GILBERT
ARIZONA

APPENDIX TO THE PUBLIC WORKS & ENGINEERING STANDARDS MANUAL

Town of Gilbert Parks Department Design and Construction Standards

August 17, 2017

Scope:

The standards in this document apply to all irrigation systems on Town property that will be owned, operated, or impact the Town of Gilbert Parks Department.

Intent:

The intent of these standards are to ensure that the irrigation systems managed by the Town of Gilbert Parks Department will be able to apply the appropriate amount of water to the landscape plant material at the appropriate intervals in the most efficient manner possible. Highly efficient irrigation systems will allow the Parks Department to maintain healthy landscapes while protecting our water resources.

In the rest of this document the terms *shall* and *required* mean that deviations or substitutions from these standards are not allowed. The term *should* mean that deviations or substitutions from these standards shall be submitted in writing in advance to the designated Parks Department representative for approval.

1.1.1 Design Standards:

The irrigations system shall be designed where no more than 10% of the operating pressure is lost through an irrigation zone.

The irrigation system shall be designed where the operating pressure at the final output component is within the manufacturer's specified operating range. The irrigation system should be designed where the operating pressure at the final output components are at the manufacturer's recommended pressure.

1.1.2 Irrigation System Site Considerations:

Irrigation system designs shall be coordinated with all other site civil, electrical, mechanical and architectural improvements. Consideration must be made for access to control systems. Access and clearance requirements for utility company requirements shall be incorporated into plans, notes, and details.

1.2.1 Existing Utilities and Structures:

The Contractor shall protect existing structures and utility services and be made responsible for their replacement. Minor adjustments in the system will be permitted to clear existing obstructions subject to the approval of the Town. Irrigation plans shall include information for utility locating via Arizona 811 with the current logo and contact information on the irrigation plans. Irrigation plans shall also identify and dimension all public and private utility easements on a project.

Utility providers include but may not be limited to:

- Arizona Public Service
- Salt River Project
- Roosevelt Water Conservation District
- Southwest Gas

- Town of Gilbert
- Water Services
- Wastewater

1.2.2 Codes:

All applicable codes shall be adhered to and a permit will be required for installation of an irrigation system. The designated Town of Gilbert Parks Department representative shall receive the preliminary half size design drawings at the 60%, 90%, and final submittals for approval. The Town of Gilbert Engineering Services Department will review and approve all irrigation systems prior to any installation. The Engineering Services division will sign final design approval.

Irrigation system designs and plans shall be prepared by a landscape architect, certified irrigation design professional or professional registrant as determined by the Arizona State Board of Technical Registration. The landscape architect assumes all responsibility and liability for the accuracy and functionality of the irrigation design with his seal. Site verification of existing actual conditions and measurements is required.

All system components installations providing water to landscape plant material shall be located entirely within the limits of the project. There shall be no overlap between public and privately maintained systems without prior approval and written authorization from the Town of Gilbert.

1.2.3 Protection of Water Supply:

All backflow prevention devices shall meet the requirements of the town of gilbert backflow prevention section, municipal code chapter 10 (building and construction regulations), article III. All backflow prevention devices installed on potable water supply lines shall be devices approved by the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research. Required installation is a reduced pressure principle backflow assembly with a wire cage enclosure. Refer to Town of Gilbert standard detail GIL-350 for proper installation.

All backflow devices shall be tested by a state certified backflow assembly tester, and results forwarded to the town of gilbert backflow specialist. The town will provide a recognized company tester list upon request. Tester fees will be at the expense of the installer.

1.3.1 Submittal Requirements:

The irrigation design submittals shall include:

Location(s) and size of the water source(s)

Location(s), size(s), and model of pump stations (if applicable)

Location and capacity of onsite reservoir (if applicable)

Location, size, type, and model of the backflow preventer (when applicable)

Location, sizes, and type of pipe of the irrigation mainlines

Location and model of irrigation controllers

Location, size, and model of the irrigation control valves

Location and size of the field control wires

Location, sizes, and type of pipe of the irrigation laterals

Location, model of sprinkler heads, and the required nozzles

Location, model, and flow delivery rate of drip irrigation emitters

Location of drip zone flush caps

1.3.2 The irrigation design shall include:

Confirmed static water pressure at the water meter

Calculated operating pressures of the first sprinkler, a middle sprinkler, and the last sprinkler of every turf irrigation zone.

