WATER ENVIRONMENT FEDERATION
ODORS AND AIR POLLUTANTS

2020

Odor & Corrosion Juggling Act: Challenges of Upgrading a Major Municipal Collection System Odor Control Program to Include Corrosion Control Objectives

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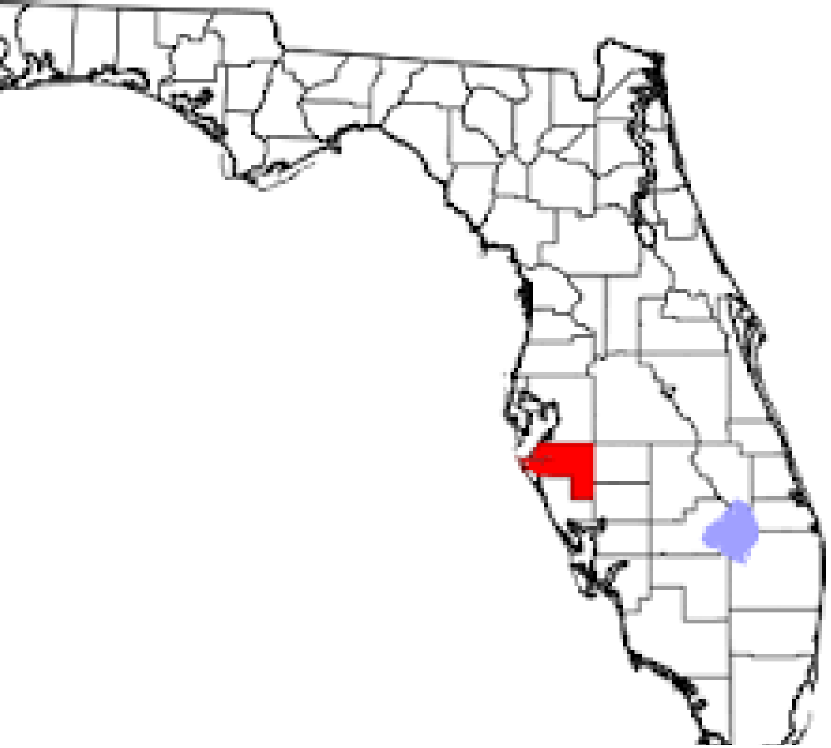
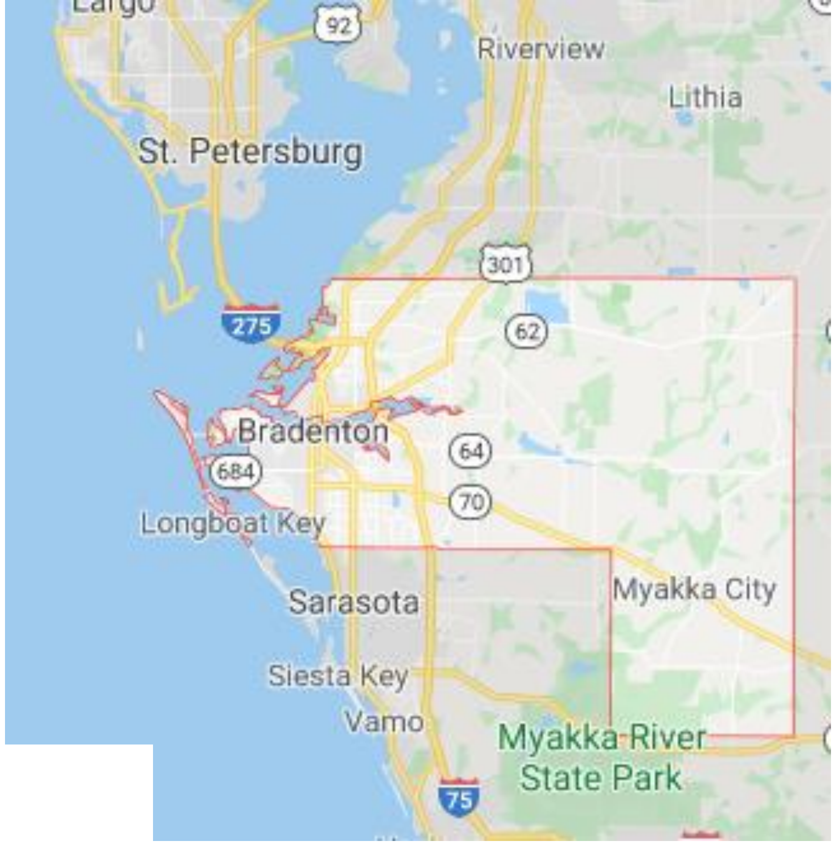




Manatee County
FLORIDA

- Area: 893 square miles
- Population: 385,571 (2017)
- Founded: 1855
- County Seat: City of Bradenton

Manatee County Utilities Collection System

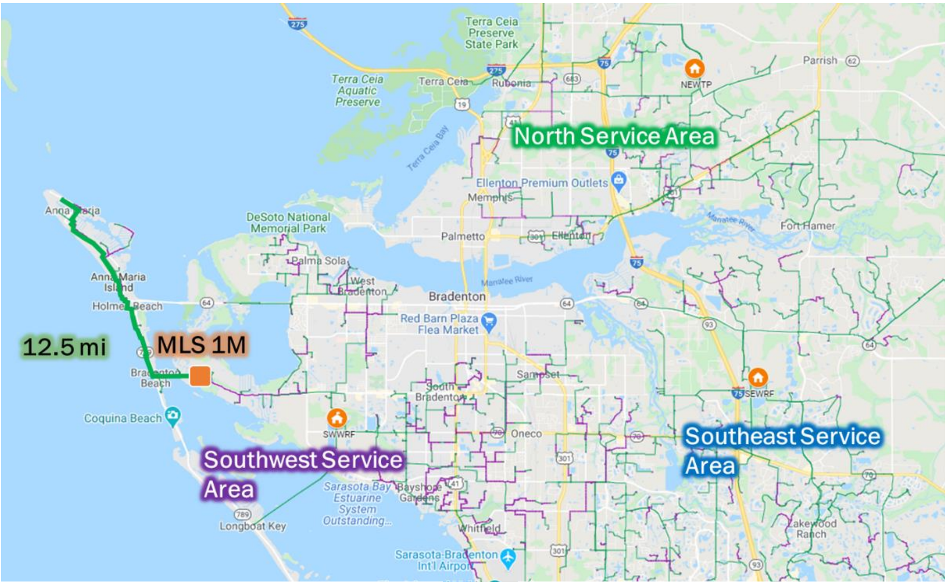
- Key Stats:

