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San Diego's Surface Water Augmentation Projects

Potable Reuse via Surface Water Augmentation: Issues and Opportunities for Bay Area Agencies

December 4, 2015



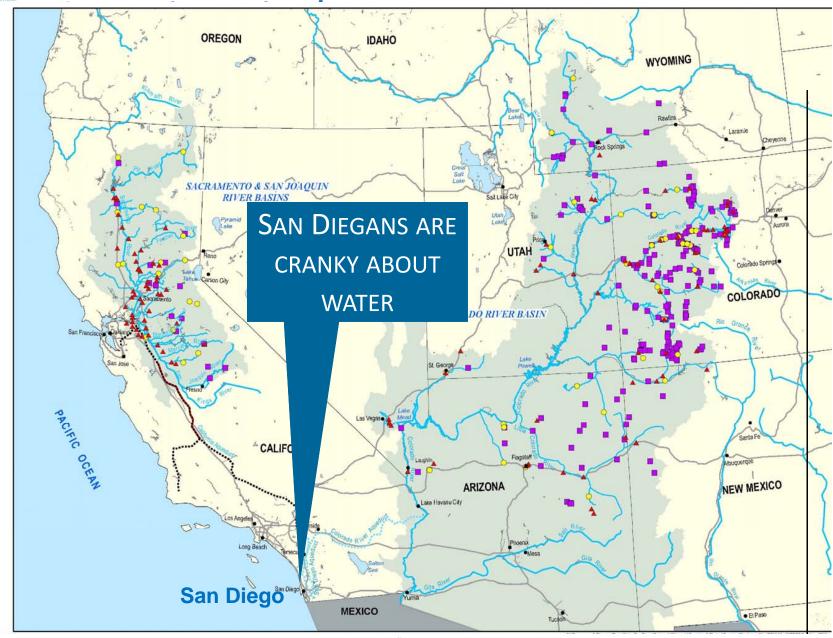




topics

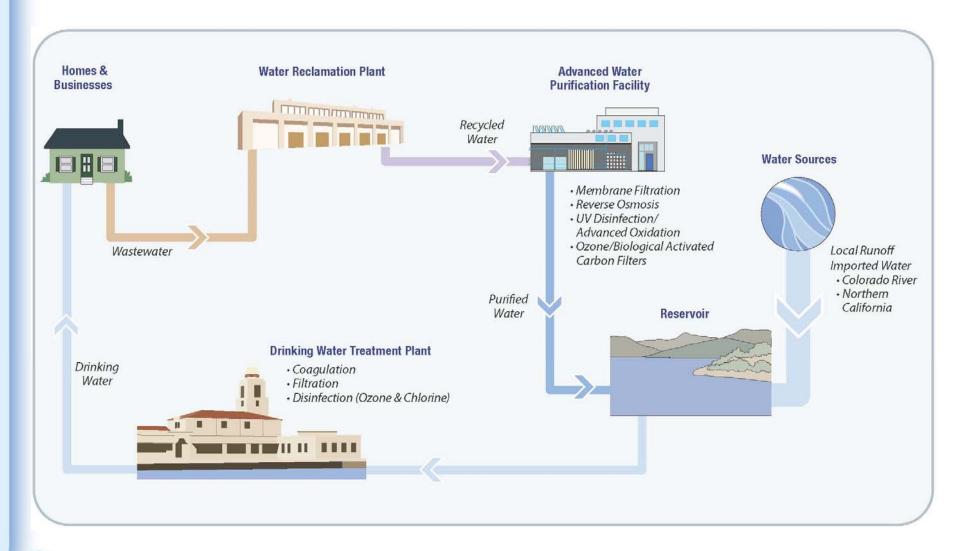
- San Diego's Pure Water Program
- role of a a reservoir in potable reuse
- reservoir studies
- regulatory approvals
- current and future work







