

SECTION 32 84 00

PLANTING IRRIGATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section is ten total written pages plus associated sample details.
- B. This section specifies elemental materials and procedures based upon published and widely accepted industry best practices to design and construct landscape irrigation system(s) in a design-build approach including the road right-of-way of Fifth Street, Lake Elmo, MN. The most recent landscape irrigation industry best practices can be found at: http://www.irrigation.org/uploadedFiles/Resources/BMP_Revised_12-2010.pdf.
- C. Landscape irrigation designs shall be crafted in workmanlike fashion preferably using CAD-based software. Designs and supporting documents shall be furnished in reproducible electronic and hardcopy fashion, to the City of Lake Elmo for approval prior to commencing work. No landscape irrigation installation work shall commence without written consent of the City of Lake Elmo, MN.
- D. Landscape irrigation design(s) and supporting documents shall depict and describe all components of the proposed landscape irrigation system including but, not limited to:
 - a. Water supply and detail including proposed enclosures and slabs
 - b. Pipeline sizing throughout
 - c. Sprinkler emitter proposed brand, model and nozzle sizing
 - d. Drip grids with associated required components
 - e. Controls including proposed pedestal enclosures and weather-based appurtenances
 - f. Projected seasonal water use month-by-month

1.2 DEFINITIONS

- A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves.
- B. Drain Piping: Downstream from circuit-piping drain valves.
- C. Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves.
- D. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 volts or for remote-control, signaling power-limited circuits.

1.3 ABBREVIATIONS

- A. FPT: Female pipe thread
- B. MPT: Male pipe thread
- C. NPT: National pipe thread
- D. HDPE: high-density polyethylene
- E. PVC: Polyvinyl chloride plastic

- F. SDR: Standard Dimension Ratio
- G. SCH: Schedule Pipe
- H. AWG: American Wire Gauge

1.4 ELEMENTAL PERFORMANCE REQUIREMENTS

- A. Irrigation water supply(ies) drawing from municipal or groundwater shall be properly permitted by authorities having jurisdiction and shall be constructed to conform to meet or exceed minimum requirements of the City of Lake Elmo, MN. See sample detail(s). All water supply(ies) and associated system mainline and circuit piping regardless of water source, shall be:
 - 1. sized not to exceed dynamic velocity greater than 5 feet per second;
 - 2. sized to enable simultaneous operation of not less than two stations of irrigation;
 - 3. sized to complete an irrigation cycle within 10 hours during the hottest month of the irrigation season.
 - 4. sized to enable operation of sprinklers at manufacturer recommended dynamic pressure(s).
- B. Irrigation stations shall not mix rotor or multi-stream, multi-trajectory sprinklers with misting spray-type sprinklers.
- C. Broadcast sprinklers shall be placed to enable 100 percent coverage, sprinkler-to-sprinkler.
- D. Broadcast sprinkler emission devices shall include matched precipitation/application rates.
- E. Broadcast sprinklers located at the bottom of slopes shall have check-valve or similar features to prevent or reduce low-head drainage.
- F. Broadcast sprinklers shall not throw over public walks or roadways.
- G. Broadcast sprinklers shall be placed and adjusted to minimize overspray onto hard surfaces.
- H. Broadcast sprinklers in the vicinity of conifers shall be placed to minimize broadcast onto conifers.
- I. Sprinklers and piping installed upon slopes shall be installed perpendicular to the slope wherever feasible.
- J. System zoning priority shall be given to soil type, plant type, topography and microclimate.
- K. Single row broadcast sprinklers shall be allowed in boulevard areas or strips of eight feet width or less.
- L. Single row broadcast sprinklers shall be placed to throw away from walks and toward streets.
- M. Use schedule 40 PVC pipe or greater for sleeves under hard surfaces.
- N. Sleeve(s) dimension shall be a minimum of two times the outside dimension of the pipe passing through.
- O. Use NSF-rated HD100 polyethylene pipe, where applicable.
- P. Use up to 2" polyethylene pipe in sleeves.
- Q. Thrust block pressure pipe 3" or larger. Follow published industry best practices.
- R. Top of mainline pipe 3" and smaller shall not be less than 18" from final grade.
- S. Top of circuit piping shall be not less than 12" from final grade.
- T. Plan for and install controller and field grounding equipment per manufacturer recommendations.

1.5 QUALITY ASSURANCE:

- A. Products Criteria:

1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either, cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

B. Installer Minimum Qualifications:

The selected installing contractor shall be an employer of workers that include not less than one Certified Irrigation Contractor in good standing as accredited by The Irrigation Association, Fairfax, VA (www.irrigation.org) and who shall be currently employed by the selected installing contractor and who shall personally conduct or oversee the conduct of all work upon this project. The selected installing contractor shall be registered in the State of Minnesota as a Technology Systems Contractor in good standing employing not less than one Minnesota licensed Power Limited Technician in good standing who shall be currently employed by the selected installing contractor and who shall personally conduct or oversee the conduct of all low voltage irrigation electrical work. The selected installing contractor shall be prepared to furnish proof of not less than 5 successful installations of projects of similar scope and complexity within the past 3 calendar years including but, not limited to successful installation, programming and operation of digital two-wire decoder irrigation control systems.

C. System Requirements:

100 percent irrigation coverage of irrigated areas is required. The actual and spirit of intent of this project outcome is clearly indicated upon the drawing sheets and within the specification documents. The selected installing contractor shall, at no additional cost be prepared to make minor adjustments necessary to avoid obstructions such as hard surfaces signs, utilities and light standards and achieve full and complete coverage of irrigated areas without overspray on roadways, sidewalks, window wells or buildings and shall protect trees from close high-spray velocity.

PART 2 - PRODUCTS

2.1 PIPES, TUBES AND FITTINGS

- A. PE pipe with controlled ID shall be ASTM F771, PE 3408 compound;
- B. Insert fittings for PE pipe: ASTM D2609, nylon or propylene plastic with barbed ends. Include stainless steel bands or other fasteners.
- C. PE pressure pipe: AWWA C906, with DR of 7.3, 9, or 9.3 and PE compound number required to give pressure rating not less than 160 psi (1100 kPa)
- D. PE butt, heat-fusion fittings shall be ASTM D3261.
- E. PE socket-type fittings shall be ASTM D2683.
- F. PVC sleeve pipe: ASTM D1785, PVC 1120 compound, Schedule 40.
- G. PVC socket fittings shall be ASTM D2466, Schedule 40 PVC threaded fittings: ASTM D2464, Schedule 80.

- H. Swing joints: Threaded fittings with elastomeric seals that allow 360 degree rotation, and designed for minimum 200 psi (1375 kPa) working pressure, may be used in lieu of standard threaded fittings.
- I. PVC socket unions: Both headpiece and tailpiece shall be PVC with socket ends.
- J. PVC Pipe: ASTM D2241, PVC 1120 compound, SDR 26.
- K. PVC socket fittings: ASTM D2467, Schedule 80.
- L. PVC socket unions: Both headpiece and tailpiece shall be PVC with socket or threaded ends.

2.2 PIPE JOINING MATERIALS

- A. Solvent cements for joining PVC piping: ASTM D2564. Include primer according to ASTM F656.
- B. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.3 VALVES

A. Underground Shut-Off Valves:

- 1. Butterfly valves 2 inches (50 mm) and larger: AWWA C504, iron body, bronze mounted, double disc with parallel or inclined seats, non-rising stem turning clockwise to close, 150 psi (1025 kPa) minimum working pressure.
- 2. Ball valves, isolation valves, 1-1/2 inch (38 mm) and smaller: Full-port ball valves with bronze body, PTFE seats, and 90 degree on/off handle. Ball valves shall have NPT female end connections.

B. Operations:

- 1. Underground applications shall use valves with 2 inch (50 mm) nut for T-Handle socket wrench operation.
- 2. Aboveground and valve pit applications shall use valves, with handwheels.
- 3. Valve ends shall accommodate the type of main pipe adjacent to valve.

C. Remote Control Valves:

- 1. All remote control valves shall be of the manufacturer and models indicated on the drawing sheets furnished. No deviation from manufacturer or model call-outs once approved, shall be allowed.
 - a. Sizes and locations as indicated on the drawing sheets. Molded-plastic body, furnished as straight or angle pattern type, normally closed diaphragm type with manual shut off and flow control adjustment. Refer to sample details or furnished and approved details submitted at the time of approval application.
 - b. Single valve digital two-wire decoder installed concurrently with each remote control valve and within the same remote control valve box, one valve per decoder, one decoder per control valve, one valve box per valve and decoder combination. No deviation from manufacturer or model call-outs once approved, shall be allowed. Refer to sample details or furnished and approved details submitted at the time of approval application. Label decoders with stencils

designating controller and circuit number with permanent white epoxy paint or with permanent paint pen.

1. Valves shall have a minimum of 150 psi (1025 kPa) working pressure.
2. Each sprinkler station shall be automatically operated by a remote control valve installed underground and operated by a single-station in-line digital decoder-governed solenoid.
3. Valve boxes shall be locking type-capable.
4. Valves shall be completely serviceable from the top without removing valve body from the system. Valves shall operate at no more than 7 psi (50 kPa) pressure loss at manufacturers maximum recommended flow rate.
5. Valves shall be diaphragm type designed to operate in water containing sand and debris and shall have a self-cleaning type contamination filter to filter all water leading to the solenoid actuator and the diaphragm chamber.

2.4 VALVE BOX

- A. Isolation valve boxes shall be precast concrete boxes with a compressive concrete strength in excess of 4000 psi (30 Mpa). Box dimension shall be adapted to depth of cover required over pipe at valve location. Mark box cover to say "Irrigation" and set flush with finished grade. Provide 2 (two) "T" handle socket wrenches of 5/8 inch (15 mm) round stock with sufficient length to extend 2 feet (600 mm) above top of deepest valve box cover.
- B. Irrigation control valve, decoder boxes and quick coupler boxes shall be HDPE green in color or black body with green cover. Boxes shall be lockable-ready. Refer to sample details or furnished and approved details submitted at the time of approval application.

