



THE CITY OF SAN DIEGO

REPORT TO THE NATURAL RESOURCES AND CULTURE COMMITTEE

# WATER PURIFICATION DEMONSTRATION PROJECT REPORT

MARSI STEIRER  
DEPUTY DIRECTOR

MARCH 20, 2013



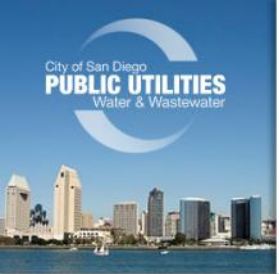
# PROJECT OBJECTIVES

- Evaluate the feasibility of using advanced treatment technology to produce water that can be sent to San Vicente Reservoir and later distributed as potable water
- Determine if the Demonstration Project provides evidence of viability for a full-scale Indirect Potable Reuse/Reservoir Augmentation (IPR/RA) project



# WATER REUSE TIMELINE

- 1993 City & County Water Authority propose Water Repurification Project
- 1994-1998 Planning, regulatory reviews & conditional approval, preliminary design on project
- Fall 1998 Water Repurification Project becomes an issue in several closely contested political campaigns
- Spring 1999 Project cancelled by City Council
- 2002-2004 City enters into a settlement agreement with environmental groups committing to:
  - Evaluate improved ocean monitoring
  - Pilot test biological aerated filters
  - Study on increased water reuse



# WATER REUSE TIMELINE

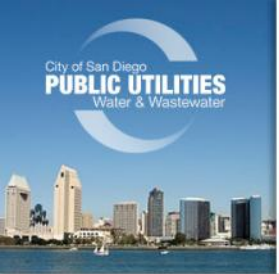
- 2004-2005                      City undertakes Water Reuse Study
- October 2007                City Council votes to proceed with the Demonstration Project

## Water Purification Demonstration Project

- November 2008            City Council approves temporary water rate increase (3.08%) to fund \$11.8 million Demonstration Project
- January 2009 - August 2010

Temporary water rates in effect





# DEMONSTRATION PROJECT COMPONENTS

- Advanced Water Purification (AWP) Facility
- Independent Advisory Panel (IAP)
- San Vicente Reservoir Study
- Regulatory requirements
- Energy and economic analysis
- Pipeline alignment study
- Public outreach & education program

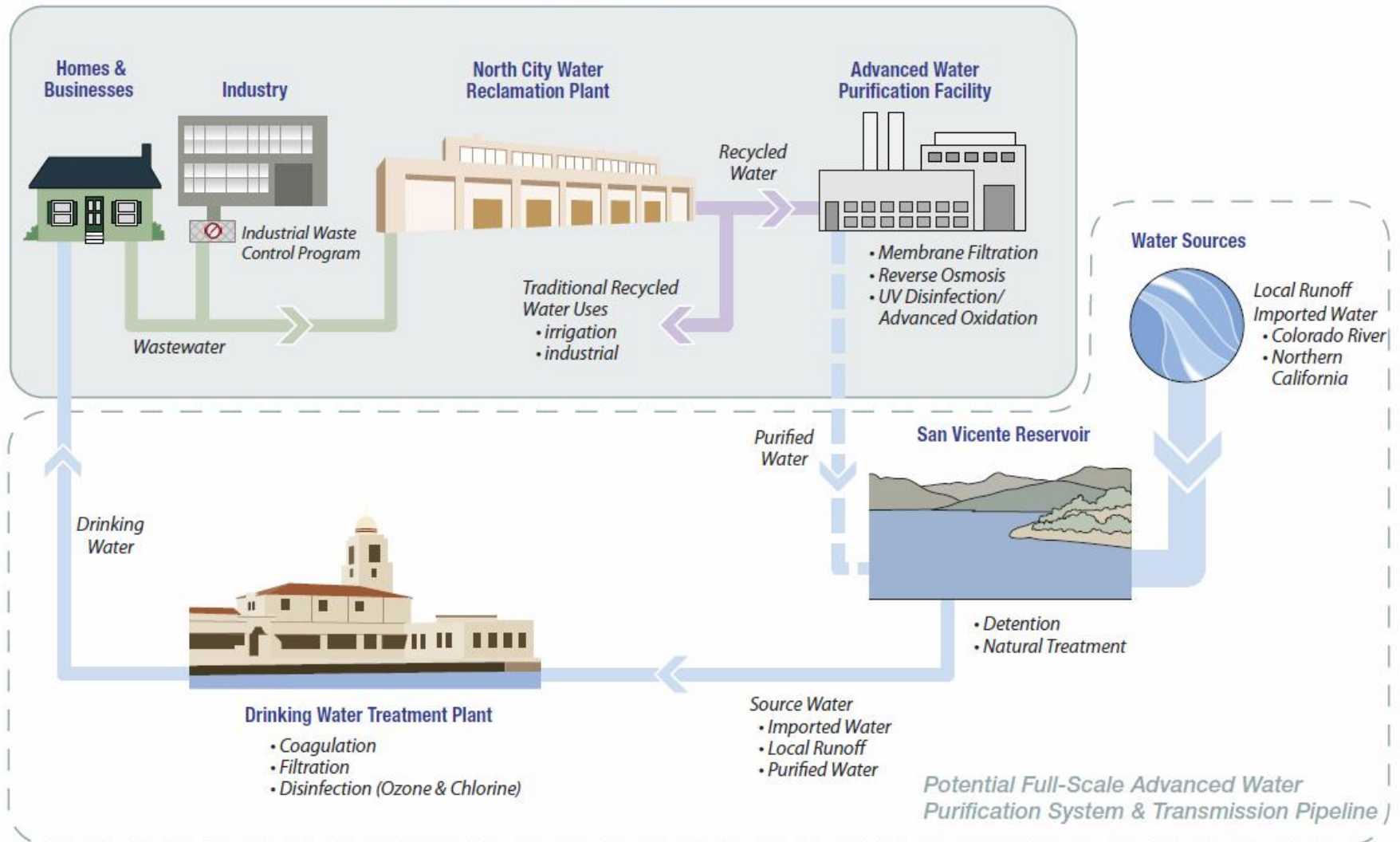




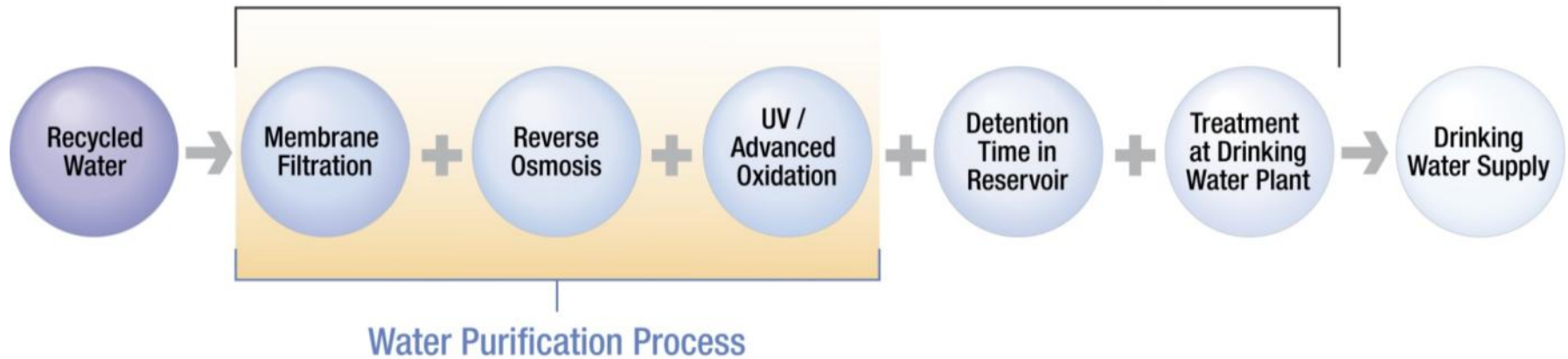
# City of San Diego's Water Purification Demonstration Project

