



SANTA ROSA SUBREGIONAL WATER RECLAMATION SYSTEM

## Incremental Recycled Water Program

# RECYCLED WATER MASTER PLAN

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# Incremental Recycled Water Program

## Recycled Water Master Plan

Prepared for  
**City of Santa Rosa**

Utilities Department  
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Santa Rosa, CA 95401

February 2004



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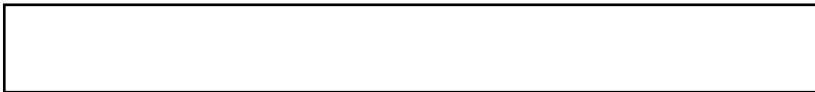
## **Executive Summary**

# Executive Summary

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The Executive Summary is bound separately. The full Executive Summary is available for public viewing at the Santa Rosa City Manager's office and the IRWP website [\[www.recycledwaterprogram.com/index.htm\]](http://www.recycledwaterprogram.com/index.htm).

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## **Acronyms and Abbreviations**

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# Acronyms and Abbreviations

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µg/L	micrograms per liter
ac-ft/yr	acre-feet per year
ADWF	average dry weather flow
AMT	advanced membrane treatment
BLM	Biotic Ligand Model
BPU	Board of Public Utilities
CEQA	California Environmental Quality Act
CII	Commercial/Industrial/Institutional
CIP	capital improvements program
City	City of Santa Rosa
CMOM	Capacity, Management, Operations and Maintenance
CTR	California Toxics Rule
CTS	California tiger salamander
ESU	equivalent single-family unit
EIR	Environmental Impact Report
EPA	U.S. Environmental Protection Agency
ERP	East Rohnert Park
gpm/ft <sup>2</sup>	gallons per minute per square foot
GWI	groundwater infiltration
I&I	infiltration and inflow
IRWP	Incremental Recycled Water Program
Laguna	Laguna de Santa Rosa (a tributary to the Russian River)
Laguna Plant	Laguna Subregional Water Reclamation Facility
MG	million gallons
MG/yr	million gallons per year
mgd	million gallons per day
mg/L	milligrams per liter

MWPCA	Monterey Water Pollution Control Agency
NCAA	North County Agricultural Area
NCRWQCB	North Coast Regional Water Quality Control Board
NPDES	National Pollutant Discharge Elimination System
PV	present value
RDI	rainfall-dependent infiltration
RDI&I	rainfall-dependent infiltration and inflow
SCWA	Sonoma County Water Agency
SECAP	System Evaluation and Capacity Assurance Plan
SIP	State Implementation Plan ( <i>Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays and Estuaries of California</i> )
SWI	stormwater inflow
SWRCB	State Water Resources Control Board
TM	technical memorandum
USFWS	U.S. Fish and Wildlife Service
WER	water effect ratio

## **Glossary of Terms**

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# Glossary of Terms

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alternative	The Incremental Recycled Water Program (IRWP), which is the “Project” evaluated in the Environmental Impact Report, consists of six alternatives that include a range of components to achieve IRWP objectives. The IRWP components are the individual elements or building blocks that make up the IRWP. Some components, such as pipelines, are common to several alternatives, while others, such as agricultural reuse or infiltration and inflow reduction, may be part of only one alternative.
common program elements	These comprise several elements, including treatment plant upgrade and relocation of the treatment plant discharge to the Russian River, that are common to and must be undertaken in conjunction with all programs regardless of which program is selected to implement the IRWP.
complexation	Formation of complex compounds.
demand	The known or projected need for recycled water for urban and agricultural irrigation, injection into the Geysers Steamfield, and other uses.
implementation strategies	Two overall strategies that were developed for the IRWP to manage current flows and future flows associated with population growth in the context of regulatory uncertainties that will not be resolved for several years.
increment	A portion of a reuse alternative.
incremental flow	The sum of flow currently discharged under the existing National Pollutant Discharge Elimination System permit and the increase in flow resulting from population growth projections in the general plans of the Subregional partners. This flow is 6,700 million gallons during the wettest year.
infiltration and inflow (I&I)	Flows that enter the sewer system through either infiltration of groundwater or inflow of rainfall runoff that must be treated and discharged or recycled.
potable water offset	An existing or future use of potable water that is made available for other purposes because it is replaced by recycled water; in other words, the recycled water offsets the use of potable water.
program	A combination of alternatives that would achieve all primary IRWP objectives and one or more of the secondary IRWP objectives.

receiving water	A body of water, such as a creek or river, into which highly treated wastewater is discharged under strict permitting requirements.
supply	Water available for recycling; the recycled water produced by the Laguna Subregional Water Reclamation Facility.

## **Section 1**

### **Purpose and Background**

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# Purpose and Background

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## Purpose

The purpose of this Master Plan is to assist the City in deciding how to manage additional wastewater flows into the Subregional Water Reclamation System resulting from updates to the general plans of Santa Rosa and Rohnert Park. It also must describe methods for managing current and future flows that are discharged and which are affected by new regulations, including the California Toxics Rule (CTR). The sum of these flows is the incremental flow to be addressed by the Incremental Recycled Water Program (IRWP). The City of Santa Rosa (City) is the managing partner for the Subregional System (shown schematically on Figure 1). This Master Plan formulates a course of actions for implementing facilities under the IRWP to manage the incremental flow.

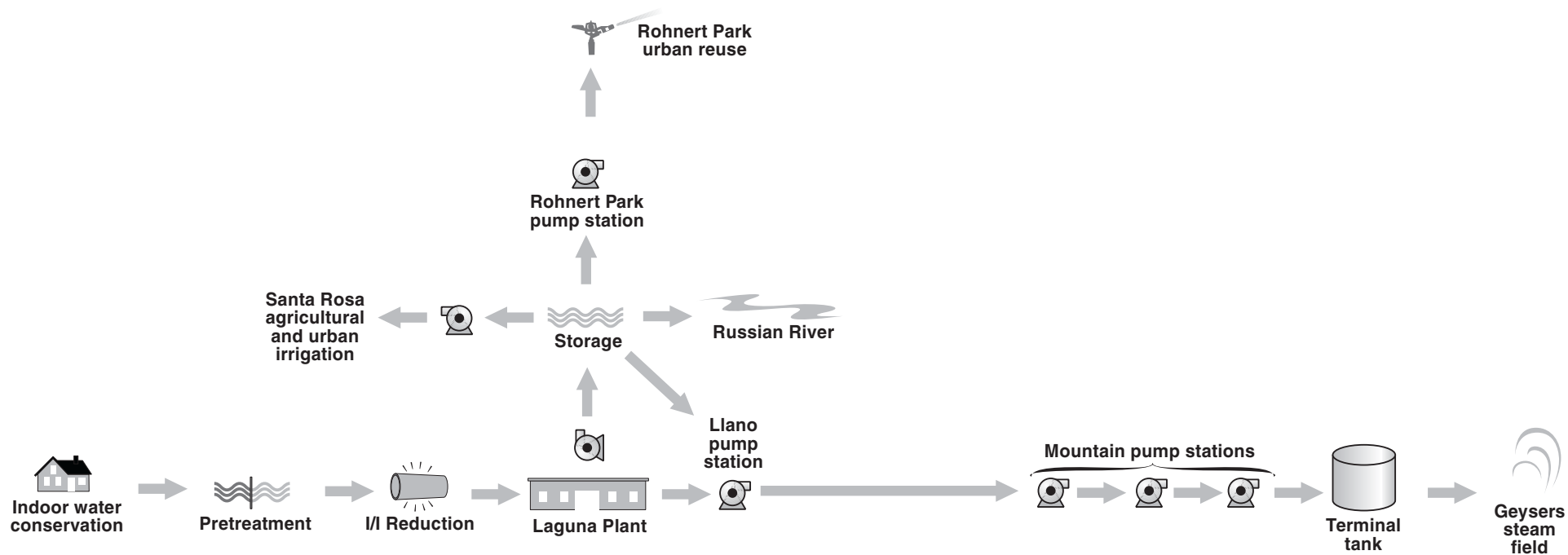
The Master Plan builds on the findings of the *Incremental Recycled Water Program Feasibility Report* (CH2M HILL, 2003) and its associated technical memoranda. The Feasibility Report describes the development and screening of alternatives for managing flow. The Feasibility Report is a part of a Program Environmental Impact Report (EIR) prepared by the City of Santa Rosa (2003) to evaluate potentially significant environmental impacts associated with implementing the alternatives in accordance with the California Environmental Quality Act (CEQA).

## Use of this Document

The purpose of the IRWP Master Plan is to provide the City of Santa Rosa Board of Public Utilities (BPU) and City Council with information to evaluate and select a course of actions to manage current and projected Laguna Plant flow and achieve compliance with new regulations. The IRWP Master Plan is divided into the following sections:

- Section 1 – Purpose and Background
- Section 2 – Description of Master Plan Alternatives
- Section 3 – Program Development
- Section 4 – Summary of Estimated Program Costs and Economic and Financial Analysis
- Section 5 – Program Evaluation
- Section 6 – Program Selection Process
- Section 7 – Selected Program
- Section 8 – Program Implementation
- Section 9 – References

Section 1 includes the IRWP objectives, briefly summarizes Feasibility Report findings, describes IRWP background and assumptions, and describes the master planning process. Section 1 also describes the Subregional Water Reclamation System flows that must be managed under the IRWP and provides the basis for Master Plan cost estimating.



**FIGURE 1**  
**EXISTING SUBREGIONAL SYSTEM**  
 SANTA ROSA INCREMENTAL RECYCLED WATER PROGRAM  
 FEASIBILITY REPORT

Section 2 describes the alternatives that were evaluated in the EIR and screened in the Feasibility Report. These alternatives are the building blocks of the programs developed and evaluated in this Master Plan.

Section 3 describes the process of program development. Ten programs, which are courses of action to achieve IRWP objectives, are presented. Each program consists of combinations of alternatives and elements common to all programs. Two implementation strategies were devised to achieve IRWP objectives in the face of regulatory uncertainty. The 10 programs are divided into two sets of five programs, and each set is assigned to one of the two implementation strategies. The primary difference between the two sets of programs is the sequence in which the various actions that comprise them would be implemented, depending on which implementation strategy is adopted. The 10 programs presented are:

- I.A – Direct Discharge
- I.B – Indirect Discharge
- I.C – Geysers (25 mgd)
- I.D – Geysers (19 mgd) Plus Urban and Agricultural Reuse
- I.E – Urban and Agricultural Reuse
- II.A – Early Reuse Plus Direct Discharge
- II.B – Early Reuse Plus Indirect Discharge
- II.C – Early Reuse Plus Geysers (25 mgd)
- II.D – Early Reuse Plus Geysers (19 mgd) Plus Urban and Agricultural Reuse
- II.E – Early Reuse Plus Urban and Agricultural Reuse

Section 4 summarizes estimated program costs and presents an economic and financial analysis of the IRWP. Included are the cost benefits of replacing potable water supplies with recycled water (for uses such as urban and agricultural irrigation) and projected user charge and demand fee increases. Section 5 presents an evaluation of the 10 programs in relation to the evaluation criteria and the environmental evaluation.

Section 6 describes the process by which the City Council and BPU will select the preferred program from among the 10 programs presented in this Draft IRWP Master Plan or select another program developed by BPU during the program selection process. After the program selection process has been completed, a Final IRWP Master Plan will be adopted, including Section 7, which will describe the selected program. Section 8 outlines the process by which the selected program will be implemented. Section 9 presents references.

## IRWP Objectives

The IRWP Feasibility Report developed alternatives that support IRWP objectives, as directed by the City of Santa Rosa Utilities Department staff, BPU, and City Council. The BPU and the City Council have adopted a Purpose and Need Statement that includes primary and secondary IRWP objectives. The IRWP goal is to accomplish all primary and one or more of the secondary IRWP objectives. The secondary objectives have not been prioritized or weighted; the BPU may do this as part of the selection process. These objectives have been further refined in Section 3 of this Master Plan to make them more meaningful as program evaluation criteria. The primary and secondary IRWP objectives follow.

## Primary IRWP Objectives

- Provide wastewater treatment, recycling, and disposal for the Santa Rosa Subregional Reclamation System to accommodate projected growth as indicated in the adopted general plans of each Subregional System partner effective as of July 2002.
- Develop and operate the wastewater treatment and disposal system in ways that protect public health and safety, protect natural resources including the Russian River and its tributaries, promote use of recycled water, meet current regulatory requirements, and provide flexibility to comply with future regulatory requirements.
- Maintain a system and components that are economically feasible and continue to be successfully financed.

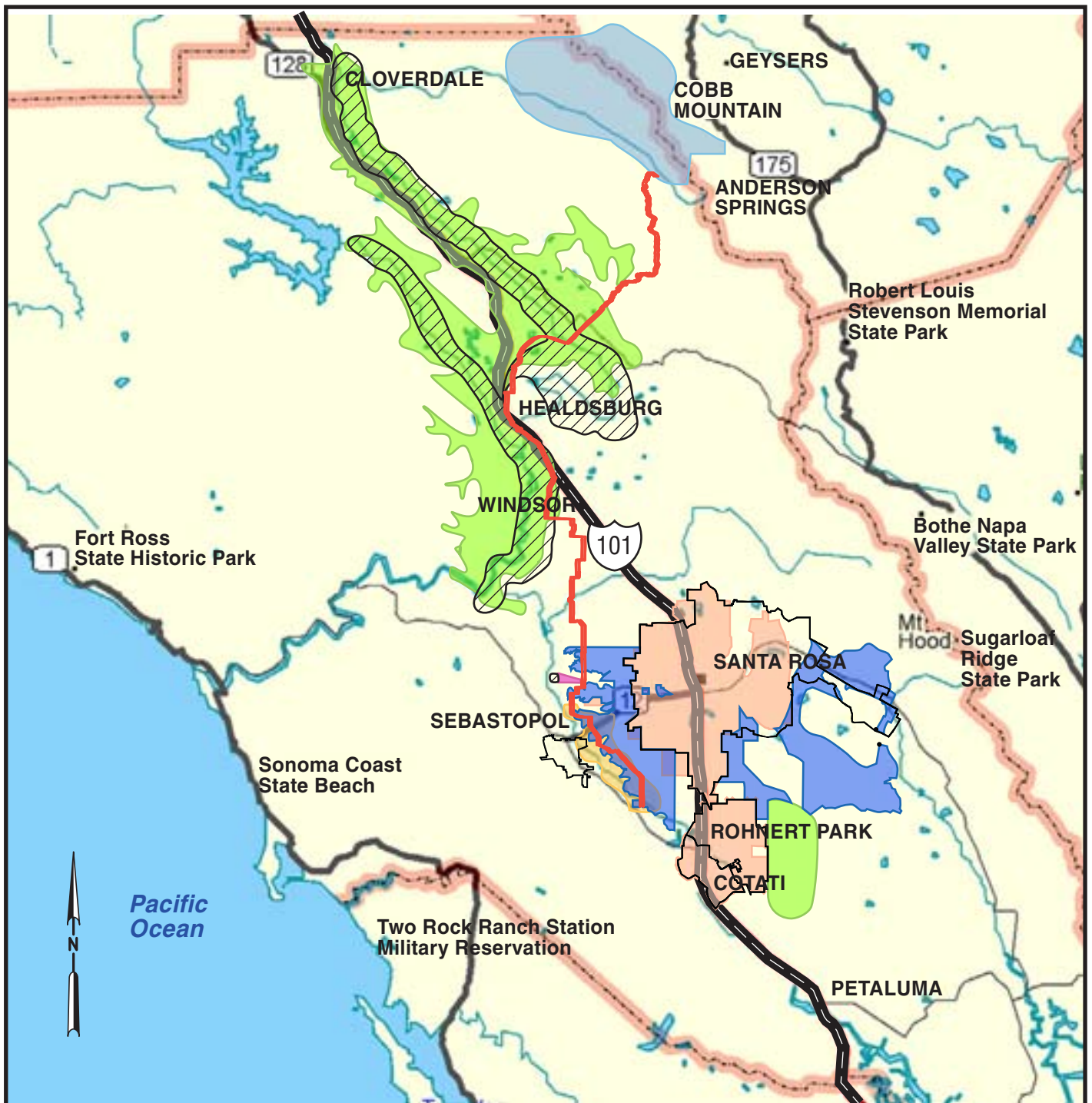
## Secondary IRWP Objectives

- Maximize use of recycled water.
- Maximize reuse opportunities where recycled water would increase the availability of potable water supplies.
- Dispose of reclaimed water in a manner that protects beneficial uses of receiving waters.
- Optimize water conservation.
- Maintain the level of weather-independence (as defined by Regional Water Quality Control Board policy) that is provided by the addition of the Geysers Recharge Project to the Subregional Reclamation System.
- Maximize use of existing infrastructure.
- Maintain a disposal system that is manageable and reliable.
- Provide flexibility to accommodate use of recycled water made available by neighboring agencies as deemed appropriate by the City of Santa Rosa.

## Feasibility Report Findings

The IRWP Feasibility Report presented and evaluated nine alternatives. These alternatives were developed through a public process involving public meetings, a project website, and comments received on both the Initial Study and Scoping Report for the 2003 IRWP Programmatic EIR prepared to comply with CEQA. All areas where alternatives would be implemented are within Sonoma County, except for a small portion of the Geysers Steamfield, which is located in Lake County (Figure 2). The nine alternatives developed during this process were narrowed to six alternatives that were found to be feasible and capable of achieving IRWP objectives. These alternatives are listed below in the order they were presented in the EIR:

- Alternative 1: Indoor water conservation
- Alternative 2: Infiltration and inflow reduction
- Alternative 3: Urban reuse



#### PROGRAM ALTERNATIVES

- INDOOR WATER CONSERVATION AND INFLOW AND INFILTRATION REDUCTION
- URBAN REUSE
- AGRICULTURAL REUSE AND STORAGE
- AGRICULTURAL IRRIGATION ON CITY-OWNED FARMS
- GEYSERS EXPANSION
- DISCHARGE (DIRECT AND INDIRECT)
- STORAGE

#### EXISTING FACILITIES

- EXISTING STORAGE
- GEYSERS PIPELINE

**FIGURE 2**  
**LOCATION OF PROGRAM ALTERNATIVES**  
 SANTA ROSA SUBREGIONAL WATER RECLAMATION SYSTEM  
 INCREMENTAL RECYCLED WATER PROGRAM

- Alternative 4: Agricultural reuse
- Alternative 5: Geysers expansion
- Alternative 6: Discharge to the Laguna de Santa Rosa (a tributary to the Russian River, hereafter referred to as the Laguna), direct to the Russian River, or indirect to the Russian River

The feasibility of the alternatives was evaluated against technological, logistical, and economic considerations.

Technological criteria include constructibility and reliability. Logistical considerations include the ability to obtain the permits, approvals, or rights necessary for construction and ongoing operation of the alternative within the allotted schedule. Economic considerations include total cost to all project participants of constructing and operating a project, net cost (i.e., cost of an alternative after the costs of benefits have been credited), and user fees. The Feasibility Report considered total capital cost, annual operating cost, and present value in comparing alternatives and combinations of alternatives. However, the Feasibility Report did not include information on user fee impacts or benefit costs. Therefore, judgment about the relationship between the estimate of total cost and affordability of alternatives was used to screen alternatives for inclusion in the EIR. However, screening decisions considered that some alternatives have beneficial effects that reduce other costs borne by the member cities in the Subregional System, such as reducing the need to develop additional potable water supplies. Information on the value of benefits and user fee impacts has since been developed and is presented in Section 4 of this Master Plan and in Appendix A.

The six alternatives have been grouped into several combinations that, for the purposes of the IRWP Master Plan, are called programs. Each program discussed in this Master Plan report was formulated for the explicit purpose of meeting all of the primary IRWP objectives and one or more of the secondary IRWP objectives.

## Background and Assumptions

### Background

The existing Subregional System consists of the following components:

- Sewer collection systems
- Laguna Plant
- Agricultural reuse system
- Urban reuse system
- Geysers Recharge Project (pump stations, pipelines, and a tank)<sup>1</sup>
- Discharge system

The City's current National Pollutant Discharge Elimination System (NPDES) permit allows the City to treat, reuse, and discharge the annual flow resulting from receiving a daily average dry weather flow (ADWF) of 21.34 million gallons per day (mgd) at the Laguna Plant. Higher winter flows that cannot be stored for agricultural or urban reuse during

<sup>1</sup> The Geysers injection facilities are owned by Calpine and are not part of the Subregional System.

summer or delivered to the Geysers Steamfield are currently discharged to the Laguna and, ultimately, the Russian River. The current permit allows discharge to occur only from October 1 through May 14 of each year.

Since the Geysers Recharge Project was approved, several important changes to the basis of system planning have occurred:

- Two Subregional System partners (Rohnert Park and Santa Rosa) have updated their general plans from 2010 to 2020, increasing population and resulting wastewater flow beyond that anticipated during planning for the Geysers project.
- The State of California enacted the CTR. These rules are implemented by the North Coast Regional Water Quality Control Board (NCRWQCB) according to the State Water Resources Control Board's (SWRCB) *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays and Estuaries of California* (2000), also known as the State Implementation Plan (SIP). The SIP outlines a process for developing wastewater treatment plant discharge limits for 126 U.S. Environmental Protection Agency (EPA) Priority Pollutants (mostly pesticides and metals). Pursuant to the SIP, new limits could be imposed for the Laguna Plant discharge. Preliminary testing indicates that it may be very difficult to meet potential discharge limits for 4 of the 126 priority pollutants. NCRWQCB is expected to impose interim effluent limits in response to the CTR in 2005.
- The City's current discharge permit requires that certain pH, temperature, and turbidity limits be met in the Laguna. These limits cannot be met under all conditions at the existing discharge locations.

## Assumptions

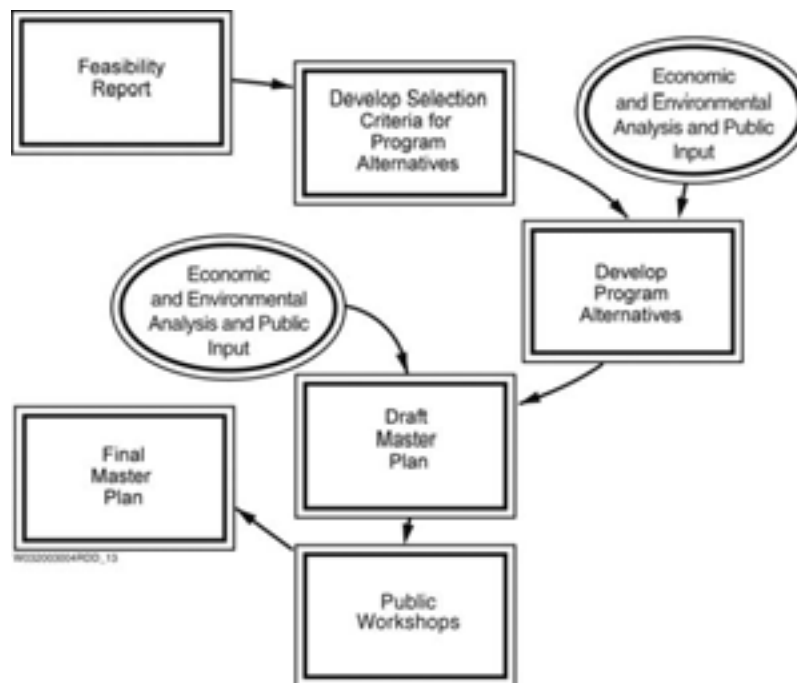
The outcome of the regulatory changes and their associated impacts on permit renewals and compliance schedules is uncertain. For the purpose of developing this Master Plan, the following assumptions have been made regarding how regulatory changes and compliance would affect the Subregional System:

- CTR limits would be imposed when the Laguna Plant NPDES permit is re-issued (scheduled for 2005). Interim limits would be imposed for constituents with limits that cannot be attained at the time of permit adoption. It is expected that a compliance schedule would be imposed in the permit, requiring final limits to be attained within 5 years. Programs have been developed for two possible outcomes of the CTR/SIP process:
  - Current effluent quality attains final effluent quality limits
  - Current effluent quality does not attain final effluent quality limits
- The City would continue to fulfill Geysers contract recycled water delivery volume and water quality obligations for the volume currently under contract.
- The City would continue to operate the existing agricultural and urban irrigation systems as they were planned to be operated at the time of Geysers Recharge Project startup (i.e., approximately 2,100 million gallons per year [MG/yr]).

## Master Planning Process

Preparation of the IRWP Master Plan began after completion of the IRWP Feasibility Report and addresses engineering, environmental, and economic data and issues. The alternatives and combinations of alternatives described in the EIR were considered during the master planning process in relation to IRWP objectives. The alternatives were further analyzed in this document and formulated into 10 combinations or “programs.” The City will ultimately select a course of action to implement the IRWP from among these 10 programs.

Figure 3 shows the IRWP master planning process, which builds on the Feasibility Report. The master planning process provides for public participation through a series of workshops. An economic analysis, as well as the EIR, has been prepared as part of the IRWP and contributes to the formulation of the Master Plan. The economic analysis report, *Preliminary Economic and Financial Assessment of IRWP Master Plan Alternatives* (HFH Consultants, 2004) is presented in Appendix A. The EIR was used as the source of conclusions regarding environmental impacts. Environmental impacts are summarized in Section 3 of this Master Plan and Appendix B.



**FIGURE 3**  
IRWP Master Planning Process

## Future Subregional System Flows

To achieve the IRWP objectives, the future system must be capable of the following:

- Providing adequate, reliable capacity to accommodate future flows generated by population and employment growth of the member entities
- Achieving the quality of recycled water that would be required by regulatory agencies to protect human health and aquatic life

Different methods were used to project dry weather and wet weather flows, as summarized below and described in Technical Memorandum (TM) No. 1 of the Feasibility Report.

### Dry Weather Flow

Future flow projections for the Subregional System are based on the population, housing, and employment growth projected by the general plans (effective as of July 2002) of the Subregional System partners. Flow projections for these projected populations were predicated on actual 2000 population (the most recent year for which data were available when the analysis was conducted) and Laguna Plant daily ADWF for each Subregional partner. In summary, the total projected ADWF at the Laguna Plant for the horizon planning year of each Subregional partner is 25.9 mgd. For Master Plan purposes, this maximum capacity of the IRWP is identified as occurring at the earliest in 2020; however, Sebastopol and Cotati general plans extend only to 2013 and 2010 respectively, and growth in all jurisdictions could occur more slowly than projected in the general plans. Table 1 summarizes ADWF projections.

**TABLE 1**  
ADWF Projections  
*Santa Rosa Incremental Recycled Water Program*

Member Entity	2000 Flows <sup>a</sup>		Flows Accommodated by Geysers Recharge Project		2020 Projected Flows <sup>b</sup>	
	mgd	Percent	mgd	Percent	mgd	Percent
Rohnert Park and SSU	3.60	20.11	3.43	16.07	5.15	19.89
SR/SPCSD	13.17	73.51	16.31	76.43	19.14	73.93
Sebastopol	0.63	3.54	0.84	3.94	0.84	3.24
Cotati	0.51	2.84	0.76	3.56	0.76	2.94
Total	17.91	100.00	21.34	100.00	25.89	100.00

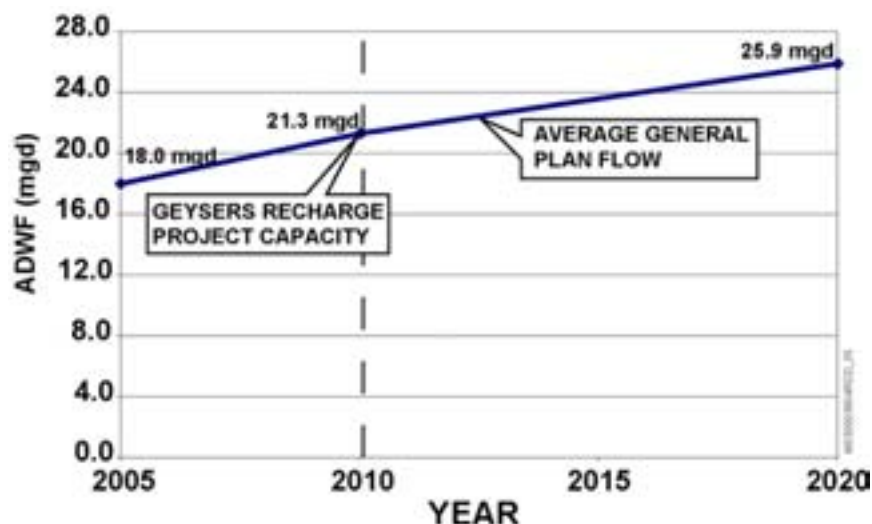
<sup>a</sup>Includes 0.39 mgd for Oakmont and 0.05 mgd correction for Cotati metering in addition to actual Laguna Plant metered flow. Including unmetered flows for septage and landfill leachate, total ADWF would be 18.1 mgd.

<sup>b</sup>General plans for Santa Rosa and Rohnert Park project populations through 2020; the Sebastopol general plan projects through 2013, and the Cotati general plan projects through 2010.

Note:

SR/SPCSD = Santa Rosa and South Park County Sanitation District.  
SSU = Sonoma State University.

The flow projections in Table 1 and Figure 4 indicate that additional system capacity beyond the Geysers Recharge Project could be needed as early as 2010. Figure 4 also shows the additional capacity needs through 2020.



**FIGURE 4**  
Future System Capacity Requirements

## Wet Weather Flow

Annual wet weather flow projections are needed to determine how to manage total system inflows and outflows throughout each year. Wet weather inflow to the plant is sensitive to hydrologic conditions, including rainfall events, Russian River flows, and groundwater levels. Among these factors, Laguna Plant wet weather inflow correlates most consistently with Russian River flow.

A water balance model was developed to simulate Laguna Plant daily inflow and daily outflows to storage, reuse, and discharge. The model uses 67 years of Russian River flow data in an algorithm to project future flows. The model yielded a peak wet weather daily inflow to the Laguna Plant of 101 mgd, corresponding to an ADWF of 25.9 mgd. This represents the highest daily plant inflow based on 67 years of record. The water balance model was further used to simulate the amount of water in storage, being discharged, or reused at any time of year for future programs. Table 2 shows the makeup of the total volume of annual flow that needs to be managed under the IRWP. Additional details regarding the water balance model are presented in Appendix C. The total volume of incremental flow to be managed is estimated to be 6,700 million gallons (MG) during the wettest year.

**TABLE 2**  
 Future Capacity of the Subregional System (all values in MG)  
*Santa Rosa Incremental Recycled Water Program*

Year Type (in 67-year Analysis)	Existing Irrigation System	Geysers Recharge Project	Discharge	Growth <sup>a</sup>	Total Subject to CTR <sup>b,c</sup>	Total System Capacity at 25.9 mgd <sup>c,d</sup>
Driest	2,200	4,000	1,600	1,700	3,300	9,500
10 <sup>th</sup> Percentile	2,100	4,000	1,800	1,800	3,700	9,800
Median (50 <sup>th</sup> Percentile)	2,100	4,000	2,400	1,900	4,400	10,500
90 <sup>th</sup> Percentile	1,900	4,000	4,300	2,100	6,400	12,300
Wettest	1,900	4,000	4,500	2,200	6,700	12,600

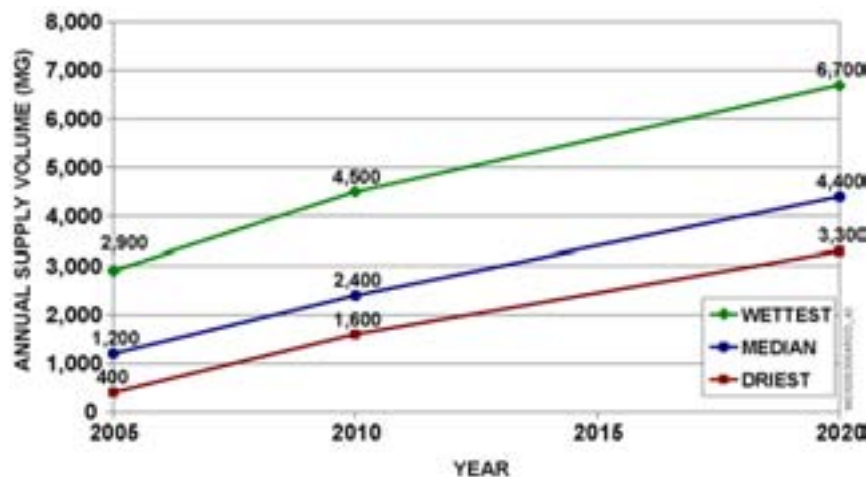
<sup>a</sup>Growth represents the total volume of Subregional System flow associated with an ADWF increase from 21.3 mgd (Geysers Recharge Project permit) to 25.9 mgd.

<sup>b</sup>Sum of Discharge and Growth.

<sup>c</sup>Values do not always total exactly because values are rounded to the nearest 100 MG.

<sup>d</sup>Total system capacity at 25.9 mgd is the sum of existing irrigation system, Geysers Recharge Project, discharge and growth.

Figure 5 shows how the incremental flow develops over time.



**FIGURE 5**  
 Wet Weather Flows

## Estimated Costs

The “Class 5” cost estimates presented in this Master Plan were prepared in accordance with the guidelines of the Association for the Advancement of Cost Engineering (AACE) International. Capital costs are presented in 2004 dollars. Present values were figured at an

interest rate of 3 percent, and operation and maintenance (O&M) annual costs through 2035 were included in the present value calculations.

The cost estimates, and any resulting conclusions on project financial or economic feasibility or funding requirements, have been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. Final costs and feasibility will depend on actual labor and material costs, competitive market conditions, actual site conditions, scope of work, implementation schedule, and other variable factors. Therefore, final costs will vary from the estimate presented here. Because of these factors, project feasibility, benefit/cost ratios, risks, and funding needs must be carefully reviewed prior to making specific financial decisions or establishing project budgets to help ensure proper project evaluation and adequate funding.

