Irrigation Specifications

DESIGNER NOTES:

Item cross-references are highlighted in blue. Please ensure that all cross-referenced items are included in contract.

Information highlighted in green represent sample language that may need to be revised to suit your contract requirements.

# Irrigation Specifications – General

Abbreviations

When the following abbreviations are used in the Irrigation Specifications, they shall have the following meanings:

AC Alternating Current

ACI American Concrete Institute

ANSI American National Standard Institute

ASA American Standards Association (formerly [American National Standards Institute](https://en.wikipedia.org/wiki/American_National_Standards_Institute) from 1928 to 1966)

ASSE American Society of Sanitary Engineering

ASTM ASTM International (formerly American Society for Testing and Materials)

AWG American Wire Gauge

AWWA American Water Works Association

c/w complete with

C Celsius

CSA CSA Group (formerly Canadian Standards Association)

DBY/DBR Direct Bury

DCVA Double check valve assembly

ELV Extra Low Voltage

ESA Electrical Safety Authority

FIPT Female (Iron) Pipe Thread

FPT/FNPT Female National Pipe Thread

GFCI Ground Fault Circuit Interrupter

GPS Global Positioning System

HDPE High Density Polyethylene

HW Handwell

IP Internet Protocol

LED Light-emitting Diode

MPT Male Pipe Thread

MTO Ministry of Transportation, Ontario

N Newton

NASTT North American Society for Trenchless Technology

NEMA National Electrical Manufacturers Association

OPSD Ontario Provincial Standard Drawing

OPSS Ontario Provincial Standard Specification

PSI Pound per Square Inch

PVC Polyvinyl Chloride

QA Quality Assurance

RWU “CSA Type Designation” for Thermoset Insulated Wires & Cables (Ontario Electrical Safety Code, 25th Edition/2012)

SDR Standard Dimensional Ratio

SIM Subscriber Identification Module

TWU “CSA Type Designation” for Thermoplastic Cable, Moisture-Resistant, Flame-Tested Thermoplastic (Ontario Electrical Safety Code, 25th Edition/2012)

UV Ultraviolet

VAC Volts Alternating Current

Scope of Work

The Contractor shall install a fully automatic irrigation system utilizing drip or other low volume components configured with the Owner’s centralized control platform in accordance with the Drawings and these Irrigation Specifications. The Work shall include furnishing, installing and testing of all irrigation equipment and points of connection and restoration of all areas to their original state or in a condition agreed upon during construction. The Work includes Part A – Miscellaneous Service, Part B – Electrical Service and Part C – Irrigation System.

Qualifications

The Contractor and/or its representatives shall be licensed by the applicable authority for the Works being performed, as described in Parts A to C below.

Materials

1. **New Materials**

All materials shall be new and without flaws or defects. Any material deemed not acceptable by the Owner shall be replaced at the Contractor’s expense.

All materials shall be installed in strict accordance with the manufacturer’s recommended procedures, standard industry practices and these Irrigation Specifications.

Materials not specified but which are indicated elsewhere in the Contract Documents as being required (including minor accessories such as connectors, fasteners, tape, etc. which are considered incidental to the Work) shall be standard construction grade materials supplied in accordance with CSA Standards to suit the application as required by recognized trade practice.

1. **Storage of Materials**

The Contractor shall not store materials (e.g. piping, etc.) at the Site if the installation of said materials will not be completed within 10 Working Days from the date that the materials is brought to the Site.

All materials shall be stored in accordance with the manufacturers’ instructions to prevent any damage, soiling or finish spoilage.

1. **Substitution of Materials**

Any requests for changes related to products and materials must be submitted to the Owner for approval prior to the commencement of the installation, including Equivalent items.

1. **Backfilling and Site Restorations**

Backfill and Site restorations shall be as shown in the typical section of the Drawings or match the existing conditions. Backfill shall consist of native material wherever possible. No backfill material shall be used that could potentially damage the irrigation components. In areas where material is excavated that is unsuitable for backfill because it could damage the irrigation components, select backfill shall be used as supplied by the Contractor. Payment for additional excavation and backfill will be made under Item R206 – Unsuitable Material Removal, Disposal and Backfill (Provisional).

Discrepancies and Verification of Quantities

Discrepancies and conflicts in the Contract Documents shall be brought to the attention of the Owner’s Quality Assurance (QA) representative prior to commencing the Work on that portion of the Work. No additional payment will be made for the correction of errors made in this regard.

The Contractor shall present to the Owner’s QA representative in writing the quantities for all major components within two (2) Working Days after that portion of the system has been completed.

Coordination

The Contractor shall coordinate the irrigation work identified in these Irrigation Specifications, including required trades and personnel, the local hydro authority and the Local Municipality for the applicable servicing and installation items described in Parts A to C below.

The installation of permanent connections to power and water shall be coordinated with the road construction. The coordination of different trades shall be planned effectively and in an appropriate consecutive order as to prevent delays and disruptions to the installation and operation of the entire irrigation system.

Scheduling of the work shall include obtaining, as indicated by the Owner and/or the Consultant, any applicable permits that may be required from the Local Municipality and local hydro authority to complete the work, as detailed in these Irrigation Specifications.

The Contractor shall coordinate any required live tap(s) to the watermain, if specified, which typically requires staff from the Local Municipality to be on Site during the procedure.

The Contractor may also be required to coordinate and perform any pressure testing, if required, during the installation of the irrigation system.

The Contractor shall be responsible for coordinating the Work and the activity of multiple trades around any existing, proposed or active construction of utilities. Any trades shall be instructed to dig by hand within 1.0 m on any side of a utility prior to any machine trenching, vibratory plowing or backhoeing. Should any damage occur, the Contractor shall contact the appropriate authority for any repairs. Any repairs shall be completed at no cost to the Owner.

The irrigation work shall be coordinated between the different trades and others required to perform the various parts of the work, as detailed in these Irrigation Specifications, so as to minimize any disturbance, alteration or damage to adjacent and/or adjoining facilities.

Should there be an interruption in the Work and one of the trades leaves the Site for an extended period of time, the Contractor shall ensure that adequate materials are available to be able to repair any failure and complete the repair within two (2) Working Days of receiving written notification from the Owner of the failure, or immediately if the repair is deemed urgent. If the failure is deemed to be related to other work being performed by the Contractor or its trades on- Site, the repair shall be completed at no cost to the Owner.

The Contractor shall be responsible for coordinating with a Natural Heritage and Forestry representative from the Owner’s Public Works Department, Operations and Services, Waste Management & Forestry, where noted. This includes, but is not limited to, inspections of irrigation components, submittals, testing, scheduling of system closing (i.e. winterization) and the configuration of the installed system with the Owner’s centralized irrigation control system.

Submittals

Prior to installation, the Contractor shall supply digital copies of the product/manufacturer’s specifications and parts lists (i.e. cut sheets) for each item reflected in these Irrigation Specifications.

Prior to installation, the Contractor shall also provide a Shop Drawing and a request for any changes, as noted under ‘Substitution of Materials’.

Upon completion of installation and at least seven (7) Working Days prior to the scheduled date of final inspection of the complete irrigation system, the Contractor shall submit digital copies of the following to the Owner’s QA Representative and a representative from the Owner’s Natural Heritage and Forestry division:

* Results of a service pressure test, when required
* Backflow Preventer Test and Inspection Report and evidence of its submission to the applicable Local Municipality backflow prevention program
* Accurate record drawings (red-line drawings) showing the following information:
* Details and dimension changes made during construction
* Significant details and dimensions not shown in the original documents
* Detailed dimensions and locations of electric valves, control wire runs not included with piping, splice kits not associated with an electric valve, and both ends of any and all sleeving
* Any empty conduits that were installed in the case of future proofing connections for future expansions of the irrigation system
* Any operations and maintenance manuals

The Contractor shall complete red-line drawings for all constructed irrigation system components and associated servicing under the Contract. Payment for the red-line drawings will be made under Item G11 – Red-Line Drawings.

Testing and Acceptance of Work

Prior to initial testing, the Contractor shall ensure that all lines in the system are flushed to clear any debris and evacuate all air from the system. Once the system is pressurized, a visual inspection of all lateral supply piping, trenches and dripline tubing shall be completed.

Each trade shall be responsible for the repair of any system malfunction or deficiencies of their respective items as identified during inspections prior to the acceptance of the system.

The Contractor shall provide the appropriate personnel to properly test or inspect the Work. Inspection shall not constitute acceptance.

Acceptance of the system shall be granted by the Owner’s QA and representative from the Owner’s Natural Heritage and Forestry division once a final inspection, after initial testing, has been arranged and the system has been proven to be fully operable and complies with the provided record drawings and other submittals and these Irrigation Specifications.

