Added Benefits: An Update of OWASA’s Advanced Gravity Sewer Management Program

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Orange Water and Sewer Authority (OWASA)

- Services Carrboro and Chapel Hill, NC
- OWASA owns & maintains
  - 326 Miles of gravity
    - 6 to 60-inches
  - 16 Miles force main
    - 2 to 48-inches
  - 21 pump stations
Agenda

- Background on Initial Prioritization Plan
- Execution and Results of the Plan
- Shift from Singular Critical to Sub-Basin Approach
- Results of First Comprehensive Rehabilitation Performed
- Total System Risk Reduction
- Conclusions
In 2010 Condition & Criticality Factors Set Priorities for Focused Assessment and Rehabilitation

- **Facilities**
  - **Condition**
    - Capacity
      - Modeling
      - I/I Issues
    - Structural
      - Material
      - Age
    - Maintenance
      - SSOs
      - Work Orders
      - Preventative Maintenance
  - **Criticality**
    - Environmental Impact
    - Size
    - Transportation Impact
    - Ease of Emergency Repair
Rehabilitation/Monitoring Approach Based on Condition and Criticality Ratings

<table>
<thead>
<tr>
<th>Condition</th>
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<th>3</th>
<th>4</th>
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2010 Desktop Results

- Low Priority: 38%
- Regular Monitoring: 23%
- Frequent Condition Evaluation: 15%
- Mid Priority Rehab Program: 10%
- High Priority Rehab Program: 10%
- Highest Priority Action: 5%
2010 Desktop “Surrogate Factor” Results

<table>
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<th>Category</th>
<th>Percent of Gravity Sewer Length (%)</th>
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<tr>
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<td>38</td>
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<td>Regular Monitoring</td>
<td>23</td>
</tr>
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Initial Plan

- Highest Priority Action projects evaluated in first 2 years
- All Frequent Condition Evaluation projects evaluated in first 5 years and repeating thereafter every 5-10 years
- High priority program rehabilitation pipes evaluated in 2nd 5 yr period
PACP Coded Databases Assist with Application of Algorithms to Give Each Pipe A Revised Condition Rating

- Grade 1 – Minor
- Grade 2 – Minor to Moderate
- Grade 3 – Moderate
- Grade 4 – Significant
- Grade 5 – Most Significant
Structural Rating Algorithm

- **Structural Quick Rating**
  - **0000**
    - Assign Level 1
  - **1000 to 2Z1Z** (Level 1 or 2 Defects)
    - Assign Level 2
  - **3000 to 3Z2Z** (Level 3 defects)
    - If Level 3 defect is a sag > 30%
      - Assign Level 4
    - Other Level 3 defects
      - Assign Level 3
  - **4000 to 4Z3Z** (Level 4 Defects)
    - If Level 4 defects is sag > 50%
      - Assign Level 5
    - Other Level 4 defects
      - Assign Level 4
  - Greater than or Equal to **5000** (Level 5 Defects)
    - Structural Failure or Imminent Structural Failure (Collapsed, Deformed, Missing Wall)
      - Assign Level 5
    - Other Level 5 defects
      - Assign Level 4
Maintenance Rating Algorithm

- **0000**
  - Assign Level 1

- **1000 to 2Z1Z** (Level 1 or 2 Defects)
  - Assign Level 2

- **3000 to 3Z2Z** (Level 3 defects)
  - Assign Level 3

- **4000 to 4Z3Z** (Level 4 Defects)
  - Assign Level 4

- **Greater than or Equal to 5000** (Level 5 Defects)
  - If taps, obstacles/obstructions, deposits >50%
    - Assign Level 5
  - If Infiltration Gusher/Runner
    - Assign Level 5
  - If not
    - Assign Level 4
Rehabilitation/Monitoring Approach Based on Condition and Criticality Ratings

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## Condition of Inspected Pipes

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<th>Phase 1 Percent of Pipe (%)</th>
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<td>Good to Fair (&lt;= Level 3)</td>
<td>73%</td>
<td>92%</td>
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<td>Poor Condition (Level 4 or 5)</td>
<td>27%</td>
<td>8%</td>
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Phase 1 = Highest Priority Action Pipes  
Phase 2 = Frequent Condition Evaluation Pipes
2015 Re-Prioritization of Future Assessment

Shift from Singular Critical to Sub-Basin Approach
Rehabilitation/Monitoring Approach Based on Condition and Criticality Ratings

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Phase 1 = Highest Priority Action Pipes

Phase 2 = Frequent Condition Evaluation Pipes

Phase 3/4 = 40% Frequent Condition Evaluation/60% High Priority Mini-Basins
Fixing Pipes in Poor Condition

- Primarily CIPP lining & Manhole rehabilitation
- Point repairs, limited open-cut, limited pipe bursting
Program Revisions & Considerations

- Rehabilitation of lateral connection in the following cases:
  - Active I/I is observed at connection
  - Defective lateral connections
  - Roots at lateral connection where I/I can enter

- Consider changing rehabilitation methods to comprehensive rehabilitation to reduce I/I where needed
  - First step: Flow monitor minibasins as a with suspected high I/I
First Comprehensive Rehabilitation Project Driven by Pump Station High Level Alarms Was a Success

- Rangewood Pump Station – Small, older, 6,000 lf development - high level alarms & pump and haul required during some large events
- OWASA does not own the laterals, but decided it was required to perform comprehensive rehabilitation (including lower laterals) in this case.
- No pre/post monitoring data available other than average run time data
- Run times have dropped and no high level alarms since comprehensive rehabilitation completed in 2015.
System Risk Calculation

Total System Risk Calculation = (Condition Level x Criticality Level x Pipe Length) / Total System Pipe Length

- **Criticality Level 1**: Mid Priority Program Rehab
- **Criticality Level 2**: High Priority Program Rehab
- **Criticality Level 3**: High Priority Program Rehab
- **Criticality Level 4**: Highest Priority Action
- **Criticality Level 5**: Highest Priority Action

- **Condition Level 1**: Regular Monitoring
- **Condition Level 2**: Regular Monitoring
- **Condition Level 3**: Regular Monitoring
- **Condition Level 4**: Regular Monitoring
- **Condition Level 5**: Regular Monitoring

16 or Higher is Very Poor Risk Score
6 or Less is Very Good Risk Score
Total System Risk Reduction

- Total System Initial Risk = 8.1
- Revised System Risk based on CCTV Inspection to date = 7.3
- Revised System Risk based on Current Rehabilitation Plan = 6.9
Conclusions

- A risk based approach is essential to identify priorities.
- Commitment to what's important vs urgent - this approach helps focus staff on what's important - look beyond fixing broken 6-inch VCP in neighborhoods and make sure first you identify and understand the condition of your critical pipes.
- Once the condition of critical assets are known and a plan is in place to re-asses, then a shift to a sub-basin approach to rehabilitation will allow OWASA to begin to focus more on I/I reduction and make critical decisions on where to perform comprehensive rehabilitation.
Conclusions

- Comprehensive rehabilitation including laterals to the clean-out will reduce I/I but the same effect is likely not seen when focused on individual pipes.

- Calculation of total system risk and ways to reduce it builds the case for increased infrastructure investment in terms that community leaders can understand.

- Understanding and addressing these infrastructure needs is vital to the long term economic vitality of our communities.
Discussion
Section Title