

Tucson Parks and Recreation Irrigation Design and Construction Requirements



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ABOUT THESE STANDARDS

These Standards have been developed by Tucson Parks and Recreation to provide uniform minimums in design, construction and materials. These Standards are intended to make it easier for the design and construction communities to know what is expected of them and for the City to better manage projects and provide a more consistent, efficient, manageable and maintainable park system.

These Standards do not cover every condition and situation that may occur. These are Standards and do not replace the need for Consultant Project Specifications that address the needs and requirements of individual projects. These Standards may be referenced, or applicable sections or requirements may be included in the Consultant's Project Specifications. Construction Details may be included in their unedited format. If revisions to a Standard Detail are required for a particular project, the detail should be shown as "revised".

It is important that there are no conflicts between these Standards and the Consultant's Project Specifications. Any deviation from these Standards must receive prior Project Manager Approval.

It is fully anticipated that improvements and revisions to these Standards will be made over time. Therefore, it is very important that the latest and most current Standards be used.

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3. Approved Irrigation Materials List
4. Irrigation Project Inspection Form

SEC. 1 DESIGN REQUIREMENTS

A. SOURCE ANALYSIS

- A. The water pressure required at the point of connection shall be analyzed at the beginning of the irrigation design process. The need for a booster pump must be approved prior to beginning any design work. The results of the preliminary pressure analysis shall be shown on Form A (Appendix).
- B. The Point of Connection shall be analyzed for the ability to provide adequate gallons per minute to meet the irrigation requirement within the water window. The calculated flow at the Point of Connection shall be shown on Form A (Appendix). As a rough guide, 40 gallons per minute per acre of turf may be used for the preliminary peak flow estimate. Water meters shall be sized to flow at a maximum of 75% of the maximum rated flow for the meter. Leaching requirements should be in addition to the above requirements.

2. WATER WINDOW

- A. The turf irrigation system shall be designed so that the turf may be irrigated during periods of peak demand within a 36-hour period per week and apply 11 inches of water per month with an estimated average efficiency of 70%. The water window is 10:30pm to 6 am.
- B. Drip irrigation systems may be designed to operate either during turf operation or when the turf system is not operating.
- C. A valve chart showing peak season operating times shall be prepared as shown in the example in the Appendix.
- D. If it is necessary to operate multiple valves simultaneously in order to apply the required water within the water window, then the mainline piping and control wires shall be sized for the worst expected case.

3. EFFICIENCY

- A. The turf irrigation system shall be designed to apply water at the following minimum application efficiencies as measured by the Low Quarter Distribution Uniformity Method after construction:

Rotors	65% DU measured by audit.
Fixed Spray Heads	60% DU measured by audit.
- B. Heads and nozzles shall be selected to provide the following estimated minimum Distribution Uniformities during design. Estimates shall be

representative of the equipment selected for the majority of areas irrigated. Estimates shall be based on simulated performance using the S.P.A.C.E. Program (Center for Irrigation Technology) or approved manufacturer's data.

Rotors	70% DU measured by estimate.
Fixed Spray Heads	65% DU measured by estimate.

4. PRECIPITATION RATE

- A. Heads and nozzles shall be selected so that the precipitation rate does not promote runoff. Where required due to slopes or tight soils, low precipitation rate heads, in conjunction with controller cycle- soak capabilities, shall be used to prevent runoff.
- B. Turf areas using large radius heads shall have full circle heads and part circle heads on separate valves. All other areas shall use matched precipitation rate heads.

5. COVERAGE

- A. For turf areas, head to head spacing, defined as sprinkler spacing not greater than the radius of throw, shall not be exceeded without prior permission from the Project Manager. Closer spacing may be required due to site conditions- wind, etc.

6. DRIP IRRIGATION REQUIREMENTS

- A. Plants with different water requirements shall be designed on separate control zones. Trees and shrubs shall have separate valves and plants with unique water requirements shall be zoned separately. Riparian, large box and high water use trees shall be zoned separately wherever practical.
- B. The different water requirements between species shall be balanced proportionately by varying the discharge rate and number of outlets per plant.
- C. A separate irrigation control zone shall be provided for trees in turf and shall be drip or bubbler as approved by the project manager.

7. RECLAIMED WATER REQUIREMENTS

- A. When reclaimed water will be used in an irrigation system, all components, signage, separations, requirements for dye testing and marking requirements shall conform to or exceed Tucson Water's Reclaimed User's Manual.

- B. Only Class A+ reclaimed water, as defined by ADEQ will be provided to irrigate landscape plants on this project in the areas designated to receive reclaimed water.
- C. The contractor shall prepare a worker education and safety guideline regarding the risks associated with working with Class A+ reclaimed water. The workers shall be trained in the proper procedures when working with reclaimed water. Verification of this training shall be submitted in writing by the contractor to the Engineer at the pre-construction conference, or a later date that is acceptable to the Engineer. The workers shall be provided with all personal safety equipment and devices necessary for accomplishing the work in accordance with OSHA Regulation 29 CFR Part 1926, Construction Safety, and Health. The contractor shall also ensure that a “Competent Person” as defined in 29 CFR Part 1926, is present on the job at all times when work involving the reclaimed water is being performed. Training, safety equipment, and other costs associated with ensuring the health and safety of the workers around the reclaimed water shall be bourn by the contractor without any additional expense to the City.
- D. Any tank truck and other equipment that is used to distribute reclaimed water shall be clearly identified with warning signs as may be required by federal, state, or local ordinances.
- E. The contractor shall be responsible for keeping all reclaimed water out of contact with the public. At no time shall the reclaimed water be allowed to escape onto the roadway or into any drainage systems.
- F. All valve boxes, valve box lids, and remote control valves, and PVC piping shall have the color purple for identification of a non-potable system. All PVC pipe shall meet the provisions for identification as set forth by the Arizona State Department of Environmental Quality for the use of Reclaimed Water. Color identification shall be purple. Plastic lids shall be integrally colored. Metal lids shall be ordered without coating as bare metal and receive a fusion bond epoxy powder coat finish. Metal lids shall be branded prior to coating as shown in the details.
- G. The contractor shall comply with all laws, from all appropriate jurisdictions, that pertain to the construction, operation, and maintenance of reclaimed water distribution systems during construction and during the establishment period. No additional payment shall be made to the contractor for constructing the system according to these laws.
- H. The irrigation system will be operated to avoid ponding or puddling. To minimize ponding or runoff, the reclaimed water shall be applied at a rate that does not exceed the infiltration rate of the soil.

