Business Case For Irrigation Technology

Subsurface Irrigation
Kelly Keicher ASLA
Goal of Drip Irrigation

Drip irrigation meets the water and nutrient needs of landscape plant material by precisely delivering water and chemicals directly to the active root zone of the plant in a timely fashion.
Advantages of Drip Irrigation

Highly Efficient

- Sprays  35% to 60% Distribution Uniformity (DU)
- Rotors  45% to 70% Distribution Uniformity (DU)
- Rainfall 92% to 95% Distribution Uniformity (DU)
- Drip  92% to 98% Distribution Uniformity (DU)

Lower pressure requirement

No overspray

No water window
Soil Water Movement

Water applied to soil moves by:

- **Infiltration:**
  - Due to gravitational forces
  - Capillary

- **Redistribution:**
  - due to soil tension
  - Slow movement; flow toward dryer soil
Inline Drip

Typical Inline Options:

- Pressure compensating
- Check valves
- Flow rates – per soil type
- Spacing's – 12”, 18”, 24”
- Different Coils sizes
Applications

Efficiently Irrigates Odd Shaped Areas
Typical Layouts

“LITE” – on surface

Grid Layout - subsurface
Basic Design Review

- You should already know how to use drip in planting beds.
- The major difference between designing an irrigation system using sprays and rotors and drip is determining the type of soil before you do the drip design.
- The soil tells us what emitter flow and spacing to use, how far apart the rows should be.
- The type of plant material determines the length of irrigation cycles.
Design Guidelines

1. What Plant material are you irrigating
2. What is your soil type
3. These two questions decides for us the emitter flowrate, emitter spacing and row spacing of the tubing

<table>
<thead>
<tr>
<th>GENERAL GUIDELINES</th>
<th>TURF</th>
<th></th>
<th></th>
<th></th>
<th>SHRUB &amp; GROUNDCOVER</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>CLAY SOIL</td>
<td>LOAM SOIL</td>
<td>SANDY SOIL</td>
<td>COARSE SOIL</td>
<td>CLAY SOIL</td>
<td>LOAM SOIL</td>
<td>SANDY SOIL</td>
<td>COARSE SOIL</td>
</tr>
<tr>
<td>Emitter Flow</td>
<td>0.33 GPH</td>
<td>0.53 GPH</td>
<td>0.77 GPH</td>
<td>1.16 GPH</td>
<td>0.33 GPH</td>
<td>0.53 GPH</td>
<td>0.77 GPH</td>
<td>1.16 GPH</td>
</tr>
<tr>
<td>Emitter Spacing</td>
<td>18”</td>
<td>12”</td>
<td>12”</td>
<td>12”</td>
<td>18”</td>
<td>18”</td>
<td>12”</td>
<td>12”</td>
</tr>
<tr>
<td>Lateral (Row) Spacing</td>
<td>18” 20” 22” 12” 18” 20” 12” 14” 16” 12” 14” 16”</td>
<td>18” 21” 24” 18” 21” 24” 16” 18” 20” 16” 18” 20”</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Burial Depth</td>
<td>Bury evenly throughout the zone from 4” to 6”</td>
<td>On-surface or bury evenly throughout the zone to a maximum of 6”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application Rate (Inches/Hour)</td>
<td>0.24 0.21 0.19 0.85 0.56 0.51 1.23 1.05 0.92 1.86 1.60 1.40</td>
<td>0.24 0.20 0.18 0.38 0.32 0.28 0.92 0.82 0.74 1.40 1.24 1.12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time to Apply 1/4” of Water (Minutes)</td>
<td>64 71 78 18 27 30 12 14 16 8 9 11</td>
<td>64 74 85 40 46 53 16 18 20 11 12 13</td>
<td></td>
<td></td>
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</table>

Following these maximum spacing guidelines, emitter flow selection can be increased if desired by the designer. 1.16 GPH flow rate available for areas requiring higher infiltration rates, such as coarse sandy soils.
Step 2 Length of our lateral lines

What pressure are we working with?