2.5 BACKFLOW PREVENTER

- A. Use reduced pressure zone backflow prevention assembly sized according to minimum system performance specifications contained herein and as approved by the authority having jurisdiction. Refer to sample details or furnished and approved details submitted at the time of approval application.

2.6 WATER METER

- A. Use water meter brand and model specified by the authority having jurisdiction. Size meter according to minimum system performance specifications contained herein. Refer to sample details or furnished and approved details submitted at the time of approval application.

2.7 AUTOMATIC CONTROL EQUIPMENT - INDEPENDENT ELECTRIC CONTROLLER WITH NO FLOW SENSING (FOR SMALL INSTALLATIONS)

- A. GENERAL STATEMENT: Irrigation control shall be digital, two-wire-based automatic operation including:
 1. rain sensing technology, placed per manufacturer recommendations and/or referenced industry best practices to interrupt irrigation during periods of sufficient moisture and fully engaged;
 2. weather-based adjustment, placed per manufacturer recommendations and/or referenced industry best practices and fully engaged;

3. controller shall be mounted in a pedestal manufactured by the selected controller manufacturer and shall be securely placed upon a concrete base per manufacturer recommendations and/or referenced industry best practices; See associated sample detail(s).
 4. field control valves shall be connected to digital control wire using one-station field decoders, placed in the associated control valve box and shall include waterproof wire fittings such as 3MDBR or equivalent on the signal input wires and the signal output wires. Follow manufacturer recommendations and/or referenced industry best practices. Field control valves shall be placed in plastic/composite surface boxes, one valve per box, minimum 10" round sized and in a fashion to prevent damage from surface activities and to enable basic field maintenance without requiring of the box. See associated sample detail(s).
- B. The independent electric automatic control system shall consist of one digital two-wire decoder-based controller located in a pedestal manufactured by the controller manufacturer, which operates individual remote control decoder-based valves and weather-based schedule adjustment (SMART) operation in accordance with timing schedules programmed into the independent unit. Refer to sample details or furnished and approved details submitted at the time of approval application.
- C. Connect, test electrically and program all irrigation stations to the digital two-wire decoder-based controller per manufacturer recommendations and Best Practices and incorporate all stations into the control system. Memorialize all programming data onto reproducible documents in a workmanlike fashion.

2.8 SPRINKLER HEADS

- A. Rotary pop-up sprinklers:
1. ¾" inlet, closed-case, gear-driven, 4" minimum pop-up height or
 2. ½" inlet spray-body mounted, six-inch minimum pop-up height, multi-stream, multi-trajectory rotating nozzle.
 3. Matched precipitation/application shall be depicted on plan submittals and practiced at the time of installation. Placement appropriate to the area characteristics being watered.
 4. Refer to sample details or furnished and approved details submitted at the time of approval application.
- B. Spray-type sprinklers (fixed):
1. ½" inlet, 4" minimum pop-up height with nozzles and placement appropriate to the area characteristics being watered.
 2. Refer to sample details or furnished and approved details submitted at the time of approval application.

2.9 QUICK COUPLERS

- A. Quick couplers shall have all parts contained in a two-piece unit and shall consist of a coupler water seal valve assembly and a removable upper body to allow the spring and key track to be serviced without shut down of the main.
- B. Metal parts shall be brass.

- C. Lids shall be lockable vinyl covered and have springs for positive closure on key removal.
- D. Each quick coupler shall be contained in valve boxes. Refer to sample details or furnished and approved details submitted at the time of approval application.
- E. Furnish 1 (one) hose swivel and operating key.

2.10 LOW VOLTAGE CONTROL VALVE WIRE

- A. Wire shall be solid copper wire, Underwriters Laboratories Inc. approved for direct burial in ground. Wire shall be digital decoder-based control wire of the same outer jacket color as that installed upon the existing landscape irrigation system. Size of wire shall be consistent with manufacturer recommendations, never less than 14 AWG.

2.11 WIRE SPLICING MATERIALS: LOW VOLTAGE RATED UV RESISTANT MOISTURE-RESISTANT GREASE-FILLED POLYPROPYLENE TUBE

- A. 3M DBR/Y-6 Direct Bury Splice Kit UL486D-approved for direct burial in ground or equal. Use upon wire splices, decoder inlet wiring and decoder outlet wiring.

2.12 SLEEVE MATERIAL

- A. ASTM D2241, PVC Schedule 40.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine proposed irrigation areas for compliance with requirements and conditions affecting installation and performance.
- B. Verify limits of irrigation and compare against approved plans.

3.2 PIPE INSTALLATION - GENERAL

- A. Layout work as closely as possible to drawing sheets. **CALL BEFORE YOU DIG (811)**.
- B. Install sprinkler lines to avoid electric, storm and sanitary sewer lines and existing water and gas mains, all of which have the right of way.
- C. Existing sidewalks and curbs shall not be cut during trenching and installation of pipe. Install pipe under sidewalks and curbs by jacking, auger boring, or by tunneling. Repair or replace any cracked concrete, due to settling during the warranty period.
- D. Do not lay pipe on unstable material, in wet trenches weather conditions are unsuitable for work.
- E. Allow a minimum of 3 inches (80 mm) between parallel pipes in the same trench.
- F. Clean the interior portion of pipe and fittings of foreign matter before installation. Securely close open ends of pipe and fittings with caps or plugs to protect fixtures and equipment against dirt, water and chemical or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
- G. The full length of each section of (PVC) pipe shall rest upon the pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipe on wood blocking.
- H. Hold pipe securely in place while joint(s) is/are being made.

- I. Do not work over, or walk on, pipe in trenches until covered by layers of earth, well tamped, in place to a depth of 12 inches (300 mm) over pipe.
- J. Irrigation lines and control wire shall run through designated lanes where possible. Refer to sample details or furnished and approved details submitted at the time of approval application.
- K. Concrete thrust blocks shall be installed upon piping 3-inch and larger where the irrigation main changes direction at "L" and "T" locations and where the irrigation main terminates. Do not pressurize pipe for a period of 36 hours following the completion of pouring of the thrust blocks. Concrete thrust blocks for supply mains shall be sized and placed in strict accordance with the pipe manufacturer's specifications and shall be of an adequate size and so placed as to take all thrust created by the maximum internal water pressure. Thrust block material shall not be poured over and around pipe and /or control wire.
- L. Minimum cover over lines under constant pressure shall be 18 inches (750 mm) for pipe sizes of 3 inch and less. Cover laterals to minimum depth of 12 inches (600 mm).

3.3 SLEEVE INSTALLATION

- A. Furnish and install where pipe and control wires pass under walks, paving, walls, and other similar areas.
- B. Sleeves to be twice line size or greater to accommodate retrieval for repair of wiring or piping and shall extend 12 inches (300 mm) beyond edges of paving or construction.
- C. Bed sleeves with a minimum of 4 inches (100 mm) of sand backfill above top of pipe in areas where pipe is placed prior to hardscape is installed.

3.4 VALVE INSTALLATION

- A. Locations of remote control valves is/are diagrammatic. Group remote control valves wherever possible and aligned at a set dimension back of curb along roads. Do not install more than one valve per valve box unless using jumbo-sized valve box and per minimums depicted herein and upon sample details included with this written specification.
- B. No valves shall be set under roads, pavement or walks.
- C. Clean interior of valves of foreign matter before installation.
- D. Set valve box cover flush with finished grade.
- E. Control valves shall never be less than 3 inches (80 mm) below finished grade. Refer to minimums depicted herein and see sample details.

3.5 SPRINKLER AND QUICK COUPLER INSTALLATION

- A. Place part circle rotary sprinklers no greater than 6 inches (150 mm) from edge of and flush with top of adjacent walks, curbs, and mowing aprons, or paved areas at time of installation.
- B. Install all sprinklers using swing joints or flexible hose-and-fitting joints (a.k.a. swing pipe). Refer to sample details included with this written specification.
- C. Install all quick couplers on swing joints. Stake for support. Refer to sample details included with this written specification.

- D. Set shrub sprinklers 4 inches (100 mm) above grade or even with bedding mulch depth and 4 inches (100 mm) from edge of curb or pavement. Place 4 inches (100 mm) from walls. Stake sprinklers prior to backfilling trenches. Support stakes shall be parallel to riser.

3.6 AUTOMATIC IRRIGATION - CONTROL SYSTEM INSTALLATION

- A. Attach new stations of irrigation to the digital two-wire decoder system and program and test each control valve for proper operation from the existing irrigation controller.
- B. Adjust master controller programming to incorporate new stations of irrigation within programs for similar plant-types or hydrozones and in accordance with necessary programming for weather-based (SMART) operation.

3.7 CONTROL WIRE INSTALLATION

- A. Wiring shall be located in trench with pressure main pipe. Splicing shall be held to a minimum. In the event a wire splice is required outside of a remote control valve location, the splice shall be contained in a valve box not smaller than 10" round with not less than 24 inches of leader or expansion looping on each end of the splice. Use 3M DBR waterproof wire splices or equivalent.
- B. Provide 12 inch (300 mm) expansion loops in wiring at each wire connection or change in wire direction. Provide not less than 24 inch (600 mm) loop at remote control valves.

3.8 FIELD TEST AND QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Pressure test pressure main line(s) before joint areas are backfilled. Backfill a minimum of 12 inches (300 mm) over the pipe to maintain pipe stability during test period.
 - 2. Inspect each joint and repair leaks.
 - 3. Flush lines before installing sprinkler heads and quick couplers.
 - 4. After installation, charge system and test visually for leaks. Repair leaks and retest until no leaks exist.
 - 5. After electrical circuitry has been activated and final adjustment of sprinklers to permanent level at ground surface is complete, test each broadcast turf sprinkler section to indicate a uniform distribution within any one sprinkler area and over the entire area.
 - 6. Operate controller and automatic control valves to demonstrate the complete and successful installation and operation of all equipment.
 - 7. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 8. Prepare test and inspection reports, programming information (including SMART operation), decoder information and details for record drawings. Furnish records in a professional and workmanlike fashion.