Pure Water San Diego



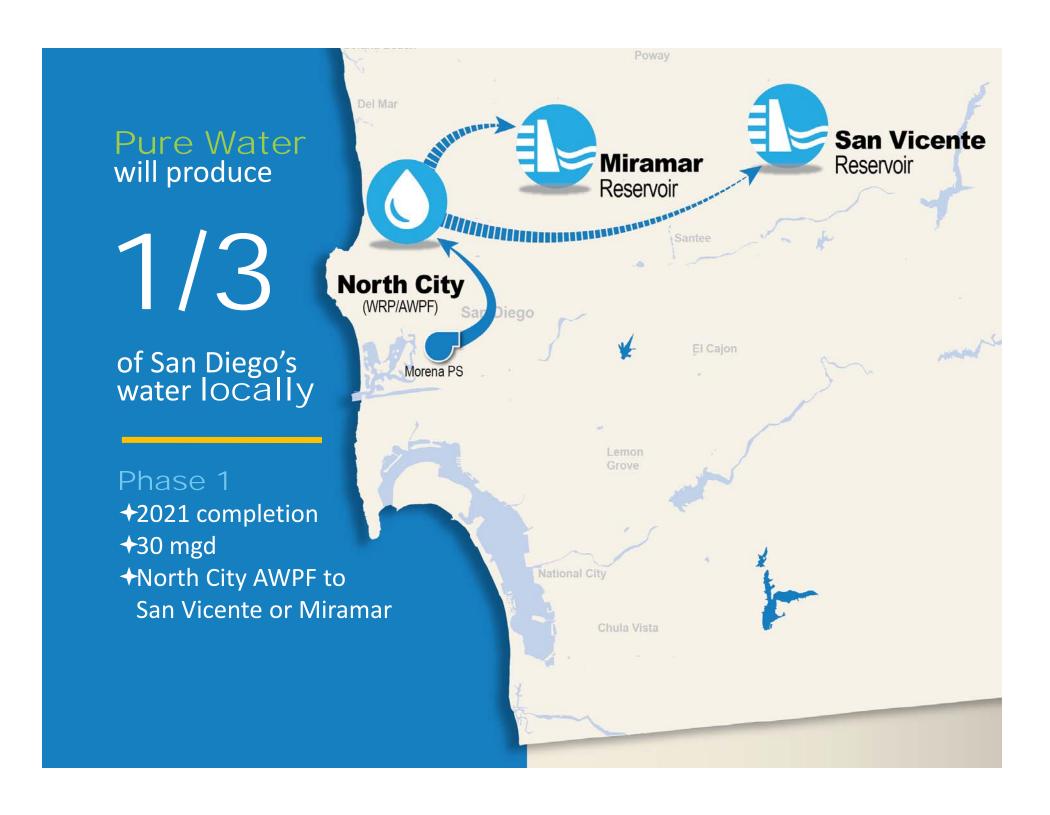




Potable reuse options

San Vicente Option Advanced Water Purification Facility (AWPF) S.V. Source → NC Water → Rec. Plant → Alvarado Distribution Membrane Wastewater > Reverse →Conveyance→ Reservoir → UV/AOP Filtration Osmosis Collection System **Miramar Option Advanced Water Purification Facility (AWPF)** Distribution Miramar Wastewater > Miramar → NC Water → Rec. Plant → Membrane + Source Reverse Miramar BAC → Conveyance → Reservoir → Ozonation + **UV/AOP** Control Collection Filtration Osmosis System System







1/3

of San Diego's water locally

Phase 2

- **+**2035 completion
- +28 − 53 mgd
- **+**Central Area AWPF to San Vicente or Lake Murray



(WRP/AWPF)

Pure Water will produce

1/3

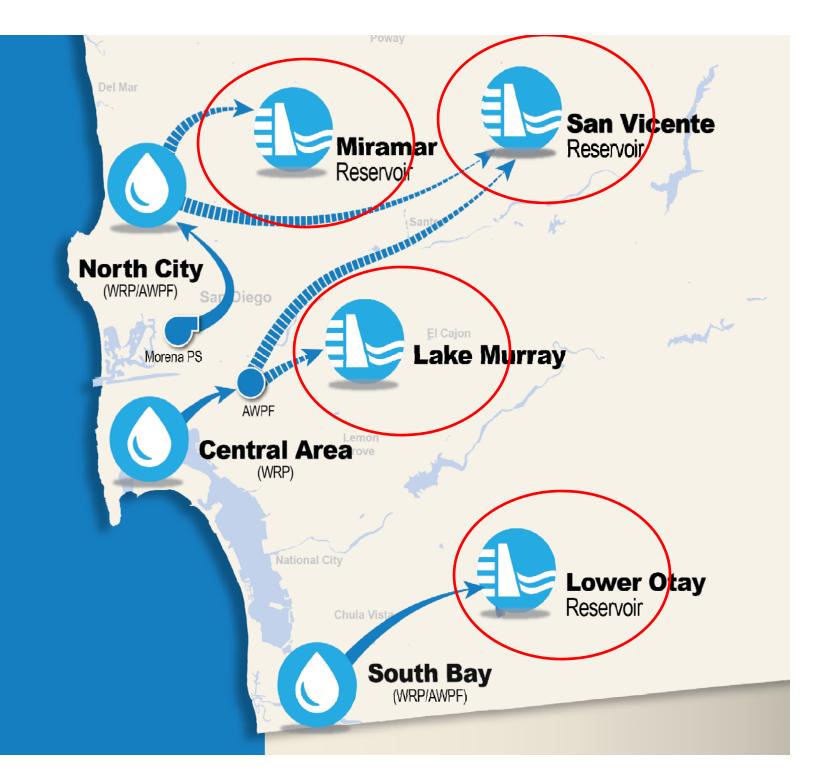
of San Diego's water locally

Phase 3

- **+**2035 completion
- **+**0 15 mgd
- ★South Bay AWPF to Otay Reservoir









The role of the reservoir in a potable reuse project

The reservoir serves as an environmental buffer that provides:

- time to respond to a treatment failure at the Advanced Water Purification Facility
- <u>attenuation of pathogens</u> introduced with purified water
 - dilution
 - inactivation [aka "die off"]
- mitigation of chemical toxins, through dilution



San Vicente Reservoir



Maximum volume 247,000 AF

Normal operating pool 150,000 – 210,000 AF [design 170,000 AF]

