Optimizing Biological Denitrification of Groundwater – Recovering Waste Backwash Water & Co-Removal of Hexavalent Chromium

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Outline

1. LA County Dept. of Public Works & Waterworks Districts
2. Configuration of the Biological Denitrification (BDN) System Evaluated
3. Pilot Testing Results
4. General Observations

LA County Dept. of Public Works

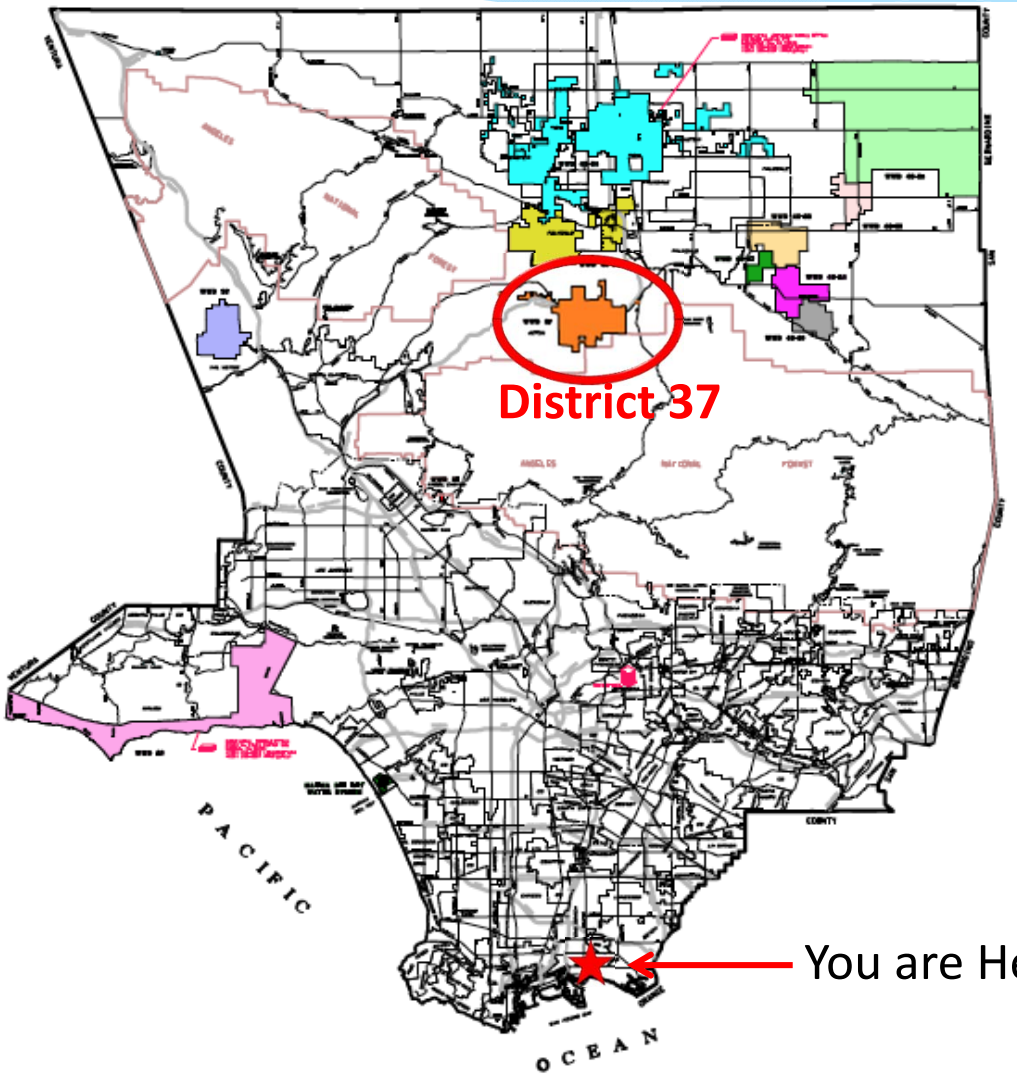
- Formed in 1985
- Consists of 34 divisions & groups
- 3400 employees in 500 job classifications
- Annual operating budget of $2 Billion
- Responsible for design, construction, operation, maintenance and repair of roads, airports, sewers, water supply, flood control, water quality, and water conservation facilities

LA County Waterworks Districts

- A division of the LA County Dept. of Public Works
- Supplies water to 200,000 residents in LA County
- Five LA County Waterworks Districts

District	Established	Connections	Estimated Population
District 21; Kagel Canyon	1935	250	990
District 29; Malibu	1959	7450	20,120
District 36; Val Verde	1963	1,320	4,650
District 37; Acton	1963	1,390	4,330
District 40; Antelope Valley	1993	54,640	170,440

