

EBMUD's Stormwater Capture Study

WaterReuse Association
Northern California Chapter Meeting
Friday, February 26, 2016

- Background
 - Study Goal
- Rainfall/Runoff Estimation
 - Climate Change Considerations
- Results
 - Storage Requirements
- Moving Forward

Background

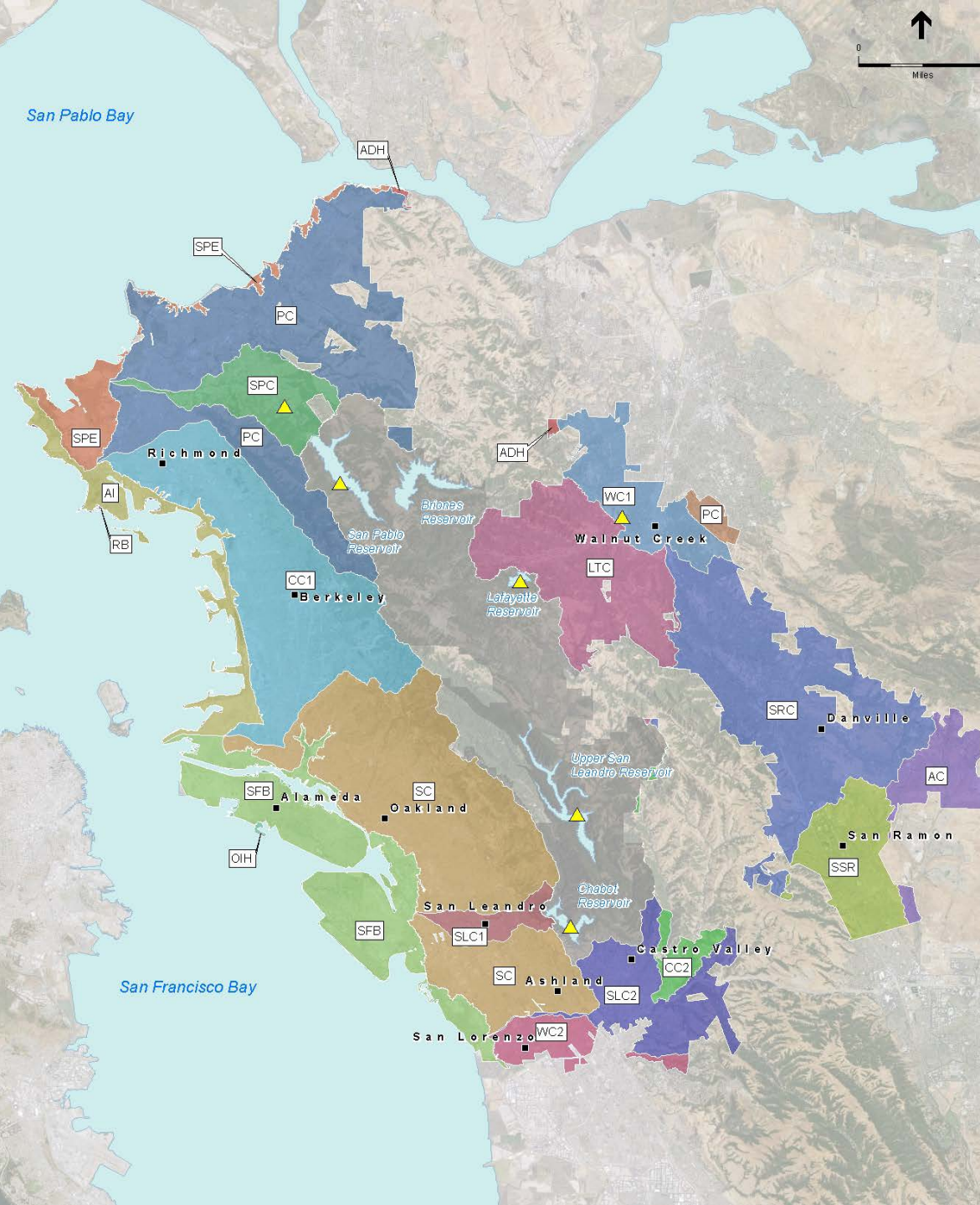


- Study performed in early 2015
- Scope
 - Delineate service area watersheds
 - Estimate average rooftop areas, runoff generation, and capture potential by watershed
 - Develop future conditions estimates in consideration of climate change
 - Calculate storage requirements
- Study goal
 - Estimate the volume of stormwater that could potentially be captured from the roofs of residential customers within the EBMUD service area, under current conditions and under two climate change scenarios for the year 2040

