

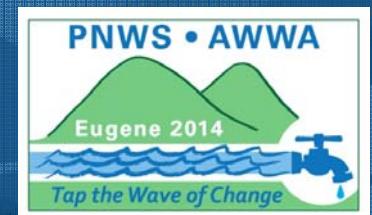
CH2MHILL®

Treatment Improvements for DBP Reduction



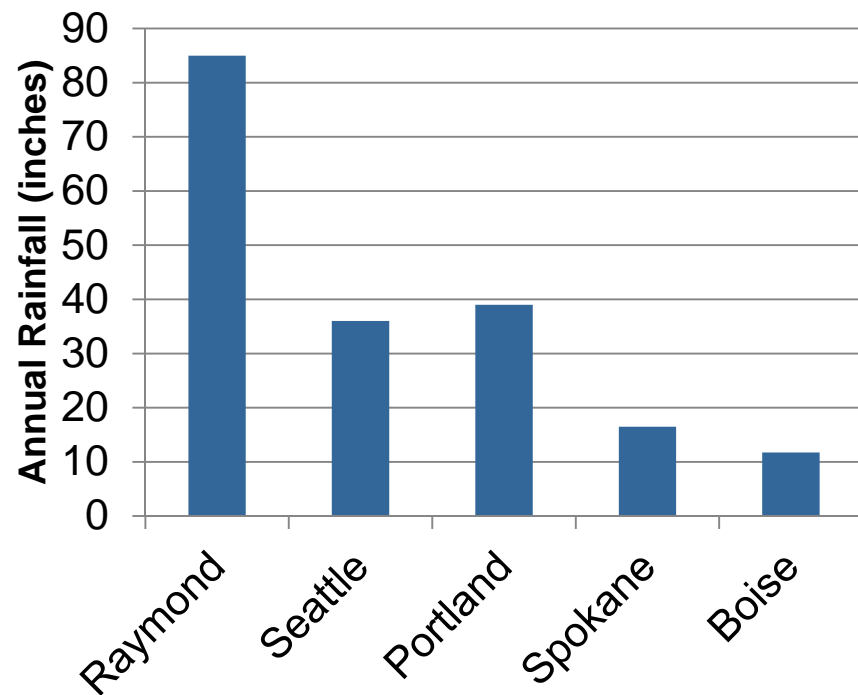
Kim Ervin, P.E.

West Region Drinking Water Service Lead



Raymond, Washington

- Population: 3,000
- Temperatures:
 - Winter 32 to 46 F
 - Summer 50 to 70 F
- Average Precipitation: 85 inches



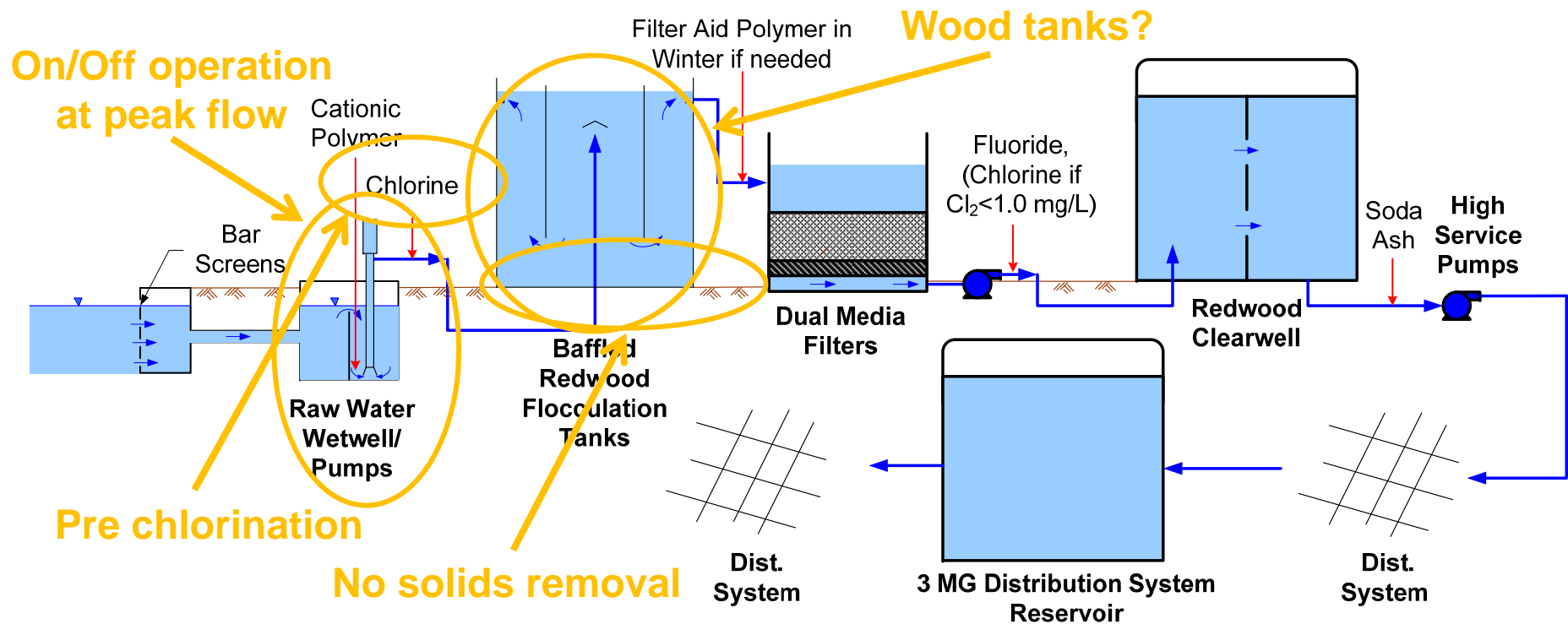
Original Water Treatment Plant

- Constructed in 1972
- Source: South Fork Willapa River
- Redwood Clarifiers, Direct Filtration, Chlorine Disinfection
 - Capacity: 1400 gpm, Average Demand: 375 gpm
 - Peak filter loading rate: 5 gpm/sf
 - Plant operates on/off to fill distribution system tank.



