OneWater Nevada
Our Sustainable Water Future

OneWater Nevada
Northern Nevada Groundwater Replenishment Project

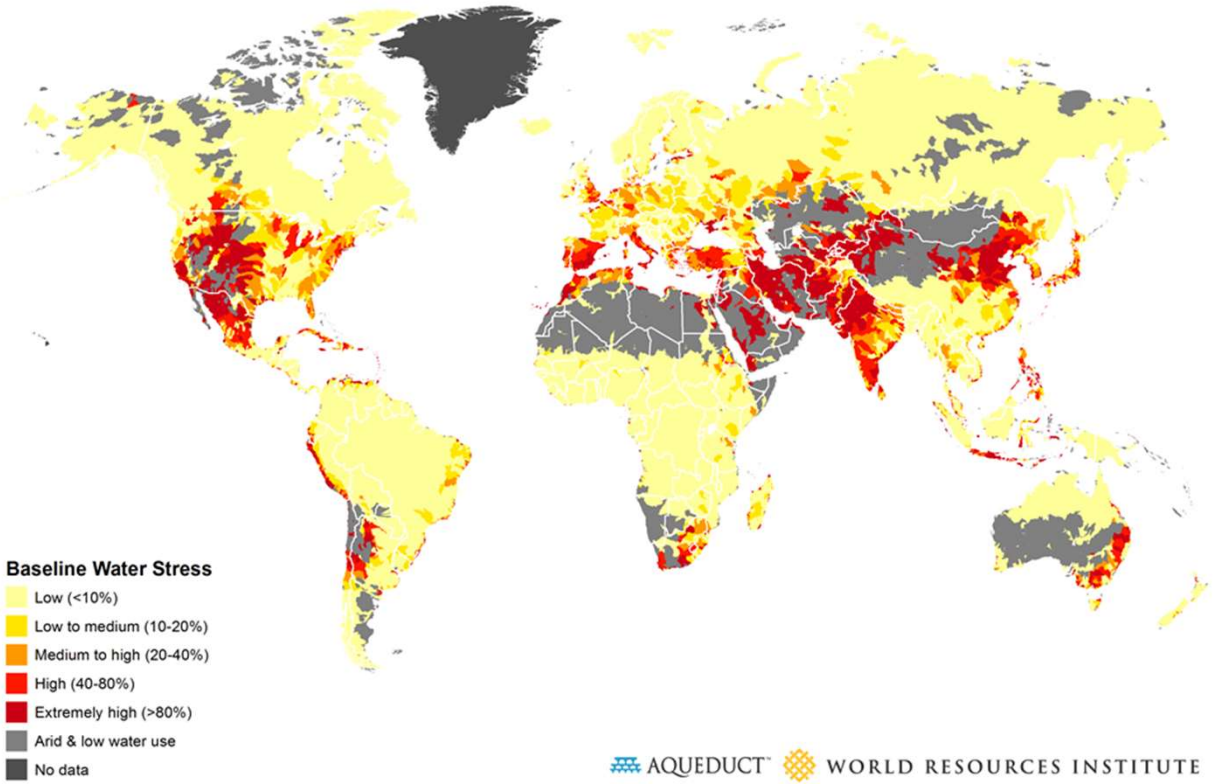
OneWater Nevada
Rick Warner, Program Manager

University of Nevada, Reno · City of Reno · Washoe County, Nevada 1861 · Truckee Meadows Water Authority — Quality. Delivered. · Western Regional Water Commission · Northern Nevada Water Planning Commission · Truckee Meadows Water Reclamation Facility · City of Sparks

Discussion topics

- Rationale for water recycling
- Nevada perspectives
- **OneWater Nevada** approaches
- Preliminary findings
- Social aspects

Global water stress 2019



Nevada perspectives

Nevada perspectives

- Many cities in Nevada operate non potable water reuse systems
- High quality recycled water for industrial uses and landscaping
- 70 % of wastewater is recycled
- Indirect potable reuse (A+ quality) regulations established in 2016

Nevada perspectives

- Arid: less than 7 inches of precipitation per year
- Managing wastewater and stormwater is far more complex than managing water supply
- Aquifer Storage and Recovery (ASR) is established
- New industries require water resiliency
- A sustainable water supply is fundamental for the economy prosperity
- Potable reuse projects are in development

Nevada A+ regulations – water quality

- Effective December 21, 2016
- Framework for Indirect Potable Reuse
  - Injection Wells or Spreading Basins
- Water Quality Requirements
  - National Primary Drinking Water Regulations (NAC445A)
  - Secondary maximum contaminant levels (NAC445A)
  - 12-log inactivation for enteric virus
  - 10-log inactivation for Giardia
  - 10-log inactivation for Cryptosporidium

Nevada A+ regulations – administrative

- Public workshops
- Project-specific engineering report
- Unregulated constituent monitoring program
- Evidence of effective treatment processes
- Wastewater source control
- Capital and operating financial plan
- Fiscal compliance
- Local health district approval
- Minimum number of treatment barriers, etc.

OneWater Nevada

Our Sustainable Water Future

- Formed in 2016
- Vision – collaboratively develop more sustainable water management strategies
- Focus - determine if A+ reclaimed water offers the northern Nevada region significant water management benefits

University of Nevada, Reno

RENO

Washoe County, Nevada 1861

Truckee Meadows Water Authority
Quality. Delivered.

Western Regional Water Commission
Northern Nevada Water Planning Commission

Truckee Meadows Water Reclamation Facility

City of Sparks

Successful potable reuse projects

- Objectives clearly defined
- Regulatory framework
- Feasibility study conducted
- Regional effort
- Drinking water authority engagement
- Effective program leadership
- Public participation opportunities

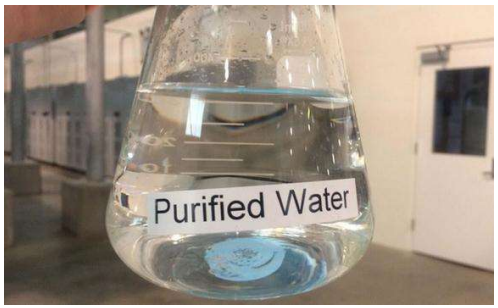
Innovations in technology and engagement

Groundwater Replenishment System of Orange County, California

- 100 million gallons per day
- Pioneer in “Agency Legitimacy” movement

Innovations in building public trust

Silicon Valley Advanced Water Purification Center



- 10 million gallons per day of potable water quality per day
- Operating as a demonstration project
- Educates the public about the value of water