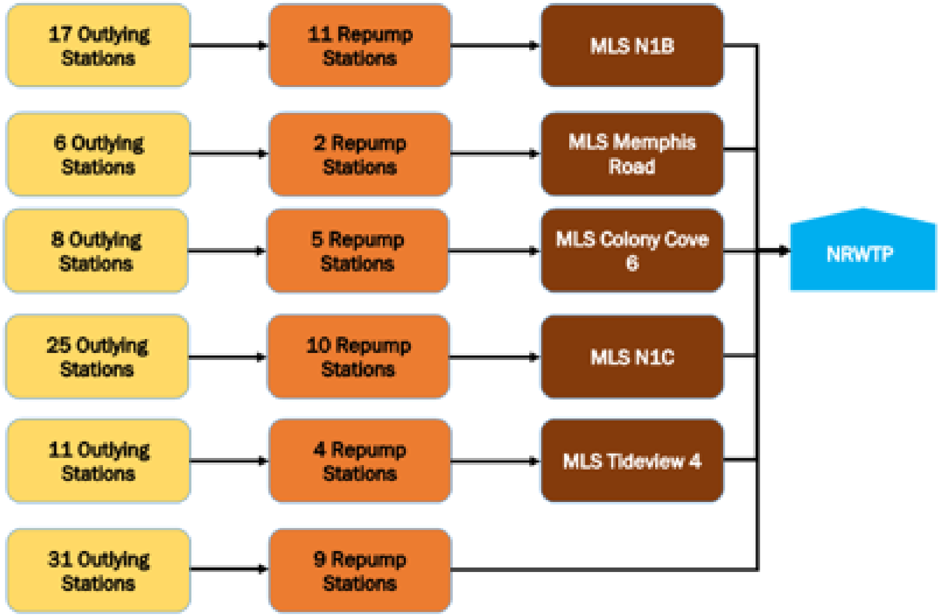
-100,000 customers

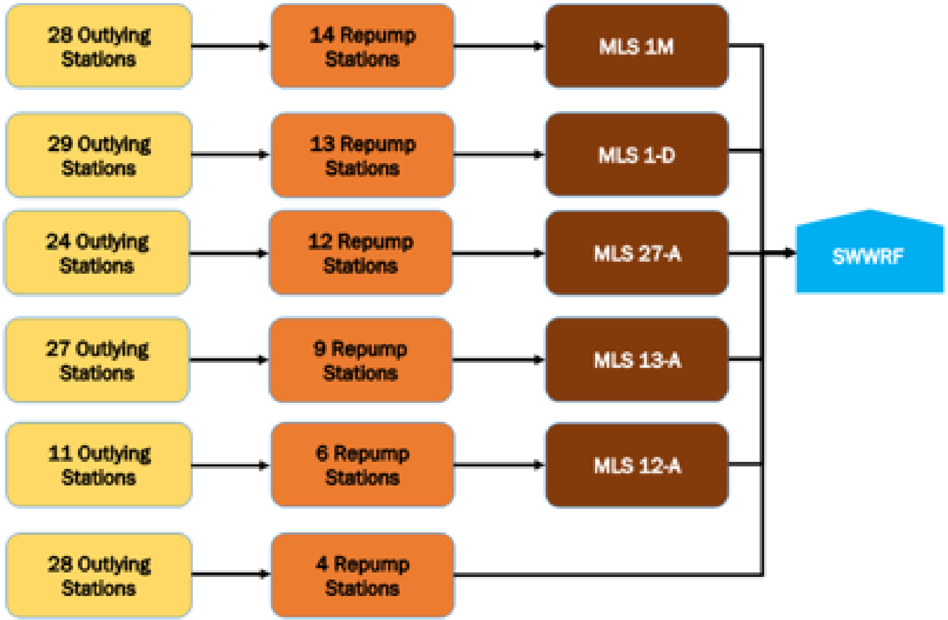
- Covers unincorporated area, majority of County
- Flat terrain → majority of flow has long RT
- Warm temperatures → wastewater quickly loses DO
- Sulfide generation extensive, H_2S release opportunity widespread

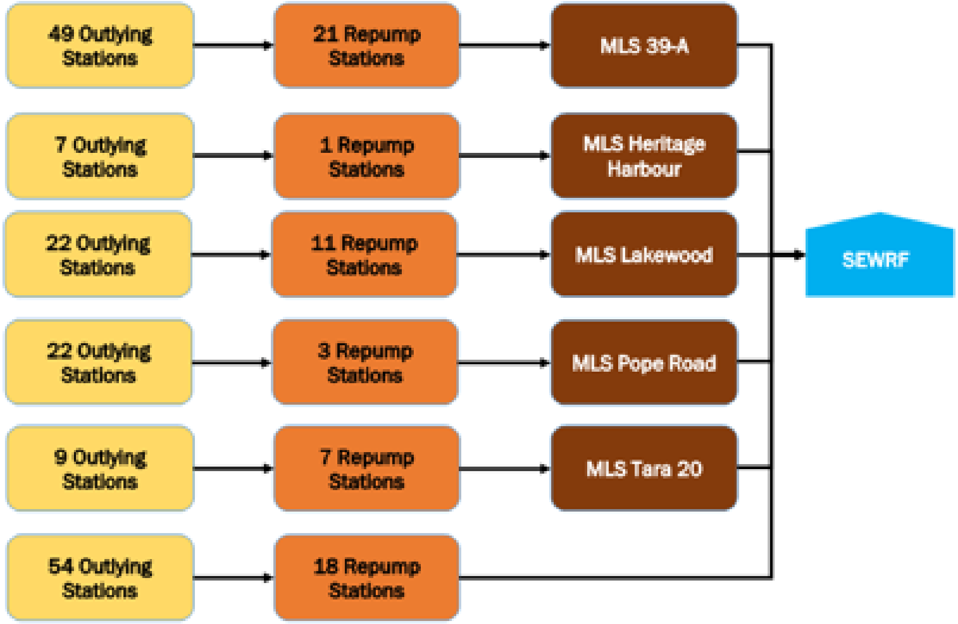
MCU Collection System

* Three WRFs
* 700+ LSs
* 22 MGD ADF









MCU Collection System Sulfide Control History

1980s - Odor complaints started as LSs/FMs grew to support regional WWTP initiative and public proximity to LSs narrowed. Variety of liquid phase chemical addition and vapor phase devices evaluated at high profile/chronic odor complaint LS locations.

