Water Conserv II: A Central Florida Water Recycling Program

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&
Luisa Maria Gomez, PE

January 16, 2014
Agenda

- Location and Scale of WCII
- Regional Water Supply Constraints
- Recycled Water Use Types at WCII
- Institute of Food & Agricultural Sciences
- Recycled Water Quantities
- Typical Recycled Water Quality
- Possible Future Development Factors
 Agenda

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  - Typical Recycled Water Quality
  - Possible Future Development Factors
Water Conserv II History

- Jointly Owned by Orange County and City of Orlando
- Regulated by 3 State Agencies
  - FDEP
  - SJRWMD
  - SFWMD
- World’s Largest Water Reclamation Project Combining Agricultural Irrigation and Rapid Infiltration Basins (RIBs)
- 1983 – Construction Started
- December 1, 1986 – Operations Began
- 1990 to 2012 – Multiple system modifications/expansions
1986 – 2013

1986
- 10 Citrus Growers
- 18 Turnouts
- 13.79 MGD Average Annual Daily Flow
- 15.88 MGD AADF RIB Capacity

2013
- 67 Customers
- 52 Turnouts
- 34.00 MGD Average Annual Daily Flow
- 32.70 MGD AADF RIB Capacity
Location Maps

Natural Recharge to the Floridan Aquifer

Source: "Water Resources Atlas of Florida", by E.A. Fernald & D.J. Patton (Editors), Florida State University, 1984
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Central Florida Water Initiative
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System Components

Transmission Main
Distribution Center
Distribution System
Supplemental Wells
System Components
Transmission Main
Distribution Center
Distribution System
Supplemental Wells
System Components

Transmission Main
Distribution Center
Distribution System
Supplemental Wells
System Components
Transmission Main
Distribution Center
Distribution System
Supplemental Wells
System Components

Multiple Ag. Irrigation Sites
Golf Courses
Sand Mine
IFAS Research Groves
RIB Sites
System Components

Multiple Ag. Irrigation Sites

Golf Courses

Sand Mine

IFAS Research Groves

RIB Sites
System Components

Multiple Ag. Irrigation Sites
Golf Courses
Sand Mine
IFAS Research Groves
RIB Sites
System Components

- Multiple Ag. Irrigation Sites
- Golf Courses
- Sand Mine
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- RIB Sites
System Components

Multiple Ag. Irrigation Sites

Golf Courses

Sand Mine

IFAS Research Groves

RIB Sites
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IFAS Crop & Recycled Water Research
IFAS Crop & Recycled Water Research

- Maximum allowable recycled water constituent concentrations for healthy citrus
- Optimum recycled water irrigation rates (citrus health & economic return)
- Appropriate fertilization rates for citrus on recycled water irrigation
- Economic value of dissolved nutrients in recycled water
- Optimum citrus root stocks and cultivars
- Economic feasibility of non-citrus crops, including:
  - Peaches
  - Figs
  - Grapes
  - Exotic timber
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Balanced Multi-application Reclaimed Water Systems

WRFs

SUPPLEMENTAL SUPPLY

INDUSTRIAL & COMMERCIAL REUSE

IRRIGATION

AQUIFER RECHARGE

STORAGE
Average Monthly Flow (MGD)

Date

Total Monthly Average Flow  Monthly Average RIB Flow  Monthly Average Customer Flow
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Minimum Recycled Water Quality Standards

- Set by rule (Florida Administrative Code)
- Rules address:
  - Treatment processes (secondary or better)
  - Disinfection processes (high level)
  - Performance standards
  - Permitting requirements and procedures
  - Quality monitoring, record keeping & reporting
  - Management of off-spec water
  - Agricultural crops that may be irrigated with recycled water
Recycled Water & Edible Crops

Chapter 62-610.475 FAC (Edible Crops)

1. Irrigation of edible crops that will be peeled, skinned cooked or thermally processed before consumption is allowed. Direct contact of the reclaimed water with such edible crops is allowed.

2. Irrigation of tobacco or citrus is allowed. Direct contact of the reclaimed water with tobacco or citrus is allowed, including citrus used for fresh table fruit, processing into concentrate, or other purposes.