The cost estimates shown include contingencies for the following:

- Contractor mobilization/bonds/permits
- Field detail allowance
- Contractor overhead and profit
- Project contingency at 30 percent
- Engineering and construction management
- City administration

## **Section 2**

# **Description of Master Plan Alternatives**

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## SECTION 2

# Description of Master Plan Alternatives

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The six alternatives that constitute the building blocks of the IRWP Master Plan are as follows:

- Indoor Water Conservation (EIR Alternative 1)
- I&I Reduction (EIR Alternative 2)
- Urban Reuse (EIR Alternative 3)
- Agricultural Reuse (North County, East of Rohnert Park, or City-owned farms) (EIR Alternatives 4A, 4B, and 4C)
- Geysers Expansion (EIR Alternative 5)
- River Discharge (direct or indirect) (EIR Alternatives 6A, 6B, 6C, 6D, and 6E)

Cost-effective phasing of urban and agricultural reuse components is described so that lower-cost opportunities initially (within approximately 5 years or less) provide infrastructure to facilitate subsequent growth of the reuse system.

Programs involving urban, agricultural, or Geysers reuse usually require additional surface storage capacity. However, the phasing and size of the alternatives within a program impact the size and timing of the storage. Therefore, storage is discussed in a subsequent section and is intentionally omitted from the description of most of the alternatives presented here.

Urban and agricultural reuse provide a potable water offset benefit. A potable water offset benefit is realized when recycled water can serve an existing or future use that would otherwise require use of potable water. In other words, the recycled water offsets the use of potable water. The value of this potable water offset is approximately \$1,840 per million gallons (MG) or \$600 per acre-foot (refer to Appendix A). The potable water offset is an annual savings; thus, it was factored into O&M cost estimates for programs, but has no effect on the capital costs. This value will be taken into account in the comparison of alternatives and cost estimates for IRWP programs. The estimate of this value does not capture all of the future costs that may be necessary to maintain the associated increment of potable water supply, but it is based on the most current information available from the Sonoma County Water Agency (SCWA).

## Indoor Water Conservation and I&I Reduction (EIR Alternatives 1 and 2)

Indoor water conservation (Alternative 1) is included in all programs and is discussed in Section 3 under the heading, “Common Program Elements.” The amount of cost-effective I&I reduction (Alternative 2) cannot currently be quantified, and further study is needed. Therefore, only Alternatives 3 through 6 are described in the following paragraphs.

## Urban Reuse (EIR Alternative 3)

TM No. 4 of the Feasibility Report describes the potential for urban reuse within the areas of Santa Rosa, Rohnert Part, Cotati, and the Golf and Country Club area. Urban reuse in Sebastopol was not considered because there are relatively few potential users, and those users are located farther away from existing reclamation facilities than in the areas of the other Subregional System partners. Up to 2,100 MG of flow could be managed annually by using urban reuse.

### Santa Rosa

As described in TM No. 4 of the Feasibility Report, using recycled water in lieu of potable water for urban irrigation provides a water supply benefit to the City. Existing Santa Rosa urban irrigators use water either from the City's potable water distribution system or wells. Customers using City potable water have irrigation meters. The existing well users draw their irrigation supply from groundwater. Future development would have to be brought into the recycled water system as the development occurs. This would provide the opportunity to serve recycled water to new development that otherwise would use City potable water.

For master planning purposes, the demand represented by existing urban irrigation users in the City of Santa Rosa was included because the demand is known and quantifiable.

TM No. 4 also shows which areas have the lowest unit cost to serve in terms of cost per MG of capacity. This information was used to develop a strategy for implementing urban reuse in Santa Rosa.

Commercial/Industrial/Institutional (CII) flow was not considered to represent a significant demand for use of recycled water in the City of Santa Rosa in comparison to irrigation. Irrigation is the largest water use that can be replaced by recycled water in an urban setting. However, CII flow was not ignored; CII volume was not included in the estimated urban reuse volume because the City has not yet identified any CII users who could use a substantial volume of recycled water. If an urban reuse program were implemented, some specific CII users would likely be identified and included in the program (in addition to their irrigation water demands).

Similarly, if a CII facility were to include dual plumbing (i.e., separate systems for potable and recycled water) during its construction, it could be connected to the recycled water distribution network. These types of facilities would be included in the planning and design of the urban recycled water distribution system.

To supply recycled water for urban reuse in Santa Rosa, a pipeline could be constructed from the Laguna Plant into the city as presented in TM No. 4. However, from a staging perspective, this represents a substantial early capital investment. Staging of the urban reuse system could involve construction of a pump station at the West College facility (previously envisioned as a backup facility) before construction of the main supply pipeline from the Laguna Plant. This pump station would be supplied from the West College Ponds, which are part of the existing reclamation system.

Distribution piping would then extend from this location predominantly into the Northwest and Central areas as a Phase 1 project (a portion of a reuse alternative). The Northwest and

Central areas are some of the most cost-effective areas shown in TM No. 4 (refer to Table 7 of the TM) and also have substantial existing demands. A Phase 2 project could extend into the Southwest, Southeast, and Bennett Valley areas. These areas were also shown to be among the most cost-effective in TM No. 4. In contrast, expansions into the Fountaingrove and Rincon Valley areas are more expensive. The Phase 1 and 2 expansions could be completed from the West College pump station location, but expansions beyond these two phases would require construction of the larger supply pipeline from the Laguna Plant. These two phases would focus on known potable water or well users, rather than the unknown growth component. However, pipelines could be sized for future development during the planning and design of a specific project. The costs presented in Table 3 do not include pipeline upsizing for future development. The incremental capital cost to account for the anticipated annual 658-MG future demand is \$50 million.

### Rohnert Park and Cotati

Rohnert Park has an existing recycled water distribution network that could be used to extend laterals into new areas for either existing parks or new development. Cotati could also be served from this system. The anticipated demand for Rohnert Park development is in close proximity to existing system. Therefore, the demand is easily served, and it provides a full potable offset benefit.

### Santa Rosa Golf and Country Club Area

Another potential urban reuse area identified in TM No. 4 is the Santa Rosa Golf and Country Club area. Serving this area with recycled water would require a pipeline extension from the existing reclamation system. However, serving recycled water to this area would not provide potable water offset because it currently is served by a well. Converting this well to municipal supply would not be practical.

### Urban Reuse Increments

The demands, potable water offset, and estimated capital costs (rounded to the nearest million dollars) of the urban reuse increments described above are shown in Table 3. As mentioned previously, storage costs are not included.

**TABLE 3**  
Urban Reuse Increments  
*Santa Rosa Incremental Recycled Water Program*

Description of Increment	Demand (MG/yr)	Potable Offset Volume (MG/yr)	Potable Offset Volume (acre-feet/yr)	Estimated Capital Cost <sup>a</sup> (\$ million)
1 – Golf and Country Club Area	81	0	0	1
2 – Santa Rosa Urban Phase 1	255	147	451	14
3 – Santa Rosa Urban Phase 2	703	364	1,117	49
4 – Rohnert Park/Cotati	196	196	602	9
<b>Total</b>	<b>1,235</b>	<b>707</b>	<b>2,170</b>	<b>73</b>

<sup>a</sup>Capital costs reflect credit for potable water offset.

The estimate of potable water offset volume shown in Table 3 is based on the amount of potable supply currently used in the area. For the two Santa Rosa urban increments, the potable water offset was calculated for existing potable water customers, but not for well users. For the well water to be considered as offset, the wells would have to be converted from irrigation to municipal wells. Because of the large number of wells that would require conversion, the geographic spread, and the small capacity, adding these wells to Santa Rosa's potable water distribution system is not considered practical. Existing information indicates that groundwater from these unused wells is not likely to be available to existing municipal wells because of the geologic composition of the aquifers underlying Santa Rosa. However, as further information is developed on Santa Rosa's underground water resources, it is possible that some of these unused wells could contribute to potable water supply.

For Rohnert Park and Cotati, the new recycled water users are either parks, or near-term, new developments. These users would otherwise have connected to a potable supply from the Cities of Rohnert Park or Cotati via SCWA or local municipal wells. Therefore, potable offset benefit is considered fully applicable to the Rohnert Park/Cotati reuse areas.

## **Agricultural Reuse (EIR Alternative 4)**

Agricultural reuse categories include North County (EIR Alternative 4A) and East of Rohnert Park (EIR Alternative 4B) agricultural irrigation and City-owned farms irrigation (EIR Alternative 4C). Up to 10,500 MG of flow could be managed annually using agricultural reuse. Increments of this volume that have the lowest unit cost for delivering recycled water were used to develop programs.

### **North County and East of Rohnert Park Agricultural Areas**

As part of the master planning effort, contacts were made with agricultural or viticultural interests in the two key areas defined in the Feasibility Report: the North County Agricultural Area (NCAA) and the East of Rohnert Park (ERP) Agricultural Area. During public meetings that were held as a part of the IRWP program development, some Dry Creek agricultural water users requested inclusion in the Master Plan. The Dry Creek area is considered to be a part of the NCAA.

In addition to these contacts, the following criteria were used to develop the agricultural areas for the Master Plan. The criteria are consistent with the primary and secondary IRWP objectives.

- For the NCAA, first consideration was given to areas irrigated from underflow or surface flow in the Russian River or tributary areas
- Priority was given to areas within reasonable proximity to existing conveyance infrastructure, primarily the Geysers Pipeline or the Rohnert Park Pipeline
- No new river crossings for distribution pipeline networks were considered
- Priority was given to areas that have existing storage or the ability to provide storage
- Large blocks of land were given preference

- Priority was given to interested landowners
- Town of Windsor's target irrigation area (along East Side Road and Old Redwood Highway from Windsor River Road to Highway 101) was not included

Using the above criteria, agricultural reuse increments were developed as shown in Table 4. As mentioned previously, storage costs are not included.

**TABLE 4**  
Agricultural Reuse Increments  
*Santa Rosa Incremental Recycled Water Program*

Description of Increment	Demand (MG/yr)	Cumulative Demand (MG/yr)	Estimated Capital Cost (\$ million)	Estimated Cumulative Capital Cost (\$ million)
<b>North County Agricultural Area</b>				
Increment 1	370	370	14	14
Increment 2	170	540	7	21
Increment 3	240	780	9	30
Increment 4 <sup>a</sup>	2,700	3,480	106	136
<b>East of Rohnert Park Agricultural Area</b>				
Increment 1 <sup>b</sup>	440	440	6	6
Increment 2	377	817	8	14
Increment 3 <sup>c</sup>	783	1,600	12	26

<sup>a</sup>Costs for Increment 4 were projected by using cost criteria defined in TM No. 5 of the IRWP Feasibility Report. Costs for Increments 1, 2, and 3 were estimated using more detailed information on specific areas.

<sup>b</sup>This increment represents the estimated maximum usage of the existing Rohnert Park pipeline to supply ERP Agricultural Area reuse without the development of dedicated storage in the ERP Agricultural Area.

<sup>c</sup>This increment, along with increments 1 and 2, represents the maximum demand that can be supplied by the existing Rohnert Park Pipeline while the existing Rohnert Park Reuse system is in use, including potential expansions of the urban reuse system in this area.

Although these criteria were developed for the purposes of identifying reuse increments for the Master Plan, it is not intended that the criteria limit the location or quantity of reuse to be implemented. For example, although only areas currently under irrigation were considered for master planning, it is possible that currently unirrigated NCAA land could be served with recycled water, as described in the EIR.

In contrast to urban reuse, no potable offset was attributed to the agricultural reuse areas. For the NCAA, there is potentially potable offset, but it is presently unquantifiable. Therefore, no potable water offset credit was included in the cost estimate for NCAA reuse. Likewise for the ERP Agricultural Area, serving recycled water to land that is currently irrigated could contribute to the Rohnert Park or Cotati water supply, but insufficient information is available to estimate this potential benefit.

## City-owned Farms

When the Geysers Pipeline begins operation, supply to the existing reclamation system will reduce (i.e., by attrition). Supply will decrease from the existing annual amount of approximately 3,700 MG to a level near 2,200 MG (based on a dry year) because there will be a reduction in available system storage after the Geysers system is on line.

Discussions with Santa Rosa reclamation staff indicate that some of the reclamation system could be returned to production as part of the IRWP. But it would not attain its previous capacity because of economic pressures on the dairy industry, expiration of reclamation contracts, and changes in crop water demands (feed/fodder crops converting to vineyards). Nevertheless, regrowth (resupply) from approximately 2,200 MG to 3,000 MG annual irrigation volume is feasible. To accomplish this, higher supply flow from the Laguna Plant and additional storage would be needed. The 800-MG regrowth also corresponds to capacity available on the City-owned farms. However, the City could use its own farms or privately owned farms for system regrowth.

In summary, this increment would be the regrowth on the City-owned farms of 800 MG. The capital cost for this regrowth would be associated with storage only, because the other distribution facilities already exist. Storage phasing and costs are addressed in a subsequent section.

## Geysers Expansion (EIR Alternative 5)

The Geysers Recharge Project is a system of pump stations and pipelines that conveys recycled water from the Llano Pump Station at the Laguna Plant to the Geysers Steamfield injection wells, currently operated by Calpine Corporation. The system includes two sections: the Valley Section and the Mountain Section. The Valley Section, which extends from the Laguna Plant to the Bear Canyon Pump Station, includes a 48-inch-diameter section and a 30-inch-diameter section of pipeline. The Valley Section can deliver water to locations along the pipeline route to The Geysers. The Mountain Section extends from the Bear Canyon Pump Station to the terminal tank at the Geysers Steamfield. This pipeline section includes a 30-inch-diameter pipe and three pump stations (Bear Canyon, Mayacmas, and Pine Flat). The Mountain Section cannot be used for purposes other than delivery of recycled water to The Geysers.

Up to 6,400 MG of flow could be managed annually using Geysers recharge. As more recharge is used, the unit cost for delivering water to the Geysers Steamfield increases.

The expansion of the flow to the Geysers Steamfield for injection was discussed in TM No. 7 of the Feasibility Report. The capacity expansions assumed in this Master Plan are essentially the same.

As presented in TM No. 7, the logical progressions in the flow expansions are:

- Increment 1 – Increase from existing contracted supply of 11 mgd (average annual flow) to 16 mgd. This utilizes the maximum design capacity of the Geysers conveyance system. No capital improvements are required within the City's conveyance system; however, any flow increase requires improvements within the Steamfield based on data provided by Calpine.

- Increment 2 – Increase from 16 mgd to 19 mgd (average annual flow). This requires utilizing the redundant fifth pump at each of the three mountain pump stations within the Geysers Recharge Project, thereby increasing the peak conveyance capacity to 20 mgd. An annual average flow of 19 mgd is used to allow for maintenance down time, because no redundant pumping units would be installed. This increment also requires additional capital improvements within the Geysers Steamfield, according to the Calpine information.
- Increment 3 – Increase from 19 mgd to 25 mgd (average annual flow). This requires expanding the three north Geysers pump stations to a maximum capacity of 27 mgd and using the Mountain Section of the Geysers Pipeline to its full capacity. The average annual flow is assumed to be 25 mgd to allow for pipeline maintenance down time, which would be needed even though the expanded pump stations could be designed to make installed redundant pumping units available. This pump station expansion would likely require at each pump station three more pumping units, with additional surge tanks and equipment, and a separate building.
- Increment 4 – This increment is the same as Increment 3, but with added storage.

Using the above increments of flow expansion, Geysers reuse increments were developed as shown in Table 5, including the cost of storage for Increment 4.

**TABLE 5**  
Geysers Reuse Increments  
*Santa Rosa Incremental Recycled Water Program*

Description of Increment	Demand (MG/yr)	Cumulative Demand (MG/yr)	Estimated Capital Cost (\$ million)	Estimated Cumulative Capital Cost (\$ million)
Increment 1 – 16 mgd	1,825	1,825	16	16
Increment 2 – 19 mgd	1,095	2,920	17	33
Increment 3 – 25 mgd	2,190	5,110	48	81
Increment 4 – 25 mgd	1,290	6,400	128	209

## Discharge (EIR Alternative 6)

Discharge could annually manage the entire incremental volume of 6,400 MG. Discharge could continue through two possible means:

- Direct discharge to the Laguna and/or Russian River (EIR Alternatives 6A and 6B)
- Indirect discharge to the Russian River (EIR Alternatives 6C, 6D, and 6E)

These options are discussed in the following sections.

### Direct Discharge to the Laguna or Russian River

As concluded in TM No. 16 of the IRWP Feasibility Report, discharge to the Laguna will likely be limited to 10 percent of the Laguna flow to ensure compliance with the receiving water quality objective. New facilities include improving the Laguna discharge by adding

flow measurement and control, at an estimated cost of approximately \$1.1 million. This is an IRWP element common to all programs.

To implement direct discharge to the Russian River, a new pipeline from the Geysers Pipeline to the river would need to be constructed, along with a river discharge structure. The Llano Pump Station would also have to be expanded to 80 mgd. The estimated capital cost of implementing this alternative is \$29 million. Depending on the location of the river discharge point, a booster pump station on the Geysers Pipeline may be required. The estimated cost of \$29 million does not include the cost of an intermediate booster pump station, which could approach \$19 million.

### **Indirect Discharge to the Russian River**

Indirect discharge could utilize injection wells, percolation ponds, or infiltration basins. Similar to direct discharge, this alternative would require regulatory approval. The criteria for defining an indirect discharge have not been developed by the NCRWQCB. If discharge using injection wells, percolation ponds, or infiltration basins is considered to be indirect for regulatory purposes, such a discharge would not be subject to the CTR/SIP. However, if the NCRWQCB considers a discharge using any of these methods to be a direct discharge and subject to the CTR/SIP, discharge using injection wells, percolation ponds, or infiltration basins may help achieve compliance with the CTR/SIP through the natural treatment process that occurs as water moves through soil. The estimated costs presented in this document are based on the development of infiltration basins.

The development of infiltration basins with capacity for a full 6,400 MG (wet year volume, year 2020 ADWF) is estimated to cost \$95 million. These costs derive from the cost estimates presented in TM No. 10 of the Feasibility Report with the most restrictive soil conditions. The expansion of the Llano Pump Station to 80 mgd is included to convey the flow out of the Santa Rosa Plain.

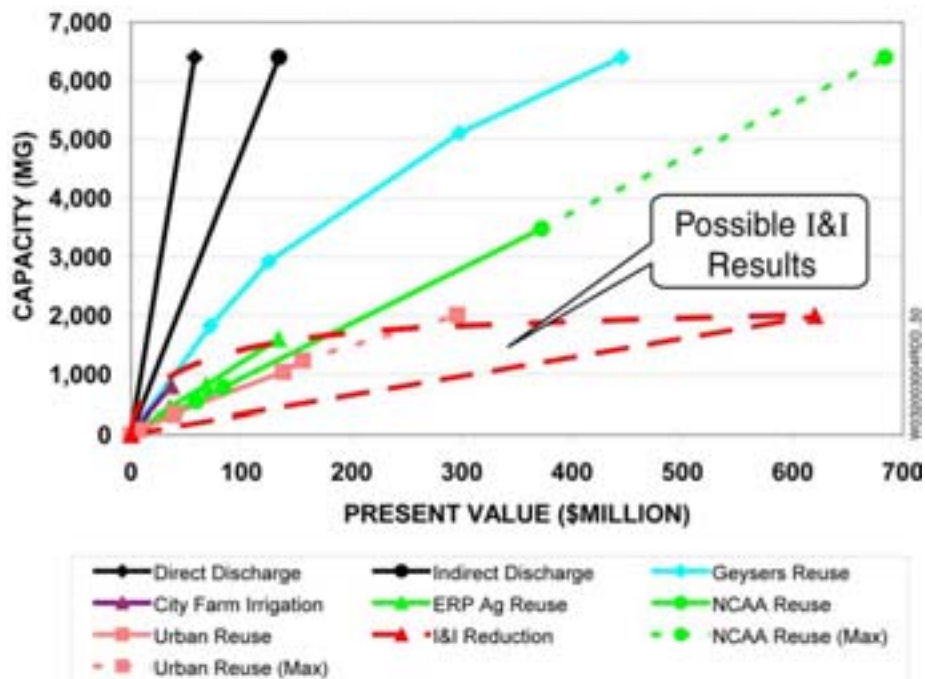
### **Advanced Membrane Treatment**

It is currently uncertain whether new discharge limits would be attainable without advanced membrane treatment (AMT). Therefore, the EIR is based on the premise that AMT could be required for either direct or indirect discharge. As presented in the IRWP Feasibility Report, the AMT facilities could range in cost from \$346 million to \$551 million, with annual O&M costs ranging from \$20 to \$35 million. Because of the high cost to construct and operate AMT facilities, the City may not choose to implement AMT because there are other, less costly programs identified in this Master Plan that would provide greater benefits.

## **Demand Cost/Capacity Comparisons**

The various uses for recycled water can be compared for their relative unit costs, including storage. The reuse alternatives are shown on Figure 6 and in Table 6, which compare the capacity increments and unit costs. The estimated costs presented on Figure 6 and in Table 6 reflect the value of potable water offset. River discharge (both direct and indirect) is also shown for comparison.

Storage is required to implement many of the reuse alternatives. However, the amount and timing of storage depends on the amount and timing of reuse implementation as discussed further in the section, Program Development. For the purpose of the comparisons presented here, it is assumed that the water balance calculations will result in a ratio of storage to demand of 5:8 for either agricultural or urban reuse. In other words, for every 80 MG of reuse demand, approximately 50 MG of storage must be provided. Geysers reuse has a unique storage function. Based on the water balance calculations found in Appendix C, storage of 1,900 MG was included at the Geysers reuse ultimate capacity of 6,400 MG. Direct and indirect discharge do not require storage, which is further demonstrated by the water balance model (Appendix C) and discussed in the section, Program Development.



**FIGURE 6**  
Demand/Cost Capacity Comparisons (Including Discharge)

The steeper lines on Figure 6 indicate lower unit costs than flatter lines. Direct and indirect discharge (without AMT) are the alternatives having the lowest unit cost, followed by Geysers reuse. City-owned farm irrigation is similar in cost to Geysers reuse. ERP and NCAA agricultural reuse are similar in cost, while urban reuse has the highest unit cost. However, as described previously, not all economic benefits of potable offset were captured in the unit price applied to urban reuse.

For reuse alternatives without the discharge or Geysers reuse alternatives, City-owned farm irrigation is expected to be the alternative with the lowest unit cost, followed by ERP Agricultural Area reuse. NCAA agricultural reuse and urban reuse are expected to be very similar in unit cost, particularly the first increments.

**TABLE 6**  
 Cost/Capacity Comparisons<sup>a,b</sup>  
*Santa Rosa Incremental Recycled Water Program*

<b>Increment</b>	<b>Description</b>	<b>Estimated Present Value (\$ million)</b>	<b>Capacity (MG/yr)</b>	<b>Estimated Unit Present Value (\$ thousand/MG)</b>
Urban Reuse - 1	G&CC Area	6.5	81	80
Urban Reuse - 2	Santa Rosa Phase 1	32.1	255	126
Urban Reuse - 3	Santa Rosa Phase 2	99.4	703	141
Urban Reuse - 4	Rohnert Park/Cotati	17.6	196	90
ERP Agricultural - 1	Max without ERP storage	34.9	440	79
ERP Agricultural - 2		33.3	377	88
ERP Agricultural - 3	Max size	65.3	783	83
NCAA – 1		40.1	370	108
NCAA – 2		18.8	170	111
NCAA – 3		24.8	240	103
NCAA – 4	Max size	293.9	2,700	109
City-owned Farm Irrigation		36.4	800	46
Geysers - 1	16 mgd	71.8	1,825	39
Geysers - 2	19 mgd	52.9	1,095	48
Geysers - 3	25 mgd	172.9	2,190	79
Geysers - 4	Ultimate capacity with additional storage	147.2	1,290	114
River Discharge		57.5	6,400	9
Indirect Discharge		134.2	6,400	21

<sup>a</sup>Does not include potential AMT cost, which could range from \$346 to \$551 million in capital cost and from \$20 to \$35 million in annual O&M costs. AMT is not included because reuse options are more cost-effective than AMT. Estimated storage costs are included.

<sup>b</sup>Increment costs are additive. For example, the present value of NCAA increments 1 and 2 is \$40.1 million + 18.8 million or \$58.9 million.

Estimated unit costs for storage are shown in Table 7. These estimated costs were developed according to the location of storage as defined in TM No. 5 and the Feasibility Report. In some cases, these costs will be blended depending on the type of reuse.

**TABLE 7**  
 Estimated Unit Capital Costs of Storage  
*Santa Rosa Incremental Recycled Water Program*

<b>Storage Location</b>	<b>Unit Cost (\$ thousand/MG)</b>
Santa Rosa Plain	52
East of Rohnert Park	63
East of Santa Rosa	82
North County	48

The estimated capital and O&M costs for the required storage facilities were then combined with the estimated capital and O&M costs for the infrastructure required for a given program, and estimated present value costs were developed. Present value costs calculated at an interest rate of 3 percent, including O&M costs through 2035, are shown on the figures in Section 3 illustrating each program, as well as in Section 4 of this Master Plan.

## **Section 3**

# **Program Development**

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## SECTION 3

# Program Development

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A program is a combination of alternatives that would achieve IRWP objectives through 2020. The initial step in program development was to identify elements that are recommended for implementation with all programs. In conjunction with City staff, criteria were developed to guide the formulation of programs. Using these criteria as guidance, strategies were developed to address future regulatory uncertainties.

## Common Program Elements

The common program elements outlined and further discussed below are intended to meet the objective of continuing to advance solutions for cost-effective treatment, recycling, or discharge in ways that adequately protect aquatic life and public health. Estimated costs and implementation schedules for the common elements are summarized at the end of this section. The common program elements fall into two categories: actions and studies.

### Common Actions:

- Implement indoor water conservation in accordance with best management practices listed in TM No. 2 of the Feasibility Report
- Expand the Laguna Plant to treat future flows
- Improve the Laguna discharge at Delta Pond to include flow measurement and control needed for receiving objective compliance

### Studies Common to all Programs:

- Conduct an I&I study to help pilot determine the appropriate role for I&I reduction in the IRWP
- Continue participating in the Monterey filtration pilot work and plant trials to evaluate alternative filtration technologies to optimize future filtration at the Laguna Plant
- Conduct Laguna, direct discharge, and indirect discharge studies to address CTR and other issues and preserve the option to discharge during the winter
- Conduct studies of California tiger salamander (CTS) habitat to guide the location of future storage facilities

## Indoor Water Conservation (EIR Alternative 1)

The indoor water conservation alternative included in all programs (refer to TM No. 2 of the Feasibility Report for a detailed description of the conservation alternative) would continue the implementation of the conservation plans adopted by each of the Subregional partners. The City of Santa Rosa indicates that most of the indoor water conservation that can be accomplished by the Go Low Flow toilet retrofit program has already been realized; most

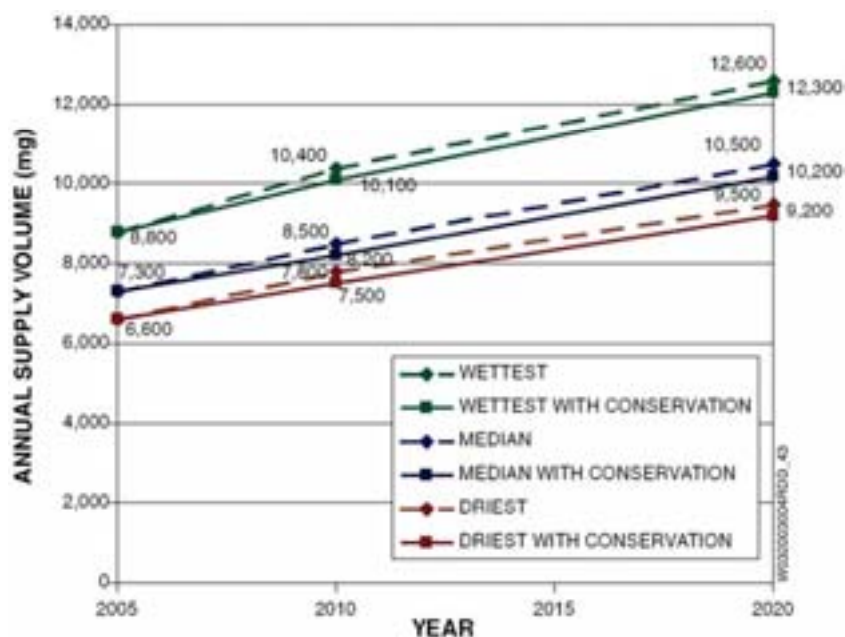
future conservation would be achieved through outdoor water conservation, which does not affect sewer flows.

Table 8 shows an estimate of how much annual indoor water conservation was accomplished by each of the Subregional partners through 2000 and estimates future savings. Much of the 288-MG annual water savings is expected to be achieved through the City of Rohnert Park's water meter installation program. The projected Laguna Plant ADWF of 25.9 mgd reflects the general plan populations of the Subregional System partners in 2020. With conservation, ADWF would be 25.1 mgd. However, peak wet weather flows at the Laguna Plant are not expected to change appreciably from initial IRWP projections because indoor water conservation would not reduce the wet weather flow contribution of I&I.

**TABLE 8**  
Summary of Indoor Water Savings  
*Santa Rosa Incremental Recycled Water Program*

	General Plan Horizon Year	Cumulative Annual Water Savings as of 2000		Potential Additional Annual Water Savings	
		(acre-feet)	(MG)	(acre-feet)	(MG)
Santa Rosa	2020	1,233	382	479	148
Rohnert Park	2020	247	80	356	110
Sebastopol	2013	54	17	38	12
Cotati	2010	28	9	58	18
Total		1,562	488	931	288

The impact of conservation on supply (the volume of water available for recycling or discharge) is illustrated on Figure 7. The cost of implementing the indoor water conservation alternative is estimated to be \$2.8 million.



**FIGURE 7**  
Impact of Indoor Water Conservation on Supply

## I&I Reduction (EIR Alternative 2)

I&I represents flows that enter the sewer system through either infiltration of groundwater or inflow of rainfall runoff that must be treated and discharged or recycled. A finding of the IRWP Feasibility Report (TM No. 14) is that the cost-effectiveness of an I&I reduction program is difficult to determine without more detailed study of the service area. A comprehensive, intensive program implemented throughout the City of Santa Rosa and, to some extent, in other Subregional member cities, was estimated to provide removal of 70 percent of the total I&I volume, and would cost approximately \$600 million. However, a wide range of results is possible, as illustrated on Figure 6. The cost-effectiveness of I&I removal needs to be defined in more detail so that the systemwide benefits can be better estimated. A study is recommended to begin this process.

## Treatment

The IRWP wet weather flow projections were made using a different method than used prior to the IRWP. In the past, projections were made based on the ratio of wet weather flow to ADWF using historical data. However, a review of the data from 1992 to 2002 shows actual wet weather flows were higher than had been projected using this approach. For the IRWP, a hydrologic model was used to project wet weather flows using a correlation between plant flow and Russian River flow. A comparison of model predictions to historical flows indicates accuracy to within  $\pm 6$  percent.

New wet weather flow projections indicate that additional wet weather capacity is needed for the current permitted flow of 21.3 mgd ADWF. However, only the treatment capacity associated with the incremental flow is included in the IRWP. These treatment capacity expansion improvements are described in TM No. 3 of the IRWP Feasibility Report. Table 9 summarizes improvements attributable to the existing permitted flow (21.3 mgd), the incremental flow (25.9 mgd), and the associated costs. Only the cost to expand capacity from 21.3 to 25.9 is included in the IRWP. The estimated cost to preserve the existing 21.3-mgd capacity is provided for information purposes only.

To read Table 9, compare the values in the second column under the heading "Full Filtration Alternative" to the values in the second column under the heading, "Partial Filtration Alternative." This will provide the comparison of full and partial filtration for capacity expansion. The first columns under these headings show improvements needed to preserve the existing 21.3-mgd capacity, which are not part of the IRWP. To determine the full effect of improvements needed for both capacity preservation and capacity expansion for either full or partial filtration, add the first and second columns together under the respective headings.

