

The State of the States on Water Reuse

- Presentation to 2024 SW Onsite Wastewater Conference
- By
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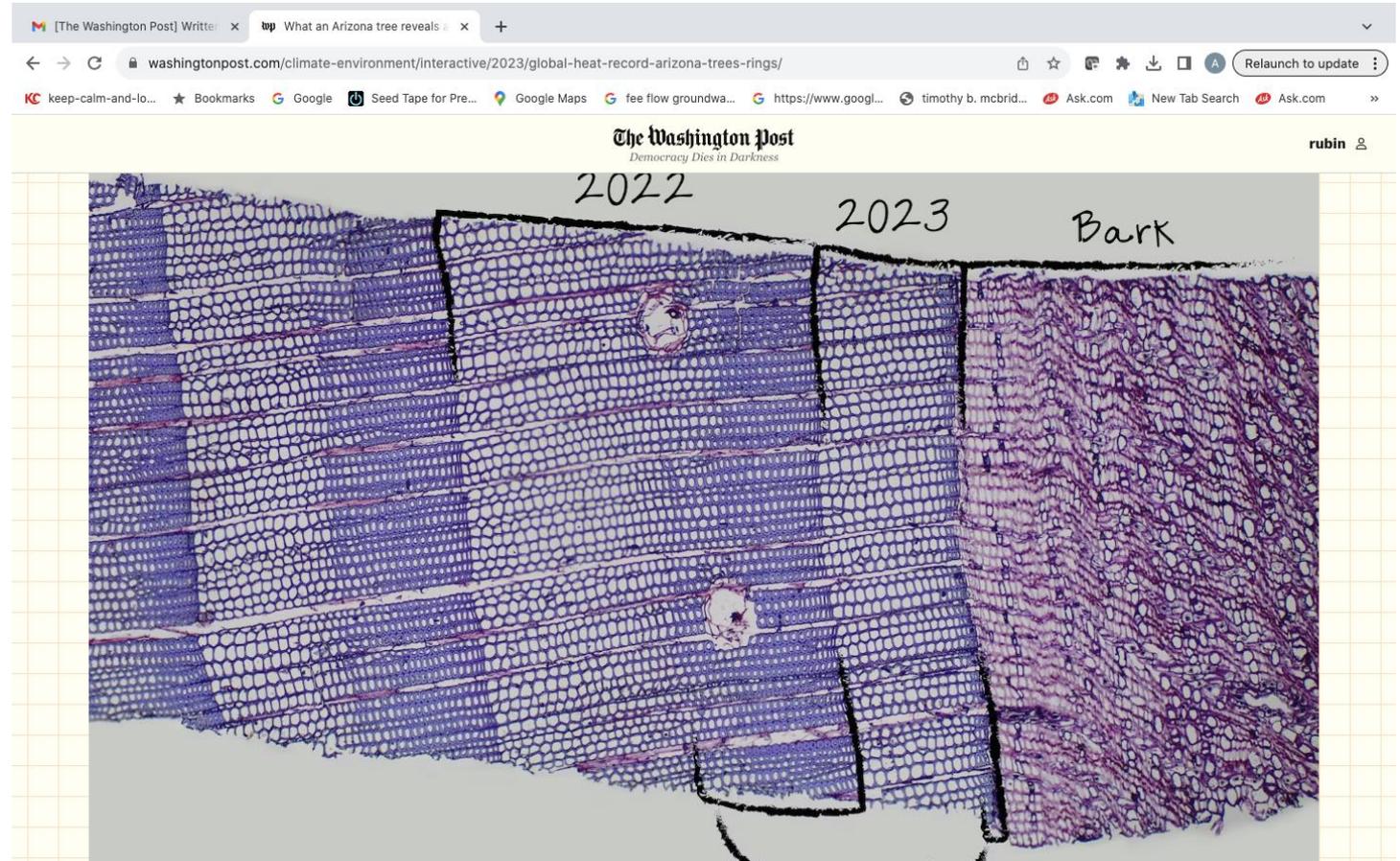
Agenda

