POTABLE REUSE PLANNING
WATER SUPPLY SYSTEM MODELING REPORT

PROJECT NO. 91304001-1215

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1 Introduction and Background

The Santa Clara Valley Water District Board of Directors authorized staff to enter into a single-source agreement with Maine Technology Modeling Group to conduct water supply system modeling in support of the Expedited Recycled and Purified Water Program (Program) on April 28, 2015. The purpose of the contract was to analyze how different potable reuse projects could be operated under a range of conditions to optimize the beneficial use of existing and proposed potable reuse supplies and facilities. The scope of services included incorporating new data and operational requirements into the District's existing water supply system model (WEAP), setting up the potable reuse projects in the model, performing dozens of modeling runs, and preparing a final report. The contract with Maine Technology Modeling Group was executed in May 2015. The original scheduled completion date was May 2016, but the Program schedule has been extended through at least 2018.

The "Long-Term Potable Reuse Implementation Modeling Report" dated July 13, 2016 in Appendix A described the new data and operational requirements that were incorporated into WEAP, the potable reuse projects that were set up in WEAP, and the results of a few dozen modeling cases. The primary question being answered at the time was, "how much water do we need to meet our level of service goal[1]?" The modeling used 2035 demands and supplies from the District's 2012 Water Supply and Infrastructure Master Plan, which included a baseline potable reuse program of 20,000 acre-feet per year (AFY) of capacity. Based on those assumptions, the modeling indicated that the District should plan for additional supplies and/or demand reductions in order to meet its level of service goal. The District's level of service goal is to develop supplies to meet 100 percent of demands in normal years and 90 percent of demand in drought years. A total of about 24,000 AFY of potable reuse capacity (the baseline amount of 20,000 AFY capacity plus another 4,200 AFY of capacity) would meet the level of service goal, but the additional capacity was not needed until 2030.

The July 2016 report also evaluated the question of, "how much water can we use?" The projected utilization[2] of purified water for potable reuse ranged from about 45 percent to 60 percent, with the higher utilization rates associated with lower amounts of potable reuse capacity. As groundwater storage nears capacity, based on the operational storage estimates in the District's Groundwater Management Plan, the model reduces and eventually stops groundwater recharge. Therefore, there is less ability to utilize the potable reuse capacity in years where groundwater storage is high. Changing the modeling rules about when recharge is reduced or stopped due to high groundwater storage could increase the utilization of purified water for potable reuse.

The District has updated the WEAP model since modeling that was reported in the July 2016 report was completed to incorporate updated supply and demand projections from the District's 2015 Urban Water Management Plan. In addition, the several assumptions regarding the potential potable reuse projects have been updated. This report summarizes the WEAP updates and assumptions changes that have

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[1] The District's current level of service goal, or reliability target, is to "develop supplies to meet 100 percent of demands in the Urban Water Management Plan in normal years and 90 percent of demands in drought years."

[2] Utilization is determined by dividing the average amount of purified water used for potable reuse divided by the potable reuse capacity. For example, if 18,000 AFY of purified water is used for recharge and potable reuse capacity is 24,000 AFY, the utilization rate would be 75 percent. The amount of purified water use can be limited by groundwater storage conditions, competition with other sources of water, and water demands.

been implemented since the July 2016 report and the water supply system modeling work that has been performed since the July 2016 report was completed. It also explores the differences between indirect potable reuse and direct potable reuse, and how potable reuse using the Los Gatos Ponds affects the District's ability to use its Los Gatos Creek water rights.

2 Water Supply System Model (WEAP) Updates

This section describes key updates that were made to WEAP following completion of the July 2016 report. The key updates are in the areas of water demands and baseline potable reuse capacity.

2.1 Water Demands

The District completed its 2015 Urban Water Management Plan (UWMP) in May 2016. The UWMP includes updated demand projections for water retailers, non-agricultural independent groundwater pumpers, agricultural groundwater pumping, untreated surface water deliveries, and distribution system losses. After the District completed its 2015 UWMP, several retailers updated their demand projections. The District is currently using the 2040 demand projections from the retailers' final 2015 UWMPs for retailer demands and the 2040 demands projections the District's UWMP for non-retailer demands for most potable reuse modeling scenarios. Table 1 shows the difference in projected countywide demands between the District's 2010 UWMP and 2015 UWMP, with the 2015 demands adjusted to reflect the retailers' final demand projections.

TABLE 1. COUNTYWIDE WATER DEMAND PROJECTIONS[3]

	2020 Demand (AF)	2025 Demand (AF)	2030 Demand (AF)	2035 Demand (AF)	2040 Demand (AF)
2010 UWMP	385,000	396,000	409,000	423,000	Not applicable
2015 UWMP	361,000	383,000	401,000	418,000	435,000
Difference	-24,000	-13,000	-8,000	-5,000	Not applicable

It is usual for demand projections, especially short-term demand projections, to decrease in UWMP updates, as shown in Table 2. The retailers often use a long-term demand projection that incorporates high growth rates and/or water use factors in their service areas, to ensure that their analysis covers a wide range of scenarios. However, actual water use is typically lower than the projections, which is reflected in the short-term demand projection. For example, the 2015 UWMP demand projection for 2020 water use is lower than actual 2013 water use, reflecting impact on short-term water use drought water reductions. In developing long-term water supply-related planning documents, it is important to recognize the uncertainty in demand projections.

[3] These demand projections incorporate planned water conservation savings.

TABLE 2. HISTORIC DEMAND PROJECTIONS

	2020 Demand (AF)	2025 Demand (AF)	2030 Demand (AF)	2035 Demand (AF)	2040 Demand (AF)
1990 UWMP	585,000				
1995 UWMP	500,000				
2000 UWMP	478,300				
2005 UWMP	405,400	425,800			
2010 UWMP	385,000	396,000	409,000	423,000	Not applicable
2015 UWMP	361,000	383,000	401,000	418,000	435,000

2.2 Baseline Potable Reuse Capacity

The District's 2012 Water Supply and Infrastructure Master Plan (WSIMP) included developing 20,000 AFY of potable reuse capacity at the District's Los Gatos Ponds. The actual capacity of the pond system is about 24,000 AFY. However, at the time the WSIMP was developed, staff assumed that the two ponds adjacent to Los Gatos Creek, with a combined capacity of about 4,000 AFY, would not be used for potable reuse due to connections between the ponds and the creek. The interest was to avoid instream impacts and associated permitting requirements. Ongoing Program work has identified the likelihood of connections between other ponds and the creek. At this point, staff has decided to address permitting issues associated with potential pond/creek connections and is assuming the full capacity of the Los Gatos Ponds (24,000 AFY) will be used for potable reuse and that the necessary environmental analyses and permitting will be conducted.

2.3 Other WEAP Updates and Assumptions

This section describes other WEAP updates that occurred after the July 2016 report or WEAP modeling assumptions that are pertinent to analyses presented later in this report.

2.3.1 Alternatives Analyses

The potable reuse program components being analyzed have been updated as described in Table 3 .

TABLE 3. POTABLE REUSE PROGRAM COMPONENT UPDATES

2016 Program Component	2017 Program Component	Explanation of Change
Los Gatos Ponds Recharge – 20,200 AFY Capacity	Los Gatos Ponds Recharge – 24,000 AFY Capacity	Reflects using the full capacity of the Los Gatos Ponds for potable reuse
Injection Wells – 10,000 AFY Capacity	Injection Wells – 6,000 AFY Capacity	Better matches the original Mid-Basin Injection Wells capacity in the 2014 SBWR Strategic and Master Plan.
Injection Wells – 15,000 AFY Capacity	Injection Wells – 11,000 AFY Capacity	Better matches the combined Mid-Basin Injection Wells and Westside Injection Wells capacity in the 2014 SBWR Strategic and Master Plan
Ford Ponds Recharge – 4,200 AFY Capacity	Ford Ponds Recharge – 4,200 AFY Capacity	Not applicable

2016 Program Component	2017 Program Component	Explanation of Change
Direct Potable Reuse – 32,000 AFY Capacity	Direct Potable Reuse – 24,000 AFY Capacity	Matches the baseline potable reuse capacity at Los Gatos Ponds

2.3.2 Los Gatos Ponds Potable Reuse "Ramping"

The modeling for the July 2016 report scenarios "ramped" down purified water production when Santa Clara Plain groundwater storage was nearing operational storage capacity of 350,000 AF. The purpose of the ramping is to slow down recharge and avoid over-filling the subbasin. When the subbasin is full in WEAP, all recharge is stopped. The 2016 and 2017 ramping rules are listed in Table 4. The newer ramping rules, which were developed through testing multiple alternatives in WEAP, increase potable reuse utilization.

TABLE 4. POTABLE REUSE RAMPING RULES

Santa Clara Plain Groundwater Storage (AF)	2016 Ramping Rule – Percent Reduction	2017 Ramping Rule – Percent Reduction
At/below 300,000	0%	0%
Greater than 300,000	25%	10%
Between 315,000 and 330,000	50%	20%
Between 330,000 and 350,000	75%	30%

It should be noted that Los Gatos Ponds has a lower demand preference than injections wells. Therefore, the reduction in potable reuse will occur at Los Gatos Ponds in scenarios that include both Los Gatos Ponds and injection wells. It should also be noted that, beginning in March 2016, the model was revised to disregard the ramping rules in critically dry and dry years, with the assumption that surface water supplies for those years would be limited and, therefore, purified water would be a welcome source of supply for recharge.

2.3.3 Demand Priorities and Water Supply Preferences

Different demand locations in WEAP have different priorities and supply preferences. In general, meeting drinking water treatment plant contract demands has the highest priority. Local supplies are generally preferred over imported supplies. Table 5 shows the various water supply preferences and demand priorities associated with potable reuse elements.

TABLE 5. DEMAND PRIORITIES AND SUPPLY PREFERENCES

Facility	Demand Priority[4]	Supply Preference[1]
Rinconda Water Treatment Plant	3	Lexington Pipeline/Los Gatos Creek = 2
		CVP = 3
		SWP = 3
		Purified Water = 11
		Groundwater = 70
Penitencia Water Treatment Plant	3	Desal=1 (not active)
		SWP = 2
Ford Ponds	12	Purified Water = 1
		Local Surface Water = 2
Injection Wells	13	Purified Water = 1
Los Gatos Ponds	15	Los Gatos Creek = 1
		Purified Water = 2
		CVP = 3
		SWP = 4

2.3.4 Other Modeling Assumptions

The baseline modeling assumptions include:

- Fisheries and Aquatic Habitat Collaborative Effort Settlement Agreement flow and release requirements,
- Completion of dam seismic retrofit projects by 2025;
- Construction of the Lexington Pipeline by 2025;
- Construction of the Saratoga Recharge Pond with a capacity of 5,000 AFY by 2025;
- Imported water supplies of about 176,000 AFY, based on the ELT scenario in the California Department of Water Resources' 2015 Delivery Capability Report;
- Expiration of the Reallocation Agreement by 2025;
- Long-term water conservation savings of 99,000 AFY by 2030;
- Non-potable water recycling based on projections by retailers; and
- Construction of 24,000 acre-feet per year (AFY) of potable reuse capacity by 2025.

3 Modeled Scenarios

This section summarizes the key potable reuse scenarios that have modeled since the July 2016 report. The scenarios are summarized in Table 6. Utilization rates vary significantly between the various scenarios, depending on demands, project combinations, and other assumptions. This variability in utilization is an important consideration for developing and implementing the potable reuse program.

[4] The lower the demand priority/supply preference, the more important the priority/preference. For instance, water treatment plant demands will be met before injection well demands because water treatment plant demands are a "3" and the injection well demands are a "13." Demand priorities and supply preferences are intended to reflect current and anticipated operations, including constraints such as the Fisheries and Aquatic Habitat Collaborative Effort Settlement Agreement and Lake and Streambed Alteration Agreements.

TABLE 6. MODELED SCENARIOS

Scenario[5]	Potable Reuse Components	Potable Reuse Capacity (AFY)	Utilization	Flows to Bay (AFY)	Lexington Pipeline
Baseline 2025 Demands	Los Gatos Ponds	24,000	46%	16,000	Yes
Baseline 2030 Demands	Los Gatos Ponds	24,000	52%	15,000	Yes
Baseline 2035 Demands	Los Gatos Ponds	24,000	61%	14,000	Yes
Baseline December 2016	Los Gatos Ponds	24,000	74%	10,000	Yes
30K IPR	Los Gatos Ponds; 6,000 AF Injection Wells	30,000	74%	10,000	Yes
35K IPR	Los Gatos Ponds; 11,000 AF Injection Wells	35,000	74%	11,000	Yes
39K IPR	Los Gatos Ponds; 11,000 AF Injection Wells; Ford Ponds	39,000	69%	9,000	Yes
Baseline June 2017[6]	Los Gatos Ponds	24,000	91%	15,000	Yes
Baseline – No Lex PL	Los Gatos Ponds	24,000	59%	16,000	No
Mixed IPR	Los Gatos Ponds at 13,000 AFY; 11,000 AFY Injection Wells	24,000	86%	15,000	Yes
Mixed IPR – No Lex PL	Los Gatos Ponds at 13,000 AFY; 11,000 AFY Injection Wells	24,000	75%	16,000	No
DPR	24,000 AFY to the South Bay Aqueduct (SBA)	24,000	93%	15,000	Yes
DPR – No Lex PL	24,000 AFY to the South Bay Aqueduct (SBA)	24,000	80%	16,000	No

3.1 Baseline Scenarios

The baseline scenarios include the Baseline 2025 Demands, Baseline 2030 Demands, Baseline 2035 Demands, and Baseline scenarios from Table 6. The modeling results are available to District staff at ..\All Years All IPR and H4 12-05-2016.xlsx. In these scenarios, demands are the only variable between the scenarios. As shown in Table 7, potable reuse utilization increases as demands for water increase. This is because the increase in demands results in an increase in groundwater use, essentially freeing up storage for potable reuse.

[5] Unless otherwise stated, the demand year is 2040.
[6] The model was updated in June 2017 to incorporate new Semitropic Groundwater Bank modeling assumptions.

TABLE 7. BASELINE SCENARIO SUMMARY

	Baseline 2025 Demands	Baseline 2030 Demands	Baseline 2035 Demands	Baseline 2040 Demands
Demand (AF)	383,000	401,000	418,000	434,000
Potable Reuse Capacity (AF)	24,000	24,000	24,000	24,000
Potable Reuse Utilization	46%	52%	61%	78%

It should be noted that none of the baseline scenarios achieve the District's water supply reliability level of service goal. The level of service goal is to develop supplies to meet 100 percent of demands in normal years and 90 percent of demands in drought years. This equates to staying in Stage 2 of the District's Water Shortage Contingency Plan or avoiding calls for water use reductions of greater than 10 percent. The District is currently preparing a 2017 Water Supply Master Plan update that evaluates various strategies for meeting the level of service goal throughout the planning horizon. Additional potable reuse is one of the project types that are being considered. Other project types include storage, transfers, water conservation and demand management, stormwater recharge, desalination, and water rights purchases.

3.2 Program Capacity Scenarios

Initial modeling evaluated potable reuse components of 20,000 AFY capacity at Los Gatos Ponds, 5 MGD of Mid-Basin Injection Well capacity, 10,000 AFY of Westside Injection Well capacity, and 4,200 AFY at Ford Ponds. However, as discussed above, staff has updated the capacity at Los Gatos Ponds to 24,000 AFY. Furthermore, groundwater studies performed as part of the Program identified potential hydrogeological constraints at both the Mid-Basin and Westside injection well locations and the two locations have been combined into a single 10 MGD location. The program capacities that are being considered in the WSMP and were evaluated by Program's groundwater consultant are the Baseline, 30K IPR, 35K IPR, and 39K IPR scenarios from Table 5. The WEAP modeling results are summarized in Table 8 and are available to District staff at P:\Indirect Potable Reuse-Planning-91304001\4. Water Supply System Modeling\Modeling Results\All IPR 12-05-2016.xlsx.

Potable reuse, as expected, increases as capacity is added. However, none of the program capacities are sufficient to meet the District's level of service goal using projected 2040 demands of about 435,000 AF, which is consistent with WSMP findings. No individual project or program is sufficient to meet the District's reliability target using 2040 demands; the WSMP will need to evaluate portfolios of projects for meeting the level of service goal.

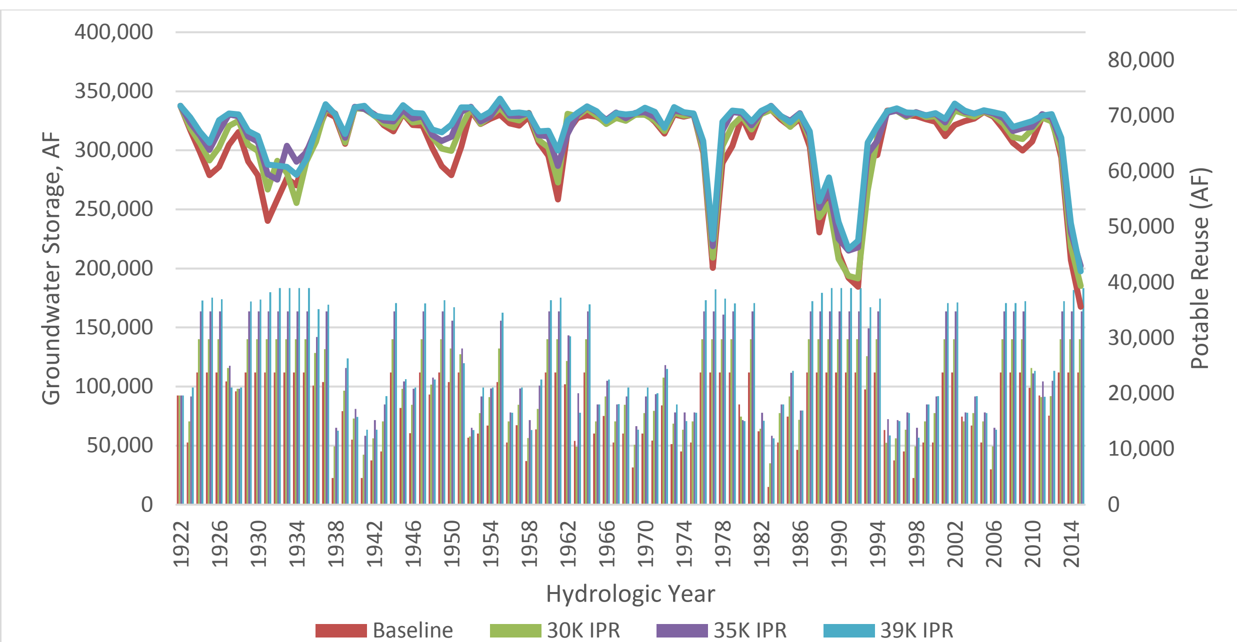
The inability of the additional program capacities to meet the level of service goal is different than findings in the July 2016 report, which found that a program capacity of just over 24,000 AFY would be sufficient to the level of service goal with 2035 demands of 423,000 AFY. This is because there is an increase in the average water demands of about 12,000 AFY, but the difference of average utilization between the 39K IPR scenario and the Baseline scenario is only about 9,000 AFY.