Calculated operating pressures of the first emitter, a middle emitter, and the last emitter of every drip irrigation zone.

Calculated precipitation rate of every turf irrigation zone.

Calculated precipitation rate of every drip irrigation zone.

Calculated low quarter distribution uniformity of every turf irrigation zone.

Calculated low quarter emission uniformity of every drip irrigation zone.

A base monthly irrigation schedule for every irrigation zone on the system for establishment and a base monthly irrigation schedule at maturity.

The calculated monthly and annual water consumption for the facility.

The source of water (domestic or reclaimed) will impact irrigation system design because of the available pressure and flow within each system. The Town of Gilbert Public Works Department can furnish water pressure data on request, if available. A seven day pressure data log shall be obtained to verify static water pressure at the site for potable irrigation systems.

1.4.1 Irrigation efficiency:

Multi-use areas designated for sports use shall be designated as athletic turf zones.

1.4.2 Ornamental turf:

Fixed pattern sprinkler zones shall have a minimum target low quarter distribution uniformity of 55% to 65%

Rotor sprinkler zones shall have a minimum target low quarter distribution uniformity of 65% to 75%

Drip irrigation zones shall have a minimum target low quarter emission uniformity of 80% to 90%

1.4.3 Athletic turf:

Athletic turf zones shall have a minimum distribution uniformity of 85%

Athletic and sports turf shall be on separate irrigation zones from ornamental turf.

1.5.1 Water Source(s):

The sources for irrigation water for landscaping in the Town of Gilbert are

- Domestic Water Supply System

  For requirements and regulations regarding connections, rates and metering of the domestic water supply refer to the Town of Gilbert Finance and Management Department Utilities Division for current information.

- Reclaimed Water Supply System

The Town of Gilbert has taken a pro-active approach to the wise use of its water resources. This includes the goal of 100% reuse of its reclaimed water. For complete explanation and regulations regarding the use of reclaimed water for landscape irrigation refer to the current Town of Gilbert Reclaimed Water User's Manual.

1.6.1 Source Water Sizing:

The water meter(s) and irrigation mainlines shall be sized appropriately to be able to apply ½" of irrigation to all turf zones at the facility within a seven and one half hour water window at peak ET (10:00 P.M. to 5:30 A.M.)

The onsite reservoir, pump station(s), and irrigation mainlines shall be sized appropriately to be able to apply ½" of irrigation to all turf zones at the facility within a seven and one half hour water window at peak ET (10:00 P.M. to 5:30 A.M.)

The onsite reservoir shall be sized appropriately to hold four irrigation days of water requirements at peak ET.

Any decorative water features or water play areas shall be metered separately from the irrigation system.

1.6.2 Pump Station(s):

Pump stations shall be variable drive.

Pump stations shall be selected to operate at peak efficiency based on the flow rates and the operating pressure of the irrigation zones during normal operation.

1.6.3 Acid injection systems:

All irrigation systems using reclaimed water shall have automated acid injection systems. Point of connection for acid injection systems shall be installed downstream of steel piping, after the piping transitions to PVC

1.7.1 Irrigation controllers:

Irrigation controller shall have enough programs to irrigate the different hydro zones at the appropriate intervals throughout the year.

Irrigation controller shall have a minimum of 5 start times per program. Controllers with a cycle and soak programming capability are excluded from this requirement.

Irrigation controllers shall have the ability to program run times of at least 6 hours to accommodate drip irrigation zones

Irrigation controller shall have a maximum calendar length of at least 31 days.

Irrigation controllers shall have the ability to receive signals and respond to flow sensors and the corresponding master valves.

Irrigation controllers shall have the ability to receive signals and respond to rain sensors.

Irrigation controllers that adjust the watering automatically in response to either ET or soil moisture content may be required.

Controllers shall require approval by the Parks Department prior to approval of design.

1.7.2 Automatic Controls and Scheduling:

All sprinkler systems shall be operated automatically by an irrigation controller which may be either automatic current or solar operated. Irrigation controllers shall be specified and included in the landscape/irrigation plan set and capable of operating all valves on a project. It is recommended that consideration be given to the use of irrigation controllers which have the capability of being expanded in the future.

