CITY OF MEDICINE HAT – PARKS AND RECREATION

IRRIGATION DESIGN STANDARD – June 2016

The Irrigation Design Standards have been prepared to assist developers, designers, and contractors in the design and installation of irrigation systems in Parks and Open Spaces within the City of Medicine Hat. Any reference to the Irrigation Design Standard shall be interpreted to mean the latest or most current edition, unless specifically stated otherwise. The City of Medicine Hat will maintain this document and publish subsequent editions, as required. Copies of this document will be made available to Irrigation consultants and contractors for the sole purpose of designing and constructing irrigation systems for City of Medicine Hat properties.

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1.0 APPLICATION OF THE STANDARD

This standard shall apply for the design of irrigation systems for all manicured turf areas. Materials, equipment and construction shall be in accordance with the City of Medicine Hat Landscape Specifications for Parks and Recreation Development.

2.0 OTHER DOCUMENTS

Development within new subdivisions is governed by the Municipal Servicing Standards Manual (MSSM). The City of Medicine Hat publishes standard drawings and specifications for the construction of irrigation water services, booster pump stations, controllers and irrigation systems. The Irrigation Design Standard document establishes the design standards for irrigation projects within the City of Medicine Hat and complements the information provided in the MSSM and the standards drawings and specifications.

3.0 DEFINITIONS

3.1 **Static Water Pressure –** The water pressure at the City's water main, at ground level, when there is no flow through the irrigation system.

3.2 **Dynamic Water Pressure –** The actual water pressure at any location in the system, when the irrigation system is operating as designed.

3.3 **System Rated Flow –** The system rated flow is the actual maximum flow at System Design Operating Pressure for the irrigation system.

3.4 **System Design Operating Pressure –** The minimum dynamic water pressure at the base of the sprinkler in the worst case location of sprinklers with the same design operating pressure.

4.0 DESIGN PHILOSOPHY

The irrigation design shall be based upon the equipment on the City of Medicine Hat Approved Irrigation Product List, included as part of this document.

The design shall consider water efficiency, capital cost and operating and maintenance costs with the goal to reduce the total life cycle cost and reduce water consumption. The quantities of sprinklers and valves shall be kept to a reasonable minimum. The use of booster pumps on sites larger than 3.7 acres (1.5 ha) should be investigated and used where the total number of

sprinklers can be significantly reduced. The design shall be consistent throughout; including sprinkler type, nozzle sizes, lateral piping configuration, valve size etc.

5.0 WATER APPLICATION AND WATER WINDOW

Irrigation systems shall be designed to meet the peak weekly evapotranspiration (ET) requirement of 38mm within a water window of 30 hours per week (5 hours per day / 6 days per week). Irrigation systems are recommended to be run during the night or early morning and not during the heat of the day.

Where site access is controlled or secured, the City will consider a longer water window; however this must be pre-approved by the City.

6.0 WATER SUPPLY FLOW RATE

The water supply shall be sized based on the "potential" irrigated area. This includes all boulevards and medians that are adjacent to the property. There shall be no deduction for hard surfaced areas except for permanent buildings, playgrounds and parking lots. Sites that have been designated as dryland or native areas shall be provided water as if they were to be irrigated, unless directed otherwise by the City.

The water supply shall be sized for potential irrigated area as follows:

1. Up to 7.7 acres (3.1 ha) — 26.3 USgpm per acre (65 USgpm per ha)
2. 7.7 acres (3.1 ha) to 17.8 acres (7.2 ha) — 25.1 USgpm per acre (62 US gpm per ha)
3. Larger than 17.8 acres (7.2 ha) — 24.3 USgpm per acre (60 USgpm per ha)

7.0 TREATED WATER SUPPLY

Treated water supply for irrigation of sites smaller than 7.7 acres (3.1 ha) shall only have one connection to the City's water distribution, and if possible adjacent properties shall be irrigated from the same water service connection. The City of Medicine Hat discourages mainline pipe crossings of roadways. Where multiple small sites within roadways are encountered, the designer should review water servicing requirements with the City. The water service shall be located at the high point in elevation on the site provided that it is easily accessible and that the City water main can provide the necessary flow at that location.

More than one water service will be considered for sites larger than 7.7 acres (3.1 ha). On sites where more than one water service is used, the irrigation system for each water service shall be separate and not connected to the other water service. The size of water service is subject to the approval of the Parks and Recreation Department, but the following guidelines shall be observed:

Table 7.1 – Water Service Sizing

Irrigated Area Size	Size of Water Service Required
0 to 2 acres (0.83 ha)	2in (50mm)
2.1 acres (0.84 ha) to 7.5 acres (3.02 ha)	4in (100mm)
7.51 acres (3.03 ha) to 16.8 acres (6.79 ha)	6in (150mm)
16.81 acres (6.80 ha) to 28.9 acres (11.70 ha)	8in (200mm)

In situations where the required water supply cannot be obtained with an 8in (200mm) water service, the designer shall contact Parks and Recreation and Environmental Utilities for further direction.

