WateReuse San Diego
Chapter Meeting

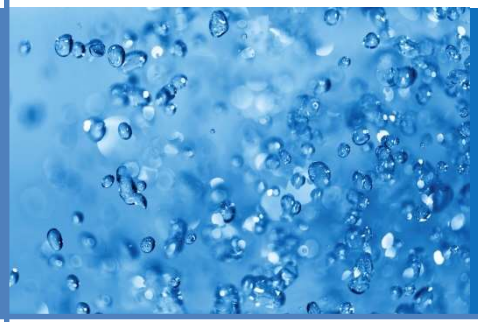
March 30, 2022

The Headworks DPR Demonstration Project: Implementing DPR in the City of LA

Brianna Plancarte- LADWP
Greg Wetterau – CDM Smith

AGENDA

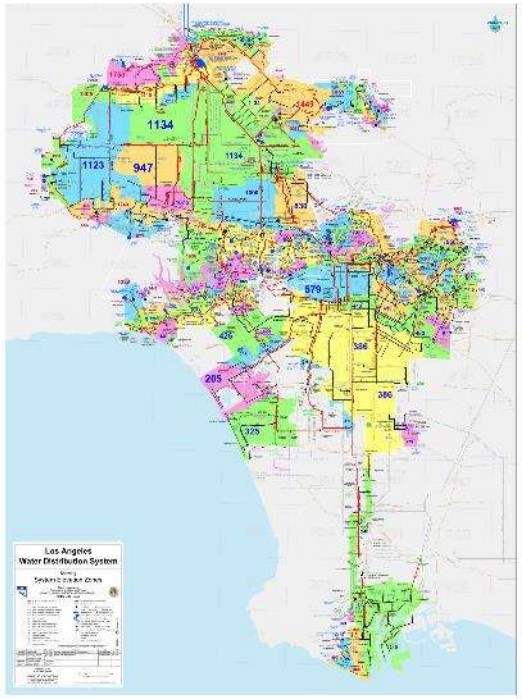
- LA Water System Background
- Project Background
- Treatment Approach
- Pathogen Removal
- Chemical Removal
- Project Schedule and Summary



Background

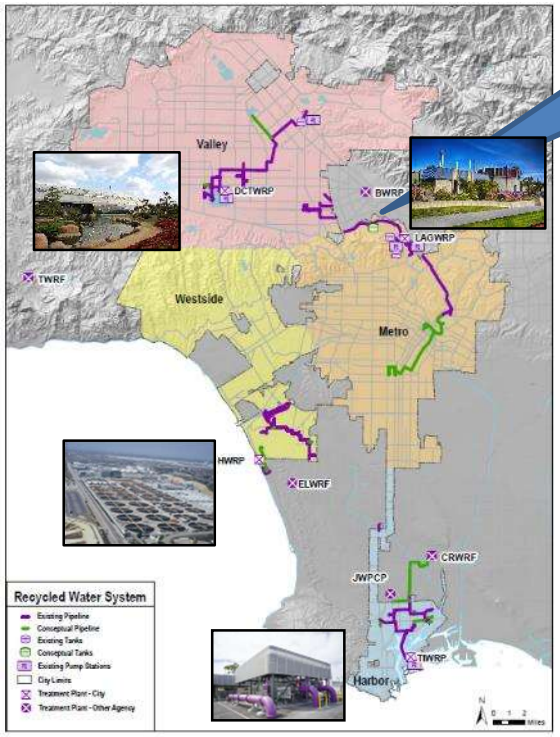
LADWP Potable Water System Overview

- 159 Billion Gallons of Water Annually
- 435 million gallons per day (GPD)
- 7,336 miles of Distribution Mains and Trunk Lines
- Over 730,000 active water service connections



LADWP Recycled Water System Overview

- Extensive history of water reuse
- Over 67 miles of purple pipeline installed
- 4 Service Areas (Valley, Metro, Westside, Harbor)
- 10,000 AFY Delivered