- I. Signs reading “CAUTION: RECLAIMED WATER, DO NOT DRINK” shall be prominently displayed on the site and at all entrances to the site. It is important to place the caution signs around any aboveground irrigation equipment. The purpose and intent of properly notifying the public is to ensure that the reclaimed water is not misused.
- J. There shall be no connection between the potable water supply and any piping containing reclaimed water.
- K. Personnel working in and about the reuse site shall be informed that reclaimed water is being used and shall take appropriate safety precautions.
- L. The contractor shall make himself aware of and comply with all Federal, State, and Municipal codes, requirement and restrictions regarding construction of the reclaimed water irrigation distribution systems, particularly with respect to worker safety, worker hygiene, worker training and required separation distances between any reclaimed water line and any potable water line.

SEC. 2 MATERIALS

1. BACKFLOW PREVENTERS

- A. Reduced pressure backflow preventers shall be used where cross connection protection is required and shall meet all local agency requirements.
- B. Above ground piping for backflow preventers shall be Type K copper for sizes up to 2 inches and ductile iron for sizes 3 inches and larger.
- C. Approved all weather insulating material shall cover all exposed piping and equipment for all units less than 3 inches in size. Access for test points and shutoffs shall be maintained. Approved insulating blankets shall be used on all backflow preventers.
- D. One inch backflow preventers and smaller shall be provided with a freeze protection device as listed in the Approved Product List.

2. BACKFLOW PREVENTER ENCLOSURES

- A. All backflow preventers installed in locations with public access or in areas requiring protection shall be installed in an enclosure.
- B. See Approved Product List for backflow preventer enclosures.

3. IRRIGATION CONTROLLER

- A. The irrigation controller shall be fully compatible with the City of Tucson's existing Central Control System. This requirement may be waived by the Project Manager for isolated small drip systems. See Approved Product List.
- B. Controllers are to be installed in standalone pedestal cabinets if possible. Installation within buildings is not recommended. When installed within a building an external antenna is required.

4. IRRIGATION CONTROLLER ENCLOSURE

The irrigation controller enclosure shall be manufactured from type 304 stainless steel and specially configured for use with the Irrigation Controller. See Approved Product List. A dual locking system shall be part of the controller enclosure.

5. MASTER VALVES / FLOW SENSORS

- A. Unless waived by the Project Manager, all projects shall have master valves and flow sensors.
- B. Master valves and flow sensors shall be fully compatible with the Irrigation Controller.

- C. Master valves and flow sensors shall be sized and installed in strict accordance with manufacturers' recommendations. Specific care shall be taken to properly provide required distances of straight runs of pipe and to minimize excessive runs of reduced mainline sizes. Sensors shall be sized to accurately read flows within the range of design flows. Where large and small flow rates occur on the same project and one size of master valve and flow sensor is not capable of proper function throughout the range, separate master valves and flow sensors shall be provided for the differing ranges of flow.
- D. Wiring between the Master Valves and Flow Sensors shall be as recommended by the manufacturers. The wiring shall be installed in plastic Sch. 40 PVC electrical conduit no less than 1-1/4 inch in size. Splices between the devices and controllers are not allowed without pre-approval in writing by the Project Manager.
- E. Where a booster pump station is used, the master valve shall be installed by the pump manufacturer inside the pump station enclosure where possible.

6. REMOTE CONTROL VALVES

- A. Remote Control Valves shall be sized based on manufacturers' recommendations.
- B. Pressure regulating modules may be used to regulate pressure for drip and spray head zones where required for proper operation.

7. ROTOR HEADS

- A. Rotor Heads shall have protective purple rubber covers.
- B. Dual opposing nozzle heads shall not be used without Project Manager's approval.
- C. Heads shall be selected based on the appropriateness of the application.
- D. See Approved Product List.

8. POP-UP SPRAY HEADS

- A. See Approved Product List. Matched precipitation nozzles shall be used.

9. SWING JOINTS

- A. See Approved Product List

10. QUICK COUPLING VALVES

- A. See Approved Product List

11. DRIP IRRIGATION COMPONENTS

- A. See Approved Product List

12. VALVE BOXES

- A. See Approved Product List
- B. All valve boxes are to have all openings sealed with approved geotextile fabric.
- C. Where valve boxes are to be installed in areas of vehicular traffic, traffic rated boxes shall be used.
- D. All valve boxes shall have locking lids.
- E. Where reclaimed water is used the valve box shall be identified for reclaimed use. Plastic valve boxes and lids for reclaimed use shall be integrally colored purple. Metallic lids for concrete boxes shall be epoxy powder coated fusion bond epoxy. Lids shall be ordered without coatings, physically and chemically cleaned down to bare metal and powder coated by the contractor. Color to be reclaimed purple.
- F. Metallic lids shall be permanently factory labeled as called for in the details.