3. Irrigation of edible crops that will not be peeled, skinned, cooked, or thermally processed before consumption is allowed if an indirect application method that will preclude direct contact with the reclaimed water (such as ridge and furrow irrigation, drip irrigation, or a subsurface distribution system) is used.

4. Irrigation of edible crops that will not be peeled, skinned, cooked or thermally processed before consumption using an application method that allows for direct contact of the reclaimed water on the crop is prohibited.
# 2012 Recycled Water Quality Ranges

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Phosphorus</td>
<td>mg/L</td>
<td>1.05</td>
<td>3.47</td>
<td>2.22</td>
</tr>
<tr>
<td>Ammonia Nitrogen</td>
<td>mg/L</td>
<td>&lt;0.12</td>
<td>10.00</td>
<td>0.89</td>
</tr>
<tr>
<td>Nitrite Nitrogen</td>
<td>mg/L</td>
<td>&lt;0.01</td>
<td>0.80</td>
<td>0.15</td>
</tr>
<tr>
<td>Nitrate Nitrogen</td>
<td>mg/L</td>
<td>1.06</td>
<td>12.30</td>
<td>5.57</td>
</tr>
<tr>
<td>Total Inorganic Nitrogen</td>
<td>mg/L</td>
<td>4.64</td>
<td>15.16</td>
<td>6.67</td>
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<tr>
<td>Organic Nitrogen</td>
<td>mg/L</td>
<td>0.44</td>
<td>4.86</td>
<td>1.45</td>
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<tr>
<td>Total Nitrogen</td>
<td>mg/L</td>
<td>5.58</td>
<td>17.16</td>
<td>8.14</td>
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<tr>
<td>Total Suspended Solids</td>
<td>mg/L</td>
<td>&lt;1</td>
<td>2.0</td>
<td>0.45</td>
</tr>
<tr>
<td>CBOD$_5$</td>
<td>mg/L</td>
<td>&lt;1</td>
<td>6.6</td>
<td>1.5</td>
</tr>
<tr>
<td>Chloride</td>
<td>mg/L</td>
<td>59.3</td>
<td>107.0</td>
<td>88.1</td>
</tr>
</tbody>
</table>
Customer Coordination on Water Quality

WATER CONSERV II
MEMORANDUM

DATE: January 14, 2014

FILE: Constituents

TO: Water Conserv II Participants

FROM: Phil Cross, Senior Project Manager

SUBJECT: Citrus Irrigation Reclaimed Water Constituent Concentrations

Enclosed is a copy of the Citrus Irrigation Reclaimed Water Constituent Concentrations for December and the preceding 5 months.
### Citrus Irrigation Reclaimed Water Constituent Concentrations