Headworks DPR Project

LA's Path to Reuse

Non-Potable Reuse

- Irrigation
- Industrial Uses
- Environmental

Indirect Potable Reuse

- Terminal Island
- Donald C. Tillman
- Operation NEXT

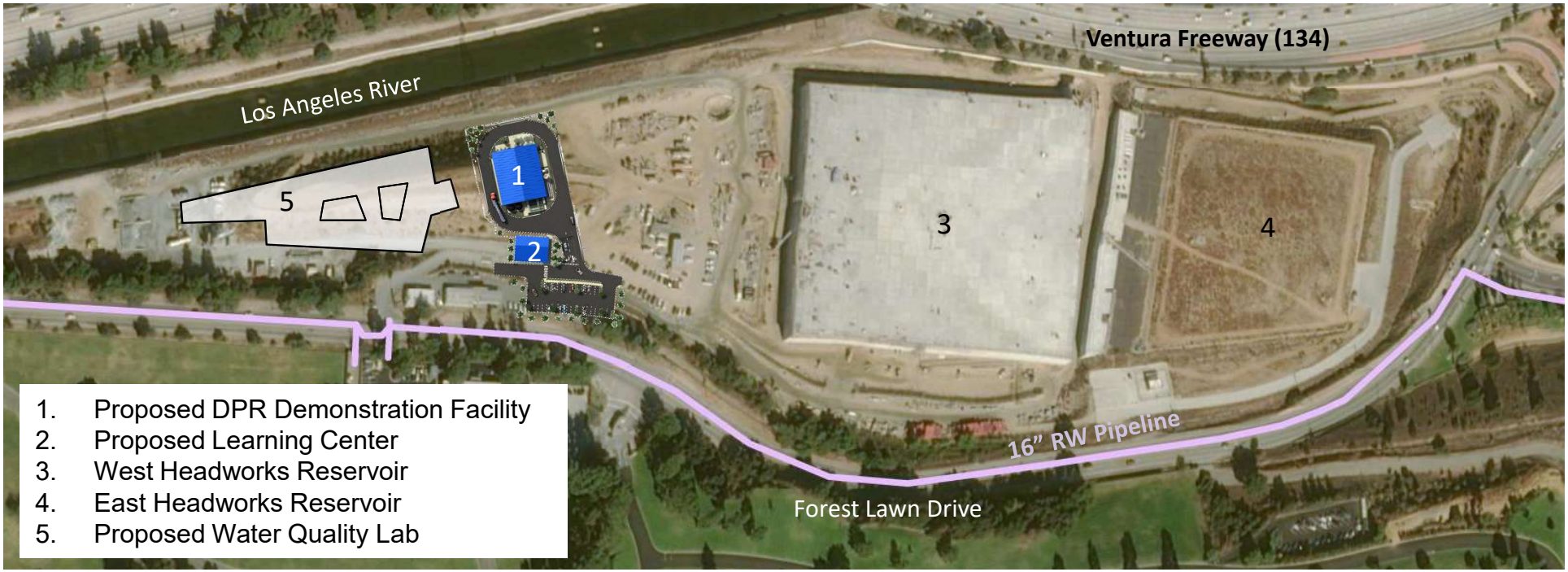
Direct Potable Reuse

- Headworks DPR
- Operation NEXT

Headworks Project Overview

- 1 MGD DPR Facility
- Learning Center
- Phased Approach

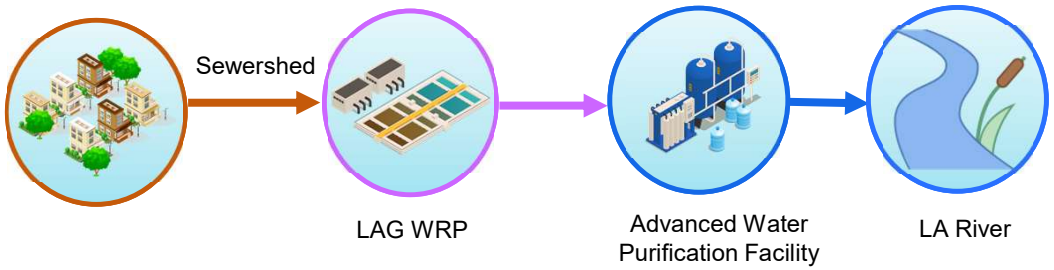
Headworks Demonstration Facility Location



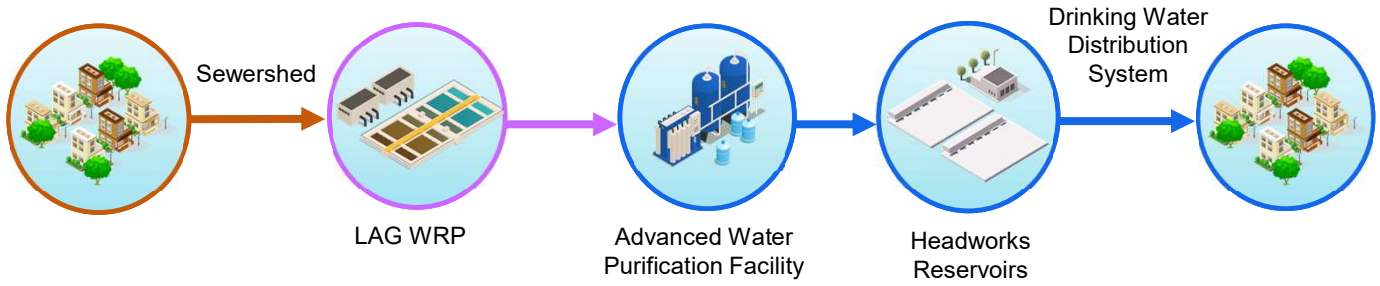
Envisioned Development

Project Phases

Phase 1 – Demonstration Facility (1 MGD)

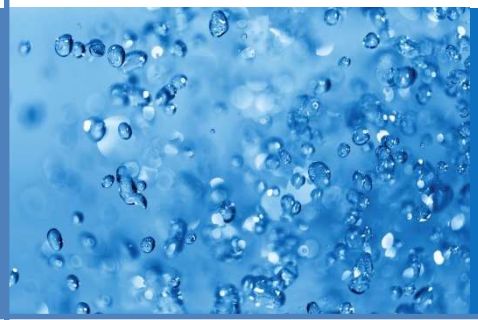


Phase 2 – Initial DPR Operation (1 MGD)