Rainfall/Runoff Estimates



- Watershed Delineation
 - Remove areas where runoff enters terminal reservoirs
- Runoff Calculation
 - Estimate runoff by Mokelumne River water year type (critical dry, dry, below normal, normal and above)
- Land Use Factors
 - Consideration of density of development, roof size square footage, etc.
- Climate Change Consideration
 - Model a range of possible futures

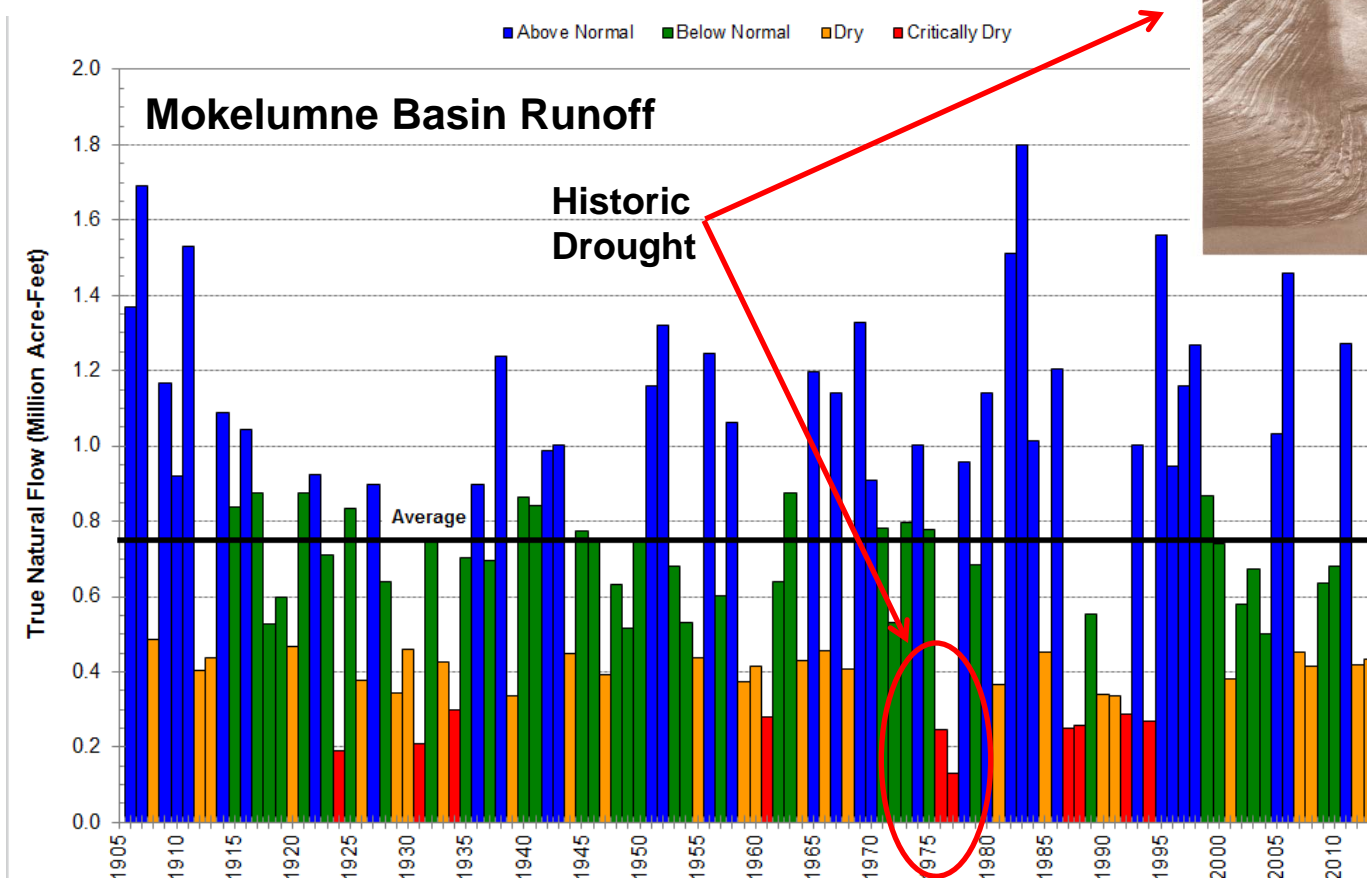


- City
- ▲ Weather Station
- ▭ EBMUD Service Area
- Watershed**
- AC- Alamo Creek
- AI- SF Bay Frontage (Angel Island+SF Bay Estuaries)
- ADH- Arroyo del Hambre + Frontal Creeks
- CC1- Cerrito Creek + Frontal SF Bay
- CC2- Crow Creek
- LTC- Las Trampas Creek
- OIH- Oakland Inner Harbor + SF Bay
- PC- Pine Creek
- PC- Pinole Creek + Frontal San Pablo
- RB- Richardson Bay+ SF Bay
- SFB- San Francisco Bay Estuaries
- SLC1- San Leandro Creek
- SLC2- San Lorenzo Creek
- SPE- San Pablo Bay Estuaries
- SPC- San Pablo Creek
- SRC- San Ramon Creek
- SC- Sausal Creek + Frontal SF Bay Estuaries
- SSR- South San Ramon Creek
- WC1- Walnut Creek + Frontal Suisin Bay Estuaries
- WC2- Ward Creek + Frontal SF Bay Estuaries
- Watershed Up stream of Reservoir (Not Analyzed)

