City of Santa Cruz Water Commission

Workshop: Recycled Water

February 6, 2017

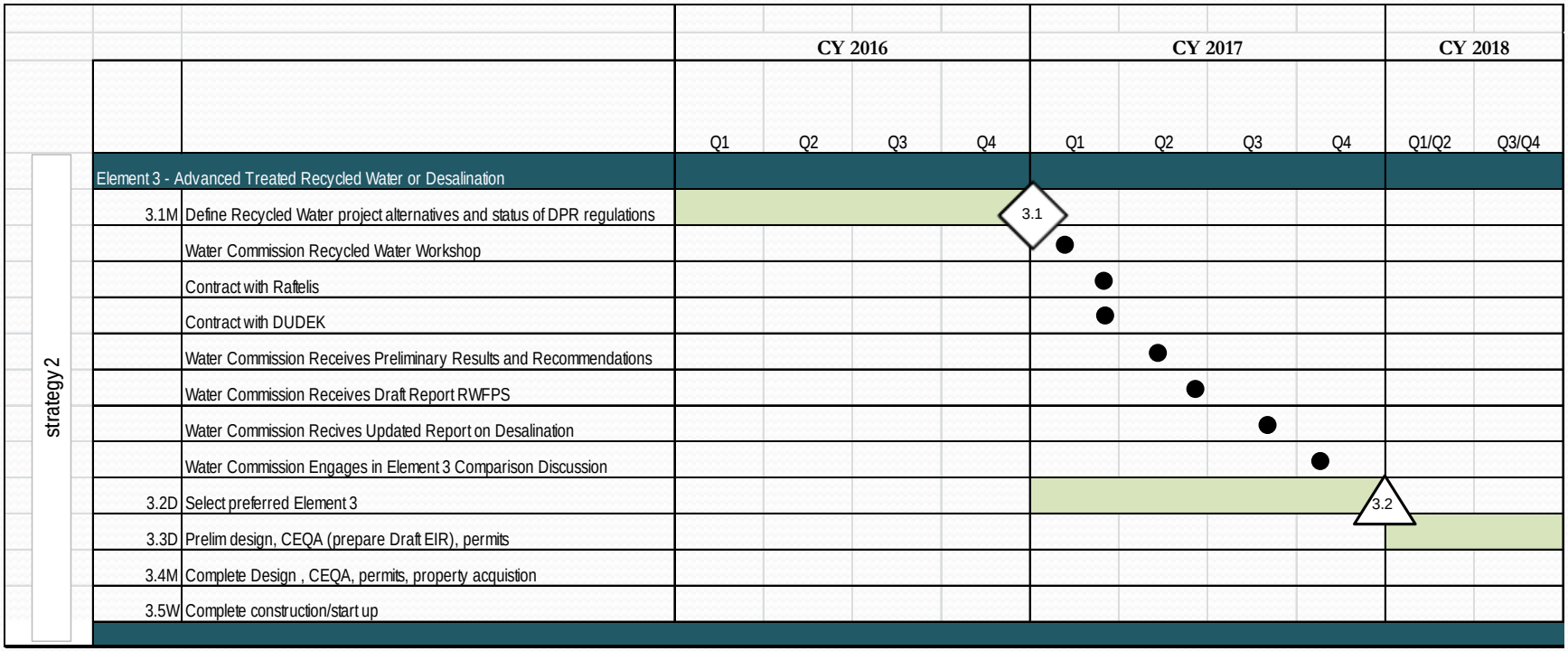
Agenda

- Study Background & Context
- Scope of Work for Recycled Water Study
- Current Alternatives Analysis
- Regulatory Framework and Treatment Technology

Project Background & Context

- WSAC Strategy 2
  - Element 3 = Advanced Treated Recycled Water or Desalination
- Recycled Water Feasibility Planning Study Grant
- City-owned WWTF
- Potential for Partnerships
  - City PW
  - Soquel Creek Water District
  - Scotts Valley Water District
  - San Lorenzo Valley Water District

Element 3: Timeline



City of Santa Cruz

REGIONAL RECYCLED WATER FACILITIES PLANNING STUDY

OVERVIEW

Presentation for City of Santa Cruz

Water Commission

February 6

2017

Photo of San Lorenzo River mouth at the Santa Cruz Beach Boardwalk

PRESENTATION TOPICS

- The Study
- Scope of Work
- Objectives
- Collaboration
- Outreach
- The Process
  - Project Components
  - Project Alternatives
    - Develop
    - Evaluate
    - Rank
- Recommended Project
- Next Steps

Loch Lomond Reservoir
November 2014

THE STUDY

- Cost: $512,000
- Duration: 18 Months
- Top Consultants in the Nation
  - Prime: Kennedy/Jenks
  - Sub consultants:
    - *Trussel Technologies*
      - WWTF Facility/Supply Analysis, Treatment Technologies, QA/QC
    - *Merrit Smith Consulting*
      - Regulatory Strategy Support
    - *Bob Raucher*
      - Triple Bottom Line Analysis
    - *GHD Inc.*
      - CEQA/Environmental Compliance Support
    - *Michael Welch, PhD.*
      - Reservoir Augmentation

Kennedy/Jenks Consultants
Engineers & Scientists

Trussell
TECHNOLOGIES INC

GHD

SCOPE OF WORK

Task	Description	% of Budget	Major Deliverables
1	Project Management QA/QC	8%	Recycled Water Market Survey Maps Tables / Graphs / Analysis Meeting Materials & Participation <u>Technical Memorandum</u> Treatment Evaluation Purisima Basin Injection Well Capacity & Siting Study Santa Margarita Basin Injection Well Capacity & Siting Study Groundwater Replenishment Surface Water Augmentation Streamflow Augmentation Direct Potable Reuse **Regional Recycled Water Facilities Planning Study Final Report**
2	Background Information	4%	
3	**RW Market Analysis**	**17%**	
4	Treatment Evaluation / Regulatory Requirements	5%	
5	**Alternatives Analysis**	**22%**	
6	Stakeholder Involvement	6%	
7	Recommended Project	4%	
8	Financial Analysis	2%	
9	**Regional RWFPS Report**	**14%**	
10	Meetings and Workshops	13%	
11	Injection Well Capacity and Siting Study	5%	

OBJECTIVES

- Assess beneficial reuse of wastewater from a resource recovery perspective
- Identify a phased approach to reuse in Santa Cruz
- Identify potential impacts to Santa Cruz WWTF operations
- Meet or reduce the water supply gap as identified by the WSAC (1.2 BGY)
- Meet schedule of Water Supply Advisory Committee (WSAC) Element #3
- Evaluate local and regional recycled water projects
- Initiate plan for continued recycled water outreach and education
- Meet State Water Resource Control Board (SWRCB) grant requirements

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COLLABORATION

Water Department

Public Works

THE COUNTY OF SANTA CRUZ
SINE PRAEJUDICIO
1850

SOQUEL CREEK WATER DISTRICT

SCOTTS VALLEY WATER DISTRICT

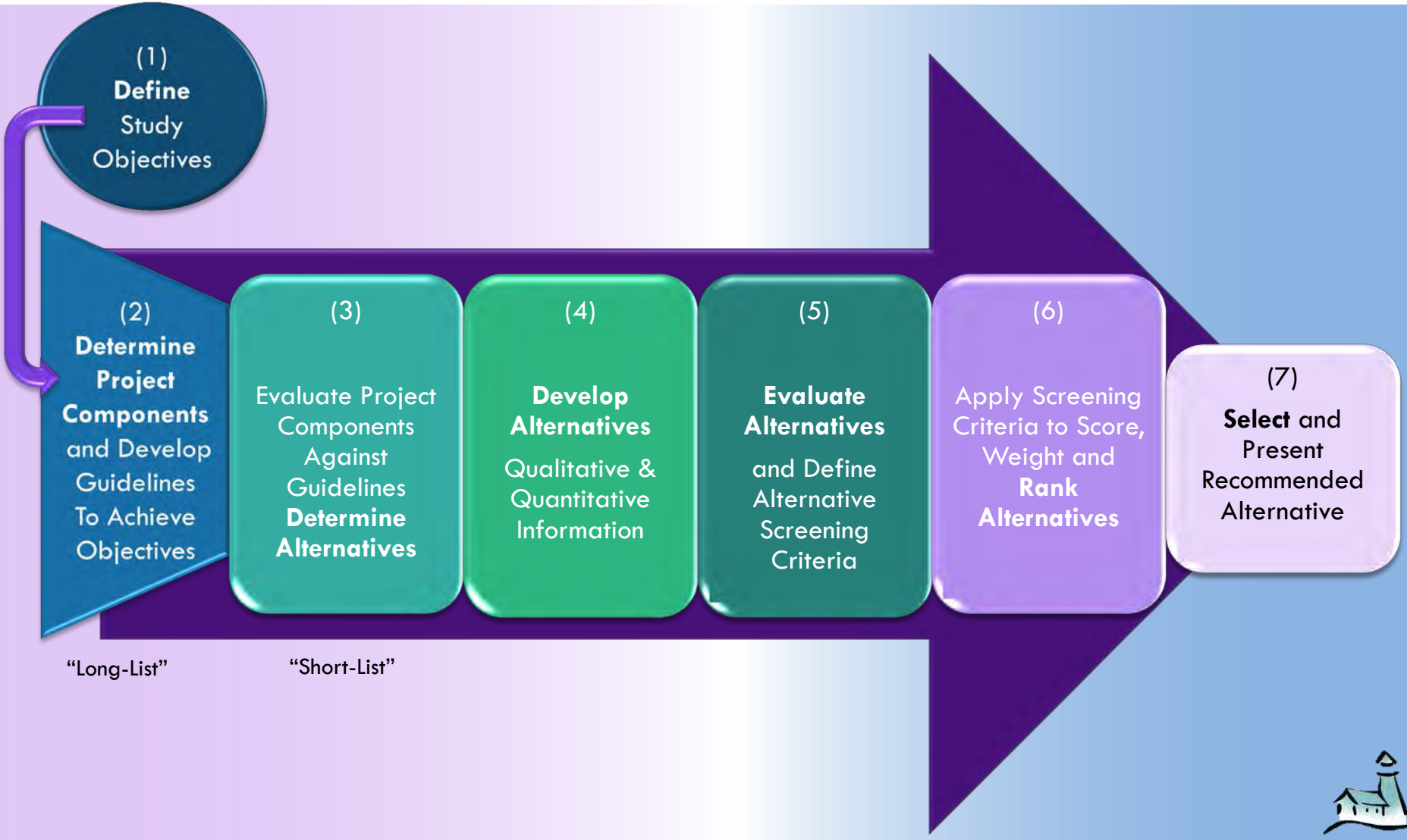
CITY OF SCOTTS VALLEY CALIFORNIA
1966

UNIVERSITY OF CALIFORNIA
SANTA CRUZ

OUTREACH

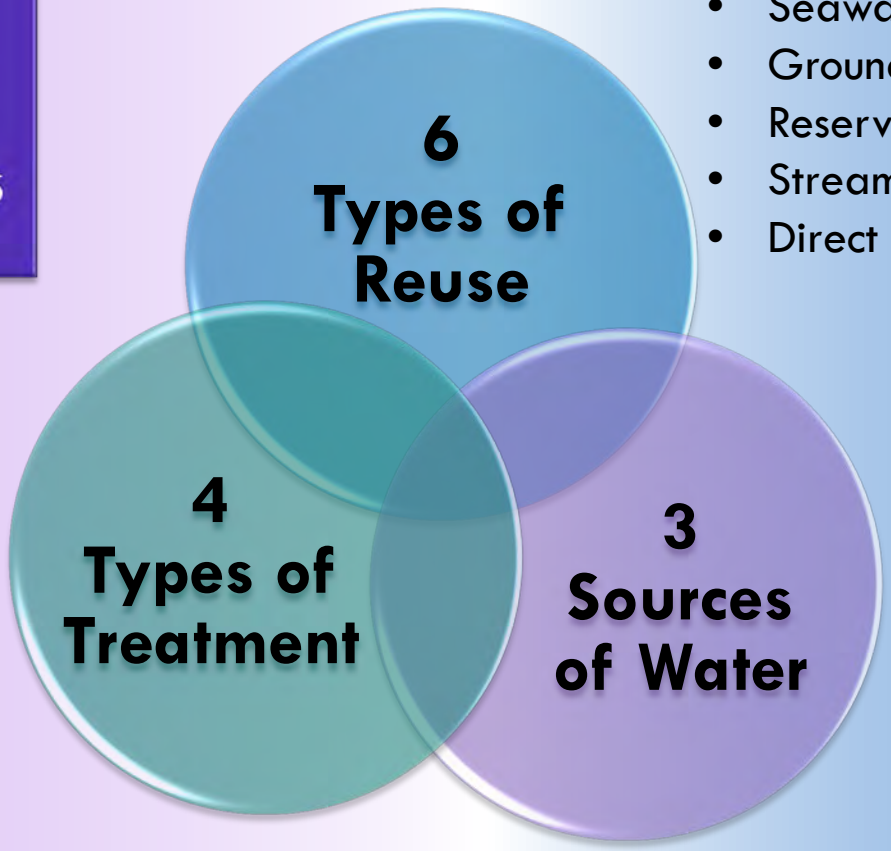
- Unified Message
  - Pure Water
- Tough Questions
  - In-House First
- Build Acceptance and Trust
  - Employees, Elected Officials, Local Groups, Public
  - 1-on-1 Meetings, No ‘Stupid’ Questions
- Media
  - Understand their needs
- Demonstration Project
  - Seeing is Believing… Tasting is Believing

THE PROCESS


(1) **Define** Study Objectives
(2) **Determine Project Components** and Develop Guidelines To Achieve Objectives
(3) Evaluate Project Components Against Guidelines **Determine Alternatives**
(4) **Develop Alternatives** Qualitative & Quantitative Information
(5) **Evaluate Alternatives** and Define Alternative Screening Criteria
(6) Apply Screening Criteria to Score, Weight and **Rank Alternatives**
(7) **Select** and Present Recommended Alternative
"Long-List"
"Short-List"

PROJECT COMPONENTS

24 Project Components



- Non-Potable
- Seawater Intrusion Barrier
- Groundwater Replenishment
- Reservoir Augmentation
- Streamflow Augmentation
- Direct Potable Reuse

- Secondary
- On-Site Filtration
- Tertiary
- Advanced

- Santa Cruz WWTF
- Local Raw Wastewater
- Scotts Valley WWTF

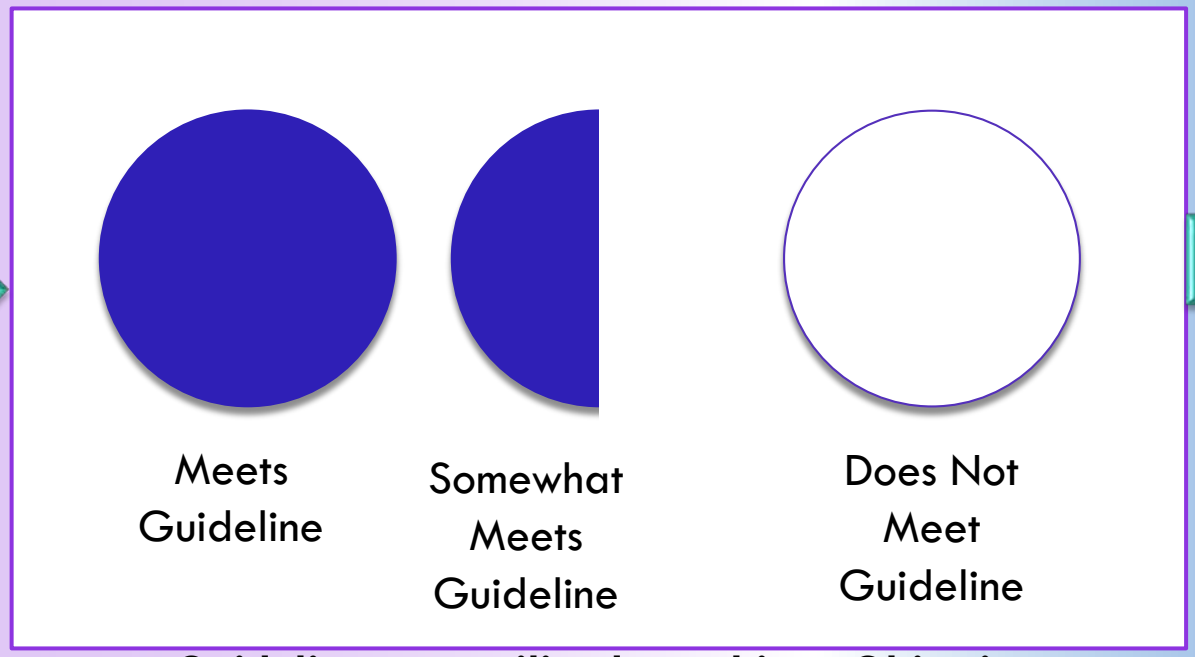
PROJECT ALTERNATIVES

High-Level Evaluation

24 Project Components

"Long-List"

Project Component must "Meet" or "Somewhat Meet" all Guidelines to become a Project Alternative



8 Project Alternatives

"Short List"

Guidelines are utilized to achieve Objectives

DEVELOP ALTERNATIVES

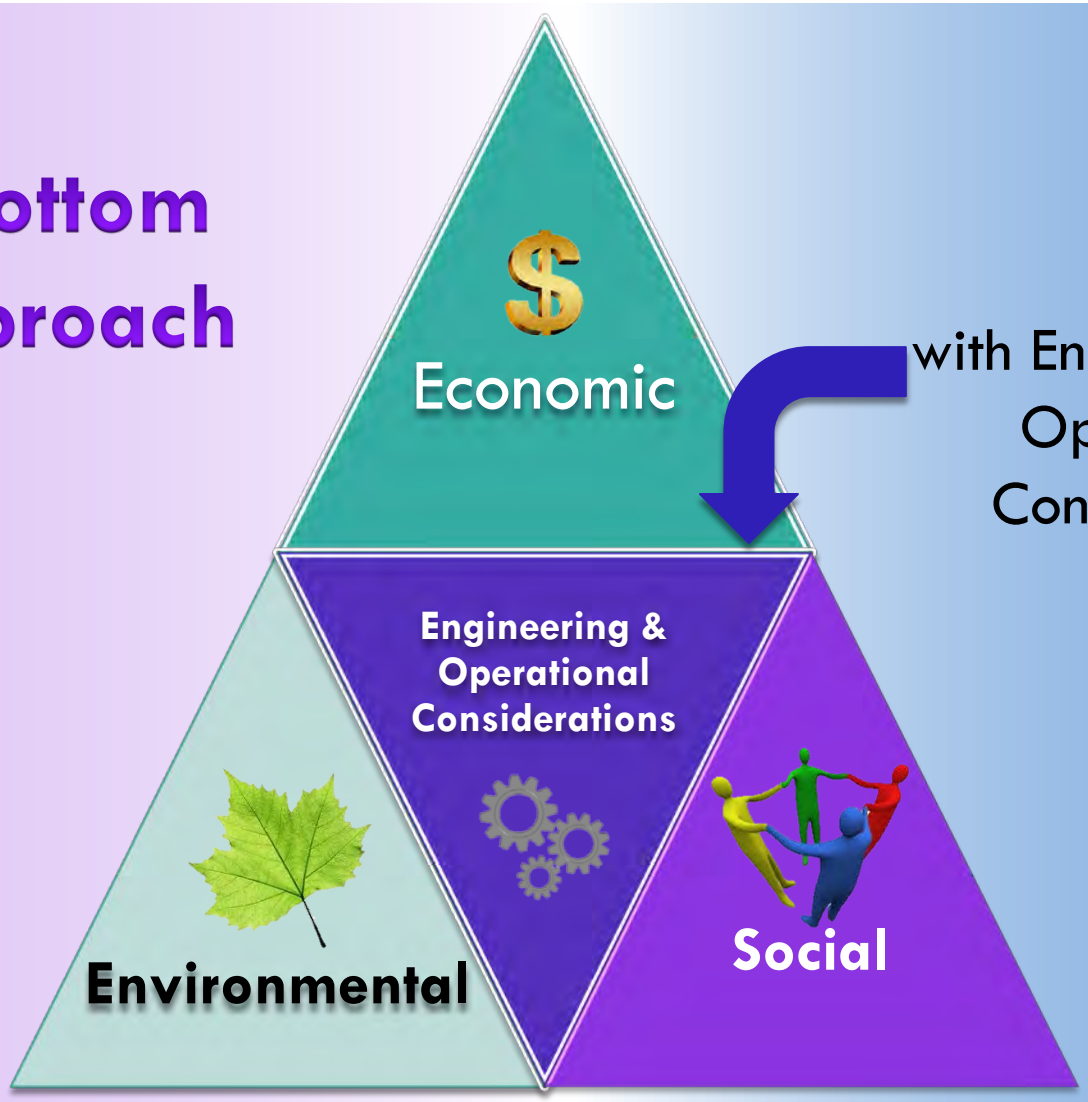
WORKSHOPS AND WEBINARS

Date	Meeting	Objective / Goal
Mar-16	**Kick-Off**	Define Study Objectives, Present Scope, Schedule and Budget
Jun-16	**Alternatives Workshop**	Present approach to identify preliminary alternatives, obtain input and select alternatives for further study, Discuss WWTF siting options
Aug-16	**Screening Webinar**	Present approach for screening alternatives, discuss screening categories, criteria, guidelines for scoring and weighting
Oct-16	**Alternative Webinar - Part I**	Presentation of 1st set of Alternatives Centralized and Decentralized Non-Potable Reuse
Dec-16	**Alternative Webinar - Part II**	Presentation of 2nd set of Alternatives • Surface Water Augmentation • Streamflow Augmentation • Direct Potable Reuse