3.11 ADJUSTMENTS

- A. Adjust settings of controller as needed during the establishment period. Should plant establishment requirements preclude engagement of weather-based (SMART) operation, assure weather-based operation is engaged prior to final walkthrough/turnover.
- B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.

C. Adjust sprinklers and devices to proper grade, radius and arc.

3.12 DEMONSTRATION AND DOCUMENTATION

A. Program controller for weather-based (SMART) operation.

C. Follow manufacturer's instructions and industry best practices.

D. Maintain and provide a complete set of as built drawings in a professional and workmanlike presentation form which shall be corrected to show changes in locations of all pipe, valves, pumps, decoders and related irrigation equipment.

E. Controller Drawings and Zone Chart(s):

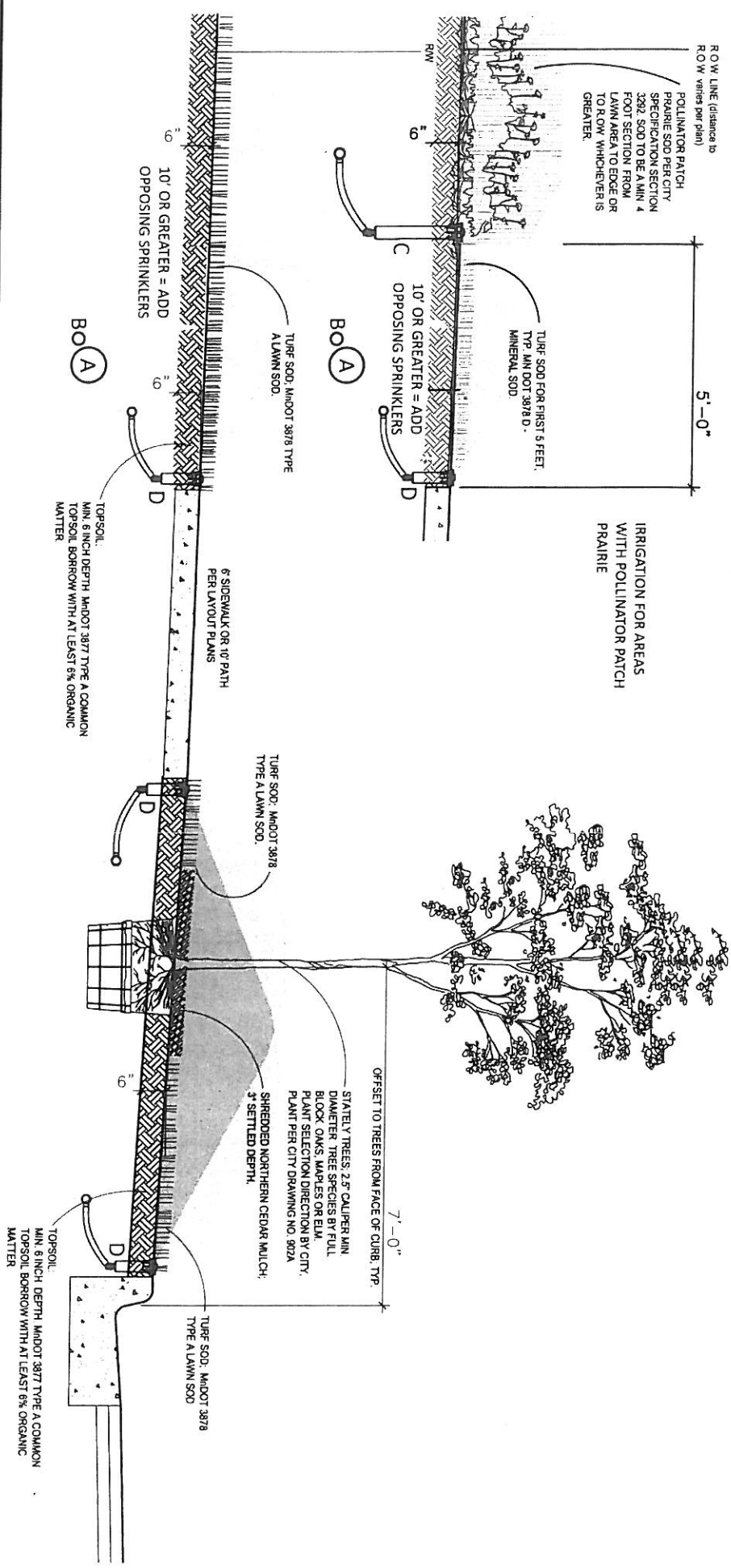
1. Prepare in electronic format a drawing mapping the location of all valves, decoders, lateral lines, and route of the control wires. Identify all valves as to size, station, number and type of irrigation. Digital formatted "as built" drawings may require approval before controller zone charts are prepared.
2. Provide one controller zone chart for each automatic controller showing the area covered by the controller. The chart shall be a reduced drawing of the actual "as built" system and fit the maximum size controller door or pedestal will allow. If controller sequence is not legible when the drawing is reduced to door size, the drawing shall be enlarged to a size that is readable and placed protected from elements (such as laminated) inside the controller door.
3. The final irrigation "as built" drawings shall be submitted in digital format with a different coding to show area of coverage for each station. All drawings and zone charts must be completed and approved prior to final inspection of the irrigation system. Upon completion, a full set of reproducible, electronic as-built drawings, decoder information and base weather-based (SMART) programming shall be furnished to the City of Lake Elmo.
4. The most recent landscape irrigation industry best practices can be found at:
http://www.irrigation.org/uploadedFiles/Resources/BMP_Revised_12-2010.pdf.

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- ADDITIONAL PLANTING NOTES:**
1. ALL TREE LOCATIONS TO BE FLAGGED PRIOR TO INSTALLATION.
 2. CONTRACTOR TO COORDINATE FIELD REVIEW WITH THE CITY PRIOR TO INSTALLATION.
 3. THE BOULEVARD AREA (FROM THE BACK OF CURB TO THE R/W) TO BE IRRIGATED. IRRIGATION PLAN AND SPECIFICATION MUST BE SUBMITTED FOR CITY REVIEW AND APPROVAL.
 4. POLLINATOR PATCH PRAIRIE SOD MAY BE INTEGRATED IN AREAS WHERE 5TH STREET RW ABUTS NATIVE PLANTING AREAS (MUST BE A MINIMUM OF 4 FEET IN WIDTH).

IRRIGATION NOTES:

- A SDR 21 PVC MAINLINE (2" OR GREATER) 24" FROM BACK OF PAVEMENT EDGE, 24" MIN. DEPTH TO TOP OF PIPE
- B CONTROL WIRE PATH
- C 12" POP-UP SPRINKLER W/ MSMT NOZZLE
- D 4" POP-UP SPRINKLER W/ SPRAY NOZZLE



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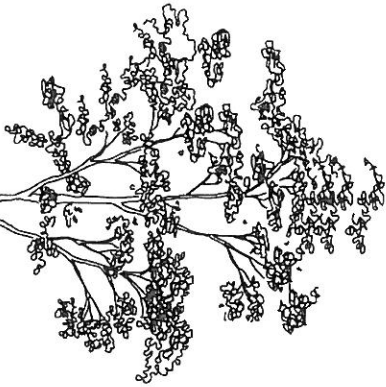
ROW LINE (distance to R.O.W. varies per plan)

POLLINATOR PATCH PRAIRIE SOD PER CITY SPECIFICATION SECTION 3202. SOD TO BE A MIN. 4 FOOT SECTION FROM EDGE OF LAWN AREA TO EDGE OF ROW, WHICHEVER IS GREATER.

TURF SOD FOR FIRST 5 FEET. TYP. MANDOT 3878 D. MINERAL SOD

IRRIGATION FOR AREAS WITH POLLINATOR PATCH PRAIRIE

5'-0"



OFFSET TO TREES FROM FACE OF CURB, TYP 7'-0"

STATELY TREES: 2.5" CALIPER MIN. DIAMETER. TREE SPECIES BY FULL BLOCK: OAKS, MAPLES OR ELM. PLANT SELECTION DIRECTION BY CITY. PLANT PER CITY DRAWING NO. 302A. 3" SETTLED DEPTH. SHREDED NORTHERN CEDAR MULCH.

TURF SOD: MANDOT 3878 TYPE A LAWN SOD.

TURF SOD: MANDOT 3878 TYPE A LAWN SOD

10' OR GREATER = ADD OPPOSING SPRINKLERS

BO (A)

