2017 NGWA Groundwater Summit

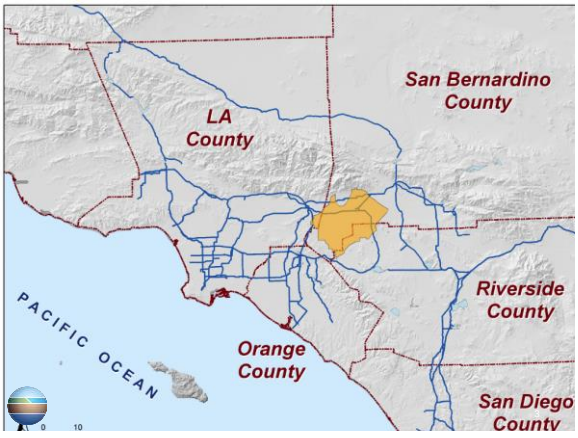
Managed Aquifer Recharge

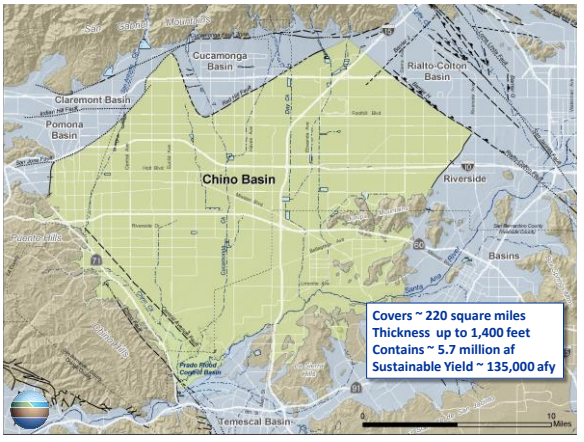
2013 Chino Basin Recharge Master Plan Implementation

Garrett Rapp, PE
December 5, 2017

Outline of talk

- Chino Basin background
- Attempting sustainability in the Chino Basin
- Role of Chino Basin recharge master plan in sustainable groundwater management
- 2013 Recharge Master Plan highlights
- Take aways





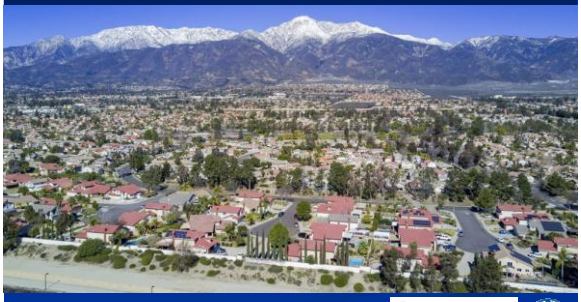
Groundwater Management Plan

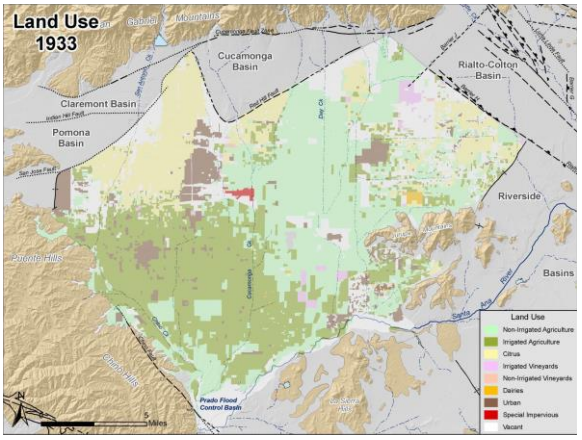
- Historically the basin was in overdraft until adjudicated by stipulated agreement in 1978
  - Pumping rights were established
  - Physical solution ensures sustainable groundwater management
- The basin stakeholders developed the Optimum Basin Management Program in 1998 and began implementation in 2000

