1. Introduction & Water Use
2. Basic Hydraulics
3. Irrigation Materials Intro
4. Irrigation Design Walkthrough
5. Pipe Sizing & Worst Case Zone
6. Irrigation Controllers
7. Legend & Construction Details
8. Construction Phase
1. Design Project Overview
2. Pipe Sizing & Worst Case Zone
3. Irrigation Controllers
4. Legend & Construction Details
5. Construction Phase
6. Alternative Water & Rainwater Harvesting
Introduction

Landscape Architecture & Irrigation Design
World Supply
- 97% of water on earth is in oceans
- 3% of water on earth is fresh water
- Less than 1% of the water on earth is readily available for human use

U.S. Supply
Shortages throughout U.S.
Climate change predicted to reduce supply
Price point of water
### Total water withdrawals, top states, 2010

[percentages calculated from unrounded values]

<table>
<thead>
<tr>
<th>State</th>
<th>Percentage of total withdrawals</th>
<th>Cumulative percentage of total withdrawals</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>Texas</td>
<td>7%</td>
<td>18%</td>
</tr>
<tr>
<td>Idaho</td>
<td>5%</td>
<td>23%</td>
</tr>
<tr>
<td>Florida</td>
<td>4%</td>
<td>27%</td>
</tr>
<tr>
<td>Illinois</td>
<td>4%</td>
<td>30%</td>
</tr>
</tbody>
</table>

#### 2010 withdrawals by category, in million gallons per day

- **Public supply**: 42,000
- **Self-supplied domestic**: 3,600
- **Irrigation**: 115,000
- **Livestock**: 2,000
- **Aquaculture**: 9,420
- **Self-supplied industrial**: 15,900
- **Mining**: 5,320
- **Thermoelectric power**: 161,000

Values do not sum to 355,000 Mgal/d because of independent rounding.

Source: USGS
Washington Water Usage – Total Withdrawals

<table>
<thead>
<tr>
<th>Year</th>
<th>Percent of Total Freshwater Withdrawals</th>
<th>Other Categories* (MGPD)</th>
<th>Public Supply* (MGPD)</th>
<th>Crop Irrigation* (MGPD)</th>
<th>Totals (MGPD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td>21%</td>
<td>1,100</td>
<td>1,050</td>
<td>3,030</td>
<td>5,870</td>
</tr>
<tr>
<td>1990</td>
<td>19%</td>
<td>1,000</td>
<td>1,160</td>
<td>3,060</td>
<td>5,400</td>
</tr>
<tr>
<td>1995</td>
<td>21%</td>
<td>1,170</td>
<td>1,180</td>
<td>3,250</td>
<td>5,400</td>
</tr>
<tr>
<td>2000</td>
<td>25%</td>
<td>1,310</td>
<td>1,020</td>
<td>3,000</td>
<td>5,330</td>
</tr>
<tr>
<td>2005</td>
<td>22%</td>
<td>1,290</td>
<td>990</td>
<td>3,500</td>
<td>5,840</td>
</tr>
<tr>
<td>Totals</td>
<td>22%</td>
<td>5,870</td>
<td>5,400</td>
<td>15,840</td>
<td></td>
</tr>
</tbody>
</table>

*In million gallons per day

Source: USGS
- Residential demand in U.S. averages more than 26 billion gallons per day.
- 59% is devoted to outdoor use (US average).
- Peak demand in hot summer months can be 1.5 – 3.0 times higher than average demand.

Source: American Water Works Association Research Foundation, End Uses of Water
Lawn Water Use Facts

- 80-90% of outdoor use goes to watering lawns and plants
- U.S. lawn obsession has resulted in significant water consumption. - Las Vegas up to 70% of residential water use
Pressure, Velocity, and Flow

Weight of Water
- Creates static pressure

Static Pressure
- Pressure of water at rest (not moving, system off)

Dynamic Pressure
- Pressure of water in motion (moving through system)
Basic Water Hydraulics

Pressure
• Force per unit area
• Psi or feet of head

Velocity
• Speed or rate of movement
• Feet per second

Flow
• Amount or discharge rate
• Gallons per minute or hour (gpm or gph)
How pressure is created by the weight of water

What water weighs at 60° F:

- 1 cubic foot (ft.\(^3\)) or 1728 cubic inches (in.\(^3\)) of water = 62.37 lb.
- 1 cubic inch, (in.\(^3\)) of water = 0.0361 lbs.

Water creates pressure in landscape irrigation systems by the accumulated weight of the water.

In Fig. 1, we can see a container 1 ft. high and 1 ft. wide, holding 1 ft.\(^3\) of water, would create a column of water 1 ft. high over every square inch on the bottom of the container.

If we look at just one of those columns, Fig. 2, we can calculate the weight of water pressing on the bottom of the column in pounds per square inch (PSI).
Important Facts

This gives us some important facts to remember. Memorize these facts:

- A column of water 1 ft. high = 1 foot of head = 0.433 PSI.
- 1.0 PSI equals the pressure created by a column of water 2.31 ft. high, or 1 PSI = 2.31 ft. of head (ft./head).
- A column of water 1 ft. high creates 0.433 PSI at the bottom, or 1 ft./head = 0.433 PSI.
Shape or size of container does not effect pressure

What does this mean in irrigation system design?
When designing landscape irrigation systems, for every 1 ft. of elevation change there will be a corresponding change of pressure of 0.433 PSI.
Static Pressure is created by elevation change or by a pump

200 ft x 0.433 psi = 86.6 psi

86.6 psi x 2.31 = 200 ft of head
A (city line) = 111 psi
B = 111 psi
C = ? psi
D = ? psi
E (meter) = 111 psi
F = ? psi
G = ? psi
A (city line) = 111 psi
B = 111 psi
C = 109.7 psi
D = 109.7 psi

E (meter) = 109.7 psi
F = 108.8 psi
G = 108.36 psi
Dynamic Pressure Exercise

Dynamic Pressure
- static pressure + friction loss
- Movement of water in pipes

Factors that affect friction loss
- Velocity
- Pipe diameter
- Roughness of inside walls of pipe
- Length of pipe
Increase velocity increases friction loss
*Approximate flow through an unrestricted 100-ft.-long section of pipe with four couplings. Pressure losses include: friction loss in pipe and couplings, velocity head and entrance losses. Exit losses not included.

