RMC
Water and Environment

IPR Case Studies and Issues for DPR

WateReuse 2013
San Diego Chapter
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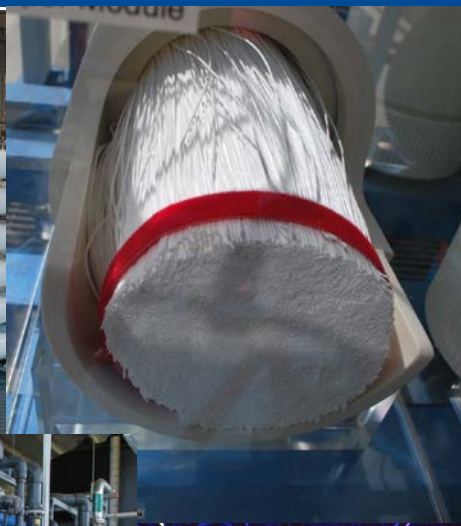
Innovative Solutions for
Water and the Environment

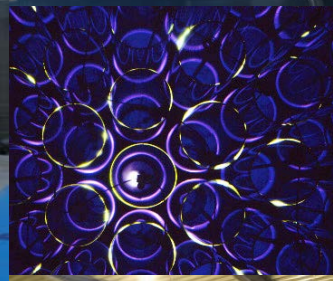
Agenda

- AWT, AWPF or FAT
- Public Perception Issues
- Case Studies
- Control of Pathogenic Microorganisms
- Surface Water Augmentation Challenges
- Pathway to DPR