2-1/2 miles long

Otay Reservoir



Maximum volume 47,000 AF

Normal operating pool 30,000 – 40,000 AF [design 35,000 AF]

2-1/2 miles long

Miramar Reservoir



Maximum volume 7,200 AF

Normal operating pool 5,500 – 6,200 AF [design 5,800 AF]

1 mile long







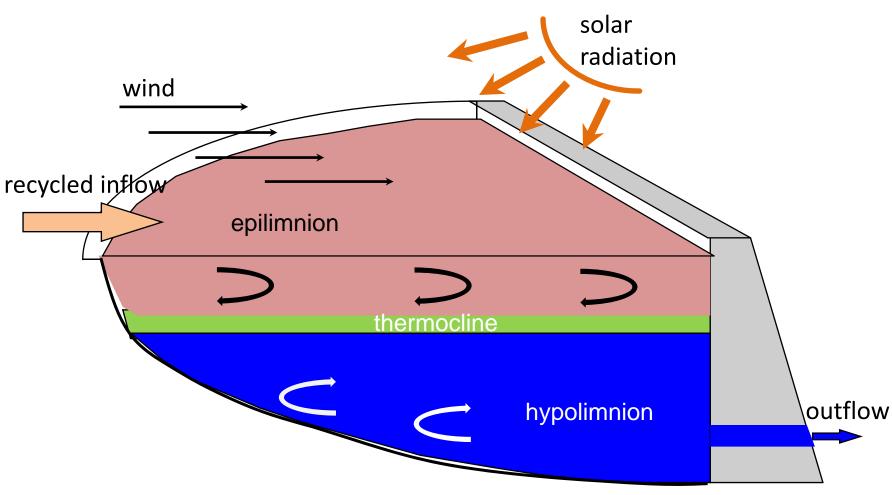


State Water Board [DDW] draft regulations for surface water augmentation

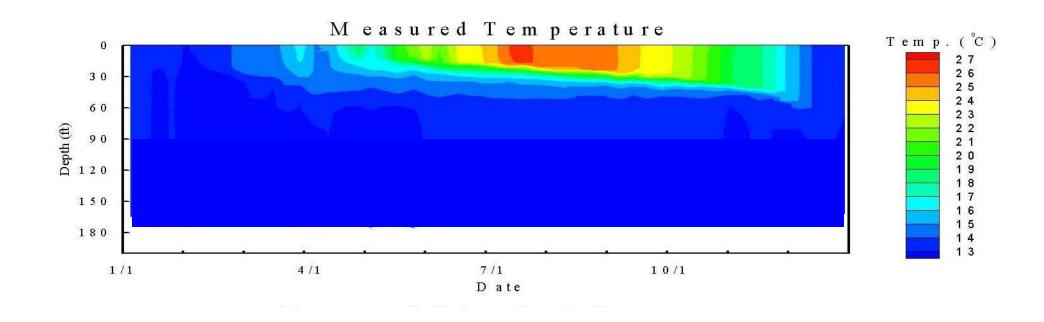
- 1a] 1% (100:1) dilution of any 24 hour inflow of purified water, measured at the outlet or
- 1b] 10% (10:1) dilution any 24 hour inflow of purified water, measured at the outlet, plus an independent treatment step providing one additional log-reduction of virus, *Cryptosporidium*, and *Giardia*and
 - 2] six month theoretical retention time

NWRI (2015). Final Panel Meeting Report #5: Surface Water Augmentation – IPR Criteria Review. Based on an Expert Panel Meeting Held June 2-3, 2015

1990s use density stratification, a fundamental characteristic of reservoirs in southern California [and NorCal]



typical density stratification in San Vicente Reservoir temperature, 1999





1990s achieved regulatory acceptance for reservoir augmentation project at San Vicente Reservoir

criteria for the reservoir

- use density stratification [thermocline] and selective withdrawal to minimize "shortcircuiting"
- tracer studies to demonstrate no "shortcircuiting"
- twelve month average hydraulic detention time
- blending: recycled water <50% of withdrawl







potable reuse revived in San Diego

new concepts for reservoir criteria

- dilution and time to respond are the important factors
- properly treated recycled water is "just water"
- focus on a 24 hour pulse of inflowing recycled water
- focus on "worst case" events
- use three-dimensional hydrodynamic modeling to study the reservoir