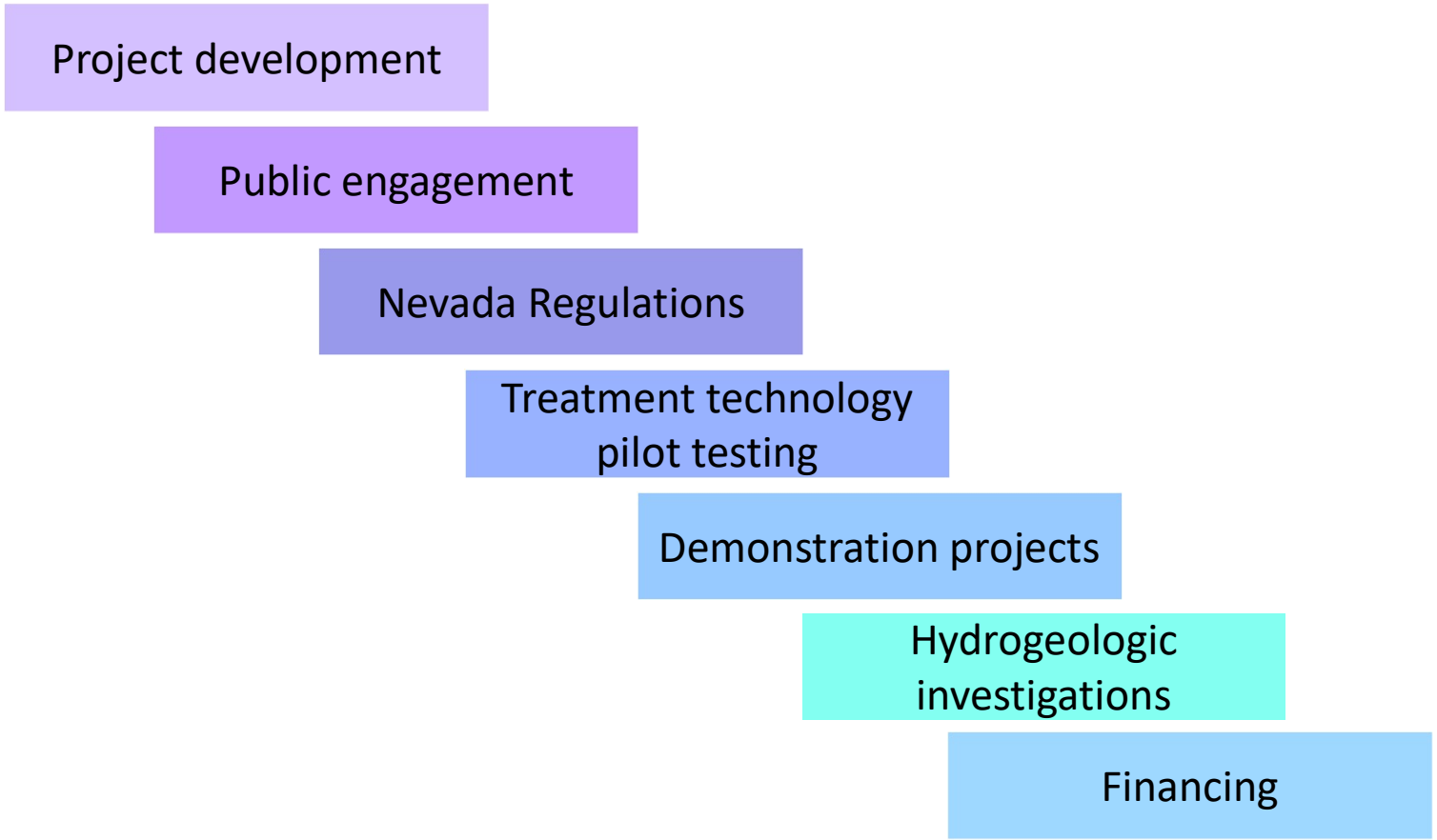
Innovations in organizational culture

Hampton Roads Sanitation District

swift Sustainable Water Initiative for Tomorrow

- 100 million gallons per day for groundwater recharge
- Innovative research collaborations with universities
- Research and demonstration facility

OneWater Nevada feasibility study



Demonstrations and Investigations

- **Treatment Technology Demonstration Projects**
  - 2017 - 2019 at South Truckee Meadows Water Reclamation Facility
  - 2019 - 2020 at Reno-Stead Water Reclamation Facility
  - 2019 - 2020 at Cold Springs Water Reclamation Facility

- **Groundwater Aquifer Investigations**
  - 2018 - 2019 at American Flat Road
  - 2018 - 2020 at Bedell Flat

