Alameda County
Water District

Integrated Resources Planning Study: 10-Year Review

December 2006

ALAMEDA COUNTY WATER DISTRICT

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EXECUTIVE SUMMARY

In 1995, the Alameda County Water District (ACWD, the District) completed its first Integrated Resources Planning Study (the IRP). An integrated resource planning approach was adopted by ACWD to ensure that the most appropriate facility and resource decisions be made in the planning process. IRP is an inclusive process that begins with the premise that a wide range of traditional and innovative supply-side and demand-side (i.e. water conservation) resources must be considered in developing water supply strategies.

As part of the 1995 IRP process, the District evaluated a wide range of water supply and water conservation options. These options were packaged into nine alternative water supply strategies, each of which was evaluated with the goal of meeting policy objectives including: (1) improving water supply reliability; (2) improving aesthetic quality of the water by reducing hardness; and (3) minimizing costs and rate impacts to ACWD's customers. The recommended water supply strategy, chosen because it best met the District's objectives, called for supplementing the District's then-existing supplies (i.e. State Water Project, San Francisco Regional and local supplies) with desalination, recycled water, additional conservation, groundwater management and off-site banking/transfers.

The purpose of this report is to provide a 10-year review of the key planning assumptions in the 1995 IRP, and to confirm that ACWD is on track to meeting its IRP objectives. This report includes: (1) a review of the implementation status of the key recommendations provided in the 1995 IRP; (2) an update of many of the key water supply planning assumptions utilized in the 1995 IRP; (3) verification that ACWD is on track to meet its planning objectives ("IRP verification"); and (4) a review of planned production facilities and their role in meeting the IRP objectives ("optimization analyses").

Chapter 1 of this report summarizes the 1995 IRP and the current implementation status of its recommendations. Chapter 2 provides an overview of the updates to key planning assumptions, including the demand forecast and water supply availability updates. Chapter 3 documents the IRP verification and optimization analyses.

The following provides a summary of the key findings of this 10-year IRP Review and recommendations for next steps.

ES-1 SUMMARY OF KEY FINDINGS

This report has provided a 10-year review of ACWD's Integrated Resources Planning Study. Key findings are listed below:

1. IRP Implementation: ACWD is on track in the implementation of the 1995 IRP recommendations. To date, ACWD has completed the following key programs:

    a. Implemented a comprehensive demand management program.
    b. Secured 150,000 AF of off-site storage at Semitropic Groundwater Banking Program, and placed over 120,000 AF in storage.
    c. Completed the Phase 1 Newark Desalination Facility and secured funding for the Phase 2 expansion.
    d. Completed a rehabilitation of the District's Quarry Lakes groundwater recharge pits.
    e. Completed a feasibility study for a recycled water project in southern Fremont and Newark.

2. Demand Forecast Updates: ACWD's 1993 demand forecast has been updated in 1998 and again in 2004. There are no significant differences between the 1993 forecast and more recent forecasts.

3. Water Conservation Program: ACWD's water conservation program has included the implementation of all cost-effective Best Management Practices, per the MOU on Urban Water Conservation. Annual savings to date are estimated to be approximately 700 AF/Yr, with an additional 2,200 AF/Yr of savings projected to be achieved by the year 2020.

4. Water Supply Reliability: The water supply reliability assumptions for all of ACWD's primary sources of supply (State Water Project, San Francisco Regional, and local supplies) have been updated. Water supply modeling has indicated that, under most conditions, ACWD is on track to meeting its water supply reliability goals of no more than 10% shortages on a 1 in 30 year basis. Two projects completed since 1995 have been essential to meeting these goals: (1) securing the 150,000 AF of off-site storage at the Semitropic Groundwater Banking Program and (2) completion of the Phase 1 Newark Desalination Facility. However, under relatively infrequent critically dry year conditions, ACWD may not have sufficient supplies to meet its reliability goals. Under these conditions ACWD may be able to limit the shortages by purchasing water from a DWR drought water bank or similar program.

5. Water Quality Goals**:** The water quality assumptions incorporated in the 1995 IRP have been updated to 2005 conditions. Water supply modeling has indicated that ACWD will be able to meet is water quality goals for hardness (150 ppm non-peak month average, 175 ppm peak month) under future conditions. Exceptions may occur under certain drought conditions when the District may need to rely more heavily on local groundwater reserves, resulting in a higher ratio of groundwater to softer San Francisco Regional water at the Blending Facility.

6. Recycled Water Planning: A recycled water project to be implemented by the year 2020 was included as a recommendation in the 1995 IRP. This 10-year review has confirmed that recycled water is still an integral part of ACWD's long-term water resources strategy. The timing for the project, however, is dependent on when the demand from two planned golf courses materializes. These golf courses would represent over half of the projected demand for recycled water, and likely will be required to make the project cost-effective.

7. Facility Planning: As of 2005, ACWD's planned production/treatment facilities include the Phase 2 Newark Desalination Facility, the Phase 1 Demineralization Facility and the Newark Inter-tie Pipeline (connecting the District's freshwater wellfields with the Newark Desalination Facility). Results of an optimization analyses indicate that the most cost-effective means to meet future production needs and achieve ACWD's water quality goals is through a combination of the Phase 2 Desalination and Newark Inter-tie projects. Under current planning assumptions, potential benefits provided by the Demineralization Facility would be redundant with benefits provided by the combined implementation of the Phase 2 Desalination and Inter-tie projects. The need for the Demineralization Facility, however, may become more apparent if local groundwater hardness increases significantly beyond existing (2005) conditions.

8. Catastrophic Loss of Supplies: Delta levee failures may result in a long-term loss of State Water Project supplies for ACWD. An analysis of the potential impacts of the loss of ACWD's State Water Project supplies (as a result of Delta levee failure) has indicated that the ACWD service area could face shortages of up to 50% or more for up to 5 consecutive years. Under such a scenario, ACWD would need to rely heavily on local groundwater resources, potentially exposing the groundwater basin to renewed seawater intrusion and contamination. ACWD may also face a significant loss of supplies due to earthquake damages to conveyance facilities of the State Water Project and/or San Francisco Regional Water System.

9. Uncertainties: ACWD continues to face a significant amount of uncertainty that may impact the reliability, quality and/or cost of its water supplies. Key uncertainties include: global warming and its impacts on supplies and demands, Delta sustainability, SFPUC contract renewal negotiations and CIP implementation, local fishery issues and continued development in the Alameda Creek Watershed.

ES-2 RECOMMENDATIONS

The 10-year IRP review led to the following recommendations for ensuring that the District will remain on track in meeting its planning objectives.

Water Supplies

1. Monitor and protect existing supplies: Uncertainties regarding the reliability, quality and cost of ACWD's water supplies will continue for the foreseeable future. ACWD needs to remain diligent and proactive in ensuring that these supplies are protected in terms of reliability, quality and cost.

2. Evaluate new supply opportunities: ACWD's current and projected water supplies are estimated to be sufficient to meet ACWD's reliability under most conditions except relatively infrequent critically dry years. However, ACWD should continue to evaluate new supply opportunities, as they become available, to ensure that ACWD employs the most cost-effective and reliable source of supplies to meet its planning goals.

Demand Management and Forecasting

3. Track demands and regularly update forecasts: Water demands in the ACWD service area are subject to annual variations as a result of weather, growth, economic conditions and other variables. ACWD should continue to track demands, and evaluate any factors that may result in significant changes to either the short-term or long-term projections.

4. Continue implementation of demand management measures and investigate new opportunities: The continued implementation of existing water conservation and public information campaigns will be required to maintain the level of conservation savings already achieved, and to achieve new savings. In addition to existing programs, ACWD should continue to monitor new advancements in water conservation and implement programs which are acceptable to ACWD's customers and are locally cost-effective.

Dry Year Reliability

5. Evaluate critical dry year supply opportunities: The water supply modeling analyses conducted for this 10-year IRP Review have confirmed that, under most conditions, ACWD is on track to meet its water supply reliability goals of no more than a 10% shortage on a 1 in 30 year basis. However, the analysis also indicates that shortages of up to 20% may occur on a less frequent basis (i.e. 1 in 37 years under 2030 conditions). ACWD should investigate opportunities to secure supplemental supplies under these relatively infrequent, critically dry year scenarios.

6. Re-evaluate dry year drawdown of the Niles Cone Groundwater Basin: Modeling analyses conducted as part of this 10-year review has indicated that the Niles Cone Groundwater Basin will be more heavily relied upon as the demand in the service area grows. This will result in an increase in frequency in which the groundwater levels may be drawn down to sea-level conditions, especially during extended drought conditions. Additional analyses should be conducted with ACWD's updated groundwater models to confirm the ability of the groundwater basin to withstand these projected dry year operations without suffering adverse impacts due to seawater intrusion or movement of brackish groundwater plumes.

Facility Planning

7. Continue with Phase 2 Desalination Planning: The Phase 2 Desalination Facility provides needed water supply, production, and water quality benefits to the ACWD service area. The modeling analyses conducted as part of this IRP review should be confirmed in the 2006-2010 Engineer's Report, along with the specific operational criteria for this facility.

8. Proceed with Newark Inter-tie Pipeline Planning: The Newark Inter-tie Pipeline will allow for the flexibility of blending hard groundwater from the Mowry and Peralta-Tyson wellfields with soft water from the Desalination Facility or directly treating the harder well water at the Desalination Facility. As with the Phase 2 Desalination, the 2006-2010 Engineer's Report should confirm the modeling analyses, and develop specific operating criteria as well as timing for the implementation of this facility.

9. Defer plans for Demineralization Facility: Planning for the Demineralization Facility should be deferred until such time that local groundwater conditions dictate the need for the facility to meet hardness goals. Future planning should re-evaluate the design and operation of such a facility to minimize concentrate discharge, while maximizing the water quality benefits.

10. Evaluate and confirm dry year and peaking production capacity: The focus of this 10-year IRP Review has been on meeting annual and monthly demands. The 2006-2010 Engineer's Report should further analyze this Review's recommendations to confirm that adequate production and peaking capacity will be provided for maximum day demands. Similarly, the IRP analysis was based on best-estimates of the operating capacity of key facilities, including the surface water treatment plants and wellfields. The Engineer's Report should include a more detailed evaluation of these facilities and confirm their operating capacity under a variety of peaking and dry year scenarios.

Optimization of Water Operations

11. Investigate optimized operations of Semitropic and local groundwater storage: Under current planning assumptions, ACWD will retrieve water from the Semitropic Groundwater Bank in dry and critical years when the District would otherwise face shortages. However, there may be opportunities to operate the ACWD's Semitropic storage more frequently, in conjunction with the management of the Niles Cone Groundwater Basin, such that local dry year reserves are maximized. Additional operational and cost analyses should be conducted to further investigate these opportunities.

12. Continue to evaluate opportunities to minimize costs while meeting reliability and quality goals: Depending on water supply availability, ACWD's diversity in supplies and production facilities provide opportunities for numerous operating scenarios. ACWD should continually evaluate these scenarios to ensure that the most cost-effective operating plans are implemented, while also meeting the IRP's water supply reliability and water quality goals.

Catastrophic Loss of Supplies

13. Develop emergency response plan for long-term catastrophic loss of supplies: The loss of ACWD's State Water Project supplies due to levee failures could result in water shortages of up to 50% lasting for up to five years. Given the potential for this worst case scenario, it is recommended that ACWD develop an emergency response plan that: (1) identifies potential mitigation measures, including securing temporary replacement supplies; and (2) identifies any operational or facility constraints that may limit ACWD's operations under such a scenario. The emergency response plan should also address shorter outages due to breaks in the conveyance systems of the State Water Project and/or San Francisco Regional Water System

IRP Updates and Annual Reporting

14. Periodically review the IRP assumptions and confirm ACWD's ability to meet IRP goals: The IRP should continue to be re-evaluated. Comprehensive reviews should occur, at a minimum, every 10 years, or more frequently if conditions warrant. To the extent practical, IRP reviews should be coordinated with updates to the District's Urban Water Management Plan.

15. Provide annual reports on IRP implementation and planning assumptions: Given the numerous uncertainties regarding service area demands and water supplies, an annual IRP report should be prepared. This report should document the implementation of key IRP related recommendations and identify any changes to key planning assumptions regarding the District's water supplies, demands and facilities.

CHAPTER 1
INTRODUCTION

1.1 BACKGROUND

In 1995, the Alameda County Water District (ACWD, the District) completed its first Integrated Resources Planning Study (the IRP). An integrated resource planning approach was adopted by ACWD to ensure that the most appropriate facility and resource decisions were made in the planning process. IRP is an inclusive process that begins with the premise that a wide range of traditional and innovative supply-side and demand-side resources must be considered. ACWD was early to adopt the IRP approach in the 1990's, an approach which is rapidly becoming the standard of sound resource management.

When ACWD began the process of developing the IRP in 1992, the District was just recovering from a multi-year (1987-92) drought. During this drought, ACWD was subject to significant cutbacks in its imported water supplies from the State Water Project and San Francisco Regional Water System, while also experiencing significant reductions in the availability of local supplies. These cutbacks were severe enough that the District implemented mandatory water use restrictions for many customers, including water budgets with penalties for over use.

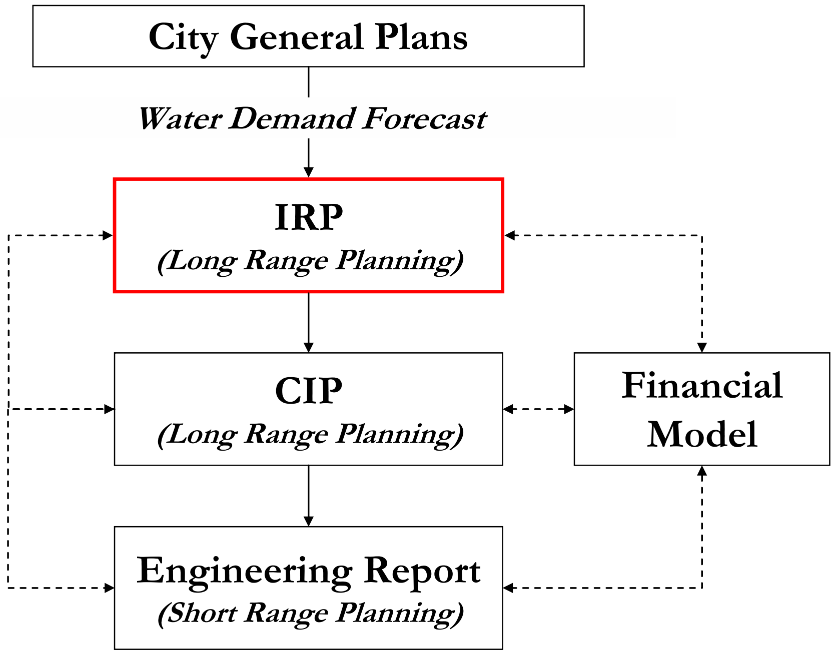
As part of the subsequent IRP process, the District evaluated a wide range of water supply and water conservation options. These options were packaged into nine alternative water supply strategies, each of which was evaluated with the goal of meeting policy objectives including: (1) improving water supply reliability; (2) improving aesthetic quality of the water by reducing hardness; and (3) minimizing costs and rate impacts to ACWD's customers. A complete list of the IRP policy objectives is provided in Table 1-1. The recommended water supply strategy, chosen because it best met the District's objectives, called for supplementing the District's then-existing supplies (i.e. State Water Project, San Francisco Regional and local supplies) with desalination, recycled water, additional conservation, groundwater management and off-site banking/transfers.