13. LATERAL PIPING AND FITTINGS

- A. Lateral Piping shall be Sch. 40 PVC with solvent weld joints.
- B. Fittings shall be Sch. 40 PVC unless otherwise shown on the Standard Details.
- C. The use of PVC Male Adapters or PVC Female Threaded Adapters is not allowed. Threaded one end (TOE) nipples shall be used where needed.
- D. PVC Unions shall be solvent weld.
- E. Purple pipe shall be used for reclaimed water.

14. MAINLINE PIPE AND FITTINGS

- A. Mainline Piping 2 inches and less in size shall be Sch. 40 PVC with solvent weld joints.
- B. Mainline Piping less than 2-1/2 inches in size shall be Class 250 SDR 17 PVC ring-tite joints.
- C. Mainline Piping 3 inches in size shall be Sch. 40 PVC with ring-tite joints.
- B. Mainline Piping 4 inches and larger size shall be C-900 DR 18 PVC with ring-tite joints.
- C. Fittings shall be Sch. 80 PVC for 3 inches and less in size.
- D. Fittings shall be mechanical joint x mechanical joint ductile iron Class 250 for fittings 4 inches and larger size. At valve manifolds, fittings shall be flanged or fully restrained.
- E. Purple pipe shall be used for reclaimed water.
- F. All buried metallic mainline fittings shall be wrapped in a protective plastic sleeve. Reclaimed pipe fittings shall be wrapped in a purple covered sleeve.
- G. PVC Unions shall be solvent weld.

15. GATE VALVES/ BALL VALVES

- A. Mainline Gate Valves 2 inches and larger to have a square operating nut and shall conform to AWWA C-509 resilient wedge.
- B. Other Gate Valves less than 2 inches shall have a cross handle operating nut and smaller shall be bronze Class 125. Lead free valves shall be used whenever possible on potable systems.
- C. Ball Valves shall be fully ported bronze lead free valves.

16. COPPER PIPE AND FITTINGS

- A. All copper piping shall be Type K rigid conforming to ASTM Standard B88 unless otherwise approved by the Project Manager for special applications.
- B. Galvanized piping and fittings are not permitted without Project manager's approval.

17. IRRIGATION BOOSTER PUMP- To Be Determined Based On Project Requirements.

- A. Irrigation booster pumps shall be designed to provide the required boost in pressure at the required flows to meet design performance and water window requirements.
- B. All booster pump stations shall be pre-manufactured and shall have a UL Listing.
- C. Booster pump stations 5 HP or larger shall be provided with a variable frequency drive (VFD) where possible.
- D. Booster pump stations except submersible stations shall be enclosed in a powder coated steel or aluminum locking enclosure.
- E. Booster pump stations shall start based on receiving a signal from the irrigation controller or based on pressure depending on the specific needs of the project.
- F. Booster pump stations located in enclosures, larger than 10 HP and closer than 300 feet from an adjacent residence shall be factory sound insulated on the inside of the enclosure with a one inch layer of sound attenuating insulating foam.
- G. Booster pump stations shall be equipped with safety shutoff features to protect the pump in the event of low flow or low inlet pressure events.
- H. When feasible, a magnetic flow meter shall be integrated into the pump station and used provide flow information to the pump control panel and the irrigation controller.
- I. When possible, the master valve shall be installed by the pump manufacturer and located inside the booster pump enclosure.

18. CONTROL WIRING

- A. Control wire for remote control valves and sensor decoders shall be per manufacturers' requirements and as listed in the Approved Materials List.
- B. All new installations shall use 2 wire conductors compatible with the City's control system and as listed in the Approved Materials List.
- C. All 2 wire conductors shall be installed in 1-1/4" minimum UL listed Sch. 40 PVC gray electrical conduit with pull boxes. Conduit and pull boxes shall be installed as described in the Construction Requirements of these Standards.

- D. Conventional control wiring for control valves shall be used only in cases where minor modifications are required to an existing conventional system. The use of conventional wiring requires the prior approval of the project manager. When conventional wiring is approved for use, 1-1/4" minimum UL listed Sch. 40 PVC gray electrical conduit with pull boxes for future 2-wire installation shall be provided along the wire path.

19. DECODERS AND GROUNDING

- A. Valve and sensor decoders shall be per manufacturers' requirements, as described below, and as listed in the Construction Requirements and in the Approved Materials List.
- B. Decoders for valves and sensors shall be Rainmaster TW-D-series for remote control valves.
- C. Lightning arrestors shall be Rainmaster LA-1.
- D. Grounding shall be per manufacturers' requirements, as described in the Construction Requirements and as listed in the Approved Materials List.

20. FLOW SENSORS

- A. Flow sensors for three inch and larger pipe shall be as Rainmaster Model FS-INSERT-B. listed in the Approved Materials List. Flow sensor shall be installed in a 2" NPT saddle tee as listed in the Approved Materials List, Romac Model 202NS or approved equal. A manufacturer's provided insertion tool shall be used to field calibrate installation depth.
- B. Flow sensor for 2-1/2" inch and smaller pipe shall be Rainmaster Model FSB with a brass tee. Plastic tee style flow sensors are not permitted.
- C. Provide required runs of straight pipe as required by the manufacturer and detailed.
- D. When an Irrigation Booster Pump is used on a project, a magnetic style flow meter shall be part of the pump station when possible and shall provide the flow information to the pump station and the irrigation controller in lieu of a paddlewheel style sensor.

