

CITY OF MEDICINE HAT – PARKS AND RECREATION

IRRIGATION DESIGN STANDARD

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 public manicured turf areas. Materials, equipment and construction shall be in accordance with the City of Medicine Hat Irrigation Installation Specifications and the Approved Products List for Parks and Recreation.

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.

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, with consideration of a watering window of 12 Midnight to 6 AM. 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 could be significantly reduced. The design shall be consistent throughout; including sprinkler type, nozzle sizes, lateral piping configuration, valve size etc.

Prior to design, the Consultant shall complete a topographical survey to verify the location of all shallow utilities within the park area. Mainlines and lateral lines should maintain the setbacks from these shallow utilities as required by the utility owners. Design drawings should illustrate locations where heads are significantly offset from the lateral lines.

5.0 WATER APPLICATION AND WATER WINDOW

Irrigation systems shall be designed to meet the peak weekly evapotranspiration (ET) requirement of 38mm (1 ½ inches) per site location per week (maximum of 6 hours per day / 6 days per week, from 12 midnight to 6am). Irrigation systems are not recommended to be run during the heat of the day.

Where site access is controlled or secured, the City will consider a longer watering 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 approved otherwise by the City.

The water supply shall be sized for 24.3 USgpm per acre.

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 it is easily accessible, and that the City water main can provide 50 psi at that location. For sites using a Booster Pump, a maximum design pressure of 70 psi shall be used.

More than one water service will be considered for sites larger than 7.7 acres (3.1 ha) with approval from Parks and Recreation Department during design. 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)

*4in (100mm) supply line is preferable.

In situations where the required water supply cannot be obtained with a 6in (150mm) water service, a second service may be required. Designer to review with Parks and Recreation for approval on a case-by-case basis. The designer is to submit a business case analysis to determine whether a single large service or two smaller services would be more suitable.

Backflow preventers 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.

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

Water services off existing mains to be constructed by the City of Medicine Hat Environmental Utilities Department (EUD) only, refer to EUD Standard Drawing EU-218 for details.

8.0 ALTERNATE WATER SUPPLIES

Alternate water supplies are typically investigated as part of new community development within subdivisions. The alternate water supply shall be a guaranteed source, and the consultant shall complete a cost-benefit analysis for discussion with the City prior to the irrigation design. 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.

9.0 BOOSTER PUMP STATIONS AND CABINETS

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. Where a programmable logic controller (PLC) is required for control, it shall be pre-programmed by a City approved controls and automation specialist.

For booster pump cabinets see Detail Drawings PK 201B, 201C, 202A, 202B, 202C, and 202D.

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;
- Booster pumps shall be equipped with a Variable Frequency Drive and pressure transducer to prevent over pressure;
- Pumps will require a duty and backup pump which alternate;
- All pump motors shall be rated for inverter duty and shall be premium efficiency;
- Wet wells to be concrete or fiberglass 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 should be combined with irrigation pumps where possible and are to be trash pumps with roof mounted hoist. Should be combined with irrigation pumping system where possible;

All pump controls, controllers and meters shall be installed inside the building. The Hydrometer shall be installed as an integral part of the pump station.

10.0 CONTROL SYSTEM PHILOSOPHY

The control system shall be designed for integration into the City’s central irrigation control system. The Irrigation Consultant may specify the supply and installation of a temporary controller to be used for the duration of the maintenance period. This controller is to be listed on the Approved Irrigation Product List and all field wiring is to be compatible with the City’s Central Control System which includes the provision of bicoders swapped out for the temporary controller bicoders when the system is turned over to Parks and Recreation. 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 or as approved by the Parks and Recreation Department.

Two-wire decoder control systems are to be used on all sites. Sites with less than 10 zones may request the use of a conventional system which requires approval 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, wire connectors and grounding;
- Two-wire decoder controller as per the Approved Irrigation Product List.

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 sprinkler heads 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 and Recreation 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. Two bubblers 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 within shrub/flower beds. Where appropriate, The City may approve the use of a 12in (300mm) pop-up riser from the spray body. Spray head shall be pressure regulated 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 to provide more suitable coverage for the 15ft to 25ft (4.6m to 7.6m) 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.

With the incorporation of alternate landscape design, specialty heads may be required dependent on the type of plant community incorporated.

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 in all situations.

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 in all situations.

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 risers shall be used in all situations.

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;
- Valves shall be 1 inch (25mm) to 2 inches (50mm) in size. No 3-inch valves are to be used;
- For rotary gear drive sprinklers, part and full circle sprinklers zoned separately;
- Sprinklers within a sports field to be zoned together. Valves shall be installed off the fields and outside of the play zone; less heads the better;
- Sprinklers around the perimeter of play zones shall be zoned together;
- Each valve is to have its own dedicated decoder and 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 (1.7 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. No mechanical saddle connections' will be accepted. Electro Fusion saddles are acceptable for change of pipe direction and head installation.

Utility setbacks will be reviewed with the relevant utility departments and it recognized that due to site conditions the designer may not be able to meet all of the setback requirements but must make best effort to meet all utility setbacks and identify where setbacks do not meet the utility department requirements.