The relationship of pressure and flow*
Pipe diameter change

Decrease in pipe diameter increases friction loss
Change in Pipe Roughness

Increase in pipe roughness increases friction loss

Effect of pipe wall roughness on dynamic pressure loss
Change in Length

Increase in pipe length increases friction loss
Hazen-Williams Formula

\[ H_t = 0.090194 \left( \frac{100}{C} \right)^{1.852} \frac{Q^{1.852}}{d^{4.866}} \]

Where \( H_t \) = pressure loss in pounds per square inch (PSI) per 100 ft. of pipe

- \( C \) = roughness factor
- \( Q \) = flow in gallons per minute (GPM)
- \( d \) = inside pipe diameter in inches

Most common used formula for pressure loss in irrigation

Don’t worry!
Charts are typically used for finding pressure loss in pipes
# Irrigation Association Friction Loss Chart 2008

## Schedule 40 PVC IPS Plastic Pipe

### ASTM D1785  C=150

psi loss per 100 feet of pipe

<table>
<thead>
<tr>
<th>Nominal Size</th>
<th>Avg. ID</th>
<th>Pipe OD</th>
<th>Avg. Wall</th>
<th>Min. Wall</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2&quot;</td>
<td>0.602</td>
<td>0.840</td>
<td>0.119</td>
<td>0.109</td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>0.804</td>
<td>1.050</td>
<td>0.123</td>
<td>0.113</td>
</tr>
<tr>
<td>1&quot;</td>
<td>1.029</td>
<td>1.315</td>
<td>0.143</td>
<td>0.133</td>
</tr>
<tr>
<td>1-1/4&quot;</td>
<td>1.360</td>
<td>1.660</td>
<td>0.150</td>
<td>0.140</td>
</tr>
<tr>
<td>1-1/2&quot;</td>
<td>1.590</td>
<td>1.900</td>
<td>0.155</td>
<td>0.145</td>
</tr>
<tr>
<td>2&quot;</td>
<td>2.047</td>
<td>2.375</td>
<td>0.164</td>
<td>0.154</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flow gpm</th>
<th>Velocity fps</th>
<th>psi Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.13</td>
<td>0.50</td>
</tr>
<tr>
<td>2</td>
<td>2.25</td>
<td>1.82</td>
</tr>
<tr>
<td>3</td>
<td>3.38</td>
<td>3.85</td>
</tr>
<tr>
<td>4</td>
<td>4.50</td>
<td>6.55</td>
</tr>
<tr>
<td>5</td>
<td>5.63</td>
<td>9.91</td>
</tr>
<tr>
<td>6</td>
<td>6.75</td>
<td>13.89</td>
</tr>
<tr>
<td>7</td>
<td>7.88</td>
<td>18.48</td>
</tr>
<tr>
<td>8</td>
<td>9.01</td>
<td>23.66</td>
</tr>
<tr>
<td>9</td>
<td>10.13</td>
<td>29.43</td>
</tr>
<tr>
<td>10</td>
<td>11.26</td>
<td>35.77</td>
</tr>
<tr>
<td>12</td>
<td>13.51</td>
<td>50.14</td>
</tr>
<tr>
<td>14</td>
<td>15.76</td>
<td>66.71</td>
</tr>
<tr>
<td>16</td>
<td>18.01</td>
<td>85.42</td>
</tr>
<tr>
<td>18</td>
<td>20.26</td>
<td>106.24</td>
</tr>
<tr>
<td>20</td>
<td>22.62</td>
<td>131.59</td>
</tr>
<tr>
<td>22</td>
<td>24.89</td>
<td>153.86</td>
</tr>
<tr>
<td>24</td>
<td>27.15</td>
<td>175.13</td>
</tr>
<tr>
<td>26</td>
<td>29.41</td>
<td>196.40</td>
</tr>
<tr>
<td>28</td>
<td>31.67</td>
<td>217.67</td>
</tr>
<tr>
<td>30</td>
<td>33.94</td>
<td>238.94</td>
</tr>
<tr>
<td>32</td>
<td>36.20</td>
<td>259.20</td>
</tr>
<tr>
<td>34</td>
<td>38.46</td>
<td>279.46</td>
</tr>
<tr>
<td>36</td>
<td>40.72</td>
<td>299.72</td>
</tr>
<tr>
<td>38</td>
<td>42.98</td>
<td>319.98</td>
</tr>
<tr>
<td>40</td>
<td>45.24</td>
<td>340.24</td>
</tr>
<tr>
<td>42</td>
<td>47.50</td>
<td>360.50</td>
</tr>
<tr>
<td>44</td>
<td>49.76</td>
<td>380.76</td>
</tr>
<tr>
<td>46</td>
<td>52.02</td>
<td>401.02</td>
</tr>
<tr>
<td>48</td>
<td>54.28</td>
<td>421.28</td>
</tr>
<tr>
<td>50</td>
<td>56.54</td>
<td>441.54</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flow gpm</th>
<th>Velocity fps</th>
<th>psi Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.13</td>
<td>0.50</td>
</tr>
<tr>
<td>2</td>
<td>2.25</td>
<td>1.82</td>
</tr>
<tr>
<td>3</td>
<td>3.38</td>
<td>3.85</td>
</tr>
<tr>
<td>4</td>
<td>4.50</td>
<td>6.55</td>
</tr>
<tr>
<td>5</td>
<td>5.63</td>
<td>9.91</td>
</tr>
<tr>
<td>6</td>
<td>6.75</td>
<td>13.89</td>
</tr>
<tr>
<td>7</td>
<td>7.88</td>
<td>18.48</td>
</tr>
<tr>
<td>8</td>
<td>9.01</td>
<td>23.66</td>
</tr>
<tr>
<td>9</td>
<td>10.13</td>
<td>29.43</td>
</tr>
<tr>
<td>10</td>
<td>11.26</td>
<td>35.77</td>
</tr>
<tr>
<td>12</td>
<td>13.51</td>
<td>50.14</td>
</tr>
<tr>
<td>14</td>
<td>15.76</td>
<td>66.71</td>
</tr>
<tr>
<td>16</td>
<td>18.01</td>
<td>85.42</td>
</tr>
<tr>
<td>18</td>
<td>20.26</td>
<td>106.24</td>
</tr>
<tr>
<td>20</td>
<td>22.62</td>
<td>131.59</td>
</tr>
<tr>
<td>22</td>
<td>24.89</td>
<td>153.86</td>
</tr>
<tr>
<td>24</td>
<td>27.15</td>
<td>175.13</td>
</tr>
<tr>
<td>26</td>
<td>29.41</td>
<td>196.40</td>
</tr>
<tr>
<td>28</td>
<td>31.67</td>
<td>217.67</td>
</tr>
<tr>
<td>30</td>
<td>33.94</td>
<td>238.94</td>
</tr>
<tr>
<td>32</td>
<td>36.20</td>
<td>259.20</td>
</tr>
<tr>
<td>34</td>
<td>38.46</td>
<td>279.46</td>
</tr>
<tr>
<td>36</td>
<td>40.72</td>
<td>299.72</td>
</tr>
<tr>
<td>38</td>
<td>42.98</td>
<td>319.98</td>
</tr>
<tr>
<td>40</td>
<td>45.24</td>
<td>340.24</td>
</tr>
<tr>
<td>42</td>
<td>47.50</td>
<td>360.50</td>
</tr>
<tr>
<td>44</td>
<td>49.76</td>
<td>380.76</td>
</tr>
<tr>
<td>46</td>
<td>52.02</td>
<td>401.02</td>
</tr>
<tr>
<td>48</td>
<td>54.28</td>
<td>421.28</td>
</tr>
<tr>
<td>50</td>
<td>56.54</td>
<td>441.54</td>
</tr>
</tbody>
</table>
Determining Dynamic Pressure Losses in Pipe

