Water Treatment Plant Startup
Issues and Considerations

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Presentation Overview

Project Background
DCWTP Improvements
Startup Issues and Operational Challenges
Current DCWTP Performance and Operations
Summary
Project Background

Nunes WTP

- Water purchased from SFPUC
- Crystal Springs Reservoir
- Pilarcitos Reservoir

Denniston Creek WTP

- Local surface water
- Pilarcitos Well Field, groundwater under the influence of surface water (Pilarcitos Creek)
Project Driver: Treat Used DC Water

- Permit treating unused portion of Dennistion Creek water rights and reduce amount of water purchase from City

- High source water turbidity (>15 NTU)
  - Unmanageable backwash frequencies
  - Local water passed to ocean unused
Project Driver: Upgrade of Old Facility

- Upgrade aging facilities (original DCWTP constructed in 1971)
  - Unreliable high lift station
  - Manual controls
  - Aging chemical feel system
  - No solids handling facility
- Pipeline failure in 2010
Original DCWTP
Original High Lift Pumps
Original Flash Mixer
Aging Chemical Facilities

- Alum Tank
- Permanganate Tank
- Caustic Soda Pumps
- Chemical Leak
- Polymer System
Pipeline Failure
Project Objectives

- Restore capacity to 1,000 gpm and enable realizing up to 250 MG/year production
  - Enable treating raw water turbidity up to 50 NTU
  - Enable processing of spent washwater and larger volume of solids

- Improve water treatment plant operation and reliability
  - Upgrade high lift source water pumps
  - Upgrade chemical storage and feed systems
  - Provide automated controls
Denniston Creek Pump Station
Pretreatment System
WWR and Solids Handling Facilities
Chemical Systems
Upgraded DCWTP
DCWTP Startup

January 2013

- **400 gpm Test** on January 17
- **700 gpm Test** on January 22, 23, 24, 25
- **1,000 gpm Test** on January 31
Raw Water Pump Startup

- Raw water pump discharge not reach plant at startup
- Raw water was discharging back into wet well due to pressure relief valve setting

⇒ Check valve setting, in addition to valve positions before startup
## Startup Testing Turbidity

<table>
<thead>
<tr>
<th>Date</th>
<th>Test</th>
<th>Alum Dose (mg/L)</th>
<th>Average Turbidity (NTU)</th>
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Contact Clarifier Performance

- Purpose of contact clarifiers is to reduce turbidity ahead of filters
- Applied coagulant dose of ~13-27 mg/L → too high clarified water turbidity (~4-7 NTU)
- Reduced coagulant dose to ~5 mg/L → significant reduction in clarified water turbidity (~1-2 NTU)

⇒ With contact clarifiers, lower coagulant dose is more effective for some operating conditions.
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Oxidation Issues: Manganese

- Observed black precipitate in chlorine analyzer → indication of manganese passing through filters
- Yellow water complaints in the neighborhood
- Measured manganese concentrations
  - Raw water manganese ~0.135 mg/L
  - Treated water manganese ~0.165 mg/L
  - Normal treated water manganese ~0.01-0.02 mg/L
- Performed permanganate soak of greensand filters and added potassium permanganate feed point ahead of filters

⇒ Adsorbed manganese can release from filter media if redox condition is not sustained.
Oxidation Issues: Iron

- High iron levels observed in raw water (1 mg/L)
- Increased potassium permanganate dose to oxidized iron (0.5 mg/L → 0.8 mg/L)
- Observed floc formation in jar test

⇒ Oxidizing ferrous iron (Fe$^{+2}$) to ferric iron (Fe$^{+3}$) provides “free” (no cost) iron coagulation (1 mg Fe$^{+3}$ = 3 mg FeCl$_3$).
Washwater Recovery

- Treatment objective is to reduce recycle water turbidity to less than 2 NTU
- Bulk of solids dropping off in WWR basin #1 with jet inlet stream in circular basin
- Great performance initially but not consistent
Controls System

- Third party SCADA system programmer
  - Pros: Owner has greater control over system controls; easier to make future changes
  - Cons: Additional level of coordination

- Contact clarifier system supplier responsible for coagulant and coagulant aid feed rate controls

⇒ Requiring pretreatment system PLC to control chemical doses can be restrictive.
Nice-to-haves Identified during Startup

- Hose spigots for wash down in contact clarifier area
- Manual shutoff valves before automatic valves on bulk chemical tanks
- Additional chemical injection points and sample ports
- Algae removal ahead of contact clarifiers
Current DCWTP Operation and Performance

- Improved filter runs and reduced washwater generation with contact clarifier pretreatment
- Switched from Alum to PACI
  - Longer filter runs
  - Lower chemical use (replaces alum and cationic polymer)
  - Less solids production
- DCWTP temporarily shut down during summer due to current low source water availability
- Work on optimizing iron oxidation when DCWTP returns online
- Still yet to observe performance of contact clarifiers under high source water turbidity conditions (raw water turbidity has been between 5 - 10 NTU since startup)
Summary

- Pressure contact clarifier pretreatment significantly reduces coagulant use, improves filter runs, and reduces generation of spent washwater in a small footprint.
- Add oxidant immediately ahead of greensand filters to prevent desorption of manganese into filtered water.
- Oxidation of iron in raw water forms trivalent coagulant aid.
- If have proprietary control system for treatment process, be sure to make arrangements to enable modifications if needed.
- PACI greatly reduces chemical use and generation of solids.
## Acknowledgments

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<th>Roberts Filter Group</th>
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<tr>
<td>David Dickson</td>
<td>Craig Thompson</td>
<td>Mike Gregg</td>
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<tr>
<td>Sean Donovan</td>
<td>Joel Faller</td>
<td>Andre “Kumar” Razeek</td>
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Questions?

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