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2016 Water Quality and Technology Conference
November 16, 2016

Distribution System Optimization- San Jose Water's Pursuit of Distribution System Water Quality Excellence

Presentation Overview

- What is the Partnership?
- Foci of Optimization
- Response to Performance
- Operational Methods for improvement
- Capital Tools for improvement
- SJWC Optimization efforts
  - Current and Planned
- Lessons learned

What is the Partnership?

AWWA Partnership for Safe Water-Distribution System Optimization Program

- Came out of 2007 WRF project
- Provides framework for improvement
- Includes utility benchmarks
- Commitment to quality and organizational improvement

What is the Partnership?

- Four Phase Process
  - Phase I: Commitment

    Utilities commit to engage staff, collect and assess data, and pursue improvement
  - Phase II: Data Collection

    Annual Data submission focusing on disinfectant residuals, pressure data, and main break statistics
  - Phase III: Self-Assessment

    Narrative report analyzing data, and identifying "performance limiting factors"
  - Phase IV: Optimized Performance

    Achieve highest level of optimization

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Foci of Optimization

Focus 1: Main Break Frequency

- ≤15 breaks per 100 miles ☑ 8.9
- Declining five year average ☑

http://www.theengineer.co.uk/Pictures/web/d/y/r/33_water_image.jpg

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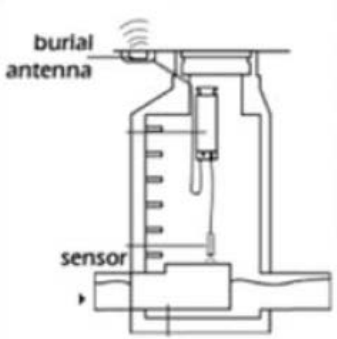
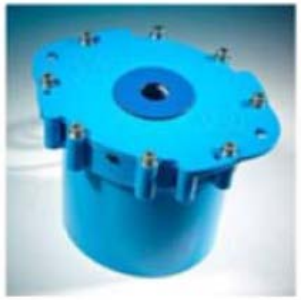
Foci of Optimization

Foci of Optimization 2: Pressure Monitoring

- 20 psi minimum in 99.5% daily minimum measurements
- Utility specified (150 psi) maximum in 95% of measurements
- Daily pressure fluctuations do not exceed utility specified goal (50% of the average) in 95% of measurements
- Pressure collected at a minimum of two critical sites in each pressure zone





TBD

Pilot cover 10 zones. Full scale install complete December 2016

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Foci of Optimization

Focus of Optimization 3: Disinfectant Residual

- 95% of monthly routine residual measurements above target levels
  - Free Chlorine Residuals ≥ 0.20 mg/L
  - Total Chlorine Residuals ≥ 0.50 mg/L

61% of all SJWC measurements meeting criteria

http://cdn2.hubspot.net/hub/15602/file-13265990-jpg/images/dpd_test-resized-600.jpg

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SJWC Background

- Privately owned public utility
  - 150 years old
  - Over one million customers
  - 2400 miles of pipe
  - 23 well fields with almost 100 wells
  - Two Water Treatment plants
  - 14 Imported Water Turnouts
  - 98 storage tanks and reservoirs
  - 140 Distribution system sample taps

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SJWC Background

- Built for reliability
  - As much extra storage as possible
  - High residence times in storage
- Built for economy
  - Highly optimized to minimize cost by automating selection of most affordable source water regardless of disinfectant
  - Source of water for an area could change day to day
  - Lots of residual blending

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SJWC Background

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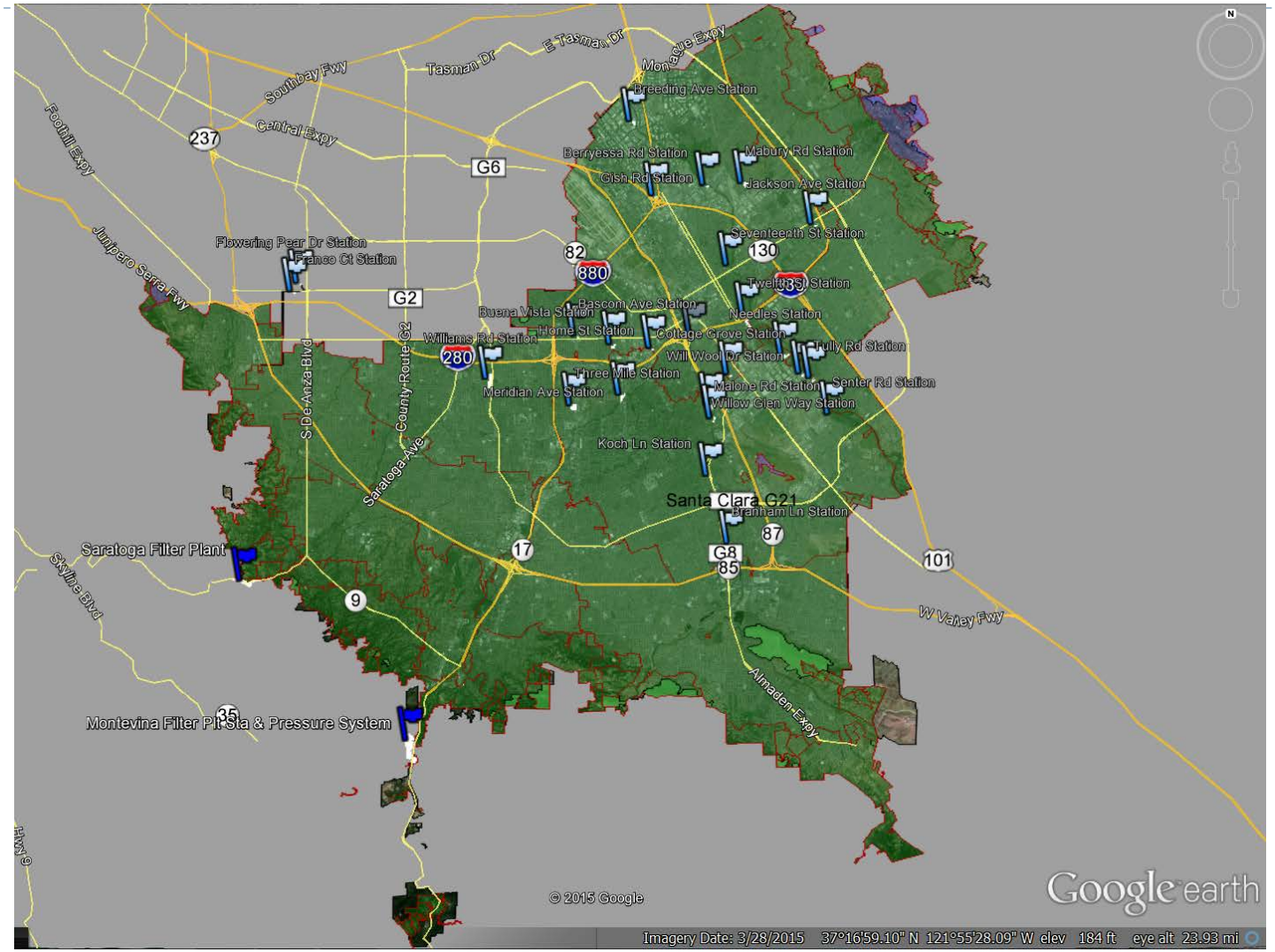
SJWC Background