When calculating dynamic pressures we use the following factors:

A) Pressure change due to elevation change.  
B) Pressure loss due to friction losses in the pipe (based on the factors mentioned on p. 12).  
C) Pressure losses in valves, meters, etc. (These losses are determined by the manufacturer and listed in product literature or technical charts.)  
D) Pressure losses due to fittings. (See p. 40 for additional information.)
In the diagram below, the pipe is 1" Class 315 PVC and the flow 12 GPM. If the dynamic pressure at point A is 45 PSI, what is the dynamic pressure at point B?
Dynamic Pressure Loss Exercise

PSI gain due to elevation change = 0.433 PSI per ft. \times (80 \text{ ft.} - 40 \text{ ft.})

PSI gain due to elevation change = 0.433 PSI per ft. \times 40 \text{ ft.}

PSI gain due to elevation change = 17.32 PSI

PSI loss in pipe = 2.43 PSI loss per 100 ft. \times (99 \text{ ft.} + 45 \text{ ft.} + 65 \text{ ft.} + 36 \text{ ft.})

PSI loss in pipe = 0.0243 per ft. \times 245 \text{ ft.}

PSI loss in pipe = 5.95 PSI

\[
\begin{align*}
45.00 & \quad \text{PSI pressure at point A} \\
+17.32 & \quad \text{PSI due to elevation change} \\
\hline
62.32 & \quad \text{PSI subtotal at point B} \\
-5.95 & \quad \text{PSI due to friction loss in pipe} \\
\hline
56.37 & \quad \text{PSI dynamic pressure at point B}
\end{align*}
\]
Irrigation Design Overview

Where do I start?

Schematic walkthrough of system

Materials review
Gather Site & System Information

Site Information
- Vegetation to be irrigated
- Soil type
- Slope
- Utilities
- Obstructions

Water Source Information
- Source type, single or multiple
- Code and regulations
- Static pressure at site
What will be irrigated?  Landscape Plan
Plant Types

Is it this?

Or this?
# Soil Type and Intake Rates

<table>
<thead>
<tr>
<th>SOIL TEXTURE</th>
<th>SOIL INTAKE RATES (inches per hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 to 5% slope</td>
</tr>
<tr>
<td></td>
<td>Cover</td>
</tr>
<tr>
<td>Coarse sandy soils</td>
<td>2.00</td>
</tr>
<tr>
<td>Coarse sandy soils over compact subsoils</td>
<td>1.75</td>
</tr>
<tr>
<td>Uniform light sandy loams</td>
<td>1.75</td>
</tr>
<tr>
<td>Light sandy loams over compact subsoils</td>
<td>1.25</td>
</tr>
<tr>
<td>Uniform silt loams</td>
<td>1.00</td>
</tr>
<tr>
<td>Silt loams over compact subsoil</td>
<td>0.60</td>
</tr>
<tr>
<td>Heavy clay or clay loam</td>
<td>0.20</td>
</tr>
</tbody>
</table>

## Soil Intake Rates for Various Soil Textures

**Figure 52**

The maximum precipitation-rate values listed are as suggested by the United States Department of Agriculture. The values are average and may vary with respect to actual soil conditions and condition of the ground cover.
Soil Type and Intake Rates

**Sandy Loam**
- 15m
- 40m
- 60m

**Clay Loam**
- 4 hr
- 24 hr
- 48 hr

**Distance from center of furrow (inches)**

**Distance from surface (inches)**

Infiltration of two different soil types measured in time and area wetted.
Water Source

Where are you getting your water from?
- City or public supply
- Rainwater harvest tank
- Pond or lake
- Well

Items to know
- Codes and regulations
- Water quality
- Static pressure at site / pump needed?
Codes & Regulations

- Typically found in landscape code section
- Be sure and check water code for other requirements
- City of Spokane example
  - Minimal code language and regulations
- City of Bellevue example
  - Significant code requirements
Site & System Information

Codes & Regulations
Spokane

- Sections 17C.200.100 & 17C.200.110
- Automatic irrigation is required in public spaces
- Water conservation measures (section 110)

Hydrozones
Soil amendments
Lawn controls
Existing vegetation retention
Codes & Regulations
Bellevue

- Sections 20.20.520 - Landscape Code
  - Irrigation plan required

- Section 24.02.205 – Irrigation Water Budget Requirement

- Specific requirements and calculations
Connecting to a water source

Typical Components

- Source / City supply line
- Service tap
- Meter (shared, deduct, isolated)
- Backflow prevention
- Flow sensor, master valve, quick coupler
SCHEMATIC POINT OF CONNECTION