**TABLE 9**  
 Laguna Plant Capacity Preservation and Capacity Expansion Estimated Costs and Staging  
*IRWP Recycled Water Master Plan*

Recommended Improvement <sup>a</sup>	Full Filtration Alternative (5 gpm/ft <sup>2</sup> ) <sup>b</sup>		Partial Filtration Alternative	
	(\$ million, 2004) 21.3 mgd ADWF	(\$ million, 2004) 25.9 mgd ADWF	(\$ million, 2004) 21.3 mgd ADWF	(\$ million, 2004) 25.9 mgd ADWF
Preliminary Treatment				
Screening	2.1	0.5	2.1	0.5
Raw Sewage Pumping	1.3	0.3	1.3	0.3
Grit Removal	0.0	1.9	0.0	1.9
Primary Treatment <sup>c</sup>				
Primary Clarifiers	3.3	3.3	3.4	3.4
Primary Sludge Pump Station	0.7	0.2	0.7	0.2
Secondary Treatment				
Aeration Basins	0.0	6.4	0.0	6.4
Secondary Clarifiers	2.0	4.0	2.0	4.0
RAS/WAS Pumping	0.6	0.2	0.6	0.2
Tertiary Treatment				
Filtration <sup>d</sup>	3.9	3.9	0.0	0.0
UV Disinfection	4.9	4.9	0.0	0.0
Sodium Hypochlorite Disinfection	0.0	0.0	0.0	0.7
Sodium Bisulfite Dechlorination	0.0	0.0	0.0	0.4
Secondary Effluent Pipeline	0.0	0.0	0.0	0.4
Solids Handling and Treatment				
WAS Gravity Belt Thickener Expansion	0.0	1.0	0.0	1.1
Digester	0.0	2.3	0.0	2.3
Digester Control Building	0.0	4.2	0.0	4.2
Standby Generation <sup>e</sup>	5.3	1.6	5.3	1.6
Miscellaneous				
Secondary Transmission Pipeline	0.0	1.8	0.0	1.8
Sitework <sup>f</sup>	2.8	8.8	1.8	8.3
<b>Subtotal</b>	<b>26.9</b>	<b>45.3</b>	<b>17.2</b>	<b>37.8</b>
Engineering (20 percent)	5.4	9.1	3.4	7.6
<b>Subtotal</b>	<b>32.3</b>	<b>54.4</b>	<b>20.6</b>	<b>45.3</b>
Legal (8 percent)	2.6	4.3	1.6	3.6
<b>Subtotal</b>	<b>34.9</b>	<b>58.7</b>	<b>22.2</b>	<b>48.9</b>
Administration (5 percent)	1.7	2.9	1.1	2.4
<b>Total, \$ millions</b>	<b>36.6</b>	<b>61.6</b>	<b>23.3</b>	<b>51.4</b>
<b>Overall Total, \$ millions</b>	<b>98.2</b>		<b>74.7</b>	
<b>Range (-50% to +100%)</b>	<b>49-196</b>		<b>37-149</b>	

**TABLE 9**  
Laguna Plant Capacity Preservation and Capacity Expansion Estimated Costs and Staging  
*IRWP Recycled Water Master Plan*

Recommended Improvement <sup>a</sup>	Full Filtration Alternative (5 gpm/ft <sup>2</sup> ) <sup>b</sup>		Partial Filtration Alternative	
	(\$ million, 2004)	(\$ million, 2004)	(\$ million, 2004)	(\$ million, 2004)
	21.3 mgd ADWF	25.9 mgd ADWF	21.3 mgd ADWF	25.9 mgd ADWF

<sup>a</sup>Costs of facilities were shown in 2002 dollars in the Feasibility Report and have been updated here to 2004 dollars.

<sup>b</sup>Filter loading rates varied for comparison: 5.0 gpm/sf corresponds to Title 22 regulations; 5.6 gpm/sf corresponds to firm filter influent pumping capacity (3 of 4 pumps running); 6.7 gpm/sf corresponds to highest observed loading rate (maximum effluent flow rate of 74 mgd recorded on January 10, 1995).

<sup>c</sup>Primary clarifiers could potentially be deferred to Phase II, and fewer could be built, by operating the existing primary clarifiers at 5,000 gpd/sf at peak day flows and improving existing primary clarifier operation.

<sup>d</sup>For the full filtration alternative, assume two filters built every 5 years.

<sup>e</sup>Technical Memorandum No. 3 of the Feasibility Report correctly apportioned the cost of standby generators as \$1.5 million (2002 dollars) resulting from hydraulic capacity for wet weather flows associated with ADWF of 21.34 mgd, and \$5 million (2002 dollars) resulting from flows predicted by the revised general plans (a total of 25.9 mgd). However, when facilities are actually built, most of the costs for the facilities will be associated with the first increment (the building, electrical work, etc.). Therefore, these numbers have been reversed and updated to 2004 dollars for the purpose of more accurately defining the cost of projects and projecting cash flow.

<sup>f</sup>Sitework includes Site Civil, Yard Piping, Electrical, and other miscellaneous items. Costs calculated as percentage of improvement costs are as follows: 15% for Phase 1, 25% for Phase 2. Phase 2 sitework estimate is higher than Phase 1 value because Phase 2 work is anticipated to take place in a previously undeveloped portion of the plant site, with less existing infrastructure.

The capital cost of incremental flow capacity expansion at the Laguna Plant is estimated to be \$62 million. Although expansion of all liquid treatment processes is needed, approximately 20 percent of these costs results from expanding tertiary treatment, including filtration and ultraviolet disinfection. A premise of the Feasibility Report (TM No. 3) and EIR was that filtration would be expanded by replicating the conventional filters currently employed at the Laguna Plant, using a maximum filter loading rate of 5 gallons per minute per square foot (gpm/ft<sup>2</sup>) as currently mandated by the State. However, the Subregional System is participating in a pilot study with the Monterey Water Pollution Control Agency (MWPCA), the lead agency, and others under the auspices of the California Department of Health Services to determine whether higher filtration rates can meet treatment objectives and adequately protect public health. MWPCA expects the pilot study to be completed by the end of 2004. Shortly thereafter, a second phase will begin, which would involve filter loading trials at MWPCA, Santa Rosa, San Jose, West Basin Municipal Water District, and one of Los Angeles County Sanitation District's plants. These trials are expected to occur during 2005.

Bypassing some flows around the filters during extreme wet weather is an alternative to filtering all of the flow. Partial filtration would produce a blend of secondary- and tertiary-treated water. Permit conditions are anticipated to be met under this option, and this approach would avoid constructing a large number of expensive filters that would rarely be used. A comparison of the full and partial filtration options also is presented in Table 9.

Concurrently, the City intends to investigate alternative filtration technologies that may offer cost benefits or water quality improvements. The filtration studies would allow the

City to determine the most cost-effective combination of existing and future facilities to meet treatment requirements. Total cost for the City to participate in the Monterey studies, Laguna Plant filter loading trials, and evaluation of alternative filtration technologies is estimated to be \$300,000.

## Storage

Storage is not an alternative, but is required to implement many of the reuse alternatives. However, the amount and timing of storage implementation depends on the amount and timing of reuse implementation. Table 10 shows the potential storage locations and unit costs for each potential reuse scenario.

**TABLE 10**

Storage Locations and Estimated Unit Capital Cost for Each Reuse Alternative  
*Santa Rosa Incremental Recycled Water Program*

Reuse Alternative	Areas Where Storage Could Be Located and Unit (\$ thousand/MG) Capital Cost			
	Santa Rosa Plain	East of Santa Rosa	ERP	NCAA
Urban Reuse	52	82	63	
Agricultural Reuse				
ERP			63	
NCAA	52	82		48
City-owned Farms in Santa Rosa Plain	52			
Additional Geysers Recharge	52	82		48
Discharge to Laguna	52	82		
Discharge to River	52	82		

The Santa Rosa Plain storage area is located in an area that the USFWS considers to be within the potential range of the CTS, recently listed as endangered. USFWS indicates that surveys for the CTS will be a necessary step in the approval process on lands where the City might wish to locate storage facilities. Protocols for conducting these surveys and policy for protecting the CTS are currently being developed by USFWS. Such surveys could require two winter seasons to conduct. If surveys begin in winter 2003/2004, permits for storage facility construction in the Santa Rosa Plain would likely not be issued until summer 2005 or 2006 if surveys do not commence until winter 2004/2005. Such surveys could result in the need for an incidental take permit pursuant to Endangered Species Act Section 7 to operate and expand the existing irrigation and storage system. The cost of these surveys, documentation, and the permitting process is expected to be \$500,000 to \$1 million. The City has commenced CTS surveys.

## Discharge

Surface water discharged from the Laguna Plant is controlled by NPDES Permit #CA0022764 administered by the NCRWQCB. This permit includes waste discharge requirements that provide temporal, quantity, and quality constraints for surface water discharge. Prohibitions and limitations that affect the quality and quantity of recycled water discharged to surface waters are summarized below.

## Current Discharge Prohibitions

Current discharge prohibitions are as follows:

- The discharge of untreated or partially treated waste is prohibited.
- Surface water discharge is prohibited between May 15 and October 1.
- For discharge to the Russian River or the Laguna, maximum discharge rates shall not exceed 5 percent of the Russian River flow rate as measured at the Hacienda Bridge, adjusted daily.

Future discharge prohibitions could be less restrictive with added treatment at the Laguna Plant. Additional treatment required to comply with the CTR would produce recycled water of such a high quality as to possibly allow for a less restrictive dilution requirement, which is now set at 5 percent of the Russian River flow. TM No. 17 – *Water Quality Improvement Technologies* addresses additional treatment options at the Laguna Plant.

## Existing Receiving Water Limitations

Existing receiving water limitations are as follows:

- Dissolved Oxygen: The discharge shall not cause oxygen concentrations of the receiving waters to be depressed below 7.0 milligrams per liter (mg/L). In the event that the receiving waters are determined to have dissolved oxygen concentration of less than 7.0 mg/L, the discharge shall not depress the dissolved oxygen concentration below the existing level.
- pH: The discharge shall not cause the pH of the receiving waters to be depressed below 6.5 nor raised above 8.5. Within this range, the discharge shall not cause the pH of the receiving waters to be changed at any time more than 0.5 unit from that which occurs naturally. If the pH of the receiving water is less than 6.5, the discharge shall not cause a further depression of the pH of the receiving water. If the pH of the receiving water is greater than 8.5, the discharge shall not cause a further increase in the pH of the receiving water.
- Turbidity: The discharge shall not cause the turbidity of the receiving waters to increase more than 20 percent above naturally occurring levels.
- Temperature:
  - When the receiving water is below 58°F, the discharge shall cause an increase of no more than 4°F in the receiving water, and shall not increase the temperature of the receiving water beyond 59°F. No instantaneous increase in receiving water temperature shall exceed 4°F at any time.
  - When the receiving water is between 59°F and 67°F, the discharge shall cause an increase of no more than 1°F in the receiving water. No instantaneous increase in receiving water temperature shall exceed 1°F at any time.
  - When the receiving water is above 68°F, the discharge shall not cause an increase in temperatures of the receiving water.

- **Other Requirements:** Receiving water limitations are stipulated in the NPDES permit for the following parameters: sediments, biostimulants, floatables, color, taste and odors, toxics, oil and grease, bioaccumulative toxics, copper, and ammonia/nitrogen.

There are currently 15 permitted locations for discharging to the Laguna, which ultimately discharges to the Russian River. Future discharge options include continued use of the existing discharge locations, a new direct discharge to the Russian River, or indirect discharge to the Russian River. This section discusses the challenges associated with each of these options.

### **Laguna Discharge**

The current primary point of discharge is via Delta Pond at the confluence of Santa Rosa Creek and the Laguna. The receiving water quality challenges associated with discharge to the Laguna include compliance with dissolved oxygen, pH, turbidity, and temperature requirements, in addition to the CTR compliance challenges described above. Analysis of historical data indicates that compliance is most difficult during the early part of the discharge season from October through December. The data also indicate that compliance can usually be achieved if discharge is maintained below about 10 percent of total flow in the Laguna. Precisely regulating discharge with respect to Laguna flow would require improvements to the existing discharge control and Laguna flow monitoring systems.

Although Laguna discharge cannot manage all of the flows to the Laguna Plant generated under future conditions and remain below the 10 percent discharge rate, preservation of the option of discharge to the Laguna is recommended. Therefore, the Delta Pond discharge should be modified to include control and measurement of the flow rate. The estimated cost of these modifications is approximately \$1.1 million.

Compliance with discharge requirements is more problematic. To maximize allowable Laguna discharge, additional studies will be necessary to ensure that the City achieves discharge compliance under the current permit conditions and future CTR. These studies are discussed in the next section.

### **Direct Discharge Studies**

Adding a point of direct discharge to the Russian River would alleviate the challenges of meeting dissolved oxygen, pH, temperature, and turbidity limits in the Laguna as a result of the much greater volume of receiving water in the river compared to the Laguna. However, discharges to either the Laguna or the Russian River (except possibly the indirect discharge option) are considered direct surface water discharges that will be regulated under the CTR/SIP.

The CTR is implemented by the NCRWQCB according to the SIP. The SIP describes a process to determine which effluent constituents have a “reasonable potential” to adversely affect surface water quality and a process to identify effluent quality limits for constituents that meet the reasonable potential test. The SIP provides for consideration of site-specific conditions when determining reasonable potential and effluent quality limits. This ensures that aquatic life and human health are protected and that limits are not more stringent than necessary to protect aquatic life and human health. Consideration of site-specific conditions in the SIP process would necessitate several studies, as discussed below.

The CTR, promulgated on May 18, 2000, sets numeric water quality objectives for 126 priority pollutants. The SIP became effective on May 22, 2000, and provides the process for establishing discharge limits to attain CTR water quality objectives. Under the SIP, analyses are performed using both effluent and receiving water quality parameters to determine which of the 126 priority pollutants show a reasonable potential for causing harm to aquatic life and, therefore, require a numeric discharge limit.

For the Subregional System, copper, lead, gamma-BHC (a pesticide), and endosulfan II (a pesticide) were shown in a preliminary analysis to have reasonable potential. Of these constituents, the metals are the more difficult to remove, and copper is the most difficult. The possible effluent limits for these constituents, particularly copper, could not be achieved without AMT, including advanced membrane filtration and disposal of its hazardous waste byproduct (i.e., brine). It is questionable whether the small improvement in water quality achieved by this treatment would warrant the additional high cost.

Calculations performed as part of the planning activity under the IRWP considered effluent limit calculations both with and without dilution. Including dilution in the calculation for the Russian River resulted in a small (1 to 2 micrograms per liter [ $\mu\text{g/L}$ ]) increase in predicted effluent limits for copper, but a 3-to-5-fold increase in predicted limits for lead, gamma-BHC, and endosulfan II. Little change resulted from including dilution in the effluent limits calculated for the Laguna because of the limited dilution available.

Studies that may be needed to resolve issues associated with CTR and SIP implementation for direct discharges to the Russian River and the Laguna are described in the following paragraphs.

**Water Effect Ratio (WER) Study.** “Water effect” refers to the ability of a particular receiving water (e.g., the Russian River) to reduce the toxic effect of a particular water quality constituent (e.g., copper). Waters contain constituents, such as naturally occurring dissolved organic compounds, which bind with and inactivate toxic constituents. Water quality criteria for the protection of aquatic life were developed in laboratories using distilled water without any such water effect. The outcome of a WER study is an adjusted water quality objective. The adjusted water quality objective is used in the reasonable potential and effluent limit-setting steps described in the SIP. Several approaches have been used to conduct WER studies, as follows:

- **Side-by-side toxicity tests.** One set of tests is conducted using distilled laboratory dilution water and the other is conducted using site water (i.e., receiving water). The endpoint obtained using site water is divided by the endpoint obtained using laboratory dilution water to calculate the WER for the particular constituent being tested.
- **Biotic Ligand Model.** The concept of the Biotic Ligand Model (BLM) is that the toxic effect of metals on aquatic animals is determined by the level of metal accumulation at the site of uptake by an animal. This concentration, in turn, is determined by an interplay between *complexation* (i.e., formation of complex compounds) of the metal in the water with organic substances and inorganic anions and *competition* of the metal ion with other cations (such as  $\text{Ca}^{++}$ ,  $\text{Mg}^{++}$ , etc.) for binding sites at the point of uptake by an animal. The BLM can then be used to calculate the effective toxicity based on water quality monitoring data collected in the discharge and in the receiving water.

Both of these methods have been developed by EPA and are recognized in SWRCB's draft *Compilation of Existing Guidance for the Development of Site-Specific Water Quality Objectives in the State of California*. The particular approach that should be used in a WER study for the IRWP would need to be developed in consultation with regulatory authorities, including the NCRWQCB and NOAA Fisheries (formerly National Marine Fisheries Service). Implementation of a WER study for the plan, developed in consultation with these agencies, is expected to require about 1 year and an estimated \$200,000 to \$400,000.

**Translator Study.** Water quality objectives for metals established by EPA in the CTR, on which the reasonable potential and effluent limit analyses are based, are expressed as the concentration of the dissolved fraction. Any effluent limits must, according to federal regulations, be expressed as the total concentration (i.e., the sum of the dissolved and particulate fractions). A translator is the number used to calculate a total recoverable permit limit from a dissolved metal criterion. The SIP specifies a generic translator (i.e., not based on site-specific water quality information) unless a site-specific translator is available. A Translator Study would provide the basis for a site-specific translator. A Translator Study would involve analyzing water quality samples to determine the ratio of dissolved to total metals under a range of conditions. The duration of a Translator Study would be about 1 year and the cost is estimated at approximately \$100,000 to \$200,000.

**Mixing Zone Study.** A mixing zone is the area in a receiving stream in which wastewater is incompletely mixed with the ambient water. Consideration of mixing zones when deriving effluent quality limits for wastewater discharges is currently permitted under state and federal regulations, and this approach has been used elsewhere in California and around the nation. The NCRWQCB's Basin Plan could be modified to allow consideration of mixing zone consistent with state and federal regulations. Federal and state mixing zone regulations require that "credit" for the dilution that occurs in the mixing zones can only be taken if toxicity would not occur in the mixing zone. The NCRWQCB has given approval to the City to begin working on the technical study and policy options for NCRWQCB consideration. Agencies, including the City of Santa Rosa, have entered into a cooperative agreement to provide funding for the necessary technical study to support this effort, because the State does not have the necessary funding at this time. The duration of the Mixing Zone Study is expected to be about 2 years and the cost is estimated to be approximately \$500,000 to \$600,000.

**Detailed Effluent Quality Studies.** In addition to the four constituents identified as having future discharge limits under the CTR, there are several constituents that have been identified as being potentially subject to effluent limits under the CTR/SIP, based on existing effluent quality data. Existing effluent quality data are generally of very high quality and reliability, but additional studies of several constituents are recommended as follows:

- **Lindane.** Lindane is occasionally found in effluent, and the presumptive source is a medication intended to control head lice. Use of Lindane for this purpose was prohibited under California law as of January 1, 2002, yet Lindane has been detected in effluent since then. A study is needed to verify that Lindane-containing shampoos are no longer available to consumers or physicians, and that Lindane is not otherwise used in the service area. Effluent monitoring frequency for Lindane would also be increased. The

study and increased monitoring would demonstrate the lack of reasonable potential for Lindane, or provide the basis for additional source control. The duration of the Lindane Study is expected to be about 6 months, and the cost is estimated to be approximately \$25,000 to \$50,000.

- **Cyanide.** Cyanide is reported in effluent samples from many treatment plants, including samples from the Laguna Plant. Cyanide is potentially formed in the treatment process and/or potentially as a result of laboratory analytical error. A broad study of many laboratories and treatment plants is being conducted to resolve this matter. This cyanide study would continue to be monitored. When results of this broad study are available, the Laguna Plant and laboratory would be evaluated to document applicability of the broad study results to the Laguna Plant. These study results could indicate lack of reasonable potential or that a study to identify cyanide sources and source reduction options would need to be conducted. The current broad cyanide study is expected to be completed in approximately 2004. The duration of the Santa Rosa Cyanide Study (to verify applicability of the broader study) is expected to be about 6 months and the cost is estimated to be approximately \$10,000.
- **1,1,2,2-Tetrachlorethane.** Tetrachlorethane, a solvent, is not expected to be present in effluent because of its extreme volatility, yet it was detected once in effluent. An intensive evaluation of tetrachlorethane throughout the treatment plant would determine if tetrachlorethane is occasionally present in effluent and should have a limit under the CTR/SIP or if tetrachlorethane is fully removed during treatment and no limit is needed. The duration of the tetrachlorethane study is expected to be about 6 months and the cost is estimated to be approximately \$20,000 to \$40,000.
- **Phthalate.** Phthalates are ubiquitous at low levels in environments where plastic materials are present. Other dischargers have found through detailed study that reports of phthalates in effluent samples are actually the result of contamination of samples by phthalate-emitting substances found in analytical laboratories. An intensive evaluation of phthalate would determine if phthalate is occasionally present in effluent and should have a limit under the CTR/SIP or if phthalate is detected as the result of sample contamination and no limit is needed. The duration of the Phthalate study is expected to be about 6 months and the cost is estimated to be approximately \$25,000 to \$50,000.

### Indirect River Discharge

Indirect discharge to the Russian River is a flexible, cost-effective method for managing wet weather flows. Indirect discharges may not be subject to the CTR.

Obtaining a permit for an indirect discharge would require considerable characterization of local geological and groundwater conditions, as well as an evaluation of the fate of recycled water quality constituents in the soils and groundwater. Because the duration of such studies is long (approximately 2 years), early initiation of these studies may be desirable to preserve the option of timely indirect discharge implementation. The scope of an Indirect River Discharge Siting Study would need to be agreed to in advance with the NCRWQCB staff to ensure that the NCRWQCB staff can determine if: (1) any proposed indirect discharge project is subject to the CTR/SIP, and (2) the effects of any such indirect discharge on groundwater quality would not adversely affect beneficial uses. An Indirect River

Discharge Siting Study would involve evaluating existing information about geological and groundwater conditions in the indirect discharge study area as well as an evaluation of the fate of recycled water quality constituents in the soil and groundwater (as defined on Figure 2).

The City of Healdsburg and the City of Cloverdale operate similar discharges and may make relevant information available to the City of Santa Rosa. An Indirect River Discharge Siting Study could subsequently involve additional hydrogeological and geochemical study that would require using existing wells and/or new wells installed for this purpose. The duration of the Indirect River Discharge Siting Study is expected to be about 2 years and the cost is estimated to be approximately \$1.5 to \$3 million.

Study of the Healdsburg indirect discharge by the Subregional System is recommended to determine if it would be a viable future option for the Subregional System partners is recommended.

## Summary of Estimated Common Program Element Costs and Schedule

Estimated costs and schedule for implementing common program elements are shown in Table 11, differentiated as either construction or studies.

**TABLE 11**  
Estimated Cost and Schedule for Common Program Elements  
*Santa Rosa Incremental Recycled Water Program*

Element	Estimated Cost (\$ million)	Implementation Schedule
<b>Construction</b>		
Implement indoor water conservation in accordance with the plans of the Subregional System partners to reduce system inflow	2.8	Ongoing
Expand the Laguna Plant to treat future flows	62	2009-2019
Improve the Delta Pond discharge to include flow measurement and control needed for receiving water compliance	1.1	2005-2006
<b>Studies</b>		
Conduct an I&I study to help determine the extent that wet weather flows may be cost-effectively reduced	0.1	2004-2007
Continue participating in the Monterey filtration pilot work and plant trials and evaluate alternative filtration technologies	0.3	2004-2005
Conduct CTS surveys to guide selection of storage sites	0.5-1.0	2003-2005 or 2004-2006
Conduct Laguna, direct discharge, and indirect discharge studies to preserve the option to discharge during the winter	2.4-4.3	2004-2007

## Program Evaluation Criteria

The IRWP objectives presented in Section 1 were expanded and refined to serve as program evaluation criteria in a workshop with City staff. These criteria were used to guide the formulation and evaluation of programs. These criteria were treated as being of equal value during the development of programs. The BPU will have the opportunity to refine, weight, and apply the criteria during the program selection process.

## Primary IRWP Objectives and Evaluation Criteria

- **Provide wastewater treatment, recycling, and disposal for the Santa Rosa Subregional Reclamation System to accommodate projected growth as indicated in the adopted general plans of each Subregional System member effective as of July 2002.**
- **Develop and operate the wastewater treatment and disposal system in ways that protect public health and safety, protect natural resources including the Russian River and its tributaries, promote use of recycled water, meet current regulatory requirements, and provide flexibility to comply with future regulatory requirements.**  
Treatment, reuse, and disposal regulations continue to become more stringent with time. If adoption of a program by the City does not preclude compliance with reasonably foreseeable regulations, it is considered to have flexibility. Programs that result in construction of facilities that may not be needed for disposal capacity under future regulatory changes are considered higher risk programs. Programs need to be evaluated with respect to environmental impacts.
- **Maintain a system and components that are economically feasible and continue to be successfully financed.** Cost is also an evaluation criterion, and is discussed separately in the section, "Summary of Estimated Program Costs and Economic and Financial Analysis," as well as within the figures presented for each program.

## Secondary IRWP Objectives and Evaluation Criteria

- **Maximize use of recycled water.** Reuse alternatives provide the ability to phase construction but other alternatives (such as river discharge) do not. This attribute takes advantage of the time value of money and reduces the risk of constructing facilities that may not be needed for disposal capacity at some time in the future.
- **Maximize reuse opportunities where recycled water would increase the availability of potable water supplies.** If recycled water can serve an existing or future user who would otherwise use a potable water supply, the use of potable water is offset. This provides a direct water supply benefit to the City. Serving recycled water to agricultural users and users on Santa Rosa City wells may provide some offset to potable supplies, but there is insufficient information to quantify the amount. Existing or future recycled water users in Rohnert Park or Cotati are considered to provide full potable offset. Reuse outside of the Subregional System boundaries is not considered to provide quantifiable potable offset.
- **Dispose of reclaimed water in a manner that protects beneficial uses of receiving waters.**
- **Optimize water conservation.** Conservation is considered an element common to all programs.
- **Maintain the level of weather-independence (as defined by Regional Water Quality Control Board policy) that is provided by the addition of the Geysers Recharge Project to the Subregional Reclamation System.** Wet weather flows treated by the Laguna Plant are highly variable. Infiltration and inflow (I&I) reduction would help reduce this variability. However, the cost-effective level of I&I reduction is not currently quantifiable. An I&I study is needed to help determine the appropriate level of I&I

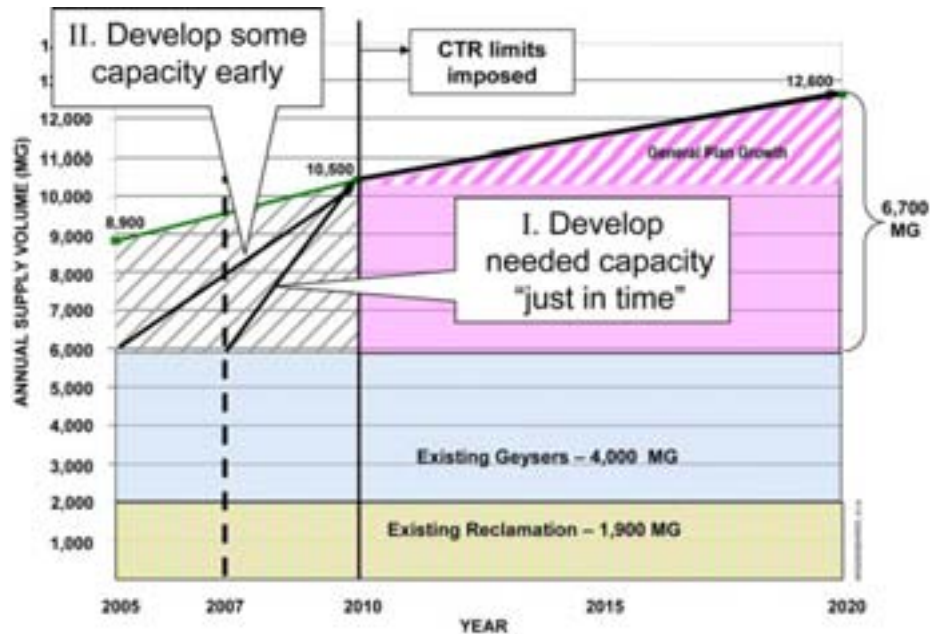
reduction to be included in the IRWP. If a program can respond quickly to wet weather flows with low risk of violating permits or agreements, it is considered to contribute to weather independence.

- **Maximize use of existing infrastructure.** Maximizing use of facilities located within the boundaries of the Subregional System is considered to be more likely to directly benefit the Subregional Partners in achieving this objective. I&I reduction would also contribute to this objective.
- **Maintain a disposal system that is manageable and reliable.** Manageable and reliable refers to system operation. If a program can respond quickly to wet weather flows with low risk of violating permits or agreements, it is considered to contribute to reliability and manageability. Programs that include discharge, for example, are easier to manage than programs that rely heavily on agricultural or urban reuse. Agricultural or urban reuse would require monitoring multiple users. Maximizing use of facilities located within the boundaries of the Subregional System is also an attribute considered to directly benefit the Subregional Partners in achieving this objective. Although gray water systems were included in the EIR, they have not been considered for implementation under any of the programs because they are not considered manageable and reliable.
- **Provide flexibility to accommodate use of recycled water made available by neighboring agencies as deemed appropriate by the City of Santa Rosa.** The existing Geysers pipeline has capacity beyond the needs of the Geysers Recharge Project. If deemed appropriate by the City, any of the programs could allocate additional capacity in the Geysers Pipeline to accommodate recycled water from neighboring agencies.

## Program Implementation Strategies

A number of actions are recommended as common elements of all IRWP programs. The objective behind these common elements is to continue advancing solutions that would make the best use of ratepayer funds by cost-effectively treating and reusing or discharging water that adequately protects aquatic life and public health.

Two strategies have been developed to manage flows discharged after the next NPDES permit is issued in 2005. The strategies are predicated on meeting both the CTR-driven permit schedule and managing system flow as it grows, as shown on Figure 8. One strategy (Strategy I – just-in-time capacity) involves waiting for better resolution of regulatory uncertainties prior to constructing new facilities. The other strategy (Strategy II – develop some capacity early) is to proceed immediately with implementation of urban and agricultural reuse.



**FIGURE 8**  
Implementation Schedule and Flow Drivers

Within the Strategy I and II major program divisions, the strategies were further subdivided into the following frameworks:

- A – Direct discharge
- B – Indirect discharge
- C – Geysers (25 mgd)
- D – Geysers (19 mgd) plus urban and agricultural reuse
- E – Urban and agricultural reuse

This results in 10 programs, designated I.A through I.E and II.A through II.E. These programs are described in detail in the following sections. Table 12 correlates the 10 Master Plan programs to the EIR combinations of alternatives.

**TABLE 12**  
Correlation Between EIR Combinations of Alternatives and Master Plan Programs  
*Santa Rosa Incremental Recycled Water Program*

EIR Combination of Alternatives	Master Plan Program	Description
1	I.B	Indirect Discharge
5	I.A	Direct Discharge
6	I.C	Geysers (25 mgd)
10	I.D	Geysers (19 mgd) plus Urban and Agricultural Reuse
11	I.E	Urban and Agricultural Reuse
12	II.A	Early Reuse plus Direct Discharge
13	II.B	Early Reuse plus Indirect Discharge
14	II.C	Early Reuse plus Geysers (25 mgd)
10	II.D	Early Reuse plus Geysers (19 mgd) plus Urban and Agricultural Reuse
11	II.E	Early Reuse plus Urban and Agricultural Reuse

The detailed capacity and cost calculations for each of the 10 programs, as well as the elements common to all programs, are shown in Appendix D. Present value calculations were supported by information in the economics analysis report (Appendix A).

Each program and its sequencing may require additional storage to support it, which is the case for frameworks C, D, or E. The water balance model (previously discussed) was used to calculate the timing and amount of storage required for any given program. Appendix C summarizes the water balance analysis and presents the model output tables. Appendix D includes storage summary tables that show the type of storage (e.g., Santa Rosa Plain, NCAA), the timing of the storage construction for a given program, and the estimated cost.

### Strategy I (Just-in-Time Implementation)

Strategy I programs are constructed just in time to reach the 2010 goal for needed capacity. The construction start date is expected to be 2007, after interim permit conditions are known in 2005 and after studies are completed to aid in achieving discharge compliance. These studies are expected to clarify current regulatory and implementation uncertainties. Also, the 2007 date allows time for an I&I study to be conducted and its results known, so that its cost-effectiveness may be better understood. Strategy I is illustrated on Figure 9.

If studies indicate that regulatory compliance with the CTR is attainable without AMT, direct or indirect discharge to the Russian River would be implemented. The Subregional System could also proceed with additional reuse at whatever level deemed appropriate by BPU and Council. This additional reuse could include any combinations of urban, agricultural, or Geysers reuse.

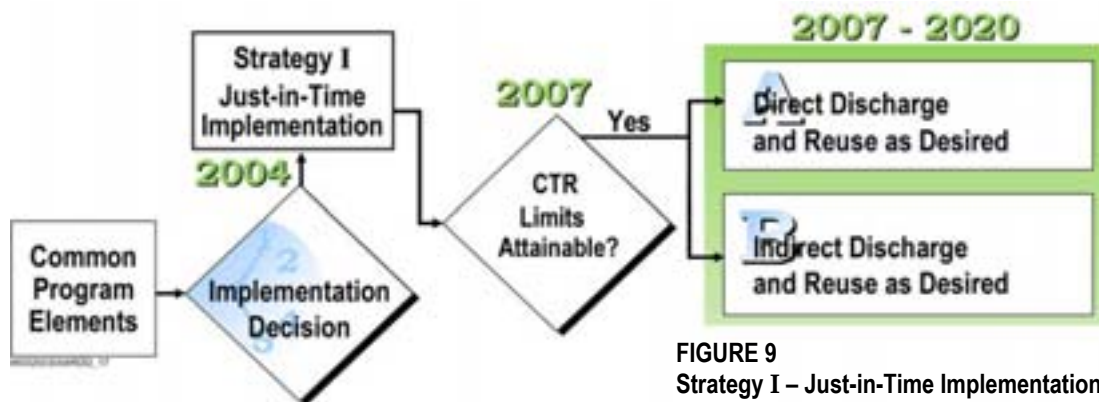


FIGURE 9  
Strategy I – Just-in-Time Implementation

If the CTR limits are attainable only with AMT, flows could be managed by conveying additional water to the Geysers Recharge Project and/or reuse (agricultural and/or urban). I&I removal could also play a role in managing these flows.

The advantages of Strategy I are as follows:

- Defers capital expenditures
- Allows for better definition of regulatory constraints
- Avoids constructing facilities that may not be needed for disposal capacity

The disadvantages of this strategy are that achieving regulatory compliance on schedule becomes riskier and the Subregional System may negotiate less favorable terms or be shut out from alternatives as a result of not initially pursuing recycling projects and agreements with willing parties. These risks could make achieving regulatory compliance and providing needed capacity potentially more expensive and difficult over the long-term.