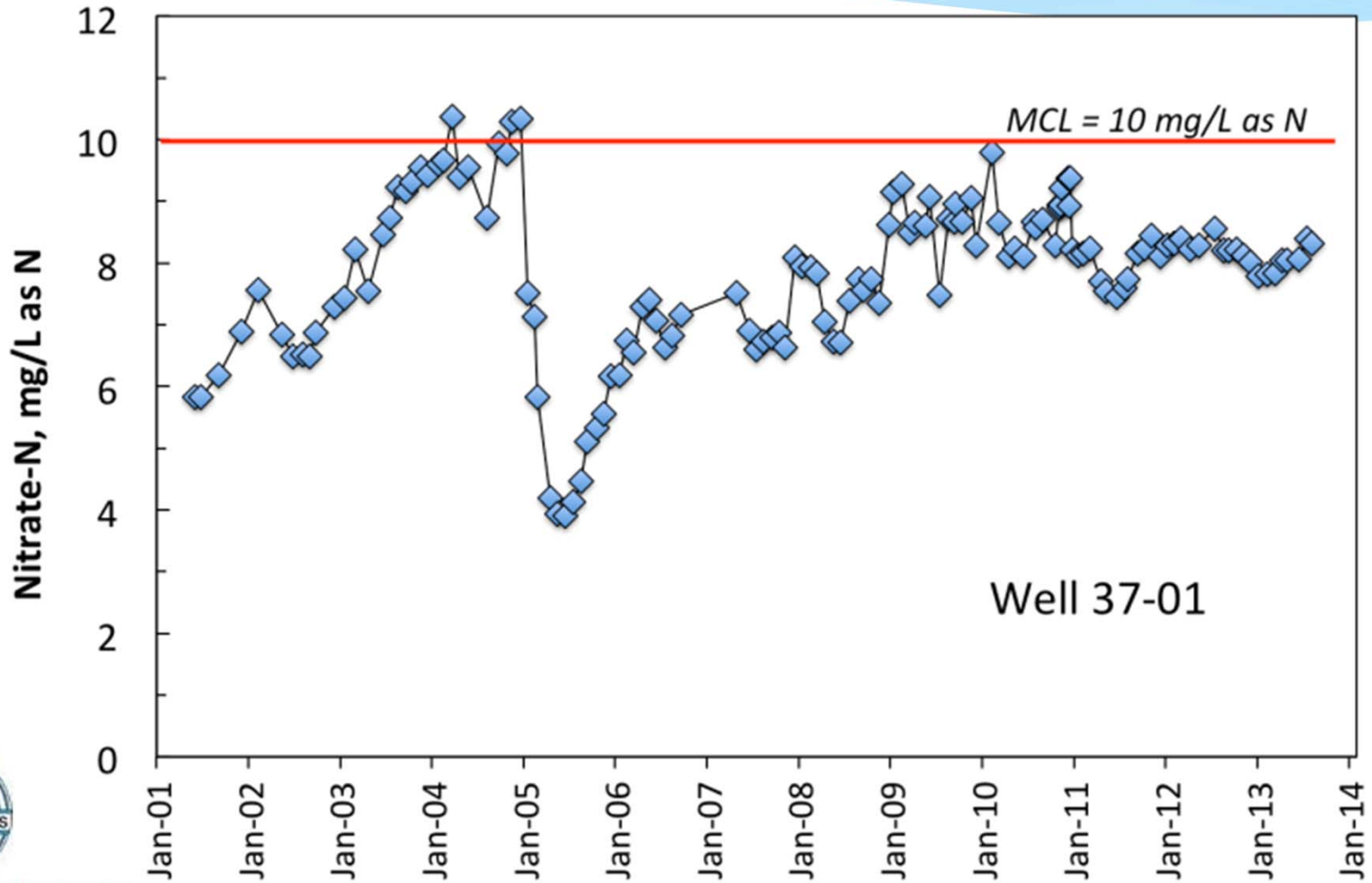
District 37



District 37

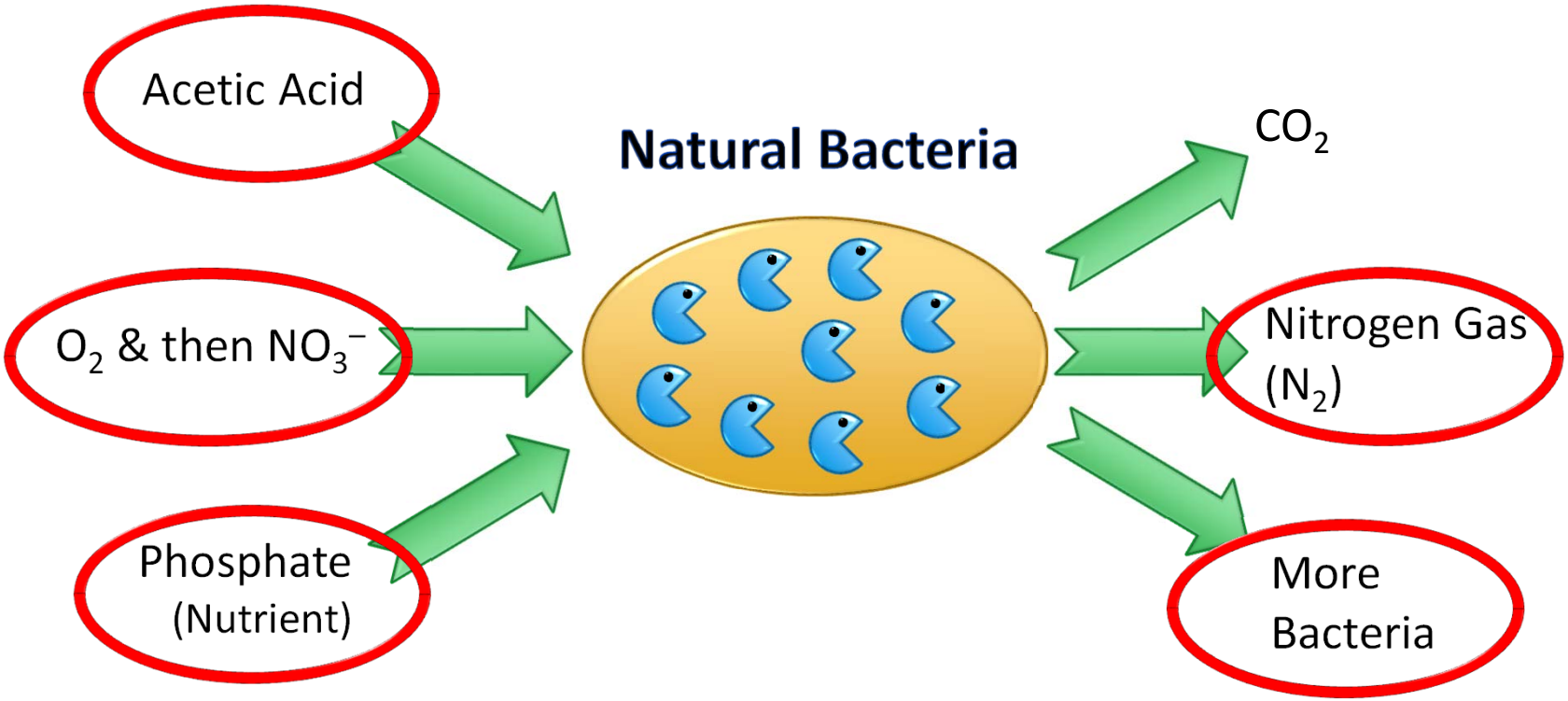
- *District 37 serves drinking water to approx. 4,400 people in Acton, California (near Palmdale)*
- *The District's water supply is primarily groundwater from 3 wells, and treated surface water from AVEK's treatment plant*
- *All three wells contain nitrate at various levels*
- *The District's service area is not sewered, limiting waste disposal options from groundwater treatment systems*