21. DRIP COMPONENTS

- A. Tree lateral piping shall be 1 inch Sch. 40 PVC pipe.
- B. Shrub lateral piping shall be 3/4 inch Sch. 40 PVC pipe.
- C. Branch laterals for emitters shall be 1/2 inch Sch. 40 PVC pipe.
- D. Additional drip components shall be as shown in the Approved Materials List.

SEC. 3 CONSTRUCTION REQUIREMENTS

1. DEPTH OF BURIAL AND PIPE SEPARATION

- A. Minimum burial shall be as shown on the Irrigation Trenching Detail.
- B. See Sec. 3.8 for requirements for piping under paving.
- C. Depths shown shall not be exceeded by three inches without prior approval of the Project Manager.
- D. Pipe separation shall be as shown in the Construction Details. There shall be no exceptions except where site conditions prohibit required separation and prior approval is obtained from the Project Manager.

2. BACKFLOW PREVENTER INSTALLATION AND TESTING

- A. Backflow preventers shall be the reduced pressure type and shall be installed as shown in the details and required by Tucson Water and in conformance with all relevant building codes.
- B. When three inch and larger backflow preventers are used and where there is a Tucson Water fenced meter enclosure, the backflow preventer may be installed inside the fenced enclosure and attached to the meter assembly.
- C. Backflow preventers shall be tested by a Certified Backflow Tester at no additional cost to the City. Associated permits shall be obtained from the water utility at no cost to the City. A copy of the certified test results shall be furnished to the City Parks Department.
- B. All testing and approval must occur prior to final acceptance by the City.

3. IRRIGATION CONTROLLER AND VALVE CHARTS

- A. Irrigation Controller and Valve Charts will be prepared by the Landscape Architect based on information provided by the Contractor.
- B. Provide one controller chart per controller or satellite.
 - 1. Chart may be a reproduction of the Record Drawing. Charts shall be reduced to fit in the controller door. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility. Coordinate with parks staff. A digital copy shall be provided for use in the City's data base.
 - 2. Chart shall be a bond print of the actual system, showing the area covered by that controller.

- C. Valve charts shall identify the area of coverage of each remote control valve, using a distinctly different transparent pastel color, drawn over the entire area of coverage.
- D. Following approval of charts by the Project Manager, they shall be hermetically sealed between two layers of 20 mil thick plastic sheet.
- E. Charts must be completed and approved prior to final acceptance of the irrigation system.

4. ANTENNA LOCATION AND TESTING

The Contractor shall employ the services of the Manufacturer's Representative to verify radio reception at the proposed antenna location(s) prior installation of the antenna.

5. MECHANICALLY RESTRAINED JOINTS/ CONCRETE THRUST BLOCKS

Mechanically restrained joints or concrete thrust blocks shall be installed at specific locations per manufacturer's recommendations and instructions and per Tucson Water Standard Specification 1406 and Standard Details 600 and 610 with the exception that pressure testing requirement shall be 150 psi. (See Appendix) Mechanically restrained joints and/or concrete thrust blocks shall be installed for main lines at all changes in direction, elevation, gate valves and tees for all main lines 2-1/2 inches and larger. All thrust blocks must bear on undisturbed soil. Additional mechanical restraints may be required as directed by the Project Manager.

6. EQUIPMENT TO BE FURNISHED

- A. The Contractor shall be required to supply the following tools as part of the construction contract:
 - 1. Two sets of special tools required for removing, disassembling and adjusting each type of sprinkler and valve supplied on this project.
 - 2. One valve box key or wrench.
 - 3. Three of each replacement sprinkler heads for each type of full and part circle head with full sets of nozzles.
 - 4. Three Quick Coupling Keys with Hose Swivels for each type of Quick Coupling Valve.
 - 5. One five foot gate valve key (where applicable).

6. Two keys for each irrigation controller and enclosure shall be provided. Keys shall be manufacturer provided with original markings.
7. Two pressure testing kits, with hose and liquid filled pressure gauge shall be provided. One shall have a pitot tube attachment and one shall have a schrader valve fitting. The hose and gauge shall be equal to the Rainbird PHG assembly.
8. The requirement for radio remotes shall be decided in the design phase of the project on a job by job basis by the Project Manager.

7. TESTING

A. Testing of Irrigation System:

1. The Contractor shall request the presence of the Project Manager at least 24 hours in advance of testing.
2. Test all pressure lines under hydrostatic pressure of 150 psi and prove water tight for a period of not less than two hours. All couplings shall be exposed and swing joints and other outlets capped.
3. All piping under paved areas shall be tested under hydrostatic pressure of 150 psi and proved water tight prior to paving.
4. All PVC lateral line pipe shall be tested at working line pressures or 75 psi, whichever is greater, with couplings exposed and swing joints and other outlets capped.
5. Sustain pressure in lines for not less than two hours. Pipe sections shall be center loaded and all couplings shall be exposed. Before testing, the line shall have been filled with water for at least four hours and provisions made for thoroughly bleeding the line of air.
6. All hydrostatic tests shall be made only in the presence of Project Manager. No pipe shall be backfilled until it has been inspected, tested and approved in writing.
7. The Contractor shall provide the force pump, gauges, water when required and all appurtenances required for the testing.
8. All lines shall be flushed prior to testing.

8. FLUSHING OF LINES

- A. After all new sprinkler pipe lines and risers are in place and connected, and prior to installation of sprinkler heads, or emitters, the control valves shall be opened and a full head of water used to flush out the system.
- B. Sprinkler heads and emitters shall be installed only after flushing of the system has been accomplished to the complete satisfaction of the Project Manager.
- C. Mainlines shall be thoroughly flushed prior to installation of master valves.