Alternatives Workshop
6/28/16

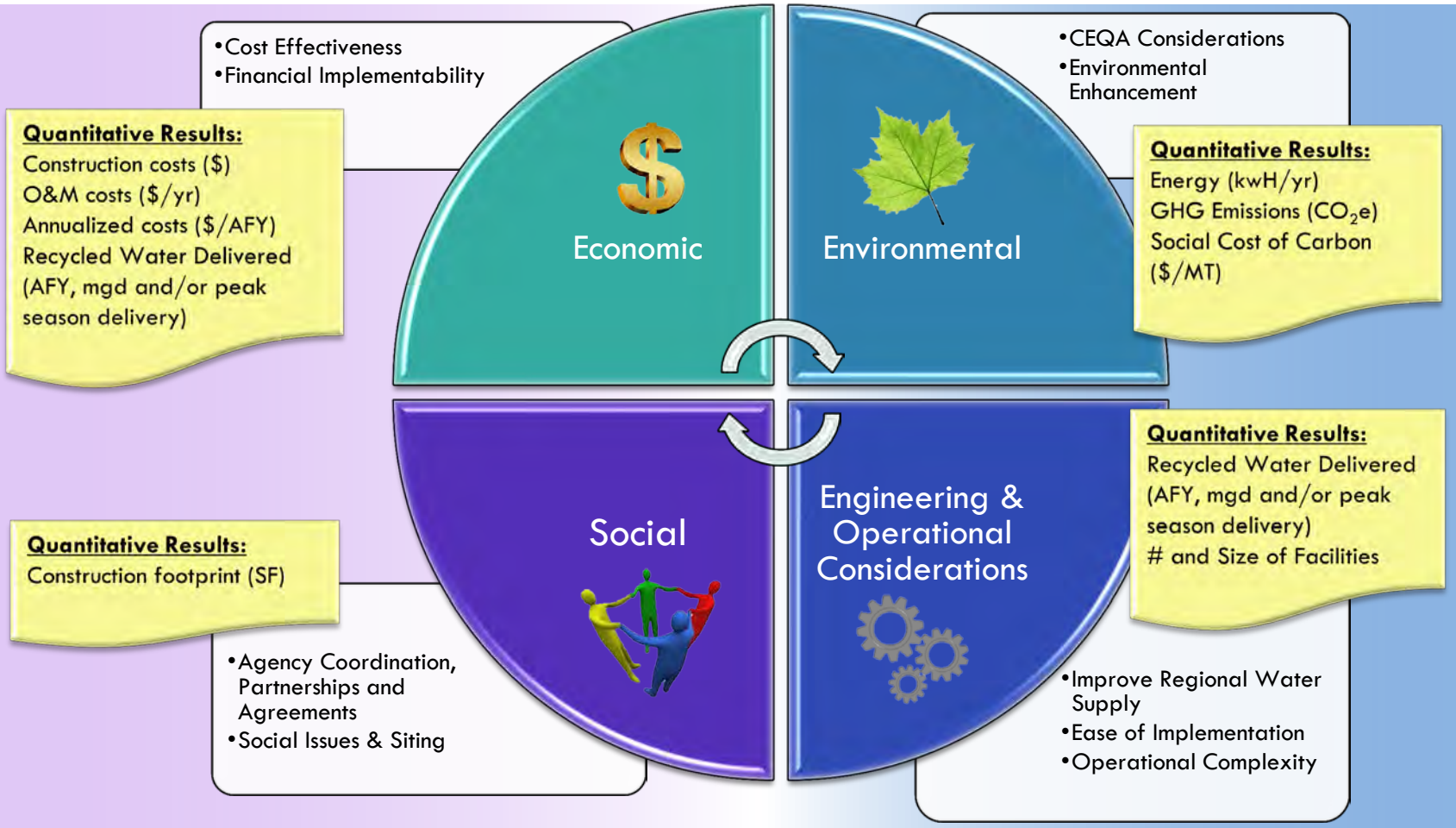
EVALUATE ALTERNATIVES

Triple Bottom Line Approach



with Engineering and Operational Considerations

EVALUATE ALTERNATIVES



LEGEND:

Qualitative Screening Criteria are used to guide scoring

Quantitative results from Alternatives Evaluation are used to inform scoring

RANK ALTERNATIVES

- Utilize qualitative / quantitative data to score then rank Alternatives against each other
- Input scores into a matrix to determine top candidates
  - Stakeholders
- Perform Sensitivity Analysis

Categories			ENGINEERING & OPERATIONAL CONSIDERATIONS	ECONOMIC	ENVIRONMENTAL	SOCIAL	Total Score	ENGINEERING & OPERATIONAL CONSIDERATIONS	ECONOMIC	ENVIRONMENTAL	SOCIAL	Total Score	Agency Weighted Objective Score	Maximize Water Supply	Limit Financially Viable	Maximize Environmental Benefits	Average Score (sensitivity analysis scenarios)	Agency Weighted Objective Score	Maximize Water Supply	Limit Financially Viable	Maximize Environmental Benefits	Average Ranking (sensitivity analysis scenarios)
Alternative	**Sub-Alt #**	**Description**	**AVE WEIGHTED RANKING**										**SENSITIVITY SCORING**					**SENSITIVITY RANKING**				
Alternative 1 – Centralized Non-Potable Reuse	1a	Santa Cruz PWD Phase 2 Project	36.8	23.3	12.2	15.6	87.9	1	1	1	1	2	153.8	216.0	159.4	112.5	160.4	2	1	4	2	2
	1b	Maximize tertiary treatment at the SC WWTF	36.6	21.2	12.2	15.1	85.1	1	2	1	2	4	148.9	213.3	148.6	110.6	155.4	4	2	5	4	4
Alternative 2 – Decentralized Non-Potable Reuse	2	UC Santa Cruz	26.7	18.0	12.2	13.0	69.9	1	6	1	6	9	122.3	161.1	124.5	99.9	126.9	9	11	10	8	10
Alternative 3 – Santa Cruz Participation in SqCWD led Groundwater Recharge Reuse (GWRR) Project	3a	Send secondary effluent from SCWWTF to SqCWD for injection in SqCWD basin (serve NPR users along the way)	30.5	26.5	12.2	15.1	84.3	1	2	1	2	5	147.5	187.1	170.3	110.0	153.7	5	7	3	5	5
	3b	Send tertiary effluent from SCWWTF to SqCWD (serve NPR users along the way)	34.5	26.5	12.2	15.1	88.2	1	2	1	2	1	154.4	206.5	173.1	112.8	161.7	1	5	1	1	2
	3c	Send additional secondary effluent from SCWWTF to SqCWD AWTF and deliver purified water from SqCWD AWTF o recharge Santa Cruz GWRR	36.3	21.2	10.8	12.0	80.2	7	7	7	7	6	140.4	208.2	145.2	101.5	148.8	6	3	6	6	5
	3d	Send advanced treated RW from SCWWTF to SqCWD, (serve NPR users along the way)	31.3	26.5	12.2	15.1	85.1	1	2	1	2	4	148.9	213.3	148.6	110.6	155.4	4	2	5	4	4
	3e	Send advanced treated RW from SCWWTF to SqCWD, (GWRR and NPR along the way)	36.0	21.2	10.8	12.0	80.2	7	7	7	7	6	140.4	208.2	145.2	101.5	148.8	6	3	6	6	5
Alternative 4 – Santa Cruz GWRR Project	4a	Santa Cruz GWRR with AWTF at SC WWTF (DO NOT serve NPR users along the way)	31.3	19.1	10.8	11.5	72.9	7	9	7	9	10	122.5	170.9	128.7	88.1	127.5	8	8	8	9	8
	4b	Santa Cruz GWRR with AWTF of secondary effluent at off-site location (DO NOT serve NPR users along the way)	29.2	19.1	9.5	11.5	69.2	10	9	10	9	10	122.5	170.9	128.7	88.1	127.5	10	9	9	10	10
	4c	Santa Cruz GWRR with MBR + AWTF at DA Porath PS (DO NOT serve NPR users along the way)	24.9	15.9	8.1	11.5	60.4	11	9	11	9	12	105.6	146.7	109.0	76.3	109.4	12	13	13	11	12
Alternative 5 – Surface Water Augmentation (SWA) in Loch Lomond Reservoir	5	Advanced treatment of Santa Cruz effluent for bending in Loch Lomond Reservoir (DO NOT serve NPR users along the way)	26.8	17.0	6.8	6.3	56.8	12	15	12	15	13	99.4	152.4	111.2	68.1	107.8	13	12	12	13	13
Alternative 6 – Streamflow Augmentation	6a	AWTF of secondary effluent with direct discharge to the San Lorenzo River b/w Felton and Tait (DO NOT serve NPR users along the way)	19.5	10.6	4.7	7.3	42.0	14	13	14	13	14	73.6	111.2	73.9	49.3	77.0	14	14	14	14	14
	6b	AWTF of secondary effluent with indirect discharge to the San Lorenzo River d/s of Tait Street Diversion at Tait Well Field (DO NOT serve NPR users along the way)	19.5	10.6	4.7	7.3	42.0	14	13	14	13	14	73.6	111.2	73.9	49.3	77.0	14	14	14	14	14
Alternative 7 – Direct Potable Reuse	7	Raw Water Blending at Graham Hill WTP (via Coast PS)	29.5	17.0	6.8	11.0	64.3	12	12	12	12	11	112.5	168.9	116.4	73.3	117.8	11	10	11	12	11

PLACEHOLDER SCORES/RANKING FOR EXAMPLE ONLY

Example Scoring Matrix

RECOMMENDED PROJECT

- **The primary objective of the Study is to recommend a project that is "safe, adequate, reliable, affordable and environmentally sustainable."**
- Ranking and scoring will be inputs into the decision of the Recommend Project
- The Recommended Project will be determined by stakeholders

NEXT STEPS

THE STUDY

Date	Meeting	Objective / Goal
Feb/Mar - 17	**Alternative Webinar - Part III**	Presentation of 3rd set of Alternatives Groundwater Recharge Reuse (GRR) through Indirect Potable Reuse Soquel Creek Water District Led Santa Cruz Water Department Led Regional (Scotts Valley, Santa Cruz and Soquel)
Apr-17	**Scoring & Ranking Workshop**	Discuss Preliminary Scoring and Ranking Identify Recommended Alternative (or Phased Projects) for further development
Jun - 17	**Present Recommended Alternative**	Present Recommended Alternative (or Phased Projects)

NEXT STEPS

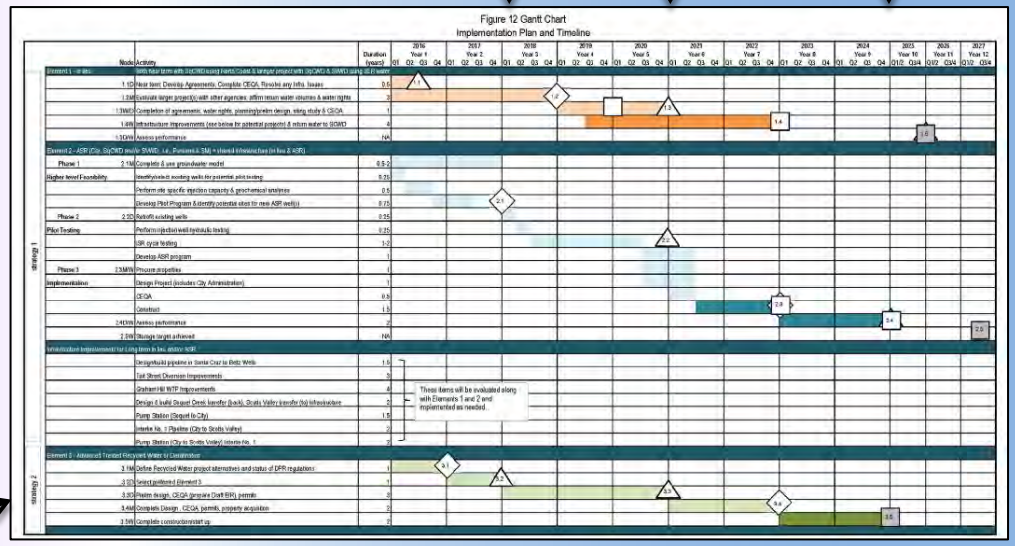
WATER SUPPLY ADVISORY COMMITTEE RECOMMENDATIONS

- Depending on the Recommended Project additional studies will be required;
  - Modeling
  - Detailed Design Considerations and Constraints
- An Element 3 project <u>may</u>* need to provide a new supply by 2024
  - *Depending on status of WSAC Strategy 1
- Planning needs to occur as if a Element 3 project <u>will</u> need to provide a new supply by 2024

Completion of preliminary design DECISION POINT 2020

Completion of high-level feasibility study 2017

Completion of water supply project by 2024



WSAC Implementation Plan and Timeline

Element 3: Recycled Water / Desalination

Our Water, Our Future

City of Santa Cruz

Water Department

David Kehn
Assistant Engineer
(831) 420-5217
dakehn@cityofsantacruz.com

City of Santa Cruz
Recycled Water Facilities Planning Study

Water Commission Workshop

Feb 6, 2017

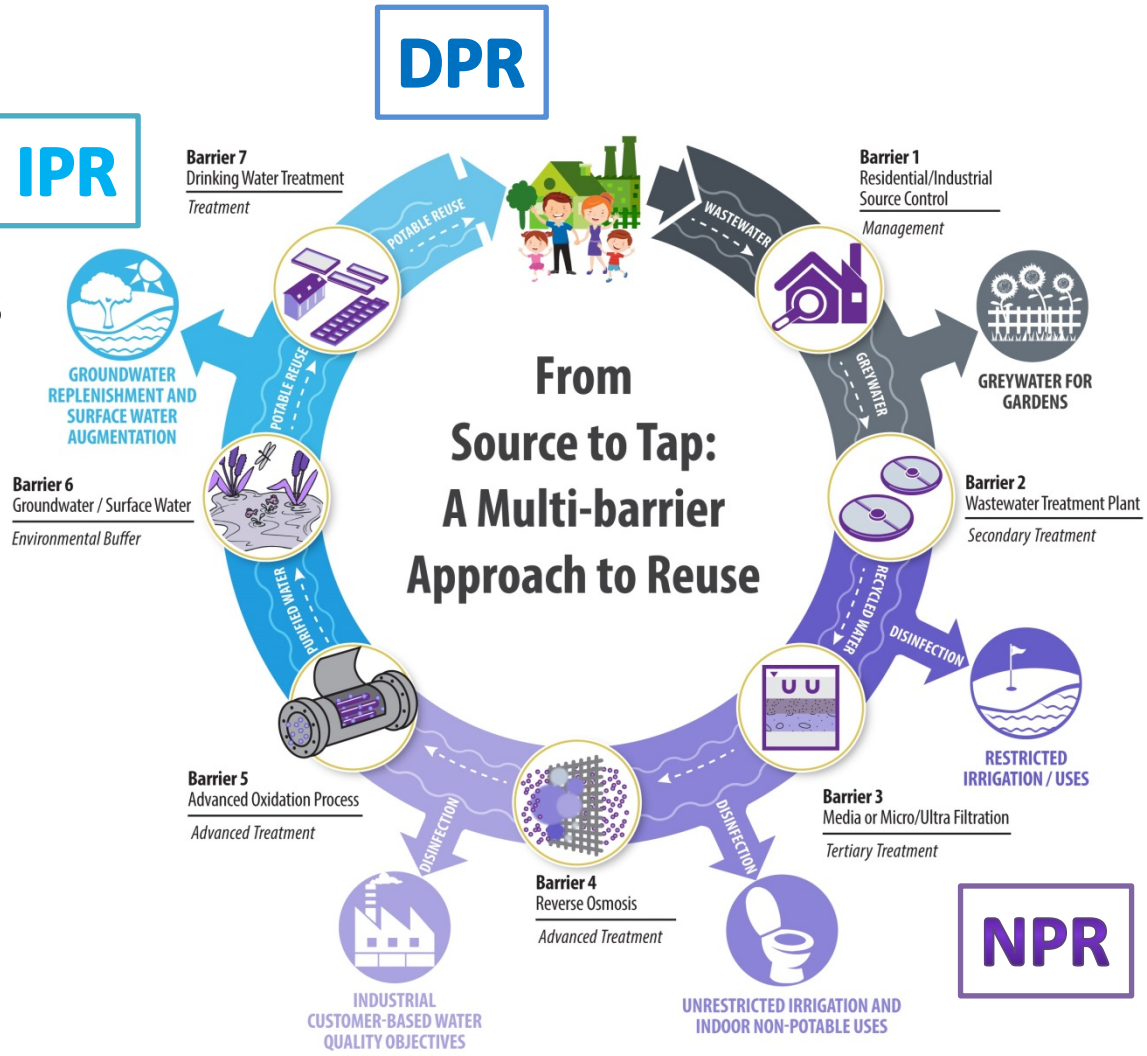
Dawn Taffler P.E., LEED

Today's Presentation

- High-level overview of alternatives; which are at varying stages of evaluation.
- Costs and facility sizes are not presented at this time; but will be an integral part of the scoring and ranking process.
- All pipeline alignments and facility locations are assumed to be preliminary; these would be further evaluated and refined in future studies as part of environmental review and design process.

Alternatives for Further Evaluation

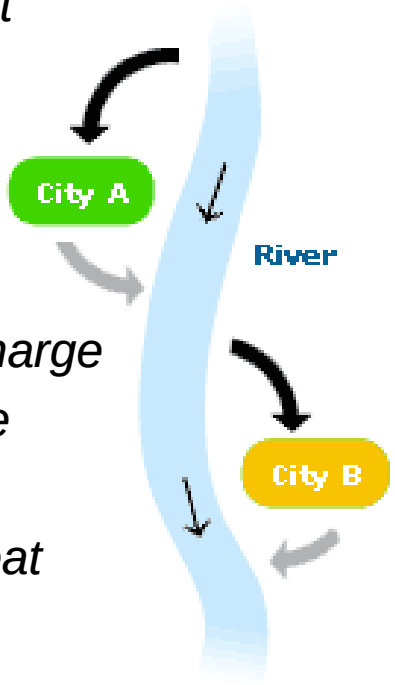
- 8 Alternatives
- 3 Broad Categories
  - Non-Potable Reuse (NPR)
  - Indirect Potable Reuse (IPR)
  - Direct Potable Reuse (DPR)
- Increasing levels of treatment barriers



Not to Be Confused with

- De Facto Reuse

Divert

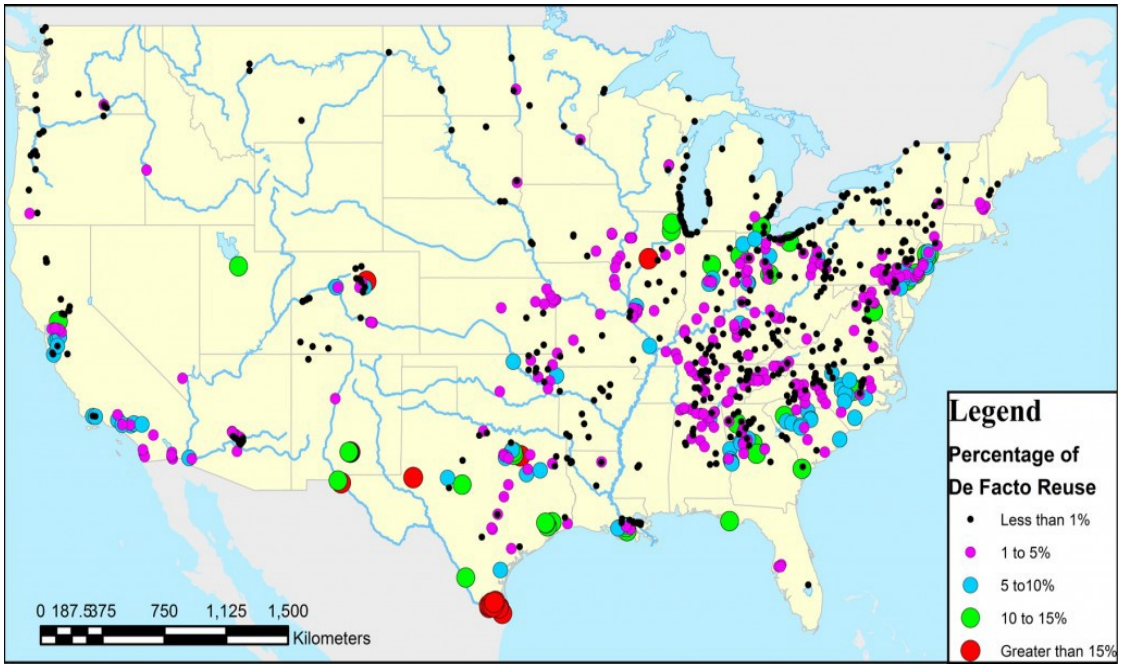


Discharge

Dilute

Repeat

De Facto Reuse in the US



Credit: Rice and Westerhoff, Environ. Sci. Technol., 2015, 49 (2), pp 982–989

Alternatives for Further Evaluation

NPR

- Alternative 1 – Centralized Non-Potable Reuse
- Alternative 2 – Decentralized Non-Potable Reuse

IPR

- Alternative 3 – Santa Cruz Participation in SqCWD-led GRR Project
- Alternative 4 – Santa Cruz GRR Project
- Alternative 5 – Surface Water Augmentation (SWA) in Loch Lomond Reservoir
- Alternative 6 – Streamflow Augmentation

DPR

- Alternative 7 – Direct Potable Reuse

IPR

- Alternative 8 – Regional GRR Project

Alt 1 - Centralized Non-Potable Reuse

Alt 1a – Santa Cruz PWD Phase 2 Project

- **Description:** Title 22 upgrades to the existing disinfected reclaimed water system at the Santa Cruz WWTF
- **Source:** Santa Cruz WWTF
- **Project Size:** 0.25 MGD tertiary RW demand
- **Uses:** In-plant uses, truck filling and La Barranca Park
- **Major Facilities:** Chlorine Contact Basin #2, Interconnecting Piping, Chemical dosing System, Control System, Other Miscellaneous Components – including pipeline to La Barranca Park and truck filling station

Alt 1a - Santa Cruz PWD Phase 2 Project

CCB = Chlorine Contact Basin

Pilot Plant AWPF at the SCWWTF

- Collaboration btw PWD and SqCWD
- Objectives (per RFP)
  - Introduce potable recycled water to the community,
  - Educate the public on the purification process, and
  - Develop design criteria for SqCWD's future full-scale
- Nexus with WSAC Element 3, which included
  - As-needed demonstration testing
  - Continued public outreach and education