Independent Advisory Panel

full, ten-member IAP met four times in 2009 -2011

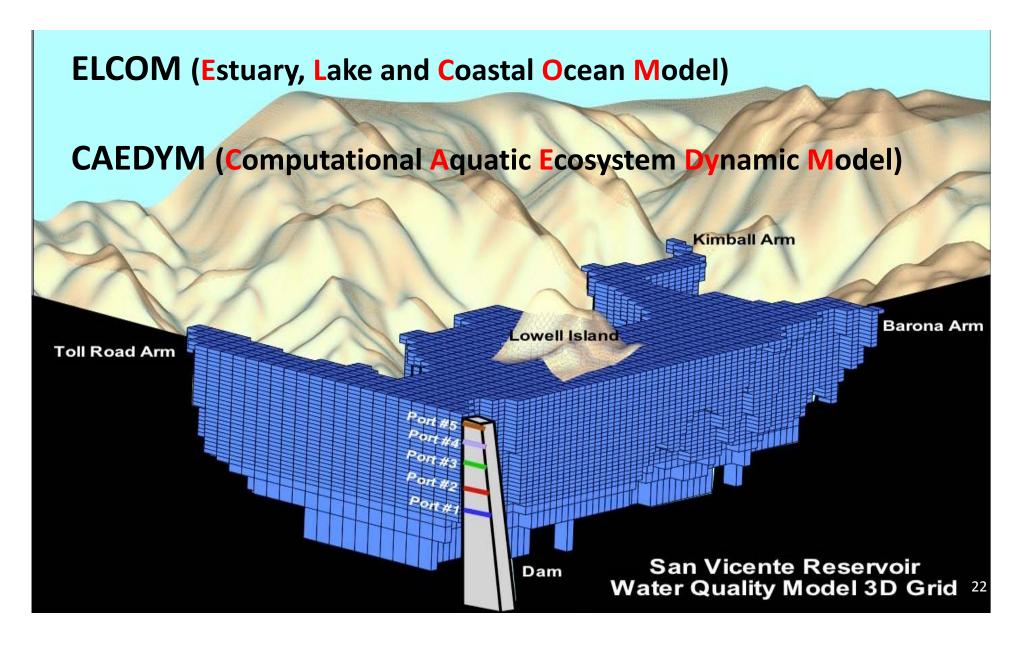
four member
limnology subcommittee has
met eight times,
with three more
meetings
planned



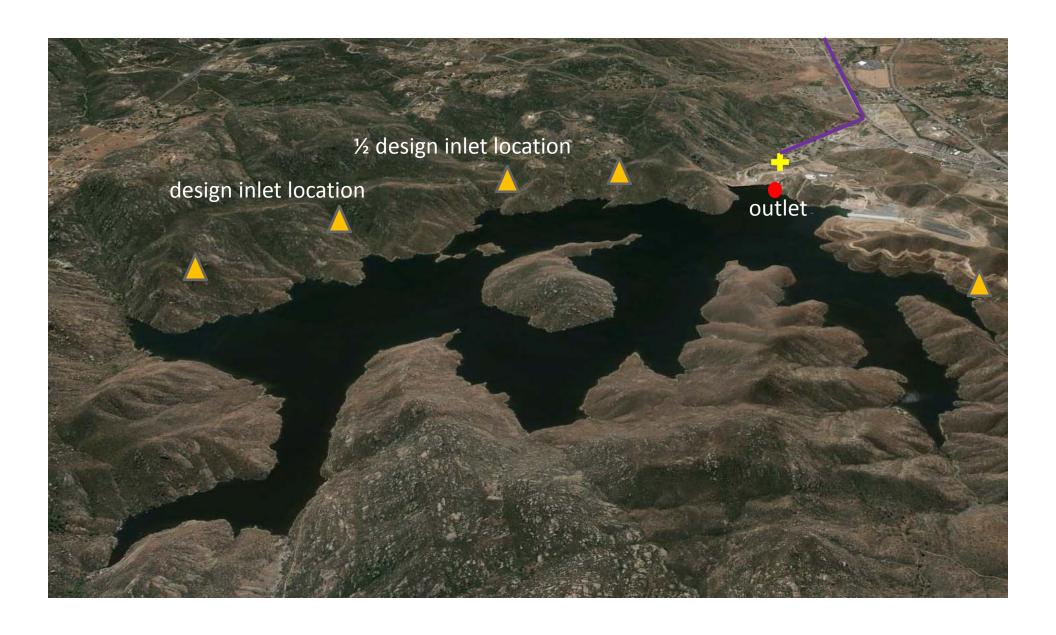
Savage Dam at Otay Reservoir, January 2014