9. BACKFILLING

- A. The trenches shall not be backfilled until all required tests are performed. Trenches shall be carefully backfilled in 12" lifts with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand, or other approved materials, free from clods of earth or stones larger than 1" in diameter. Backfill shall be mechanically compacted in landscaped areas to a dry density equal to adjacent undisturbed soil in planting areas. Backfill will conform to adjacent grades without dips, sunken areas, humps or other surface irregularities. Backfilling shall not be performed while trenches or backfill material is in a wet or muddy condition.
- B. A fine granular material backfill will be initially placed on all lines to a depth of 3". No foreign matter larger than 1/2" in size will be permitted in the initial backfill.
- C. Flooding of trenches will be permitted only with approval of the Project Manager.
- D. If settlement occurs and subsequent adjustments in pipe, valves, sprinkler heads, lawn or planting, or other construction are necessary, the Contractor shall make all required adjustments without cost to the City.

10. TRENCHING AND BACKFILL UNDER PAVING

- A. Trenches located under areas where paving, asphaltic concrete or concrete will be installed shall be backfilled with sand (a layer 6 inches below the pipe and 3 inches above the pipe) and compacted in layers to 90% compaction, using manual or mechanical tamping devices. Trenching for piping shall be compacted to equal the compaction of the existing adjacent undisturbed soil and shall be left in a firm, unyielding condition. All trenches shall be left flush with the adjoining grade. The sprinkler irrigation Contractor shall set in place, cap, and pressure test all piping under paving prior to the paving work.

- B. Provide for a minimum cover of 24 inches between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete paving.
- C. Where the plans or site conditions require the existing paving to be cut, the saw cut method shall be used. The removed paving shall be replaced in kind in conformance with Tucson Water Standard detail SD-650. (See Appendix)

11. TRENCHING ADJACENT TO EXISTING TREES

- A. Where it is necessary to excavate adjacent to existing trees, the Contractor shall use all possible care to avoid injury to trees and tree roots. Excavation in areas where 2 inches and larger roots occur shall be done by hand. All roots 6 inches and larger in diameter, except directly in the path of pipe or conduit, shall be tunneled under and shall be heavily wrapped with burlap to prevent scarring or excessive drying. Where a ditching machine is run close to trees having roots smaller than 2 inches in diameter, the wall of the trench adjacent to the tree shall be hand trimmed, making clean cuts. Trenches adjacent to trees should be backfilled within 24 hours, and where this is not possible the side of the trench adjacent to the tree shall be kept shaded with burlap or canvas.

12. BACKFILLING TRENCHES AND HEADS IN EXISTING FIELDS

- A. When backfilling trenches in existing turf area the top 3 inches of backfill mix shall be a mix of 60% clean sand and 40% approved mulch.
- B. When backfilling trenches in existing infield areas the top 3 inches of backfill mix shall be a mix of 60% clean sand and 40% approved mulch.
- C. When replacing heads in existing fields the backfill around the head shall be 3/8" minus clean fill. Sand is not permitted for this use.

13. PIPE CLEARANCES

- A. All lines shall have a minimum clearance of 4 inches from each other, and from lines of other trades. Parallel lines shall not be installed directly over one another.
- B. Where reclaimed water is used for irrigation on a site, clearances between reclaimed lines and potable or sewer lines shall conform to Tucson Water requirements. Reclaimed piping shall have a minimum separation of 2 feet vertical and 6 feet horizontal from potable pressure lines.

14. SLEEVES

Sleeves shall be provided where shown on the drawings and specified herein.

- A. All main lines 3 inches size and less, lateral line piping, emitter headers and lateral piping and all control wire shall be installed in a sleeve under all paving, walls and concrete surfaces.
- B. All sleeving shall be Schedule 40 PVC solvent weld.
- C. All joints shall be solvent welded. Welds to be primed and glued as per pipe size.
- D. All sleeves shall be capped and kept clean of dirt and debris.
- E. Excavation and backfill shall be as specified in Section 808.3.02 of the current edition of the City of Tucson Standard Specification for Public Improvements.
- F. All sleeves shall extend a minimum of 2 feet into the planting area.
- G. Location of sleeves shall be shown on the record drawings.
- H. Each sleeve shall be taped along its entire length with metallic locator tape manufactured for that purpose.
- I. Sleeves shall have a minimum horizontal clearance of 12 inches from each other and other piping. Sleeves shall not be installed parallel and directly over another line. Sleeves shall have a minimum of 6 inches vertical clearance where they cross other lines.
- J. Sleeves shall be a minimum size of 2 inches or 2 pipe sizes larger than the pipe being sleeved. Each pipe shall have its own sleeve unless approved by the Project Manager.

15. DECODERS AND GROUNDING FOR CONTROLLERS AND 2-WIRE SYSTEMS

- A. Decoders for valves and sensors shall be Rainmaster TW-D-series for remote control valves.
- B. Lightning arrestors shall be Rainmaster LA-1.
- C. Grounding of decoders and lightning arrestors shall be in strict conformance with the manufacturer's recommendations and as shown on the project plans.