## Strategy II (Early Implementation of Reuse)

Under Strategy II, the City would proceed in 2004 with implementing early reuse, defined as Geyser, agricultural, or urban reuse, as illustrated on Figure 10.

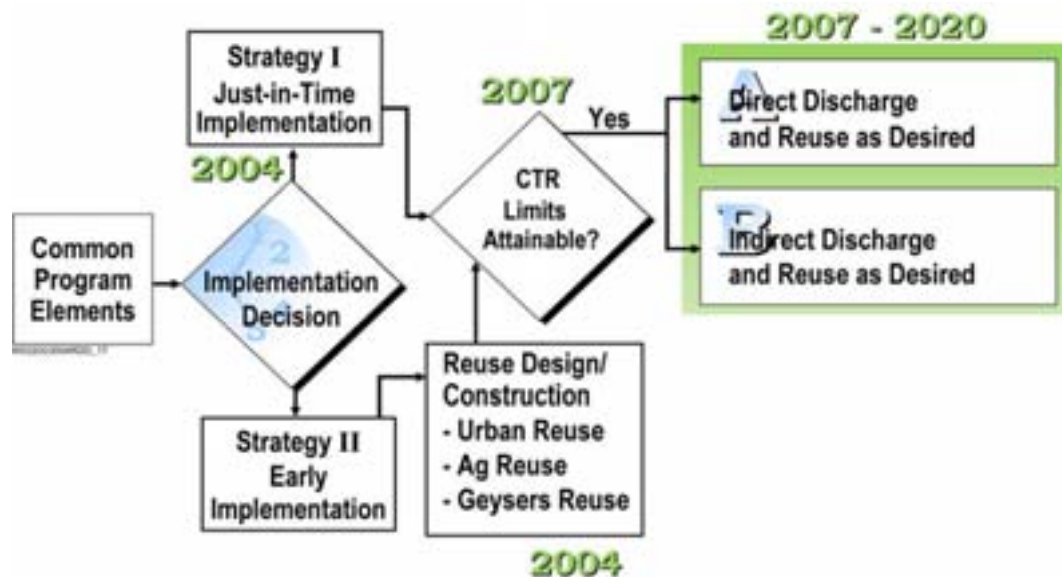


FIGURE 10  
Strategy II – Early Implementation of Reuse

If studies completed by 2007 indicate that discharge is capable of achieving CTR compliance without AMT, the preferred flow management alternatives of Laguna direct discharge or direct or indirect Russian River discharge could be implemented. The Subregional System could also proceed with additional reuse at whatever level is deemed appropriate by BPU and the City Council, considering water market conditions.

If the CTR limits are attainable only with AMT, flows could be managed by conveying additional flow to the Geysers Recharge Project and/or reuse (agricultural and urban) as shown on Figure 11.

The advantages of Strategy II are as follows:

- Increases ability to meet potential regulatory compliance schedules
- Provides early water supply benefit
- Provides flexibility for implementation
- Increases commitment to reuse

The disadvantage of Strategy II is that some facilities constructed to meet system disposal requirements may not be needed if CTR compliance is attainable.

Figure 11 shows the overall decision process including both Strategies I and II.

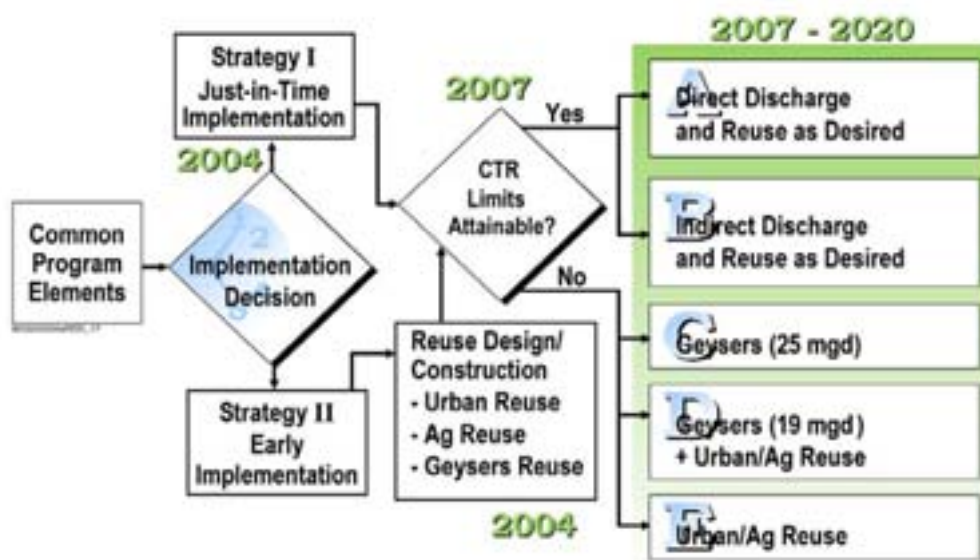


FIGURE 11  
Summary Decision Flowchart

In summary, a decision should be made in 2004 to include early reuse (Strategy II) or not (Strategy I). An indication of the preferred framework (A, B, C, D, E) can also be included in the decision. Then, in 2007, an additional decision should be made to chart the course for the 2010 program requirements including the final program framework to be used.

## Strategy I Programs

As discussed previously, Strategy I involves a “just-in-time” approach to resolving CTR compliance, and delays capital improvements leading up the 4,200-MG annual capacity needed in 2010 as long as possible.

### Strategy I Program Sequencing

A decision would be made in 2007 regarding whether or not discharge is allowed in 2010. If direct discharge is allowed, no more capital improvements need to be made to comply with the CTR; however, reuse projects could be implemented at the City’s option. If direct discharge is no longer allowed, a 3-year sequence of capital improvements to reach the 4,200-MG capacity would need to begin, and then continue from 2010 to 2020 to reach the ultimate 2020 capacity of 6,400 MG.

### Strategy I Program Descriptions

#### Program I.A – Direct Discharge

Under Program I.A, direct discharge into the Russian River may continue beyond 2010, but Laguna discharge would be restricted to 10 percent of the flow in the Laguna, and a new discharge point directly into the Russian River would be established. This new discharge

point will need to be constructed as part of this program. The Llano Pump Station would have to be expanded to 80 mgd in 2010 to carry the required flow out of the Laguna Plant. The City could implement additional reuse at its option.

In 2007, a decision must be made whether to continue Russian River discharge. If the decision is to continue with river discharge, then the Llano Pump Station would need to be expanded and the river discharge pipeline and discharge structure would be constructed. If the decision is to abandon discharge because effluent limits cannot be met without AMT, the City may choose a new program, such as Program I.C, I.D, or I.E.

If direct discharge continues beyond 2007, the Llano Pump Station expansion would need to occur in 2009, as shown on Figure 12, which would then allow the capacity required from 2010 to 2020 to be in place. No new storage is required for this program, as shown by the water balance, Appendix C. Program I.A is shown on Figure 13, including a location map, costs, cash flow, and example priority for water delivery.

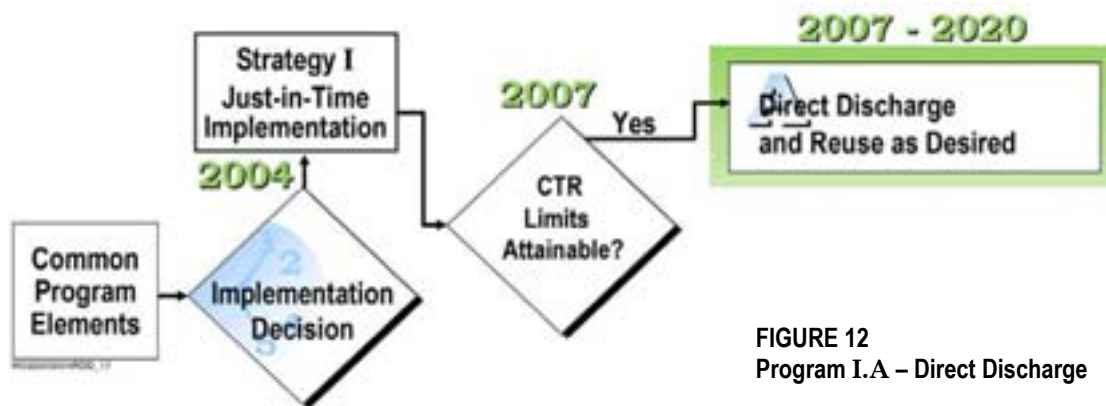
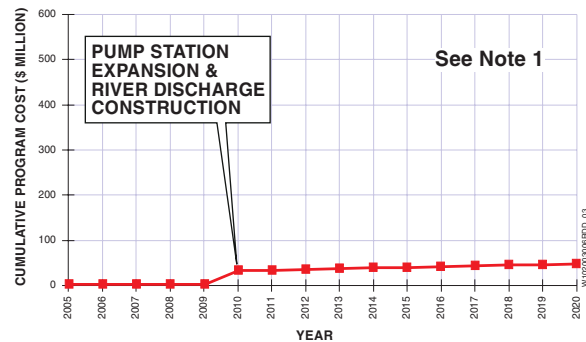


FIGURE 12  
Program I.A – Direct Discharge

The performance of this program in relation to evaluation criteria is summarized as follows:

- **Provide capacity to treat, recycle, and dispose** – This program provides capacity to treat, recycle, and dispose of all flow projected through 2020 through discharge. The City could implement additional reuse at its option.
- **Protect natural resources, promote use of recycled water, meet current regulatory requirements, and provide flexibility for future regulations** – This program, without AMT, provides flexibility for managing regulatory changes because it does not preclude implementing future options. If discharge were later abandoned, the cost of the river discharge facilities could be at risk.

Very minor temporary construction impacts to natural resources are associated with direct discharge; only the area around Llano Pump Station would be involved. However, if reuse projects are implemented, there would be significant construction-period impacts on traffic and noise. Loss of farmland also could be a significant impact if reuse projects are implemented in addition to discharge. Significant induced seismicity impacts and increases in Llano Pump Station noise levels could result if any expansion of Geysers reuse should occur. The extent of water quality impacts, if any,



NOTE: 1. Does not include Common Elements  
2. This program could also include reuse in any of the areas shown on Figure 2.

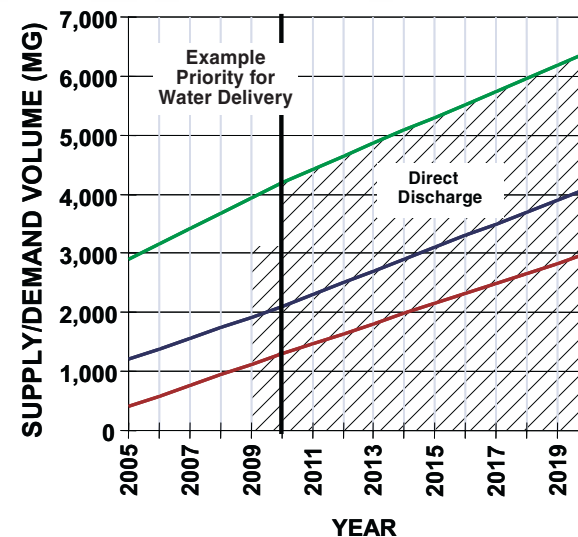
#### ESTIMATED COSTS AND VOLUME FOR PROGRAM I.A Santa Rosa Incremental Recycled Water Program

Program Elements	Estimated Capital Costs (\$ million)	Estimated Present Value (\$ million)	Volume of Flow Managed (MG)
Direct Discharge	29 <sup>a</sup>		6,400
Indirect Discharge			
Geysers			
Urban Reuse			
Agricultural Reuse			
Storage			
Subtotal	29 <sup>a</sup>	45 <sup>a</sup>	
Common Elements	72	122	300
Total Program	102 <sup>a</sup>	167 <sup>a</sup>	6,700

<sup>a</sup>Does not include potential AMT cost, which could range from \$346 to \$551 million in capital cost and from \$20 to \$35 million in annual O&M costs.

Monthly user charge increase (per ESU) = \$5.32 for Santa Rosa

Demand fee increase (per ESU) = \$3,377 for Santa Rosa



**FIGURE 13**  
**PROGRAM I.A-DIRECT DISCHARGE**  
SANTA ROSA SUBREGIONAL WATER RECLAMATION SYSTEM  
INCREMENTAL RECYCLED WATER PROGRAM

could be determined by future CTR interpretations. Potential for pipeline rupture associated with reuse projects would be considered a significant impact. Loss of habitat associated with reuse projects could be avoided or new habitat could be created as compensation to mitigate impacts to less than significant. If additional reuse projects are pursued, other pump stations could produce significant operational noise impacts. Some minor visual impacts would occur at Llano Pump Station. If other reuse projects are implemented, storage could result in significant visual impacts.

- **Maintain a system that is economically feasible and successfully financed** – See Table 19 in Section 4 of this Master Plan for a comparison of costs to implement each program, as well as the costs shown on figures presented for each program in this section.
- **Maximize use of recycled water** – Although flow would be discharged to the Russian River, the City could elect to implement additional reuse and commit to reuse agreements and associated operating risk at its discretion.
- **Maximize potable water supplies** – This program does not provide a potable water offset unless additional urban or agricultural reuse is implemented.
- **Dispose of reclaimed water while protecting beneficial uses of receiving waters** – Discharged water will be treated to comply with all NPDES permit stipulations and effluent quality limits under the CTR/SIP.
- **Optimize water conservation** – Conservation is an element common to all programs.
- **Maintain weather-independence** – This program provides flexibility for responding quickly to variations in wet weather flow. I&I reduction would provide additional flexibility, and an I&I study is needed to help determine the appropriate level of I&I reduction to be included in the IRWP.
- **Maintain a manageable and reliable disposal system** – This program, which relies on discharge, is highly manageable in comparison to programs that rely heavily on urban and agricultural reuse.
- **Provide flexibility to accommodate flows from neighboring agencies** – Additional flows from neighboring agencies could be accommodated by allocating additional capacity in the Geysers Pipeline for Geysers reuse or wheeling water to reuse sites.

### **Program I.B – Indirect Discharge**

Program I.B is based on the premise that indirect river discharge would be utilized to satisfy regulatory requirements beyond 2010, and Laguna discharge would not be allowed. The Llano Pump Station would have to be expanded to 80 mgd to carry the required flow out of the Laguna Plant. The City can implement additional reuse at its option.

In 2007, a decision must be made whether to start constructing indirect discharge facilities. If the decision is to implement indirect discharge, then the Llano Pump Station would need to be expanded and the indirect discharge facilities would need to be constructed. If the decision is that indirect discharge is feasible only with AMT, the City may choose a new program, such as Program I.C, I.D, or I.E.

If indirect discharge is implemented beyond 2007, the Llano Pump Station would need to be expanded in 2008 and 2009, as shown on Figure 14. This would provide the capacity needed from 2010 to 2020. Construction of indirect discharge facilities would begin in 2008 to provide the 4,200-MG capacity needed by 2010. Construction of additional indirect discharge facilities would continue incrementally from 2010 to 2020 to provide the capacity needed to keep pace with flow increases. No new storage is required for this program, as shown by the water balance, Appendix C. Program I.B is shown on Figure 15, including a location map, costs, cash flow, and example priority for water delivery.

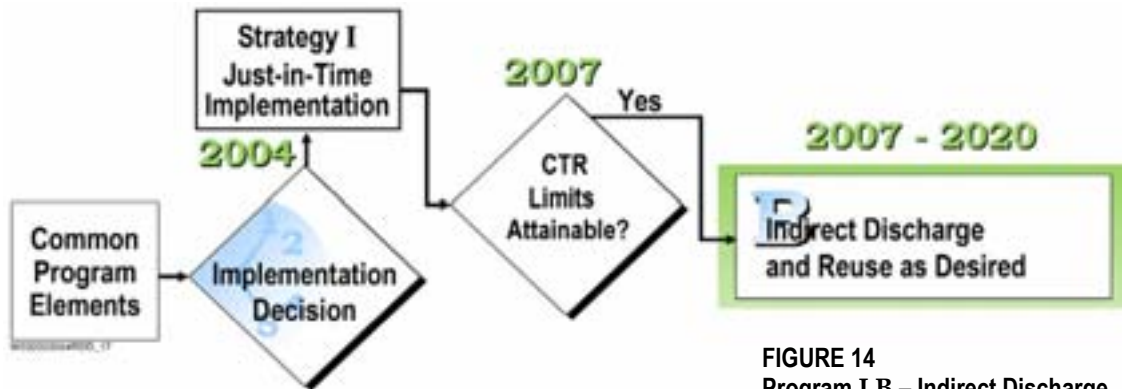
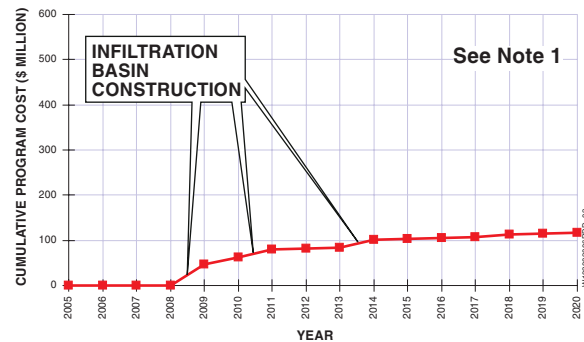


FIGURE 14  
Program I.B – Indirect Discharge

The performance of this program in relation to evaluation criteria is summarized as follows:

- **Provide capacity to treat, recycle, and dispose** – This program provides capacity to treat, recycle, and dispose of all flow projected through 2020 through indirect discharge. If it is determined that indirect discharge is feasible only with AMT, the City may choose another program.
- **Protect natural resources, promote use of recycled water, meet current regulatory requirements, and provide flexibility for future regulations** – This program, without AMT, would not preclude the City from implementing other programs, but the cost of the indirect discharge system would be at risk. If indirect discharge were abandoned in the future, additional Geysers recharge, urban or agricultural reuse systems would need to be constructed, or a combination of both would need to occur. If agricultural/urban reuse water quality standards or indirect discharge standards become more stringent, additional treatment could be required.

Considering the areas required for the infiltration basins, injection wells, or percolation ponds, there will be localized temporary construction impacts in these areas. However, it is likely that any existing ponds could be converted to infiltration basins without much additional excavation. If reuse projects were implemented, there could be significant construction-period impacts on traffic and noise. Because the locations of indirect discharge facilities have not been identified, the potential loss of farmland has been considered a significant impact, although indirect discharge facilities could be sited without taking farmland. If any expansion of Geysers recharge should occur, significant induced seismicity and noise impacts could result. Some potential exists for loss of



**NOTE:**

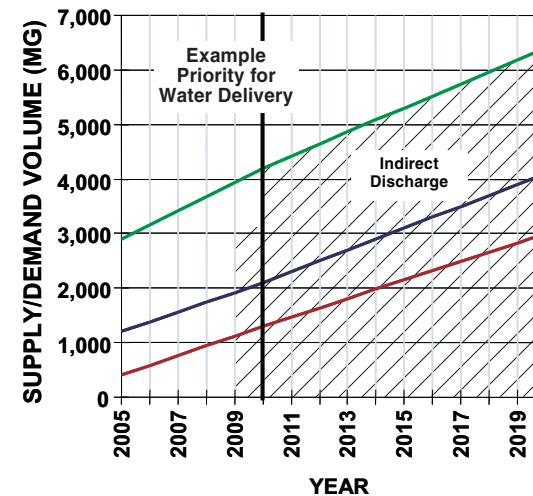
- Does not include Common Elements
- This program could also include reuse in any of the areas shown on Figure 2.

#### ESTIMATED COSTS AND VOLUME FOR PROGRAM I.B Santa Rosa Incremental Recycled Water Program

Program Elements	Estimated Capital Costs (\$ million)	Estimated Present Value (\$ million)	Volume of Flow Managed (MG)
Direct Discharge			
Indirect Discharge	97 <sup>a</sup>		6,400
Geysers			
Urban Reuse			
Agricultural Reuse			
Storage			
Subtotal	97 <sup>a</sup>	108 <sup>a</sup>	
Common Elements	72	122	300
<b>Total Program</b>	<b>170<sup>a</sup></b>	<b>230<sup>a</sup></b>	<b>6,700</b>

<sup>a</sup>Does not include potential AMT cost, which could range from \$346 to \$551 million in capital cost and from \$20 to \$35 million in annual O&M costs.

Monthly user charge increase (per ESU) = \$8.18 for Santa Rosa  
Demand fee increase (per ESU) = \$3,883 for Santa Rosa



**FIGURE 15**  
**PROGRAM I.B—INDIRECT DISCHARGE**  
SANTA ROSA SUBREGIONAL WATER RECLAMATION SYSTEM  
INCREMENTAL RECYCLED WATER PROGRAM

habitat, although well designed infiltration basins might actually provide enhancements. Loss of habitat associated with reuse projects could be avoided or new habitat could be created as compensation so that impacts would be mitigated to less than significant. If additional reuse projects are pursued, other pump stations could result in significant operational noise impacts. Some minor visual impacts could occur at Llano Pump Station, along with potentially significant visual impacts for facilities related to percolation ponds. If other reuse projects are implemented, storage, tanks, and pump stations could have significant visual impacts.

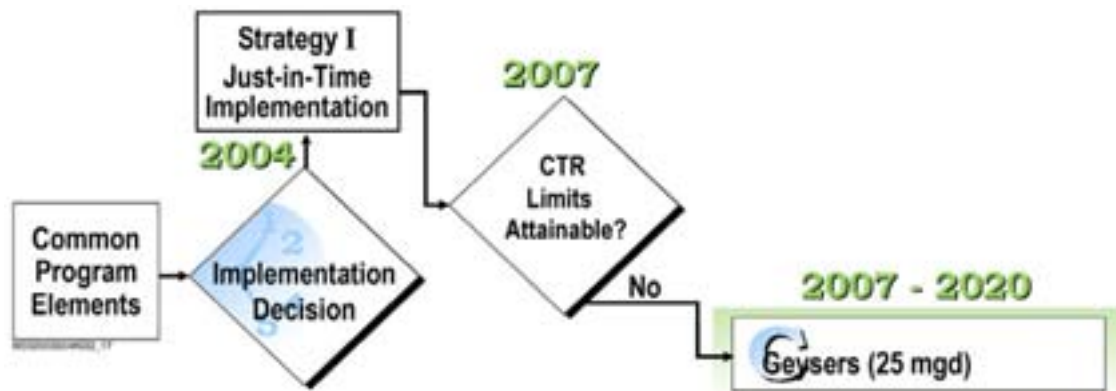
- **Maintain a system that is economically feasible and successfully financed** – See Table 19 in Section 4 of this Master Plan for a comparison of costs to implement each program, as well as the costs shown on figures presented for each program in this section.
- **Maximize use of recycled water** – Although flow would ultimately be discharged to the Russian River, the City could elect to implement additional reuse and commit to reuse agreements and associated operating risk at its discretion.
- **Maximize potable water supplies** – This program does not provide a potable water offset unless additional urban or agricultural reuse is implemented.
- **Dispose of reclaimed water while protecting beneficial uses of receiving waters** – Discharged water will be treated to comply with all NPDES permit stipulations and effluent quality limits under the CTR/SIP.
- **Optimize water conservation** – Conservation is an element common to all programs.
- **Maintain weather-independence** – The infiltration basins could accommodate variable flows. Injection wells or percolation ponds could be built as needed. I&I reduction would provide additional flexibility, and an I&I study is needed to help determine the appropriate level of I&I reduction to be included in the IRWP.
- **Maintain a manageable and reliable disposal system** – This program could require an operating agreement with an outside party for indirect discharge facilities. Although there are no additional agreements needed with other outside parties because no additional reuse is included in this program, the City could elect to implement additional reuse and commit to reuse agreements and associated operating risk at its discretion.
- **Provide flexibility to accommodate flows from neighboring agencies** – Additional flows from neighboring agencies could be accommodated by allocating additional capacity in the Geysers Pipeline for Geysers reuse or wheeling water to reuse sites.

### **Program I.C – Geysers (25 mgd)**

Program I.C utilizes all of the possible capacity of the Geysers conveyance system. The capital improvements to accomplish this would include expansion of the three Geysers mountain pump stations and Geysers Steamfield improvements. The City could implement additional urban or agricultural reuse at its option.

In 2007, a decision must be made whether to start constructing additional Geysers facilities. If the decision is to continue with Program I.C, then new Geysers facilities would need to be constructed. If the decision is to abandon Program I.C, the City may choose a new program, such as Program I.D or I.E.

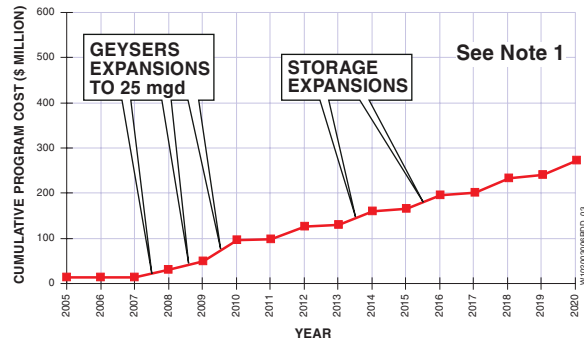
If it is decided in 2007 to continue Program I.C, the capacity expansion would need to occur in 2007 (16 mgd), 2008 (19 mgd), and 2009 (25 mgd), as shown on Figure 16. These expansions would provide the capacity needed from 2010 to 2020, except for storage. Without storage, the expansion to 25 mgd creates an annual demand of 5,110 MG, which would provide sufficient capacity only through 2014.



**FIGURE 16**  
**Program I.C – Geysers (25 mgd)**

The water balance calculations (Appendix C) indicate that large amounts of new storage are required to allow the system to operate reliably during the wettest year of record. The initial calculation indicates that approximately 3,000 MG of additional storage would be required. An additional review of the specific water year that generated this result (1983) shows that the storage was nearly full coming into the water year. However, the 1982 water year was also wetter than normal, resulting in existing Laguna storage remaining full. Without this antecedent condition, the required additional storage for 1983 would have been 1,900 MG. Therefore, the maximum additional storage to support this program is adjusted down to 1,900 MG. This assumes that adequate conservatism related to system reliability has already been accounted for by assuming the wettest water year of record (1983). New storage construction would begin in 2010 and continue expanding through 2020.

As part of Program I.C, the City will simultaneously pursue a long-term Laguna and/or Russian River discharge that complies with the CTR. To do so, the City will need to perform discharge studies outlined in the section, “Common Program Elements.” It is intended that these studies support CTR discharge limits that can be met with existing Laguna Plant effluent quality. As described previously in Strategy (I or II), there will be a decision point in approximately 2007, after the study results are known. At this point, the City will need to decide whether to develop the Geysers capacity required for Program I.C, continue with direct discharge, or implement some combination of both. Program I.C is shown on Figure 17, including a location map, costs, cash flow, and example priority for water delivery.



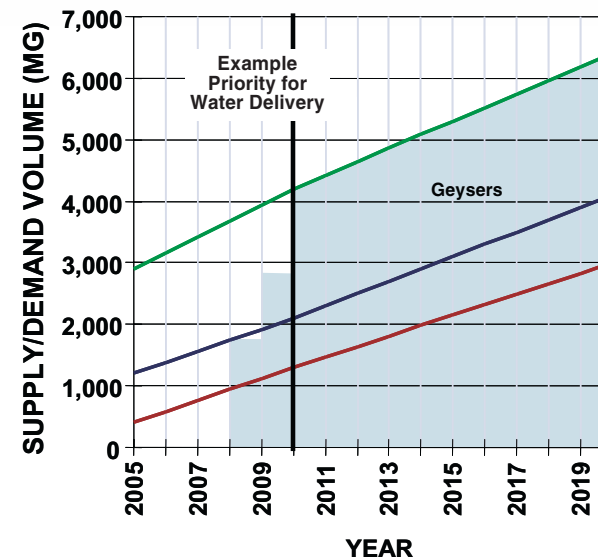
**NOTE:**

- Does not include Common Elements
- This program could also include reuse in any of the areas shown on Figure 2.

#### ESTIMATED COSTS AND VOLUME FOR PROGRAM I.C Santa Rosa Incremental Recycled Water Program

Program Elements	Estimated Capital Costs (\$ million)	Estimated Present Value (\$ million)	Volume of Flow Managed (MG)
Direct Discharge			
Indirect Discharge			
Geysers	81		6,400
Urban Reuse			
Agricultural Reuse			
Storage (1,900 MG)	128		
Subtotal	209	286	
Common Elements	72	122	300
<b>Total Program</b>	<b>282</b>	<b>408</b>	<b>6,700</b>

Monthly user charge increase (per ESU) = \$15.25 for Santa Rosa  
Demand fee increase (per ESU) = \$8,806 for Santa Rosa



**FIGURE 17**  
**PROGRAM I.C-GEYSERS (25 mgd)**  
SANTA ROSA SUBREGIONAL WATER RECLAMATION SYSTEM  
INCREMENTAL RECYCLED WATER PROGRAM

The performance of this program in relation evaluation criteria is summarized as follows:

- **Provide capacity to treat, recycle, and dispose** – This program provides the necessary capacity to treat, recycle, and dispose of all flow projected through 2014 with a combination of Geysers reuse and discharge that complies with the CTR. With additional storage, this program could accommodate flows through 2020. The City also could implement additional urban or agricultural use at its option.
- **Protect natural resources, promote use of recycled water, meet current regulatory requirements, and provide flexibility for future regulations** – Flows to The Geysers would not likely be subject to water quality provisions as stringent as required for other forms of reuse. However, reliance on Geysers reuse would not address future potential regulatory changes affecting the existing reclamation system. If water quality requirements for urban or agricultural reuse could not be met in the future, additional treatment could be required or additional storage could potentially substitute for construction of additional treatment. If the City were to enter into agreements with new urban or agricultural recycled water users whom the City might not be able to supply in the future, the construction cost and revenue from those systems could be at risk. The City could also be at risk for any penalties resulting from breaking contracts with those users.

Significant temporary construction impacts would result from pipeline construction and well drilling within the Geysers Steamfield, Geysers North Pump Station expansions, and excavation activities and piping improvements accompanying construction of storage. Significant loss of farmland impacts are related to storage development. Induced seismicity and noise impacts from recharging the Geysers Steamfield also are significant. The extent of water quality impacts would be determined by future CTR interpretations for the duration of discharge. This program represents some potential for significant loss of natural habitat because of storage construction and pump station expansion. Associated loss of habitat could be avoided or new habitat could be created as compensation, so that impacts would be mitigated to less than significant. Significant visual impacts would occur at Geysers mountain pump stations and from new storage ponds.

- **Maintain a system that is economically feasible and successfully financed** – See Table 19 in Section 4 of this Master Plan for a comparison of costs to implement each program, as well as the costs shown on figures presented for each program in this section.
- **Maximize use of recycled water** – At full capacity, all recycled flow would be reused under this program for recharging the Geysers Steamfield.
- **Maximize potable water supplies** – This program does not provide a potable water offset unless additional urban or agricultural reuse is implemented.
- **Dispose of reclaimed water while protecting beneficial uses of receiving waters** – For the duration of discharge, any discharged water will be treated to comply with all NPDES permit stipulations and effluent quality limits under the CTR/SIP.
- **Optimize water conservation** – Conservation is an element common to all programs.

- **Maintain weather-independence** – Depending on the contract arrangements with Calpine, much flexibility could be included to manage wet weather flow. I&I reduction would provide additional flexibility, and an I&I study is needed to help determine the appropriate level of I&I reduction to be included in the IRWP.
- **Maintain a manageable and reliable disposal system** – Control is relinquished to a large extent because of the necessary contract arrangement with Calpine. The City could be affected by Calpine's operation of the Geysers Steamfield, its future financial condition, and conditions in the power market.
- **Provide flexibility to accommodate flows from neighboring agencies** – Additional flows from neighboring agencies could be accommodated through Geysers recharge, depending on contract arrangements with Calpine, or by wheeling water to reuse sites.

### Program I.D – Geysers (19 mgd) Plus Urban and Agricultural Reuse

Program I.D limits the Geysers conveyance system capacity to 19 mgd to avoid expanding the three Geysers mountain pump stations. The 19-mgd expansion provides 2,920 MG of the 6,400 MG capacity needed in 2020. The remaining demand is fulfilled by urban and agricultural reuse projects. These projects and their capacities are shown in Table 13.

In 2007, a decision must be made whether to develop an agreement with Calpine for increased flow to the Geysers and add City-owned farms irrigation and urban reuse. If the decision is to continue with Program I.D, a new agreement would need to be finalized with Calpine before 2009. The Geysers expansion to 19 mgd is an advantage because it allows the system to quickly reach the needed level of 4,200 MG of capacity needed by 2010 without construction of any major facilities. If an agreement is not finalized with Calpine by 2009, additional urban and agricultural reuse could be implemented (Program II.E).