Original Treatment Train

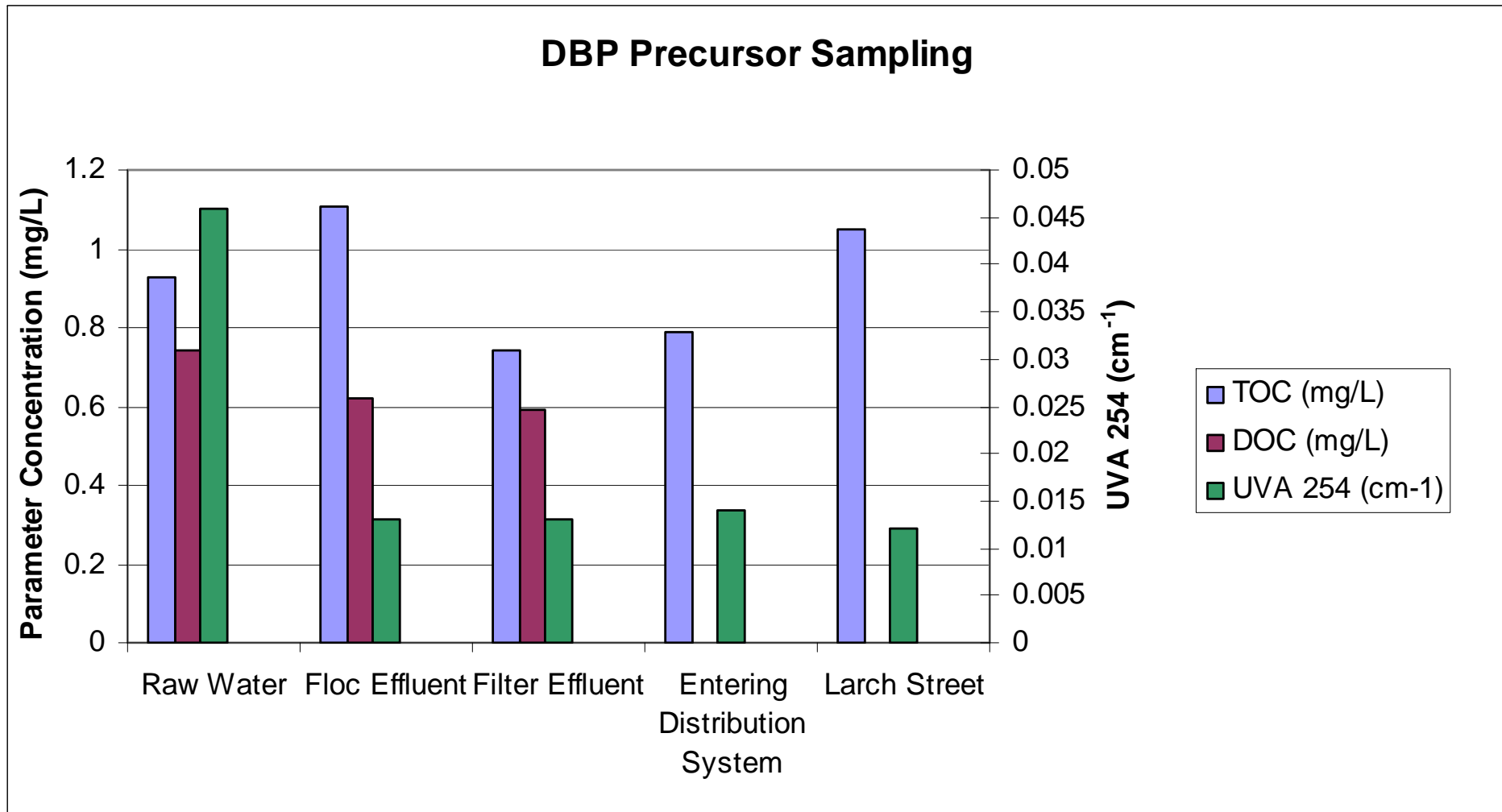
Elevated DBPs from current treatment approach.