AWPF = Advanced Water Purification Facility

Pilot Plant AWPF at the SCWWTF

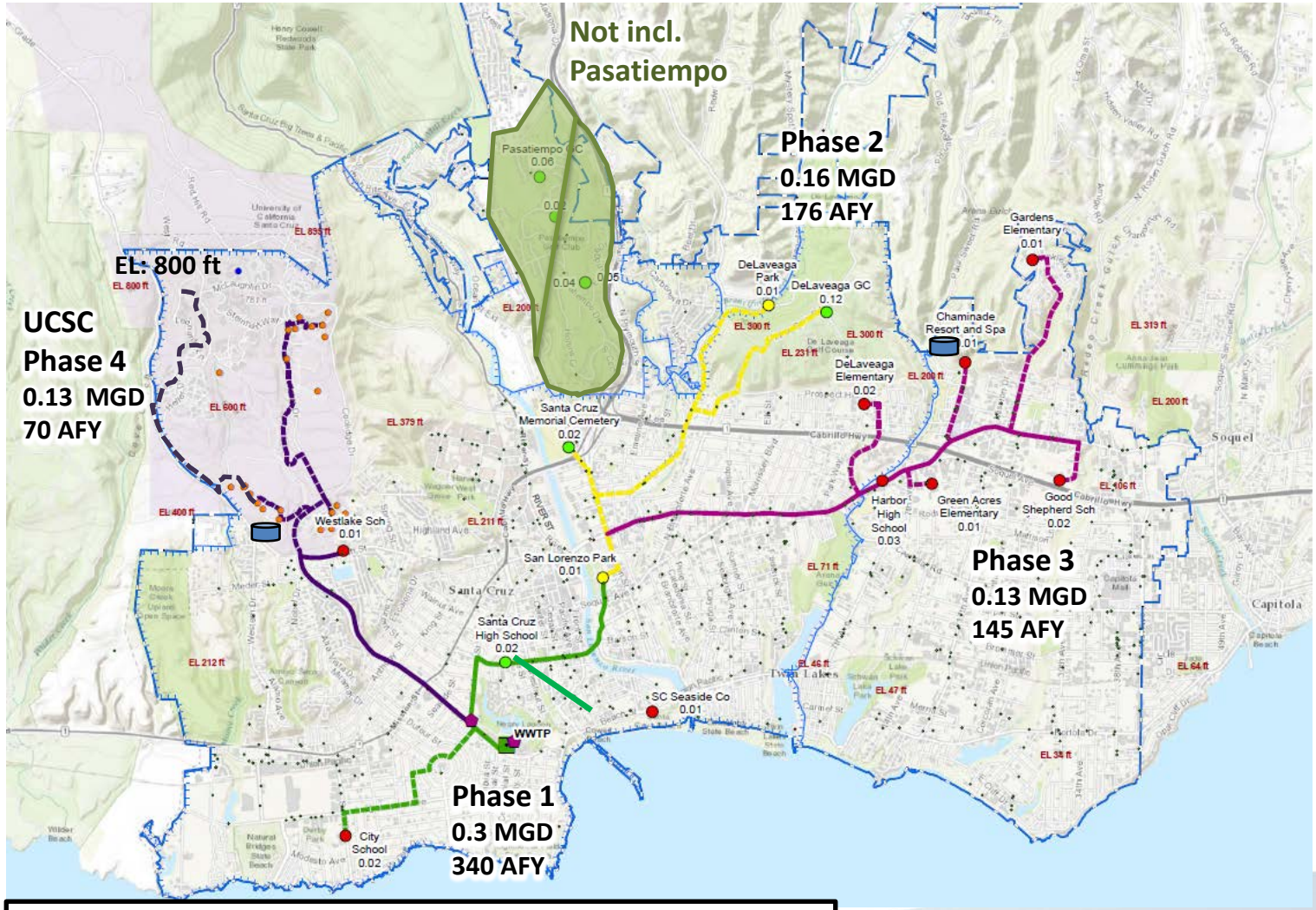
- Potential Nexus with City Water Department Activities
  - Making the pilot more suitable for tours and a longer-term facility
  - Additional water quality testing (constituents, frequency, duration), equipment and modeling consistent with typical drinking water quality parameters
  - Opportunity to evaluate multiple treatment trains
  - Verification if/when we apply for log-removal credit
  - Operator/engineering experience with the advanced treatment train process(es)

Alt 1 - Centralized Non-Potable Reuse

Alt 1b – Maximize Tertiary Treatment

- **Description:** New tertiary treatment at Santa Cruz WWTF (or off-site) to meet identified non-potable demands within the City's service area.
- **Source:** Santa Cruz WWTF
- **Project Size:** ~0.7 mgd tertiary RW demand
- **Uses:** Irrigation, in-plant uses, bulk water stations, existing dual-plumbed buildings and cooling towers. Approx 50 customer sites in City.
- **Major Facilities:** tertiary treatment facility, conveyance and distribution pipelines, pump stations, storage

Alt 1b - Maximize Tertiary Treatment & Alt 2 – Decentralized Non Potable Reuse



** All alignments are preliminary and would be refined in future studies*

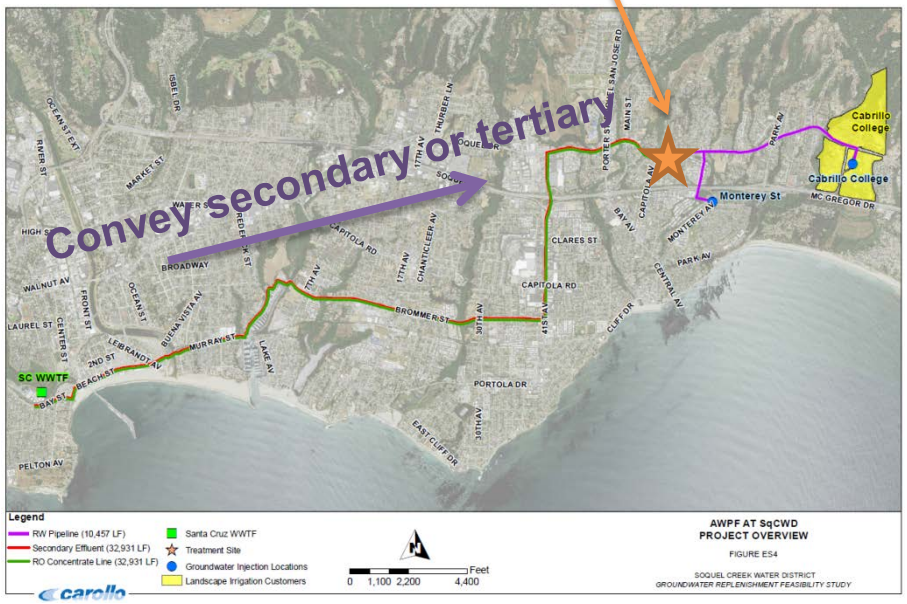
Alt 3 - Santa Cruz Participation in a SqCWD-led GRRP

- **Description:** partner with SqCWD to meet regional demands and share facilities.
- **Source:** Santa Cruz WWTF
- **Project Size:** assume 1.3 mgd of groundwater recharge in SqCWD, demand in Santa Cruz varies by sub-alternative
- **Uses:** Groundwater recharge and irrigation
- **Major Facilities:** treatment facility, conveyance and distribution pipelines, pump stations, injection wells, brine discharge via connection to existing ocean outfall or parallel brine line.

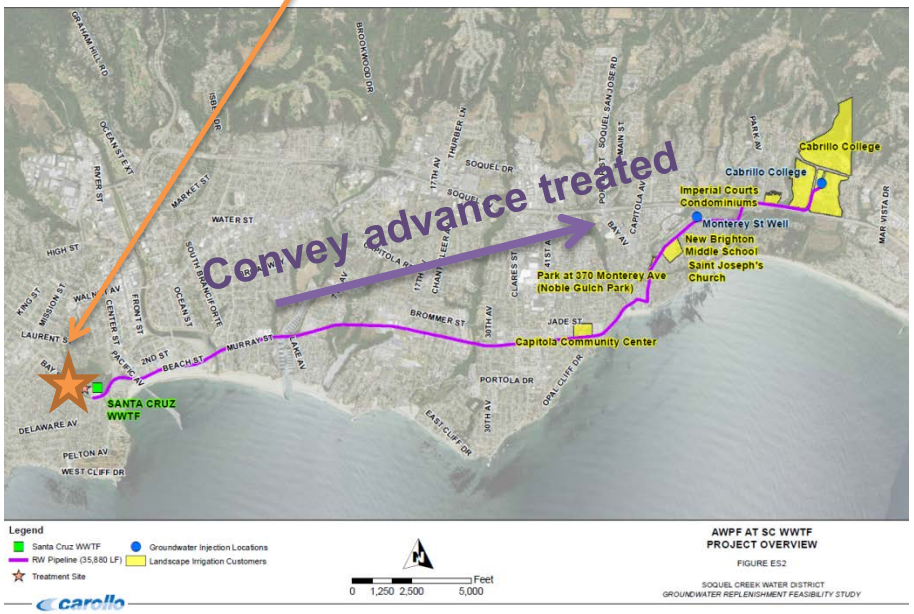
Alt 3 - Santa Cruz Participation in a SqCWD-led GRRP

Draft SqCWD RWFPS looked at 2 Advanced Water Treatment Facility (AWTF) sites to utilize Santa Cruz WWTF effluent

@ SqCWD Headquarters



@ Santa Cruz WWTF



Alt 3 - Santa Cruz Participation in a SqCWD-led GWRR

- **AWPF @ SqCWD Headquarters** **(3 Sub-alternatives)**
  - Alt 3a - Send secondary effluent from SCWWTF to SqCWD for injection in SqCWD basin
    - ✓ *Baseline – no use in Santa Cruz
  - Alt 3b - Send tertiary effluent from SCWWTF to SqCWD
    - ✓ Serve tertiary RW to NPR users along the way
  - Alt 3c - Send additional secondary effluent from SCWWTF to SqCWD AWTF and deliver purified water from SqCWD AWTF
    - ✓ Recharge advanced treated RW in Santa Cruz GW basin

Injection capacity and siting study underway

- **AWPF @ Santa Cruz WWTF** **(2 Sub-alternatives)**
  - Alt 3d - Send advanced treated RW from SCWWTF to SqCWD
    - ✓ Serve advanced treated RW to NPR users along the way
  - Alt 3e - Send advanced treated RW from SCWWTF to SqCWD,
    - ✓ Recharge advanced treated RW in Santa Cruz GW Basin
    - ✓ Serve advanced treated RW to NPR along the way

Injection capacity and siting study underway

Alt 3 - Santa Cruz Participation in a SqCWD-led GWRR

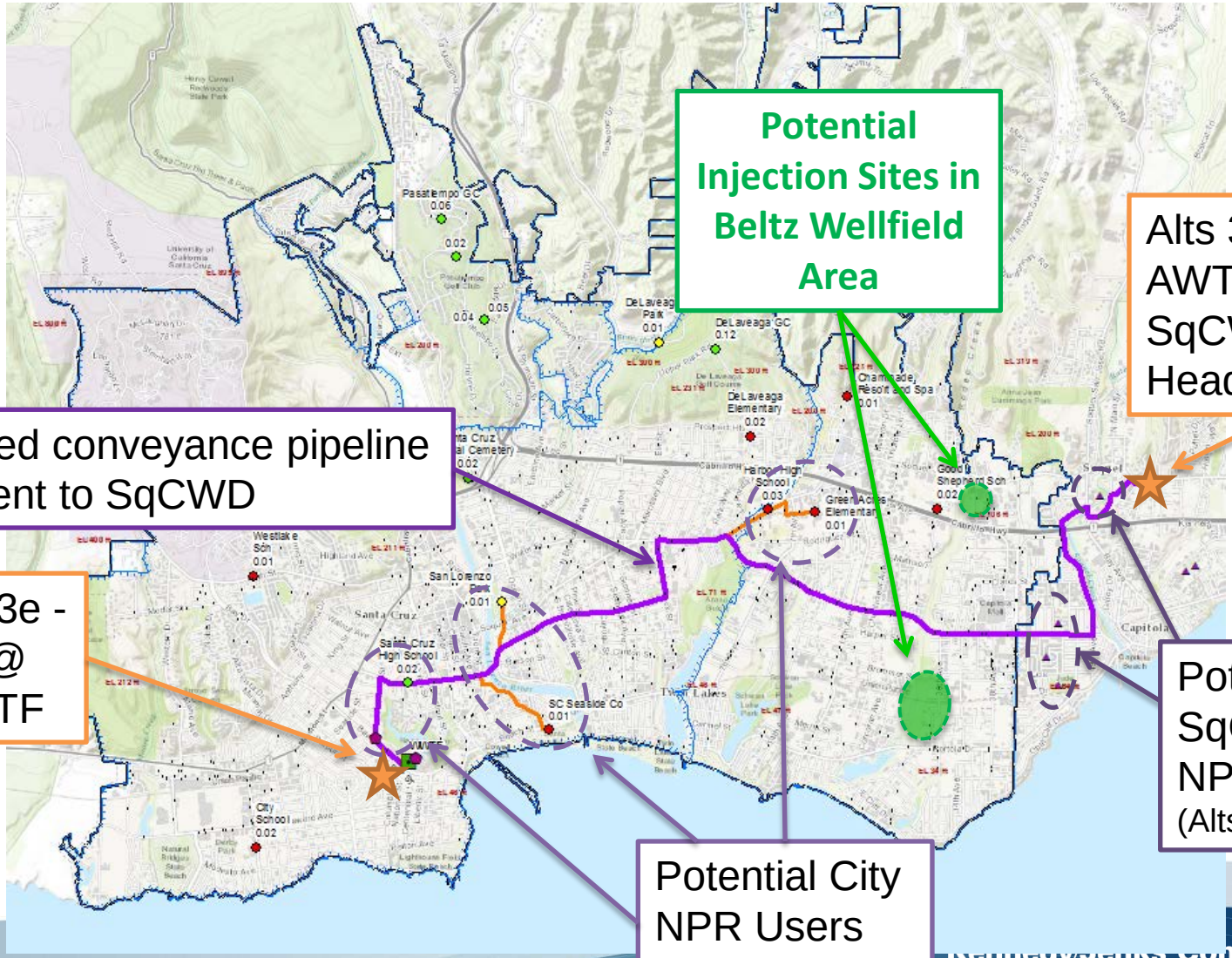
	Alt	Delivery to SqCWD	Use in Santa Cruz	Major Facilities in Santa Cruz
AWTF @ SqCWD Headquarters	3a	1.7 mgd secondary	None	Pump Station (PS) at SCWWTF, pipeline to SqCWD
	3b	1.7 mgd tertiary	0.12 mgd NPR (~30 sites)	Tertiary Treatment and PS at SCWWTF, pipeline to SqCWD, distribution pipelines to customer sites
	3c	> 1.7 mgd secondary	~TBD* mgd for GRR	PS at SCWWTF, pipeline to SqCWD, pipeline from SqCWD to GW injection sites, GW injection wells
AWTF @ SCWWTF	3d	1.3 mgd purified	0.12 mgd NPR	AWTF and PS at SCWWTF, pipeline to SqCWD, distribution pipelines to customer sites
	3e	1.3 mgd purified	0.12 mgd NPR + TBD* mgd for GRR	AWTF and PS at SCWWTF, pipeline to SqCWD, distribution pipelines to customer sites and GW injection sites, GW injection wells

**Injection capacity and siting study underway to estimate potential for GRR in Beltz Wellfield*

Other Considerations

- Beneficial reuse of ww to maintain GW levels
- Coordination required between multiple agencies
- Interagency infrastructure challenges (ownership, ops, construction, etc)
- Potential for cost-sharing and pursuing funding as a region
- Future studies needed

Alt 3 - Santa Cruz Participation in a SqCWD-led GWRR



Alt 4 - Santa Cruz GRRP

Alt 4a - AWTF at SC WWTF

- **Description:** independent GRRP in Santa Cruz with an , Advance Water Treatment Facility (AWTF), at the SC WWTF (or a nearby location)
- **Source:** Santa Cruz WWTF
- **Project Size:** Groundwater recharge (TBD mgd) based on injection capacity and siting study underway
- **Uses:** Groundwater recharge and irrigation
- **Major Facilities:** AWTF, conveyance and distribution pipelines, pump stations, injection wells, brine discharge via connection to existing ocean outfall

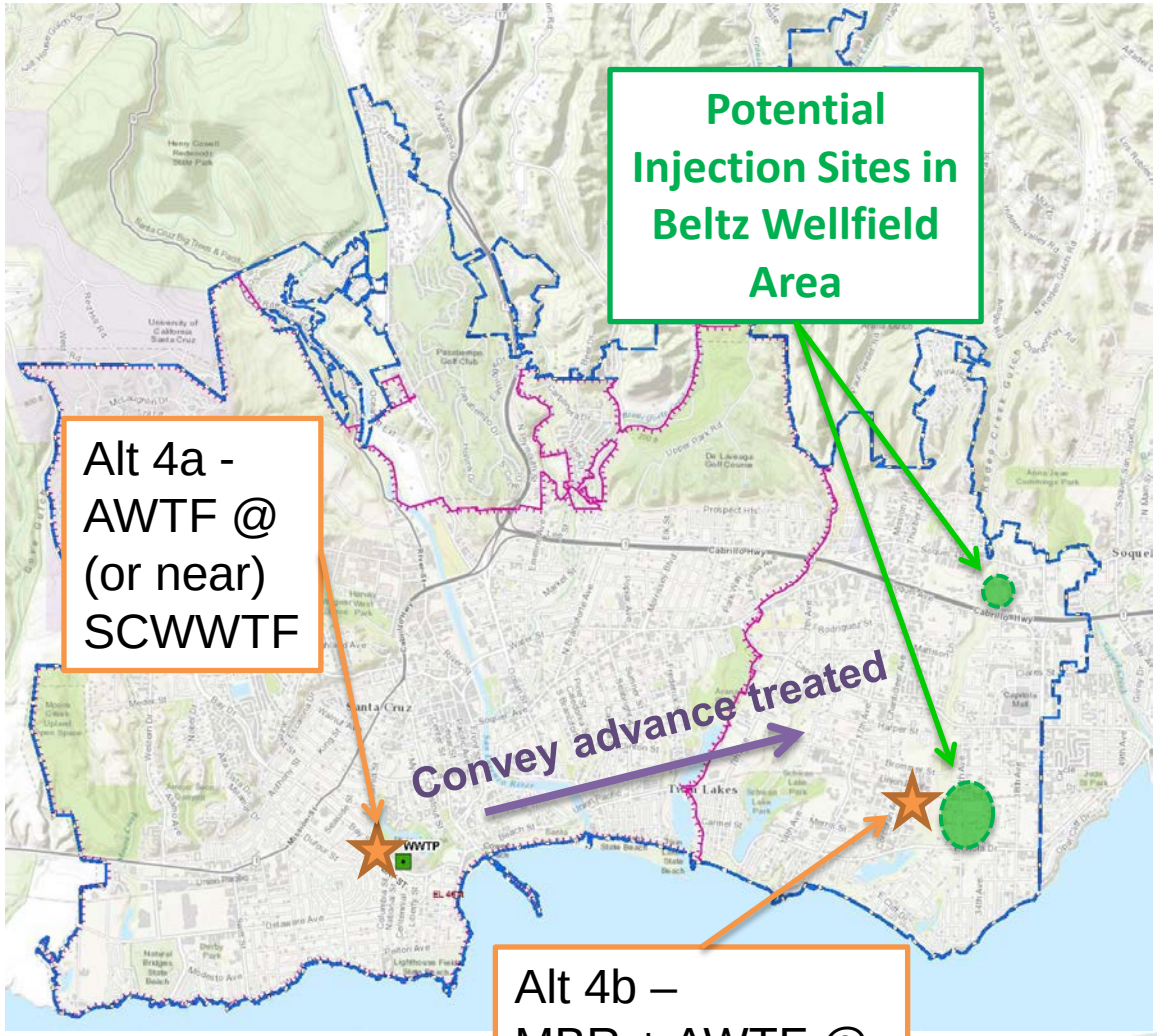
Alt 4 - Santa Cruz GRRP

Alt 4b – MBR + AWTF

- **Description:** independent GRRP in Santa Cruz with a satellite treatment facility at the DA Porath Pump Station
- **Source:** Santa Cruz County wastewater collection system
- **Project Size:** Groundwater recharge (TBD* mgd) based on injection capacity and siting study underway
- **Uses:** Groundwater recharge only
- **Major Facilities:** Membrane Bioreactor (MBR) for tertiary treatment, AWTF, conveyance and distribution pipelines, pump stations, injection wells, brine discharge via sewer or connection to existing ocean outfall

**Injection capacity and siting study underway to estimate potential for GRR in Beltz Wellfield*

Alt 4 - Santa Cruz GRRP



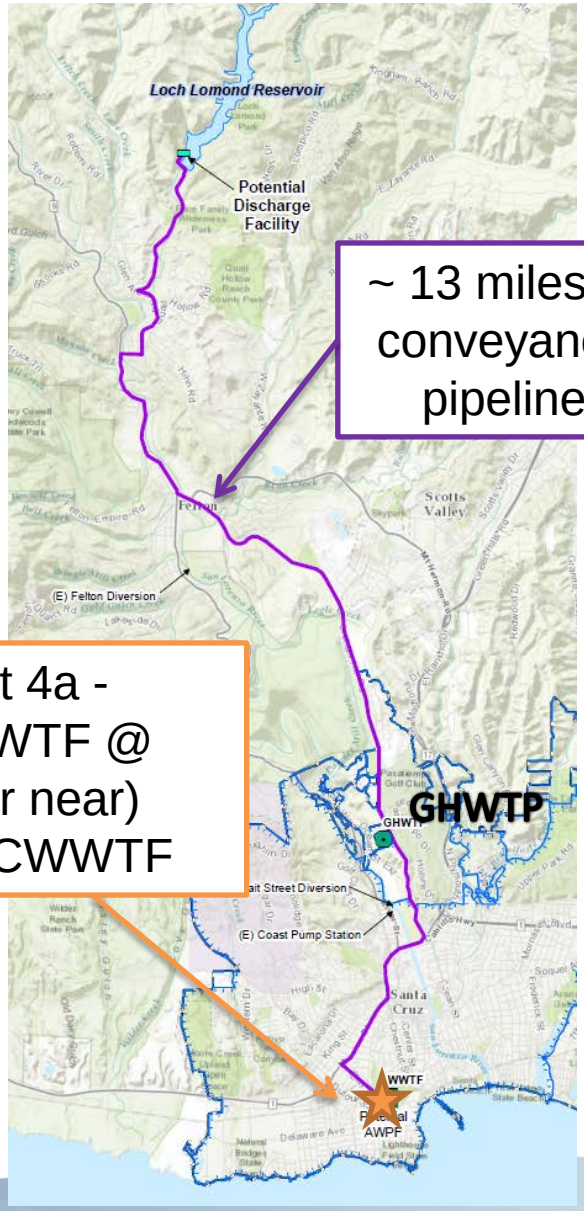
Other Considerations

- Maximizes beneficial reuse of wastewater in summer
- Maintaining GW levels
- Siting issues for MBR
- Operational complexity and energy for treatment
- Public acceptance uncertain
- Additional studies needed to confirm assumptions

Alt 5 – Surface Water Augmentation

- **Description:** Advanced treatment of Santa Cruz effluent for blending and storage in Loch Lomond, to be conveyed to the GHWTP and enter the City's potable water distribution system.
- **Source:** Santa Cruz WWTF
- **Project Size:** 3.2 mgd AWTF capacity
- **Uses:** Advanced treated water to augment Loch Lomond Reservoir when available capacity (1.6 to 3.2 mgd annual average)
- **Other Demands:** Phase 2 tertiary demand (0.25 mgd), secondary deliveries to SqCWD (1.7 mgd)
- **Major Facilities:** AWTF at SCWWTF (or at a nearby location), conveyance pipelines to Loch Lomond, pump station, discharge facility at reservoir, brine discharge via connection to existing ocean outfall