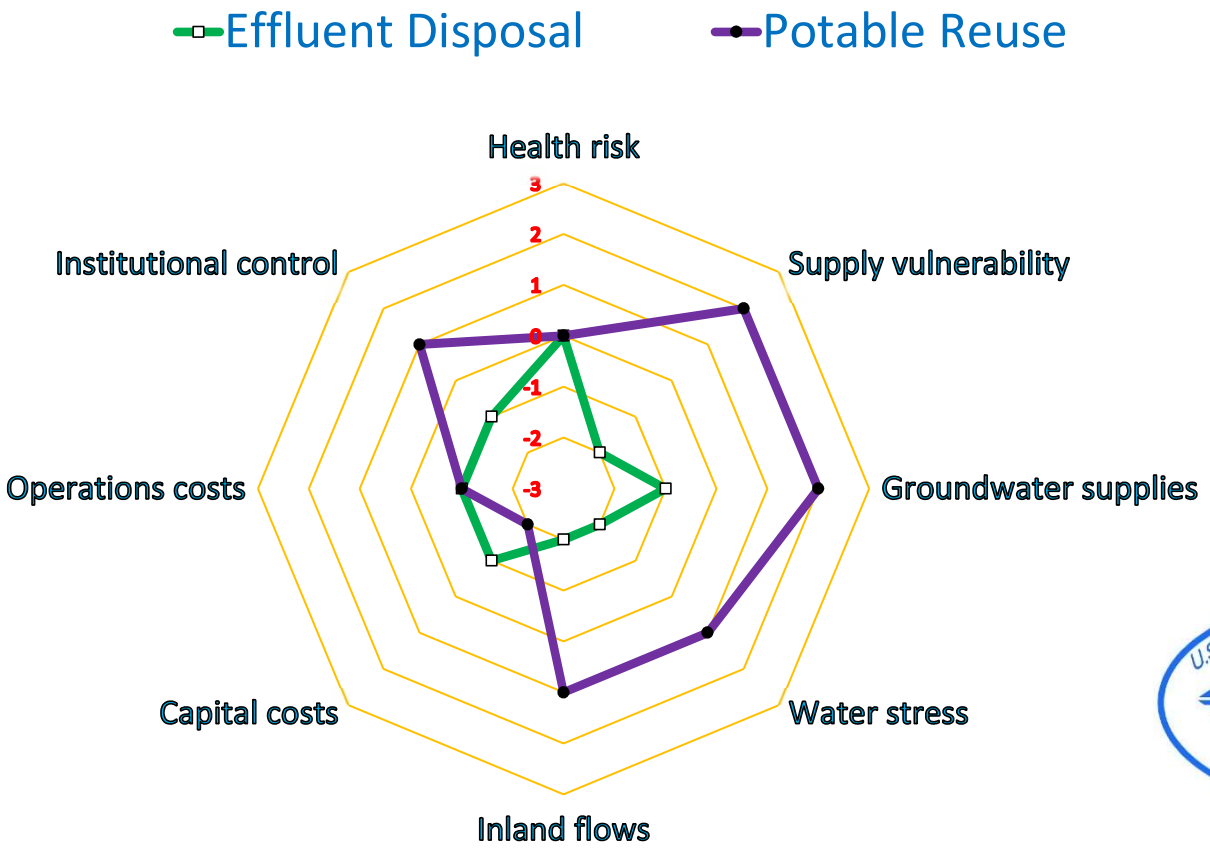
Bedell Flat, Washoe County Nevada

Preliminary results

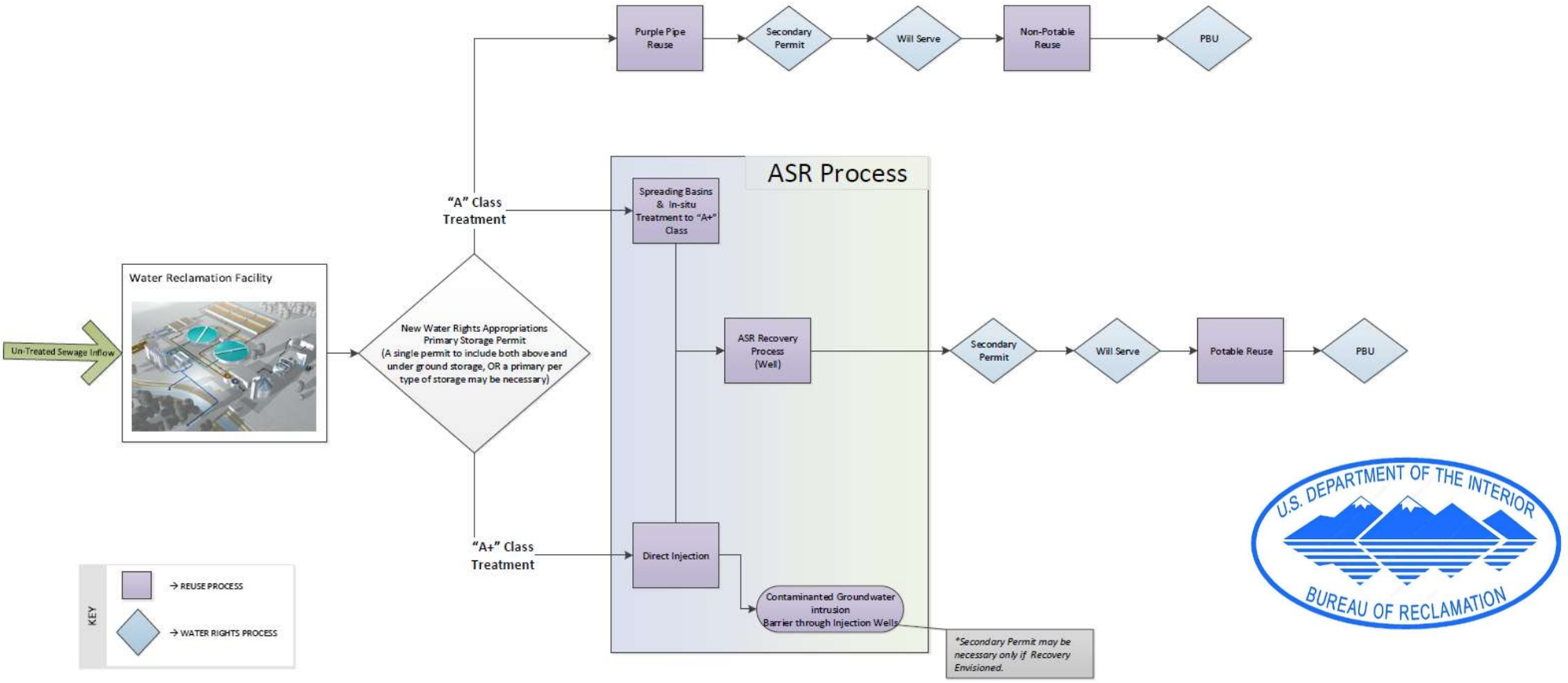
2 years of testing have provided favorable results

- Project rationale
- Water rights
- Treatment processes
  - Filtration
  - Ozone biological activated carbon filtration
- Hydrogeologic evaluations
- Early public engagement

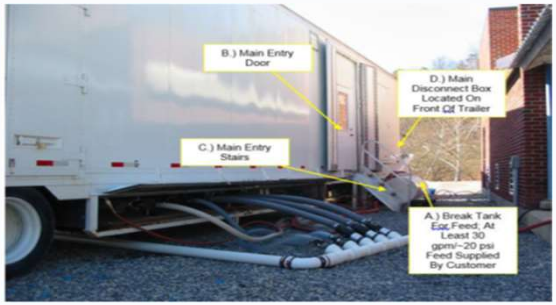
Project rationale



State of Nevada water rights evaluation



OneWater Nevada initial treatment technologies



Conventional Filtration

Ozone Biological Filter

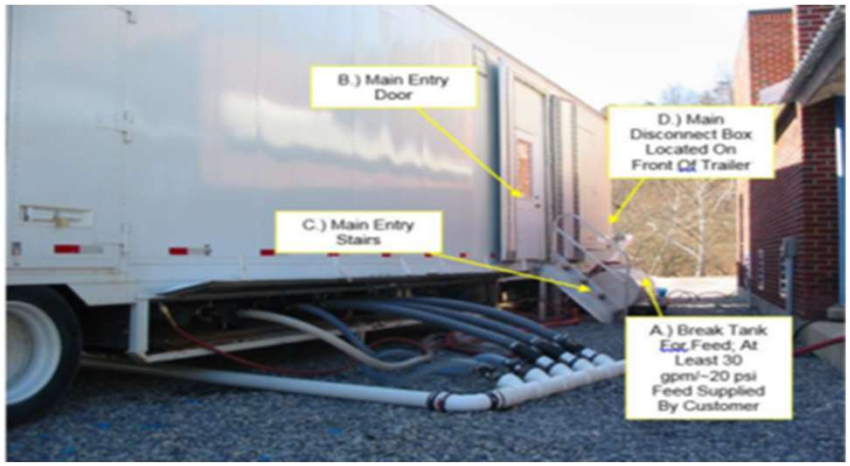
GAC and UV

Pathogen log reduction targets

Injection Well Train 3 (Ozone-BAC AWT)			
Process	**Virus**	**Giardia**	**Crypto**
Secondary Treatment	2	2	1
Coagulation/Flocculation/Clarification/ Granular Media Filtration (see Note 1)		3	3
Ozonation (see Note 2)	5	TBD	TBD
Biological Activated Carbon Filtration (BAC)	TBD	TBD	TBD
GAC			
UV Disinfection (see Note 3)	6	6	6
Injection - Saturated Zone Travel Time	6	NCG	NCG
Total Log Reduction	**19+**	**11+**	**10+**
Required Log Reduction	**12**	**10**	**10**

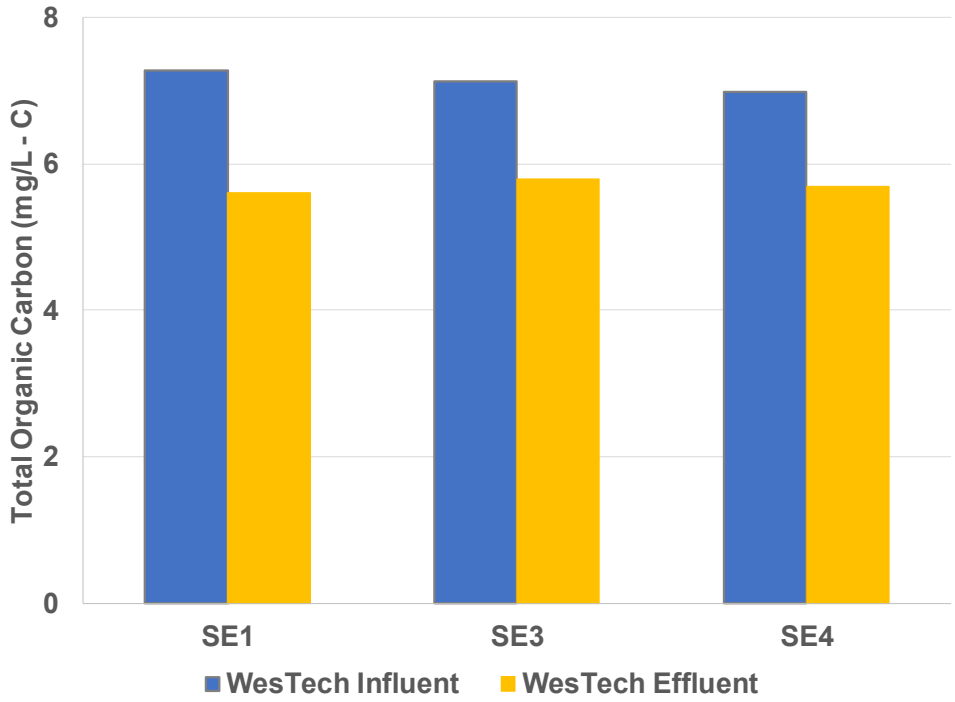
Note 1: GMF will be operated continuously with coagulation/flocculation/clarification pretreatment.
Note 2: Peroxide will be added upstream of ozone if bromate mitigation is required.
Note 3: UV system will be operated either in disinfection mode without peroxide addition or advanced oxidation process (AOP) mode with peroxide addition.