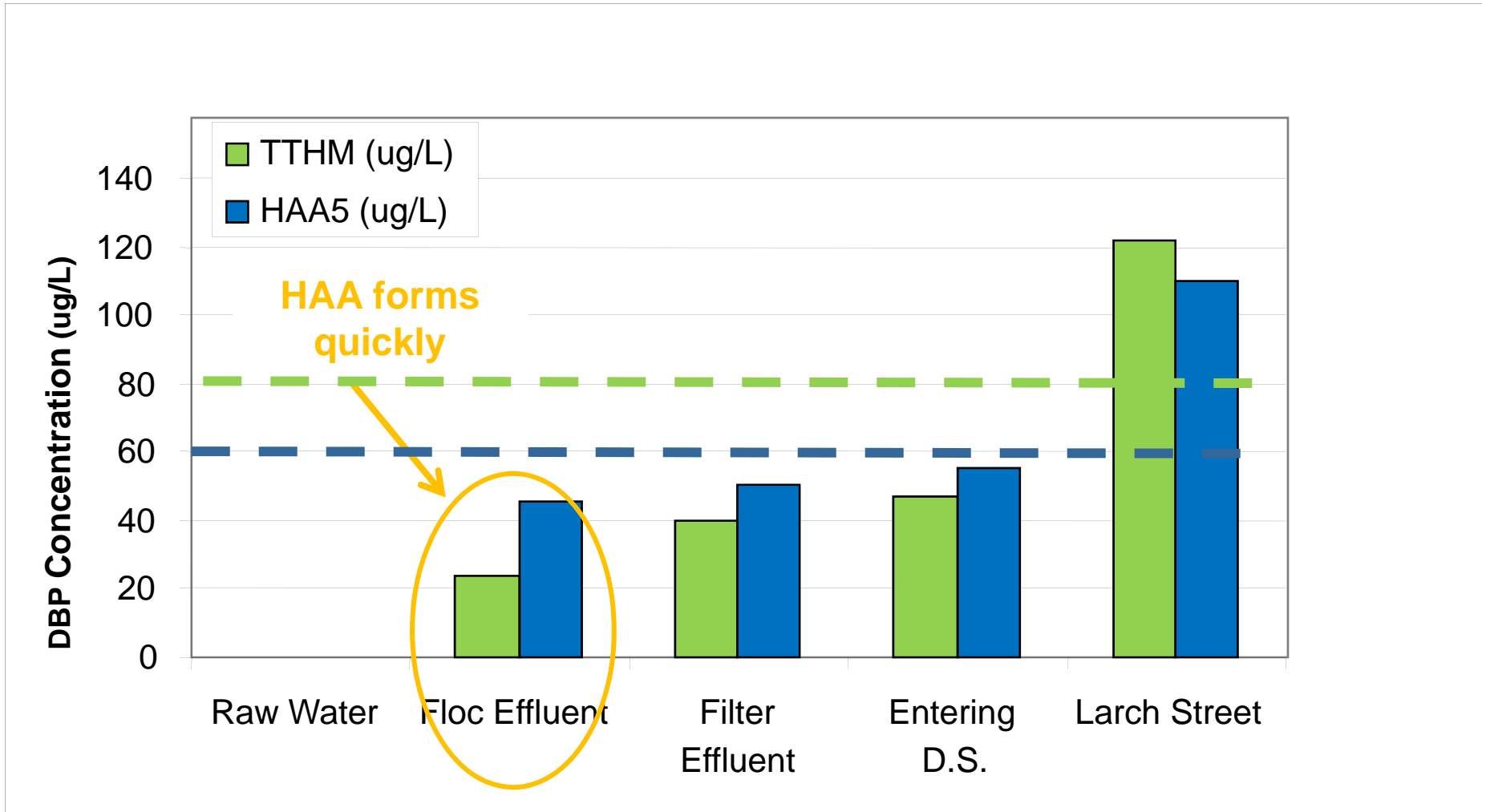
Typical Raw Water Quality

Sample Information				
Project Name		Raymond WTP	Raymond WTP	Raymond WTP
Sample Description		Raw Water	Raw Water	Raw Water
Sample Collection Date		8/17/2011	11/22/2011	2/22/2012
General Chemistry Analysis				
pH	Units	7.71	7.17	7.45
Turbidity	NTU	1.6	31	74
TOC	mg/L	1.21	2.8	3.2
DOC	mg/L	1.16	2.5	2.3
UV₂₅₄	abs *cm ⁻¹	0.0400	0.1505	0.1225
SUVA w/DOC	L/mg-m	3.45	6.09	5.28
Alkalinity	mg/L as CaCO ₃	25.9	16.8	9.2
Ammonia	mg/L as N	0.048	<0.10	<0.10

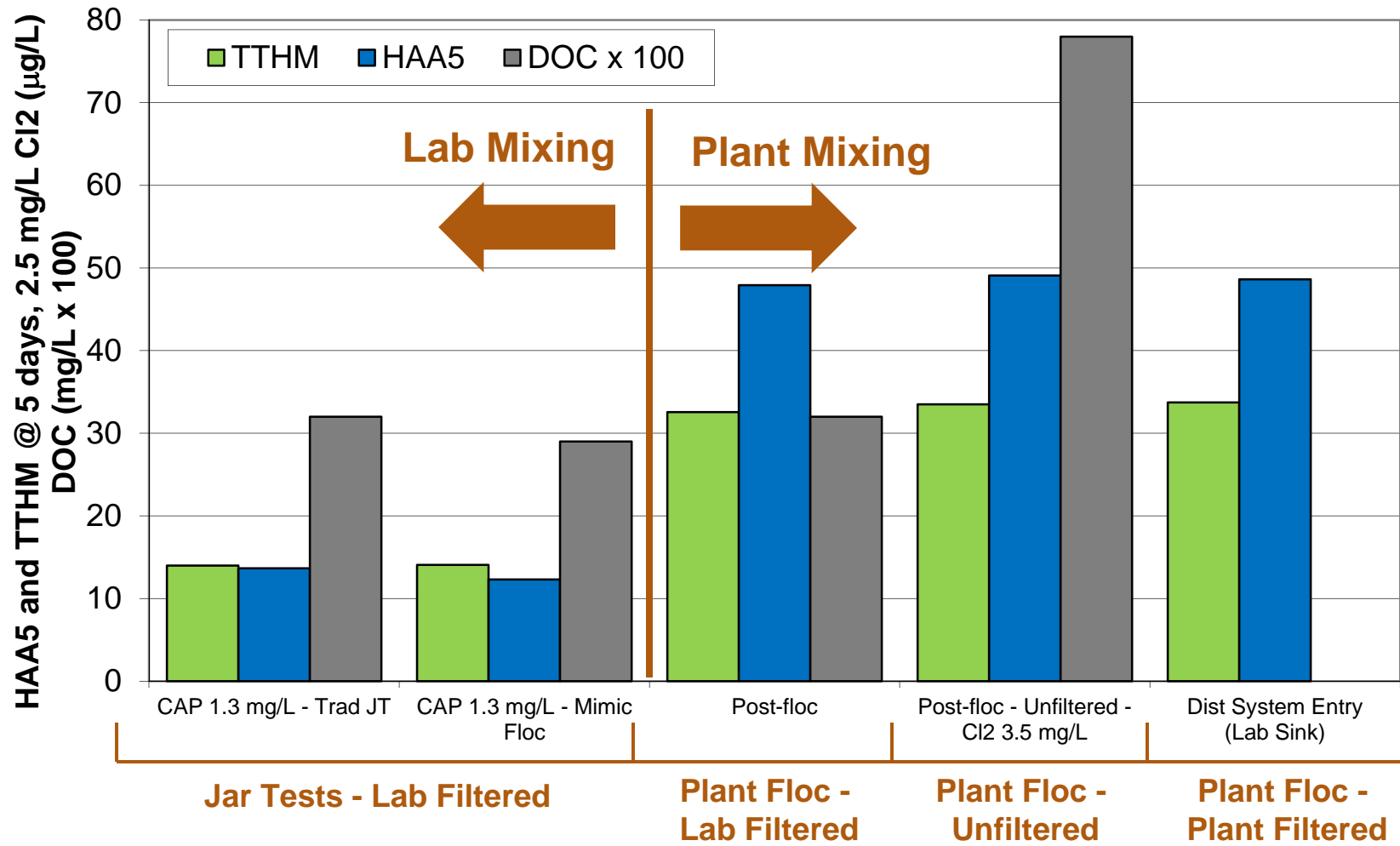
DBP Precursors Through Treatment Process