TABLE 8. PROGRAM CAPACITY SCENARIOS

	Baseline December 2016	**30K IPR**	**35K IPR**	**39K IPR**
Potable Reuse Components	Los Gatos Ponds	Los Gatos Ponds; 6,000 AF Injection Wells	Los Gatos Ponds; 11,000 AF Injection Wells	Los Gatos Ponds; 11,000 AF Injection Wells; Ford Ponds
Capacity (AFY)	24,000	30,000	35,000	39,000
Minimum Annual Purified Water Use (AFY)	3,000	7,000	12,000	12,000
Maximum Annual Purified Water Use (AFY)	24,000	30,000	35,000	39,000
Average Annual Purified Water Use (AFY)	18,000	22,000	26,000	27,000
Average Utilization Rate	74%	74%	74%	69%
Percent of Years with Santa Clara Plain Groundwater Storage above 300,000 AF	70%	80%	85%	85%
Meets Level of Service Goal	No	No	No	No

It appears that, while utilization rates are higher with 2040 demands, high groundwater storage continues to limit indirect potable reuse. Figure 1 shows Santa Clara Plain groundwater storage (lines at top) and potable reuse (bars at bottom) at different potable reuse program capacities. Even in lowest capacity potable reuse program (the Baseline Scenario), groundwater storage is full or nearly full 70 percent of the time.

FIGURE 1. GROUNDWATER STORAGE VS. POTABLE REUSE



3.3 Potable Reuse Variations

The next question the modeling evaluated was differences in different potable reuse variations. The specific scenarios that were evaluated were Baseline, Mixed IPR, and DPR. The results for these scenarios are available to District staff at ..\WEAP Output Available Related to IPR DPR Lexington Pipeline 4.xlsx. The primary difference between the scenarios is that there is about 4,000 AFY more groundwater recharge in the Mixed IPR scenario than in the Baseline and DPR scenarios, resulting in higher average groundwater storage in the Santa Clara Plain and fewer years with short-term water use reductions. Because average groundwater storage is higher in the Mixed IPR scenario, the utilization of potable reuse capacity is lower than in the other scenarios. In summary, the Mixed IPR scenario may provide greater water supply benefits than the Baseline and DPR scenarios, based on the reduced frequency of short-term water use reductions. However, those water supply benefits would come with increased costs and unit costs.

TABLE 9. COMPARISON OF POTABLE REUSE VARIATIONS

Parameter		Baseline June 2017	Mixed IPR	DPR
Santa Clara Plain, End of CY GW Storage (AF)	Avg	285,000	302,000	283,000
Lexington Reservoir End of CY Storage (AF)	Avg	4,000	4,000	4,000
Lexington Pipeline Diversion (AFY)	Avg	10,000	10,000	10,000
Los Gatos Ponds Recharge, Local (AFY)	Avg	0	0	0
Los Gatos Ponds Recharge, CVP (AFY)	Avg	2,000	6,000	8,000
Los Gatos Ponds Recharge, SWP (AFY)	Avg	0	4,000	4,000
Los Gatos Ponds Recharge, IPR (AFY)	Avg	22,000	9,000	10,000
Los Gatos Ponds Recharge, Total (AFY)	Avg	23,000	19,000	22,000
Injection (AFY)	Avg	0	11,000	0
DPR to SBA (AFY)	Avg	0		12,000
IPR/DPR Total (AFY)	Avg	22,000	20,000	22,000
Santa Clara Plain, Facility Recharge + GW Injection (AFY)	Avg	66,000	70,000	66,000
Los Gatos Creek Flows to Bay (AFY)	Avg	7,000	7,000	7,000
Years with Demand Reductions	Count	30	21	30
Demand Reduction	Max	30%	30%	30%
Total Water Supply System Yield (AFY)	Avg	437,000	438,000	437,000
Los Gatos Creek Water Rights Utilization (AF)	Avg	15,000	15,000	15,000
Potable Reuse Utilization	Avg	91%	85%	93%

3.4 Lexington Pipeline

The Baseline, Mixed IPR, and DPR scenarios were modeled with and without the Lexington Pipeline to assess the value of the Lexington Pipeline in utilizing water rights utilization, potable reuse capacity utilization, and overall water supply benefits. Water rights utilization was between 1,500 and 2,400 AFY year higher with the Lexington Pipeline, potable reuse capacity utilization was between 10 and 32% higher with the Lexington Pipeline, and overall water supply yield was between 5,000 and 8,000 AFY higher with the Lexington Pipeline. In all the cases, the greatest differences in the Baseline scenario, which is 24,000 AFY of potable reuse capacity at the Los Gatos Ponds.

TABLE 10. WITH AND WITHOUT LEXINGTON PIPELINE SCENARIOS

Parameter	Baseline June 2017		Mixed IPR		DPR	
	With Lexington Pipeline	Without Lexington Pipeline	With Lexington Pipeline	Without Lexington Pipeline	With Lexington Pipeline	Without Lexington Pipeline
Los Gatos Creek Water Rights Utilization (AFY)	15,489	13,919	15,488	13,097	15,489	13,988
Potable Reuse Capacity Utilization	91%	59%	85%	75%	93%	80%
Total Water Supply Yield (AFY)	437,000	429,000	438,000	432,000	438,000	433,000

Appendix B includes a longer list of parameters than shown in Tables 9 and 10.

4 Summary

Modeling performed indicates the following:

1) Potable reuse capacity utilization can vary significantly depending on demand assumptions, project combinations, and other assumptions.
2) Potable reuse capacity utilization increases with increasing demands.
3) Potable reuse by itself is insufficient to achieve the District's water supply reliability level of service goal.
4) Groundwater storage capacity can limit potable reuse capacity utilization.
5) Scenarios that include injection wells may provide greater water supply benefits, but at a higher cost.
6) Lexington Pipeline increases local water rights utilization, potable reuse capacity utilization, and overall water supply yield in all the potable reuse scenarios, with the greatest benefits observed in the Base Case/Los Gatos Ponds scenario.

5 Recommendations

The variability in potable reuse utilization is an important consideration for developing and implementing the potable reuse program. Given the sensitivity in utilization to variations in assumptions, ongoing water supply system modeling should be performed as the District makes decisions regarding projects and programs that could affect utilization rates and potable reuse operations. For example, the District Board approved the Water Supply Master Plan Update 2018 "No Regrets" package of water conservation and stormwater projects in September 2017. The "No Regrets" package is projected to decrease 2040 demands by about 10,000 AFY and increase supplies by about

1,000 AFY. As noted above, demand assumptions affect utilization rates. Also, the District Board approved conditional participation in California WaterFix in October 2017. The modeling should be updated to evaluate how these actions, along with future Board actions related to the Water Supply Master Plan Update 2018, could affect water supply operations and potable reuse utilization.

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Long-Term Potable Reuse Implementation Modeling Report

June 2016

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Appendices

1 Introduction

The Long-Term Potable Water Implementation Modeling Project was initiated in May 2015. As part of the project, the District's WEAP (Water Evaluation and Planning) model was updated with current conditions and assumptions, compared to the WEAP model used for the District's 2012 Water Supply and Infrastructure Master Plan (2012 WSIMP), updated to include various potable reuse components, and run for various potable reuse scenarios.

Seven potable reuse alternatives and a baseline case have been modeled with the WEAP model for a comparison of long-term water supply reliability. The alternatives include:

1. Baseline (20,200 AFY of potable reuse capacity in the Los Gatos Ponds from Silicon Valley Advanced Water Purification Center)
2. Baseline + combined 15 mgd of potable reuse groundwater injection from Silicon Valley Advanced Water Purification Center (SVAWPC)
3. Baseline + Westside 10 mgd of potable reuse groundwater injection from SVAWPC
4. Baseline + 4,200 AFY potable reuse from South Bay Water Recycling (SBWR) Coyote to Ford Ponds
5. Baseline + combined 15 mgd of potable reuse groundwater injection from SVAWPC + reuse from SBWR Coyote to Ford Ponds
6. Baseline with 32 mgd DPR available to the South Bay Aqueduct (SBA) upstream of Penitencia Water Treatment Plant
7. Baseline with No IPR and No Lexington Pipeline
8. Baseline with No FAHCE Operations

This report describes the model assumptions for each alternative, specifics for how the above alternatives were setup, a description of interim alternatives that were modeled, and the findings/results for each alternative with comparisons to the other results. The report concludes with an assessment of "How Much Water We Need." Additional modeling will likely be performed to optimize the preferred alternative (s).

The potable reuse modeling described in this report re-affirms the value of the projects in the 2012 WSIMP, including the 20,200 AFY of potable reuse capacity in the Baseline, for water supply reliability. Changes in assumptions since the 2012 WSIMP resulted in the need for additional supplies/demand management measures to meet the District's water supply reliability target in 2035. Approximately 4,200 AFY of additional potable reuse capacity could be sufficient to meet the reliability target in 2035.

2 WEAP Model Summary

The District uses the Water Evaluation and Planning (WEAP) system model to evaluate reliability under different conditions. This water supply modeling tool takes an integrated approach to water resources planning. The WEAP model is used primarily to simulate the District's water supply system comprised of facilities to recharge the county's groundwater subbasins, local water supply systems including the operation of reservoirs and creeks, treatment and distribution facilities, and raw water conveyance systems. The model also accounts for non-District sources and distribution of water in the county such as supplies from the San Francisco Public Utilities Commission, recycled water, and local water developed by other agencies such as San Jose Water Company. In essence, the model was formulated to simulate the management of the current and future water resources within the county.

For each modeled scenario, WEAP estimates how water supplies would be distributed and stored in each month of the historical hydrologic sequence. It uses input files of demands and supply availability to estimate how much water is delivered to treatment plants, how much water is delivered to each recharge facility, reservoir storage, groundwater storage, carryover, Semitropic puts and takes and storage, unmet demands, and the need for water use reductions to preserve groundwater storage.

3 Baseline and Potable Reuse Alternative General Assumptions

The modeling was conducted using projected facilities, supplies and demands for Calendar Year 2035. The hydrologic period modeled is 1922 through 2015 on a monthly time increment. All the alternatives start with a baseline set of assumptions that include existing and planned projects and programs that are in place, planned improvements to the system (e.g., dam seismic retrofits, Rinconada Water Treatment Plant improvements, 30,000 AFY of non-potable recycling, and 99,000 AFY of water conservation savings) and the following projects and programs from the 2012 Water Supply and Infrastructure Master Plan (2012 WSIMP):

- 20,200 acre-feet per year of potable reuse capacity via SVAWPC to Los Gatos Ponds
- A pipeline connecting Lexington Reservoir to the raw water system at Vasona Pumping Plant
- Additional North County recharge capacity of 4,000 acre-feet per year
- Transfers/dry year options of 12,000 acre-feet in critical dry years via the South Bay Aqueduct (SBA)

In addition, imported water allocations are derived from the California Department of Water Resources (DWR) 2015 Delivery Capability Report (DCR) - Early Long-Term Scenario. This includes climate change, biological opinions, and Fall X2; and uses an Ag contract amount of 33,100 AFY and M&I historic use of 130,000 AFY (with a maximum combined delivery amount of 152,500 AFY). The CVP Reallocation Agreement is assumed to be expired and no longer used. Because the modeling for DWR's 2015 DCR only includes hydrologic years 1922 through 2003, actual imported water allocations were used for the years 2004 through 2015.

The table in Appendix A describes in detail the full modeling assumptions for the Baseline and five potable reuse alternatives and two adjusted Baseline alternatives.

The following section describes the model setup of key components for each alternative.

4 Differences in Baseline 2015 Compared to 2012 WSIMP Baseline

The Long-Term Potable Water Implementation Modeling Project started near the end of May 2015. The first task for the IPR Modeling was to setup baseline assumptions and carry out a simulation model run of the baseline that represented an accurate starting point for the model analysis. Many changes to data available and District operations were discussed and analyzed for inclusion in the new baseline alternative. The 2015 Baseline results were different from the 2012 WSIMP Baseline, even though the same demands, sources of supply, and facilities were included in the two baselines.

The significant difference between the 2012 WSIMP baseline results and the 2015 Potable Reuse baseline results is that the 2012 WSIMP baseline had 2 occurrences of WSCP water use reductions with a worst-case reduction of 7.5%, while the 2015 Potable Reuse baseline generates 4 occurrences with a worst-case reduction of 20%.

Staff reconciled the difference between 2015 Baseline model results and the 2012 WSIMP Baseline. This work included case runs using the newest WEAP model with data revised to reasonably match 2012 data, and to ensure that the current model and previous 2012 model were synchronized. Several conditions have changed in the simulation modeling since the 2012 WSIMP projects. The major changes, reasons for those changes and impacts are described below.

4.1 Extended simulation time period to 2015

All necessary hydrologic and imported water data is now available to extend the model simulation time period from 1922-2003 to 1922-2015. The simulation time period was extended to include the most recent three-year drought. Because CALSIM II allocation information is only defined until 2003, actual imported water allocations obtained by the District for 2004-2015 were used.

Even though the most recent 2012-2015 drought has been extreme (2015 had the lowest imported water allocation on record), the 1987-1994 drought results in the most difficult time period to manage for water supplies meeting demands.

4.2 New UWMP 2015 demands

New demands and new supplies for recycled water have been compiled by staff as of April 28, 2016, but not yet implemented in the 2015 Potable Reuse analysis to keep several sets of previous model runs consistent. The new demands will be implemented in the potable reuse modeling prior to the optimization phase.

4.3 Imported Water Allocations

The 2015 Potable Reuse project uses the recent new allocations from the 2015 Delivery Capability Report - Early Long-Term Scenario. It includes climate change, biological opinions, and Fall X2. This is the set of CALSIM II data projections for imported water that are prescribed to be used for the 2015 UWMP.

The CVP Reallocation Agreement is assumed to expire long before to the 2035 simulation demand year and is therefore not used for the determination of yearly import allocations. Updates to respective San Luis Reservoir storage are also including with the 2015 Delivery Capability Report, and this information is used to define San Luis low Point events.

The 2010 UWMP and 2012 WSIMP used the 2009 Department of Water Resources (DWR) reliability study & Central Valley Project (CVP) allocations from CALSIM II results with Reallocation Agreement.

Appendix D details the differences in allocations between the 2012 WSIMP analysis and 2015 Potable Reuse analysis (with and without the Reallocation Agreement). While the overall average allocation percentage does not change significantly among these comparison sets, a key difference can be seen in the 1987-1992 drought period. The most recent 2015 CVP allocations without the Reallocation Agreement in place accumulate to a decrease of more than 110,000 AF of CVP supply in the 1987-1992 drought vs the 2012 WSIMP allocations. This is a key reason why the newest baseline model simulation does not meet the reliability target, while the 2012 WSIMP baseline model simulation does.

4.4 San Luis Low Point Operations

The 2012 WSIMP did not model San Luis low point events, whereas low point events were included for the 2015 Potable Reuse and UWMP analysis. A San Luis low point event is assumed to be triggered in any month where San Luis Reservoir storage goes below 250,000 AF.

When a low point event occurs, Rinconada and Santa Teresa treatment plant deliveries from CVP are reduced to 75% of normal demand due to water quality issues associated with low point. The model anticipates and compensates for low point events. When current year Anderson reservoir storage is below 35,000 AF and the current month is March or April, any excess CVP supply is sent to Anderson reservoir. Also, in any given month, if Anderson has supplies above FAHCE flow requirements and imported allocations are less than WTP demands, water is released from Anderson to the CVP pipelines, where it will be delivered to the highest priority treatment plants.

4.5 Dry Year Options Trigger (SRI)

The new imported water allocation data also provides a new set of Sacramento River Index (SRI) year types. The SRI for each model year is one of 5 types - critical dry, dry, below normal, above normal and wet. Dry Year Options are defined in all the baseline models to provide 12,000 AF of additional SWP supply when the SRI year type is critical dry. The SRI data for the 2012 WSIMP analysis is different than the SRI data for the 2015 Potable Reuse and UWMP analysis. The following years were defined as critical dry in the 2012 WSIMP but were not in 2015 – 1930, 1960, 1961, 1987, 1989. With 1987 and 1989 not being Dry Year Option events, the long-term drought of 1987-1992 is further impacted when considering the reduced CVP import allocation definition – when comparing 2012 WSIMP results to 2015 analysis.

4.6 Semitropic Initial Storage, Max Put, New Take Operations

Three changes to the Semitropic Bank have been made for the 2015 Potable Reuse and UWMP analysis. The new initial model conditions are setup to match January 1, 2014. Because of this change the initial storage for the Semitropic Bank is 200,000 AF, instead of 250,000 AF (used in the 2012 WSIMP).

The calculation of the maximum "Put" to the Semitropic Bank was changed on around 07/17/2013 based on staff information. The 2012 WSIMP model has the expression:

0.35 * ((1.0 – swp_alloc) * 224,000 + 90,500).
The revised expression is:

0.35 * 90,500.

This results in a smaller maximum put and potentially slower recovery of banking supplies in high imported water allocation years when comparing the 2012 WSIMP to 2015 analysis.

To counteract this change to maximum put, several re-operations were implemented for Semitropic (in the 2015 analysis) to allow for quicker bank storage recovery when storage is getting low, and more efficient carryover rules to prevent carryover loss. If the Semitropic Bank is not very full (less than 100,000 AF) then the model will "put" to the bank before saving carryover to SWP and cvp; if San Luis Reservoir is near full, puts to Semitropic will occur after only 7,000 AF carryover is achieved in SWP and 10,700 AF is achieved in CVP. These amounts approximate the treated water needs in January and February with the presumption that San Luis storage is near full – it may fill and trigger complete loss of all remaining Carryover accumulation; otherwise, puts to Semitropic are made after 20,000 carryover is achieved in both SWP and CVP.

This last rule is the original Semitropic/Carryover definition. When excess import allocations are remaining, the priority was to set aside 20,000 AF of imported supply to both SWP and CVP (if available), then "put" to the Semitropic Bank (up to max put, or max Bank capacity), then continue to accumulate CVP and SWP Carryover up to a maximum of 75,000 AF in CVP and 50,000 AF in SWP.

4.7 Carryover in CVP and SWP

The previous section described the interaction and rules between the Semitropic Bank and imported water Carryover. These changes were implemented per staff recommendations.. For the 2015 analysis, the maximum Carryover for both the SWP and CVP is defined at 45,000 AF. AF. As mentioned above, when San Luis Reservoir is approaching full capacity, the first round of Carryover is reduced from 20,000 in each project to a combined 17,700 AF. Thereafter, "puts" to the Semitropic Bank are made, and any remaining unused imports are sent to Carryover where they may be lost if San Luis storage exceeds 2,000,000 AF.

4.8 Initial Groundwater Storage

In the 2012 WSIMP, initial groundwater subbasin storages were set as 268,600 AF in North County, 18,000 AF in Coyote, and 75,000 AF in Llagas.

In the 2015 analysis (with an initial condition setup of January 1, 2014) initial groundwater subbasin storages were set as 301,400 AF in North County, 10,300 AF in Coyote Valley, and 26,000 AF in the Llagas Subbasin.

4.9 Lexington Pipeline Maximum Diversion

In the 2012 WSIMP analysis, there was no maximum diversion defined for Lexington Pipeline. Flow was therefore unlimited and only defined by available supply in Lexington Reservoir. One of the main purposes of the Lexington Pipeline was to prevent loss of local supplies via flow to the bay when IPR supplies were added for recharge in Los Gatos Ponds.

In the 2015 analysis, maximum diversions were implemented in Lexington Pipeline to ensure that the FAHCE rules for Lexington are properly implemented. A challenge is to avoid draining Lexington Reservoir very quickly and not leaving enough water in late summer and fall for minimum required flows. The maximum diversion for the Lexington Pipeline is 30,000 AFY, equivalent to the Lexington Reservoir water right license amount.

4.10 Madrone Channel Flow Requirements

A change was made to the 2015 WEAP model to prioritize maintaining a minimum flow to Madrone Channel. Staff advises that the total minimum demand for both Main and Madrone is 7 cfs. The 2015 WEAP model assigns all of the 7 cfs to Madrone Channel. Staff recommends that if supplies are inadequate to meet demands to both the WTPs and Madrone Channel, then they should be reduced proportionally/equally.