Alternate water supplies, such as irrigation district, reclaimed, storm, well or river water should always be investigated in place of potable water. If these are not viable and the City's water supply must be utilized, additional investigations to determine if more than one 6in (150mm) water service can be used, and if not, the most suitable location for installation of a larger water service. Refer to the Municipal Servicing Standards Manual for further information.

Backflow preventions are required for all connections to the City's potable water system, as per the City's Water Bylaw 2379. The Backflow Preventer shall meet the requirements of the City of Medicine Hat Environmental Utilities Department and shall be sized for no more than 6.0 psi loss at **System Rated Flow**. Environmental Utilities Cross-Connection Control Officer is available to provide further guidance.

Backflow preventers shall be sized as equal to the pipe size of the incoming potable water line. Reduced and/or multiple valve designs shall be reviewed on a case-by-case basis, and the Parks and Recreation Department reserves the right to specify the design.

ARAD Hydrometer shall be sized for the **System Rated Flow** using the normal maximum flow of the hydrometer as shown in **Table 7.3**. The maximum flow can be used if the designer can verify that there will be no negative impact on overall system design.

Table 7.3 – ARAD Hydrometer Sizing

Size	Normal Maximum Flow	Pressure loss at Normal Max Flow	Maximum Flow	Pressure loss at Maximum Flow
2in (50mm)	80 US gpm	4.2 psi	100 US gpm	7.1 psi
3in (75mm)	230 US gpm	4.2 psi	300 US gpm	7.1 psi
4in (100mm)	400 US gpm	4.2 psi	530 US gpm	7.1 psi
6in (150mm)	840 US gpm	4.2 psi	990 US gpm	7.1 psi
8in (200mm)	1320 US gpm	4.2 psi	1900 US gpm	7.1 psi

8.0 ALTERNATE WATER SUPPLIES

Alternate water supplies are typically investigated as part of new community development within subdivisions and must follow the procedures documented within the Service Agreement and Municipal Servicing Standards Manual. The alternate water supply shall be a guaranteed source, and the consultant shall complete a cost-benefit analysis for discussion with the City. If potable water is also supplied to the site, there shall be no cross-connection between the alternate water supply and the potable water system.

Irrigation pump stations shall include the following:

- Metal clad building with no windows and Insulated steel doors, with interior and exterior lighting;
- Sound reduction insulation in residential areas;
- Lockable roof hatches for pump removal;
- Thermostatically controlled ventilation systems;
- Auxiliary heat system sized to prevent freezing;
- Water filtration system;
- Variable Frequency Drive pump systems: Pumps shall be vertical turbine style. Only one pump is required for pump stations with a requirement of 20 Horsepower or less. Where horsepower requirements exceed 20 horsepower, two or more pumps shall be used;
- All pump motors shall be rated for inverter duty and shall be premium efficiency;
- Wet wells to be concrete and sized for 125% of design flow;
- Intakes pipes to be sized for maximum inflow velocity of 0.15 m/s at 125% of pump station design flow and to be equipped with shutoff valve into wet well. Intake shall be concrete, PVC or HDPE pipe;

- Water fall and stream supply pumps to be trash pumps with roof mounted hoist;
- Two hard copies of operating and maintenance manuals in binders and one digital copy in PDF format.

9.0 BOOSTER PUMP STATIONS AND CABINETS

Booster pump stations are normally cost effective for sites larger than 3.7 acres. If the available sprinkler operating pressure is less than 50 psi, the designer shall undertake two conceptual designs, one at available pressure and the other at a sprinkler operating pressure of 60 psi. The results of the two designs including preliminary cost estimate for each, shall be submitted to the City for review. Booster pumps shall be used when the higher operating pressure results in a significant reduction in the number of sprinklers, and when approved by Parks and Recreation.

Booster pumps shall be equipped with a Variable Frequency Drive and pressure transducer to prevent over pressure. Where a programmable logic controller (PLC) is required for control, it shall be pre-programmed by a City approved controls and automation specialist. Vertical in Line centrifugal pumps operating at 1,750 RPM shall be used.

Booster pump cabinets shall include the following items and parameters:

- Above ground that will avoid confined spaces wherever possible;
- To be steel, stainless or powder-coated, lockable, and water-proof;
- Mechanical enclosure to be equipped with dual sliding lids and metal ventilation louvers;
- A concrete base for the enclosure.

The ARAD Hydrometer shall be installed as an integral part of the pump station. The contractor can utilize the manual over-ride on projects where operation and maintenance is being provided.