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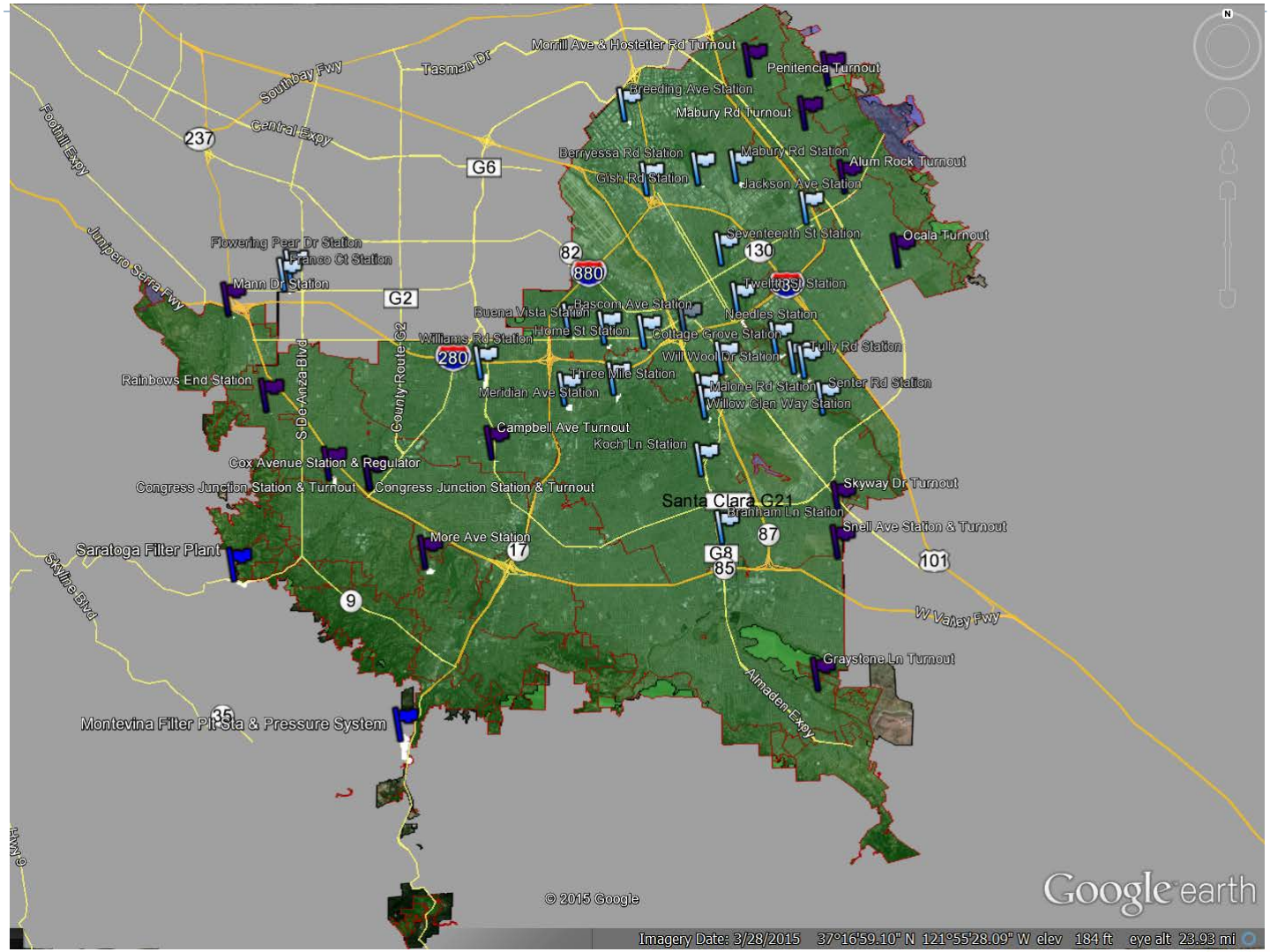
SJWC Background



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SJWC Response

Where to start?

Step 1- Get Better Data

- Jan 2014- SL1000's deployed for nitrification monitoring
- Total chlorine, monochloramine, free ammonia, nitrite weekly at every tank

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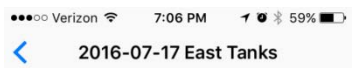
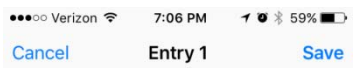
SJWC Response

Step 2- Make your data useful

- Migration to Locus EIM cloud database
  - Better data accessibility/reporting/tracking
  - Accommodates mobile data entry with real time alerts

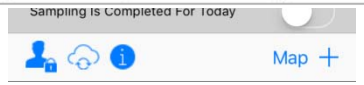


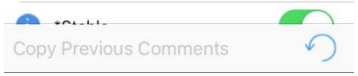


From: support@locustec.com
To: Feffer, Adam
Cc:
Subject: Potential Exceedance for Field Measurement Parameters on EDD Upload for EIM Site San Jose Water (Dataset No. 7494)

The following potential field parameter exceedances were detected in EIM Site: San Jose Water (Dataset No. 7494):

Action Limit Name	Sampling Program	Field Sample ID	Sample Date	Location ID	Field Measurement Medium	Sample Type	Parameter Name	Measurement Value	Measurement Start Depth
Water Quality field monitoring	Nitrification Monitoring		07/12/2016	Bayview			Chlorine (Total)	0.07	