#### WATER CONSERV II
CITRUS IRRIGATION RECLAIMED WATER CONSTITUENT CONCENTRATIONS
December 2013

<table>
<thead>
<tr>
<th>CONSTITUENTS</th>
<th>MACL</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
<th>November</th>
<th>December</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>0.10</td>
<td>&lt;0.001272</td>
<td>&lt;0.001272</td>
<td>&lt;0.001272</td>
<td>&lt;0.001272</td>
<td>&lt;0.001272</td>
<td>&lt;0.001272</td>
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<tr>
<td>Barium</td>
<td>2.0</td>
<td>&lt;0.016</td>
<td>&lt;0.016</td>
<td>&lt;0.016</td>
<td>&lt;0.016</td>
<td>&lt;0.016</td>
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<tr>
<td>Beryllium</td>
<td>0.10</td>
<td>&lt;0.0008</td>
<td>&lt;0.0008</td>
<td>&lt;0.0008</td>
<td>&lt;0.0008</td>
<td>&lt;0.0008</td>
<td>&lt;0.0008</td>
</tr>
<tr>
<td>Bicarbonate (Alkalinity)</td>
<td>200</td>
<td>111</td>
<td>110</td>
<td>107</td>
<td>106</td>
<td>103</td>
<td>117</td>
</tr>
<tr>
<td>CBOD5 (Carb Biochemical Oxygen Demand)</td>
<td>30</td>
<td>1.6</td>
<td>1.5</td>
<td>1.4</td>
<td>1.6</td>
<td>1.5</td>
<td>1.4</td>
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<tr>
<td>Boron</td>
<td>1.0</td>
<td>0.130</td>
<td>0.140</td>
<td>0.140</td>
<td>0.140</td>
<td>0.140</td>
<td>0.150</td>
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<tr>
<td>Cadmium</td>
<td>0.01</td>
<td>&lt;0.0024</td>
<td>&lt;0.0024</td>
<td>&lt;0.0024</td>
<td>&lt;0.0024</td>
<td>&lt;0.0024</td>
<td>&lt;0.0024</td>
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<tr>
<td>Calcium</td>
<td>200</td>
<td>47.0</td>
<td>49.0</td>
<td>45.0</td>
<td>51.0</td>
<td>48.0</td>
<td>50.0</td>
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<tr>
<td>Chemical Oxygen Demand</td>
<td>120</td>
<td>20</td>
<td>17</td>
<td>23</td>
<td>27</td>
<td>33</td>
<td>13</td>
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<tr>
<td>Chloride</td>
<td>100</td>
<td>78</td>
<td>79</td>
<td>76</td>
<td>84</td>
<td>87</td>
<td>85</td>
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<tr>
<td>Chlorine</td>
<td>10.0</td>
<td>2.0</td>
<td>2.2</td>
<td>2.0</td>
<td>1.8</td>
<td>2.0</td>
<td>2.0</td>
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<tr>
<td>Chromium</td>
<td>0.01</td>
<td>&lt;0.008</td>
<td>&lt;0.008</td>
<td>&lt;0.008</td>
<td>&lt;0.008</td>
<td>&lt;0.008</td>
<td>&lt;0.008</td>
</tr>
<tr>
<td>Cobalt</td>
<td>0.05</td>
<td>---</td>
<td>&lt;0.008</td>
<td>---</td>
<td>&lt;0.008</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Copper</td>
<td>0.20</td>
<td>&lt;0.0120</td>
<td>&lt;0.0120</td>
<td>&lt;0.0120</td>
<td>&lt;0.0120</td>
<td>&lt;0.0120</td>
<td>&lt;0.0120</td>
</tr>
<tr>
<td>ECW (umhos)</td>
<td>1100</td>
<td>653</td>
<td>844</td>
<td>635</td>
<td>631</td>
<td>616</td>
<td>886</td>
</tr>
<tr>
<td>Iron</td>
<td>5.0</td>
<td>0.06</td>
<td>0.06</td>
<td>0.07</td>
<td>0.06</td>
<td>0.06</td>
<td>0.07</td>
</tr>
<tr>
<td>Lead</td>
<td>0.1</td>
<td>&lt;0.000648</td>
<td>&lt;0.000648</td>
<td>&lt;0.000648</td>
<td>&lt;0.001756</td>
<td>&lt;0.000648</td>
<td>&lt;0.000648</td>
</tr>
<tr>
<td>Lithium</td>
<td>0.01</td>
<td>---</td>
<td>&lt;0.02</td>
<td>---</td>
<td>&lt;0.02</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Manganese</td>
<td>0.20</td>
<td>0.015</td>
<td>0.010</td>
<td>0.018</td>
<td>0.009</td>
<td>0.007</td>
<td>0.009</td>
</tr>
<tr>
<td>Magnesium</td>
<td>25.0</td>
<td>---</td>
<td>9.0</td>
<td>---</td>
<td>9.4</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.01</td>
<td>&lt;0.000048</td>
<td>&lt;0.000048</td>
<td>&lt;0.000048</td>
<td>&lt;0.000048</td>
<td>&lt;0.000048</td>
<td>&lt;0.000048</td>
</tr>
</tbody>
</table>
### Citrus Irrigation Reclaimed Water Constituent Concentrations