10.0 CONTROL SYSTEM PHILOSOPHY

The control system shall be designed for integration into the City's central irrigation control system. The Irrigation Consultant shall arrange for communication tests to determine if the Motorola control system will operate reliably at the chosen controller location. Where the provision of central control and the costs associated with electric service are not warranted, as directed by the City, the designer shall utilize an alternate control system, such as solar powered or battery operated controllers as noted in the Approved Irrigation Product List, or as approved by the Parks and Recreation Department.

Two-wire decoder control systems can only be used on sites where their specific use has been pre-approved by the City of Medicine Hat. They shall include the following requirements:

- Complete system as per Approved Equipment list ;
- One decoder per electric valve;
- Use of manufacturer's recommended wire and wire connectors;
- Rainbird or Hunter two-wire decoder controller.

11.0 SPRINKLER DESIGN

The basic premise for design of sprinklers is to keep the number of sprinklers to a practical minimum. The design shall consider the size and shape of site, constraints, available pressure and type of vegetation to be irrigated. ***Sprinklers shall be selected from the City of Medicine Hat Approved Irrigation Products list, latest edition.***

In high pressure areas, or for low pressure sprays/bubblers etc, pressure compensating nozzles should be used.

Sprinklers shall be designed with a square pattern and shall be spaced at no more than 50% of rated diameter for both heads and rows. Triangular sprinkler design can be used for spray heads on medians and boulevards. Sprinklers in a triangular pattern shall be spaced with heads no more than 50% of diameter and rows at no more than 43% of diameter.

Part Circle sprinklers shall be used on the perimeter of all hard surface areas and overspray shall be kept to an absolute minimum. This requirement does not include trails in the middle of grassed areas, unless, they are used as a boundary between irrigated and natural grassed areas. Where the Park or Public Utility Lot (PUL) boundary is parallel to a roadway with a grass boulevard, part circle sprinklers shall be installed at back of curb, unless the boundary is secured with a fence that would interfere with sprinkler uniformity. Post and chain fence, low 3ft

(900mm) chain link and many ornamental iron fences do not impact the spray pattern significantly. Heads should be oriented and positioned to avoid direct spray on buildings and structures.

The sprinkler selection shall be based on size of site, available pressure and quantity of obstructions. The sprinkler types should be considered in the following situations:

1. Type 1 - Bubblers – Trees and shrubs located in non-irrigated areas, shrub beds on medians and boulevards and trees and shrub beds within irrigated areas, where appropriate or where turf irrigation will not provide sufficient water.
2. Type 2 Spray Heads – Narrow, linear landscaped areas and shrub beds
3. Type 3 Sprinklers – Special areas that can't be effectively irrigated with other sprinklers. Prior to using this type of sprinkler, the designer shall meet with the City of Medicine Hat Parks Department and obtain approval for the proposed design.
4. Type 4 Sprinklers – Parks up to 3.2 acres (1.3 ha), boulevards, medians, tot lots
5. Type 5 Sprinklers – Any Park or open space larger than 3.2 acres (1.3 ha), excluding linear parks, tot lots and roadways
6. Type 6 Sprinklers – Very large open spaces such as regional parks, golf courses and major sports field complex. Prior to using this type of sprinkler, the designer shall meet with the City and obtain their approval.

11.1 Type 1 – Bubblers

Bubblers shall be used for trees within non-irrigated areas. Bubblers shall consist of a 4in (100mm) minimum pop up spray body and shall be pressure compensating type with a fixed flow rate and shall be equipped with a drain check valve. One bubbler shall be installed per individual tree. Bubblers shall be placed on the uphill side of the tree. Where bubblers are placed within shrub beds, they shall be spaced at intervals not exceeding 8ft, 10.5in (2.4 m). Operating times shall be calculated based on the following:

- 15 gallons per week for individual trees or
- 1½in (38mm) per week application within shrub beds

11.2 Type 2 – Spray Heads

Spray heads are typically rated for 30 psi or less and spacing can be from 5ft to 18ft (1.5m to 5.5m) and will be used for narrow grass areas and also within shrub/flower beds. Where appropriate, spray heads used in shrub beds shall have a 12in (300mm) pop-up riser from the spray body. Spray head shall be pressure compensating and include a drain check valve.

Fixed radius arcs with matched precipitation rate should be used for regular shaped area. Variable arc nozzles are to be used where boundaries are not regular and where future adjustment is anticipated.

11.3 Type 3 – Specialty Heads

Special sprinklers are constantly being developed to provide solutions for difficult areas. The most recent developments have been in the stream rotor, developed to provide more suitable coverage for the 18ft to 30ft (5.5m to 9m) range. To reduce substantial misting, small nozzles with 70 PSI should not be used. The designer shall obtain approval from the City prior to using these types of heads in the design. Once approved for use in the City of Medicine Hat, the use of these heads should be limited to only cover the areas that require this specific head. They shall not be used where either spray heads or rotary heads will provide a reasonable design.