The IRP is one component of ACWD's planning process. As indicated in Figure 1-1, the land use projections as designated in the adopted General Plans of Fremont, Newark and Union City, serve as the basis for the long-term demand forecasts in the IRP. The IRP utilizes these water demand projections as a first step, together with the IRP policy objectives, in developing the District's water supply strategy. Facility recommendations from the IRP are then carried forward to the District's Capital Improvement Plan (CIP) and 5-year Engineer's Report, which provide the long-term and near-term capital project planning, respectively. These planning documents all feed into the District's financial model and, through an iterative process, are evaluated to ensure that the planned facilities and their costs are consistent with the District's financial objectives and constraints.

Table 1-1
1995 IRP Policy Criteria

Criterion	Objectives	Evaluation Criterion	Discussion
Cost	• Minimize resources costs • Maintain low average customer bills	Net present value of fixed and variable costs	The most appropriate measure of the success of a particular resource sequence in meeting this objective is the discounted net present value of all of the costs that the District faces over the planning period
Reliability	• Maintain a high level of service reliability	Shortages in drought conditions, expressed as a percent of annual demand.	• Maintain high level of service reliability, focusing on long-term reliability (short term reliability such as peak day capacity, target storage volume, etc is not part of IRP) • District determined the following shortages to be unacceptable: o greater than 10%, 1 in 30 years o Small frequent shortages (no quantitative specification)
Water Quality	Avoid sudden changes in water taste or appearance	Maximum monthly hardness during drought years	Hardness (as $CaCO_3$) selected as a determinate of taste with goal of 150 ppm (ave) and 175 ppm (max) as modified in the 1996-2001 Engineers Report (Note: This objective is directed toward secondary, aesthetic water quality parameters. ACWD will prioritize health and regulatory water quality)
Environmental Impacts	Avoid or mitigate environmental impacts	Score based on current knowledge of potential environmental impacts	Refers to long-term environmental impacts associated with a resource option, not construction and other temporary impacts.
Local Control	Maximize District control of resources	Relative rating (see discussion column.)	To address uncertainty of imported supplies, District determined that local control of future resources is most desirable. Rating for evaluation criterion include: • Number of entities involved in the resource option • Firmness of District's water rights / allocation • State or federal involvement in water allocation
Risk	Minimize risks due to future uncertainty	• Financial risk • Water quality risk • Water availability risk	• Financial risk: likelihood of spending more money than expected or necessary • WQ regulatory risk: likelihood of noncompliance with future WQ regulations • Availability risk: likelihood that a supply source is not available due to external legal or regulatory changes. Uncertainties in allocation

Figure 1-1
ACWD Planning Process



This IRP planning process has allowed ACWD to proceed rapidly and efficiently with a clearly defined capital improvement plan over the past ten years. The IRP has also served as the basis for ACWD's 2000 and 2005 Urban Water Management Plans, required by the California Water Code to be submitted to the California Department of Water Resources every five years. In addition, the IRP has provided ACWD with the background information required to secure $2.8 million in state grant funding for the expansion of the Newark Desalination Facility, and facilitated ACWD's participation in several regional planning efforts, including San Francisco Public Utility Commission's Water Supply Improvement Program (WSIP) and the Bay Area Integrated Regional Water Management Plan (Bay Area IRWMP).

1. 2 IRP REVIEW OBJECTIVES

ACWD has seen changes to many of its planning assumptions since completion of the IRP in 1995. These changes have included highly variable economic conditions with short and long-term water demand impacts, environmental pressures on imported and local supplies, impacts on local water supplies from accelerated and expanded development in the Alameda Creek watershed, and a shift toward regional land-use and water management planning.

The purpose of this report is to provide a 10-year review of the planning assumptions in the 1995 IRP, and to confirm that ACWD is on track to meeting its IRP objectives. This IRP 10-year Review report includes:

1. A review of the implementation status of the key recommendations provided in the 1995 IRP;

2. An update of many of the key water supply planning assumptions utilized in the 1995 IRP;

3. Verification that ACWD is on track to meet its planning objectives ("IRP verification"); and

4. A review of planned water supply and production facilities and their role in meeting the IRP objectives ("optimization analyses").

The process for the Review is outlined in Figure 1-2 below. Chapter 1 of this report summarizes the 1995 IRP and the current implementation status of its recommendations. Chapter 2 provides an overview of the updates to key planning assumptions, including the demand forecast and water supply availability updates. Chapter 3 documents the IRP verification and optimization analyses. An evaluation of risks and uncertainties as well as the potential impacts of the catastrophic loss of ACWD's supplies is also included in Chapter 3.

The primary focus of this IRP Review is to address IRP criteria as outlined in Table 1-1, with an emphasis on water supply reliability and water quality.

As indicated in Figure 1-2, this 10-year IRP Review was prepared as a follow-up to ACWD's 2006-2010 Urban Water Management Plan (2006 UWMP), and is intended to be a companion document to the 2006 UWMP. Accordingly, detailed information on the service area, ACWD's demand management program, and water supplies may be found in the 2006 UWMP and is not repeated in this report.

1. 3 IRP IMPLEMENTATION STATUS

Since 1995, ACWD has made substantial progress in implementing the IRP recommendations. A summary of these recommendations and their respective implementation status is provided in Table 1-2 below. As indicated in the table, ACWD is currently on track in terms of implementing the 1995 IRP recommendations.

In addition to serving as ACWD's long-term strategic planning document, the IRP has also provided the basis for protecting and securing ACWD's existing sources of supply. Between 1995 and 2005 ACWD encountered numerous challenges to maintaining the quality and reliability of the District's imported and local supplies. The IRP clearly defines the importance of these supplies in meeting ACWD's long-term water needs and articulates the Board-adopted water quality and supply reliability policy. Accordingly, the IRP has been used as a tool by ACWD to protect these resources. A summary of the key issues ACWD has faced over the past ten years, and how these issues have been resolved, is provided in Table 1-3 below.

Figure 1-2
IRP Verification and Review Procedures

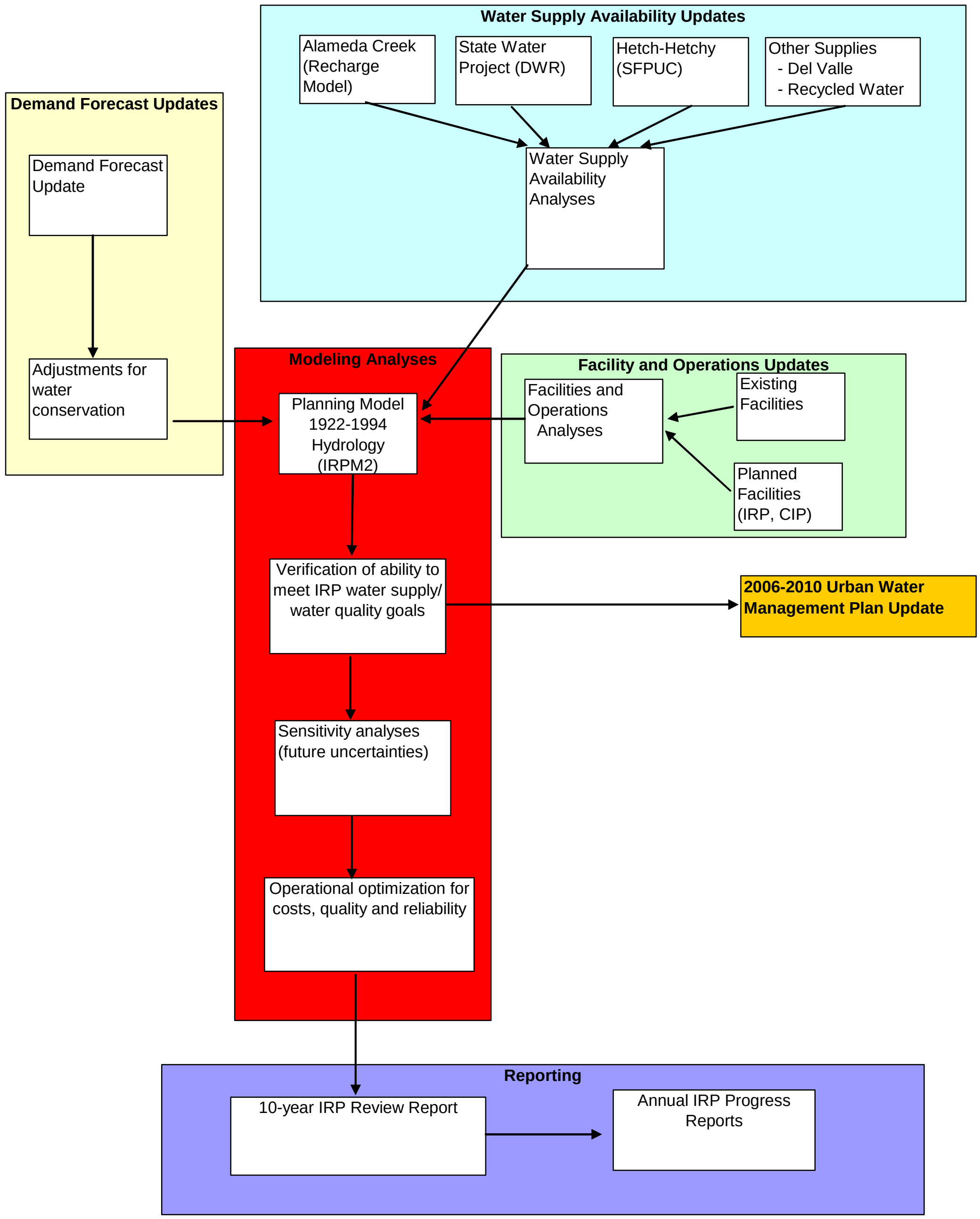


Table 1-2
Recommended IRP Strategies and Implementation Status as of 2006

IRP COMPONENT	1995 IRP RECOMMENDATION				IMPLEMENTATION STATUS
	2000	2010	2020	2030	
Demand Management	Implement cost-effective conservation measures with focus on outdoor water use (IRP Package 2)				All cost-effective BMPs are being implemented. New programs focused on landscape irrigation in place.
Desalination	5 mgd	10 mgd	10 mgd	10 mgd	Phase 1 Desal (5 mgd) completed and in operation. Grant funding secured for Phase 2 (10 mgd).
	Note: 1995 IRP recommendation of 3 mgd and 8 mgd was revised to 5 mgd and 10 mgd as part of the 1996-2001 Engineer's Report.				
Off-Site Storage/Banking Capacity	65,000 AF	95,000 AF	100,000 AF	140,000 AF	Secured 150,000 AF of off-site banking storage capacity at Semitropic Groundwater Banking Program.
Groundwater Management (Minimum inland groundwater elevation)	+1 ft, msl	-5 ft, msl	-5 ft, msl	-5 ft, msl	Completed the Quarry Lakes rehabilitation project to enhance groundwater recharge capacity. Modeling confirms these levels are sufficient for dry year supply planning and shortage policy, given the remainder of supply and facilities currently planned.
Treatment Plant Upgrades	---	---	---	4 mgd	Nominal production rate of TP2 increased from 17 to 21mgd.
Recycled Water			Phase 1: 1,600 AF/Yr	Phase 2: 1,000 AF/Yr	ACWD/USD Recycled Water Master Plan updated and satellite treatment plant feasibility study completed. Installed 1.8 miles of distribution main and 14 service lines to carry reclaimed water once Phase I is completed.

Table 1-3
Examples of non-ACWD Projects/Issues Potentially Impacting ACWD Supplies

PROJECT	DATE	KEY ISSUE	RESOLUTION
DSRSD-EBMUD Recycled Water Project (DERWA)	1996-1997	Upstream use of recycled water would increase the salt loading in Alameda Creek (used by ACWD for groundwater recharge), ultimately increasing the hardness and salinity in ACWD's groundwater supplies.	ACWD and DERWA entered into an MOU whereby DERWA agreed to provide reimbursement for ACWD's additional costs required to remove salts and meet IRP hardness goals.
Livermore-Amador Valley Water Management Authority (LAVWMA) Wet-Weather Discharge	1997-1998	Upstream discharge of secondary-treated wastewater during wet-weather events would degrade water quality used for ACWD's recharge, possibly requiring ACWD to forego groundwater pumping.	ACWD and LAVWMA enter into an MOU whereby LAVWMA agrees to limit discharges to a 1 in 20 year frequency flow event, and to provide ACWD with $8.25 million for a groundwater treatment facility.
San Francisco PUC Water Supply Improvement Program (WSIP)	2000-present	SFPUC Facilities Reliability Report indicates potential for water outages of up to 60 days due to seismic failure of Hetchy-Hetchy Aqueducts. Water supply studies indicate the potential for extended shortages of up to 20% or more during droughts due to increasing demands on the system.	BAWSCA, together with ACWD and other BAWSCA agencies, worked with the SFPUC to develop WSIP and seismic retrofit program. In 2002, AB 1823, the Wholesale Regional Water System Security and Reliability Act is signed by the governor.
EBMUD Bayside Groundwater Project	2001-2005	Proposed groundwater project adjacent to ACWD would extract 10 to 15 mgd of dry year supplies from deep aquifers that are hydraulically connected to the Niles Cone Groundwater Basin, thereby depleting ACWD's groundwater supplies.	ACWD and EBMUD conduct joint investigation of project impacts and mitigation. EBMUD reconfigures proposed project and limits groundwater extraction to 1 mgd for Phase 1 project.
Delta Levees Failure Risk	On-going	Scientific studies indicate the risk of failure of Delta levees and massive seawater intrusion as 2 out 3 in the next 30 years. ACWD and other SWP contractors could lose SWP supplies for 3 to 5 years, resulting in significant shortages.	ACWD is working with SBA and other SWP contractors to represent water supply interests in CALFED and Delta Visioning process.