4.11 FAHCE Operations

FAHCE Operations are defined for Stevens Creek, Los Gatos Creek, Guadalupe Creek and Coyote Creek in the 2015 Potable Reuse and UWMP analysis. They were not defined in the 2012 WSIMP analysis. A separate model definition and analysis specifically for FAHCE operations is being developed concurrent with the IPR project analysis. The FAHCE models uses a daily time step which will make comparisons to IPR model results difficult. In general, the current WEAP simulation configuration for FAHCE operations in the 2015 IPR WEAP model is representative of how the FAHCE model will be implemented.

An additional model alternative was recently run to define the impact of FAHCE operation implementation on the 2015 Baseline. The summary results (Appendix B) show a slight improvement in local and bank reservoir storage. Lost Carryover increases in the Baseline with No FAHCE alternative and Flows to Bay decrease by similar amounts. Potable Reuse utilization decreases slightly in the Baseline with No FAHCE alternative – 57% vs 59%. The worst-case WSCP water use reduction factor also improves in the Baseline with No FAHCE alternative, compared to the Baseline – 15% vs 20%. The Reliability Target is barely met in the Baseline with No FAHCE alternative (it is not achieved in the Baseline case).

4.12 Ramping IPR

In the 2015 analysis, IPR is ramped to make more efficient use of IPR water (i.e., to avoid producing purified water then finding the system has no capacity to receive it). Staff implemented the ramping or ratcheting down of Los Gatos and Coyote potable reuse in 25% increments as North County groundwater storage fills. This approach produces less potable reuse supply that cannot be stored in the subbasin, and prevents other losses of supplies such as imported water carryover.

The following rule was applied for ramping down purified water supply based on North County groundwater storage:

If NC storage > 300 KAF then use 75%
If NC storage > 315 KAF then use 50%

If NC storage > 330 KAF then use 25%
else use 100%

Staff also implemented a refinement to this ramping operation – if the current SRI year type is "critical dry" or "dry", do not carry out the ramping IPR reductions.

4.13 New Coyote Groundwater Subbasin Calculation for Natural Groundwater Recharge

A new method for calculating Coyote Subbasin Natural Groundwater recharge was implemented in the 2015 WEAP model. Instead of using natural groundwater recharge values provided by groundwater modeling results, WEAP now calculates the natural recharge method using the same method in the groundwater model. The natural recharge calculation includes deep percolation of precipitation, septic system return flows, and agricultural return flows.

This change results in more natural groundwater recharge to the Coyote Subbasin. Appendix E provides a comparison of Coyote Natural Groundwater Recharge from the 2012 WEAP model and the 2015 IPR WEAP model.

4.14 Recharge facility demand priorities

Priorities at various recharge and treatment plant facilities were modified to better match current operations. Appendix G shows facility prioritization modifications.

4.15 Downstream accretion

Improvements and updates were made to the WEAP model for downstream accretions and reservoir inflow data for the 2015 analysis in December 2015. Downstream accretional flows were estimated in Excel by performing a linear regression that relates monthly flow to the average of the current month's rainfall and the previous month's rainfall, where existing values are available. The improvements and updates reduce downstream accretion on average for all facilities by approximately 1,500 af/month. The downstream accretion values are being reviewed and updated as part of a separate FAHCE Modeling Study.

5 Model Setup

This section describes how the various elements of the potable reuse scenarios were set up in the WEAP model.

SVAWPC Supply: An "Other Supply" node is setup in the WEAP model to define potable reuse supplies that can deliver purified water to groundwater recharge, injection facilities (IPR - indirect potable reuse) and to treatment plants (DPR - direct potable reuse). The Baseline alternative (and all other alternatives) are defined with 20,200 AFY of IPR water directed to recharge in Los Gatos Ponds. When additional SVAWPC delivery locations are defined in an alternative, the extra supply is added to the Other Supply node with a limitation capping total deliveries to 32 mgd. The WEAP model is also setup to calculate "ramping" reductions to the total SVAWPC supply in a given month based on how close Santa

Clara Plain (hereinafter North County) groundwater storage is getting to full capacity. This ramping reduction is done in 25% increments, to mimic how the District might operate to prevent inefficient use (or wasteful loss) of imported and local supplies including SWP and CVP carryover. This ramping calculation will be optimized later in the project. Currently, the model reduces total SVAWPC production by 75% when North County Subbasin groundwater storage is above 330,000 AF at the end of the previous month in the simulation. Total SVAWPC production is reduced/ramped by 50% when North County Subbasin groundwater storage is above 315,000 AF at the end of the previous month in the simulation. Total SVAWPC production is reduced/ramped by 25% when North County Subbasin groundwater storage is above 300,000 AF at the end of the previous month in the simulation. (Total North County Subbasin groundwater storage capacity is defined as 350,000 af). The model does not apply ramping if the current model year has a Sacramento River Index (SRI) year type of critical dry or dry.

IPR water delivered to Los Gatos Ponds: This Baseline definition includes 20,200 AFY of purified water that can be distributed evenly over 12 months to Los Gatos Ponds (matching Los Gatos Ponds recharge capacity). A demand node is defined in the model for the Los Gatos Pond recharge facility and a transmission link is defined from the SVAWPC supply node to the Los Gatos Ponds demand node. The transmission link is defined with unlimited maximum flow volume capacity (so all purified water available up to the total recharge demand capacity could be delivered). However, this capacity can be reduced all the way down to zero if North County Subbasin storage gets close to full capacity (within 20,000 AF of full), to prevent groundwater overflow and wasting purified water when there is no capacity for it to be recharged and stored. 100% of all water delivered to the demand node is passed directly to the North County Subbasin storage node – simulating groundwater recharge. There are three other supply sources available that can deliver water to Los Gatos Ponds – State Water Project (SWP) imported water, Central Valley Project (CVP) imported water, and local water flowing down Los Gatos Creek. The WEAP model allows for the setup of “Supply Preferences” to prioritize sources. Currently the model gives local water the first priority for Los Gatos Ponds deliveries, then purified water, then CVP imports, followed by SWP imports. The Supply Preference can be a very dynamic calculation. Staff has experimented with several optimization schemes to balance better use of purified water with the risk of wasting local and imported supplies. The Supply Preference will be further optimized in the near future.

Combined 15 mgd Potable Reuse: This alternative includes 15 mgd of additional potable reuse capacity. This is defined as a combined Westside injection facility in the model with the 15 mgd supply added to the SVAWPC supply node. Splitting the facility into two facilities (Westside plus Mid-basin) does not affect the modeling results. A demand node is defined in the model to take this same 15 mgd amount of potable reuse supply. 100% of all purified water delivered to the demand node is passed directly to the North County Subbasin storage node – simulating groundwater injection. A transmission link from the SVAWPC supply node to the Westside injection demand node is also set with a maximum capacity of 15 mgd, but this capacity can be reduced all the way down to zero if North County Subbasin storage gets close to full capacity (within 20,000 AF of full) to prevent groundwater overflow and wasting of purified water when there is no place for it to be stored. This reduction is bypassed if the current SRI year type is critical dry or dry.

Westside 10 mgd Potable Reuse: This alternative includes 10 mgd of additional potable reuse capacity. This is defined as the Westside injection facility in the model with the 10 mgd supply added to the SVAWPC supply node. A demand node is defined in the model to take this same 10 mgd amount of potable reuse supply. 100% of all purified water delivered to the demand node is passed directly to the North County Subbasin storage node – simulating groundwater injection. A transmission link from the SVAWPC supply node to the Westside injection demand node is also set with a maximum capacity of 10 mgd, but this capacity can be reduced all the way down to zero if North County Subbasin storage gets close to full capacity (within 20,000 AF of full) to prevent groundwater overflow and wasting of purified water when there is no place for it to be stored. This reduction is bypassed if the current SRI year type is "critical dry" or "dry".

Potable Reuse from SBWR Coyote to Ford Ponds: This alternative is defined with a different "Other Supply" node activated to simulate the SBWR Coyote Potable Reuse facility with a full capacity of 8,400 AFY, corresponding to the potential production capacity of a satellite treatment facility. A demand node is defined in the model to be 50% of total Coyote supply node capacity 4,200 AFY. 100% of all purified water delivered to the demand node is passed directly to the North County groundwater storage node – simulating groundwater recharge at Ford Ponds. A transmission link from the SBWR Coyote supply node to the Ford Ponds demand node is set to also be 50% of total Coyote supply node capacity, but this transmission delivery can be reduced all the way down to zero if North County groundwater storage gets close to full capacity (within 20,000 AF of full) . A future optimization would be to cancel/bypass this restriction if the SRI year type is "critical" or "dry".

32 mgd DPR available to the South Bay Aqueduct (SBA): This alternative defines the SVAWPC potable reuse "Other Supply" node in WEAP with 32 mgd of purified water available for use. This alternative includes "ramping" (described earlier in this document) in 25% increments to reduce SVAWPC production when the North County groundwater storage is getting close to full is removed for this scenario.

WEAP transmission links are defined from the SVAWPC supply node to deliver available potable reuse water to SBA at a point upstream of Penitencia Water Treatment Plant and to Los Gatos Ponds. (Other transmission links are defined to Westside groundwater injection and Mid-basin groundwater injection, but turned off for this alternative).

The transmission link for DPR to SBA was improved to better prioritize this delivery over deliveries to Los Gatos Ponds by adding a Demand node between the transmission link node/line and the SBA diversion node/pipeline. Previously, it was assumed the demand nodes for Penitencia, Rinconada and Santa Teresa that are connected to downstream flows in the WEAP definition would be prioritized and delivered to first (vs. Los Gatos ponds), but this did not seem to be the case. Therefore, by adding this extra demand node and setting its priority to the highest possible value, purified water deliveries to the SBA will be maximized before purified water is delivered to Los Gatos Ponds.

The expression for the maximum diversion flow (MGD) in the DPR to SBA transmission link is calculated as the total supply available times a factor (value between 1 and 0) that represents the amount of water needed from this source to fill any treatment plant demands in the given month that cannot be met by all other imported water sources.

Current month demands for all three treatment plants are totaled, and the sum of current month CVP supply, CVP carryover storage available, SWP supply, SWP carryover storage available, and any current month dry year option water available is subtracted from the total treatment plant demand. If there is not enough imported water in the given month to meet the three water treatment plant needs, the factor is calculated as the amount of missing treatment plant demand divided by total DPR supply available. If there is no missing treatment plant demand, this factor is zero. If there is more treatment plant demand than DPR supply, this factor is set to 1.

6 Alternative Analyses

In September 2015, a large variety of Potable Reuse alternatives were defined and simulated after the baseline case was established. These alternatives include:

1. Base case with no Los Gatos Ponds potable reuse, no Lexington pipeline, and no Saratoga/IWRP recharge facility
2. Base case with Ford Pond potable reuse
3. Base case with original Westside potable reuse
4. Base case with hybrid Westside potable reuse (splitting half of new supply going to the planned Saratoga/IWRP recharge facility)
5. Base case with Mid-basin potable reuse
6. Base case with Sunnyvale potable reuse
7. Base case with all potable reuse (with original Westside)

In late September 2015, new initial groundwater storage conditions were defined and a new method of calculating Coyote Natural Groundwater Yield was implemented. With this information setup in the WEAP model, another round of Base plus IPR alternatives were re-run.

During the month of October, a variety of different IPR alternatives were modeled, as well as an iterative process of adding Dry Year Options to answer the question "How Much More Water Do We Need?" A DPR to Central pipeline alternative and an alternative that includes an 80,000 AF Pacheco Reservoir were also investigated. Analysis was also carried out to evaluate the impact of supply preference between local and IPR water supplies on average IPR utilization. Staff investigated changes to Treated Water Assumptions, such as removing 20,000 AF of non-contract treated water deliveries, to determine whether this provides a larger amount of available IPR supplies to Los Gatos Ponds and Westside Groundwater injection.

In December, additional new alternatives were modeled, including more North County Subbasin recharge, a new water bank with similar capacity to Semitropic, DPR to Central Pipeline, and a 2:1 Exchange contract. The model was updated to include a significant new set of data– The new data added includes new imported water allocation factors from the 2015 Delivery Capability Report - Early Long-Term Scenario; and staff's decision to exclude the CVP Reallocation Agreement (which expires in

2022) and to use 130,000 AF CVP as M&I historic use. Full hydrology for 2004-2015 was also implemented, so that the model simulation time period includes 1922-2015. With this new data, another round of IPR alternatives were run and alternatives to look at 300,000 AF additional storage in a new Water Bank and a preliminary 50,000 AF of Los Vaqueros participation.

Finally in March, additional IPR model runs were conducted to include the alternatives listed below. These additional runs do not incorporate IPR ramping reductions (due to groundwater storage getting close to full) if the current year has an SRI year type of “Critical Dry” or “Dry”. Also, with the set of new model runs the District’s data gathering spreadsheets have been enhanced/fine-tuned from all of the previous work to date.

1. Baseline
2. Baseline plus Ford Road
3. Baseline plus 15K injection
4. Baseline plus Ford plus 15K injection
5. Baseline plus 10K injection
6. 32 MGD to SBA
7. Baseline with No IPR and No Lexington Pipeline
8. Baseline with No FAHCE Operations

A summary of all the alternatives modeled is included in Appendix H.

7 Model Findings and Results

Appendix B provides a summary of results for each of the model alternatives arranged to compare and contrast the benefits and risks for each alternative. Appendix B is best viewed as a spreadsheet. Each alternative has its own column of results in columns B – I. The rows of information in Appendix B are broken into sets. Each set is described below.

Groundwater Storage: The first set of gathered results shows average monthly Groundwater Storage in AF over the entire model simulation period (1922-2015). The results do not vary greatly between model alternatives when looking at a simple average over the entire hydrologic period. Appendix C presents charts for model results to illustrate how groundwater storage varies over the complete simulation hydrologic period. The charts show that groundwater storage drops to critically low levels three times between 1922 and 2015.

Local Reservoir Storage: This set of gathered summary results shows average monthly Local Reservoir storage in AF over the entire model simulation period. There is very little change in results when comparing each model alternative since local supplies do not vary among the alternatives. The only slight difference that can be seen among alternatives in this set of data happens when potable reuse to Ford Ponds is set to active. When Ford Ponds are active and Potable Reuse ramping reductions occur, more local deliveries from Anderson Reservoir takes place. This results in Anderson average storage going down by 3,000 AF when Ford Ponds are active. This is another area where optimization (to avoid Anderson deliveries to Ford Ponds when ramping is occurring) could be considered.

Banking and Imported Water Carryover Storage: This set of results shows average monthly storage for:

- the Semitropic Bank,
- a New Bank facility (not used and any of these alternatives),
- CVP Carryover and
- SWP Carryover.

In addition, the storage at the end of the simulation (December 2015) for the accumulation of CVP and SWP carryover that could not be used (lost) is displayed with this set of data. The CVP and SWP carryover that could not be used is useful for comparing scenarios and assessing when there may be challenges to maximizing use of available CVP and SWP supplies.

The maximum Carryover capacity is 45,000 AF for both SWP and CVP. Any Carryover defined in the early months of a year is used first by the WEAP model. However if in a given month San Luis Storage goes above 2,000,000 AF, all current Carryover is lost via logic that moves it into an accumulator reservoir. The maximum capacity of the Semitropic bank is 350,000 AF.

The WEAP model is configured with logic to save excess imported water supplies as either Carryover or as a “put” to the Semitropic Bank depending on specific current conditions. If the Semitropic Bank is not very full (less than 100,000 AF) then the model will “put” to the bank before saving Carryover to SWP and CVP; if San Luis Reservoir is near full, puts to Semitropic will occur after 7,000 AF Carryover is achieved in SWP and 10,700 AF is achieved in CVP; else puts to Semitropic are made after 20,000 AF carryover is achieved in both SWP and CVP. These amounts approximate treated water needs in January and February with a presumption that if San Luis storage is near full – it may fill and trigger complete loss of all remaining Carryover accumulation.

When compared to the Baseline case, each alternative shows an increase in average Semitropic storage. As expected, alternatives with more IPR supply generate higher increases in average Semitropic storage. There is opportunity to look into the use of Semitropic storage as part of the optimization analysis yet to be carried out. Even in the baseline case, the amount of Semitropic storage is not fully utilized during the 1987-1994 drought (when the majority of WSCP events occur). This is due to maximum “take” restrictions. Other banking arrangements that could concurrently allow takes of portions of this storage in a drought could be of great value. Selling some Semitropic water to allow purchase of more dry year options or exchange contracts may also be worth pursuing.

Accumulated SWP and CVP Carryover lost or not used also gets larger in each alternative compared to the Baseline. Alternatives with more IPR supply (except DPR to SBA) create higher accumulations compared to alternatives with lower IPR supply. IPR supplies compete with imported water supplies for use in the District’s operations. Ramping of IPR supplies as subbasins get close to full helps lower this larger accumulation of lost imports. New storage facilities or banks could also decrease the accumulation.

Unmet Treated Water Deliveries: This set of data shows the accumulated water treatment plant demands that were not met over the entire simulation. The three water treatment plants receive raw water from the imported water supplies (CVP, SWP, dry year options, Semitropic Bank). Water can also be released from Anderson and Calero Reservoirs into the pipelines to the treatment plants when imported supplies are not sufficient and local reservoir storage is available (with considerations for FAHCE requirements and minimum rule curve strategies). When all of these supplies are insufficient to meet treatment plant contract demands in a given month, this unmet amount is calculated and accumulated as a model result.   The model then triggers pumping by all retailers that have groundwater pumping capacity to replace unmet treated water deliveries.

The results here show minor improvements (i.e., less unmet treated water demands) in all alternatives compared to the baseline case. As expected, the DBA to SBA alternative provides very significant improvement to the amount of unmet treated water demands.

Flow to Bay: This set of data shows the accumulated amount of water that is lost to the Bay via Los Gatos Creek and Coyote Creek that is associated with runoff from Lexington Reservoir and Anderson/Coyote Reservoirs respectively. Flow to Bay goes up slightly in all potable reuse alternatives (compared to the Baseline case) in Los Gatos Creek with the exception of the DPR to SBA alternative. This is due to less competition for delivery of water to Los Gatos Ponds and more time that recharge capacity is cut off to Los Gatos Ponds when the North County Subbasin Groundwater storage gets close to full. Flow to Bay goes up slightly in Coyote Creek in the alternatives that do not include Ford Ponds IPR, due to groundwater storage increasing more often and causing recharge reductions. In the Ford Ponds IPR alternatives, a new recharge facility is in place that may be allowing more local water to be recharged instead of flowing to the bay. This needs to be reviewed further to see if ramping is optimized.

Potable Reuse Deliveries by Project: This set of data shows the accumulated amount of potable reuse water that is actually delivered to the associated facility (groundwater injection, recharge, raw water pipeline). The results here show some competition for use among the various alternatives and some counterintuitive accumulations. For example, potable reuse to Los Gatos ponds goes up when compared to the base case when 10 or 15 mgd of groundwater injection potable reuse is added. This results from demand priorities that are currently set to prefer Los Gatos pond recharge over groundwater injection. When there is potable reuse ramping/reductions taking place due to high groundwater storage (near full capacity), more of the reduced PR supply gets to Los Gatos Ponds first. Staff will investigate to see if there is any optimization benefit to change the demands priorities to be equal when ramping is taking place.

The information presented here can be further analyzed by looking at other results described below – Potable Reuse Capacity and Utilization.

Water Shortage Contingency Plan Actions: This set of data shows one way to evaluate whether an alternative provides an adequate amount of supplies throughout the hydrologic period of simulation. Specifically it accounts for frequency of water shortage contingency plan actions (counted in years) and magnitude of water use reductions required (maximum percentage reduction to normal demand).