1990s – Initiated “full-service” odor control program contract approach with multiple LPOC/VPOC tools. Focused on reducing DS, via iron and nitrate, along with vapor phase odor treatment, chemical scrubbers, to mitigate odor issues with discharges from long DT FMs.

2000-2017 – Continued FSOC program. High rate biofilters use evolved, delivered lower VPOC operating cost for higher H_2S. LPOC treatment primarily biochemical based. Odor control objectives achieved. Corrosive atmosphere history drove increasing LS, FM, & sewer rehab activity.

2015-2018 – Identified need to upgrade sulfide control objectives to include mitigating corrosion. Started engineering assessment; led to recommendation to evaluate elevating wastewater pH to reduce H_2S release.

2019 - Embarked on upgrading sulfide control program to be two pronged: prevent odor complaints and minimize corrosive conditions. Incorporated magnesium hydroxide into LPOC plan to elevate wastewater pH.

Approach to Reducing Corrosive Conditions …

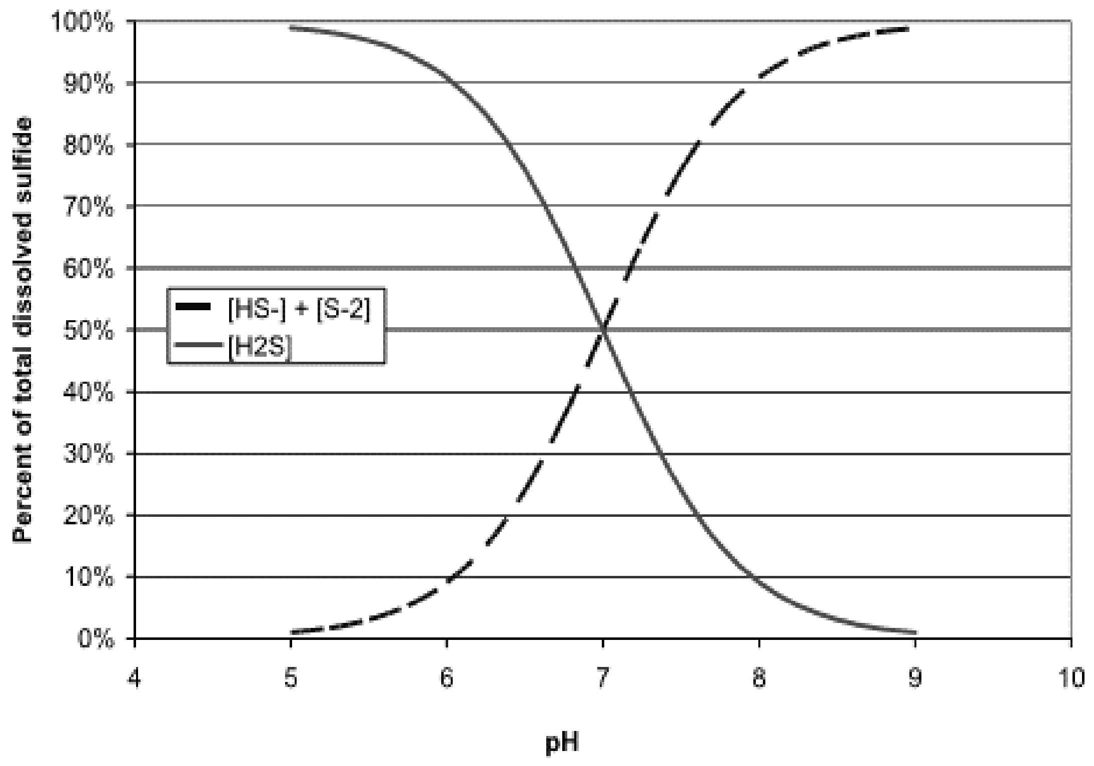
…., While Continuing to Mitigate Public Odor Impacts….

….Involved Strategically Layering pH Elevation into the Existing Odor Control Program of each MLS Basin.

Key LS flow contributors were assessed as possible magnesium hydroxide dose sites.
Goals:

- Minimize dose sites to raise MLS wastewater pH to 8.0-8.5.
- Leverage existing LPOC dose locations when possible.
- Dose at LSs with significant flow & pump run time/frequency.

By MLS basin, adjust LPOC program to deliver optimum combination of dissolved sulfide reduction & pH elevation to achieve MLS H2S target goals: 20 ppm average, 50 ppm peak.



H_2S <----> HS^- + H^+

pH 7.0: 48% vs 52%, pH 7.5: 22% vs 78%
pH 8.0: 8% vs 92%, pH 8.5: 3% vs 97%

MLS 1M Basin Implementation at LS5

MLS 1M Basin pH Elevation Optimization

- ADF (mgd): MLS 1M = 2.5, LS 5 = 1.5

- Pre pH elevation baseline (early-mid May):
  - LS 5 Dose: 480 gpd nitrate-chlorite
  - LS 5 FM MH: DS = 0-2 mg/L, pH = 7.4-7.7, H_2S = 10-90ppm, temp = 28-29 C
  - MLS 1M: DS = 3-7 mg/L, pH = 7.1-7.4, H_2S = 20-300ppm, 100-500ppm (late May)