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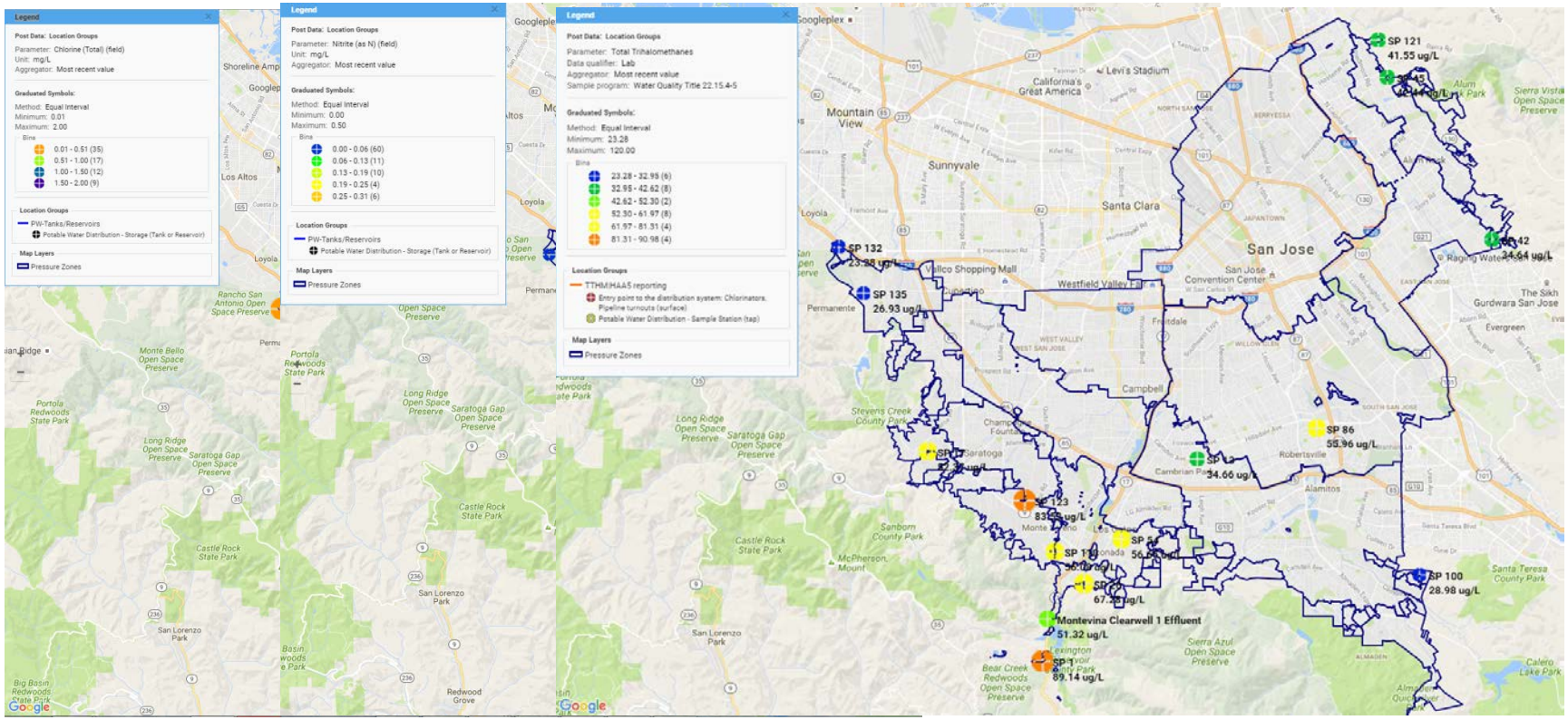
SJWC Response

Step 2- Make your data useful (cont'd)

- Live online WQ GIS maps



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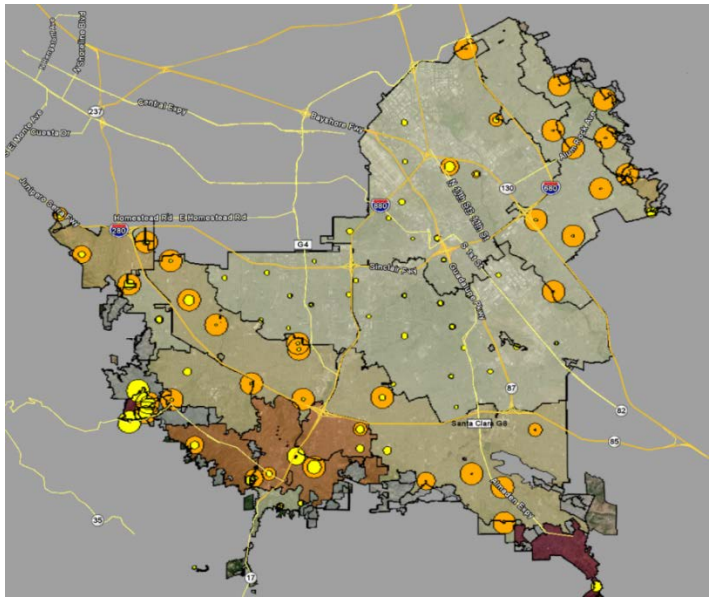
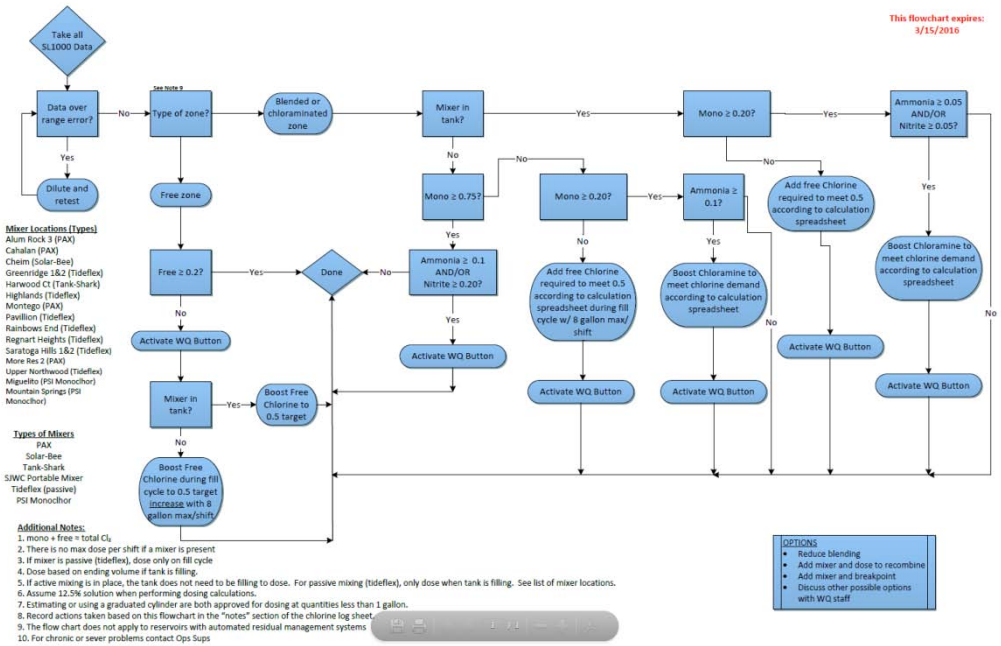
SJWC Response