Alt 5 - Surface Water Augmentation



Other Considerations

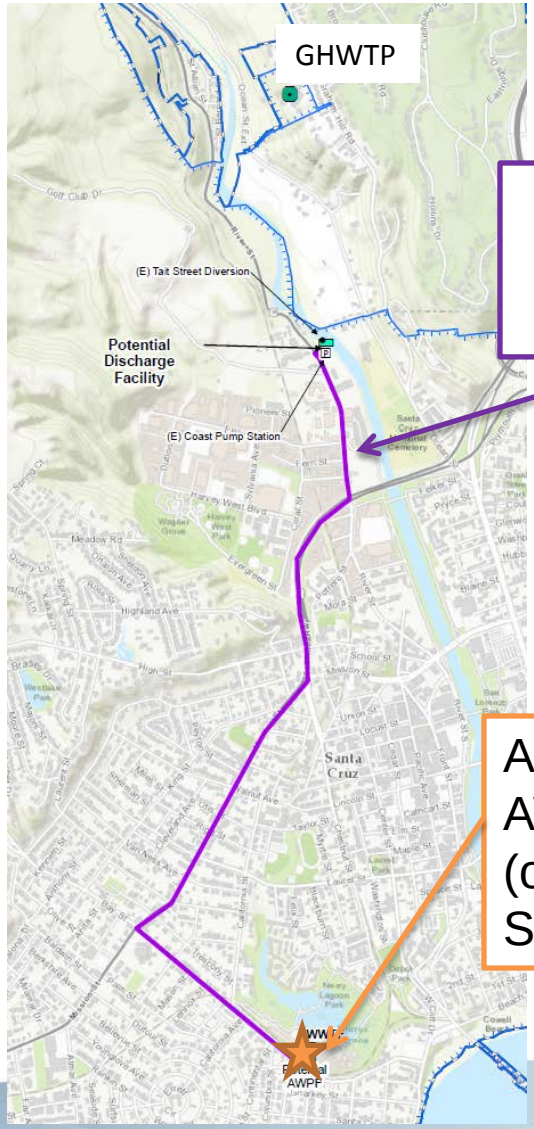
- Maximizes beneficial reuse of wastewater in summer
- Environmental benefits to maintaining lake levels
- Challenging but viable regulatory requirements
- Operational complexity for treatment and reservoir operations
- Significant energy for treatment and conveyance
- Public acceptance uncertain
- Additional studies needed to confirm assumptions

Alt 6 – Streamflow Augmentation

- **Description:** Augment San Lorenzo River flows to meet in stream flow requirements and maximize water supply.
- **Source:** Santa Cruz WWTF
- **Project Size:** 3.2 mgd AWTF capacity
- **Uses:** Advanced treated water to augment the San Lorenzo River in summer months only (ave annual ~1.6 mgd)
- **Other Demands:** Phase 2 tertiary demand (0.25 mgd), secondary deliveries to SqCWD (1.7 mgd)
- **Major Facilities:** AWTF at SCWWTF (or at a nearby location), conveyance pipelines to San Lorenzo River d/s of Tait Street Diversion, pump station, discharge facility, brine discharge via connection to existing ocean outfall

Alt 6 - Streamflow Augmentation

Direct Discharge to San Lorenzo River



~ 3 miles of conveyance pipeline

Alt 4a - AWTF @ (or near) SCWWTF

Other Considerations

- Potential to maximize beneficial reuse of wastewater in summer
- Benefits to providing fishery flows
- Regulatory viability is highly uncertain (TMDL/WQOs)
- Operational complexity for treatment
- Significant energy for treatment
- Public acceptance uncertain
- Proximity of point of discharge to Tait Street Diversion

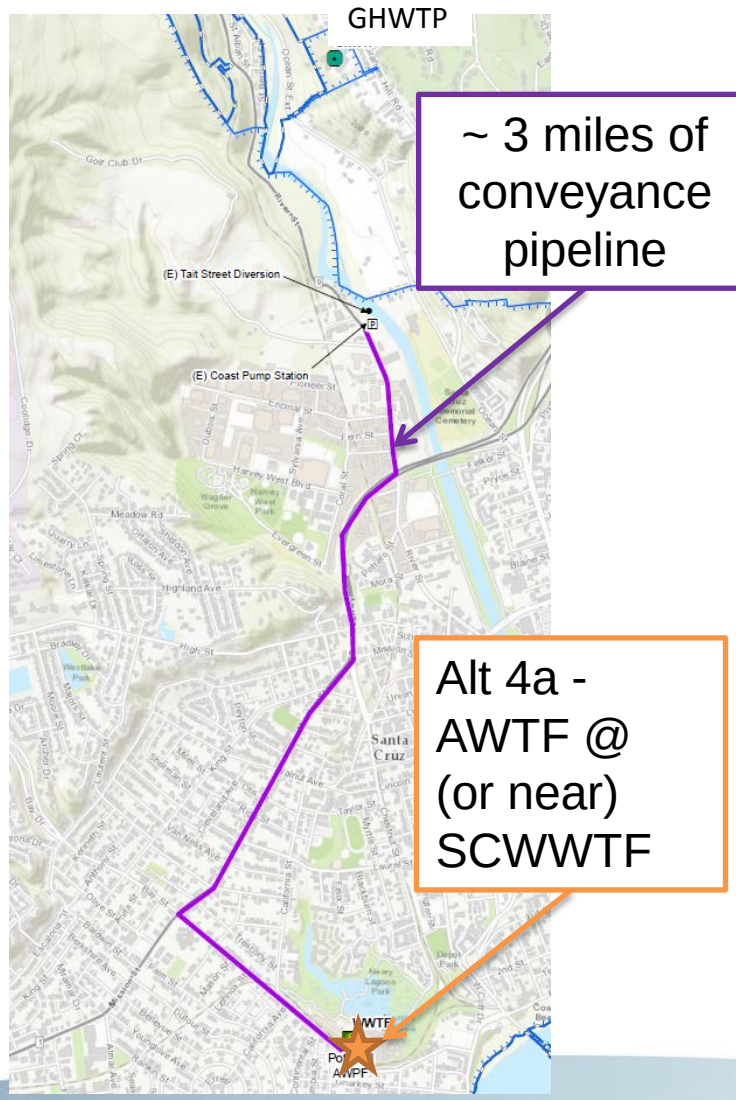
Alt 7 – Direct Potable Reuse

Raw Water Blending at Graham Hill WTP

- **Description:** Advanced treated water would be blended with raw water coming from city's other flowing sources for further treatment at the GHWTP prior to distribution as finished water.
- **Source:** Santa Cruz WWTF
- **Project Size:** 3.2 mgd AWTF capacity
- **Uses:** Advanced treated water to augment potable water supplies (3.2 mgd annual average)
- **Other Demands:** Phase 2 tertiary demand (0.25 mgd), secondary deliveries to SqCWD (1.7 mgd)
- **Major Facilities:** AWTF at SCWWTF (or at a nearby location), conveyance pipelines and connection to Coast Pump Station, pump station, brine discharge via connection to existing ocean outfall

Alt 7 – Direct Potable Reuse

Raw Water Blending at Graham Hill WTP



Other Considerations

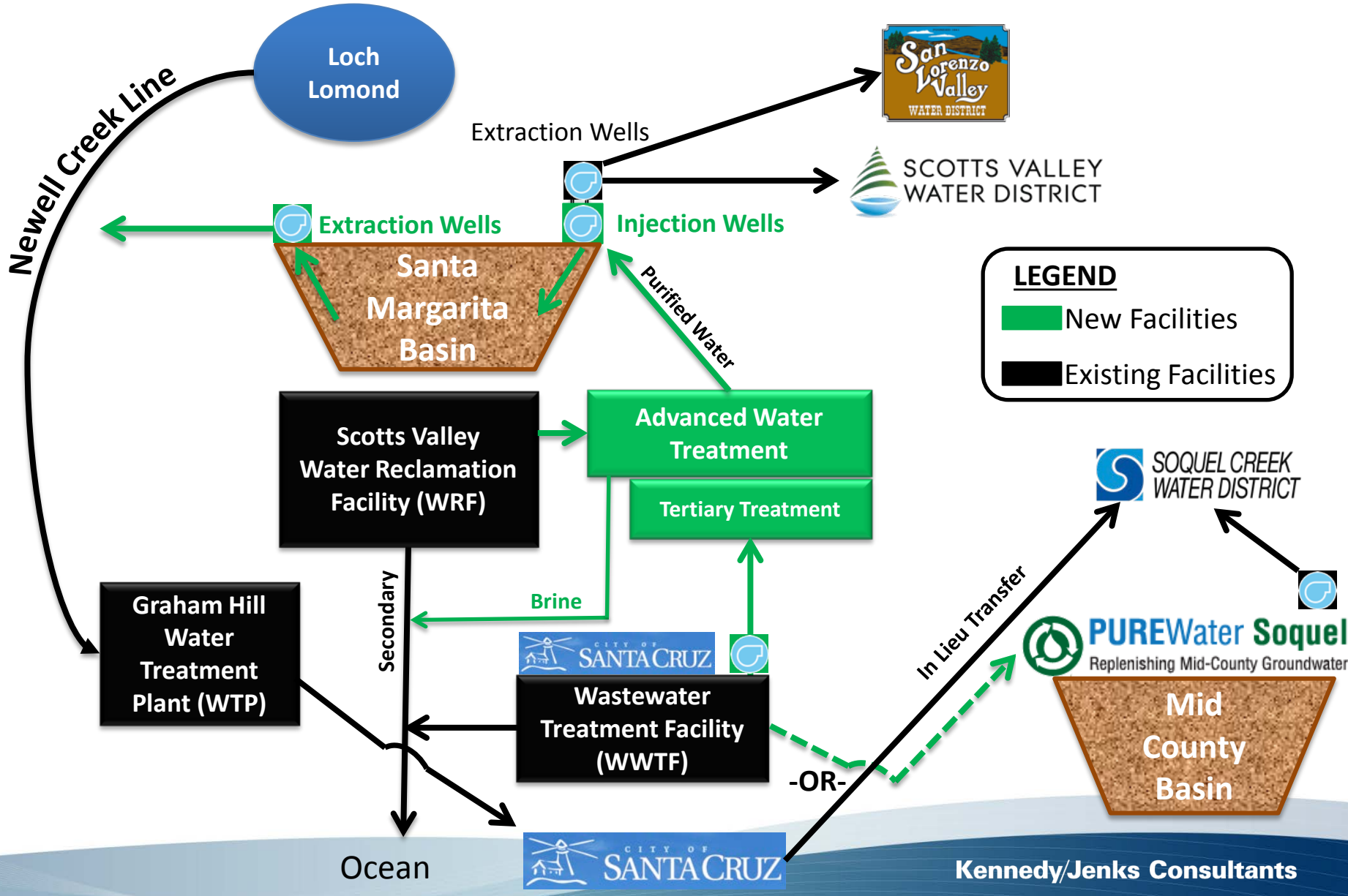
- Maximize beneficial reuse of wastewater year-round
- No DPR projects currently exist in California
- Existing regulations have not been developed
- Operational complexity for treatment
- Potential Impact on GHWTP source water issues (i.e. high turbidity, high TOC, DBPs, solids, etc)
- Significant energy for treatment
- Public acceptance uncertain
- Synergies between GHWTP investments and AWPF will impact siting and blending.

Alt 8 – Regional GRR Project

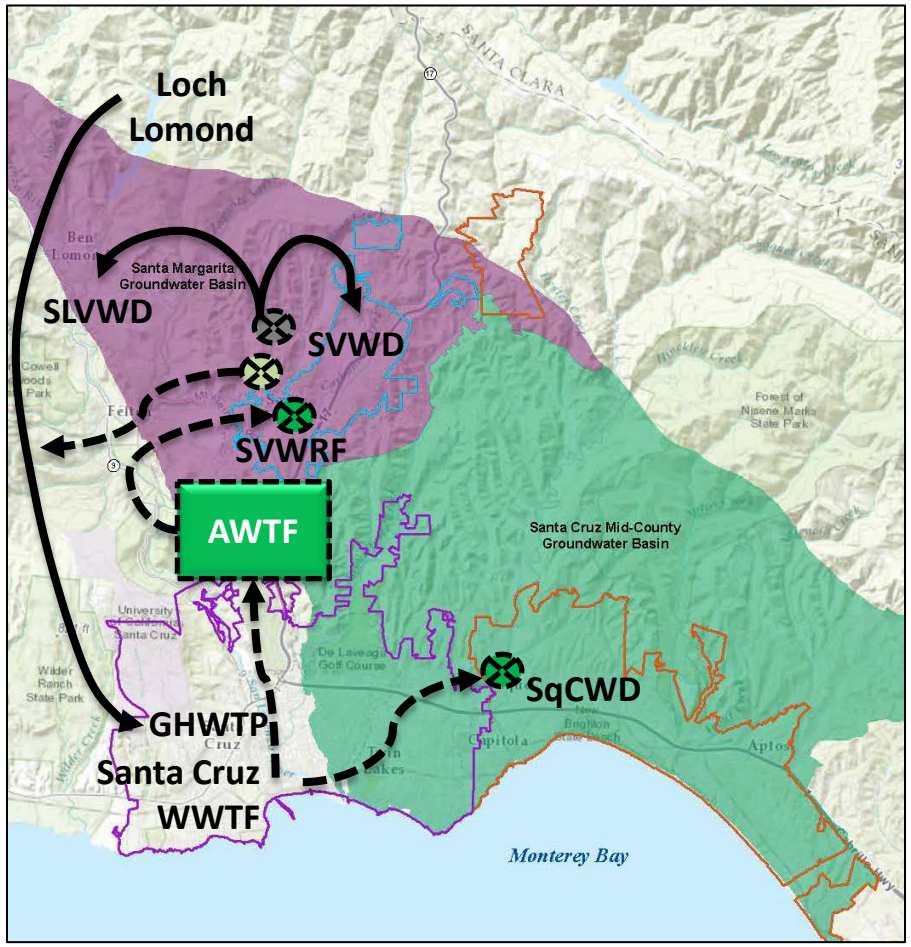
- **Description:** Regional AWTF to produce purified water for groundwater replenishment in the Santa Margarita Groundwater Basin. Utilize existing or new production wells to serve Santa Cruz, SVWD, SLVWD and SqCWD .
- **Source:** Santa Cruz WWTF + Scotts Valley WRF
- **Project Size:** Groundwater recharge (TBD* mgd) based on injection capacity and siting study underway
- **Uses:** Groundwater recharge only
- **Major Facilities:** AWTF, conveyance and distribution pipelines, pump stations, injection wells, production wells, brine discharge via the ocean outfall.

**Injection capacity and siting study underway to estimate potential for GRR in Santa Margarita Basin*

Alt 8 – Regional GRR Project



Alt 8 – Regional GRR Project



Other Considerations

- Maximizes beneficial reuse of wastewater in the Region
- Operational complexity for treatment
- Significant energy for treatment and conveyance
- Level of cooperation and coordination required between multiple agencies
- Interagency infrastructure challenges (ownership, operations, construction, etc)
- Potential for cost-sharing and pursuing funding as a region
- Water rights and transfer agreements
- Future studies needed

Next Steps

2017 Activities

- Feb Alternative Webinars Part 3 (GRR Beltz)
- Mar Alternative Webinars Part 4 (Regional Alts)
- Apr Scoring and Ranking Workshop
- Jun Recommended Facilities Plan Workshop
- Jul Draft RWFPS for SWRCB Review
- Sept Final RWFPS
- Dec SWRCB Grant Deadline

QUESTIONS

Water Reuse: Types, Treatment, and Regulations

Brian Pecson, Ph.D., P.E.

Trussell Technologies

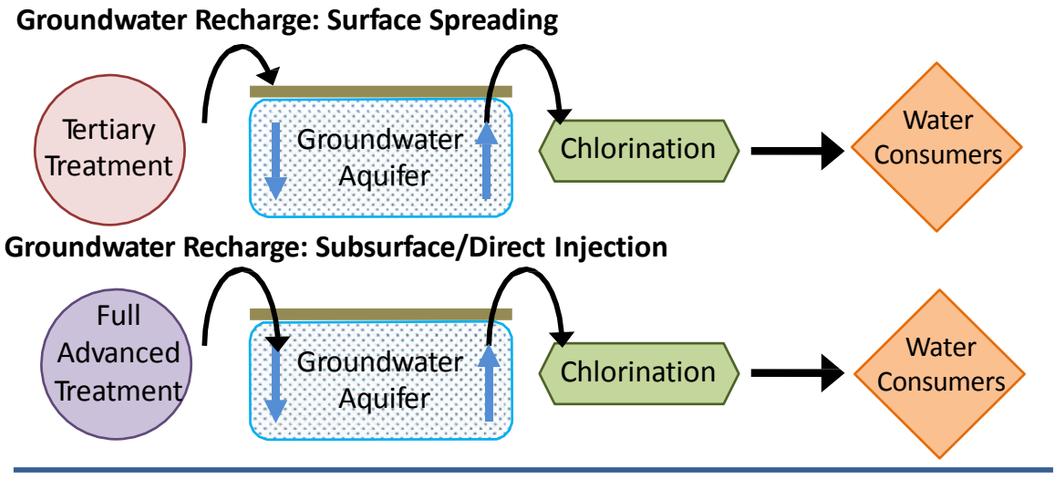
Water Commission Workshop

February 6, 2017

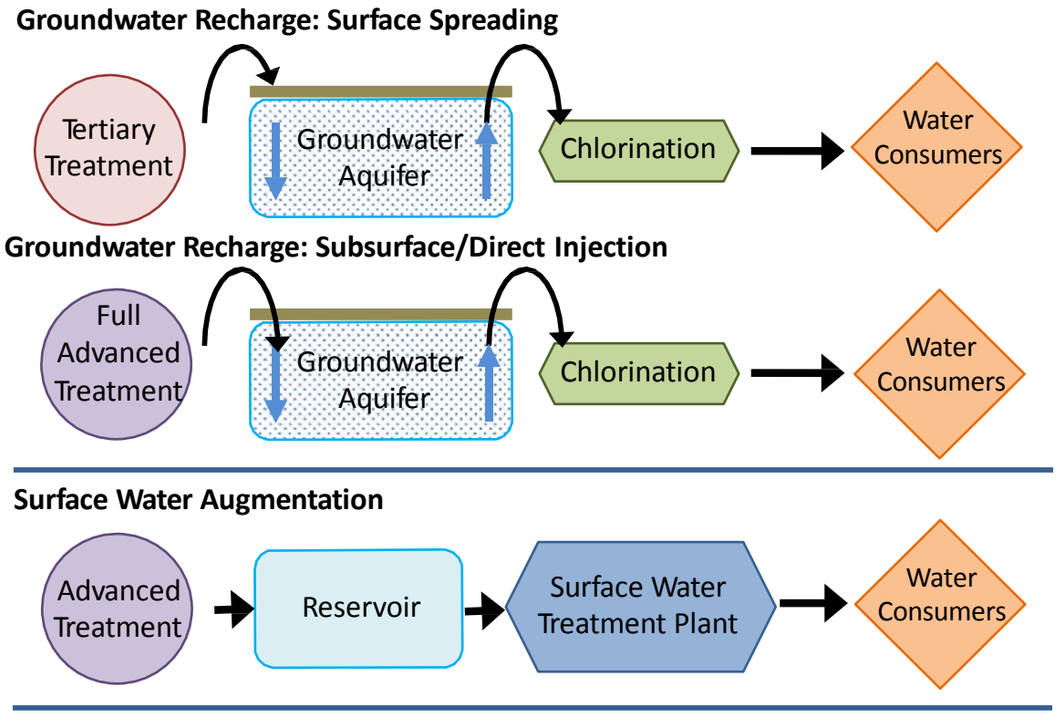

The Reuse Landscape is Changing
Non-Potable Reuse
Groundwater Recharge


The Reuse Landscape is Changing
Source Water Augmentation
Surface Water Augmentation
Flange-to-Flange DPR