1-1/2" SCH 40 P.Y.C. MAINLINE TO ZONES

RAINBIRD 33DLRC QUICK COUPLING VALVE

FEBCO 825Y 1" BACKFLOW PREVENTER
BACKFLOW PREVENTOR

1-1/2" GATE VALVE

1" IRRIGATION METER

CITY SERVICE LINE
Seattle Parks POC

- (SIZE)** SCHEDULE 40 PVC MAINLINE TO AUTOMATIC CONTROL VALVES
- 5X PIPE I.D. MIN. CLEARANCE REQUIRED TO FIRST JOINT OR FITTING
- (SIZE)** RAINBIRD FS-220P FLOW SENSOR IN VALVE BOX
- 10X PIPE I.D. MIN. CLEARANCE REQUIRED TO FLOW SENSOR
- (SIZE)** SUPERIOR MODEL 3100 (NORMALLY CLOSED) MASTER VALVE IN VALVE BOX
- (SIZE)** BRASS PIPE FROM PRV TO MASTER VALVE
- 1” BUCKNER QB44LRC-10 QUICK COUPLING VALVES IN 10” DIA. ROUND BOX (AS REQUIRED)
- (SIZE)** SEPARATE SCH.40 PVC OR HDPE MAINLINE FOR QUICK COUPLING VALVES (AS REQUIRED TYP.)
- (SIZE)** FEBCO MODEL 805Y DOUBLE CHECK ASSEMBLY
- (FOR 1–1/2” & LARGER SIZE) FOGTITE MODEL #25-TA CONCRETE VAULT WITH LOCKING LIDS
- (”3/4”) MUELLER STOP/WASTE VALVE & TYPE ‘K’ COPPER LINE TO DRINKING FOUNTAIN (WHEN APPLICABLE)
- (SIZE)** WILKINS 600 SERIES COMBINED PRESSUREREDUCING VALVE & STRAINER
- (SIZE)** BRASS PIPE FROM GATE VALVE TO PRV
- (SIZE)** KENNEDY, MUELLER OR HAMMOND BRONZE GATE VALVE IN CAST IRON BOX
- (SIZE)** BRASS PIPE FROM DEDUCT METER TO GATE VALVE
- (SIZE)** DEDUCT METER WITH SETTER IN METAL METER BOX
- (SIZE)** TYPE ‘K’ COPPER PIPE FROM METER TO GATE VALVE
- (SIZE)** TYPE ‘K’ COPPER PIPE TO BUILDING, ETC. (WHEN APPLICABLE)
- (SIZE)** MAIN WATER METER/SETTER IN METAL METER BOX (BY SPU)
- (SIZE)** WATER SERVICE MAINLINE (BY SPU)
Water Meter

- Cut-off Valve
- Leak Indicator

(open/closed states)
Backflow Assembly Anatomy

- Test cocks
- If either handle is *not* in this position then the system is not being supplied with water.

- Inflow from Main Water Source
- Water Flow Direction
- Butterfly handle - open position.
- Outflow to Sprinkler System
Series 850
Double Check Valve Assemblies
Size: ½" - 2" (15mm - 50mm)

The FEBCO Series 850 Double Check Valve Assemblies are designed for non-health hazard applications. End Connections – NPT ANSI / ASME B1.20.1

Pressure – Temperature
Max. Working Pressure: 175psi (12.1 bar)
Hydrostatic Test Press.: 350psi (24.1 bar)
Temperature Range: 32°F to 140°F (0°C to 60°C)

Materials
- Valve Body: Bronze
- Elastomers: Silicone
- Springs: Stainless Steel

Models
- Wye - Strainer

Approvals – Standards
- ANSI/AWWA Conformance (C510-92)
- Approved by the Foundation for Cross-Connection Control and Hydraulic Research at the University of Southern California.
Master Valve Connection
Types of sprinkler heads
- Pop-up spray head
- Rotor head
- Impact head

Selection & Layout Considerations
- Vegetation type
- Size of landscape bed
- Precipitation rate
- Soil type
- Client desires
- Codes and regulations
Pop-Up Spray Head

- Typically used in smaller spaces
- 5ft – 18ft throw radius
- 15 – 70 psi range
- 30 psi optimum
- High precipitation rates
- Wide selection of nozzles
- Most common sprinkler
- 4”, 6”, and 12” sizes
Rotor Head

- Typically used in larger planting areas or lawns
- 17ft – 80ft throw radius
- 30 – 100 psi range
- 50 psi optimum
- Low precipitation rates
- Wide selection of nozzles and models
- 5”, 6”, and 10” sizes
Head Layout & Precipitation Rate

1 gpm
2 gpm
4 gpm

gpm = gallons per minute
Head Layout & Precipitation Rate

\[
PR = \frac{96.3 \times \text{gpm (applied to the area)}}{S \times L}
\]

\[
\left( \frac{PR = 1000 \times \text{m}^3/\text{h} \ [\text{applied to the area}]}{S \times L} \right)
\]

Where:

- \(PR\) = the average precipitation rate in inches per hour
- 96.3 = a constant which incorporates inches per square foot per hour
- \(gpm\) = the total gpm applied to the area by the sprinklers
- \(S\) = the spacing between sprinklers
- \(L\) = the spacing between rows of sprinklers
- \(PR\) = the average precipitation rate in millimeters per hour
- 1000 = a constant which converts meters to millimeters
- \(m^3/\text{h}\) = the total \(m^3/\text{h}\) applied to the area by the sprinklers
- \(S\) = the spacing between sprinklers
- \(L\) = the spacing between rows of sprinklers
Head Layout & Precipitation Rate

Figure 43: Square sprinkler spacing pattern with full circle sprinkler

The formula for this example would be:

$$PR = \frac{96.3 \times 4.4 \text{ gpm}}{40 \text{ ft} \times 40 \text{ ft}} = \frac{423.72}{1600} = 0.2648 \text{ in/h}$$

$$PR = \frac{1000 \times 1 \text{ m}^3/\text{h}}{12 \text{ m} \times 12 \text{ m}} = \frac{1000}{144} = 6.94 \text{ mm/h}$$
Spray sprinklers have fixed arcs of coverage and some have matched precipitation rates. Let’s look at a PR calculation for four spray sprinklers in the corner of a lawn area with these statistics:

Spacing: S = 11 ft (3 m), L = 12 ft (4 m)
Operating pressure at the sprinklers = 25 psi (1.7 bar)
Radius of throw = 11 ft (3 m), regardless of pattern
Discharge: Full circle = 2.4 gpm (0.56 m³/h)
Half circle = 1.2 gpm (0.28 m³/h)
Quarter circle = .6 gpm (0.14 m³/h)

The spacing pattern might look like this:

![Diagram of spacing pattern with labels for full circle, half circle, and quarter circle discharges with specified radii and spacings.]