TOPSOIL: MIN. 6 INCH DEPTH. MANDOT 3877 TYPE A COMMON TOPSOIL BORROW WITH AT LEAST 8% ORGANIC MATTER

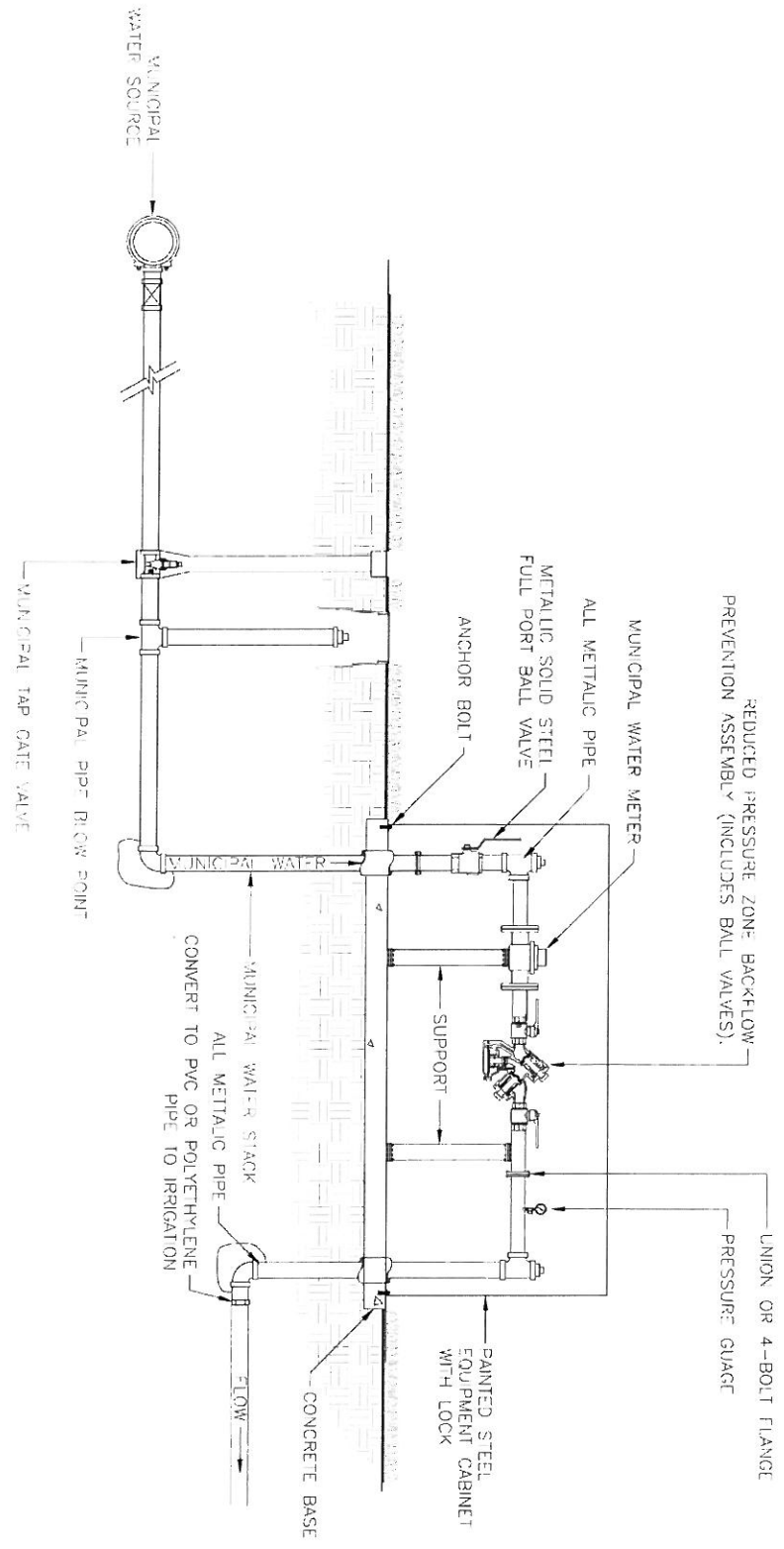
6 SIDEWALK OR 10' PATH PER LAYOUT PLANS

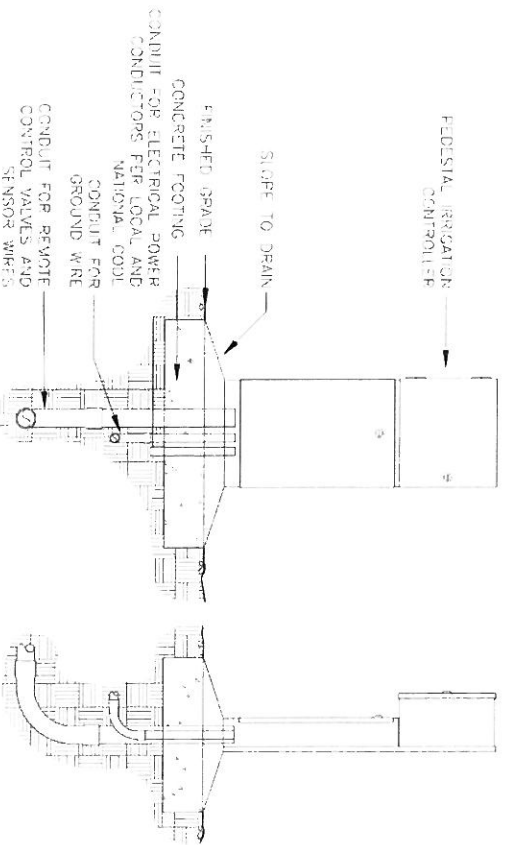
10'

10'

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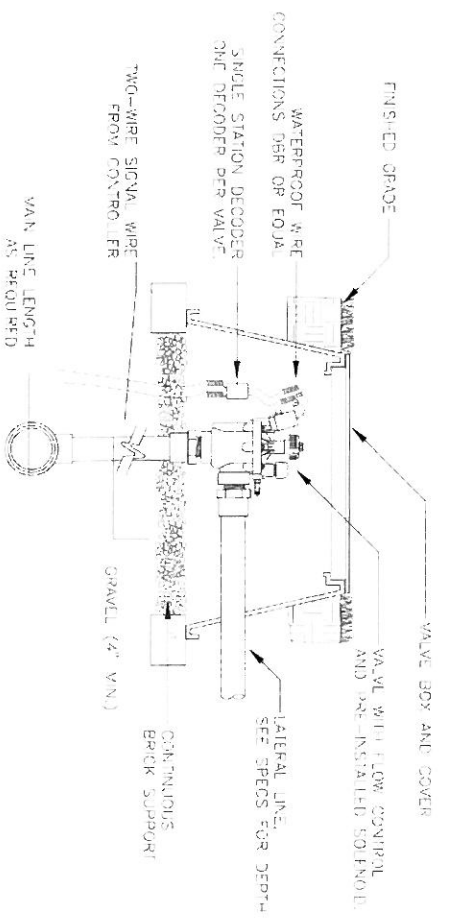
1 WATER SUPPLY (MUNICIPAL) SAMPLE





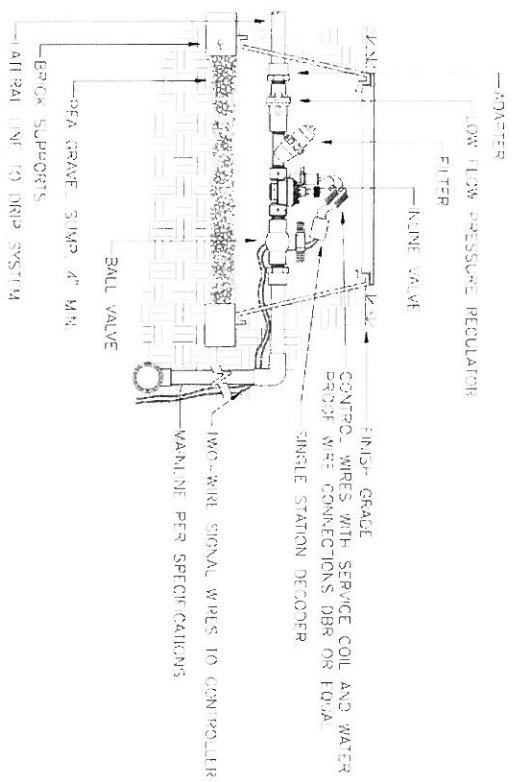
- NOTE
1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS AND BEST PRACTICES.
 2. HIGH AND LOW VOLTAGE ELECTRICAL WORK IS TO BE PERFORMED BY A LICENSED ELECTRICIAN.
 3. GROUND CONTROLLER IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION.

2 2-WIRE PEDESTAL CONTROLLER SAMPLE
 1" = 1'-0"



- NOTE
1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS AND BEST PRACTICES.
 2. SET VALVE BOXES AT FINISHED GRADE OR HIGHER AS LANDSCAPE INDICATES SO THAT THEY ARE VISIBLE BUT NOT A HAZARD.
 3. VALVE BOX BOTTOMS ARE TO BE SUPPORTED ON BRICKS OR SUITABLE HARD MATERIAL TO PREVENT BOXES FROM BEING PUSHED BELOW GRADE.
 4. INSTALL CONCRETE VALVE IN PROPER IRRIGATION BOXES, AS PER INDUSTRY STANDARDS FOR LAST OF STRIKI AND MANUAL OR RATION. SEE IRRIGATION SPECIFICATION.
 5. UTILIZE EXTENSION WITS AS REQUIRED.
 6. ADD FOUR-INCHES OF 3/4-INCH CRUSHED GRAVEL SUMP PER BOX.
 7. ALLOW FOR NOT LESS THAN 24" WIRE SLACK COILED NEARBY IN CONTROL BOX.

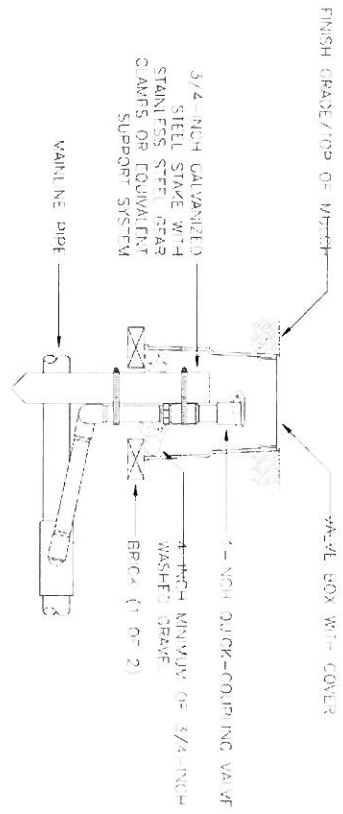
3 VALVE W/ SOLENOID AND DECODER SAMPLE
 1 1/2" = 1'-0"



- NOTE:
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 4. INSTALL CONTROL VALVE IN PROPOSED IRRIGATION BOX, AS PER INDUSTRY STANDARDS FOR FAST OF SERVICE AND MANUAL OPERATION. SEE IRRIGATION SPECIFICATION.
 5. UTILIZE EXTENSION KITS AS REQUIRED.
 6. ADD FOUR-INCHES OF 1/4-INCH CRUSHED GRAVEL SUMP PER BOX.
 7. ALLOW FOR NOT LESS THAN 2" WIRE SLACK COILED NEATLY IN CONTROL BOX.