DBP Profile through the Plant



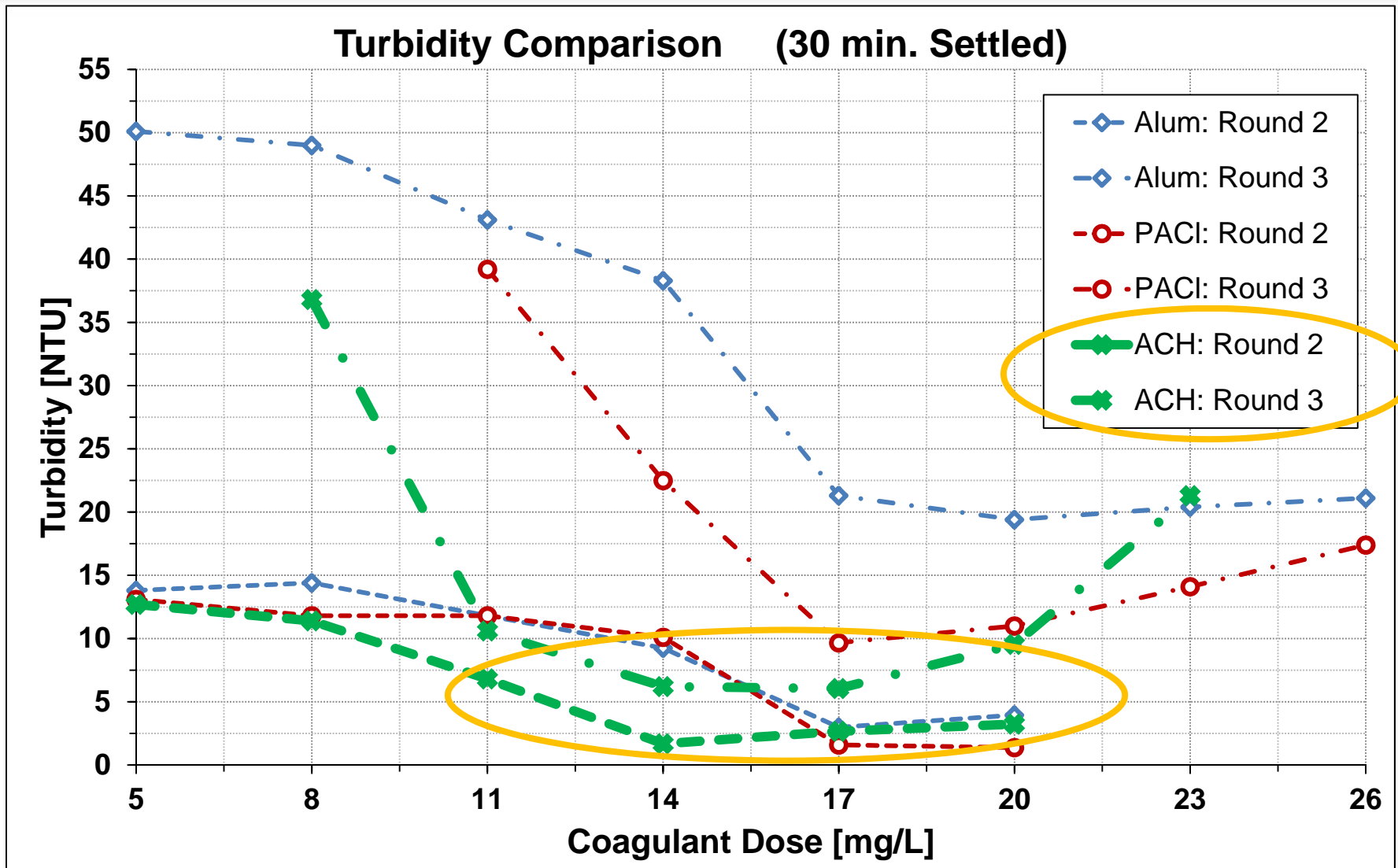
The Importance of Mixing



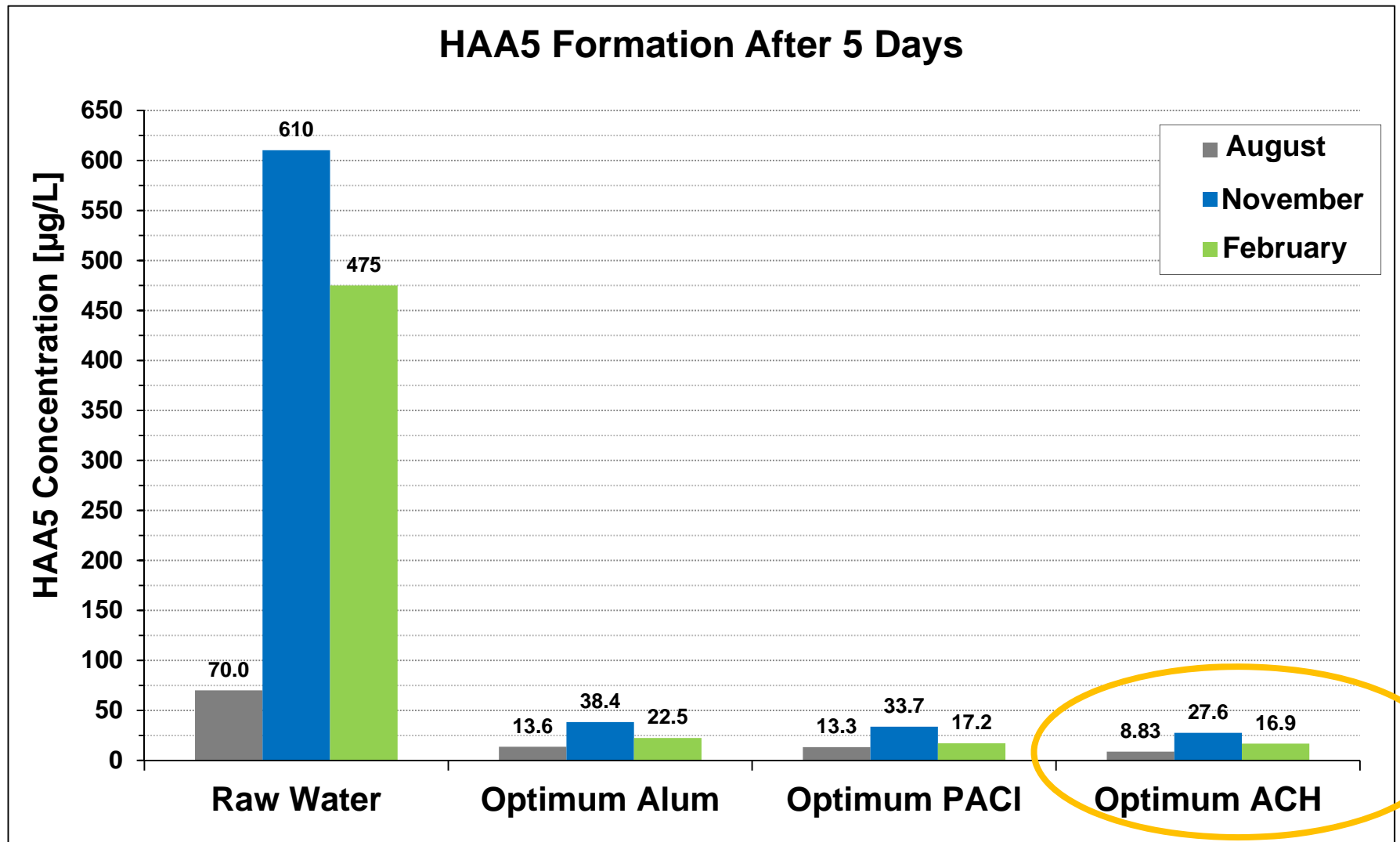
Impact of Redwood Clarifier on DBP Formation