Duration of watering cycles, days of watering, and time of day shall be scheduled with timing appropriate for the season at the start of the maintenance period. Adjustments are to be made by the maintenance contractor for change in seasons or water needs based on plant types, throughout the maintenance period.

At the time of Final Acceptance of the project by the Town of Gilbert, the controller schedule shall be properly set for the upcoming season and a printed, laminated schedule shall be provided to the Town's CIP project manager and the Parks Department designated representative.

Valve chart providing controller output number, identify plant zone type "trees", "shrubs", "ground cover" location. Chart shall be a reproduction of Record Drawings' color coded areas.

Valve identification tags "Christy Tags" or approved equal. Valve identification tags shall correspond with actual controller station assignments.

1.8.1 Controller Field Wiring:

All wiring to be used for connection of the automatic controller to the electric solenoid actuated remote control valves shall be equivalent to Type UF-600V, solid copper, PVC insulation, single conductor, UL approved underground feeder cable. All station or hot wires are to be one color and all "common" wires are to be white. Wiring shall conform to local codes and shall be installed according to the manufacturer's recommendations. Minimum wire size shall be 14 gauge. All wire connections shall be made with an epoxy filled cylinder type wire connector. All wire connections shall be made inside of junction boxes for access. When two wire systems are used the wire paths shall be installed in a minimum of schedule 80 PVC conduit. A minimum of two extra control wires shall be included with each wiring zone/bundle.

1.8.2 Field wire Sizing:

Control and common field wires shall be sized to ensure voltage drop does not exceed losses required to actuate solenoids at existing static pressures

1.9.1 Irrigation valves:

Irrigation valves using reclaimed water shall be labeled for that use by the manufacturer.

Irrigation valves shall have flow control capabilities.

Irrigation valves shall be sized appropriately to minimize the water velocity and pressure loss at the normal operating flows of the zones.

Both block and valve in head systems are acceptable design options.

2.1.1 Flow sensing:

Flow sensors shall be installed in conjunction with a master valve. The control system shall have the ability to shut down the water in cases of high flows.

2.1.2 Rain sensors:

Rain sensors shall be installed on all irrigation systems. The rain sensor shall measure rainfall at the site.

3.1.1 Pipe:

1. All pipe shall be properly sized and indicated on the drawings.

2. No galvanized pipe shall be used. No Marlex cut off risers shall be used. Schedule 80 PVC nipples shall be used for sprinkler swing joints when required to be constructed. Lasco (or equivalent) swing joints are acceptable on sprinkler connections ½" and ¾" in size. Sprinkler heads with an inlet size of ½" may use schedule 80 nipples when required by the Parks Department representative. Use of schedule 80 nipples must have prior approval.

3. Type K hard copper shall be used for all main line piping above grade, and extending to the appropriate depth based on pipe size.

4. Plastic PVC lines below paving shall be installed within separate schedule 40 sleeves. For PVC lines 1 inch to 2 1/2 inches the sleeve shall be 2 nominal sizes larger. For PVC lines 3 inches and larger the sleeve shall be 1 nominal size larger. Sleeves for water lines shall not exceed manufacturers recommended deflection for encased water line. Wiring shall be installed in separate sleeves.

5. All mainline pipe shall be thoroughly embedded and completely covered in sand or approved imported topsoil.

6. Plastic pipe shall be as described on the drawings. It shall be of the type specified on the plans. The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, deleterious wrinkles, and dents.

3.1.2 Plastic Pipe, Fittings and Connections on Laterals:

All pipe shall be as shown on design. All fittings shall be molded fittings manufactured of the same materials as the pipe and shall be suitable for either solvent weld or screwed connections. Only Schedule 80 PVC pipe may be threaded. Emitter connections only may be made with a schedule 40 male adapter. Irrigation lateral lines shall be Sch. 40 PVC pipe

Class 125 PVC pipe shall not be used in any part of the irrigation system.

3.1.3 Plastic Pipe, Fittings and Connections on Mains:

Mainline pipe shall be rated to at least 2 times the normal operating pressure.

All pipe and fittings shall be either solvent weld pipe or rubber ring joint pipe. Threaded plastic connections shall use a PVC Schedule 80 nipple. Joint compound shall be virgin teflon or tape.