**TABLE 13**

Program I.D Reuse Increments

*Santa Rosa Incremental Recycled Water Program*

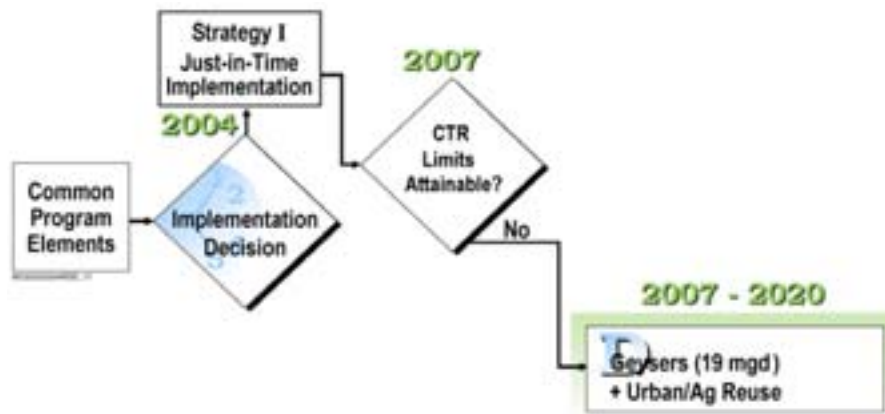
Reuse Increment	Capacity (MG/yr)
City-owned farm irrigation	800
NCAA reuse	780
ERP Agricultural Area reuse	817
Urban reuse	1,083
Geysers reuse	2,920
<b>Total</b>	<b>6,400</b>

Note: Total storage requirement: 2,600 MG

Increments of urban and agricultural reuse (and storage, if needed) would be need to be constructed from 2008 to 2018, as shown on Figure 18 and in the Appendix D calculations. Although a sequence is shown for the four increments listed above, the actual order would likely depend on other factors such as user agreements, land acquisition, and permitting. Therefore, the sequence serves the purpose here of showing the relative magnitude of the

reuse increments needed, as well as giving a magnitude of cost and providing information for sizing storage.

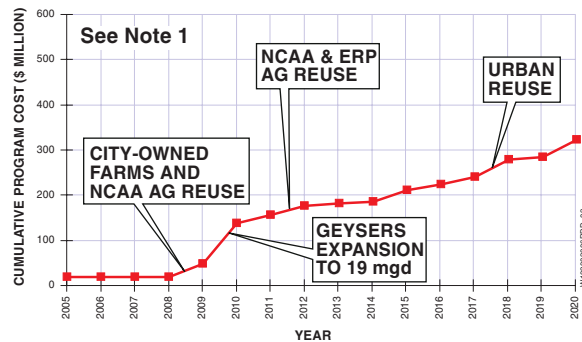
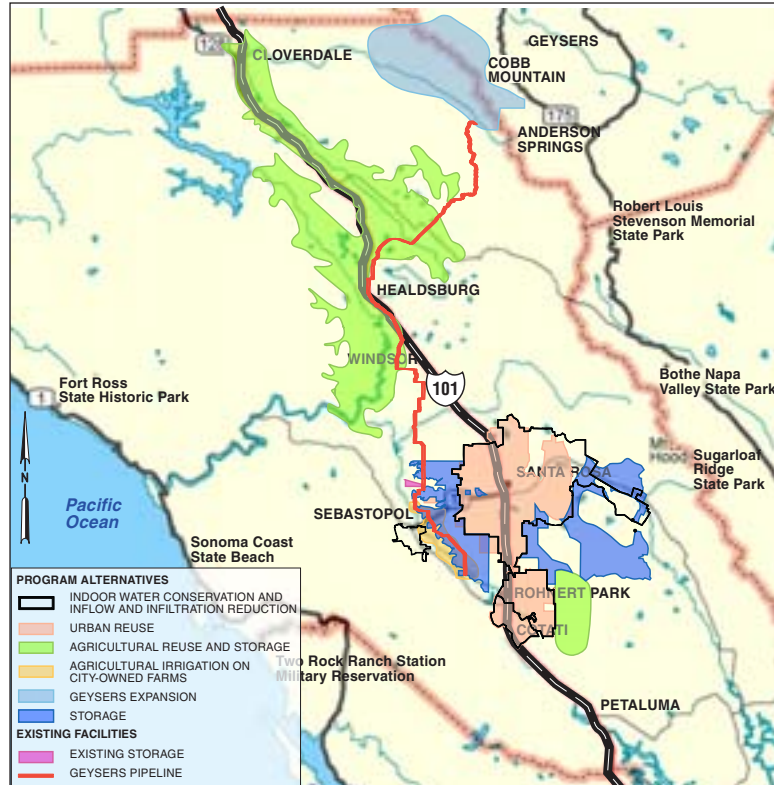
The supply curves show that the difference between the wet year supply and normal year supply varies from 2,100 MG in 2010 to 2,300 MG in 2020, as shown by the shaded area on Figure 19. This represents a volume of water that would not be available to some users during half of the years. With the possible exception of City-owned farm irrigation, the new urban or agricultural reuse demands (totaling 2,680 MG without City-owned farms) would greatly depend on the recycled water supply in every year. This shows the need for a portion of a given program to have the ability to accommodate large variability in annual wet weather flow. For Program I.D, Geysers reuse could accommodate this variability because the Geysers can accommodate up to 2,920 MG, which is greater than the wet year variable demand of 2,300 MG. This would provide agricultural and urban reuse with a reasonable level of service reliability. This also shows the need to establish the Geysers capacity prior to 2010 so that the wet year flexibility is accounted for while the other agricultural and urban capacity, which represents dry year reliability, is developed.



**FIGURE 18**  
**Program I.D – Geysers (19 mgd)**  
**Plus Urban and Agricultural Reuse**

As part of Program I.D, the City will simultaneously pursue a long-term Laguna and/or Russian River discharge that complies with the CTR. To do so, the City will need to perform discharge studies outlined in the section, “Common Program Elements.” It is intended that these studies support CTR discharge limits that can be met with existing Laguna Plant effluent quality. As described previously in Strategy (I or II), there will be a decision point in approximately 2007, after the study results are known. At this point, the City will need to decide whether to develop the reuse capacity required for Program I.D, continue with direct discharge, or implement some combination of both.

The water balance calculations (Appendix C) indicate that storage construction would begin in 2009 and continue through 2020, with a maximum of 2,600 MG of new storage required. Program I.D is shown on Figure 19, including a location map, costs, cash flow, and example priority for water delivery.



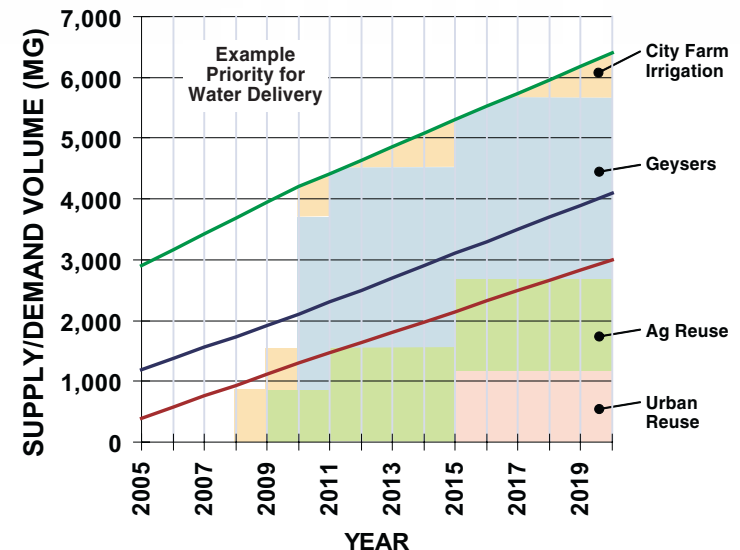
NOTE: 1. Does not include Common Elements

#### ESTIMATED COSTS AND VOLUME FOR PROGRAM I.D Santa Rosa Incremental Recycled Water Program

Program Elements	Estimated Capital Costs (\$ million)	Estimated Present Value (\$ million)	Volume of Flow Managed (MG)
Direct Discharge			
Indirect Discharge			
Geysers	33		2,900
Urban Reuse	62		1,100
Agricultural Reuse	44		2,400
Storage (2,600 MG)	146		
Subtotal	285	306	
Common Elements	72	122	300
Total Program	358	428	6,700

Monthly user charge increase (per ESU) = \$15.00 for Santa Rosa

Demand fee increase (per ESU) = \$9,650 for Santa Rosa



**FIGURE 19**  
**PROGRAM I.D-GEYSERS (19 mgd)**  
**PLUS URBAN AND AGRICULTURAL REUSE**  
SANTA ROSA SUBREGIONAL WATER RECLAMATION SYSTEM  
INCREMENTAL RECYCLED WATER PROGRAM

The performance of this program in relation to evaluation criteria is summarized as follows:

- **Provide capacity to treat, recycle, and dispose** – This program provides 2,920 MG of the 6,400-MG capacity needed by 2020 by expanding the Geysers Pipeline system to 19-mgd capacity. The remainder of the needed capacity is provided by urban and agricultural reuse projects.
- **Protect natural resources, promote use of recycled water, meet current regulatory requirements, and provide flexibility for future regulations** – Flow to The Geysers would not likely be subject to water quality provisions as stringent as those for other forms of reuse. However, reliance on Geysers reuse would not address future potential regulatory changes affecting the existing reclamation system or future agricultural or urban users. If water quality requirements for urban or agricultural reuse could not be met in the future, additional treatment could be required or the Geysers contract would need to be renegotiated to increase capacity. If the decision is to increase Geysers capacity, the cost of the agricultural/urban reuse systems could be at risk. If the City were to stop supplying urban or agricultural users added as part of this program, the construction cost and revenue from those systems could be at risk. The City could also be at risk if there were any penalties resulting from breaking contracts with those users.

Significant traffic and noise impacts would result from pipeline construction and well drilling within the Geysers Steamfield, excavation activities and piping improvements accompanying construction of storage, pipeline construction for agricultural reuse, and pipeline and tank construction for urban reuse. Significant loss of farmland impacts are related to storage development. Significant induced seismicity and noise impacts would be associated with recharging the Geysers Steamfield. The extent of water quality impacts would be determined by future CTR interpretations for the duration of discharge. Some potential for significant loss of natural habitat because of storage and pipeline construction, as well as potential irrigation of lands not presently irrigated. Loss of habitat associated with reuse projects could be avoided or new habitat could be created as compensation, so that impacts would be mitigated to less than significant. Pump stations for other reuse projects would result in significant operational noise impacts. Significant visual impacts would result from new storage ponds or urban reuse storage tanks and booster pump stations.

- **Maintain a system that is economically feasible and successfully financed** – See Table 19 in Section 4 of this Master Plan for a comparison of costs to implement each program, as well as the costs shown on figures presented for each program in this section.
- **Maximize use of recycled water** – When fully implemented, all recycled flow would be reused under this program.
- **Maximize potable water supplies** – This program provides a potable water offset of 627 MG/yr.
- **Dispose of reclaimed water while protecting beneficial uses of receiving waters** – For the duration of discharge, any discharged water will be treated to comply with all NPDES permit stipulations and effluent quality limits under the CTR/SIP.

- **Optimize water conservation** – Conservation is an element common to all programs.
- **Maintain weather-independence** – The Geysers capacity expanded to 19 mgd is the component that provides the most flexibility to manage future flows, with some minor flexibility provided by City-owned farms irrigation. I&I reduction would provide additional flexibility, and an I&I study is needed to help determine the appropriate level of I&I reduction to be included in the IRWP.
- **Maintain a manageable and reliable disposal system** – This program provides operating control over 1,900 MG of capacity for urban and agricultural reuse, although user agreements and additional monitoring would be required for a large number of users. The City could be affected by Calpine’s operation of the Geysers Steamfield, its future financial condition, and conditions of the power market.
- **Provide flexibility to accommodate flows from neighboring agencies** – Additional flows from neighboring agencies could be accommodated, depending on contract arrangements with Calpine, by phased expansion of Geysers reuse capacity or wheeling water to reuse sites.

### Program I.E – Urban and Agricultural Reuse

Program I.E does not rely on any river discharge or Geysers expansions and depends fully on agricultural and urban reuse. The schedule for constructing capacity to meet the 2010 and 2020 goals is shown on Figure 20. Construction would need to start in 2005 to meet the 2010 capacity requirement, because of the added time and facilities needed for these types of reuse. Program I.E. digresses from the Strategy I guideline of waiting until the 2007 decision point to construct facilities, but early construction is necessary in this case because the magnitude of facilities required to create 4,200-MG of capacity likely could not be constructed in 3 years.



FIGURE 20  
Program I.E –Urban and Agricultural Reuse

The reuse increments and their capacities are shown in Table 14.

**TABLE 14**  
Program I.E Reuse Increments  
*Santa Rosa Incremental Recycled Water Program*

<b>Reuse Increment</b>	<b>Capacity (MG/yr)</b>
City-owned farm irrigation	800
NCAA reuse	2,765
ERP Agricultural Area reuse	1,600
Urban reuse	1,235
<b>Total</b>	<b>6,400</b>

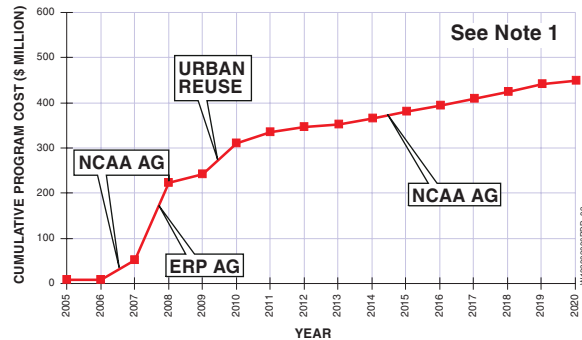
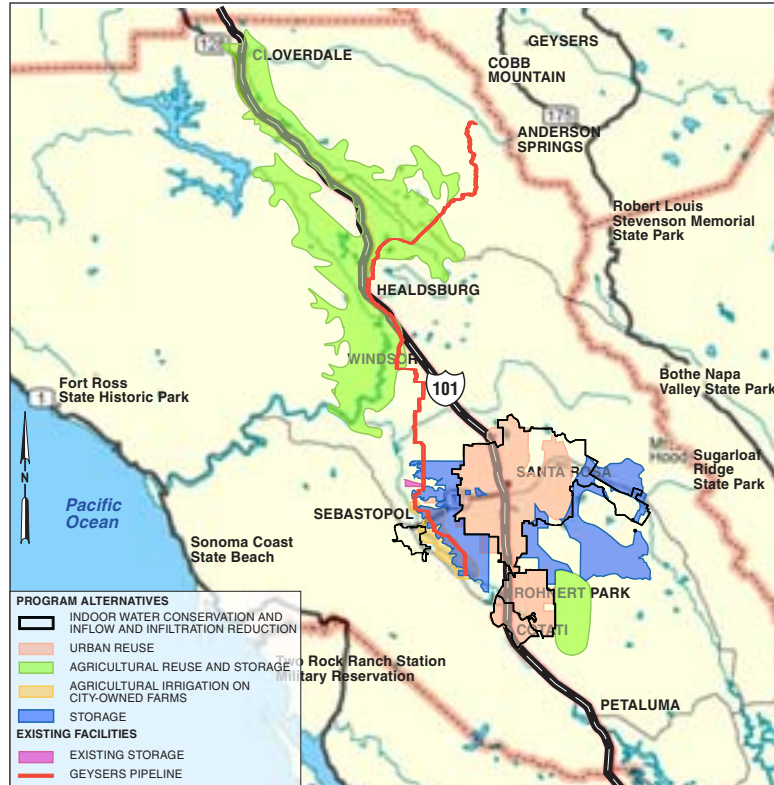
Note: Total storage requirement: 3,900 MG

These increments are scheduled from 2005 to 2018, as shown on Figure 20 and in Appendix D. Although a sequence is shown for the four increments listed above, the actual order would likely depend on other factors such as user agreements, land acquisition, and permitting. Therefore, the sequence serves the purpose here of showing the relative magnitude of the reuse increments needed, as well as giving a magnitude of cost and providing information for storage sizing.

In contrast to Program I.D, the flexibility in this program has to be provided by agricultural or urban users, which means that some users will only occasionally get water, and only in the very wettest water years. The previously mentioned volume of 2,100 MG to 2,300 MG would represent the maximum water available in only above-normal water years. Of this volume, 800 MG could be accounted for by reduced City-owned farm irrigation. This leaves 1,300 MG to 1,500 MG of capacity that would need to be in place for wet years, but these users would not receive recycled water in normal years. This area would likely be located in one of the agricultural reuse areas, because this level of service would not be acceptable for urban reuse customers. Similarly, this program would require construction of storage that would rarely be used.

To provide flexibility for intermittent supply, crops such as hay or grains could be planted and harvested annually, in contrast to vineyards, which need water every year. To establish an agricultural system with this type of flexibility, it might be possible to establish a water availability schedule each spring, so a given user would know if water would be available and the amount. It is possible that in some areas where water is not currently available, this type of arrangement could be considered.

The water balance calculations (Appendix C) indicate that storage construction would begin in 2007 and continue through 2019, with a maximum of approximately 3,900 MG of new storage required. Program I.E is shown in Figure 21, including a location map, costs, cash flow, and example priority for water delivery.



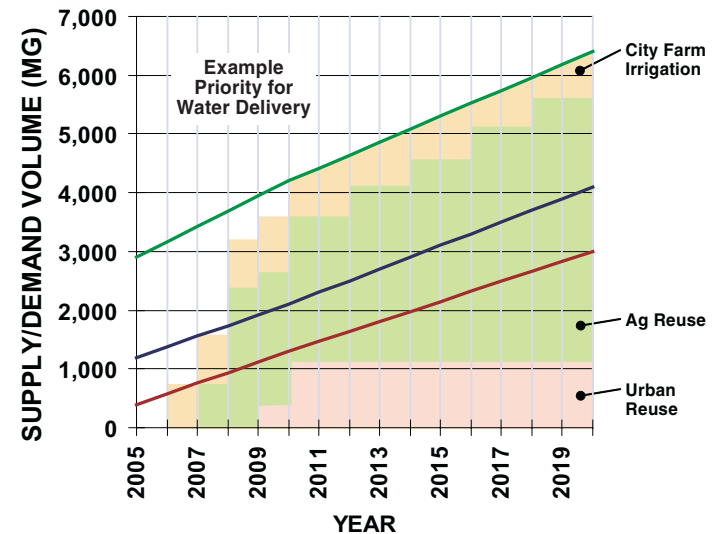
**NOTE:**

1. Does not include Common Elements
2. This program could also include reuse in any of the areas shown on Figure 2.

#### ESTIMATED COSTS AND VOLUME FOR PROGRAM I.E Santa Rosa Incremental Recycled Water Program

Program Elements	Estimated Capital Costs (\$ million)	Estimated Present Value (\$ million)	Volume of Flow Managed (MG)
Direct Discharge			
Indirect Discharge			
Geysers			
Urban Reuse	73		1,200
Agricultural Reuse	87		5,200
Storage (3,920 MG)	233		
Subtotal	393	458	
Common Elements	72	122	300
Total Program	466	580	6,700

Monthly user charge increase (per ESU) = \$22.88 for Santa Rosa  
Demand fee increase (per ESU) = \$7,229 for Santa Rosa



**FIGURE 21**  
**PROGRAM I.E-URBAN AND AGRICULTURAL REUSE**  
SANTA ROSA SUBREGIONAL WATER RECLAMATION SYSTEM  
INCREMENTAL RECYCLED WATER PROGRAM

As part of Program I.E, the City will simultaneously pursue a long-term Laguna and/or Russian River discharge that complies with the CTR. To do so, the City will need to perform discharge studies outlined in the section, “Common Program Elements.” It is intended that these studies support CTR discharge limits that can be met with existing Laguna Plant effluent quality. As described previously in Strategy (I or II), there will be a decision point in approximately 2007, after the study results are known. At this point, the City will need to decide whether to develop the reuse capacity required for Program I.E, continue with direct discharge, or implement some combination of both.

The performance of this program in relation to evaluation criteria is summarized as follows:

- **Provide capacity to treat, recycle, and dispose** – This program relies fully on urban and agricultural reuse to provide the necessary capacity.
- **Protect natural resources, promote use of recycled water, meet current regulatory requirements, and provide flexibility for future regulations** – If water quality requirements for urban or agricultural reuse could not be met in the future, additional treatment could be required or more Geysers recharge would be needed. If the decision is to increase Geysers reuse capacity, the cost of the agricultural/urban reuse systems could be at risk. If the City were to stop supplying urban or agricultural users taken on as part of this program, the construction cost and revenue from those systems could be at risk. The City could also be at risk if there were any penalties resulting from breaking contracts with users.

Significant temporary traffic and noise impacts would result from pipeline construction, excavation activities, and piping improvements accompanying construction of storage, pipeline construction for agricultural reuse, and pipeline and tank construction for urban reuse. Significant loss of farmland could occur related to storage development. The extent of water quality impacts would be determined by future CTR interpretations for the duration of discharge. Some potential exists for significant loss of habitat resulting from storage and pipeline construction, as well as potential irrigation of lands not presently irrigated. Loss of habitat associated with reuse projects could be avoided or new habitat could be created as compensation, so that impacts would be mitigated to less than significant. Significant noise increases would result from pump stations, and significant visual impacts would result from new storage ponds or urban reuse storage tanks and booster pump stations.

- **Maintain a system that is economically feasible and successfully financed** – See Table 19 in Section 4 of this Master Plan for a comparison of costs to implement each program, as well as the costs shown on figures presented for each program in this section.
- **Maximize use of recycled water** – When fully implemented, all recycled flow would be reused under this program.
- **Maximize potable water supplies** – This program provides a potable water offset of 707 MG/yr.

- **Dispose of reclaimed water while protecting beneficial uses of receiving waters** – For the duration of discharge, any discharged water will be treated to comply with all NPDES permit stipulations and effluent quality limits under the CTR/SIP.
- **Optimize water conservation** – Conservation is an element common to all programs.
- **Maintain weather-independence** – To provide flexibility, the City must reach agreements with many users who are willing to receive and store water that will be available infrequently. This type of user base will be difficult to establish.
- **Maintain a manageable and reliable disposal system** – Maintaining and monitoring the large number of contracts and users needed with this program will be challenging.
- **Provide flexibility to accommodate flows from neighboring agencies** – Additional flows from neighboring agencies could be accommodated, depending on contract arrangements with Calpine, by phased expansion of Geysers reuse capacity or wheeling water to reuse sites.

## Strategy II Programs

Strategy II involves constructing some capacity in advance of the 2007 decision point, then provides capacity incrementally as needed leading up to 4,200-MG annual capacity required in 2010.

### Strategy II Program Sequencing

A decision would be made in 2007 regarding whether or not discharge is allowed after 2010. If direct discharge is allowed to continue after 2010, no more capital improvements would be needed to avoid discharge. However, reuse projects could be implemented at the City's option. If direct discharge would no longer be allowed or feasible, a 3-year sequence of capital improvements to reach the 4,200-MG capacity would need to begin, and then continue from 2010 to 2020 to reach the ultimate 2020 capacity of 6,400 MG.

The amount of capacity to construct prior to 2007 was determined to be 1,300 MG. This is based on the fact that the Geysers capacity at 19 mgd is approximately 2,900 MG and, as discussed previously, this capacity increment can be implemented relatively quickly. Therefore, if 1,300 MG of urban or agricultural reuse capacity is in place by 2007, the Geysers expansion to 19 mgd could quickly bring the system capacity up to 4,200 MG, meeting the 2010 requirements. If the 2007 decision is to continue river discharge, the Geysers expansion is not needed, but the 1,300-MG of reuse is a committed cost.

It is also possible that this 1,300-MG component could include some Geysers expansion. If some Geysers expansion were included, some of the 2,900-MG Geysers capacity would be available earlier. But the outcome would still be that 1,300 MG of agricultural or urban reuse would need to be combined with Geysers expansion to 19 mgd to meet the 2010 capacity requirements.

The 1,300-MG increment is the same for programs II.A, II.B, II.C, and II.D. For Program II.E, the capacity must be developed on a faster schedule, similar to Program I.E. This 1,300-MG capacity is assumed to consist of 800 MG of City-owned farm irrigation and 500 MG of

urban reuse, although this capacity could be achieved using different capacities and reuse opportunities

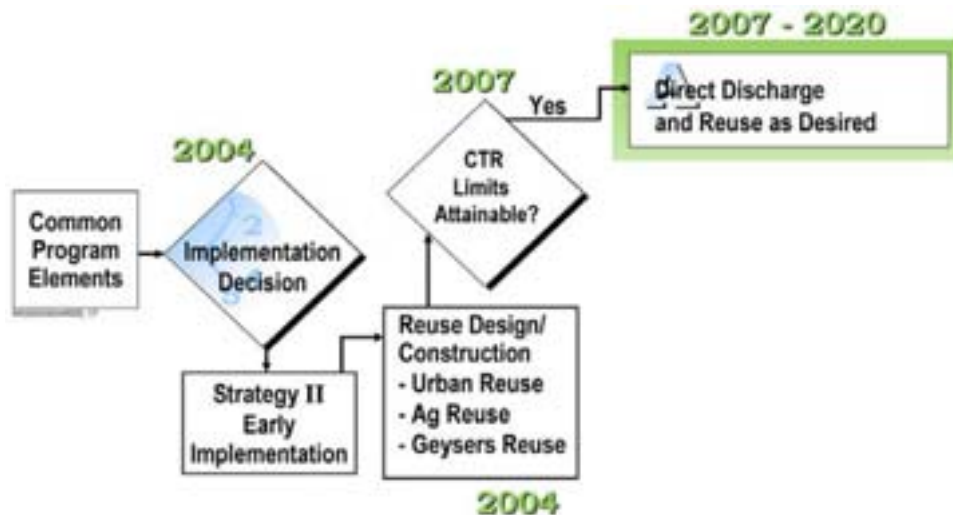
## Strategy II Program Descriptions

### Program II.A – Early Reuse Plus Direct Discharge

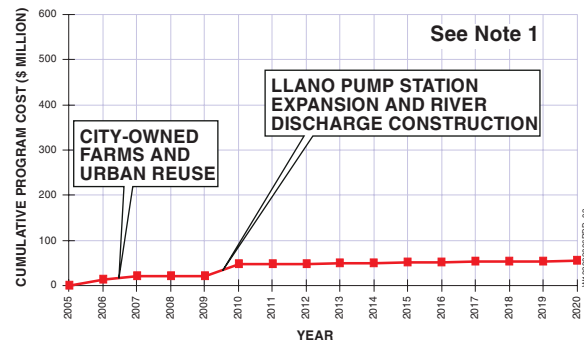
Program II.A is similar to Program I.A, except for the 1,300 MG of early reuse. Direct river discharge would continue beyond 2010, but Laguna discharge would be restricted to 10 percent of the Laguna flow. A new direct discharge point into the Russian River would be utilized. This new discharge pipeline and structure will need to be constructed as part of this program. The Llano Pump Station would need to be expanded to 80 mgd in 2010 to carry the required flow out of the Laguna Plant.

In 2007, a decision must be made whether to continue Russian River discharge. If the decision is to continue with river discharge, then the Llano Pump Station would need to be expanded and the river discharge pipeline and discharge structure would be constructed. If the decision is to abandon discharge because effluent limits cannot be met without AMT, the City may choose a new program, such as Program I.C, I.D, or I.E.

If Program II.A is implemented, the Llano Pump Station expansion would need to occur in 2009, as shown on Figure 22. This expansion would provide the capacity required from 2010 to 2020. Program II.A is shown on Figure 23, including a location map, costs, cash flow, and example priority for water delivery.



**FIGURE 22**  
Program II.A – Early Reuse Plus Direct Discharge



**NOTE:**

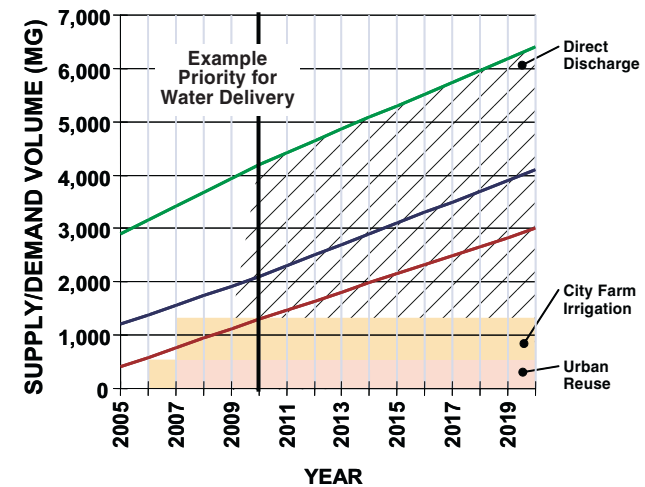
- Does not include Common Elements
- This program could also include reuse in any of the areas shown on Figure 2.

#### ESTIMATED COSTS AND VOLUME FOR PROGRAM II.A Santa Rosa Incremental Recycled Water Program

Program Elements	Estimated Capital Costs (\$ million)	Estimated Present Value (\$ million)	Volume of Flow Managed (MG)
Direct Discharge	29 <sup>a</sup>		5,100
Indirect Discharge			
Geysers			
Urban Reuse	24		500
Agricultural Reuse	0		800
Storage			
Subtotal	53 <sup>a</sup>	60 <sup>a</sup>	
Common Elements	72	122	300
<b>Total Program</b>	<b>126<sup>a</sup></b>	<b>182<sup>a</sup></b>	<b>6,700</b>

<sup>a</sup>Does not include potential AMT cost, which could range from \$346 to \$551 million in capital cost and from \$20 to \$35 million in annual O&M costs

Monthly user charge increase (per ESU) = \$5.37 for Santa Rosa  
Demand fee increase (per ESU) = \$3,692 for Santa Rosa



**FIGURE 23**  
**PROGRAM II.A-EARLY REUSE**  
**PLUS DIRECT DISCHARGE**  
SANTA ROSA SUBREGIONAL WATER RECLAMATION SYSTEM  
INCREMENTAL RECYCLED WATER PROGRAM

No new storage is required for this program, as explained in the Appendix C, Water Balance Summary, despite the new 1,300-MG demand. The increase in Laguna Plant flow by 2007, as defined by the supply curve, replaces the need for storage.

The performance of this program in relation to evaluation criteria is summarized as follows:

- **Provide capacity to treat, recycle, and dispose** – This program uses a combination of reuse and direct discharge to the Russian River to manage flows through 2010. If the decision is made in 2007 to abandon discharge because effluent limits cannot be met without AMT, a new program must be chosen, such as Program I.C, I.D, or I.E, to manage flows through 2020.
- **Protect natural resources, promote use of recycled water, meet current regulatory requirements, and provide flexibility for future regulations** – This program, without AMT, provides flexibility for managing regulatory changes because it does not preclude implementing future options. If discharge were later abandoned, the cost of the river discharge facilities could be at risk.

Significant temporary traffic and noise impacts would result from pipeline and tank construction for urban reuse. Potential loss of farmland resulting from pipelines, discharge facilities, and pump stations and tanks would be considered a significant impact. If any expansion of Geysers recharge were to occur, significant induced seismicity impacts could result. The extent of water quality impacts could be determined by future CTR interpretations. Potential for pipeline rupture associated with reuse projects would be considered a significant impact. Loss of habitat resulting from irrigation, pump stations, and tanks could be avoided or new habitat could be created as compensation, so that impacts would be mitigated to less than significant. Increases in noise levels at Llano Pump Station or from urban booster pump stations would be significant. Some minor visual impacts may occur at Llano Pump Station. Impacts from urban reuse storage tanks and small booster pump stations would be significant.

- **Maintain a system that is economically feasible and successfully financed** – See Table 19 in Section 4 of this Master Plan for a comparison of costs to implement each program, as well as the costs shown on figures presented for each program in this section.
- **Maximize use of recycled water** – This program would annually provide 1,300 MG of urban or agricultural reuse. The remainder of the flow would be discharged.
- **Maximize potable water supplies** – This program provides a potable water offset of 343 MG/yr.
- **Dispose of reclaimed water while protecting beneficial uses of receiving waters** – For the duration of discharge, any discharged water will be treated to comply with all NPDES permit stipulations and effluent quality limits under the CTR/SIP.
- **Optimize water conservation** – Conservation is an element common to all programs.
- **Maintain weather-independence** – This program provides flexibility for responding quickly to variations in wet weather flow.

- **Maintain a manageable and reliable disposal system** – This program provides the City with a high degree of control because the City would be the sole system operator. Although there are no additional agreements needed with outside parties for reuse, the City could elect to implement additional reuse and commit to reuse agreements and associated operating risk at its discretion.
- **Provide flexibility to accommodate flows from neighboring agencies** – Additional flows from neighboring agencies could be accommodated by allocating additional capacity in the Geysers Pipeline for Geysers reuse or wheeling water to reuse sites.

### Program II.B – Early Reuse Plus Indirect Discharge

Program II.B is similar to Program I.B except for the 1,300 MG of early reuse. This program is based on the premise that indirect river discharge would be utilized to satisfy the regulatory requirements beyond 2010, and Laguna discharge would not be allowed. The Llano Pump Station would need to be expanded to 80 mgd to convey the required flow out of the Laguna Plant.

In 2007, a decision must be made whether to start constructing indirect discharge facilities. If the decision is to implement indirect discharge, then the Llano Pump Station would need to be expanded and the indirect discharge facilities would need to be constructed. If the decision is that indirect discharge is feasible only with AMT, the City may choose a new program, such as Program I.C, I.D, or I.E.

If indirect discharge is built with or without AMT beyond 2007, the Llano Pump Station would need to be expanded in 2008 and 2009, as shown on Figure 24. This would provide the capacity needed from 2010 to 2020. Construction of indirect discharge facilities would begin in 2008 to provide the 4,200-MG capacity needed by 2010. Construction of additional indirect discharge facilities would continue incrementally from 2010 to 2020 to provide the capacity needed to keep pace with flow increases. No new storage is required for this program; the explanation is the same as for Program II.A (see also Appendix C).

Program II.B is shown on Figure 25, including a location map, costs, cash flow, and example priority for water delivery.