The rules for Water Shortage Contingency Plan (WSCP) Actions are as follows:

- There are 5 groundwater storage thresholds or stages the model uses to trigger a WSCP demand reduction action or event:
  - Stage 1 occurs when total groundwater storage in all 3 subbasins is above 300,000 AF in December of the previous year. AF. (Full capacity is 530,000 AF) This is the “no action” stage.
  - Stage 2 occurs when total groundwater storage in all 3 subbasins drops below 300,000 AF.
  - Stage 3 occurs when total groundwater storage in all 3 subbasins drops below 250,000 AF.
  - Stage 4 occurs when total groundwater storage in all 3 subbasins drops below 200,000 AF.
  - Stage 5 occurs when total groundwater storage in all 3 subbasins drops below 150,000 AF.
- Each stage has a base demand reduction factor assigned to it:
  - Stage 1 = 0%
  - Stage 2 = 10%
  - Stage 3 = 20%
  - Stage 4 = 25%
  - Stage 5 = 50%
- The model also keeps a count of sequential years in which WSCP action events have occurred (i.e., Stage is equal or greater than 2). The first time a Stage 2 or greater case is detected, this counter is set to 1. If the next year generates a Stage 2 or greater event, the counter is incremented to 2, and so on. This counter is reset to zero each time a Stage 1 state is detected.
- A separate count factor is calculated based on the count of sequential years a WSCP action event is in place, where:
  - Count value of 1 = .5
  - Count value of 2 = .75
  - Count value of 3 or higher = 1.0
- The WSCP demand reduction factor (when Stage is 2 or greater) is then calculated as the count factor multiplied by the base demand reduction factor. This adjustment accounts for the time required (up to three years) to fully implement a mandatory water use reduction program. For example if the model was at a Stage 2 (10% conservation level) for 3 straight years, in the first year a 5% conservation reduction would occur, in the second year a 7.5% conservation reduction would occur and then in the 3rd year a 10% conservation reduction to demands would take place.

An approach to evaluating whether a model alternative case is sufficient to supply enough water to meet demands in all hydrologic year types and sequences would be to say the maximum WSCP water use reduction factor should never go above 10%.

Baseline Supplies This set of results shows all the major water supplies available during each model alternative run on an average annual basis. The list includes:

- Natural Groundwater Recharge
- Local Surface Water

- Recycled Water (does not include potable reuse)
- Potable Reuse
- San Francisco Public Utilities Commission (Hetch-Hetchy or SFPUC)
- Delta Conveyed (SWP and CVP)

Many of these supplies do not vary among alternative cases. Hetch-Hetchy varies slightly due to WSCP reductions that cause service area retailers who rely heavily on Hetch-Hetchy to not use all of their available SFPUC supply. Potable Reuse is dependent on the alternative case defined, which may then compete with Local Surface Water.

Supplemental Dry Year Supplies are Dry Year Options which remain the same in all alternative cases since they are based on SRI year type. This supply is 12,000 AF when the year type is “Critical Dry”.

Minimum Total Supply: This set of results is a calculation of the minimum annual result for all simulation hydrologic years that include Baseline and Supplemental Supplies and Reserves such as Groundwater Pumping and Semitropic Takes and Local Reservoir releases to Pipelines for deliver to treatment plants. This calculation is the basis for the Reliability Target result described below.

Potable Reuse Capacity and Utilization: This set of results shows all possible Potable Reuse available to each model alternative case and the percentage of actual use. The percentage of actual use is less than 100% due to ramping, potential competition among supply sources, and curtailment of groundwater recharge and groundwater injection when there is little or no remaiing groundwater storage.

Reliability Target: This result is a simple Yes or No value that reflects whether the calculated Minimum Total Supply is less than 90% of average annual water demand. The target for long-term water supply reliability approved by the Board of Directors on June 12, 2012 is, “develop water supplies designed to meet 100 percent of average annual water demand identified in the District’s [most recent] Urban Water Management Plan during non-drought years and at least 90 percent of average annual water demand in drought years.”

In all of the model cases, the total amount of demand is 422,616 AFY. 90% of this total demand is 380,354 AFY. Therefore, this calculation compares the calculated Minimum Total Supply to the 90% demand threshold, 380,354 AFY. If any year in the simulation (represented by this minimum value) is less than the 90% demand threshold, then the Reliability Target has not been met.

8 Findings and Next Steps

The purpose of this section is to provide an assessment of the amount of potable reuse that needs to be developed to meet the District’s reliability target and identify some issues that should be considered during development of the potable reuse program. The assessment is based on reviewing the results for all the alternatives modeled to date, which are summarized in Appendices B and H. There are notes in Appendix H that describe each scenario and summarize its performance.

The 2015 Baseline includes 20,200 AFY of potable reuse in the Los Gatos Pond system, because that is the amount that was included in the Board-adopted 2012 WSIMP. This baseline case assumes all the features of the the Board-adopted 2012 WSIMP will be implemented, which includes 20,200 AFY of potable reuse capacity, a pipeline between Lexington Reservoir and Vasona Pumping Plant, additional North County recharge capacity (4,000 AFY percolation pond in the West Basin), and options for transfers in "critical dry" years. In addition, the WSIMP assumes 30,000 AFY of non-potable reuse by 2035 and 99,000 AFY of water conservation savings by 2030. Without the WSIMP projects, the model projects shortages of up to 50 percent, and the frequency of shortage is more than double than with the WSIMP projects (the Baseline in this analysis). With the Baseline, shortages of up to 20% were indicated in three out of the 94 years included in the simulation.

The Baseline in this analysis falls short of the District's reliability target, using 2035 demands and the assumptions described above that used for the 2015 analysis. Accordingly, the District should plan for additional supplies and/or demand reductions before 2035, assuming that demands grow as projected. If demand grows at a slower pace, the timing of the need for additional supplies would be delayed. The planning for additional supplies and/or demand reductions should occur as part of the WSIMP update scheduled to begin in Summer 2016. The WSIMP will consider dry year options, additional conservation, storage, and stormwater capture and reuse. The District is also participating in the Bay Area Regional Reliability project, which is evaluating options to improve drought response and resiliency.

8.1 How Much Water We Need

The amount of additional water required to meet the reliability target in 2035 ranges from 0 to about 25,000 AFY. The lower end of the range corresponds to storage options (both surface and groundwater) that optimize the District's ability to utilize existing supplies. The upper end of the range is if the water supply need was met solely with dry year options/transfers. If potable reuse alone is used to meet the reliability target, then at least 4,200 AFY of additional potable reuse capacity (in addition to the 20,200 AFY in the baseline) is needed based on the modeling results (see the March Ford Pond Potable Reuse alternative). The 4,200 AFY of potable reuse could occur anywhere in the Santa Clara Plain portion of the Santa Clara Subbasin. These different options for meeting the reliability target are discussed below.

8.1.1 Additional Storage

Additional storage was analyzed because the model indicated that there were many years when potable reuse capacity was not being utilized, and the average rate of utilization is about 50%. Additional storage, either local surface water storage, surface storage located outside of the county, or groundwater banking, optimizes the District's ability to use its existing supplies. While drier year imported water allocations have decreased compared to the 2012 WSIMP, the average imported water deliveries are about the same. The District can bank the wetter year water for use in drier years. Additional storage options could become more valuable in the future in the event that expected changes in precipitation patterns due to climate change occur.

The disadvantages of additional storage include costs and potential limits on the ability to bring in water stored outside the county when it is needed. In addition, if future regulations governing pumping the

Delta reduce imported water allocations sufficiently, there may not be sufficient water to put into storage and large investments could become stranded assets. This was observed during modeling performed in early 2016 as part of the California WaterFix business case analysis.

8.1.2 Dry-Year Options/Transfers

Dry-year options/transfers were analyzed because the amount and frequency of shortages did not significantly improve with the addition of potable reuse capacity. The Baseline has three years where water use reductions are needed, with a maximum reduction of 20%. Adding the Ford Pond project, at a higher cost, did not reduce the frequency of water use reductions and only reduced the amount of reduction from 20% to 15%.

A key advantage of dry-year options or transfers is that they are generally a lower cost than other water supply options and they can be called upon only in the years they are needed. However, given current water conveyance facilities, regulations, Delta operations, and politics, the ability to secure dry-year options can be limited.

8.1.3 Potable Reuse

Potable reuse provides a locally-controlled, drought-proof supply of high quality water. In addition, it improves water use efficiency and is consistent with a “One Water” approach to resource management. All the potable reuse alternatives modeled in March 2016 met the District’s reliability target. As more potable reuse capacity was added, the frequency and magnitude of shortage was reduced, with development of 20,000 AFY of additional potable reuse capacity lowering the maximum water use reduction to 5% (compared to 20% in the Baseline) and water use reductions occurring in only one year (compared to three in the Baseline).

Construction and operations and maintenance costs for developing potable reuse are high, and full capacity would probably not be utilized in most years. Projected utilization of purified water in the March 2016 analysis ranged from about 45% to 60%, with the higher utilization rates associated with lower amounts of potable reuse capacity. The low utilization rate and uncertainties associated with demand projections could result in costly assets that are used minimally and infrequently if too much potable reuse capacity is developed in the near term.

8.1.4 Other Options

This analysis did not include an evaluation of additional demand management measures, additional non-potable reuse opportunities, or additional stormwater capture and reuse opportunities. These opportunities, as well as the opportunities described above will be evaluated during the WSIMP update.

8.2 Next Steps

The next steps in the potable reuse water supply system modeling could include:

- Updating the demand projections based on the 2015 Urban Water Management Plan (UWMP). The countywide demand projection has increased slightly (less than 2,000 AFY in 2035) compared to projection in the 2010 UWMP. However, the demands in the North County Subbasin are about 10,000 AFY lower in the 2015 projection compared to the 2010 project for

2035. This could reduce potable reuse utilization factor and/or the need for additional potable reuse capacity.

- Optimize the utilization of potable reuse capacity. One alternative modeled in October 2015 turned off the availability of non-contract water and increase the utilization rate from 50% to 61%. Preliminary groundwater modeling for the potable reuse program indicates that the "ramping" and "stop recharge" assumptions in WEAP may be too conservative – the basin may be able to take more water than is indicated in WEAP. Some iterations between the WEAP and groundwater model could improve the assumptions in WEAP.
- Evaluate the timing of additional potable reuse capacity. It is clear that the Baseline potable reuse capacity is of value to the District. The modeling for the 2015 UWMP shows that we need that potable reuse capacity as soon as possible to meet the District's reliability target. The key question to be further evaluated is when additional reuse capacity may be needed. Preliminary UWMP modeling indicates that existing and planned supplies from the 2015 WSIMP are sufficient to meet demands on average. However, there are shortages during multiple-year droughts beginning in 2030, assuming demands increase as projected.

8.3 Summary

The potable reuse modeling described in this report re-affirms the value of the projects in the 2012 WSIMP, including the 20,200 AFY of potable reuse capacity in the Baseline, for water supply reliability. Changes in assumptions since the 2012 WSIMP resulted in the need for additional supplies/demand management measures to meet the District's water supply reliability target in 2035. Approximately 4,200 AFY of additional potable reuse capacity could be sufficient to meet the reliability target in 2035.

Additional modeling should be performed to evaluate how the utilization factor for potable reuse capacity could be increased, confirm the amount of potable reuse needed based on updated demand projections, and better identify the timing of any additional potable reuse capacity.

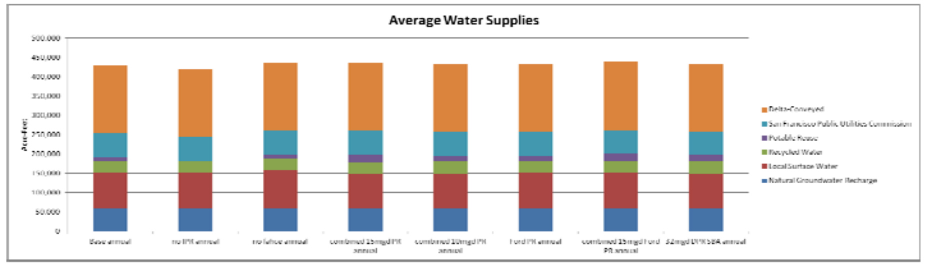
The District is scheduled to update its WSIMP beginning in 2016, with a targeted completion date in 2017. In addition to considering potable reuse, the District is also considering the California WaterFix, dry year options, additional conservation, storage, and stormwater capture and reuse. The District is also participating in the Bay Area Regional Reliability project, which is evaluating options to improve drought response and resiliency. Potable reuse development beyond the 20,200 AFY of capacity in the Baseline/2012 WSIMP should be evaluated in comparison to other alternatives in the context of the WSIMP update.