CHAPTER 2
DEMAND FORECAST, WATER SUPPLY AND FACILITY UPDATES

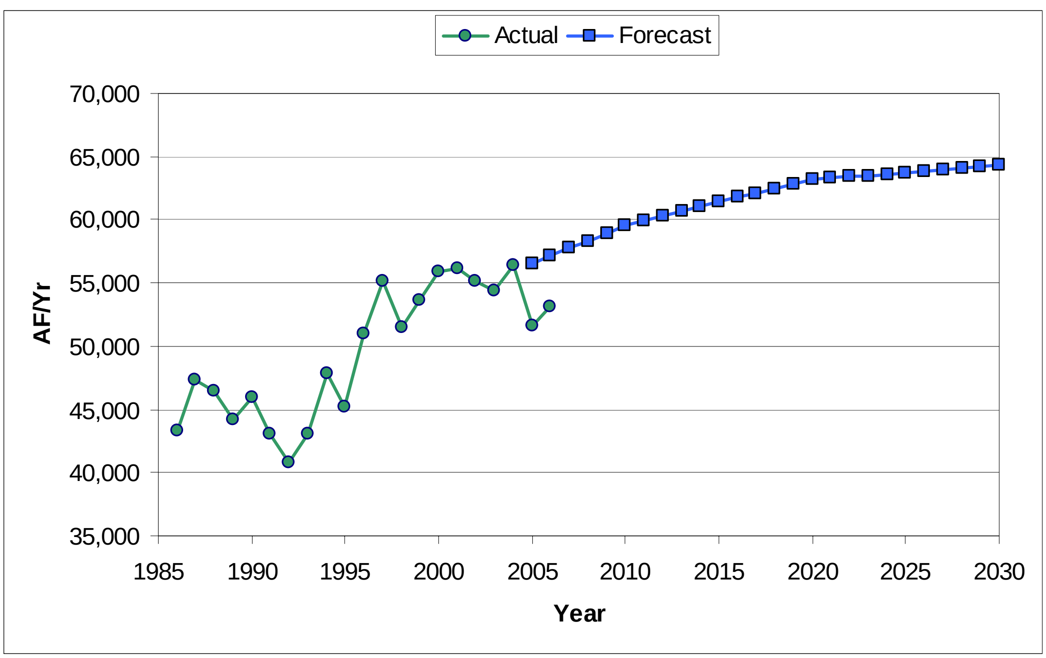
The following provides a discussion of updates to key IRP planning assumptions including demand forecasts, water supply availability, and production and treatment facilities. These updated planning assumptions are utilized in the IRP verification and optimization analyses, as presented in Chapter 3.

2.1 DEMAND FORECAST UPDATE

The forecast of water demands is an essential first step in the determination of actions needed to provide a reliable supply to current and future customers. The 1995 IRP relied on demand forecasts developed in 1993 (1993 Demand Forecast). The 1993 Demand Forecast projected water demands in the service area through the planning horizon (2030) and was based on future land use as designated in the General Plans of Fremont, Newark and Union City. This forecast was updated in 1999 and again in 2004. In both updates, ACWD contacted the local city planning departments to obtain the most recent land use planning documents and general plan updates.

Results of the 2004 Demand Forecast (Figure 2-1) are little changed from the 1993 and 1999 Forecasts. Key differences appear in the type of demand (customer class) rather than the total demand, with a higher number of housing units and less commercial and industrial development than previously anticipated.

Figure 2-1
2004 Distribution System Demand Forecast
(with system losses and natural conservation)
(source: 2006-2010 ACWD Urban Water Management Plan)



In addition to the distribution demand forecast, ACWD's water supply planning also accounts for local groundwater system demands. Groundwater system demand is the amount of water required to operate the groundwater basin for District and private uses. Groundwater system demands include: (1) private (non-District) groundwater pumping; (2) District's Aquifer Reclamation Program (ARP) pumping, which is required to reclaim the groundwater from previous seawater intrusion and protect the District wellfields from brackish groundwater intrusion; and (3) natural saline groundwater outflows, required to prevent new seawater intrusion and flush existing salt water plumes from the upper aquifer system. These groundwater system demands are estimated to be approximately 14,800 AF/Yr, and are not anticipated to change significantly within the planning horizon (except during dry years when the demands may be lessened due to temporarily decreasing natural saline outflows as groundwater elevations are lowered).

ACWD's total projected demands (distribution system demand and groundwater system demand) are listed in Table 2-1 below.

Table 2-1
ACWD Future Water Demands (AF/Yr)
(source: ACWD 2006-2010 Urban Water Management Plan)

Water Use Category	***Year***				
	2010	***2015***	***2020***	***2025***	***2030***
Distribution System Demand (with losses)	**59,500**	**61,400**	**63,200**	**63,700**	**64,300**
Groundwater System Demand	**14,800**	**14,800**	**14,800**	**14,800**	**14,800**
Total Demand	**74,300**	**76,200**	**78,000**	**78,500**	**79,100**

Notes:
1. All values rounded to the nearest 100.
2. Distribution System Demand includes adjustment for natural conservation (i.e. estimated savings due to retrofit of pre-1994 plumbing fixtures with water efficient models).
5. Total Distribution System Demand (with losses) includes estimated system losses of 8%.
6. Groundwater System demands include private pumping, ARP pumping and natural saline groundwater outflows.

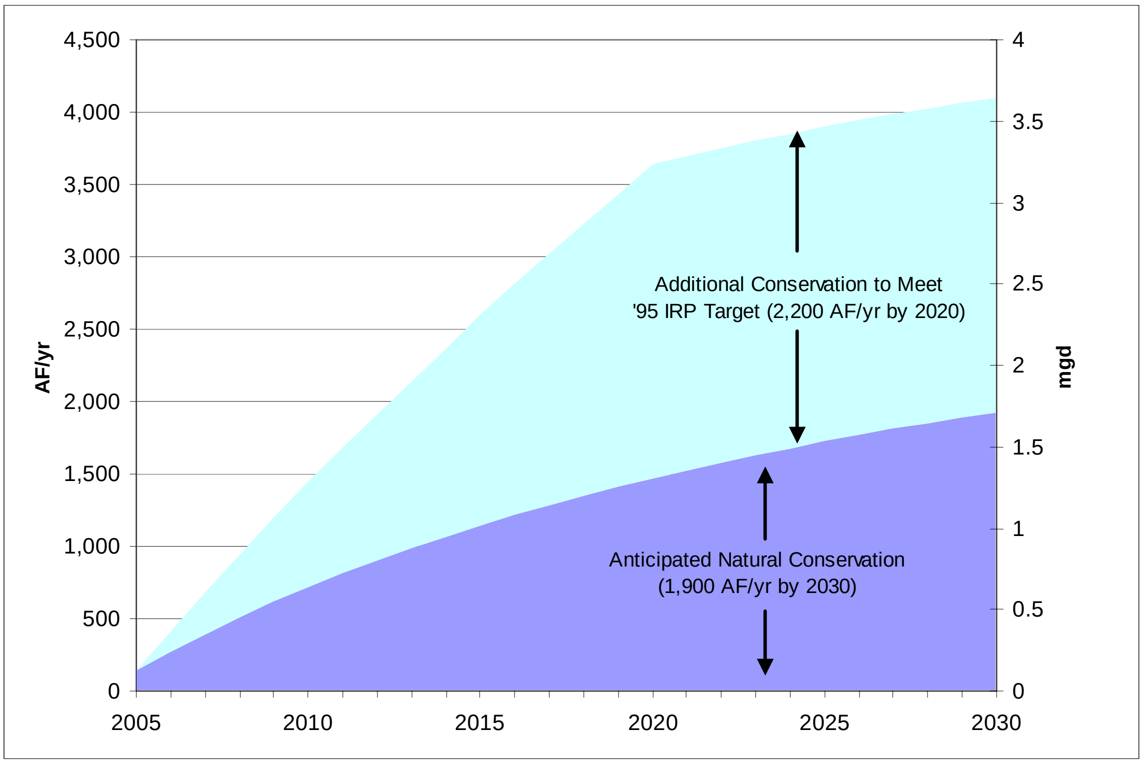
2.2 DEMAND MANAGEMENT UPDATE

Demand management is a key component of ACWD's long-term water supply and management strategy. The 1995 IRP screened a wide variety of conservation measures for economic and implementation feasibility. The present value costs of the preferred conservation measures were compared to the water supply development costs that would be avoided as a result of the conservation associated with the proposed measures. In doing so, conservation was analyzed on an equivalent basis with other water supply alternatives.

Ultimately, the individual measures were bundled into packages targeting different customer classes and end-uses. The recommended Package ("Package 2") captured the most cost-effective and highest benefits, with long-term savings estimated to range from 1,550 to 4,900 acre-feet per year by the year 2020. Package 2 includes components to reduce both indoor and outdoor water use for all customer groups, but places emphasis on reducing peak summer demands to reduce the need for additional production and storage facilities. While the intent was to avoid capital costs, Package 2 also reduces operating costs as peak month production costs can be substantially higher than other months.

A detailed discussion of ACWD's on-going water conservation program is provided in the 2006 UWMP. For planning purposes ACWD has estimated that approximately 2,900 AF/Yr of savings will be achieved over the twenty year period from 2000 to 2020, with 700 AF/Yr of conservation savings already achieved through 2005. The remaining programmatic conservation to be achieved from 2005 through 2020 is estimated at 2,200 AF/yr (see Figure 2-2), much of which will be achieved through implementation of the cost-effective best management practices ("BMPs") contained in the California Urban Water Conservation Council (CUWCC) MOU. ACWD demands are also experiencing reductions stemming from "natural conservation." Natural conservation savings occur as a result of the 1992 Plumbing Code which legislated maximum flow rates for shower-heads, faucets and toilets. These savings are already factored into the 2004 Demand Forecast, and are also shown in Figure 2-2 below.

Figure 2-2
ACWD Conservation Savings Assumptions (relative to year 2005)



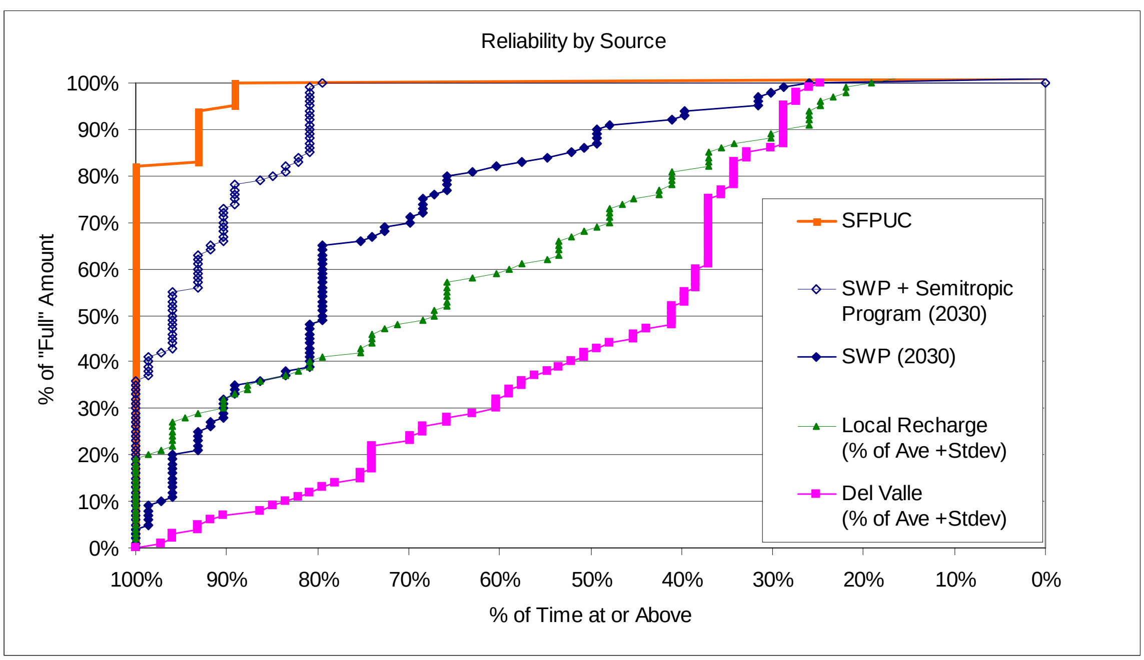
2.3 WATER SUPPLY AVAILABILITY UPDATE

ACWD's three primary sources of water supply are: (1) the State Water Project (SWP), (2) San Francisco's Regional Water System and (3) local supplies. The SWP and San Francisco Regional Water supplies are imported into the District service area through the South Bay Aqueduct and Hetch-Hetchy Aqueduct, respectively. Local supplies include fresh groundwater from the Niles Cone Groundwater Basin, desalinated brackish groundwater from portions of the groundwater basin previously impacted by seawater intrusion, and surface water from the Del Valle Reservoir. Recycled water is also planned as a future, local supply.

A detailed description of ACWD's water supply sources is provided in the 1995 IRP and the 2006 UWMP. As part of the development of the 2006 UWMP, ACWD updated its planning assumptions regarding water supply availability for all of its sources. Updated information on projected supply availability for the State Water Project and San Francisco Regional Water supplies was provided by the California Department of Water Resources (DWR) and the San Francisco Public Utilities Commission (SFPUC), respectively. ACWD also conducted an update of projected supply availability of local groundwater and surface water supplies. These water supply availability updates are documented in the District's 2006 UWMP, and were utilized in the subsequent planning analyses for this 10-year IRP review. A summary of the reliability and the availability for each of the District's existing supplies is provided in Tables 2-2 and 2-3, respectively.

As described in the 2006 UWMP, each of ACWD's water supplies originates from a different region of California, is managed by a different organization, serves different end-uses and levels of demand, and has a unique combination of conveyance and storage characteristics. As a result, each supply has a unique availability, creating the condition where one source can be plentiful while another is experiencing cutbacks. This diversity in ACWD's water supply portfolio is a strength of ACWD's system in that ACWD is not dependent on a single source of supply. A comparison of estimated water supply reliability for each of the District's sources of supply is provided in Figure 2-3.