Prior to the final inspection, or when requested by the Owner’s representative, the Contractor shall be responsible for completing a Backflow Prevention Test and Inspection Report completed by a certified plumber prior to start up. The Contractor shall submit the report to the Local Municipality backflow prevention program and submit a digital copy to the Owner.

During final inspection, appropriate personnel shall demonstrate and instruct the attendees on the operation of the automated system and its zoning, including the following:

* Manually operating each drip zone in the system to ensure all components are operating to specifications
* Operating the controller from the central controller
* Operating the controller from the Owner’s IQ platform, as confirmed with the representative from the Owner’s Natural Heritage and Forestry division, to ensure proper configuration

Refer to the ‘Construction Schedule and Delays’ section below under ‘Warranty and Maintenance’ for related testing requirements.

Warranty and Maintenance

1. **Manufacturers and Workmanship**

During the warranty period as set out in the Contract Documents, the Contractor shall be responsible for the immediate repair of any system malfunction or defect (due to faulty materials or workmanship) which is observed during that period.

If, in the Owner’s opinion, a malfunction or other failure renders the irrigation system, or a portion of the system, inoperable and this results in erosion, loss of grass, plantings or vegetation or other damage to the Site during the construction period, the cost of corrective work necessary to repair, replant or otherwise return the damaged area to an acceptable condition shall be the sole responsibility of the Contractor.

The Contractor acknowledges and understands that the Drawings identify Not-in-Contract Landscape Plan items that will be completed (i.e. planted and maintained) by others at the Site during the warranty period.

The Contractor further acknowledges and understands that the Site, as it relates to the irrigation system(s) in these Specifications, will be operated by the Owner during the warranty period. The operation of the system(s) will include the Owner’s standard practices for general maintenance and general inspection of the irrigation system to service (i.e. provide irrigation/watering to) the location(s) shown on the Drawings.

With the prior approval of the Owner, the Contractor will be able to have a representative present during system opening and closing procedures, solely for the purpose of observing the work being performed by others on assets that are still under warranty. If present, the Contractor’s representative shall bring forward any concerns to the Owner within 10 Working Days of observing the work.

The irrigation system maintenance performed during the warranty period will include the reasonable performance of basic repairs such as minor dripline tubing leaks, and system opening and closing. These reasonable actions/activities shall not be considered to be reason for the Contractor to refuse the repair of any major faults or issues identified in the system(s), including system malfunctions and defects, during the warranty period.

Examples of system malfunctions or defects that the Contractor will be required to repair during the warranty period include, but are not limited to:

* All underground infrastructure invisible to a basic visual inspection of the irrigation system (i.e. water service, electrical service, conduits and piping, etc.)
* Any cracked or defective components within the backflow prevention assembly as a result of improper winterization, as described in the ‘Winterization’ section below.
* Any cracking, poor settling or levelling issues with the concrete pad for the backflow prevention assembly enclosure and irrigation controller
* Faulty and/or leaking valves, including those part of the water service connections
* Improper configuration of the irrigation system, including wiring and zones, with the Owner’s IQ software
* Resetting any valve boxes that have settled at an angle or off the proper grade and repair any trench lines that have settled
* Repairing any headers that have settled to ensure that the top of the pipe is flush with the finished soil grade

Warranty defects shall exclude minor punctures to, and the related fittings required for, the subsurface dripline tubing under Item IR306 – Supply and Install Dripline Tubing.

1. **Winterization**

When requested by the representative from the Owner’s Natural Heritage and Forestry division, the Contractor shall be responsible for blowing out and winterizing the system in the fall after installation. This includes all plumbing and system components starting from Owner’s curb stop and throughout the irrigation system.

The backflow prevention assembly must be winterized prior to the winter season to prevent damage. This will be accomplished by draining the double check valve assembly and the incoming vertical riser pipe upstream from the double check valve assembly by closing the draining curb stop (i.e. in the off position) and allowing sufficient time for drainage. The Contractor shall follow best practices to avoid damage to the assembly, including the use of blown air.

The Contractor shall winterize the backflow prevention assembly prior to the first winter after the system has received any water, whether the system has undergone final inspection, and will be required to be winterized prior to every subsequent winter until the Owner has taken over system operations upon the start of the warranty period. Any winterization work required under this section is deemed to be included in the Contract Price.

1. **Construction Schedule and Delays**

The Contractor shall be responsible for periodically testing the irrigation system when requested by the Owner during the course of the Contract and proving its continued performance of proper functionality and operations. Testing may be requested in the following circumstances:

* as a result of potential impacts to the irrigation system caused by other work coordinated by the Contractor and concurrently happening on the construction schedule;
* during construction delays where the system has been partially completed and/or tested and/or is being operated by the Owner to maintain portions of the Site due to revised scheduling of the installation of plant material; and/or
* after the irrigation system has been inspected for its initial testing or final inspection as described in the ‘Testing and Acceptance of Work’ section above.

Additional testing may include opening the system after it has been winterized or left ‘off’ (i.e. unopened) due to other delays for the post-construction installation of plant material occurring in a later season and/or year.

Should testing of the irrigation system fail prior to Total Performance of the Contract being achieved, any items requiring repair and/or replacement, including system malfunctions and defects, shall be deemed to be a deficiency in the Work. Any additional testing required under this section shall be deemed to be included in the Contract Price.

# Irrigation Specifications – Items

## Part A – Miscellaneous Service Items

**Water Service Application**

The Contractor shall obtain, at its own expense, the appropriate permits from the Local Municipality. This shall include applying for a new water meter with the Local Municipality and any required inspections or service fees for new backflow prevention device(s). The application shall be coordinated with the representative from the Owner’s Natural Heritage and Forestry division to ensure accurate account and Owner information is provided.

### Item IR101 Construct Concrete Pad for Irrigation Servicing Components

The following Standard Drawings are applicable to this item: NHF-500, NHF-501 and NHF-513.

A concrete pad, upon which the backflow prevention assembly, backflow prevention assembly enclosure and pedestal mounted irrigation controller is to be installed, shall be constructed in the location(s) shown on the Drawings and in accordance with Standard Drawings NHF-500, NHF-501 and NHF-513.

The pad must be coordinated to provide conduits in the appropriate locations for backflow prevention assembly piping, and the power and grounding wiring to the controller shall be in accordance with the controller pedestal manufacturers instructions and the backflow enclosure requirements.

All concrete footings shall be vibrated during the concrete pour and cured using methods appropriate for the weather conditions.

**Measurement for Payment**

Measurement for payment shall be a count of each concrete pad constructed.

**Basis of Payment**

Payment shall be made at the unit price and shall be full compensation for all labour, equipment and materials necessary to complete the work as specified.

### Item IR102 Supply and Install Backflow Prevention Assembly with Heat Trace Cable

The following Standard Drawings are applicable to this item: NHF-500, NHF-501 and NHF-513.

The Contractor shall supply and install the backflow prevention assembly with heat trace cable within the enclosure provided under Item IR103 – Supply and Install Backflow Prevention Assembly Enclosure on the concrete pad provided under Item IR101 – Construct Concrete Pad for Irrigation Servicing Components. The backflow prevention assembly with heat trace cable shall be installed in the location(s) shown on the Drawings and in accordance with the manufacturer’s specifications and Standard Drawings NHF-500, NHF-501 and NHF-513.

The Contractor shall provide other service components to complete the backflow prevention assembly. Upstream and downstream from the double check valve assembly (DCVA), a ball valve with plug installed on a tee, a gate valve and an elbow coupling, specified herein, shall be installed on each end for servicing and maintenance. Between all components, Type K Copper shall be used for consistency between all aboveground and underground components.

The Contractor shall install two (2) supports to the backflow prevention assembly utilizing 3/8 galvanized threaded rods between the concrete pad and the bottom of the assembly. The rods shall be cut to length (i.e. field fitted appropriately). The rod shall be installed with a drop-in anchor to the concrete and a riser clamp for copper on the assembly. The two (2) supports shall be located at each end of the DCVA to support its weight and prevent vertical movement within the enclosure.

The Contractor shall supply and install the heat trace cable to wrap around the assembly according to manufacturer’s installation ensuring the cable is attached starting at the base of the vertical inlet pipe upstream from the DCVA and ending at the downstream elbow. The cable shall not be cut to size or at any point to fit within the enclosure; any excess cable shall be double wrapped going back over the assembly if necessary. The cable must be handled with proper care. Damage to the outer sheaths or jackets of the cable shall be avoided. The heat trace cable will be installed in the provided 120 VAC electrical outlet, which is ground fault protected, provided under Item IR208 – Supply and Install Wire for Power Supply to Irrigation Controller and Backflow Prevention Assembly Enclosure.