4 DRIP ZONE CONTROL SAMPLE

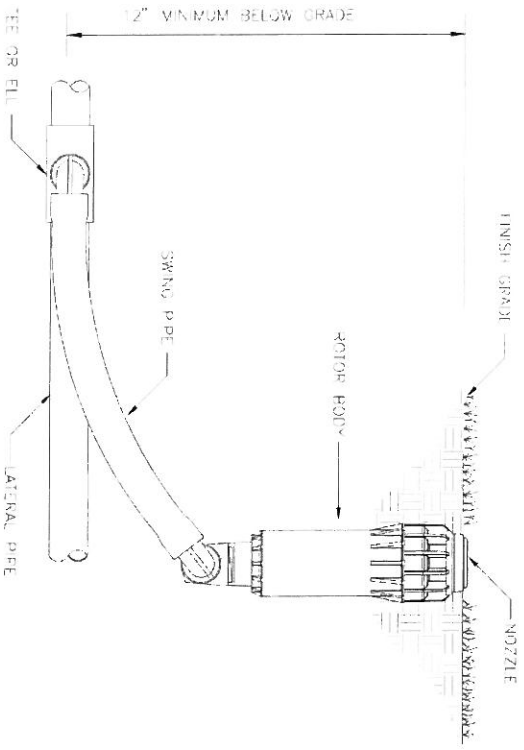
1/2" = 1'-0"



- NOTE:
1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS AND BEST PRACTICES.
 2. SET VALVE BOXES AT FINAL GRADE OR HIGHER AS LANDSCAPE INDICATES SO THAT THEY ARE VISIBLE BUT NOT A HAZARD.
 3. VALVE BOTTOMS ARE TO BE SUPPORTED ON BRICKS OR SUITABLE HARD MATERIAL TO PREVENT BOXES FROM BEING PUSHED BELOW GRADE.
 4. INSTALL VALVE IN PROPOSED IRRIGATION BOX, AS PER INDUSTRY STANDARDS FOR FAST OF SERVICE AND MANUAL OPERATION. SEE IRRIGATION SPECIFICATION.
 5. FURNISH FITTINGS AND PIPING NOMINALLY SIZED IDENTICAL TO NOMINAL QUICK COUPLING VALVE INLET SIZE.
 6. ADD FOUR-INCHES OF 3/4-INCH CRUSHED GRAVEL SUMP PER BOX.

5 QUICK COUPLING VALVE SAMPLE

1/2" = 1'-0"

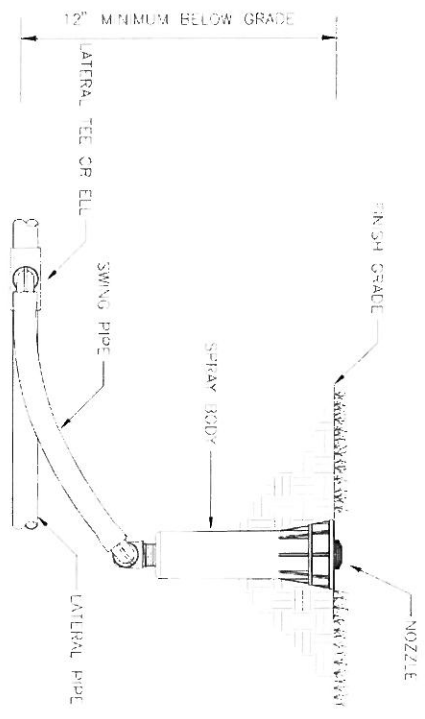


- NOTE:
1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS AND BEST PRACTICES.
 2. SPRINKLER SHALL OPERATE CLOSE TO DESIGNER SPECIFIED PRESSURE RATING.
 3. DO NOT MOUNT SPRINKLER DIRECTLY NEXT TO HARDSCAPES OR FENCES. PLACE 2" - 4" AWAY TO ALLOW FOR MAINTENANCE.
 4. SPRINKLER SHALL BE PLACED PERPENDICULAR TO FINISHED GRADE FOR OPTIMUM PERFORMANCE.

6 ROTOR W/ SWING JOINT SAMPLE

3" = 1'-0"

DETAIL-FILE



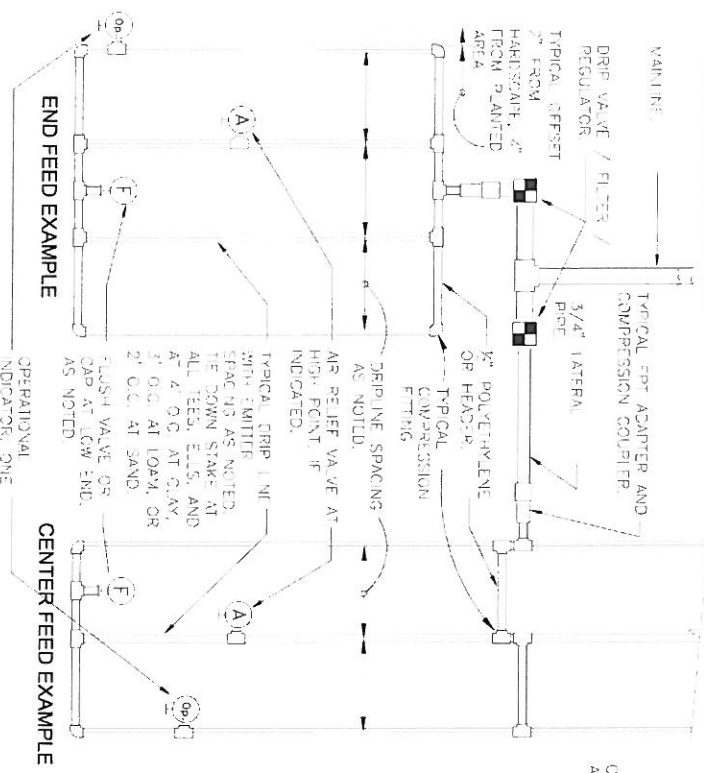
- NOTE:
1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS AND BEST PRACTICES.
 2. SPRINKLER SHALL OPERATE AS CLOSE TO MANUFACTURER OPTIMUM PRESSURE RATING AS POSSIBLE.
 3. DO NOT MOUNT SPRINKLER DIRECTLY NEXT TO HARDSCAPES OR FENCES. PLACE 2" - 4" AWAY TO ALLOW FOR MAINTENANCE.
 4. SPRINKLER SHALL BE PLACED PERPENDICULAR TO FINISHED GRADE FOR OPTIMUM PERFORMANCE.

7 SPRAY W/ SWING JOINT SAMPLE

3" = 1'-0"

MAXIMUM FLOW PER ZONE	
SCHEDULE	PSI LOSS
40' AVG. HEAD SIZE	
1/2"	4.7 GPM / 7.7 PSI
3/4"	9.3 GPM / 9.6 PSI
1"	13.5 GPM / 12.2 PSI
1-1/8"	18.9 GPM / 16.9 PSI
2"	52.4 GPM / 49.9 PSI

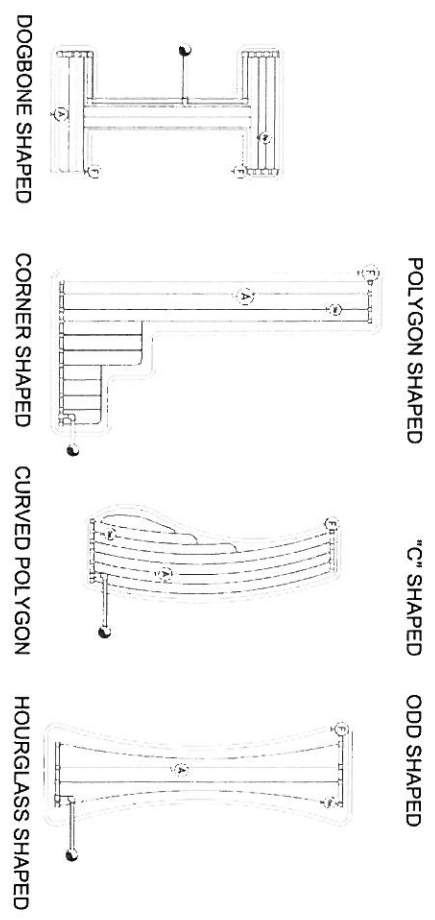
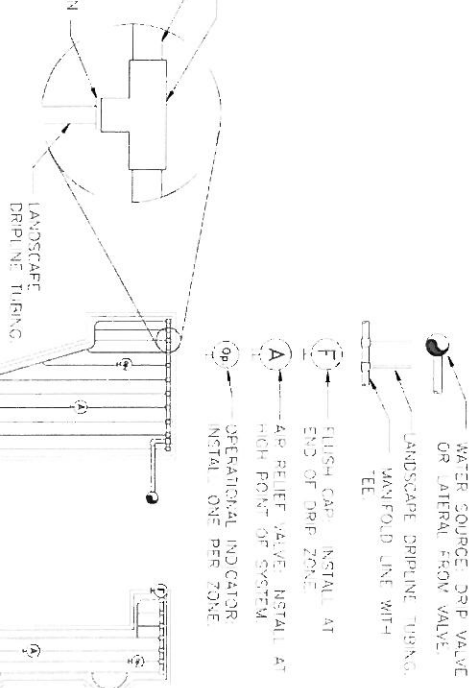
SLOPED CONDITION NOTE:
 1. DRIPLINE LATERALS SHOULD FOLLOW THE CONTOURS OF THE SLOPE WHENEVER POSSIBLE. INITIAL AIR RELIEF VALVE AT HIGHEST POINT.
 2. REMOVE SPACING WITHIN THE TOP 1/3 OF SLOPE.
 3. INITIAL DRIPLINE AT 25% GREATER SPACING AT THE BOTTOM 1/3 OF THE SLOPE.
 4. ZONE THE BOTTOM 1/3 ON A SEPARATE VALVE.