## Purification Process

*Demonstration-Scale Project*



# WATER PURIFICATION PROCESS



## Microfiltration & Ultrafiltration



## Reverse Osmosis



## Ultraviolet Light / Hydrogen Peroxide



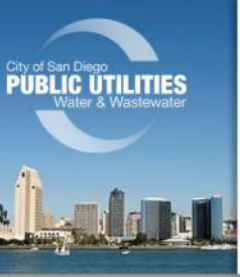


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# ADVANCED WATER PURIFICATION FACILITY





# AWP FACILITY

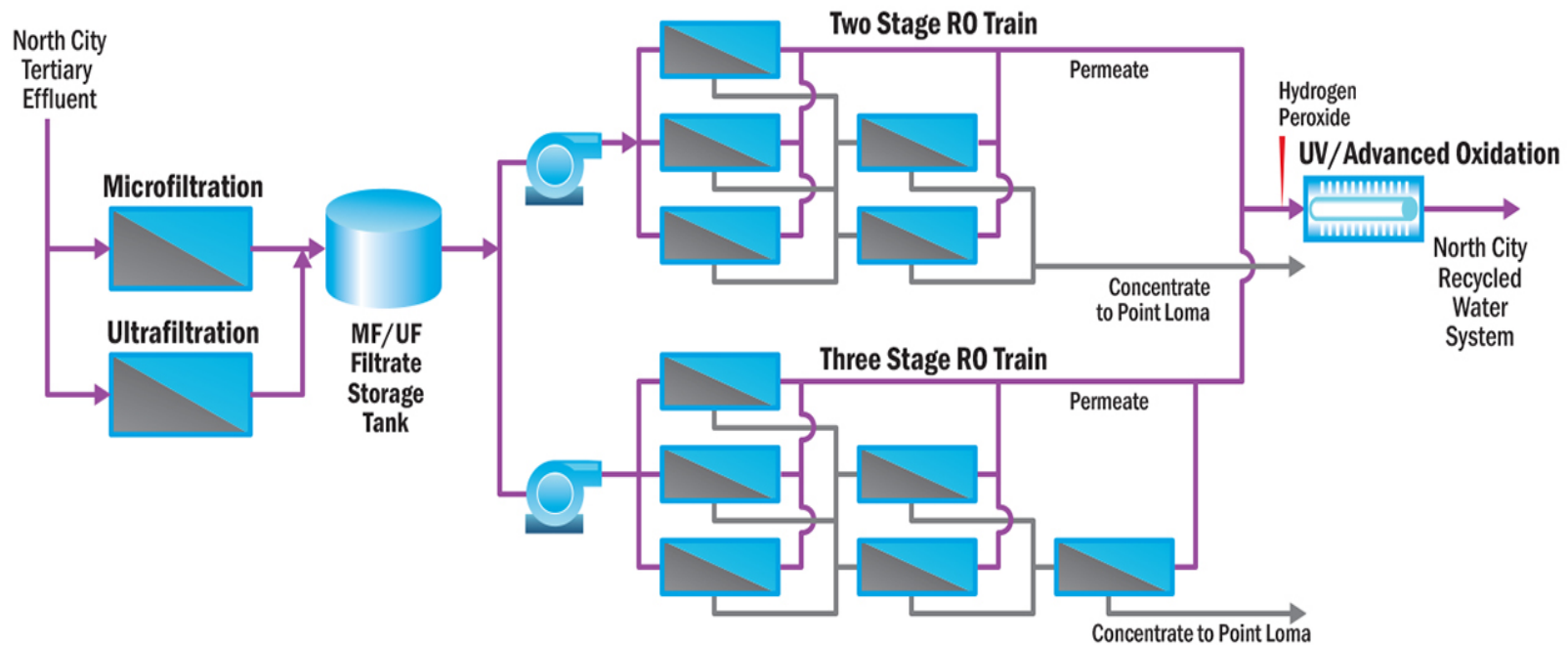
## SCOPE OF WORK

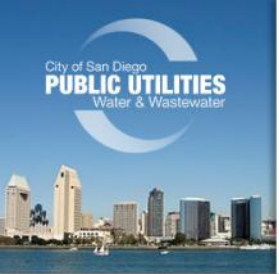
- Design, procure, install, operate, and test a one million-gallon per day (mgd) AWP Facility at North City
- Develop and implement a Testing and Monitoring Plan
- Prepare a report based on the operation and testing of the demonstration facility



# ADVANCED WATER PURIFICATION FACILITY

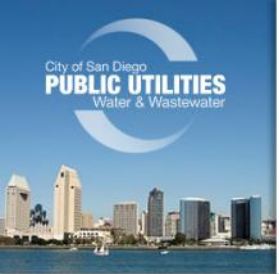
- Uses same three step treatment process as the Orange County Water District 70 MGD facility
- Equipment selected is scalable for a full-scale facility
- Operated for 12 months in accordance with a Testing & Monitoring Plan based on IAP, CDPH & RWQCB comments





# AWP FACILITY TESTING & MONITORING PLAN

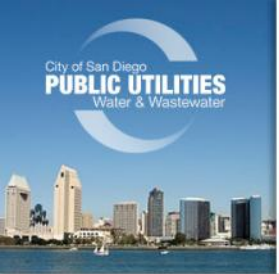
- Testing period August 1, 2011 to July 31, 2012
- Measured for 342 constituents and parameters in recycled water, purified water, and imported water
- Conducted 9,000 individual water quality laboratory tests
- Implemented continuous and daily monitoring before and after each treatment step to verify integrity of each treatment process



# AWP FACILITY TESTING & MONITORING PLAN CONCLUSIONS

- Purified water met all federal and state drinking water standards
- Continuous and daily monitoring verified the integrity of the treatment process and equipment
- Lab tests plus continuous monitoring ensures only high quality water is produced
- Water quality comparable to Orange County's Groundwater Replenishment System





# AWP FACILITY TESTING & MONITORING PLAN CONCLUSIONS

- Overall water quality was exceptional, comparable to distilled water

Example of water quality results:

	TDS (SALTS)	TOC (ORGANICS)
Purified Water	~15 ppm*	~0.1 ppm
Aqueduct water	~500 ppm	~3.0 ppm
Drinking water	~500 ppm	~2.5 ppm

*\* parts per million*





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# INDEPENDENT ADVISORY PANEL