**WATER CONSERV II**  
**CITRUS IRRIGATION RECLAIMED WATER**  
**CONSTITUENT CONCENTRATIONS**  
**December 2013**

<table>
<thead>
<tr>
<th>CONSTITUENTS</th>
<th>MACL</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
<th>November</th>
<th>December</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel</td>
<td>0.20</td>
<td>&lt;0.0080</td>
<td>&lt;0.0080</td>
<td>&lt;0.0080</td>
<td>&lt;0.0080</td>
<td>&lt;0.0080</td>
<td>&lt;0.0080</td>
</tr>
<tr>
<td>Nitrite</td>
<td>---</td>
<td>0.283</td>
<td>0.131</td>
<td>0.161</td>
<td>0.143</td>
<td>0.117</td>
<td>0.192</td>
</tr>
<tr>
<td>Nitrate</td>
<td>---</td>
<td>6.71</td>
<td>5.91</td>
<td>5.26</td>
<td>6.88</td>
<td>5.98</td>
<td>5.86</td>
</tr>
<tr>
<td>Nitrogen (Total)</td>
<td>30</td>
<td>9.64</td>
<td>8.16</td>
<td>7.57</td>
<td>9.40</td>
<td>8.15</td>
<td>9.24</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>10</td>
<td>1.62</td>
<td>1.48</td>
<td>1.81</td>
<td>2.45</td>
<td>1.70</td>
<td>1.98</td>
</tr>
<tr>
<td>pH</td>
<td>0.0-0.5</td>
<td>7.0</td>
<td>7.0</td>
<td>7.0</td>
<td>0.9</td>
<td>0.9</td>
<td>7.0</td>
</tr>
<tr>
<td>Potassium</td>
<td>30</td>
<td>13.0</td>
<td>14.0</td>
<td>13.0</td>
<td>16.0</td>
<td>14.0</td>
<td>14.0</td>
</tr>
<tr>
<td>Selenium</td>
<td>0.02</td>
<td>&lt;0.0016560</td>
<td>&lt;0.0016560</td>
<td>&lt;0.0016560</td>
<td>&lt;0.0007880</td>
<td>&lt;0.0016560</td>
<td>&lt;0.0016560</td>
</tr>
<tr>
<td>Silver</td>
<td>0.05</td>
<td>&lt;0.0040</td>
<td>&lt;0.0040</td>
<td>&lt;0.0040</td>
<td>&lt;0.0040</td>
<td>&lt;0.0040</td>
<td>&lt;0.0040</td>
</tr>
<tr>
<td>Sodium</td>
<td>70</td>
<td>60.8</td>
<td>58.8</td>
<td>61.0</td>
<td>64.8</td>
<td>66.0</td>
<td>65.8</td>
</tr>
<tr>
<td>Sulfate</td>
<td>100</td>
<td>37.3</td>
<td>35.2</td>
<td>34.2</td>
<td>38.2</td>
<td>39.4</td>
<td>55.3</td>
</tr>
<tr>
<td>Total Suspended Solids</td>
<td>5</td>
<td>&lt;1</td>
<td>&lt;1</td>
<td>&lt;1</td>
<td>&lt;1</td>
<td>&lt;1</td>
<td>1</td>
</tr>
<tr>
<td>Zinc</td>
<td>1.0</td>
<td>0.035</td>
<td>0.033</td>
<td>0.032</td>
<td>0.035</td>
<td>0.042</td>
<td>0.040</td>
</tr>
</tbody>
</table>

**NOTES:**  
1. **MACL** - Maximum Average Concentration Limits  
2. Limits in mg/L - pH is reported in Standard Units (SU) and Conductivity is reported in uohms/cm.

* No results due to lab error  
--- Not scheduled to be sampled
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The Future: Driven by Urbanization & Environmental Constraints

- Increasing urbanization
  - Loss of agricultural land and irrigation customers
  - Urban irrigation generate higher revenues .. and higher costs

- Recycled water is private property, not “Waters of the State”, but...
  - Water Management District pressure to supply recycled water to adjacent communities with expensive Alternative Water Supply options
  - Water Management District pressure to export recycled water for restoration of surface water flows and levels

- Pressure to protect surface waters by reducing recycled water nutrient concentrations
  - Recent Numerical Nutrient Criteria rule
  - Draft Springs Protection legislation

- Direct potable reuse … when?
  - Rapidly becoming cheaper to treat it for direct potable reuse than for “purple pipe” recycling or other Alternative Water Supplies
QUESTIONS?