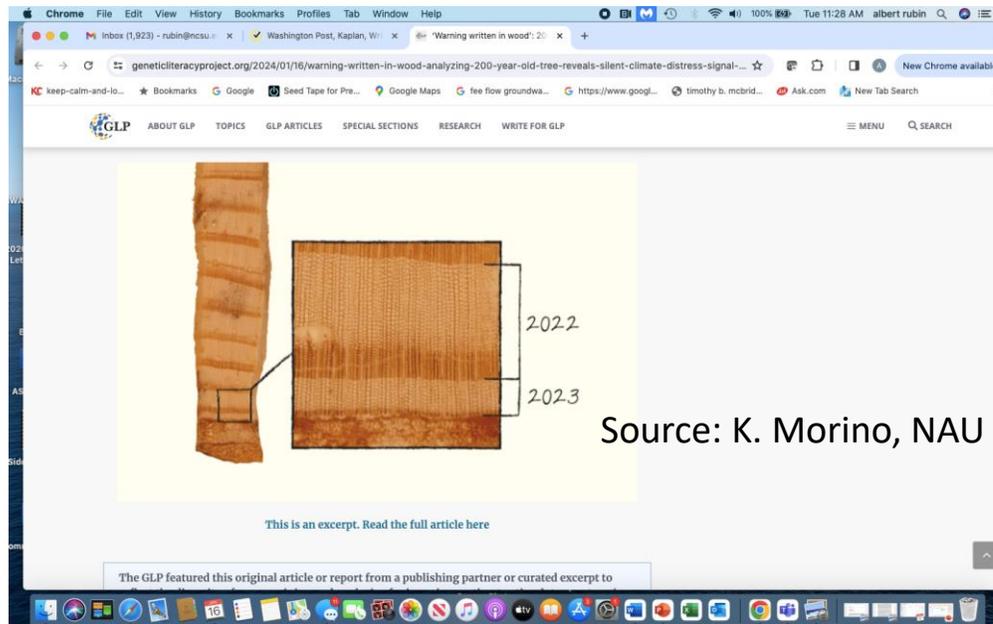
- What challenges drive centralized and decentralized water reuse efforts (demands vs sources)
- How have guidelines and rules changed over time
- What can we expect in the future

Some Challenges

- Any Idea what this shows?
- Washington Post, Kaplan, et al.
- 20 Dec 2023, Written in the Wood