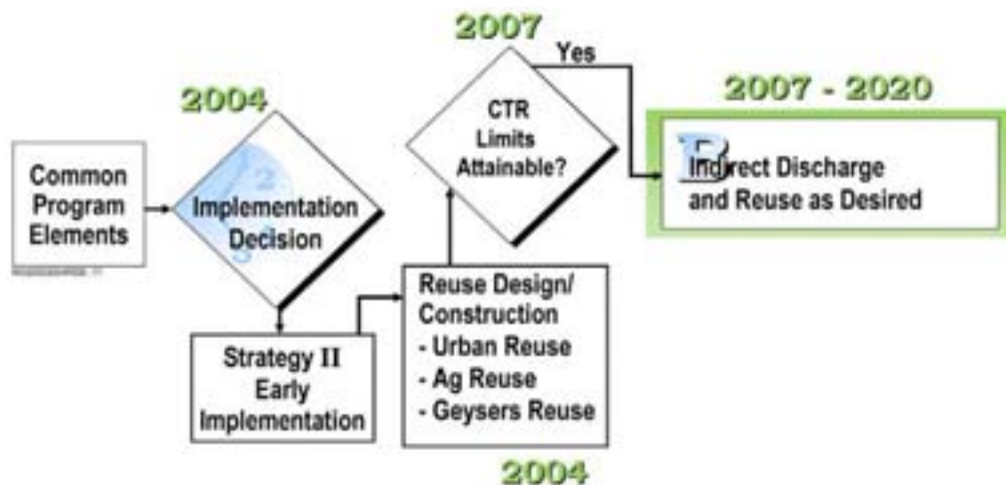
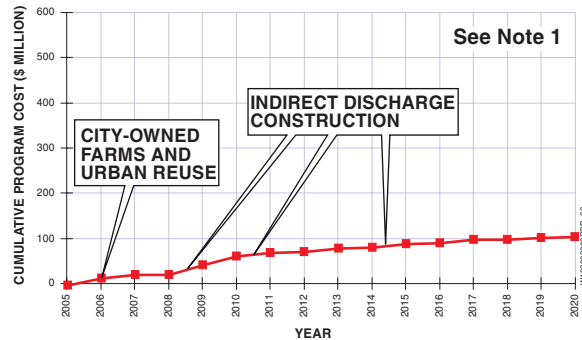


FIGURE 24  
Program II.B – Early Reuse Plus Indirect Discharge



**NOTE:**

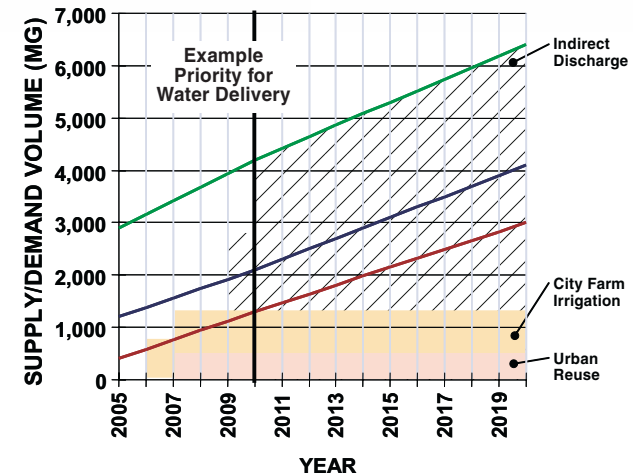
- Does not include Common Elements
- This program could also include reuse in any of the areas shown on Figure 2.

#### ESTIMATED COSTS AND VOLUME FOR PROGRAM II.B Santa Rosa Incremental Recycled Water Program

Program Elements	Estimated Capital Costs (\$ million)	Estimated Present Value (\$ million)	Volume of Flow Managed (MG)
Direct Discharge			
Indirect Discharge	77 <sup>a</sup>		5,100
Geysers			
Urban Reuse	24		500
Agricultural Reuse	0		800
Storage			
Subtotal	101 <sup>a</sup>	101 <sup>a</sup>	
Common Elements	72	122	300
Total Program	174 <sup>a</sup>	223 <sup>a</sup>	6,700

<sup>a</sup>Does not include potential AMT cost, which could range from \$346 to \$551 million in capital cost and from \$20 to \$35 million in annual O&M costs.

Monthly user charge increase (per ESU) = \$7.60 for Santa Rosa  
Demand fee increase (per ESU) = \$3,942 for Santa Rosa



**FIGURE 25**  
**PROGRAM II.B-EARLY REUSE**  
**PLUS INDIRECT DISCHARGE**  
SANTA ROSA SUBREGIONAL WATER RECLAMATION SYSTEM  
INCREMENTAL RECYCLED WATER PROGRAM

The performance of this program in relation to evaluation criteria is summarized as follows:

- **Provide capacity to treat, recycle, and dispose** – This program uses a combination of reuse and indirect discharge to manage flows through 2010. If the decision is made in 2007 to abandon discharge because effluent limits cannot be met without AMT, a new program must be chosen, such as Program I.C, I.D, or I.E, to manage flows through 2020.
- **Protect natural resources, promote use of recycled water, meet current regulatory requirements, and provide flexibility for future regulations** – This program, without AMT, would not preclude the City from implementing other programs, but the cost of the indirect discharge system would be at risk. If indirect discharge were abandoned in the future, additional Geysers recharge would be needed, urban or agricultural reuse systems would need to be constructed, or a combination of both would be needed. If urban and agricultural reuse water quality standards or indirect discharge standards become more stringent, additional treatment could be required.

Considering the areas required for the infiltration basins, injection wells, or percolation ponds, there will be localized temporary construction-period impacts in the areas required for indirect discharge facilities. However, it is likely that existing ponds can be converted to infiltration basins to a large extent without much additional excavation. Also, there would be significant temporary impacts related to pipeline and tank construction for urban reuse. Because the locations of indirect discharge facilities have not been identified, the potential loss of farmland has been considered a significant impact, although indirect discharge facilities could be sited without taking farmland. If any expansion of Geysers recharge should occur, significant induced seismicity impacts would result. The extent of water quality impacts could be determined by future CTR interpretations. Potential for pipeline rupture associated with reuse projects would be considered a significant impact. Some potential exists for loss of habitat, although well designed infiltration basins might actually provide enhancements. Loss of habitat resulting from reuse projects could be avoided or new habitat could be created as compensation so that impacts would be mitigated to less than significant. Increases in noise levels at Llano Pump Station, or from small booster pump stations within the urban reuse system, would be significant. Some minor visual impacts at Llano Pump Station, some potential visual impacts for facilities related to percolation ponds, and significant impacts from urban storage tanks and pump stations would occur.

- **Maintain a system that is economically feasible and successfully financed** – See Table 19 in Section 4 of this Master Plan for a comparison of costs to implement each program, as well as the costs shown on figures presented for each program in this section.
- **Maximize use of recycled water** – This program would annually provide 1,300 MG of urban or agricultural reuse. The remainder of the flow would be discharged.
- **Maximize potable water supplies** – This program provides a potable water offset of 343 MG/yr.
- **Dispose of reclaimed water while protecting beneficial uses of receiving waters** – For the duration of discharge, any discharged water will be treated to comply with all NPDES permit stipulations and effluent quality limits under the CTR/SIP.

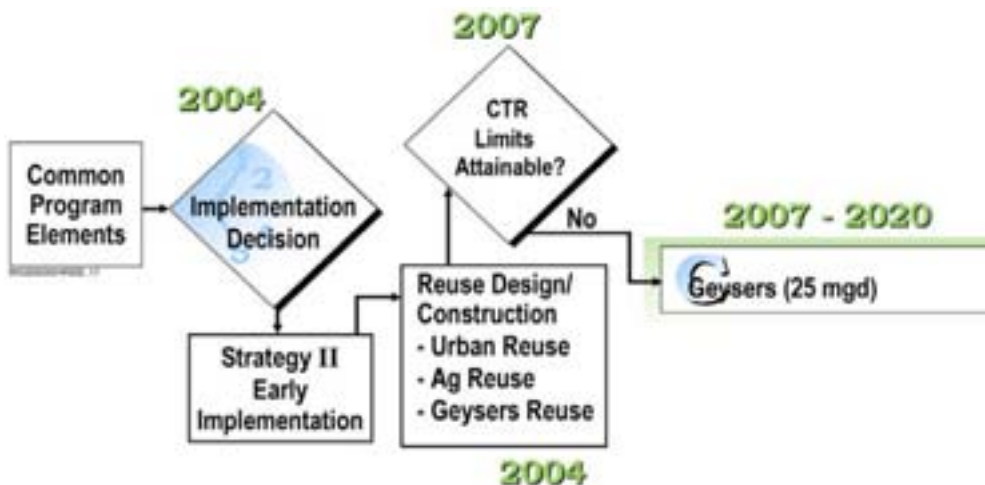
- **Optimize water conservation** – Conservation is an element common to all programs.
- **Maintain weather-independence** – Indirect discharge facilities can accommodate variable flows.
- **Maintain a manageable and reliable disposal system** – This program could require an operating agreement with an outside party for indirect discharge facilities. User agreements and monitoring would be required for urban or agricultural reuse.
- **Provide flexibility to accommodate flows from neighboring agencies** – Additional flows from neighboring agencies could be accommodated by allocating additional capacity in the Geysers Pipeline for Geysers reuse or wheeling water to reuse sites.

### Program II.C – Early Reuse Plus Geysers (25 mgd)

Program II.C utilizes all of the possible capacity of the Geysers conveyance system. The capital improvements to accomplish this were discussed previously in the review of the alternative. The primary differences from Program I.C is that early reuse is added, which reduces some of the storage requirements to reach the full 6,400-MG capacity needed. This early reuse is less costly than the storage that would otherwise be necessary.

In 2007, a decision must be made whether to start constructing additional Geysers capacity. If the decision is to continue with Program II.C, then new Geysers facilities would need to be constructed to reach 19-mgd capacity by 2010. Additional incremental construction would be needed to increase capacity up to 25 mgd beyond 2010. If the decision is to abandon Program II.C, the City may choose a new program, such as Program II.D or II.E.

Geysers capacity expansion would need to occur in 2007 (16 mgd), 2008 (19 mgd), and 2009 (25 mgd), as shown on Figure 26. These incremental expansions of the Geysers capacity would provide the capacity needed from 2010 to 2020, except for storage.



**FIGURE 26**  
Program II.C – Early Reuse Plus Geysers (25 mgd)

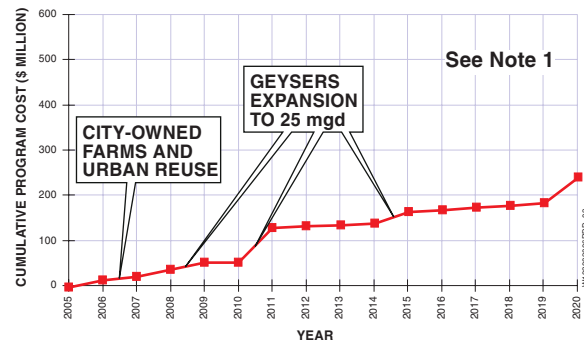
The water balance calculations (Appendix C) indicate that by including the 1,300 MG of early reuse, the storage requirements for this program are 1,600 MG. This storage would be needed between 2010 and 2020. Program II.C is shown on Figure 27, including a location map, costs, cash flow, and example priority for water delivery.

As part of Program II.C, the City will simultaneously pursue a long-term Laguna and/or Russian River discharge that complies with the CTR. To do so, the City will need to perform discharge studies outlined in the section, “Common Program Elements.” It is intended that these studies support CTR discharge limits that can be met with existing Laguna Plant effluent quality. As described previously in Strategy (I or II), there will be a decision point in approximately 2007, after the study results are known. At this point, the City will need to decide whether to develop the reuse capacity required for Program II.C, continue with direct discharge, or implement some combination of both.

The performance of this program in relation to evaluation criteria is summarized as follows:

- **Provide capacity to treat, recycle, and dispose** – This program uses a combination of 1,300 MG of early reuse annually and phased expansion of Geysers recharge to manage flows through 2010. If the decision is made in 2007 to continue with this program, Additional incremental expansion of Geysers recharge will be constructed to manage all flows through 2020. If the decision is made to abandon program II.C, the City may choose a new program, such as Program II.D or II.E, to manage flows through 2020.
- **Protect natural resources, promote use of recycled water, meet current regulatory requirements, and provide flexibility for future regulations** – Flows to the Geysers would not likely be subject to water quality provisions as stringent as required for other forms of reuse. However, reliance on Geysers reuse would not address future potential regulatory changes affecting agricultural and urban reuse systems. If water quality requirements for urban or agricultural reuse could not be met in the future, additional treatment could be required. It is doubtful that additional storage would be feasible to convey the agricultural and urban reuse flow to the Geysers, although this water balance has not been modeled. If the City were to stop supplying agricultural and urban reuse under this scenario, the construction cost and revenue from those systems could be at risk. The City could also be at risk for any penalties resulting from breaking contracts with those users.

Significant temporary traffic and noise impacts would result from pipeline construction and well drilling within the Geysers Steamfield, Geysers mountain pump station expansions, and excavation activities and piping improvements accompanying construction of storage. Significant temporary impacts would also result from pipeline and tank construction for urban reuse. Significant impacts resulting from storage development. Significant loss of farmland would result from storage development. Induced seismicity impacts associated with Geysers recharge would be significant. The extent of water quality impacts would be determined by future CTR interpretations for the duration of discharge. Some potential loss of habitat could result from storage construction and pump station expansion. Loss of habitat resulting from reuse projects could be avoided or new habitat could be created as compensation, so that impacts would be mitigated to less than significant. Significant noise increases would occur within the Geysers Steamfield from added injection operations, from Geysers mountain



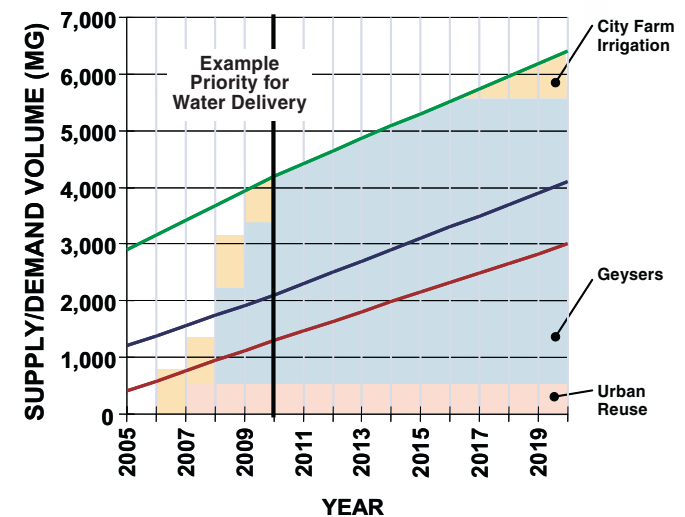
**NOTE:**

- Does not include Common Elements
- This program could also include reuse in any of the areas shown on Figure 2.

#### ESTIMATED COSTS AND VOLUME FOR PROGRAM ILC Santa Rosa Incremental Recycled Water Program

Program Elements	Estimated Capital Costs (\$ million)	Estimated Present Value (\$ million)	Volume of Flow Managed (MG)
Direct Discharge			
Indirect Discharge			
Geysers	81		5,100
Urban Reuse	24		500
Agricultural Reuse	0		800
Storage (1,600 MG)	108		
Subtotal	212	245	
Common Elements	72	122	300
<b>Total Program</b>	<b>285</b>	<b>367</b>	<b>6,700</b>

Monthly user charge increase (per ESU) = \$13.29 for Santa Rosa  
Demand fee increase (per ESU) = \$8,136 for Santa Rosa



**FIGURE 27**  
**PROGRAM ILC-EARLY REUSE**  
**PLUS GEYSERS (25 mgd)**

SANTA ROSA SUBREGIONAL WATER RECLAMATION SYSTEM  
INCREMENTAL RECYCLED WATER PROGRAM

pump station expansions, and at urban booster pump stations. Significant visual impacts would occur at Geysers mountain pump stations, new storage ponds, and urban tanks and booster pump stations.

- **Maintain a system that is economically feasible and successfully financed** – See Table 19 in Section 4 of this Master Plan for a comparison of costs to implement each program, as well as the costs shown on figures presented for each program in this section.
- **Maximize use of recycled water** – This program would reuse all Subregional System flow that is not discharged under the CTR discharge limits. Discharge studies will determine whether CTR limits can be met with existing Laguna Plant effluent quality.
- **Maximize potable water supplies** – This program provides a potable water offset of 343 MG/yr.
- **Dispose of reclaimed water while protecting beneficial uses of receiving waters** – For the duration of discharge, any discharged water will be treated to comply with all NPDES permit stipulations and effluent quality limits under the CTR/SIP.
- **Optimize water conservation** – Conservation is an element common to all programs.
- **Maintain weather-independence** – Depending on the contract arrangements with Calpine, much flexibility could be included to manage wet weather flow.
- **Maintain a manageable and reliable disposal system** – Control is relinquished to a large extent because of the necessary contract arrangement with Calpine. The City could be affected by Calpine's operation of the Geysers Steamfield, its future financial condition, and conditions in the power market. Monitoring would also be required for the urban and agricultural users.

**Provide flexibility to accommodate flows from neighboring agencies** – Additional flows from neighboring agencies could be accommodated by allocating additional capacity in the Geysers Pipeline for Geysers reuse or wheeling water to reuse sites.

#### **Program II.D – Early Reuse Plus Geysers (19 mgd) Plus Urban and Agricultural Reuse**

This program has the same capacities as Program I.D, but the sequence is changed so that the 1,300 MG of reuse capacity is constructed earlier.

In 2007, a decision must be made whether to negotiate an agreement with Calpine increase flow to the Geysers to 19 mgd by 2010. If the decision is to continue with Program II.D, then a new agreement would need to be finalized with Calpine before 2010. If an agreement is not finalized with Calpine by 2010, additional urban and agricultural reuse could be implemented.

Similar to Program I.D, Program II.D does not utilize all of the possible capacity of the Geysers conveyance system, but limits it to 19 mgd to avoid expanding the Geysers north pump stations. The 19-mgd expansion provides 2,920 MG of the 6,400 MG capacity needed. The remaining capacity is fulfilled by reuse. These increments and their capacities are shown in Table 15.

TABLE 15

Program II.D Reuse Increments

*Santa Rosa Incremental Recycled Water Program*

Reuse Increment	Capacity (MG/yr)
City-owned farm irrigation	800
NCAA reuse	780
ERP Agricultural Area reuse	817
Urban reuse	1,083
<b>Total</b>	<b>3,480</b>

Note: Total storage requirement: 2,600 MG

These increments are scheduled from 2005 to 2017, as shown on Figure 28 and in Appendix D. Although a sequence is shown for the four increments listed above, the actual order would likely depend on other factors, such as user agreements, land acquisition, and permitting. Therefore, the sequence serves the purpose here of showing the relative magnitude of the reuse projects needed, as well as giving a magnitude of cost and providing information for storage sizing.

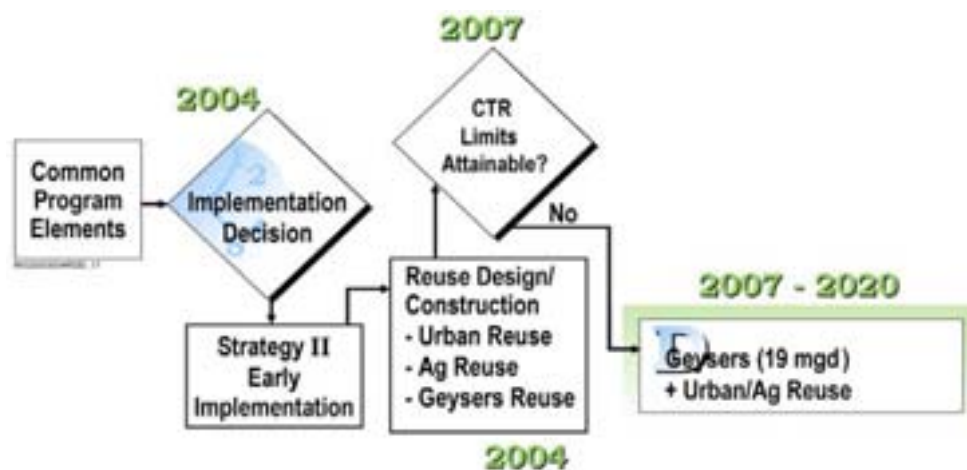
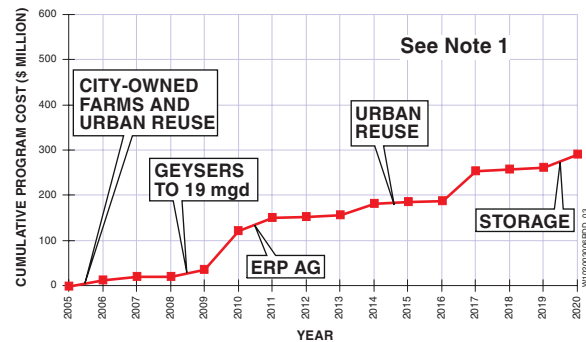


FIGURE 28

Program II.D – Early Reuse Plus Geysers (19 mgd)  
Plus Urban and Agricultural Reuse

The Geysers expansion to 19 mgd in 2010 is an advantage because it allows the system to quickly reach the needed level of 4,200 MG of capacity without any major construction of facilities. The 1,300 MG of early reuse is constructed starting in 2005 in contrast to Program I.D in which construction does not begin until 2008.

The water balance calculations (Appendix C) indicate that storage construction would begin in 2010 and continue through 2020, with a maximum of approximately 2,600 MG of new storage required. Program II.D is shown on Figure 29, including a location map, costs, cash flow, and example priority for water delivery.

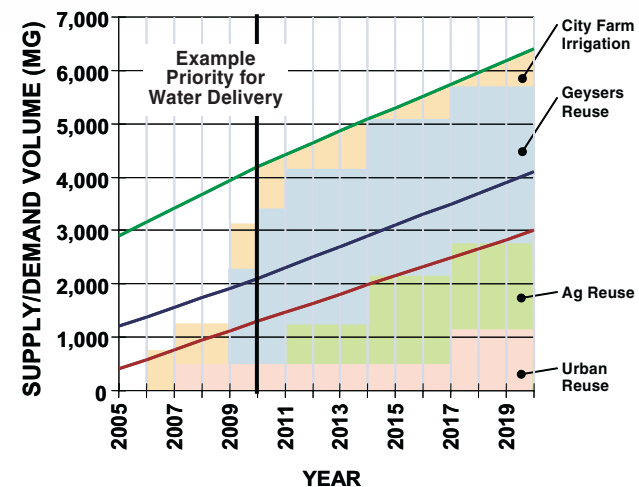


NOTE: 1. Does not include Common Elements

#### ESTIMATED COSTS AND VOLUME FOR PROGRAM II.D Santa Rosa Incremental Recycled Water Program

Program Elements	Estimated Capital Costs (\$ million)	Estimated Present Value (\$ million)	Volume of Flow Managed (MG)
Direct Discharge			
Indirect Discharge			
Geysers	33		2,900
Urban Reuse	62		1,100
Agricultural Reuse	44		2,400
Storage (2,620 MG)	146		
Subtotal	286	297	
Common Elements	72	122	300
Total Program	359	419	6,700

Monthly user charge increase (per ESU) = \$15.02 for Santa Rosa  
Demand fee increase (per ESU) = \$8,985 for Santa Rosa



**FIGURE 29**  
**PROGRAM II.D-EARLY REUSE**  
**PLUS GEYSERS (19 mgd)**  
**PLUS URBAN AND AGRICULTURAL REUSE**  
SANTA ROSA SUBREGIONAL WATER RECLAMATION SYSTEM  
INCREMENTAL RECYCLED WATER PROGRAM

As part of Program II.D, the City will simultaneously pursue a long-term Laguna and/or Russian River discharge that complies with the CTR. To do so, the City will need to perform discharge studies outlined in the section, "Common Program Elements." It is intended that these studies support CTR discharge limits that can be met with existing Laguna Plant effluent quality. As described previously in Strategy (I or II), there will be a decision point in approximately 2007, after the study results are known. At this point, the City will need to decide whether to develop the reuse capacity required for Program II.D, continue with direct discharge, or implement some combination of both.

The performance of this program in relation to evaluation criteria is summarized as follows:

- Provide capacity to treat, recycle, and dispose** – This program uses a combination of urban and agricultural reuse and Geysers expansion to manage flows through 2010. If the decision is made in 2007 to continue with this program, then a new agreement would need to be finalized with Calpine before 2010. If an agreement is not finalized with Calpine by 2010, additional urban and agricultural reuse could be implemented to manage flows through 2020. Discharge studies also will be performed to determine whether CTR discharge limits can be met with existing Laguna Plant effluent quality. Depending on the outcome of these studies, the City will decide in 2007 whether to develop the reuse capacity required for Program II.D through 2020, continue with direct discharge, or implement some combination of both.
- Protect natural resources, promote use of recycled water, meet current regulatory requirements, and provide flexibility for future regulations** – Flows to the Geysers would not likely be subject to water quality provisions as stringent as required for other forms of reuse. However, reliance on Geysers reuse would not address future potential regulatory changes affecting urban and agricultural reuse. If water quality requirements for urban or agricultural reuse could not be met in the future, additional treatment could be required or the Geysers contract would need to be renegotiated to increase capacity. If the City were to stop providing water to urban and agricultural users, the construction cost and revenue from the urban and agricultural reuse systems would be at risk. The City could also be at risk if penalties resulted from breaking contracts with those users.

Significant temporary traffic and noise impacts would result from pipeline construction and well drilling within the Geysers Steamfield, excavation activities and piping improvements accompanying construction of storage, pipeline construction for agricultural reuse, and pipeline and tank construction for urban reuse. Significant loss of farmland could result from storage development. Induced seismicity and noise impacts associated with Geysers recharge would be significant. The extent of water quality impacts would be determined by future CTR interpretations for the duration of discharge. Some potential loss of habitat would result from storage and pipeline construction, as well as potential irrigation of lands not presently irrigated. Loss of habitat resulting from reuse projects could be avoided or new habitat could be created as compensation, so that impacts would be mitigated to less than significant. Significant visual impacts would occur from new storage ponds or urban reuse storage tanks and booster pump stations.

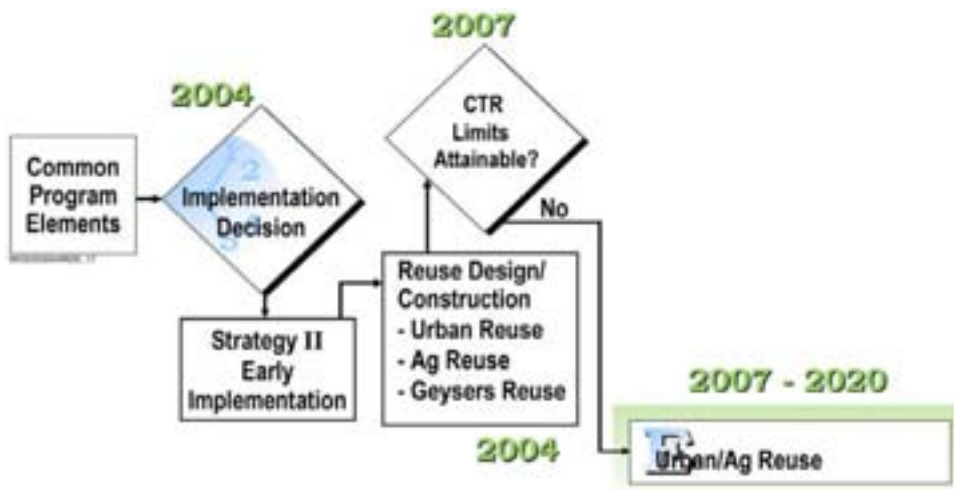
- **Maintain a system that is economically feasible and successfully financed** – See Table 19 in Section 4 of this Master Plan for a comparison of costs to implement each program, as well as the costs shown on figures presented for each program in this section.
- **Maximize use of recycled water** – This program would reuse all Subregional System flow that is not discharged under the CTR discharge limits. Discharge studies will determine whether CTR limits can be met with existing Laguna Plant effluent quality.
- **Maximize potable water supplies** – This program provides a potable water offset of 627 MG/yr.
- **Dispose of reclaimed water while protecting beneficial uses of receiving waters** – For the duration of discharge, any discharged water will be treated to comply with all NPDES permit stipulations and effluent quality limits under the CTR/SIP.
- **Optimize water conservation** – Conservation is an element common to all programs.
- **Maintain weather-independence** – Depending on the contract arrangements with Calpine, much flexibility could be included to manage wet weather flow.
- **Maintain a manageable and reliable disposal system** – This program provides operating control over 1,900 MG of capacity for urban and agricultural reuse, although user agreements and additional monitoring would be required for a large number of users. The City could be affected by Calpine's operation of the Geysers Steamfield, its future financial condition, and conditions of the power market.
- **Provide flexibility to accommodate flows from neighboring agencies** – Additional flows from neighboring agencies could be accommodated by allocating additional capacity in the Geysers Pipeline for Geysers reuse or wheeling water to reuse sites.

### **Program II.E – Early Reuse Plus Urban and Agricultural Reuse**

This program has the same capacities as Program I.E, but the sequence changes so that the 1,300 MG of reuse capacity is constructed earlier.

Program I.E does not rely on any river discharge or Geysers expansions and depends fully on agricultural and urban reuse. Figure 30 shows the schedule for constructing capacity to meet the 2010 and 2020 goals. Construction would need to start in 2005 to meet the 2010 capacity requirement, because of the added time and facilities needed for these types of reuse. Instead of stopping at 1,300 MG of added capacity as with the other Strategy II programs, construction would continue to allow the 2010 capacity to be met on schedule.

The reuse increments and their capacities are shown in Table 16.



**FIGURE 30**  
**Program II.E – Early Reuse Plus Urban and**  
**Agricultural Reuse**

**TABLE 16**  
 Program II.E Reuse Increments  
*Santa Rosa Incremental Recycled Water Program*

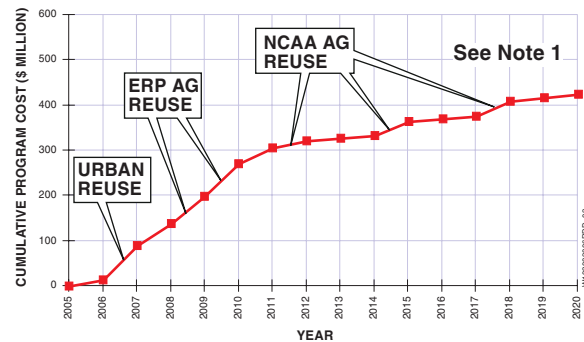
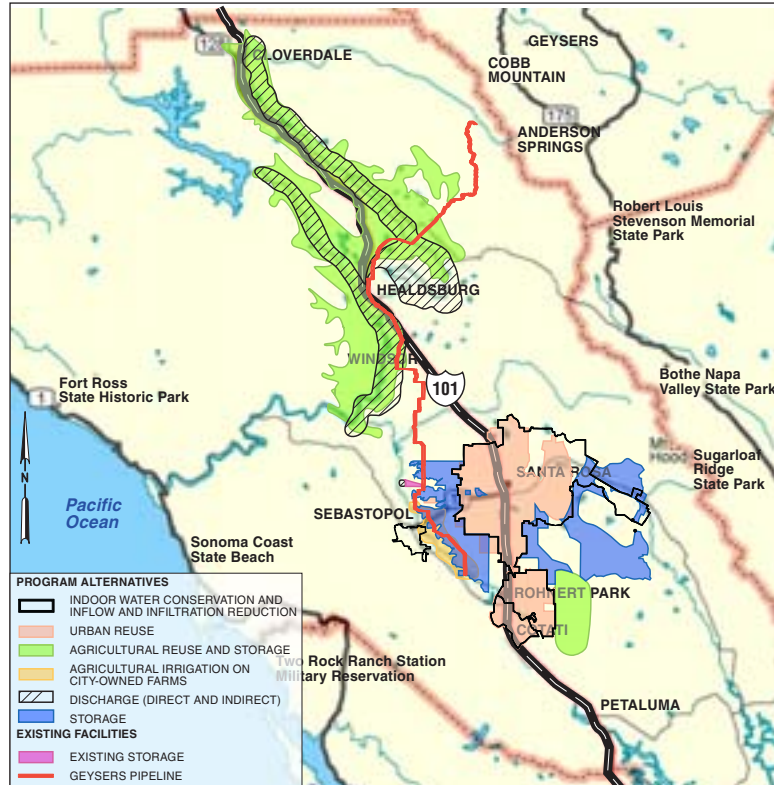
Reuse Increment	Capacity (MG/yr)
City-owned farm irrigation	800
NCAA reuse	2,765
ERP Agricultural Area reuse	1,600
Urban reuse	1,235
<b>Total</b>	<b>6,400</b>

Note: Total storage requirement: 4,000 MG

The reuse increments shown in Table 16 are scheduled from 2005 to 2018 (see also Appendix D). Similar to the other framework D or E programs, the ordering of these reuse increments could change.

The water balance calculations (Appendix C) indicate that storage construction would begin in 2007 and continue through 2018, with a maximum of approximately 4,000 MG of new storage required. Program II.E is shown on Figure 31.

As part of Program II.E, the City will simultaneously pursue a long-term Laguna and/or Russian River discharge that complies with the CTR. To do so, the City will need to perform discharge studies outlined in the section, “Common Program Elements.” It is intended that these studies support CTR discharge limits that can be met with existing Laguna Plant effluent quality. As described previously in Strategy (I or II), there will be a decision point in approximately 2007, after the study results are known. At this point, the City will need to decide whether to develop the reuse capacity required for Program II.E, continue with direct discharge, or implement some combination of both.