Filtration performance demonstration



WESTECH®

Chemical enhanced filtration – TOC removal

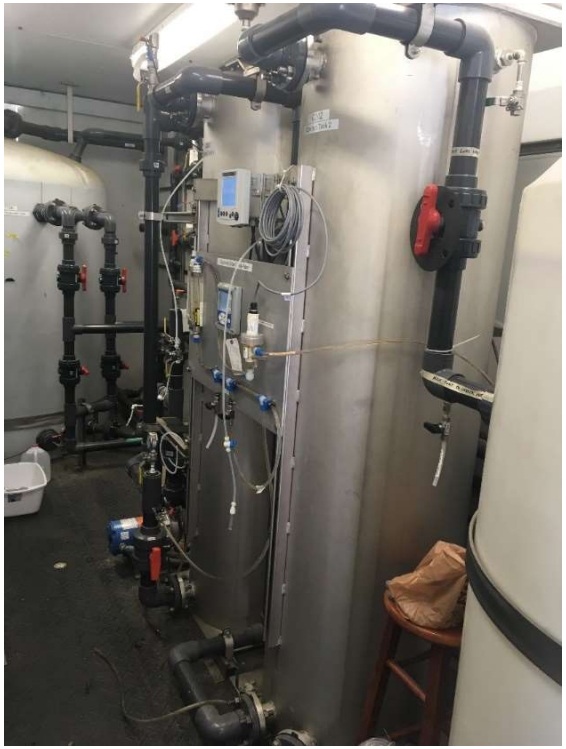


Coagulant and Polymer doses applied			
SAMPLING EVENT	PAX-XL8 (mg/L)	EC-461 (mg/L)	VK201 (mg/L)
SE1	36.3	10.0	0.46
SE2	44.6	10.6	0.56
SE3	34.5	10.5	0.55
SE4	40.0	10.5	0.55

~ 20.0% Average TOC Removal

Ozone-BAC performance demonstration

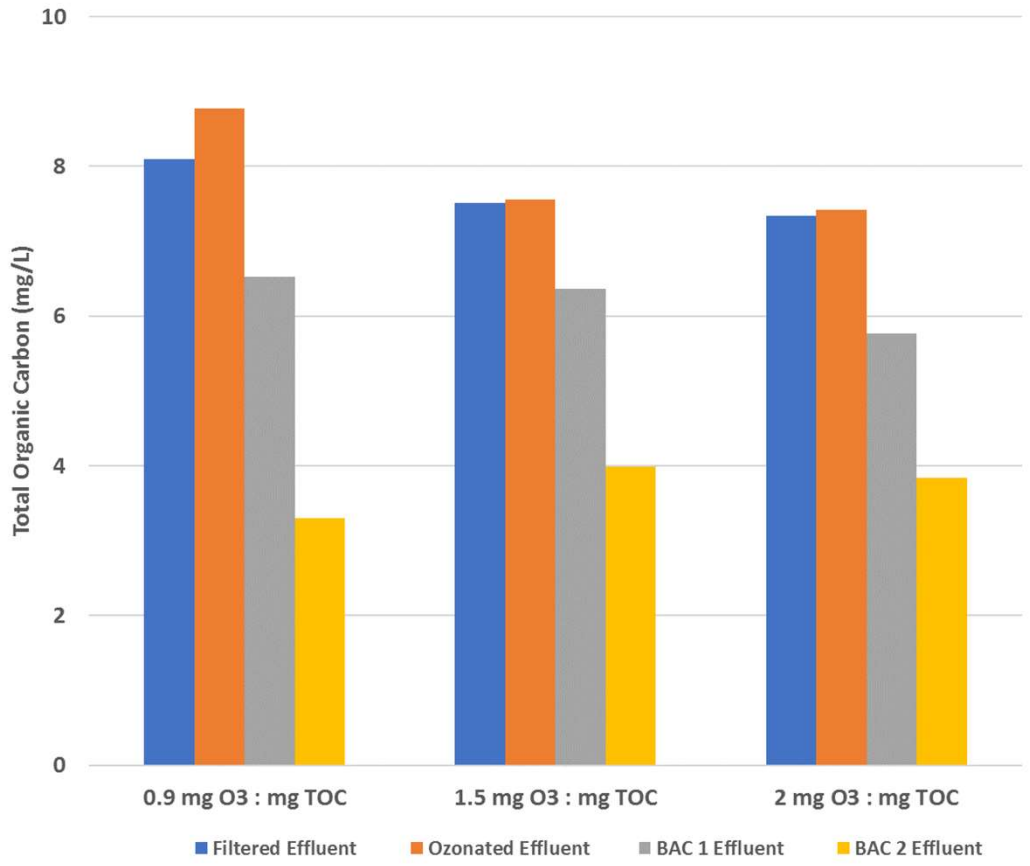
xylem
Let's Solve Water



STMWRF Demonstration Project

- **Water Research Foundation Project 15-10 (2017)**
  - Ozone – Biological Activated Carbon Filtration Evaluations
  - American Water / Stantec / Washoe County
- **OneWater Nevada Project (2018/2019)**
  - Conventional filtration added in 2018
    - Turbidity, Arsenic, Organic Carbon, and Nitrogen control
  - University of Nevada, Reno Engagement
    - Basis of Design, Sampling and Testing

Ozone-BAC performance - TOC



GAC - UV performance demonstration

Jacobi CARBONS

suez

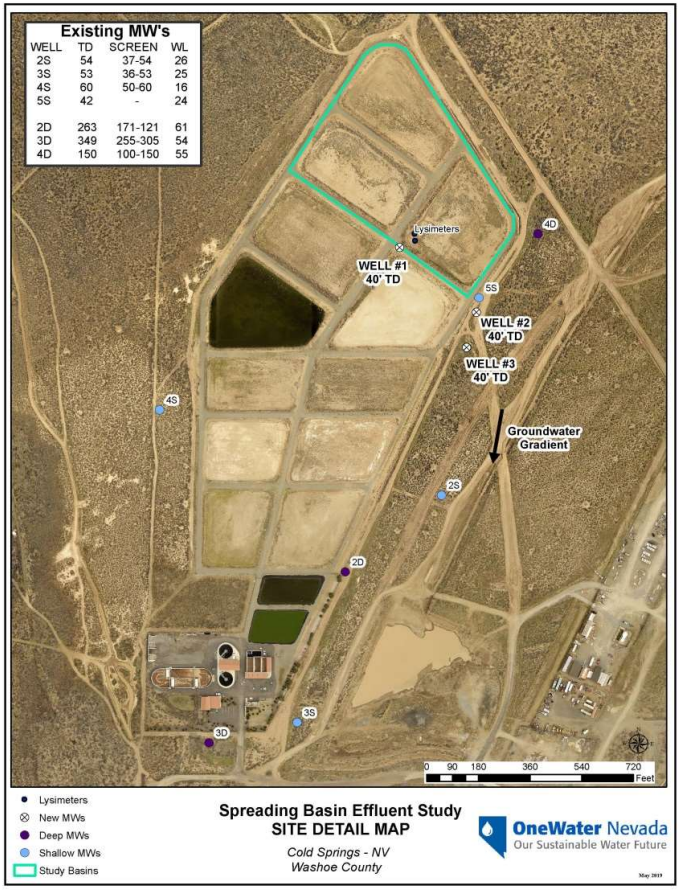
TROJAN UV™ WATER CONFIDENCE™

Hydrobasin evaluations

- 4 aquifers being considered for the long-term water storage
- A project demonstrating injecting A+ reclaimed water in an aquifer will begin in November 2019
- Validate pathogen LRV, travel times, TOC, CEC, aquifer water quality compatibility, etc.