Hydrology of Primary Supply Watershed

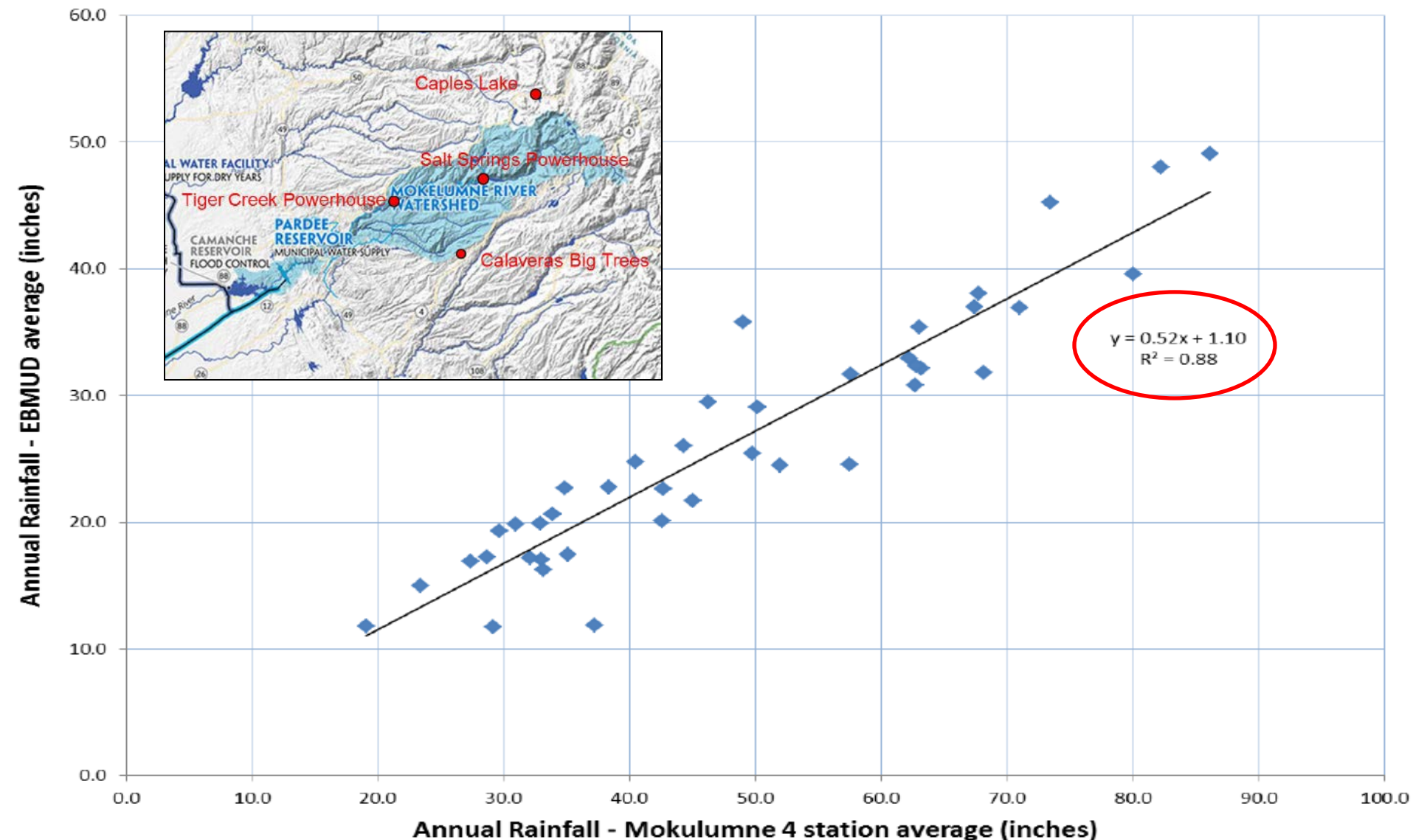