Irrigation mainline with a diameter of 3" or smaller shall be Schedule 40 PVC pipe with solvent weld joints.

Irrigation mainline with a diameter 4" or greater shall be class 200 PVC with ring-tite joints.

Irrigation mainline shall be sized so the velocity does not exceed five feet per second at any time during normal operation of the irrigation system.

Thrust blocking shall be installed where the water changes direction.

4.1.1 Pressure management:

Pressure regulation shall be used when necessary to ensure operating pressures are within the manufacturer's specifications.

4.1.2 Check Valves:

Check valves shall be used to prevent low head drainage. Sprinkler heads with built in check valves are acceptable. Check valves shall be able to withhold 10 feet of head pressure.

5.1.1 Sprinkler zoning:

Sprinkler zones shall be designed so all of the heads on the zone have matched precipitation rates.

Full Circle rotor heads shall be zoned separately from part circle rotor heads.

Sloped area sprinkler heads shall be zoned separately from flat area sprinkler heads.

Sprinkler zones should be zoned appropriately to account for sun exposure

5.1.2 Sprinkler heads:

Fixed pattern spray head bodies shall have built in pressure regulators, check valves, and a mechanism to reduce flow in the event of a damaged pop up stem or nozzle.

6.1.1 Drip irrigation zoning:

Drip irrigation emitters shall be pressure compensating with a manufacturers coefficient of variation of less than 7%.

Plant materials with different run time and irrigation frequency requirements shall be zoned into separate hydrozones. Trees shall be on separate hydrozones at a minimum.

Plant materials with different sun exposures should be zoned into separate hydrozones.

The irrigation valve and lateral lines shall be sized appropriately to accommodate the flow capacity of the zones plant materials at maturity.

6.1.1 Filtration:

Filtration at control valves shall be specified to provide adequate filtration for pressure compensating emitters based on emitter flow rate.

7.1.1 Construction Standards:

7.1.2 Substitutions and Materials:

Once the Town has approved the plans, no substitutions shall be allowed without prior written authorization by the designated Parks Department representative. Any requests for substitutions shall be submitted in writing and in advance to the Town of Gilbert designated Parks Department Representative. The designated Town of Gilbert Parks Department Representative shall approve all such substitutions in writing prior to their installation. All materials shall be new and the best of their class and kind. All materials and workmanship shall be guaranteed for a period of one year from the time of Town acceptance against material defects and workmanship.

All plans and substitutions submitted for approval shall specify the brand, model, and nozzle size(s) of the heads. The brand, model, and size of all electric valves; and also the brand and model number of the electric controller, the brand, model, and size of the backflow preventer. Also to be submitted are all the pertinent data on such miscellaneous items as valve boxes, covers, size and type of pipe, in addition to all the necessary details.

7.1.3 Backflow Preventers:

All backflow preventers shall have a vacuum breaker security cage.

The backflow prevention assemblies shall be selected from the most current Town-approved list.

Upstream piping from the backflow prevention assembly shall be flushed in a manner that will not lodge dirt, rocks, and debris in the assembly itself.

Prior to final acceptance of the irrigation systems, each backflow prevention assembly

shall be tested by a certified and approved backflow prevention assembly tester, to ensure the device is operating correctly within manufacturers recommendations. A list of approved testers may be obtained from the Town. Test reports shall be sent to the Development Services and Plan Review Division at the Town of Gilbert. An approved test report form may be obtained from the Town.

Those devices not meeting test requirements shall be repaired and re-tested prior to final acceptance. In the case where reduced pressure principle assemblies are used, a splash pad shall be used under the relief part for discharge water. An acceptable method of handling discharge water from the device must also be approved prior to the installation of such a device.

7.1.4 Ball Valve:

Ball valve shall be PVC Asahi brand Duo Bloc Tru Union ball valve. Ball Valves shall not be threaded. Ball valves shall be installed with Schedule 80 TOE nipples.

Every electric remote control valve shall have one ball valve on the pressure side as an isolation valve. Ball valve shall be the same size as the electric remote control valve.

Every backflow preventer shall have two ball valves same size as the backflow preventer.

7.1.5 Check Valves:

1. Check valves 2 inch and smaller shall be swing type, bronze bodied with threaded connections and replaceable composition disc, rated at 150 pounds S.W.P.