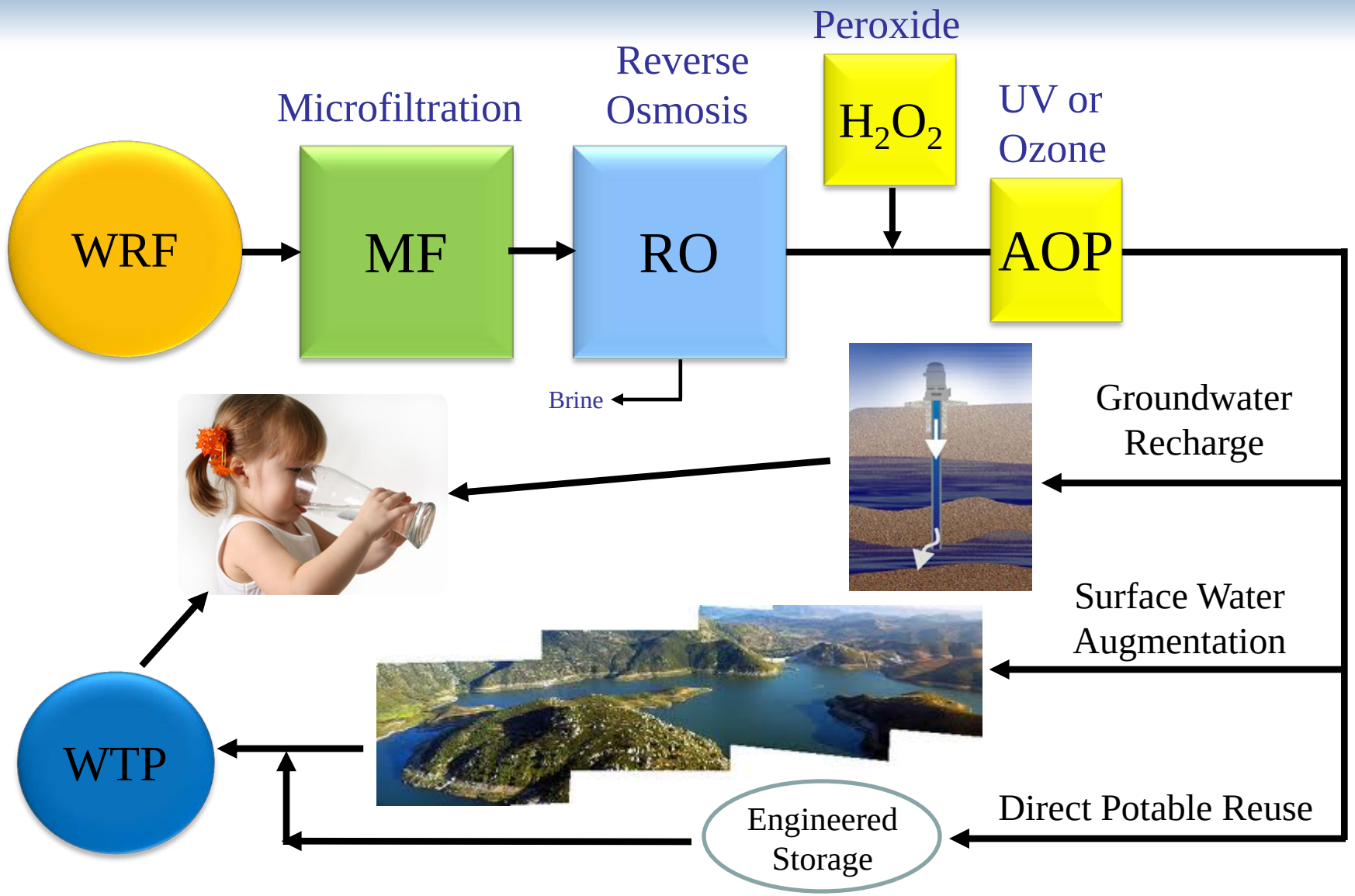
AWT References

- West Basin Municipal Water District
- Orange County Water District
- Water Replenishment District (WRD)
- City of Los Angeles (Terminal Island)
- City of Los Angeles (Donald C. Tillman)
- City of San Diego (Water Purification)
- Rancho California Water District




Full Advanced Treatment (FAT) Configuration



Why get FAT?

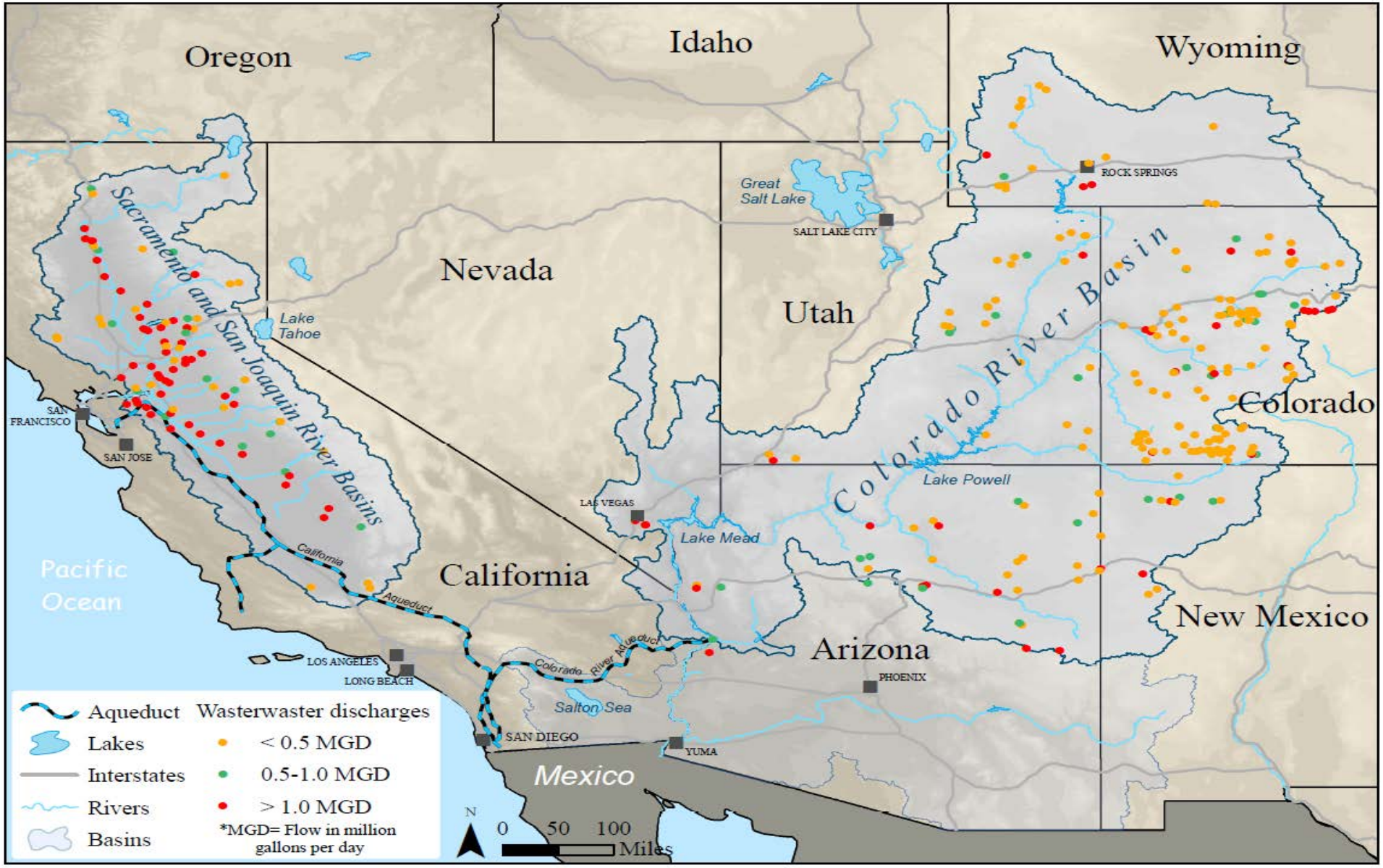
- Reduce Reliance on Imported water
  - Develop New Source
    - Sea Water Intrusion and Augment GW Supplies (Past and Present)
    - Augment Surface Water Supplies (Future)
  - Salt Management Strategy
    - Industrial Use or Irrigation supplies
- Reduce environmental impacts from a WW discharge
- Pathway to DPR

How Effective is FAT?