The Contractor shall coordinate the clean out of the strainer prior to irrigation system connection to ensure no debris is pushed through the irrigation mainline.

Prior to final inspection of the irrigation system, the double check valve assembly backflow preventer must be certified for use by a certified plumber. The heat trace cable shall be plugged in per seasonal conditions. If system closing (i.e. winterization) is complete, the cable shall be plugged into the provided electrical outlet within the assembly enclosure. If the system is opening for spring operations, the cable shall remain unplugged.

**Materials – General**

The backflow preventer shall be a double check valve assembly consisting of two (2) positive seating check modules with captured springs and rubber seat discs. The check module seats and seat discs shall be replaceable. Service of all internal components shall be through a single bronze or stainless-steel access cover secured with stainless steel bolts. It shall be sized at 2” and include union end connections and bronze strainer.

The assembly shall include two (2) resilient seated isolation valves and four (4) top mounted resilient seated test cocks. The assembly shall meet the requirements of ASSE Std. 1015 and AWWA Std. C510.

The heat trace cable shall have self-regulating heating cable technology and be used externally (outside of the pipe) to provide reliable freeze protection. The cable shall be capable of being installed on metal and non-metal pipes and in wet locations.

The 2 x ¾ compression tee shall have an installed 19 mm ball valve with a plug and chain.

The gate valve shall include a packing gland and brass retainer and be 50 mm. The gate valve shall be installed above the service tee.

The elbows for the assembly shall be 50 mm and be of a quick connect model for connection to the vertical piping and the backflow prevention assembly.

Installation of all components shall meet the requirements of CSA B64.10-11. Maintenance and field testing shall meet the requirements of CSA B64.10.1-11.

Materials – Specific

* 50 mm (2”) Watts Model U007M1-QT-S-2 Series 007 Double Check Valve assembly with Strainer, or Equivalent
* Heat-line Paladin for Pipe, PLD1-020-GFC, or Equivalent
* 2 – 50 mm (2”) solder gate valve, Red-White Valve Corp model 207AB, or Equivalent
* 2- 50 mm (2”) elbow quick connect coupling, Cambridge brass model No. 105NL-H7H7, or Equivalent
* 2- 50 mm (2”) x 19 mm (3/4”) compression tee, Cambridge brass model No. 151NL-H7F3, or Equivalent
* 2- 19 mm (3/4”) hose connection ball valve with plug and chain, ‘FNW’ model 426A – FNPT
* 2- 3/8” Galvanized threaded rod supports using drop-in anchors and Epoxy-plated riser clamps for Copper
* 50 mm (2”) Copper Type K piping and fittings, as required

**Measurement for Payment**

Measurement for payment shall be a count of each backflow prevention assembly with heat trace cable supplied and installed.

**Basis of Payment**

Payment shall be made at the unit price and shall be full compensation for all labour, equipment and materials necessary to complete the work as specified.

Payment for the assembly enclosure will be made under Item IR103 – Supply and Install Backflow Prevention Assembly Enclosure, payment for the concrete pad will be made under Item IR101 – Construct Concrete Pad for Irrigation Servicing Components and payment for the electrical outlet for the heat trace cable will be made under Item IR208 – Supply and Install Wire for Power Supply to Irrigation Controller and Backflow Prevention Assembly Enclosure.

### Item IR103 Supply and Install Backflow Prevention Assembly Enclosure

The following Standard Drawings are applicable to this item: NHF-500, NHF-501 and NHF-513.

The Contractor shall supply and install the backflow prevention assembly enclosure on the concrete pad. The assembly enclosure shall be installed in the location(s) shown on the Drawings and in accordance with the manufacturer’s specifications and Standard Drawings NHF-500, NHF-501 and NHF-513.

The Contractor shall store the assembly enclosure in shipping containers and maintained in a dry place until installation.

The Contractor shall install the unit with the supplied anchor pads and wedges onto the concrete pad. Payment for the concrete pad will be made under Item IR101 – Construct Concrete Pad for Irrigation Servicing Components. The unit must be installed properly squared and levelled to ensure proper closure of the lid(s).

The Contractor shall coordinate with the installation of Item IR101– Construct Concrete Pad for Irrigation Servicing Components and Item IR102 – Supply and Install Backflow Prevention Assembly with Heat Trace Cable for proper timing and practical installation of interior components of the enclosure.

**Materials – General**

The backflow prevention assembly enclosure shall be a fabricated unit constructed of 3003 aluminum sheeting (0.51”/16 Gauge) with a stucco embossed finish and shall meet the requirement of ASTM B209. The stucco embossed finish shall reduce glare and help hide any surface scratches or imperfections received in the field.It shall meet ASSE 1060 certification for strength and design of the unit.

The assembly enclosure shall have an inside width of 559 mm , an inside length of 1524 mm and an inside height of 762 mm.

The enclosure shall provide top and side access via the use of dual fold doors. The enclosure shall include drain ports sized for full port backflow discharge that allow one-way operation only but prevent wind, debris and small animals from entering the enclosure.

The backflow enclosure shall be designed to support a minimum vertical load of 100 pounds per square foot and winds up to 130 km/h (80 MPH). The backflow enclosure bracing shall be 6063-T52 aluminum and shall meet the requirements of ASTM B221. Internal anchor pads shall be galvanized steel supplied with 3/8-16 UNC x 44 mm (2¾”) long zinc plated wedge anchors.

The backflow enclosure shall be insulated, but not heated or require additional heating equipment. There shall be 38 mm (1.5”) unicellular, non-wicking, Poly isocyanate foam sprayed in place that forms a monolithic bond between the aluminum bracing and the aluminum sheeting. The insulation shall have an R-Value of 10, dimensional stability of less than 2% linear change, compressive strength of 51 PSI, flame point of 163ºC (325ºF), water absorption of .037 PSF and porosity of 91%.

Materials – Specific

* Hot Box DF2.5L, Dura Fold, Unheated, Insulated, aluminum enclosure, or Equivalent.

**Measurement for Payment**

Measurement for payment shall be a count of each backflow prevention assembly enclosure supplied and installed.

**Basis of Payment**

Payment shall be made at the unit price and shall be full compensation for all labour, equipment and materials necessary to complete the work as specified.

Payment for the concrete pad will be made under Item IR101 – Construct Concrete Pad for Irrigation Servicing Components and payment for the backflow prevention assembly with heat trace cable will be made under Item IR102 – Supply and Install Backflow Prevention Assembly with Heat Trace Cable.

### Item IR104 Supply and Install Rigid PVC Conduit by Open Cut for Irrigation System Piping (All Sizes)

*This Specification shall be read in conjunction with OPSS.MUNI 1010 (Nov 2013) and OPSS.MUNI 1359 (Nov 2016).*

*The following Standard Drawing is applicable to this item: NHF-519.*

The Contractor shall supply and install rigid PVC conduit by open cut in the location(s) shown on the Drawings and/or indicated by the Owner on Site for the irrigation system piping (i.e. mainline and lateral supply piping) in accordance with Standard Drawing NHF-519. The rigid PVC conduit shall conform to the requirements of CSA C22.2, No. 211.2.

All conduit for mainline piping shall be accompanied by an additional 25 mm conduit for control wiring to ensure the separation of the mainline piping and control wiring. Mainline piping and control wiring shall be installed under Item IR303 – Supply and Install Mainline Piping and Control Wiring.

The supply and installation of other conduits specifically for the electrical service to the irrigation system are a separate item and will be paid for under Item IR201 – Supply and Install Rigid PVC Conduit by Open Cut for Irrigation Service (All Sizes).

The wall thickness of the conduit shall be as follows [remove any below conduit sizes not applicable to the project]:

* 3.4 mm (0.133 inches) for 25 mm conduit
* 3.7 mm (0.145 inches) for 38 mm conduit
* 3.9 mm (0.154 inches) for 50 mm conduit
* 5.5 mm (0.216 inches) for 75 mm conduit
* 6.0 mm (0.237 inches) for 100 mm conduit

The Contractor shall excavate the trench, supply and install rigid PVC conduit in the trench, backfill the trench and compact the backfill in the trench.

The conduit shall be installed 600 mm below the final grade. The Contractor shall adjust the depth of the conduit where the proposed conduit conflicts with the sub drain. The excavation and conduit shall be kept free of water at all times.

Material removed as a result of tunnelling under the existing concrete sidewalks, asphalt spillways, multi-use path or other active transportation facilities, and curb and gutter shall be replaced by tamping intermittently to ensure proper compaction to 100% maximum dry density with no cavities.