Figure 45: PR calculation for four spray heads
Factors to consider when creating a zone

- Number of heads in zone (GPM cap)
- Valve location and size
- Mainline routing
- Landscape types and hydrozone considerations
- Calculate GPM (or GPH for drip)
Creating Spray Head & Rotor Zones

GPM Cap

- Meter flow
- Mainline size
- Valve size
- What is the bottleneck that controls GPM per zone?
Valves, Types, and Sizing

- Valve types
- Valve sizes (gpm cap)
- Valve location (on plan and in field)
- Station numbering
Zone 1

Lateral layout
Irrigation Demand & Water Budget

How do we determine water needs for site?
- Vegetation type
- Soil type
- Irrigated area
- Evapotranspiration rate
- Irrigation efficiency

Water Budget Calculations
- Required in California and other arid locations
- City of Bellevue Example
Determining the Landscape’s Irrigation Water Budget & Total Estimated Water Use

A. A landscape design’s IWB shall be calculated based upon the total square footage of the proposed landscape area, excluding retained native vegetation areas and impervious surfaces, using the following formula:

\[ \text{IWB} = \text{ET} \times \text{AF} \times \text{LA} \times \text{CF} \]

**IWB**: Irrigation Water Budget allowed.

**ET**: Evapotranspiration Rate of 14.49 inches (per irrigation season, see Section W3-12.3).

**AF**: Adjustment Factor of 0.8 (0.5/0.625 irrigation efficient).

**LA**: Landscape Area in square feet.

**CF**: Conversion Factor of 0.62 (inches to gallons per square foot).
City of Bellevue Water Budget Calculations

Provided Evapotranspiration (ET) Rates

<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.59</td>
<td>3.13</td>
<td>4.46</td>
<td>3.51</td>
<td>1.77</td>
<td>0.03</td>
<td>0.00</td>
<td>0.00</td>
<td>14.49</td>
</tr>
</tbody>
</table>
4351 SF of landscape area

IWB = ET x AF x LA x CF
IWB = 14.49 x 0.8 x 4351 x 0.62

Where
ET = 14.49 in
AF = 0.8
LA = 4351 sf
CF = 0.62

**IWB = 31,271 gallons**
City of Bellevue Water Budget Calculations

\[
EWU = \frac{(ET \times PF \times HA \times CF)}{IE}
\]

EWU: Estimated Water Use (for each hydrozone)

ET: Evapotranspiration Rate of 14.49 inches (per irrigation season, see Section W3-12.3).

PF: Plant Factor value for hydrozone (see Section W3-12.4).

HA: Hydrozone Area in square feet.

CF: Conversion Factor of 0.62 (inches to gallons per square foot).

IE: Irrigation Efficiency value for hydrozone (see Section W3-12.5).
What is a Hydrozone?

- Planting areas with similar water demands
- Lawns and Turf
- Native areas
- Parking lots
- Shady areas
Aberdeen Starbucks Water Budget

Compile Hydrozones

4351 SF of total landscape area

3 Hydrozones

HZ1 (Street frontage) = 2685 sf
HZ2 (drip area) = 514 sf
HZ3 (north building area) = 1152 sf
Hydrozone 1 Calculations

\[ EWU = \frac{(ET \times PF \times HA \times CF)}{IE} \]

Where
\[ ET = 14.49 \text{ in} \]
\[ PF = ? \]
\[ HA = 2685 \text{ sf} \]
\[ CF = 0.62 \]
\[ IE = ? \]
## City of Bellevue Water Budget Calculations

<table>
<thead>
<tr>
<th>BASIC PLANT FACTOR CLASS</th>
<th>PF RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low water use plants</td>
<td>0.0 to 0.3</td>
</tr>
<tr>
<td>Medium water use plants</td>
<td>0.4 to 0.6</td>
</tr>
<tr>
<td>High water use plants</td>
<td>0.7 to 1.0</td>
</tr>
<tr>
<td>All irrigated turf grass</td>
<td>0.8 to 1.0</td>
</tr>
</tbody>
</table>

### Type of Irrigation System Used in Hydrozone

<table>
<thead>
<tr>
<th>Efficiency Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Overhead Spray System: (i.e.: rotors and pop-up spray systems; most commonly used to irrigate turf, but also used in plant beds)</td>
</tr>
<tr>
<td>Low Volume or Drip Irrigation System: (i.e.: micro-spray, bubbler, drip, or other low volume systems which apply water below the ground surface, or directly to the plants root zone; most commonly used</td>
</tr>
</tbody>
</table>
Hydrozone 1 Calculations

$$\text{EWU} = \frac{(\text{ET} \times \text{PF} \times \text{HA} \times \text{CF})}{\text{IE}}$$
$$\text{EWU} = \frac{(14.49 \times 0.6 \times 2685 \times 0.62)}{0.625}$$

Where

- ET = 14.49 in
- PF = 0.6
- HA = 2685 sf
- CF = 0.62
- IE = 0.625

$$\text{EWU (HZ1)} = 23,157 \text{ gallons}$$
Aberdeen Starbucks Water Budget

Run Hydrozone 2 and Hydrozone 3 Calculations to get Site EWU.

HZ2 (drip area) = 514 sf
HZ3 (north building area) = 1152 sf

EWU = (ET x PF x HA x CF) / IE

Site EWU = EWU1 (23,157) + EWU2 + EWU3

Site EWU must be less than IWB of 31,271 gallons
Drip irrigation benefits and types

- Extremely efficient
- Low precipitation rates
- Commercial & Residential Grades
- Dripline and Drip tube
Drip Irrigation

Drip irrigation challenges

• Commercial applications – dripline tubing
• Exposed tubing, tripping hazard
• Leak detection, difficult to spot puncture
• Monitoring and Maintenance
Drip Irrigation

Dripline with Emitters

• Irrigates at the source
• Extremely efficient
• Low precipitation rates
Dripline Layout

- Supply Header
- XF Series Dripline Laterals
- Control Zone Kit in Valve Box
- Flush Valve
- Flush Header
- Dripline Lateral Run Length
- From Water Source
- Insert or Compression Fittings
## Dripline Selection