Removal of Organic Chemicals in AWT Processes

Chemical	MF	RO	UV / AOP	Ozone / AOP
Atrazine	Poor	Excellent	Mod To High	Excellent
Carbamazepine	Poor	Excellent	Excellent	Excellent
DEET	Poor	Excellent	Moderate	Excellent
1,4 Dioxane	Poor	Poor	Mod To High	Mod to High
Nitrosomines	Poor	Mod	Mod to High	Moderate
Estrone	Poor	Excellent	Excellent	Excellent
Gemfibrozil	Poor	Excellent	Excellent	Excellent
Meprobamate	Poor	Excellent	Fair to Mod	Excellent
Sulfamethoxazole	Poor	Excellent	Excellent	Excellent
TCEP	Poor	Excellent	Poor	Fair to Moderate

Public Perceptions on Water Reuse



Be Prepared for Emerging Issues

- What will be the target issues in the future?
  - New emerging contaminants
    - Tritium

    - Lithium

- As IPR Programs evolve - more stringent protection and public education of the sewer shed

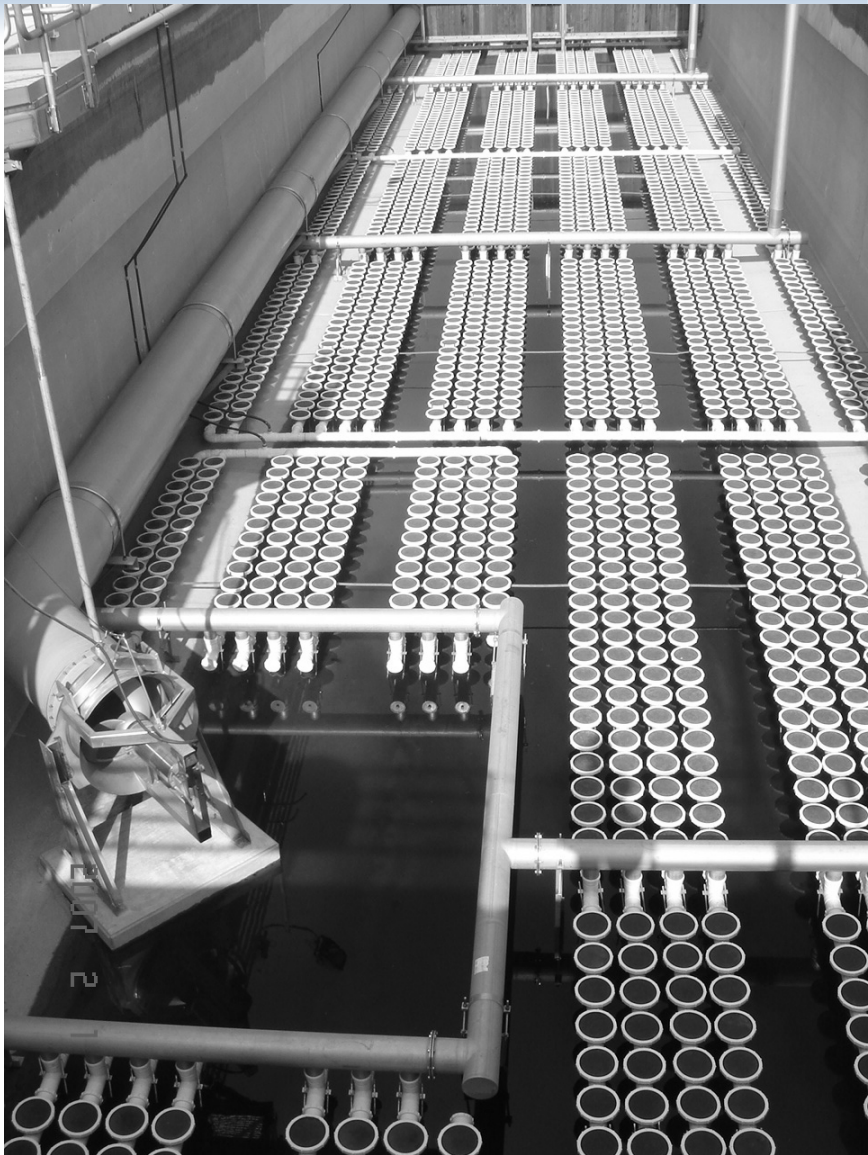
Bio-cremation may pose Public Concerns

- Not legal in California
- Process
  - Potassium Hydroxide
  - Heat, pressure and time
- Waste Stream to sewer
- Public Outreach challenge

