inspector and the Engineer of Record. All costs associated with the Geotechnical Engineer are the responsibility of the entity installing the utility.

An Engineer of Record or his authorized representative is required to be present during installation and all testing of the utility. The Engineer of Record is responsible for the required documentation of the utility testing and submittals required by Global Water and all Governmental Agencies; including, ADEQ or MCESD. The Engineer of Record is responsible for accuracy of the as-builts of the utility. All cost associated with the Engineer of Record are the responsibility of the entity installing the utility.

TESTING

Testing shall be conducted by the Contractor. All expenses associated with testing, including equipment, labor and material are the responsibility of the Contractor. Equipment necessary to perform testing shall be the type, quality and capacity to perform the operations required to execute the test specified. Testing shall be conducted after the dry utilities have been installed and prior to concrete or paving operations. Testing of water lines shall be per MAG standard specifications 610.15. The bedding and backfill density test (compaction) must pass prior to the following required tests:

1. Pressure Test
2. Leakage Test
3. Sterilization of Pipe Lines

All testing shall be accomplished in the presence of the Engineer of Record or his authorized representative and witnessed by the Global Inspector or his authorized representative.

Global Water shall be notified 48 hours in advance of the testing.

Testing shall not commence on any portion of the pipeline, until all field placed concrete in contact with the pipe, fittings or appurtenances is adequately cured.

Test results shall be approved by the Global Water Inspector prior to start of concrete and/or paving operations.

PRESSURE TEST

The line shall be tested at a pressure of 200 psi for pipes 14" and smaller, and 150 psi for pipes 16" and greater.

The duration of each pressure test shall be a minimum of two (2) hours or as directed by the Global Water Inspector.

Each valved section of pipe shall be slowly filled with water at the specified test pressure measured at the point of lowest elevation. The pressure shall be applied and maintained by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection, and all necessary apparatus, except metered backflow prevention device, shall be furnished by the Contractor, and the Contractor shall furnish all necessary labor for connecting the pump, metered backflow prevention device, and gages.

As the line is being filled and before applying the test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made, if necessary, at points of highest elevation. After the test, the taps shall be tightly plugged per the requirements of the Global Water Inspector.

During the time the test pressure is on the pipe, the line shall be carefully checked at regular intervals for breaks or leaks. Any joints showing appreciable leaks shall be repaired and any cracked or defective pipes or fittings shall be removed and replaced with sound material and the test shall be repeated until satisfactory results are obtained.

LEAKAGE TEST

After all defects have been satisfactorily repaired and all visible leaks stopped, a leakage test shall be made on each valved section of the lines to determine the quantity of water lost by leakage. The Contractor shall furnish all labor, material, and equipment required for making the test. The leakage shall be determined by measuring the quantity of water supplied to each valved section of the lines, during the test period, when the various sections of the lines are under pressure. No pipe installation will be accepted until or unless the leakage as determined by the above test is less than the amount set forth below.

The allowable leakage (gallons per hour) shall not be greater than determined by the following formula:

$$L = \frac{ND\sqrt{P}}{4500}$$

L = Gallons per Hour

D = Nominal Pipe Diameter (in.)

N = Number of Joints

P = Test Pressure (PSI)

If individual sections show leakage greater than the limits specified above, the Contractor shall, at his own expense, locate and repair the defective joints until the leakage is within the specified allowance.

STERILIZATION OF PIPE LINES

On completion of the leakage test and the pressure tests, all water mains are required to be super-chlorinated and tested prior to acceptance.

The Contractor shall furnish all labor, equipment and material necessary for the chlorination of the new pipe lines which shall be sterilized before being placed in service. The lines shall be sterilized by the application of the chlorinating agent. The chlorinating agent must be NSF certified and can be liquid chlorine, liquid chlorine gas-water mixture, or a calcium hypochlorite solution, which shall be fed into the

lines through a suitable solution-feed device, or other methods approved by the Global Water Inspector. The chlorinating agent shall be applied at or near the point from which the line is being filled, and through a corporation stop or other approved connection inserted in the horizontal axis of the newly laid pipe. The water being used to fill the line shall be controlled to flow into the section to be sterilized very slowly, and the rate of application of the chlorinating agent shall be in such proportion of water entering the pipe that the chlorine dose applied to the water entering the line shall be a minimum of 50 parts per million (ppm) not to exceed 80 ppm. This shall be verified by a Global Water Inspector by testing the concentration levels in the pipe with chlorine tests. The super-chlorinated water shall be retained in the section of pipe for a period of twenty-four (24) hours.