Step 3: Figure out what to do with it short term

- Weekly Ops/WQ meeting for residual, GIS, and project review
  - Map tools
  - Flow chart protocol





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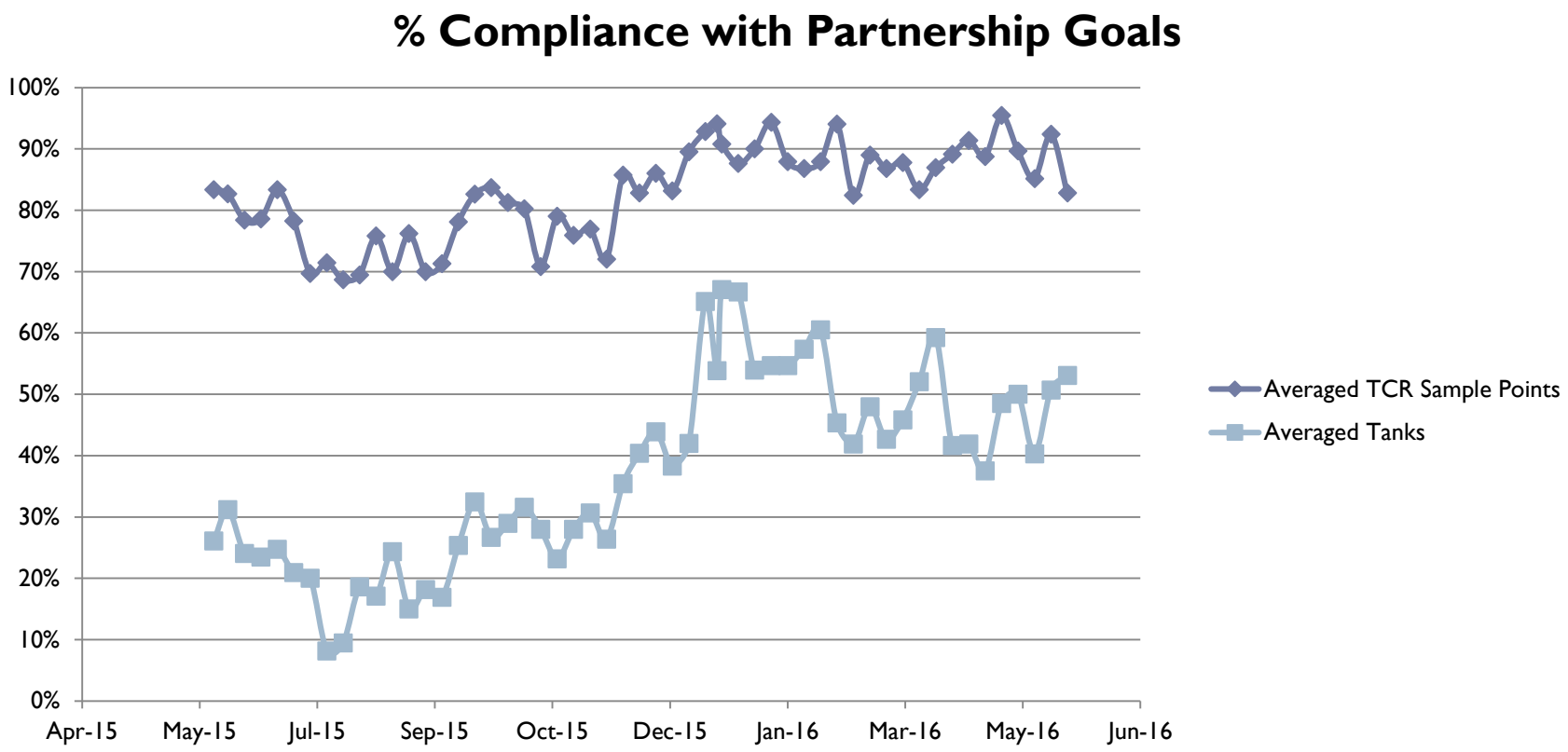
SJWC Response

- Step 3: Figure out what to do with it short term (cont'd)



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SJWC Response

Step 4: Figure out what to do with it-Long term

- Possibilities for operational improvements
- Tools for Capital Projects

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SJWC Response

Step 4: Figure out what to do with it-Long term Operational Methods for Improvement:

- New or revised SOPs
- New skills or personnel
  - Training- conceptual or technical
  - Hire staff if needed
- Modified Treatment processes
  - Check for unexerted biological or chemical demand

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SJWC Response

Step 4: Figure out what to do with it-Long term

Tools for Capital Projects:

1. Residual boosting systems
2. SCADA controlled operational zone valves to reduce water age
3. Tank mixing systems (manual venturi boosting) to preserve residual and facilitate corrective action

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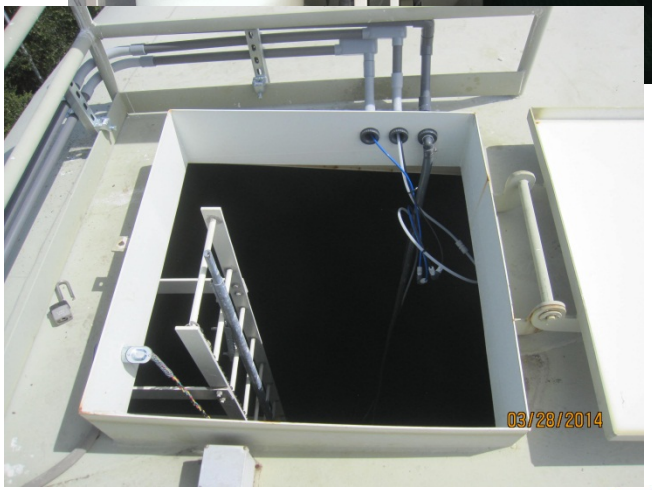
Tools for Optimization