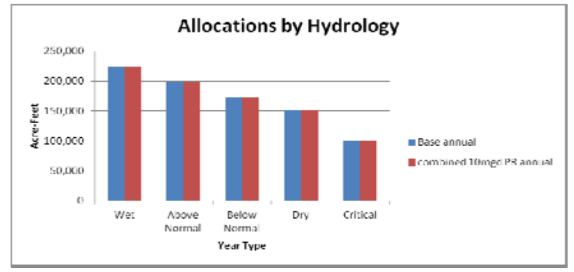
Appendix A - Model Assumptions

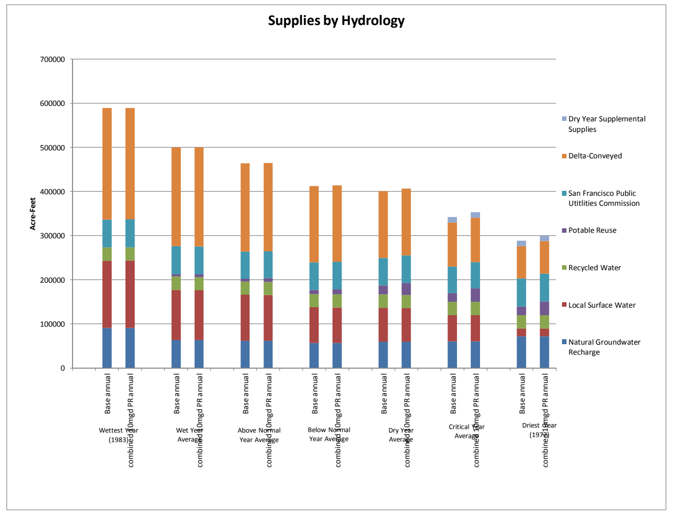
	2015 Baseline	Base + combined 15mgd PR injection	Base + combined 10mgd PR injection	Base + Ford PR	Base + combined 15mgd injection + Ford PR	32 mgd DPR to SBA	No IPR No Lex PL case	2015 Baseline with NO FAHCE
1 General								
Historical Hydrology	1922 – 2015	1922 – 2015	1922 – 2015	1922 – 2015	1922 – 2015	1922 – 2015	1922 – 2015	1922 – 2015
Demand Year	2035	2035	2035	2035	2035	2035	2035	2035
Model Version	Water Evaluation And Planning model (WEAP), Version: 2015.0014, February 19, 2016 Dictionary Version: 361	Water Evaluation And Planning model (WEAP), Version: 2015.0014, February 19, 2016 Dictionary Version: 361	Water Evaluation And Planning model (WEAP), Version: 2015.0014, February 19, 2016 Dictionary Version: 361	Water Evaluation And Planning model (WEAP), Version: 2015.0014, February 19, 2016 Dictionary Version: 361	Water Evaluation And Planning model (WEAP), Version: 2015.0014, February 19, 2016 Dictionary Version: 361	Water Evaluation And Planning model (WEAP), Version: 2015.0014, February 19, 2016 Dictionary Version: 361	Water Evaluation And Planning model (WEAP), Version: 2015.0014, February 19, 2016 Dictionary Version: 361	Water Evaluation And Planning model (WEAP), Version: 2015.0014, February 19, 2016 Dictionary Version: 361
Model Name	Master WEAP Model September 2015 v009	Master WEAP Model September 2015 v009	Master WEAP Model September 2015 v009	Master WEAP Model September 2015 v009	Master WEAP Model September 2015 v009	Master WEAP Model September 2015 v009	Master WEAP Model September 2015 v009	Master WEAP Model September 2015 v009
Elements modeled	Complete water supply system	Complete water supply system	Complete water supply system	Complete water supply system	Complete water supply system	Complete water supply system	Complete water supply system	Complete water supply system
General Scenario Description	Planned operations for 2035	Planned operations for 2035	Planned operations for 2035	Planned operations for 2035	Planned operations for 2035	Planned operations for 2035	Planned operations for 2035	Planned operations for 2035
Model Method	Deterministic	Deterministic	Deterministic	Deterministic	Deterministic	Deterministic	Deterministic	Deterministic
2 Surface Water Supplies								
CVP Supplies to Coyote Creek	Downstream recharge requirement less 2 cfs min Anderson release if combined (Anderson and Coyote) storage is less than: Nov: 42.0 TAF Dec: 46.1 TAF Jan: 71.3 TAF Feb: 74.8 TAF Mar: 87.6 TAF Apr: 87.6 TAF May - Oct: 0 cfs	Downstream recharge requirement less 2 cfs min Anderson release if combined (Anderson and Coyote) storage is less than: Nov: 42.0 TAF Dec: 46.1 TAF Jan: 71.3 TAF Feb: 74.8 TAF Mar: 87.6 TAF Apr: 87.6 TAF May - Oct: 0 cfs	Downstream recharge requirement less 2 cfs min Anderson release if combined (Anderson and Coyote) storage is less than: Nov: 42.0 TAF Dec: 46.1 TAF Jan: 71.3 TAF Feb: 74.8 TAF Mar: 87.6 TAF Apr: 87.6 TAF May - Oct: 0 cfs	Downstream recharge requirement less 2 cfs min Anderson release if combined (Anderson and Coyote) storage is less than: Nov: 42.0 TAF Dec: 46.1 TAF Jan: 71.3 TAF Feb: 74.8 TAF Mar: 87.6 TAF Apr: 87.6 TAF May - Oct: 0 cfs	Downstream recharge requirement less 2 cfs min Anderson release if combined (Anderson and Coyote) storage is less than: Nov: 42.0 TAF Dec: 46.1 TAF Jan: 71.3 TAF Feb: 74.8 TAF Mar: 87.6 TAF Apr: 87.6 TAF May - Oct: 0 cfs	Downstream recharge requirement less 2 cfs min Anderson release if combined (Anderson and Coyote) storage is less than: Nov: 42.0 TAF Dec: 46.1 TAF Jan: 71.3 TAF Feb: 74.8 TAF Mar: 87.6 TAF Apr: 87.6 TAF May - Oct: 0 cfs	Downstream recharge requirement less 2 cfs min Anderson release if combined (Anderson and Coyote) storage is less than: Nov: 42.0 TAF Dec: 46.1 TAF Jan: 71.3 TAF Feb: 74.8 TAF Mar: 87.6 TAF Apr: 87.6 TAF May - Oct: 0 cfs	Downstream recharge requirement less 2 cfs min Anderson release if combined (Anderson and Coyote) storage is less than: Nov: 42.0 TAF Dec: 46.1 TAF Jan: 71.3 TAF Feb: 74.8 TAF Mar: 87.6 TAF Apr: 87.6 TAF May - Oct: 0 cfs
CVP supplies to Anderson Reservoir	Yes if month is March or April and Anderson storage < 35,000 af; then move 100 cfs until storage reaches 35,000 af	Yes if month is March or April and Anderson storage < 35,000 af; then move 100 cfs until storage reaches 35,000 af	Yes if month is March or April and Anderson storage < 35,000 af; then move 100 cfs until storage reaches 35,000 af	Yes if month is March or April and Anderson storage < 35,000 af; then move 100 cfs until storage reaches 35,000 af	Yes if month is March or April and Anderson storage < 35,000 af; then move 100 cfs until storage reaches 35,000 af	Yes if month is March or April and Anderson storage < 35,000 af; then move 100 cfs until storage reaches 35,000 af	Yes if month is March or April and Anderson storage < 35,000 af; then move 100 cfs until storage reaches 35,000 af	Yes if month is March or April and Anderson storage < 35,000 af; then move 100 cfs until storage reaches 35,000 af
CVP supplies priorities	1 - Minimum flows to Upper Coyote (9 cfs) and Llagas (7 cfs) 2 - Treatment Plants 3 - Remaining recharge in Upper Coyote and Llagas 4 - Other Coyote recharge 5 - Alamitos/Guadalupe and most other recharge 6 - Westside recharge	1 - Minimum flows to Upper Coyote (9 cfs) and Llagas (7 cfs) 2 - Treatment Plants 3 - Remaining recharge in Upper Coyote and Llagas 4 - Other Coyote recharge 5 - Alamitos/Guadalupe and most other recharge 6 - Westside recharge	1 - Minimum flows to Upper Coyote (9 cfs) and Llagas (7 cfs) 2 - Treatment Plants 3 - Remaining recharge in Upper Coyote and Llagas 4 - Other Coyote recharge 5 - Alamitos/Guadalupe and most other recharge 6 - Westside recharge	1 - Minimum flows to Upper Coyote (9 cfs) and Llagas (7 cfs) 2 - Treatment Plants 3 - Remaining recharge in Upper Coyote and Llagas 4 - Other Coyote recharge 5 - Alamitos/Guadalupe and most other recharge 6 - Westside recharge	1 - Minimum flows to Upper Coyote (9 cfs) and Llagas (7 cfs) 2 - Treatment Plants 3 - Remaining recharge in Upper Coyote and Llagas 4 - Other Coyote recharge 5 - Alamitos/Guadalupe and most other recharge 6 - Westside recharge	1 - Minimum flows to Upper Coyote (9 cfs) and Llagas (7 cfs) 2 - Treatment Plants 3 - Remaining recharge in Upper Coyote and Llagas 4 - Other Coyote recharge 5 - Alamitos/Guadalupe and most other recharge 6 - Westside recharge	1 - Minimum flows to Upper Coyote (9 cfs) and Llagas (7 cfs) 2 - Treatment Plants 3 - Remaining recharge in Upper Coyote and Llagas 4 - Other Coyote recharge 5 - Alamitos/Guadalupe and most other recharge 6 - Westside recharge	1 - Minimum flows to Upper Coyote (9 cfs) and Llagas (7 cfs) 2 - Treatment Plants 3 - Remaining recharge in Upper Coyote and Llagas 4 - Other Coyote recharge 5 - Alamitos/Guadalupe and most other recharge 6 - Westside recharge
CVP Reallocation Agreement[3] (1997 - 25 year agreement)	Assumed to expire and no longer be used	Assumed to expire and no longer be used	Assumed to expire and no longer be used	Assumed to expire and no longer be used	Assumed to expire and no longer be used	Assumed to expire and no longer be used	Assumed to expire and no longer be used	Assumed to expire and no longer be used
Imported Water Allocations	2015 Draft Delivery Capability Report - Early Long-Term Scenario. Includes climate change, biological opinions, and Fall X2. Ag contract amount of 33,100 AFY and M&I historic use of 130,000 AFY. Maximum deliveries of 152,500 AFY	2015 Draft Delivery Capability Report - Early Long-Term Scenario. Includes climate change, biological opinions, and Fall X2. Ag contract amount of 33,100 AFY and M&I historic use of 130,000 AFY. Maximum deliveries of 152,500 AFY	2015 Draft Delivery Capability Report - Early Long-Term Scenario. Includes climate change, biological opinions, and Fall X2. Ag contract amount of 33,100 AFY and M&I historic use of 130,000 AFY. Maximum deliveries of 152,500 AFY	2015 Draft Delivery Capability Report - Early Long-Term Scenario. Includes climate change, biological opinions, and Fall X2. Ag contract amount of 33,100 AFY and M&I historic use of 130,000 AFY. Maximum deliveries of 152,500 AFY	2015 Draft Delivery Capability Report - Early Long-Term Scenario. Includes climate change, biological opinions, and Fall X2. Ag contract amount of 33,100 AFY and M&I historic use of 130,000 AFY. Maximum deliveries of 152,500 AFY	2015 Draft Delivery Capability Report - Early Long-Term Scenario. Includes climate change, biological opinions, and Fall X2. Ag contract amount of 33,100 AFY and M&I historic use of 130,000 AFY. Maximum deliveries of 152,500 AFY	2015 Draft Delivery Capability Report - Early Long-Term Scenario. Includes climate change, biological opinions, and Fall X2. Ag contract amount of 33,100 AFY and M&I historic use of 130,000 AFY	2015 Draft Delivery Capability Report - Early Long-Term Scenario. Includes climate change, biological opinions, and Fall X2. Ag contract amount of 33,100 AFY and M&I historic use of 130,000 AFY
Semitropic Participation	350,000 acre-foot (AF) capacity; initial storage = 200,000 AF	350,000 acre-foot (AF) capacity; initial storage = 200,000 AF	350,000 acre-foot (AF) capacity; initial storage = 200,000 AF	350,000 acre-foot (AF) capacity; initial storage = 200,000 AF	350,000 acre-foot (AF) capacity; initial storage = 200,000 AF	350,000 acre-foot (AF) capacity; initial storage = 200,000 AF	350,000 acre-foot (AF) capacity; initial storage = 200,000 AF	350,000 acre-foot (AF) capacity; initial storage = 200,000 AF
Semitropic Water Bank "Put"	If Semitropic banks is not very full (less than 100,000 af) then put to the bank before using carryover to swp and cvp; if SLR is near full, put to semitropic after 7,000 af carryover in swp and 10,700 af in cvp; else put to semitropic after 20,000 carryover in both swp and cvp	If Semitropic banks is not very full (less than 100,000 af) then put to the bank before using carryover to swp and cvp; if SLR is near full, put to semitropic after 7,000 af carryover in swp and 10,700 af in cvp; else put to semitropic after 20,000 carryover in both swp and cvp	If Semitropic banks is not very full (less than 100,000 af) then put to the bank before using carryover to swp and cvp; if SLR is near full, put to semitropic after 7,000 af carryover in swp and 10,700 af in cvp; else put to semitropic after 20,000 carryover in both swp and cvp	If Semitropic banks is not very full (less than 100,000 af) then put to the bank before using carryover to swp and cvp; if SLR is near full, put to semitropic after 7,000 af carryover in swp and 10,700 af in cvp; else put to semitropic after 20,000 carryover in both swp and cvp	If Semitropic banks is not very full (less than 100,000 af) then put to the bank before using carryover to swp and cvp; if SLR is near full, put to semitropic after 7,000 af carryover in swp and 10,700 af in cvp; else put to semitropic after 20,000 carryover in both swp and cvp	If Semitropic banks is not very full (less than 100,000 af) then put to the bank before using carryover to swp and cvp; if SLR is near full, put to semitropic after 7,000 af carryover in swp and 10,700 af in cvp; else put to semitropic after 20,000 carryover in both swp and cvp	If Semitropic banks is not very full (less than 100,000 af) then put to the bank before using carryover to swp and cvp; if SLR is near full, put to semitropic after 7,000 af carryover in swp and 10,700 af in cvp; else put to semitropic after 20,000 carryover in both swp and cvp	If Semitropic banks is not very full (less than 100,000 af) then put to the bank before using carryover to swp and cvp; if SLR is near full, put to semitropic after 7,000 af carryover in swp and 10,700 af in cvp; else put to semitropic after 20,000 carryover in both swp and cvp
Semitropic Water Bank "Take"	If treated water contract demand is not met and/or groundwater storage falls below 300,000 AF; take increases as groundwater storage decreases	If treated water contract demand is not met and/or groundwater storage falls below 300,000 AF; take increases as groundwater storage decreases	If treated water contract demand is not met and/or groundwater storage falls below 300,000 AF; take increases as groundwater storage decreases	If treated water contract demand is not met and/or groundwater storage falls below 300,000 AF; take increases as groundwater storage decreases	If treated water contract demand is not met and/or groundwater storage falls below 300,000 AF; take increases as groundwater storage decreases	If treated water contract demand is not met and/or groundwater storage falls below 300,000 AF; take increases as groundwater storage decreases	If treated water contract demand is not met and/or groundwater storage falls below 300,000 AF; take increases as groundwater storage decreases	If treated water contract demand is not met and/or groundwater storage falls below 300,000 AF; take increases as groundwater storage decreases
Semitropic Reoperations	If storage exceeds 300,000 move amount in excess to an accumulation reservoir to account how much Bank water could be sold	If storage exceeds 300,000 move amount in excess to an accumulation reservoir to account how much Bank water could be sold	If storage exceeds 300,000 move amount in excess to an accumulation reservoir to account how much Bank water could be sold	If storage exceeds 300,000 move amount in excess to an accumulation reservoir to account how much Bank water could be sold	If storage exceeds 300,000 move amount in excess to an accumulation reservoir to account how much Bank water could be sold	If storage exceeds 300,000 move amount in excess to an accumulation reservoir to account how much Bank water could be sold	If storage exceeds 300,000 move amount in excess to an accumulation reservoir to account how much Bank water could be sold	If storage exceeds 300,000 move amount in excess to an accumulation reservoir to account how much Bank water could be sold
San Luis Reservoir	2015 Draft Delivery Capability Report - Early Long-Term Scenario. Includes climate change, biological opinions, and Fall X2.	2015 Draft Delivery Capability Report - Early Long-Term Scenario. Includes climate change, biological opinions, and Fall X2.	2015 Draft Delivery Capability Report - Early Long-Term Scenario. Includes climate change, biological opinions, and Fall X2.	2015 Draft Delivery Capability Report - Early Long-Term Scenario. Includes climate change, biological opinions, and Fall X2.	2015 Draft Delivery Capability Report - Early Long-Term Scenario. Includes climate change, biological opinions, and Fall X2.	2015 Draft Delivery Capability Report - Early Long-Term Scenario. Includes climate change, biological opinions, and Fall X2.	2015 Draft Delivery Capability Report - Early Long-Term Scenario. Includes climate change, biological opinions, and Fall X2.	2015 Draft Delivery Capability Report - Early Long-Term Scenario. Includes climate change, biological opinions, and Fall X2.
San Luis Low Point	CVP deliveries are restricted to 75% of allocation to Santa Teresa and Rinconada WTP when a low point event is active (San Luis storage < 250,000 af); however if expanded Anderson or Pacheco Reservoirs are active AND their storage is available for release, this restriction is not implemented.	CVP deliveries are restricted to 75% of allocation to Santa Teresa and Rinconada WTP when a low point event is active (San Luis storage < 250,000 af); however if expanded Anderson or Pacheco Reservoirs are active AND their storage is available for release, this restriction is not implemented.	CVP deliveries are restricted to 75% of allocation to Santa Teresa and Rinconada WTP when a low point event is active (San Luis storage < 250,000 af); however if expanded Anderson or Pacheco Reservoirs are active AND their storage is available for release, this restriction is not implemented.	CVP deliveries are restricted to 75% of allocation to Santa Teresa and Rinconada WTP when a low point event is active (San Luis storage < 250,000 af); however if expanded Anderson or Pacheco Reservoirs are active AND their storage is available for release, this restriction is not implemented.	CVP deliveries are restricted to 75% of allocation to Santa Teresa and Rinconada WTP when a low point event is active (San Luis storage < 250,000 af); however if expanded Anderson or Pacheco Reservoirs are active AND their storage is available for release, this restriction is not implemented.	CVP deliveries are restricted to 75% of allocation to Santa Teresa and Rinconada WTP when a low point event is active (San Luis storage < 250,000 af); however if expanded Anderson or Pacheco Reservoirs are active AND their storage is available for release, this restriction is not implemented.	CVP deliveries are restricted to 75% of allocation to Santa Teresa and Rinconada WTP when a low point event is active (San Luis storage < 250,000 af); however if expanded Anderson or Pacheco Reservoirs are active AND their storage is available for release, this restriction is not implemented.	CVP deliveries are restricted to 75% of allocation to Santa Teresa and Rinconada WTP when a low point event is active (San Luis storage < 250,000 af); however if expanded Anderson or Pacheco Reservoirs are active AND their storage is available for release, this restriction is not implemented.
CVP Carryover	45,000 AF max per year; lost if San Luis Reservoir storage goes to 2,000,000 AF; See Semitropic "Put" assumptions	45,000 AF max per year; lost if San Luis Reservoir storage goes to 2,000,000 AF; See Semitropic "Put" assumptions	45,000 AF max per year; lost if San Luis Reservoir storage goes to 2,000,000 AF; See Semitropic "Put" assumptions	45,000 AF max per year; lost if San Luis Reservoir storage goes to 2,000,000 AF; See Semitropic "Put" assumptions	45,000 AF max per year; lost if San Luis Reservoir storage goes to 2,000,000 AF; See Semitropic "Put" assumptions	45,000 AF max per year; lost if San Luis Reservoir storage goes to 2,000,000 AF; See Semitropic "Put" assumptions	45,000 AF max per year; lost if San Luis Reservoir storage goes to 2,000,000 AF; See Semitropic "Put" assumptions	45,000 AF max per year; lost if San Luis Reservoir storage goes to 2,000,000 AF; See Semitropic "Put" assumptions
SWP Carryover	45,000 AF max per year; lost if San Luis Reservoir storage goes to 2,000,000 AF; See Semitropic "Put" assumptions	45,000 AF max per year; lost if San Luis Reservoir storage goes to 2,000,000 AF; See Semitropic "Put" assumptions	45,000 AF max per year; lost if San Luis Reservoir storage goes to 2,000,000 AF; See Semitropic "Put" assumptions	45,000 AF max per year; lost if San Luis Reservoir storage goes to 2,000,000 AF; See Semitropic "Put" assumptions	45,000 AF max per year; lost if San Luis Reservoir storage goes to 2,000,000 AF; See Semitropic "Put" assumptions	45,000 AF max per year; lost if San Luis Reservoir storage goes to 2,000,000 AF; See Semitropic "Put" assumptions	45,000 AF max per year; lost if San Luis Reservoir storage goes to 2,000,000 AF; See Semitropic "Put" assumptions	45,000 AF max per year; lost if San Luis Reservoir storage goes to 2,000,000 AF; See Semitropic "Put" assumptions