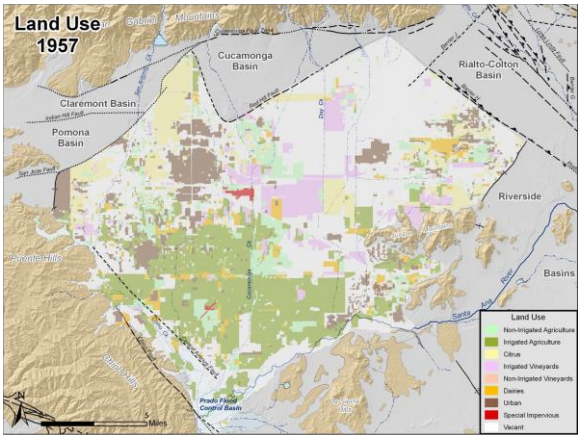
The OBMP Includes Nine Program Elements

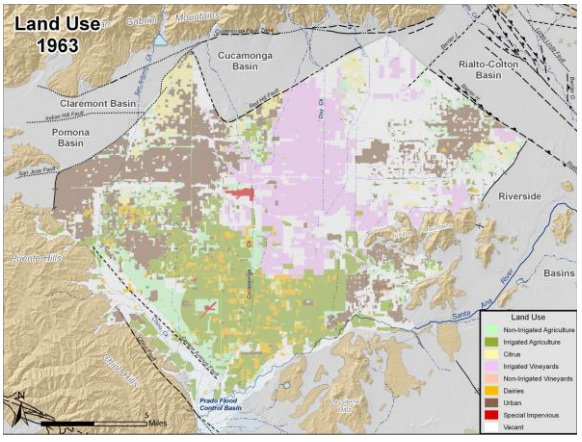
- Comprehensive Monitoring Program – PE 1
- **Comprehensive Recharge Program – PE 2**
- Water Supply Plan for Impaired Areas – PE 3
- Subsidence Area Management Program – PE 4
- Regional Supplemental Water Program – PE 5
- Cooperative Programs with Regulators – PE 6
- Salt Management Program – PE 7
- Storage Management Program – PE 8
- Storage and Recovery Program – PE 9