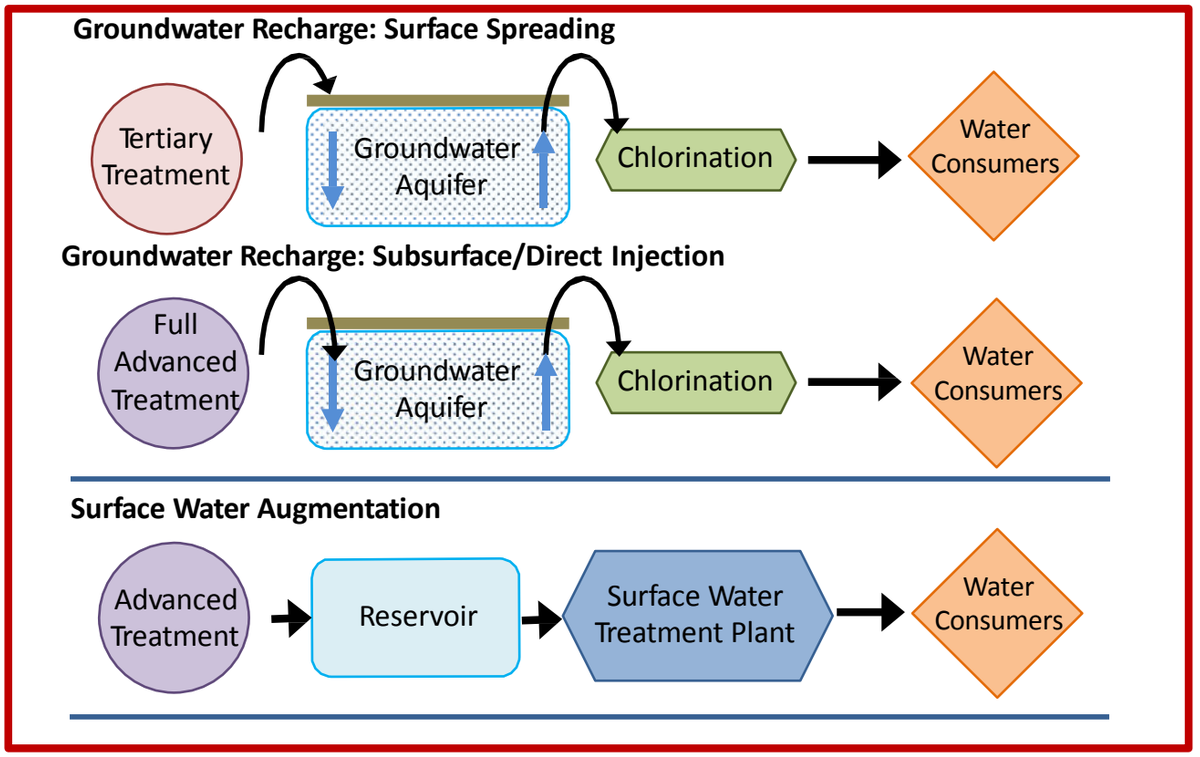
Types of Potable Reuse



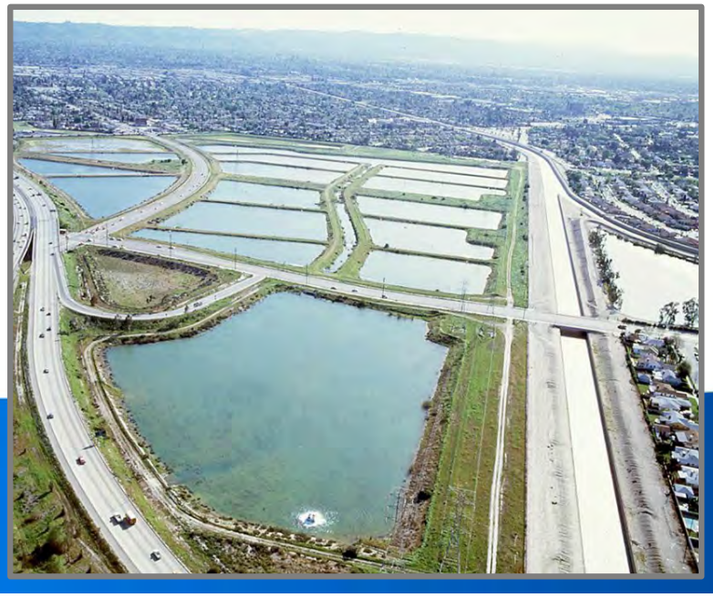
Types of Potable Reuse



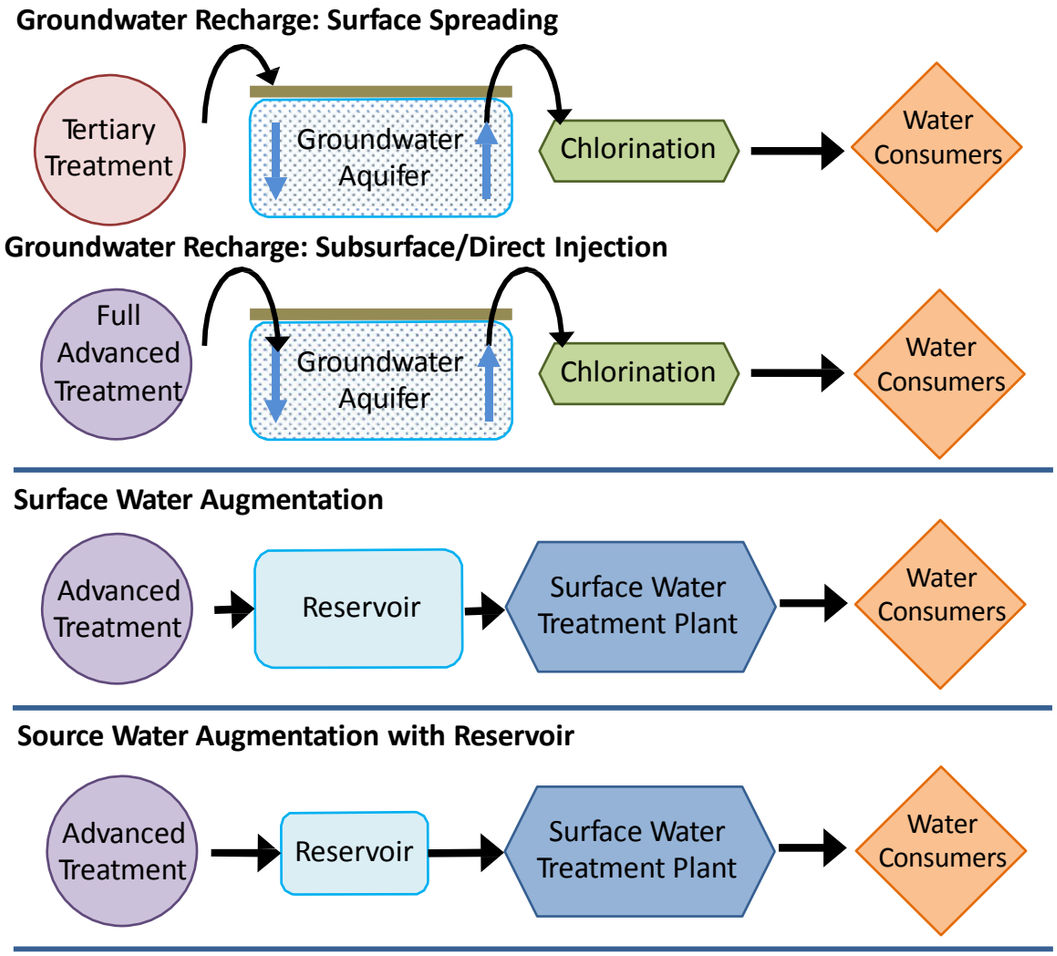
Types of Potable Reuse



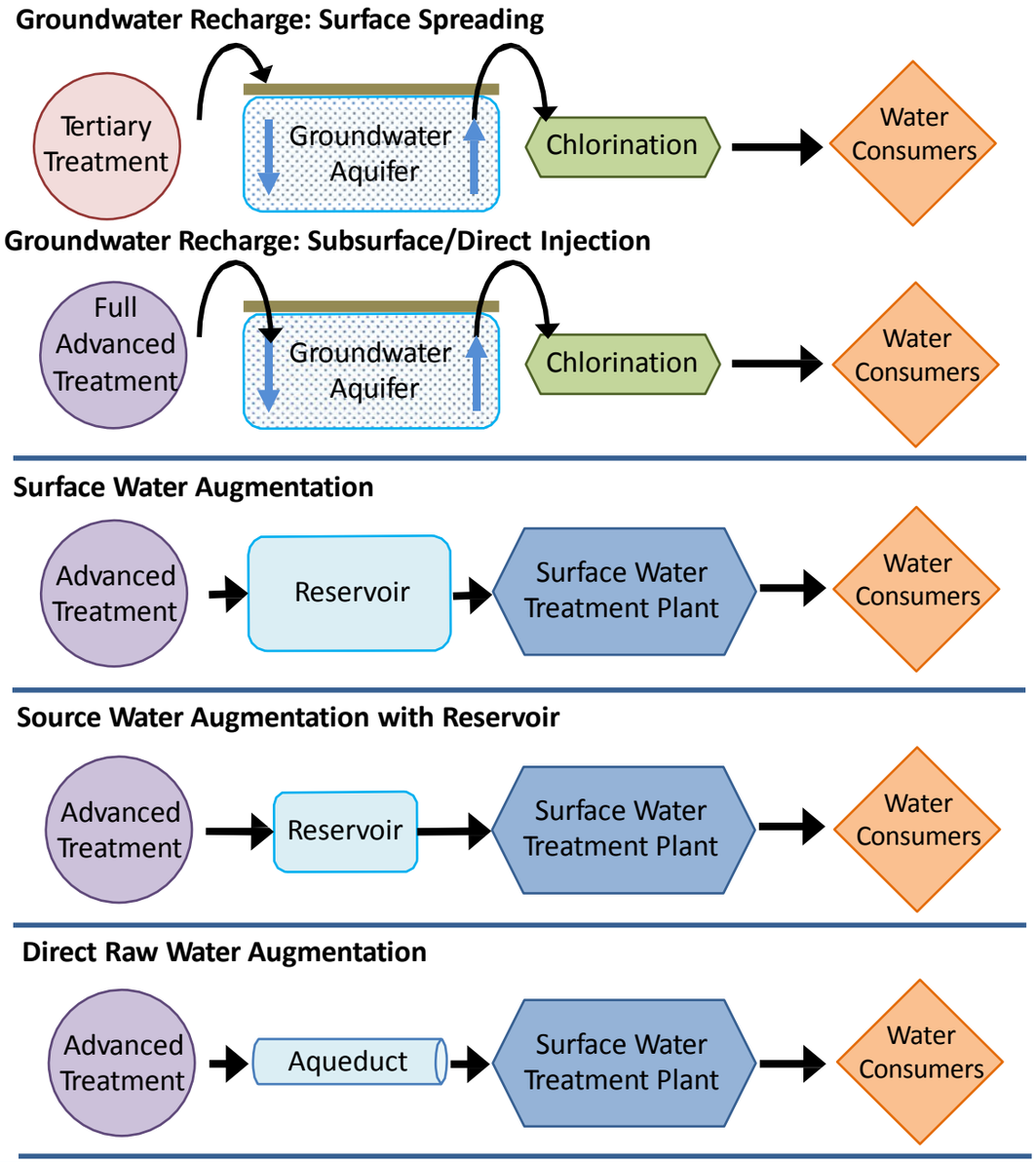
Indirect Potable Reuse



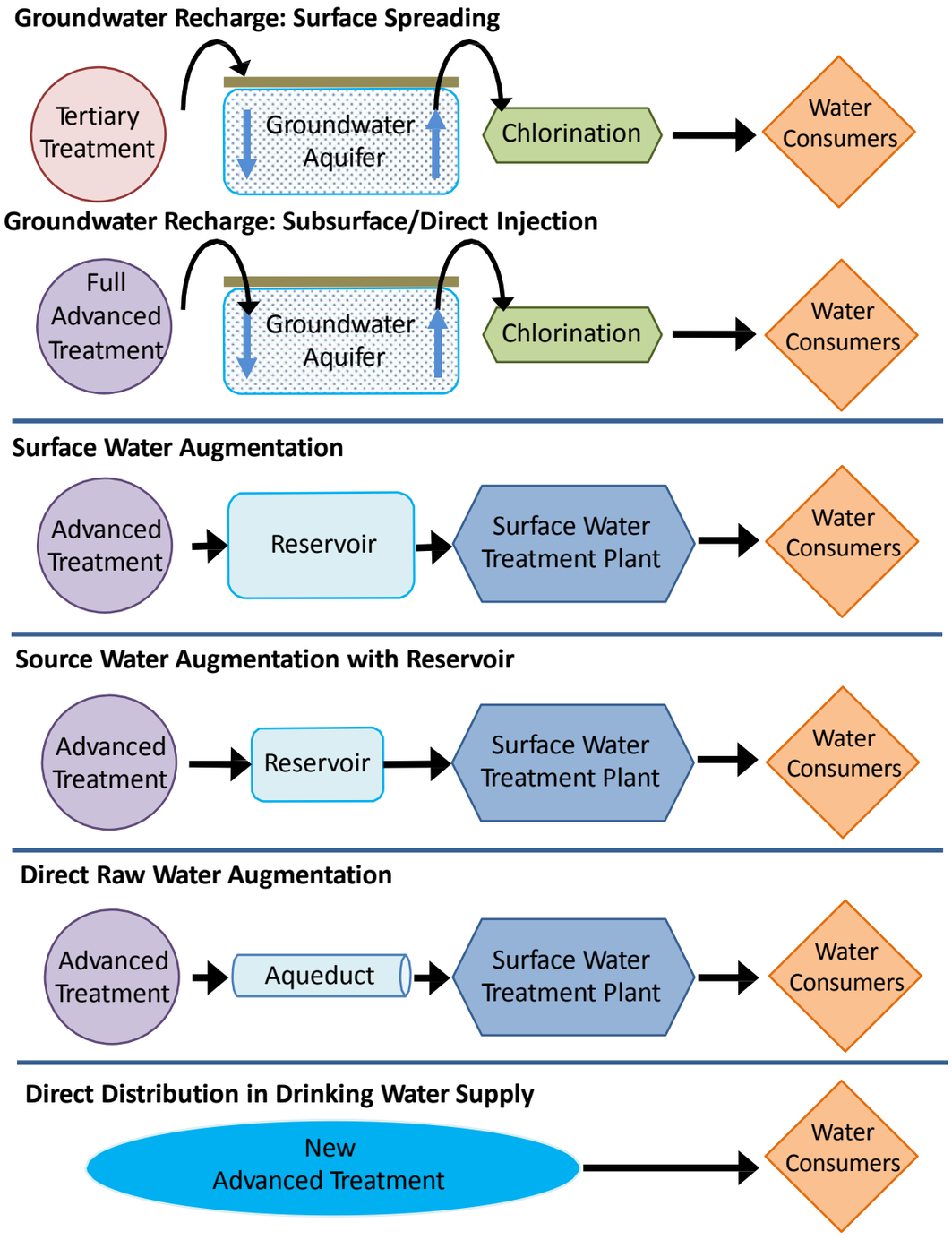
Types of Potable Reuse



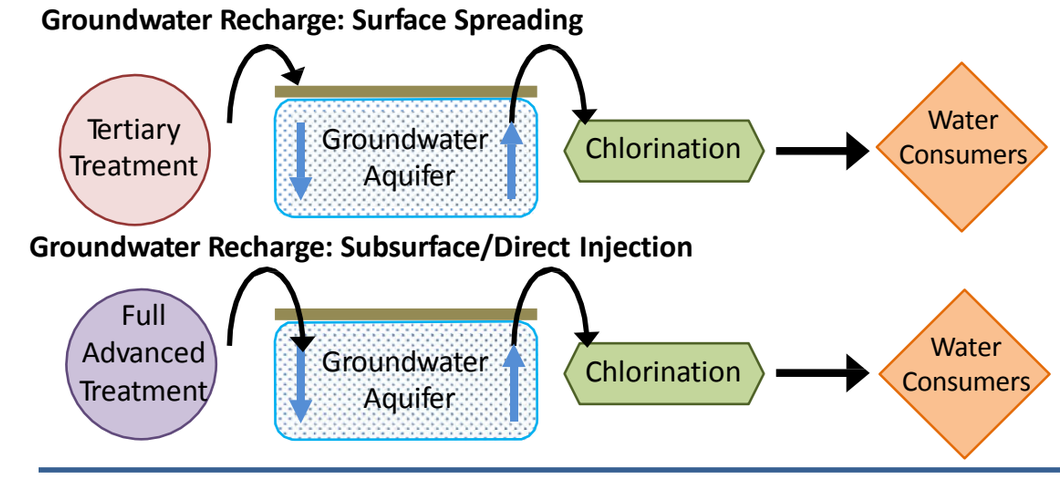
Types of Potable Reuse

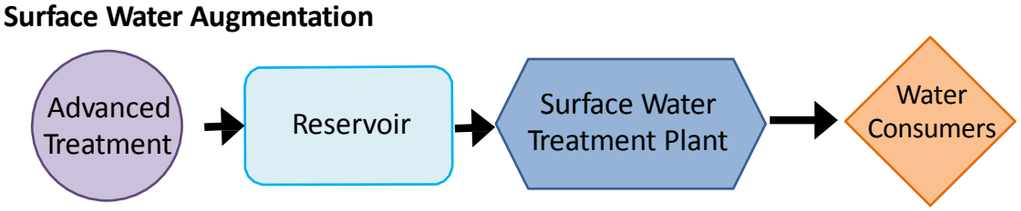


Types of Potable Reuse

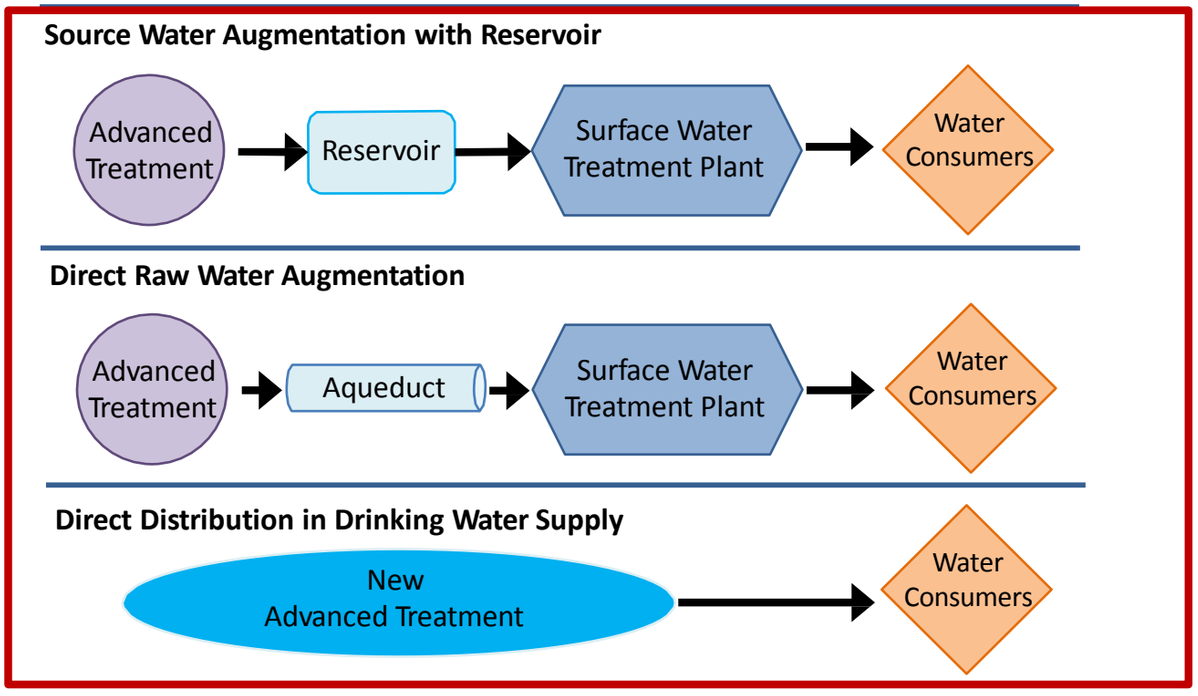


Types of Potable Reuse





Direct Potable Reuse



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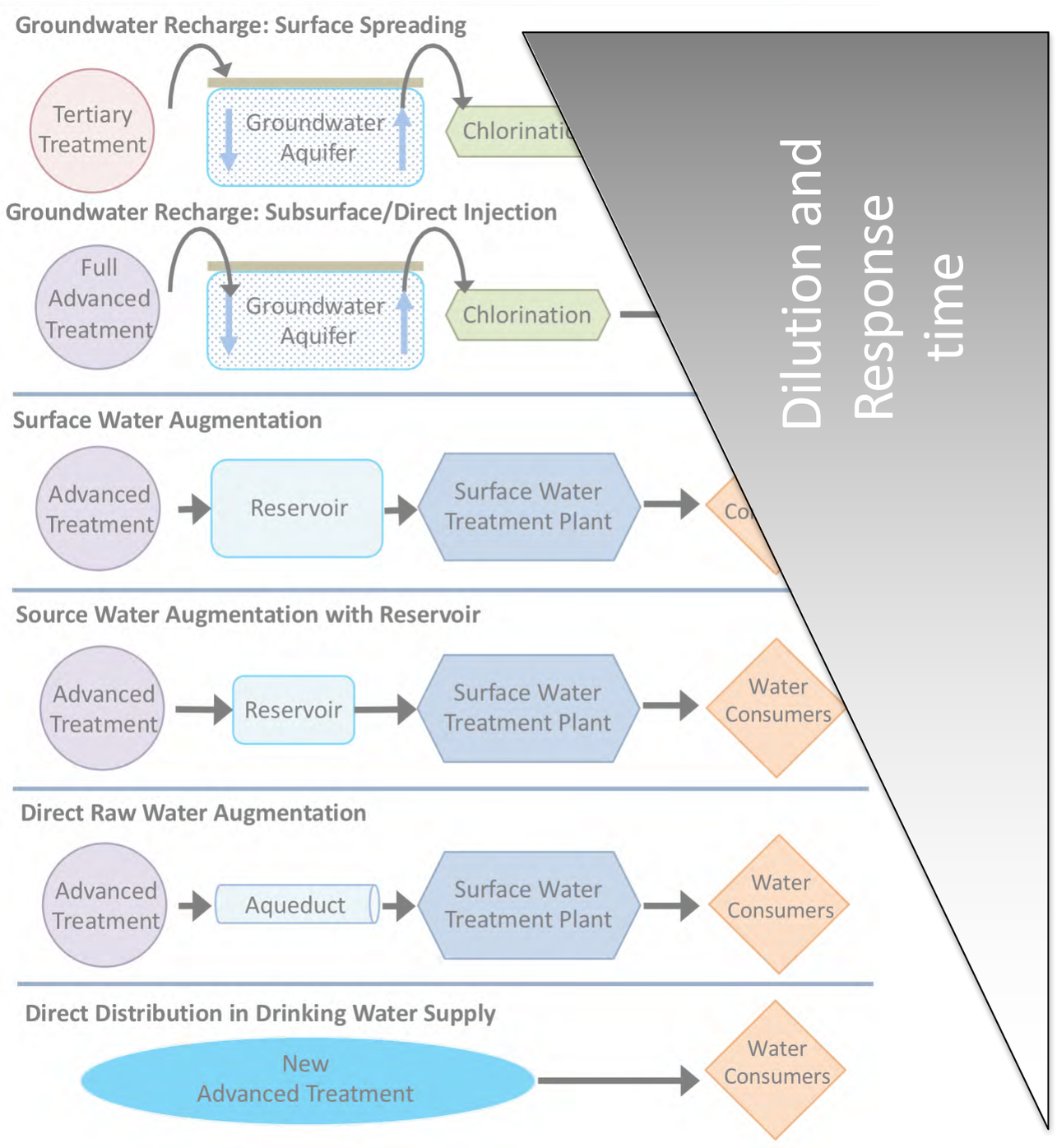
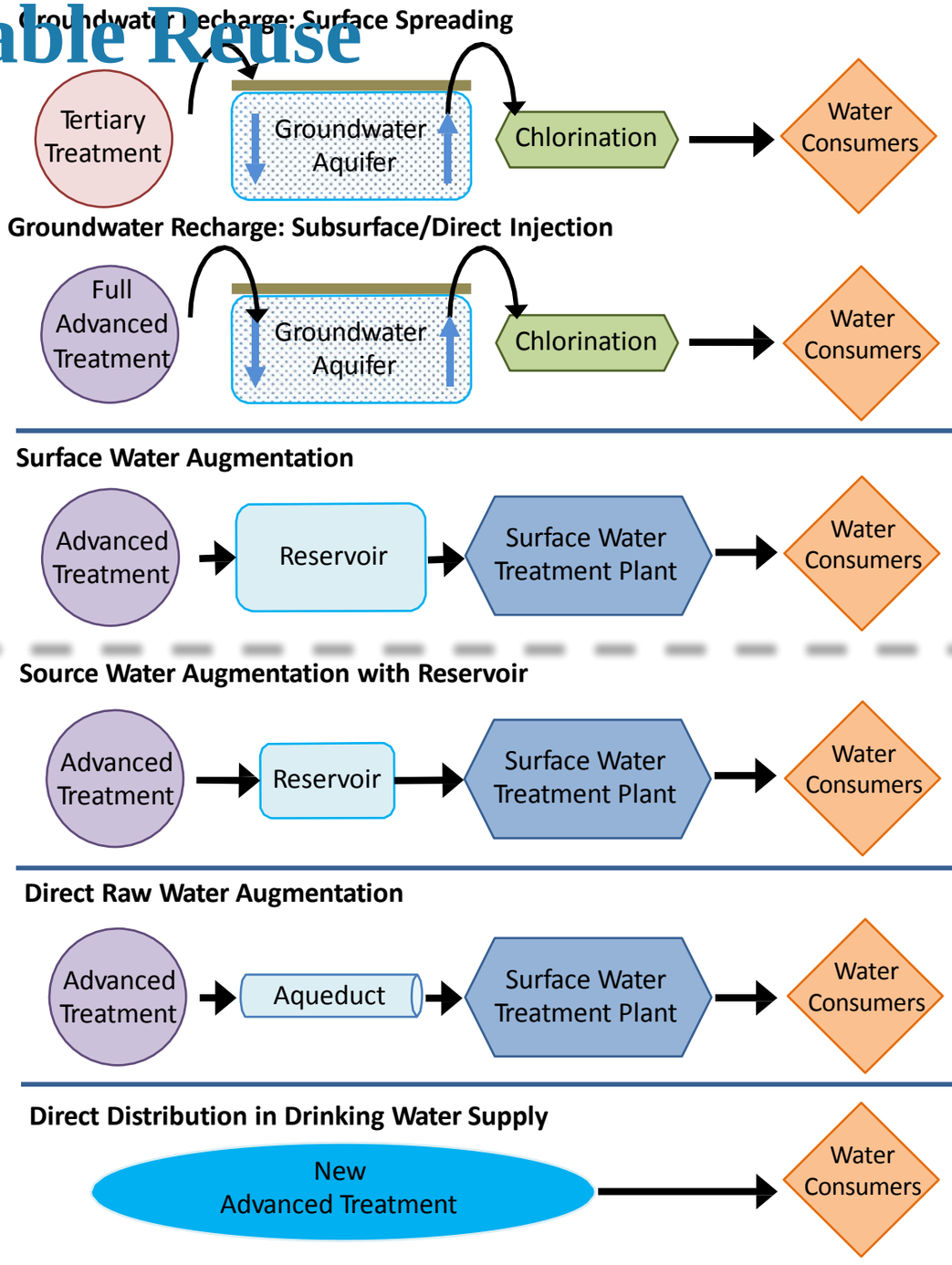


Types of Potable Reuse

Regulated Forms of Potable Reuse In CA

Future Forms of Potable Reuse Being Discussed



Public Health Protection

DPR must not harm public health!!!