Automated Chloramine Boosting System



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Tools for Optimization

Boosting System Installation at Miguelito

- Two mixers in each of two 1.5 MG reservoirs
- One dosing point in each reservoir
- Motive force from higher zone pressure
- Onsite hypochlorite generation
- Fully automated chemical feed to achieve target set point
- Liquid ammonium sulfate- comparatively safe
- Full SCADA integration
- Full Secondary containment

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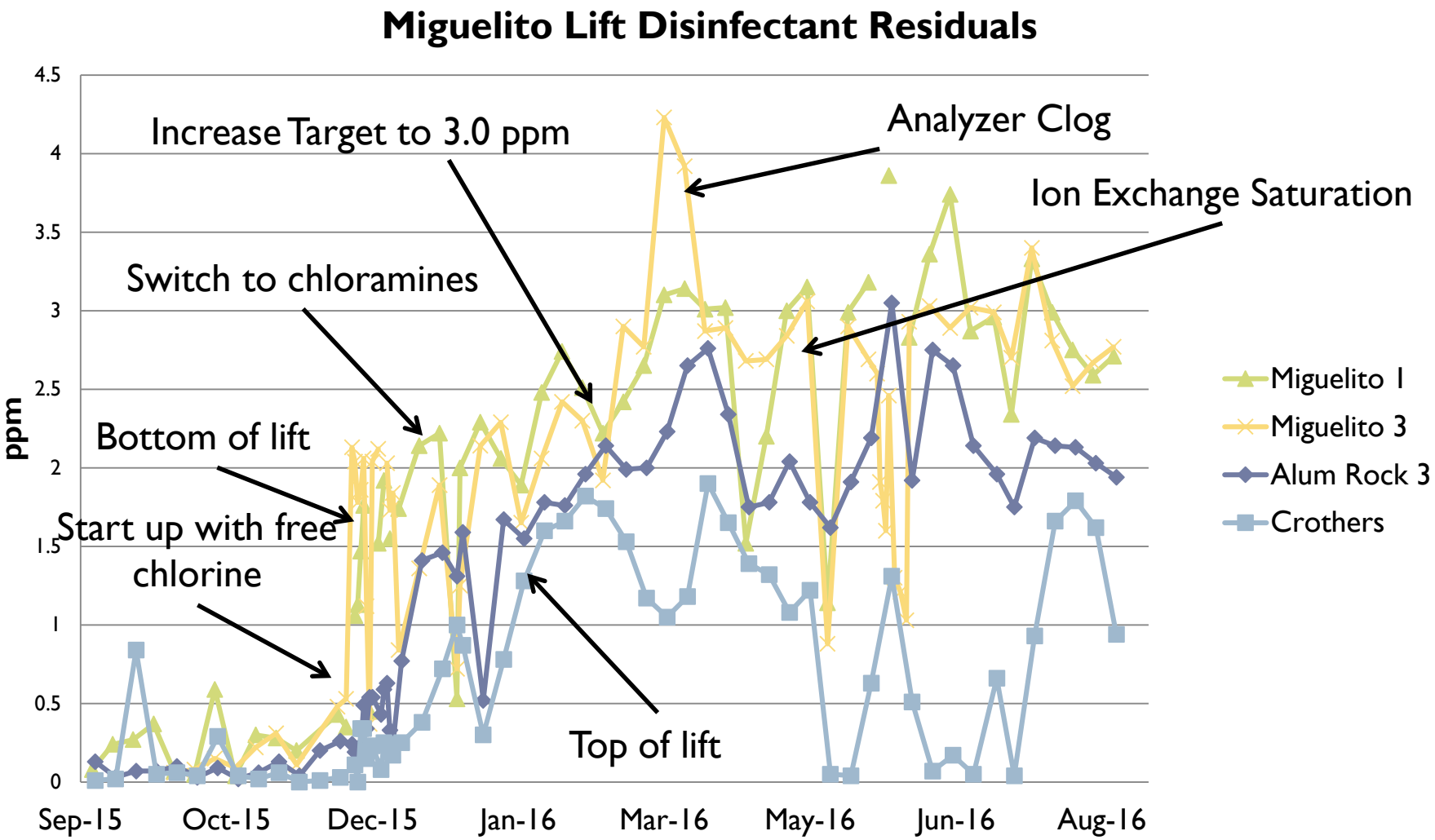
Tools for Optimization



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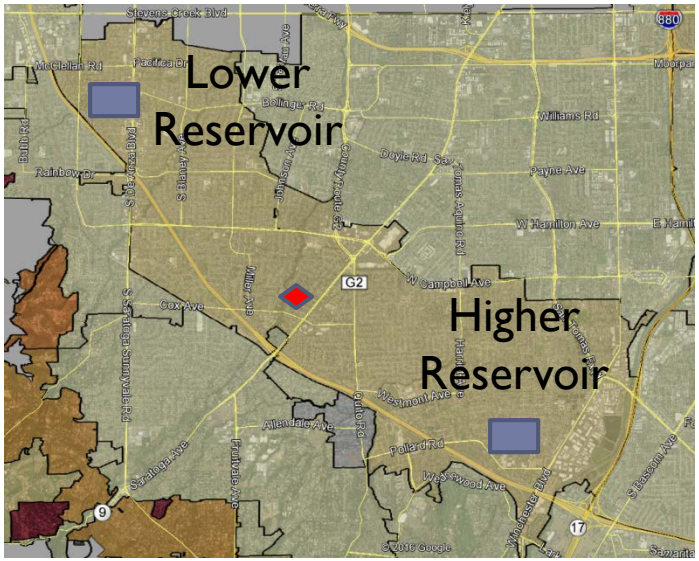
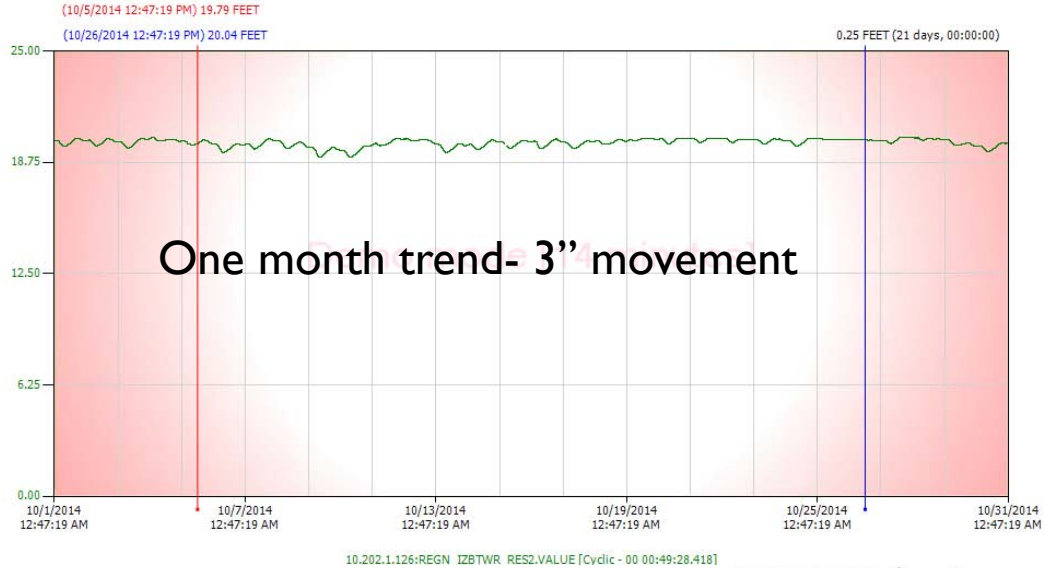
Tools for Optimization