- Data from K. Morino, NAU, Bigelow224





Source: K. Morino, NAU

Tree Ring data excellent indicator of weather conditions in an area

Cell count in ring for 2023 is 9

Long term record shows extreme drought in 2023

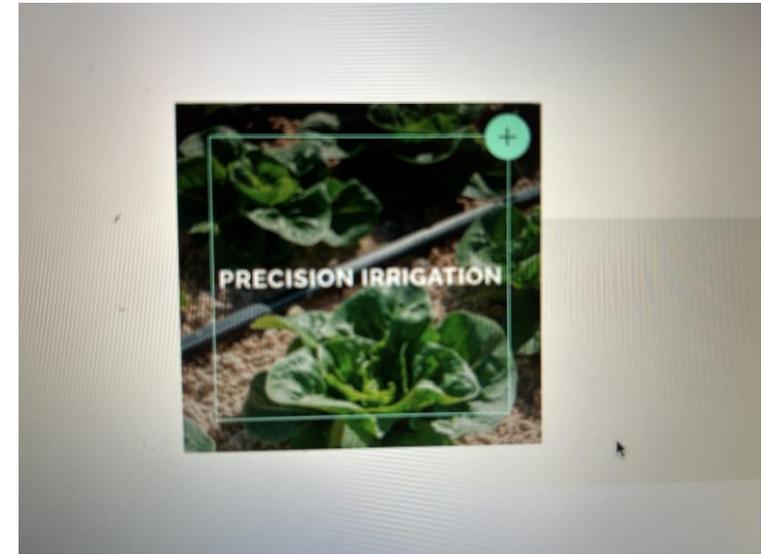
Population Changes in AZ

- Human populations consume and discharge water

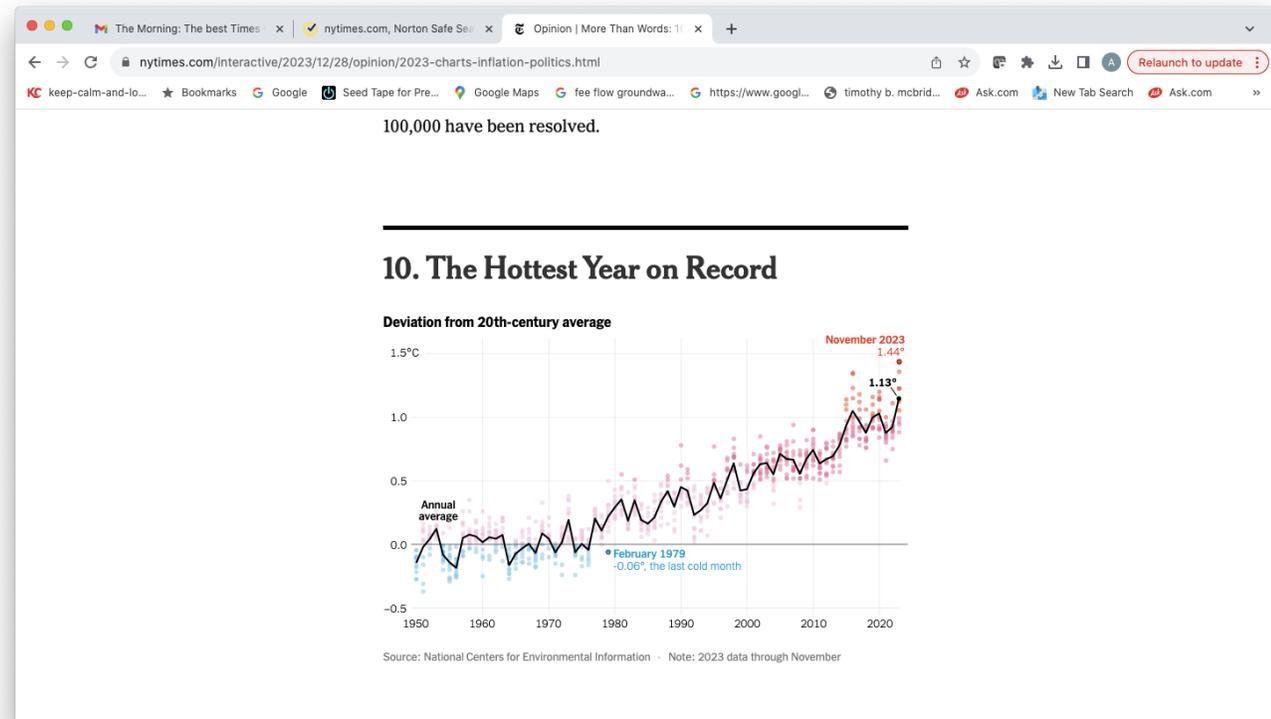


Agricultural use in Az

- Agriculture exports water
- Vegetable crops are over 90% water with a little flavor added
- Significant portion of U.S. fresh vegetable winter supply is AZ



