Corrosion and Odour Control in Gold Coast’s Sewers

Presentation to: Urban Water Forum 2016
Advanced Water Management Centre
The University of Queensland

Presenter: Mark M. Hunting
Executive Coordinator Sewerage Catchment Planning
City of Gold Coast
The Gold Coast Sewer Network

- 4 Sewage Treatment Plants – Pimpama, Coombabah, Merrimac, Elanora
- 360 km of rising mains
- 2,600 km of gravity sewers with 59,000 manholes
- 530 pumping stations
Odour and Corrosion in the Sewerage System

- Odour & Corrosion
- Air Release Valve
- Manholes
- Gravity Sewers
- Rising Mains
- Pump Stations
- Sewage Treatment Plant
Odour and Corrosion in the Sewerage System

\[ \text{H}_2\text{S} + \text{O}_2 \rightarrow \text{H}_2\text{SO}_4 \]

- Odour & Corrosion
- Concrete/Metal Corrosion
- Biofilm
- H\(_2\)S
- Molecular H\(_2\)S
- Soluble HS
- Organic Carbon
- Volatile Organic Compounds
- Dissolved Sulfide
- HS + H\(_2\)S
- H\(_2\)SO\(_4\)
- H\(_2\)O (Moisture)
- Emission
- Sewer Wall
- Sediment

Air

Water
Challenges and Drivers

- Long and flat terrain
- Premature asset failure
- Customer complaints
- Regulatory compliance
- Chemical costs
Gold Coast Water’s Aims

- Control strategies for prevention of asset failures due to premature corrosion
- Manage and understand system behaviour for optimal process control
- Mitigation of odour
- Sewer Corrosion and Odour Management Plan
Research Integration in the Industry

- Hydrogen Sulfide in Sewer Networks
- Identify the Needs to Mitigate the Issue
- Research Institution
- Research Grants and Funds
- Partnership with Water Utilities
- Research and Development
- Pilot Testing
- Results Interpretation
- Model Development and Simulations (MATLAB Based)
- Data Gathering
- SeweX
- Large Scale Application
- Rising Mains and Gravity Sewers

Water Utilities
UQ Partnership with the City of Gold Coast

- Sulfide Generation Model Development (UC09), 2003
- ARC Linkage Project 1 (Biotransformation project), 2004-2007
- ARC Linkage Project 2 (SCORe project), 2008-2013
- Odour Control at Elanora (Rising main) and STP, 2010
- Cloevis pilot study, 2012
- Coombabah Wastewater Treatment Plant Odour Abatement Project, 2013
- ECG project - pilot study (ongoing in UC09)
The \( \text{H}_2\text{S} \) Model (SeweX)

ARC Linkage project in collaboration with UQ-AWMC, GCW, Sydney Water Corp, Brisbane Water, SA Water and UQ

A dynamic model that predicts corrosion rates, dissolved sulfide and sulfate, pH and COD

Model built for SPS C27, B49 and B9 trunk rising main using

- Sewer details from site inspections and GIS
- Online - monitoring checks (S::CAN)
- Measured online flow data from STP

Calibrated using grab samples and online total dissolved sulfide
C27 Elanora Catchment

- Built in the 1980’s
- 204 km total gravity sewers
- 36 km rising mains
- 9 km C27 trunk
- 57 Pump Stations
- 4900 Manholes
- 58,000 EP @ 12MLD ADWF
Elanora Catchment Optimization

- **Sulfide modelling results**
  - Reduction of $\text{H}_2\text{S}$ using Oxygen Dosing
  - Reduction of $\text{H}_2\text{S}$ using Ferric Chloride Dosing
  - Reduction of $\text{H}_2\text{S}$ using Magnesium Hydroxide Dosing

<table>
<thead>
<tr>
<th>Network</th>
<th>Chemical</th>
<th>Injection Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>C27</td>
<td>Oxygen</td>
<td>1770m upstream of STP</td>
</tr>
<tr>
<td></td>
<td>Ferric chloride</td>
<td>544m upstream of STP</td>
</tr>
<tr>
<td></td>
<td>Magnesium hydroxide</td>
<td>50m upstream of C27 PS</td>
</tr>
</tbody>
</table>
Oxygen Injection Dosing Results
Ferric Chloride Dosing Results
Magnesium Hydroxide Dosing in C27
Gold Coast Water Benefits

- Obtain an optimal network-based sulfide control strategy for the Elanora rising main system.
- Implementation of the strategy removed the number of oxygen injection stations and saved $0.5M/year of oxygen injection cost.
- Added bonus of asset protection in the network (asset deterioration estimated at $1.5M/year for the Elanora catchment, SKM 2007).
What are our Challenges?

- Choice between emerging technologies which are applied to networks with knock-on benefits through STP’s
- Justification of various options through cost benefit analysis
- Knowledge transfer to utilities for optimised control
Moving Forward

- Application of the modelling process to both gravity and rising main networks
  - Elanora Sewerage Catchment
    - Model Development/ Build-up - March 2016
    - Field Monitoring/ Model Calibration - July 2017
    - Project Completion - December 2017

- Implementation in other Gold Coast sewerage catchments
  - Coombabah Catchment: - January 2017
  - Stapylton Catchment: - July 2017
  - Merrimac East & West Catchment: - January 2018
  - Helensvale Catchment: - January 2019
Thank You!
Contact details

Mark Hunting  
Executive Coordinator Sewerage Catchment Planning  
E mhunting@goldcoast.qld.gov.au  
W cityofgoldcoast.com.au

Enrico Olympia  
Modelling/Planning Engineer  
E eolympia@goldcoast.qld.gov.au  
W cityofgoldcoast.com.au