use three-dimensional hydrodynamic modeling

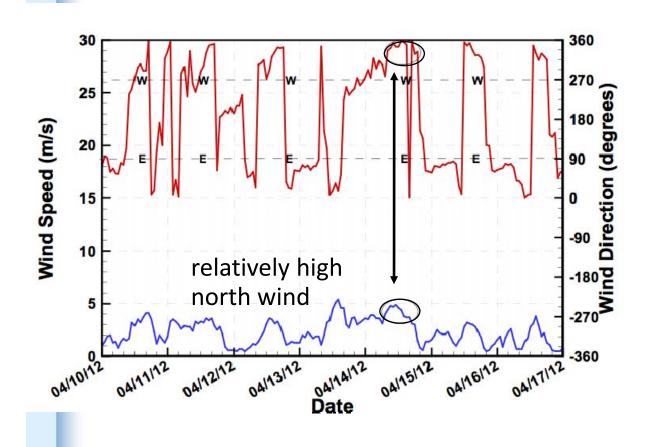


use model to assess different inlet locations





The Black Swan focus on "worst case" events



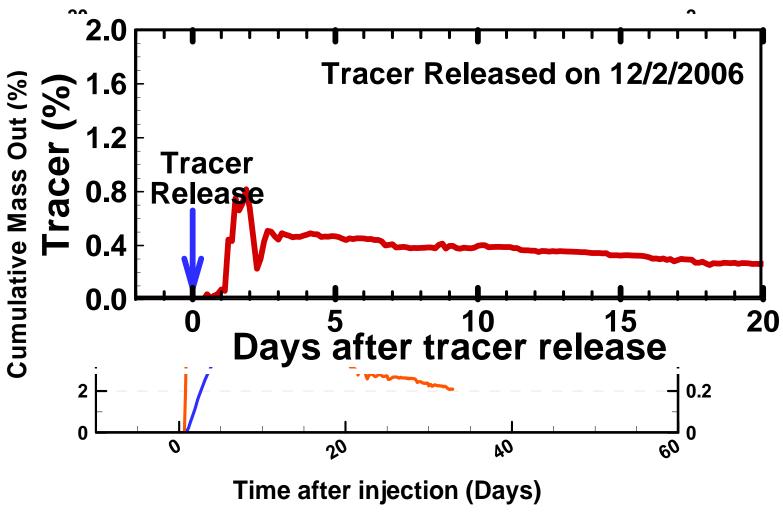
winter season when reservoir not stratified