Wheeling CVP to SWP	Wheel CVP water thru SBA when we have problems with the SLR low point - when SLR storage drops below 250 TAF.	Wheel CVP water thru SBA when we have problems with the SLR low point - when SLR storage drops below 250 TAF.	Wheel CVP water thru SBA when we have problems with the SLR low point - when SLR storage drops below 250 TAF.	Wheel CVP water thru SBA when we have problems with the SLR low point - when SLR storage drops below 250 TAF.	Wheel CVP water thru SBA when we have problems with the SLR low point - when SLR storage drops below 250 TAF.	Wheel CVP water thru SBA when we have problems with the SLR low point - when SLR storage drops below 250 TAF.	Wheel CVP water thru SBA when we have problems with the SLR low point - when SLR storage drops below 250 TAF.	Wheel CVP water thru SBA when we have problems with the SLR low point - when SLR storage drops below 250 TAF.
Bay Delta "Fix"	No	No	No	No	No	No	No	No
San Francisco Public Utilities Commission (SFPUC)	SFPUC supplies based on Interim Supply Allocations adopted by SFPUC in December 2010, Procedure for Pro-Rata Reduction of Wholesale Customers' Individual Supply Guarantees under 2010 demand conditions, and Tier 2 Allocations calculation spreadsheet	SFPUC supplies based on Interim Supply Allocations adopted by SFPUC in December 2010, Procedure for Pro-Rata Reduction of Wholesale Customers' Individual Supply Guarantees under 2010 demand conditions, and Tier 2 Allocations calculation spreadsheet	SFPUC supplies based on Interim Supply Allocations adopted by SFPUC in December 2010, Procedure for Pro-Rata Reduction of Wholesale Customers' Individual Supply Guarantees under 2010 demand conditions, and Tier 2 Allocations calculation spreadsheet	SFPUC supplies based on Interim Supply Allocations adopted by SFPUC in December 2010, Procedure for Pro-Rata Reduction of Wholesale Customers' Individual Supply Guarantees under 2010 demand conditions, and Tier 2 Allocations calculation spreadsheet	SFPUC supplies based on Interim Supply Allocations adopted by SFPUC in December 2010, Procedure for Pro-Rata Reduction of Wholesale Customers' Individual Supply Guarantees under 2010 demand conditions, and Tier 2 Allocations calculation spreadsheet	SFPUC supplies based on Interim Supply Allocations adopted by SFPUC in December 2010, Procedure for Pro-Rata Reduction of Wholesale Customers' Individual Supply Guarantees under 2010 demand conditions, and Tier 2 Allocations calculation spreadsheet	SFPUC supplies based on Interim Supply Allocations adopted by SFPUC in December 2010, Procedure for Pro-Rata Reduction of Wholesale Customers' Individual Supply Guarantees under 2010 demand conditions, and Tier 2 Allocations calculation spreadsheet	SFPUC supplies based on Interim Supply Allocations adopted by SFPUC in December 2010, Procedure for Pro-Rata Reduction of Wholesale Customers' Individual Supply Guarantees under 2010 demand conditions, and Tier 2 Allocations calculation spreadsheet
Climate Change	Included in Imported Water Allocations and San Luis Reservoir storage	Included in Imported Water Allocations and San Luis Reservoir storage	Included in Imported Water Allocations and San Luis Reservoir storage	Included in Imported Water Allocations and San Luis Reservoir storage	Included in Imported Water Allocations and San Luis Reservoir storage	Included in Imported Water Allocations and San Luis Reservoir storage	Included in Imported Water Allocations and San Luis Reservoir storage	Included in Imported Water Allocations and San Luis Reservoir storage
3 Recycled Water								
Recycled Water Demands	Included in 2010 UWMP demand setup from retailers' master plans; 30,150 af in 2035	Included in 2010 UWMP demand setup from retailers' master plans; 30,150 af in 2035	Included in 2010 UWMP demand setup from retailers' master plans; 30,150 af in 2035	Included in 2010 UWMP demand setup from retailers' master plans; 30,150 af in 2035	Included in 2010 UWMP demand setup from retailers' master plans; 30,150 af in 2035	Included in 2010 UWMP demand setup from retailers' master plans; 30,150 af in 2035	Included in 2010 UWMP demand setup from retailers' master plans; 30,150 af in 2035	Included in 2010 UWMP demand setup from retailers' master plans; 30,150 af in 2035
4 Groundwater								
Natural Groundwater Recharge (Annual Average)	Santa Clara Plain = 36,900 AFY	Santa Clara Plain = 36,900 AFY	Santa Clara Plain = 36,900 AFY	Santa Clara Plain = 36,900 AFY	Santa Clara Plain = 36,900 AFY	Santa Clara Plain = 36,900 AFY	Santa Clara Plain = 36,900 AFY	Santa Clara Plain = 36,900 AFY
	Coyote Valley Study Area = 2678 AFY	Coyote Valley Study Area = 2678 AFY	Coyote Valley Study Area = 2678 AFY	Coyote Valley Study Area = 2678 AFY	Coyote Valley Study Area = 2678 AFY	Coyote Valley Study Area = 2678 AFY	Coyote Valley Study Area = 22416 AFY	Coyote Valley Study Area = 22416 AFY
	Llagas = 22,541 AFY	Llagas = 22,541 AFY	Llagas = 22,541 AFY	Llagas = 22,541 AFY	Llagas = 22,541 AFY	Llagas = 22,541 AFY	Llagas = 22,541 AFY	Llagas = 22,541 AFY
Net groundwater losses (average)	0	0	0	0	0	0	0	0
Includes subbasin exchanges?	No	No	No	No	No	No	No	No
Initial Groundwater Storage	Santa Clara Plain = 301,400 AF (EOY 2013)	Santa Clara Plain = 301,400 AF (EOY 2013)	Santa Clara Plain = 301,400 AF (EOY 2013)	Santa Clara Plain = 301,400 AF (EOY 2013)	Santa Clara Plain = 301,400 AF (EOY 2013)	Santa Clara Plain = 301,400 AF (EOY 2013)	Santa Clara Plain = 301,400 AF (EOY 2013)	Santa Clara Plain = 301,400 AF (EOY 2013)
	Coyote Valley Study Area = 10,300 AF (EOY 2013)	Coyote Valley Study Area = 10,300 AF (EOY 2013)	Coyote Valley Study Area = 10,300 AF (EOY 2013)	Coyote Valley Study Area = 10,300 AF (EOY 2013)	Coyote Valley Study Area = 10,300 AF (EOY 2013)	Coyote Valley Study Area = 10,300 AF (EOY 2013)	Coyote Valley Study Area = 10,300 AF (EOY 2013)	Coyote Valley Study Area = 10,300 AF (EOY 2013)
	Llagas = 26,600 AF (EOY 2013)	Llagas = 26,600 AF (EOY 2013)	Llagas = 26,600 AF (EOY 2013)	Llagas = 26,600 AF (EOY 2013)	Llagas = 26,600 AF (EOY 2013)	Llagas = 26,600 AF (EOY 2013)	Llagas = 26,600 AF (EOY 2013)	Llagas = 26,600 AF (EOY 2013)
Maximum Groundwater Pumping Capacity	Santa Clara Plain – 200,000 AF	Santa Clara Plain – 200,000 AF	Santa Clara Plain – 200,000 AF	Santa Clara Plain – 200,000 AF	Santa Clara Plain – 200,000 AF	Santa Clara Plain – 200,000 AF	Santa Clara Plain – 200,000 AF	Santa Clara Plain – 200,000 AF
Groundwater Storage Capacity	Santa Clara Plain = 350,000 AF	Santa Clara Plain = 350,000 AF	Santa Clara Plain = 350,000 AF	Santa Clara Plain = 350,000 AF	Santa Clara Plain = 350,000 AF	Santa Clara Plain = 350,000 AF	Santa Clara Plain = 350,000 AF	Santa Clara Plain = 350,000 AF
	Coyote Valley Study Area = 25,000 AF	Coyote Valley Study Area = 25,000 AF	Coyote Valley Study Area = 25,000 AF	Coyote Valley Study Area = 25,000 AF	Coyote Valley Study Area = 25,000 AF	Coyote Valley Study Area = 25,000 AF	Coyote Valley Study Area = 25,000 AF	Coyote Valley Study Area = 25,000 AF
	Llagas = 155,000 AF	Llagas = 155,000 AF	Llagas = 155,000 AF	Llagas = 155,000 AF	Llagas = 155,000 AF	Llagas = 155,000 AF	Llagas = 155,000 AF	Llagas = 155,000 AF
5 Reservoir Operations								
Fisheries and Aquatic Habitat Collaborative Effort (FAHCE) Operations	Active	Active	Active	Active	Active	Active	Active	**Inactive**
South County LSAA Reservoir Flow Requirements	Active	Active	Active	Active	Active	Active	Active	Active
Anderson / Coyote combined Reservoir Operations Rule Curve	Dec - 82,000 Jan - 90,000 Feb - 100,000 Mar - 105,000 Apr - 111,998	Dec - 82,000 Jan - 90,000 Feb - 100,000 Mar - 105,000 Apr - 111,998	Dec - 82,000 Jan - 90,000 Feb - 100,000 Mar - 105,000 Apr - 111,998	Dec - 82,000 Jan - 90,000 Feb - 100,000 Mar - 105,000 Apr - 111,998	Dec - 82,000 Jan - 90,000 Feb - 100,000 Mar - 105,000 Apr - 111,998	Dec - 82,000 Jan - 90,000 Feb - 100,000 Mar - 105,000 Apr - 111,998	Dec - 82,000 Jan - 90,000 Feb - 100,000 Mar - 105,000 Apr - 111,998	Dec - 82,000 Jan - 90,000 Feb - 100,000 Mar - 105,000 Apr - 111,998
Anderson and Coyote Water Rights	Max annual withdrawal of 43,370 + 24,560 AF/year	Max annual withdrawal of 43,370 + 24,560 AF/year	Max annual withdrawal of 43,370 + 24,560 AF/year	Max annual withdrawal of 43,370 + 24,560 AF/year	Max annual withdrawal of 43,370 + 24,560 AF/year	Max annual withdrawal of 43,370 + 24,560 AF/year	Max annual withdrawal of 43,370 + 24,560 AF/year	Max annual withdrawal of 43,370 + 24,560 AF/year
Anderson supplies to Main and Madrone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Emergency Storage for Water Supply	Anderson 20,000 AF; Calero 4,000 AF	Anderson 20,000 AF; Calero 4,000 AF	Anderson 20,000 AF; Calero 4,000 AF	Anderson 20,000 AF; Calero 4,000 AF	Anderson 20,000 AF; Calero 4,000 AF	Anderson 20,000 AF; Calero 4,000 AF	Anderson 20,000 AF; Calero 4,000 AF	Anderson 20,000 AF; Calero 4,000 AF
Anderson to distribution system	Release 6TAF/mo less required for downstream recharge if Anderson Storage plus inflow > 62TAF	Release 6TAF/mo less required for downstream recharge if Anderson Storage plus inflow > 62TAF	Release 6TAF/mo less required for downstream recharge if Anderson Storage plus inflow > 62TAF	Release 6TAF/mo less required for downstream recharge if Anderson Storage plus inflow > 62TAF	Release 6TAF/mo less required for downstream recharge if Anderson Storage plus inflow > 62TAF	Release 6TAF/mo less required for downstream recharge if Anderson Storage plus inflow > 62TAF	Release 6TAF/mo less required for downstream recharge if Anderson Storage plus inflow > 62TAF	Release 6TAF/mo less required for downstream recharge if Anderson Storage plus inflow > 62TAF
Division of Safety of Dams (DSOD) Seismic Restrictions	Coyote Reservoir - per DSOD storage management compliance procedure, December 1992	Coyote Reservoir - per DSOD storage management compliance procedure, December 1992	Coyote Reservoir - per DSOD storage management compliance procedure, December 1992	Coyote Reservoir - per DSOD storage management compliance procedure, December 1992	Coyote Reservoir - per DSOD storage management compliance procedure, December 1992	Coyote Reservoir - per DSOD storage management compliance procedure, December 1992	Coyote Reservoir - per DSOD storage management compliance procedure, December 1992	Coyote Reservoir - per DSOD storage management compliance procedure, December 1992
Almaden-Calero Canal	Calero below flood rule curve; maximum of 6,000 AFY and Almaden has storage above FAHCE flow requirements	Calero below flood rule curve; maximum of 6,000 AFY and Almaden has storage above FAHCE flow requirements	Calero below flood rule curve; maximum of 6,000 AFY and Almaden has storage above FAHCE flow requirements	Calero below flood rule curve; maximum of 6,000 AFY and Almaden has storage above FAHCE flow requirements	Calero below flood rule curve; maximum of 6,000 AFY and Almaden has storage above FAHCE flow requirements	Calero below flood rule curve; maximum of 6,000 AFY and Almaden has storage above FAHCE flow requirements	Calero below flood rule curve; maximum of 6,000 AFY and Almaden has storage above FAHCE flow requirements	Calero below flood rule curve; maximum of 6,000 AFY and Almaden has storage above FAHCE flow requirements
	6 Recharge	**6 Recharge**	**6 Recharge**	**6 Recharge**	**6 Recharge**	**6 Recharge**	**6 Recharge**	**6 Recharge**
Total recharge capacity	Santa Clara Plain = 92,600 AFY	Santa Clara Plain = 92,600 AFY	Santa Clara Plain = 92,600 AFY	Santa Clara Plain = 92,600 AFY	Santa Clara Plain = 92,600 AFY	Santa Clara Plain = 92,600 AFY	Santa Clara Plain = 92,600 AFY	Santa Clara Plain = 92,600 AFY
	Coyote = 17,100 AFY	Coyote = 17,100 AFY	Coyote = 17,100 AFY	Coyote = 17,100 AFY	Coyote = 17,100 AFY	Coyote = 17,100 AFY	Coyote = 17,100 AFY	Coyote = 17,100 AFY
	Llagas = 39,300 AFY	Llagas = 39,300 AFY	Llagas = 39,300 AFY	Llagas = 39,300 AFY	Llagas = 39,300 AFY	Llagas = 39,300 AFY	Llagas = 39,300 AFY	Llagas = 39,300 AFY
7 Demands								
Demand Projections	District's 2010 Urban Water Management Plan (UWMP)	District's 2010 Urban Water Management Plan (UWMP)	District's 2010 Urban Water Management Plan (UWMP)	District's 2010 Urban Water Management Plan (UWMP)	District's 2010 Urban Water Management Plan (UWMP)	District's 2010 Urban Water Management Plan (UWMP)	District's 2010 Urban Water Management Plan (UWMP)	District's 2010 Urban Water Management Plan (UWMP)
Weather Demand Reduction Factors	None	None	None	None	None	None	None	None
Conservation ('92 Baseline) including Agriculture	2035: 98,800 AF with inclusion of 300 af of gray water going to SJ Water Co.	2035: 98,800 AF with inclusion of 300 af of gray water going to SJ Water Co.	2035: 98,800 AF with inclusion of 300 af of gray water going to SJ Water Co.	2035: 98,800 AF with inclusion of 300 af of gray water going to SJ Water Co.	2035: 98,800 AF with inclusion of 300 af of gray water going to SJ Water Co.	2035: 98,800 AF with inclusion of 300 af of gray water going to SJ Water Co.	2035: 98,800 AF with inclusion of 300 af of gray water going to SJ Water Co.	2035: 98,800 AF with inclusion of 300 af of gray water going to SJ Water Co.
Water Shortage Contingency Plan Actions	Evaluated with Water Shortage Contingency Plan actions identified in the District's 2010 Urban Water Management Plan (UWMP)	Evaluated with Water Shortage Contingency Plan actions identified in the District's 2010 Urban Water Management Plan (UWMP)	Evaluated with Water Shortage Contingency Plan actions identified in the District's 2010 Urban Water Management Plan (UWMP)	Evaluated with Water Shortage Contingency Plan actions identified in the District's 2010 Urban Water Management Plan (UWMP)	Evaluated with Water Shortage Contingency Plan actions identified in the District's 2010 Urban Water Management Plan (UWMP)	Evaluated with Water Shortage Contingency Plan actions identified in the District's 2010 Urban Water Management Plan (UWMP)	Evaluated with Water Shortage Contingency Plan actions identified in the District's 2010 Urban Water Management Plan (UWMP)	Evaluated with Water Shortage Contingency Plan actions identified in the District's 2010 Urban Water Management Plan (UWMP)
Total Countywide Demands	2035: 422,900 AF, based on District's 2010 UWMP	2035: 422,900 AF, based on District's 2010 UWMP	2035: 422,900 AF, based on District's 2010 UWMP	2035: 422,900 AF, based on District's 2010 UWMP	2035: 422,900 AF, based on District's 2010 UWMP	2035: 422,900 AF, based on District's 2010 UWMP	2035: 422,900 AF, based on District's 2010 UWMP	2035: 422,900 AF, based on District's 2010 UWMP
Increased Demand Allocation	Per retailers, maintain groundwater/treated water proportion for incremental increases in demand	Per retailers, maintain groundwater/treated water proportion for incremental increases in demand	Per retailers, maintain groundwater/treated water proportion for incremental increases in demand	Per retailers, maintain groundwater/treated water proportion for incremental increases in demand	Per retailers, maintain groundwater/treated water proportion for incremental increases in demand	Per retailers, maintain groundwater/treated water proportion for incremental increases in demand	Per retailers, maintain groundwater/treated water proportion for incremental increases in demand	Per retailers, maintain groundwater/treated water proportion for incremental increases in demand
8 Treated Water								
Water Treatment Plant (WTP) Capacity	Rinconada WTP = 80 MGD	Rinconada WTP = 80 MGD	Rinconada WTP = 80 MGD	Rinconada WTP = 80 MGD	Rinconada WTP = 80 MGD	Rinconada WTP = 80 MGD	Rinconada WTP = 80 MGD	Rinconada WTP = 80 MGD
	Penitencia WTP = 40 MGD	Penitencia WTP = 40 MGD	Penitencia WTP = 40 MGD	Penitencia WTP = 40 MGD	Penitencia WTP = 40 MGD	Penitencia WTP = 40 MGD	Penitencia WTP = 40 MGD	Penitencia WTP = 40 MGD
	Santa Teresa WTP = 100 MGD	Santa Teresa WTP = 100 MGD	Santa Teresa WTP = 100 MGD	Santa Teresa WTP = 100 MGD	Santa Teresa WTP = 100 MGD	Santa Teresa WTP = 100 MGD	Santa Teresa WTP = 100 MGD	Santa Teresa WTP = 100 MGD
Treated Water (Contract)	2035: 143,000 AF	2035: 143,000 AF	2035: 143,000 AF	2035: 143,000 AF	2035: 143,000 AF	2035: 143,000 AF	2035: 143,000 AF	2035: 143,000 AF
Treated Water (Non-Contract)	20,000 AFY; 0 if SWP allocation is less than 52%	20,000 AFY; 0 if SWP allocation is less than 52%	20,000 AFY; 0 if SWP allocation is less than 52%	20,000 AFY; 0 if SWP allocation is less than 52%	20,000 AFY; 0 if SWP allocation is less than 52%	20,000 AFY; 0 if SWP allocation is less than 52%	20,000 AFY; 0 if SWP allocation is less than 52%	20,000 AFY; 0 if SWP allocation is less than 52%
9 Project Implementation								
Dam Seismic Upgrades	Almaden, Anderson, Calero, and Guadalupe completed	Almaden, Anderson, Calero, and Guadalupe completed	Almaden, Anderson, Calero, and Guadalupe completed	Almaden, Anderson, Calero, and Guadalupe completed	Almaden, Anderson, Calero, and Guadalupe completed	Almaden, Anderson, Calero, and Guadalupe completed	Almaden, Anderson, Calero, and Guadalupe completed	Almaden, Anderson, Calero, and Guadalupe completed
Dry Year Option	12000 AFY	12000 AFY	12000 AFY	12000 AFY	12000 AFY	12000 AFY	12000 AFY	12000 AFY
Lexington Reservoir Pipeline	**Active**	**Active**	**Active**	**Active**	**Active**	**Active**	**Inactive**	**Active**
Los Gatos Ponds IPR	**Active, Supply preference to LG Ponds - local, IPR, CVP, SWP**	**Active, Supply preference to LG Ponds - local, IPR, CVP, SWP**	**Active, Supply preference to LG Ponds - local, IPR, CVP, SWP**	**Active, Supply preference to LG Ponds - local, IPR, CVP, SWP**	**Active, Supply preference to LG Ponds - local, IPR, CVP, SWP**	**Active, Supply preference to LG Ponds - local, IPR, CVP, SWP with DPR to SBA active for a total of 35,840 af/year of SVAWPC supply (20,200 going to LG Ponds)**	**Inactive**	**Active, Supply preference to LG Ponds - local, IPR, CVP, SWP**
Coyote IPR	Inactive	Inactive	Inactive	**Active Ford Ponds only**	**Active Ford Ponds only**	Inactive	Inactive	Inactive
Mid-Basin IPR Injection	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
Westside IPR Injection	Inactive	**Active treated as a combined facility with mid-basin injection and 15 mgd total capacity**	**Active treated as a combined facility with mid-basin injection and 10 mgd total capacity**	Inactive	**Active treated as a combined facility with mid-basin injection and 15 mgd total capacity**	Inactive	**Active treated as a combined facility with mid-basin injection and 15 mgd total capacity**	Inactive
Sunnyvale IPR Injection	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
New Banking	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
New 2:1 Exchange	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
North County (Saratoga) Recharge Ponds	**Active**	**Active**	**Active**	**Active**	**Active**	**Active**	**Active**	**Active**
North County (Stevens Creek) Recharge Ponds	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
Campbell Well Field (treated water available to westside retailers)	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
Madrone Pipeline	**Active**	**Active**	**Active**	**Active**	**Active**	**Active**	**Active**	**Active**
Main Ave Pipeline	**Active**	**Active**	**Active**	**Active**	**Active**	**Active**	**Active**	**Active**
New Llagas Recharge	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
Los Vaqeros Reservoir Expansion	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
Transfer-Bethany Pipeline	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive

