



**ABSTRACT & POWERPOINT PRESENTATION**

***Planning and Operations Experiences  
with the Chino Basin Groundwater Recharge Program***

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Managed Aquifer Recharge Symposium  
January 25-26, 2011  
Irvine, California

Symposium Organizers:

- National Water Research Institute
- Orange County Water District
- Water Research Foundation

[www.nwri-usa.org/rechargesymposium2011.htm](http://www.nwri-usa.org/rechargesymposium2011.htm)

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**ABSTRACT**

Planning and Operations Advice from Experiences with the Chino Basin Groundwater Recharge Program

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In 2005, Inland Empire Utilities Agency (IEUA) and Chino Basin Watermaster (CBWM) began operation of newly constructed recharge improvements intended to provide 164,000 acre-feet per year of recharge capacity. Prior to 2005, Chino Basin groundwater recharge was conducted on a more limited scale by the Chino Basin Water Conservation District and through conservation efforts of San Bernardino County Flood Control District. These four agencies partnered to develop the Chino Basin Facilities Improvement Project. The need for a groundwater recharge facility development project and operations program was a key element of the region's 1999 Optimum Basin Management Plan. From 2000 to 2005, the facilities were designed and constructed. Since 2005, operational experiences have led to periodic improvement projects and operations changes based on experience. Key experiences include development of realistic infiltration estimates, regular communication with project partners, considerations for dry weather flows and conservation berm failures, managing vegetation, resolving operational limits in basins owned by others, and managing basin restoration soil contractors.

Planning for recharge often includes estimating recharge and is linked with decisions for capital expenditures and regular maintenance activities. Recharge program planning should utilize a range of infiltration rates and consider cycles of water availability to appropriately estimate the need for project facilities. Annual maintenance programs and schedules are necessary to maintain infiltration rates. To the extent possible, large scale infiltration testing should be conducted during planning and operations.

In the Chino Basin, the recharge basins were designed for the capture of stormwater and significant flows of recycled water and imported water. However, dry weather flows are common and can provide both a significant recharge source and maintenance issues. Original basin modifications typically had broad flat bottoms that resulted in significant maintenance of plant growth and vector control. Reshaping the basin bottoms to contain and route dry weather flows has greatly reduced maintenance needs.

Many of the basins were originally designed with conservation berms constructed of soil due to much higher costs of soil-cement construction. While built with flow-through conveyance piping, large storm flows have topped soil berms creating significant washouts. Washed out berms cannot be repaired during a storm and can result in significant lost opportunity to capture stormwater. Due to these washouts and the need to conserve additional stormwater, several conservation berms have been rebuilt taller with either hardened spill points or replaced entirely with soil-cement.

Operational conflicts can occur when the basin operator for recharge is not the basin owner. Regular communications and special modifications can resolve conflicts in basin usage. An example of such a resolved use-conflict is the basin owner's use of the basin for soil processing during a time when the winter storm season provided water for capture. Through regular communication of objectives, a solution to the use-conflict was to construct temporary earthen containment berms to hold water while keeping the soil processing areas safely outside of the water capture area. IEUA and CBWM strive for good working relationships with the basin owners to facilitate operation and maintenance activities for the mutual benefit of the Chino Basin as a whole.

# Planning and Operations

## Experiences with the Chino Basin Groundwater Recharge Program

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IEUA Groundwater Recharge Coordinator

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# Chino Basin Water Supply Planning

- Challenges
  - Population Projections
  - Increasing water demand
  - Significant imported water supply reductions and decreased reliability
- Solution
  - Increased development of local water supplies

Chino Basin is one of the largest groundwater basins in Southern California



# Recharge Program Goals

- Conduct groundwater replenishment for water supply reliability
- Water Sources
  - Maximize stormwater capture
  - Maximize recycled water within program and permit limits
  - Utilize imported water, as available