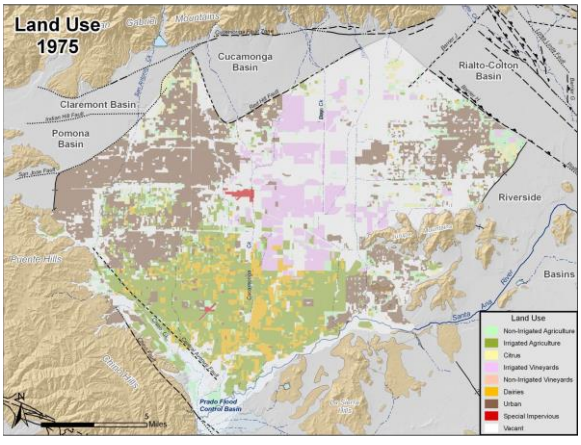
Increase in Impervious Area

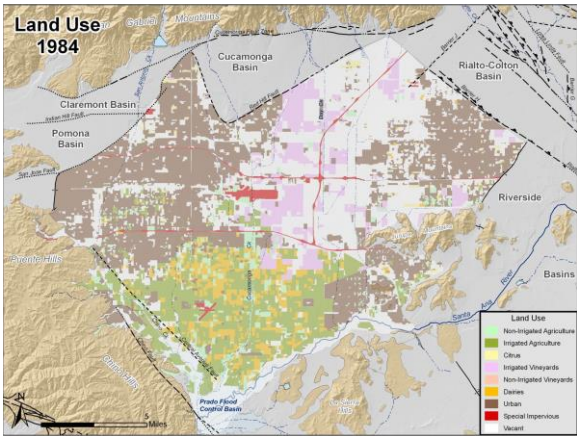


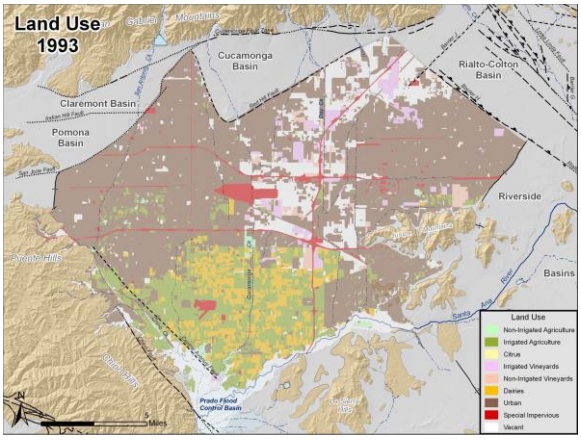


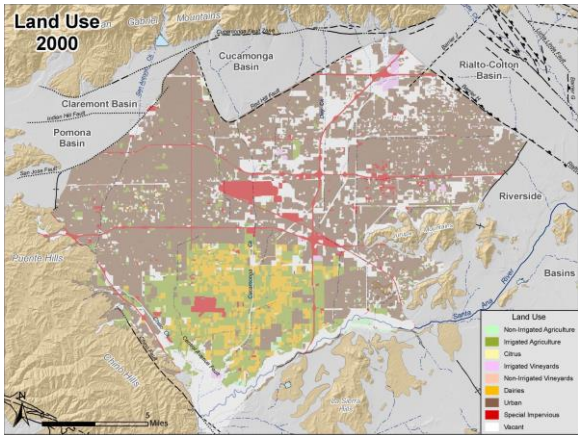


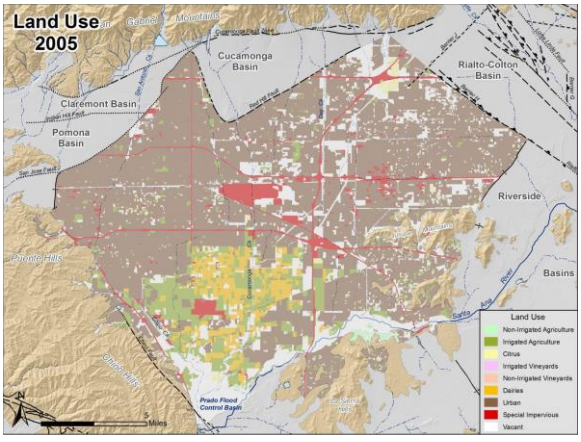




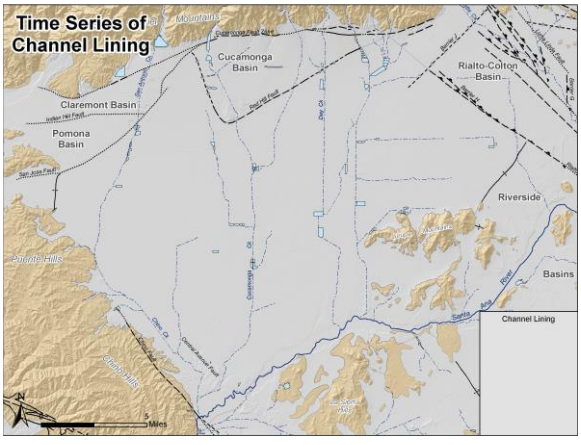


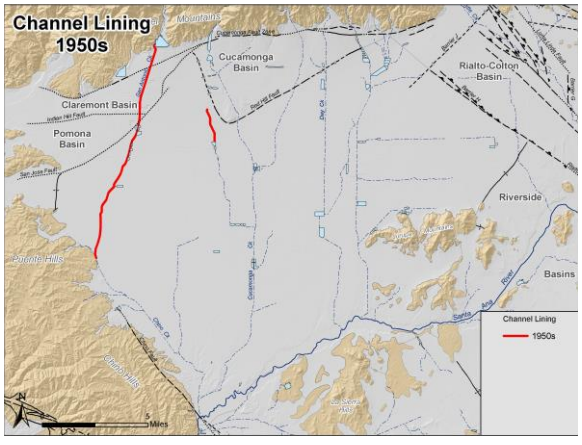

Land Use
1993
Cucamonga Basin
Rialto-Colton Basin
Claremont Basin
Pomona Basin
Riverside Basins
Prado Flood Control Basin
Land Use
Non-Irrigated Agriculture
Irrigated Agriculture
Citrus
Irrigated Vineyards
Non-Irrigated Vineyards
Dairies
Urban
Special Impervious
Vacant
5 Miles