Backfill shall conform to the requirements of OPSS.MUNI 1010 for Granular ‘A’ and Granular ‘B’ Type 1 and shall be compacted to 100% maximum dry density. Granular ‘B’ Type 1 backfill shall be used up to the elevation where Granular ‘A’ is shown on typical sections on the Drawings. Earth backfill shall be compacted to 95% maximum dry density.

Unshrinkable fill shall be used as backfill in place of granular material when adequate compaction cannot be achieved. When a trencher equipped with a rock wheel is used, the crossing must be backfilled with unshrinkable fill. The unshrinkable fill shall be 0.70 Mpa (K-crete) to at least 1.0 metre beyond the existing edge of pavement and/or curb. Unshrinkable fill shall conform to OPSS.MUNI 1359. Payment for the unshrinkable fill will be made under Item R903 – Unshrinkable Fill (Provisional).

The Contractor shall restore all asphalt boulevards (including asphalt splash strips) and median islands using 50 mm of HL-3 asphalt. Cold patch asphalt may be used for minor restorations with the prior approval of the Owner. All hard surfaces, including concrete curb and gutter, shall be restored to their original, pre-construction condition or better.

Couplings, as manufactured by the manufacturer of the conduit supplied, shall be used to join the sections of rigid conduit and shall be installed to provide a tight fit in accordance with the manufacturer’s recommended practice for joining conduit. The Contractor shall ensure that couplings are not split or damaged in any way which would allow the seepage of water and/or foreign material into the conduit.

The Contractor shall install a 400 N test nylon fish line in all conduits, both when it is left empty for future use or has wiring installed in it and shall leave 1.5 m of line coiled in the bottom of the handwell at the end of each conduit run.

The Contractor shall install a 150 mm wide, red plastic “CAUTION” tape, buried 300 mm above the conduit, for the full length of the conduit, where there is a possibility of open excavation.

The extension of any existing under pavement crossings as indicated on the Drawings shall be completed at the applicable unit price for the size of conduit used.

Upon completion of the conduit crossing, the Contractor shall obtain approval of satisfactory completion from the Owner. In the presence of the Owner, the conduit shall be proven to be free of stones, dirt, water and other debris by pulling a test mandrel, which is 300 mm in length by 6.4 mm smaller in diameter than the nominal conduit size, through the conduit crossing.

**Measurement for Payment**

Measurement for payment shall be per metre (m) along the centerline of conduit supplied and installed.

**Basis of Payment**

Payment shall be made at the unit price and shall be full compensation for all labour, equipment and materials necessary to complete the work as specified.

### Item IR10# Supply and Install ## mm Water Valve Chamber including Gate Valve as per [insert Local Municipality] for Region Irrigation

Refer to Owner or local municipal watermain owner for the appropriate specifications and standard drawings required for project-specific water service connections, including water meter chamber arrangements, type of connection to existing or proposed watermains, local curb stop and Owner-owned curb stop.

Include a reference within the specification to Standard Drawings NHF-500 and NHF-501 that supports this specification.

### Item IR10# Connection to Existing [or Proposed] Watermain for Region Irrigation

Refer to Owner or local municipal watermain owner for the appropriate specifications and standard drawings required for project-specific water service connections, including water meter chamber arrangements, type of connection to existing or proposed watermains, local curb stop and Owner-owned curb stop.

Include a reference within the specification to Standard Drawings NHF-500 and NHF-501 that supports this specification.

### Item IR10# [insert additional items for water source connections as needed]

## Part B – Electrical Service Items

**Hydro Service Application**

The Contractor shall obtain, at its own expense, the appropriate permits from the local hydro authority. This shall include applying for a new service connection with the local hydro authority to provide the irrigation power. The application shall be coordinated with the representative from the Owner’s Natural Heritage and Forestry division to ensure accurate account and Owner information is provided.

### Item IR201 Supply and Install Rigid PVC Conduit by Open Cut for Irrigation Service (All Sizes)

[Designer to insert the latest York Region Electrical Specification:

* **Item E101 – Supply and Install Rigid PVC Conduit by Open Cut (All Sizes)**
	+ Insert specification text only (do not change the irrigation item number and title above)
	+ Include references to provincial standard specifications and standard drawings, as applicable
	+ Remove reference to standard drawing E-3.25
	+ Delete last sentence in 1st paragraph referencing drawing E-3.25
	+ Do not copy measurement for payment and basis of payment sections]

**Measurement for Payment**

Measurement for payment shall be per metre (m) along the centerline of conduit supplied and installed, measured from centre to centre of handwells, pole bases and/or concrete pad for irrigation service components.

**Basis of Payment**

Payment shall be made at the unit price and shall be full compensation for all labour, equipment and materials necessary to complete the work as specified.

### Item IR202 Supply and Install Concrete Handwell for Irrigation Service

[Designer to insert the latest York Region Electrical Specification:

* **Item E105 – Supply and Install Concrete Handwell (All Sizes)**
	+ Insert specification text only (do not change the irrigation item number and title above)
	+ Include language to provide a 300 mm diameter handwell
	+ Include references to provincial standard specifications and standard drawings, as applicable
	+ Do not copy measurement for payment and basis of payment sections]

**Measurement for Payment**

Measurement for payment shall be a count of each concrete handwell constructed.

**Basis of Payment**

Payment shall be made at the unit price and shall be full compensation for all labour, equipment and materials necessary to complete the work as specified.

### Item IR203 Construct Concrete Pole Base with Anchorage Assembly for Irrigation Service

[Designer to insert the latest York Region Electrical Specification:

* **Item E201 – Construct Concrete Pole Base with Anchorage Assembly (All Sizes)**
	+ Insert specification text only (do not change the irrigation item number and title above)
	+ Include language to provide a 600 mm diameter concrete pole base
	+ Update references to electrical standard drawings based on pole base sizes.
	+ Do not copy measurement for payment and basis of payment sections]

**Measurement for Payment**

Measurement for payment shall be a count of each concrete pole base with anchorage assembly constructed.

**Basis of Payment**

Payment shall be made at the unit price and shall be full compensation for all labour, equipment and materials necessary to complete the work as specified.

### Item IR204 Supply and Install Octagonal Steel Pole for Irrigation Service

[Designer to insert the latest York Region Electrical Specification:

* **Item E205 – Supply and Install Octagonal Steel Pole**
	+ Insert specification text only (do not change the irrigation item number and title above)
	+ Include references to provincial standard specifications and standard drawings, as applicable
	+ Update references to electrical standard drawings, as applicable
	+ Do not copy measurement for payment and basis of payment sections]

**Measurement for Payment**

Measurement for payment shall be a count of each pole supplied and installed.

**Basis of Payment**

Payment shall be made at the unit price and shall be full compensation for all labour, equipment and materials necessary to complete the work as specified.

### Item IR205 Supply and Install Ground Rod for Irrigation Service

[Designer to insert the latest York Region Electrical Specification:

* **Item E414 – Supply and Install Ground Rod**
	+ Insert specification text only (do not change the irrigation item number and title above)
	+ Update references to electrical standard drawings, as applicable
	+ Do not copy measurement for payment and basis of payment sections]

**Measurement for Payment**

Measurement for payment shall be a count of each ground rod supplied and installed.

**Basis of Payment**

Payment shall be made at the unit price and shall be full compensation for all labour, equipment and materials necessary to complete the work as specified.

### Item IR206 Supply and Install Equipment for Power Supply for Irrigation Service

[Designer to insert the latest York Region Electrical Specification:

* **Item E416 – Supply and Install Equipment for Power Supply**
	+ Insert specification text only (do not change the irrigation item number and title above)
	+ Update references to electrical standard drawings, as applicable
	+ Update references to ground wire and ground rod items with irrigation item numbers (IR207, IR205)
	+ Do not copy measurement for payment and basis of payment sections]

**Measurement for Payment**

Measurement for payment shall be a count of each power supply supplied and installed.

**Basis of Payment**

Payment shall be made at the unit price and shall be full compensation for all labour, equipment and materials necessary to complete the work as specified.

### Item IR207 Supply and Install Buried Ground Wire for Irrigation Service

[Designer to insert the latest York Region Electrical Specification:

* **Item E611 – Supply and Install Ground Wire**
	+ Insert specification text only (do not change the irrigation item number and title above)
	+ Update references to electrical standard drawings, as applicable
	+ Remove references to aerial installation
	+ Do not copy measurement for payment and basis of payment sections]

**Measurement for Payment**

Measurement for payment shall be per metre (m) of buried ground wire supplied and installed, based on plan quantity measurement.