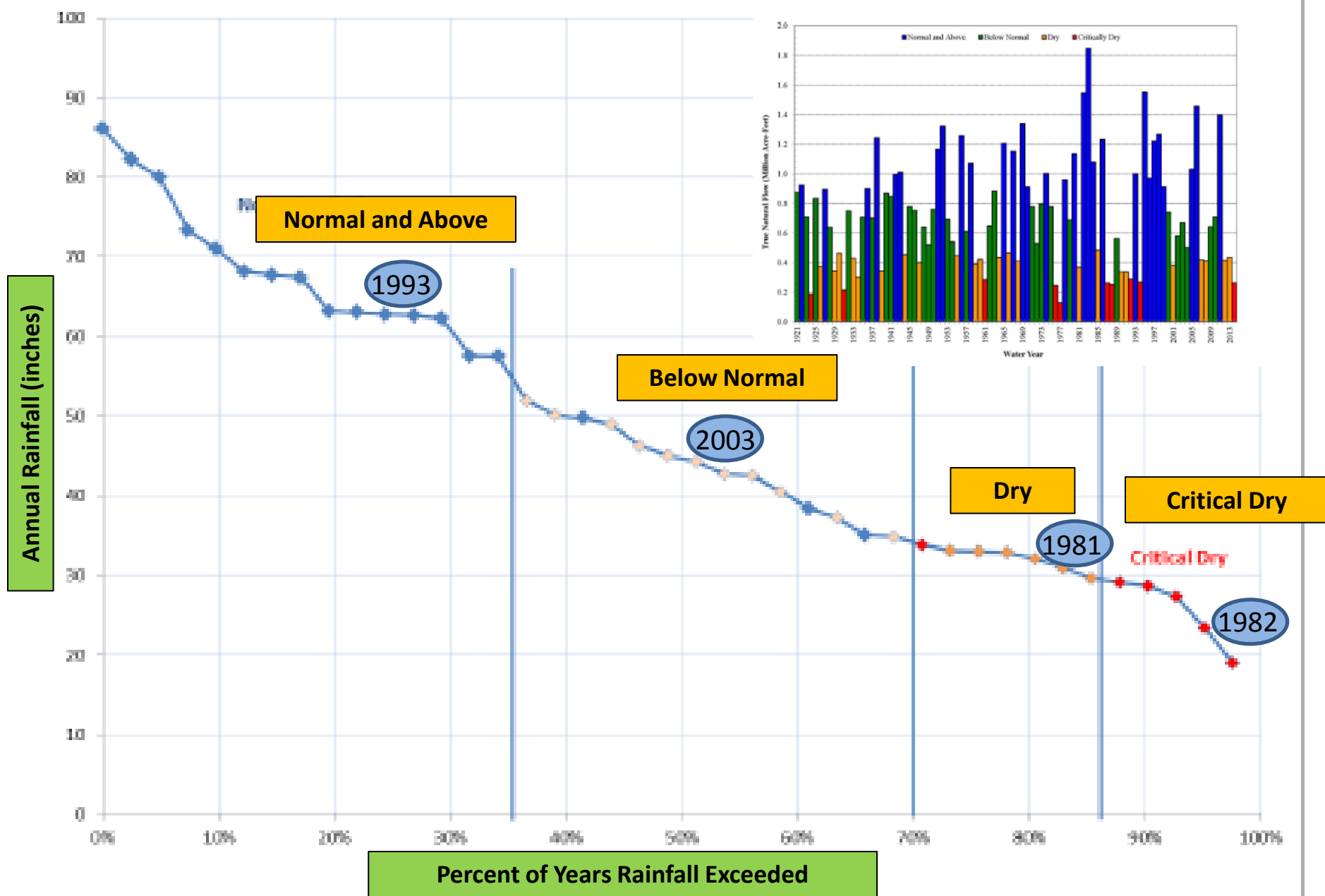
Factor-in Mokelumne River Watershed



**Pardee
Reservoir (1977)**