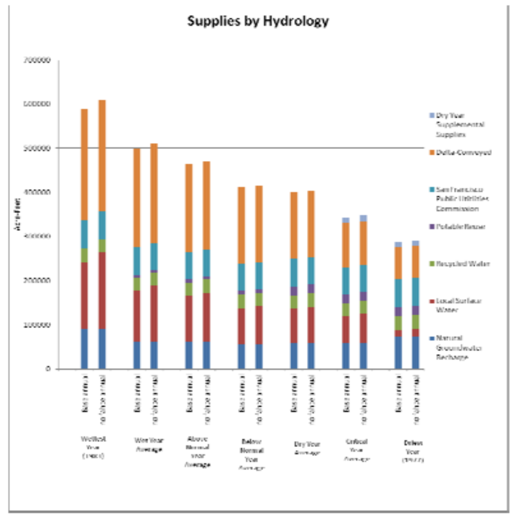
Appendix B - Results Summary

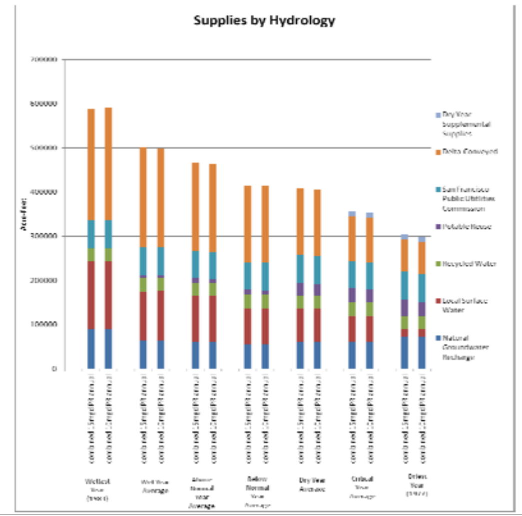
Model Master WEAP Model September 2015 v009	2015 Baseline	Base + combined 15mgd PR injection	Base + combined 10mgd PR injection	Base + Ford PR	Base + combined 15mgd PR injection + Ford PR	32 mgd DPR to SBA	No IPR No Lex PL	Base with No FAHCE
Groundwater Storage (Acre-foot)								
Coyote Subbasin	18,772	18,894	18,919	18,756	18,781	18,935	18,662	19,595
Llagas Subbasin	127,958	128,010	127,947	127,822	127,827	128,428	128,051	127,794
North County Santa Clara Sbb	308,178	319,540	317,501	312,470	321,200	311,983	282,637	312,429
Sum	454,909	466,443	464,367	459,048	467,807	459,346	429,349	459,817
Reservoir Storage Volume (Acre-foot)								
Almaden Reservoir	742	742	742	742	742	742	742	645
Anderson Reservoir	52,785	53,352	53,244	50,057	50,321	53,329	51,888	54,396
Calero Reservoir	6,328	6,413	6,389	6,386	6,456	6,356	6,251	6,972
Chesbro Reservoir	3,151	3,151	3,151	3,151	3,151	3,151	3,151	3,151
Coyote Reservoir	9,589	9,613	9,601	9,569	9,562	9,611	9,560	9,154
Guadalupe Reservoir	1,496	1,496	1,496	1,496	1,496	1,496	1,496	2,277
Lexington Reservoir	6,286	6,286	6,286	6,286	6,286	6,286	6,286	5,737
Stevens Creek Reservoir	1,885	1,885	1,885	1,885	1,885	1,885	1,885	2,017
Uvas Reservoir	5,538	5,538	5,538	5,538	5,538	5,538	5,538	5,538
Sum	87,799	88,475	88,331	85,108	85,436	88,393	86,796	89,887
Semitropic	187,664	208,865	205,425	205,112	219,943	226,923	114,802	209,920
CVP Carryover	4,685	5,223	5,125	5,360	5,811	5,046	3,432	5,783
CVP Overflow Not Used	701,071	818,114	795,479	802,070	889,246	769,455	453,399	1,059,141
swp carryover	2,691	3,107	3,053	3,171	3,447	2,985	1,335	3,329
SWP Overflow Not Used	68,354	87,376	75,251	72,027	93,534	75,215	65,230	89,740
New Bank	0	0	0	0	0	0	0	0
Unmet Demand (Acre-foot)								
Penitencia WTP	55,385	49,263	49,648	52,206	48,952	4,451	65,504	47,863
Rinconada WTP	92,269	81,658	82,289	86,888	81,045	11,058	109,350	79,161
Santa Teresa WTP	0	0	0	0	0	0	0	0
Sum	147,655	130,922	131,937	139,095	129,997	15,509	174,854	127,023
Flow to Bay								
Los Gatos Creek	514,018	532,596	530,884	531,005	534,759	519,422	492,071	356,161
Lower Coyote	371,364	389,966	385,178	258,628	263,569	374,792	341,510	102,140
PR Use								
IPR Coyote to Coyote Service Area	0	0	0	0	0	0	0	0
IPR Coyote to Ford Pond Recharge	0	0	0	193,735	165,897	0	0	0
IPR Coyote to IPR Coyote to Cross Valley PL	0	0	0	0	0	0	0	0
IPR Los Gatos to IPR GW injection demand	0	471,010	367,647	0	423,191	0	0	0
IPR Los Gatos to IPR MidBasin GW Injection	0	0	0	0	0	0	0	0
IPR Los Gatos to LG DPR to Central PL	0	0	0	0	0	0	0	0
IPR Los Gatos to Los Gatos Ponds	1,126,845	1,207,944	1,175,127	1,052,601	1,131,687	1,042,217	12,189	1,083,831
IPR Los Gatos to Send DPR to SBA	0	0	0	0	0	506,368	0	0
Water Shortage Contingency Plan Actions								
Count of Years with Demand Reductions	3	2	2	3	1	2	8	3
Maximum Demand Reduction	-20.00%	-7.50%	-15.00%	-15.00%	-5.00%	-15.00%	-50.00%	-15.00%
Baseline Supplies								
Natural Groundwater Recharge	60,630	60,631	60,630	60,628	60,629	60,631	60,624	60,636
Local Surface Water	89,968	88,853	89,082	92,083	91,435	89,576	91,397	96,666
Recycled Water	30,149	30,149	30,149	30,149	30,149	30,149	29,955	30,149
Potable Reuse	11,988	17,861	16,412	13,259	18,306	16,474	130	11,530
San Francisco Public Utilities Commission	62,069	62,072	62,072	62,059	62,072	62,072	61,919	62,059
Delta-Conveyed	175,279	175,279	175,279	175,279	175,279	175,279	175,279	175,279
Sum	430,083	434,844	433,624	433,456	437,870	434,181	419,303	436,319
Supplemental Dry Year Supplies	1,914	1,914	1,914	1,914	1,914	1,914	1,914	1,914
Baseline Plus Supplemental Supplies	431,997	436,758	435,538	435,371	439,784	436,095	421,217	438,233
Minimum Total Supply (Baseline + Supplemental + Re	362,282	400,303	400,303	381,085	409,444	400,303	347,982	381,538
Potable Reuse Capacity	20,148	35,842	31,349	24,348	40,042	35,839	12,189	20,148
Potable Reuse Utilization	59%	50%	52%	54%	46%	46%	N/A	57%
Meets Reliability Targets	No	Yes	Yes	Yes	Yes	Yes	No	Yes

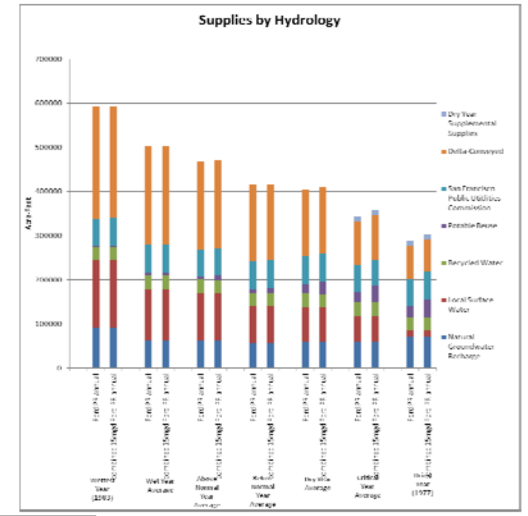

Average Water Supplies
Acre-Feet
Delta-Conveyed
San Francisco Public Utilities Commission
Potable Reuse
Recycled Water
Local Surface Water
Natural Groundwater Recharge

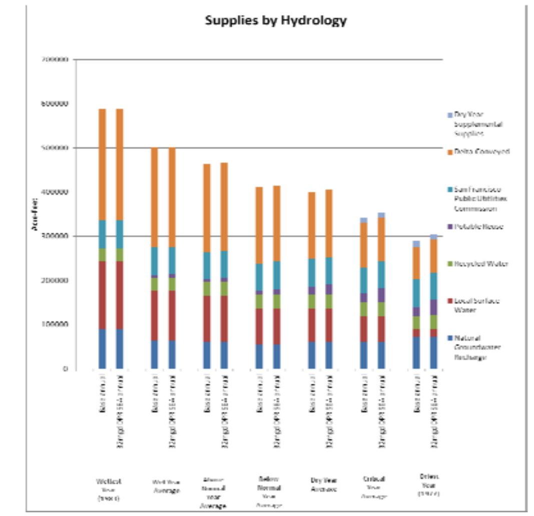

Allocations by Hydrology
Acre-Feet
Wet
Above Normal
Below Normal
Dry
Critical
Year Type
Base annual

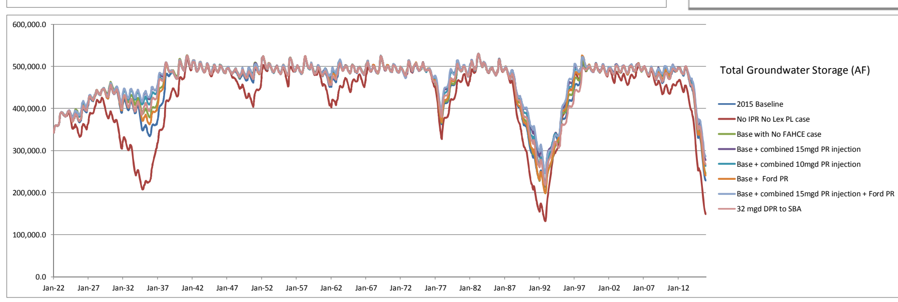

Supplies by Hydrology
Acre-Feet
Dry Year Supplemental Supplies
Delta-Conveyed
San Francisco Public Utitlities Commission
Potable Reuse
Recycled Water
Local Surface Water
Natural Groundwater Recharge
Base annual
combined 10mgd PR annual
Wettest Year (1983)
Wet Year Average
Above Normal Year Average
Below Normal Year Average
Dry Year Average
Critical Year Average
Driest Year (1977)

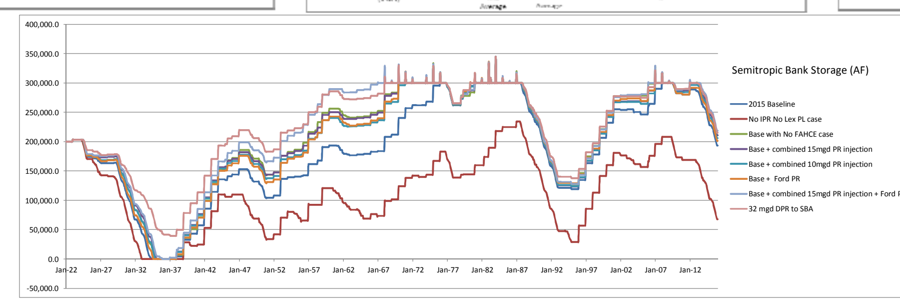

Supplies by Hydrology


Supplies by Hydrology


Supplies by Hydrology


Supplies by Hydrology


Total Groundwater Storage (AF)
2015 Baseline
No IPR No Lex PL case
Base with No FAHCE case
Base + combined 15mgd PR injection
Base + combined 10mgd PR injection
Base + Ford PR
Base + combined 15mgd PR injection + Ford PR
32 mgd DPR to SBA


Semitropic Bank Storage (AF)
2015 Baseline
No IPR No Lex PL case
Base with No FAHCE case
Base + combined 15mgd PR injection
Base + combined 10mgd PR injection
Base + Ford PR
Base + combined 15mgd PR injection + Ford PR
32 mgd DPR to SBA

Appendix D - Comparison of 2015 and 2012 Imported Water Allocations

2015	cvp af	cvp alloc	swp alloc	2012	cvp af	cvp alloc	swp alloc	diff 2015-2012	cvp alloc	swp alloc
1922	137,248	0.90	0.72		132,675	0.87	0.74		0.03	-0.02
1923	100,648	0.66	0.62		114,375	0.75	0.61		-0.09	0.01
1924	73,199	0.48	0.18		80,825	0.53	0.20		-0.05	-0.02
1925	109,798	0.72	0.47		115,900	0.76	0.50		-0.04	-0.03
1926	82,349	0.54	0.48		82,350	0.54	0.56		0.00	-0.08
1927	115,898	0.76	0.65		115,900	0.76	0.70		0.00	-0.05
1928	105,223	0.69	0.76		111,325	0.73	0.71		-0.04	0.05
1929	89,974	0.59	0.18		65,575	0.43	0.25		0.16	-0.07
1930	67,099	0.44	0.47		91,500	0.60	0.31		-0.16	0.16
1931	59,474	0.39	0.20		83,875	0.55	0.39		-0.16	-0.19
1932	59,474	0.39	0.46		103,700	0.68	0.31		-0.29	0.15
1933	59,474	0.39	0.35		73,200	0.48	0.42		-0.09	-0.07
1934	71,674	0.47	0.28		86,925	0.57	0.26		-0.10	0.02
1935	88,448	0.58	0.64		102,175	0.67	0.67		-0.09	-0.03
1936	102,174	0.67	0.73		112,850	0.74	0.79		-0.07	-0.06
1937	97,598	0.64	0.73		108,275	0.71	0.87		-0.07	-0.14
1938	152,497	1.00	0.97		152,500	1.00	1.00		0.00	-0.03
1939	105,223	0.69	0.37		106,750	0.70	0.54		-0.01	-0.17
1940	102,174	0.67	0.66		112,850	0.74	0.64		-0.07	0.02
1941	144,873	0.95	0.82		123,525	0.81	0.84		0.14	-0.02
1942	149,447	0.98	0.74		132,675	0.87	0.70		0.11	0.04
1943	129,623	0.85	0.81		123,525	0.81	0.88		0.04	-0.07
1944	77,774	0.51	0.40		99,125	0.65	0.39		-0.14	0.01
1945	102,174	0.67	0.73		118,950	0.78	0.75		-0.11	-0.02
1946	126,573	0.83	0.69		117,425	0.77	0.72		0.06	-0.03
1947	88,448	0.58	0.50		111,325	0.73	0.70		-0.15	-0.20
1948	99,124	0.65	0.52		106,750	0.70	0.52		-0.05	0.00
1949	103,698	0.68	0.42		117,425	0.77	0.49		-0.09	-0.07
1950	93,024	0.61	0.55		106,750	0.70	0.60		-0.09	-0.05
1951	129,623	0.85	0.78		118,950	0.78	0.79		0.07	-0.01
1952	152,497	1.00	0.93		152,500	1.00	0.94		0.00	-0.01
1953	105,223	0.69	0.52		111,325	0.73	0.56		-0.04	-0.04
1954	105,223	0.69	0.63		111,325	0.73	0.64		-0.04	-0.01
1955	97,598	0.64	0.45		109,800	0.72	0.38		-0.08	0.07
1956	146,398	0.96	0.88		125,050	0.82	0.89		0.14	-0.01
1957	102,174	0.67	0.52		108,275	0.71	0.55		-0.04	-0.03
1958	152,497	1.00	0.93		149,450	0.98	0.99		0.02	-0.06
1959	103,698	0.68	0.47		109,800	0.72	0.53		-0.04	-0.06
1960	91,498	0.60	0.48		108,275	0.71	0.54		-0.11	-0.06
1961	100,648	0.66	0.33		111,325	0.73	0.45		-0.07	-0.12
1962	103,698	0.68	0.59		112,850	0.74	0.59		-0.06	0.00
1963	109,798	0.72	0.68		114,375	0.75	0.67		-0.03	0.01
1964	96,074	0.63	0.56		109,800	0.72	0.66		-0.09	-0.10
1965	129,623	0.85	0.69		123,525	0.81	0.69		0.04	0.00
1966	121,998	0.80	0.66		114,375	0.75	0.64		0.05	0.02
1967	152,497	1.00	0.83		152,500	1.00	0.96		0.00	-0.13
1968	103,698	0.68	0.54		109,800	0.72	0.54		-0.04	0.00
1969	152,497	1.00	0.97		152,500	1.00	1.00		0.00	-0.03
1970	108,274	0.71	0.72		117,425	0.77	0.77		-0.06	-0.05
1971	100,648	0.66	0.65		108,275	0.71	0.66		-0.05	-0.01
1972	99,124	0.65	0.52		111,325	0.73	0.53		-0.08	-0.01
1973	126,573	0.83	0.77		115,900	0.76	0.78		0.07	-0.01
1974	134,197	0.88	0.75		131,150	0.86	0.84		0.02	-0.09
1975	115,898	0.76	0.71		118,950	0.78	0.71		-0.02	0.00
1976	71,674	0.47	0.44		77,775	0.51	0.40		-0.04	0.04
1977	59,474	0.39	0.08		76,250	0.50	0.17		-0.11	-0.09
1978	150,973	0.99	0.85		152,500	1.00	0.78		-0.01	0.07
1979	100,648	0.66	0.73		115,900	0.76	0.72		-0.10	0.01
1980	135,723	0.89	0.96		126,575	0.83	1.00		0.06	-0.04
1981	108,274	0.71	0.42		111,325	0.73	0.57		-0.02	-0.15
1982	152,497	1.00	0.96		152,500	1.00	1.00		0.00	-0.04
1983	152,497	1.00	0.94		152,500	1.00	1.00		0.00	-0.06
1984	143,347	0.94	0.85		118,950	0.78	0.79		0.16	0.06
1985	108,274	0.71	0.66		114,375	0.75	0.73		-0.04	-0.07
1986	109,798	0.72	0.76		117,425	0.77	0.93		-0.05	-0.17
1987	79,299	0.52	0.22		102,175	0.67	0.19		-0.15	0.03
1988	65,574	0.43	0.15		65,575	0.43	0.26		0.00	-0.11
1989	91,498	0.60	0.60		106,750	0.70	0.62		-0.10	-0.02
1990	59,474	0.39	0.22		65,575	0.43	0.18		-0.04	0.04
1991	70,149	0.46	0.16		91,500	0.60	0.17		-0.14	-0.01
1992	59,474	0.39	0.22		106,750	0.70	0.25		-0.31	-0.03
1993	118,948	0.78	0.62		118,950	0.78	0.68		0.00	-0.06
1994	114,373	0.75	0.44		115,900	0.76	0.44		-0.01	0.00
1995	150,973	0.99	0.85		143,350	0.94	0.91		0.05	-0.06
1996	144,873	0.95	0.72		122,000	0.80	0.76		0.15	-0.04
1997	128,098	0.84	0.84		123,525	0.81	0.84		0.03	0.00
1998	152,497	1.00	0.91		152,500	1.00	0.84		0.00	0.07
1999	114,373	0.75	0.66		114,375	0.75	0.79		0.00	-0.13
2000	120,473	0.79	0.71		114,375	0.75	0.70		0.04	0.01
2001	86,924	0.57	0.29		108,275	0.71	0.27		-0.14	0.02
2002	105,223	0.69	0.52		111,325	0.73	0.75		-0.04	-0.23
2003	105,223	0.69	0.55		114,375	0.75	0.55		-0.06	0.00
Average	108,496	0.71	0.60		113,575	0.74	0.63		-0.03	-0.03
Min	59,474	0.39	0.08		65,575	0.43	0.17		-0.31	-0.23
Max	152,497	1.00	0.97		152,500	1.00	1.00		0.16	0.16
87-92 Average	70,912	0.46	0.26		89,721	0.59	0.28		-0.12	-0.02
87-92 Sum	425,470				538,325					

withOUT reallocation a	CVP	%	with reallocation a	CVP	%
1922	137,248	0.90	1922	120,473	0.79
1923	100,648	0.66	1923	108,273	0.71
1924	73,199	0.48	1924	79,299	0.52
1925	109,798	0.72	1925	114,373	0.75
1926	82,349	0.54	1926	89,974	0.59
1927	115,898	0.76	1927	115,898	0.76
1928	105,223	0.69	1928	112,848	0.74
1929	89,974	0.59	1929	97,598	0.64
1930	67,099	0.44	1930	73,199	0.48
1931	59,474	0.39	1931	65,574	0.43
1932	59,474	0.39	1932	65,574	0.43
1933	59,474	0.39	1933	65,574	0.43
1934	71,674	0.47	1934	77,774	0.51
1935	88,448	0.58	1935	96,073	0.63
1936	102,174	0.67	1936	109,798	0.72
1937	97,598	0.64	1937	106,748	0.70
1938	152,497	1.00	1938	152,497	1.00
1939	105,223	0.69	1939	112,848	0.74
1940	102,174	0.67	1940	109,798	0.72
1941	144,873	0.95	1941	123,523	0.81
1942	149,447	0.98	1942	137,248	0.90
1943	129,623	0.85	1943	118,948	0.78
1944	77,774	0.51	1944	83,874	0.55
1945	102,174	0.67	1945	109,798	0.72
1946	126,573	0.83	1946	118,948	0.78
1947	88,448	0.58	1947	96,073	0.63
1948	99,124	0.65	1948	106,748	0.70
1949	103,698	0.68	1949	111,323	0.73
1950	93,024	0.61	1950	100,648	0.66
1951	129,623	0.85	1951	118,948	0.78
1952	152,497	1.00	1952	152,497	1.00
1953	105,223	0.69	1953	112,848	0.74
1954	105,223	0.69	1954	112,848	0.74
1955	97,598	0.64	1955	105,223	0.69
1956	146,398	0.96	1956	125,048	0.82
1957	102,174	0.67	1957	109,798	0.72
1958	152,497	1.00	1958	152,497	1.00
1959	103,698	0.68	1959	111,323	0.73
1960	91,498	0.60	1960	99,123	0.65
1961	100,648	0.66	1961	108,273	0.71
1962	103,698	0.68	1962	111,323	0.73
1963	109,798	0.72	1963	114,373	0.75
1964	96,074	0.63	1964	103,698	0.68
1965	129,623	0.85	1965	118,948	0.78
1966	121,998	0.80	1966	117,423	0.77
1967	152,497	1.00	1967	152,497	1.00
1968	103,698	0.68	1968	111,323	0.73
1969	152,497	1.00	1969	152,497	1.00
1970	108,274	0.71	1970	114,373	0.75
1971	100,648	0.66	1971	109,798	0.72
1972	99,124	0.65	1972	106,748	0.70
1973	126,573	0.83	1973	118,948	0.78
1974	134,197	0.88	1974	120,473	0.79
1975	115,898	0.76	1975	115,898	0.76
1976	71,674	0.47	1976	77,774	0.51
1977	59,474	0.39	1977	65,574	0.43
1978	150,973	0.99	1978	144,872	0.95
1979	100,648	0.66	1979	108,273	0.71
1980	135,723	0.89	1980	120,473	0.79
1981	108,274	0.71	1981	114,373	0.75
1982	152,497	1.00	1982	152,497	1.00
1983	152,497	1.00	1983	152,497	1.00
1984	143,347	0.94	1984	121,998	0.80
1985	108,274	0.71	1985	114,373	0.75
1986	109,798	0.72	1986	114,373	0.75
1987	79,299	0.52	1987	86,923	0.57
1988	65,574	0.43	1988	71,674	0.47
1989	91,498	0.60	1989	99,123	0.65
1990	59,474	0.39	1990	65,574	0.43
1991	70,149	0.46	1991	76,249	0.50
1992	59,474	0.39	1992	65,574	0.43
1993	118,948	0.78	1993	117,423	0.77
1994	114,373	0.75	1994	115,898	0.76
1995	150,973	0.99	1995	143,347	0.94
1996	144,873	0.95	1996	123,523	0.81
1997	128,098	0.84	1997	118,948	0.78
1998	152,497	1.00	1998	152,497	1.00
1999	114,373	0.75	1999	115,898	0.76
2000	120,473	0.79	2000	117,423	0.77
2001	86,924	0.57	2001	94,548	0.62
2002	105,223	0.69	2002	112,848	0.74
2003	105,223	0.69	2003	114,373	0.75
2004	120,473	0.79	2004	120,473	0.79
2005	129,623	0.85	2005	129,623	0.85
2006	152,497	1.00	2006	152,497	1.00
2007	114,373	0.75	2007	114,373	0.75
2008	111,323	0.73	2008	111,323	0.73
2009	80,824	0.53	2009	80,824	0.53
2010	112,848	0.74	2010	112,848	0.74
2011	123,523	0.81	2011	123,523	0.81
2012	111,323	0.73	2012	111,323	0.73
2013	97,598	0.64	2013	97,598	0.64
2014	65,574	0.43	2014	65,574	0.43
2015	39,649	0.26	2015	39,649	0.26
Sum	10,156,339			10,322,544	
Average	108,046	0.71		109,539	0.72
Min	39,649	0.26		39,649	0.26
Max	152,497	1.00		152,497	1.00
87-92	70,912	0.46		77,520	0.51

