City of Spokane Pilot Reuse Water Project 2008 (Year 1)

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Outline

- Objectives
- 5 sites used in the pilot study
- Compare suitability of Reuse to City water currently used for irrigation
- Soil Test
- Soil physical properties at 2 sites
- Turfgrass tissue analysis and visual observations
Objectives

- To determine the long term (2 year – 2008-09) effects of irrigation with Reuse water compared to non-effluent city/pond water, on soil chemical and physical properties and turfgrass tissue and quality parameters at 2 City of Spokane Golf Courses: Downriver and The Creek at Qualchan

- Monitor Reuse water quality
Downriver Sites
- #6 Tee
- #7 Rough

Qualchan Sites
- #15 Green
- #16 Tee
- #16 Fairway
Soil Profile Downriver Sites

- #6 Tee
  - Sand cap over native soil

- #7 Rough
  - Native soil (Gravelly sandy loam)
Soil Profile Qualchan Sites

- **#15 Green**
  - USGA sand-based green with drainage
  - Very well suited for Reuse water use
  - Reconstructed Fall 2008

- **#16 Tee**
  - Sand cap over native soil
  - Old established forward tee (Pond)
  - Newly constructed back tee (Reuse)

- **#16 Fairway**
  - Native soil (Sandy loam)
Reuse water was applied through 2 sprinkler heads at each of the 5 sites.
“CLASS A” RECLAIMED WATER FOR IRRIGATION ONLY
(The right water for the right use!)
Water Samples

- 2 times (July and October)

- Samples
  - Reuse water (Downriver and Qualchan)
  - City water (Downriver)
  - Irrigation Pond water (Qualchan)

- Analysis
  - Heavy metals
  - Irrigation water suitability
<table>
<thead>
<tr>
<th>Beryllium</th>
<th>Silver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chromium</td>
<td>Cadmium</td>
</tr>
<tr>
<td>Cobalt</td>
<td>Barium</td>
</tr>
<tr>
<td>Nickel</td>
<td>Lead</td>
</tr>
<tr>
<td>Copper</td>
<td>Mercury</td>
</tr>
<tr>
<td>Arsenic</td>
<td>Vanadium</td>
</tr>
<tr>
<td>Selenium</td>
<td>Manganese</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>Zinc</td>
</tr>
</tbody>
</table>

Reuse water heavy metals all well below EPA limits
<table>
<thead>
<tr>
<th>Units</th>
<th>Reuse water</th>
<th>City water</th>
<th>Satisfactory range</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>7.8</td>
<td>8.0</td>
<td>5.5 – 7.5</td>
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<tr>
<td>Sodium</td>
<td>meq/l</td>
<td>2.3</td>
<td>0 – 2.9</td>
</tr>
<tr>
<td>Chloride</td>
<td>ppm</td>
<td>52.7</td>
<td>0 – 140</td>
</tr>
<tr>
<td>Boron</td>
<td>ppm</td>
<td>0.2</td>
<td>0 – 0.5</td>
</tr>
<tr>
<td>EC&lt;sub&gt;salinity&lt;/sub&gt;</td>
<td>mmhos/cm</td>
<td>0.7</td>
<td>0 – 0.75</td>
</tr>
<tr>
<td>SAR</td>
<td>meq/l</td>
<td>2.6</td>
<td>0 – 6.0</td>
</tr>
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</table>
## Plant Nutrients in Water

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Reuse water (ppm)</th>
<th>City water (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrate</td>
<td>22.8</td>
<td>7.4</td>
</tr>
<tr>
<td>Phosphate</td>
<td>0.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Potassium</td>
<td>9.6</td>
<td>2.6</td>
</tr>
<tr>
<td>Magnesium</td>
<td>24.7</td>
<td>15.2</td>
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<tr>
<td>Calcium</td>
<td>44.3</td>
<td>59.6</td>
</tr>
<tr>
<td>Sulfate</td>
<td>65.7</td>
<td>15.6</td>
</tr>
</tbody>
</table>
Soil Samples

- 3 times during the growing season (May, July, and October)

- Analysis
  - Basic soil test
  - SAR
Soil Test Results

- Few differences in soil nutrient levels between Reuse and City water.

- EC (soil salinity) similar regardless of irrigation source and within satisfactory range.

- Sodium and SAR soil levels increased at all 5 sites receiving reuse water. However, SAR levels all within satisfactory range.
Soil Physical Properties

- **#6 Tee at Downriver**
  - Poor sand selection: Sand profile too high in fine sand creates poor water infiltration conditions

- **#16 Fairway Qualchan**
  - Excessive thatch layer
  - Poor water infiltration
Recommendations

- #6 Tee Downriver
  - Aerate
  - USGA specified topdress sand

- #16 fairway Qualchan
  - Dethatch to remove excess thatch
  - Aerate
Turfgrass tissue analysis and visual observations
Turfgrass Results

- Slight differences in leaf tissue nutrient levels between Reuse and City water

- All 5 sites irrigated with Reuse water had no adverse visual effect on turfgrass
First Year Conclusions

- ‘Class A’ Reuse water has low heavy metal levels.
- Reuse water within satisfactory limits of Sodium, Chloride, Boron, EC (salinity), and SAR although much higher compared to City water.
- Reuse water provides a number of essential plant nutrients at levels above the City water currently used.
First Year Conclusions

- Few differences in soil nutrient levels
- No difference in soil EC (soil salinity)
- Sodium levels in soil increased at all 5 sites irrigated with Reuse water
- Poor soil drainage issues should be identified and corrected
- No adverse effects on turfgrass tissue chemistry or visual turfgrass quality parameters
- Year 2 (2009) sampling will be a repeat of Year 1.
Questions?