Goals of Demonstration

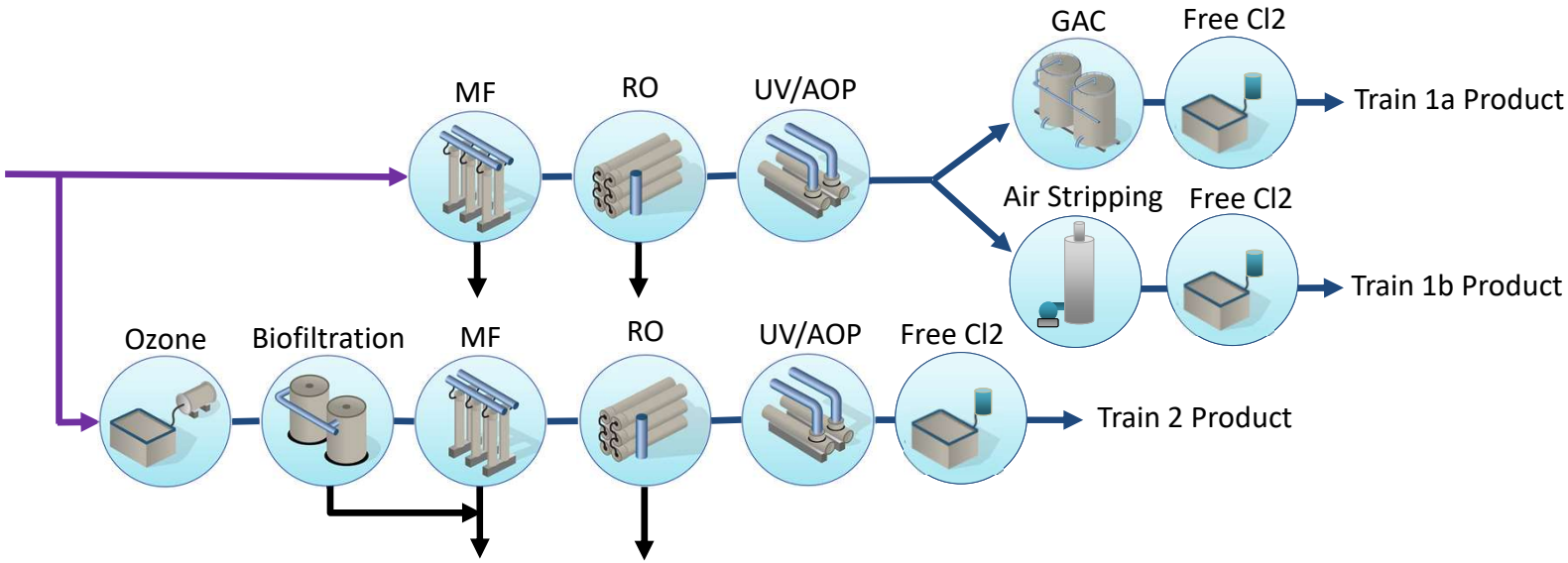
- Establish LADWP's DPR program
- Provide operator training
- Public and regulatory engagement
- Demonstrate integrity monitoring for critical control points
- Optimize unit processes for Phase 2 operation



Treatment Approach

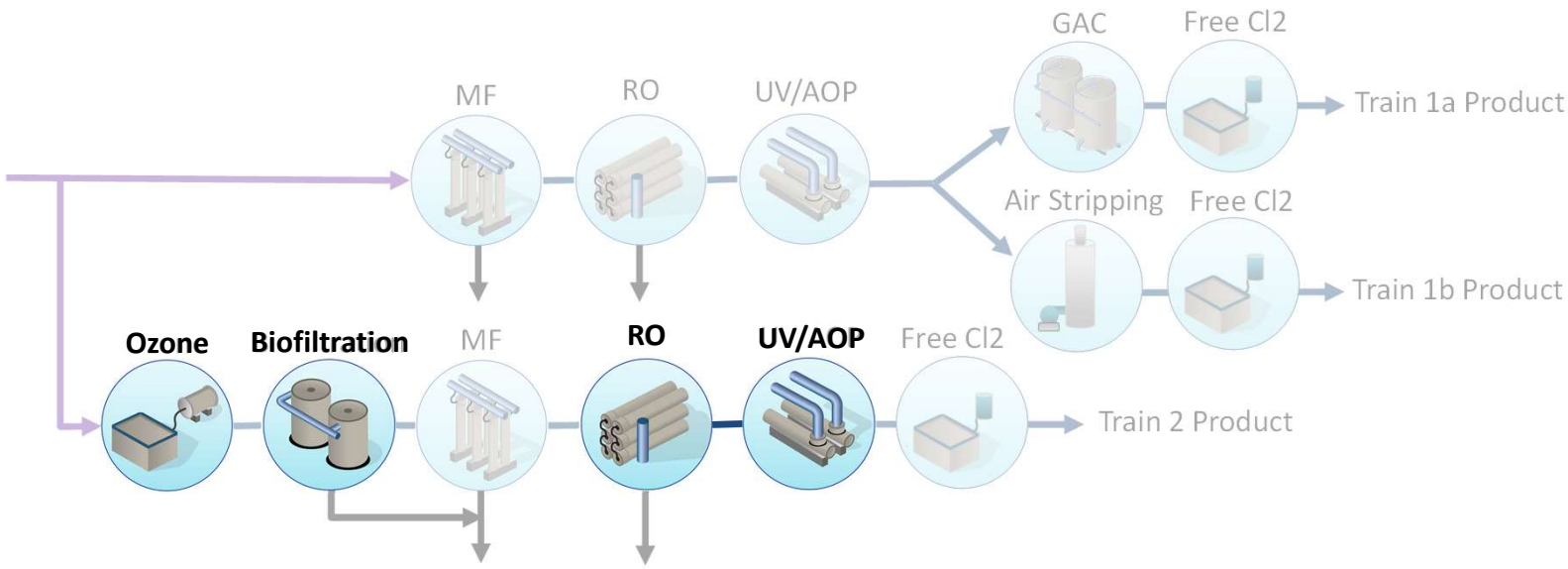
Demonstration Facility Treatment Approach