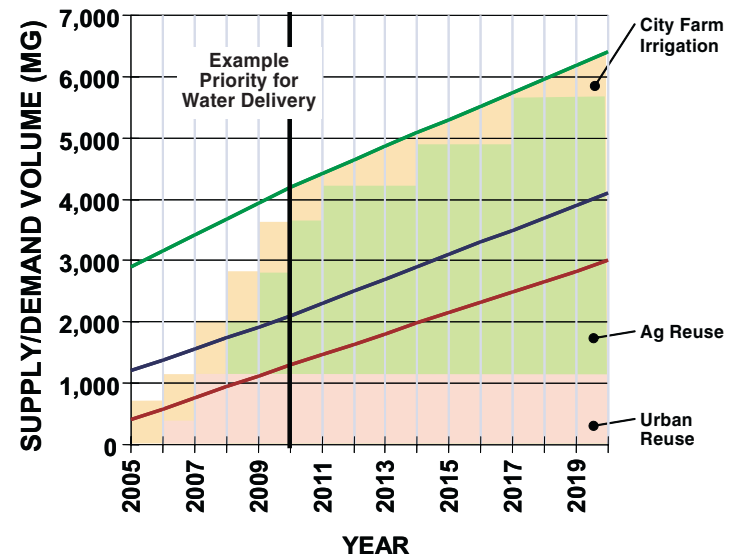
**NOTE:**

- Does not include Common Elements
- This program could also include reuse in any of the areas shown on Figure 2.

#### ESTIMATED COSTS AND VOLUME FOR PROGRAM ILE Santa Rosa Incremental Recycled Water Program

Program Elements	Estimated Capital Costs (\$ million)	Estimated Present Value (\$ million)	Volume of Flow Managed (MG)
Direct Discharge			
Indirect Discharge			
Geysers			
Urban Reuse	73		1,200
Agricultural Reuse	90		5,200
Storage (4,017 MG)	234		
Subtotal	398	457	
Common Elements	72	122	300
<b>Total Program</b>	<b>471</b>	<b>579</b>	<b>6,700</b>

Monthly user charge increase (per ESU) = \$22.99 for Santa Rosa  
Demand fee increase (per ESU) = \$7,468 for Santa Rosa



**FIGURE 31**  
**PROGRAM ILE-EARLY REUSE PLUS**  
**URBAN AND AGRICULTURAL REUSE**  
SANTA ROSA SUBREGIONAL WATER RECLAMATION SYSTEM  
INCREMENTAL RECYCLED WATER PROGRAM

The performance of this program in relation to evaluation criteria is summarized as follows:

- **Provide capacity to treat, recycle, and dispose** – This program depends fully on urban and agricultural reuse to manage all flow.
- **Protect natural resources, promote use of recycled water, meet current regulatory requirements, and provide flexibility for future regulations** – If water quality requirements for urban or agricultural reuse could not be met in the future, additional treatment or additional Geysers recharge could be required to increase capacity. If the decision is to increase Geysers capacity, the cost of the urban and agricultural reuse systems could be at risk. If the City were to stop supplying urban or agricultural users taken on as part of this program, the construction cost and revenue from those systems could be at risk. The City could also be at risk if penalties resulted from breaking contracts with those users.

Significant temporary traffic and noise impacts would result from pipeline construction, excavation activities and piping improvements accompanying construction of storage, pipeline construction for agricultural reuse, and pipeline and tank construction for urban reuse. Significant loss of farmland could result from storage development. If there were any expansion of Geysers recharge, there could be significant induced seismicity and noise impacts. The extent of water quality impacts would be determined by future CTR interpretations for the duration of discharge. Some potential loss of habitat could result from storage and pipeline construction, as well as potential irrigation of lands not presently irrigated. Loss of habitat resulting from reuse projects could be avoided or new habitat could be created as compensation, so that impacts would be mitigated to less than significant. Significant visual impacts would occur from new storage ponds or urban reuse storage tanks and booster pump stations.

- **Maintain a system that is economically feasible and successfully financed** – See Table 19 in Section 4 of this Master Plan for a comparison of costs to implement each program, as well as the costs shown on figures presented for each program in this section.
- **Maximize use of recycled water** – This program would reuse all Subregional System flow that is not discharged under the CTR discharge limits. Discharge studies will determine whether CTR limits can be met with existing Laguna Plant effluent quality.
- **Maximize potable water supplies** – This program provides a potable water offset of 707 MG/yr.
- **Dispose of reclaimed water while protecting beneficial uses of receiving waters** – For the duration of discharge, any discharged water will be treated to comply with all NPDES permit stipulations and effluent quality limits under the CTR/SIP.
- **Optimize water conservation** – Conservation is an element common to all programs.
- **Maintain weather-independence** – To provide flexibility to manage wet weather flow, the City must reach agreements with many users who are willing to receive and store water that will be available infrequently. This type of user base will be difficult to establish.

- **Maintain a manageable and reliable disposal system** – Maintaining and monitoring the large number of contracts and users needed with this program will be challenging.
- **Provide flexibility to accommodate flows from neighboring agencies** – Additional flows from neighboring agencies could be accommodated by allocating additional capacity in the Geysers Pipeline for Geysers reuse or wheeling water to reuse sites.

**Section 4**  
**Summary of Estimated Program Costs and**  
**Economic and Financial Analysis**

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## SECTION 4

# Summary of Estimated Program Costs and Economic and Financial Analysis

## Capital and Operating Costs, Net Present Value

Table 17 shows the estimated present value for each of the Strategy I and Strategy II programs, without the common program elements. Because the common program elements are in every program, this table allows a direct comparison of the relative costs of programs. Appendix D summarizes estimated capital and O&M costs for each program.

**TABLE 17**

Summary of Estimated Program Costs (Without Common Program Elements)<sup>a</sup>  
*Santa Rosa Incremental Recycled Water Program*

		Estimated Costs (\$ million)	
		Strategy I	Strategy II
Program	Description		
A	Direct Discharge	45 <sup>b</sup>	60 <sup>b</sup>
B	Indirect Discharge	108 <sup>b</sup>	101 <sup>b</sup>
C	Geysers (25 mgd)	286	245
D	Geysers (19 mgd) plus Urban and Agricultural Reuse	306	297
E	Urban and Agricultural Reuse	458	457

<sup>a</sup>All costs in present value.

<sup>b</sup>Does not include potential AMT cost, which could range from \$346 to \$551 million in capital cost and from \$20 to \$35 million in annual O&M costs.

Strategy I is less costly than Strategy II for Program A, because Strategy I relies entirely on discharge and does not include early implementation of reuse. Strategy II is less costly than Strategy I for Programs B, C, and D, primarily because of the use of City-owned farm irrigation. City-owned farm irrigation is particularly cost-effective because of its use of existing infrastructure. The cost of Program E is approximately the same for either Strategy I or Strategy II because Program E relies entirely on agricultural and urban reuse. Only the order of implementation differs between the two strategies.

Table 18 shows the estimated capital costs and present value costs of the common program elements. Table 19 shows estimated total costs and present values for each of the 10 programs, including the common program elements.

The economic analysis report in Appendix A discusses rate impacts and presents an affordability analysis of the costs represented by these programs.

**TABLE 18**  
 Estimated Costs for Common Program Elements  
*Santa Rosa Incremental Recycled Water Program*

<b>Common Program Elements</b>	<b>Total Capital Cost (\$ million)</b>	<b>Total Present Value Cost (\$ million)</b>
<b>Actions</b>		
Laguna Plant Upgrade	62	86
Indoor Water Conservation	3	24
Laguna Discharge Improvements	1.1	6
<b>Studies</b>		
I&I Pilot Program	0.1	0.1
Discharge Studies	2.4-4.3	2.4-4.3
Filtration Studies	0.3	0.3
CTS Surveys	0.5-1.0	0.5-1.0
<b>Total Common Program Elements</b>	<b>69.4-71.8</b>	<b>119.3-121.7</b>

## Economic and Financial Analysis

The purpose of the financial analysis, Appendix A, is to document the economic and financial analysis that was conducted for the IRWP. The analysis determined savings that would occur if recycled water were used instead of potable water. This savings is a cost that is avoided and was included in the economic analysis as a credit against the costs of the ten alternative IRWP programs. The analysis also addresses the potential financial impacts on wastewater rate payers associated with the cost of the 10 IRWP programs.

### Potable Water Offset

The use of recycled water will offset the demand for potable water in some IRWP programs. Table 20 shows the estimated amount and value of potable water offset for each program. The cost savings resulting from the reduced need for potable water is a benefit created by substituting recycled water for potable water. This analysis understates the potential cost savings; recycling likely provides greater economic benefit than is described in the economic analysis. The potable water offset provided by urban irrigation that is currently metered can be readily quantified. However, potable water offset associated with agricultural reuse and discharge is not easily quantifiable and could not be estimated with sufficient certainty to include in the economic analysis.

Recycled water used for urban reuse is assumed to offset potable water supplied by SCWA. The 3,327 acre-feet per year (ac-ft/yr) of urban reuse included in the Master Plan programs would be used by Santa Rosa, Rohnert Park, and Cotati, all of which are SCWA contractors. Although Rohnert Park's potable water supply is mostly groundwater, potable water offset was calculated at the same unit cost as SCWA water.

**TABLE 19**  
**Estimated Costs and Present Values for Programs**  
*Santa Rosa Incremental Recycled Water Program*

<b>Program Elements</b>	<b>Estimated Capital Cost (\$ million)</b>	<b>Estimated Present Value (\$ million)</b>	<b>Estimated Capital Cost (\$ million)</b>	<b>Estimated Present Value (\$ million)</b>	<b>Estimated Capital Cost (\$ million)</b>	<b>Estimated Present Value (\$ million)</b>	<b>Estimated Capital Cost (\$ million)</b>	<b>Estimated Present Value (\$ million)</b>	<b>Estimated Capital Cost (\$ million)</b>	<b>Estimated Present Value (\$ million)</b>
<b>Programs I.A through I.E</b>	<b>I.A</b>		<b>I.B</b>		<b>I.C</b>		<b>I.D</b>		<b>I.E</b>	
Direct Discharge	29 <sup>a</sup>									
Indirect Discharge			97 <sup>a</sup>							
Geysers					81		33			
Urban Reuse							62		73	
Agricultural Reuse							44		87	
Storage					128		146		233	
Subtotal	29 <sup>a</sup>	45 <sup>a</sup>	97 <sup>a</sup>	108 <sup>a</sup>	209	286	285	306	393	458
Common Elements	72	122	72	122	72	122	72	122	72	122
Total Program	102 <sup>a</sup>	167 <sup>a</sup>	170 <sup>a</sup>	230 <sup>a</sup>	282	408	358	428	466	580
<b>Programs II.A through II.E</b>	<b>II.A</b>		<b>II.B</b>		<b>II.C</b>		<b>II.D</b>		<b>II.E</b>	
Direct Discharge	29 <sup>a</sup>									
Indirect Discharge			77 <sup>a</sup>							
Geysers					81		33			
Urban Reuse	24		24		24		62		73	
Agricultural Reuse	0		0		0		44		90	
Storage					108		146		234	
Subtotal	53 <sup>a</sup>	60 <sup>a</sup>	101 <sup>a</sup>	101 <sup>a</sup>	212	245	286	297	398	457
Common Elements	72	122	72	122	72	122	72	122	72	122
Total Program	126 <sup>a</sup>	182 <sup>a</sup>	174 <sup>a</sup>	223 <sup>a</sup>	285	367	359	419	471	579

<sup>a</sup>Does not include potential AMT cost, which could range from \$346 to \$551 million in capital cost and from \$20 to \$35 million in annual O&M costs.

**TABLE 20**  
**Potable Water Offset for Each IRWP Program**  
*Santa Rosa Incremental Recycled Water Program*

<b>IRWP Programs</b>	<b>Potable Water Offset (MG/yr)</b>	<b>Annual Value of Potable Water Offset<sup>a</sup> (\$ thousand)</b>	<b>Present Value Benefit of Potable Water Offset (\$ thousand)</b>
I.A – Direct Discharge	0	0	0
I.B – Indirect Discharge	0	0	0
I.C – Geysers (25 mgd)	0	0	0
I.D – Geysers (19 mgd) Plus Urban and Agricultural Reuse	627	1,150	11,500
I.E – Urban and Agricultural Reuse	707	1,300	20,300
II.A – Early Reuse Plus Direct Discharge	343	630	11,700
II.B – Early Reuse Plus Indirect Discharge	343	630	11,700
II.C – Early Reuse Plus Geysers (25 mgd)	343	630	11,700
II.D – Early Reuse Plus Geysers (19 mgd) Plus Urban and Agricultural Reuse	627	1,150	16,900
II.E – Early Reuse Plus Urban and Agricultural Reuse	707	1,300	23,800

<sup>a</sup>Calculations on this table were made at \$600/acre-foot or \$1,840/MG. However, program costs were calculated using a potable water offset value of \$640/acre-foot (or \$1,965/MG).

The analysis yielded the following results based on demand projections and financial data for 2002:

- **Reduced potable water savings.** Offsetting 3,327 ac-ft/yr of potable water sales with recycled water would reduce the current water sales of approximately 61,500 ac-ft/yr by 5.4 percent.
- **Reduced SCWA costs.** SCWA's variable costs would be reduced by approximately \$316,000 per year out of a total of \$21,142,000 revenue requirement, or about 1.5 percent.
- **Increased O&M charge.** SCWA's O&M charge would increase from \$339.12/ac-ft to \$353.07/ac-ft or about 4.1 percent.
- **O&M cost savings.** The three Subregional partners that are SCWA partners would pay approximately \$804,000 less in potable water purchases, which is a savings of about \$240/ac-ft/yr of recycled water.
- **Long-range cost savings.** A proportionate reduction in the long-range capital program, including capital costs and estimated O&M costs, results in an avoided cost of about \$360/ac-ft/yr of recycled water.

The analysis of benefits did not include other potential benefits such as increased water supply, increased water supply reliability, improved planning and management, power revenues, recreation and aesthetic values, and wildlife and habitat values.

## IRWP Cost Allocations

The economic analysis allocated IRWP capital and O&M costs to current and future capacity. Current and future capacity are defined as follows:

- **Current capacity.** 2004 to 2010 – the period during which the current 21.3-mgd system capacity is projected to be fully used by all of the Subregional partners. These costs are referred to as “capacity preservation” costs.
- **Future capacity.** 2011 to 2020 – the period during which the system is projected to be expanded from 21.3 mgd to 25.9 mgd. These costs are referred to as “capacity expansion” costs.

Costs also were allocated to each in proportion to their Subregional partner respective shares of future flow. These steps resulted in costs that could be divided between user charges and demand fees for each partner.

Table 21 summarizes the allocation factors for capital costs. In addition to showing the allocation of costs among the Subregional partners, Table 22 also shows the allocation of capacity preservation costs between the existing users (92 percent) and future users (8 percent).

**TABLE 21**  
Capital Cost (Debt Service) Allocation Factors  
*Santa Rosa Incremental Recycled Water Program*

	Cotati	Rohnert Park	Santa Rosa	Sebastopol	Total	Growth Increment Allocation
<b>Capacity Preservation</b>						
Existing Users						
Current Capacity (mgd in 2010)	0.76	3.43	16.31	0.84	21.34	
Factor	3.56%	16.07%	76.43%	3.94%	100.00%	
Growth Increment						
2004 Flows (mgd)	0.61	3.91	14.43	0.71	19.66	92%
Growth (mgd)	0.12	0.28	1.19	0.09	1.68	8%
2010 Flows (mgd)	0.73	4.19	15.62	0.80	21.34	100%
Factor	7.01%	16.64%	70.97%	5.38%	100.00%	
<b>Capacity Expansion</b>						
21.3 to 25.9 mgd increment						
Current Capacity (mgd)	0.76	3.43	16.31	0.84	21.34	
Future Capacity (mgd)	0.76	5.15	19.14	0.84	25.89	
Difference (mgd)	0	1.72	2.83	0	4.55	
Factor	0.00%	37.80%	62.20%	0.00%	100.00%	

Table 22 summarizes the capital cost allocations of each IRWP program to the Subregional partners. These amounts represent debt service on the construction costs through the term of the debt (which extends beyond 2020). The debt service is based on the construction costs escalated to the estimated date of construction.

**TABLE 22**

Debt Service Allocations (Through Term of Debt in \$ million)

*Santa Rosa Incremental Recycled Water Program*

<b>IRWP Programs</b>	<b>Cotati</b>	<b>Rohnert Park</b>	<b>Santa Rosa</b>	<b>Sebastopol</b>	<b>Total</b>
I.A – Direct Discharge	0.4	54.0	93.3	0.4	148.1
I.B – Indirect Discharge	4.0	74.0	171.5	4.3	253.8
I.C – Geysers (25 mgd)	3.9	150.7	296.5	4.2	455.3
I.D – Geysers (19 mgd) + Urban Reuse	7.9	177.0	388.7	8.4	582.0
I.E – Urban and Agricultural Reuse	17.0	169.2	489.0	18.2	693.4
II.A – Early Reuse + Direct Discharge	1.2	61.7	116.2	1.3	180.4
II.B – Early Reuse + Indirect Discharge	4.2	75.4	175.7	4.5	259.7
II.C – Early Reuse + Geysers (25 mgd)	5.1	144.3	301.0	5.5	456.0
II.D – Early Reuse + Geysers (19 mgd) + Urban and Agricultural Reuse	8.7	169.4	386.5	9.3	573.9
II.E – Early Reuse + Urban and Agricultural Reuse	17.0	173.1	496.0	18.3	704.3

Table 23 summarizes the O&M cost allocations to the Subregional partners. These amounts represent the cumulative annual O&M costs from 2004 through 2020.

**TABLE 23**

O&amp;M Cost Allocations (2004 to 2020 in \$ million)

*Santa Rosa Incremental Recycled Water Program*

<b>IRWP Programs</b>	<b>Cotati</b>	<b>Rohnert Park</b>	<b>Santa Rosa</b>	<b>Sebastopol</b>	<b>Total</b>
I.A – Direct Discharge	2.3	14.6	54.5	2.6	74.0
I.B – Indirect Discharge	2.5	15.8	58.9	2.8	80.1
I.C – Geysers (25 mgd)	5.0	31.7	117.8	5.5	159.9
I.D – Geysers (19 mgd) + Urban Reuse	4.1	26.0	96.8	4.6	131.4
I.E – Urban and Agricultural Reuse	5.3	33.4	124.4	5.9	169.0
II.A – Early Reuse + Direct Discharge	2.1	13.2	48.9	2.3	66.5
II.B – Early Reuse + Indirect Discharge	2.2	13.8	51.5	2.4	69.9
II.C – Early Reuse + Geysers (25 mgd)	3.6	22.8	84.7	4.0	115.0
II.D – Early Reuse + Geysers (19 mgd) + Urban and Agricultural Reuse	3.6	22.8	84.9	4.0	115.3
II.E – Early Reuse + Urban and Agricultural Reuse	5.1	32.4	120.6	5.7	163.8

## User Charge and Demand Fee Increases

User charges and demand fees are the two principal sources of funding for capital and O&M costs currently used by the Subregional partners. User charges and demand fees were also assumed to fund all of the IRWP program costs. No funding from other potential sources, such as the SCWA, Calpine, urban water users, or agricultural water users, was included. Contributions from parties other than rate payers and developers, depend on contractual arrangements that do not currently exist.

A common set of assumptions was applied to the Subregional partners to calculate the potential impacts on their user charges and demand fees. Each Subregional partner will ultimately establish its own user charges and demand fees.

Table 24 summarizes the O&M and debt service costs that were allocated to user charges for each Subregional partner.

Table 25 summarizes the incremental increase in monthly user charges per residential dwelling unit in 2020 resulting from implementation of each program. The incremental costs represent how much user charges are projected to increase by 2020 as a result of each IRWP program. User charges projected for 2020 are the sum of the baseline user charge plus the IRWP cost increment. The baseline user charges are shown with the incremental monthly cost associated with each IRWP program.

Table 26 shows the Subregional partners' existing demand fees and the incremental cost per ESU associated with each IRWP program. The incremental cost equals the sum of all growth-related debt service (through the term of the debt service, 2035) divided by the growth to buildout in 2020.

The sum of the baseline and incremental demand fees, multiplied by the number of additional ESUs, is the amount revenue generated by demand fees to fund local and IRWP capital costs attributable to growth. These demand fees, expressed as percentage increases, are shown in Table 27.

**TABLE 24**

O&amp;M and Debt Service Costs Funded by User Charges (\$ million)

*Santa Rosa Incremental Recycled Water Program*

IRWP Programs	Cotati			Rohnert Park			Santa Rosa			Sebastopol			Totals		
	User Charges	Demand Fees	Total	User Charges	Demand Fees	Total	User Charges	Demand Fees	Total	User Charges	Demand Fees	Total	User Charges	Demand Fees	Grand Total
I.A – Direct Discharge	0.3	0.1	0.4	1.6	37.8	39.4	6.4	87.0	93.3	0.3	0.0	0.4	8.6	124.9	133.5
I.B – Indirect Discharge	3.4	0.6	4.0	17.7	40.6	58.3	71.5	100.0	171.5	3.8	0.5	4.3	96.3	141.7	238.1
I.C – Geysers (25 mgd)	3.3	0.6	3.9	17.2	96.3	113.5	69.6	226.8	296.5	3.7	0.5	4.2	93.8	324.2	418.0
I.D – Geysers (19 mgd) + Urban Reuse	6.7	1.1	7.9	34.6	102.7	137.3	140.1	248.6	388.7	7.4	1.0	8.4	188.9	353.4	524.3
I.E – Urban and Agricultural Reuse	14.5	2.5	17.0	74.8	68.1	142.8	302.8	186.2	489.0	16.1	2.1	18.2	408.2	258.9	667.0
II.A – Early Reuse + Direct Discharge	1.0	0.2	1.2	5.2	40.7	45.9	21.1	95.1	116.2	1.1	0.1	1.3	28.5	136.2	164.6
II.B – Early Reuse + Indirect Discharge	3.6	0.6	4.2	18.3	41.2	59.5	74.1	101.5	175.7	3.9	0.5	4.5	99.9	143.8	243.8
II.C – Early Reuse + Geysers (25 mgd)	4.4	0.7	5.1	22.6	87.7	110.3	91.4	209.6	301.0	4.9	0.6	5.5	123.3	298.7	422.0
II.D – Early Reuse + Geysers (19 mgd) + Urban and Agricultural Reuse	7.4	1.3	8.7	38.3	94.5	132.8	155.1	231.4	386.5	8.2	1.1	9.3	209.1	328.3	537.4
II.E – Early Reuse + Urban and Agricultural Reuse	14.6	2.5	17.0	75.0	70.7	145.7	303.6	192.4	496.0	16.1	2.1	18.3	409.3	267.7	677.0

**TABLE 25**  
 Monthly User Charges Per Equivalent Single-Family Unit  
*Santa Rosa Incremental Recycled Water Program*

Programs	Cotati		Rohnert Park		Santa Rosa		Sebastopol		Average	
	\$	%	\$	%	\$	%	\$	%	\$	%
<b>Baseline</b> (without IRWP, 2004 \$)	<b>46.38</b>		<b>34.73</b>		<b>35.73</b>		<b>44.37</b>		<b>40.30</b>	
<b>Incremental IRWP Cost</b> (2020 \$)										
I.A – Direct Discharge	5.81	12.5	8.58	24.7	5.32	14.9	4.85	10.9	6.14	15.2
I.B – Indirect Discharge	9.47	20.4	11.85	34.1	8.18	22.9	7.91	17.8	9.35	23.2
I.C – Geysers (25 mgd)	17.10	36.9	23.63	68.0	15.25	42.7	14.28	32.2	17.57	43.6
I.D – Geysers (19 mgd) + Urban/Ag Reuse	17.44	37.6	23.50	67.6	15.00	42.0	14.56	32.8	17.63	43.7
I.E – Urban/Ag Reuse	26.80	57.8	29.87	86.0	22.88	64.0	22.85	51.5	25.60	63.5
II.A – Early Reuse + Direct Discharge	5.99	12.9	8.77	25.2	5.37	15.0	5.00	11.3	6.28	15.6
II.B – Early Reuse + Indirect Discharge	8.87	19.1	11.21	32.3	7.60	21.3	7.41	16.7	8.77	21.8
II.C – Early Reuse + Geysers (25 mgd)	15.17	32.7	20.73	59.7	13.29	37.2	12.67	28.5	15.46	38.4
II.D – Early Reuse + Geysers (19 mgd) + Urban/Ag Reuse	17.59	37.9	22.94	66.0	15.02	42.0	14.69	33.1	17.56	43.6
II.E – Early Reuse + Urban/Ag Reuse	27.50	59.3	30.17	86.9	22.99	64.3	22.96	51.7	25.91	64.3

**TABLE 26**  
 Demand Fee for IRWP Cost Increments Per ESU  
*Santa Rosa Incremental Recycled Water Program*

IRWP Programs	Cotati (\$)	Rohnert Park (\$)	Santa Rosa (\$)	Sebastopol (\$)
<b>Baseline</b> (Current Fees, 2004 \$)	<b>12,468</b>	<b>6,797</b>	<b>4,117</b>	<b>6,360</b>
<b>Incremental IRWP Cost</b> (Future \$)				
I.A – Direct Discharge	54	5,858	3,377	50
I.B – Indirect Discharge	605	6,291	3,883	564
I.C – Geysers (25 mgd)	589	14,908	8,806	550
I.D – Geysers (19 mgd) + Urban/Ag Reuse	1,186	15,895	9,650	1,106
I.E – Urban/Ag Reuse	2,562	10,538	7,229	2,390
II.A – Early Reuse + Direct Discharge	179	6,307	3,692	167
II.B – Early Reuse + Indirect Discharge	627	6,376	3,942	585
II.C – Early Reuse + Geysers (25 mgd)	774	13,586	8,136	722
II.D – Early Reuse + Geysers (19 mgd) + Urban/Ag Reuse	1,312	14,629	8,985	1,224
II.E – Early Reuse + Urban/Ag Reuse	2,569	10,950	7,468	2,397

**TABLE 27**  
 IRWP Cost Increments as a Percent of Current Demand Fees  
*Santa Rosa Incremental Recycled Water Program*

<b>IRWP Programs</b>	<b>Cotati (%)</b>	<b>Rohnert Park (%)</b>	<b>Santa Rosa (%)</b>	<b>Sebastopol (%)</b>
<b>Incremental IRWP Cost (Future \$)</b>				
I.A – River Discharge	0.4	86.2	82.0	0.8
I.B – Indirect Discharge	4.9	92.6	94.3	8.9
I.C – Geysers (25 mgd)	4.7	219.4	213.9	8.6
I.D – Geysers (19 mgd) + Reuse	9.5	233.9	234.4	17.4
I.E – Reuse (no Geysers or Discharge)	20.5	155.1	175.6	37.6
II.A – Early Reuse + River Discharge	1.4	92.8	89.7	2.6
II.B – Early Reuse + Indirect Discharge	5.0	93.8	95.7	9.2
II.C – Early Reuse + Geysers (25 mgd)	6.2	199.9	197.6	11.4
II.D – Early Reuse + Geysers (19 mgd) + Reuse	10.5	215.2	218.2	19.3
II.E – Early Reuse + Reuse (no Geysers or Discharge)	20.6	161.1	181.4	37.7

## **Section 5**

### **Program Evaluation**

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## SECTION 5

# Program Evaluation

Table 28 compares programs against the objectives and criteria presented in Section 3. Criteria have not been weighted or ranked. It is expected that this will be done by BPU as part of the selection process. For further detail on environmental impacts, refer to Table 29.

**TABLE 28**  
Qualitative Comparison of Programs  
*Santa Rosa Incremental Recycled Water Program*

Program	I.A	I.B	I.C	I.D	I.E	II.A	II.B	II.C	II.D	II.E
<b>Primary Objectives</b>										
Provide capacity to treat, recycle, and dispose	+	+	+	+	±	±	+	+	+	±
Protect natural resources, promote use of recycled water, meet current regulatory requirements, and provide flexibility for future regulations	±	±	+	±	+	±	±	±	±	+
Maintain a system that is economically feasible and successfully financed	+	+	±	±	±	+	+	±	±	±
<b>Secondary Objectives</b>										
Maximize use of recycled water	-	-	+	+	+	±	±	+	+	+
Maximize potable water supplies	±	±	-	±	+	±	±	±	±	+
Dispose of reclaimed water while protecting beneficial uses of receiving waters	±	±	+	+	+	±	±	+	+	+
Optimize water conservation	+	+	+	+	+	+	+	+	+	+
Maintain weather-independence	+	+	±	±	-	±	±	±	±	-
Maintain a manageable and reliable disposal system	+	+	±	±	-	+	+	±	±	-
Provide flexibility to accommodate flows from neighboring agencies	+	+	+	+	+	+	+	+	+	+
Total	5	5	5	5	4	4	5	5	5	4

Notes:

+ = Fulfills objective; 1 point

± = Fulfills objective, but not to the extent of some other programs; 0 point

- = Does not fulfill objective; 1 point

Evaluation Criteria	<b>Table 29</b> <b>Environmental Evaluation of Programs<sup>a</sup></b>									
	I.A. Direct Discharge	I.B. Indirect Discharge	I.C. Geysers (25 mgd)	I.D. Geysers (19 mgd) + Urban/Ag Reuse	I.E. Urban/Ag Reuse	II.A. Early Reuse + Direct Discharge	II.B. Early Reuse + Indirect Discharge	II.C. Early Reuse + Geysers (25 mgd)	II.D. Early Reuse + Geysers (19 mgd) + Urban/Ag Reuse	II.E. Early Reuse + Urban/Ag Reuse
Program includes EIR Alternative Numbers:	1, 3, 4, 5, 6A, 6B	1, 3, 4, 5, 6A, 6C-E	1, 5, 6A	1, 3, 4, 5, 6A	1, 3, 4, 6A	1, 3, 4, 5, 6A, 6B	1, 3, 4, 5, 6A, 6C-E	1, 3, 4, 5, 6A	1, 3, 4, 5, 6A	1, 3, 4, 5, 6A
Temporary Construction Impacts	●	●	●	●	●	●	●	●	●	●
Permanent Loss of Farmland	●	●	●	●	●	●	●	●	●	●
Induced Seismicity Impacts	●	●	●	●	●	●	●	●	●	●
Water Quality Impacts	●	●	●	●	●	●	●	●	●	●
Permanent Loss of Natural Habitat	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙
Noise from Operations	●	●	●	●	●	●	●	●	●	●
Visual Impacts	●	●	●	●	●	●	●	●	●	●
<b>Level of Significance</b>										
●	370	554	156	219	153	370	554	219	219	219
⊙	431	648	176	330	252	431	648	330	330	330
+	5	8	3	4	3	5	8	4	4	4
<sup>a</sup> This top matrix presents only a portion of the impacts identified in the EIR. Refer to the Summary Table in Chapter 1 of the EIR for a complete list of impacts, and to the entire EIR for a full evaluation of impacts. The number of impacts in the bottom matrix is dependent upon the number of alternatives included in each program; e.g., Program 1C which is made up of 3 alternatives has fewer significant impacts than Program IIC which is made up of 5 alternatives.										
+	Beneficial effect									
●	Significant adverse impact before and after mitigation (significant unavoidable impact)									
⊙	Significant impact before mitigation, less than significant after mitigation									

## **Section 6**

### **Program Selection Process**

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## SECTION 6

# Program Selection Process

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The City will begin to consider the programs outlined in the Master Plan in public meetings held in fall and winter 2003/2004, after certification of the EIR. The following describes the public meetings:

- **Joint City Council and BPU meeting.** The staff will present the programs outlined in the Master Plan to the City Council and BPU. The Council and BPU will have the opportunity to refine the evaluation criteria in the Master Plan, and the public will have an opportunity to provide input.
- **BPU meeting.** The staff will apply the refined evaluation criteria to the alternative programs. The BPU will have the opportunity to review the application of the criteria, and the public will have an opportunity to provide input.
- **BPU meeting.** The staff will describe the preferred program developed by the BPU at the previous meeting. The public will have an opportunity to provide additional input. When all public input has been considered, the BPU will have the opportunity to identify the preferred program and request Council concurrence. The BPU will request environmental review of the identified preferred program as required by CEQA. Following concurrence by the Council, the preferred program would then be compared to the combinations of alternatives evaluated in the EIR to verify that the environmental impacts of the preferred program are fully described in the EIR. This evaluation will be summarized in a CEQA document as an Addendum to the EIR.
- **City Council meeting.** The City Council will consider concurrence with BPU's preferred program.
- **Joint City Council and BPU meeting.** The City will consider certification of the document and adoption of the Master Plan.

When the Final Master Plan has been approved, the City may proceed with implementation of the selected program.

**Section 7**  
**Selected Program**

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## SECTION 7

# Selected Program

The Selected Program consists of a combination of alternatives analyzed in the Program EIR. The Selected Program was designed to meet the Subregional System's design requirements of 25.9 mgd ADWF and disposal of up to a 6,700-MG annual flow increment in the wettest year. The future capacity of the Subregional System is reflected in Table 30.

**TABLE 30**

Future Capacity of the Subregional System (all values in MG except where noted)  
*Santa Rosa Incremental Recycled Water Program*

Year Type (in 67-Year Analysis)	Existing System		IRWP			Total System Capacity at 25.9 (mgd) <sup>c</sup>
	Irrigation	Geysers	Reuse <sup>a</sup>	Discharge <sup>b</sup>	Total	
Driest	2,200	4,000	2,200	1,100	3,300	9,500
10 <sup>th</sup> percentile	2,100	4,000	2,200	1,500	3,700	9,800
Median (50 <sup>th</sup> percentile)	2,100	4,000	2,200	2,200	4,400	10,500
90 <sup>th</sup> percentile	1,900	4,000	2,200	4,200	6,400	12,300
Wettest	1,900	4,000	2,200	4,500	6,700	12,600

<sup>a</sup>Includes urban, agricultural, and Geysers reuse plus conservation.