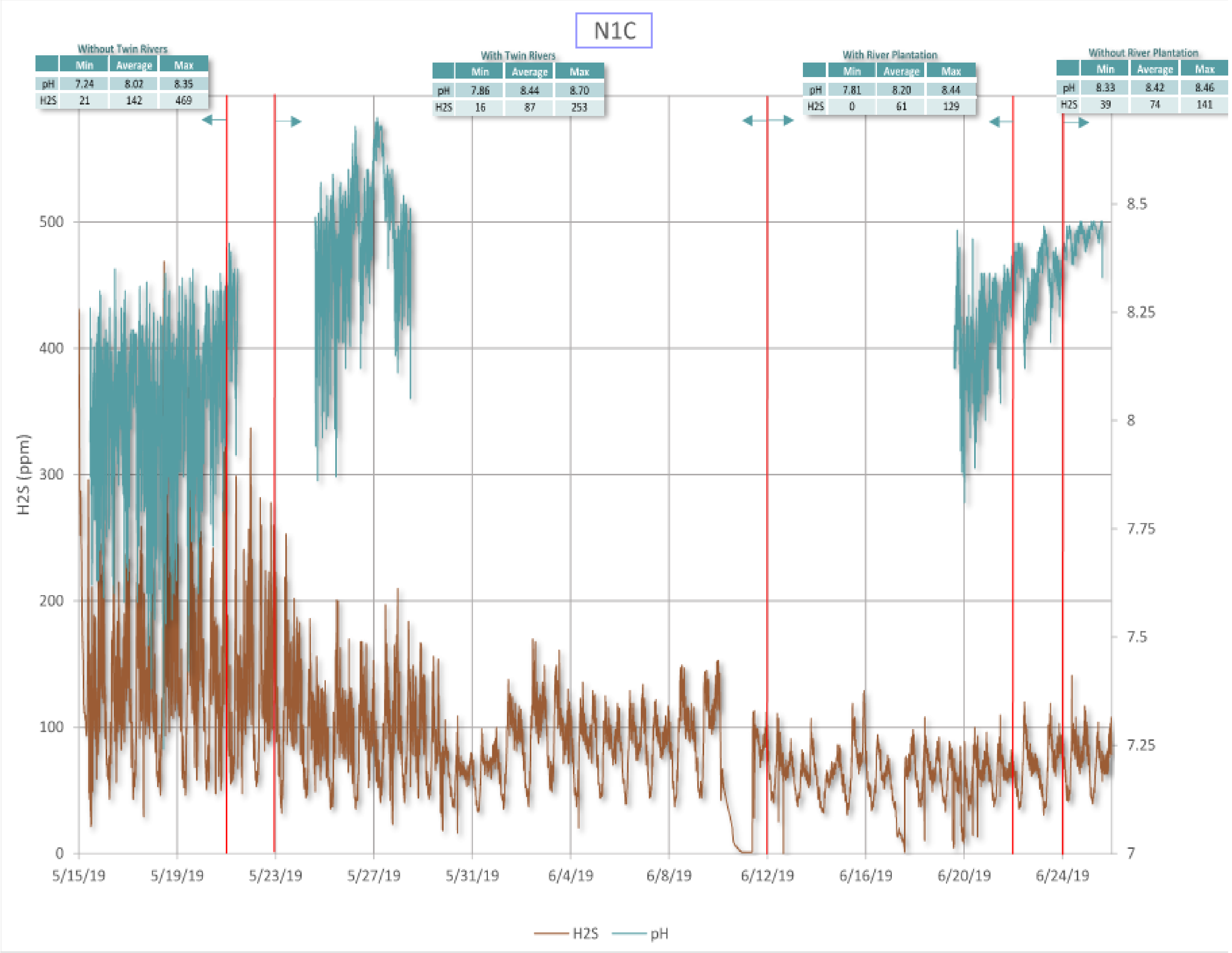
- Initial pH elevation(late May-mid June):
  - LS 5 Dose: 400 gpd mag hydroxide
  - LS 5 FM MH: DS = 3-9 mg/L, pH = 8.5-8.8, H_2S = 10-90ppm
  - MLS 1M: DS = 8-15 mg/L, pH = 8.0-8.3, H_2S = 20-110ppm

- Mixing of west elevated pH gravity flow with untreated east gravity flow at manhole upstream of MLS 1M prevented maintaining total 1M flow pH>8.1.
- Minimal difference of 300 vs 400 gpd at LS5.
- Led to adding second magnesium hydroxide dose site upstream on east flow (at LS 19D)
- Dosing 350 gpd at LS5 and 50 gpd at LS 19D reduced MLS 1M average H2S to 40-50 ppm, deemed adequate for MLS 1M condition.
- Change from 480 gpd nitrate-chlorite to 400 gpd mag hydroxide resulted in dramatically less corrosive conditions at MLS 1M and upstream gravity system at a ~$600/day cost savings.