# INDEPENDENT ADVISORY PANEL (IAP)

- Joseph A. Cotruvo, Ph.D., Joseph Cotruvo Associates
- Richard Gersberg, Ph.D., Occupational & Environmental Health, SDSU
- George Tchobanoglous (Chair), Ph.D., P.E., UC Davis
- James Crook, Ph.D., P.E., Water Reuse
- Audrey D. Levine, Ph.D., P.E., DEE, Drinking Water Research, U.S. EPA
- Sunny Jiang, Ph.D., Civil and Environmental Engineering, UC Irvine
- Michael A. Anderson, Ph.D., Environmental Chemistry, UC Riverside
- Richard J. Bull, Ph.D., Toxicologist, Mobull Consulting
- Michael P. Wehner, Assistant General Manager, OC Water District
- David R. Schubert, Ph.D., Salk Institute for Biological Studies



Listed left to right, by row

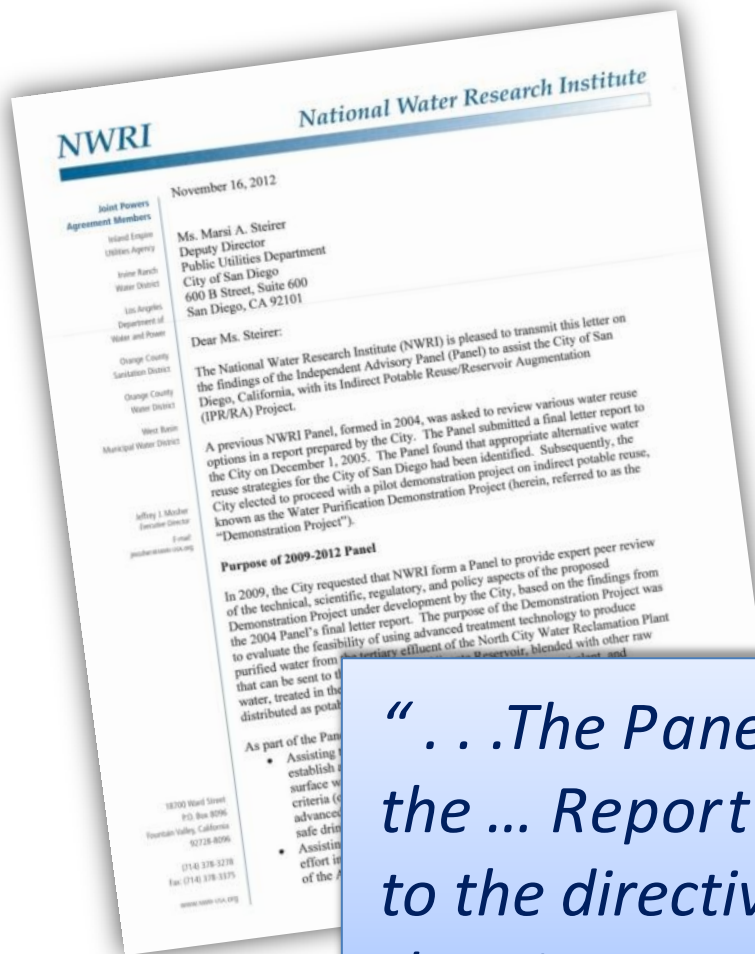
# INDEPENDENT ADVISORY PANEL

- Convened to provide expert peer review of the technical, scientific, and regulatory aspects of the Demonstration Project
- Similar role as IAP for the City's Water Reuse Study & Orange County's Groundwater Replenishment Project
- Provided feedback regarding
  - San Vicente Reservoir
  - AWP Facility
  - Proposed regulatory framework



# INDEPENDENT ADVISORY PANEL CONCLUSIONS

- Ten IAP meetings over three years
- IAP issued summary “letter of findings” November 16, 2012
- Unanimously concluded the Demonstration Project satisfied all City Council directives, and a San Vicente Reservoir augmentation project would be a landmark project



*“...The Panel believes that the ... Report... (is) responsive to the directives set forth by the City Council.”*

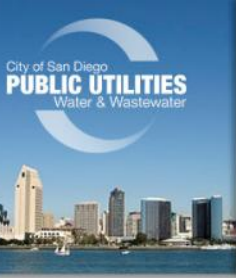


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# SAN VICENTE RESERVOIR STUDY





# SAN VICENTE RESERVOIR STUDY

## RESERVOIR ENLARGEMENT

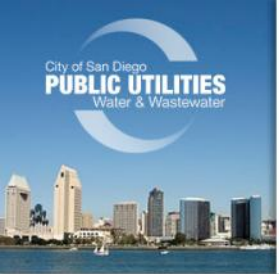
- San Vicente Dam and Reservoir constructed in 1944
- Reservoir enlarged from 90,000 acre feet to 247,000 acre feet
- Water Authority is constructing facilities
- City will operate reservoir, dam, and outlet works
- Refilling will take three to five years

1944 to 2012



2013





# SAN VICENTE RESERVOIR STUDY

## OBJECTIVES

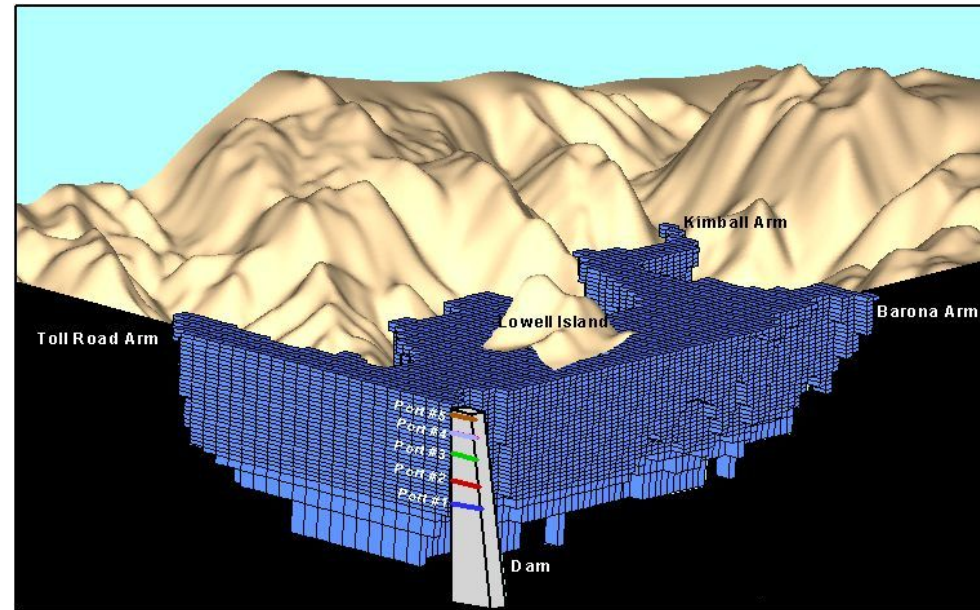
- Understand the characteristics of the enlarged reservoir
- Establish the retention time and dilution of purified water in the reservoir
- Determine water quality effects of purified water in the reservoir
- Secure regulatory approval from CDPH and San Diego Water Board



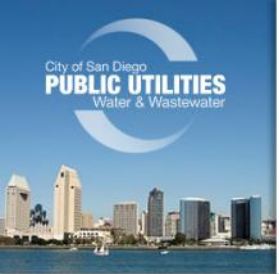
# SAN VICENTE RESERVOIR STUDY

## CONDUCT OF THE STUDY

- Reservoir studied using three-dimensional computer model
- Model calibrated and validated with measured data from the reservoir
- Input from CDPH and IAP
- Study methods approved by IAP
- Modeled ten different scenarios with varying
  - reservoir volumes
  - purified water inlet locations
  - seasonal changes