- Concurrent operation with 3 process trains



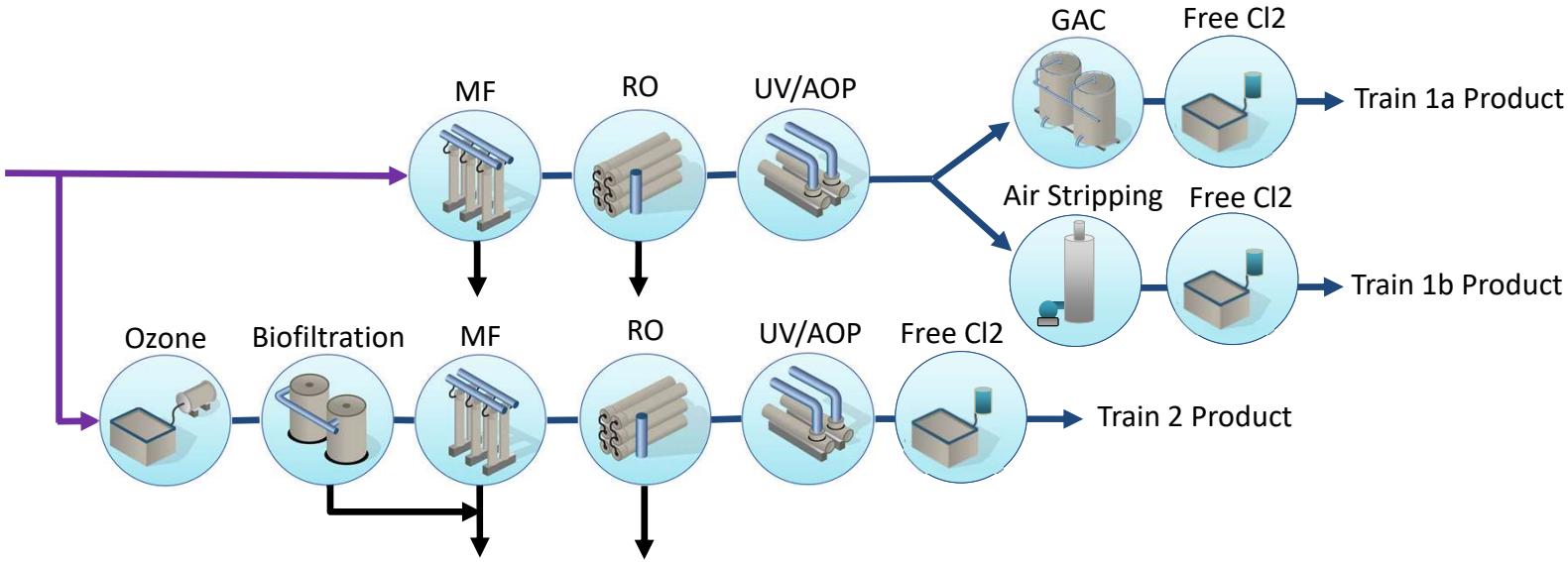
Demonstration Facility Treatment Approach

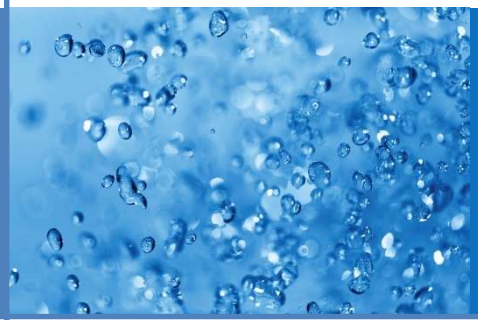
- Concurrent operation with 3 process trains
  - Train 2 based on core processes in DDW Draft DPR Regulations



Demonstration Facility Treatment Approach

- Concurrent operation with 3 process trains
  - Train 2 based on core processes in DDW Draft DPR Regulations
  - Testing will confirm equivalency of alternative trains



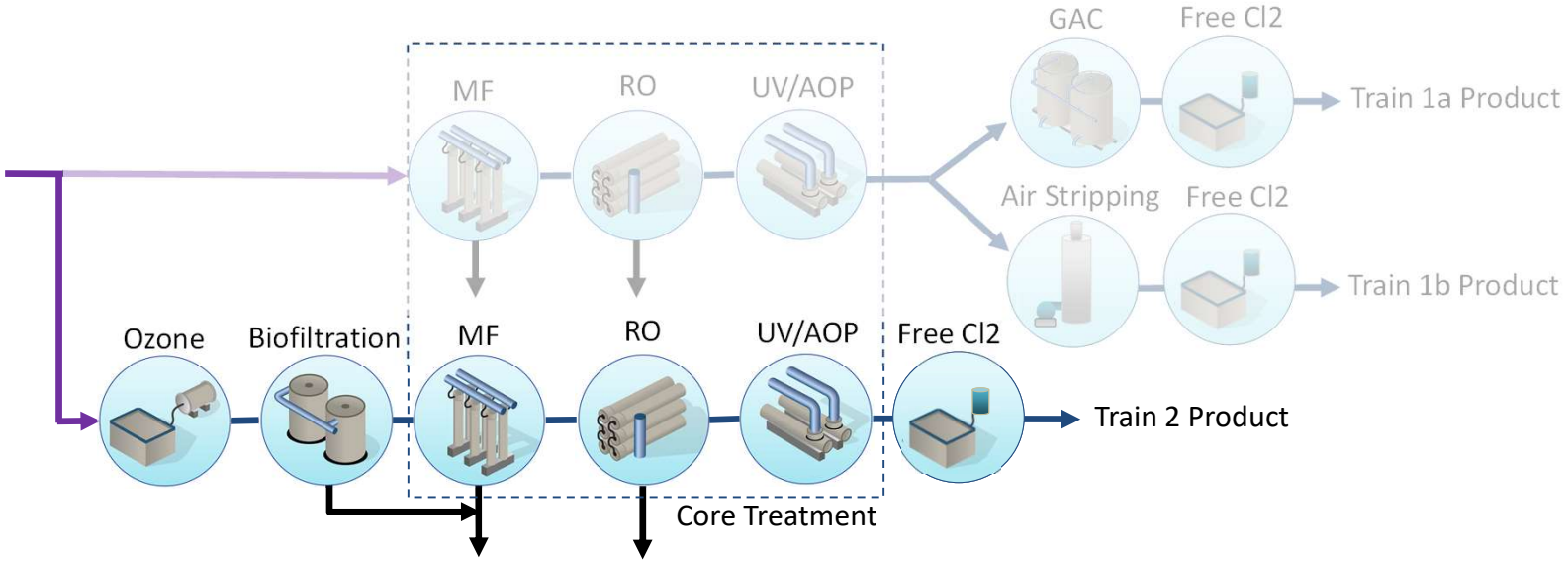


Pathogen Removal

Train 2 Pathogen Removal

- Achieves 20-14-15 with minimum 4 barriers for each pathogen
- Credits per process similar to existing full-scale plants