Cold Springs soil aquifer treatment demonstration

- Spreading basin demonstration
- Add to current monitoring well network and add lysimeters
- Monitor secondary effluent SAT efficiency
- Develop operational strategies
- Determine treatment options
- Arizona provided inspiration



Monitoring network installation

- Conductor rig with bucket auger
- Drilled 3 monitoring wells to 12 meters
  - Screened throughout water table
- Uniform sandy soil with some clay
- Core samples taken every 0.3 m for soil columns

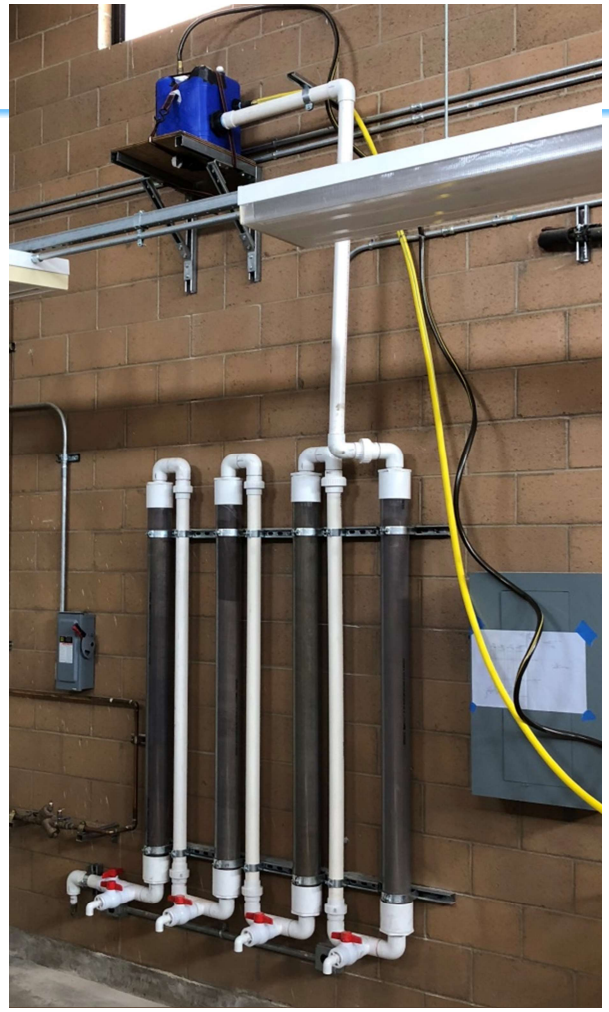
Lysimeter installation

- Monitor vadose zone SAT at varying depths
  - Porous stainless-steel sampling device
  - Installed in 1.5 meters depth intervals
  - Collects undiluted samples of recharge water prior to reaching water table/compliance point

University of Nevada, Reno

Soil columns

- Laboratory controlled system to mimic vadose zone
- Utilize native material that is relatively undisturbed
- Ability to perform matrix spikes
- Sample ports at varying depths



University of Nevada, Reno

American Flat Road Hydrological Study

- The feasibility study at the American Flat Road site is being conducted in phases:

Phase 1 is underway at 450 GPM of potable water limited to understanding the geology, hydrogeology, aquifer properties, and potential recharge storage volume

Phase 2 – Potential A+ implementation site

Reno-Stead demonstration

- **Goal:** *Demonstrate ability to comply with regulations, treatment requirements, and ability to monitor and control*
  - 3 wells in place

Phase 1 – Potable water injection to examine the aquifer hydraulic properties and water quality

Phase 2 - Category A+ reclaimed water injection to examine water quality of the aquifer during a demonstration for category A+ reclaimed water sourced from the RSWRF.

Technical indications

- Conventional water treatment approaches show promise to produce drinking water quality from wastewater secondary effluent
- Near-term focus will address pathogen log removal value validations and unregulated organic constituents
- Multiple pilot-scale treatment processes are challenging to integrate and operate
- Fast learning curve regarding operator and maintenance staff requirements
- Sampling and monitoring plans are much more challenging to produce and implement than anticipated
- Hydrogeologic evaluations offer significant implementation feasibility insights

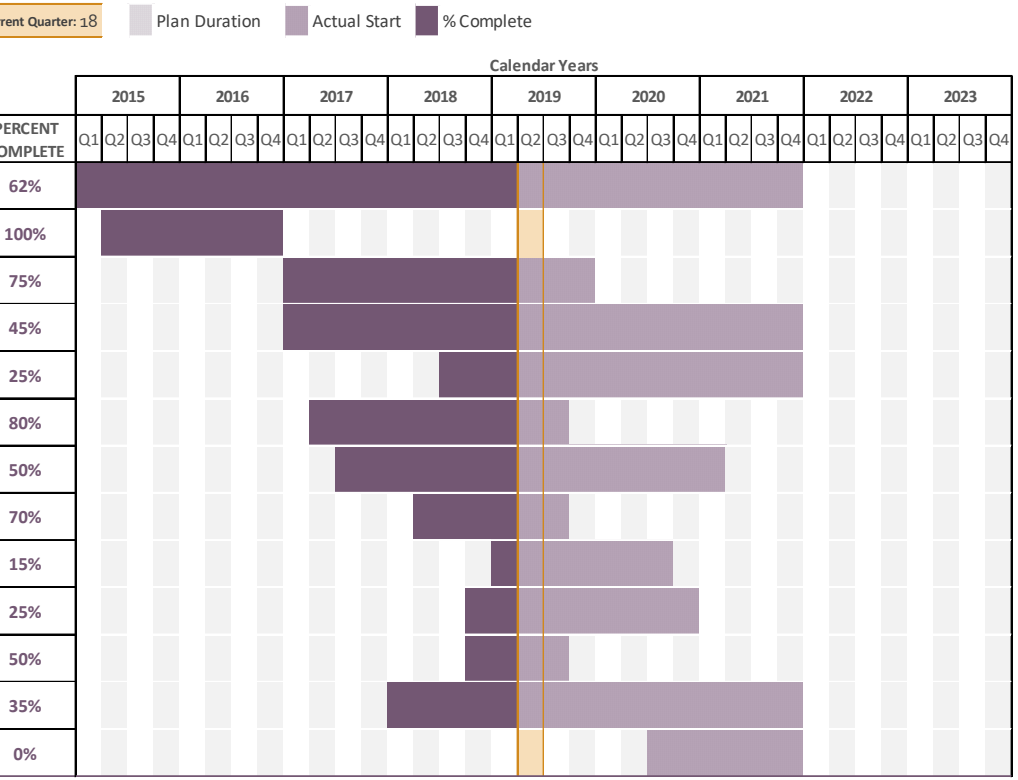
Near-term technical next steps

- Validate LRVs across AWT treatment units
- Validate LRV from water reclamation unit processes
- Validate vadose zone water quality improvements
- Is MF or UF needed?
- UV dosage requirements
  - Feed water quality
- Sampling and monitoring plans
- Operator and maintenance staffing

