REPLACEMENT SEWER LIFT STATION LOCATION AND CAPACITY EVALUATION: GREENSBORO CASE STUDY

Presented by:
David Hamilton, PE and Mauricio (Mo) Pacini, PE
Arcadis

NC AWWA-WEA Annual Conference
Raleigh, NC
November 13, 2017
Need for Project
Feasibility of Alternatives
Feasibility of Alternatives

- Locations
- Flows
- Costs
Locations
Location 1

South side of Hilltop Rd
Location 2

Downstream of Sedgefield Lake
Location 3

Downstream of Mackay Rd
## Flow Summary

### Location 1

<table>
<thead>
<tr>
<th>Flow (MGD)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Day Dry Weather</td>
<td>0.65</td>
</tr>
<tr>
<td>Current Day Wet Weather</td>
<td>1.4</td>
</tr>
<tr>
<td>2050 Dry Weather</td>
<td>0.8</td>
</tr>
<tr>
<td>2050 Wet Weather (Peak)</td>
<td>1.7</td>
</tr>
</tbody>
</table>

### Location 2

<table>
<thead>
<tr>
<th>Flow (MGD)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Day Dry Weather</td>
<td>0.77</td>
</tr>
<tr>
<td>Current Day Wet Weather</td>
<td>2.4</td>
</tr>
<tr>
<td>2050 Dry Weather</td>
<td>1.15</td>
</tr>
<tr>
<td>2050 Wet Weather (Peak)</td>
<td>2.8</td>
</tr>
</tbody>
</table>

### Location 3

<table>
<thead>
<tr>
<th>Flow (MGD)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Day Dry Weather</td>
<td>2.0</td>
</tr>
<tr>
<td>Current Day Wet Weather</td>
<td>5.2</td>
</tr>
<tr>
<td>2050 Dry Weather</td>
<td>2.4</td>
</tr>
<tr>
<td>2050 Wet Weather (Peak)</td>
<td>5.5</td>
</tr>
</tbody>
</table>
## Flow - Location 2 (downstream of Sedgefield Lake)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Flow (MGD)</th>
<th>Pressure (PSI)</th>
<th>Velocity (ft/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Day Dry Weather (16” FM)</td>
<td>0.77</td>
<td></td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Current Day Wet Weather (16” FM)</td>
<td>2.4</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>2050 Dry Weather (16” FM)</td>
<td>1.15</td>
<td></td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>2050 Wet Weather (16” FM)</td>
<td>2.8</td>
<td>3.1</td>
<td></td>
</tr>
<tr>
<td>Proposed Pump Station Operating Condition – 16” FM (Dry)</td>
<td>1.8</td>
<td>60</td>
<td>2.0</td>
</tr>
<tr>
<td>3 Pumps (1 running)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proposed Pump Station Operating Condition – 16” FM (Wet)</td>
<td>2.8</td>
<td>68</td>
<td>3.1</td>
</tr>
<tr>
<td>3 Pumps (2 running)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Cost Summary

<table>
<thead>
<tr>
<th>Pump Station Location</th>
<th>Upstream Gravity</th>
<th>Pump Station Capacity</th>
<th>Force Main Gravity</th>
<th>Downstream Gravity</th>
<th>Total Project Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hilltop Rd</td>
<td>200 LF – 12”</td>
<td>2.0 MGD</td>
<td>10,200 LF – 16”</td>
<td>N/A</td>
<td>$7.5 M</td>
</tr>
<tr>
<td>Location 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Downstream of Sedgefield Lake</td>
<td>200 LF – 12”</td>
<td>2.8 MGD</td>
<td>12,200 LF – 16”</td>
<td>700 LF – 18”</td>
<td>$11.2 M</td>
</tr>
<tr>
<td></td>
<td>4,400 LF – 15”</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Downstream of Mackay Rd</td>
<td>200 LF – 12”</td>
<td>5.5 MGD</td>
<td>21,500 LF – 24”</td>
<td>700 LF – 12”</td>
<td>$22.2 M</td>
</tr>
<tr>
<td></td>
<td>4,400 LF – 15”</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8,200 LF – 24”</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Pump Station Siting
Pump Station Siting