# Milestones for the Chino Basin Recharge Program

- 1978 - Chino Basin Judgment
- 1999 - Optimum Basin Management Plan
- 2002 - CBWM adopted Recharge Master Plan
- 2002 - IEUA Certified PEIR for RW Master Plan
- 2002 - CBWM approved IEUA 30,000 AFY RW recharge
- 2004 - Maximum Benefit Basin Plan Amendment for TDS
- 2004 - MOU with OCWD for Hydraulic Control
- 2005 - Facilities Improvements Operational
- 2005 & 2007 - Recharge Permit and update
- 2009 - Permit Amendment for Underflow and Averaging Period
- 2010 - CBWM Recharge Master Plan Update

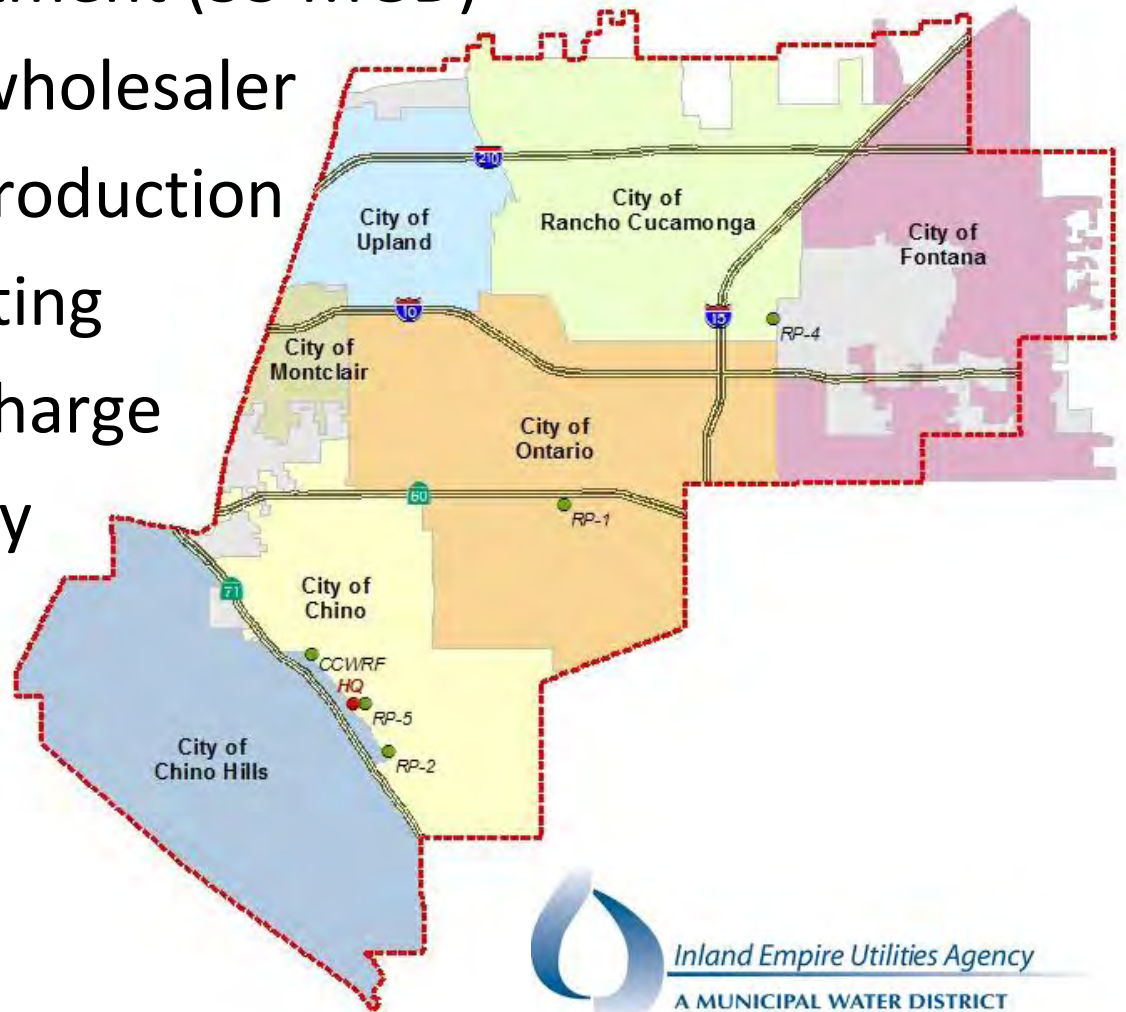
# Project Partners

- Chino Basin Water Conservation District
- San Bernardino County Flood Control District
- Chino Basin Watermaster
- Inland Empire Utilities Agency