- D. Grounding and lightening protection for the two wire system shall occur at each valve group, at spurs, end of runs, at the controller, master valve/sensor and the pump as detailed, and as recommended by the manufacturer and as shown on the project plans. Maximum spacing shall 600'. The size of the grounding rods shall be in accordance with the controller manufacturer's written instructions and shall be copper clad steel of 5/8" minimum diameter and eight foot length. All ground rod connections shall be made using exothermic Cadweld connections. The ground rods shall be located at right angles and at a distance of 8' to the run of the two wire path when possible. Ground rods shall be located in a 10 inch round valve box to facilitate ground resistance testing. The box location shall be shown on the as-built drawings and by GPS.
- E. Earth resistance at the ground rods shall be measured using Simplified Fall of Potential Test (62% Method) using an AMEC 4620 or 4630 Ground Resistance Tester Megger type tester or equal. Grounding shall meet the requirements of a maximum 25 ohms resistance at each field ground rod. If the required resistance is not achieved the contractor shall remedy the deficiency by adding additional ground rods or ground plates with earth contact material at no additional cost to the City. Resistance test shall be performed by the certified supplier or independent electrician and verified per manufacturer guidelines with both the Manufacturer & the City.
- F. Controllers shall be grounded as shown in the Standard Detail. Grounding shall meet the requirements of a maximum of 10 Ohms resistance at the controller. The earth contact material for use with the ground plate shall be Paige PowerSet or equal. All connections to the ground rod(s) and grounding plate shall be made using exothermic Cadweld connections.

16. DRIP COMPONENTS

- A. All drip irrigation laterals shall have a green #16 AWG tracer wire installed along the entire length of the laterals. The wire shall be looped around the flush valve riser at the end of each lateral. Branch laterals shall have the tracer wires joined with approved connectors.
- B. Drip laterals shall not be run in the root zone of the tree except for branch feeder laterals.

17. PULL BOXES FOR 2-WIRE PATH

- A. Pull boxes shall be installed at roadway crossings and at the midpoint where distance between valves exceed 250 feet or there are more than (4) 90 degree bends.
- B. Pull box locations shall be shown on the record drawings and located by GPS.

18. PROTECTION OF PIPING

- A. PVC piping shall be kept protected from damaging ultraviolet rays during storage and while in the trench. Piping that has become discolored due to exposure to ultraviolet rays shall be replaced at the Contractor's expense.
- B. All piping shall be protected from debris entering the pipe ends when left unattended. Caps or other approved devices shall be used to protect the piping.

19. SALVAGE OF EXISTING COMPONENTS

In areas where new irrigation is shown, the existing irrigation system valves, heads, controllers, valve boxes and swing joints to be replaced shall be removed prior to trenching and cleaned, inventoried and delivered to the Project Manager. Parts of the existing system shall be used for the new system as noted. Any parts brought to the surface as the result of turf preparation or trenching shall be disposed of in a manner acceptable to the Project Manager. Exposed pipes and components to be abandoned shall not be knowingly left within 12" of finish grade. Certain existing pipes may require caps as directed by the Project Manager.

20. PROTECTION OF POTABLE LINES

Potable water lines shall be protected in place. Should potable lines be broken during construction, those potable lines shall be disinfected per Tucson Water requirements.

21. REPLACING SPRINKLER HEADS

When sprinkler heads and or swing joints are replaced, the new heads shall be set to proper grade. This may require the raising of swing joints if the existing laterals are unusually deep or the lowering of existing swing joints if the replacement head is longer in length than the head being replaced.

22. PLACEMENT OF SPRINKLER HEADS AT EDGES OF TURF

When placing new sprinkler heads or replacing exiting sprinkler heads they shall be located one foot inside the edge of turf.

23. INSPECTIONS

- A. All irrigation installations shall be inspected by the COT Parks and Recreation Plumber prior to the work being covered.
- B. Any work covered prior to a required inspection shall be uncovered at the Contractor's expense to allow inspection.

- C. The Contractor shall give a minimum of 24 hours advance notice to the COT Parks and Recreation Plumber for required inspections.
- D. Required Inspections are shown on the Inspection Form in the Appendix.

SEC. 4 STANDARD DETAILS

1. Master Valve- 4” and larger
2. Master Valve – 3” and smaller
3. Master Valve at grade
4. Master Valve in enclosure
5. Flow Sensor – 2-1/2” and smaller
6. Flow Sensor – 3” and larger
7. Remote Control Valve Assembly for conventional wiring
8. Remote Control Valve Assembly – 2 wire
9. Remote Control Valve and Filter – Drip/Bubbler for conventional wiring
10. Remote Control Valve and Filter – Drip/Bubbler – 2 wire
11. Remote Control Valve Group Assembly
12. Quick Coupler Assembly
13. Quick Coupler behind pitcher’s rubber for softball
14. Quick Coupler behind pitcher’s rubber for baseball
15. Controller Enclosure
16. Wall Mount Controller
17. Solar Controller
18. Controller Grounding
19. Controller High Gain Antenna at grade
20. Controller High Gain Antenna on roof
21. Rotor Sprinkler Head
22. Pop-Up Sprinkler Head
23. Sprinkler Head at picnic tables and bench in turf on reclaimed
24. High Speed Head placement at adult baseball
25. High Speed Head placement at adult softball
26. High Speed Head placement at little league
27. Gate Valve – 2” and larger - mainline
28. Gate Valve – smaller than 2” - mainline
29. Reduced Pressure Backflow Preventor – 3” and larger
30. Reduced Pressure Backflow Preventor – 2” and smaller
31. Enclosure Signage
32. Air Release Valve
33. Pressure Regulator Riser
34. Lateral End Cap
35. Pull Box
36. Two-Wire Schematic
37. Grounding 2-wire System
38. Irrigation Trenching Depth

39. Irrigation Trenching Multiple Lines in common trench
40. Sleeving
41. Coupling new to existing
42. Valve Box Lid
43. Thrust Blocks
44. Multi-Outlet Emitter Assembly
45. Emitter Location Trees
46. Emitter Location Trees – Large
47. Emitter Location Shrubs
48. Deep Root Watering System
49. Booster Pump with master valve
50. Extension of Tucson Water Fence Enclosure w/ backflow preventor
51. Extension of Tucson Water Fence Enclosure w/ pressure regulating valve
52. Drinking Fountain with vertical floor drain sump
53. Drinking Fountain with horizontal pea gravel drain sump

SEC. 5 APPENDIX

1. Preliminary Irrigation Design Submittal#1 (Form A) (30%)
2. Irrigation Design Submittal #2 (Form B) (60%)
3. Approved Irrigation Materials List
4. Irrigation Project Inspection Form

FORM A (30%)

PRELIMINARY IRRIGATION DESIGN SUBMITTAL #1

This form must be completed by the designer prior to the 30% design submittal. Any changes to information supplied on this form must be submitted in writing to the Parks Department.