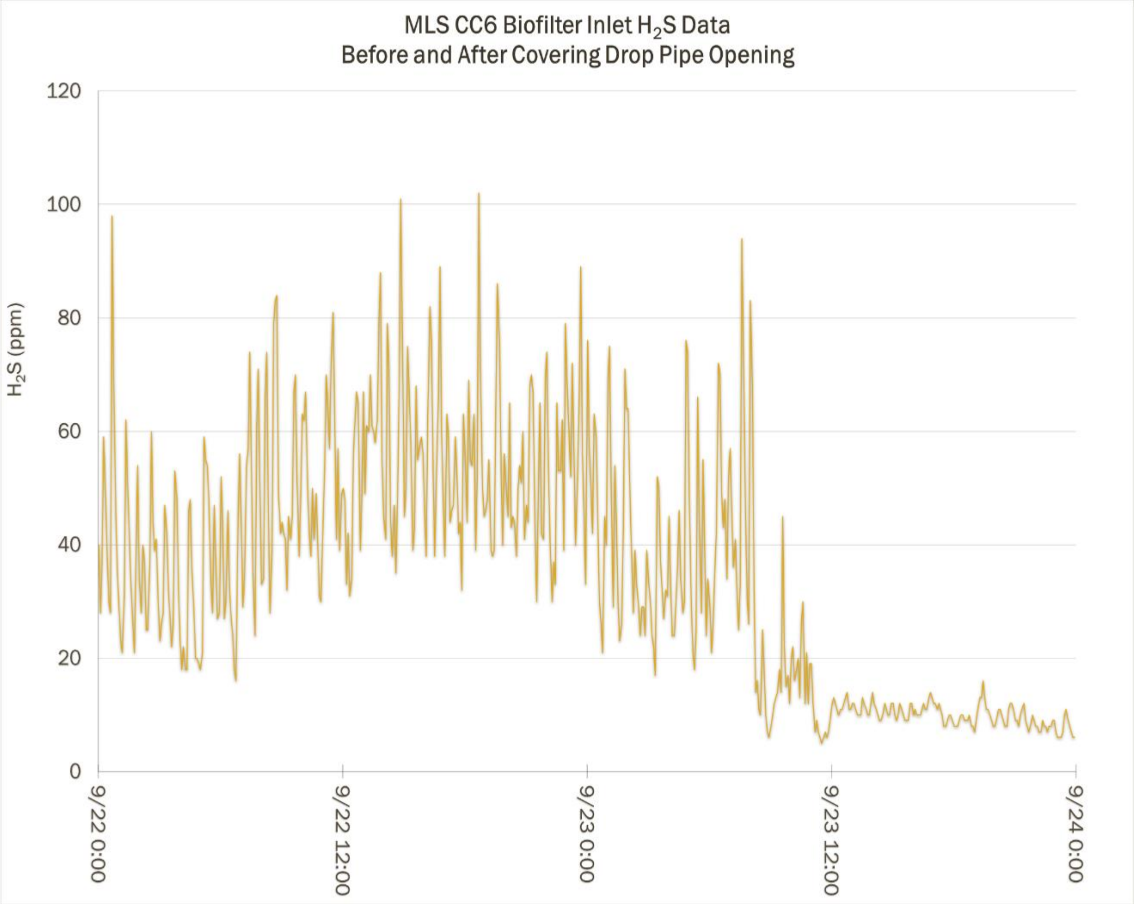
MLS N1C Basin Optimization

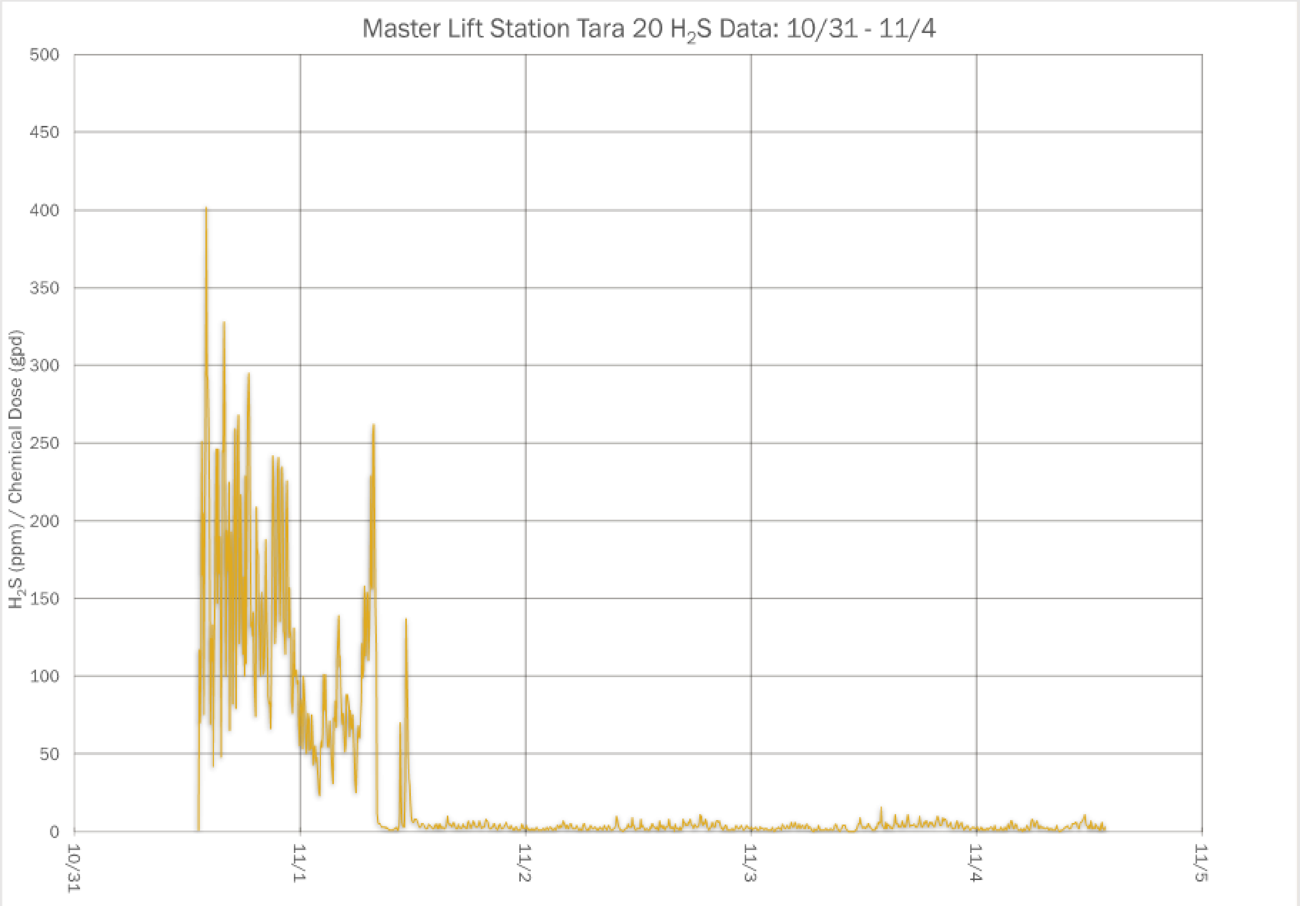
- N1C ADF=0.5 mgd. DS=15-25 mg/L.

- Initial mag site (in south sector): River Wilderness LS, 100 gpd. N1C: pH 7.7-8.0,H2S 50-300 ppm.
- Second mag site (in east sector): Twin Rivers LS, 40 gpd. N1C: pH 8.2-8.6,H2S 50-150 ppm.
- Third mag site (in east sector): River Plantation LS, 40 gpd. N1C: no pH increase, minimal H2S improvement.
- Turned off RP dose, raised N1C well level to reduce turbulence. Average H2S dropped from 70 to 38 ppm (44% reduction).