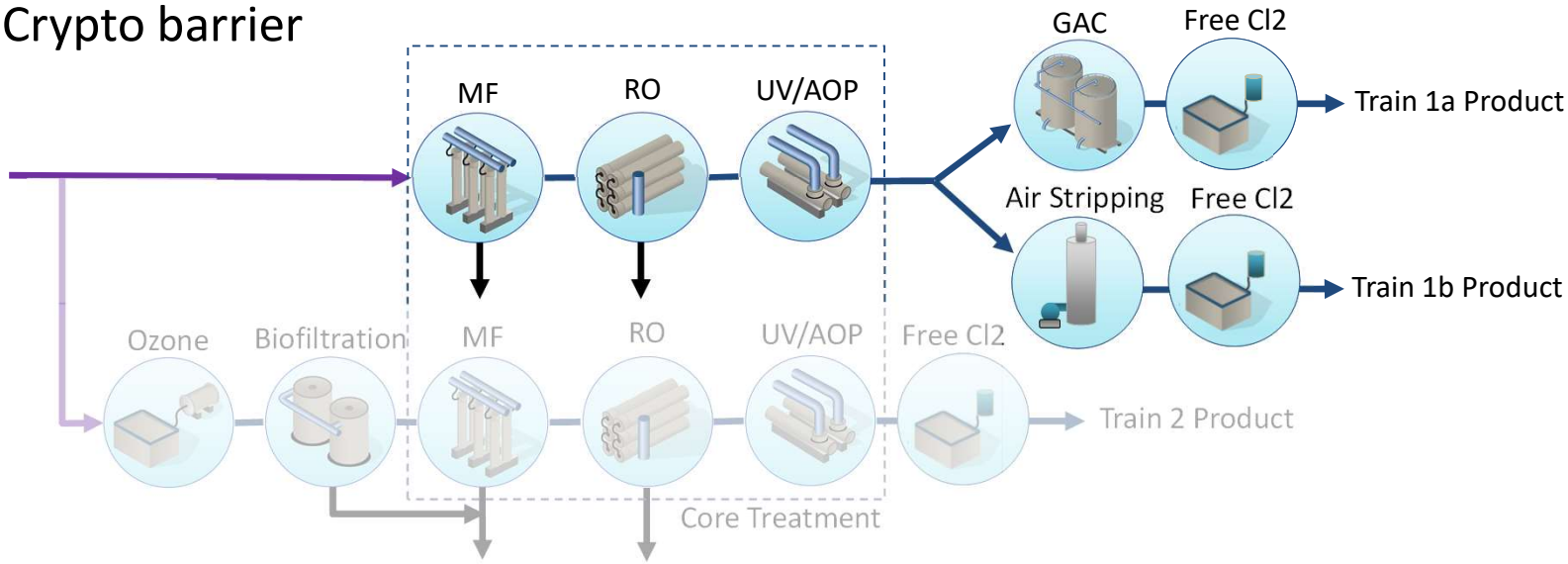
Process	Virus	Crypto
Ozone	6	1
MF	0	4
Cartridge Filters	0	2
RO	2	2
UV	6	6
Free Chlorine	6	0
Total	**20**	**15**



Train 1 Pathogen Removal

- Requires enhanced credits for MF and RO to achieve 20-14-15
- Cartridge filters provide 4th Crypto barrier

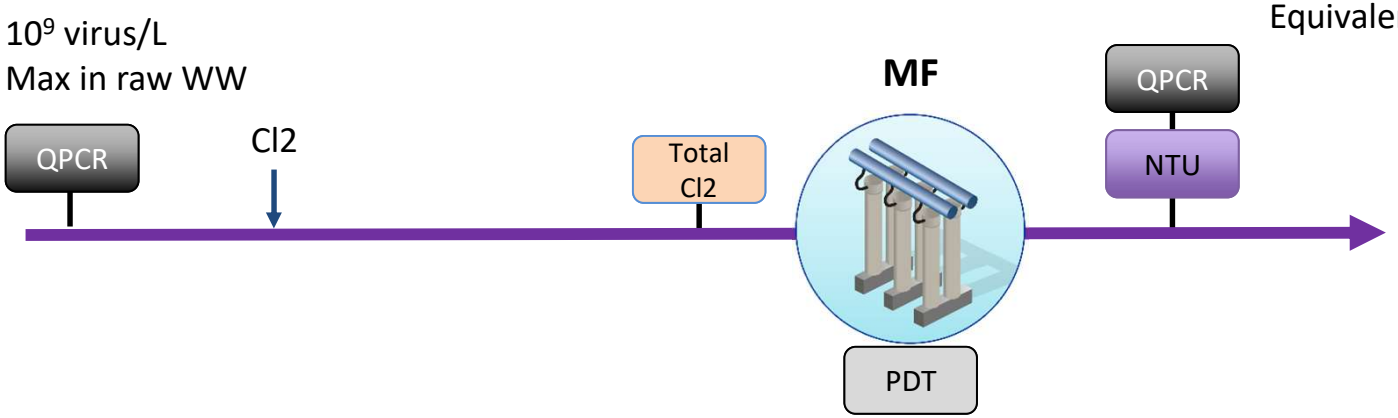
Process	Virus	Crypto
WWTP + CL2 + MF	5	4.5-5
Cartridge Filters	0	2
RO	3	3
UV	6	6
Free Chlorine	6	0
Total	**20**	**15.5-16**



Pathogen Removal for MF

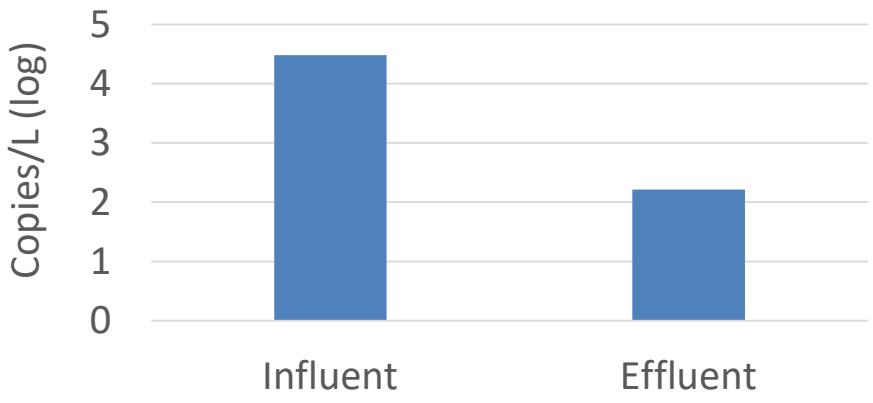
- Giardia/Crypto confirmed using daily PDT and continuous turbidity, targeting 4.5 to 5-log
- qPCR evaluated for virus reduction
  - Directly measure viruses in raw WW and MF permeate daily, seeking credit for combined processes rather than single unit process
  - Targeting ND values for 5-log virus credit
  - Somatic coliphage, norovirus or PMMoV being considered