Figure 2-3
Estimated Reliability of ACWD Sources



Note: Del Valle and Local Recharge do not have a fixed "full" availability; their reliability is thus represented as their long term average + one standard deviation, respectively.

Table 2-2
Summary of Water Supply Availability for Existing Supplies (AF/Yr)
(Source: 2006 ACWD Urban Water Management Plan)

SUPPLY COMPONENT	Estimated Water Supply Availability: Median Year[1] (1944 Conditions)	Long-Term Average[2]	Maximum Availability[3]	Minimum Availability[4]
Imported Supplies				
State Water Project	31,600	28,800	42,000	1,600
San Francisco Regional	15,300	15,000	15,300	11,700
Local Supplies				
Groundwater Recharge[5]	23,200	21,400	40,000	7,600
Groundwater Storage	N/A	N/A	10,000	0
Del Valle Release	3,500	7,100	20,200	0
Desalination[6]	5,100	5,100	5,600	5,100
Banking/Transfers				
Semitropic Banking	N/A	N/A	33,450	13,500
TOTAL SUPPLY	*78,700*	*77,400*	*N/A*	*N/A*

N/A Not Applicable
Notes:

1. Median Year values represent the median projected supply availability considering the sum of all of ACWD existing supplies and are based on the 1922-1994 historical hydrologic conditions (assuming 2005 operating conditions). The water supply availability under the year 1944 hydrologic conditions is utilized for the Median Year. Local Groundwater Storage and Semitropic Banking are not included in the Median Year because these supply components are used solely for dry year supplies and not under Median Year conditions.

2. Long-term Average values represent the average water supply availability based on the 1922-94 historical hydrologic conditions. Local Groundwater Storage and Semitropic Banking are not included in the Long-term Average because these supply components only provide dry year supplies and are based on a balanced "put" and "take" over the long-term.

3. Maximum Availability represents the maximum quantity of supply from each supply component. For the imported supplies, these quantities represent the maximum contractual amount that ACWD can receive from these sources. For local supplies, the maximum quantities represent the maximum amount projected to be available based on the 1922-94 historical hydrologic conditions. For Groundwater Storage, the maximum assumes that the groundwater basin is within normal operating levels in the beginning of the year. For Semitropic Banking, the maximum amount is based on maximum contractual return capacity to ACWD assuming 100% SWP allocation. The Maximum supply quantities listed above are not additive because the availability of these individual supplies may not occur under the same year/hydrologic condition.

4. Minimum Availability represents the minimum quantity of supply from each supply component. These quantities represent the minimum projected supply availability based on the 1922-94 historical hydrologic conditions. For Groundwater Storage, the minimum quantity assumes that the groundwater basin was at the minimum operating groundwater elevation in the beginning of the year and there is no usable groundwater storage available. For Semitropic Banking, the minimum quantity assumes that only Semitropic "pumpback" capacity is available to return banked water to ACWD. The Minimum Availability quantities are not additive because the availability of these individual supplies may not occur under the same year/hydrologic condition.

5. Groundwater Recharge is calculated as recharge from deep percolation of rainfall and applied water plus recharge at ACWD's groundwater percolation facilities (with local runoff from the Alameda Creek Watershed) less "Other Outflows" (as described in ACWD's annual Groundwater Survey Reports). Groundwater Recharge values do not include recharge from State Water Project or Del Valle Reservoir supplies.

6. Maximum Availability of Desalination based on Phase 1 Newark Desalination Facility capacity of 5 mgd operated year-round. Median Year availability based on 10% outage. Minimum Availability based on modeling analyses with 2005 supply/demand conditions and long-term hydrologic conditions (1922-1994). Minimum Availability under future demand conditions may be less due to Aquifer Reclamation Program pumping limitations if groundwater elevations are lowered during extended dry periods.

Table 2-3
ACWD Supply Source Overview

SUPPLY SOURCE		DESCRIPTION			
		Water Supply	**Water Quality**	**Production**	**Dry Year Reliability**
State Water Project with Semitropic Storage		- Availability subject to Delta constraints - ACWD's wet year SWP supplies can be stored at Semitropic to improve dry year reliability	- Lower hardness and TDS than local groundwater - TOC and bromide are primary quality concerns	- SWP supplies are treated at ACWD water treatment plants prior to distribution system use - SWP supplies also provide summer/fall source of groundwater recharge	- Projected cutbacks of up to 96% in droughts - Semitropic improves dry year reliability by storing wet year supplies for use during droughts
SFPUC Purchases		- Minimum purchase amount of 8 mgd (approx. 9000 AF/Yr) - Contract with SFPUC to be re-negotiated in 2009	- High quality supply, low hardness and TDS (no treatment needed)	- Blended with high TDS/hardness local groundwater at blending facility - SFPUC takeoffs provide up to 24 mgd of production capacity (contractual maximum)	- Most reliable source of supply for ACWD - Future reliability based on implementation of SFPUC's CIP - Dry year allocation based on BAWSCA formula, includes disincentive for minimizing normal/wet year use
Local Resources	**Groundwater**	- Primary source of recharge comes from Alameda Creek watershed, quantity available highly variable from year to year - Limitations on groundwater pumping due to seawater intrusion	- Relatively high hardness and TDS, requires blending with SFPUC supplies to meet ACWD quality goals	- Groundwater extracted at Peralta-Tyson and Mowry well fields prior to blending with SFPUC supplies	- Groundwater basin provides limited dry year storage - Recharge source is highly variable, can be reduced significantly in dry years
	Desal	- Source of supply is brackish groundwater in western service area - Annual supply is limited due to seawater intrusion if extraction exceeds recharge	- High quality supply, low hardness and TDS - May require pretreatment for iron and manganese	- Phase 1 Desal provides up to 5 mgd production capacity - Phase 2 (planned) will provide an additional 5 mgd	- Dry year reliability may be impacted by excessive groundwater drawdown during droughts
	Del Valle	- ACWD has 7,500 AF of seasonal storage at Del Valle Reservoir - Small upstream watershed, highly variable source of supply	- Lower hardness and TDS than local groundwater	- Del Valle supplies are treated at ACWD water treatment plants prior to distribution system use	- Due to small Del Valle watershed, dry year supplies may be reduced to zero.
	Recycled Water (planned)	- Phase 1 (1600 AF) planned by 2020. - Project dependent on planned golf courses, sanitary district (USD) participation	- Recycled water project may reduce need for groundwater, thereby improving blend of SFPUC to groundwater at blending facility	- Recycled water facility will be sized to meet peak day needs for recycled water customers, reducing potable system production needs	- Recycled water is considered to be a firm supply, no dry year cutbacks

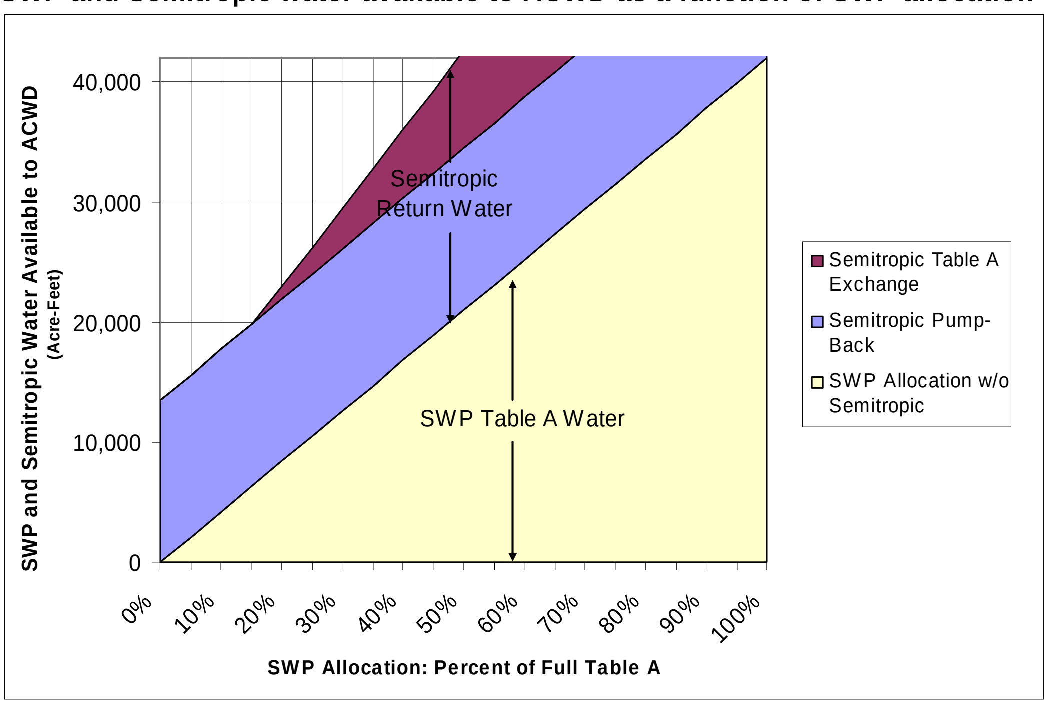
State Water Project Supplies

The District's State Water Project supplies originate in the northern Sierras and are conveyed through the Delta and the South Bay Aqueduct to the ACWD service area. Updated projections provided by the DWR (2005) indicate that these supplies are subject to significant potential cutbacks (i.e. over 95% cutbacks under severe drought conditions) due to hydrologic conditions and environmental concerns regarding the Delta ecosystem. In addition, recent information from the DWR indicates that this entire supply is at risk due to Delta levee failure and subsequent seawater contamination from San Francisco Bay. Under this worst-case scenario, the DWR has estimated that Delta water supplies could be rendered unusable for 3-5 years.

<u>Semitropic Banking of SWP Supplies</u>

In 1996 ACWD secured 50,000 AF of storage at the Semitropic Groundwater Banking Program followed by the purchase of an additional 100,000 AF of storage capacity in 2001. The Semitropic Banking program allows ACWD to store its excess SWP supplies during wet and above normal years, for use during dry years. Stored water can be recovered through exchanges, either a direct exchange of SWP Table A water ("Table A exchange") with Semitropic or by means of a pumpback program whereby water stored in the Semitropic groundwater basin is pumped directly into the California Aqueduct and ACWD exchanges this water with Table A water of downstream SWP contractors ("pumpback"). The pumpback quantity provides a firm 13,500 AF/Yr of dry year return capacity. However, the Table A exchange component is variable, being tied to the SWP availability. That is, the greater the SWP allocation in that year, the more water can be returned via the Table A exchange component. Semitropic banking, coupled with SWP availability in any given year, allows ACWD to have the equivalent of 100% allocation when the SWP allocation alone would be no more than 50% (see Figure 2-4) and raises the projected minimum of 4% of Table A water to over 35%.

Figure 2-4
SWP and Semitropic water available to ACWD as a function of SWP allocation



San Francisco Regional Water Supply

In addition to providing a water supply, the San Francisco Regional Water System also provides ACWD with production capacity. Because of the relatively low hardness of this supply, it is blended with harder local groundwater to extend local supplies and to meet ACWD's water quality goals. As indicated in Figure 2-3, SFPUC Regional Water System supplies are also ACWD's most reliable source of supply.

Key issues regarding the District's future use of San Francisco Regional Water supplies include:

1. Dry year allocation: Under the current dry year water supply allocation formula (Interim Water Supply Allocation Plan), the allocation of San Francisco Regional supplies among BAWSCA agencies in dry years is based, in part, on the previous years' purchases. This provides a disincentive for reducing SFPUC purchases in wet years when other, more cost-effective, sources of supply may be available to ACWD.

2. Costs: San Francisco Regional water is also one ACWD's most expensive sources, and the costs are anticipated to increase dramatically over the next ten years as the SFPUC implements its Capital Improvement Program.

3. SFPUC CIP Implementation: The successful implementation of the SFPUC's proposed Water Supply Improvement Program and Capital Improvement Program is critical to restore and improve the seismic reliability of the San Francisco Regional water supplies.

4. Contract Renewal: Existing water purchase contracts with SFPUC are due to expire in 2009. ACWD is currently working with BAWSCA and SFPUC to negotiate terms for a new contract for this supply.

Local Groundwater

The primary source of recharge for the Niles Cone Groundwater Basin is local runoff from the Alameda Creek Watershed, which is captured, diverted and recharged at the District's groundwater recharge facilities. Infiltration of rainfall and applied water also provides a local source of recharge for the groundwater basin. ACWD also uses a portion of its imported State Water Project supplies for groundwater recharge. ACWD operates two wellfields (Peralta-Tyson and Mowry) to recover potable groundwater. Because of the high hardness of this local groundwater, ACWD blends this source with San Francisco Regional Water System supplies (which have a much lower hardness). Potential future issues regarding the use of local groundwater include: (1) increased TDS and hardness due to increases in salt loading in the Alameda Creek source water (as a result of development and other activities in the upper watershed); and (2) competition for Alameda Creek supplies with environmental needs, including a potential restored steelhead fishery.

Desalination

ACWD completed construction of the Phase 1 (5 mgd) Newark Desalination Facility (Desal Facility) in 2003. The source water for this facility is the District's Aquifer Reclamation Program (ARP), which pumps brackish groundwater from portions of the groundwater basin previously impacted by seawater intrusion. Prior to the implementation of the Desal Facility, the brackish groundwater extracted from the ARP wells was discharged to flood control channels which flowed to San Francisco Bay. Permeate (treated water) from the Desal Facility is very low in mineral content, and as such, raw water from the ARP wells is blended with the permeate to provide a balanced mineral content and hardness, prior to delivery to customers.

ACWD plans on expanding the Desalination Facility to 10 mgd and has received a $2.8 million grant from the DWR for the expansion.

Del Valle Reservoir

ACWD has 7,500 AF of seasonal storage capacity at Del Valle Reservoir; however, the amount of supply available from year to year is highly variable. The use of water from Del Valle, when available, allows ACWD to reduce SWP imports into the service area, thereby providing for additional SWP supplies for Semitropic storage.