Operational Zone Valve

- Large Zone (~20k services)- multiple reservoirs
  - One Reservoir site sits 20' higher than the other
  - One zone input on south side (can't split zone)
  - One main connects zone across a creek





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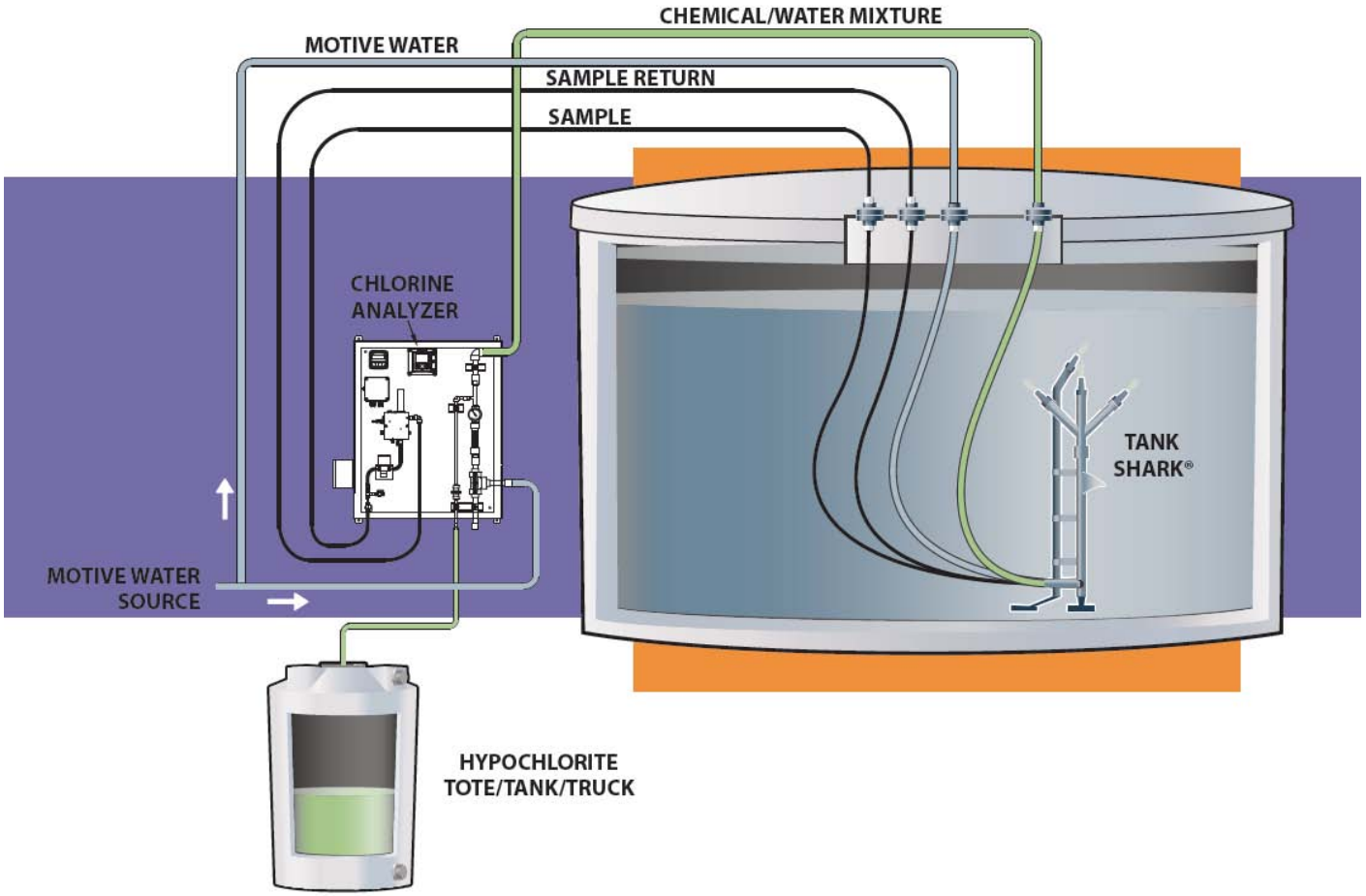
Tools for Optimization

