Water Supply Challenges for an Island Community

2008 SC Water Resources Conference

Britton Corbin, P.E.

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Overview

- Background
- Challenges
- Distribution
- Storage
- Supply
Background

Location
Existing Infrastructure

- 6 Wells – 90 GPM to 495 GPM
- 1 – 100,000 gallon Elevated Storage Tank – pedesphere
- 1 ground storage tank – 200,000 gallons
- 2 Booster Pumps
- Distribution system consisting of PVC and DIP – sizes 2” to 10”
- 133 fire hydrants
- Approximately 2,300 customers
Consumption Parameters

- Annual water consumption approx. 200 MG
- Peak month is July consuming 30 MG
- Peak day is around 4\textsuperscript{th} of July – approx 1.3 MG
Water System Layout
Booster Pumps and Ground Storage Tank
Booster Pumps and Ground Storage Tank
Booster Pumps (cont.)
Annual Demand Curve

Edisto Beach Monthly Water Usage - 2007

<table>
<thead>
<tr>
<th>Month</th>
<th>Million Gallons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>8.93</td>
</tr>
<tr>
<td>Feb</td>
<td>8.17</td>
</tr>
<tr>
<td>Mar</td>
<td>11.27</td>
</tr>
<tr>
<td>Apr</td>
<td>17.27</td>
</tr>
<tr>
<td>May</td>
<td>21.14</td>
</tr>
<tr>
<td>Jun</td>
<td>25.63</td>
</tr>
<tr>
<td>Jul</td>
<td>29.25</td>
</tr>
<tr>
<td>Aug</td>
<td>23.19</td>
</tr>
<tr>
<td>Sept</td>
<td>16.89</td>
</tr>
<tr>
<td>Oct</td>
<td>15.42</td>
</tr>
<tr>
<td>Nov</td>
<td>13.48</td>
</tr>
<tr>
<td>Dec</td>
<td>11.07</td>
</tr>
</tbody>
</table>
**Operational Parameters**

- System pressures range from 60 to 70 psi.
- Well and booster pump operation are controlled by elevated storage tank water levels.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Water level (on)</th>
<th>Water level (Off)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>21 ft</td>
<td>24 ft</td>
</tr>
<tr>
<td>2</td>
<td>20 ft</td>
<td>24 ft</td>
</tr>
<tr>
<td>3</td>
<td>18 ft</td>
<td>23 ft</td>
</tr>
</tbody>
</table>
Operational Parameters

- Booster Pumps 1, & 2 and Well #6 are large resources
- Wells 1, 2, 3, 4 & 5 are small resources
- Each stage uses a large and small resource
What are the Challenges?

- Distribution and Supply - adequate fire flows throughout the distribution system
- Storage - adequate water supply and storage during peak season
- Challenges stem from meeting fire flow demand combined with peak domestic flow
Challenge #1 - Booster Pump Operation

- Some hydrants located on the east end of the island would have inadequate fire flow without the booster pumps in operation.
- Most hydrants east of Portia Street produce less than desirable fire flows using only the energy from the elevated storage tank.
- Booster pumps are controlled by water level in elevated storage tank.
Booster Pump Operation
Challenge #1 - Booster Pump Operation

- Fire flows on portions of system undesirable (less than 750 GPM)
- Critical time would be lost in a fire event due to the time it would take for the tank level to drop to a level necessary to initiate the booster pumps
- Best way to improve fire flows and improve response time
Solutions

- Install pressure switch near the State Park
- Pressure switch would signal the pressure drop that would indicate a fire in the area
- Booster pumps would be initiated immediately in case of a fire
Solutions

- Provide better control to operators by installing SCADA System
- Allows operator to monitor and control various water system resources via laptop from any location
Challenge #2 – Water Storage During Peak Month

- Water usage fluctuates greatly throughout the year
- Heavy tourist population during summer contribute to high demands
- Peak usage occurs near the 4th of July – approx. 1.3 MGD
Annual Demand Curve

Edisto Beach Monthly Water Usage - 2007

Month

Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sept  Oct  Nov  Dec

Million Gallons

0.00  5.00  10.00  15.00  20.00  25.00  30.00  35.00

## Well Performance

<table>
<thead>
<tr>
<th>Well</th>
<th>Diameter (inches) (From Layne Atlantic Inspection Reports)</th>
<th>Flow Rate (GPM) (From Layne Atlantic Inspection Reports)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well 1</td>
<td>6</td>
<td>125</td>
</tr>
<tr>
<td>Well 2</td>
<td>6</td>
<td>135</td>
</tr>
<tr>
<td>Well 3</td>
<td>4</td>
<td>90</td>
</tr>
<tr>
<td>Booster Pump 1</td>
<td>-</td>
<td>350</td>
</tr>
<tr>
<td>Booster Pump 2</td>
<td>-</td>
<td>350</td>
</tr>
<tr>
<td>Well 6</td>
<td>8</td>
<td>495</td>
</tr>
</tbody>
</table>