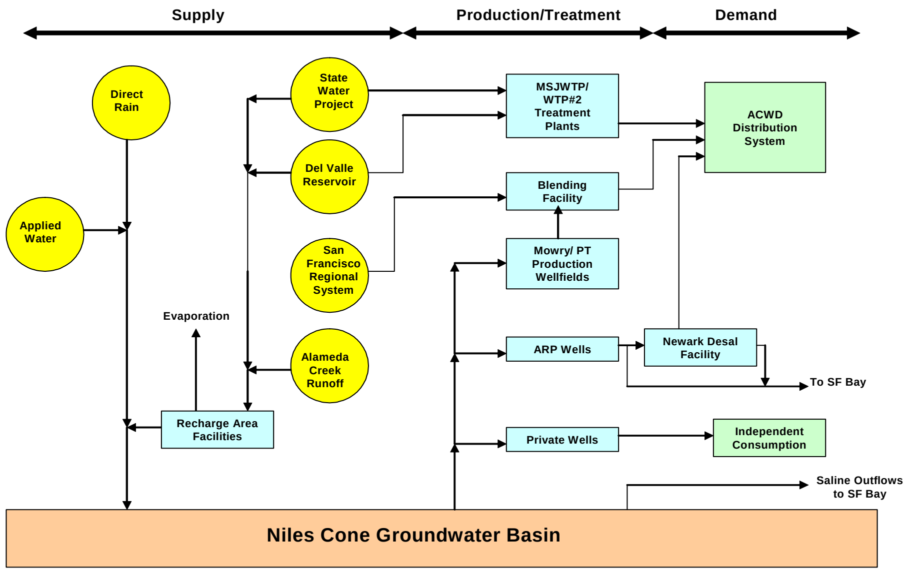
Recycled Water (Planned)

ACWD's 1995 IRP water supply strategy includes plans for a recycled water project in the service area by the year 2020. As recommended in the 1995 IRP, a brackish groundwater desalination facility was implemented prior to a recycled water project because the desalination project was determined to be more cost-effective while also providing a high-quality potable source of supply (as opposed to a non-potable recycled water supply). ACWD's IRP strategy includes providing up to 1,600 AF/Yr of recycled water by the year 2020. In 2003, ACWD and Union Sanitary District completed a feasibility study of a satellite recycled water project that could provide up to 1,600 AF/Yr of recycled water. However, demands from the primary customers (two planned golf courses) have not yet materialized. It is unlikely that this project will proceed, as currently planned, without the implementation of at least one of these golf courses.

2. 4 WATER SUPPLY FACILTIES AND OPERATING CONSTRAINTS

As shown in Figure 2-5, the District's water production and treatment facilities include two surface water treatment plants, two freshwater wellfields, a blending facility, a desalination facility and Aquifer Reclamation Program wells. The District's water treatment plants (Mission San Jose WTP [MSJWTP] and Water Treatment Plant No. 2 [or WTP2]) treat surface water from the State Water Project and Del Valle Reservoir. The Blending Facility blends relatively hard local groundwater from the District's Mowry and Peralta Tyson wellfields with softer water from the San Francisco Regional Water System. The District's Aquifer Reclamation Program (ARP) wells pump out brackish groundwater from portions of the basin previously impacted by seawater intrusion. This brackish water is treated at the District's desalination facility and provided as a potable supply to the distribution system.

Figure 2-5
ACWD Water supply and Production Schematic



The following provides an update of ACWD's: (1) water quality goals; (2) existing and planned production facilities; and (3) local groundwater management.

Water Quality Goals

The highest priority for ACWD is to ensure that all potable water delivered to ACWD's customers meets or surpasses the state and federal drinking water standards, as set by the California Department of Health Services and U.S. Environmental Protection Agency, respectively. All of ACWD's production and treatment facilities are designed, constructed and operated to meet these standards. In addition, the 1995 IRP also set goals to meet aesthetic standards for ACWD's potable water supplies (defined in terms of hardness). The adopted IRP goal, as modified as part of the subsequent 1996-2001 Engineer's Report, is to provide water with a maximum hardness of 150 ppm in all months except summer months. During the high demand conditions in the summer months (June through September), the maximum monthly hardness goal is 175 ppm.

In general, ACWD plans to meet these goals by either: (1) blending high quality (low hardness) water with local groundwater to lower the overall hardness of the delivered water (e.g. such as blending Hetch-Hetchy water with local groundwater at the Blending Facility); and/or (2) removing minerals and other impurities that contribute to hardness from the local groundwater through reverse osmosis treatment (e.g. treating brackish groundwater at the Newark Desalination Facility). The operating assumptions of the Blending Facility (and the corresponding use of local groundwater and San Francisco Regional supplies) are largely dictated by these hardness goals. In addition, ACWD also actively manages the Niles Cone Groundwater Basin to protect it from increases in salinity and hardness. As part of this effort, ACWD has worked closely with upstream stakeholders in the Alameda Creek Watershed to ensure that source waters utilized for groundwater recharge are protected.

Table 2-4 provides a summary of the ACWD hardness goal as well as assumptions utilized in this IRP Review for hardness of source water at the District's Blending Facility.

Table 2-4
ACWD Water Quality Goals and Planning Assumptions

ITEM	***HARDNESS (ppm)***
IRP Goals	
Average Month (Oct – May)	**150 ppm**
Maximum Month (June – Sept)	**175 ppm**
Blending Facility Planning Assumptions	
Mowry Wellfield	**320 ppm**
Peralta Tyson Wellfield	**280 ppm**
San Francisco Regional (Hetch-Hetchy)	**15 ppm**

Existing Production Facilities

As described above, ACWD's existing water production and treatment facilities include surface water treatment plants, a blending facility (combination of local groundwater and San Francisco Regional Water supply), and a brackish groundwater desalination facility (Figure 2-6). Due primarily to its size, ACWD's distribution system has evolved in such a manner that different supplies serve different facilities, which in turn serve different parts of the system. This creates an additional consideration in planning how ACWD is to manage its resources, particularly in dry years. For example, ACWD's surface water treatment plants (SWTPs) cannot effectively serve the northern parts of the service area (which are normally served by the Blending Facility). In a normal year, this may restrict the possibility of expanding the use of lower-cost treated State Water Project or Del Valle water. In addition, during a locally dry year with low groundwater elevations, ACWD may have difficulty using the SWTPs to supplement local groundwater produced at the Blending Facility.

Figure 2-6
ACWD Existing and Planned Production Facilities

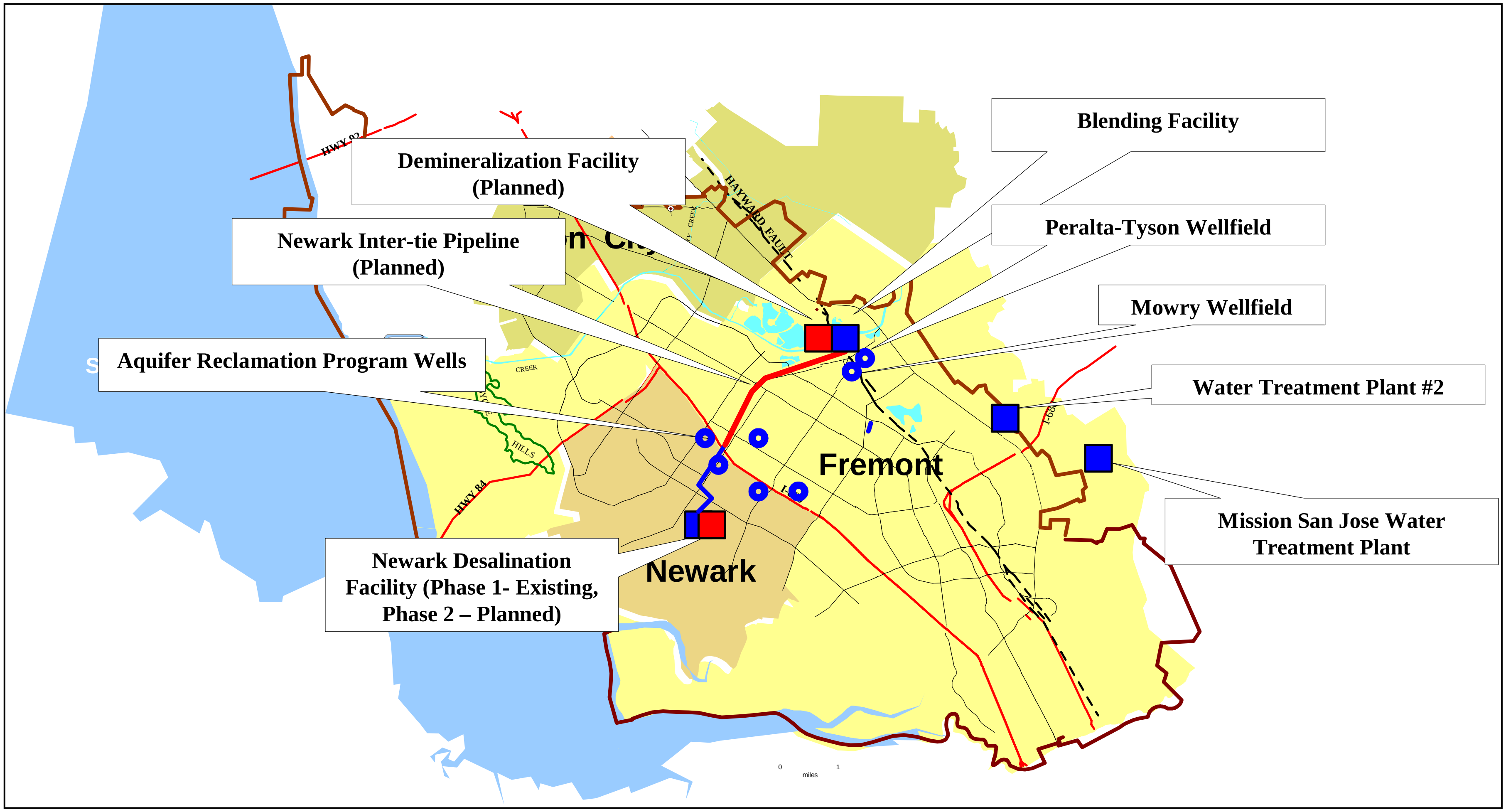


Table 2-5 provides a summary of the District's production facilities and the key assumptions for the water supply and operating criteria incorporated in this 10-year IRP Review.

Table 2-5
ACWD Existing Production Facilities

PRODUCTION FACILITY	***SOURCE WATER***	***MAXIMUM CAPACITY (mgd)***	***OPERATING CONSTRAINTS AND ASSUMPTIONS***
Surface Water Treatment			
- Mission San Jose WTP	SWP, Del Valle	4 - 7.5 mgd	Capacity variable depending on time of year. Reduced capacity assumed in non-peak months.
- WTP2	SWP, Del Valle	14 - 21 mgd	
Blending Facility			
- Mowry Wellfield	Groundwater (BHF)	15 mgd	Groundwater production rates may be impacted by lower groundwater elevations.
- Peralta-Tyson Wellfield	Groundwater (AHF)	14.5 mgd	
- SFPUC Takeoff	Hetch-Hetchy Reservoir and Alameda Creek Watershed	24 mgd	Per SFPUC contract, maximum daily takeoff is 24 mgd.
- Blending Facility	Goundwater and SFPUC	48 mgd	Blending facility constrained by hardness goals (150/175 ppm) under non-drought operating conditions
Newark Desalination Facility			Newark Desalination Facility with ARP Blend-Around targets 100 ppm hardness year-round. Minimum Desal operating rate of 2.5 mgd to avoid "pickling" membranes.
- Desal Facility	ARP wells	5 mgd	
- ARP Blend around	ARP wells	0.5 mgd	
- Total Desal	Desal permeate and ARP wells	5.5 mgd	

Planned ACWD Production Facilities

ACWD's planning for new production facilities is based on the goals and objectives established in the 1995 IRP, with further refinement as part of the development of the Engineer's Report and Capital Improvement Program. As of 2005, planned future production facilities include: (1) an expansion of the Newark Desalination Facility to 10 mgd; (2) construction of the first phase of a demineralization facility to treat local groundwater from the Mowry and Peralta-Tyson wellfields ("Demineralization Facility"); and (3) an inter-tie pipeline to convey groundwater from the wellfields to the Desal Facility for blending ("Newark Inter-tie Pipeline"); These planned facilities are shown in Figure 2-6 and described in greater detail in Table 2-6 below.

Table 2-6
Planned ACWD Production Facilities

FACILITY	DESCRIPTION	PRIMARY BENEFITS
Phase 2 Newark Desalination Facility	Expansion of the existing Newark Desalination Facility from 5 mgd to 10 mgd. Source water will continue to be brackish groundwater from ARP wells.	- Production capacity - Water quality - Water supply (normal and wet year) - Reliability (production west of the Hayward Fault)
Demineralization Facility (Phase 1)	Reverse osmosis treatment facility (4 mgd) to remove minerals and reduce hardness of local groundwater from Mowry and Peralta-Tyson wellfields.	- Water quality
Newark Inter-tie Pipeline	Pipeline to connect Mowry and Peralta-Tyson wellfields with Newark Desalination Facility, allowing for blending of high quality desal permeate with groundwater to reduce hardness. Project will also improve the blending ratio of Hetch-Hetchy to groundwater at the Blending Facility, and will allow for Mowry and Peralta-Tyson wellfield water to be treated at the Newark Desalination Facility.	- Water quality

Each of these facilities is further evaluated in Chapter 3 – IRP Review Analyses.

Groundwater Management

A key consideration in this 10-year IRP Review is the management of the Niles Cone Groundwater Basin, including the associated groundwater recharge facilities and wellfields. Since the IRP was adopted in 1995, the District has completed a rehabilitation of the Quarry Lakes recharge facilities, including reconfiguring several of the recharge ponds and stabilizing the banks of the ponds. ACWD has also updated its groundwater management policy to include the protection of upstream source waters as a means to maintain and protect the water quality in the groundwater basin.