Overall Schedule

OneWater Nevada

Regional Reclaimed Water Feasibility Study



	ACTIVITY	PERCENT COMPLETE
1	Program Development	62%
2	Category A+ Regulatory Development	100%
3	Social, Environmental, and Economic Evaluations	75%
4	Policy Maker Engagement	45%
5	Public Engagement	25%
6	Pilot Testing and Research Foundation Studies	80%
7	Treatment Technology Evaluation - UNR	50%
8	Demonstration Project - STMWRF	70%
9	Demonstration Project - RSWRF	15%
10	Demonstration Project - Cold Springs	25%
11	Hydrogeologic Evaluation- American Flat Road	50%
12	Hydrogeologic Evaluation - Bedell Flat	35%
13	Feasibility Study Final Report	0%

Implementation challenges

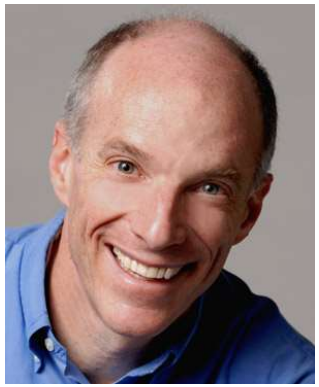
Potable reuse is still a complex social topic

P2T

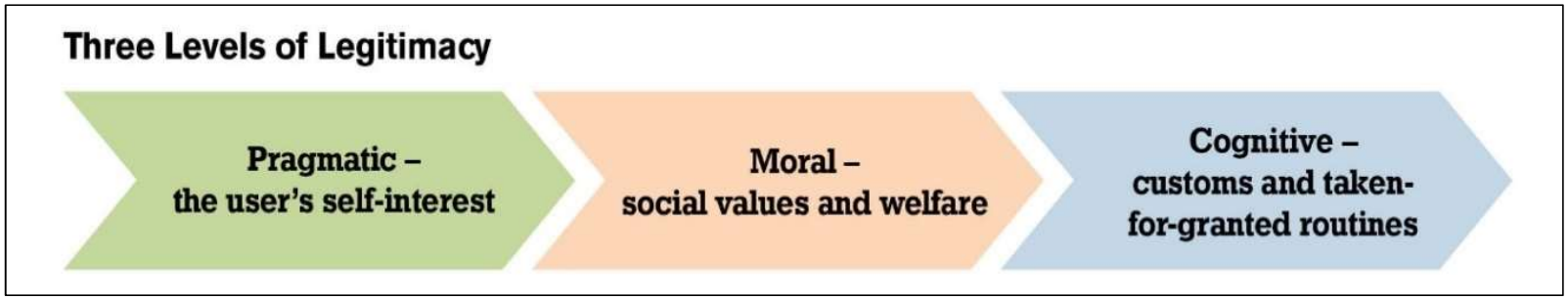
Innovations through legitimacy

A legitimacy framework for water reuse in California

Christian Hines and David Sedlack



- Examined successful and failed water recycling projects
- Establishing a “legitimate agency” to gain public trust is vital
- Creating a partnership with the community is essential



Social aspects for the success of the program

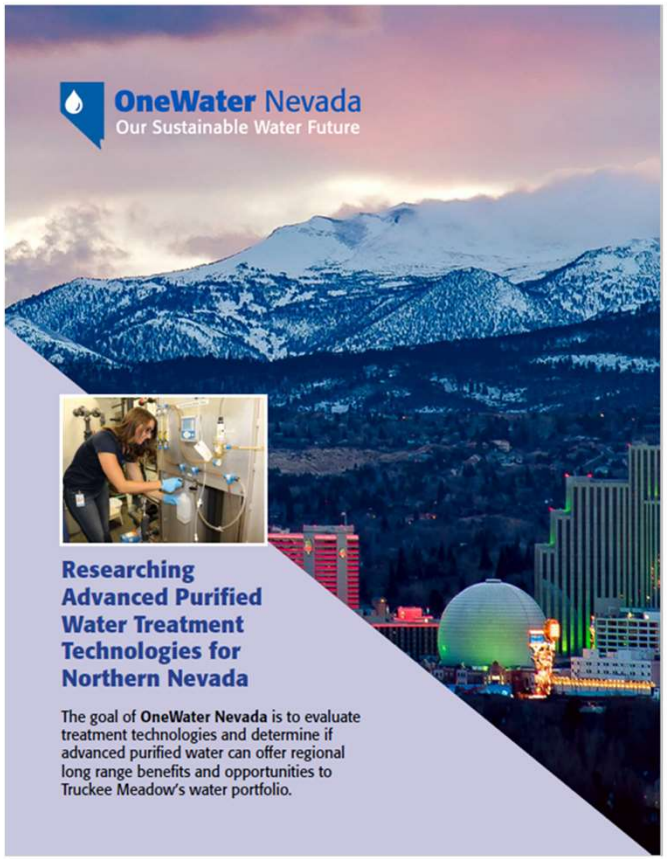
Model communication plans to increase awareness and promote acceptance of reuse of drinking water

Mark Millan

- Develop public trust
- Focus on water quality
- Be honest and ethical
- The leadership must be credible

WATEREUSE

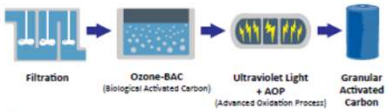
Social aspects for the success of the program



Field Scale Demonstration Trailers Will be Used to Inform the Public

The University of Nevada, Reno will lead the treatment technology evaluations and water quality testing and compliance programs. Each demonstration project is envisioned to operate 9-12 months. Multiple trailers will be equipped with advanced water purification technology as illustrated below.

After the advanced treatment process, the purified water will be introduced to local groundwater at a small scale for an extended period of time. This allows the environment to naturally filter the purified water, adding yet another treatment step.



Filtration: Solids are filtered out in this initial step toward purification.
Ozone-BAC: Ozonation with biological treatment removes organic matter and chemicals.
Ultraviolet Light+AOP: Ultraviolet light plus the Advanced Oxidation Process inactivates any remaining viruses and breaks down trace organic compounds.
Granular Activated Carbon: Acts as a final polishing step.

How the Project Benefits the Area

Advanced purified water is a local, reliable, drought-proof water source which provides vital benefits:

Safe, reliable water supply
Advanced purified water uses proven technology that cleans water to a level that tests cleaner than most bottled water.

Sustainable water supply option
Advanced purified water could help diversify the region's water portfolio by adding an option that is both sustainable and energy-efficient.

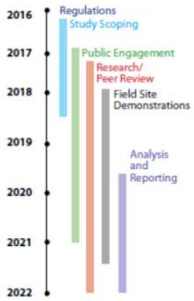
Environmental benefits
Advanced purified water could reduce reliance on the Truckee River, leaving more water in the river for aquatic life and recreation.

Drought-proof water supply
Having a safe, sustainable water supply ensures water is available even during periods of drought.

Independent of weather variability
Advanced purified water may enhance the region's water supply resiliency to help address future uncertainties of climate change, such as longer growing seasons, snowpack changes and runoff timing.

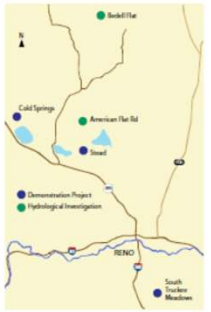
Project Timeline

The project schedule will be updated as the project evolves.



Potential Project Sites

The sites shown here are demonstration project and hydrogeologic investigation areas.