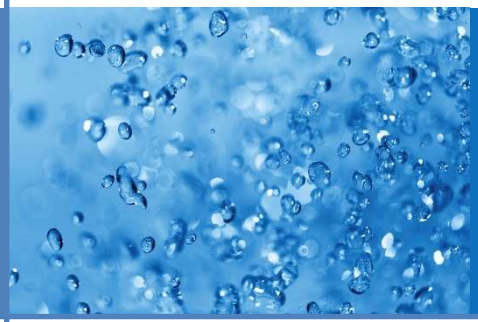
Confirm < 1 virus/mL (10^3/L)
Equivalent to 6-log reduction



Pathogen Removal for MF

- qPCR proof testing for PMMoV conducted for DPR pilot in SC
- Around 6 hour process for all samples
- Demonstrated 2.5-log reduction of PMMoV across MF alone

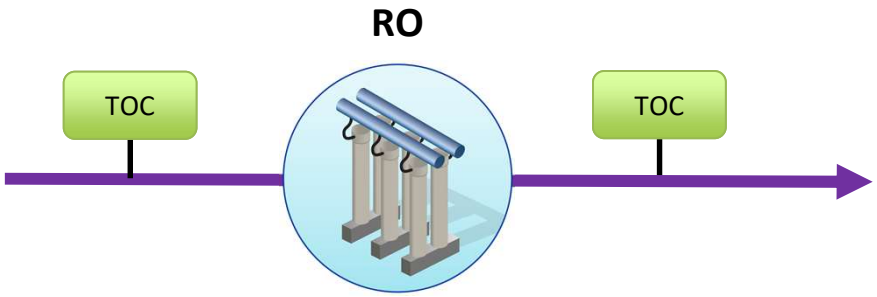




Chemical Removal

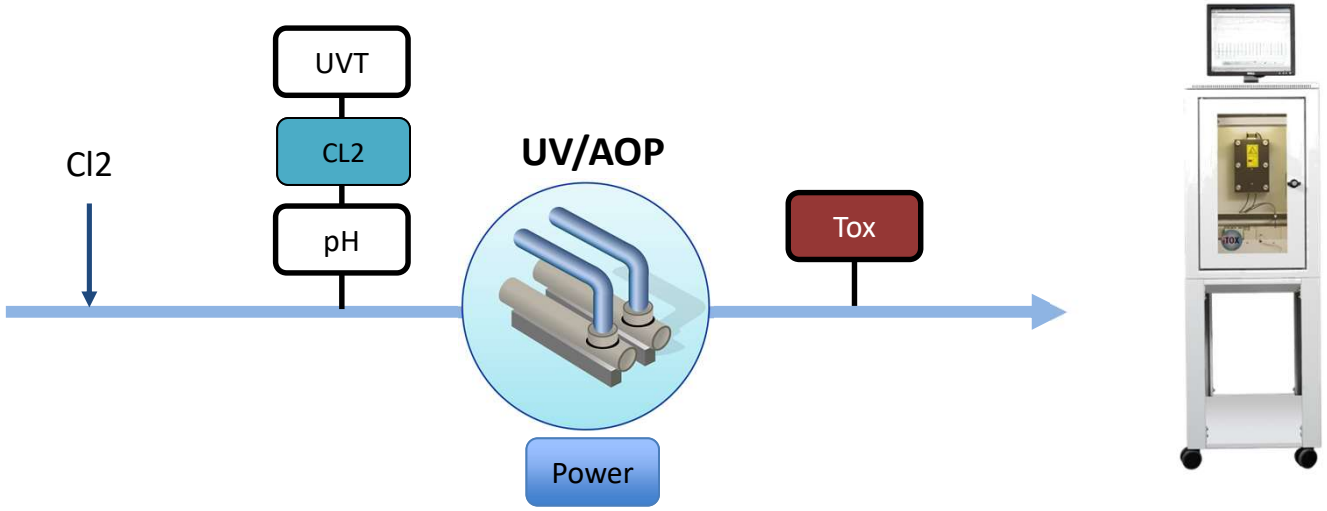
Chemical Removal - RO

- > 99% reduction of bulk organic chemicals
- Comply with DPR requirements for TOC
  - Maintain TOC < 0.5 mg/L at all times
  - 95% of samples < 0.25 mg/L
  - Evaluate integrity (vessel probing) if > 0.15 mg/L