Nitrate in Well 37-01

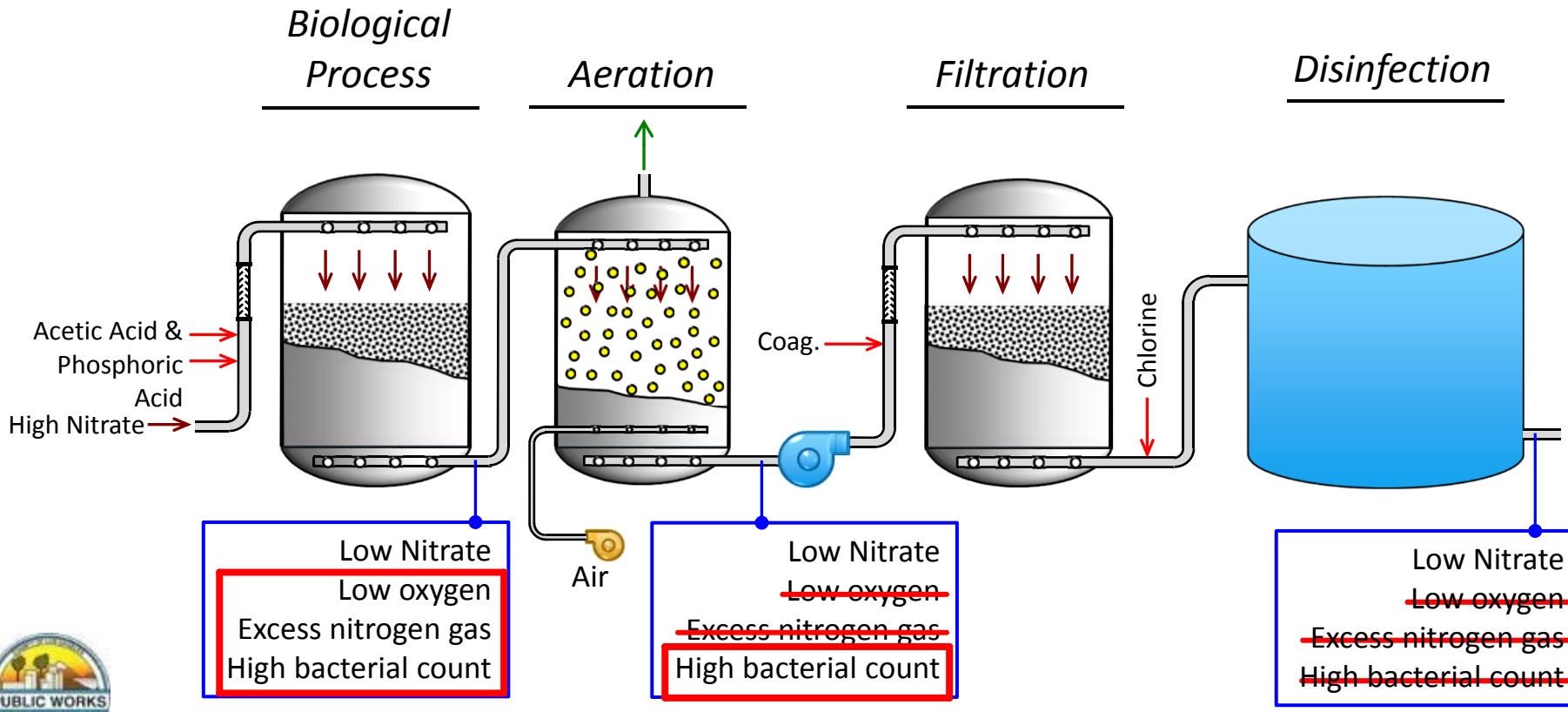


Biological Treatment System Configuration

Fundamentals



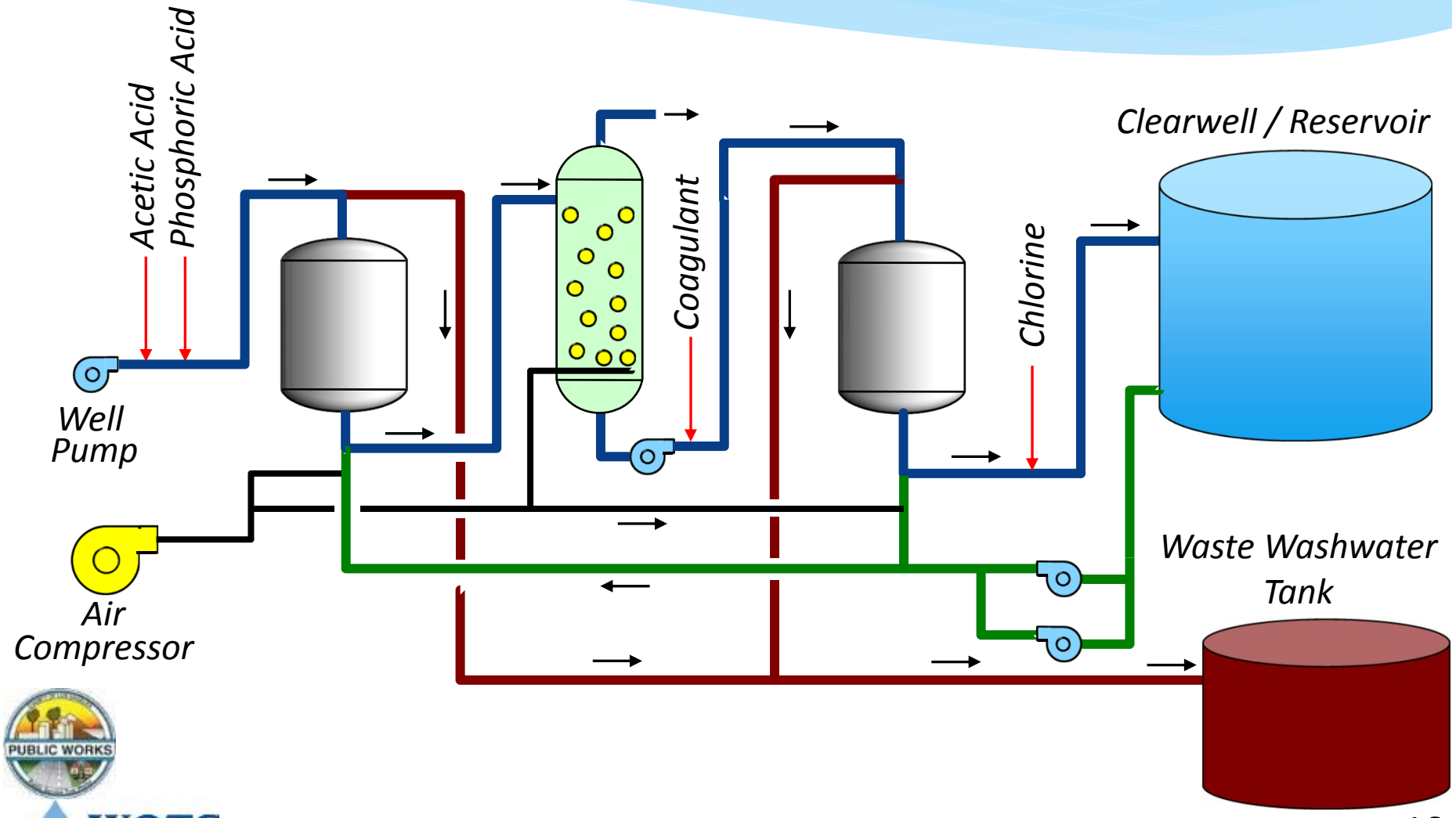
Overall Treatment System



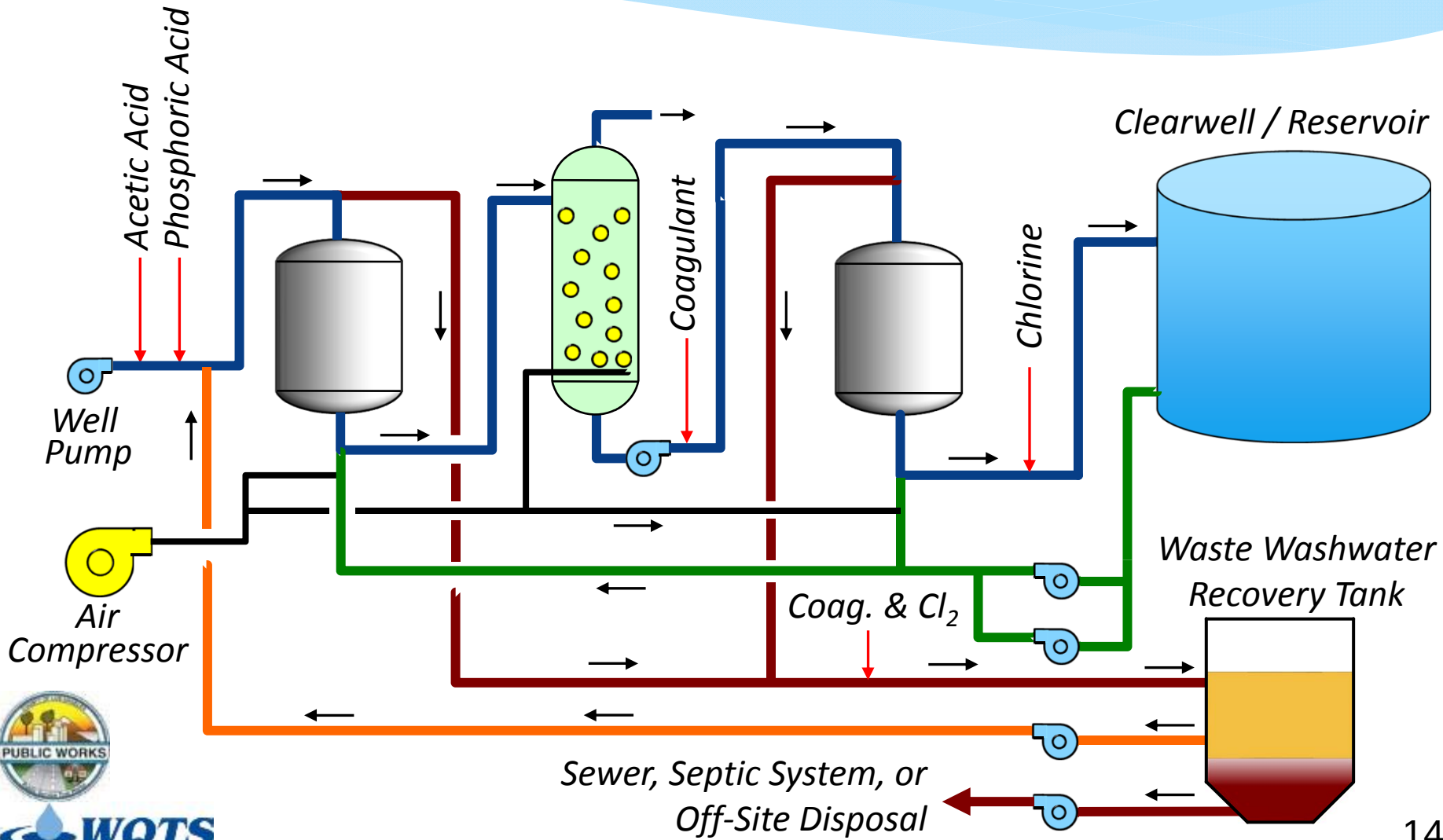
General Design & Operational Parameters

Parameter	Value
Biological Contactor EBCT	10 min
Filtration Rate	3.0 gpm/sf
Runtime Between Backwashes	24 – 48 hrs
Unit Backwash Volume	~150 gal/sf
Water Wastage Rate	6% to 12%