<table>
<thead>
<tr>
<th>Emitter Spacing</th>
<th>12”</th>
<th>18”</th>
<th>24”</th>
<th>12”</th>
<th>18”</th>
<th>24”</th>
<th>12”</th>
<th>18”</th>
<th>24”</th>
<th>12”</th>
<th>18”</th>
<th>24”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emitter Flow (GPH)</td>
<td>0.33</td>
<td>0.53</td>
<td>0.77</td>
<td>1.16</td>
<td>0.33</td>
<td>0.53</td>
<td>0.77</td>
<td>1.16</td>
<td>0.77</td>
<td>1.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 psi</td>
<td>237</td>
<td>173</td>
<td>136</td>
<td>103</td>
<td>335</td>
<td>246</td>
<td>192</td>
<td>146</td>
<td>244</td>
<td>184</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 psi</td>
<td>327</td>
<td>240</td>
<td>187</td>
<td>142</td>
<td>464</td>
<td>341</td>
<td>266</td>
<td>203</td>
<td>338</td>
<td>258</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35 psi</td>
<td>385</td>
<td>282</td>
<td>221</td>
<td>168</td>
<td>546</td>
<td>401</td>
<td>314</td>
<td>239</td>
<td>400</td>
<td>304</td>
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</tr>
<tr>
<td>40 psi</td>
<td>429</td>
<td>315</td>
<td>247</td>
<td>187</td>
<td>611</td>
<td>449</td>
<td>351</td>
<td>267</td>
<td>446</td>
<td>340</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45 psi</td>
<td>467</td>
<td>342</td>
<td>268</td>
<td>203</td>
<td>663</td>
<td>488</td>
<td>381</td>
<td>290</td>
<td>486</td>
<td>370</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 psi</td>
<td>499</td>
<td>366</td>
<td>287</td>
<td>218</td>
<td>710</td>
<td>521</td>
<td>408</td>
<td>311</td>
<td>520</td>
<td>396</td>
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<tr>
<td>55 psi</td>
<td>528</td>
<td>387</td>
<td>303</td>
<td>230</td>
<td>752</td>
<td>552</td>
<td>432</td>
<td>329</td>
<td>550</td>
<td>418</td>
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</tr>
<tr>
<td>60 psi</td>
<td>554</td>
<td>406</td>
<td>318</td>
<td>241</td>
<td>788</td>
<td>579</td>
<td>453</td>
<td>345</td>
<td>578</td>
<td>440</td>
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</table>
Step 3 – Flowrate of the zone

Length of Tubing / 100 x (times) GPM per 100

253/100 = 2.53 x .77 = 1.94 GPM

<table>
<thead>
<tr>
<th>Emitter Spacing</th>
<th>0.33 Emitter</th>
<th>0.53 Emitter</th>
<th>0.77 Emitter</th>
<th>1.16 Emitter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GPH</td>
<td>GPM</td>
<td>GPH</td>
<td>GPM</td>
</tr>
<tr>
<td>12”</td>
<td>33.0</td>
<td>0.55</td>
<td>53.0</td>
<td>0.88</td>
</tr>
<tr>
<td>18”</td>
<td>22.0</td>
<td>0.37</td>
<td>35.3</td>
<td>0.59</td>
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<tr>
<td>24”</td>
<td>16.5</td>
<td>0.28</td>
<td>26.5</td>
<td>0.44</td>
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</tbody>
</table>
Shrub Beds
Divide into Zones

Same as for Conventional Systems

- Plant Requirements
- Environmental Issues
- Elevation
- Precipitation Rate

And Maximum Length of a Single Lateral

- Looping or Center Feeding will double the maximum run length of a lateral
- Use the chart
Select Filter, Valve, and Pressure Regulator

Select a filter base upon the flow
- ¾” to 13 GPM
- 1” to 22 GPM
- 1½ to 35 GPM
- 2” to 132 GPM

Select a valve
- Note the minimum & Maximum flow range

Select a pressure regulator base upon the flow
- ¾” to 0.5 - 5 GPM (low flow model)
- ¾” to 3.5 - 20 GPM (high flow model)
- 1½ to 7.0 - 40 GPM
- Other models up to 500 GPM are available
Other Considerations