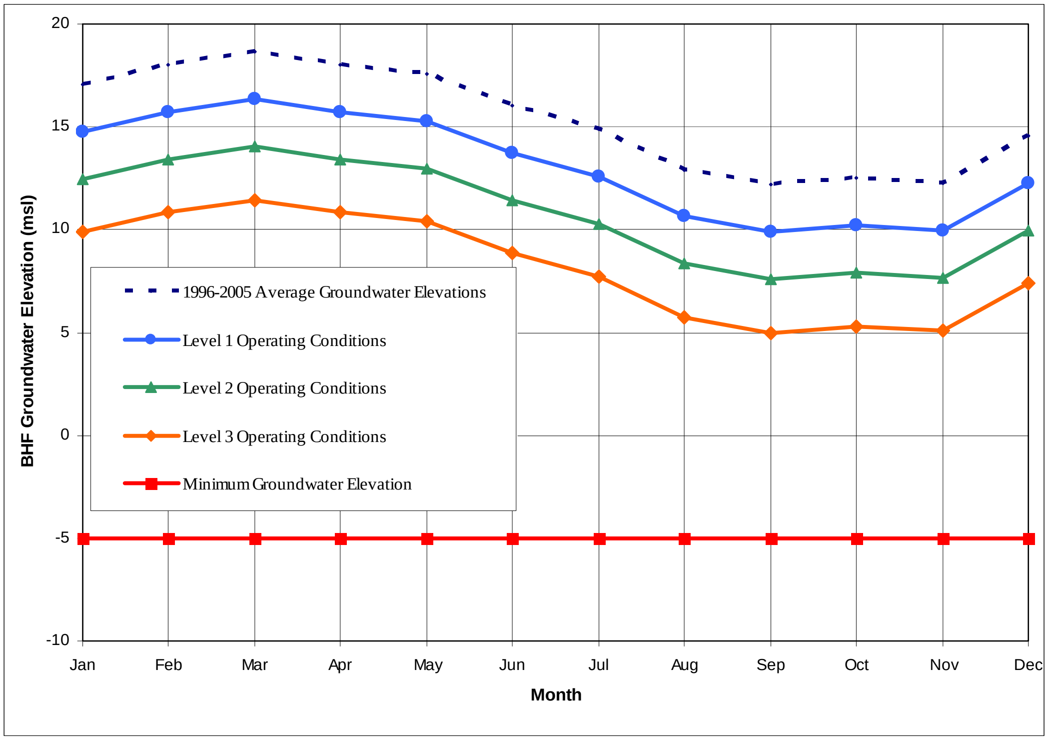
As described in the 2006 UWMP, the Niles Cone Groundwater Basin is separated by the Hayward Fault into two distinct aquifer systems, known as the Above the Hayward Fault ("AHF") and Below the Hayward Fault ("BHF") aquifers. ACWD's groundwater recharge facilities and wellfields are located in both the AHF and BHF aquifers. In general, the AHF aquifer system is much smaller than the BHF aquifer, is isolated from seawater intrusion (due to the Hayward Fault which acts as a groundwater barrier), and due to its small size, has very limited storage capacity. As such, the AHF aquifer is primarily operated in a "put and take" mode whereby annual groundwater recharge and extraction are generally balanced. Because the BHF aquifer is much larger, it is operated in a conjunctive use mode whereby water can be stored in the aquifer from one year to another. However, the amount of storage is limited due to maximum and minimum operating levels which have been established to: (1) prevent excessive outflows (if groundwater elevations are maintained too high), and (2) prevent seawater intrusion (if groundwater elevations are too low). The eastern portion of the BHF aquifer is characterized by fresh water conditions; however this transitions into brackish groundwater in the central and western portion of the basin. ACWD's Aquifer Reclamation Program (ARP) has been developed to reclaim the portions of the basin previously impacted by seawater intrusion.

ACWD's priorities for managing the groundwater basin include: (1) ensuring adequate water supply and (2) protecting and reclaiming the groundwater basin from seawater intrusion. For purposes of this IRP review, specific operating assumptions have been developed for continued management of this resource. Table 2-7 provides an overview of the general operating assumptions, while Figure 2-7 provides assumptions for monthly target elevations in the BHF aquifer system under a range of hydrologic conditions.

Table 2-7
Groundwater Management Operating Assumptions

ITEM	*OPERATING ASSUMPTION*
Groundwater Target Operating Levels, mean seal level (msl)	
- AHF Range of Operating Levels	+20' to +40' msl
- BHF Range of Operating Levels	+10' to +20' msl
- BHF Minimum Operating Level (dry year)	- 5' msl
Aquifer Reclamation Program	
-Target Pumping (Normal Year)	7,000 AF/Yr
-Target Pumping (Dry Year)	6,000 AF/Yr

Figure 2-7
BHF Groundwater Basin –Operating Assumptions for 10-Year IRP Review



Notes:

1. 1996-2005 Average Groundwater Conditions represents current average, end of month levels (post Quarry Lake Rehabilitation). This 10-year period is characterized by normal to wet local conditions.

2. Level 1 Operating Conditions represent lower extent of ACWD's annual put/take operation for conjunctive use. Operation below this line begins to draw on dry year groundwater reserves. The following operating assumptions are assumed if BHF groundwater elevations drop below these levels:

   - No discretionary ARP pumping (i.e. all ARP pumping is routed to the Desalination Facility, no direct discharge of ARP water to the Bay); and
   - Increase recharge imports to sustain groundwater production capacity and remain above the Level 1 Conditions

3. Level 2 Operating Conditions reflect continued lowering of the groundwater basin, representing below normal year conditions. The following operating assumptions are assumed if groundwater elevations drop below these levels:

   - Minimize ARP pumping;
   - Demineralization Facility (if implemented) offline to minimize concentrate discharge;
   - Reduce groundwater production and increase SWTP production;
   - Fully utilize available imported water supplies; and
   - Further increase recharge imports including during the diversion season (i.e. winter/spring months).

4. Level 3 Operating Conditions represent dry year operating conditions. For planning purposes, this line also represents the target minimum groundwater levels during the first year of a drought. However, groundwater levels may drop lower if available groundwater storage (above level 3 conditions) is less than 10,000 AF during the first year of the drought. In addition, the following operating assumptions are assumed:

   - Base load water treatment plants to extent possible; minimize use of groundwater; and
   - Maximize use of all available imported water including Semitropic supplies.

5. The Minimum Groundwater Elevation (five feet below mean sea level, or -5 feet msl) represents the lowest temporary operating elevation that can occur without inducing new seawater intrusion.

CHAPTER 3
IRP REVIEW ANALYSES

The purpose of this section is to document the IRP Review analyses, including the development of new planning models, verification that ACWD is on track to meet its water supply reliability and water quality goals, the optimization of planned facilities to achieve these goals, and a review of potential risks and uncertainties that may impact ACWD's ability to achieve these goals.

3.1 VERIFICATION OF IRP

Development of Planning Models

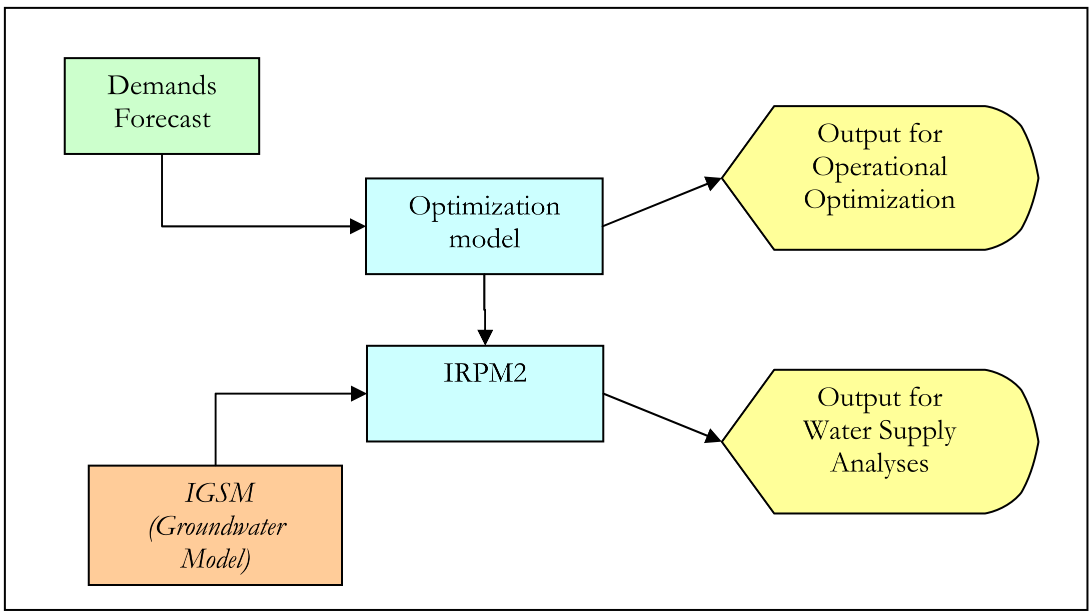
The process of verifying ACWD's ability to meet the 1995 IRP goals and criterion relies heavily on computer models. These models provide the means to test supply options and production facilities, based on performance assumptions, under a variety of hydrologic conditions as well as anticipated future levels of demand. Several models were developed or modified for use in the IRP review process and are summarized in Table 3-1 below.

Table 3-1
Models used for IRP verification and optimization

MODEL	DESCRIPTION	PRIMARY USE IN IRP	OUTPUT
Demand Forecast Model	Spreadsheet model that combines City development plans with GIS data for vacant lands.	Provide baseline demands in all years	Net system demand factoring in natural conservation. Provides end-use break down as well
Integrated Resources Planning Model 2 (IRPM2)	Monthly model to test ACWD ability to provide water under a wide variety of historic hydrologic conditions, covering years 1922-1994.	Test long-term water supply impacts. Test ACWD ability to meet IRP goals for shortages during extended dry-periods and water quality (hardness).	Monthly and annual: - water supply - water production - shortages - water quality (hardness)
Optimization model	Produces suggested monthly production budget based on a wide variety of objectives	Produce variable-cost optimized assumptions for use of facilities.	Monthly production figures for each facility. Variable production cost.
Other models instrumental to the development of the above listed models.			
Integrated Groundwater-Surface Water Model (IGSM)	Groundwater model.	Used to develop simplified model of Groundwater basin for use in the IRPM2	GW storage and elevation data
Groundwater Recharge Facilities Model (GWRFM)	Daily model to estimate groundwater recharge.	Integrated into the IRPM2. Test sensitivities to potential future modifications to ACWD recharge operations	Daily recharge and groundwater levels

Figure 3-1 provides an overview of how these models are used in the planning process. In general, the Integrated Resources Planning Model (IRPM2) was utilized to conduct water supply analyses under a wide-range of hydrologic conditions, including critical dry year and multiple-dry year conditions.   This analysis was performed to confirm that ACWD's projected supplies and production facilities are sufficient to meet future demands. The optimization model was utilized to evaluate alternative production and resource usage under average year conditions. This optimization analysis was performed to: (1) evaluate the operation of production facilities; and (2) evaluate the need for new production facilities such that capital and operating costs could be minimized, while still achieving the water supply reliability and water quality goals established in the 1995 IRP.

Figure 3-1
IRP Review Modeling Process



IRP Review Planning Scenarios

As part of the IRP verification process, "baseline" IRP scenarios were evaluated utilizing the modeling methodology discussed above. These scenarios include future conditions (years 2010, 2020 and 2030 conditions) which are based on projected demands, and assume the implementation of new production/treatment facilities as included in the District's 2005 Capital Improvement Plan (note: the CIP has been modified since 2005). In each scenario, the District's planning model (IRPM2) was utilized to analyze the ability to meet the 1995 IRP water supply and water quality goals under a range of water supply and hydrologic conditions. Each of these IRP review scenarios is summarized in Table 3-2 below:

Table 3-2
IRP Verification - Facilities Assumptions

IRP SCENARIO	DISTRIBUTION SYSTEM DEMAND (MGD)	DESCRIPTION	PRODUCTION FACILITIES
2010 Conditions	52.5 mgd	Projected future demand conditions (2010) with assumption that all potable water production facilities will be on-line.	Existing facilities, plus: - Phase 2 Desal - Demineralization - Inter-tie Pipeline
2020 Conditions	54.5 mgd	Projected future demand conditions (2020) with assumption that all planned potable water production and recycled water facilities will be on-line.	2005 Facilities, plus: - Phase 2 Desal - Demineralization - Inter-tie Pipeline - Recycled Water
2030 Conditions	55.4 mgd	Projected future demand conditions (2030) with assumption that all planned potable water production and recycled water facilities will be on-line	2005 Facilities, plus: - Phase 2 Desal - Demineralization - Inter-tie Pipeline - Recycled Water

IRP Review Verification Results

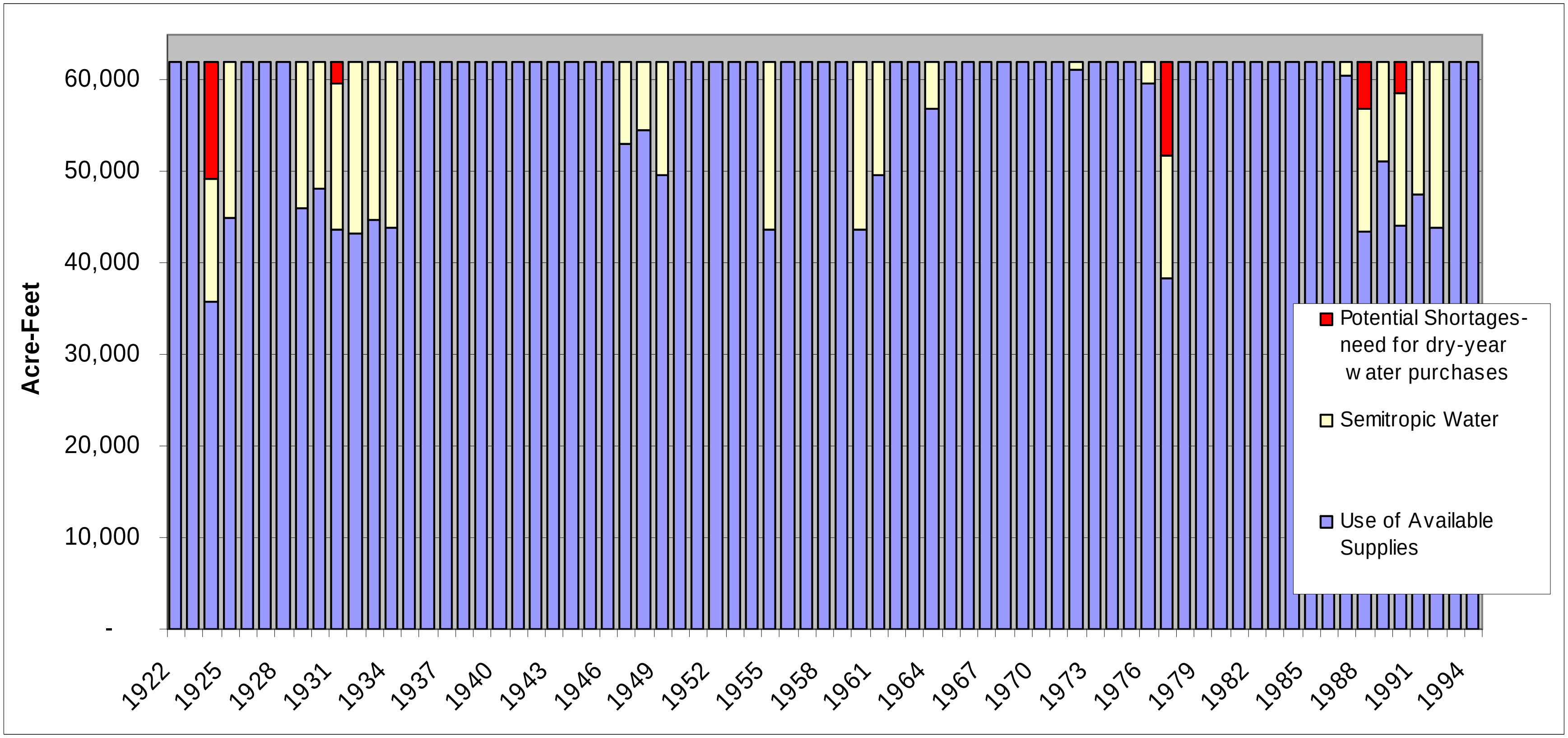
The results of the IRP verification model runs are presented in Table 3-3 below. In general, the verification process has confirmed that ACWD is on track to meet its water supply and water quality goals. Specifically, through the update of key planning assumptions (e.g. water demands, supply availability, facility planning, etc) and through the use of new planning models, it has been verified that:

- Under most conditions, ACWD's water supply reliability objectives (i.e. no more than 10% shortage on a 1 in 30 year frequency) can be met with ACWD's current implementation plan. The ability to meet the IRP water supply reliability goals is due in large part to: (1) securing storage at Semitropic Groundwater Banking Program; and (2) construction of the desalination facility. The Semitropic program significantly improves the dry year reliability of ACWD's SWP supplies, while the Desalination Facility provides a new, in-District supply that frees up SWP supplies to be sent to Semitropic for storage in normal and wet years. However, under relatively infrequent critically dry year conditions, ACWD may not have sufficient supplies to meet its reliability goals. For example, under 2030 conditions potential shortages exceeding 10% would occur on a 1 in 37 year frequency (Figure 3-2). Under these conditions ACWD may limit the shortages by purchasing water from a DWR drought water bank or similar program.

Table 3-3
IRP Verification Results – Water Supply Reliability, Groundwater Elevations and Water Quality

IRP SCENARIO	WATER SUPPLY RELIABILITY			GROUNDWATER MANAGEMENT			WATER QUALITY
	Frequency of Shortages	Frequency of shortages greater than 10%	Max Single Year Shortage	Frequency of BHF Elevation below 3' msl	Frequency of BHF Elevation below 0' msl	Maximum consecutive period below 0' msl	Frequency that Hardness Goals are not met
2010 Conditions	1 in 24 yrs	1 in 73 yrs	19%	1 in 7 yrs	1 in 37 yrs	2 yrs	1 in 7 yrs
2020 Conditions	1 in 18 yrs	No shortages exceeding 10%	9%	1 in 6 yrs	1 in 37 yrs	2 yrs	1 in 37 yrs
2030 Conditions	1 in 15 yrs	1 in 37 yrs	21%	1 in 3 yrs	1 in 12 yrs	2 yrs	1 in 10 yrs

Figure 3-2
Projected Distribution Supply and Shortages under 2030 Conditions
(based on 1921-1994 hydrologic conditions)



- ACWD can meet hardness goals in all years except during certain drought conditions. As described in Table 3-3, the modeling analyses indicates that ACWD can meet its hardness goals (i.e. 150 ppm non-peak months and 175 ppm summer months) at the Blending Facility during most years. Under certain drought conditions, ACWD will not be able to meet the hardness goals, primarily due to: (1) cutbacks in San Francisco Regional supplies; and (2) the need to temporarily shut-down the proposed Demineralization Facility under drought conditions (in order to conserve the local groundwater supplies, assuming 75% efficiency, a 4 mgd Demineralization Facility would “lose” approximately 1 mgd as concentrate discharge) and (3) the need to reduce ARP pumping to 6,000 AF/Yr, also to conserve local groundwater supplies. However, because these occurrences are projected to be rather infrequent (1 in 10 years under 2030 conditions), it is not considered to be a significant deviation from the 1995 IRP goals.

- Some shortages may result from impaired production capacity at groundwater facilities due to lowered groundwater elevations during dry periods. Under the assumptions provided, Peralta-Tyson wellfield capacity is diminished by concerns of air-entrainment at lower groundwater levels.

- In addition to the reliance on the Semitropic Groundwater Bank during dry year conditions, ACWD will also need to rely heavily on storage in the Niles Cone Groundwater Basin. During these drought conditions, ACWD may be required to temporarily extract more water from the basin than is being replenished. This use of local dry year groundwater “reserves” is essential to meeting ACWD’s water supply reliability goals. However, a constraint on the operation of the groundwater basin is to limit extractions to prevent any significant amount of new seawater intrusion from occurring. The IRP Review analyses indicates that the groundwater basin will be drawn on more heavily as the demand increases over time (reflected in the increase in frequency in which groundwater elevations will be drawn down to below 3’ msl). However, under all scenarios the groundwater basin will be maintained above -5’ msl (a 1995 IRP operating constraint) and with a maximum duration of two years below sea-level.

- ACWD has improved local control and reduced risk by implementing the Phase I Desal and the Quarry Lakes rehabilitation projects. Both of these projects have significantly improved ACWD’s capability to manage its local resources and increase the overall efficiency of the local groundwater management and supply program. Without these projects, ACWD would have become more dependent on its imported supplies and suffered greater shortages during dry-periods.

Based on this verification analyses, ACWD is on track to achieving 1995 IRP goals it has set for itself. With the updated planning assumptions, ACWD will have the capability to meet its water supply reliability and water quality goals under most conditions. Therefore, a major revisit of the IRP supply scenarios and analyses of new alternatives is not considered to be necessary. However, as described in the next section, a review of the planned production/treatment facilities is warranted.

3.2 OPTIMIZATION ANALYSES

The purpose of the facility optimization analyses is to further review the planned production and treatment facilities to verify the role of these facilities in meeting the District's IRP goals. As described in Section 2, ACWD's planned supply and production facilities include:

- Phase 2 Newark Desalination Facility ("Phase 2 Desalination")
- Groundwater Demineralization Facility ("Demineralization Facility");
- Newark Inter-tie Pipeline ("Inter-tie Pipeline"); and
- Recycled Water Treatment and Distribution System ("Recycled Water project")

Of these planned facilities, the optimization analysis is primarily focused on the Demineralization Facility and Inter-tie Pipeline. ACWD has already received state and local funding for the Phase 2 Desalination Facility, and planning for this facility is well underway. The optimization analyses assume that this project will be completed in the next several years, and it is therefore included in all optimization scenarios. In addition, previous analysis by ACWD has indicated that the recycled water project would become feasible only when projected demands at two planned golf courses materialize. It is assumed that once on-line, this facility will be base-loaded. If the demands do not materialize, then it is unlikely that the recycled water project, as currently configured, would proceed. Therefore, the recycled water project is considered to be primarily dependent on these new demands and is included as a common element in all optimization scenarios.

Table 3-4 summarizes the optimization scenarios that were developed and analyzed:

Table 3-4
IRP Review Optimization Scenarios

OPTIMIZATION SCENARIO	FACILITY ASSUMPTIONS
Scenario 1: 2030 Baseline	Existing facilities, plus: - Phase 2 Desalination - Demineralization Facility - Inter-tie Pipeline - Recycled water project
Scenario 2: Phase 2 Desal only	Existing facilities, plus: - Phase 2 Desalination - Recycled water project
Scenario 3: No Inter-tie Pipeline	Existing facilities, plus: - Phase 2 Desalination - Demineralization Facility - Recycled water project
Scenario 4: No Demineralization Facility	Existing facilities, plus: - Phase 2 Desalination - Inter-tie Pipeline - Recycled water project

The optimization model was utilized in this analysis to determine the ability of the above facility scenarios to meet ACWD's water quality goals and production demands, while minimizing variable costs. This analysis is based on projected 2030 levels of demands and assumes average year (median) hydrologic conditions and water supply availability. Other key assumptions common for each optimization scenario are listed in Table 3-5 below. Input data to the optimization model also included projected variable operation and maintenance costs for each production/treatment facility, including power, chemical, and purchased water costs. Annualized capital costs for each new facility (excluding recycled water) were also considered in the analysis. These cost assumptions are summarized in Table 3-6 below.

Table 3-5
Optimization Analyses – Common Assumptions

ITEM	DESCRIPTION
Demand Conditions	2030 Demands (55.4 mgd)
Water Supply/Production	
- Groundwater	A combined 27,000 AF available to Mowry, Peralta-Tyson and ARP wellfields. ARP pumping limited to a maximum of 14,000 AF/Yr
- Surface Water	A combined 26,000 AF from SWP and Del Valle treated at TP1 and TP2.
- San Francisco Regional	Contractual maximum available
- Recycled Water	Phase 1 recycled water project provides 1600 AF/Yr
- Other	Desalination and Demineralization minimum flow at 50% of design capacity to avoid "pickling" of reverse osmosis membranes
Groundwater Quality (Hardness) [(1)]	
- Mowry Wellfield	290 – 340 ppm
- Peralta-Tyson Wellfield	270 - 275 ppm
Blended Water Quality Goals	
- Average Month Hardness	150 ppm
- Summer Month Hardness	175 ppm
- Minimum Hardness	100 ppm
- Maximum monthly variation	25 pm

Note: (1) For purpose of optimization analyses, Mowry and Peralta Tyson Wellfield hardness levels are assumed to be variable depending on wellfield production rate and preferential well selection, based on 2005 water quality conditions.

Table 3-6
Optimization Analyses – Variable and Capital Costs Assumptions

ITEM	COST
Variable Costs[1] (Projected 2030 costs, in 2005$), $/AF	
Groundwater Production	
Mowry Wellfield	$51/AF - $66/AF
Peralta-Tyson Wellfield	$52/AF - $61/AF
Aquifer Reclamation Program (ARP) Wells	$18/AF
Blending Facility	$6/AF
Desalination Facility[2]	$91/AF - $113/AF
Demineralization Facility[3]	$56/AF - $78/AF
Surface Water Treatment	
Treatment Plant #1 (TP1, or MSJWTP)	$156/AF - $205/AF
Treatment Plant #2 (TP2)	$42/AF - $97/AF
San Francisco Regional Supplies[4]	$924/AF
Capital Costs (2005$), $Million	
Phase 2 Desalination[5]	$11.1
Demineralization Facility	$12.8
Newark Inter-tie Pipeline	$10.5

Notes:

1. Variable costs include power, chemicals, solids handling, and water supply purchase costs. Labor and replacement costs (e.g. membrane replacement costs) are not included. Range in variable costs reflects seasonal variations in power costs and local water supply availability.
2. Desalination variable costs do not include Aquifer Reclamation Program production costs.
3. Demineralization Facility costs estimated to be lower than desalination costs due to lower TDS concentrations in source water. Costs do not include groundwater production costs.
4. San Francisco Regional Supply costs are based on projected 2016 purchase costs ($1469/AF), expressed in 2005$ (assuming a 4% inflation rate)
5. Phase 2 Desalination costs do not include funding from the Proposition 50 desalination grant ($2.8 million) and other non-District funding (approximately $8 million).

For each scenario, the optimization model was run with the goal of meeting production demands and hardness goals, while minimizing the overall costs. Key decision variables included monthly groundwater pumping at each of the wellfields (ARP, Mowry and Peralta-Tyson), and monthly production at the Blending, Demineralization and Desalination facilities.

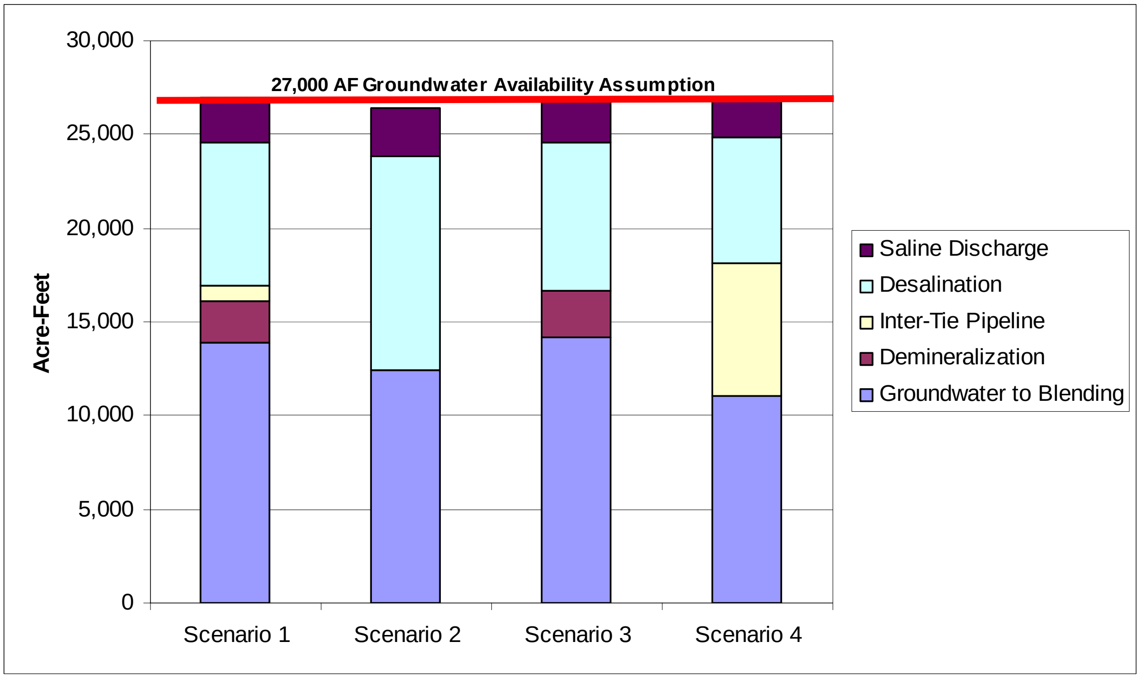
The results from the optimization analyses are presented in Figure 3-3 and Table 3-7 below. As shown in the table, the modeling analyses indicate that, under the assumptions outlined in Table 3-5, ACWD would be able to meet all of its 2030 production demands and water quality goals under all four facility scenarios. The results also indicate that, under these water quality, supply and operating assumptions, the most-cost effective combination of future facilities would include a combination of the Phase 2 Desalination and the Newark Inter-tie Pipeline, but would not include the Demineralization Facility (i.e. Scenario 4).