Overall System

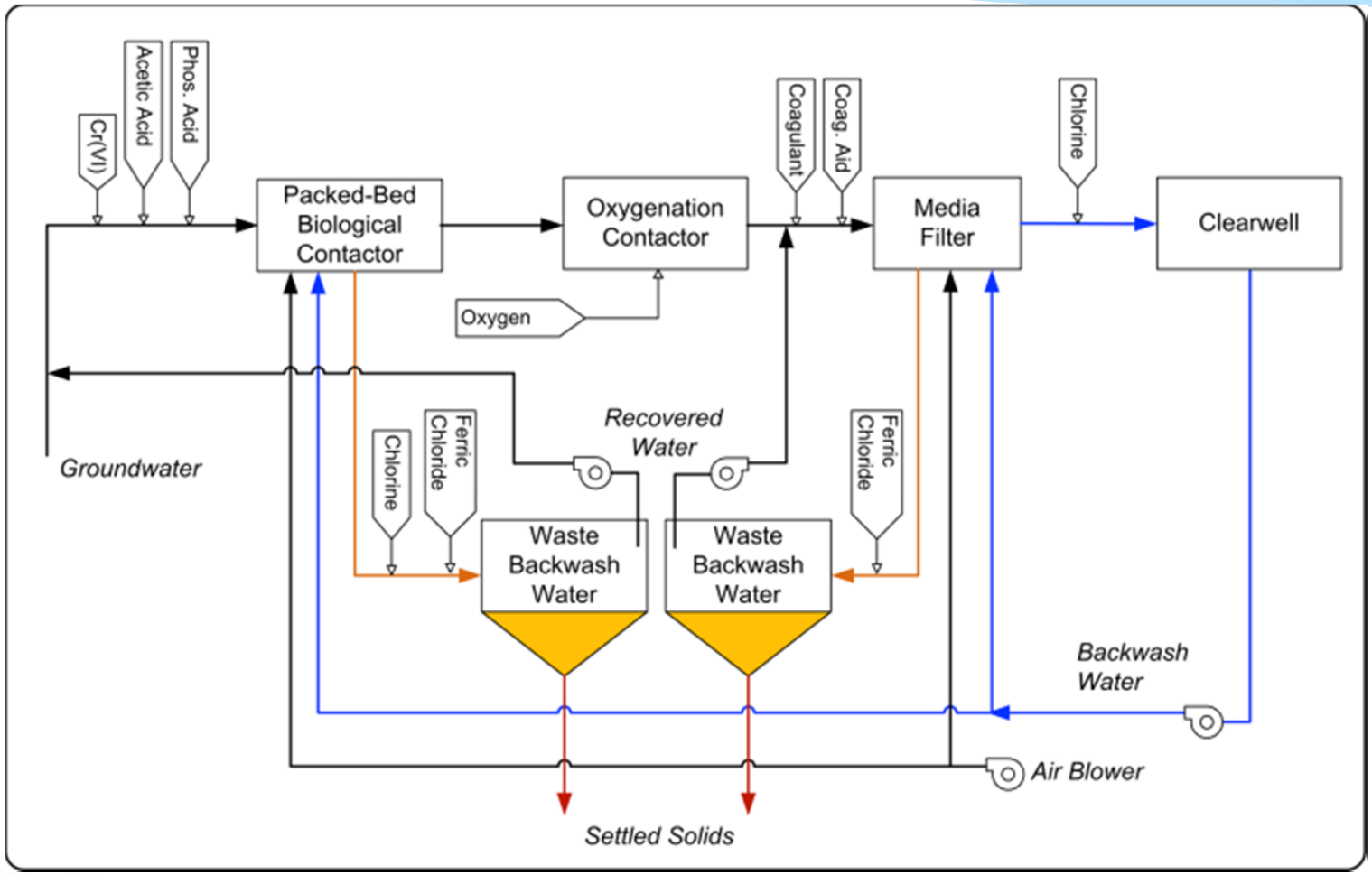


with Washwater Recovery



Pilot Testing Results

Pilot Plant Configuration



Washwater Recovery System Operation

Parameter	Value
Coagulant Type	Ferric Chloride
Coagulant Dose (Bio. Contactor WBW)	75 mg/L
Coagulant Dose (Filter WBW)	50 mg/L
Clarification Time	2 hrs
Return Flow (as % of Feed Flow)	10% to 15%