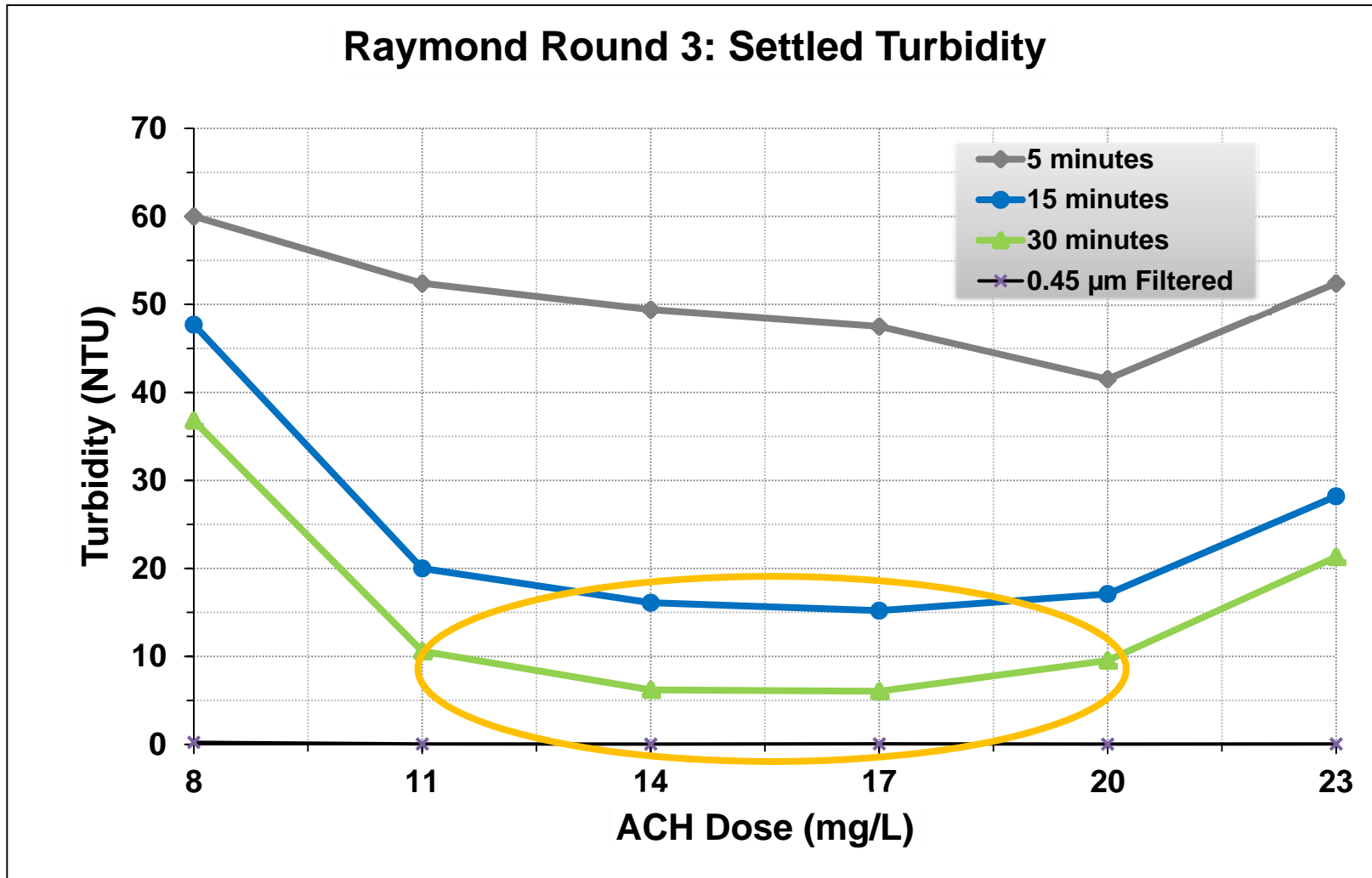
Optimizing the Coagulant: Turbidity



Optimizing the Coagulant: DBPs



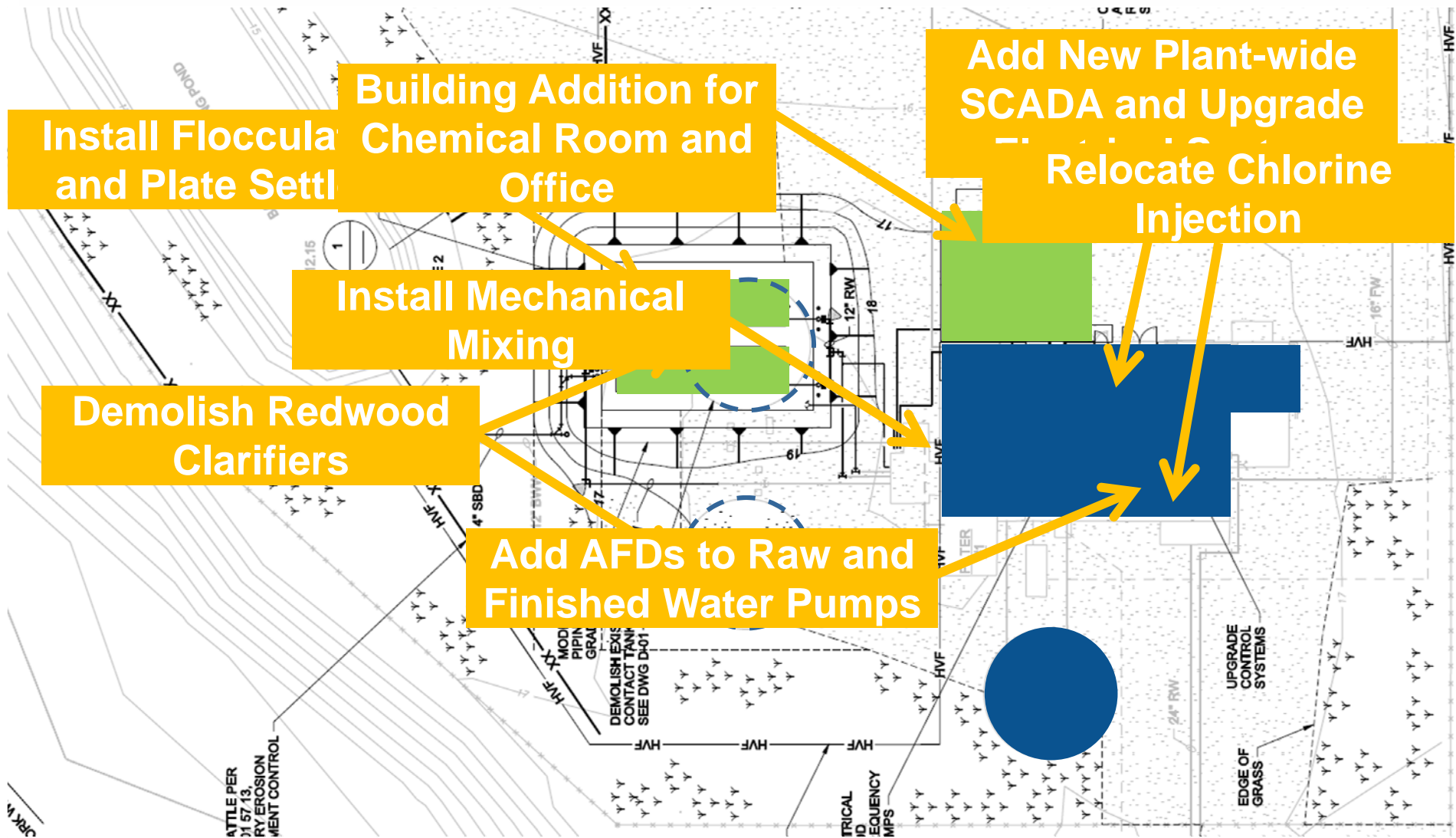
Optimizing Flocculation Time



Process Flow Diagram with Improvements