### TABLE 5: APPLICATION RATE

<table>
<thead>
<tr>
<th>Emitter Spacing</th>
<th>12”</th>
<th>13”</th>
<th>14”</th>
<th>15”</th>
<th>16”</th>
<th>17”</th>
<th>18”</th>
<th>19”</th>
<th>20”</th>
<th>22”</th>
<th>24”</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lateral Row Spacing (in Inches)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12”</td>
<td>0.96</td>
<td>0.89</td>
<td>0.83</td>
<td>0.77</td>
<td>0.72</td>
<td>0.68</td>
<td>0.64</td>
<td>0.61</td>
<td>0.58</td>
<td>0.53</td>
<td>0.48</td>
</tr>
<tr>
<td>18”</td>
<td>0.64</td>
<td>0.59</td>
<td>0.55</td>
<td>0.51</td>
<td>0.48</td>
<td>0.45</td>
<td>0.43</td>
<td>0.40</td>
<td>0.39</td>
<td>0.35</td>
<td>0.32</td>
</tr>
<tr>
<td>24”</td>
<td>0.48</td>
<td>0.44</td>
<td>0.41</td>
<td>0.39</td>
<td>0.36</td>
<td>0.34</td>
<td>0.32</td>
<td>0.30</td>
<td>0.29</td>
<td>0.26</td>
<td>0.24</td>
</tr>
</tbody>
</table>

**0.6 GPH Emitter Flow (Inches per hour)**

<table>
<thead>
<tr>
<th>Emitter Spacing</th>
<th>12”</th>
<th>13”</th>
<th>14”</th>
<th>15”</th>
<th>16”</th>
<th>17”</th>
<th>18”</th>
<th>19”</th>
<th>20”</th>
<th>22”</th>
<th>24”</th>
</tr>
</thead>
<tbody>
<tr>
<td>12”</td>
<td>1.44</td>
<td>1.33</td>
<td>1.24</td>
<td>1.16</td>
<td>1.08</td>
<td>1.02</td>
<td>0.96</td>
<td>0.91</td>
<td>0.87</td>
<td>0.79</td>
<td>0.72</td>
</tr>
<tr>
<td>18”</td>
<td>0.96</td>
<td>0.89</td>
<td>0.83</td>
<td>0.77</td>
<td>0.72</td>
<td>0.68</td>
<td>0.64</td>
<td>0.61</td>
<td>0.58</td>
<td>0.53</td>
<td>0.48</td>
</tr>
<tr>
<td>24”</td>
<td>0.72</td>
<td>0.67</td>
<td>0.62</td>
<td>0.58</td>
<td>0.54</td>
<td>0.51</td>
<td>0.48</td>
<td>0.46</td>
<td>0.43</td>
<td>0.39</td>
<td>0.36</td>
</tr>
</tbody>
</table>

**0.9 GPH Emitter Flow (Inches per hour)**

<table>
<thead>
<tr>
<th>Emitter Spacing</th>
<th>12”</th>
<th>13”</th>
<th>14”</th>
<th>15”</th>
<th>16”</th>
<th>17”</th>
<th>18”</th>
<th>19”</th>
<th>20”</th>
<th>22”</th>
<th>24”</th>
</tr>
</thead>
<tbody>
<tr>
<td>12”</td>
<td>1.44</td>
<td>1.33</td>
<td>1.24</td>
<td>1.16</td>
<td>1.08</td>
<td>1.02</td>
<td>0.96</td>
<td>0.91</td>
<td>0.87</td>
<td>0.79</td>
<td>0.72</td>
</tr>
<tr>
<td>18”</td>
<td>0.96</td>
<td>0.89</td>
<td>0.83</td>
<td>0.77</td>
<td>0.72</td>
<td>0.68</td>
<td>0.64</td>
<td>0.61</td>
<td>0.58</td>
<td>0.53</td>
<td>0.48</td>
</tr>
<tr>
<td>24”</td>
<td>0.72</td>
<td>0.67</td>
<td>0.62</td>
<td>0.58</td>
<td>0.54</td>
<td>0.51</td>
<td>0.48</td>
<td>0.46</td>
<td>0.43</td>
<td>0.39</td>
<td>0.36</td>
</tr>
</tbody>
</table>
Dripline Selection

### TABLE 1: OVERALL DESIGN PLAN FOR THE SITE

<table>
<thead>
<tr>
<th>Percent of Slope</th>
<th>Soil Infiltration Rates in Inches per Hour</th>
<th>Soil Infiltration Rates in CM per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Clay</td>
<td>Loam</td>
</tr>
<tr>
<td>0% - 4%</td>
<td>0.13 - 0.44</td>
<td>0.44 - 0.88</td>
</tr>
<tr>
<td>5% - 8%</td>
<td>0.1 - 0.35</td>
<td>0.35 - 0.7</td>
</tr>
</tbody>
</table>

**Note:** As the slope increases, infiltration rates will continue to decrease. These values are derived from USDA information.

### DETERMINE SOIL TYPE

**WHAT IS YOUR SOIL TYPE?**

The objective of a well-designed dripline system is to create an even wetting pattern of water in the soil throughout the planting zone. There are four factors to consider for planting areas to create an even wetting pattern:

- Soil type (Clay, Loam, Sand)
- Emitter flow rate (0.6 GPH or 0.9 GPH / 2.3 l/hr or 3.4 l/hr)
- Emitter spacing (12", 18" or 24" / 0.30m, 0.45m or 0.61m)
- Lateral spacing (distance between the dripline rows)

These illustrations show water movement in a sub-surface application. These guidelines apply to on-surface as well as sub-surface installations.
## Dripline Selection

### TECHLINE® CV General Guidelines

#### Table 1

<table>
<thead>
<tr>
<th></th>
<th>TURF</th>
<th>SHRUB and GROUND COVER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Clay Soil</td>
<td>Loam Soil</td>
</tr>
<tr>
<td>Dripper Flow</td>
<td>0.26 GPH</td>
<td>0.4 GPH</td>
</tr>
<tr>
<td>Dripper Interval</td>
<td>18&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>Lateral (Row) Spacings</td>
<td>18&quot; - 22&quot;</td>
<td>18&quot; - 22&quot;</td>
</tr>
<tr>
<td>Burial Depth</td>
<td>Bury evenly throughout the zone 4&quot; to 6&quot;</td>
<td>On-surface or bury evenly throughout the zone to a maximum of 6 inches</td>
</tr>
<tr>
<td>Application Rate (in./hr.)</td>
<td>.19 - .15</td>
<td>.43 - .35</td>
</tr>
<tr>
<td>Time to Apply 1/4&quot; of Water (in minutes)</td>
<td>79 - 100</td>
<td>35 - 43</td>
</tr>
</tbody>
</table>