All HDPE pipe connections shall be completed utilizing Butt Fusion or Electro Fusion methods **ONLY**. No other connection methods will be allowed or accepted.

Lateral pipes can be plowed where ground conditions are suitable or trenched with either butt or electro fusion fittings and connections. 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 shall be High Density Polyethylene (HDPE) DR 11 PE4710).

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	13	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 11 PE4710 where maximum pressure does not exceed 160 psi;
- Sites larger than 5 acres (2.0 ha) may be conducive to looping the mainline pipe. Looping is required where practical or with the City’s permission. 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, a minimum of 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)
2in (50mm)*	49 (3.1)	69 (4.3)	59 (3.7)	1.97 (1.39)
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)

*2" Main's must be approved by Parks and Recreation prior to Design Approval.

**Larger diameter sizing will only be considered for extenuating circumstances.

15.0 ISOLATION VALVES AND ACCESSORIES

Mainline connections for 3" (150mm) gate valves shall have stainless steel hardware and shall be installed at a minimum of 6½ft (2m) spacing along the mainline from other accessories. Mainline connections for 4" or larger mainline gate valve connections shall be flanged with stainless steel bolts. 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 zones covering each sports field and separate parcels. Grouping of zone valves into a common vault is preferred 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 gasket sewer pipe, IPEX Ring-Tite or HDPE DR11

where drilled and PVC C900 or HDPE DR11 for roadway crossings. All crossings must be directionally drilled, no tunneling is allowed. 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 a minimum 2in (50mm). Roadway conduits shall extend 3ft (1m) from the hard surface edge and shall be accessible for future maintenance. Conduits may need to be extended even further in proximity to a shallow utility Utility Right-of-Way. Roadway conduits should not be installed in shrub/flower beds.

16.2 Trail and Road Crossings

The top of the conduit shall be a minimum 16in (400mm) 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 and concrete surfaces. The top of the conduit shall be a minimum 16in (400mm) 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	Nominal Conduit Pipe Size
Control Wire	2in (100mm)
1.5in (38mm)	4in (100mm)
2in (50mm)	4in (100mm)
3in (75 mm)	6in (150mm)
4in (100 mm)	8in (200mm)
6in (150 mm)	10in (250mm)

17.0 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 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.

All drawing submissions must include the following:

1. All irrigation design drawings and related calculations shall be prepared and stamped by a Certified Irrigation Designer (CID).
2. Irrigation legends shall include all components used in the design, complete with all related technical information.
3. All irrigation design drawings must include a municipal address, legal description of the property, including a registered plan number, and lot and block numbers or site and surrounding areas. If more than one address applies, refer to the location of the park's water service location.
4. An overall site plan shall be included and must show property lines, bearings, surrounding site uses, north location, on-site structures, utilities, fences, buildings, walkways and shrub bed locations.
5. 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.
6. Irrigation symbols shall be 2.5mm at full scale plot.
7. Drawings must be black and white and not contain color. Landscape elements which are not part of the irrigation system shall be shown in half tone.
8. 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.

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 drawing Legend which shows all the pertinent symbols shown on the plans.
2. A chart listing specific sprinkler information as illustrated in the attached Chart "A" – Sprinkler and Zone Information (pg.21).
3. 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 "B" – Scheduling Information (pg.21).

18.0 RECORD DRAWINGS – include O&M Manuals

At the completion of construction, an accurate survey using GPS or total station equipment is to be completed. 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 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.

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.

All record drawing submissions must include:

1. Digital files must be submitted in AutoCAD 2010 DWG format, using the 3TM coordinate system, along with the PDF file.
2. Data must conform to NAD '83 3TM coordinates, geo-referenced to the City's cadastral base.
3. Label as "As-built Irrigation System".
4. Include key plan showing location of site, including street names.
5. All elements must be part of the original drawing file, must be to scale and show the exact as-built location of the system relative to the property line, and must not have any referenced file or attachments associated with them.
6. Provide specific make, model, type and size of all components.
7. Provide an updated irrigation schedule.
8. Show all 110-volt electrical wire and 110-volt electrical conduit locations.

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

19.0 IRRIGATION HYDRAULIC CALCULATION WORKSHEET SAMPLE

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 & ZONE INFORMATION (EXAMPLE)

Zone Number	No. of Heads	Type of Heads	Nozzle Type	Gallon per Min.	Design Pressure (psi)	Valve Size (mm)	Precipitation Rate (1.5in/hr)	Min. Per Week	Min. Per Day (5 Days/Week)
1	6	Hunter I-25	#8	8.2	40	50	0.7	125	25
	2	Hunter I-25	#4	4.5	40	50	0.35	255	51
2	8	Hunter I-24	#7	7.9	40	50	0.7	255	51
3	7	Hunter PRS-30	#15	2.4	30	25	0.35	125	25
	8	Hunter PRS-30	#12	1.8	30	25	0.35	125	25

CHART "B" – 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