low reservoir levels

high wind events from inlet toward outlet

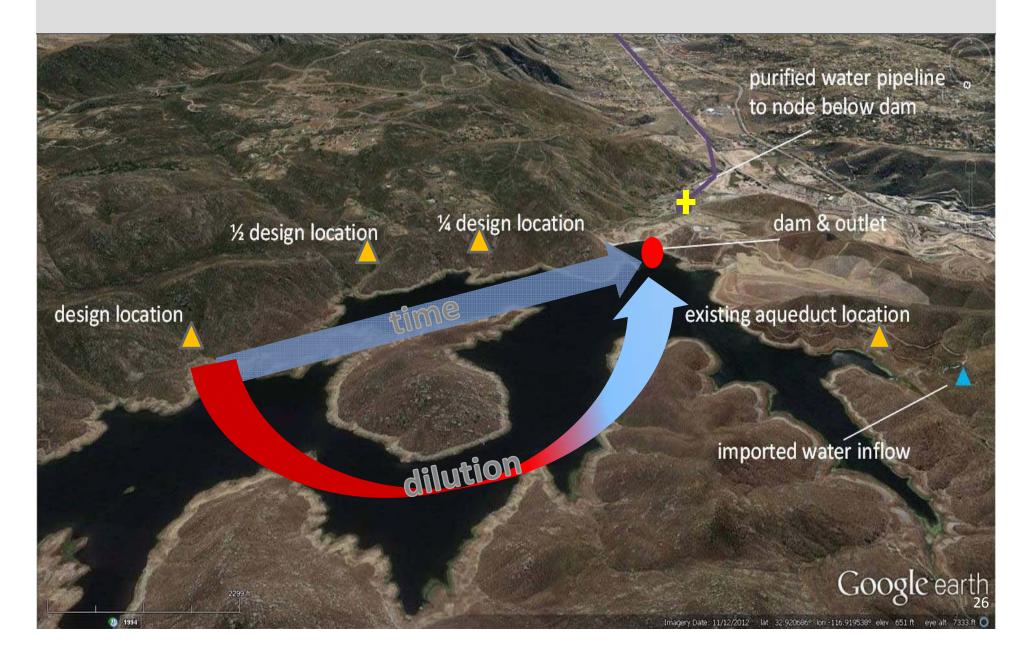


use model to calculate dilution and time to respond

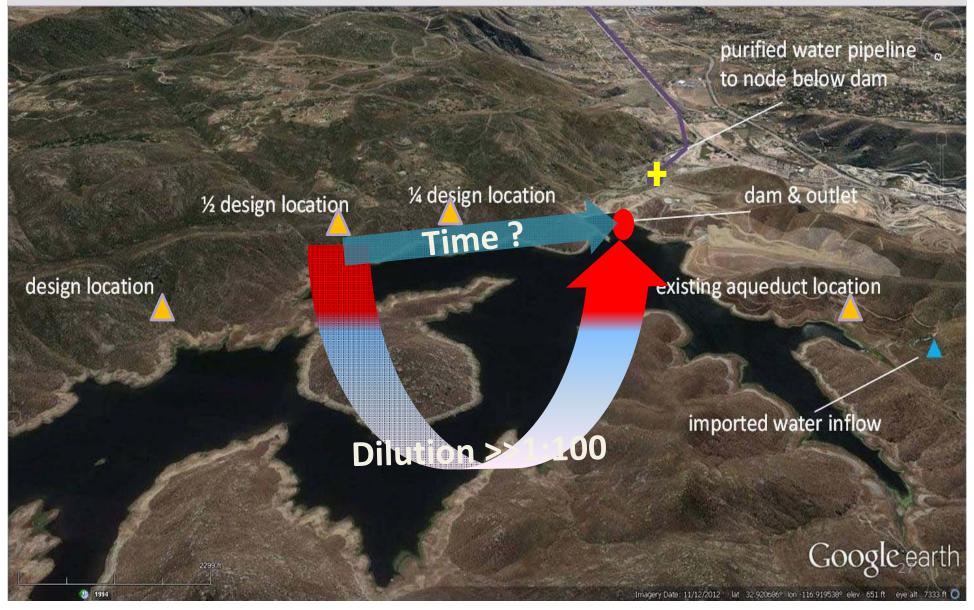




use model to assess different inlet locations



Key findings for San Vicente Reservoir: inlet location, dilution, and time



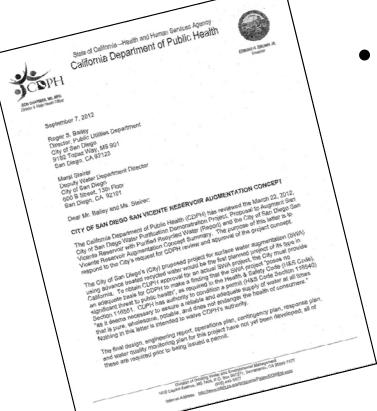


Key findings for San Vicente Reservoir

- Adding purified water to the reservoir will not affect hydrologic conditions, specifically seasonal stratification
- Dilution and retention provides a substantial environmental barrier
- Purified water will be diluted at least 100:1 (1%) under all anticipated reservoir operations, at the selected purified water inlet locations
- Adding purified water to the reservoir will not affect water quality







PUBLIC UTILITIES

 City submitted concept proposal in March 2012

concept approval letter
 September 7, 2012

"Based on CDPH's review of the City's ... submittal ... CDPH approves the San Vicente Reservoir Augmentation Concept."

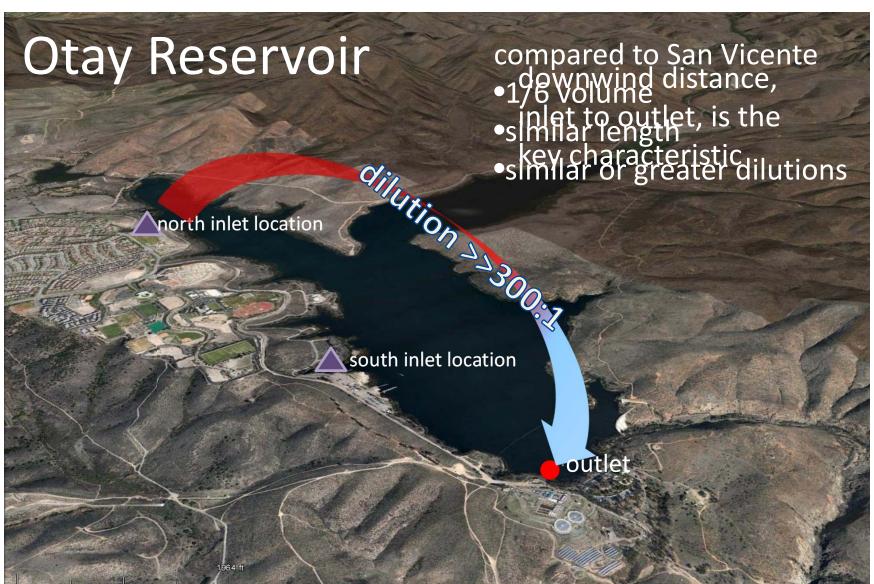
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 - 2] <u>six month</u> theoretical retention <u>time</u>

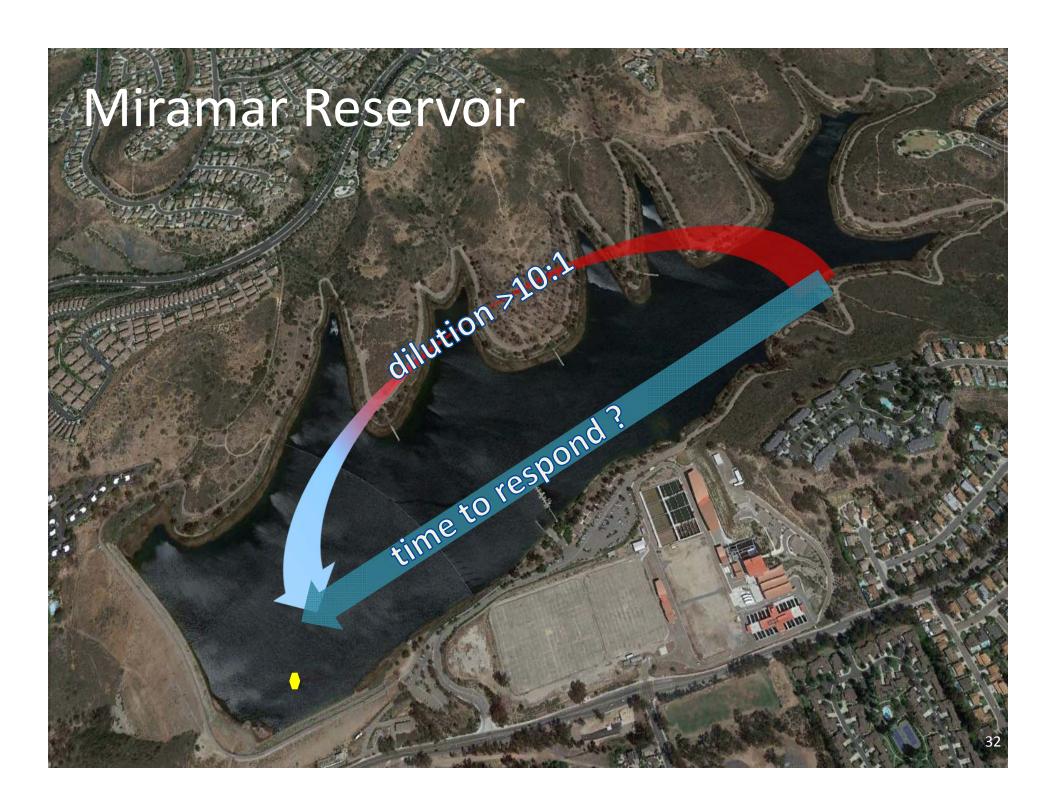
NWRI (2015). Final Panel Meeting Report #5: Surface Water Augmentation – IPR Criteria Review. Based on an Expert Panel Meeting Held June 2-3, 2015