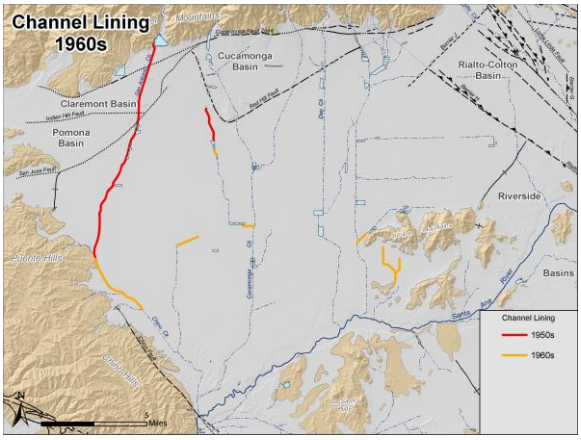

Land Use
2000
Cucamonga Basin
Rialto-Colton Basin
Claremont Basin
Pomona Basin
Riverside Basins
Land Use
Non-Irrigated Agriculture
Irrigated Agriculture
Citrus
Irrigated Vineyards
Non-Irrigated Vineyards
Dairies
Urban
Special Impervious
Vacant
5 Miles

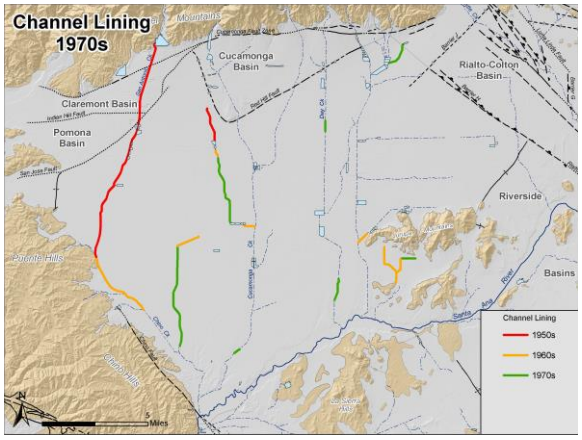

Land Use
2005
Cucamonga Basin
Rialto-Colton Basin
Claremont Basin
Pomona Basin
Riverside Basins
Prado Flood Control Basin
Land Use
Non-Irrigated Agriculture
Irrigated Agriculture
Citrus
Irrigated Vineyards
Non-Irrigated Vineyards
Dairies
Urban
Special Impervious
Vacant
5 Miles