TYPICAL DRIPLINE SPACING AS NOTED.
 AIR RELIEF VALVE AT HIGH POINT IF INDICATED.
 TYPICAL DRIPLINE WITH EMITTER SPACING AS NOTED. SPACING AS NOTED AT ALL TEES, ELBS, AND AT 4' O.C. AT CLAY, 3' O.C. AT LOAM, OR 2' O.C. AT SAND.
 FLUSH VALVE OR CAP AT LOW END. AS NOTED.
 OPERATIONAL INDICATOR ONE PER DRIPLINE ZONE.

8 TYPICAL DRIPLINE SAMPLE

NOT TO SCALE

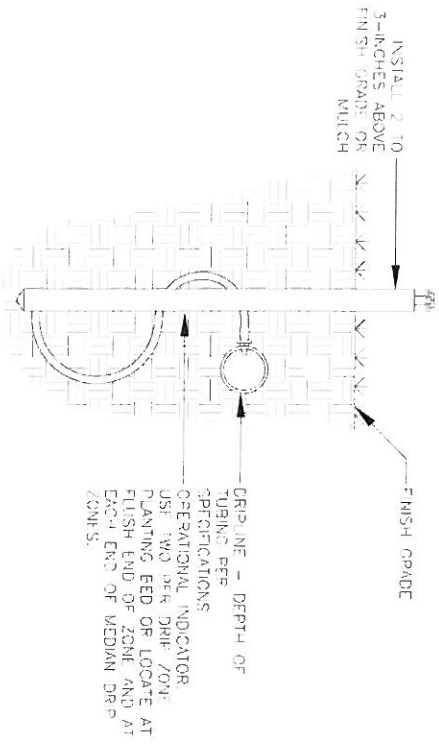


NOTE:
 1. DO NOT EXCEED 2900 SF PER DRIPLINE ZONE



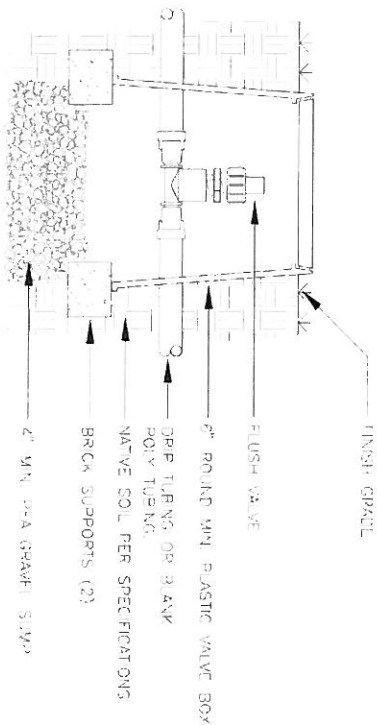
STANDARD DETAILS
 OCTOBER 2015

IRRIGATION DETAILS



- NOTE
1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS AND BEST PRACTICES.
 2. INSTALL ONE POP UP OPERATION INDICATOR IN EACH DRIP BED IN A LOCATION THAT WILL BE VISIBLE AT A DISTANCE, BUT NOT A TRIPPING HAZARD.
 3. POP UP OPERATION INDICATOR WILL SIGNAL WHEN STATION IS RUNNING. INDICATOR WILL ALSO SIGNAL POTENTIAL DAMAGE TO DRIPLINE IF NOT ELEVATED DURING OPERATION.

9 DRIP GRID POP-UP OPERATION INDICATOR SAMPLE
 $3' = 1''-0''$



- NOTE
1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS AND BEST PRACTICES.
 2. USE ONE FLUSH VALVE FOR EVERY 7 GPM PER ZONE.
 3. LOCATE FLUSH VALVE ASSEMBLY AT LOW POINTS.
 4. FLUSH RATE IS 0.8 GPM.
 5. FLUSH PRESSURE IS 2 PSI.
 6. THE SYSTEM MUST BE FLUSHED THOROUGHLY AFTER REPAIRS OR ALTERATIONS ARE MADE TO THE IRRIGATION COMPONENTS. FLUSH CAPS DO NOT ALLOW ENOUGH WATER TO PASS THROUGH EXTENSIVE DEBRIS AND THEREFORE MUST BE REMOVED IN ORDER TO EFFECT A MANUAL FLUSH.

10 DRIP GRID FLUSH VALVE SAMPLE
 $3' = 1''-0''$

SECTION 32 84 00

PLANTING IRRIGATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section is ten total written pages plus associated sample details.
- B. This section specifies elemental materials and procedures based upon published and widely accepted industry best practices to design and construct landscape irrigation system(s) in a design-build approach including the developments, and road right-of-ways. The most recent landscape irrigation industry best practices can be found at: http://www.irrigation.org/uploadedFiles/Resources/BMP_Revised_12-2010.pdf.

1.2 SUBMITTAL

- A. All right-of-way and city owned/maintained outlots as well as HOA owned and maintained outlots need to provide 100% irrigation coverage for all proposed landscape improvements excluding native seeding areas.
- B. Landscape irrigation designs shall be crafted in workmanlike fashion preferably using CAD-based software. Scaled irrigation plans shall include the entire project limits. Designs and supporting documents shall be furnished in reproducible electronic and hardcopy fashion, to the City of Lake Elmo for approval prior to commencing work. No landscape irrigation installation work shall commence without written consent of the City of Lake Elmo, MN.
- C. Landscape irrigation design(s) and supporting documents shall depict and describe all components of the proposed landscape irrigation system including but, not limited to:
 - a. Water supply and detail including proposed enclosures and slabs
 - b. Pipeline sizing throughout
 - c. Sprinkler emitter proposed brand, model and nozzle sizing
 - d. Drip grids with associated required components
 - e. Controls including proposed pedestal enclosures and weather-based appurtenances
 - f. Projected seasonal water use month-by-month

1.3 DEFINITIONS

- A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves.
- B. Drain Piping: Downstream from circuit-piping drain valves.
- C. Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves.
- D. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 volts or for remote-control, signaling power-limited circuits.

1.4 ABBREVIATIONS

- A. FPT: Female pipe thread

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- B. MPT: Male pipe thread
- C. NPT: National pipe thread
- D. HDPE: high-density polyethylene
- E. PVC: Polyvinyl chloride plastic
- F. SDR: Standard Dimension Ratio
- G. SCH: Schedule Pipe
- H. AWG: American Wire Gauge

1.5 ELEMENTAL PERFORMANCE REQUIREMENTS

- A. Irrigation water supply shall be water re-use as primary.
- B. Backup irrigation water supply(ies) drawing from municipal or groundwater shall be properly permitted by authorities having jurisdiction and shall be constructed to conform to meet or exceed minimum requirements of the City of Lake Elmo, MN. See sample detail(s). All water supply(ies) and associated system mainline and circuit piping regardless of water source, shall be:
 - 1. sized not to exceed dynamic velocity greater than 5 feet per second;
 - 2. sized to enable simultaneous operation of not less than two stations of irrigation;
 - 3. sized to complete an irrigation cycle within 10 hours during the hottest month of the irrigation season.
 - 4. sized to enable operation of sprinklers at manufacturer recommended dynamic pressure(s).
- C. Irrigation stations shall not mix rotor or multi-stream, multi-trajectory sprinklers with misting spray-type sprinklers.
- D. Broadcast sprinklers shall be placed to enable 100 percent coverage, sprinkler-to-sprinkler.
- E. Turf areas shall have broadcast sprinklers.
- F. Islands and planting beds shall have drip irrigation.
- G. Broadcast sprinkler emission devices shall include matched precipitation/application rates.
- H. Broadcast sprinklers located at the bottom of slopes shall have check-valve or similar features to prevent or reduce low-head drainage.
- I. Broadcast sprinklers shall not throw over public walks or roadways.
- J. Broadcast sprinklers shall be placed and adjusted to minimize overspray onto hard surfaces.
- K. Broadcast sprinklers in the vicinity of conifers shall be placed to minimize broadcast onto conifers.
- L. Sprinklers and piping installed upon slopes shall be installed perpendicular to the slope wherever feasible.
- M. System zoning priority shall be given to soil type, plant type, topography and microclimate.
- N. Single row broadcast sprinklers shall be allowed in boulevard areas or strips of eight feet width or less.
- O. Single row broadcast sprinklers shall be placed to throw away from walks and toward streets.
- P. Use schedule 40 PVC pipe or greater for sleeves under hard surfaces.
- Q. Sleeve(s) dimension shall be a minimum of two times the outside dimension of the pipe passing through.
- R. Use NSF-rated HD100 polyethylene pipe, where applicable.
- S. Use up to 2" polyethylene pipe in sleeves.

- T. Thrust block pressure pipe 3" or larger. Follow published industry best practices.
- U. Top of mainline pipe 3" and smaller shall not be less than 18" from final grade.
- V. Top of circuit piping shall be not less than 12" from final grade.
- W. Plan for and install controller and field grounding equipment per manufacturer recommendations.

1.6 QUALITY ASSURANCE:

A. Products Criteria:

1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either, cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

B. Installer Minimum Qualifications:

The selected installing contractor shall be an employer of workers that include not less than one Certified Irrigation Contractor in good standing as accredited by The Irrigation Association, Fairfax, VA (www.irrigation.org) and who shall be currently employed by the selected installing contractor and who shall personally conduct or oversee the conduct of all work upon this project. The selected installing contractor shall be registered in the State of Minnesota as a Technology Systems Contractor in good standing employing not less than one Minnesota licensed Power Limited Technician in good standing who shall be currently employed by the selected installing contractor and who shall personally conduct or oversee the conduct of all low voltage irrigation electrical work. The selected installing contractor shall be prepared to furnish proof of not less than 5 successful installations of projects of similar scope and complexity within the past 3 calendar years including but, not limited to successful installation, programming and operation of digital two-wire decoder irrigation control systems.

C. System Requirements:

100 percent irrigation coverage of irrigated areas is required. The actual and spirit of intent of this project outcome is clearly indicated upon the drawing sheets and within the specification documents. The selected installing contractor shall, at no additional cost be prepared to make minor adjustments necessary to avoid obstructions such as hard surfaces signs, utilities and light standards and achieve full and complete coverage of irrigated areas without overspray on roadways, sidewalks, window wells or buildings and shall protect trees from close high-spray velocity.