11.4 Type 4 – Low Pressure Rotary Head

Low volume/pressure rotary gear drive sprinklers typically operate between 1.5 and 8 US gpm, at pressures from 30 to 50 psi and spacing between 30ft to 43ft (3m to 13m). Several manufacturers have developed a short radius version of this sprinkler to allow coverage down to 18ft (5.5m) and the use of this sprinkler in lieu of spray heads is preferred. Type 4 sprinklers shall be equipped with drain check valves. Stainless steel risers shall be used along roadways, sidewalks, playgrounds and within or adjacent to baseball infield areas.

11.5 Type 5 – Medium Pressure Rotary Head

Medium volume/pressure rotary gear drive sprinklers operate between 8 and 20 US gpm at pressures from 60 to 70 psi. (under the head) and spacing between 46ft and 66ft (14m and 20m). Type 5 sprinklers shall be equipped with drain check valves. Stainless steel risers shall be used along roadways, sidewalks, playgrounds and within or adjacent to baseball infield areas.

11.6 Type 6 – High Pressure Rotary Head

High volume/pressure rotary gear drive sprinklers operate between 20 and 50 US gpm at pressures from 70 to 90 psi. and spacing between 66ft to 85ft (20m to 26m). The designer shall obtain the City's approval prior to using this type of sprinkler on any design. Sprinklers shall be equipped with drain check valves. Stainless steel riser (if available) shall be used along roadways, sidewalks, playgrounds and within or adjacent to baseball infield areas.

12.0 ZONING DESIGN

Sprinkler zoning design includes the placement of sprinklers on the appropriate electric valves to accomplish the following:

- Simplicity of piping layout;
- Consistency of piping design throughout;
- Reduction of trail, mainline and lateral pipe crossings;
- Sprinklers of same type and precipitation rate zoned together;
- No sprinklers designed for back to back installation;
- Part circle sprinklers on west boundaries zoned together;
- Part circle sprinklers on east boundaries zoned together;
- Part circle sprinklers around playgrounds zoned together;
- Sprinklers on hills and slopes zoned together;
- Sprinklers in low or drainage areas zoned together;
- Flower bed sprinklers shall be zoned separately from grassed areas;
- Nominal zone size of 50 US gpm for 1.5in (38mm) electric valves;
- Nominal zone size of 100 US gpm for 2in (50mm) electric valves;
- Nominal zone size of 200 US gpm for 3in (75mm) electric valves;
- For rotary gear drive sprinklers, part and full circle sprinklers zoned separately;
- Sprinklers within a sports field to be zoned together;
- Only one valve shall be wired to a controller station.

On larger sites where more than one valve will operate at the same time, the designer shall provide a controller **Scheduling Information Chart** to identify which zones operate on each controller station. Although each zone can be programmed separately, the designer should assume that they will be programmed together. Controllers shall be designated A, B, C etc. and each controller shall be designed for normal operation within the designated water window.

As such, the following basic principles shall be applied to the **Scheduling Information Chart**

- Zones of similar precipitation rate to be grouped together;
- Zones of similar site conditions to be grouped together;
- Zones spread out to reduce mainline losses and balance operating pressure;
- Zones to be selected to reduce impact on site usage such as trails, playgrounds and sports fields;
- Zone flows to be grouped to maintain consistent station total flows.

13.0 LATERAL PIPE DESIGN

Lateral pipe shall be sized so that velocity does not exceed 5ft (1.5 m)/s, and to minimize zone pressure loss. **Table 13.1** provides the maximum flow allowable in any lateral pipe. The minimum pipe size for Type 1 sprinklers is 1in (25mm). Minimum pipe size for Type 2 and Type 3 sprinklers is normally 1½in (38mm); however the City will consider the use of 1in (25mm) pipe with Parks and Recreation approval in special circumstances. The minimum pipe size for Type 4, Type 5 and Type 6 sprinklers is 2in (50mm).

Lateral pipe pressure loss in any zone shall not exceed 5.0 psi, unless it can be demonstrated that there will be no negative impact on overall system performance.

Pipe layout shall be designed primarily with standard available fittings including elbows. As a note, no saddle connections will be accepted.

Lateral pipes shall be ploughed in existing grass areas, unless otherwise approved by the City or where soil conditions are not suitable. On new construction sites, the pipes may be either ploughed or trenched. All lateral pipes shall be installed in a separate trench. The minimum separation between lateral pipes shall be 2ft (600mm) for maintenance and repair. The minimum separation for lateral pipes from a mainline pipe shall be 3ft (1m). Separation distances in narrow linear properties can be reduced at the City's discretion.

Lateral pipe up to and including 2in (50mm) shall be High Density Polyethylene Series 160. Parks and Recreation may approve low density when requested for extenuating circumstances. Lateral pipes larger than 2in (50mm) shall be High Density Polyethylene DR 13.5 (128 psi rated).