Considerations and Case Studies

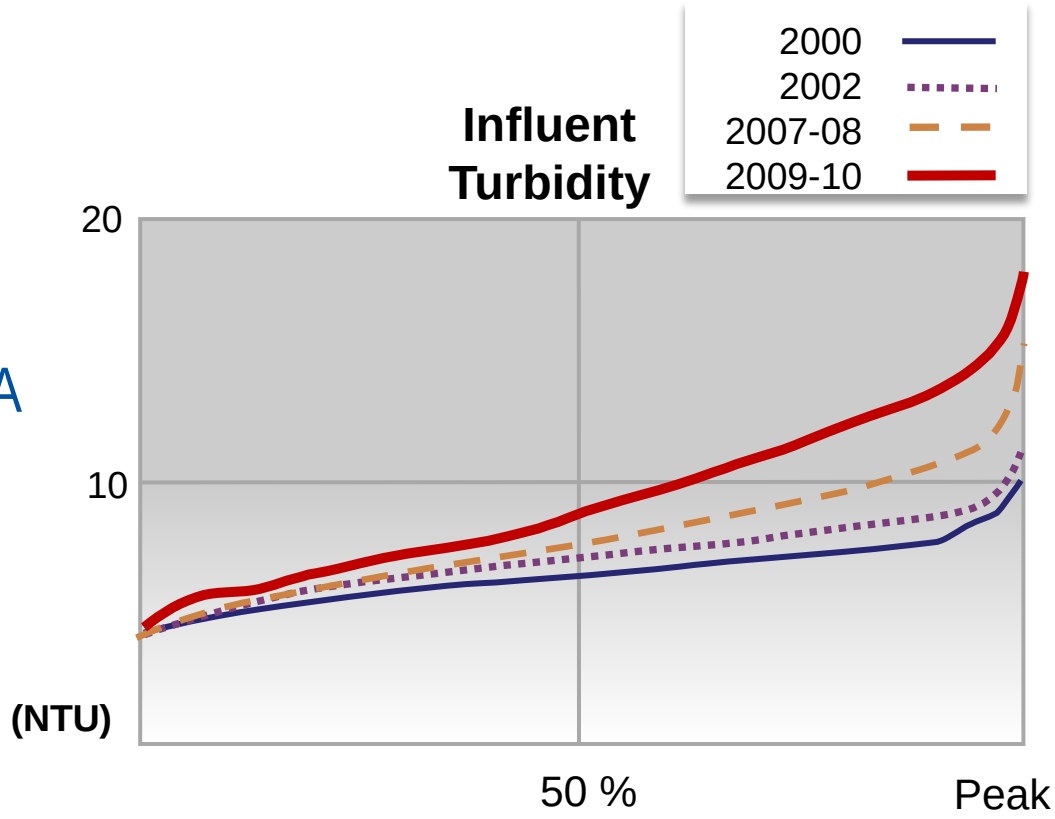
FAT Considerations

- Biological Treatment Impacts
  - Diurnal variability
  - Plan to address off-spec water
- Nitrification
  - Improves FAT performance
  - Lower production of NDMA
  - Necessary for SWA/DPR
- How FAT recycle flows impact biological operations?