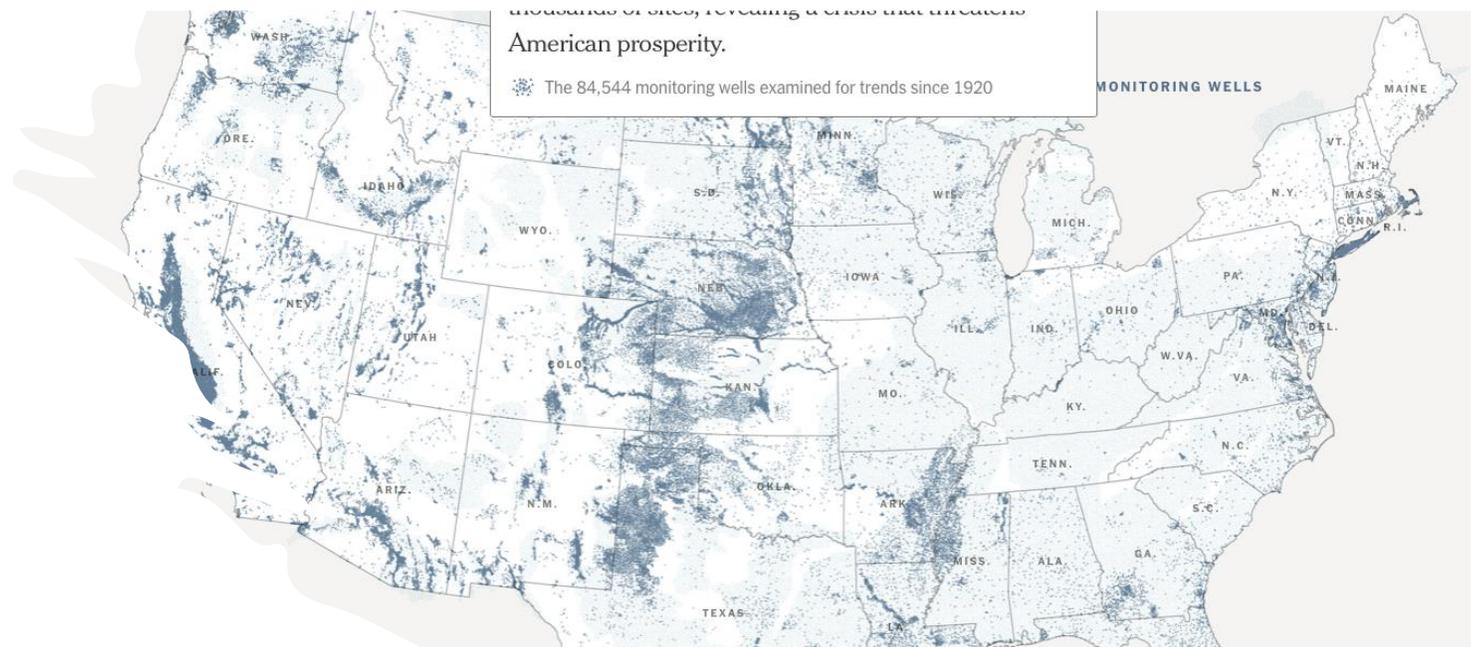
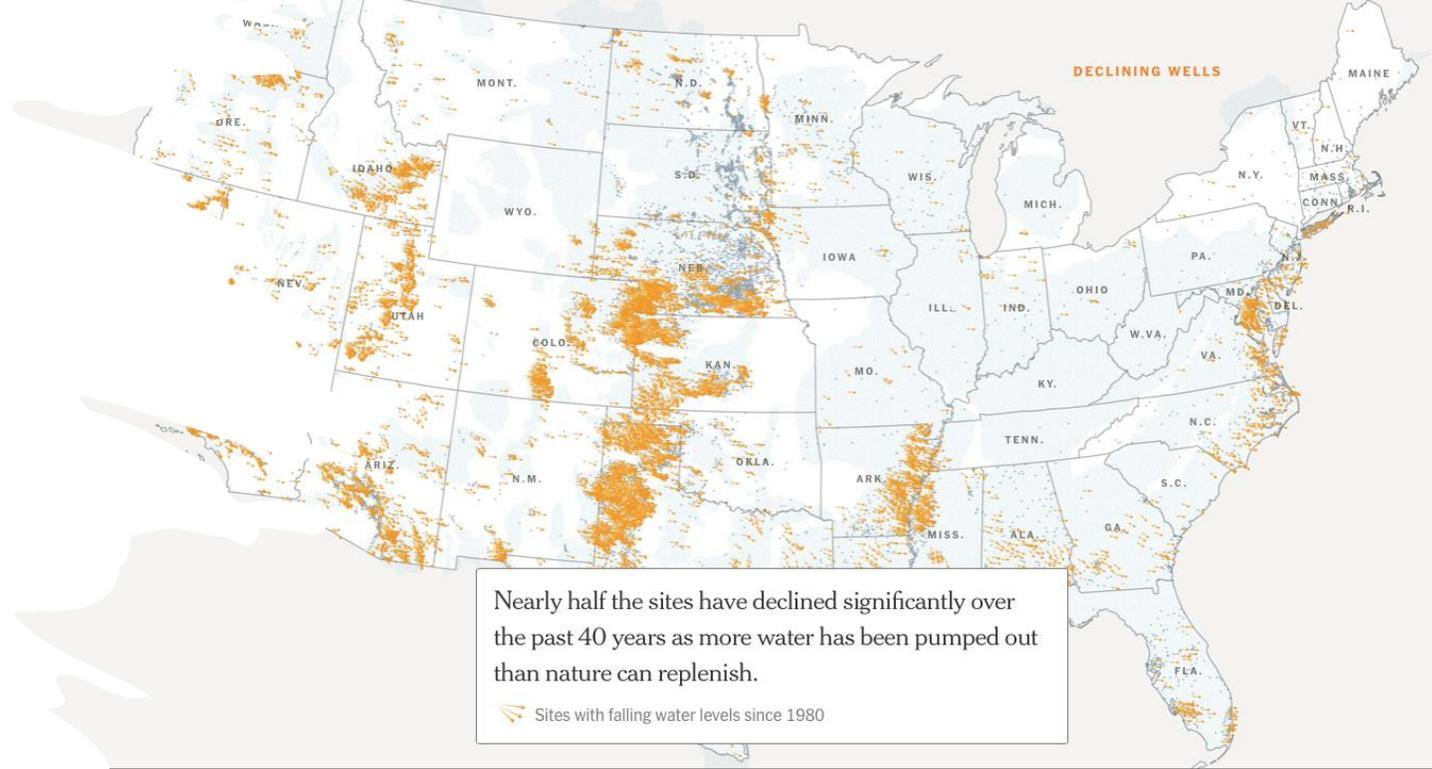
More Climate Challenges