The 2/0 cable for the ground grid at the service will not be measured for payment purposes; all costs associated with the 2/0 cable shall be included in the unit price(s) for this item.

Plan quantity measurement is not a true quantity measurement (riser cables are not included), but is a horizontal measurement taken from the Drawings between handwells, poles, transformers and controller cabinets.

**Basis of Payment**

Payment shall be made at the unit price and shall be full compensation for all labour, equipment and materials necessary to complete the work as specified.

### Item IR208 Supply and Install Wire and Receptacles for Power Supply to Irrigation Controller and Backflow Prevention Assembly Enclosure

*This Specification shall be read in conjunction with OPSS.MUNI 604 (Nov 2017).*

*The following Standard Drawings are applicable to this item: NHF-500, NHF-501 and NHF-513.*

The Contractor shall supply and install power supply cable from the service to both the irrigation controller and backflow assembly enclosure in the conduits in accordance with Standard Drawings NHF-500, NHF-501 and NHF-513.

Power supply cable shall be 12 AWG NMWU (non-metallic wet underground).

Low voltage cables shall meet the requirements of OPSS.MUNI 604.

The Contractor shall supply and install a T-Slot type, 20 AMP GFCI receptacle with waterproof cover in both the irrigation controller and backflow assembly enclosure for a total of two (2) receptables for the irrigation system.

**Measurement for Payment**

Measurement for payment shall be a count of each complete irrigation system in which power supply wire and two (2) receptacles are supplied and installed, regardless of the length of power supply wire required.

**Basis of Payment**

Payment shall be made at the unit price and shall be full compensation for all labour, equipment and materials necessary to complete the work as specified.

### Item IR400 Irrigation Service Connection to Power by Local Hydro Authority (Cash Allowance)

The Contractor shall contact the local hydro authority and arrange for the connection to power.

The Contractor shall be responsible for all costs associated with the connection to power by the local hydro authority.

**Basis of Payment**

Payment from the cash allowance will be made based on paid invoices from the local hydro authorities for connection to power, without any markup or additional fees. Under no circumstances shall the Contractor be entitled to payment in excess of payments actually made to the local hydro authorities, as substantiated by paid invoices.

## Part C – Irrigation System Items

**Qualifications**

The Contractor/Subcontractor performing this Work shall have a minimum of five (5) years of experience installing irrigation systems and shall have a minimum of one (1) personnel certified by the Irrigation Association (IA) as a Certified Irrigation Contractor (CIC).

Only trained workers shall be involved in the on-Site installation under the direct supervision of a qualified staff person who is a Certified Irrigation Technician with a minimum of five (5) years of experience performing similar installations.

**Verification of Layout**

The Contractor shall be prepared to supply all labour, equipment and materials to perform the lay out of all dripline tubing and all other system components. Wire flags, wooden stakes or other marking supplies shall be used to mark control valves, flush valves, air/vacuum relief valves and any other components prior to installation.

Prior to installation of laid out components, the Owner’s QA representative and representative from the Owner’s Natural Heritage and Forestry division shall be provided a minimum of 48 hours’ notice as a window for inspection.

Any items used for laying out purposes shall be removed and disposed of by the Contractor at its own expense.

**Installation Methods**

The following directions shall apply throughout the performance of Work:

1. **Station Wiring**

During installation, wire(s) shall not be yanked, stretched or excessively pulled. The Contractor shall provide a minimum of 30 cm (12”) of slack in an expansion coil in each 60 m (200’) of wire and at changes in direction.

Workers must take strict precautions to ensure that wires are not cut, scraped or nicked during installation. Wire must not be laid above or on top of any piping.

All station wire shall be encased in conduit under all hardscapes and softscape areas.

All electric zone valve wires shall be TWU 14 Solid CSA Approved single conductor wire with PVC insulation suitable for direct burial.

All 120 VAC power wire shall be NMWU 14/2 CSA Approved two-conductor wire with bare ground wire in a single PVC insulated jacket suitable for direct burial.

At wire splice locations, sufficient slack shall be provided to allow the splice to be raised a minimum of 60 cm (24”) above grade for inspection.

1. **Station Sequencing**

All valve station wires shall be installed to operate in an easy-to-view progressive sequence from the irrigation controller throughout the Site. Station sequencing shall be recorded on the controller door.

1. **Wire Splicing**

All wires shall be spliced in accordance with ESA Ontario Electrical Safety Code requirements or to any increased specifications noted elsewhere in the Contract Documents, whichever is more restrictive.

Direct bury splice kits shall be installed at all wire connections. This shall be completed by leaving 19 mm (3/4”) of copper conductor bare, twisting the leads together and installing the correct sized insulated wire nut. The splice shall be completely waterproof by inserting the wire and nut into the supplied pre-pilled gel tube. Only one (1) splice shall be put in a connector kit.

All splices not located at electric valves shall be accessible and housed in a separate 250 mm (10”) minimum round valve box with locking lid and included on the record drawings.

1. **Valve Boxes**

The Contractor shall prepare the location for all valve boxes to be level and on dry ground. A Class 1 geotextile, nonwoven, shall be laid on the soil surface. All valve boxes shall be supported on bricks or concrete blocks, properly notched, or “saddled”, as to prevent any damage to occur to piping or wire if the boxes are pushed down.

Valve boxes shall be flush with finished grade or top of planting soil and on level dry ground with a minimum of 75 mm (3”) of washed clear stone at the base for drainage.

If additional valve boxes are required for wire connections determined during installation, a 10” round valve box with lockable lid shall be supplied and installed as required at no additional cost to the Owner.

### Item IR301 Supply, Install and Configure Pedestal Mounted Controller with Cellular Cartridge and Rain/Freeze Sensor

The following Standard Drawings are applicable to this item: NHF-513 and NHF-515.

The Contractor shall supply and provide the entire controller set up and all components, including a lockable stainless-steel cabinet and lockable stainless-steel pedestal, the controller, wiring and accessories, and cellular cartridge required for centralized control system communications in the location(s) shown on the Drawings and in accordance with Standard Drawing NHF-513. Configuring the system includes connection of field wiring, required controller modules and sensors.

The controller shall be enclosed in a lockable stainless-steel cabinet and mounted on a lockable stainless-steel pedestal. The Contractor shall install the pedestal and cabinet on the concrete slab beside the backflow enclosure in accordance with the manufacturer’s specifications and with ESA Ontario Electrical Safety Code requirements. Payment for the concrete pad will be made under Item IR101 – Construct Concrete Pad for Irrigation Servicing Components. The controller shall operate on 120 VAC incoming power with 24 VAC outputs and have the capability of operating two (2) electric valves on a station.

The controller shall be installed using the manufacturer’s templates. Connect power to the controller using the provided power outlet and ensure the controller is properly surge protected and grounded. ProSmart module and station modules shall be installed.

The controller shall include an IQ4 NCC Cellular Cartridge to allow communication with the latest IQ platform, as confirmed with the Owner’s representative. The Contractor shall install the cartridge and the cellular internal antenna for proper connection. If the internal antenna provided is insufficient to communicate with IQ4, an external antenna shall be purchased and installed at no additional cost to the Owner.

The NMWU 14/2 power wire shall be installed into the base of the pedestal. Wire leads shall be connected to the power terminal. Station wires shall be installed through the conduit into the base of the pedestal and connected to the terminal strip in the proper sequence.

Upon controller installation, the Contractor shall be responsible for installing the accompanying wireless rain/freeze sensor according to manufacturer’s instructions and in accordance with Standard Drawing NHF-515.

The designated location of the sensor shall be determined on Site based on an appropriate location reasonably inaccessible by the public. The location of the sensor shall be agreed upon with the representative from the Owner’s Natural Heritage and Forestry division prior to installation. The sensor’s wireless receiver shall be installed inside the controller pedestal and connected to the power and sensor terminals.

**Materials – General**

The controller shall be housed in a wall mountable, weather-resistant plastic cabinet with a key-locking cabinet door suitable for either indoor or outdoor installation. The display shall show programming options and operating instructions in the chosen language without altering the programming or operation information. The controller shall have an electronic, diagnostic circuit breaker that shall sense a station with an electrical overload or short circuit and shall bypass that station and continue to operate all other stations.

The controller shall incorporate a FloManager feature providing real-time flow, power and station management. Module features shall include a FloWatch Learn Flow Utility which learns the normal flow rate of each station. FloWatch shall automatically determine the location of the flow problem and isolate the problem by turning off the affected station or master valve. FloWatch shall be compatible with both normally closed and open master valves.