Table 3-7
Optimization Model Results

Item	Scenario 1 (Baseline)	Scenario 2	Scenario 3	Scenario 4
Facilities	- Phase 2 Desal - Demineralization - Inter-tie	- Phase 2 Desal	- Phase 2 Desal - Demineralization	- Phase 2 Desal - Inter-tie
Ability to Meet 2030 Production Demands and Water Quality Goals				
2030 Production Demands	Yes	Yes	Yes	Yes
Hardness Goals	Yes	Yes	Yes	Yes
Changes from Projected Baseline (Scenario 1) Costs[1]				
Variable	---	+$590,000/Yr	+$35,000/Yr	-$190,000/Yr
Variable and Annualized Capital	---	-$744,000/Yr	-$565,000/Yr	-$918,000/Yr

Notes: (1) Cost estimates are based on projected 2030 variable costs and are shown in 2005 $$. A positive value indicates costs are higher than the Baseline scenario, and a negative value indicates that the projected costs are less than that of the Baseline scenario. Annualized capital costs are net of non-ACWD funding (e.g. grant funding), based on a 30 year amortization and 4% discount rate.

Figure 3-3
Optimization Modeling Results - Annual Production from Groundwater Facilities



Other key observations regarding the optimization analyses include:

- With the modeling assumptions outlined above, a combination of the Phase 2 Desalination and Inter-tie Pipeline provides the most cost-effective means of meeting the District's projected production demands, while still achieving the water quality goals established as part of the 1995 IRP. The modeling analysis also indicates that the Phase 2 Desalination, without Demineralization and the Inter-tie Pipeline (Scenario 2), could achieve the same production and water quality goals. However, the variable costs under this scenario are substantially higher, primarily due to the need for: (1) higher annual production rates at the desalination facility, and (2) the need for more imported water purchases to serve the Blending Facility (as compared with Scenario 4, Phase 2 Desalination Facility and Inter-tie Pipeline). These increased variable costs in Scenario 2 exceed the additional annualized capital costs (for the Inter-tie Pipeline) included in Scenario 4.

- The Demineralization and Phase 2 Desalination Facilities would provide similar, and to a large degree, redundant benefits in terms of meeting hardness goals in future years. That is, the additional 5 mgd capacity at the Desalination Facility provides the opportunity to reduce the groundwater needed for the Blending Facility, thereby increasing the ratio of high quality San Francisco Regional water with the harder local groundwater. The Demineralization Facility, on the other hand, would accomplish the same goal (improving the ratio of high quality water to hard groundwater) by lowering the hardness of a portion (up to 4 mgd) of the groundwater before it enters the Blending Facility. However, the Phase 2 Desalination provides the added benefits of: (1) providing additional production capacity; and (2) providing a new water supply for the District (during years that groundwater conditions allow for additional ARP pumping). In addition, because the Demineralization Facility would likely require additional staffing, ACWD would save in labor costs under scenario 4.

- Evaluation of Scenario 1 (Baseline Conditions) indicates that the Inter-tie Pipeline and Demineralization Facility also provide redundant benefits, with the result being that the Inter-tie Pipeline has minimal use (when both facilities are evaluated together). In effect, the Demineralization Facility is utilized to meet hardness goals, even though it may be less expensive to use the combination of Phase 2 Desalination and Inter-tie Pipeline to achieve these same goals. This is primarily due to an operating constraint, set as input to the optimization model, that requires the Demineralization Facility to operate at a minimum capacity of 2 mgd. This minimum operating flow was incorporated to eliminate the potential for temporarily shutting this facility down, which would require "pickling" of the membranes (an expensive process that also would reduce the useful life of the membranes). No minimum operating constraint is placed on the operation of the Inter-tie Pipeline

As a next step, Scenario 4 was further analyzed to confirm that this scenario would be able to meet the District's water supply reliability goals under a range of hydrologic conditions. Subsequent modeling analyses utilizing the District's planning model (IRPM2) has confirmed that Scenario 4 (no Demineralization Facility) could achieve the same long-term water supply reliability and water quality goals as that of the 2030 Conditions scenario (with Demineralization Facility), as evaluated in Section 3.1.

3.3 CATASTROPHIC LOSS OF SUPPLIES

The purpose of this section is to evaluate the potential water shortage impacts that the ACWD service area may face in the event of the catastrophic loss of supplies. Recently, several state-funded studies have focused on Delta levee failure and the associated impacts. The Delta levees are acknowledged to be susceptible to massive failure during a major earthquake. Such a levee failure would result in seawater intrusion from San Francisco Bay and the entrapment of billions of gallons of salt water in the Delta, rendering the water undrinkable. Even if the levees were repaired, the salt and brackish water would remain trapped within the Delta. The California Department of Water Resources has estimated that it could take 3 to 5 years to reclaim the Delta to freshwater conditions after a massive Delta levee failure. Under this scenario, ACWD could lose both its State Water Project supply and Semitropic storage, which are conveyed through the Delta, for this extended period.

The prospects of an extended supply failure with ACWD's other primary supplies (San Francisco Regional or local supplies) are assumed to be less severe. Previous analyses by the SFPUC and BAWSCA have indicated that a San Francisco Regional supplies could be interrupted for up to 60 days to Hetch-Hetchy Aqueduct failures, however this is considered to be relatively short-term as compared with the 3 to 5 year loss of SWP supplies. Similarly, it is also assumed that if a massive loss of local wells and recharge facilities were to occur due to a major seismic event, replacement facilities (e.g. cofferdams and new production wells) could be installed in a relatively short time frame. Therefore, the focus of this analysis is on ACWD's State Water Project supplies and the potential impacts associated with the loss of these supplies due to a catastrophic failure of Delta levees.

This scenario evaluates ACWD's ability to provide water without the SWP supplies under two 5-year periods representing: (1) critically dry conditions; and (2) average hydrologic conditions. The analysis was conducted utilizing the District's Integrated Resources Planning Model (IRPM2), assuming 2030 demand conditions and full implementation of the District's Capital Improvement Program, including Phase 2 Desalination, Newark Inter-tie Pipeline, and recycled water facilities. The analysis did not include use of the proposed Demineralization Facility. In order to conserve water (i.e. concentrate discharge, assumed to be 25% of inflow), it is assumed that this facility, if implemented, would be off-line during a water shortage emergency.

Other key assumptions in the analyses include:

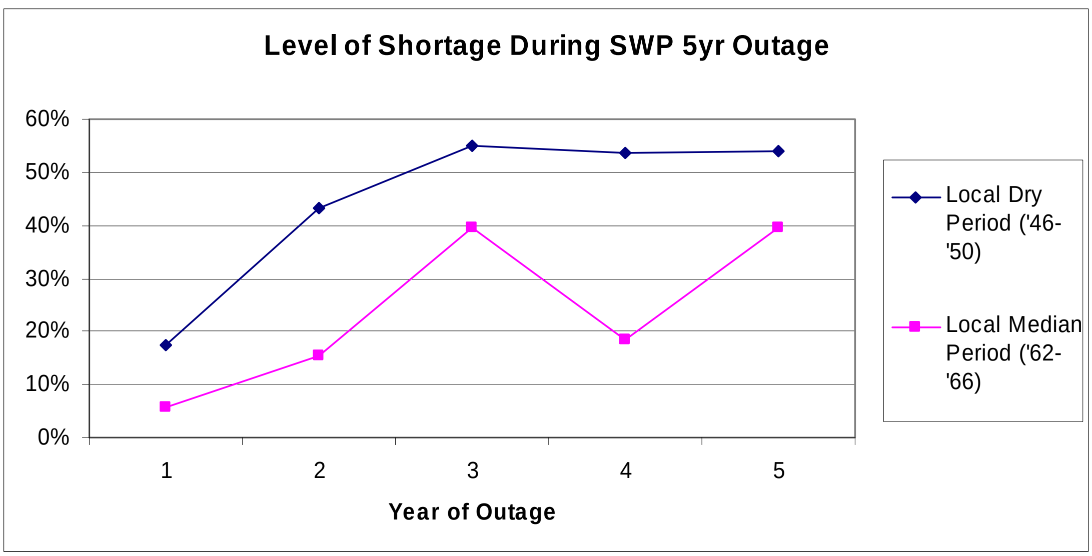
- SWP pumping from the Delta is lost for five consecutive years, due to levee failures and massive saltwater intrusion. In addition, no water would be available to ACWD from the Semitropic Groundwater Bank, as this water would have to flow through the Delta to be returned to ACWD.

- Emergency water supplies of up to 6,000 AF from the Del Valle Reservoir would be available to ACWD during the first year following the Delta levee failure.

- Limited production (1 to 2 mgd) at ACWD's Peralta-Tyson wellfield (AHF aquifer system) could be maintained with AHF groundwater elevations as low as 10' msl.

The results from this modeling analysis are presented in Figure 3-4. Under average (median) local hydrologic conditions, average annual shortages range for the five-year period are estimated to be approximately 24%, with a maximum shortage of approximately 40%. Under locally dry conditions, shortages are estimated to be significantly greater, with annual average shortages of 45% and maximum annual shortages exceeding 50%. These potential shortages are significantly greater than ACWD's reliability goals (no more than a 10% shortage on 1 in 30 year occurrence), and would likely result in potentially significant impacts to the communities served by ACWD. The 2006 UWMP addresses the measures that ACWD would implement under this range of emergency water shortages, including mandatory cutbacks for all of ACWD's customers (see 2006 UWMP, Chapter 9, Water Shortage Contingency Plan).

Figure 3-4
Estimated Water Supply Shortage due to Catastrophic Loss of SWP Supplies



In addition to the significant water shortage impacts associated with the catastrophic failure of Delta levees, other key considerations for ACWD include:

- Constraints regarding the ability of ACWD to deliver local and San Francisco Regional supplies to portions of the distribution system that are normally served by the District's surface water treatment plants (southern end of Zone 1 and all upper pressure zones). In all likelihood, ACWD would need to increase capacity from key SFPUC take-offs into these pressure zones.

- Impacts to the Niles Cone Groundwater Basin, as it would be heavily relied upon during such an emergency. Groundwater pumping would likely exceed recharge, thereby resulting groundwater elevations in the BHF aquifer dropping as low as -5' msl. While this level of drawdown is anticipated in ACWD's dry year planning, a catastrophic event may require that the groundwater elevations be maintained at these low levels for the duration of the outage (up to 5 years). Potential impacts may include new seawater intrusion and drawing existing saltwater plumes closer to ACWD's wellfields.

- Financial impacts of such an emergency may be severe. ACWD would likely face increased operating costs due to a variety of factors including: pumping of water from the lower pressure zones to upper zones, increased pumping lifts due to lowered groundwater levels, and increased purchases of San Francisco Regional Water supplies. At the same time, ACWD may also face a significant reduction in revenue due to a decrease in water sales.

Potential mitigating measures that ACWD could pursue to mitigate the severity of the water supply shortages include: (1) emergency assistance from neighboring agencies using alternate imported water conveyance systems (e.g. SFPUC, EBMUD); and (2) releases from the reservoirs in the Alameda Creek Watershed (e.g. SFPUC's Calaveras and/or San Antonio Reservoirs) for downstream percolation at ACWD's groundwater recharge facilities.

3.4 RISK AND UNCERTAINTIES

The 1995 IRP identified key areas of uncertainty which may impact ACWD's ability to meet its planning goals. The purpose of this section is to identify and update the factors which may impact current planning assumptions, the significance and magnitude of which are currently unknown. These factors are divided into three broad categories: (1) factors which may influence future demands; (2) factors which may impact water supplies; and (3) global warming and climate changes, which may impact both demands and supply availability.

Demand Projections

- <u>Demands:</u> Future demands in the ACWD service area are subject to a degree of uncertainty due to a variety of factors including: economic conditions; changes in projected land use; increasing densification; and changes to industrial water use.

- <u>Conservation savings</u>: Future demands may also be influenced by water conservation measures, including new technologies and advancements in conservation, and potential new plumbing code requirements for clothes washers and other appliances.

Water Supplies

- Local Supplies: The availability of ACWD's local supplies may be influenced by a variety of factors including operational and facility modifications to accommodate fishery restoration efforts. Upstream activities in the Alameda Creek Watershed may also impact the supply and quality of water available at ACWD's groundwater recharge facilities. Similarly, efforts to develop groundwater supplies by agencies in the South East Bay Plain (north of ACWD) may also impact ACWD's groundwater supply availability.

- State Water Project Supplies: The reliability of ACWD's State Water Project supplies will continue to remain uncertain due to the on-going concerns regarding the sustainability of the Delta. These concerns include the Delta ecosystem and potential future environmental regulations, levee stability and the potential for catastrophic failure of these levees, urban encroachment within the Delta, and water quality within the Delta due to urban and agricultural discharges. ACWD's use of the Semitropic Groundwater Banking Program to store SWP supplies also faces some uncertainty, primarily due to concerns regarding the quality of the water returned to the California Aqueduct.

- San Francisco Regional Supplies: The SFPUC is currently in the process of developing the environmental documentation for its Water Supply Improvement Plan (WSIP). Completion of the projects in the WSIP is critical to ensuring the reliability of the San Francisco Regional supplies. However, it is currently uncertain if the SFPUC will be successful in implementing this program, and if it will be accomplished in a timely manner. In addition, the SFPUC water supply contract with ACWD, as well as those with other SFPUC wholesale customers, will expire in 2009. It is not clear what the terms of the re-negotiated contracts will be, or how they may impact ACWD's planning assumptions.

Global Warming

- Climate Changes: Future climate changes as a result of global warming may have an impact on both ACWD's water supply assumptions as well as demand forecasts. Climate changes may result in warmer weather with less snowfall and more rain. Under current conditions, much of ACWD's imported water supplies are held in "storage" in winter and spring snowpacks in the Sierra Nevada Mountains. Without this natural storage, the yield of the State Water Project and San Francisco Regional System may be significantly impacted. In addition, warmer weather may also result in increased evapotranspiration rates and higher local demands, the extent of which is currently unkown.

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Alameda County Water District

P.O. BOX 5110 • 43885 SOUTH GRIMMER BOULEVARD,

FREMONT, CA 94537

PHONE (510) 668-4200

FAX (510) 770-1793