After the 24 hour period, the section of pipe shall be checked to assure a minimum concentration of 10 ppm chlorine residual is maintained throughout. This shall be verified by a Global Water Inspector through the use of chlorine test strips at each sampling location. Upon verification the section of pipe held 10 ppm chlorine residual throughout, the contractor shall flush to a chlorine residual of less than 1 ppm or what is representative in the distribution system. Upon completion of flushing, the section of pipe shall be sampled for bacteriologic growth by a Global Water sampling technician. The section of pipe shall be sampled in piece sections of no more than 1000 ft. The chlorine residual shall be measured for Free and Total chlorine as well as the pH/Temp of the water. On receipt of acceptable bacteriological analysis, the line may be brought into service with the approval of the Global Water Inspector.

The sampling riser shall be located at a location farthest from the point of chlorination. The riser shall be above ground a minimum of 18" and equipped with a faucet for control of flow during sampling.

The City will require a "Compliance Letter" from Global Water prior to allowing the concrete/paving to begin. The Engineer of Record shall prepare a submittal package to Global Water indicating that all test data has been reviewed and approved for compliance of the plans and specifications. The submittal package is to be sealed and signed by the Engineer of Record. The following items are to be included in the submittal package for all potable and raw mains: test results for density, pressure test and leak test, disinfection test results and a copy of the ECC submittal ADEQ or MCESD (potable water only). Global Water's Inspector will review submittal package within seven (7) days. Incomplete submittal packages will be rejected without any review. The metered backflow device is to be removed from the potable water system and the lines tied in to existing system.

Prior to the issuance to the "Compliance Letter" the Contractor will install a white hydrant ring on all new fire hydrants 4½" pumper connection. White hydrant ring will remain on fire hydrant until the pre-final walk through has been conducted. Contractor will also verify that there is water to all curb stops prior to the issuance of the "Compliance Letter".

ACCEPTANCE

A PRE-FINAL walk through will be conducted after when the utilities, paving and parkway grading are complete. A copy of the as-built plans will be given to the Global Water Inspector prior to pre-final walk through. During the walk through a punch list will be generated noting any deficiencies in workmanship or materials. A copy of the punch list will be provided to the entity installing the utility and the Contractor. The Contractor shall remedy, at his own expense, any deficiencies noted on the punch list.

Provisional acceptance will be granted after the water system punch list items are corrected to the satisfaction of the Global Water Inspector and all other provisional acceptance requirements are met.

Under no circumstances shall any portion of the water distribution system be placed in operations unless the pipeline has been approved by Global Water.

Appendix D**CONSTRUCTION, INSPECTION, TESTING, APPROVAL AND ACCEPTANCE OF RECYCLED WATER MAINS****INTRODUCTION**

This section applies to the construction, inspection, testing, approval and acceptance of recycled water mains, including appurtenances normally installed as part of the system. The installation of the utility is to conform to the requirements of Global Water, the approved plans and specifications, MAG specifications and the requirements of all Governmental Agencies, including but not limited to, ADEQ or MCESD, and the Local Governing Authority

MATERIALS

The utility is to be constructed with materials that meet the requirements of Global Water, the approved plans and specifications, MAG specification and the requirements of all Governmental Agencies, including but not limited to ADEQ or MCESD, and the Local Governing Authority. All recycled water lines shall be constructed per M.A.G. standard specifications 616.

INSPECTION

Global Water's Inspector or authorized representative shall inspect and approve all the work accomplished per plans and specifications signed and sealed by a Registered (Civil) Engineer and approved by Global Water. These plans and specification will require re-approval if any substantial change to the scope of work is made during the construction process. Plan approval is limited to the time stated on plans.

Prior to construction of any utility that is to be owned and maintained by Global Water a preconstruction meeting is to be scheduled. The preconstruction meeting is to be scheduled a minimum of 48 hours in advance. Prior to scheduling the preconstruction meeting two (2) reduced copies, 11 X 17, of the approved plans, list of material to be installed with the date of manufacture, copies of all permits, including City and/or County building permits, ADEQ or MCESD permits, and County dust control permit, are to be given to the Global Water Inspector. The required attendees for the preconstruction meeting are representative of: entity installing the utility, Contractor, City Inspector if work within City jurisdiction, County Inspector if work is in County Right-of-Way and Global Water Inspector. Other suggested attendees for the preconstruction meeting are representatives of Engineer of Record, Geotechnical Engineer and Registered Land Surveyor.

Any construction performed without a preconstruction meeting or without the knowledge of the Global Water Inspector is considered at risk. The Contractor is responsible for all costs and any corrective action required by Global Water to bring the utility into compliance with the approved plans & specifications, including removal and replacement, if required.

Prior to construction of any recycled water line the Contractor is to verify the existing lines being connected to, and the location, depth and size of pipe. Global Water will require cut stakes to the top of pipe when constructing recycled water lines. The interval of the cut stakes will be approved by the Global Water Inspector.

Ductile iron pipe used in recycled water lines will be wrapped in purple polyethylene wrap for the entire length of the pipe in accordance with MAG 610.5. Installation of polyethylene wrapped ductile iron pipe will be performed using a strap to prevent damage to the polyethylene wrap.