The controller shall have an alarm indicator light on the front panel visible through the outer door with the door closed and locked. The alarm light shall prompt the user to select the alarm softkey to review the alarm condition(s). A port for an external alarm is also available.

The controller shall be compatible with the IQ4™ Platform utilizing Network Communication Cartridges (NCC). The NCC Cartridge shall provide communication with the IQ Central Computer and other controllers via a variety of communication options. The IQ Platform shall provide remote computer control of the controller providing automatic or manual program adjustments.

The system hardware interface to the controller shall be the NCC. The communication cartridge shall receive power through a ribbon cable connection to the controller front panel. The communication cartridge shall be configured and monitored through a dedicated dial position on the controller front panel. The 4G Cellular communication cartridge (IQ4614) shall incorporate a 4G Cellular data modem. A SIM card configured with a static IP address on a wireless network is required and will be provided by the Owner. The 4G Cellular communication cartridge (IQ4614X) shall incorporate a 4G Cellular data modem and a SIM card configured with a static IP address on a wireless network with one (1) year of service.

The sensor shall be wired to normally closed (N.C.) controllers in series with the valve common, or alternately, wires shall be inserted into the appropriate controller sensor terminal ports. The device shall be of rugged construction to withstand the elements, including exposure to sunlight and precipitation. Antennas shall be concealed within the sensor and controller interface to improve aesthetics and product robustness.

The sensor device shall be used with 24VAC controllers and shall be of sufficient capacity to be used with a maximum of six (6) 24VAC 7VA solenoids plus an additional master valve or pump start that does not exceed 53VA. The wireless rain sensor shall incorporate a provision that allows the installer to select from several rainfall or low temperature settings that can be programmed through the use of icons on a controller interface. A sensor LED shall communicate signal strength during the installation process.

**Materials – Specific**

* Rain Bird ESPLXME2P - LXME2 PRO Rain Bird controller
	+ PSM-LXME2 ProSmart module
	+ ESPLXM-SM12 12 station module
* WR2-RFC wireless rain/freeze sensor, or Equivalent
* LXMMSS Stainless Steel Wall Mount Enclosure for ESP-LX Series Controllers
* LXMMSSPED Stainless Steel Metal Pedestal for ESP-LX Series Controllers
* IQ-NCC 4G Cellular Cartridge, using IQ4G-CAN
* IQEXTANTGP 4G IQ External Antenna, if required

System Configuration

Prior to final inspection, the Contractor shall request and acquire Owner supplied SIM card(s) and related data in accordance with GC 59 – Owner Supplied Material. The Owner will prepare and coordinate the SIM Card(s) and related data for the controller. The Contractor shall arrange for pick up of the SIM Card(s) at a location designated by the representative from the Owner’s Natural Heritage and Forestry division.

Once received, the Contractor shall configure the controller(s) and successfully integrate each controller into the Owner Rain Bird IQ central control platform software. Upon connection of all valve wires and sensors, the Contractor shall complete the installation with running a Diagnostic program to test all stations.

Confirmation of controller operation, recognition of the rain/freeze sensor and communications with the Owner’s system shall be completed prior to acceptance of the system.

Measurement for Payment

Measurement for payment shall be a count of each combination of pedestal mounted controller, with cellular cartridge and rain/freeze sensor configured, supplied and installed.

Basis of Payment

Payment shall be made at the unit price and shall be full compensation for all labour, equipment and materials necessary to complete the work as specified.

### Item IR302 Supply and Install Master Valve and Flow Sensor Assembly (All Sizes)

The following Standard Drawing is applicable to this item: NHF-502.

The master valve(s) and flow sensor(s) shall be installed in the location(s) shown on the Drawings and in accordance with the manufacturer’s specifications and Standard Drawing NHF-502.

The Contractor shall install the master valve onto the mainline ensuring the inlet and outlet sides are correctly positioned so that the solenoid is on the downstream side of the valve. Pipe thread or pipe dope compound shall not be used. Two (2) wraps of Teflon tape shall be secured along inlet and outlet pipe threads and the unit shall not be overtightened. Waterproof wire connectors shall be used to connect the solenoid wire to the controller common wire and the other to the controller power wire.

The Contractor shall install the pressure regulating module PRS-D, or Equivalent, according to its installation manual by removing the solenoid, adapter and valve cap and hand tightening the dial housing, then threading the dial cartridge into the housing.

The Contractor shall use union fittings on both sides of the flow sensor and upstream from the master valve for ease of install and maintenance. The flow sensor unit shall be installed to ensure that the arrow faces the direction of flow. Teflon tape shall be applied to all threaded connections and shall not be over tightened.

Following the electrical installation procedure, use WC-20 Wire Splice connectors, or Equivalent, to connect the wire leads from the flow sensor to a 2-conductor shielded 20 AWG flow sensor cable.

To connect to the controller, route the cable from the flow sensor to the irrigation controller and ensure excess cable is left to allow for future service. Connect the red wire to FLOW (+) terminal or wire, connect the black wire to FLOW (-) terminal or wire.

Each master valve and flow sensor assembly shall be housed in a Rain Bird Jumbo rectangular valve box with locking lid, or Equivalent.

**Materials – General**

The electric master valve shall be a normally closed 24 VAC 50/60- Hz solenoid actuated globe pattern design. The valve pressure rating shall not be less than 150 PSI. The valve body and bonnet shall be constructed of high-impact, water-resistant PVC for the body and glass-filled nylon for the bonnet with stainless steel screws.

The valve shall have manual open/close control (internal bleed) for manual opening and closing of valve without electrically energizing the solenoid. The valve’s internal bleed shall prevent flooding of the valve box.

The valve shall house a fully encapsulated, one-piece solenoid. The solenoid shall have a captured plunger with a removable retainer for easy servicing and a leverage handle for easy turning. This 24 VAC 50/60 Hz solenoid shall open with 19.6 VAC minimum at 150 psi (10.35 bar). At 24 VAC, average inrush current shall not exceed 0.41 amps. Average holding current shall not exceed 0.28 amps. The valve shall have a flow control stem for accurate manual regulation and/or shut off of outlet flow. The valve must open or close in less than 1 minute at 150 psi (10.35 bar), and less than 30 seconds at 20 psi (1.38 bar).

The valve construction shall provide for all internal parts to be removable from the top of the valve without disturbing the valve installation. The body shall have a removable O-ringed plug for installation.

The master valve shall also include an additional pressure regulation device capable of regulating outlet pressure between 15 and 100 psi with an adjusting knob. The pressure regulating module shall be a two-piece device consisting of a glass-filled, UV resistant nylon housing and dial cartridge. The regulator shall have a visible pressure indication scale ranging from 0-100 psi (0.0 to 6.90 bar). The protective cover shall snap tight to deter vandalism.

The flow sensor shall be an in-line type with ultrasonic transducers and acoustical reflectors, with no moving parts, rather than the impeller sensor model, and shall be accurate +/- 2% across full flow range. The flow sensor shall operate at 200 PSI working pressure. The suggested operating range of the flow sensor installed shall be appropriately sized to the irrigation system.

The body material shall be Glass Filled Nylon (GFN). The upper electronics housing shall be Poly Phenyl Oxide (PPO). The flow sensor shall be rated for IP 68 and/or NEMA 4X, suitable for pollution degree 4 environments, outdoor use below grade, and submerged installations. The sensor shall be capable of operating in line pressure up to 200 psi (13.7 bars) and liquid temperatures ranging 32° F (0° C) to 150° F (65° C). The flow sensor cable shall be Paige P7162D shielded cable, or Equivalent, with drain wire and outer jacket of polyethylene.

Payment for controllers, to receive master valve and flow sensor programming, will be made under Item IR301 – Supply, Install and Configure Pedestal Mounted Controller with Cellular Cartridge and Rain/Freeze Sensor.

Materials – Specific [ensure items below reflect valve types on Drawings]

* 25 mm (1”) Rain Bird Model 100-PESB-PRS-D Electric valve, or Equivalent
* 38 mm (1.5”) Rain Bird Model 150-PESB-PRS-D Electric valve, or Equivalent
* 50 mm (2”) Rain Bird Model 200-PESB-PRS-D Electric valve, or Equivalent
* 25 mm (1”) Rain Bird Ultrasonic Flow Sensor Model UFS100, NPT, or Equivalent
* 38 mm (1.5”) Rain Bird Ultrasonic Flow Sensor Model UFS150, NPT, or Equivalent
* 50 mm (2”) Rain Bird Ultrasonic Flow Sensor Model UFS200, NPT, or Equivalent and,
* Rain Bird PRS-D Pressure Regulating Module, or Equivalent
* Paige P7162D shielded cable, or Equivalent
* Rain Bird PVB-JMB Jumbo valve box with locking lid, or Equivalent
* 3 - Union fittings

**System Configuration**

Prior to final inspection, the Contractor shall be responsible for performing a test procedure and ensuring proper connection of the flow sensor to the controller through Flow Sensor programming.