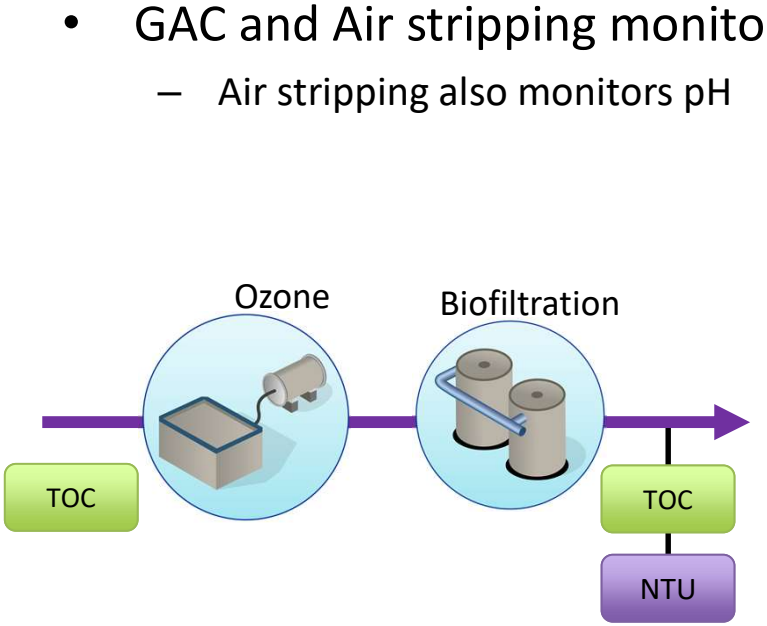
Chemical Removal - AOP

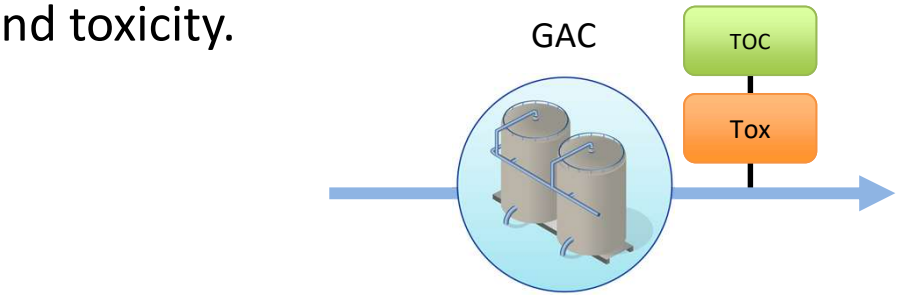
- Continuous monitoring of pH, free Cl2, and UVT upstream of UV
- Spiking study to demonstrate 0.5-log reduction of 1,4-dioxane and develop correlation of UV-chlorine dose product
- Online bioassay of product using MicroLAN iTOX, serving as additional confirmation for toxicity spikes

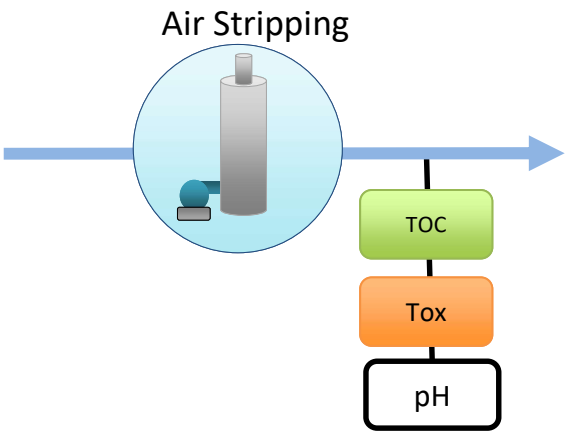


Chemical Removal – Supplemental Process

- O3-BAF will monitor TOC and turbidity
- GAC and Air stripping monitor TOC and toxicity.
  - Air stripping also monitors pH



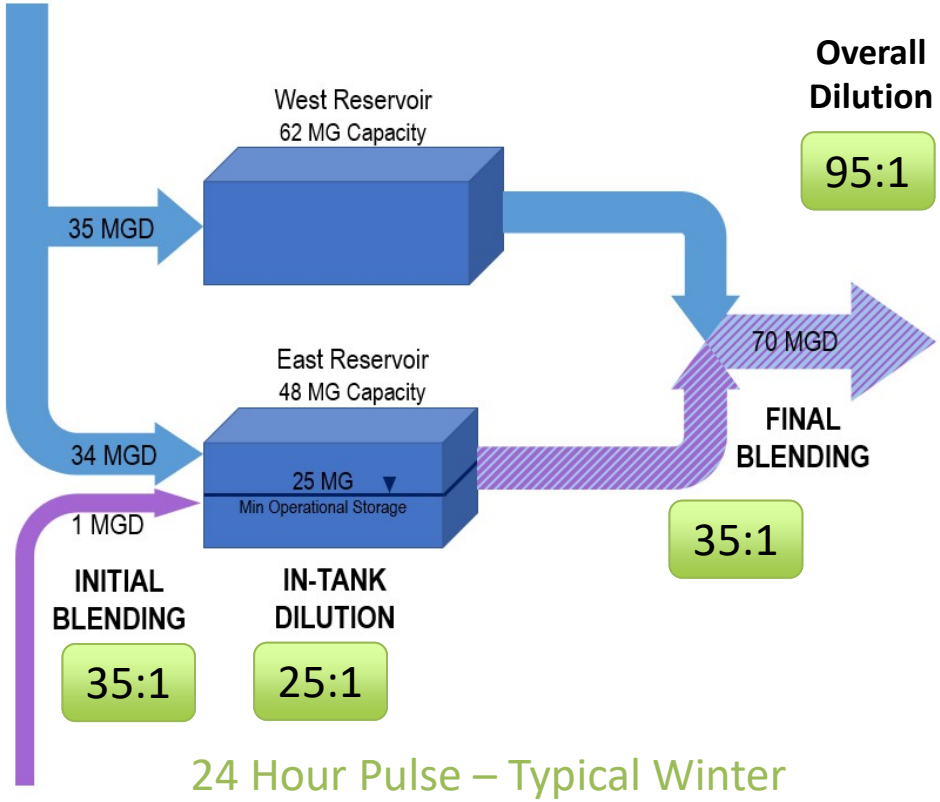




Blending Provides Final Barrier to Chemical Spikes

Demand Scenario	Blending Ratio (Total Flow to Purified Water Flow)
Typical Summer Day	83:1
Typical Winter Day	70:1

Winter Flow Scenario Duration of Off Spec Pulse, Δt (hour)	In-Tank Dilution Factor (t_r / f * Δt)
1	601:1
2	300:1
4	150:1
8	75:1
12	50:1
16	38:1
24	25:1