- This one is pretty obvious, and it is immaterial whether it is anthropogenic or natural cycle!
- What are the implications of increased global temperatures

And These?

- Do you think we may be depleting groundwater reserves?
- How long will it take to recharge
- In Eastern NC, Ralph Heath suggested 1 inch recovery/year - with normal rainfall!



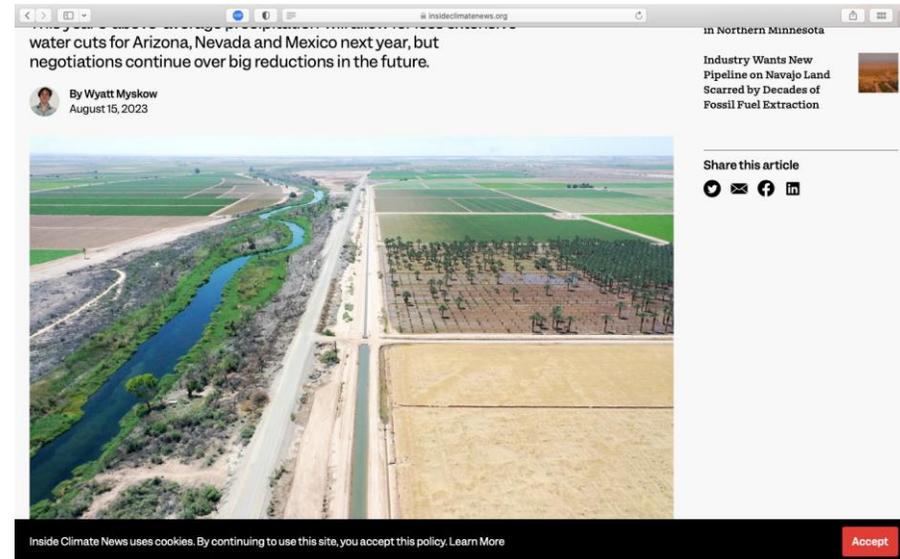
Western States Water Allocation Reductions