Table 13.1 – Allowable Flows in Lateral Pipes

Lateral Pipe Size	**1in** (25mm)	**1½in** (38 mm)	**2in** (50mm)	**3in** (75mm)
Maximum Flow in US gpm	15	30	55	125

14.0 MAINLINE PIPE DESIGN

The mainline pipe shall be designed to provide the required flow to the electric zone valves with minimal pressure loss. The basic premise for design is to minimize the total length of all pipes within the system. Grouping of valves at the water service to eliminate main line pipe is not permitted. Mainline pipe shall be designed to pass near special landscape features where supplemental water during the day may be required for maintenance purposes. These include playgrounds, water parks, hard surface play areas, shale areas on ball fields etc. The mainline pipe hydraulic design shall consider the impact of elevation variances on the site.

Mainline pipe shall be designed for a maximum velocity of 5ft (1.5 m)/s at System Rated Flow. The pipeline shall also be designed for a maximum velocity of 7ft (2.15m)/s at 150% of System Rated Flow. Mainline pipe shall be sized for a maximum pressure loss of 5.0 psi; unless it can be proven that there will be no detrimental effect on the system design. Mainline and lateral pipes shall be designed using the actual nominal inside diameter and a Hazen-Williams co-efficient of 140. **Table 14.1** can be used for less complex sites.

Mainline Pipe shall meet the following material specifications:

- High Density Polyethylene Pipe DR 13.5 (128 psi rated), PE3408 or PE4710, where maximum pressure does not exceed 120 psi;
- High Density Polyethylene Pipe DR 11 (160 psi rated) PE3408 or PE4710 where maximum pressure is between 120 psi and 160 psi;
- Sites larger than 5 acres (2.0 ha) may be conducive to looping the mainline pipe. Pressure drop for looped mainlines shall be calculated using 50% of the System Rated Flow over one half of the total looped length. Where looped mainlines are used, three isolation valves shall be used to split the mainline in approximate half.

Table 14.1 – HDPE DR 11 Mainline Pipe Sizing Chart

Mainline Pipe Size	Rated Flow 5 fps (1.5m/s) GPM (L/s)	150% of Rated Flow 7 fps (2.1m/s) GPM (L/s)	Maximum Pipe Rated Flow 6 fps (1.8m/s) GPM (L/s)	Headloss at Allowable Rated Flow 5 fps (1.5m/s) PSI/100ft (m/30.5m)
1.5in (40mm)	0	0	0	0
2in (50mm)	49 (3.1)	69 (4.3)	59 (3.7)	1.97 (1.39)
3in (75mm)	107 (6.7)	149 (9.4)	128 (8.1)	1.26 (0.88)
4in (100mm)	176 (11.1)	247 (15.6)	212 (13.3)	0.94 (0.66)
6in (150mm)	382 (24.1)	535 (33.7)	458 (28.9)	0.60 (0.42)
8in (200mm)	648 (40.8)	907 (57.1)	777 (49.0)	0.44 (0.31)
10in (250mm)	1,006 (63.4)	1,409 (88.8)	1,208 (76.1)	0.34 (0.24)
12in (300mm)	1,416 (89.2)	1,982 (124.9)	1,700 (107.0)	0.28 (0.20)

Table 14.2 – HDPE DR 13.5 Mainline Pipe Sizing Chart

Mainline Pipe Size	Rated Flow 5 fps (1.5m/s) GPM (L/s)	150% of Rated Flow 7 fps (2.1m/s) GPM (L/s)	Maximum Pipe Rated Flow 6 fps (1.8m/s) GPM (L/s)	Headloss at Allowable Rated Flow 5 fps (1.5m/s) PSI/100ft (m/30.5m)
1.5in (40mm)	29 (1.8)	41 (2.6)	35 (2.2)	2.68 (1.89)
2in (50mm)	45 (2.8)	63 (4.0)	54 (3.4)	2.07 (1.46)
3in (75mm)	98 (6.2)	137 (8.6)	117 (7.4)	1.32 (0.93)
4in (100mm)	162 (10.2)	226 (14.3)	194 (12.2)	0.99 (0.69)
6in (150mm)	351 (22.1)	491 (30.9)	421 (26.5)	0.63 (0.44)
8in (200mm)	594 (37.4)	832 (52.4)	713 (44.9)	0.46 (0.33)
10in (250mm)	923 (58.1)	1,292 (81.4)	1,107 (69.8)	0.36 (0.25)
12in (300mm)	1,298 (81.8)	1,817 (114.5)	1,558 (98.1)	0.29 (0.21)

15.0 VALVES AND ACCESSORIES

Mainline connections for valves shall be installed at minimum 6½ft (2m) spacing along the mainline. Four way cross fittings are not permitted. Valves and accessories shall not be installed in low areas prone to water ponding, in shrub beds or areas that create obstacles to maintenance and repair. Isolation valves, with a quick coupler valve for blowout purposes, shall be limited to very large sites and those with looped mainlines. An isolation valve shall be installed on the upstream side of all mainline pipe road crossings. An Isolation valve shall be provided for each ball field and separate properties. Grouping of zone valves into a common vault is permitted where the total length of lateral pipe does not increase significantly.