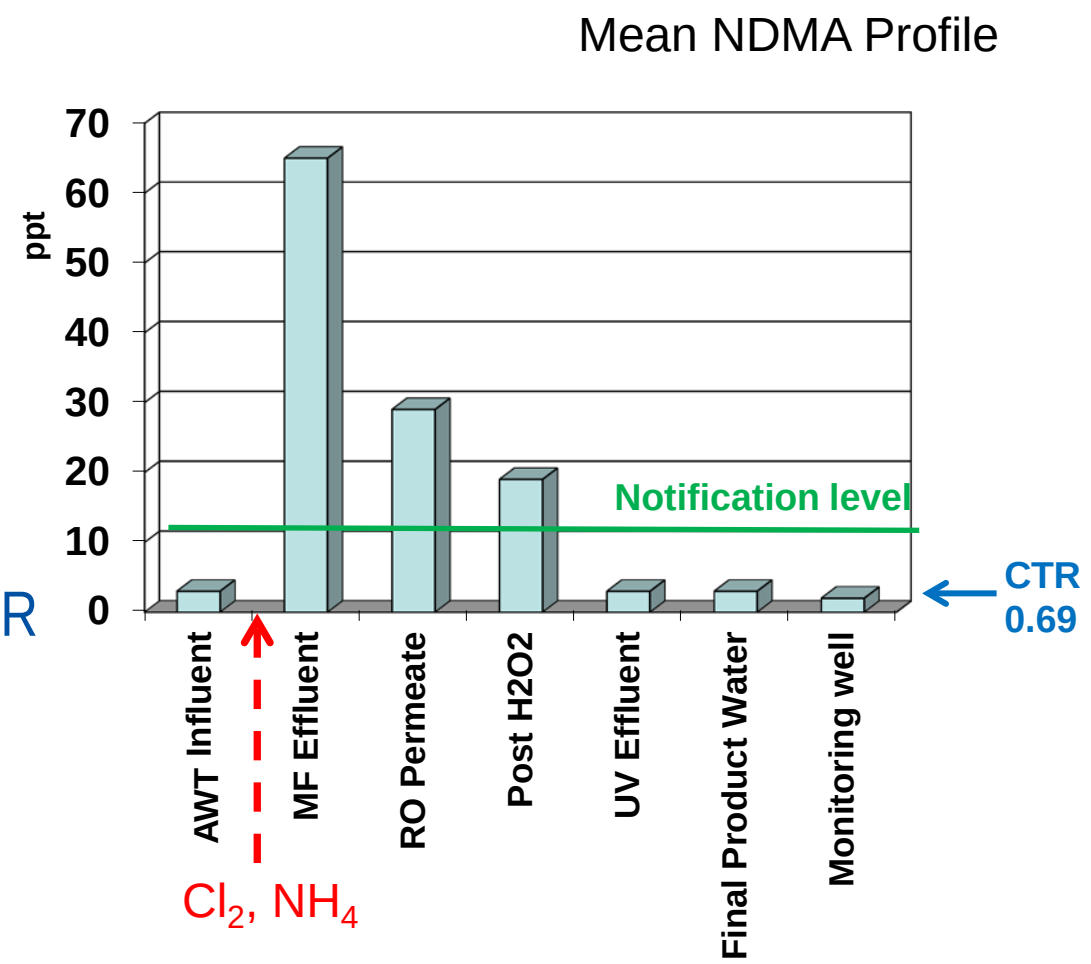
Case Study A: Feed Water Quality

- Consider feed water quality changes, diurnal effects and biological process upsets
  - Operations Impacts
    - Flux decline
    - Increased fouling
    - Increased CIP
    - Capacity
  - Potential Impacts for SWA
    - Nutrients
    - California Toxics Rule



Case Study B: Chemicals Create Challenges

- Chlorine
  - DBPs (SWA)
  - NDMA
- AOP
  - Formaldehyde
  - Bromate
- Ammonia
  - Impacts to SWA/DPR
- Polymers
- SWA: CTR