Model grid in SVR



# SAN VICENTE RESERVOIR STUDY

## RESULTS

- Reservoir provides an environmental barrier that satisfies anticipated regulatory requirements
- Purified water will be diluted at least 200:1 under all anticipated reservoir operations
- Important aspects of water quality in San Vicente will not be affected by adding purified water
- Reservoir expansion will improve water quality; purified water will not substantially change this





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# REGULATORY FRAMEWORK



# REGULATORY FRAMEWORK

- Regulatory agencies, CDPH, Regional Water Board, and County Dept of Environmental Health, attended IAP meetings
- Regulators commented on:
  - AWP Facility equipment
  - Testing & Monitoring Plan
  - San Vicente Reservoir Study



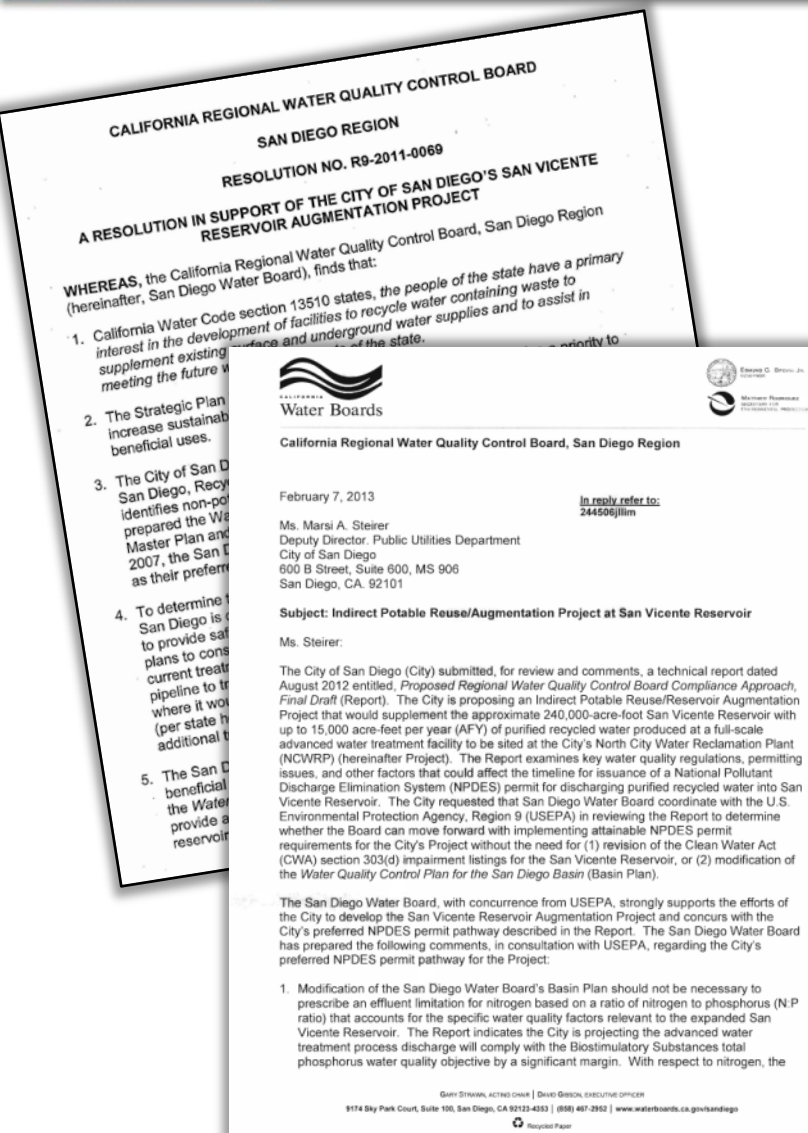
# CALIFORNIA DEPARTMENT OF PUBLIC HEALTH CONCEPT APPROVAL

- City submitted concept proposal to CDPH in March 2012
- CDPH concept approval letter September 7, 2012



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

# REGIONAL WATER BOARD



- Regional Water Board Resolution re. IPR/RA, October 12, 2011

*Regional WaterBoard "... supports efforts to develop the Reservoir Augmentation Project at San Vicente Reservoir."*

- City submitted Proposed Compliance Approach to Regional Water Board on August 30, 2012
- City received a letter of concurrence from the Regional Water Board on February 12, 2013

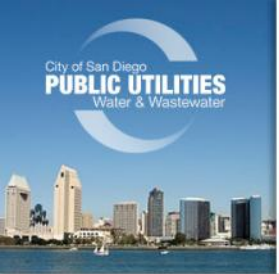
*"The . . . WaterBoard, with concurrence from USEPA, strongly supports the efforts of the City to develop the San Vicente Reservoir Augmentation Project..."*



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# ENERGY & ECONOMIC ANALYSIS & FULL-SCALE FACILITIES

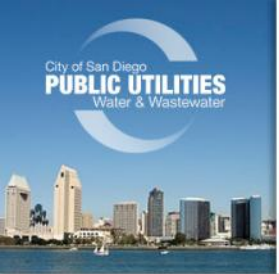


# LONG-RANGE WATER RESOURCES PLAN 2012 UPDATE ENERGY & ECONOMIC ANALYSIS

An Energy and Economic Analysis of various water supply options and portfolios was performed through the Long-Range Water Resources Plan (LRWRP) 2012 Update

- Energy consumption and greenhouse gas emissions of purified water delivered to San Vicente comparable to that of imported water
- Energy consumption and greenhouse gas emissions of purified water lower than ocean desalination





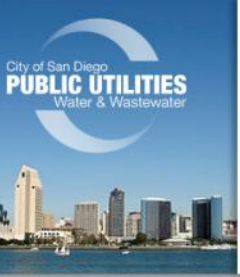
# LONG-RANGE WATER RESOURCES PLAN 2012 UPDATE

## ENERGY & ECONOMIC ANALYSIS

- Various water supply portfolios were evaluated and ranked based on their performance in meeting stakeholder objectives:

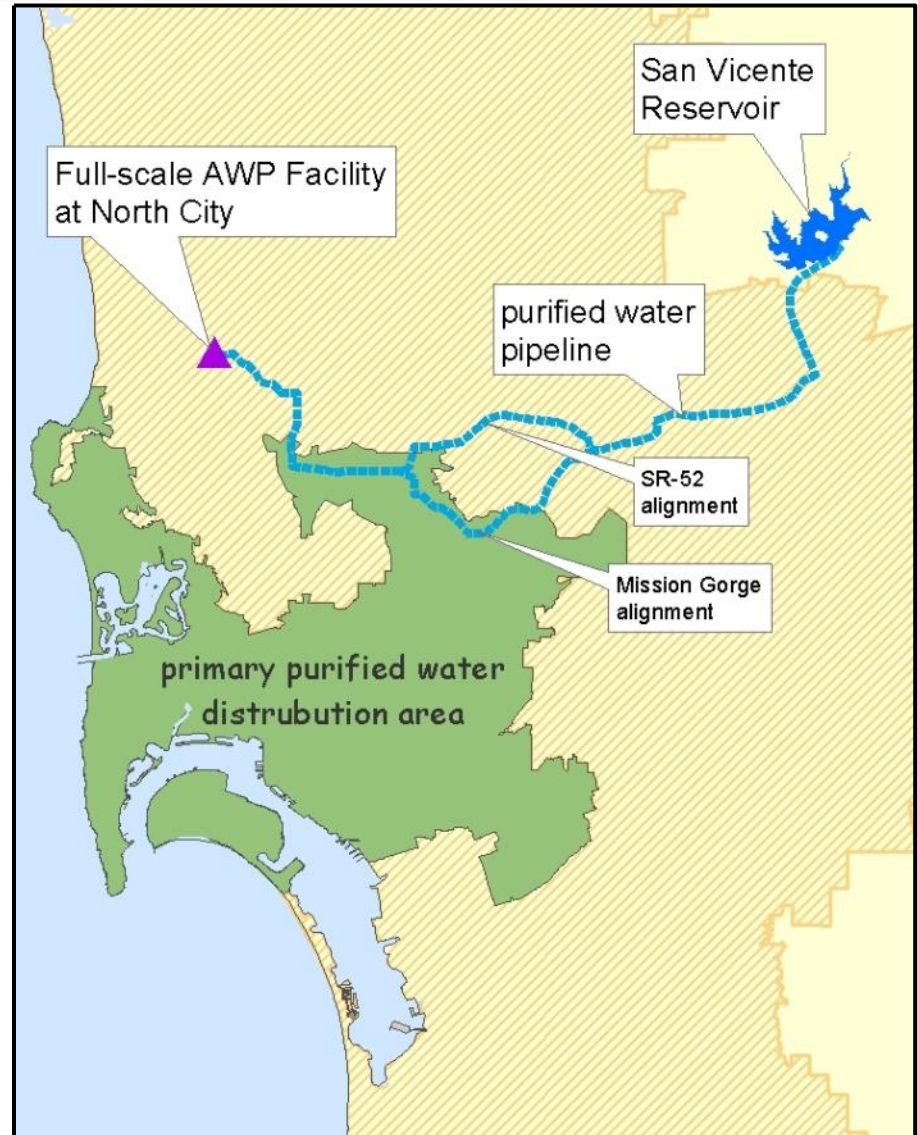
Supply reliability	Managing cost	Maximize water use efficiency	Scalability
Maintain assets	Local control	Readiness	Protect quality of life
Protect habitats & wildlife	Reduce energy footprint	Protect water quality	

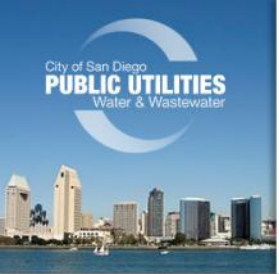
- The three highest-ranked portfolios included San Vicente IPR/RA
- Estimated cost of San Vicente IPR/RA: \$2,100/acre-foot to \$2,300/acre-foot
  - Portfolio rankings do not change over this range
  - Costs exclude potential for grants and local resource credits



# PROPOSED FULL-SCALE FACILITIES & FEATURES

- Full-scale AWP Facility
- Pipeline (two alignments studied)
- San Vicente Reservoir
- Purified water distribution area



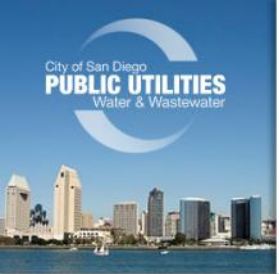


# DEMONSTRATION PROJECT

## SAN VICENTE IPR/RA COST ESTIMATE

	Capital	Annual Operating and Maintenance
AWP Facility	\$144,700,000	\$8,145,000
Pipeline & Pump station	\$224,500,000	\$3,385,000
Increased North City Tertiary Treatment	\$0	\$3,965,000
<b>Total</b>	<b>\$369,200,000</b>	<b>\$15,495,000</b>

- Result - \$2,000 per acre-foot to produce and convey 15 mgd of purified water to San Vicente Reservoir



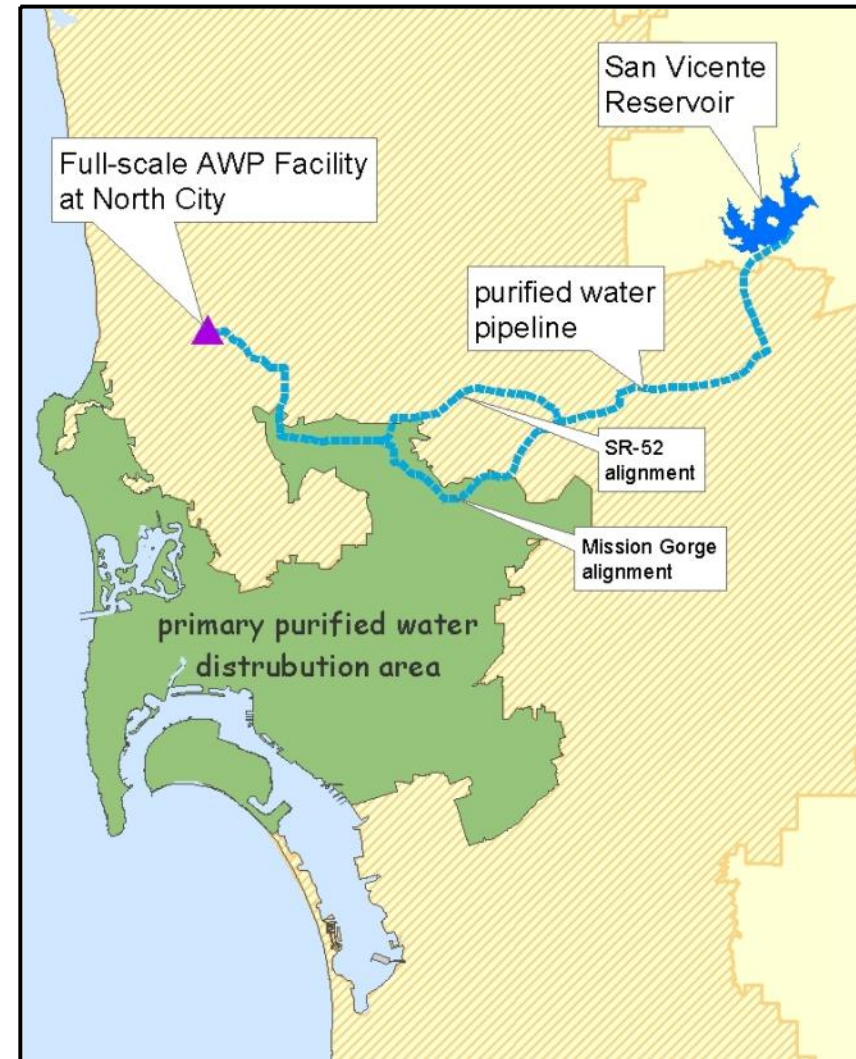
# DEMONSTRATION PROJECT, SAN VICENTE IPR/RA AVOIDED WASTEWATER COSTS

	Capital	Annual Operating and Maintenance
Point Loma Wet Weather Storage Facility	\$123,000,000	\$6,150,000
Reduced Treatment at Point Loma	\$0	\$2,210,000
Reduced Pumping at Pump Station No. 2	\$0	\$450,000
<b>Total</b>	<b>\$123,000,000</b>	<b>\$8,810,000</b>
<b>Total (per-acre-foot basis)</b>	<b>\$1,000</b>	