Name of Project _____

Date _____

Consultant Firm _____

Person Completing Form _____

Total Acreage _____

Is Reclaimed Water to be used for this project? _____

Estimated Pressure Range During Peak Season _____ PSI

Method of Pressure Estimate _____

Is a Booster Pump Required for this Project? _____

Estimated Turf Acreage _____

Water Meters at Site are Existing or Proposed

Size and Number of Meters (Existing or Proposed) _____ Meters @ _____ inch size

Estimated Peak Demand _____ GPM

Estimated Maximum Water Window (Turf Only) _____ Hours

Estimated # of Valves Req'd to Operate Simultaneously to Meet Water Window _____

Equipment Proposed for Project

Large Rotors _____

Medium Rotors _____

Small Rotors _____

Pop-up Spray Heads _____
Remote Control Valves _____
Master Valve and Flow Sensor Size and Mfg. _____
Quick Coupling Valves _____
Backflow Preventers Model _____
Backflow Preventers Number and Size _____
Controller _____
Gate Valves _____
Emitters _____
Drip Pressure Regulator _____
Drip Filter _____
Specialty Equipment Required for This Project _____

Prepared By

Date

IRRIGATION DESIGN SUBMITTAL #2

PROJECT _____

This form must be completed by the designer prior to the 60% submittal. Any changes to information supplied on this form must be submitted in writing to the Parks Department.

Estimated Distribution Uniformity for Heads. Submit data with form.
(representative areas for each major head type or nozzle)

Head #1

Head _____	Nozzle _____
GPM @ PSI &Radius _____	Spacing (Sq. or Triang) _____
DU _____	Precipitation Rate (In/Hr) _____

Head #2

Head _____	Nozzle _____
GPM @ PSI &Radius _____	Spacing (Sq. or Triang) _____
DU _____	Precipitation Rate (In/Hr) _____

Head #3

Head _____	Nozzle _____
GPM @ PSI &Radius _____	Spacing (Sq. or Triang) _____
DU _____	Precipitation Rate (In/Hr) _____

Prepared By _____ Date _____

APPROVED IRRIGATION MATERIAL LIST

All Changes from this list must be approved in writing by the City Representative.

DATE: July 1, 2019

	ITEM	MANUFACTURER/ MODEL	COMMENT
1.	Backflow Preventer- Reduced Pressure up to 2 inches	Watts U-LF009-QT	For 1 inch and smaller backflow preventers provide Wilkins ZWFR Freeze Relief Valve on #4 test cock.
2.	Backflow Preventer- Reduced Pressure 3 inches and larger	Backflow Direct Deringer Model 40 Reduced Pressure or Equal	
2.	Backflow Preventer Enclosure	Guardshack HGS Series	Tan color. Size as req'd for 6" min clearance and opening. Hinged only
	Master Valve Enclosure (above ground)	Guardshack HGS Series	Tan Color for potable, Purple for reclaimed. Clamshell style when req'd.
3.	Remote Control Valve Turf	Griswold DWS Series DW- 100,DW-150,DW-200	Size as req'd- use pressure regulating module for spray heads and small rotors as required.
4.	Remote Control Valve Drip	Griswold DWS Series	Size as req'd. Pressure regulating
5.	Master Valve 3 inches and less	Griswold DWS Series 2000 Griswold Model 2230	Normally Closed Pressure regulating for drip and bubbler Standard copper solenoid req'd. Reclaimed ID when req'd.
6.	Master Valve 4 inch and larger	Griswold Model 2000 Griswold Model 2230	Normally Closed with Epoxy coating Pressure regulating Standard copper solenoid req'd. Reclaimed ID when req'd.
7.	Control Valve Identification Tags	Pre-printed by T. Christy Enterprises Potable Irrigation Source Model ID.STD.Y-X Reclaimed Irrigation Source Model ID.STD.P-X	Yellow for potable source. Purple for reclaimed. Tags required for Master Valves, Flow Sensors and Remote Control valves
8.	Flow Sensor up to 2- 1/2" Size	Rainmaster FSB Series	Brass Body