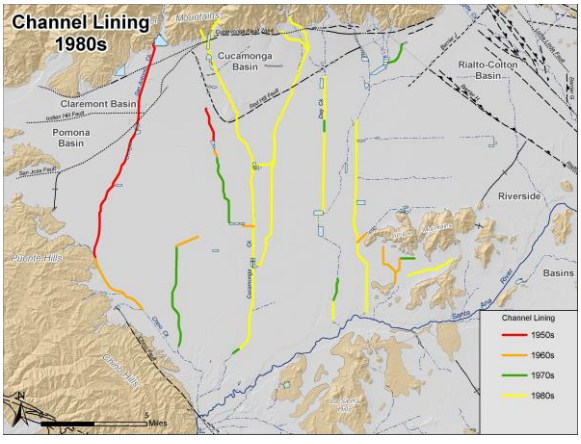

Channelization of Creek Systems

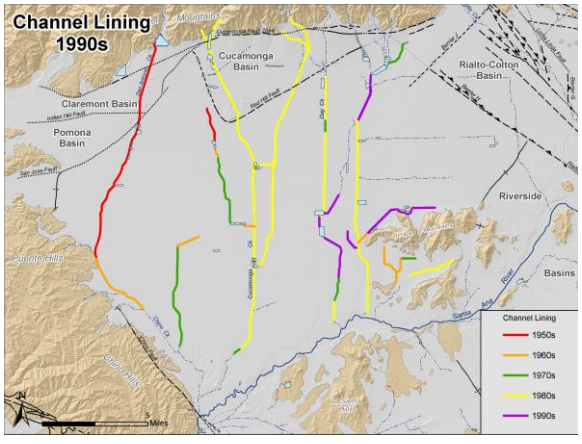

Time Series of
Channel Lining
Cucamonga Basin
Rialto-Colton Basin
Claremont Basin
Pomona Basin
Riverside Basins
Channel Lining
5 Miles

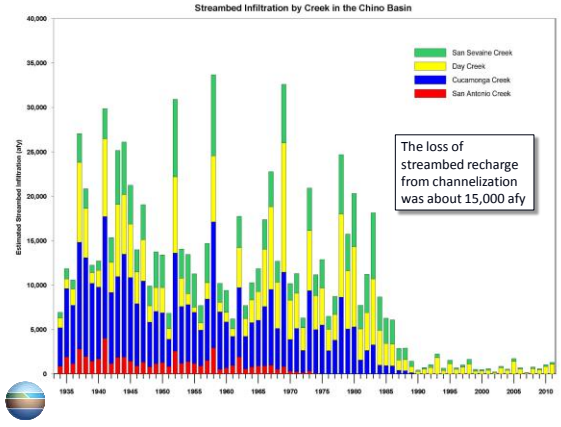

Channel Lining
1950s
Cucamonga Basin
Rialto-Colton Basin
Claremont Basin
Pomona Basin
Riverside Basins
Channel Lining
1950s
5 Miles











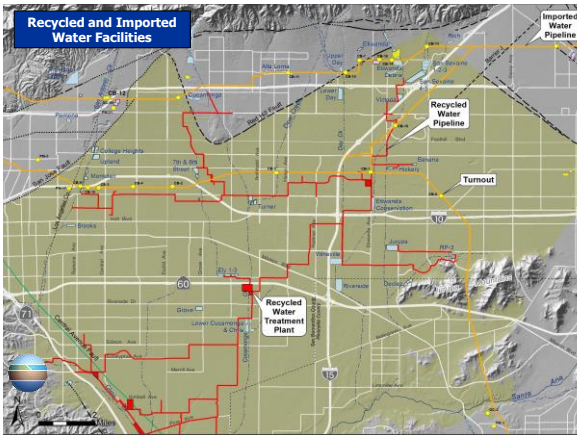
Why do a recharge master plan?

- Since the adjudication:
  - Deep infiltration of precipitation and applied water decreased ~18,000 afy
  - Streambed infiltration decreased ~15,000 afy
- The recharge master plan was incorporated into the OBMP PE 2 to mitigate the lost recharge
- Recharge master planning is a continuous process

What is a recharge master plan?

- Facilities plan that identifies the universe of storm and supplemental water recharge projects
- Evaluates them based on stakeholder criteria
- Recommends projects for implementation
- Includes an implementation plan to refine, design, prepare environmental documentation, permit, finance, and construct projects

25



Scientifically-Defensible Basis of Design for New Stormwater Projects

- Developed surface water model to estimate a long-term daily time history of discharge at points of interest
  - Daily precipitation record July 1949 through June 2012
  - Current land use (2012) and drainage management

27

Scientifically-Defensible Basis of Design for New Stormwater Projects

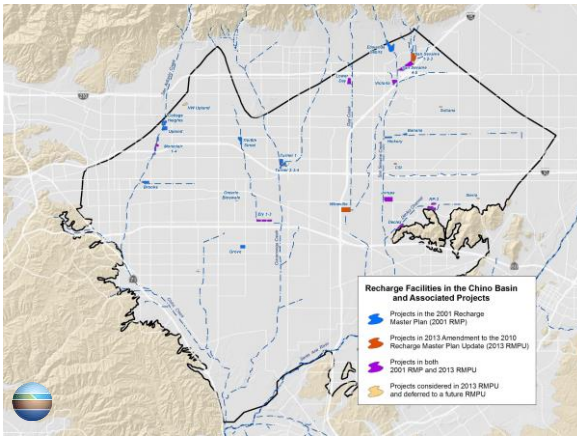
- Daily storm flow hydrographs were routed through the drainage system
  - Used as-built drawings of existing channels and stormwater management facilities
  - Created recharge facilities alternatives and operating plans
  - Simulated long-term operation of recharge facilities alternatives
  - Computed long-term average annual estimates of new stormwater recharge