Water Treatment Plant Improvements



Before and After – Coagulant Addition



Before and After – Flocculation and Sedimentation



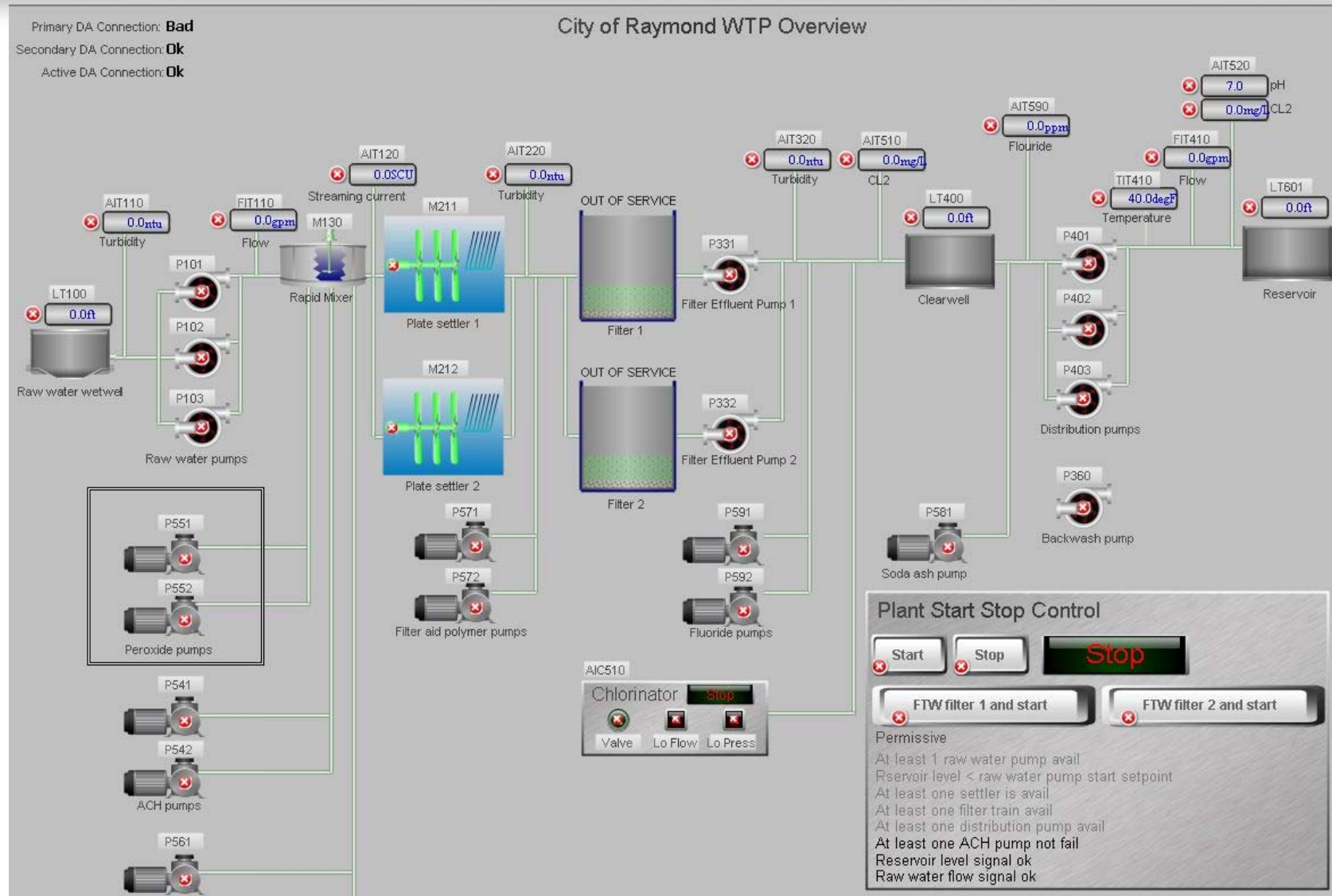
Before and After – Chemical Storage and Feed



