A Case Study of Latham Water District’s Mohawk View Water Treatment Plant - Filter Failure
Outline

- The Mohawk View Water Treatment Plant & 2005 Expansion
- What Happened?
  - 2010 Failure and Subsequent Failures
  - Investigation of the Failure
- Remediation & Repair
- What We Learned
- Q&A
Plant Expansion to 31.5 MGD
- Rebuilt Filters 1 - 6
- New Filters 7 - 10
EXPANSION

Capacity: 31.5 MGD

2005: Completed $24 Million Expansion

- 4 New Dual Media Filters
- 6 Existing Filters Rebuilt
- All Filters Had Under Drain Systems and Utilized Filter Media Support Caps
Orifice Plate

Mechanically attached to the old tank wall

Integral connection between old and new
Under Drain Block

Media Support Cap

Underdrain Block
Plant Expansion to 31.5 MGD
- Rebuilt Filters 1 - 6
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Grout Repairs in Filters 7 & 8
- Manufacturer Representative instructs operators on repair techniques
- Repairs went well

All appears fine...making water
Timeline

Plant Expansion to 31.5 MGD
- Rebuilt Filters 1 - 6
- New Filters 7 - 10

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Grout Repairs in Filters 7 & 8
- Manufacturer
  Representative instructs operators on repair techniques
- Repairs went well

Media loss observed in Filter 4
- Underdrain uplift noted
- Manufacturer notified
Initial Inspections by Plant

Block Connections Broke
O-Rings Exposed
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May 2011 – Media removed from Filter 4

June 2011 – Manufacturer site visit & inspection of failure

July, 2011 – Manufacturer’s report
- Rebuild Filter 4 with new underdrains
- Town decides to have an independent review of the failure
Manufacturer’s Initial Inspection

**Findings:**

- Filter has approximately 11 lifted laterals. Grout was seen pushed out of the vertical joints at the failure point.
Manufacturer’s Initial Inspection

- Buckled underdrain system
- Damaged grout and block connections
Manufacturer’s Initial Inspection

- The 45 degree chamfer that covers the orifice plate on the water entry side has areas where the grout has broken free and several noticeable leaks can be seen.
Manufacturer’s Initial Inspection

- A split media support cap was found at the back end of the filter
- No noticeable leaks were found where the media support cap attaches to the underdrain blocks
Manufacturer’s Initial Inspection

cold joint clean break full grout penetration no issue

L-rod pulled out no epoxy found

blocks lifted from basegrout media underneath

basegrout stuck to tank floor
Manufacturer’s Inspection Conclusions

- Leaks along orifice plate allowed media to enter underdrain
- Not much media inside laterals away from failure point
- Media support caps hydraulically tested – pressure drop in “normal range”
- Media under caps only where cap was split
- L-rod installed improperly ... no epoxy, easily pulled out of the tank floor
Manufacturer’s Recommendations

REBUILD FILTER

• Remove all underdrains and base grout
• Backwash and flush all media from filter #4 flume and piping
• Remove and clean & reinstall the orifice plate
• Install new underdrain
• Test new system and re-install media
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B&L begins investigation of filter failure

Timeline
Filter Investigation

✓ Determine the Cause of Filter 4 Failure

✓ Assess Potential for Other Filters to Fail
Filter Investigation
Filter Investigation

Backwash Observations:

✓ Continued air release during High Rate Wash

✓ Significant Boils along Gullet wall
Filter Investigation

Air must vent through underdrains

Air vent during water wash

Air line installed low
Filter Investigation
Filter Investigation

No caulk evident at orifice – wall interface

Orifice fasteners found loose
Seal at Orifice Plate

Misplaced Caulk
Filter Media in Effluent Flume
Filter Media Escapes Filter Tank
Filter Investigation

From top of media support cap

From bottom of media support cap
Filter Investigation

Significant amount of GAC found under media support caps
Filter Investigation

- Exposed Orifice Plate
- Failing Grout at Fillet
- ‘Old’ Rough Existing Concrete
Filter Investigation

Here is what happens when media builds up under media support caps.

Filters 1 & 5 Shut Down
Filters 1, & 5 Media in Flume
Plant Expansion to 31.5 MGD
- Rebuilt Filters 1 - 6
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Media loss observed at Filters 1 & 5
Filters 1 & 5 shut down

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Today
B&L Filter Investigation

Conclusions

- Low air vent from flume results in boils and loss of media during backwash
- Media leakage around orifice plate resulted in
  - Media buildup under support caps
  - Excessive backwash cycle pressure
- CATISTROPHIC FAILURE OF Filter 4 UNDERDRAIN STRUCTURE
- Repair Filters 4, 1 & 5 as “Emergency”
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B&L begins investigation of filter failure

Media loss observed at Filters 1 & 5
Filters 1 & 5 shut down

Emergency declared
- Filters 1, 4 & 5 Fast-track rehab initiated
- Filters 2, 3 & 6 rehab also initiated

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Demolition
Filter 4 Rebuild
Re-installing Orifice Plate
Filter 4 Rebuild
Ready To Install Support System
Filters 1, & 5 Repair

Clean media out of flume and piping
Filters 1 & 5
Repair
Flush media from Underdrains
Filters 1 & 5
Filters 1 & 5 Repair

Filter Support
Block Orifice
Plate Interface
Filters 1, 2, 3, 5 & 6 Repair

Seal at the orifice plate
Monitoring of Future Problems
Monitoring Backwash Pressure
Monitoring Backwash Pressure
What Was Learned

- ‘Institutional Knowledge’ Has Left The Building
  - retirement of key workers
- Do Not Underestimate Apparently Small Problems
  - track down problems to their root cause
  - relentless attitude is needed when problems arise
- Get Others Involved Early
  - Design Engineers
  - Manufacturers
“It’s the little details that are vital. Little things make big things happen.” — John Wooden