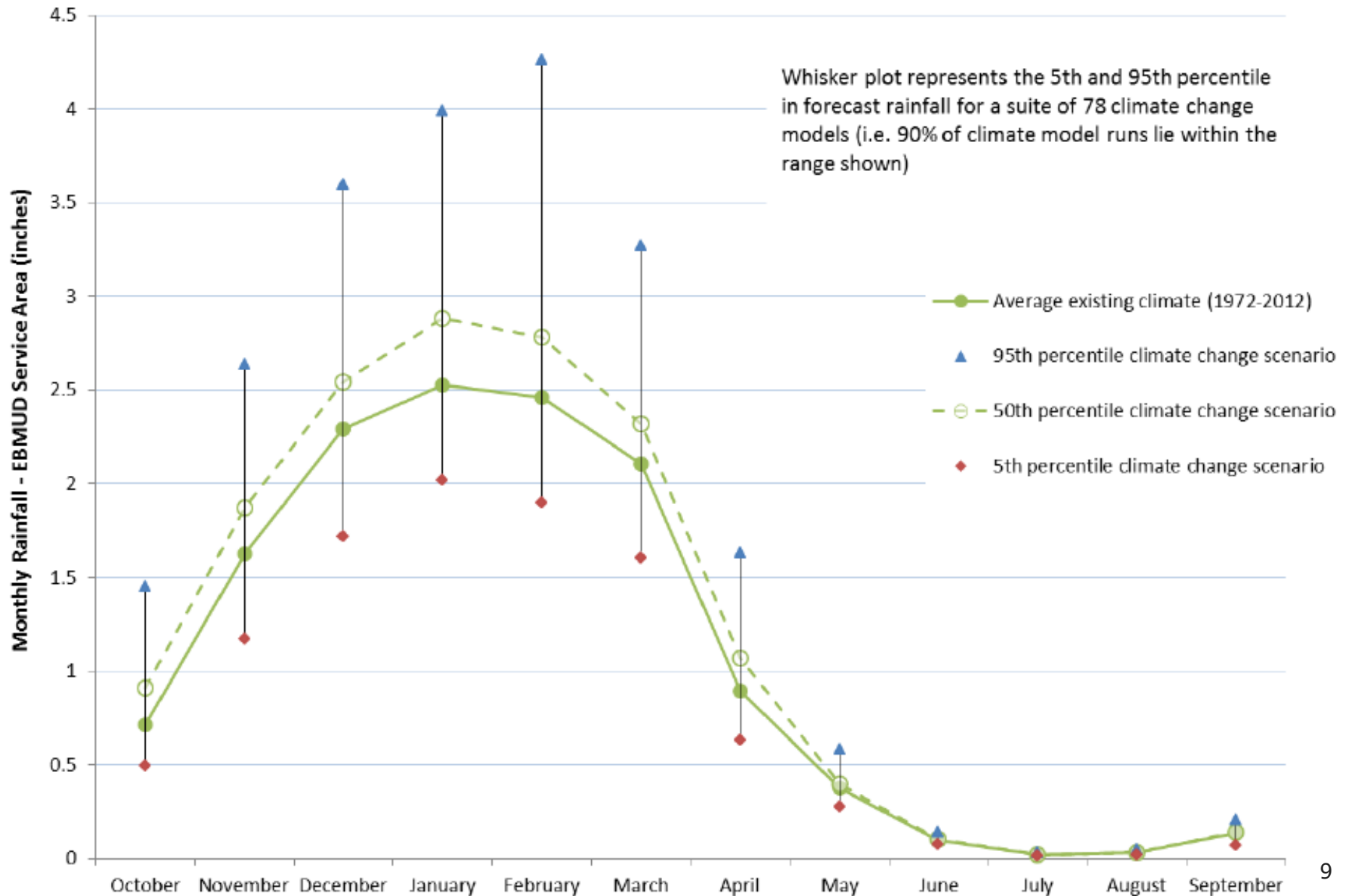
Service Area Rainfall Estimation by Mokelumne River Year Type