# Inland Empire Utilities Agency

- Wastewater treatment (55 MGD)
- Imported water wholesaler
- Recycled water production
- Regional composting
- Groundwater recharge
- Renewable energy
- 235 square miles
- 800,000 people



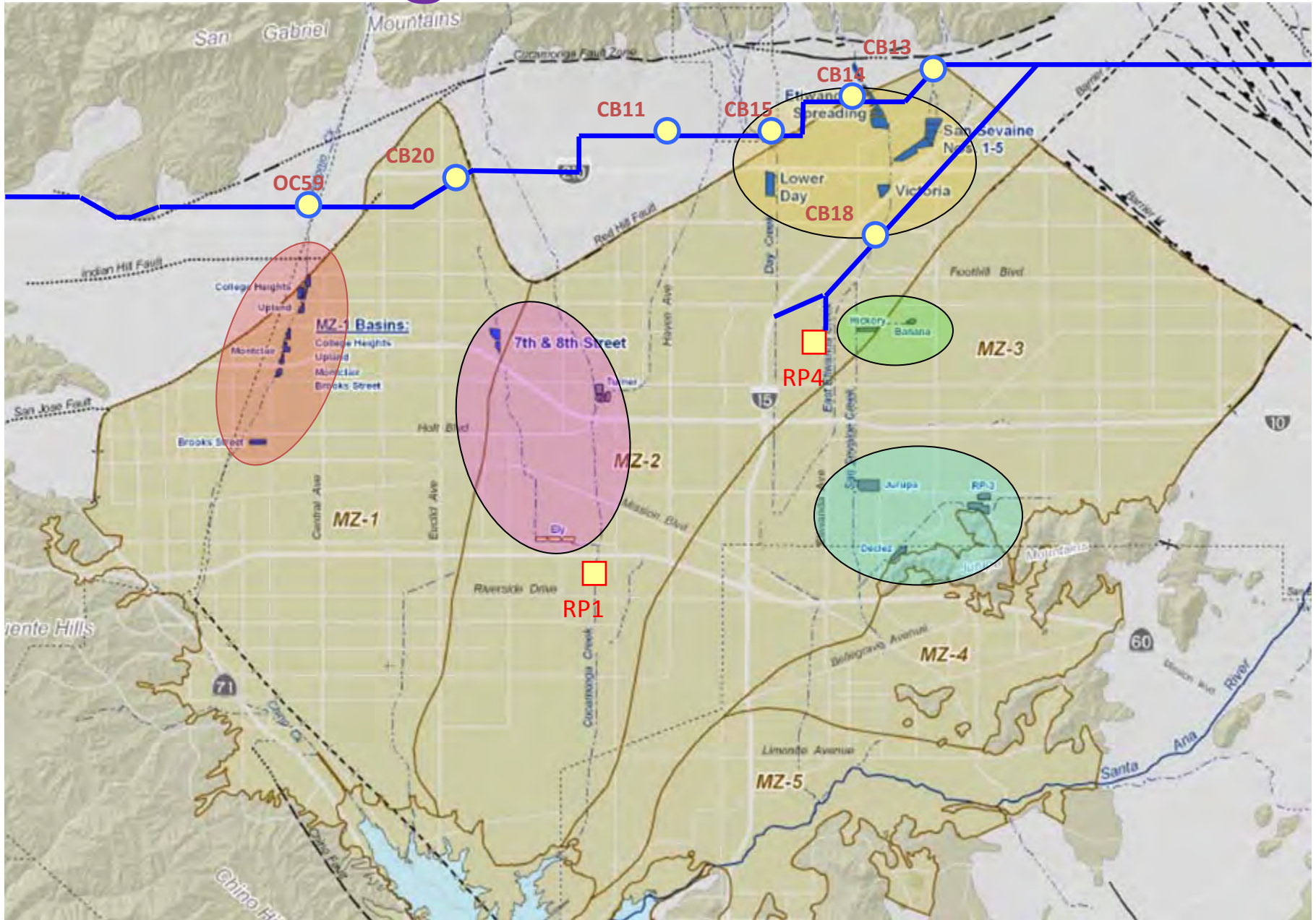
# Experiences from the Chino Basin Recharge Program