Appendix E - Comparison of Old and New Coyote Subbasin Natural Groundwater Yield

Natural Recharge (monthly) (AF)

Scenario: 2035 Master Baseline July 2015

new ngwy	**sum**	**min**	**max**	**ave**
Coyote Subbasin	210,671.5	14.0	1,628.1	214.1

old ngwy				
Coyote Subbasin	183,393.1	0.0	1,565.7	186.4

Appendix G: Various Demand Priorities

Note: the lower the number the higher the priority in the WEAP model; for example a faciltiy with a priority of 3 will get all of its demands met before another faciity with of priority 4 or larger

WEAP Object	Object Type	Previous Priority	New 2015 Priority
Rinconada WTP	Treated Water	3	3
Penitencia WTP	Treated Water	3	3
Santa Teresa WTP	Treated Water	1	1
Church Ponds Recharge	South County Recharge	12	12
Lower Llagas Recharge	South County Recharge	12	12
Madrone Channel	South County Recharge	12	4
Madrone Channel Minimum Flow Requirement	South County Recharge	N/A	1
Main Ave Ponds	South County Recharge	12	4
San Pedro Ponds	South County Recharge	12	4
Uvas Recharge	South County Recharge	12	12
Upper Coyote Creek Recharge	Coyote Recharge	9	9
NC Coyote Pond Recharge	Coyote Recharge	11	11
NC Upper Coyote Recharge	Coyote Recharge	11	11
Ford Pond Recharge	Coyote Recharge	11	12
Lower Coyote Creek Recharge	Coyote Recharge	13	13
Calabazas Creek Recharge	Westside Recharge	10	20
McClellan Pond Recharge	Westside Recharge	10	20
Regnart Creek Recharge	Westside Recharge	10	20
Rodeo Creek Recharge	Westside Recharge	10	20
San Tomas Creek Recharge	Westside Recharge	10	20
Saratoga Creek Recharge	Westside Recharge	10	20
Stevens Creek Recharge	Westside Recharge	10	9
Wildcat Creek Recharge	Westside Recharge	10	20
Los Gatos Pond Recharge	Westside Recharge	9	12
Kooser Pond Recharge	Almaden Valley Recharge	11	15
Los Capitancillos Recharge	Almaden Valley Recharge	11	15
Alamitos and Guadalupe Recharge	Almaden Valley Recharge	11	15
Ross Creek Recharge	Almaden Valley Recharge	11	15
Calero Creek Recharge	Almaden Valley Recharge	11	15
Penitencia Creek Recharge	Almaden Valley Recharge	11	15
Thompson Creek Recharge	Almaden Valley Recharge	11	15

Appendix H - Summary of Scenario Alternatives

Date	Scenario	Average Annual Supply (AF)	Minimum Annual Supply with Reserves(1) (AF)	Minimum NC Storage (AF)	Potable Reuse Capacity (AF)	Averge Potable Reuse Utilization (AF)	Averge Potable Reuse Utilization (%)	Max WSCP Water Use Reduction	# Years with WSCP	File
Oct-15	Without Baseline Facilities	412,071	316,962	40,520	-	-	-	25%	10	Potable Reuse Output 2015-10-01.xlsx
Oct-15	Baseline	420,511	359,224	97,279	20,100	10,300	51%	20%	3	Potable Reuse Output 2015-10-01.xlsx
Oct-15	Coyote Potable Reuse	424,552	380,354	89,753	28,500	14,900	52%	15%	3	Potable Reuse Output 2015-10-01.xlsx
Oct-15	Midbasin Potable Reuse	422,896	359,224	125,785	25,700	13,400	52%	20%	3	Potable Reuse Output 2015-10-01.xlsx
Oct-15	Westside Potable Reuse	424,933	401,485	103,851	31,300	15,700	50%	15%	2	Potable Reuse Output 2015-10-01.xlsx
Oct-15	Westside Potable Reuse Hybrid	428,837	401,485	103,335	31,300	16,200	52%	15%	2	Potable Reuse Output 2015-10-01.xlsx
Oct-15	All Potable Reuse	430,327	401,485	150,201	44,200	21,700	49%	7.5%	2	Potable Reuse Output 2015-10-01.xlsx
Oct-15	Dry Year Options (25,500 AF)	422,680	401,485	138,944	20,100	9,100	45%	7.5%	2	W:\Water Supply Modeling Analysis\Recycled Water\Potable Reuse\Long Term Potable Water Reuse Implementation Operations Mod
Oct-15	Ford + Dry Year Options (19,000 AF)	425,378	401,485	139,676	24,300	10,100	42%	7.5%	2	W:\Water Supply Modeling Analysis\Recycled Water\Potable Reuse\Long Term Potable Water Reuse Implementation Operations Mod
Oct-15	Westside + Dry Year Options (10,000 AF)	425,579	401,485	140,522	31,300	15,100	48%	7.5%	2	W:\Water Supply Modeling Analysis\Recycled Water\Potable Reuse\Long Term Potable Water Reuse Implementation Operations Mod
Oct-15	Westside + Midbasin	424,316	401,485	125,016	36,900	17,135	46%	15%	2	Potable Reuse Output 5 - 2 new cases.xlsx
Oct-15	Westside + Midbasin + DYO (4K AF)	426,470	401,485	139,968	36,900	17,000	46%	7.5%	2	Potable Reuse Output 5b - 2 new cases.xlsx
Oct-15	Westside - Non-Contract Water	429,983	380,354	104,862	31,300	19,100	61%	15%	3	W:\Water Supply Modeling Analysis\Recycled Water\Potable Reuse\Long Term Potable Water Reuse Implementation Operations Mod
Oct-15	Central Pipeline DPR (20,200 AF)	430,087	359,224	102,521	20,200	19,920	99%	20%	3	W:\Water Supply Modeling Analysis\Recycled Water\Potable Reuse\Long Term Potable Water Reuse Implementation Operations Mod
Oct-15	Pacheco Reservoir (80,000 AF)	432,490	401,485	102,309	20,200	10,790	53%	15%	3	..\..\..\..\Miscellaneous Analyses\compare expanded reservoir cases 3 tah adds.xlsx
Oct-15	Westside + Pacheco Reservoir	429,894	422,616	141,330	31,300	15,896	51%	5%	2	Potable Reuse Output 5 - 2 new cases.xlsx
	New **Preliminary** imported water allocation factors from the 2015 Delivery Capability Report - Early Long-Term Scenario Also expanded simulation to 1922 - 2015									
Dec-15	Additional Recharge in North County (5,000 AF)	415,360	310,941	93,509	20,200	10,291	51%	20%	4	Potable Reuse Output - additional hydrology 2004-2015 TEMPLATE.xlsx
Dec-15	Additional Banking (duplicate Semitropic Bank)	416,211	344,564	95,936	20,200	10,883	54%	15%	4	Potable Reuse Output - additional hydrology 2004-2015 TEMPLATE.xlsx
Dec-15	Central Pipeline DPR (30,000 AF)	433,188	382,596	93,384	30,000	28,725	96%	15%	3	Potable Reuse Output - additional hydrology 2004-2015 TEMPLATE.xlsx
Dec-15	2:1 Exchange Contract	418,445	310,941	94,049	20,200	11,333	56%	20%	5	Potable Reuse Output - additional hydrology 2004-2015 TEMPLATE.xlsx
	New imported water allocation factors from the 2015 Delivery Capability Report - Early Long-Term Scenario; **and decisions to not include the CVP Reallocation Agreement (since it will expire in 2022) and to use CVP 130,000 af as M&I historic us**									
Dec-15	Baseline	430,390	362,282	97,846	20,148	10,137	50%	20%	3	Potable Reuse Output 10 cases no reallocation agmt and cvp MI hist use at 130000 af tah format.xlsx
Dec-15	Base High M&I Hist Use	439,306	381,423	104,888	20,148	8,967	45%	15%	2	Potable Reuse Output 10 cases no reallocation agmt and cvp MI hist use at 130000 af tah format.xlsx
Dec-15	Base + combined 15mgd PR injection	434,776	400,303	123,321	35,842	15,164	42%	15%	2	Potable Reuse Output 10 cases no reallocation agmt and cvp MI hist use at 130000 af tah format.xlsx
Dec-15	Base + combined 10mgd PR injection	433,784	400,303	101,796	31,349	14,008	45%	15%	2	Potable Reuse Output 10 cases no reallocation agmt and cvp MI hist use at 130000 af tah format.xlsx
Dec-15	Base + Ford and Coyote NPR	434,627	382,383	88,151	28,547	14,963	52%	15%	3	Potable Reuse Output 10 cases no reallocation agmt and cvp MI hist use at 130000 af tah format.xlsx
Dec-15	Base + Ford and Coyote DPR	437,059	381,085	102,044	28,548	14,780	52%	15%	2	Potable Reuse Output 10 cases no reallocation agmt and cvp MI hist use at 130000 af tah format.xlsx
Dec-15	Base + combined 15mgd injection + Ford PR	437,563	400,303	145,638	40,042	15,578	39%	7.5%	2	Potable Reuse Output 10 cases no reallocation agmt and cvp MI hist use at 130000 af tah format.xlsx
Dec-15	32 mgd DPR to SBA	435,906	400,303	108,547	35,839	16,426	46%	15%	2	Potable Reuse Output 10 cases no reallocation agmt and cvp MI hist use at 130000 af tah format.xlsx
Dec-15	New 50 kaf LVE Bank	430,564	381,085	104,141	20,148	10,134	50%	15%	2	Potable Reuse Output 10 cases no reallocation agmt and cvp MI hist use at 130000 af tah format.xlsx
Dec-15	New 300 kaf Bank	429,350	411,130	176,322	20,148	9,376	47%	5%	1	Potable Reuse Output 10 cases no reallocation agmt and cvp MI hist use at 130000 af tah format.xlsx
Mar-16	2015 Baseline	431,997	362,282	105,126	20,148	11,988	59%	20%	3	Potable Reuse April 15 2016 Baseline and 6 alternatives and no FAHCE cases.xlsx
Mar-16	No IPR No Lex PL case	421,217	347,982	22,263				50%	8	Potable Reuse April 15 2016 Baseline and 6 alternatives and no FAHCE cases.xlsx
Mar-16	Base with No FAHCE case	438,233	381,538	94,711	20,148	11,530	57%	15%	3	Potable Reuse April 15 2016 Baseline and 6 alternatives and no FAHCE cases.xlsx
Mar-16	Base + combined 15mgd PR injection	436,758	400,303	141,487	35,842	17,861	50%	7.5%	2	Potable Reuse April 15 2016 Baseline and 6 alternatives and no FAHCE cases.xlsx
Mar-16	Base + combined 10mgd PR injection	435,538	400,303	118,337	31,349	16,412	52%	15%	2	Potable Reuse April 15 2016 Baseline and 6 alternatives and no FAHCE cases.xlsx
Mar-16	Base + Ford PR	435,371	381,085	92,925	24,348	13,259	54%	15%	3	Potable Reuse April 15 2016 Baseline and 6 alternatives and no FAHCE cases.xlsx
Mar-16	Base + combined 15mgd PR injection + Ford PR	439,784	409,444	141,892	40,042	18,306	46%	5%	1	Potable Reuse April 15 2016 Baseline and 6 alternatives and no FAHCE cases.xlsx
Mar-16	32 mgd DPR to SBA	436,095	400,303	108,116	35,839	16,474	46%	15%	2	Potable Reuse April 15 2016 Baseline and 6 alternatives and no FAHCE cases.xlsx
	(1) Reliability Target is 380,354 AF									
	380354.4									

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Summary of Modeling Results for Various Scenarios with/without Lexington Pipeline, Los Gatos Indirect Potable Reuse (IPR), Direct Potable Reuse (DPR), Injection Wells

		2040 Baseline UWMP ELT	IPR No Lexington PL, With Saratoga Recharge	IPR With Lexington PL, With Saratoga Recharge, With Injection	IPR No Lexington PL, With Saratoga Recharge, With Injection	IPR/DPR With Lexington PL, With Saratoga Recharge	IPR/DPR No Lexington PL, With Saratoga Recharge
Santa Clara Plain, End of CY GW Storage (AF)	Avg	284,899	283,792	301,995	301,343	283,455	282,786
	Max	344,449	340,991	348,175	349,127	338,292	337,598
	Min	149,063	148,229	159,331	155,717	148,905	146,106
	Median	293,001	286,517	313,764	313,633	290,565	291,482
Lexington Reservoir End of CY Storage (AF)	Avg	3,653	3,653	3,653	3,653	3,653	3,653
	Max	14,000	14,000	14,000	14,000	14,000	14,000
	Min	1,201	1,201	1,201	1,201	1,201	1,201
	Median	2,688	2,688	2,688	2,688	2,688	2,688
Lexington Pipeline Diversion (AF)	Avg	10,148	-	10,213	-	10,132	-
	Max	24,319	-	24,320	-	23,612	-
	Min	-	-	-	-	-	-
	Median	8,489	-	8,685	-	8,489	-
Los Gatos Ponds Recharge, Local (AF)	Avg	3	9,076	3	7,952	25	9,151
Los Gatos Ponds Recharge, CVP (AF)	Avg	1,589	351	5,884	3,311	8,098	4,601
Los Gatos Ponds Recharge, SWP (AF)	Avg	4	0	4,029	1,630	3,663	1,323
Los Gatos Ponds Recharge, IPR (AF)	Avg	21,690	13,965	9,281	6,904	10,211	7,239
Los Gatos Ponds Recharge, Total (AF)	Avg	23,287	23,393	19,197	19,798	21,997	22,315
	Max	23,798	23,798	23,798	23,798	23,798	23,798
	Min	15,974	15,974	12,382	11,804	13,279	13,407
	Median	23,798	23,798	19,675	20,990	23,413	23,732
Los Gatos Creek Recharge, Local (AF)	Avg	5,085	5,093	5,019	5,017	5,101	5,100
Los Gatos Creek Recharge, CVP (AF)	Avg	-	-	-	-	-	-
Los Gatos Creek Recharge, SWP (AF)	Avg	-	-	-	-	-	-
Los Gatos Creek Recharge, Total (AF)	Avg	5,085	5,093	5,019	5,017	5,101	5,100
	Max	5,840	5,840	5,840	5,840	5,840	5,840
	Min	429	429	429	429	429	429
	Median	5,475	5,480	5,423	5,414	5,480	5,480
Westside Injection (AF)	Avg	-	-	5,999	5,999	-	-
Mid-Basin Injection (AF)	Avg	-	-	4,999	4,999	-	-
DPR to South Bay Aqueduct (AF)	Avg	-	-	-	-	11,881	11,888
IPR/DPR Total, Including to LG Ponds Above (AF)	Avg	21,690	13,965	20,279	17,903	22,091	19,127
	Max	23,798	23,798	23,798	23,798	23,798	23,798
	Min	11,181	2,225	14,317	12,275	15,498	13,025
	Median	23,399	15,415	21,620	17,450	23,796	19,442
Santa Clara Plain, Facility Recharge + GW Injection (AF)	Avg	66,345	66,031	70,184	70,281	65,663	65,679
	Max	81,105	81,695	91,521	91,521	81,695	81,338
	Min	31,395	31,456	31,512	31,512	22,379	22,382
	Median	68,125	67,681	71,892	72,127	68,149	67,807
SJWC Lake Elsman (AF)	Avg	9,898	9,898	9,898	9,898	9,898	9,898
Los Gatos Creek Flows to Bay (AF)	Avg	6,596	7,664	6,598	8,864	6,574	7,582
	Max	49,072	51,697	49,106	60,441	47,028	51,697
	Min	-	-	-	-	-	-
	Median	2,362	2,728	2,362	2,943	2,362	2,728
Semitropic Water Bank Storage (AF)	Avg	262,537	240,666	252,343	242,646	262,983	250,697
	Max	345,000	345,000	345,000	345,000	345,000	345,000
	Min	85,227	32,520	89,936	59,635	85,122	54,707
	Median	294,740	265,155	269,737	267,646	294,121	285,782
CVP Carryover Not Used, Annual Change (AF)	Sum	441,568	253,351	367,172	228,209	455,202	369,408
	Avg	4,748	2,724	3,948	2,454	4,895	3,972
SWP Carryover Not Used, Annual Change (AF)	Sum	246,431	129,762	189,920	118,984	259,087	209,060
	Avg	2,650	1,395	2,042	1,279	2,786	2,248
Count of Years with Demand Reductions		30	31	21	21	30	30
Maximum Demand Reduction		30%	30%	30%	30%	30%	30%
Water Rights Utilization (AF)[1]	Avg	15,489	13,919	15,488	13,097	15,489	13,988
	Max	31,954	29,962	31,954	29,962	31,954	29,962
	Min	1,276	1,276	1,276	1,276	1,276	1,276
	Median	13,268	12,011	13,268	11,380	13,268	12,011

1: Water rights utilization based upon existing beneficial uses; it does not include proposed amendments to water rights related to the Fisheries and Aquatic Habitat Collaborative Effort (FAHCE)