Mixer/Analyzer/Venturi boosting



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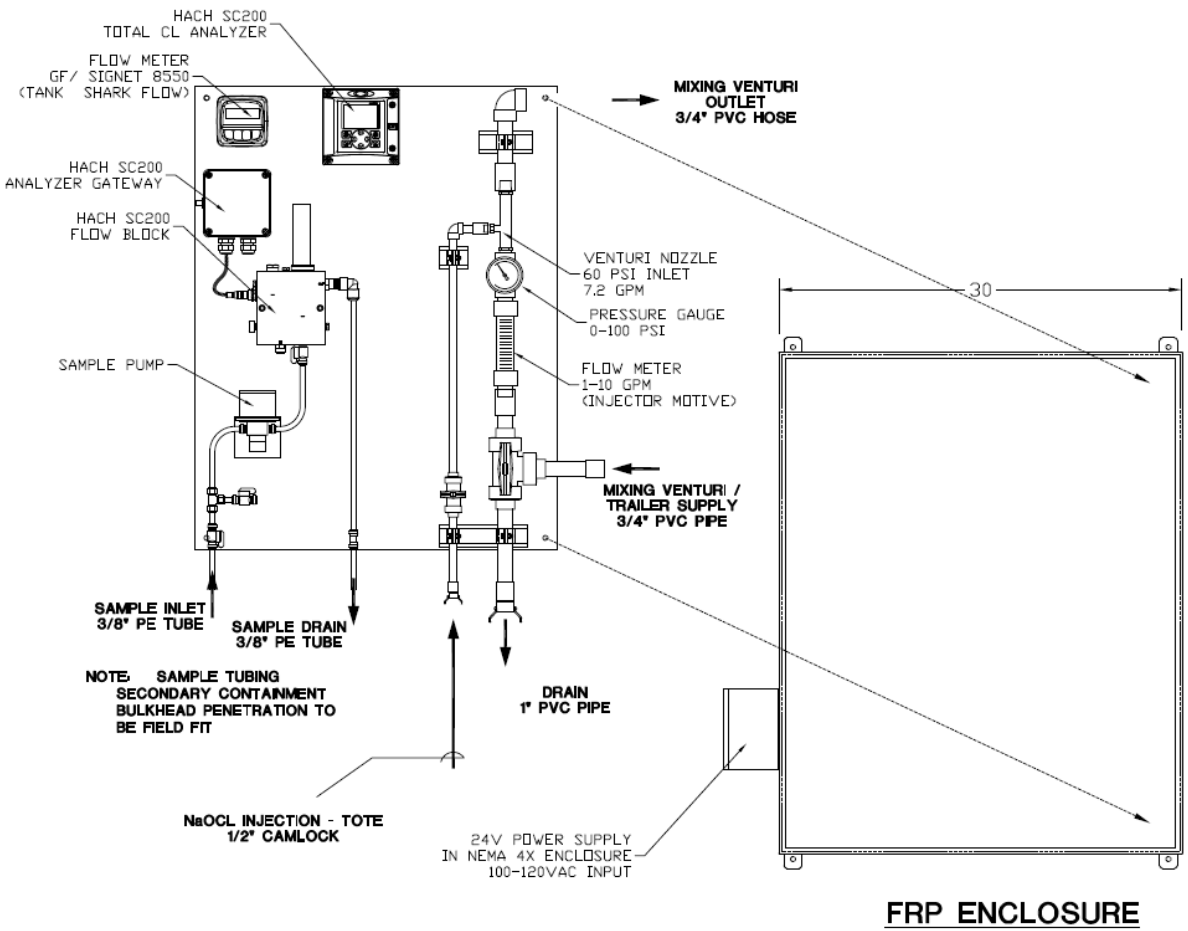
Tools for Optimization

Mixer/Analyzer/Venturi boosting



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SJWC Optimization Efforts

- Revision of main break response SOP to incorporate risk-based "triage" strategy (per AWWA C651-14 and WRF Project 4307 *Effective Microbial Control Strategies for Main Breaks and Depressurization)*
- Improved SOPs for tank inspection and cleaning in draft
- Hydraulic model improvements to incorporate water age and disinfectant residual

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SJWC Optimization Efforts

Planned Outcomes: CIP

- SCADA controlled valves (3 in progress)
- Four residual boosting systems approved in years 2015-2017- two are complete
- Mixing systems with venturi-style dosing ports at 7 key sites in 2016. All tanks and reservoirs by 2019
- Two key well fields chloraminated to reduce disinfectant blending

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Lessons Learned

- Residual less that 2 ppm cannot be sustained
  - EPA's Distribution System Optimization program for Comprehensive Performance Evaluation requires 2 ppm minimum in chloraminated systems to be considered "optimized"
- Beware of cometabolism of residual by Ammonia Oxidizing Bacteria
  - Can cause rapid residual loss without the occurrence of nitrification
  - May account for upwards of 40% of residual loss

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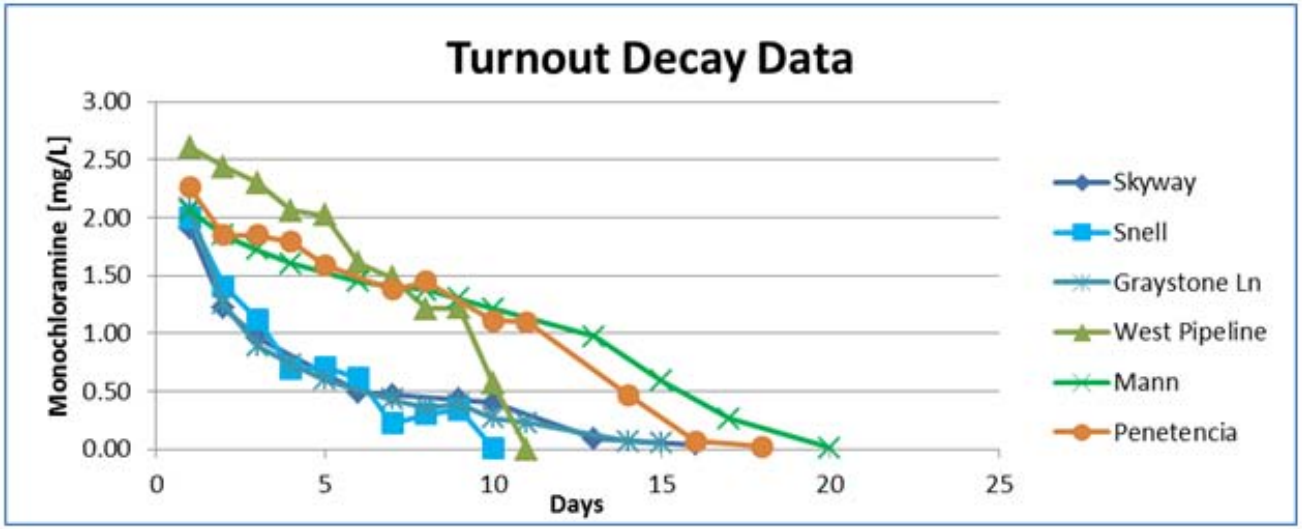
Lessons Learned

- Residual less that 2 ppm cannot be sustained
  - EPA's Distribution System Optimization program for Comprehensive Performance Evaluation requires 2 ppm minimum in chloraminated systems to be considered "optimized"
- Beware lingering demand