Quick coupling valves shall be installed at the end of all bubbler lateral lines, near playgrounds etc.

Drain valves shall only be used on mainline pipe in the following locations:

- On road crossings where the pipe under the road is more than 3ft (1m) deeper than the mainline pipe.
- Where the mainline pipe has trapped lows that can't be readily blown out.
- On systems where long mainlines drain back to the water service point

Isolation valves and drain valves shall be installed a minimum distance of 33ft (10m) from any road surface. If this is not possible, the designer shall review with the City. Isolation and drain valves shall be a minimum distance of 6½ft (2m) from any hard surfaced area and 16.4ft (5m) from the playing surface of any sports field.

16.0 CROSSINGS

16.1 General

All mainline and lateral pipe that crosses a hard surfaced area shall be installed in a conduit (sleeve), which shall be SDR 35 PVC gasketed sewer pipe, IPEX Ring-Tite or approved equal. Only one pipe per conduit shall be used except for special circumstances, and only with the prior approval of the City. Where the installation of two pipes in one conduit is approved, the size of the conduit pipe shall be increased from that shown in **Table 16.1**. Unless approved otherwise, low voltage (24 Volt) valve control wiring shall be installed in a separate conduit. The conduit for control wires shall be twice the diameter necessary for installation of the wires. The ends of pipe conduits shall be accessible for future maintenance. They should be a minimum of 3ft (1m) from hard surface areas and should not be located in shrub/flower beds.

16.2 Trail and Road Crossings

Irrigation main or lateral pipe for trail, sidewalk and other hard surface crossings within the park shall be of the same type and pressure rating as the pipe within the park. The top of the conduit shall be a minimum 12in (300mm) below the finished surface and the conduit shall extend 3ft (1m) beyond the hard surface. Conduit and road crossings should be at a flat grade at the same elevation to prevent dips in the line.

The conduit for all road and parking lot crossings shall extend a minimum of 3ft (1m) beyond the road surface. Kor-N-Seal pipe ends seals shall be installed on all road crossings. The top of the conduit shall be a minimum 12in (300mm) below the lowest point in the road section. The irrigation pipe shall extend beyond the conduit to a point where the grade of the pipe matches the nominal pipe grade of the irrigation system. This transition shall be smooth and bending radius shall not exceed the manufacturer's recommendations.

Open excavation for park trail crossings is acceptable, though not for roads. For other hard surfaces, the excavation technique is subject to the approval of the Parks and Recreation Department.

The size of the conduit pipe shall be determined from the following **Table 16.1**:

Table 16.1 – Conduit Pipe Size Chart

Nominal Irrigation Pipe Size	Conduit Pipe Type	Nominal Conduit Pipe Size
1.5in (38mm)	PVC – DR 35	4in (100mm)
2in (50mm)	PVC – DR 35	4in (100mm)
3in (75 mm)	PVC – DR 35	6in (150mm)
4in (100 mm)	PVC – DR 35	8in (200mm)
6in (150 mm)	PVC – DR 35	10in (250mm)
8in (200 mm)	PVC – DR 35	15in (375mm)
10in (250 mm)	PVC – DR 35	15in (375mm)
12in (300 mm)	PVC – DR 35	18in (450mm)

17.0 PRESSURE BALANCING

Upon completion of the preliminary design, the system shall be adjusted to provide optimal pressure balance so that the sprinkler operating pressure is as consistent as possible throughout the site. Where actual sprinkler operating pressure varies by more than 15 psi from the design operating pressure the designer shall review with the City to determine if or what corrective measures should be considered.

Potential measures may include the use of pressure regulating valves, changing of main and lateral pipe size to increase or decrease pressure loss, change nozzles to reflect the actual zone operating pressure, local re-design of sprinkler spacing to reflect the actual sprinkler operating pressure anticipated in that area or simply identifying the actual sprinkler operating pressure to be expected within the Sprinkler, Zoning and Schedule Information Charts.

18.0 CADD STANDARDS

In addition to the CADD drawing standards specified in the Municipal Subdivision Servicing Standards the following additional requirements must be met for irrigation record drawings issued to the City. It is recognized that construction drawings must relay information to the contractor, and this, particularly with existing systems may be difficult to portray if the entire standard is followed.

The City currently uses Autodesk AutoCAD and ESRI ArcGIS. To ensure compatibility and interoperability between this software, the following requirements must be observed with all digital file submissions.