2. Check valves 2-1/2 inches and larger shall be swing type, iron body, bronze mounted with flanged or threaded connections and replaceable rubber disc, rated at 125 pounds S.W.P.

7.1.6 Master Valve – Flow Sensor:

Each water source shall have a master valve and flow sensor.

7.1.7 Booster Pumps:

If a booster pump is used it shall be enclosed within a 6 foot high slump block wall along with the controller, the backflow preventer and all electric controls. Access shall be a 6 foot gate with a lock. The Town will assist in the selection of an acceptable booster pump.

7.1.8 Electric Controller:

1. Automatically operated irrigation controllers shall be capable of operating on 117 volts, 60 cycle A.C. current and shall provide output current of 24-26.5 volts at 1.1 amps for electric solenoid valves. Controller shall be sized to perform the sprinkling efficiently and adequately. All controllers shall be installed with a

rechargeable NiCad battery.

2. All controllers that are not cloud based shall be equipped with a Rainmaster plug-type harness for a remote control attachment. Wiring shall correspond to the geographic location of the valve and station controlled.

   Solar Controller may be used where approved by the Town of Gilbert where it is not feasible to connect to an electrical source. Solar controller shall be approved by Gilbert Parks Department representative.

8.1.1 Excavation, Backfilling and Compaction:

All excavation, backfilling, and compaction of trenches for landscape irrigation systems shall be in accordance with MAG Standard Specifications Section 601.

Mainlines shall have locator tracer tape installed a minimum of 12" above mainline pipe. Control wiring shall be a maximum depth of 2 inches below the main line. When in common trenches, the control wiring shall be laid first, which must be taped and bundled every 10 feet, to be followed by a minimum of 2 inches of fine backfill, then the main lines shall be laid. It is then followed by a minimum of 4 inches of fine backfill; then the laterals and final backfill and compaction. Bundled control wiring shall not be in contact with pipe.

8.1.2 Pipe Depth:

Mainlines 2" – 4" pipe: minimum 18" cover/maximum 24"cover from top of pipe.

Mainlines 6" – 8" pipe: minimum 24" cover/maximum 36" cover from top of pipe.

Mainlines 10" – 12" pipe: minimum 36" cover/maximum 48" cover from top of pipe.

Lateral lines: Minimum 12" cover/maximum 18" cover from top of pipe.

8.1.3 Installation of Plastic Pipe for drip irrigation:

Plastic pipe shall be installed in a manner so as to provide for expansion and contraction as recommended by the manufacturer.

For irrigation systems only rigid type PVC or schedule 80 flex hose riser materials shall be used with drip type heads. Use of poly pipe is prohibited. Connection from PVC pipe to multiport emitters with ("spaghetti") tubing shall not be used. Poly tubing may have limited use in the initial and temporary distribution of water at tree installations and shall be used only in conjunction with single-outlet emitters. All horizontal installations of poly tubing shall be installed and anchored a minimum of 4 inches below the finished landscape area surface.

When flex emitter risers are used 795 solvent shall be used. Rigid Sch. 80 PVC connections may be used where traffic conditions are not be a concern.

All emitters shall be rigid "hard" plastic, 0.5 inch diameter threaded/screw on type installation.

8.1.4 PVC pipe solvent welds:

Primer and glue shall be appropriate for the type of pipe. Primer shall be used on all solvent weld connections.

9.1.1 Control valve field wiring:

Valve control wiring shall be installed under the mainline

2 wire systems wiring shall be in conduit

When conduit is used for 2 wire path control systems, tracer wire or tape shall be installed in the conduit trench.

Control wire shall be one contiguous run from the controller to the control valve.

10.1.1 Remote Control Valves and Boxes:

Remote control valves shall be normally closed 24 volt a.c. 60 cycle solenoid actuated globe/angle pattern diaphragm type except when DC latching solenoids are required. The valve body and bonnet shall be constructed of either heavy cast brass or heavy duty glass-filled nylon. Solenoid coil shall be encapsulated in molded epoxy. The valve shall have a flow control stem with wheel handle for regulation or shutting off the flow of water and a bleed screw for manual operation without electronically energizing the solenoid. The valve construction and installation shall be such as to provide for all internal parts to be removable from the top of the valve. Schedule 80 Asahi dual block true union Isolation ball valve shall be installed directly in front of control valve. Ball valve shall be the same size as the control valve.