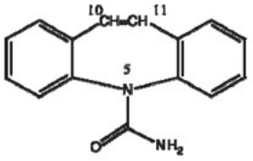
Public Health Protection

DPR must not harm public health!!!

Pathogens

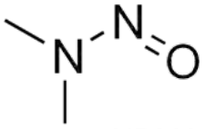


Chemicals



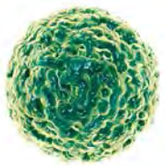
Carbamazepine

PFOS



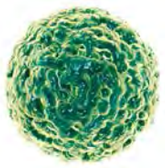
NDMA

Pathogens vs. Chemicals



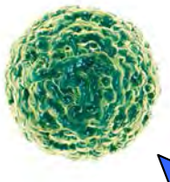
- Pathogen control: the most important aspect

Pathogens vs. Chemicals



- Pathogen control: the most important aspect

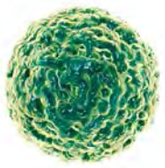
- Why is this the case?



Norovirus

Triclosan

Pathogens vs. Chemicals



- Pathogen control: the most important aspect

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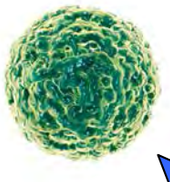
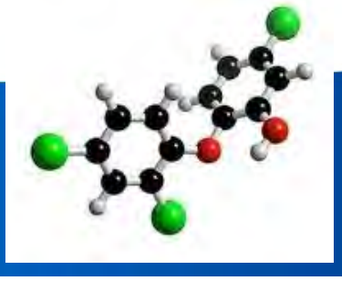


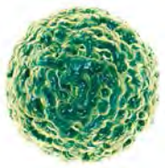
Norovirus

Triclosan



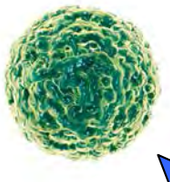
One time exposure

Pathogens vs. Chemicals



- Pathogen control: the most important aspect

- Why is this the case?



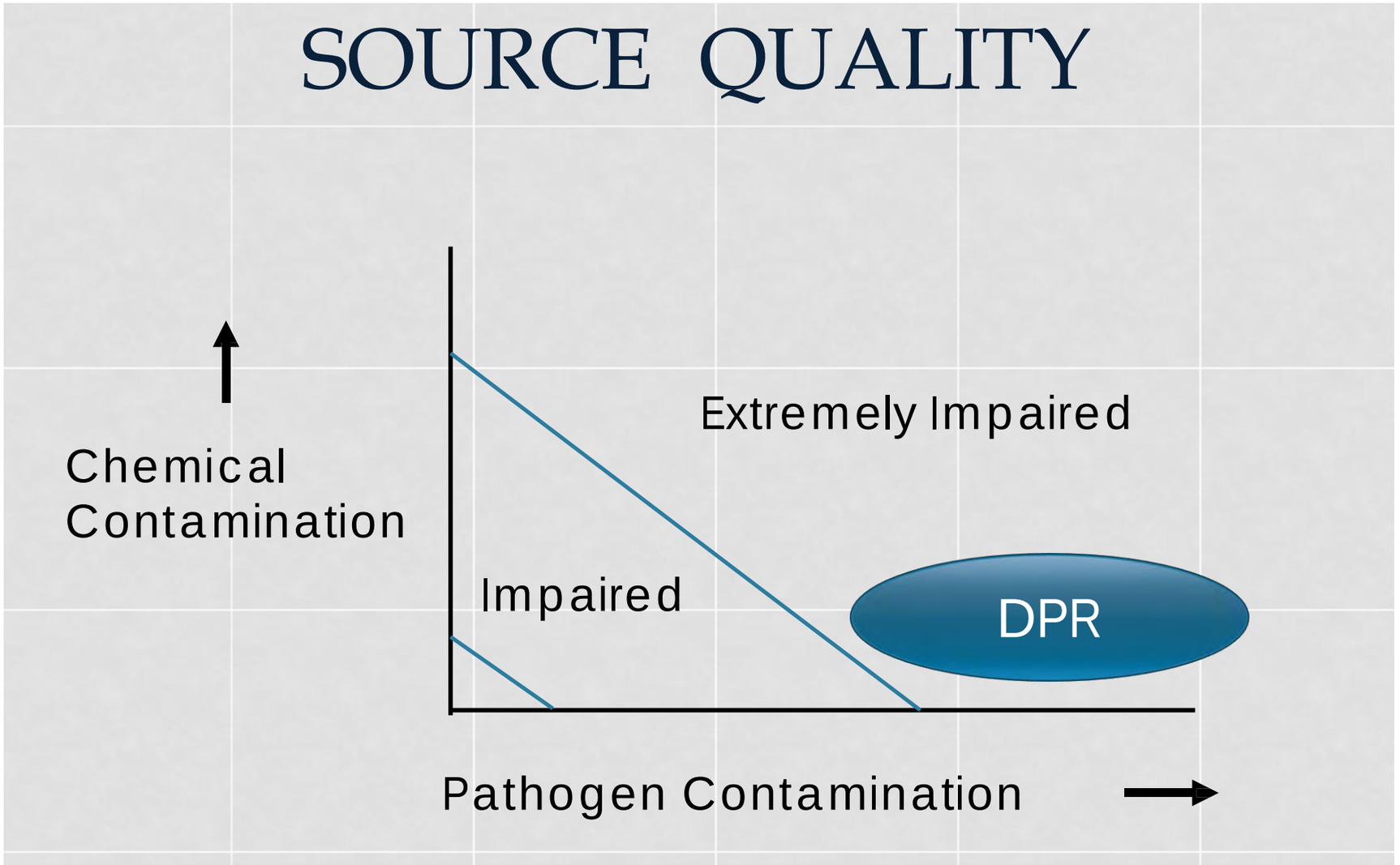
Norovirus

Triclosan

One time exposure

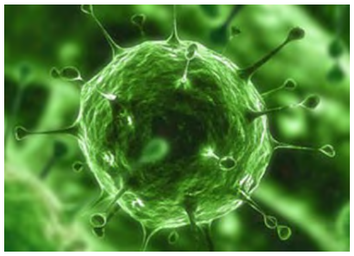
Lifetime Exposure

DDW Perspective on Risks



Courtesy of Bob Hultquist (DDW consultant)

GWR Pathogen Requirements



Virus: 12-log removal à 99.9999999999%

Giardia: 10-log removal à 99.99999999%

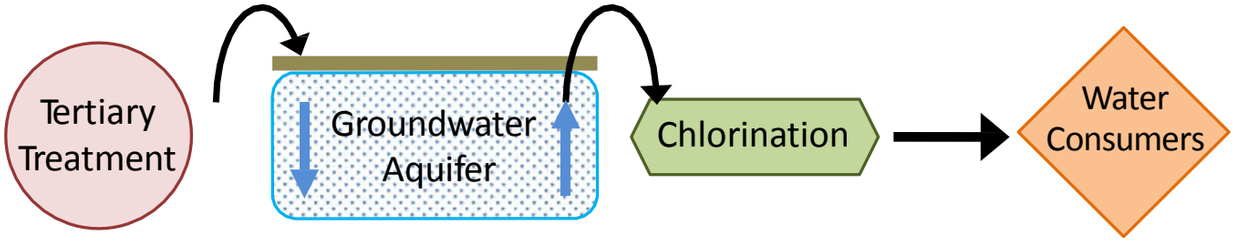
Crypto: 10-log removal à 99.99999999%

Also referred to as:

- Log Removal Value (LRV) for Virus/*Giardia*/*Crypto* (V/G/C)
- For example - 12/10/10 or >13/11/11

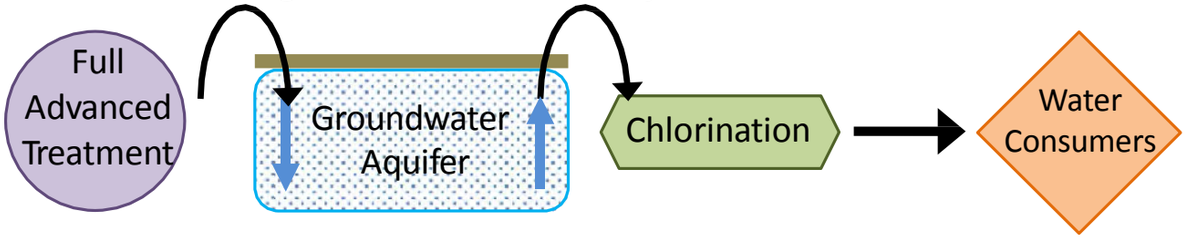
Groundwater Recharge

Groundwater Recharge: Surface Spreading



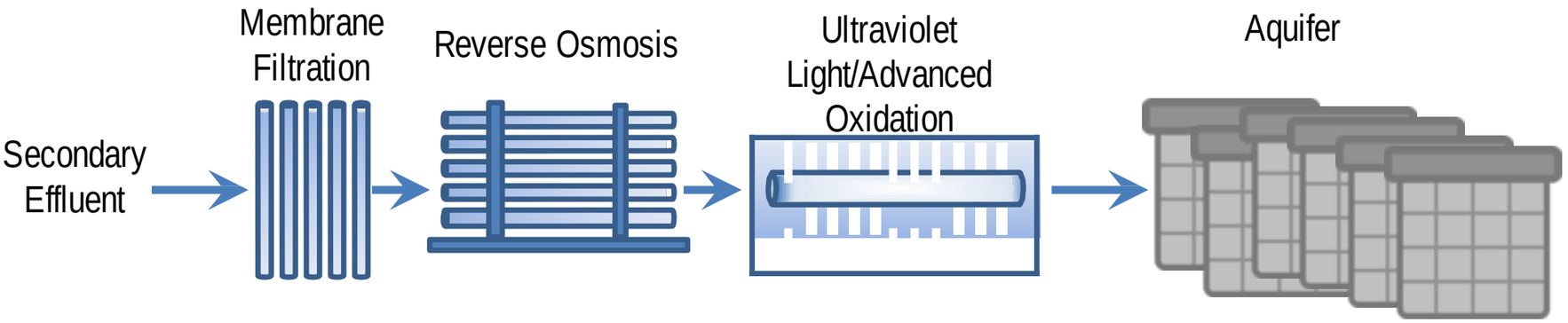
- Treatment: Tertiary filtration + disinfection
- Retention time: typically 6+ months

Groundwater Recharge: Subsurface/Direct Injection



- Treatment: Full Advanced Treatment (MF, RO, UV/AOP)
- Retention time: as low as 2 months

Full Advanced Treatment Train



17β-Estradiol

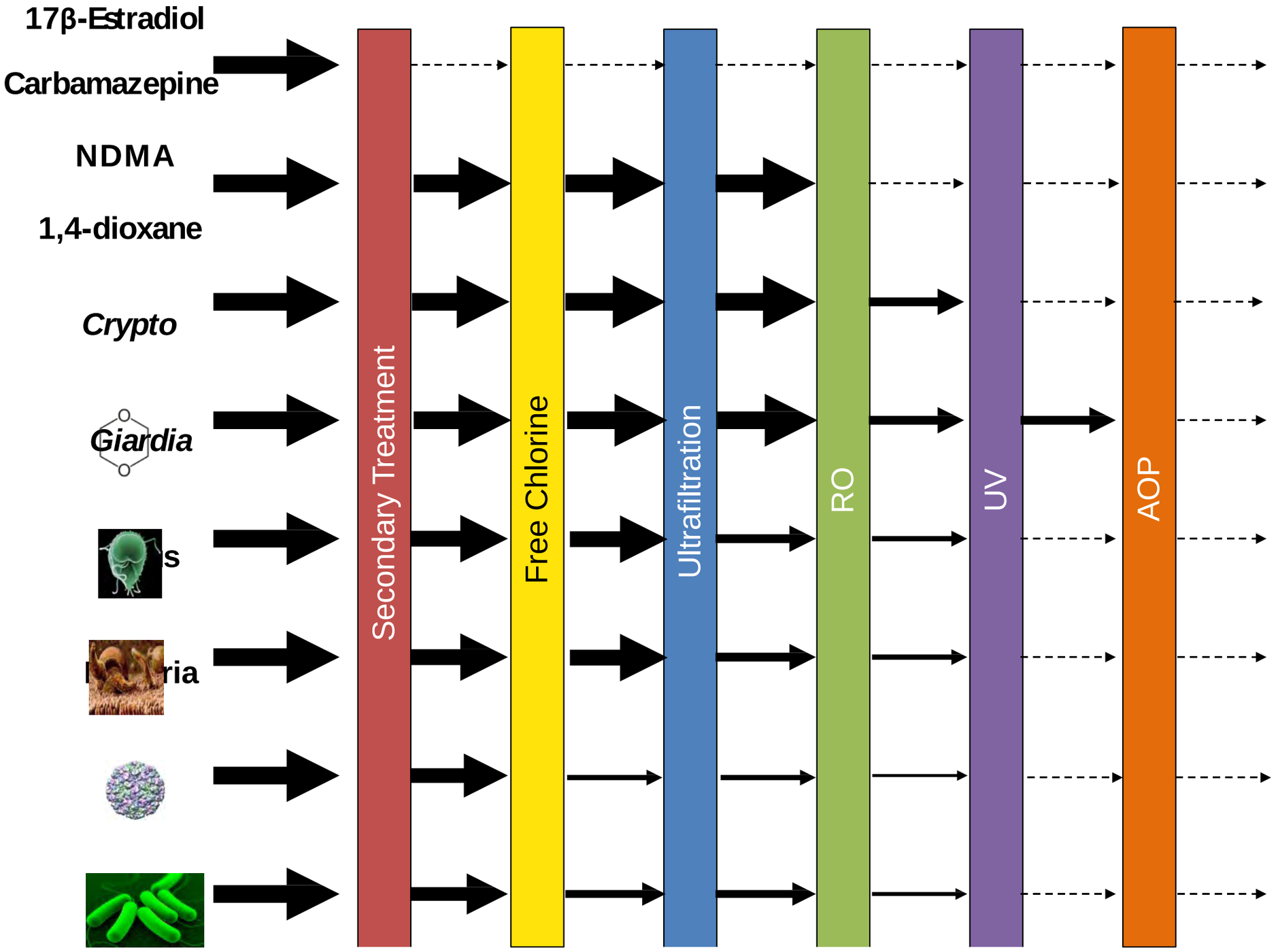
Carbamazepine

NDMA

1,4-dioxane

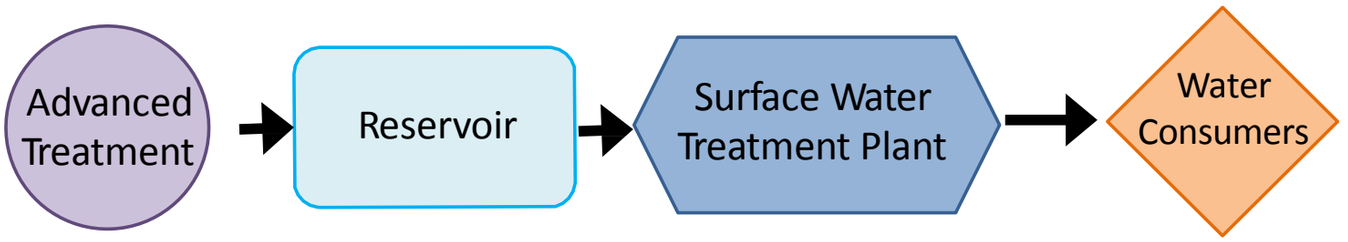
Crypto

Giardia


17β-Estradiol
Carbamazepine
NDMA
1,4-dioxane
Crypto
Giardia
Secondary Treatment
Free Chlorine
Ultrafiltration
RO
UV
AOP

Surface Water Augmentation

- Draft regulations to be released in early 2017…



Retention Time (V/Q)	Dilution	Treatment
Originally 6+ months, but as low as 2 months	Impacts level of required treatment	Includes both AWTF (with full advanced treatment) and DWTP
Based on monthly volume of aquifer (V) and monthly flow out (Q)	• 100-fold dilution, *or* • 10-fold with +1-log treatment	• 12/10/10 for V/G/C *or* • 13/11/11

First two SWA Projects both Pursuing V/Q < 6 months

San Diego

Demonstration Project

V/Q = 2 months

Miramar
6,000 AF

Q = 30 MGD

Padre Dam

Demonstration Project

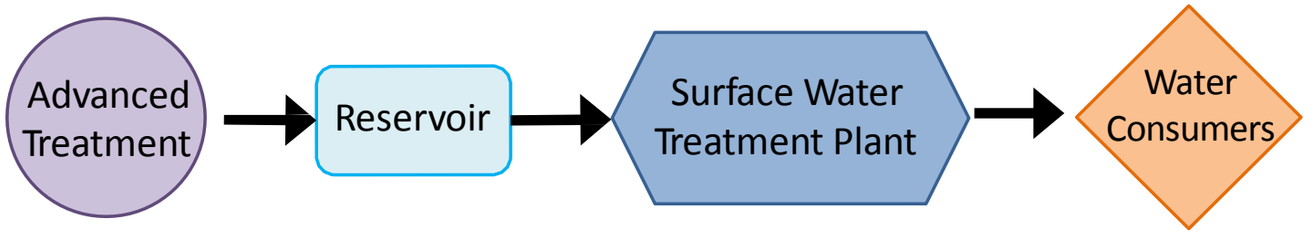
V/Q = 4 months

Jennings
8,000 AF

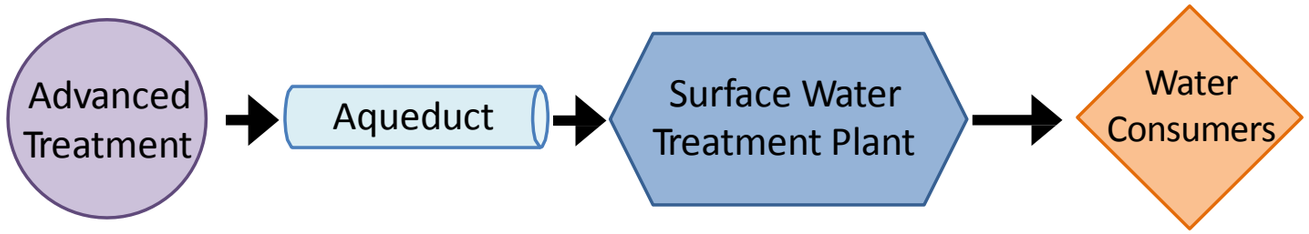
Q = 16 MGD

Direct Potable Reuse

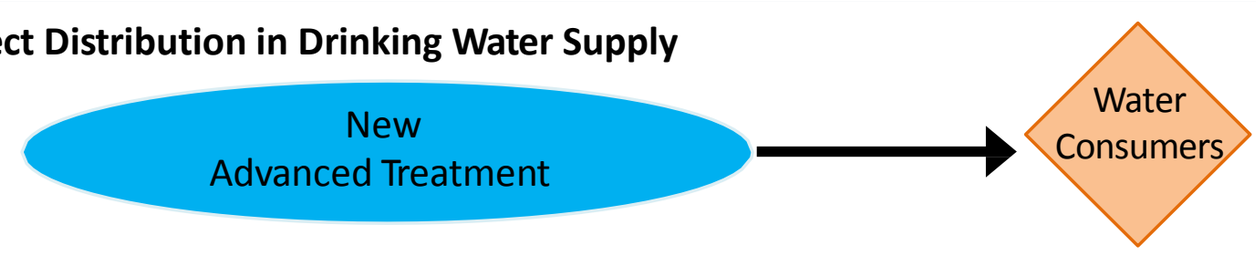
Source Water Augmentation with Reservoir



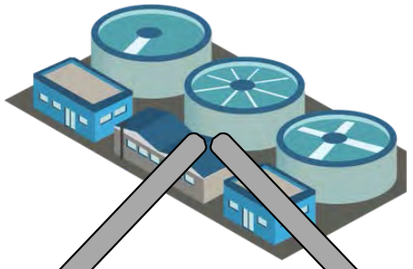
Direct Raw Water Augmentation



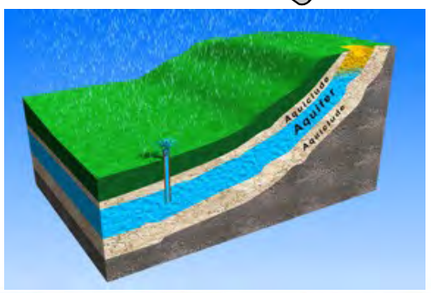
Direct Distribution in Drinking Water Supply



Why not stick with Indirect Potable Reuse?