All recycled water lines are to be marked with Purple locator tape placed one (1) foot above the pipe.

Purple locator balls are to be placed in at all vertical and horizontal angle points of the recycled water lines.

A Geotechnical Engineer or his authorized representative shall be present during bedding and backfill operation, as required by the Global Water or the Local Governmental Inspector, to test bedding and backfill to insure required compaction densities are met. The Geotechnical Engineer or his authorized representative will keep a record of these tests and give copies of the test results to both the Global Water Inspector and the Engineer of Record. All costs associated with the Geotechnical Engineer are the responsibility of the entity installing the utility.

An Engineer of Record or his authorized representative is required to be present during installation and all testing of the utility. The Engineer of Record is responsible for the required documentation of the utility testing and submittals required by Global Water and all Governmental Agencies; including, ADEQ or MCESD. The Engineer of Record is responsible for accuracy of the as-builts of the utility. All cost associated with the Engineer of Record are the responsibility of the entity installing the utility.

TESTING

Testing shall be conducted by the Contractor. All expenses associated with testing, including equipment, labor and material are the responsibility of the Contractor. Equipment necessary to perform testing shall be the type, quality and capacity to perform the operations required to execute the test specified. Testing shall be conducted after the dry utilities have been installed and prior to concrete or paving operations. Testing of reclaimed water lines shall be per M.A.G standard specifications 610.15. The bedding and backfill density test (compaction) must pass prior to the following required tests:

1. Pressure Test
2. Leakage Test

Water used in testing of reclaimed water mains shall be 'reclaimed or raw' water only.

All testing shall be accomplished in the presence of the Engineer of Record or his authorized representative and witnessed by the Global Inspector or his authorized representative.

Global Water shall be notified 48 hours in advance of the testing.

Testing shall not commence on any portion of the pipeline, until all field placed concrete in contact with the pipe, fittings or appurtenances is adequately cured.

PRESSURE TEST

The line shall be tested at a pressure of 200 psi for pipes 14" and smaller, and 150 psi for pipes 16" and greater.

Each valved section of pipe shall be slowly filled with water at the specified test pressure measured at the point of lowest elevation. Pressure shall be applied and maintained by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection, and all necessary apparatus, except metered backflow prevention device, shall be furnished by the Contractor, and the Contractor shall furnish all necessary labor for connecting the pump, metered backflow prevention device, and gages.

As the line is being filled and before applying the test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made, if necessary, at points of highest elevation. After the test, the taps shall be tightly plugged per the requirements of the Global Water Inspector.

During the time the test pressure is on the pipe, the line shall be carefully checked at regular intervals for breaks or leaks. Any joints showing appreciable leaks shall be repaired and any cracked or defective pipes or fittings shall be removed and replaced with sound material and the test shall be repeated until satisfactory results are obtained.

LEAKAGE TEST

After all defects have been satisfactorily repaired and all visible leaks stopped, a leakage test shall be made on each valved section of the lines to determine the quantity of water lost by leakage. The Contractor shall furnish all labor, material, and equipment required for making the test. The leakage shall be determined by measuring the quantity of water supplied to each valved section of the lines, during the test period, when the various sections of the lines are under pressure. No pipe installation will be accepted until or unless the leakage as determined by the above test is less than the amount set forth below.

The allowable leakage (gallons per hour) shall not be greater than determined by the following formula:

$$L = \frac{ND\sqrt{P}}{4500}$$

L = Gallons per Hour

D = Nominal Pipe Diameter (in.)

N = Number of Joints

P = Test Pressure (PSI)

If individual sections show leakage greater than the limits specified above, the Contractor shall, at his own expense, locate and repair the defective joints until the leakage is within the specified allowance.

The City will require a "Compliance Letter" from Global Water prior to allowing the concrete/paving to begin. The Engineer of Record shall prepare a submittal package to Global Water indicating that all test data has been reviewed and approved for compliance of the plans and specifications. The submittal package is to be sealed and signed by the Engineer of Record. The following items are to be included in the submittal package for recycled water lines: test results for density, pressure test and leak test. Global Water's Inspector will review submittal package within seven (7) days. Incomplete submittal packages will be rejected without any review.

ACCEPTANCE

A PRE-FINAL walk through will be conducted when the utilities, paving and parkway grading are complete. A copy of the as-built plans will be given to the Global Water Inspector prior to pre-final walk through. During the walk through a punch list will be generated noting any deficiencies in workmanship or materials. A copy of the punch list will be provided to the entity installing the utility and the Contractor. The Contractor shall remedy, at his own expense, any deficiencies noted on the punch list.

Provisional acceptance will be granted after all the recycled water main punch list items are corrected to the satisfaction of the Global Water Inspector and all other provisional acceptance requirements are met.