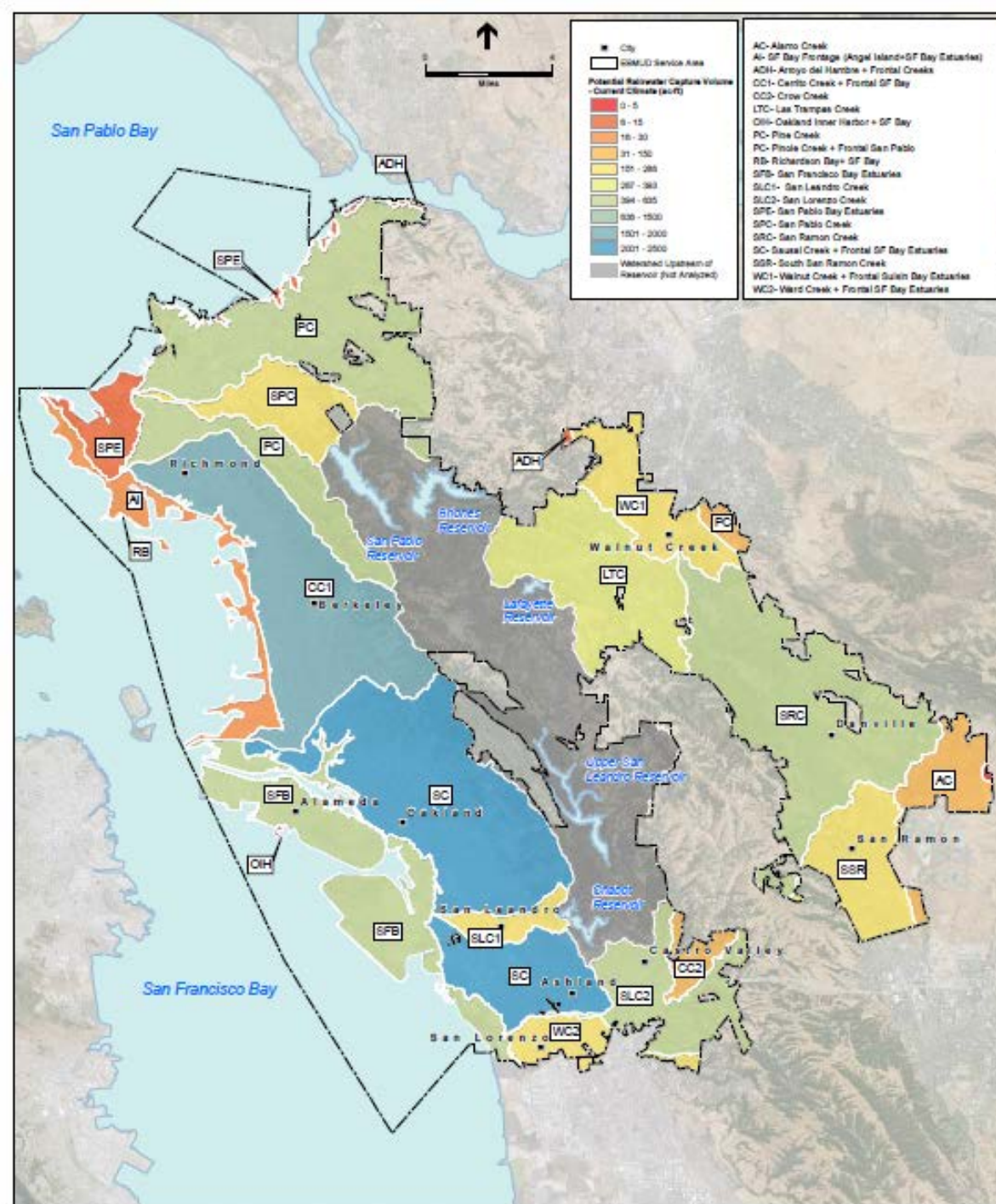


Percent exceedance curve for Mokelumne 4 Stations rainfall (1972-2012) with Mokelumne River water supply year types superimposed. Years used to represent each year type are indicated