Before and After – Instrument Replacement



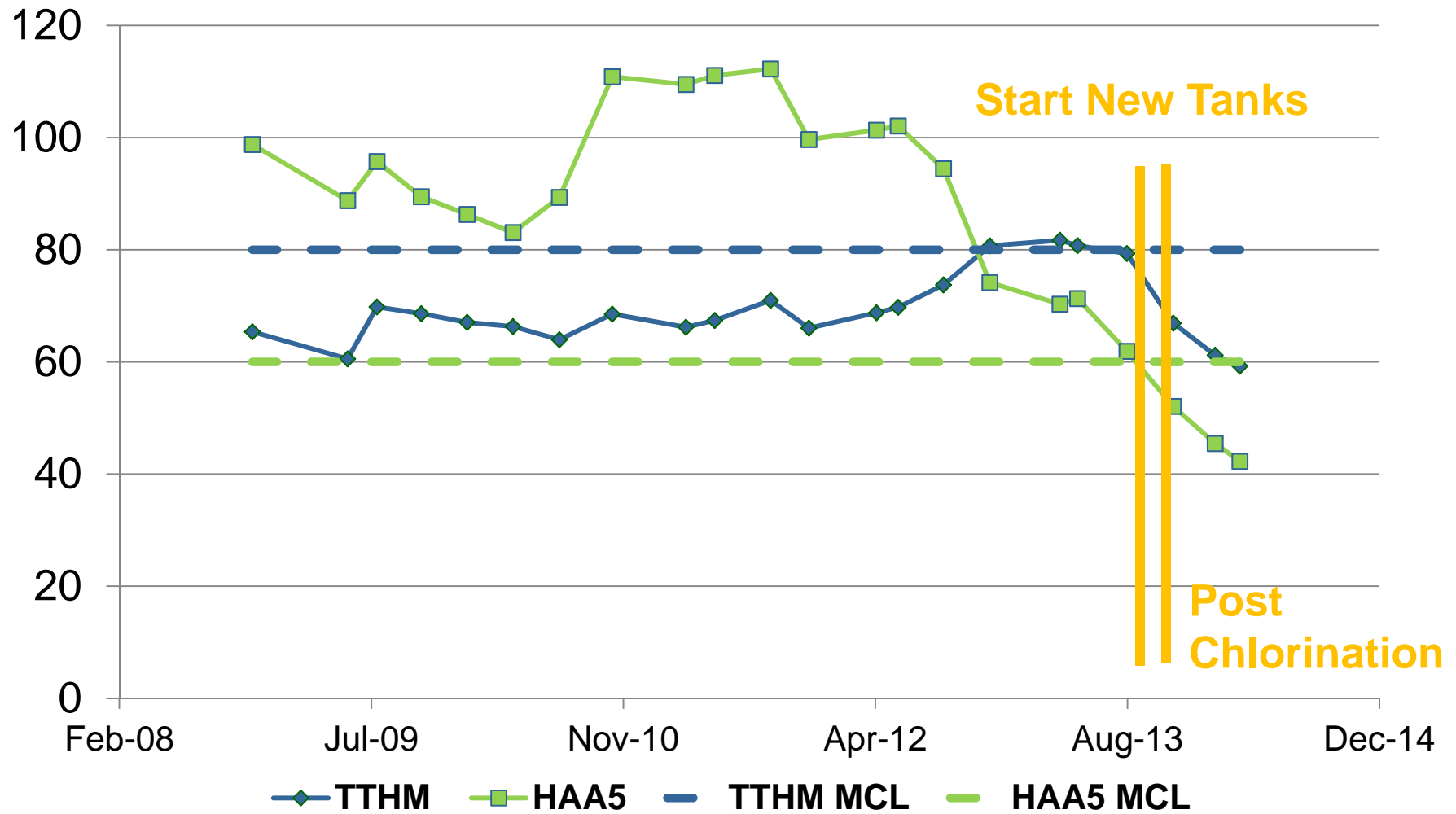
Before and After – New SCADA and Upgrade Electrical System