• Below grade installations
  – Inline drip can effectively irrigate turf
  – Installation is 4” to 6” below grade
  – Staples are not necessary but recommended
• Above Grade Installations
  – Staples are required every three to five feet
• Winterization is the same as for conventional systems
• Maintenance
  – Open the drain valve and thoroughly flush the system at spring start up
  – Clean the filter annually or more frequent
Sub Surface Turf

Benefits:

• Can run system 24hrs a day.
• Low evaporation / high uniformity
• No heads to trip over / break / liability.
• Alternate water source issues (health codes).
• Low maintenance / less vandalism.
• Reduces need for aeration.
• Lower flow requirements.
SSDI vs Sprayheads

SSDI

Sprayheads
SSDI vs Sprayheads

SSDI

Sprayheads
SSDI – Commerce City  installed summer 2003 picture 8-13
The District
Salt Lake
Woodlands Medians Historical Water Usage Castle Rock, Colorado 2000 2010

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>2536-01 68060</td>
<td></td>
<td>4 Irr Scott Blvd</td>
<td>1386</td>
<td>103,125</td>
<td>0</td>
<td>103,125</td>
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<tr>
<td>2540-01 IA 68140</td>
<td></td>
<td>InActive</td>
<td>1390</td>
<td>4,375</td>
<td>0</td>
<td>4,375</td>
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<tr>
<td>2530-01 67160</td>
<td></td>
<td>1 Irr Woodlands Blvd</td>
<td>1381</td>
<td>45,375</td>
<td>4,000</td>
<td>41,375</td>
<td></td>
</tr>
<tr>
<td>2531-01 67180</td>
<td></td>
<td>2 Irr Woodlands Blvd</td>
<td>1382</td>
<td>404,375</td>
<td>257,000</td>
<td>147,375</td>
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<tr>
<td>2532-01 67200</td>
<td></td>
<td>3 Irr Woodlands Blvd</td>
<td>1383</td>
<td>326,000</td>
<td>129,000</td>
<td>197,000</td>
<td></td>
</tr>
<tr>
<td>2538-01 68100</td>
<td></td>
<td>2 Irr Scott Blvd</td>
<td>1388</td>
<td>62,625</td>
<td>169,000</td>
<td>-106,375</td>
<td>* 108Kgal used in June. Would attribute that usage to a leak or improper programming.</td>
</tr>
<tr>
<td>2539-01 68120</td>
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<td>1 Irr Scott Blvd</td>
<td>1389</td>
<td>960,125</td>
<td>91,000</td>
<td>869,125</td>
<td></td>
</tr>
<tr>
<td>2537-01 68080</td>
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<td>3 Irr Scott Blvd</td>
<td>1387</td>
<td>91,375</td>
<td>205,000</td>
<td>-113,625</td>
<td>Not sure why consumption was up on this account. Will investigate further.</td>
</tr>
<tr>
<td>2533-01 IA 67220</td>
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<td>InActive</td>
<td>1384</td>
<td>29,000</td>
<td>0</td>
<td>29,000</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>2,026,375</strong></td>
<td><strong>855,000</strong></td>
<td><strong>42.19%</strong></td>
<td></td>
</tr>
</tbody>
</table>

2010 usage is 42.19% of the average usage for 2000-2007

This equals a savings of **57.81%**

1,171,375 Gallons saved as compared to the historical average consumption

1,171 1,000's of gallons saved

$17,453.49 Total Dollars Saved in one year of conversion!
Maintenance

Center for Irrigation Technology reported:

1. Subsurface drip irrigation required less maintenance than a conventional system
2. Subsurface drip irrigation received less complaints regarding water run-off
3. Subsurface drip irrigation required less water than a conventional irrigation system

Irrigation systems with in-line emitters require less maintenance than a conventional system

Winterization is the same as conventional systems, turn down the pressure

Filters usually require annual cleanings
MAINTENANCE

Pressure

Filtration - Flushing

Flow Testing

Troubleshooting

Less maintenance doesn't mean no maintenance
Contact Information

Thank You!

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Email kelly.keicher@Netafim.com