9.	Flow Sensor for 3" and Larger Pipe	Rainmaster FS Insert B Series	Insert style in saddle tee-see approved saddle tees
10	Flow Sensor in Pump Station	Badger M-Series Mag Meter	
11.	Irrigation Controller	Rainmaster DX3	Configure to meet project requirements
12.	Irrigation Controller Enclosure-Pedestal	Strongbox 18SS with PED-18SS 12" Riser	Pre-assembled with controller by Manufacturer's Representative.
13.	Irrigation Controller Enclosure-Wall Mount	Strongbox SB-18SSW	Use requires pre-approval by Project Manager. Pre-assembled with controller by Manufacturer's Representative.
14.	Solar Irrigation Controller	DIG LEIT Models 4000, x, or XRC	As req'd by project needs. Use requires pre-approval by Project Manager.
15.	Radio Remote	Rainmaster Pro Max	As req'd by project needs and approval by Project Manager.
16.	Flow Sensor Cable	Rainmaster EV- CAB-SEN	
17.	Valve Decoder	Rainmaster TW-D Series	
18.	Lightening Arrestors	Rainmaster LA-1	
19.	Swing Joint Assembly (Heads)-1"	Lasco T 922-212 or approved equal	Lay length may vary.
20.	Swing Joint Assembly (Heads)-3/4"	Lasco T 722-212 or approved equal	Lay length may vary.
21.	Swing Joint Assembly (Heads)-1/2"	Lasco T 522-212 or approved equal	Lay length may vary.
22.	Swing Joint Assembly (QC)-1-1/4"	Hunter HSJ-2-2-S-2-18	Use brass Nipple from swing joint to base of QC. Brass male top with SnapLoc System
23.	Air Relief Valve	Crispin Model UL-10	Install in Guardshack HGS as detailed.
24.	Gate Valve 2" and Larger in Piping	Clow, Watrous, Nibco or approved equal	Resilient Seat- AWWA C-509 Purple body with reclaimed.
25.	Gate Valve Less than 2"	Nibco T-113-K for use with Reclaimed Nibco T-113-K-LF for use with Potable	
26.	Ball Valve	Nibco T-FP600A-LF	Fully Ported Brass- Lead Free
27.	Weather Station	Rainmaster EV-WETHR-CENTR2	
28.	Pop-Up Spray Heads	Hunter Pros-04-PRS-40-CV-R-F Hunter MP Rotator	Hunter MP Rotator or Pro Adj
29.	Small Diameter Rotors- Part Circle	Hunter I-20-04-SS-R	Factory installed Nozzles Reclaimed top req'd
30.	Medium Diameter Rotors	Hunter I-25-04-SS-R	Factory installed Nozzles Reclaimed top req'd
31.	Large Diameter Rotors	Hunter I-40-04-SS-HS-R	Factory installed Nozzles

			Reclaimed top req'd
32.	High Speed Rotors for Skinned Areas	Hunter I-40-04-SS-HS-R	Factory installed Nozzles Reclaimed top req'd
33.	Valve Box for Pull Box, Isolation Valve, Flow Sensor	Oldcastle Christy B1017	Reclaimed Site Lids are raw metal no paint when order
34.	Valve Box for Remote Control Valve, Master Valve	Oldcastle Christy B1730	Reclaimed Site Lids are raw metal no paint when order
35.	Valve Box Quick Coupling Valve	Oldcastle 910	Bolt down. Purple as req'd.
36.	Drip Pressure Regulator	Senninger 25psi- 1" or 3/4" as req'd	Low or Medium Flow as req'd
37.	Pressure Reducing Valve	Clay-Val, Model 90-01	Options are project specific
38.	Drip Filter	Amiad 1" S NPT POM BLK MOLD 150 3/4" VLV NBR	150 psi rating req'd 200 mesh filter
39.	Mainline Spin Filter	Morrill Tornado	Provide Guardshack Clamshell Enclosure and RCV flush valve and sump. May be installed upstream and in same enclosure as Master Valve.
40.	Emitter Multi Outlet	Hunter MPE	
41.	Emitter Single Outlet	Hunter HEB-XX-BR Series	
42.	Multi Emitter Box	Oldcastle 6" or approved equal	Bolt down. Purple as req'd.
43.	Bubbler	Hunter	
44.	Main Line Fittings 3" and larger	Ductile Iron CL 250 Harco, Sigma or approved equal	
45.	Mainline Joint Restraints	Harco, EBBA MegaLug, Sigma or approved equal	
46.	Solvent Weld Cement and Primer Laterals and Sch. 40 Fittings	Weld-On 705 or approved equal Weld-On P-68 Purple Primer or approved equal	
47.	Solvent Weld Cement and Primer Mainlines and Sch. 80 Fittings	Weld-On 711 or approved equal Weld-On P-68 Purple Primer or approved equal	
48.	Saddle Tee	Romac Model 202NS or approved equal	
49.	Pipe Repair Clamp	Romac SS1, SS2 and SS3 or approved equal.	Prior approval by Project Manager required.

50.	Pipe Coupling	Romac Macro HP and Model 501 & RC501 (for transitions)	Prior approval by Project Manager required.
51.	Deep Water for Trees and Shrubs	Hunter RZWS-36-25-CV-R for trees, Hunter RZWS-10-25-CV-R for shrubs.	Use when req'd by Project Manager. Install in 6 inch valve box. Use of pressure regulating valve req'd.
52.	Wire Connectors	Rainmaster TW-Splice or approved equal.	
53.	Booster Pump Station	Munro Pump	Size and configuration dependent on project requirements.
54.	Drinking Fountain	Most Dependable Fountains Trough Style Series	

CITY OF TUCSON PARKS AND RECREATION IRRIGATION PROJECT INSPECTION FORM

<u>INSTALLATION INSPECTIONS</u>	<u>DATE</u>	<u>BY</u>	<u>COMMENTS</u>
1. Point of Connection Location, Backflow Preventer Location, Controller Location			
2. Mainline Routing, Valve, Flow Sensor, Quick Coupling, Master Valve Layout			
3. Mainline and Thrust Block Inspection			
4. Master Valve, Flow Sensor, Valve and Control Wire, Backflow Preventer Installation			
5. Controller and Controller Grounding			
6. Sprinkler Head Layout			
7. Emitter Lateral and Component Inspection			
8. Lateral Line Pressure Test			
9. Head and Emitter Coverage Test			
10. Final Inspection and Controller Scheduling			