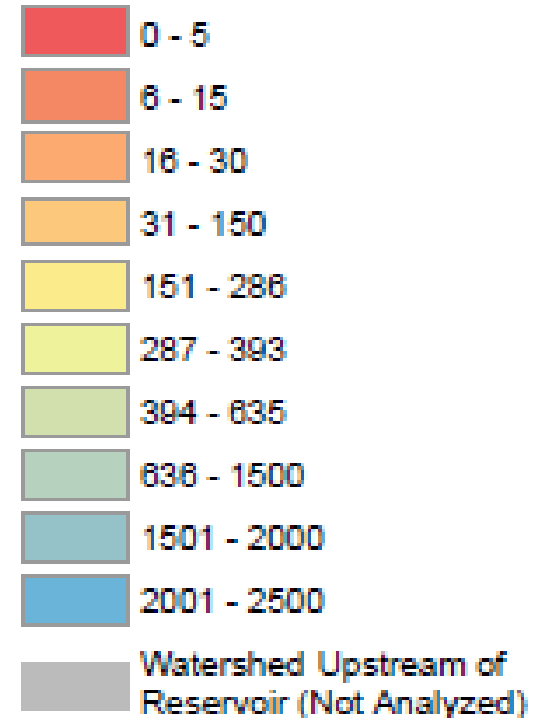
Monthly Rainfall During a Critical Dry Year, Under Existing Climate Conditions (1972 - 2012) and 2040 Climate Change Scenario (RCP 8.5)