Otay Reservoir: inlet locations, dilution, and time to respond







Cty of San Diego PUBLIC UTILITIES Water & Wastewater

Anticipated findings for Miramar Reservoir

- scaling down from San Vicente or Otay to Miramar should provide reasonable estimates of dilution
- Miramar is one fifth the volume of Otay, and the purified water inflow rate is double; thus at Miramar expect dilutions (1/5) x (1/2) = one tenth of Otay
- expect dilutions at Miramar to be 30:1 to 60:1, and always greater than 10:1
- theoretical retention time < 6 months [~2months]





conclusions

"Most agree a surface water reservoir does provide additional public health protection provides additional response retention time provides an opportunity for dilution"

"A reservoir of any size can make an important contribution to public health protection in a potable reuse project . . . "

R. Rhodes Trussell, Trussell Technologies, Inc., presentation to DDW Advisory Panel, 20 Oct 2015



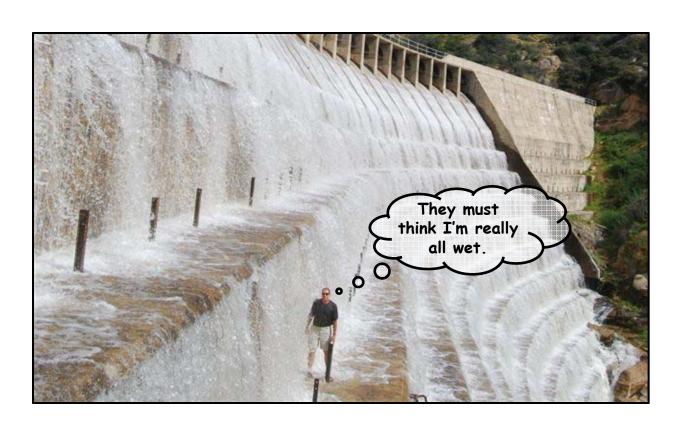


Summary: criteria for the reservoir in a surface water augmentation project

- Metric for dilution is at hand
 - Dilution of a 24 hour inflow, measured at the reservoir outlet
 - Can be calculated with modeling or measured with real-world tracer studies
- Reservoir volume is important for dilution
- Distance from inlet to outlet may be more important
- Metric for response retention time yet to be worked out



questions and discussion







Regional Water Board **Concept Approval**

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

SAN DIEGO REGION

RESOLUTION NO. R9-2011-0069

A RESOLUTION IN SUPPORT OF THE CITY OF SAN DIEGO'S SAN VICENTE RESERVOIR AUGMENTATION PROJECT

WHEREAS, the Cal (herelmafter, San Di

1. California Wate interest in the c supplement ex meeting the fu

2. The Strategic increase sust beneficial us

3. The City of San Diego, identifies n prepared to Master Pla 2007, the as their p

> 4. To deter San Die to provid current



California Regional Water Quality Control Board, San Diego Region

February 7, 2013

Ms. Marsi A. Steire Deputy Director, Public Utilities Department San Diego, CA, 92101

Subject: Indirect Potable Reuse/Augmentation Project at San Vicente Reservoir

The City of San Diego (City) submitted, for review and comments, a technical report dated August 2012 entitled, Proposed Regional Water Quality Control Board Compliance Approach, Final Draft (Report). The City is proposing an Indirect Potable Reuse/Reservoir Augmentation Project that would supplement the approximate 240,000-acre-foot San Vicente Reservoir with up to 15,000 acre-feet per year (AFY) of pruffied recycled water produced at a full-scale op to 15,000 acre-reet per yealf (yet "r) or pulmeto recycled water produces at a lum-clase advanced water treatment facility to be sited at the City's which City Water Reclamation Plant (NCWRP) (hereinafter Project). The Report examines key water quality regulations, permittin issues, and other factors that could affect the timeline for insuance of a National Pollutant Discharge Elimination System (NPDES) permit for discharging purified recycled water into San Vicente Reservoir. The City requested that San Disco Water Board coordinate with the U.S. Environmental Protection Agency, Region 9 (USEPA) in reviewing the Report to determine whether the Board can move forward with implementing attainable NPDES permit. requirements for the City's Project without the need for (1) revision of the Clean Water Act (CWA) section 303(d) impairment it sitings for the San Vicente Reservoir, or (2) modification of the Water Quality Control Plan for the San Diego Basin (Basin Plan).