PART 2 - PRODUCTS

2.1 PIPES, TUBES AND FITTINGS

- A. PE pipe with controlled ID shall be ASTM F771, PE 3408 compound;
- B. Insert fittings for PE pipe: ASTM D2609, nylon or propylene plastic with barbed ends. Include stainless steel bands or other fasteners.

- C. PE pressure pipe: AWWA C906, with DR of 7.3, 9, or 9.3 and PE compound number required to give pressure rating not less than 160 psi (1100 kPa)
- D. PE butt, heat-fusion fittings shall be ASTM D3261.
- E. PE socket-type fittings shall be ASTM D2683.
- F. PVC sleeve pipe: ASTM D1785, PVC 1120 compound, Schedule 40.
- G. PVC socket fittings shall be ASTM D2466, Schedule 40 PVC threaded fittings: ASTM D2464, Schedule 80.
- H. Swing joints: Threaded fittings with elastomeric seals that allow 360 degree rotation, and designed for minimum 200 psi (1375 kPa) working pressure, may be used in lieu of standard threaded fittings.
- I. PVC socket unions: Both headpiece and tailpiece shall be PVC with socket ends.
- J. PVC Pipe: ASTM D2241, PVC 1120 compound, SDR 26.
- K. PVC socket fittings: ASTM D2467, Schedule 80.
- L. PVC socket unions: Both headpiece and tailpiece shall be PVC with socket or threaded ends.

2.2 PIPE JOINING MATERIALS

- A. Solvent cements for joining PVC piping: ASTM D2564. Include primer according to ASTM F656.
- B. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.3 VALVES

- A. Underground Shut-Off Valves:
 - 1. Butterfly valves 2 inches (50 mm) and larger: AWWA C504, iron body, bronze mounted, double disc with parallel or inclined seats, non-rising stem turning clockwise to close, 150 psi (1025 kPa) minimum working pressure.
 - 2. Ball valves, isolation valves, 1-1/2 inch (38 mm) and smaller: Full-port ball valves with bronze body, PTFE seats, and 90 degree on/off handle. Ball valves shall have NPT female end connections.
- B. Operations:
 - 1. Underground applications shall use valves with 2 inch (50 mm) nut for T-Handle socket wrench operation.
 - 2. Aboveground and valve pit applications shall use valves, with handwheels.
 - 3. Valve ends shall accommodate the type of main pipe adjacent to valve.
- C. Remote Control Valves:
 - 1. All remote control valves shall be of the manufacturer and models indicated on the drawing sheets furnished. No deviation from manufacturer or model call-outs once approved, shall be allowed.
 - a. Sizes and locations as indicated on the drawing sheets. Molded-plastic body, furnished as straight or angle pattern type, normally closed diaphragm type with manual shut off and flow control adjustment. Refer to sample details or furnished and approved details submitted at the time of approval application.

b. Single valve digital two-wire decoder installed concurrently with each remote control valve and within the same remote control valve box, one valve per decoder, one decoder per control valve, one valve box per valve and decoder combination. No deviation from manufacturer or model call-outs once approved, shall be allowed. Refer to sample details or furnished and approved details submitted at the time of approval application. Label decoders with stencils designating controller and circuit number with permanent white epoxy paint or with permanent paint pen.

1. Valves shall have a minimum of 150 psi (1025 kPa) working pressure.
2. Each sprinkler station shall be automatically operated by a remote control valve installed underground and operated by a single-station in-line digital decoder-governed solenoid.
3. Valve boxes shall be locking type-capable.
4. Valves shall be completely serviceable from the top without removing valve body from the system. Valves shall operate at no more than 7 psi (50 kPa) pressure loss at manufacturers maximum recommended flow rate.
5. Valves shall be diaphragm type designed to operate in water containing sand and debris and shall have a self-cleaning type contamination filter to filter all water leading to the solenoid actuator and the diaphragm chamber.

2.4 VALVE BOX

- A. Isolation valve boxes shall be precast concrete boxes with a compressive concrete strength in excess of 4000 psi (30 Mpa). Box dimension shall be adapted to depth of cover required over pipe at valve location. Mark box cover to say "Irrigation" and set flush with finished grade. Provide 2 (two) "T" handle socket wrenches of 5/8 inch (15 mm) round stock with sufficient length to extend 2 feet (600 mm) above top of deepest valve box cover.
- B. Irrigation control valve, decoder boxes and quick coupler boxes shall be HDPE green in color or black body with green cover. Boxes shall be lockable-ready. Refer to sample details or furnished and approved details submitted at the time of approval application.

2.5 BACKFLOW PREVENTER

- A. Use reduced pressure zone backflow prevention assembly sized according to minimum system performance specifications contained herein and as approved by the authority having jurisdiction. Refer to sample details or furnished and approved details submitted at the time of approval application.

2.6 WATER METER

- A. Use water meter brand and model specified by the authority having jurisdiction. Size meter according to minimum system performance specifications contained herein. Refer to sample details or furnished and approved details submitted at the time of approval application.

2.7 AUTOMATIC CONTROL EQUIPMENT - INDEPENDENT ELECTRIC CONTROLLER WITH NO FLOW SENSING (FOR SMALL INSTALLATIONS)

- A. GENERAL STATEMENT: Irrigation control shall be digital, two-wire-based automatic operation including:

1. rain sensing technology, placed per manufacturer recommendations and/or referenced industry best practices to interrupt irrigation during periods of sufficient moisture and fully engaged;
 2. weather-based adjustment, placed per manufacturer recommendations and/or referenced industry best practices and fully engaged;
 3. controller shall be mounted in a pedestal manufactured by the selected controller manufacturer and shall be securely placed upon a concrete base per manufacturer recommendations and/or referenced industry best practices; See associated sample detail(s).
 4. field control valves shall be connected to digital control wire using one-station field decoders, placed in the associated control valve box and shall include waterproof wire fittings such as 3MDBR or equivalent on the signal input wires and the signal output wires. Follow manufacturer recommendations and/or referenced industry best practices. Field control valves shall be placed in plastic/composite surface boxes, one valve per box, minimum 10" round sized and in a fashion to prevent damage from surface activities and to enable basic field maintenance without requiring of the box. See associated sample detail(s).
- B. The independent electric automatic control system shall consist of one digital two-wire decoder-based controller located in a pedestal manufactured by the controller manufacturer, which operates individual remote control decoder-based valves and weather-based schedule adjustment (SMART) operation in accordance with timing schedules programmed into the independent unit. Refer to sample details or furnished and approved details submitted at the time of approval application.
- C. Connect, test electrically and program all irrigation stations to the digital two-wire decoder-based controller per manufacturer recommendations and Best Practices and incorporate all stations into the control system. Memorialize all programming data onto reproducible documents in a workmanlike fashion.

2.8 SPRINKLER HEADS

- A. Rotary pop-up sprinklers:
1. ¾" inlet, closed-case, gear-driven, 4" minimum pop-up height or
 2. ½" inlet spray-body mounted, six-inch minimum pop-up height, multi-stream, multi-trajectory rotating nozzle.
 3. Matched precipitation/application shall be depicted on plan submittals and practiced at the time of installation. Placement appropriate to the area characteristics being watered.
 4. Refer to sample details or furnished and approved details submitted at the time of approval application.
- B. Spray-type sprinklers (fixed):
1. ½" inlet, 4" minimum pop-up height with nozzles and placement appropriate to the area characteristics being watered.
 2. Refer to sample details or furnished and approved details submitted at the time of approval application.

2.9 QUICK COUPLERS

- A. Quick couplers shall have all parts contained in a two-piece unit and shall consist of a coupler water seal valve assembly and a removable upper body to allow the spring and key track to be serviced without shut down of the main.
- B. Metal parts shall be brass.
- C. Lids shall be lockable vinyl covered and have springs for positive closure on key removal.
- D. Each quick coupler shall be contained in valve boxes. Refer to sample details or furnished and approved details submitted at the time of approval application.
- E. Furnish 1 (one) hose swivel and operating key.

2.10 LOW VOLTAGE CONTROL VALVE WIRE

- A. Wire shall be solid copper wire, Underwriters Laboratories Inc. approved for direct burial in ground. Wire shall be digital decoder-based control wire of the same outer jacket color as that installed upon the existing landscape irrigation system. Size of wire shall be consistent with manufacturer recommendations, never less than 14 AWG.

2.11 WIRE SPLICING MATERIALS: LOW VOLTAGE RATED UV RESISTANT MOISTURE-RESISTANT GREASE-FILLED POLYPROPYLENE TUBE

- A. 3M DBR/Y-6 Direct Bury Splice Kit UL486D-approved for direct burial in ground or equal. Use upon wire splices, decoder inlet wiring and decoder outlet wiring.

2.12 SLEEVE MATERIAL

- A. ASTM D2241, PVC Schedule 40.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine proposed irrigation areas for compliance with requirements and conditions affecting installation and performance.
- B. Verify limits of irrigation and compare against approved plans.

3.2 PIPE INSTALLATION - GENERAL

- A. Layout work as closely as possible to drawing sheets. **CALL BEFORE YOU DIG (811)**.
- B. Install sprinkler lines to avoid electric, storm and sanitary sewer lines and existing water and gas mains, all of which have the right of way.
- C. Existing sidewalks and curbs shall not be cut during trenching and installation of pipe. Install pipe under sidewalks and curbs by jacking, auger boring, or by tunneling. Repair or replace any cracked concrete, due to settling during the warranty period.
- D. Do not lay pipe on unstable material, in wet trenches weather conditions are unsuitable for work.
- E. Allow a minimum of 3 inches (80 mm) between parallel pipes in the same trench.