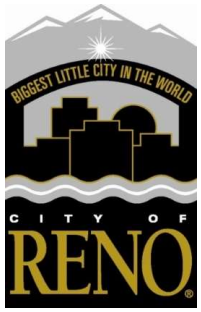


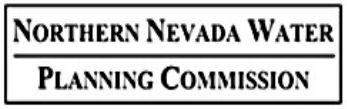
Social aspects for the success of the program

Water Reuse Independent Expert Panel

Social aspects for the success of the program

Social aspects for the success of the program





Nevada Water Innovation Institute

University of Nevada, Reno

Innovative partnership creating water management solutions

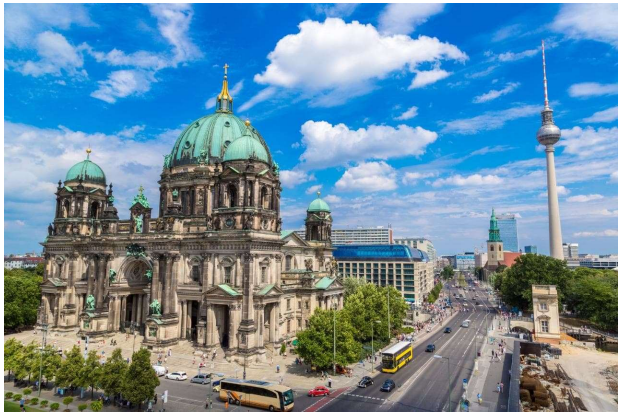
OneWater Nevada
Our Sustainable Water Future

Contact Information

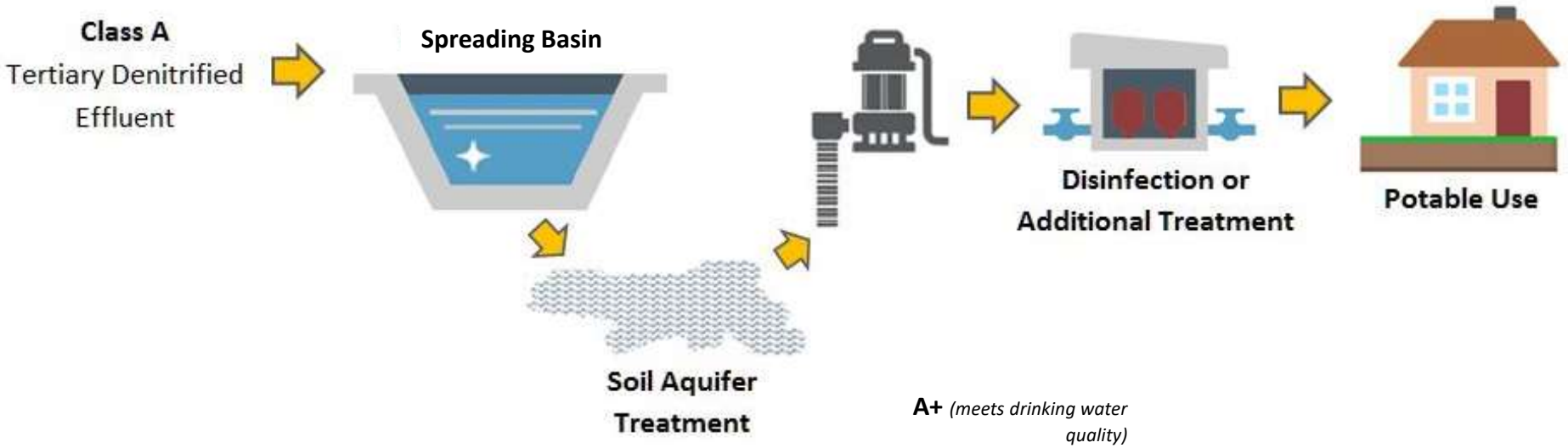
Rick Warner
Program Manager
(775) 843-7939
rick@warnerh2o.com

University of Nevada, Reno · City of Reno · Washoe County, Nevada 1861 · Truckee Meadows Water Authority — Quality. Delivered. · Western Regional Water Commission · Northern Nevada Water Planning Commission · Truckee Meadows Water Reclamation Facility · City of Sparks

Rationale for water recycling

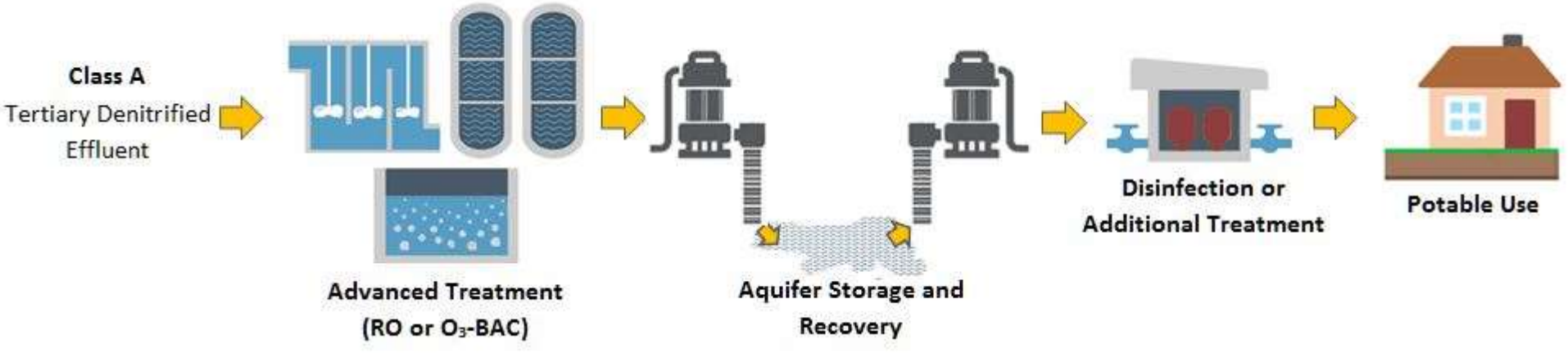


Achieving A+ quality with spreading basins



A+ *(meets drinking water quality)*

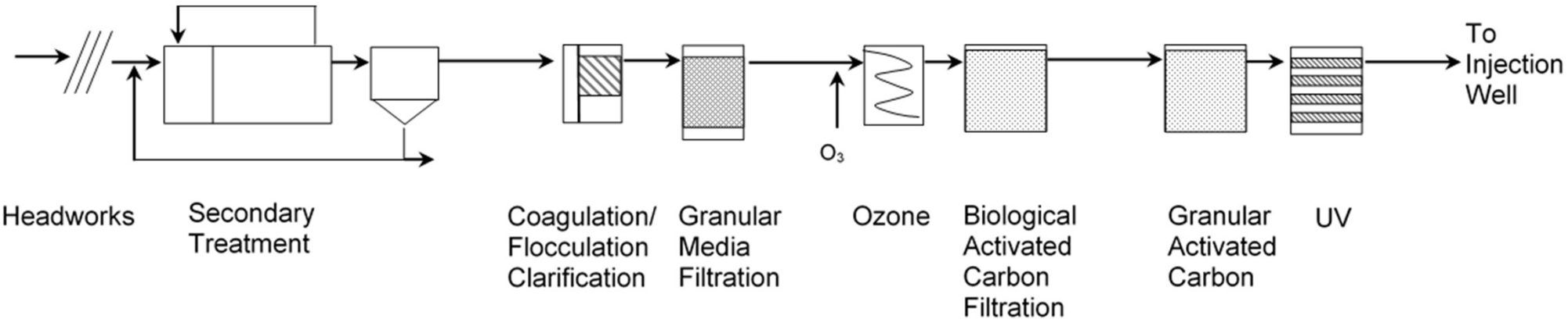
Achieving A+ quality with direct well injection



A+ *(meets drinking water quality)*

Treatment Technology Evaluations

- **Proposed treatment processes for direct injection well**



Chemically enhanced filtration – pathogens

SAMPLING EVENT	*Giardia spp.*		*Cryptosporidium spp.*	
	INFLUENT	EFFLUENT	INFFLUENT	EFFLUENT
SE 1	43	0	0	0
SE 2	23	0	0	0
SE 3	7	0	1	0
SE 4	19	0	0	0

- ✓CFCGMF treatment technology in full compliance with the SWTR and LT2ESWTR can achieve 3.0-log removals values for both protozoa pathogens: *Cryptosporidium* and *Giardia.*
- ✓The CFCGMF treatment technology is able of reaching 0.15 NTU effluent turbidity values most of the time (>95%), if the system is operated continuously.
- ✓Therefore, additional 1.0-log removal and 0.5-log removal for *Cryptosporidium* and *Giardia* credits can be obtained.