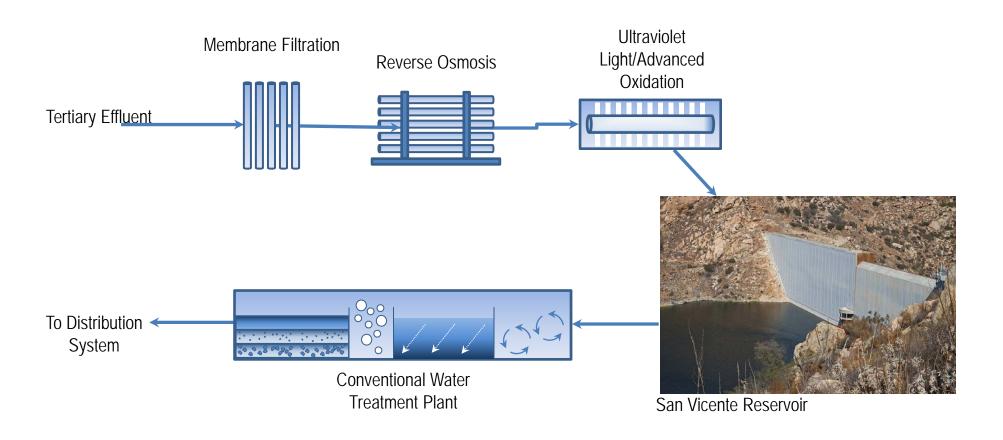
The San Diego Water Board, with concurrence from USEPA, strongly supports the efforts of the City to develop the San Vicente Reservoir Augmentation Project and concurs with the City's preferred NPDES permit pathway described in the Report. The San Diego Water Board has prepared the following comments, in consultation with USEPA, regarding the City's preferred NPDES permit pathway for the Project:

prescribe an effluent limitation for nitrogen based on a ratio of nitrogen to phosphorus (N:P ratio) that accounts for the specific water quality factors relevant to the expanded San Vicente Reservoir. The Report indicates the City is projecting the advanced water treatment process discharge will comply with the Biostimulatory Substances total phosphorus water quality objective by a significant margin. With respect to nitrogen, the

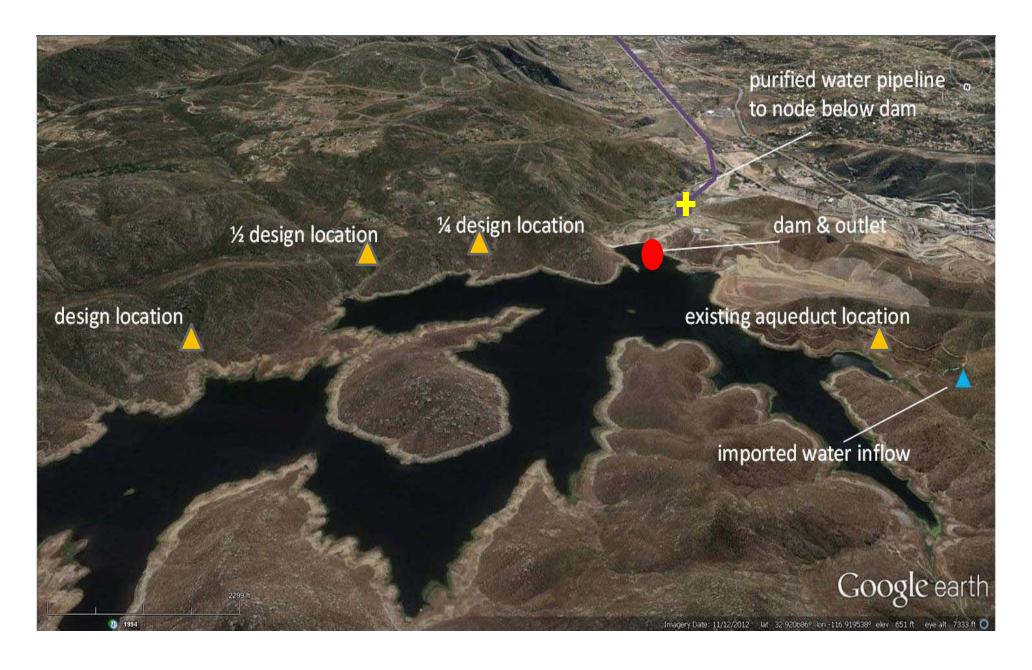
> 9174 Sky Park Court, Suite 100, San Diego, CA 92123-4353 | (858) 467-2952 | www.malerboards.ca.gov/s O Recycled Paper

"The . . . Water Board, with concurrence from USEPA, strongly supports the efforts of the City to develop the San Vicente Reservoir Augmentation Project..."

reservoir augmentation treatment train



use model to assess different inlet locations



density stratification is consistent: San Vicente Reservoir, 2000-2007