Watershed	Single Family Residential Critical Dry Year			Multi family Residential Critical Dry Year		
	Current climate (ac-ft)	2040 Mid range (ac-ft)	2040 Dry range (ac -ft)	Current climate (ac-ft)	2040 Mid range (ac-ft)	2040 Dry Range (ac -ft)
Alamo Creek	41.49	46.25	32.32	-	-	-
SF Bay Frontage (Angel Island + SF Bay Estuaries)	14.6	16.3	11.4	3.0	3.4	2.4
Arroyo del Hambre + Frontal Creeks	4.9	5.5	3.8	1.4	1.5	1.1
Cerrito Creek + Frontal SF Bay Estuaries	1,389.6	1,548.9	1,082.4	474.6	529.0	369.7
Crow Creek	68.0	75.8	53.0	8.2	9.2	6.4
Las Trampas Creek	388.8	433.4	302.9	4.2	4.7	3.3
Oakland Inner Harbor + SF Bay	0.1	0.2	0.1	2.5	2.8	2.0
Pine Creek	33.9	37.7	26.4	-	-	-
Pinole Creek + Frontal San Pablo Bay Estuaries	610.0	679.8	475.1	25.1	27.9	19.5
Richardson Bay + SF Bay	0.3	0.4	0.3	-	-	-
San Francisco Bay Estuaries	359.6	400.8	280.1	160.9	179.3	125.3
San Leandro Creek	147.3	164.1	114.7	29.1	32.5	22.7
San Lorenzo Creek	449.4	500.9	350.0	62.5	69.7	48.7
San Pablo Bay Estuaries	13.0	14.5	10.2	1.7	1.9	1.3
San Pablo Creek	166.8	185.9	129.9	1.8	2.0	1.4
San Ramon Creek	514.3	573.2	400.6	1.6	1.8	1.2
Sausal Creek + Frontal SF Bay Estuaries	1,824.5	2,033.6	1,421.1	603.2	672.3	469.9
South San Ramon Creek	164.1	182.9	127.8	-	-	-
Walnut Creek + Frontal Suisin Bay Estuaries	261.4	291.4	203.6	9.6	10.7	7.5
Ward Creek + Frontal SF Bay Estuaries	228.4	254.6	177.9	57.5	64.1	44.8
Total	6,681	7,446	5,204	1,447	1,613	1,127



Potential Rainwater Capture Volume - Current Climate (ac-ft)



Total Runoff – EBMUD Service Area



	<i>Single Family Residential</i>			<i>Multi family Residential</i>			
	<i>Current climate (ac-ft)</i>	<i>2040 Mid range (ac-ft)</i>	<i>2040 Dry range (ac-ft)</i>	<i>Current climate (ac-ft)</i>	<i>2040 Mid range (ac-ft)</i>	<i>2040 Dry Range (ac-ft)</i>	
Total	6,681	7,446	5,204	1,447	1,613	1,127	<i>Critical Dry Year</i>
Total	8,951	9,976	6,972	1,939	2,161	1,510	<i>Dry Year</i>
Total	11,888	13,250	9,259	2,575	2,870	2,006	<i>Below Normal Year</i>
Total	16,974	18,919	13,221	3,677	4,098	2,864	<i>Normal and Above Year</i>

Key Findings

- If every residential customer installs a rooftop collection system
 - In a wet year, total volume collected = 21,000 acre feet
 - In a dry year, total volume collected = 8,000 acre feet
- Experience indicates maximum adoption rates = 5 to 10%
 - Total volume collected in a dry year = 400 to 800 acre feet
 - Adoption rates a factor of
 - Cost/financial incentives
 - Customer interest/conservation commitment
 - Presence of capable contractors
 - Size of capture systems needed
- Retrofitting all residences is cost prohibitive
 - Total Estimated cost = \$3 to \$6 Billion

Rooftop Storage – Tank Size Perspective

250 gallons (poly-mart.com)



500 gallons (<http://activerain.trulia.com>)



2,500 gallons (<http://www.egreengroup.com/recent-projects.html>)



2 x 5,000 gallons (<http://rainbank.info/category/residential-rainwater-collection>)

Moving Forward



- Consider on-line tools to assist customers (calculate capture volume, barrel size, etc.)
- Continue Water Conservation Dept. customer rebates, yet recognize that rooftop capture is unlikely to be a significant supplemental supply
- Promote linking grey water reuse systems with stormwater capture systems for greater savings
- Participate in CUWA efforts to develop fact sheet / white paper
- Track Statewide legislation
- Cooperate with Community Efforts in Service Area
- Consider as part of Bay Area Regional Reliability Drought Contingency Plan
- Consider as part of SGMA / Groundwater Sustainability Plan development

QUESTIONS