- Lot Size
- Topo
- Floodplain

- Stream Buffers
- Setbacks
- Security / Privacy
Pump Station Features & Layout
PS, Gravity Sewer & FM Design
PS, Gravity Sewer & FM Design

- Modelling
- Pipeline Route / Alignment
- Survey / Utility Locations
- Geotech
- Design Elements
- Construction Methods
- Environmental & Regulatory
- Property / Easements
- Construction Cost Opinion
Modelling

- Confirm behavior of joining force mains
- Verify final pipe size/slope and pump selections
- Backup for regulatory applications
Pipeline Route / Alignment

- Streams and wetlands
- Existing sewers and easements
- Road rights-of-way
- Existing commercial development
Survey / Utility Locations

• Aerial and ground survey
• Utility locations (vacuum excavations)
• Prep for easement (property locations)
Survey / Utility Locations
Aerial and ground survey
Survey / Utility Locations
Utility locations (vacuum excavations)

Figure 1 - Bottom View of Test Hole

Figure 2 – Side View of Test Hole with measurement
Bores at PS along pipeline route (esp. at horiz. bores)
Geotech

NCDOT bridge soils report (I-73/Bridford Pkwy Bridge)
Design Elements

• Air Valves

• Pipe Materials Selection

• MHs
Construction Methods

• Horizontal Directional Drilling

• Horizontal Boring (Boring and Jacking)

• PS Access Bridge
Construction Methods

• Horizontal Directional Drilling – consulted contractors and manufacturers on site
Construction Methods

• Horizontal Boring (Boring and Jacking) – consulted contractors on site
Construction Methods

• PS Access Bridge
Environmental & Regulatory Considerations

- FEMA / USFW
- USACE / NCDEQ
- NCDEMLR
- NCDEQ - PERCS

- County Health Dept. (Wells, Septic, Hazardous Sites)
- NCDOT
- City of Greensboro
Environmental & Regulatory Considerations

- FEMA / USFW
- USACE / NCDEQ
- NCDEMLR
- NCDEQ - PERCS
- County Health Dept. (Wells, Septic, Hazardous Sites)
- NCDOT
- City of Greensboro
Environmental & Regulatory Considerations

- FEMA / USFW
Environmental & Regulatory Considerations

• USACE / NCDEQ
Environmental & Regulatory Considerations

- County Health Dept.
  Wells, Septic, Hazardous Sites
Environmental & Regulatory Considerations

- NCDOT
- Casing design
- Shoring design
Property / Easements

• Purchase of PS property

• 25 easements
**Construction Cost Opinion**

<table>
<thead>
<tr>
<th>Description</th>
<th>OPCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump Station</td>
<td>$2.5 M</td>
</tr>
<tr>
<td>Gravity Sewer</td>
<td>$3.0 M</td>
</tr>
<tr>
<td>Force Main</td>
<td>$4.5 M</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$10.0 M</strong></td>
</tr>
</tbody>
</table>
SUMMARY

Need for Project
Feasibility of Alternatives
Pump Station Siting
PS, Gravity Sewer & FM Design
Acknowledgments

- Robbie Bald, PE / City of Greensboro
- Melinda King, PE / City of Greensboro
- Andy Larrick, PE / DMP
Thank you!

MAURICIO (MO) PACINI, PE
Associate Project Manager, Arcadis (Greensboro)
- 336 443 2433
- 336 880 3400
- mo.pacini@arcadis.com

DAVID HAMILTON, PE
Project Manager, Arcadis (Greensboro)
- 336 443 2472
- 336 207 0616
- david.hamilton@arcadis.com