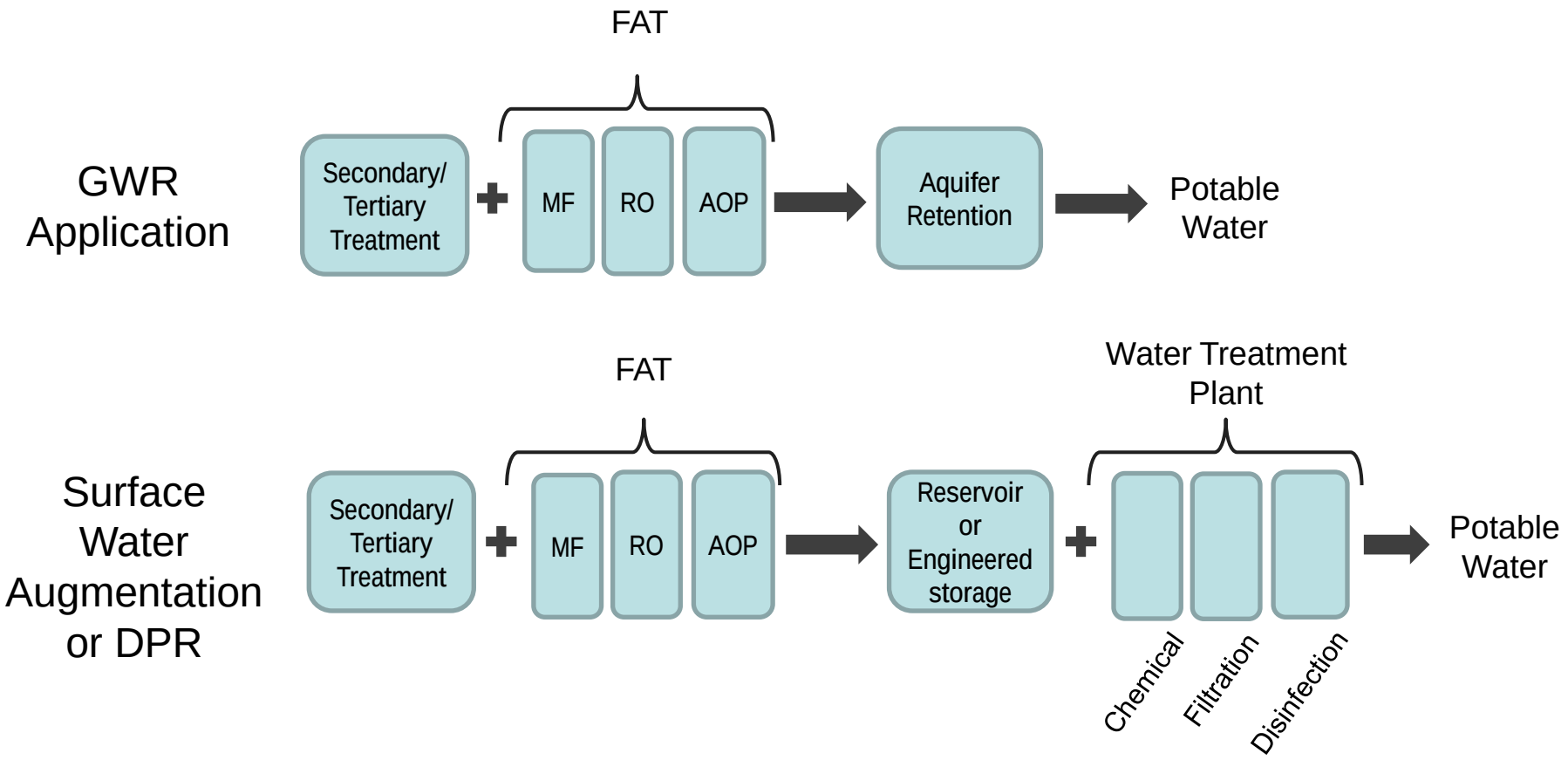


Case Study C: pH Stabilization

- Lime
  - Operators don't like it
  - Requires a lot of attention
  - O&M challenges
  - Difficult to meet GW injection criteria w/o
    - pH
    - LSI
- More flexibility on alternative strategies with SWA/DPR
  - Caustic
  - Caustic and Blend with other sources
  - Calcium Chloride

Control of Pathogenic Microorganisms

Comparison of GWR with SWA/DPR



Pathogen Log Removal – GWR 6 months retention time

Organism	Log Reduction Required	Log Reduction Obtained	Biological and Tertiary Treatment	Membrane Filtration	Reverse Osmosis	UV Disinfection	Advanced Oxidation	Aquifer Retention
Crypto	10	**16**		4		6		6
Giardia	10	**14**		2		6		6
Viruses	12	**12**		0		6		6

1. No credits taken for biological or tertiary treatment
2. No credits taken for reverse osmosis
3. No credits shown for peroxide addition or AOP
4. Ozone can be used instead of UV but credits for Crypto inactivation need to be validated. Likely need a contactor.

Pathogen Log Removal – GWR with less than 6 months retention

Organism	Log Reduction Required	Log Reduction Obtained	Biological and Tertiary Treatment	Membrane Filtration	Reverse Osmosis	UV Disinfection	Advanced Oxidation	Aquifer Retention
Crypto	10	**15**	2	4	1	6		2
Giardia	10	**13**	2	2	1	6		2
Viruses	12	**12**	1	2[a]	1	6		2

a. Removal is a result from chlorine used as a biocide
b. Other credits proposed are conservative estimates based on literature research

Potential Pathogen Log Removal - SWA

Organism	Log Reduction Required	Log Reduction Obtained	Tertiary Treatment	Membrane Filtration	Reverse Osmosis	UV Disinfection	Advanced Oxidation	Reservoir	Water Treatment Plant
Crypto	10	**15**	2	4	1	6		2	*2*
Giardia	10	**14**	2	2	1	6		2	*3*
Viruses	12	**14**	1	2	1	6		2	*4*

a. Log removal credits shown do not take credit from the Reservoir or any post treatment chlorination, which should probably be avoided