- F. Clean the interior portion of pipe and fittings of foreign matter before installation. Securely close open ends of pipe and fittings with caps or plugs to protect fixtures and equipment against dirt, water and chemical or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
- G. The full length of each section of (PVC) pipe shall rest upon the pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipe on wood blocking.
- H. Hold pipe securely in place while joint(s) is/are being made.
- I. Do not work over, or walk on, pipe in trenches until covered by layers of earth, well tamped, in place to a depth of 12 inches (300 mm) over pipe.
- J. Irrigation lines and control wire shall run through designated lanes where possible. Refer to sample details or furnished and approved details submitted at the time of approval application.
- K. Concrete thrust blocks shall be installed upon piping 3-inch and larger where the irrigation main changes direction at "L" and "T" locations and where the irrigation main terminates. Do not pressurize pipe for a period of 36 hours following the completion of pouring of the thrust blocks. Concrete thrust blocks for supply mains shall be sized and placed in strict accordance with the pipe manufacturer's specifications and shall be of an adequate size and so placed as to take all thrust created by the maximum internal water pressure. Thrust block material shall not be poured over and around pipe and /or control wire.
- L. Minimum cover over lines under constant pressure shall be 18 inches (750 mm) for pipe sizes of 3 inch and less. Cover laterals to minimum depth of 12 inches (600 mm).

3.3 SLEEVE INSTALLATION

- A. Furnish and install where pipe and control wires pass under walks, paving, walls, and other similar areas.
- B. Sleeves to be twice line size or greater to accommodate retrieval for repair of wiring or piping and shall extend 12 inches (300 mm) beyond edges of paving or construction.
- C. Bed sleeves with a minimum of 4 inches (100 mm) of sand backfill above top of pipe in areas where pipe is placed prior to hardscape is installed.

3.4 VALVE INSTALLATION

- A. Locations of remote control valves is/are diagrammatic. Group remote control valves wherever possible and aligned at a set dimension back of curb along roads. Do not install more than one valve per valve box unless using jumbo-sized valve box and per minimums depicted herein and upon sample details included with this written specification.
- B. No valves shall be set under roads, pavement or walks.
- C. Clean interior of valves of foreign matter before installation.
- D. Set valve box cover flush with finished grade.
- E. Control valves shall never be less than 3 inches (80 mm) below finished grade. Refer to minimums depicted herein and see sample details.

3.5 SPRINKLER AND QUICK COUPLER INSTALLATION

- A. Place part circle rotary sprinklers no greater than 6 inches (150 mm) from edge of and flush with top of adjacent walks, curbs, and mowing aprons, or paved areas at time of installation.
- B. Install all sprinklers using swing joints or flexible hose-and-fitting joints (a.k.a. swing pipe). Refer to sample details included with this written specification.
- C. Install all quick couplers on swing joints. Stake for support. Refer to sample details included with this written specification.
- D. Set shrub sprinklers 4 inches (100 mm) above grade or even with bedding mulch depth and 4 inches (100 mm) from edge of curb or pavement. Place 4 inches (100 mm) from walls. Stake sprinklers prior to backfilling trenches. Support stakes shall be parallel to riser.

3.6 AUTOMATIC IRRIGATION - CONTROL SYSTEM INSTALLATION

- A. Attach new stations of irrigation to the digital two-wire decoder system and program and test each control valve for proper operation from the existing irrigation controller.
- B. Adjust master controller programming to incorporate new stations of irrigation within programs for similar plant-types or hydrozones and in accordance with necessary programming for weather-based (SMART) operation.

3.7 CONTROL WIRE INSTALLATION

- A. Wiring shall be located in trench with pressure main pipe. Splicing shall be held to a minimum. In the event a wire splice is required outside of a remote control valve location, the splice shall be contained in a valve box not smaller than 10" round with not less than 24 inches of leader or expansion looping on each end of the splice. Use 3M DBR waterproof wire splices or equivalent.
- B. Provide 12 inch (300 mm) expansion loops in wiring at each wire connection or change in wire direction. Provide not less than 24 inch (600 mm) loop at remote control valves.

3.8 FIELD TEST AND QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Pressure test pressure main line(s) before joint areas are backfilled. Backfill a minimum of 12 inches (300 mm) over the pipe to maintain pipe stability during test period.
 - 2. Inspect each joint and repair leaks.
 - 3. Flush lines before installing sprinkler heads and quick couplers.
 - 4. After installation, charge system and test visually for leaks. Repair leaks and retest until no leaks exist.
 - 5. After electrical circuitry has been activated and final adjustment of sprinklers to permanent level at ground surface is complete, test each broadcast turf sprinkler section to indicate a uniform distribution within any one sprinkler area and over the entire area.
 - 6. Operate controller and automatic control valves to demonstrate the complete and successful installation and operation of all equipment.
 - 7. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

8. Prepare test and inspection reports, programming information (including SMART operation), decoder information and details for record drawings. Furnish records in a professional and workmanlike fashion.

3.11 ADJUSTMENTS

- A. Adjust settings of controller as needed during the establishment period. Should plant establishment requirements preclude engagement of weather-based (SMART) operation, assure weather-based operation is engaged prior to final walkthrough/turnover.
- B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.
- C. Adjust sprinklers and devices to proper grade, radius and arc.

3.12 DEMONSTRATION AND DOCUMENTATION

- A. Program controller for weather-based (SMART) operation.
- C. Follow manufacturer's instructions and industry best practices.
- D. Maintain and provide a complete set of as built drawings in a professional and workmanlike presentation form which shall be corrected to show changes in locations of all pipe, valves, pumps, decoders and related irrigation equipment.
- E. Controller Drawings and Zone Chart(s):
 1. Prepare in electronic format a drawing mapping the location of all valves, decoders, lateral lines, and route of the control wires. Identify all valves as to size, station, number and type of irrigation. Digital formatted "as built" drawings may require approval before controller zone charts are prepared.
 2. Provide one controller zone chart for each automatic controller showing the area covered by the controller. The chart shall be a reduced drawing of the actual "as built" system and fit the maximum size controller door or pedestal will allow. If controller sequence is not legible when the drawing is reduced to door size, the drawing shall be enlarged to a size that is readable and placed protected from elements (such as laminated) inside the controller door.
 3. The final irrigation "as built" drawings shall be submitted in digital format with a different coding to show area of coverage for each station. All drawings and zone charts must be completed and approved prior to final inspection of the irrigation system. Upon completion, a full set of reproducible, electronic as-built drawings, decoder information and base weather-based (SMART) programming shall be furnished to the City of Lake Elmo.
 4. The most recent landscape irrigation industry best practices can be found at:
http://www.irrigation.org/uploadedFiles/Resources/BMP_Revised_12-2010.pdf.

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MEMO

DATE: January 13, 2015

TO: Mitchell Cookas

FROM: Tim Malooly

RE: Comments on Lake Elmo best practices-based landscape irrigation performance specification guidance

The performance specification reviewed is intended to furnish minimum best practice-based criteria for design-build irrigation systems that helps ensure consistency of system design and installation and to furnish criteria from which to review, approve, request improvements to or reject plans submitted to the owner or owner's representative prior to installation. The specification also furnishes criteria from which, to inspect and accept or reject equipment or installation practices as a condition of turnover to the owner.

1.1B. The Irrigation Association best practice documents are widely accepted nation-wide in myriad forums including local codes and green-build supplements. Each best practice is easily defended from many points including efficient use of resources and system maintainability.

1.2A 100% coverage ensures even distribution of water on to a planted area and conforms to best practices and manufacturer recommendations.

1.2C This directive enables the owner to properly catalogue, obtain inventory, maintain and perhaps most importantly, properly schedule irrigation events.

1.5A, B Whenever opportunity exists to avoid use of municipal potable water, feasibility of use of non-potable water shall be undertaken and if deemed feasible, municipal water shall be used as backup only. If reuse water source is deemed non-feasible, documentation will exist to defend such a decision.

Items 1-4 conform to best practices, system longevity and contribute to water manager's ability to properly complete irrigation events in reasonable timeframes.

- 1.5H Although slightly more costly to purchase, check valve-equipped sprinklers located at bottom of slopes will conserve water, reduce damage to landscapes and hard surfaces and reduce liability to the City associated with pedestrian injury from slippery surfaces.
- 1.5I, J & O No water over walkways is a water efficient best practice and reduces liability to the City associated with pedestrian injury from slippery surfaces.
- 1.5K Conifer damage is costly, unsightly and expensive. Avoiding direct spray onto such plants reduces risk of damage or death.
- 1.5S Flexible pipe in sleeves where applicable helps reduce costly maintenance resultant of cracked pipes in sleeves from winter freeze conditions.
- 1.6A This provision helps ensure products are new, matching and easily maintained by City personnel.
- 1.6B PLT is Minnesota law. CiC helps minimize risk of installation deficiencies and maintenance challenges resultant of non-qualified installers. CiC is nationally-recognized, third party accredited. Many local contractors have employees who are CiC.
- 2.3Cb Decoder-based irrigation systems enable long term flexibility and reasonable ability to retrofit systems with new technology over time. When installing digital decoder-based control, single decoder per control valve assures proper installation and minimizes confusion during maintenance.
- 2.4A Identification of control boxes and adequate slack of control wire contributes to efficient maintenance and lower corresponding costs of maintenance.
- 2.7A1 Including properly functioning rain sensing technology is Minnesota law.
- 2.7A2 SMART irrigation control minimizes waste of resources and reduces cost of maintenance.
- 2.73 Pedestal-based installation reduces propensity of non-code conforming installation, ensures safe operation of control equipment.
- 2.8A3 Matched application nozzles reduce water waste, reduce plant death from overwatering and promote an even look to the landscape.

- 3.3B Sleeves sized 2x pipe passing through ensures ability to repair damaged pipe if necessary and reduces propensity of damage to inserted pipe or wire at the time of construction.
- 3.4A Grouped or manifolded control valves reduces the number of potential points of vandalism/damage from mowers, etc. and promotes efficient maintenance.
- 3.8A1 Pressure testing mainline is a best practice. This call-out has been minimized (from common expectations) in terms of requirements for passage to minimize unnecessary installation cost.
- 3.12E Completing the work listed ensures the owner will have necessary and workmanlike records to catalogue systems and efficiently maintain systems.



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Water in Motion proudly employs EPA WaterSense Partners.