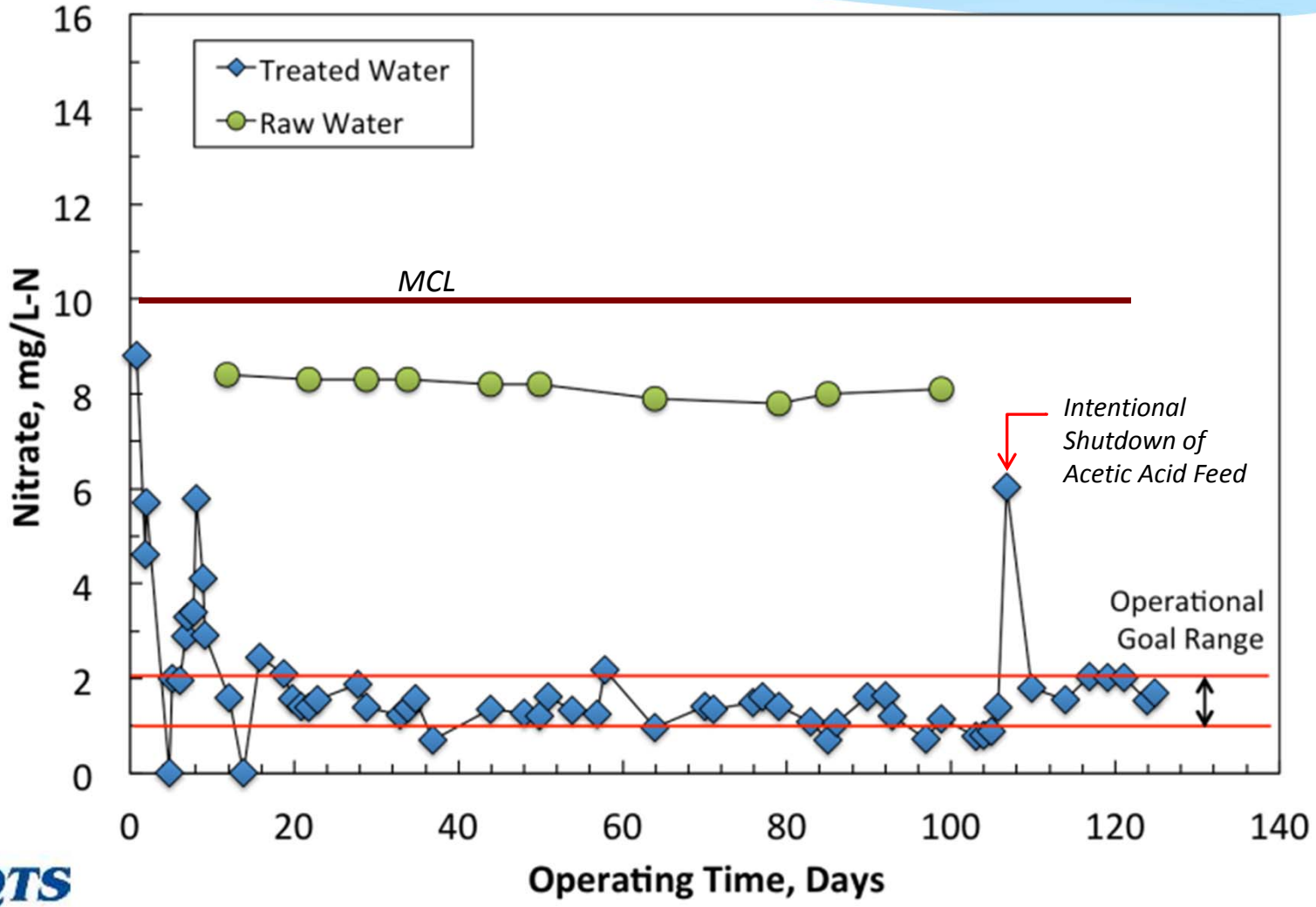
Groundwater Quality

Parameter	Unit	Ave. Value
Nitrate	mg/L as N	8.2
Dissolved Oxygen	mg/L	8.2
Turbidity	NTU	0.15
pH	--	7.5
Temperature	^{o}C	21.4
Alkalinity	mg/L $CaCO_3$	174
Hardness	mg/L $CaCO_3$	320
TOC	mg/L	0.54

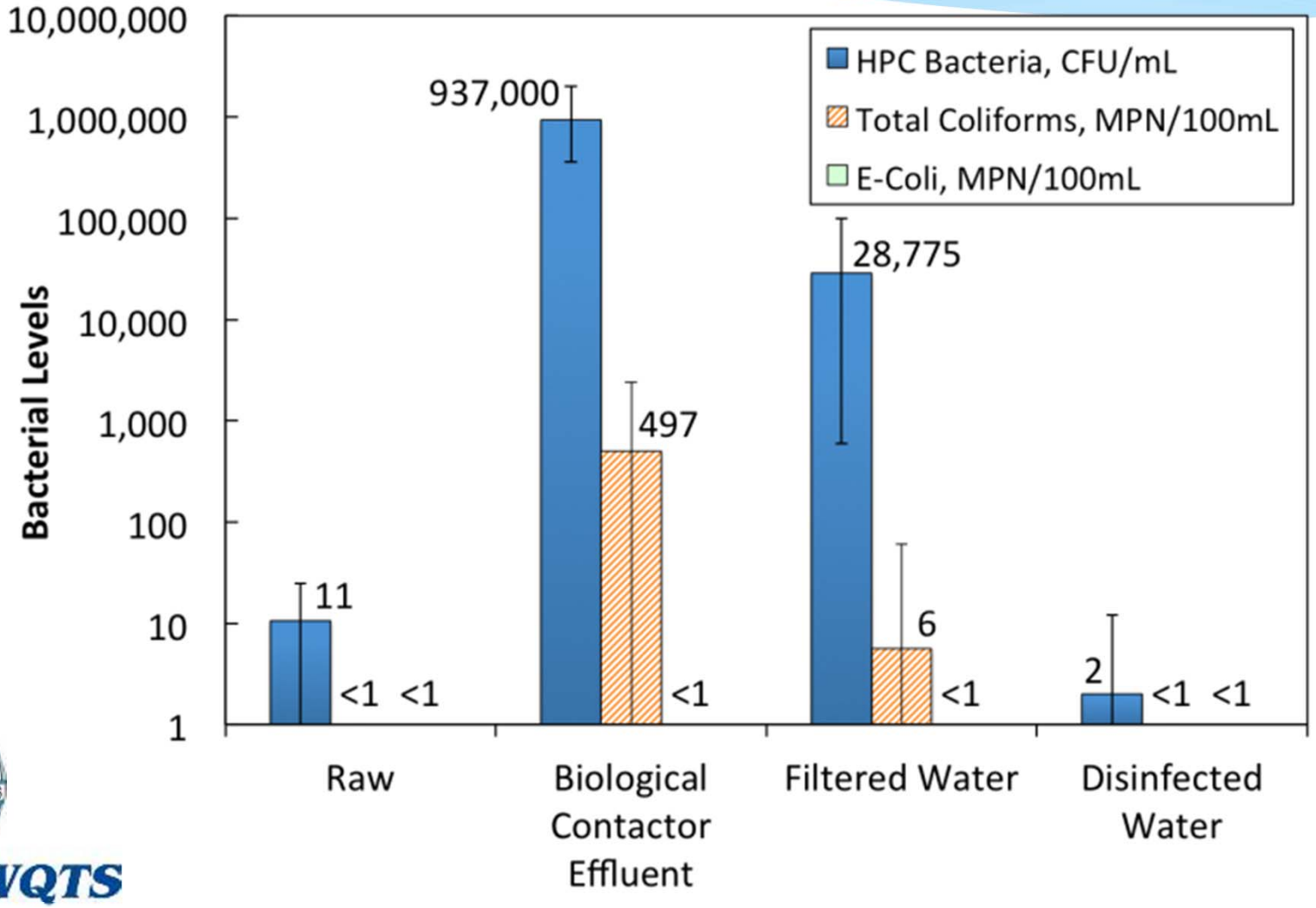
Return Washwater Quality

Parameter	Unit	Biological Contactor	Media Filter
Turbidity	NTU	20	3
Iron	mg/L	14	5
Chromium	µg/L	16	4
HPC	CFU/mL	2×10^6	0.6×10^6
TOC	mg/L	50	4.6
Odor	TON	100	200