1. Digital files must be submitted in AutoCAD 2007 DWG format.
2. Data must conform to NAD ’83 3TM coordinates, geo-referenced to the City’s cadastral base.
3. All elements must be part of the original drawing file, and must not have any referenced file or attachments associated with them.
4. Text must be clear and legible and must not be placed over important drawing elements. Text shall be a minimum of 2mm at full scale plot.
5. Landscape elements which are not part of the irrigation system shall be shown in half tone.
6. Irrigation symbols shall be 2.5mm at full scale plot.
7. Only the drawing base elements are allowed in Paper Space. This includes elements such as title blocks, borders, north arrows, logos, etc. All other elements must be drawn in model space.
8. Drawings must be black and white and not contain color.
9. LINE WORK: Style to be continuous throughout, with the exception of the limit of work boundary line which is to have the 'hidden' style and a weight of 0.70 (for the main and lateral lines see Mainline & Lateral.

AUTOCAD STANDARDS			
Elements	**AutoCAD Layer**	**Line Style**	**Line Width**
Text (Legend & Schedule)	IR-text_leg_sched	Continuous	0.25
Text (Active Work)	IR-text_active	Continuous	0.25
Text (Non-Active Work)	IR-text_nonactive	Continuous	0.18
Non Active Phase	IR-non_act_phase	Continuous	0.25
Sprinkler Heads (Full)	IR-sphead_full	Solid Fill	0.25
Sprinkler Heads (Part)	IR-sphead_part	Open Circle	0.25
Irrigation Mainlines	IR-main_pipe	Continuous	0.90
Irrigation Lateral Lines	IR-lateral_pipe	Hidden/Dash	0.50
Valve Control Wire	IR-control_wire	Continuous	0.25
Miscellaneous valves	IR-misc_valves	Continuous	0.25
Zone valves	IR-zone_valve	Continuous	0.25
Irrigation Controller	IR-controller	Continuous	0.25
Water Supply	IR-water_supply	Continuous	0.50

Detail Sheets

Where information is clustered and or difficult to read on the site plan, additional detail sheets will be required. These sheets should be produced at a sufficient scale to ensure that all details related to the design are clearly visible.

The maximum scale for an irrigation drawing is 1:500. On large or linear sites, where more than one drawing is required to portray all required information, an overall site plan, at an appropriate scale shall be included. This drawing shall clearly show the mainline pipe, mainline pipe size, electric valves, isolation valves and quick coupling valves. The size of symbols shall be increased to clearly show this information. Sprinklers and lateral pipe shall also be shown; however the size of symbols does not need to be increased.

Drawing Information

Each irrigation drawing should include the following:

1. A Legend which shows all of the pertinent symbols.
2. A chart listing specific sprinkler information as illustrated in the attached Chart "A" – Sprinkler Information (pg.21).
3. A chart listing specific zone design and operating information as illustrated in the attached Chart "B" – Zone Information (pg.21).
4. Where the site design requires the operation of more than one zone valve at a time, the drawings shall also include a chart which lists the controller scheduling information as illustrated in the attached Chart "C" – Scheduling Information (pg.21).

19.0 RECORD DRAWINGS

At the completion of construction, the contractor is responsible to undertake accurate survey using GPS or total station equipment. Survey method and equipment shall attain an accuracy of 0.15in (5cm) or less. This survey shall include the location of all sprinklers, valves, mainline pipe, lateral pipe, crossings, controllers, wire routes, water services, vaults, water shutoff valve, wire sequence and colour coding, wire splices and pump stations. This information, supplemented with contractors measurements and markups with all changes from the design noted shall be submitted to the City as final record drawings. Legend, notes, sprinkler and zone information charts and scheduling chart shall be updated to reflect the actual installation.

The City shall verify the information submitted including sprinkler types and nozzles used. Legend, notes, sprinkler and zone information charts and scheduling chart shall be updated to reflect the actual installation.

Operations and maintenance manuals are required for booster pump and pump stations. These manuals shall be submitted as three hard copies and a digital file.

20.0 APPROVED IRRIGATION PRODUCT LIST

PRODUCT GROUP	TYPE	MANUFACTURER	MODEL	REMARKS
SPRINKLERS				
	1 – Bubblers	Hunter Rainbird	PRS-30 1800	PCN Nozzle (0.5 gpm)
	2 – Sprays	Hunter Rainbird	PRS-30 1800-PRS	
	3 – Specialty	Hunter	1-20	
	4 – Low Pressure	Hunter	I-20	Stainless Steel Riser
	5 – Med Pressure	Hunter Hunter	I-25 I-40/I-40-ON	Stainless Steel Riser Stainless Steel Riser
	6 – High Pressure	Hunter	I-90	Stainless Steel Riser
VALVES				
	Electric Zone Valves	Hunter	EFB-CP IBV	With Flow Control With Flow Control
	Gate Valves to 100mm	Toyo (Red & White)	206A	Class 125
	Gate valves 150mm and larger	AWWA Cast Iron	Non-Rising Stem	Class 150 with Flanged connection
	Quick coupling Valves	Rainbird Rainbird Rainbird	3RC 5RC 7	¾", one Piece, single Lug 1", one piece, single lug 1½", one piece, single lug Hunter and Buckner devices are all compatible with Rainbird product.
METERS				
	Hydrometer	ARAD	BM	
VALVE BOXES				
	Electric Valves	Carson	1419 Regular 1220 Jumbo	Locking cover
	Junction box	Carson	910-12B	