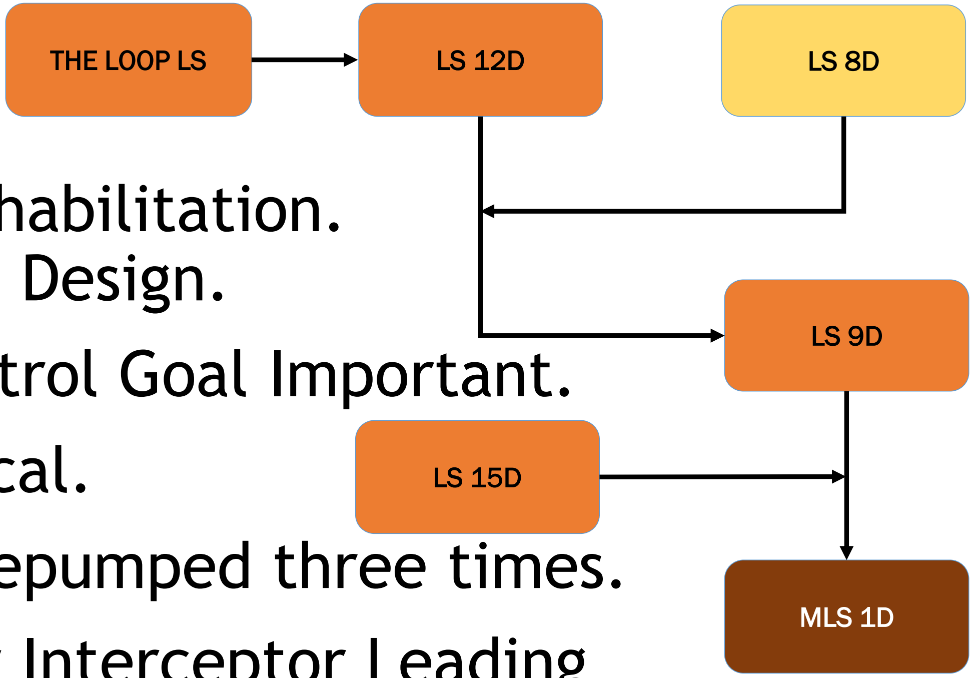


Leveraging Turbulence Reduction



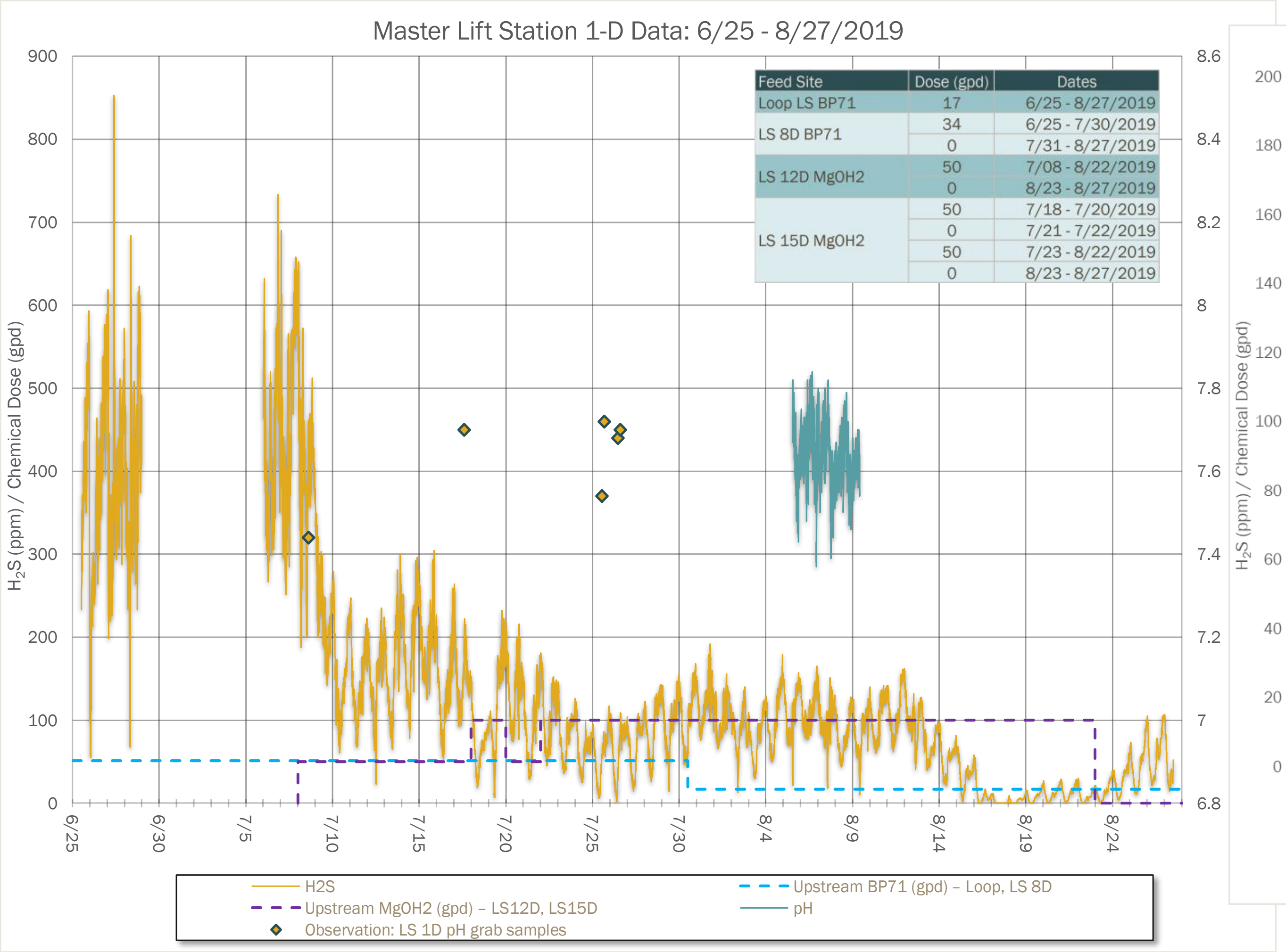


MLS 1D Basin:

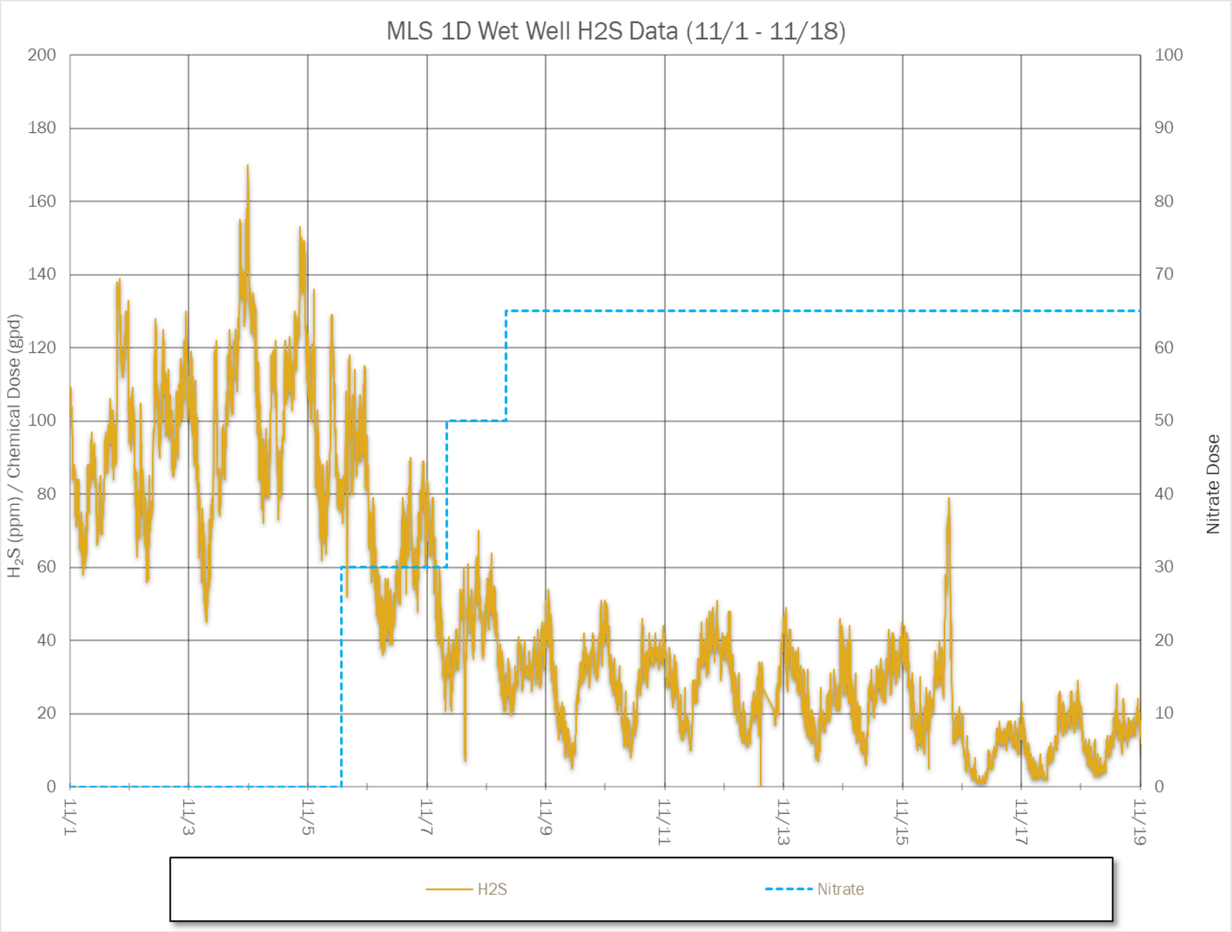


- MLS 1D: Recent rehabilitation. Wet Well/Dry Well Design.
- H2S Corrosion Control Goal Important.
- Odor Control Critical.
- Some LS 9D flow repumped three times.
- Significant Gravity Interceptor Leading to MLS 1D.

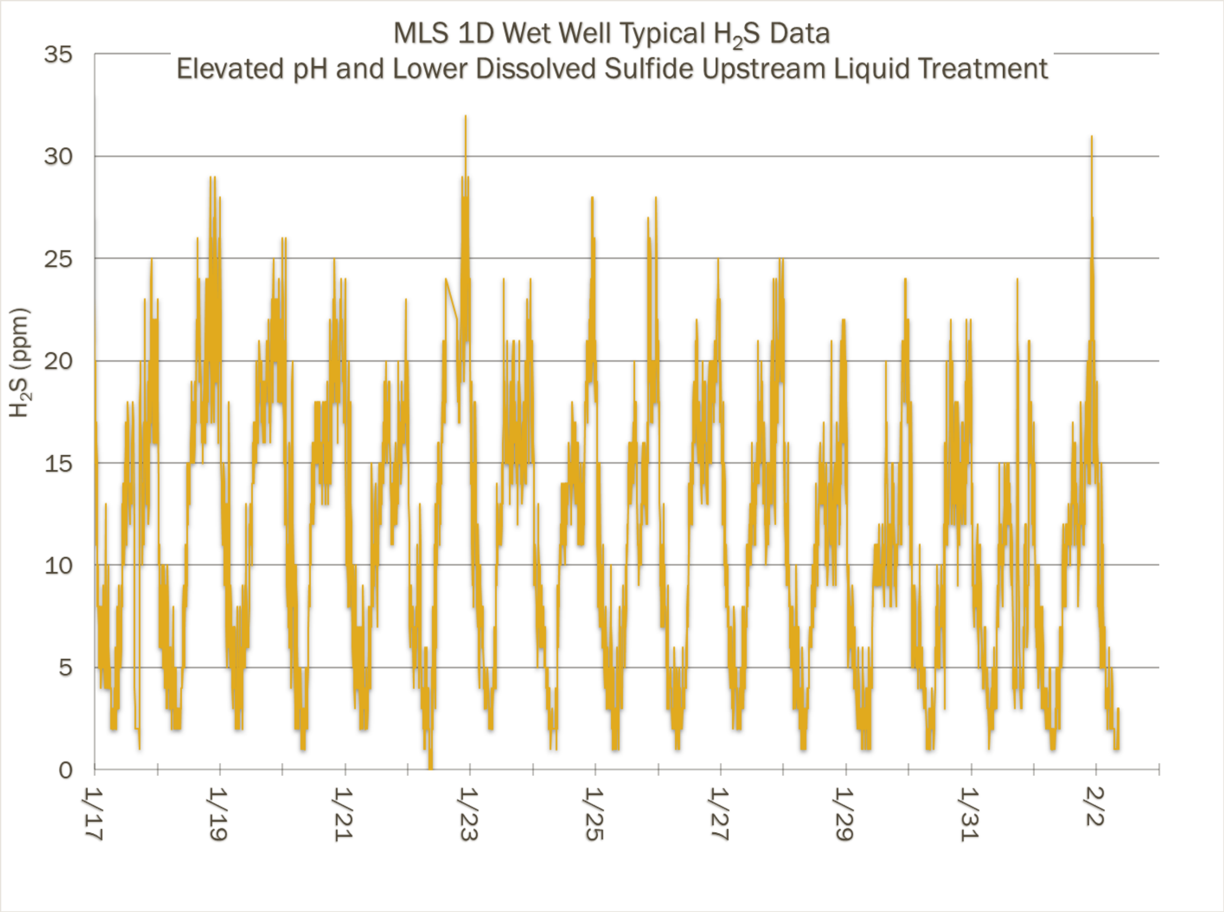
MLS 1D pH Elevation & DS Reduction Optimization