Maximum spacing recommendations: Following these spacing guidelines, dripper flow selection can be increased if desired by the designer.
### TABLE 3: Calculating Zone Water Requirements

#### XF Series Dripline Flow (per 100 feet)

<table>
<thead>
<tr>
<th>Emitter Spacing</th>
<th>0.6 GPH Emitter</th>
<th>0.9 GPH Emitter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inches</td>
<td>GPH</td>
<td>GPM</td>
</tr>
<tr>
<td>12”</td>
<td>61.00</td>
<td>1.02</td>
</tr>
<tr>
<td>18”</td>
<td>41.00</td>
<td>0.68</td>
</tr>
<tr>
<td>24”</td>
<td>31.00</td>
<td>0.52</td>
</tr>
</tbody>
</table>

#### XF Series Dripline Flow (per 100 Meters)

<table>
<thead>
<tr>
<th>Emitter Spacing</th>
<th>2.31 L/Hr</th>
<th>3.41 L/Hr</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L/Hr</td>
<td>L/Min</td>
</tr>
<tr>
<td>Meters</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.30</td>
<td>757.9</td>
<td>12.6</td>
</tr>
<tr>
<td>0.46</td>
<td>502.2</td>
<td>8.37</td>
</tr>
<tr>
<td>0.61</td>
<td>378.7</td>
<td>6.31</td>
</tr>
</tbody>
</table>
# Dripline Valve Kits

## Flow Range

<table>
<thead>
<tr>
<th>Filter Type</th>
<th>0.2 GPM to 5.0 GPM</th>
<th>3.0 GPM to 15.0 GPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure Regulating Manual Flush</td>
<td>Pressure Regulating Manual Flush</td>
<td></td>
</tr>
</tbody>
</table>

## Dripline Valve Kits Features

<table>
<thead>
<tr>
<th>Model #</th>
<th>XCZ-075-PRF</th>
<th>XCZ-LF-100-PRF</th>
<th>XCZ-100-PRF</th>
</tr>
</thead>
<tbody>
<tr>
<td>XACZ-075-PRF</td>
<td>Anti-Siphon</td>
<td>Anti-Siphon</td>
<td>Anti-Siphon</td>
</tr>
<tr>
<td>Valve</td>
<td>Low Flow</td>
<td>Low Flow</td>
<td>DV or Anti-Siphon</td>
</tr>
<tr>
<td>Inlet x Outlet Size</td>
<td>3/4&quot; FPT x 3/4&quot; MPT</td>
<td>1&quot; FPT x 3/4&quot; MPT</td>
<td>1&quot; FPT x 1&quot; MPT</td>
</tr>
<tr>
<td>Inlet Pressure</td>
<td>20 to 120 PSI (1.38 to 8.28 bar)</td>
<td>20 to 120 PSI (1.38 to 8.28 bar)</td>
<td></td>
</tr>
<tr>
<td>Regulating Pressure</td>
<td>30 PSI (2 bar)</td>
<td>40 PSI (2.7 bar)</td>
<td></td>
</tr>
<tr>
<td>Filter</td>
<td>200 Mesh Stainless Steel (75 micron)</td>
<td>200 Mesh Stainless Steel (75 micron)</td>
<td></td>
</tr>
<tr>
<td>Replacement Filter</td>
<td>RBY200SSMX</td>
<td>RBY200SSMX</td>
<td></td>
</tr>
</tbody>
</table>
Dripline Valve Kits
DRIP IRRIGATION INFORMATION

1. Irrigation contractor shall adhere to manufacturer specifications regarding design and installation of the drip irrigation system.

2. Adjust dripper spacing for individual planting requirements.

3. Product to be Rainbird Landscape Dripline or Equal.

4. Operating pressure range 8 to 60 PSI. System designed for 35 PSI.

DRIP IRRIGATION ZONE INFORMATION

1. Drip line spacing 18"

2. Emitter spacing 18"

3. Emitter discharge 0.6 GPH

4. Dripline to be Rainbird LD-06-18-500

5. Maximum lateral length to be 435 FT at 35 PSI.

6. Valve to be Rainbird Control Zone Kit XACZ-075.
Drip Irrigation

Drip Zone Calculations

Get total length of dripline in zone
385 ft at Aberdeen site

Divide by emitter spacing to get # of emitters
385’ / 1.5’ = 257

Multiply # of emitters by dripline GPH
257 * .6 gph = 154.2 zone gph

Divide total by 60 to convert to minutes
154.2 / 60 = 2.57 gpm
Pipe Sizing & Worst Case Zone

- Showing pipe sizes for proper system function
- 5 feet per second rule
- Friction loss charts are our friends!
- Adjust pipe sizes as necessary to minimize cost
- Run pressure loss calculations on your worst zone
Pipe Sizing Example

Main Line

A 1 ¼”  B 1”  C ¾”  D ½”  E

50’  50’  50’  50’

20 gpm  15 gpm  10 gpm  5 gpm

Typical Sprinkler Lateral
Pipe Sizing Example

Each Head is 5 GPM

Static pressure is 60 psi

Need 50 psi at each head to function

50’ spacing and lateral length

Use 5 FPS rule and size each lateral section

Start at mainline and work out
Pipe Sizing Example

20 GPM flow for first lateral section

Friction loss chart shows 1-1/4” meets 5 FPS rule

Friction loss is 1.51 psi per 100 ft
15 GPM flow for first second lateral section

Friction loss chart shows 1” meets 5 FPS rule

Friction loss is 3.11 psi per 100 ft

Now at 57.74 psi
Pipe Sizing Example

<table>
<thead>
<tr>
<th></th>
<th>PVC Schedule 40</th>
<th>PVC Class 200</th>
<th>Polyethylene Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4&quot;</td>
<td>8 GPM</td>
<td>3/4&quot;</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>1&quot;</td>
<td>13 GPM</td>
<td>1&quot;</td>
<td>1&quot;</td>
</tr>
<tr>
<td>1 1/4&quot;</td>
<td>22 GPM</td>
<td>1 1/4&quot;</td>
<td>1 1/4&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16 GPM</td>
<td>13 GPM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>26 GPM</td>
<td>22 GPM</td>
</tr>
</tbody>
</table>
Worst Case Zone