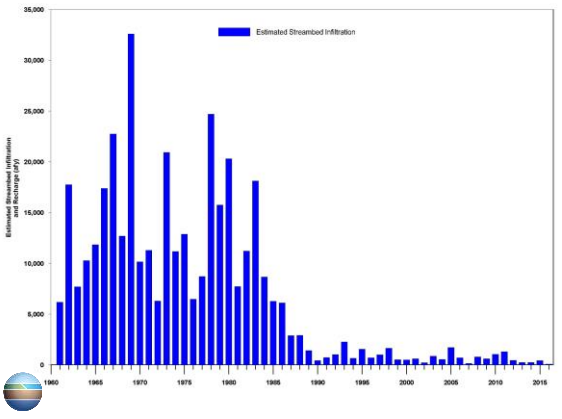
28

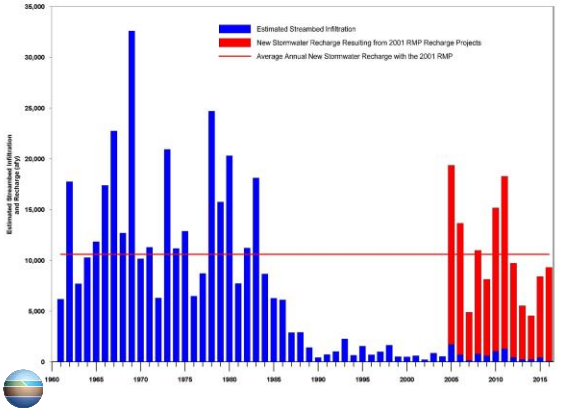
2013 RMPU Project Identification and Screening Process

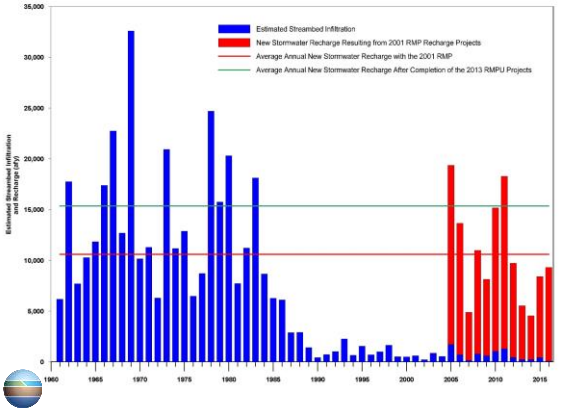
- Recharge master plan steering committee:
  - Issued a call for projects to all stakeholders
  - Developed evaluation criteria
  - Used modeling tools to estimate new recharge
  - Developed cost opinions
  - Applied evaluation criteria
- 35 facility improvement projects and eight O&M improvement projects were evaluated
- Nine facility improvement projects were selected for implementation

29









Recharge Capacity in the Chino Basin (afy)

Water Type	Pre-OBMP Recharge Capacity in 2000	Capacity after 2001 RMP Recharge Projects Were Completed in 2004	Capacity after 2013 RMPU Recharge Projects Are Completed in 2020
Storm	~2,000	11,000	15,900
Recycled	500	13,200	20,300
Imported	28,500	45,900	38,800
Total	31,000	70,100	75,000