- Flood control facilities improved for recharge
- Key operations experiences for planners
  - Program performance will vary
  - Manage dry weather flows
  - Design for maintenance too
  - Communicate with project partners
  - Manage expectations

# Typical Program Recharge Basin



# Recharge Basin Locations



# Recharge Capacity Expectations and Performance

- Recharge capacity
  - 1999 Program EIR: 164,000 AFY
  - 2006 Engineering Report: 134,000 AFY
  - 2010 Recharge Master Plan: 117,500 AFY

Chino Basin Groundwater Recharge FY2005/06 through FY2009/10

Period	Storm Water (AF)	MWD (AF)	Recycled (AF)	Total (AF)	Unit Value (\$/AF)	
					MWD Tier 2 Treated	Value
FY 2005/06	12,999	33,756	1,304	48,059	\$ 524	\$ 25,182,877
FY 2006/07	4,734	32,991	2,754	40,478	\$ 549	\$ 22,222,659
FY 2007/08	10,243	-	2,340	12,583	\$ 574	\$ 7,222,629
FY 2008/09	7,590	-	2,750	10,340	\$ 606	\$ 6,266,040
FY 2009/10	14,141	5,001	7,210	26,352	\$ 811	\$ 21,371,472
Subtotals	49,707	71,748	16,357	137,812		\$ 82,265,677

# Planning Estimates of Recharge Volumes

- Infiltration rates
  - Text book vs. Field Tests
  - Degraded infiltration rates
- Cycles of water availability
  - Drought
  - Delta issues
  - Basin down time
  - Project partner needs
- Impacts on program
  - Over estimated benefit
  - Impacts of grant performance



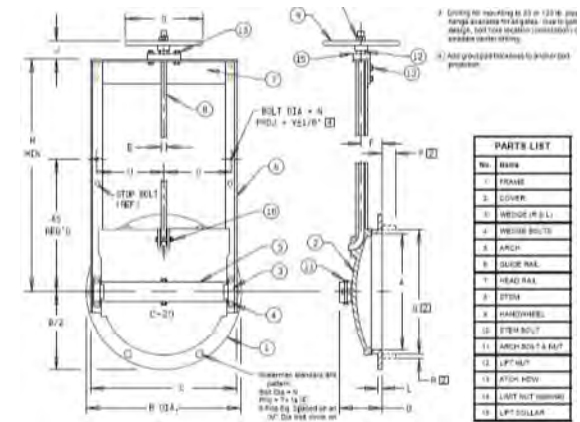
# Managing Dry Weather Flows

- A significant recharge source
- Require design considerations
- Create maintenance issues
  - Vegetation (nestable)
  - Vector control
  - Algal blooms
- Can be managed by basin configuration
  - Confine water to nuisance channels
  - Lined vs. Open channels
  - Shorten inter-basin channels



# Flood Control to Recharge Conversion

- Conservation berm leakage
- Conservation berm erosion
  - Soil vs. Soil cement
  - When to repair washouts
- Other issues
  - Accessibility of structures and instrumentation
  - Inlet type selection
  - Multiple basin uses





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Accessibility



## Conservation Berm Erosion



# Inlet Type Selection

## Rubber Dam vs. Drop Inlets



# Multiple Basin Uses

## Avoiding and Resolving Conflicts

- Conflicts Arise
  - Soil Brokering in Jurupa and San Sevaine Basins
  - Grove Basin Elevation Restriction and Operation
- Develop good working relationships
  - Meet Regularly
  - Be Responsive
  - Develop Trust





## Grove Basin Elevation Restriction and Operation



# Experiences from the Chino Basin Recharge Program

- Flood control facilities augmented for recharge
- Key operations experiences for planners
  - Program performance will vary
  - Manage dry weather flows
  - Communicate with project partners
  - Manage expectations

**Thank you!**