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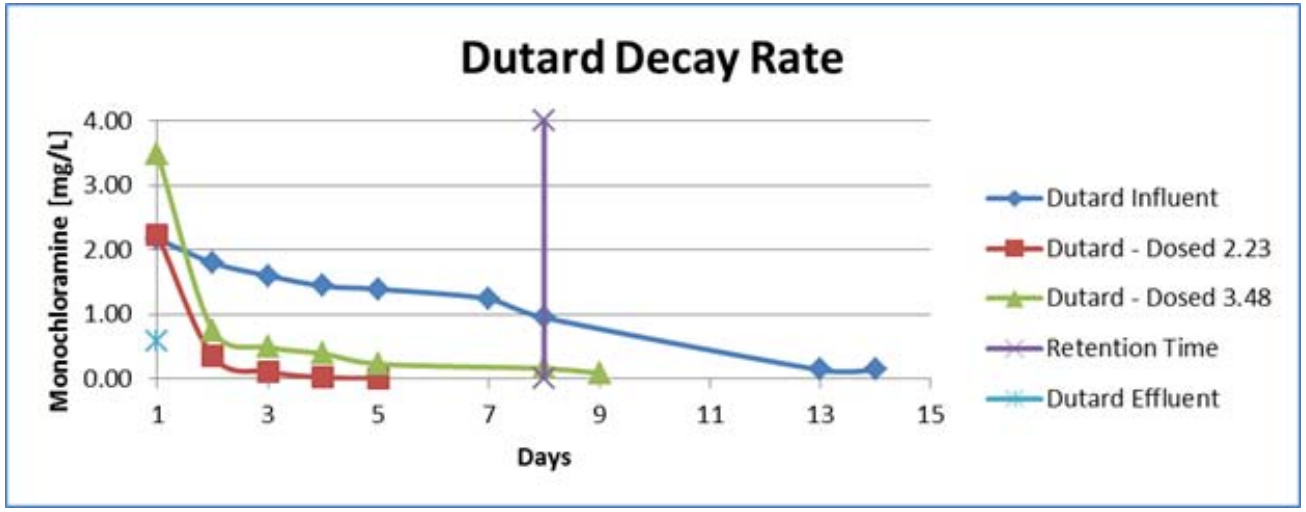
Lessons Learned

- Make good use of decay curves



- Characterizing residence time and entry point residual compared to normalized decay curve for influent water can help determine the need for boosting

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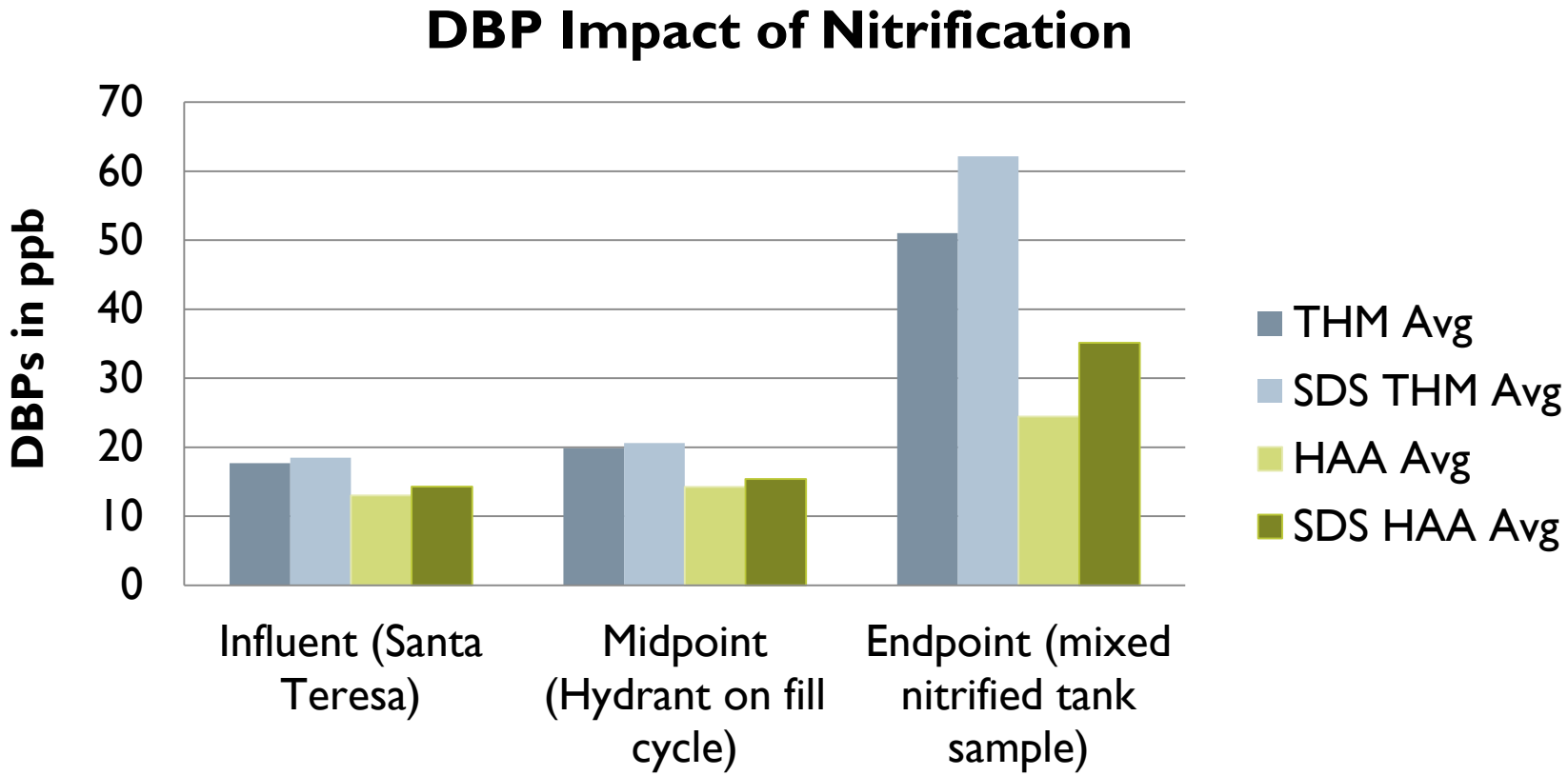
Lessons Learned

- Nitrification makes your DBPs worse
  - Stanford Study with Teng Zeng and Bill Mitch



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Focus: Residual- Lessons Learned

- Focusing on the worst residuals will not solve most of your residual problems
  - Must pinpoint and understand causes of degradation
- Mixers facilitate operational response
  - Will not sustain residual or reverse nitrification in progress
  - Will assist boosting, breakover, or help sustain non-nitrifying waters
- Operations-Water Quality partnership is essential

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Distribution System Optimization

Questions?

Adam Feffer

Senior Water Quality Engineer

Adam.Feffer@sjwater.com

Cell: 408-605-5193

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