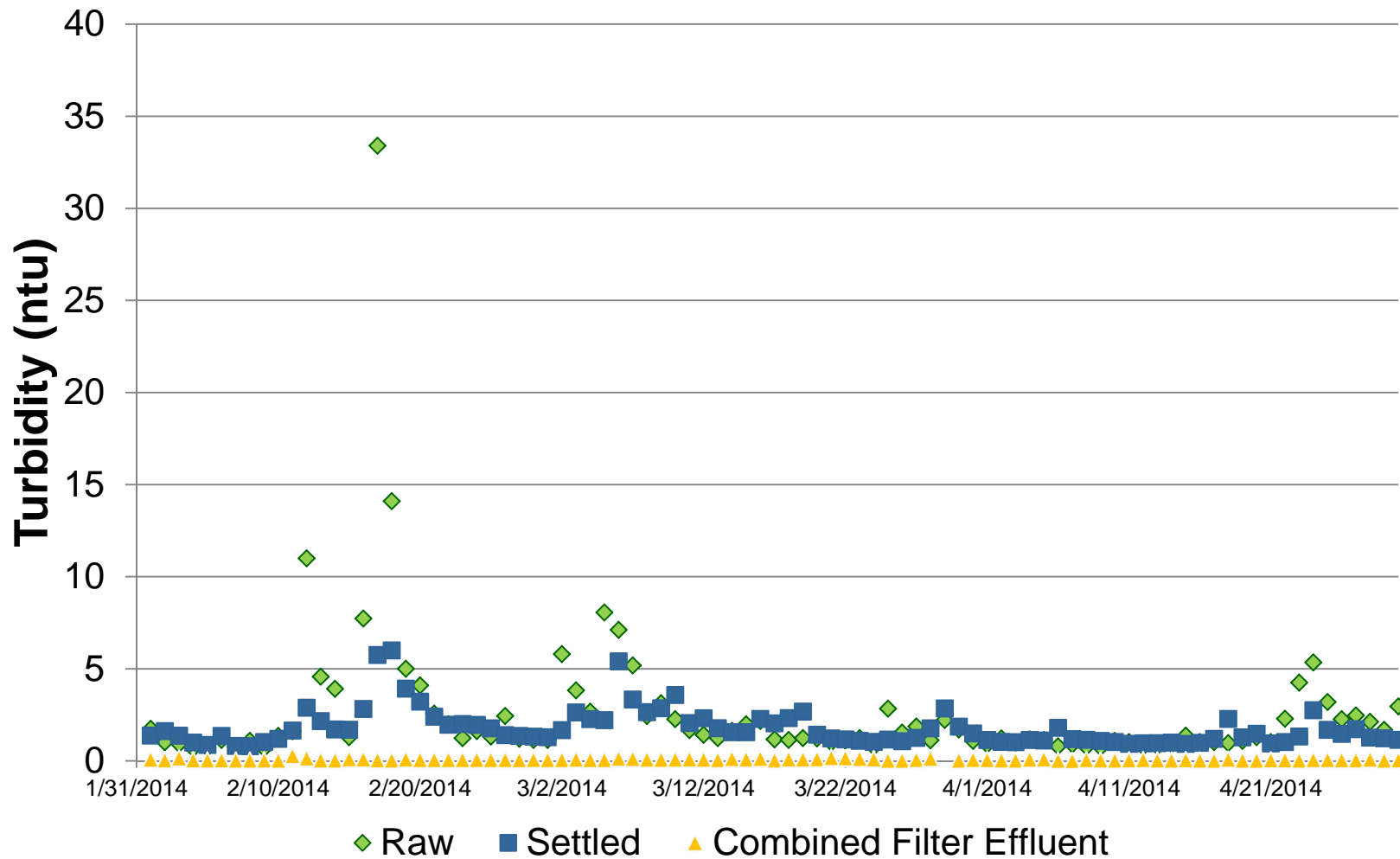
Before and After – A New Face



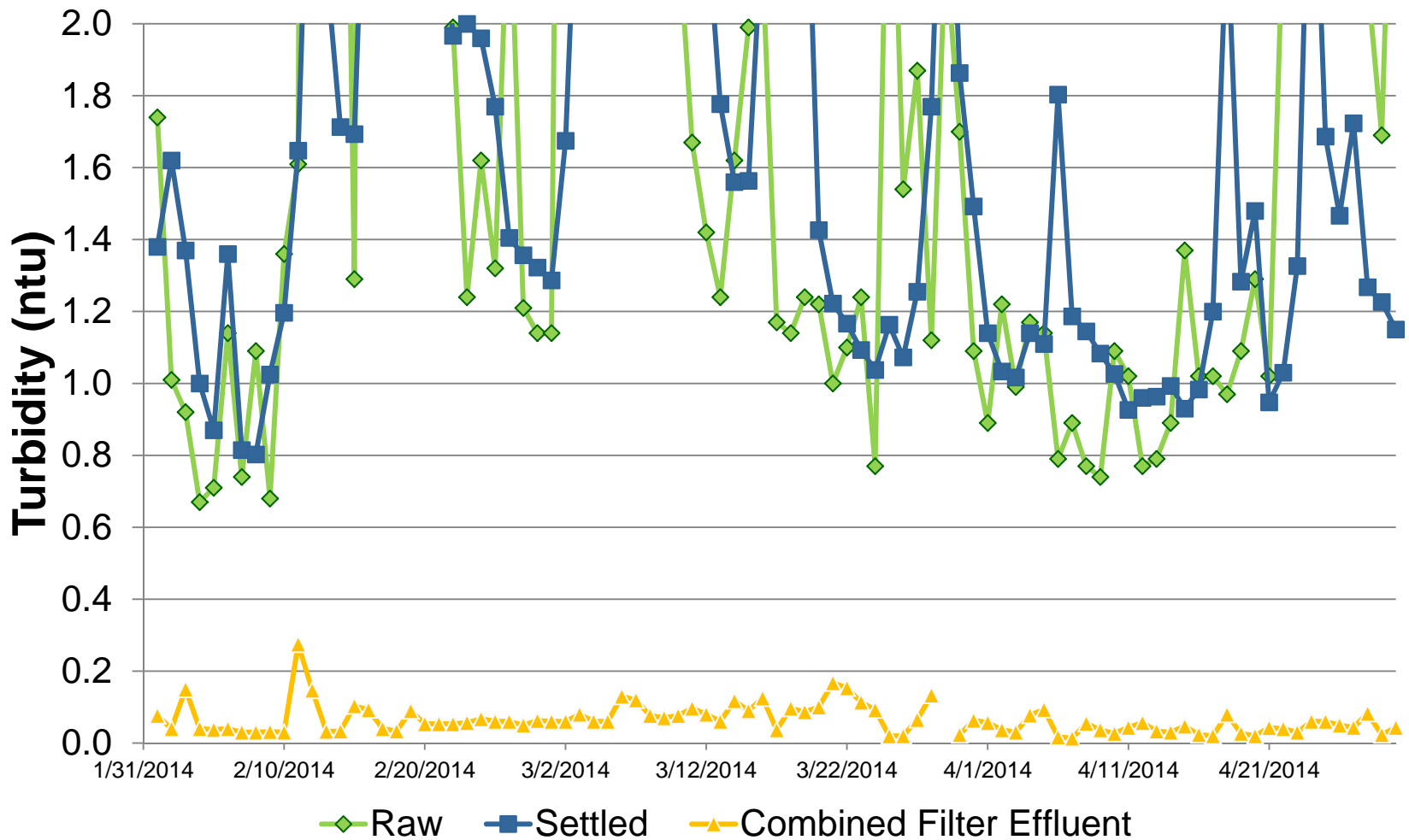
Disinfection Byproduct Level Maximum Locational Running Annual Average



Turbidity Performance – Cationic Polymer



Turbidity Performance – Cationic Polymer



Still to Come

- Coagulant Optimization
 - ACH and polymer at full-scale
 - ACH/polymer blends
- TOC seasonal testing



The End



Kim Ervin
CH2M HILL
Kim.ervin@ch2m.com