Colorado River

Ca - 13%

Az - 18%

Nv - 7%



Inside Climate News, August 2023

Drivers

Scarce supplies

Competition for resource

Costs

Equity

NC Senate Bill 1946

Paper purports to:

- Describe water quality and process requirements
- Describe ongoing reuse efforts

Water
Planning-
incorporate
all sources



Harvested rainwater



Stormwater



Treated wastewater

End Uses- supplanted source

- Indoor
 - Toilet flush
 - Heating/cooling
 - Fire protection
- Outdoor
 - Irrigation
 - Dust control
 - Ecosystem enhancement
 - Aesthetic ponds



Water is water

- Using this as a mandate:
 - Water should be treated to standard protective of public health and the environment and fit for the intended purpose
 - Regardless of source, waters will require treatment (and management)

Intended Use of reclaimed water drives issue

Risk Based Management

Assessing Quality

- Performance – industry standard until recently
- LRT and performance monitoring – emerging approach

Treatment Requirements

- Constituents of concern (BOD, TSS, Turbidity, NH₄, organisms)
- Treatment and Disinfection
 - Microbiological
 - Organic
 - Nutrients and salts

- Effluent monitoring for BOD, TSS, and Coliform levels
- Virus monitoring emerged as coliphage detection improved
- Typical BOD and TSS levels ranged between 10 and 30 mg/l
- Typical coliform levels between 14 and 10⁴-recreational bathing water standard

- Initial Reuse publication
- Follow-on publications in
- Recent efforts promote LRT process and QMRA (later)
- USEPA actively encouraging water reuse through Water Reuse Action Plan (WRAP)
 - www.epa.gov/waterreuse
 - WRAP actions seek to advance the consideration of reuse to improve the security, sustainability, and resilience of our nation's water resources
- BUT still no national standards

NC Reclaimed Water Standards for Indoor Use and Outdoor Use (15 A NCAC 02U) and 15 A NCAC 18e for onsite applications

- These represent the second iteration of reuse standards in NC

Use	BOD	TSS	NH4	Turbidity	E. Coli	LRT Bact	LRT Pro	LRT V
Indoor	5	5	4	2	2.2	5	4	6
Outdoor	10	5	10	10	14	NR	NR	NR

Colorado Standards for Distributed Reclaimed Water (5 CCR 1002 – 84.9)

Category	Turbidity	Coliform	Max & % Detect
1	30 TSS	126	235
2	3	126	235
3	3	ND in 75% of samples	126/mo

- Secondary treatment with filtration and disinfection
- Single building (but not SFH) or district project with approval from local govt.
- Category 1
- Category 2
- Category 3 - Indoor

Water Reuse in Texas (Title 30, Chapter 210.33)

Parameter	Standard
TSS	5
BOD	5
Turbidity	3
Fecal Coliform	20
Enterococci	4

- Type 1
- Unrestricted public access
- Indoor use for toilet flushing

Reuse in Virginia (9 VAC 25-740-70)

Parameter	Standard
BOD	10 mg/l
Turbidity	2 NTU
Coliform (E. coli)	14 counts/100 ml (11/100 ml)
Cl	1 mg/l

- Type 1 allowed for indoor use, but not in single family dwelling
- Type 1 allowed for unrestricted irrigation any setting

BOD 10, TSS 10

Total Coliform 100, E. coli 2.2

2 NTU

Pending standard to retain BOD/TSS/turbidity and mimic Blue Ribbon Commission values and regulatory authority will change to NYC Health and Mental Hygiene, 2024?