- Find valve with highest GPM
- Find valve farthest away from water source
- Calculate friction loss to the last head on zone
- Include pressure demand at head
- Compare to available pressure
- Does it work?
Irrigation Controllers

- Selecting a Controller
- Locating the Controller
- Power & Wiring Requirements
- Central Controls
- Water Conservation Features
  - Cycle & Soak
  - ET based
  - Rain shut off device
Irrigation Controllers

Locating the Controller on the Plan / Site

• Power Requirements
• Maintenance and Access
• Wire Routing and Distance
• Inside / Outside
• Client Preference
Irrigation Controllers

Wiring Types and Sizes

• Wire gauge & distances
• Connections & Splicing
• Wire Routing and Distance
Wires come in different sizes. The maximum current each size can conduct safely is shown.
## Wire Sizing

<table>
<thead>
<tr>
<th>Wire and Cable Gauge</th>
<th>Amps</th>
<th>Max Wattage Load</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>14-gauge</td>
<td>15 amps</td>
<td>1440 watts (120 volts)</td>
<td>Common residential wiring: Light fixtures, receptacles</td>
</tr>
<tr>
<td>12-gauge</td>
<td>20 amps</td>
<td>1920 watts (120 volts) 3840 watts (240 volts)</td>
<td>Common residential wiring: Light fixtures, receptacles, small appliances like a microwave</td>
</tr>
<tr>
<td>10-gauge</td>
<td>30 amps</td>
<td>2880 watts (120 volts) 5760 watts (240 volts)</td>
<td>Large appliances: Window a/c unit, clothes dryer</td>
</tr>
<tr>
<td>8-gauge</td>
<td>40 amps</td>
<td>7680 watts (240 volts)</td>
<td>Large appliances: Electric range, central a/c</td>
</tr>
<tr>
<td>6-gauge</td>
<td>50 amps</td>
<td>9600 watts (240 volts)</td>
<td>Large appliances: Central a/c, electric furnace</td>
</tr>
</tbody>
</table>
Finalizing a Design

- Legend & Notes
- Construction Details
- Re-visit code requirements
- Specifications
IRRIGATION LEGEND

- **Rainbird Drip Irrigation Valve** (Control Zone Kit - See Notes Below)
- **Rainbird Drip-Pak-8 Series Valve** (Size 48-60 Noted)
- **Class 200 PVC Laterals**
- **8x6 PVC 3" Mainline**
- **Rainbird Landscape Dripline (See Notes L2-2)**
- **Rainbird ESP-NC-8 Automatic Clock/Controller Wall Mount**
- **Rainbird 33 DLRG 3/4" Quick Coupling Valve**
- **4" Min. Class 200 PVC Sleeve**
- **Point of Connection (See Schematic Below)**
- **1" Water Meter Per City Standards**

HEAD KEY

- **Rainbird 182-541 5" Rad Half Circle** (185 GPM @ 30 PSI)
- **Rainbird 182-541 5" Rad Gtr Circle** (220 GPM @ 30 PSI)
- **Rainbird 182-541 7" Rad Half Circle** (350 GPM @ 30 PSI)
- **Rainbird 182-541 7" Rad Gtr Circle** (420 GPM @ 30 PSI)
- **Rainbird 182-541 10" Rad Full Circle** (650 GPM @ 30 PSI)
- **Rainbird 182-541 10" Rad 3/4 Circle** (450 GPM @ 30 PSI)
- **Rainbird 182-541 14" Rad Half Circle** (875 GPM @ 30 PSI)
- **Rainbird 182-541 18" Rad Gtr Circle** (825 GPM @ 30 PSI)
- **Rainbird 182-541 5" Rad Full Circle** (950 GPM @ 30 PSI)
- **Rainbird 182-541 5" Rad Gtr Circle** (1025 GPM @ 30 PSI)
- **Rainbird 182-541 4"x8' Side Strip** (120 GPM @ 30 PSI)
- **Rainbird 182-541 4"x8' End Strip** (65 GPM @ 30 PSI)

Schematic Point of Connection

- 1-1/2" 8x6 PVC Mainline to Zones
- Rainbird 33 DLRG 3/4" Quick Coupling Valve
- Ferroco 60x48 1" Backflow Preventer
- 1-1/2" Gate Valve
- 1" Irrigation Meter
- City Service Line

GENERAL NOTES

1. All shrub area pop-up spray heads to be 6" height.
2. All piping is diagrammatic in nature to show trenches where possible. Separate common piping by 6" max.
3. Adjust spray pattern for maximum coverage and minimum overspray.
4. Irrigation Contractor to provide irrigation clock/controller (Verify location prior to beginning bored)
5. General Contractor to provide and install all conduit to clock location.
6. General Contractor to provide power source for clock (Verify location prior to beginning bored)
7. Irrigation Contractor is responsible for locating all public and private utilities within the project area prior to construction. Notify landscape architect of all discrepancies.
8. Contractor shall comply with all applicable codes and appropriate safety regulations.

VALVE KEY

- **Valve Sequence Number 1 Controller ID**
- **Valve Size**
- **Gallons Per Minute**

DRIP IRRIGATION INFORMATION

1. Irrigation Contractor shall adhere to manufacturer specifications regarding design and installation of the drip irrigation system.
2. Adjust dripper spacing for individual planting requirements.
3. Product to be Rainbird landscape dripline or equivalent.
4. Operating pressure range 8 to 60 PSI, system designed for 30 PSI

DRIP IRRIGATION ZONE INFORMATION

1. Drip line spacing 18".
2. Emitter spacing 18".
3. Emitter discharge 0.6 GPH.
4. Drip line to be Rainbird LD-066-18-BD80.
5. Maximum lateral length to be 435 ft at 30 PSI.
6. Valve to be Rainbird Control Zone Kit RACE-076.
Lessons Learned

- Be sure to coordinate
  Architect, Landscape arch, civil, owner, contractor
- Know when you don’t know
- Power and controls, who does it?
- Contractor qualification
- Follow through, stay involved
QUESTIONS ??

End of Session

See you in two weeks!

v-dahilg@microsoft.com
(425) 445-7397