**Total System Supply** 1,545 GPM
Check Pumping Deficit During Fire Scenario

- 1,545 GPM Supply
- 900 GPM Domestic withdrawal
- 1,200 GPM Fire flow
- 555 GPM = Deficit
- Town could fight fire for 3 hours
- Goal is to be able to fight fire for 4 hours
Solution(s)

- Additional water flow during a fire can be in the form of a new supply well or a new elevated storage tank
- Short term improvement – new supply well
- Long term improvement – new elevated storage tank
Solution(s)

- New supply source best choice
- Lower upfront costs
- Can be place in operation quicker
- Do we have to drill a new well?
WELL AND PUMP INSPECTION REPORT
LAYNE ATLANTIC
BLOOMINGDALE, GA

Owner: Edisto Beach Island, Town of
City: Edisto Beach
State: SC
Zip: 29438
Job: 78-6828

Well No.: Well 1
Location: Dockside
DIA.: 6"
DEPTH: 500
TYPE: Openhole Limestone

DATE DRILLED: Unknown
PERSON TO CONTACT: Bob Doub

<table>
<thead>
<tr>
<th>4x3</th>
<th>LAST INSPECTION</th>
<th>Date: 2-16-2006</th>
<th>4x3</th>
<th>PRESENT INSPECTION</th>
<th>Date: 1-18-2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drift</td>
<td>Static</td>
<td>GPM</td>
<td>Pressure</td>
<td>Pumping Level</td>
<td>Specific Capacity</td>
</tr>
<tr>
<td>23&quot;</td>
<td>27'</td>
<td>200</td>
<td>10</td>
<td>34'</td>
<td>29 g/ft</td>
</tr>
<tr>
<td>23&quot;</td>
<td>27'</td>
<td>190</td>
<td>20</td>
<td>33'</td>
<td>32 g/ft</td>
</tr>
<tr>
<td>18&quot;</td>
<td>27'</td>
<td>168</td>
<td>40</td>
<td>32.5'</td>
<td>31 g/ft</td>
</tr>
<tr>
<td>12&quot;</td>
<td>27'</td>
<td>137</td>
<td>60</td>
<td>31.5'</td>
<td>30 g/ft</td>
</tr>
<tr>
<td>7&quot;</td>
<td>27'</td>
<td>105</td>
<td>80</td>
<td>30.5'</td>
<td>30 g/ft</td>
</tr>
<tr>
<td>4.5&quot;</td>
<td>25'</td>
<td>95</td>
<td>90</td>
<td>27'</td>
<td>31 g/ft</td>
</tr>
</tbody>
</table>

Shut Off 105

TEST WILL BE COMPLETE THROUGH:

<table>
<thead>
<tr>
<th>AIRLINE LENGTH</th>
<th>83'</th>
<th>Top of Check</th>
<th>Meter</th>
<th>yes</th>
<th>Flange or</th>
<th>Thread Size</th>
<th>3&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump Mfg</td>
<td>Unknown Submersible</td>
<td>Ser. No.</td>
<td>n/a 3&quot; Column</td>
<td>HP</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated Capacity</td>
<td>est 122</td>
<td>GPM</td>
<td>est 192.7</td>
<td>TDH; Operating Pressure</td>
<td>70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date Installed</td>
<td>n/a</td>
<td>Date of Overhaul</td>
<td>n/a</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Is check valve leaking? ☐ Yes ☑ No
Is stuffing box leaking? ☐ Yes ☑ No
Does Stuffing Box Have Spring? ☑ Yes ☐ No

THE FOLLOWING IS TO BE PERFORMED DURING EACH INSPECTION:

Change Motor Oil & Grease ☐
Repack Pump ☐
Grease Pump ☐

Pump is presently developing 125 GPM: 70 psi
Present TDH at Rated GPM n/a FT.
Electrical Data with Pump in Operation:
27-30-28 AMPS: 240 VOLTS: 3 PHASE
## Comparison of Existing Wells

<table>
<thead>
<tr>
<th>Well No.</th>
<th>Capacity (GPM)</th>
<th>Water Level Above Pump (Ft)</th>
<th>Specific Capacity (GPM/Ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>125</td>
<td>30</td>
<td>29</td>
</tr>
<tr>
<td>2</td>
<td>135</td>
<td>-</td>
<td>3.6 (2006)</td>
</tr>
<tr>
<td>3</td>
<td>90</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>198</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>431</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>495</td>
<td>39</td>
<td>30</td>
</tr>
</tbody>
</table>
Results

- Installed new 6” 250 GPM submersible pump at Well #1
- Increased system pumping capacity by 125 GPM
- Total system pumping capacity is now 1,670 GPM
- Deficit is reduced to 430 GPM
- The extra 125 GPM allows for an increase from 180 minutes up to 233 minutes to fight a 1,200 GPM fire during the maximum day
Lessons Learned

- Location, Location, Location (infrastructure)
- Ability to control small water systems key to desirable operation
- Master planning is key
Questions