Chemically enhanced filtration – pathogens LRV

Regulation	*Cryptosporidium*	*Giardia*	Virus	Turbidity	
				Combined filter effluents	Conventional Treatment/ Direct Filtration
SWTR	-	3-log	4-log	<5.0 NTU	<0.5 NTU
IESWTR (1998), LT1ESWTR (2002)	2-log	3-log	4-log	<1.0 NTU	<0.3 NTU
LT2ESWTR	2.5-log- 3-log (1)	3-log	4-log		

(1) Cryptosporidium treatment credit towards LT2ESWTR requirements applies in full compliance with the SWTR, IESWTR, and LT1ESWTR. EPA assigns 2.5-log inactivation to direct filtration plants which lack of sedimentation processes, while 3.0-log removal to conventional, slow sand, and diatomaceous earth filtration.

Treatment Performance Toolbox Component	
Combined filter performance	0.5-log credit for combined filter effluent turbidity less than or equal to 0.15 NTU in at least 95 percent of measurements each month. See 40 CFR 141.718 (a) and Chapter 7 of this manual for specific criteria.
Individual filter performance	0.5-log credit (in addition to 0.5-log combined filter performance credit) if individual filter effluent turbidity is less than or equal to 0.15 NTU in at least 95 percent of samples each month in each filter and is never greater than 0.3 NTU in two consecutive measurements in any filter. See 141.718 (b) and Chapter 7 of this manual for specific criteria.

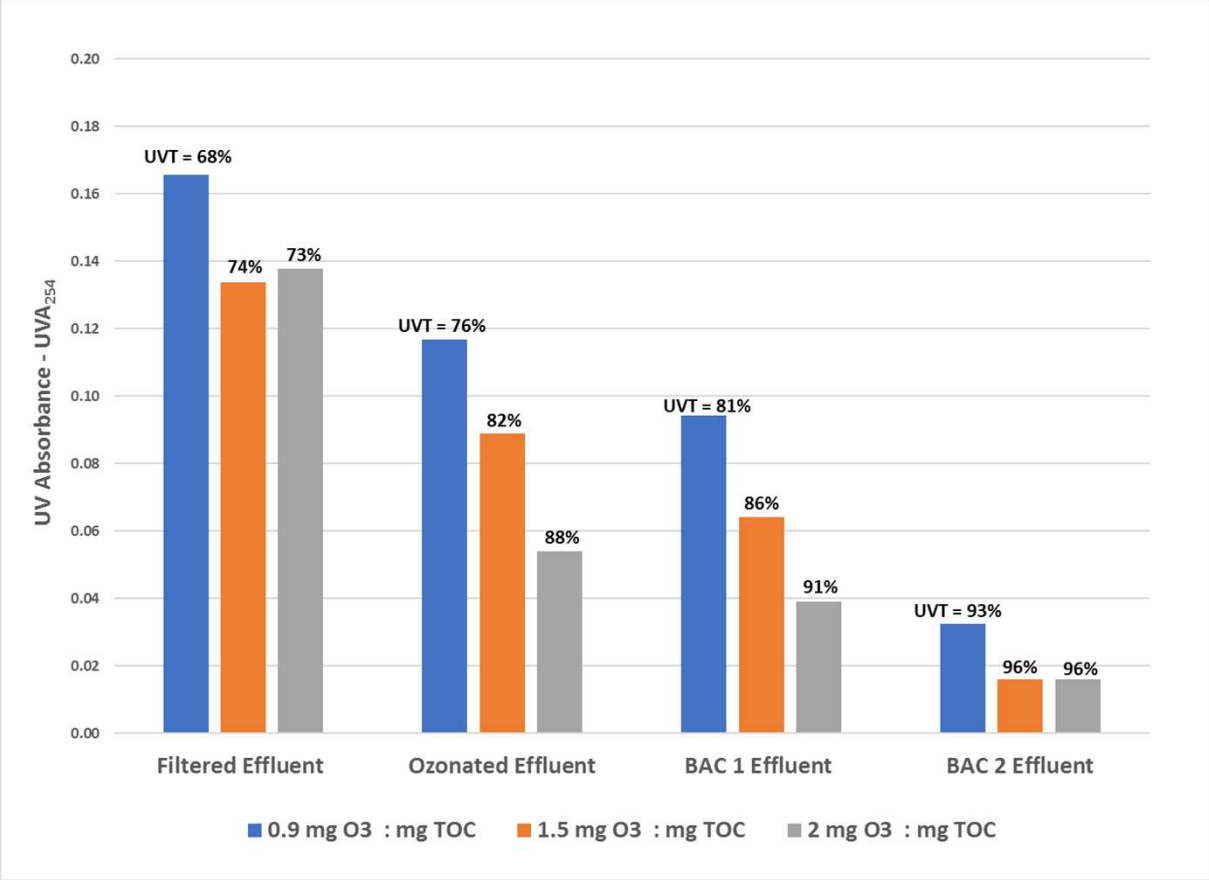
Chemically enhanced filtration – CECs removal

CECs	Average Concentration or MRL		Percent Reduction of CECs (%)
	Influent	Effluent	
Perfluorooctanesulfonic acid (PFOS)	< 1.85 ng/L	ND	ND
Ethinyl Estradiol	< 5 ng/L	ND	ND
17- β - Estradiol	< 5 ng/L	ND	ND
Estrone	187.75	163.75	13%
Triclosan	63.5	54.25	15%
Carbamazepine	160	157.50	2%
Caffeine	167	139	17%
Tris (2-Chloroethyl) phosphate (TCEP)	109	109.50	-0.5%
Cotinine	50.25	44.75	11%
Meprobamate	48.75	52.00	-7%
Atenolol	145	142.25	2%
Sucralose	57000	53000	7%
Primidone	250	245.00	2%
DEET	388.25	345.25	11%
Perfluorooctanoic acid (PFOA)	0.0182	0.0285	-57%

Ozone-BAC performance - CECs

CECs	Average Influent Concentration or MRL	Percent Reduction of CECs (%)			
		Filter Effluent	Ozone Effluent	BAC 1 Effluent (10 min)	BAC 2 Effluent (20 min)
Perfluorooctane sulfonate (PFOS)	<1.85 ng/L				
Ethinyl estradiol	<5 ng/L				
17-β-estradiol	<5 ng/L				
Estrone	41 ng/L				
Triclosan	47 ng/L				
Carbamazepine	123 ng/L				
Caffeine	15 ng/L				
Tris (2-Chloroethyl) phosphate (TCEP)	102 ng/L		8	11 -28	
Cotinine	31 ng/L		16 - 43	47 – 49	
Meprobamate	48 ng/L		22 - 65	30 – 32	
Atenolol	112 ng/L		44 – 100	86 – 92	
Sucralose	54000 ng/L		20 - 43	25 - 43	96 - 97
Primidone	220 ng/L		38 - 80	46 - 64	96 - 100
N,N-diethyl-meta-toluamide (DEET)	150 ng/L		29 - 73	9 – 58	95 - 100
Perfluorooctanoic acid (PFOA)	29 ng/L		0	19 - 25	84 - 93

Ozone-BAC performance – UV absorbance/UVT



Ozone-BAC byproduct formation - NDMA