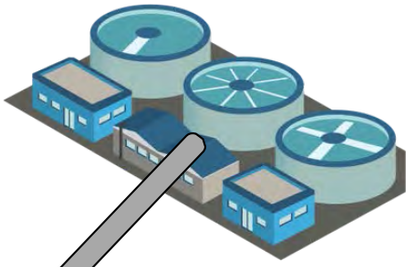
Aquifer



Reservoir

DPR has many benefits!

Lower Energy



Wider distribution

DPR

Lower Cost

Improved
Water Quality

California's Big Question

Division of Drinking Water (DDW)

Is it <u>feasible</u> to do potable reuse without an environmental buffer (DPR)?

California's Big Question

Division of Drinking Water (DDW)

Is it <u>feasible</u> to do potable reuse without an environmental buffer (DPR)?

California's Big Question

Division of Drinking Water (DDW)

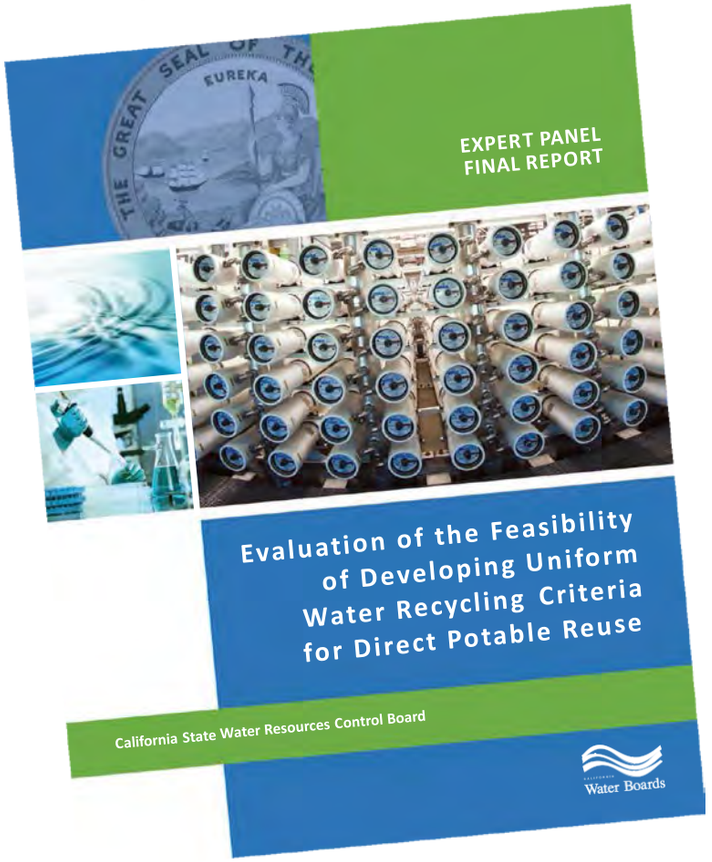
Is it <u>feasible</u> to do potable reuse without an environmental buffer (DPR)?

KEY QUESTION

Can we do DPR <u>safely</u>?

DPR Perspectives

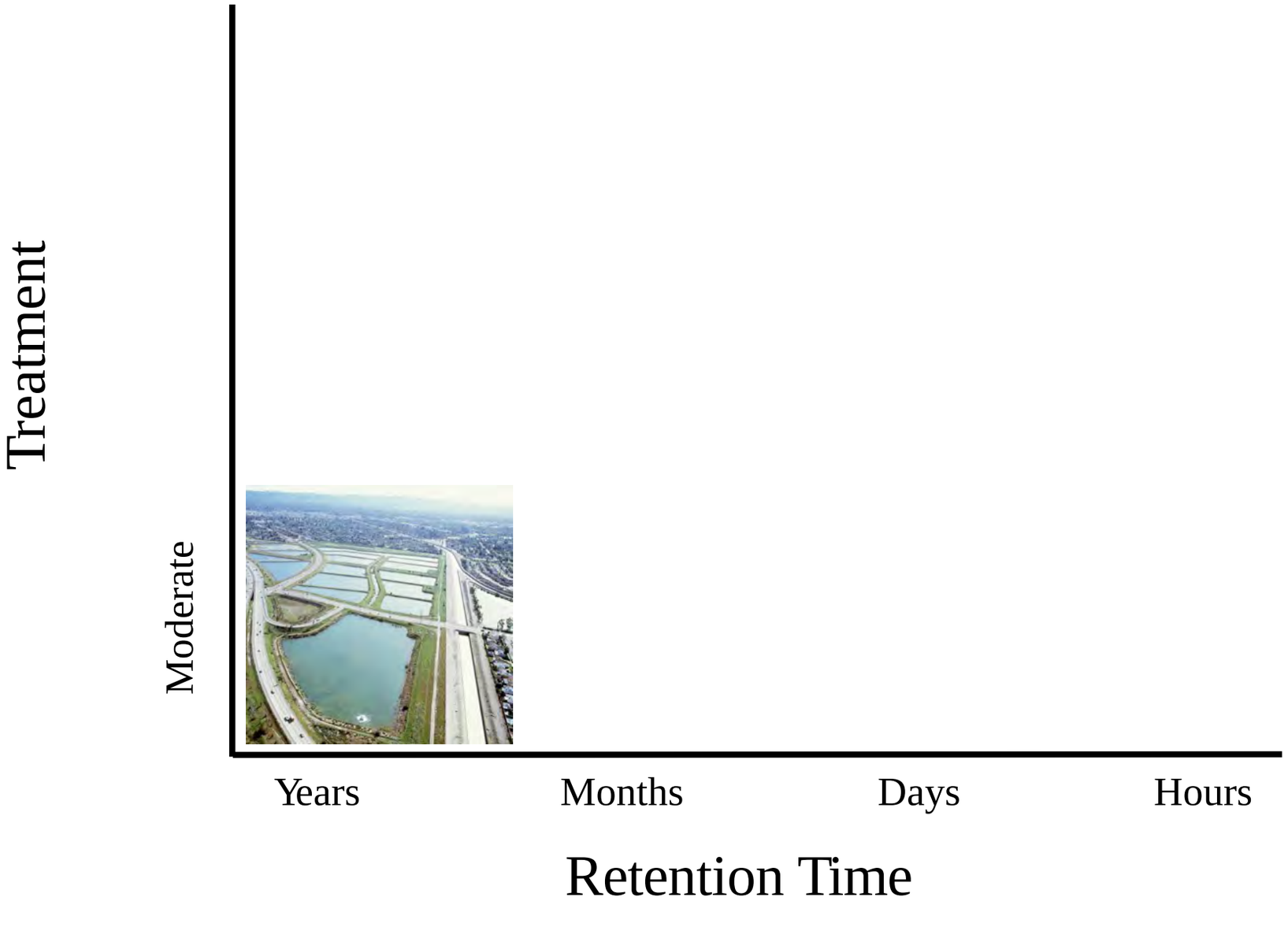
- CA State Expert Panel concluded it is feasible to create uniform regulations for DPR



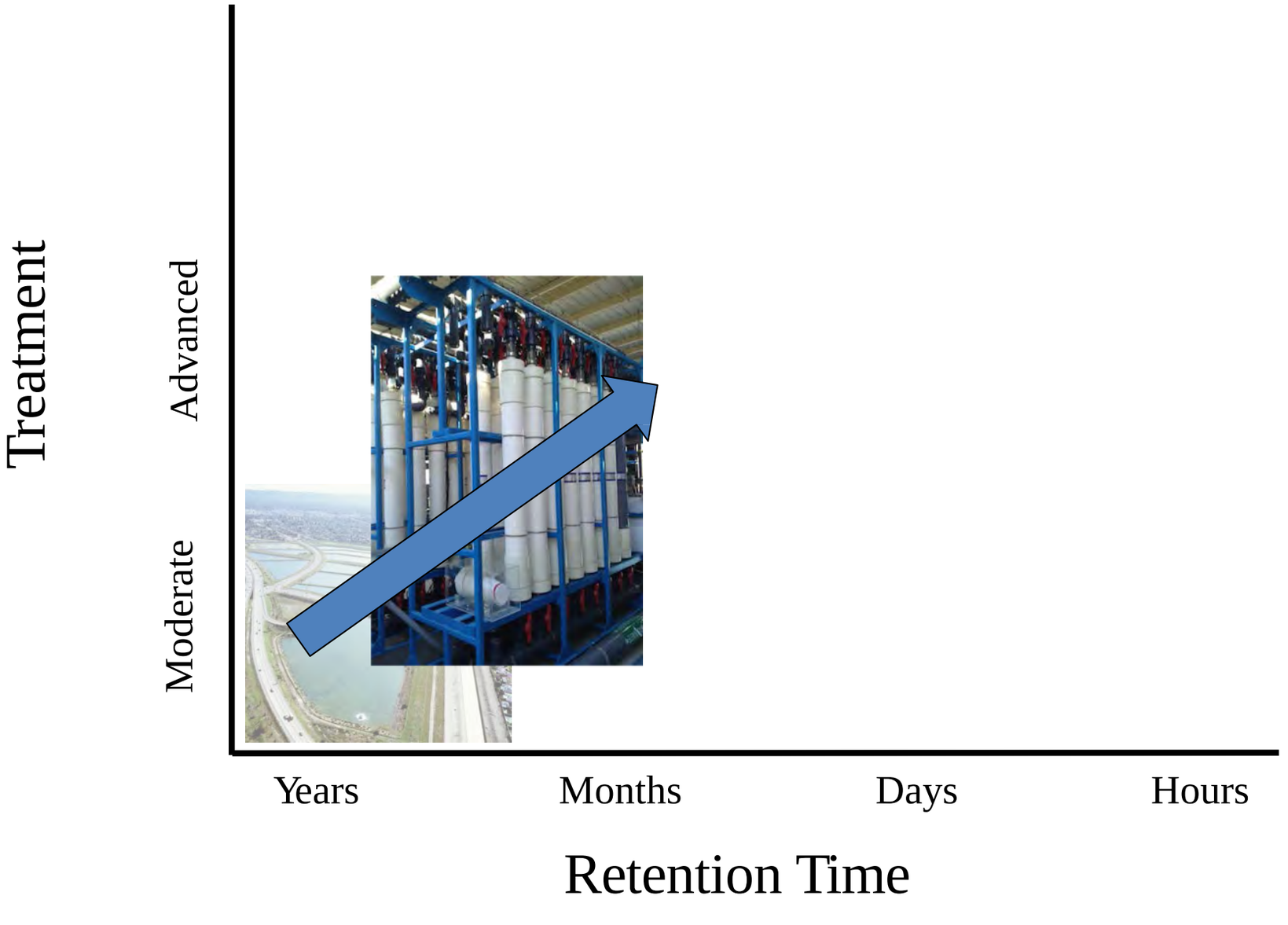
DPR Perspectives

- CA State Expert Panel concluded it is feasible to create uniform regulations for DPR
- DPR can provide public health protection as good or better than conventional drinking water supplies
- Design DPR with strong failure prevention features
  - High reliance on treatment and monitoring
  - Reduces reliance on failure response

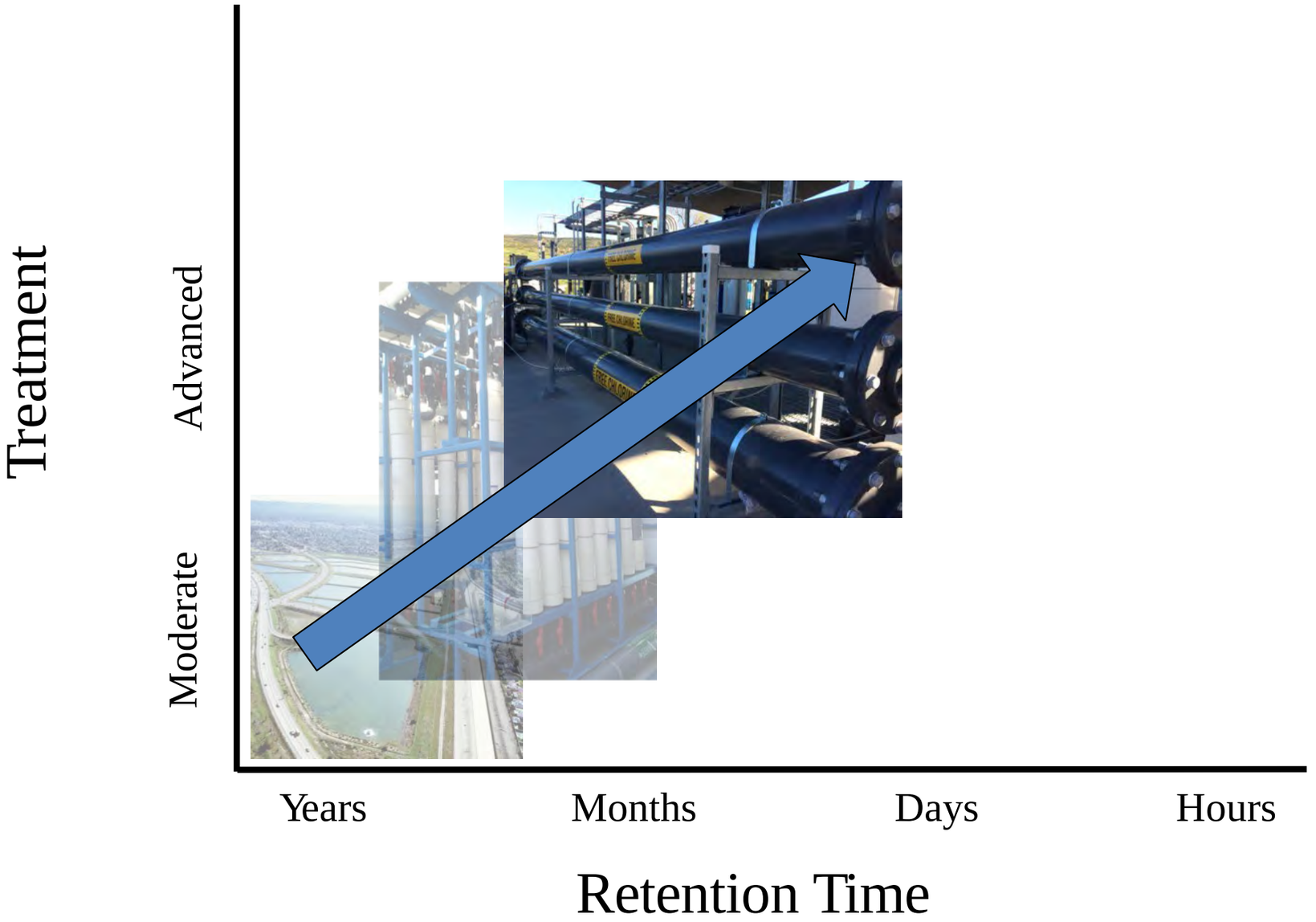
Evolution of Potable Reuse



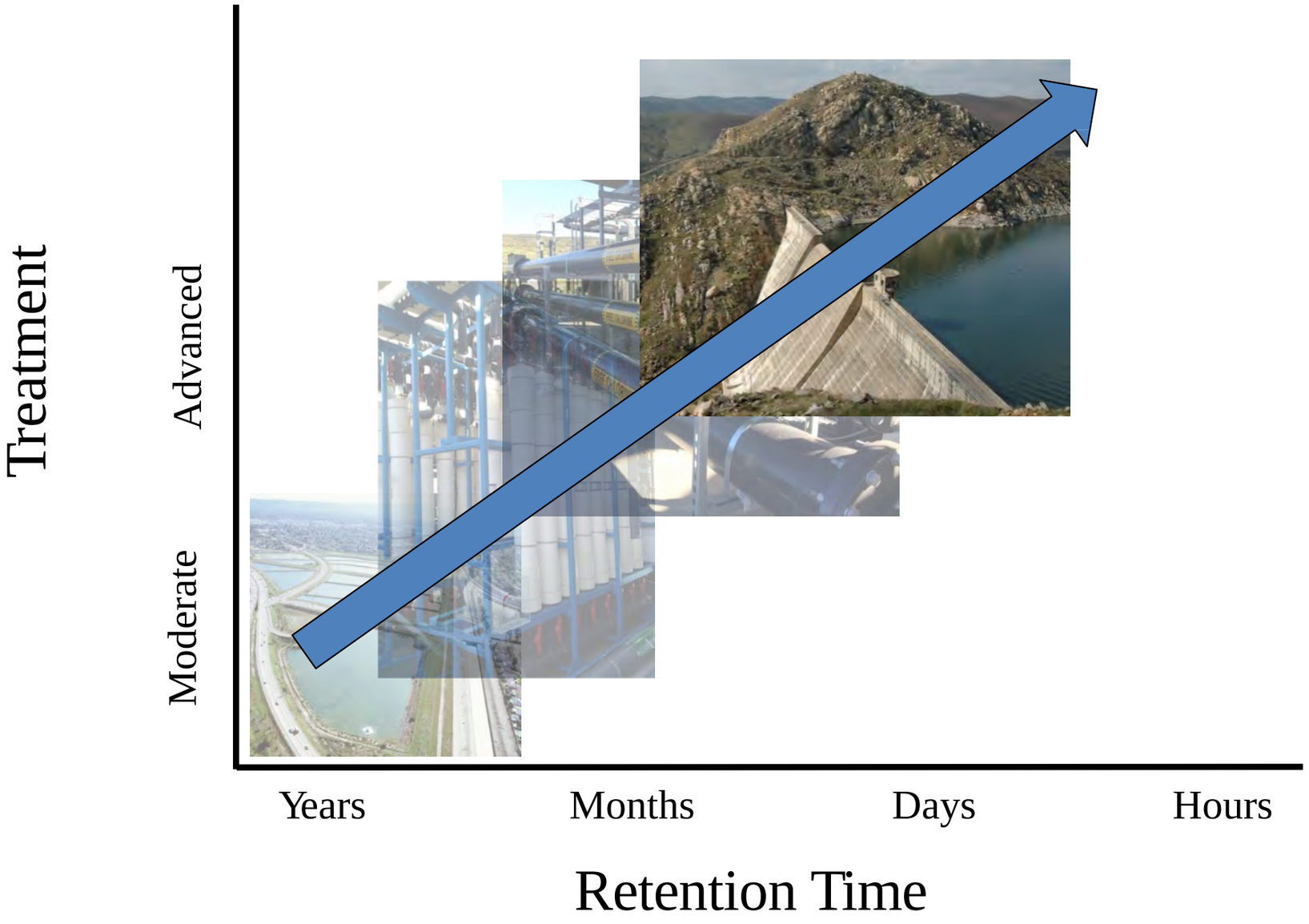
Evolution of Potable Reuse



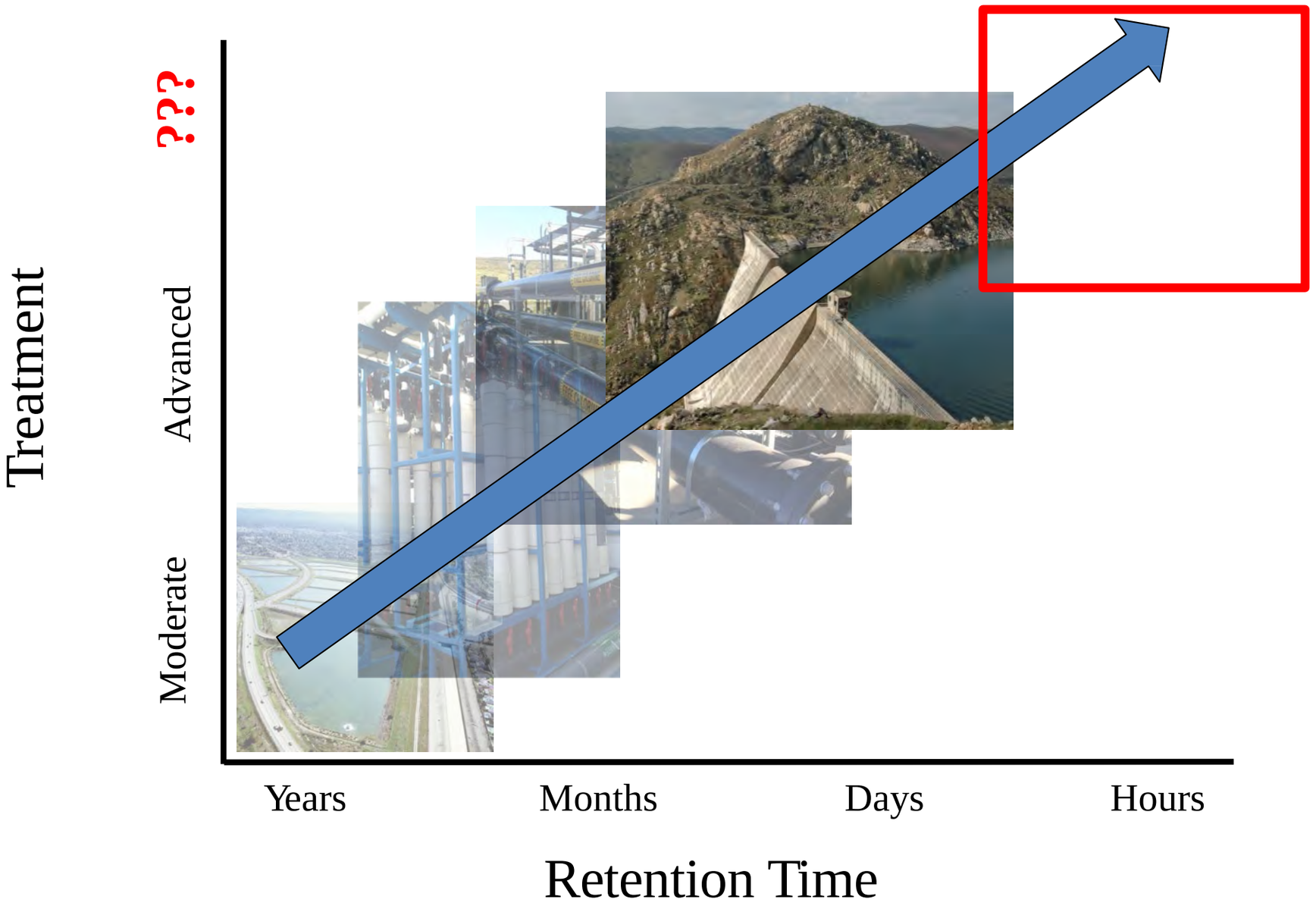
Evolution of Potable Reuse



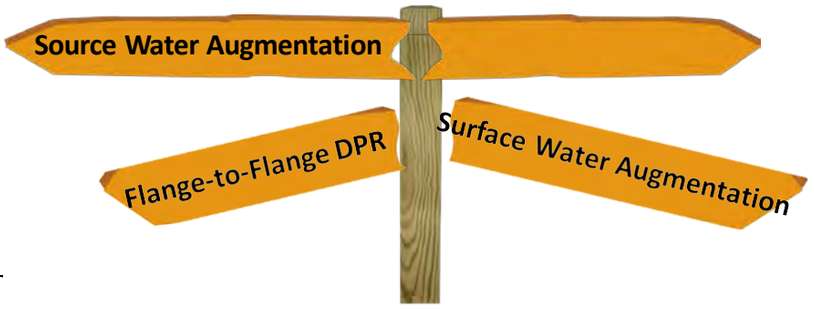
Evolution of Potable Reuse



Evolution of Potable Reuse

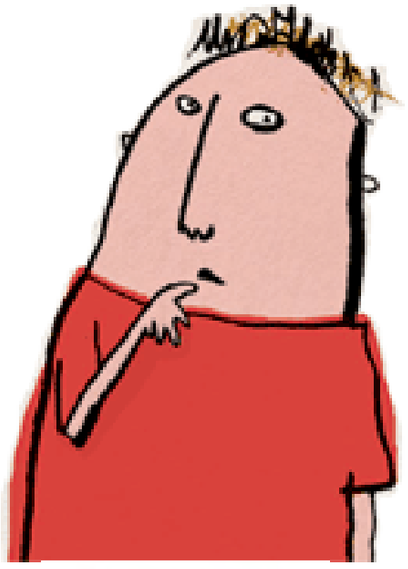


Conclusions

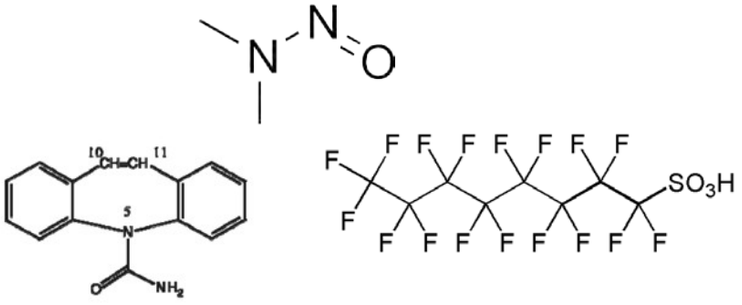


- Multiple paths open for potable re
- Long GWR history; first projects pursuing SWA
- Newer forms require rebalancing of system elements (treatment, monitoring, failure response)
- DPR will move forward but slowly and on a phased approach
- Additional needs for DPR
  - Further research
  - Better understanding of public health protection

What's Important?