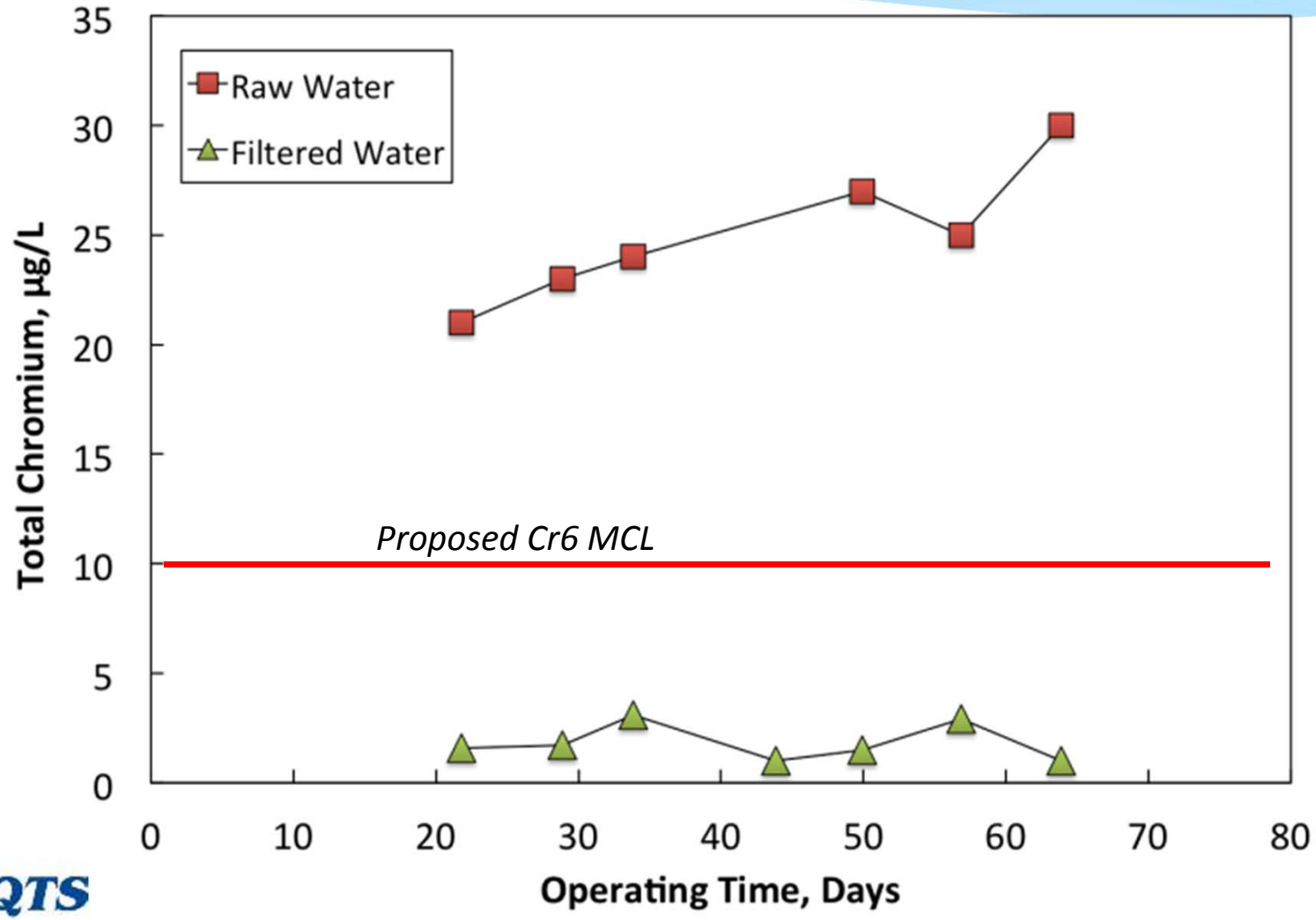
Nitrate Removal



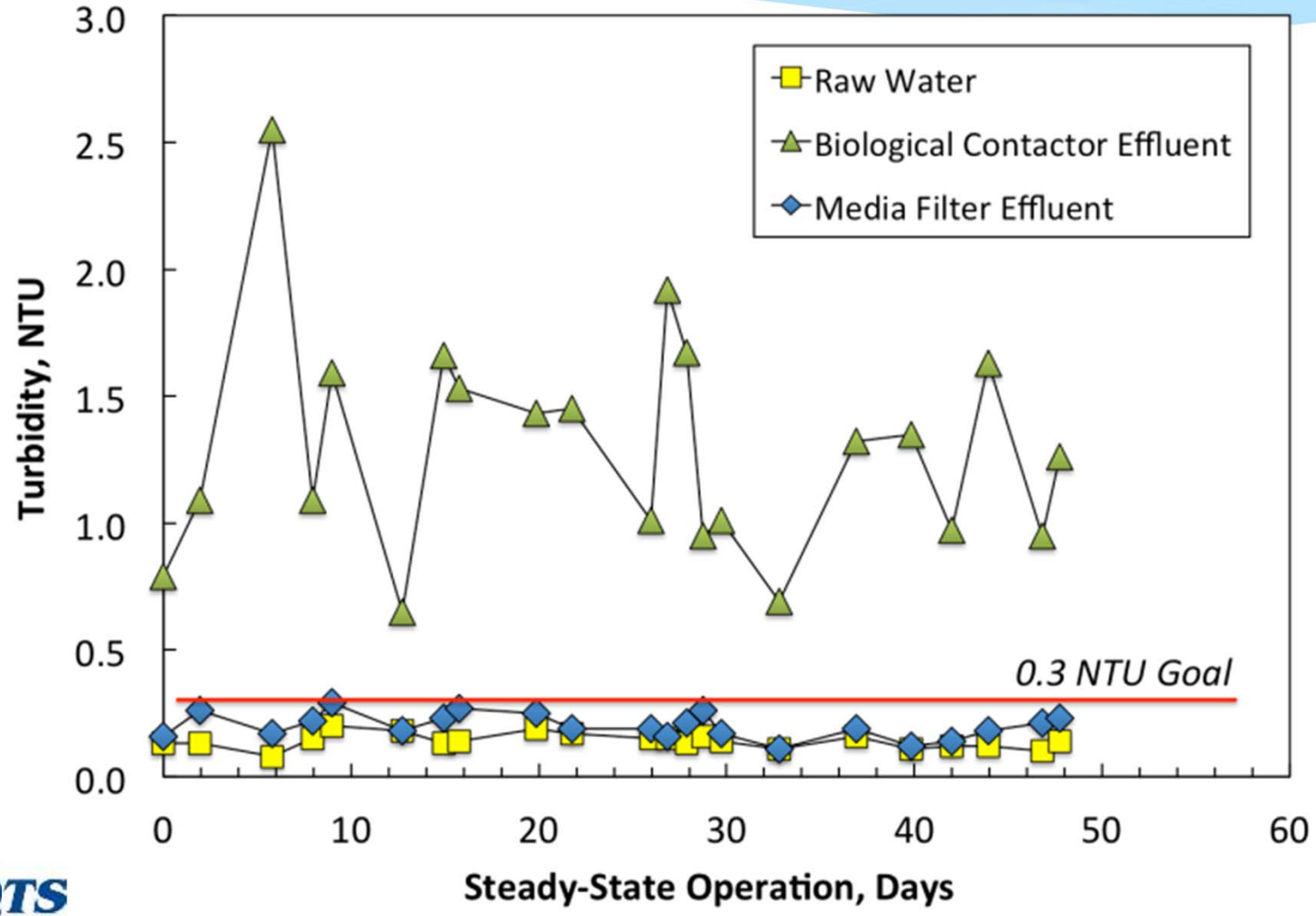
Bacterial Levels



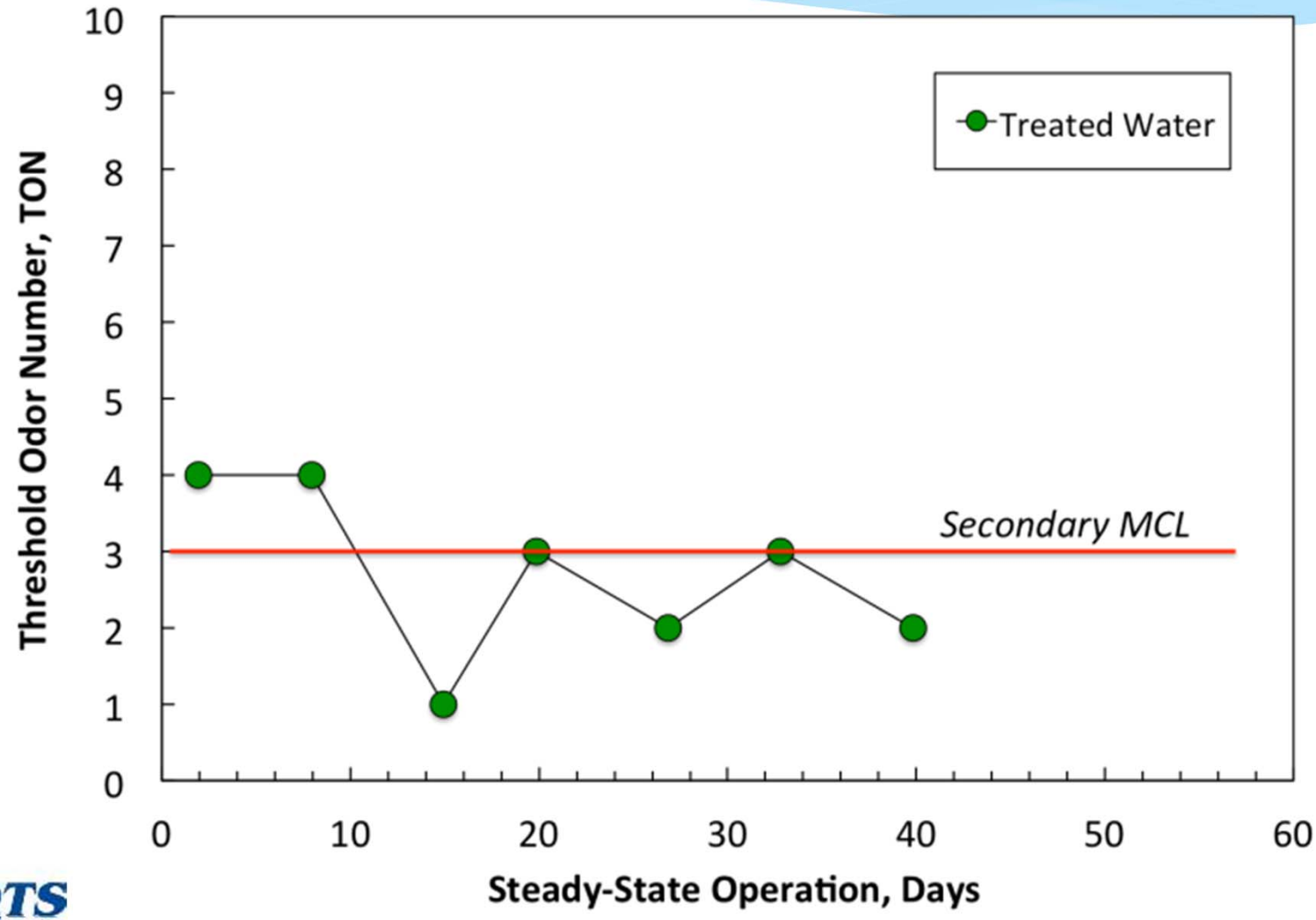
Removal of Chromium



Turbidity


Raw Water
Biological Contactor Effluent
Media Filter Effluent
0.3 NTU Goal
Turbidity, NTU
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
10
20
30
40
50
60
Steady-State Operation, Days

Threshold Odor Number (TON)



General Observations

- *Biological treatment is highly effective at removing nitrate.*
- *Biological treatment also achieves effective removal of Cr(VI).*
- *Recovery of waste backwash water is technically feasible.*
- *Wastage rate can be reduced from about 12% without washwater recovery, to <1% with washwater recovery.*
- *However, washwater recovery adds operational and water quality challenges that should be taken into consideration.*

Thank You!

Questions?

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