**Measurement for Payment**

Measurement for payment shall be a count of each electric master valve with the pressure regulating dial and ultrasonic flow sensor assembly supplied and installed.

**Basis of Payment**

Payment shall be made at the unit price and shall be full compensation for all labour, equipment and materials necessary to complete the work as specified.

### Item IR303 Supply and Install Mainline Piping and Control Wiring

The following Standard Drawing is applicable to this item: NHF-519.

The irrigation mainline piping and control wiring for water distribution shall be installed in the location(s) shown on the Drawings and in accordance with the manufacturer’s specifications and Standard Drawing NHF-519.

The Contractor shall be responsible for coordinating the installation of required conduits prior to performing the work under this item. Payment for irrigation conduits will be made under Item IR104 – Supply and Install Rigid PVC Conduit by Open Cut for Irrigation System Piping (All Sizes).

The Contractor shall install mainline piping in irrigation conduits already installed and install control wiring in the provided wiring conduits running along the mainline conduit. In areas without conduit, control wiring shall be installed either via open trench or vibratory plow, if conditions allow. If open trench, control wiring shall be laid under the mainline. When plowing, a wire blade must be used so that the wire is not stretched or pulled.

Store PVC pipe and fittings such that they are protected from oil and grease and from prolonged exposure to sunlight and excessive heat. Make all field cuts and bevels to manufacturer's specifications.

Install fittings by following solvent welding recommendations and ASTM Standards D2564 and D2855, especially as they apply to ambient temperatures.

**Materials – General**

Main line piping shall be CSA Approved IPS PVC pipe with solvent bell ends as manufactured by IPEX Inc. meeting the requirements of ASTM D2241 and CSA B137.3, or Equivalent. Pipe shall have continuous permanent markings of the manufacturer, size, class and type of pipe.

Threaded fittings shall be minimum Schedule 80 dimensions produced from PVC Type 1, Cell Classification 12454-B solvent weld fittings meeting the requirements of ASTM D-2466. Schedule 40 PVC fittings shall be manufactured by Lasco, Dura or Equivalent.

All solvent welded connections shall be made using Weld-On P-70 Purple Primer, or Equivalent, meeting ASTM F 656 specifications and 711 Solvent Cement meeting ASTM D 2564 and CSA B137.3 specifications. Solvent cement and primer shall be manufactured by IPEX Inc., or Equivalent.

Wire from valves to the irrigation controller shall be 14-gauge TWU-40. For runs 500 feet or less, 18-gauge may be used. All wire connections shall be made with 3M DBY or DBR connectors, or Equivalent. All connections, whether made at a valve or not, shall be placed in a valve box. All wire connections shall contain enough extra wire to allow the connection to be lifted above grade for testing or repair.

Materials – Specific [revise items to show piping types as shown on Drawings]

* 25 mm (1”) SDR 21 Class 200 PVC
* 38 mm (1.5”) SDR 26 Class 160 PVC
* 50 mm (2”) SDR 26 Class 160 PVC
* 14-gauge TWU-40 single strand wire
* 18-gauge multi-strand direct burial wire
* Weld-On P-70 Purple Primer, or Equivalent

Excavation

Excavate any trenches only wide enough to allow for proper tamping around the pipe in accordance with the manufacturer’s recommendations.

Ensure that the bottom of the trench is clean and smooth with all rock, loose soil and organic matter removed and that there are no materials in the trench that could damage the pipe or wires.

All PVC shall be open trenched.

Backfill and Compaction

Backfill trenches using excavated material with a maximum size of 1” (25 mm) diameter. No rock or other unsuitable material which could damage the pipe or wires is permitted. Cover the pipe to a depth of 100 mm (4”) before any machine backfilling or tamping is used. In filling around pipe, keep material on both sides at equal height and tamp with the same thoroughness. Backfill in 150 mm (6”) steps to ensure proper compaction. Additional material to a depth of 50 mm (2”) below the pipe grade shall be removed.

Remove and dispose of any and all excess or unsuitable material on site as required.

Excavated material which consists of rock larger than 50 mm (2”) diameter or other material unsuitable for backfill shall be as deleterious material.

Measurement for Payment

Measurement for payment shall be per metre (m) of piping supplied and installed. No separate measurement or payment will be made for the control wiring that runs alongside the piping.

Basis of Payment

Payment shall be made at the unit price and shall be full compensation for all labour, equipment and materials necessary to complete the work as specified, including the control wiring that runs alongside the piping.

### Item IR304 Supply and Install Quick Coupling Valve with Swing Joint and Stabilizer

The following Standard Drawing is applicable to this item: NHF-503.

The quick coupling valves(s) with swing joints shall be installed in the location(s) shown on the Drawings and in accordance with the manufacturer’s specifications and Standard Drawing NHF-503.

The swing joints shall be installed so that downward pressure tightens the threads. The valve shall be vertically supported with rebar utilizing a stabilizer assembly and required hardware lugs.

The quick coupling valves(s) with swing joints shall be housed in a 250 mm (10”) round valve box with locking lid.

The Contractor shall provide one (1) single valve key and one (1) hose swivel with corresponding nipple to the representative from the Owner’s Natural Heritage and Forestry division.

The Contractor shall provide one (1) locking cover key for each quick coupling valve supplied and installed to the representative from the Owner’s Natural Heritage and Forestry division.

**Materials – General**

The quick coupling valve shall be a one-piece body type. The valve body shall be constructed of red brass. The cover shall be a durable, protective self-closing locking rubber cover.

Hose swivels shall be 25 mm (1”) x 25 mm (1”) female pipe thread x male hose thread. One (1) 25 mm (1”) x 50 mm (2”) brass nipple shall be supplied with each hose swivel.

Quick coupling valves shall be installed onto a factory assembled swing joint with a brass nipple molded into the outlet and utilizing a LASCO SnapLok assembly, or Equivalent, with rebar to secure the valve to the swing joint. All swing joint rotating components shall be connected with ACME threads and O-ring seals in accordance with ASTM F2768-09.

Materials – Specific

* Rain Bird Model 5-LRC quick coupling valve, or Equivalent
* Rain Bird Model 2049 locking cover key, or Equivalent
* Rain Bird 55-K-1: 1" (26/34) valve key, or Equivalent
* Hose swivel to be Model SH-2, or Equivalent
* Lasco Model G13S-212, 1” swing joint with 1” MIPT brass outlet, or Equivalent
* Lasco SnapLok assembly, or Equivalent
* 2- Rebar

**Measurement for Payment**

Measurement for payment shall be a count of each quick coupling valve with swing joint and stabilizer supplied and installed.

**Basis of Payment**

Payment shall be made at the unit price and shall be full compensation for all labour, equipment and materials necessary to complete the work as specified.

### Item IR305 Supply and Install Drip Control Zone (All Sizes)

*The following Standard Drawings are applicable to this item: NHF-504, NHF-505, NHF-506, NHF-510 and NHF-511.*

The drip control zones, including all listed components, shall be installed in the location(s) shown on the Drawings and in accordance with the manufacturer’s specifications and Standard Drawings NHF-504, NHF-505, NHF-506, NHF-510 and NHF-511.

Dripline tubing for all zones will be supplied and installed under Item IR306 – Supply and Install Dripline Tubing.

Mainline piping and control wiring will be supplied and installed under Item IR303 – Supply and Install Mainline Piping and Control Wiring.

The Contractor shall install lateral piping from the drip zone kit to the headers located at both ends of each drip zone a minimum of 300 mm (12”) below grade in an open trench according to the Drawings. Lateral supply piping shall have a minimum 250 mm (10”) cover. Compact via tamping, or other form as approved by the Owner and/or the Consultant, to eliminate voids and minimize future settling.

The Contractor shall install an automatic flush valve at the farthest point in each drip zone and in an exhaust header, or a line that runs perpendicular to the lateral rows, to ensure all rows can utilize the valve from its installed location and installmanual flush valve(s) at the ends of the lateral supply piping to manually flush the system during initial start-up, winterization and annual spring start up. Air/vacuum relief valves shall be installed at the highest point in each drip zone or as indicated in these Specifications.

The Contractor shall flush all lateral supply lines through the manual flush valve prior to introducing water to the drip zones.