Chemicals



Pathogens

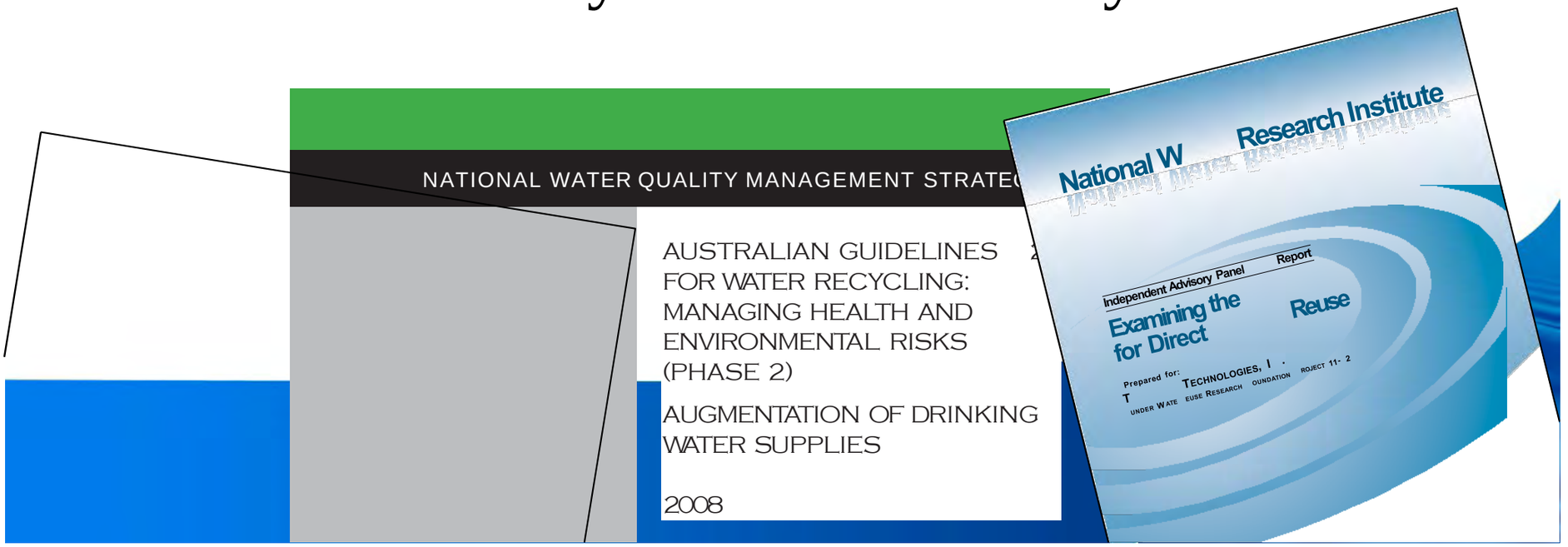

...AND A GLASS OF ICE WATER
YOU NEED A PRESCRIPTION FOR THAT
DRUGS IN TAP WATER


Rx Directions:
FILL THIS CONTAINER WITH TAP WATER; DRINK TWICE DAILY
PHARMACEUTICALS FOUND IN NATION'S TAP WATER
DRUGS, MEDICATIONS


Mike Keefe THE DENVER POST 03/13/08
ASK YOUR DOCTOR IF TAP WATER IS RIGHT FOR YOU.
www.cagecartoons.com

Multiple Panels Have Evaluated CECs

- California State Water Resources Control Board
- Australian Water Recycling Guidelines
- NWRI Expert Panel for WateReuse 11-02
- …and the industry continues to study CECs



List of CECs in WRRF 11-02

Acesulfame K Diclofenac Meprobamate Simazine
Atenolol Diphenhydramine Naproxen Sucralose
Atrazine Ditiazem Norgestrol Sulfamethoxazole
Benzophenone Estrone Perfluorobutyric acid (PFBA)
TCEP Benzotriazole Fluoxetine
Perfluorobutane sulfonate (PFBS) Tris(1-chloro-2-propyl) phosphate (TCPP) Bisphenol A Gemfibrozil PFOA
Testosterone Caffeine Hydrocortisone PFOS
Triclocarban Carbamazepine Ibuprofen
Perfluorohexanoic acid (PFHxA) Triclosan Clofibric Acid Iohexol Prednisone Trimethoprim DEET
Iopamidol Primidone Dexamethasone
Iopromide Propylparaben

WATEREUSE

CECs that were ubiquitous

Acesulfame K Diclofenac Meprobamate Simazine
Atenolol Diphenhydramine Naproxen Sucralose
Atrazine Ditiazem Norgestrol Sulfamethoxazole
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Perfluorohexanoic acid (PFHxA) Triclosan Clofibric Acid Iohexol Prednisone Trimethoprim DEET
Iopamidol Primidone Dexamethasone
Iopromide Propylparaben

WATEREUSE

CECs that were ubiquitous (or nearly)

Acesulfame K
Atenolol
Atrazine
Benzophenone
TCEP
Perfluorobutane sulfonate (PFBS)
phosphate (TCPP)
Testosterone
Triclocarban
Perfluorohexanoic acid (PFHxA)
Acid
Iopamidol
Iopromide

Diclofenac
Diphenhydramine
Ditiazem
Estrone
Benzotriazole
Bisphenol A
Caffeine
Carbamazepine
Iohexol
Primidone
Propylparaben

Meprobamate
Naproxen
Norgestrol
Perfluorobutyric acid (PFBA)
Fluoxetine
Tris(1-chloro-2-propyl)
Gemfibrozil
Hydrocortisone
Ibuprofen
Triclosan
Prednisone
Dexamethasone

Simazine
Sucralose
Sulfamethoxazole
PFOA
PFOS
Clofibric
Trimethoprim
DEET

WATEREUSE

CECs selected by NWRI panel

Acesulfame K Diclofenac Meprobamate Simazine
Atenolol Diphenhydramine Naproxen Sucralose
Atrazine Ditiazem Norgestrol Sulfamethoxazole
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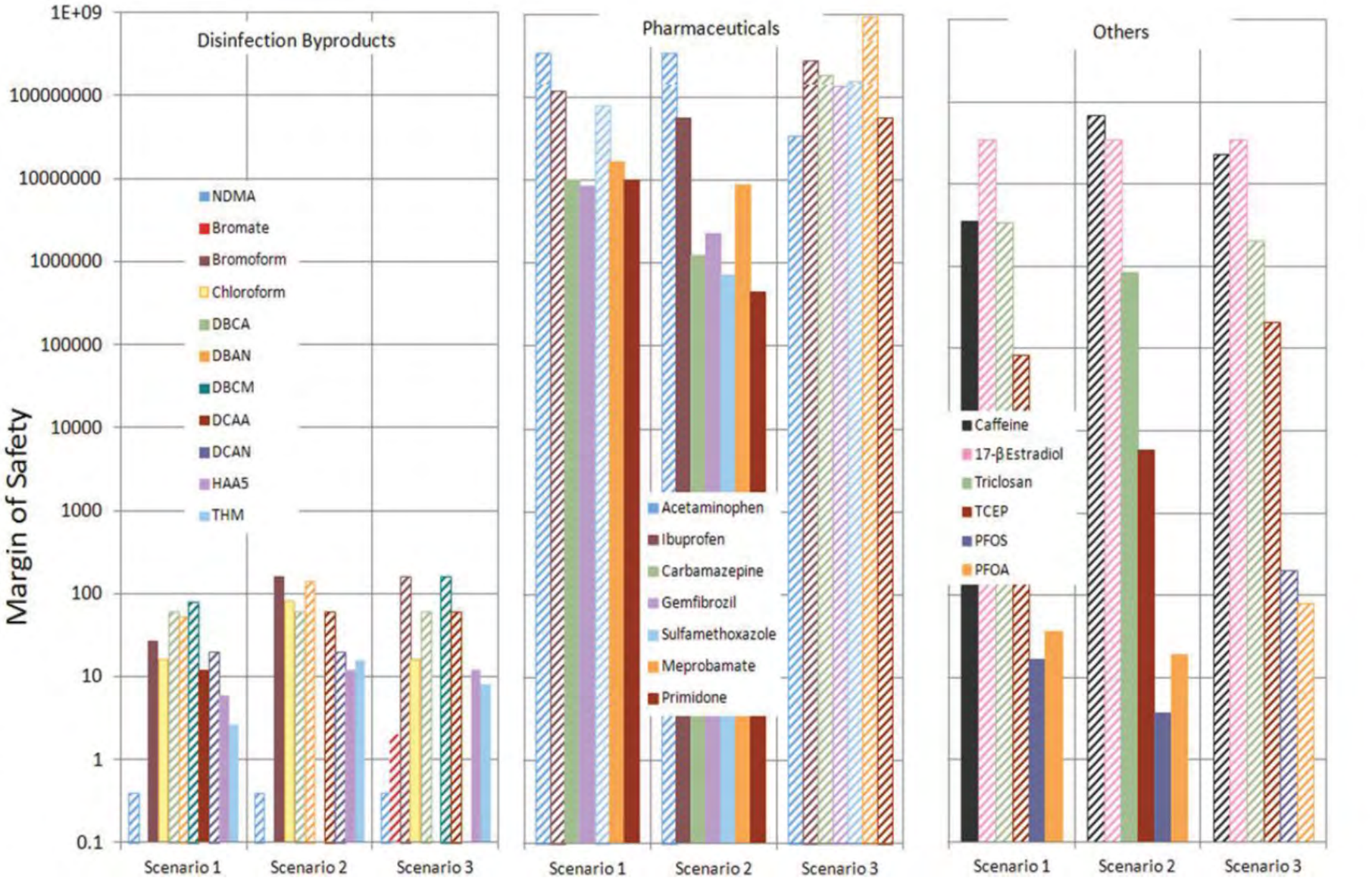
Acid Iohexol Prednisone Trimethoprim DEET
Iopamidol Primidone Dexamethasone
Iopromide Propylparaben

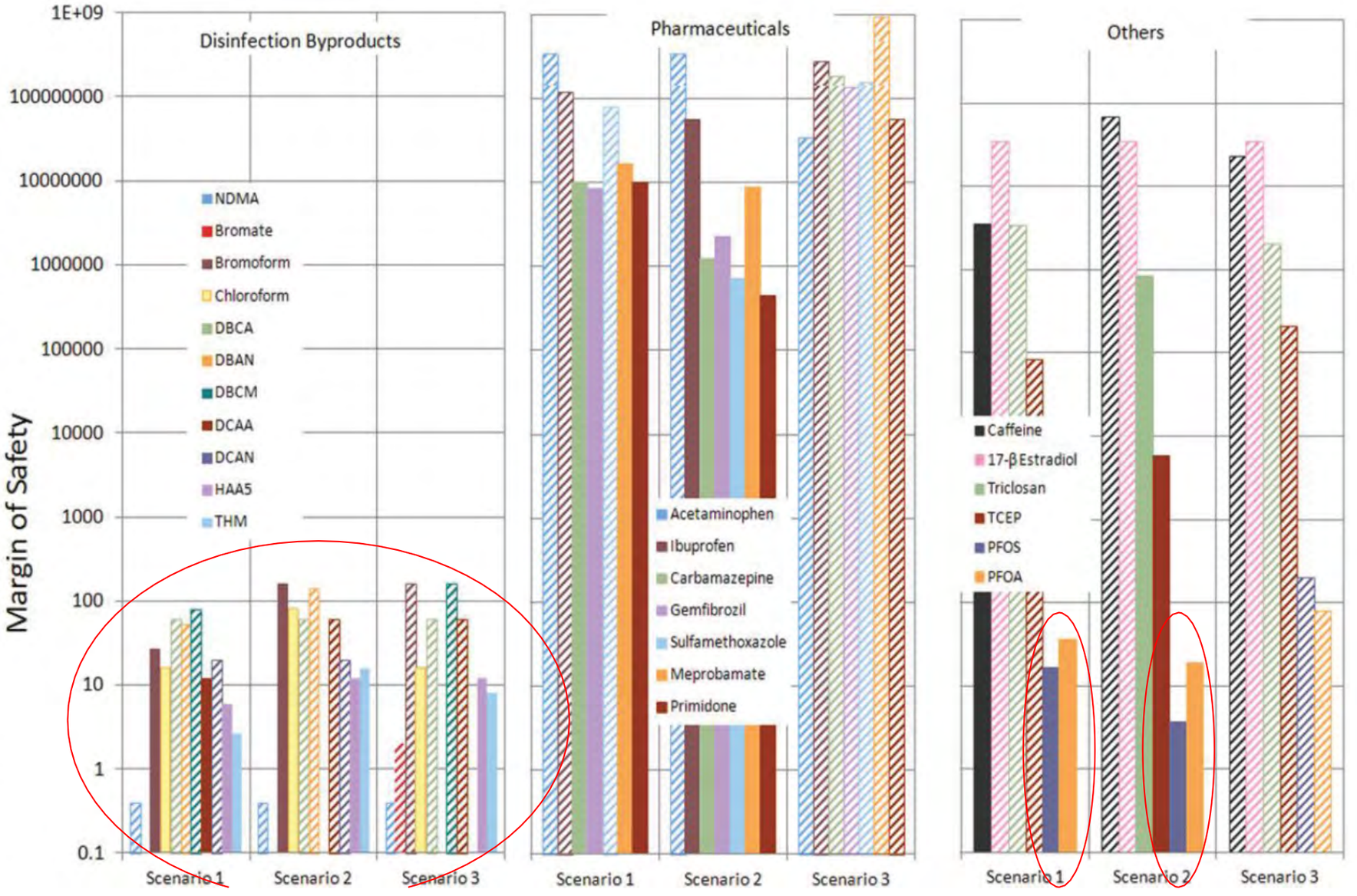
Criteria met in high quality 2ry effluents

Constituent	NWRI Criterion	SJCWRP	El Paso	UOSA	SD AWPF	OCSD/ GWRS
Atenolol	4,000	63	110	130	130	555
Carbamazepine	10,000	192	328	185	190	263
DEET	200,000	53	33	51	130	528
Estrone	320	NDL	< 36	< 46	< 4	41
Mebrobamate	200,000	351	174	115	125	401
PFOA	400	11	11.5	24	NM	NM
PFOS	200	< 14	NDL	< 13	NM	NM
Primidone	10,000	166	121	148	91	100
Sucralose	150,000,000	25,450	35,500	34.950	41,000	NM
TCEP	5,000	NDL	406	335	375	338
Triclosan	2,100,000	89	NDL	27	64	324

The NRC looked at the margin of safety (MOS) for 24 chemicals.



Of these 13 had an MOS of 100 or less … and all but two of these were DBPs



What is Science telling us about CECs?

To date, all studies lead to the same conclusion:

While we see trace organics in our potable water, it does not appear that they present an important health risk

What is the public telling us about the CECs?

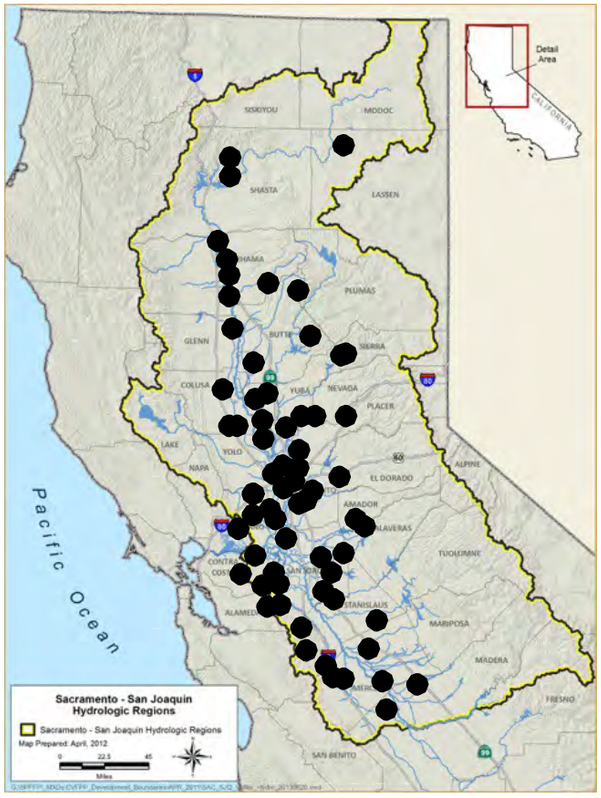
The interest the media continues to have in the trace organics tells us that the scientific argument has not overcome public concern:

Therefore, today's potable reuse strategy must maintain trace organics at levels at or below those in conventional drinking water supplies or it is unlikely to receive public support

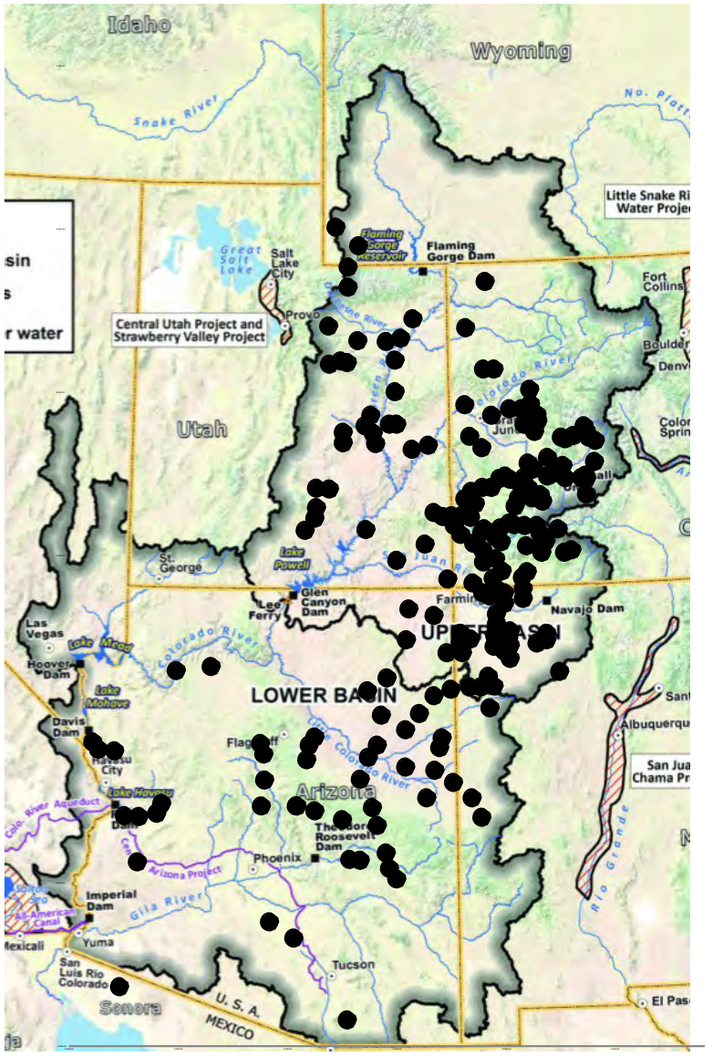
Conclusions

- Most critical public health threats from DPR depend on perspective:
  - Scientific view: pathogens
  - Public perception: CECs
- Potable reuse trains have evolved to provide excellent protection against pathogens and CECs
- DPR requires enhancing our successful existing practices
- On-going studies demonstrate we can do new forms of reuse safely and reliably

The CEC Issue is not exclusive to DPR!



Studies show that Both the CA State Water Project & the Colorado River have a WW Content on the order of 5%



- *De facto* potable reuse

- Many most important chemicals have been a drinking water issue for last three decades

Acknowledgements

- Rhodes Trussell
- Shane Trussell

Thank you!

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