BACKFLOW PREVENTION				
		Watts	007MIQT	Backflow preventors larger than 2 inches to be approved by Parks & Recreation on a case by case basis
BOOSTER PUMPS				
	Vertical-in-line	Gould	3 Hp 5 Hp 7.5 Hp	
		Paco	3Hp 5Hp 7.5 Hp	
PRODUCT GROUP	**TYPE**	**MANUFACTURER**	**MODEL**	**REMARKS**
CONTROLLERS				
	Interim	Rainbird	ESP-LXME	8-48 Station
	Computerized	Motorola	ICC Central Control System	Model and type to be approved by Parks

21.0 IRRIGATION HYDRAULIC CALCULATION WORKSHEET

DESIGN FACILITY/SITE

Estimated Static Water Pressure at City Water Main (psi) _____

Pressure loss through service at System Rated Flow _____

Pressure loss through DCVA at System Rated Flow _____

Pressure loss through Meter at System Rated Flow _____

Ground Elevation at Water Service _____

Dynamic Pressure at Water Service at Elevation _____

Determine Lowest Sprinkler Operating Pressure

Highest Main line Pipe Pressure loss at System Rated Flow _____

Electric Valve Pressure loss _____

Highest lateral pipe zone loss _____

Highest ground elevation at sprinklers _____

Highest elevation pressure differential (+ if higher than water service) _____

(- if lower than water service) _____

Booster Pump Station Added Pressure at System Rated Flow _____

Lowest Possible Sprinkler Operating Pressure Available _____

Determine Highest Sprinkler Operating Pressure

Lowest Main line Pipe Pressure loss at System Rated Flow _____

Electric Valve Pressure loss _____

Lowest lateral pipe zone loss _____

Lowest ground elevation at sprinklers _____

Lowest elevation pressure differential (+ if higher than water service) _____

(- if lower than water service)

Booster Pump Station Added Pressure at System Rated Flow _____

Highest Possible Sprinkler Operating Pressure Available _____

The designer shall complete the **Hydraulic Calculation Sheet** prior to sprinkler selection and sprinkler design. Mainline and lateral pipe losses shall be estimated, and this shall be used as a guide to determine optimum sprinkler operating pressure. On sites larger than 1.5 Ha, the potential to use a booster pump shall be investigated and presented to Parks and Recreation for final decision.

After sprinkler selection and design, zoning and mainline pipe design is complete; the **Hydraulic Calculation Sheet** shall be completed again.

The designer shall review all zones with respect to the hydraulic design and shall optimize the design to ensure that all zones can operate at or above the **System Design Operating Pressure**. This evaluation shall consider the actual flow through the system for each zone. On larger systems with multiple zones operating on a controller station, the designer shall consider actual flows for each station and the impact on pressure for the zones operating.

Charts shall be included in the drawing set as per the examples on the following page:

CHART "A" – SPRINKLER INFORMATION (EXAMPLE)

Zone Number	Head Type	Make	Model	Nozzle	Zone Operating Pressure (psi)	Radius (Feet)	Head Flow (US gpm)	Quantity
1	4	Hunter	I-25	#8	40	47.6	8.2	6
	4	Hunter	I-25	#4	40	41.6	4.5	2
2	4	Hunter	I-25	#7	40	46.6	7.9	8
3	2	Hunter	PRS-30	#15	30	18.0	2.4	7
	2	Hunter	PRS-30	#12	30	15.1	1.8	8

CHART" B" – ZONE INFORMATION (EXAMPLE)

Controller A	Total Zone Flow (US gpm)	Precipitation Rate (inches/hr)	Weekly Application (inches)	Minutes per Week	Minutes per Day (5 day/wk)
1	100.5	.7	1½	125	25
2	98.7	.35	1½	255	51
3	87.5	.7	1½	255	51
4	102.4	.35	1½	125	25

CHART "C" – SCHEDULING INFORMATION - FOR MULTIPLE ZONE OPERATION (EXAMPLE)

Controller Station	Zone No.	Flow US gpm	Zone No.	Flow US gpm	Zone No.	Flow US gpm	Total Flow US gpm
1	A1	87	B4	92	C8	108	287
2	A2	95	B2	108	C2	91	294