Schedule 80 PVC unions with Acme threads shall be installed directly after the control valve Unions shall be installed so that they may be removed without excavating the valve box.

Valve box shall be wrapped in geo-textile.

Control valve shall be installed with a minimum of 3" above drainage gravel.

Valve boxes shall include covers which are water proof and secured with stainless steel bolts and washers.

Valve boxes shall be Carson 1220 Jumbo or approved equal. All valve boxes shall include brick supports and pea gravel. Soil shall be returned to full compaction to prevent boxes from settling. Top of valve box shall be flush with finish grade. Two wire decoders shall be installed in a valve box.

Quick coupling Valves: Quick coupler valve assembly shall be installed below grade in a box with a minimum 10" opening. The valve shall be stabilized to prevent damage in a manner approved by the Town Parks Department representative.

11.1.1 Sprinkler head installation:

Sprinkler heads shall be installed with nozzles specified in design. All heads of a particular type of function in the system shall be of the same manufacturer and shall be marked with the manufacturer's name and identification in such a position that they can be identified without being removed from the system. All sprinkler heads, which are to be installed in lawn areas where the turf has not yet been established, shall be set one (1) inch above the proposed finished grade. Heads installed in this manner shall be lowered to grade when the turf is sufficiently established to allow walking on it without appreciable destruction. All nozzles on rotary pop-up sprinklers shall be tightened after installation. All sprinklers having an adjustment stem shall be adjusted for the proper radius, diameter, and/or gallons.

12.1.1 Drip emitter installation:

Multiport emitters shall be installed below grade in a box with a minimum 4" opening. Flush caps shall be installed below grade in a box with a minimum 4" opening.

A drip system shall be installed in such a manner that the emitters and smaller tubing are to be below grade and vandal resistant. The final water output shall be a minimum of 2" above final DG grade.

13.1.1 Inspections:

The Town of Gilbert's project manager or designated construction inspector will inspect and approve the work at the following stages of completion. Any work completed without these inspections shall be removed prior to acceptance of that phase of work. These stages are:

Completion of all trenching and installation of all main lines prior to back-filling, including the backflow preventer, quick couplers, electric valves, and any isolation valves.

The main line shall be pressure tested with water and must maintain pressure at 150 PSI for four hours. The Town of Gilbert Parks Department designated representative shall confirm pressure at the beginning of the test and at the end of the test. Documentation of pressure readings shall be provided to the Town of Gilbert Parks Department designated representative at the completion of testing and with project close-out materials and included on the Record Drawings.

Completion of installation of all control wires prior to backfilling.

Installation of all valves, lateral lines, and heads prior to backfilling.

Verification that irrigation system provides 100% coverage and meets/conforms to system design specifications.

14.1.1 Flushing and Testing:

After all new sprinkler piping and risers are in place and connected and all necessary division work has been completed and prior to the installation of sprinkler heads, control valves shall be opened and a full head of water used to flush out the system. After the system is thoroughly flushed, the heads and nozzles shall be installed and the system operating pressure shall be tested prior to backfilling the laterals. The operating pressure shall be tested at the first head, a middle zone head, and the last head on the zone. The pressures shall be recorded and reported to the designated Parks Department representative. The pressures shall correspond with the calculated design pressures.

15.1.1 Record Drawings:

The developer or contractor shall be responsible for providing one hard copy of the final set of Record Drawings produced using the original approved project plan set, and one electronic set in pdf format on CD. The pdf format shall be able to be opened by commonly used pdf readers. The Contractor may utilize a pdf editing method to create the Record Drawings or they may be neatly and legibly hand written.

The pdf plan set shall be saved on the CD as one file with plan sheets in the same sequential order and file name as the original plan set with the view zoomed tight to the plan sheet. The CD shall be delivered in a clear case with the CD and case clearly labeled with project name, project number (as assigned by the Town of Gilbert), date of CD preparation.

The Record Drawings shall include all changes made by the contractor during the course of construction, to indicate actual changes made from the original plans (As-Builts). This shall be given to the Town prior to Final Acceptance. No final payment will be made until the Record Drawings have been received by the Town. The plans shall include an inventory list of all irrigation components. The inventory shall include the quantity, brand, make, model, and size of each component.