Potential Pathogen Log Removal - DPR

Organism	Log Reduction Required	Log Reduction Obtained	Tertiary Treatment	Membrane Filtration	Reverse Osmosis	UV Disinfection	Post Treatment Chlor.	Reservoir or Eng Storage	Water Treatment Plant
Crypto	10	**15**	2	4	1	6			*2*
Giardia	10	**14**	2	2	1	6			*3*
Viruses	12	**16[a]**	1	2	1	6	2		*4*

a. Probably would have post treatment chlorination with this configuration

Surface Water Augmentation

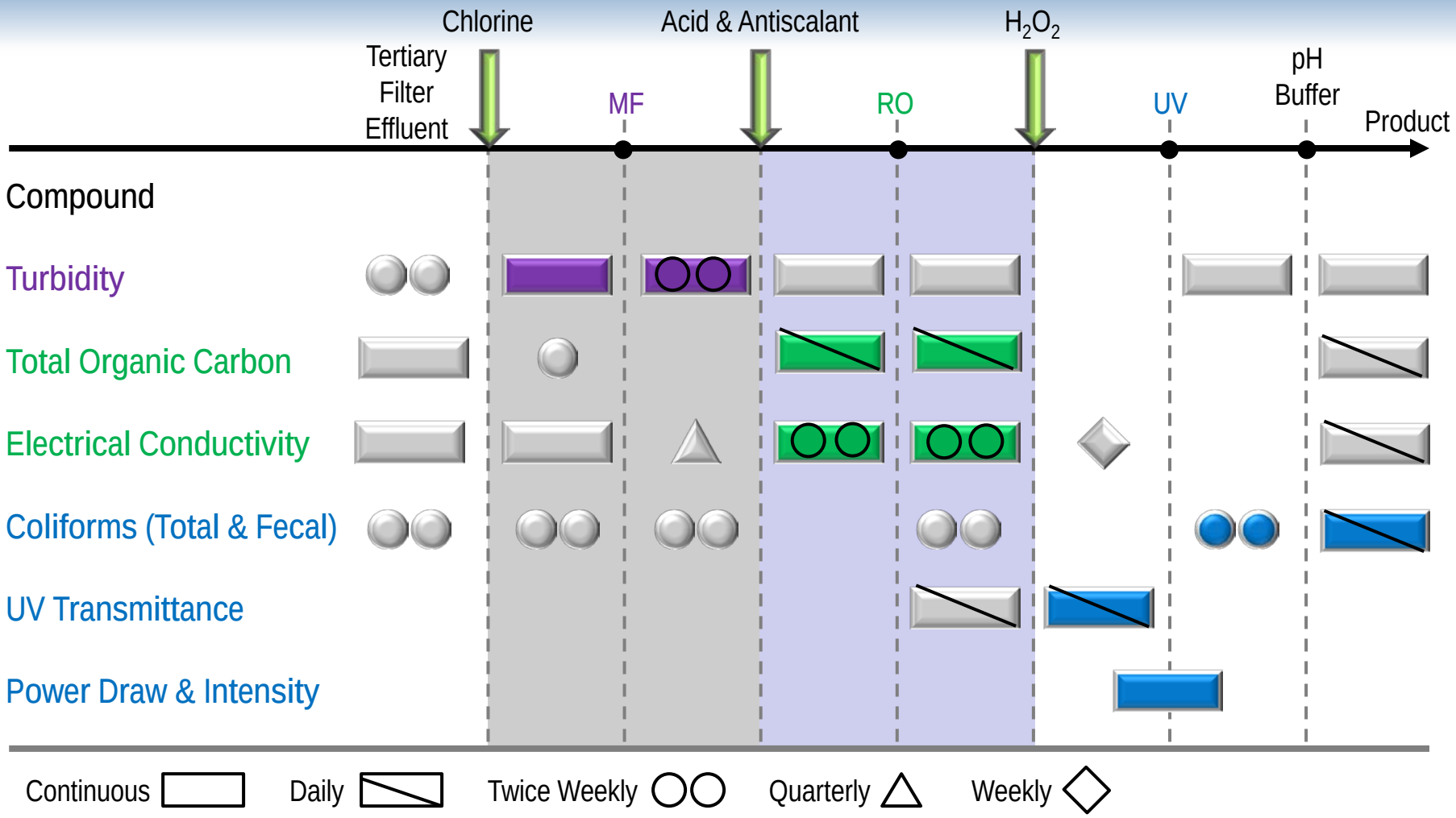
Surface Water Augmentation Challenges

- Currently regulated by NPDES permit
  - Goals for nutrients
    - Uphold natural N/P ratio
    - Limits established on interpretation of Basin Plan objectives
  - California Toxics Rule (CTR)
    - NDMA – 0.69 ppt
    - DBPs – individual DBPs are 500 times < total THMs in imported water
    - A mixing zone raises questions when the receiving water has higher concentrations
- Is the best water quality sent to the reservoir
  - When does FAT water become a supply vs a discharge?
  - Why are we treating it as an inferior supply?