Unit Cost of Stormwater Recharge

	2001 RMP	2013 RMPU
Yield (afy)	+9,000	+4,900
Capital Cost	$65 million	$30 million
Annualized Capital Cost	$4.2 million	$1.9 million
Annual O&M Cost	$0.27 million	$0.18 million
Unit Cost	$500/af	$440/af
Avoided Imported Water Unit Cost	$666/af in 2017 $1,000/af in 2025	

Implementation Status

- 2013 Recharge Master Plan Update adopted by IEUA and the Watermaster in 2013
- Five projects are in pre-construction/final design
- Some projects have received grant funds and low-interest financing; more funding is being sought
- Construction of five projects is expected to be completed in 2020
- Next recharge master plan update is scheduled for 2018

Take Aways

- Chino Basin stakeholders developed and applied a scientifically-defensible, systems-approach to:
  - identify recharge opportunities
  - characterize and assess feasibility
- Approach was used in the 1998, 2001, and 2013 recharge master plans; and is planned in 2018

Take Aways

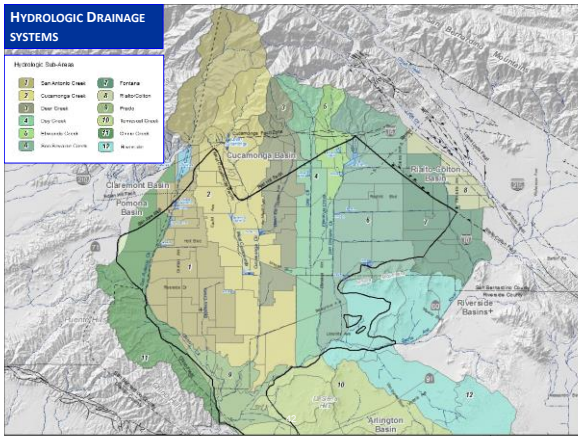
- The recharge projects implemented through 2020 will replace the stormwater recharge lost to channelization
- The Chino Basin recharge master plan stakeholder and technical processes can be reproduced anywhere

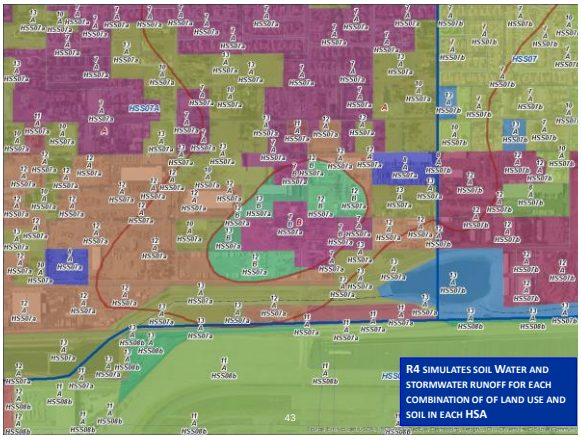
Questions

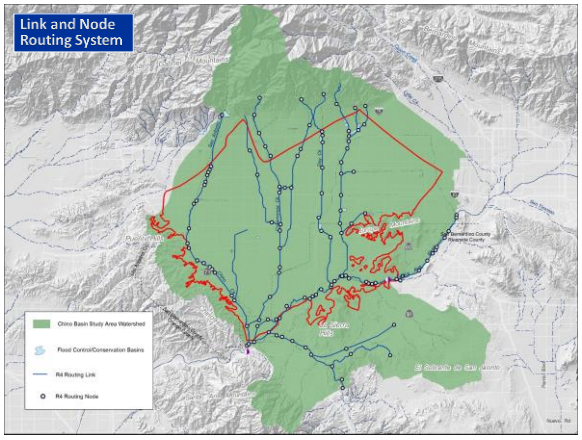
Contact me at:
grapp@weiwater.com
+1 949-600-7525

Technical documents can be viewed here:
http://www.cbwm.org/rep_engineering.htm

End




R4 SIMULATES SOIL WATER AND STORMWATER RUNOFF FOR EACH COMBINATION OF OF LAND USE AND SOIL IN EACH HSA


Link and Node Routing System
Chino Basin Study Area Watershed
Flood Control/Conservation Basins
R4 Routing Link
R4 Routing Node