24 Hour Pulse – Typical Winter

Chemical Spiking

- Focus on low MW organic compounds that are also poorly biodegraded
- Target compounds with lower K_{OH*} than 1,4-dioxane
- Evaluate 2-3 compounds in addition to formaldehyde and 1,4-dioxane

Chemical	Regulatory Limit (ug/L)	Molecular Weight (Dalton)	Hydroxyl Radical Rate (Log K_{OH*})	Hydro-phobicity (Log K_{OW})	Henry's Law Coefficient Hc (atm-L/mol)
		Removal w/ RO	Removal w/ AOP	Removal w/ GAC	Removal w/ AS
Formaldehyde	100*	30	9.30	0.35	0.0003
1,4-dioxane	1*	88	9.37	-0.27	0.0048
Acetone	N/A	58	7.99	-0.24	3.5
Acetonitrile	N/A	41	6.54	-0.34	0.034
Benzene	1	78	9.89	2.1	5.6
Chloroform	80	119	7.15	2.0	3.7
MTBE	13	88	9.17	0.94	0.59

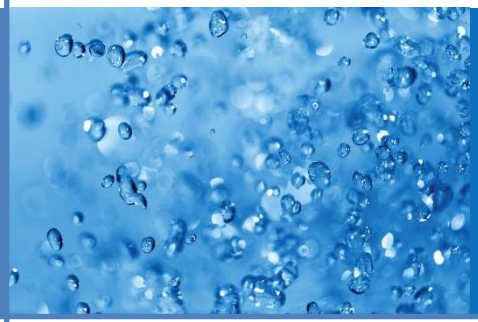
** Notification level*

Testing with DBP Related Compounds

- Looking at formation of byproducts in process trains
- Key question:
  - Is it better for form DBPs/OPs before RO than in UV/AOP?



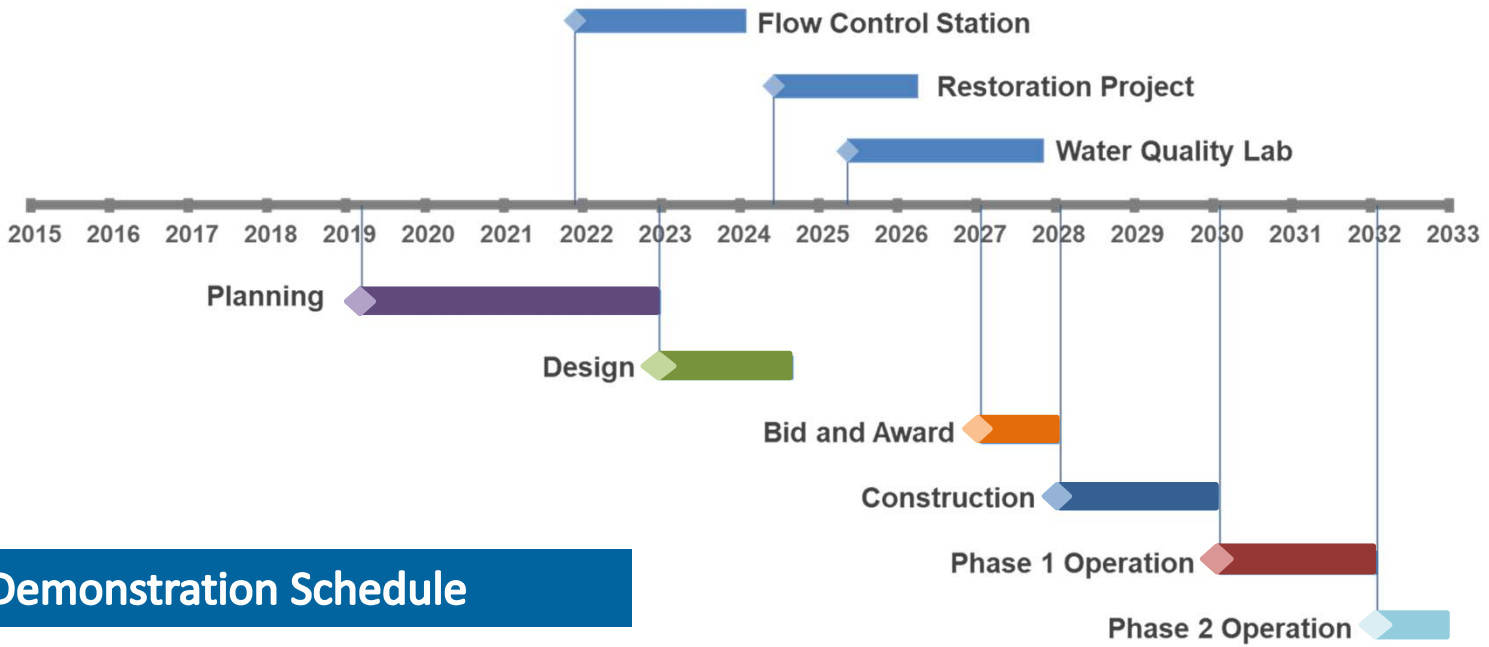

Chemical	Molecular Weight (Dalton)	Hydroxyl Radical Rate (Log K_{OH*})	Hydro-phobicity (Log K_{OW})	Henry's Law Coefficient Hc (atm-L/mol)
Formaldehyde	30	9.30	0.35	0.0003
Chloroform	119	7.15	2.0	3.7
NDMA	153	9.10	-0.38	0.0365
Dimethylamine	45	10.69	-0.38	0.018
Bromide	80	N/A	N/A	N/A
Chromium-3	52	N/A	N/A	N/A



Project Schedule

Project Schedule

Headworks Construction Activity



DPR Demonstration Schedule

Summary

- Multi-phase Approach
- Outreach Opportunities
- Testing Platform

First Step in Developing LADWP's DPR Program

Thank You

LA DWP

LASAN

CDM Smith 75th

Trussell TECHNOLOGIES INC

Woodard & Curran