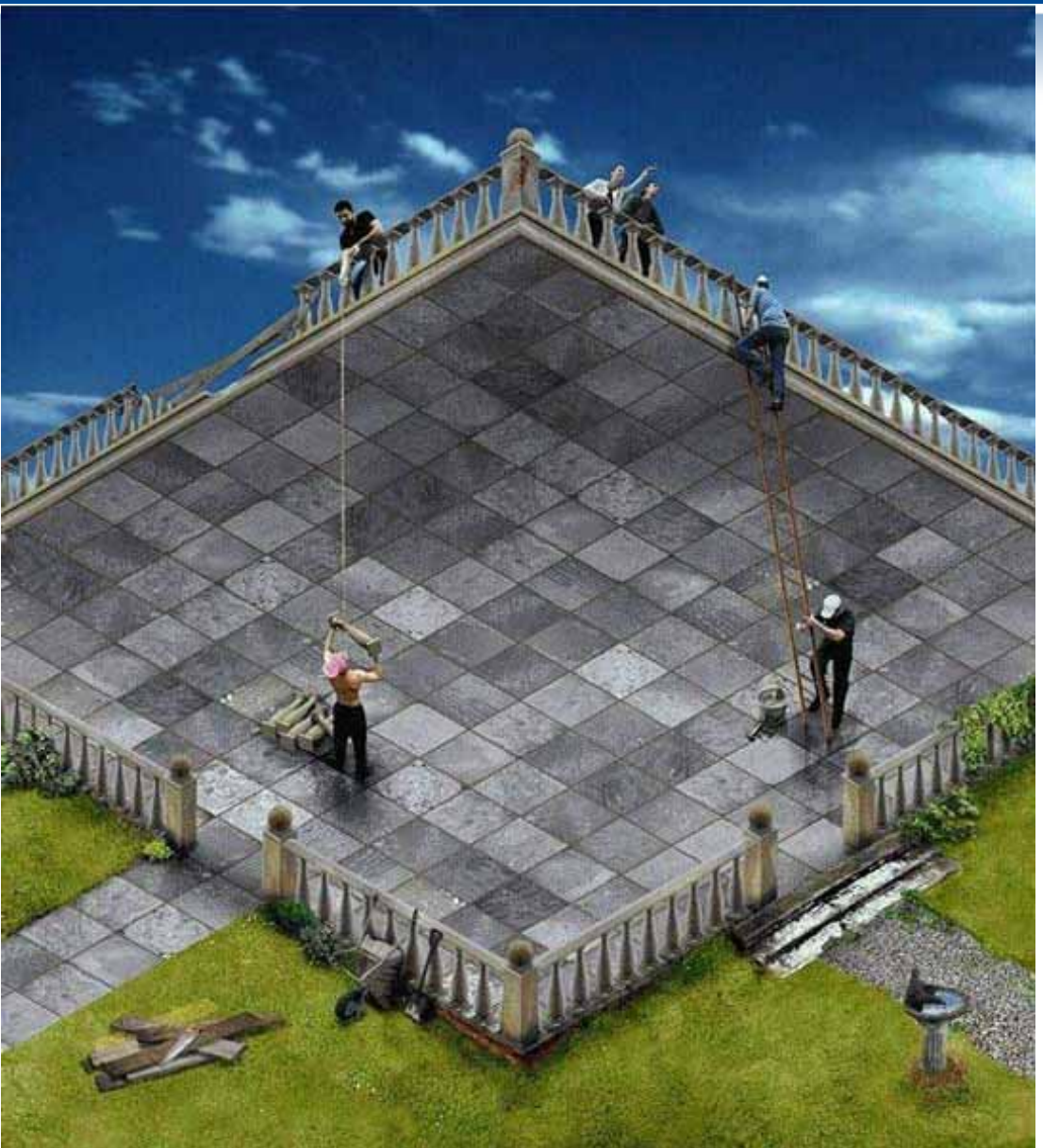
Potential Metrics for Reservoir or Engineered Storage or DPR

- Dilution
  - For San Vicente project > 200:1
  - Ability to take the reservoir/FAT off-line
- Response Retention Time - Engineered Storage
  - Subject to monitoring frequency and assessment that enables timely intervention
  - Online Monitoring
    - Goal is to develop indicators of process performance that are very sensitive and provide real time feedback
    - Seeking two analytical parameters for each barrier that have a routine verification to address redundancy and reliability

Online Monitoring



Look at FAT Product Water Differently



- Inferior Source Water?
  - GW - Diluent Water
  - SWA - Dilution scenarios
- FAT is actually diluting other supplies

Pathway for DPR

- Public Acceptance
- Risk Management Strategies – focus on acute risks
  - Define, assess risk and health based targets - Multiple barriers to minimize the chance of a complete failure of treatment
  - Preventative measures including dilution
  - Continuously verify performance and failure response readiness
- Alternative treatment strategies must provide same level of protection

Conclusion

Advanced Water Treatment is a safe, reliable and sustainable source of water.

All water is reused over and over. Properly treated water is the safest on the planet.

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