California Standards for Reclaimed Water
(Source: Staff Workshop Slides, 1 Aug 2022)

BW Source	Virus LRT	Giardia LRT	Crypto LRT
Indoor	8	6.5	5.5
Outdoor	7.5	5.5	5

- Required by 2022 legislation
- Standards proposed, not yet released
- 10E-4 risk (1 in 10,000)
- Process verification
- Continuous monitoring capability
- Monitor T. coli 2.2

- In general, high level of biological treatment required
- High level disinfection required
- LRT concept emerging into increasing number of state programs
- Process monitoring required
- Continuous process monitoring emerging as mechanism to validate LRT: Turbidity, UV intensity
- NSF 350, 2022, provides guidance now including LRT/LRC Process

What does LRC/LRT represent

- Log Reduction Target is a pathogen specific log reduction value associated with achieving a 1:10,000 risk reduction
- Log reduction credit is a value assigned to a treatment or disinfection process for lowering pathogen levels
- The log reduction for a specific system is assigned based on the sum of all credits for treatment and disinfection

NSF 350,
2022
proposes
the
following
technology
specific LRC
Values

	Virus	Protozoan	Bacteria
MBR	1	2.5	4
MicroFiltration	1	4	1
Media based system	1	1	2
UV*	Up to 6	Up to 6	Up to 6
Cl*	Up to 5		Up to 5
Septic tank			1

- * Level of removal Dose dependent, normative annex NSF 350

Log reduction levels based on source water and intended use in 350 Normative annex

Source and Use	Virus	Protozoan	Bacteria
BW/Irrigation	8	7	6
BW/indoor use (Flushing)	8.5	7	6
GW/Irrigation	5.5	4.5	3.5
GW/indoor	6	4.5	3.5

- Example: MBR Treatment unit intending unrestricted outdoor irrigation (GW) requires 5.5/4.5/3.5:
- Treatment Unit = 1 virus, 2.5 protozoan, 4 bacteria
- UV at high dose = 6 virus, 6 protozoan, 6 bacteria
- LRC: 7 virus, 8.5 protozoan, 10 bacteria, the credits adequate to support end use

- Environmental and Public Health Consequences
 - Discharge elimination
 - Reliable supply of high quality water-potable demand management
 - LEED
 - Important tool

- Resource Allocation Consequences
 - Extends water supplies
 - Reduces energy demands on potable system
 - Saves Dollars
 - Important tool

Planning for WATER REUSE

- Microorganism levels reduced to detection
- Advanced treatment and Multi-barrier disinfection processes where exposure high
 - Chemical (chlorine, ultraviolet light, PAA, O₃)
 - Barriers (microfiltration)

Planning for *WATER REUSE*

- Treatment and Disinfection
- Standards currently flexible pending data gathering
- Reliability
- Redundancy
- Monitoring
- Individual system management
- Overall program management

- Treatment system design and permitting
 - System must meet permit conditions
 - Are adequate back-up processes in design?
 - How are Upsets handled?
 - Critical component redundancy
 - Aeration?
 - Disinfection?
 - Equalization?
- Supply Adequacy
 - Demand determination
 - Peak demand-not average
 - Pumping capacity
 - Distribution capacity
 - Back-up

System O and M
Inspections
Frequency
Operator Training and certification
Asset management for
management entity
Residuals management
Reporting
Notification at property transfer



Operator training at onsite reuse in Orange County, NC

An on-site or district water reuse is infrastructure

- Infrastructure MUST be managed
- Trained, certified operators essential
- Management entity critical
 - Public
 - County health agency
 - Service district
 - Special use district
 - Private
 - Private utility
 - Bonded service provider

NCAC 18E (effective 1 January 2024)

Rule .1002

- Onsite reuse
- Indoor or outdoor
- EOP option primarily
- Type 1 and 2 effluent standards
 - 1-BOD 5, coliform 2.2, and LRT's
 - 2 – BOD 10, coliform 14

O and M Flow dependent

Health dept rev	Management	Frequency
2/yr	Certified	< 3K : 1/mo
	Operator and Public entity	3K-10K : 1/wk
	Or private	10K-25K : 2/wk
	Bonded	25K-50K : 3/wk
	entity	>50K : 5/wk

And a continuous process monitor required on all

Management requirements are state specific and are essential for success of reuse efforts

Operators of advanced systems generally require specialized training

No national training body such as ABC

Some conclusions

- Many incentives and drivers for reuse
- Technologies available to achieve currently required levels of treatment
- No uniform national standards, but some common elements
- Certified operators essential
- Sustainable management entity oversight is critical to success