SECTION 32 84 00

PLANTING IRRIGATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section is twelve total written pages. Refer to details Lake Elmo Standard Details LI1-LI10 for more information

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.

1.2 SUBMITTAL

A. All right-of-way and city owned/maintained outlots as well as HOA owned and maintained outlots shall 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

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 REQUIREMENTS

A. Irrigation water supply shall be irrigation water supply(ies) drawing from municipal or groundwater shall be metered and 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). Refer to City of Lake Elmo Process for obtaining a water meter. 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. Turf areas shall have broadcast sprinklers.

E. Islands and planting beds shall have drip irrigation.

F. Broadcast sprinkler emission devices shall include matched precipitation/application rates.

G. Broadcast sprinklers located at the bottom of slopes shall have check-valve or similar features to prevent or reduce low-head drainage.

H. Broadcast sprinklers shall not throw over public walks or roadways.

I. Broadcast sprinklers shall be placed and adjusted to minimize overspray onto hard surfaces.

J. Broadcast sprinklers in the vicinity of conifers shall be placed to minimize broadcast onto conifers.

K. Sprinklers and piping installed upon slopes shall be installed perpendicular to the slope wherever feasible.

L. System zoning priority shall be given to soil type, plant type, topography and microclimate.

M. Single row broadcast sprinklers shall be allowed in boulevard areas or strips of eight feet width or less.

N. Single row broadcast sprinklers shall be placed to throw away from walks and toward streets.

O. Use schedule 40 PVC pipe or greater for sleeves under hard surfaces.

P. Sleeve(s) dimension shall be a minimum of two times the outside dimension of the pipe passing through.

Q. Use NSF-rated HD100 polyethylene pipe, where applicable.

R. Use up to 2” polyethylene pipe in sleeves.

S. Pressure main isolation valve with quick coupler immediately downstream shall be placed:

1. Immediately following each “TEE-end” of a looped mainline;
2. Prior to routing underneath any substantial hard surface such as a roadway, intersection or similar;
3. At the point immediately following a directional change that results in “leg” or “stub” lengths

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, controller pedestal, corresponding electrical 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 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. Above ground 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) maximum 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 assembl(ies) sized to accommodate minimum system performance specifications contained herein and as approved in writing by the authority having jurisdiction. Refer to Lake Elmo Standard Details LI1.

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.

B. Refer to City of Lake Elmo Process for obtaining a water meter.

2.7 PLUMBING ENCLOSURE AND SLAB:

A. The enclosure shall house the backflow prevention assembl(ies), water meter(s) and booster pump(s), if required for a given project. Enclosure shall be mounted on a concrete slab of minimum 4” depth with sleeve openings for water lines and booster pipe electrical wires, if applicable. The slab shall extend beyond the enclosure a minimum of 6”. All piping in and out of the enclosure shall be copper and/or brass and/or threaded galvanized steel and/or Victaulic-grooved pipe and shall extend beyond the slab a minimum of 5 feet before converting to other pipe material.

B. Enclosure shall conform ASSE 5110, 5130 and related, for backflow prevention assembly clearances.

C. Enclosure shall be constructed of 14 gauge all steel construction (minimum) and include the following:

1. Gas shock supports for cover.

2. Lockable Hasp
3. Lift handles on cover.
4. 2" flanges bent top and bottom.
5. Louvers both ends for ventilation.
6. Painted "Transformer Green".
7. Stainless Steel hinges.
8. Dimensions based on plumbing needs. Shall have a minimum 2 foot working distance between plumbing and all enclosure walls.

D. Shop drawings listing all components, slab location, slab penetrations and steel enclosure shall be furnished for review and approval prior to ordering parts or commencing construction of this element.

E. Provide 6" minimum clearance from all valves, meters, backflow prevention assembl(ies), and piping for serviceability and conform to Item 2.7b above.

F. Unless otherwise approved in writing by authority having jurisdiction and prior to commencing design work or installation, only one water supply point of connection shall be permitted per development. If development is planned to be comprised of multiple phases of construction, all phases shall be master planned and sized for one water supply point of connection unless otherwise approved in writing by authority having jurisdiction.

G. Water supply, slab and enclosure shall be placed within dimensional requirements of the City of Lake Elmo from curbs, walks, utilities and related and location(s) shall be approved in writing to accommodate rights-of-way clearance requirements during the design phase of work and prior to commencing installation.

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

A. Controller, controller pedestal and slab shall be placed within dimensional requirements of the City of Lake Elmo from curbs, walks, utilities and related and location(s) shall be approved in writing to accommodate rights-of-way clearance requirements during the design phase of work and prior to commencing installation.

B. 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/on 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).

C. The independent electric automatic control system shall consist of one digital two-wire decoder-based controller located in a stainless steel 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.

D. 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.

2.9 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.

2.10 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.

2.11 LOW VOLTAGE CONTROL VALVE WIRE

A. Wire shall be solid copper wire, Underwriters Laboratories Inc. approved for direct burial and approved by the specified irrigation control manufacturer for use in digital two-wire decoder based irrigation control systems. Size of wire shall be consistent with manufacturer recommendations and not less than 14 AWG.

2.12 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.

2.13 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).

M. Quick couplers, properly anchored/secured in surface boxes shall be placed at the termination of all main line piping.

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. Group remote control valves wherever possible and aligned at a set dimension back of curb, sidewalk and/or along roads.

B. Pressure main isolation valve with quick coupler immediately downstream shall be placed:

   a. Immediately following each “TEE-end” of a looped mainline;

   b. Prior to routing underneath any substantial hard surface such as a roadway, intersection or similar;

   c. At the point immediately following a directional change that results in “leg” or “stub” lengths

C. No valves shall be set under roads, pavement or walks.

D. Clean interior of valves of foreign matter before installation.

E. Set valve box cover flush with finished grade.

F. 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.

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