- Net cost: \$1,000 per acre-foot to produce and convey 15 mgd of purified water to San Vicente Reservoir

# PIPELINE ALIGNMENT STUDY

- 22 mile, 36-inch pipeline to convey water from the AWP Facility to San Vicente Reservoir
- Two potential alignments identified:
  - State Route 52 alignment
  - Mission Gorge alignment
- Additional analysis is needed to refine alignment



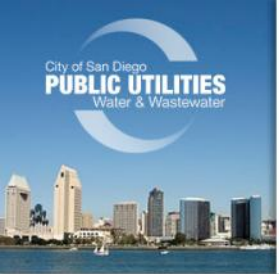




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# PUBLIC OUTREACH & EDUCATION PROGRAM

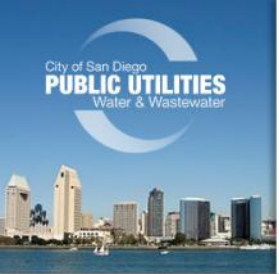


# PUBLIC OUTREACH & EDUCATION PROGRAM

## Program Components:

- Comprehensive Education & Outreach
- Outreach Materials & Tools
- Community Outreach
- Media Outreach
- Speakers Bureau
- Internal Department & City communications



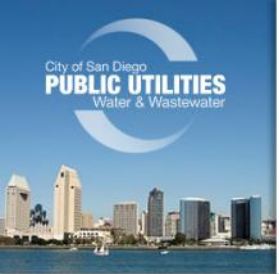


# PUBLIC OUTREACH & EDUCATION PROGRAM

## Program Statistics through December 31, 2012

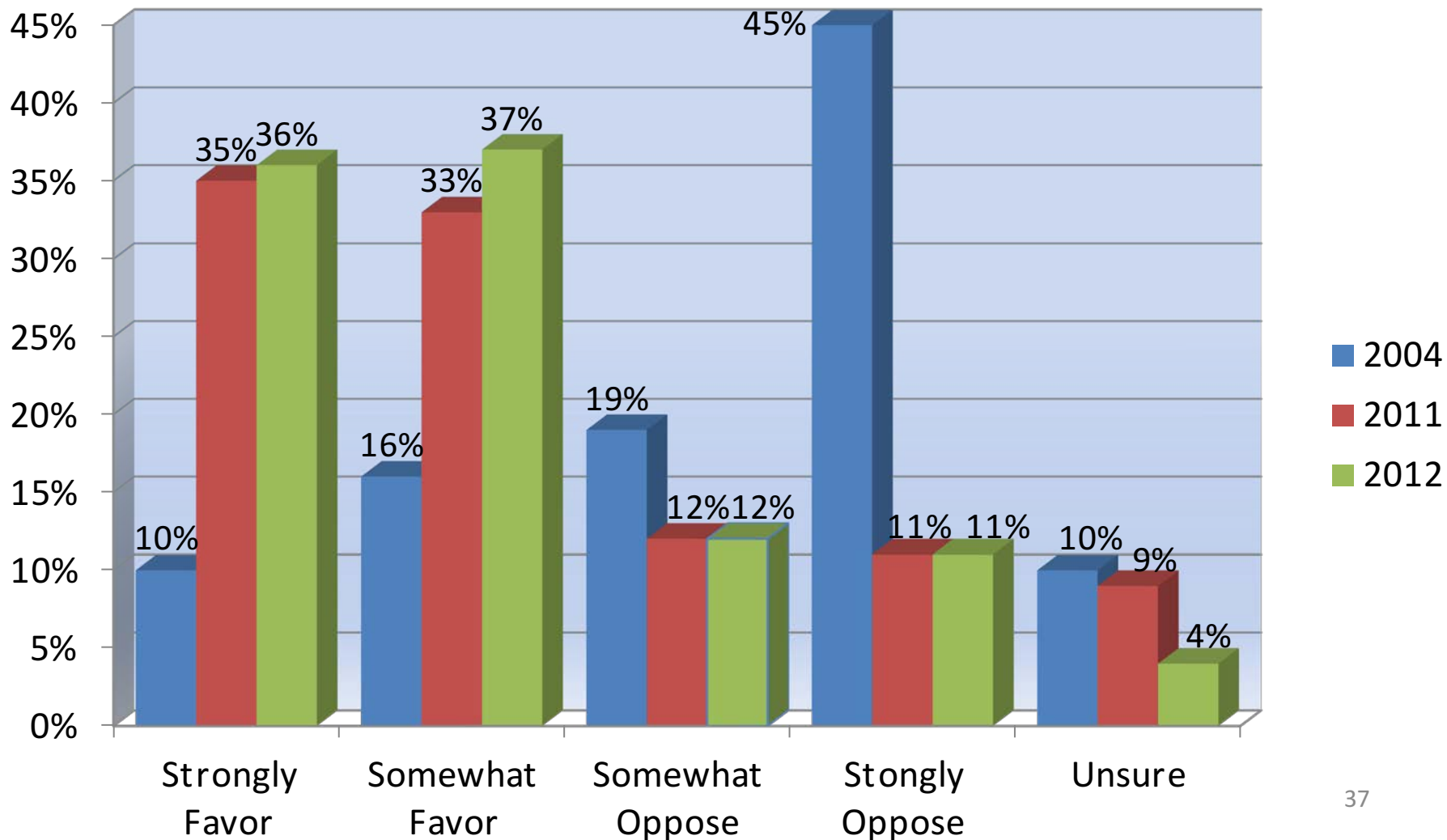
- Speakers Bureau presentations/attendees 130/3,500
- Community events/attendees 43/4,500
- Facility tours/visitors 234/3,255