Feed Site	Dose (gpd)	Dates
Loop LS BP71	17	6/25 - 8/27/2019
LS 8D BP71	34	6/25 - 7/30/2019
	0	7/31 - 8/27/2019
LS 12D MgOH2	50	7/08 - 8/22/2019
	0	8/23 - 8/27/2019
LS 15D MgOH2	50	7/18 - 7/20/2019
	0	7/21 - 7/22/2019
	50	7/23 - 8/22/2019
	0	8/23 - 8/27/2019



MLS 1D Optimization Summary



- MLS 1D Basin LPOC Dosing Changes:

  1) LS 12D – New Site, 50 gpd mag.

  2) LS 15D – Converted iron site to magnesium hydroxide, 50 gpd.

  3) LS 8D – Converted nitrate-chlorite site to mag, 50 gpd.

  4) LS 9D – New Site, 65 gpd nitrate.

  MLS 1D H_2S Achieved: 12 ppm average, 30 ppm peak. 95% reduction.

  Cost Difference: ~$410/day more.

  Turbulence Reduction Not Currently Possible.

Challenges Experienced/Lessons Learned

Manifolded FM networks, lack of dominant flow LSs, and insufficient mixing time prevented pH > 8 at some MLSs.

Calcium hydroxide employed in some instances.

MLS DS levels and turbulence conditions influenced ability to achieve H_2S targets with pH of 8.0-8.5.

Balancing pH, DS, & turbulence critical to cost effectively reducing H_2S < 50 ppm.

Turbulence reduction limited by MLS designs & local gravity sewer factors.

Delivered major H_2S reductions when utilized.

Incorporating pH elevation along with other tools to achieve/maintain low H_2S goal was new for all parties.

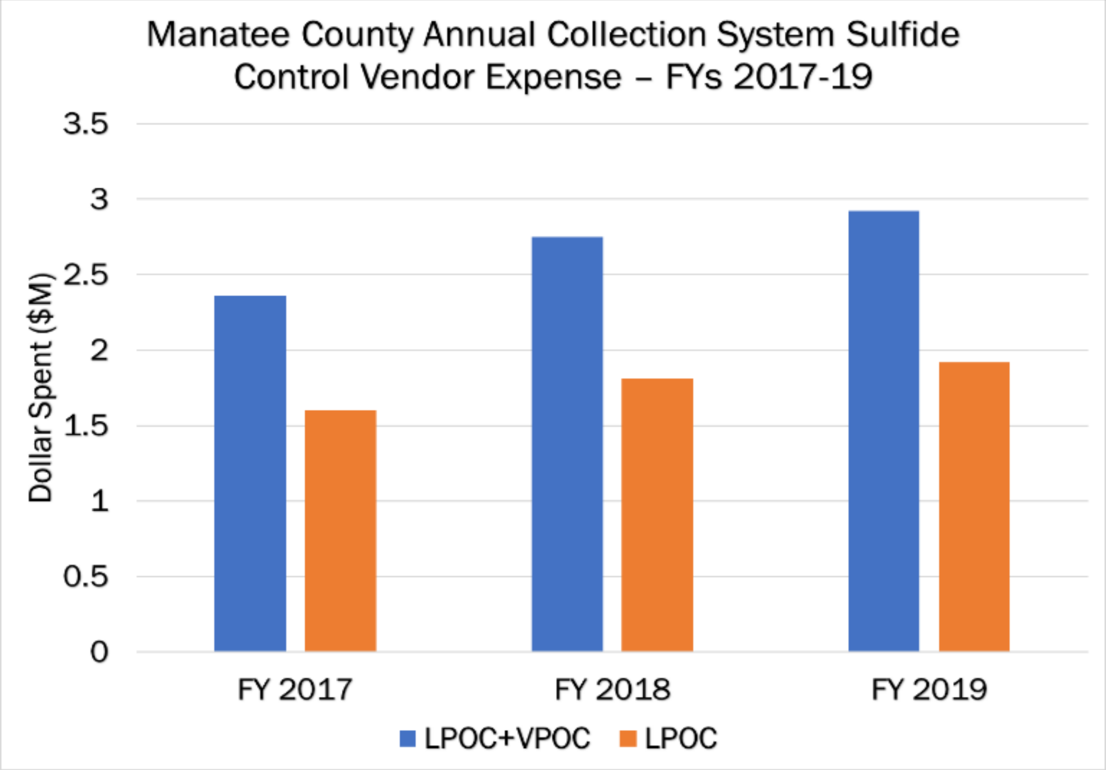
Significant communication, data gathering/analysis, and iterative trial & error learning overcame this lack of experience.

Key MCU Odor & Corrosion Program Achievements

MCU's Collecton Systems & WRFs benefited from raising sewage pH to reduce dissolved sulfide volatility.

Utilization of pH elevation, in concert with DS & turbulence reduction lowered H_2S levels dramatically, from 150-600 ppm to 5-60 ppm at most MLSs, and in turn corrosive conditions.

This dramatically greater sulfide control was achieved at a minimal LPOC cost increase (6% more in first year).



Key Collection System Odor & Corrosion Control Program Development Considerations

A collection system wide sulfide control program that strives for odor and corrosion control requires stakeholders set clear goals. Performance must be closely monitored to confirm goals are realistic given system conditions/limitations, budgets, & seasonal factors.

Iterative process to develop cost-effective O&C program requires significant time/energy commitment of utility mgmt and operation staff familiar with collection system history, operating criteria, & upcoming changes.

THANK YOU FOR YOUR PARTICIPATION!

Questions ??