**Materials – General**

Each drip control zone supply and installation must include the following components:

1. Control Zone Kit: shall be accessible and housed in a standard rectangular valve box. The kit shall include:
	1. Electric valve shall be normally closed, electrically actuated, diaphragm-operated remote-control valves. The valve shall be available in a globe body style with FIPT inlet and outlet. The valve working pressure shall be from 15 to 150 PSI. The valve body and bonnet shall be constructed of durable glass-filled nylon, stainless-steel, and other chemical/UV resistant materials. The diaphragm shall be constructed of durable Buna-N rubber material reinforced with nylon. The one-piece solenoid shall be an energy efficient 24 VAC unit with captured plunger and 90 mesh (200 micron) screen. Inlet pressure shall be rated for 15 to 150 PSI.
	2. Filter and pressure regulator shall be a jar top unit with FIPT inlet and outlet that incorporates a stainless-steel screen element with a basket design to capture debris and prevent the debris from falling into the downstream line when performing maintenance. The body shall be constructed of impact resistant glass-filled polypropylene. The cap shall be constructed of impact resistant glass-filled nylon and include a UV resistant polyurethane indicator window that indicates when the filter needs to be cleaned. The screen element shall be 200 mesh (75 micron) reinforced with polypropylene ribs to increase durability. The complete filter shall be rated for 150 PSI operating pressure.
	3. Isolation ball valve shall be PVC double union quarter turn ball valves with FIPT ends rated for 150 PSI. The valve shall be sized the same as the remainder of the zone kit. The valve shall incorporate a patented gear drive thermoplastic handle mechanism that allows for a 360⁰ rotation of the handle to achieve a 90⁰ turn of the ball.
2. Lateral supply piping shall be PVC and similarly installed as mainline piping as described in Item IR303 – Supply and Install Mainline Piping and Control Wiring.
3. Header(s) shall be a flexible, prefabricated header made of polyethylene tubing meant for dripline installations at the specific dripline spacing using rotating pre-installed elbows guaranteed at the required spacing.
4. Air/vacuum relief valve(s) shall be installed at the highest point in each drip zone and in an exhaust header, or a line that runs perpendicular to the lateral rows, to ensure all rows can utilize the valve from its installed location. The valve shall be installed into a compression x compression x FIPT compression Tee installed in the dripline tubing or insert x FIPT fitting to install on the dripline header. The valve shall have a 12.5 mm (½”) diameter inlet that connects to a compression x compression x FIPT Tee or insert x FIPT fitting. The air/vacuum relief valve shall be housed in a 250 mm (10”) round valve box with locking lid.
5. Automatic flush valve(s) shall be installed into the dripline exhaust header. The valve shall flush approximately 3.8 Liters (1 US Gallon) per cycle. The valve shall have a 12.5 mm (½”) diameter inlet by insert x FIPT Tee. The automatic flush valve shall be housed in a 250 mm (10”) round valve box with locking lid.
6. Manual flush valve(s) shall be installed using a Schedule 80 PVC nipple on Schedule 40 PVC elbow and Schedule 40 adapter. The valve shall be installed on the dripline exhaust header. The manual flush valve shall be housed in a 250 mm (10”) round valve box with locking lid.
7. All necessary fittings and lockable valve boxes.

**Materials – Specific [confirm valve and piping types as indicated on Drawings]**

* Rain Bird XCZ-100-PRB-COM Control Zone Kit containing:
	+ Rain Bird 100-PESB Electric valve, or Equivalent
	+ Rain Bird PRB-QKCHK-100 25 mm (1”) diameter Quick Check Basket Filter with Built-in 40 PSI Pressure Regulator, or Equivalent
	+ Colonial Model SC Series Thermoplastic True Union (Isolation) 25 mm (1”) Ball Valve, or Equivalent
* Rain Bird XCZ-150-PRB-COM Control Zone Kit, containing:
	+ Rain Bird 150-PESB Electric valve, or Equivalent
	+ Rain Bird PRB-QKCHK-150 40 mm (1.5”) diameter Quick Check Basket Filter with Built-in 40 PSI Pressure Regulator, or Equivalent
	+ Colonial Model SC Series Thermoplastic True Union (Isolation) 40 mm (1.5”) Ball Valve, or Equivalent
* 25 mm (1”) PVC Class 160 SDR 26
* 40 mm (1.5”) PVC Class 160 SDR 26
* Rain Bird XQF-1012100 QF Dripline Headers, or Equivalent
* Rain Bird AR050 air/vacuum relief valve, or Equivalent
* Netafim TL050MFV-1 automatic flush valve, or Equivalent
* 25 mm (1”) FIPT PVC ball (manual flush) valve, or Equivalent
* Rain Bird PVB-STD 12” standard rectangular valve box with lockable lid, or Equivalent

**Measurement for Payment**

Measurement for payment shall be a count of each drip control zone supplied and installed.

**Basis of Payment**

Payment shall be made at the unit price and shall be full compensation for all labour, equipment and materials necessary to complete the work as specified.

Payment for dripline tubing will be made under Item IR306 – Supply and Install Dripline Tubing, and payment for mainline piping and control wiring will be made under Item IR303 – Supply and Install Mainline Piping and Control Wiring.

### Item IR306 Supply and Install Dripline Tubing

The following Standard Drawings are applicable to this item: NHF-506, NHF-507 and NHF-508.

The dripline tubing shall be installed in the location(s) shown on the Drawings and in accordance with the manufacturer’s specifications and Standard Drawings NHF-506, NHF-507 and NHF-508.

The Contractor shall install and supply the dripline tubing according to manufacturer’s instructions, including compression fittings and tie down stakes. This Specification shall be read to provide subsurface dripline tubing with emitters throughout the area to be watered and blank dripline tubing located where no planted material exists. The dripline tubing shall be installed on top of the finished grade of planting soil, prior to any installation of mulch and/or plant material, unless indicated otherwise by the Owner. Tubing shall be installed in a grid pattern at 300 mm (12”) spacing with inline emitters spaced in a triangular pattern. Compression fittings shall be installed by pressing them onto the dripline tubing.

Tie-down stakes shall be installed every 1200 mm (4’) on the dripline tubing and close to each leg of a fitting to hold tubing in place and secure fittings.

**Materials – General**

Subsurface dripline tubing shall be copper-coloured dual-layered flexible polyethylene tubing conforming to an outside diameter (O.D.) of 16 mm (0.634”) and an inside diameter (I.D.) of 13.6 mm (0.536”) with factory installed copper-infused pressure-compensating, inline emitters spaced 30.5 cm (12”) on-center. The flow from each installed inline emitter shall be 3.4 LPH (0.9 GPH) when the inlet pressure is between 8.5 to 60 PSI. The inline emitter diaphragm shall have a pressure compensating diaphragm with a spring action allowing it to self-rinse if there is a plug at the outlet hole. The inline emitter shall have a copper shield technology installed to protect the emitter from root intrusion. The inline emitter inlet shall be raised off the inside tube wall to minimize dirt intrusion. The dripline tubing shall contain at least 20% post-consumer recycled polyethylene which qualifies for LEED credit 4.2.

Blank tubing shall be brown-coloured dual-layered flexible polyethylene tubing conforming to an outside diameter (O.D.) of 16 mm (0.634”) and an inside diameter (I.D.) of 13.6 mm (0.536”).

Fittings shall be compression or barbed type. Compression-type fittings shall provide a leak-free connection for all tubing with an O.D. of 0.630” to 0.669” at an operating pressure range of 0 to 60 PSI. These fittings shall be molded from a UV-resistant ABS material with a Buna seal. Compression fittings shall be available in tees, elbows, couplings, male adapters, female adapters and flush cap end closure. Barbed insert fittings shall have an operating range of 0 to 50 psi, or up to 60 psi when requiring clamps.

Stakes shall be constructed of corrosion-resistant 12-gaguge galvanized steel.

**Materials – Specific**

* Rain Bird Model XFS-09-12 Sub-surface Copper-Coloured Dripline with Copper Shield™ Technology and pressure compensating inline emitters, or Equivalent
* Rain Bird Model XF Blank Tubing, or Equivalent
* Rain Bird Model Easy Fit Compression Fittings, or Equivalent
* Rain Bird XF Insert Fittings, or Equivalent
* Rain Bird Model TDS-050 tie down stakes, or Equivalent

**Storage**

All dripline tubing and fittings shall be stored in a manner that protects all materials from oil and grease and from prolonged exposure to sunlight and excessive heat.

**Basis of Payment**

Payment shall be made at the lump sum price and shall be full compensation for all labour, equipment and materials necessary to complete the work as specified. Payment shall be made in one (1) lump sum payment upon completion of all work under this item to the satisfaction of the Owner.

### Item IR30# [insert additional items for project-specific irrigation system requirements as needed]