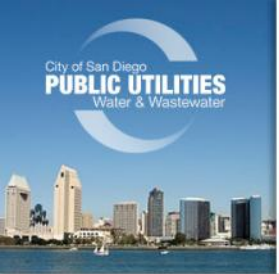




# PUBLIC OUTREACH & EDUCATION PROGRAM RESEARCH RESULTS

## USE ADVANCED TREATED RECYCLED WATER AS AN ADDITION TO DRINKING WATER SUPPLY

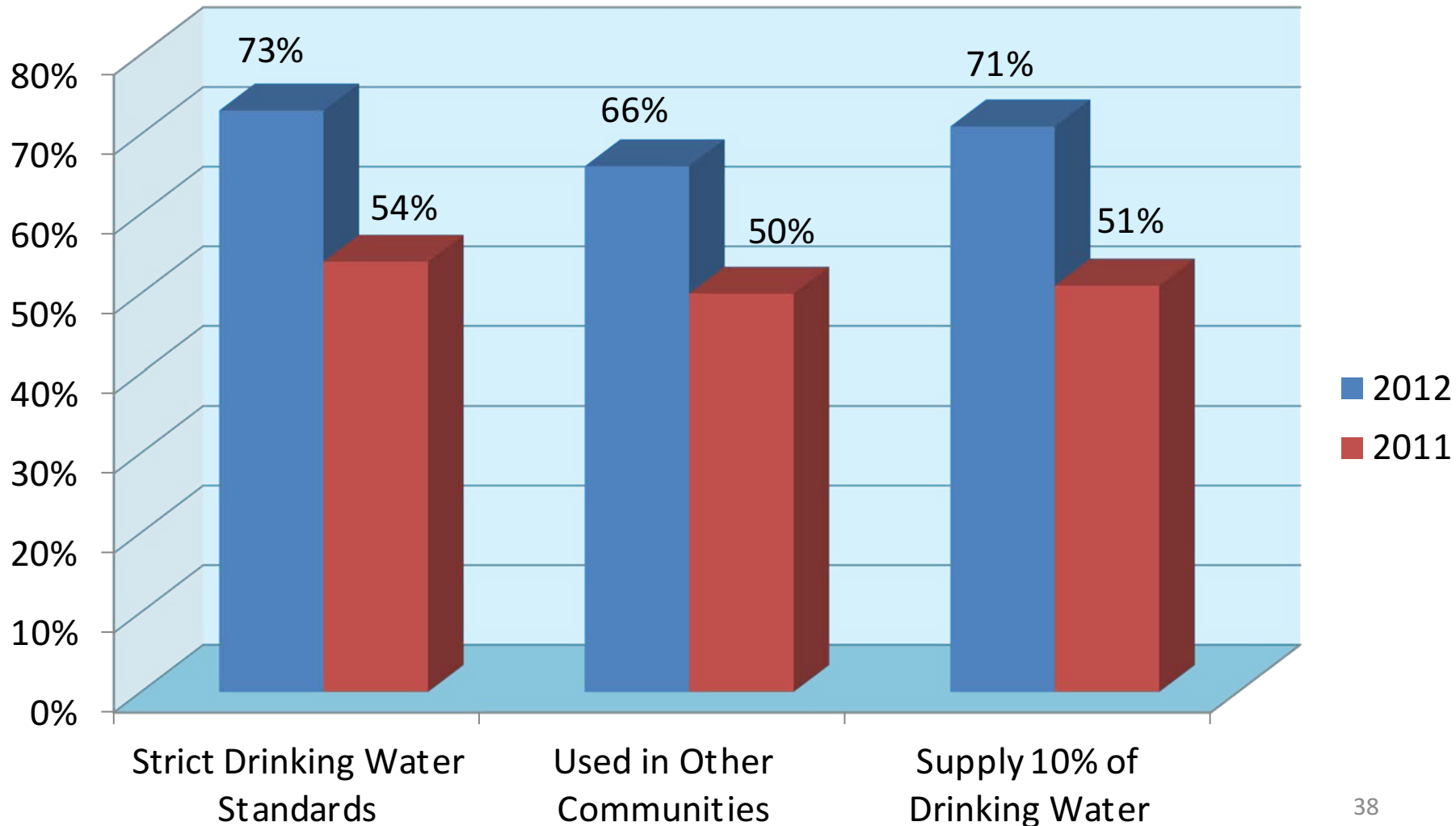




# PUBLIC OUTREACH & EDUCATION PROGRAM

## RESEARCH RESULTS

ACCEPTING OF RECYCLED WATER TO SUPPLEMENT DRINKING WATER IF RESPONDENT LEARNED CERTAIN FACTS





# PUBLIC OUTREACH & EDUCATION PROGRAM RESEARCH FINDINGS



- Gauge progress
- Re-direct outreach efforts based on research results and public feedback
- Identify gaps

Dear Tour Leader,

I Love the raindrop. I liked The Tour.  
I Love the part when they changed from  
badwater to clean water. Thank you for the  
Tour

# PUBLIC OUTREACH & EDUCATION PROGRAM



## COVER STORY

### From toilets

As water becomes more precious, more drinking water will come from treated sewage. Here's how it works.

### to tap



**Ultraviolet light**  
As a precaution, water is exposed to high-voltage UV light and hydrogen peroxide to destroy any organisms.

**Reverse osmosis**  
Water is pushed through a semi-permeable membrane that removes salts, minerals and pharmaceuticals.

**Microfiltration**  
Water is pushed through a semi-permeable membrane that removes suspended solids and bacteria.

Water is then used for a variety of purposes, including irrigation, industrial processes, and even drinking water.

Edward R. Moss  
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## EDITORIAL

### THE YUCK FACTOR: GET OVER IT

As San Diego spends about \$5 million people could be in just 10 more years, and a projected 4.4 million by 2050, the greatest threat to our economic health and quality of life is an uncertain supply of water. This urban cul-de-sac at the bottom of California is at the tail end of the pipelines that deliver 80 percent or more of our water. That

seeping and industrial processes, then purify and send it some more to nearby distant water standards. The demonstration project is to produce 1 million gallons a day for a year, during which it will be continually monitored and studied, but not distributed for public consumption. If it proves safe and affordable, the city could then consider it

## RESERVED FOR THE MAYOR

### Future of Water on Display at San Diego's Water Purification Demonstration Project

By San Diego Mayor Jerry Sanders



San Diego Mayor Jerry Sanders

This past summer, San Diego launched a one-year test of advanced water purification treatment on recycled water. Located in northern San Diego, the Advanced Water Purification (AWP) Facility is a small-scale testing ground that purifies one million gallons of recycled water each day to be used as a "closed-loop" water supply.

The facility is one component of the city's Water Purification Demonstration Project that is examining the safety and cost of purifying recycled water. If the project is approved by San Diego voters, the purified water would blend with the city's recycled water supply at San Vicente Reservoir and would become part of the city's water supply for the city's residents.

Another component of the demonstration project is the study of San Vicente Reservoir and the potential effects of adding purified water to it. During the test phase, purified water will not be sent to the reservoir or the city's drinking water supply. The purified water will be added to the city's existing "recycled" water supply.

San Diego is examining water purification as a way to diversify its water supply. The city's water supply is currently made up of a mix of surface water, groundwater, and recycled water. The city's water supply is currently made up of a mix of surface water, groundwater, and recycled water.

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December 19, 2011

## HUFFPOST GREEN

Jim Lauria  
Vice President of Marketing and Business Development for Amiad Filtration

### The Emotion of Wastewater

Posted: 06/12/11 09:28 PM ET



### Wastewater getting new life across county

By MICHAEL

07/04/11 10:41 AM PDT

Drought fears are fading for San Diego County residents, but because of the past pushed utility leaders across the region toward an unprecedented array of projects to locate supplies for irrigation, industry and even drinking water.

The concept goes back decades and it's been embraced in places without coming potential. The untapped possibilities are prompting campaigns to treat wastewater rather than a liability and likely means expensive — and expensive — forays

Think of it as the dawn of a new era in which every drop of sewage is scrutinized



## The New York Times

© 2011 The New York Times

FRIDAY, FEBRUARY 10, 2012

### As 'Yuck Factor' Subsides, Treated Wastewater Flows From Toilets

By HELENE K. BARBER

SAN DIEGO — Almost invisible in the northwest hills, the pilot water treatment plant here does not seem a far-flung outpost of innovation. It cost \$22 million, uses big-scale technology and produces a million gallons a day.

San Diego's water managers, if they think about drinking water from wastewater, with the park's water supply people from anything. They think about drinking water from wastewater, with the park's water supply people from anything.

## 大紀元時報

The Epoch Times 2011年8月5日-2011年8月11日 第1033號 聖地牙哥

### 污水變飲水 聖市再邁一步

【本報記者報導】位於聖地牙哥西北山區的「先進水處理示範計畫」(AWP)廠，目前正進行一項為期一年的測試，將處理過的污水用於灌溉、工業及飲用水。該計畫旨在展示如何將污水轉化為可飲用的水，以應對日益嚴重的乾旱問題。



### Breaking the Taboo on "Toilet to Tap"

Posted by BRYAN WALSH

Wednesday, August 16, 2011 at 12:29 pm

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As I wrote in [this week's Going Green column](#), the American South is gripped by a terrible dry spell, one lasting for months. In Texas alone, [99.93% of the country](#) is in some state of drought. These are extreme times—and they call for extreme measures. Like drinking urine—sort of.

In a sense, that's what one Texas town is ready to do. An [ABC News report](#) earlier this week, the town of Big Spring in parched West Texas has broken ground on a plant that will capture treated wastewater and use it for recycling. It won't exactly be direct "toilet to tap"—rather, the planet will take treated wastewater



NBC SAN DIEGO

NEWS • LOCAL

### Can San Diego Go From Toilet to Tap?

Sanders proposes plan to turn wastewater into drinking water

By Lauren Melnick | Thursday, Jan. 26, 2011 | Updated 1:10 PM PST



Here's a thought: To solve San Diego's water problem, how about flushing our wastewater right back into the tap?

San Diego's water problem is a complex one. The city's water supply is currently made up of a mix of surface water, groundwater, and recycled water. The city's water supply is currently made up of a mix of surface water, groundwater, and recycled water.



The advanced purified water will be continuously analyzed in the laboratory. The wastewater will be treated with the facility's recycled water and delivered to recycled water customers. That's about the selling drinking water in the recycled system, which means it's being recycled water for the first time.

Wastewater (Thursday) there was a relatively "bad off" for the project of the San Diego Water. Water is not the same as drinking water. It's not the same as drinking water.





THE CITY OF SAN DIEGO



# DEMONSTRATION PROJECT BUDGET

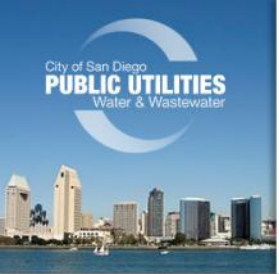
# BUDGET AND EXPENDITURES

PROJECT TASK	ORIGINAL BUDGET	ACTUAL CONTRACT	EXPENDITURES THRU FY2013
Program Management	\$1,688,000	\$1,781,742	\$1,635,537
Independent Advisory Panel	\$250,000	\$250,000	\$217,074
AWP Facility	\$7,400,000	\$7,400,000	\$7,146,897
Energy and Economic Analysis	Done through the Long Range Water Resources Plan 2012 Update		
Limnology and Reservoir Study	\$385,000	\$420,000	\$419,457
Pipeline Alignment Study	\$50,000	Incl. in Program Management Contract	
Public Outreach and Education	\$1,700,000	\$1,499,611	\$1,645,866 <sup>3</sup>
Contingency	\$338,000	\$459,647	\$328,399
<i>Regulatory Staff Charges<sup>1</sup></i>			\$122,075
<i>Non-personnel expenses<sup>2</sup></i>			\$206,324
Total	\$11,811,000	\$11,811,000	\$11,393,230 (\$417,770 under budget)

<sup>1</sup>Regulatory staff participated in IAP meetings and commented on AWP Facility Testing and Monitoring Plan

<sup>2</sup>Incurred in support of above project tasks; majority of expenses were due to production of outreach materials.

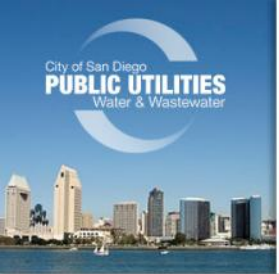
<sup>3</sup>Supports extended outreach activities through December 31, 2013



# SOURCES OF FUNDING AND REMAINING FUNDS

	Amount
Revenue from Special Rate Increase (Jan 2009 – Aug 2010)	\$10,738,165
State Prop 50 Grant	\$1,072,835
Bureau of Reclamation Grant ( <i>received subsequent to special rate increase</i> )	\$2,952,750
<b>Total Project Funding</b>	<b>\$14,763,750</b>
(Project Expenditures thru FY2013)	-\$11,393,230
(City Staff Charges thru FY2013)	-\$1,813,112
(Cost to Continue Operating AWP Facility thru FY2013)	-\$200,000
<b>Total Remaining Funds</b>	<b>\$1,357,408</b>



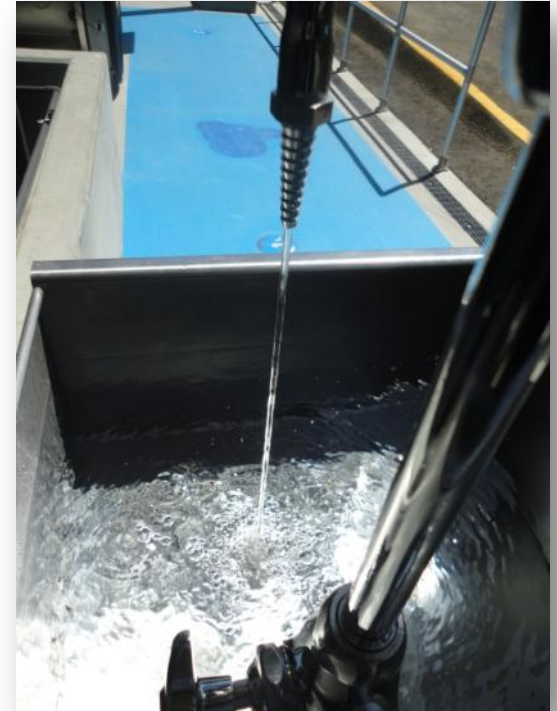


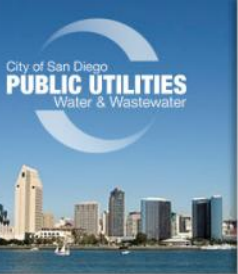
# ON-GOING USE OF REMAINING FUNDS

- Continuing AWP Facility operations
  - Prop 50 extended testing (2013 - 2014)
  - Prop 84 potable reuse study (2014 - 2015)
- AWP Facility tours
- Continuing outreach efforts
  - Tours
  - Speakers Bureau
  - Community events
- Next steps

# NEXT STEPS

- Determine appropriate cost-sharing concepts for water-wastewater funding sources
- Determine contracting modes
- Refine pipeline alignment
- Coordinate with Point Loma 2015 Permit Renewal and next steps associated with the Recycled Water Study
- Monitor development of direct potable reuse regulations





# SUMMARY

## AWP FACILITY

Operated for 12 months, producing water that met all state and federal drinking water standards

## RESERVOIR STUDY

Reservoir provides an environmental barrier that satisfies anticipated regulatory requirements

## REGULATORY COORDINATION

Received conceptual approval for a full-scale project from CDPH & Regional Board

## ENERGY & COST ANALYSIS

Energy comparable to imported water and cost is \$2,100 - \$2,300 per AF

## EDUCATION & OUTREACH

Outreach increased resident's understanding of water purification

Public opinion continues on an upward scale toward favoring purified water



# Water Purification | Demonstration Project

PureWaterSD.org

Marsi A. Steirer | [msteirer@sandiego.gov](mailto:msteirer@sandiego.gov) | 619.533.4112



Water Purification Demonstration Project



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