<sup>b</sup>1,100 MG is the discharge in the 2020 driest year flow conditions, but discharge in the driest year may be greater (up to 1,600 MG) prior to 2020, depending on when reuse is implemented.

<sup>c</sup>Total system capacity at 25.9 mgd ADWF is the sum of existing irrigation system, Geysers Recharge Project, IRWP reuse and discharge.

The Selected Program is based on and meets the IRWP's primary objectives and many of the secondary objectives adopted by the Council and BPU in 2001 at the outset of the IRWP. This chapter describes the Selected Program and discusses its relationship to the size of the alternatives analyzed in the Program EIR.

For the complete project description of alternatives and components, please refer to the certified Program EIR (October, 2003). Where alternatives or components in the Selected Program differ from the Program EIR, those differences are described in this section. If no differences are identified, the description remains the same as in the Program EIR. The City certified an Addendum to the Program EIR on March 4, 2004, that evaluates the environmental effects specifically associated with implementing the Selected Program.

The Selected Program combines the following five alternatives from the Program EIR.

- Alternative 1 – Indoor Water Conservation
- Alternative 3 – Urban Reuse
- Alternative 4 – Agricultural Reuse
- Alternative 5 – Geysers Expansion
- Alternative 6 – Discharge

In addition to these five alternatives, the Selected Program also includes Laguna Plant upgrade, storage, and the option of creating wetlands. Alternative 2, I&I Removal, is not included in the Selected Program because insufficient information is available to determine if a greater extent of I&I removal beyond that achieved by the City's existing I&I program would be cost-effective. A study is recommended to better quantify the effectiveness of I&I removal.

The Selected Program establishes both a target and range for recycled water use and discharge as summarized in Table 31.

**TABLE 31**  
Size of Selected Program  
*Santa Rosa Incremental Recycled Water Program*

<b>Program Elements</b>	<b>Target</b>	<b>Range</b>	<b>Maximum Size Studied in the Program EIR</b>
Alternative 1 – Indoor Water Conservation	300 MG	150 to 300 MG	300 MG
Alternative 3 – Urban Reuse	500 MG	0 to 2,200 MG	2,200 MG
Alternative 4 – Agricultural Reuse	1,000 MG	0 to 2,200 MG	6,400 MG
Alternative 5 – Geysers Expansion	400 MG	0 to 2,200 MG	6,700 MG
Alternative 6 – Discharge	4,500 MG	1,600 to 4,500 MG <sup>a</sup>	6,700 MG
<b>Total Recycled Water Use</b>	<b>6,700 MG</b>	<b>6,700 MG</b>	<b>6,700 MG</b>
Laguna Plant Upgrade	25.9 mgd	25.9 mgd	25.9 mgd
Storage	1,200 MG	0 to 3,190 MG <sup>b</sup>	3,190 MG
Created Wetlands	0	0 to 30 acres	30 acres

<sup>a</sup>Range represents the maximum discharge in driest and wettest years. If discharge is precluded, the lower end of the range could be 0 MG. Laguna discharge is within permit limits (lower end of range could be 0 MG), with remainder to the Russian River. River discharge can be direct or indirect.

<sup>b</sup>Storage may be needed for Urban Reuse, Agricultural Reuse, Geysers Expansion, or Discharge.

The Selected Program preserves a wide range of alternatives for future reuse and disposal. It fulfills all of the following IRWP primary objectives:

- Provide wastewater treatment, recycling, and disposal for the Santa Rosa Subregional Reclamation System to accommodate projected growth as indicated in the adopted general plans of each Subregional System partner effective as of July 2002.
- Develop and operate the wastewater treatment and disposal system in ways that protect public health and safety, protect natural resources including the Russian River and its tributaries, promote use of recycled water, meet current regulatory requirements, and provide flexibility to comply with future regulatory requirements.
- Maintain a system and components that are economically feasible and continue to be successfully financed.

Each of the alternatives presents its own distinct advantages, satisfying many of the secondary objectives, as follows:

- **Indoor Water Conservation.** This alternative provides cost-effective flow reduction and a water supply benefit. Conservation is a reliable means of avoiding wastewater disposal.
- **Urban Reuse.** Urban reuse provides a water supply benefit. This alternative provides a reliable means for disposal of recycled water, while protecting the beneficial uses of receiving waters.
- **Agricultural Reuse.** This alternative potentially provides a water supply benefit and maximizes use of existing facilities. This alternative provides a reliable means for disposal of recycled water, while protecting the beneficial uses of receiving waters. This alternative also provides the flexibility to accommodate flows from neighboring agencies.
- **Geysers Expansion.** This alternative maximizes the use of existing facilities and provides the flexibility to accommodate use of recycled water made available by neighboring agencies. This alternative provides a reliable means for disposal of recycled water, while protecting the beneficial uses of receiving waters. Additional flow to The Geysers also helps to maintain system weather independence. This alternative also provides the flexibility to accommodate flows from neighboring agencies.
- **Direct Discharge.** This is a relatively low-cost method of disposal that preserves weather independence for the Subregional System. Discharge may provide a water supply benefit, although it is currently unquantifiable. It is a reliable disposal system that can accommodate flows from neighboring agencies, while protecting beneficial uses of receiving waters.

The IRWP objectives were used as program selection criteria. Figure 32 summarizes the evaluation of the Selected Program based on these criteria.

QUALITATIVE COMPARISON OF ALTERNATIVES SANTA ROSA INCREMENTAL RECYCLED WATER PROGRAM					
SELECTION CRITERIA	ALTERNATIVES				
	1	2	3	4	5
<b>Primary Objectives</b>					
Provide capacity to treat, recycle, and dispose	●	●	●	●	●
Protect natural resources, promote use of recycled water, meet current regulatory requirements, and provide flexibility for future regulations	●	●	●	●	●
Maintain a system that is economically feasible and successfully financed	●	●	●	●	●
<b>Secondary Objectives</b>					
Maximize use of recycled water		●	●	●	
Maximize potable water supplies	●	●	●		●
Dispose of reclaimed water while protecting beneficial uses of receiving waters	●	●	●	●	●
Optimize water conservation	●	●	●		
Maintain weather-independence				●	●
Maintain a manageable and reliable disposal system	●	●	●	●	●
Provide flexibility to accommodate flows from neighboring agencies			●	●	●

**FIGURE 32**  
Qualitative Comparison of Alternatives

Two strategies were developed for program implementation: some reuse early (Early Implementation) or just in time to meet capacity needs and regulatory requirements (Just-in-Time Reuse). These two strategies are illustrated on Figure 33. Early Implementation has the following advantages.

- Increases ability to meet potential regulatory compliance schedules
- Provides early water supply benefit
- Provides flexibility for implementation
- Increases commitment to reuse

Actual implementation is planned to occur between these two schedules; projects will be implemented sooner than needed but not as rapidly as possible.

The Selected Program caps future discharge at an amount consistent with the existing permit (4,500 MG) and manages flows resulting from growth with conservation and reuse.

Studies are needed to better define the I&I Alternative (EIR Alternative 2), define discharge compliance, and guide the location of future storage (the California tiger salamander habitat studies are already in progress). The City also is participating in an ongoing study in Monterey involving pilot testing and plant trials to evaluate alternative filtration technologies that could optimize future filtration at the Laguna Plant. For a more detailed description of these studies, refer to Section 3, Program Development.

A summary of the Selected Program, including location, cost, rate impacts, and volume of water managed through the planning horizon of 2020, is shown on Figure 33.

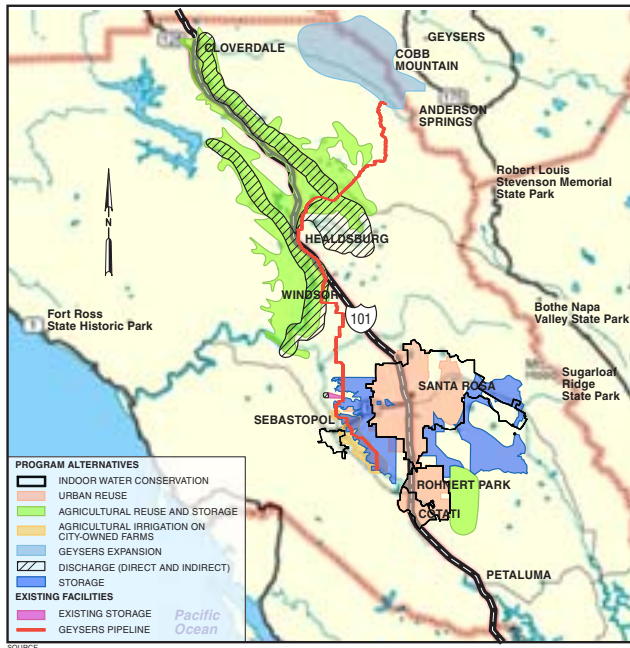
## Alternative 1 – Indoor Water Conservation

The target for indoor water conservation is 300 MG and could range from 150 to 300 MG (Table 32). The 300-MG target represents the conservation to be achieved if all Subregional Partners implement the Indoor Water Conservation Best Management Practices (BMPs) in their jurisdictions. The volume of conservation that can be achieved through implementation of only the City of Santa Rosa Indoor Water Conservation BMPs is 150 MG.

This alternative is intended to reduce sewer flows through conservation in the indoor use of water, thereby reducing the need to treat sewage and reuse or dispose of recycled water. This focus is on indoor water use as opposed to outdoor water use, landscape, or irrigation programs, which do not affect sewer flows.

**TABLE 32**  
Indoor Water Conservation in the Selected Program  
*Santa Rosa Incremental Recycled Water Program*

<b>Program Elements</b>	<b>Estimated Capital Costs for Target (\$)</b>	<b>Target (MG)</b>	<b>Range (MG)</b>	<b>Maximum Size Studied in the Program EIR (MG)</b>
Alternative 1 – Indoor Water Conservation	3 million	300	150 to 300	300



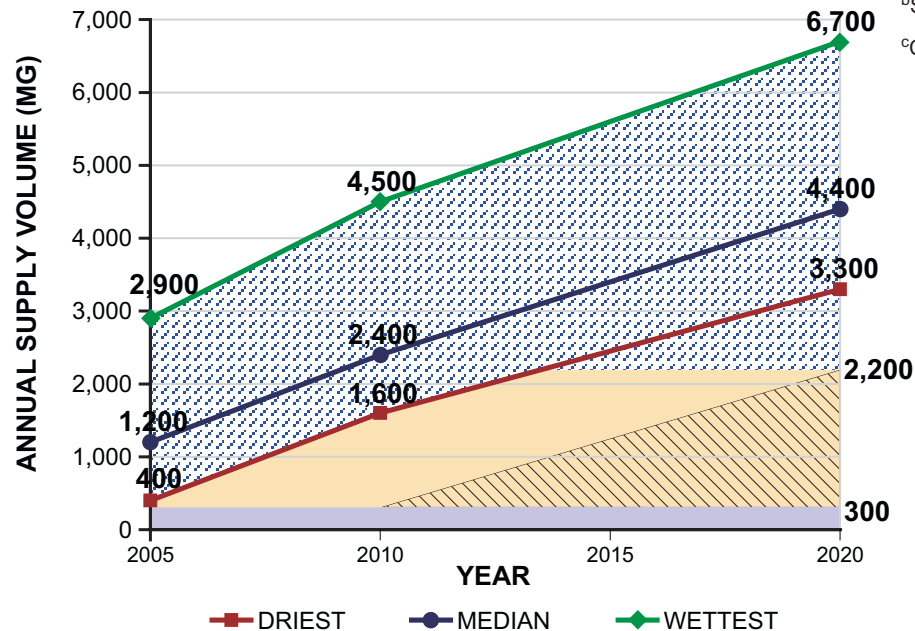
## Estimated Costs and Volumes

Program Elements	Estimated Capital Costs <sup>c</sup> (\$ million)	Volume Managed (MG)	
		Target	Range
Conservation	3	300	150 to 300
Discharge	30	4,500 <sup>a</sup>	1,600 to 4,500 <sup>a</sup>
Geysers Reuse	3	400	0 to 2,200
Urban Reuse	27	500	0 to 2,200
Agricultural Reuse	3	1,000	0 to 2,200
Storage	62	1,200 <sup>b</sup>	250 to 3,190
Treatment Plant Expansion	62		
<b>Total Capital Cost</b>	<b>190</b>		
Studies	6		
<b>Total Program</b>	<b>196</b>	<b>6,700</b>	<b>6,700</b>

<sup>a</sup>Range represents the maximum discharge in driest and wettest years. If discharge is precluded, the lower end of the range could be 0 MG. Laguna discharge is within permit limits (lower end of range could be 0 MG), with remainder to Russian River. River discharge can be direct or indirect.

<sup>b</sup>Storage not included in total program volume.

<sup>c</sup>Costs reflect target volume.



## Alternative 3 – Urban Reuse

The target for recycled water disposal by means of the Urban Reuse Alternative is 500 MG annually and could range from 0 to 2,200 MG annually (Table 33). Urban Reuse occurs in any area identified for potential urban reuse in the Program EIR.

Urban reuse is already occurring in Santa Rosa, Rohnert Park, and Sebastopol with recycled water from the Subregional System. This alternative increases the amount of urban reuse within Santa Rosa, Cotati, and Rohnert Park supplied by recycled water. Disposal of recycled water via urban reuse provides not only irrigation water, but may also replace potable water currently used for urban irrigation. It also provides for the potential use of dual piping systems in new development, gray water systems for onsite reuse, and other urban reuse as listed in the certified EIR project description.

**TABLE 33**  
Urban Reuse in the Selected Program  
*Santa Rosa Incremental Recycled Water Program*

Program Elements	Estimated Capital Costs for Target (\$)	Target (MG)	Range (MG)	Maximum Size Studied in the Program EIR (MG)
Alternative 3 – Urban Reuse	\$27 million	500	0 to 2,200	2,200

Components under this alternative include:

- **Urban Irrigation.** Urban irrigation provides recycled water from the Laguna Plant to urban reuse sites to replace either potable, municipally supplied water or well water used for irrigating landscaped areas, or for commercial/industrial reuse. Under this component, recycled water is supplied to replace existing irrigation systems, as well as to irrigate landscaped areas in new development.

Industrial reuse replaces water in industrial processes and for indoor plumbing (such as fire sprinklers and toilets) in commercial buildings.

Gray water systems, which could be allowed by the Subregional Partners under this component (subject to regulatory approval), reduce sewage flows by reusing or disposing of residential or commercial wash water onsite at the residence or commercial buildings.

- **Pipelines.** Pipelines will be constructed to carry recycled water from the Laguna Plant to the irrigation sites in the urban reuse area (possibly including a series of storage tanks). Pipelines may also be required to convey recycled water to and from storage facilities.
- **Pump Stations and Tanks.** Pump stations and tanks include a new pump station at the West College Ponds and booster pump stations at various locations within the urban reuse system. Any storage facility in the Santa Rosa Plain may also require construction of a booster pump station to pump water back to the reuse system. Also, if storage is provided east of Santa Rosa, a booster pump station may be required at storage facilities located at higher elevations. Storage tanks could be located within the urban reuse areas. If storage tanks were provided, smaller pipelines could serve portions of the system.

## Alternative 4 – Agricultural Reuse

The target for recycled water disposal by means of the Agricultural Reuse Alternative is 1,000 MG annually, and could range from 0 to 2,200 MG annually. Agricultural reuse could occur in any area identified for potential agricultural reuse in the Program EIR.

This alternative involves providing recycled water for agricultural irrigation within areas of Sonoma County. This alternative has three options:

- **North County Agricultural Reuse.** Within the North County, there are 51,500 acres currently cultivated or uncultivated but potentially suitable for irrigation. Recycled water for North County Agricultural Reuse comes from the Geysers Pipeline or from new storage facilities located in the North County that are supplied by the Geysers Pipeline.
- **East of Rohnert Park Agricultural Reuse.** This area includes approximately 5,700 acres that may be suitable for cultivation. Recycled water for East of Rohnert Park agricultural reuse is conveyed from the Laguna Plant using the existing Rohnert Park urban reuse pipeline or from storage facilities.
- **City-owned Farms.** Within the City-owned farms reuse area identified in the IRWP EIR, about 2,800 acres of land are potentially available for irrigation. City-owned farms would continue to be served through the existing reclamation system or by recycled water conveyed from storage facilities.

Recycled water would potentially be available to a wide variety of agricultural uses including vineyards, pasture, and silviculture (e.g., redwoods cultivation). This alternative includes irrigation on lands currently being irrigated, as well as lands that are not currently being irrigated. The recycled water supplied for agricultural reuse may also be used for frost control. In portions of the County, this alternative is being developed in coordination with local agricultural groups and individual operators who may be interested in using recycled water for agricultural crops in the future.

The Geysers Recharge Project began operating in December 2003. At that time, water that had formerly been delivered to the existing irrigation system was delivered to the Geysers Recharge Project. The amount of land irrigated by the existing irrigation system was reduced by 40 percent to approximately 3,600 acres because of the reduced availability of recycled water. The annual irrigation volume declined from about 3,700 MG to about 2,100 MG in a normal rainfall year, a reduction of 1,600 MG. With additional supply provided by the IRWP and construction of storage, City-owned land remains at production levels similar to those prior to implementation of the Geysers Recharge Project (Table 34).

**TABLE 34**  
Agricultural Reuse in the Selected Program  
*Santa Rosa Incremental Recycled Water Program*

Program Elements	Estimated Capital Costs for Target (\$)	Target (MG)	Range (MG)	Maximum Size Studied in the Program EIR (MG)
Alternative 4 – Agricultural Reuse	3 million	1,000	0 to 2,200	6,400

Components of this alternative include the following:

- **Agricultural Irrigation.** This component provides water for irrigation and frost control to agricultural users in the North County, the area East of Rohnert Park, and City-owned Farms.
- **Pipelines.** Distribution pipelines from the existing Geysers Pipeline carry recycled water to the Alexander Valley, Dry Creek Valley, and Russian River irrigation areas.

The system of distribution pipelines for the area east of Rohnert Park would be constructed from the end of the existing urban reuse pipeline in Rohnert Park. No new pipelines are required for the City-owned farms, as this area would continue to be served through the existing reclamation system. Pipelines may be needed to convey recycled water to and from new storage facilities.

- **Pump Stations.** Expansion of the Geysers Llano Pump Station capacity, along with construction of up to two new pump stations and four surge tanks in the Valley section of the Geysers Pipeline between the Laguna Plant and Healdsburg, may be required to provide sufficient capacity in the Geysers Pipeline to fully implement this alternative in the North County area (conveyance of recycled water to the area east of Rohnert Park and City-owned farms areas would not use the Geysers Pipeline). For any storage facilities located at higher elevations, or providing recycled water to parcels located at higher elevations, booster pump stations are required.

## Alternative 5 – Geysers Expansion

The Geysers Expansion Alternative has a target of recycling 400 MG (1.1 mgd). Annually, the volume could range from 0 to 2,200 MG (6 mgd) (Table 35).

Calpine is the steamfield operator. Under its existing contract with Calpine, the City supplies the Geysers Steamfield with an average daily flow rate of 11 mgd of recycled water. Under this alternative, the City would supply up to 6 mgd of additional recycled water to the Geysers Steamfield over and above the 11-mgd in the existing contract. For Geysers expansion, no modifications to the Subregional System pipelines or pump stations are necessary, with the exception of some changes in the pump station controls and operational procedures. The private steamfield operators construct steamfield improvements and manage the injection of the recycled water for electricity production.

**TABLE 35**

Geysers Expansion in the Selected Program  
*Santa Rosa Incremental Recycled Water Program*

Program Elements	Estimated Capital Costs for Target (\$)	Target (MG)	Range (MG)	Maximum Size Studied in the Program EIR (MG)
Alternative 5 – Geysers Expansion	3 million	400 (1.1 mgd)	0 to 2,200 (up to 6 mgd)	6,700

This alternative involves the following components:

- **Pipelines.** No modification to the Geysers Pipeline is necessary to accommodate additional flows under this alternative. However, additional pipelines within the Geysers Steamfield are required to convey the recycled water to the additional injection wells; these pipelines are included in the Geysers Steamfield Expansion component below. Pipelines may be required to convey recycled water to and from storage facilities.
- **Pump Stations.** To accommodate the maximum delivery of an additional 2,200 MG for a total annual average flow of 17 mgd to The Geysers, expansion of the Geysers Llano Pump Station capacity may be required to provide sufficient capacity in the Geysers Pipeline. For storage facilities located at higher elevations, booster pump stations could be required at the reservoir sites. Depending on the location and volume of North County agricultural reuse or Russian River discharge, booster pump station(s) and surge tanks could be required on the Geysers Pipeline.
- **Geysers Steamfield Expansion.** With the increased potential for recycled water disposal up to 17 mgd annual average flow, additional injection capacity is required at The Geysers. To provide this capacity, the target disposal volume may require one geothermal well to be converted from production to injection. Additional disposal of 2,200 MG of recycled water at The Geysers, the maximum allowable under the Selected Program, requires up to six well conversions and three new wells. For either the target or maximum range of recycled water annual volumes, up to 7 miles of aboveground pipelines would be constructed within the Geysers Steamfield. Under this component, recycled water could also be provided to the cooling towers at the Geysers Steamfield.

## Alternative 6 – Discharge

The target for recycled water disposal by means of discharge is 4,500 MG annually of direct discharge to the Laguna and/or Russian River. The range is from 1,600 to 4,500 MG annually via direct discharge to the Laguna or Russian River or indirect discharge to the River. If discharge were precluded at some point in the future because effluent limits are imposed pursuant to the California Toxics Rule (CTR) or other reasons, the volume of discharge could be 0 MG.

The California Toxics Rule (CTR) is expected to result in new requirements for recycled water quality for water that is discharged to surface waters. Additional treatment to improve the quality of recycled water may be necessary to meet CTR requirements under all five discharge options. This treatment could be provided by an AMT facility that would be located at a point along the Geysers Pipeline or at the point of discharge.

With AMT, the treatment process would remove solids from the recycled water, including constituents regulated under the CTR, specifically copper, lead, gamma-BHC, and endosulfan II. The solids removed from the recycled water are left in a residual concentrate called “brine.” The brine may be disposed of by conveying the brine (either mixed with recycled water or as pure brine) to The Geysers for injection or by processing the brine through “crystallization,” a procedure that reduces the liquid brine to crystalline-like solids, which are then trucked to an appropriate solid waste disposal facility. If the AMT facility processes 4,500 MG annually of recycled water, the capacity of the Geysers Pipeline (20 mgd) would be insufficient to convey all brine, and so disposal of brine at the Geysers

Steamfield would need to be augmented by crystallization. If the volume of recycled water through the facility is less than 4,500 MG, Geysers disposal alone may be feasible. Crystallization along (i.e., without Geysers brine disposal) is feasible up to 4,500 MG.

The target Discharge Alternative does not include the cost of constructing AMT facilities. The City would not likely implement AMT because reuse is less costly and provides greater benefits.

The maximum discharge of 4,500 MG, combined with the existing irrigation system and Geysers Recharge Project, meets the anticipated system needs up to 21.3 mgd, expected to occur in approximately 2010. Recycled water generated from growth occurring between approximately 2010 and 2020, which will increase ADWF from 21.3 to 25.9 mgd, is disposed of through conservation and reuse.

Discharge may occur through several combinations of the discharge alternatives, 6A through 6E, as shown in Table 36.

**TABLE 36**

Annual Discharge Volumes in the Selected Program (MG)<sup>a</sup>  
*Santa Rosa Incremental Recycled Water Program*

Discharge Combinations	6A <sup>b</sup> (Laguna Direct)	6B (River Direct)	6C, D, and/or E (River Indirect)	Total
Direct to Laguna and River <sup>c,d</sup>	3,900	600 <sup>e</sup>	0	4,500
Direct to River Only	0	4,500	0	4,500
Direct to Laguna, Indirect to River <sup>c,e</sup>	3,900	0	600	4,500
Indirect to River <sup>e</sup>	0	0	4,500	4,500

<sup>a</sup>Reflects conditions under 2020 flows, wettest year.

<sup>b</sup>In drier conditions when total discharge volume is reduced, Laguna discharge will decrease and River discharge will increase.

<sup>c</sup>Laguna discharge is within permit limits (lower end of range could be 0 MG), with remainder to Russian River.

<sup>d</sup>This is the target discharge combination.

<sup>e</sup>Some portion of discharge may also be direct to the River, but the amount is not known at this time.

This alternative includes the following options:

- **Direct Discharge from Delta Pond to the Laguna (Alternative 6A).** Under this option, discharge from Delta Pond to the Laguna at its confluence with Santa Rosa Creek occurs between October 1 through May 14. Other permitted discharge points, including the discharge from Meadowlane Pond, may also be used when and where effluent and receiving water limits can be achieved. Improvements are required for the discharge facilities at Delta Pond to regulate and measure flows. Discharge occurs at a rate that meets permit limits, expected to be between 0 and 10 percent of flow in the Laguna. At 25.9 mgd ADWF, a 10 percent discharge restriction on the Laguna results in insufficient discharge capacity. The remainder of the discharge occurs in the Russian River consistent with Alternatives 6B, 6C, 6D, and/or 6E.
- **Direct Discharge to the Russian River (Alternative 6B).** Discharge volume could range from 0 to 4,500 MG maximum during the wettest year. A new discharge directly to the Russian River is located at a point between north of Healdsburg and Mirabel (to be determined in future studies). Recycled water is pumped from the Laguna Plant through the Geysers Pipeline to a location near the discharge point and conveyed

through new pipeline, pumping, and discharge facilities on the Russian River. Discharge occurs between October 1 and May 14.

- **Indirect Discharge into the Russian River or Dry Creek (Alternatives 6C, D, and E).** Indirect discharge volume could range from 0 to 4,500 MG maximum in the wettest year. Indirect discharge may occur via percolation ponds (6C), infiltration basins (6D), or injection wells (6E). Indirect discharge potentially allows for additional treatment of the recycled water through the soil-aquifer system before it reaches surface water or deeper aquifers.

Under all of the options, the Discharge Alternative includes additional pretreatment for commercial and industrial dischargers to address effluent limitations under the CTR. All options under the Discharge Alternative also include a community education program to reduce contaminants in sewage, particularly from residential sources that are not subject to the pretreatment requirements. Table 37 summarizes this alternative.

**TABLE 37**  
Discharge in the Selected Program  
*Santa Rosa Incremental Recycled Water Program*

Program Elements	Estimated Capital Costs for Target <sup>a</sup> (M\$)	Target (MG)	Range <sup>b</sup> (MG)	Maximum Size Studied in the Program EIR (MG)
Alternative 6 – Discharge	30 million	4,500	1,600 to 4,500	6,700

<sup>a</sup>The estimated capital costs do not include AMT or brine disposal.

<sup>b</sup>Range represents maximum discharge in driest and wettest years.

Under all of the options, implementation of direct or indirect discharge involves the following components:

- **Pipelines.** None of the discharge options requires modifications to the Geysers Pipeline (pump station modifications to increase capacity are addressed below). Under each direct or indirect discharge option, pipelines are required to carry recycled water from the Geysers Pipeline to the discharge facilities. Pipelines may also be required to convey recycled water to and from storage facilities.
- **Pump Stations.** Expansion of the Geysers Pipeline capacity to 80 mgd for Russian River Direct Discharge (Alternative 6B) or for Indirect Discharge (Alternatives 6C, 6D, and 6E) requires construction of up to two additional pump stations with storage facilities and four surge tanks along the Geysers Pipeline valley segment between the Llano Pump Station and the Alexander Valley. These options also require expansion of the Llano Pump Station.
- **Geysers Steamfield Expansion.** To dispose of “brine” from the AMT plant, up to 20 mgd may be injected at the Geysers Steamfield. To provide this capacity, up to six well conversions and three new injection wells will be constructed. To convey the brine to the new or converted wells, up to approximately 7 miles of aboveground pipelines will be constructed within the steamfield. Expansion of the Geysers mountain pump stations is not included.
- **Direct Discharge.** Volumes of discharge are presented in Table 30.

Under Alternative 6A (Laguna Discharge), improvements to the existing facilities at Delta Pond are required, while under Alternative 6B (Russian River Direct Discharge), new discharge facilities are located on the Russian River.

Facilities for indirect discharge consist of any of the following:

- **Percolation Ponds (Alternative 6C).** Percolation ponds are constructed along the Russian River or Dry Creek. These ponds are shallow basins that allow the recycled water to infiltrate indirectly into the groundwater through the unsaturated soils and then into the waterway.
- **Infiltration Basins (Alternative 6D).** Basins are used to infiltrate recycled water directly into the groundwater through the saturated soil layer and then into the waterway. These basins are deeper than percolation ponds.
- **Injection Wells (Alternative 6E).** Wells are constructed to inject recycled water underground into groundwater and the Russian River underflow prior to infiltrating into the River. The wells are constructed along the Russian River or Dry Creek.

## Laguna Plant Upgrade

Laguna Plant upgrade includes additional pumping capacity as well as upgrades to in-plant processes to accommodate the anticipated increase in future flows from 21.3 mgd to 25.9 mgd ADWF. The option for secondary-treated discharge of recycled water during peak storm events is not included in the Selected Program.

## Storage

For Urban Reuse, Agricultural Reuse, Geysers Expansion, and Discharge alternatives, storage facilities are needed for recycled water. The target reuse volume may require up to 1,200 MG of storage capacity. The details of how this volume was derived are shown in a water balance technical memorandum prepared specifically for the Selected Program, presented as Appendix E. The maximum range of reuse could require up to 3,190 MG of storage capacity. These facilities are located in any of the geographic areas analyzed for storage in the Program EIR.

## Created Wetlands

Wetlands using recycled water may be constructed as an optional component under the Master Plan, but it is not included in the target volume for recycled water disposal. These wetlands would be constructed for the purpose of habitat enhancement and could include marsh or open water as well as riparian or upland habitat. These habitats could support a variety of plant species valuable to wildlife and ecosystem functions. The created wetlands also may provide opportunities to mitigate IRWP impacts. Locations for these created wetlands have not been determined, but could be along any IRWP pipeline, as well as adjacent to any of the indirect discharge facilities or storage reservoirs. The wetlands could be of a variety of sizes and types, and interpretive trails and viewing points could also be provided.

## **Section 8**

# **Program Implementation**

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## SECTION 8

# Program Implementation

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The Final Master Plan will define the size, sequencing, timing, general location, and estimated cost of the program selected for implementation. Following the adoption of the Master Plan, the individual projects that constitute the program will be developed. Preliminary engineering will be performed for the project or combination of projects needed during the near-term (including actual location, size, and better cost definition), and the City will provide additional CEQA documentation for those projects. Design and construction can proceed upon approval of the project-specific environmental documentation. As additional reuse or discharge capacity is needed, the City will prepare additional project-specific environmental documentation to implement specific projects.

## **Section 9**

### **References**

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## SECTION 9

# References

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**Appendix A**  
**Executive Summary – Preliminary Economic and**  
**Financial Assessment of IRWP Master Plan**  
**Alternatives**

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**CITY OF SANTA ROSA**

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**INCREMENTAL RECYCLED WATER PROGRAM:  
ECONOMIC AND FINANCIAL ASSESSMENT**

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**HILTON FARNKOPF & HOBSON, LLC**

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*February 12, 2004*



## **CITY OF SANTA ROSA**

UTILITIES DEPARTMENT

69 STONY CIRCLE

SANTA ROSA, CA 95401

# **INCREMENTAL RECYCLED WATER PROGRAM: ECONOMIC AND FINANCIAL ASSESSMENT**

February 12, 2004



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## GLOSSARY

AF – acre-feet.

AF/Y – acre-feet per year.

Capacity expansion – expansion of wastewater treatment and reuse capacity to meet the needs of the planned growth in the service area (i.e., the increase in average dry weather flow from 21.3 to 25.9 MGD).

Capacity preservation – preservation of wastewater treatment and reuse capacity at 21.3 MGD average dry weather flow.

CIP – capital improvement program.

Debt Service – principal and interest payments on financed capital costs.

Demand fee – a term for wastewater development impact fees synonymous with “capacity fee”, “connection fee”, and similar terms. Development impact fees are paid once at the time each new connection is made to the system.

EDU – equivalent dwelling unit.

EPA – United States Environmental Protection Agency.

IRWP – Incremental Recycled Water Program.

MG – million gallons.

MGD– million gallons per day.

SCWA – Sonoma County Water Agency.

User charges – Also referred to as “rates”, which are typically monthly or bi-monthly charges paid by users connected to wastewater systems.

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*Ten programs described in the draft Master Plan of November 2003 were evaluated in the Draft Economic and Financial Assessment Report of November 6, 2003. The City of Santa Rosa's Board of Public Utilities and City Council subsequently identified a preferred program (described in the last chapter of the Master Plan) that it intends to consider selecting for implementation on March 4, 2004 (hereinafter referred to as the selected program). The Economic and Financial Assessment Report has been modified from the November 6 draft report to present the analysis of the selected program in a new Section V, which is also summarized at the end of the Executive Summary. The November 6 draft report was also edited for minor grammatical, typographical, and consistency errors.*

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## **I. EXECUTIVE SUMMARY**

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Avoided Cost of Potable Water  
IRWP Cost Allocations  
User Charge and Demand Fee Incremental Costs  
Selected Program Analysis

# I. Executive Summary

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The purpose of this report is to document the economic and financial analysis that was conducted as part of the development of recycled water by the agencies comprising the Santa Rosa Subregional wastewater partners.<sup>1</sup> Two distinct areas were studied. The first area was concerned with determining any savings that could occur if recycled water were used instead of potable water. This savings is a cost that is avoided and was included in the economic analysis as a credit against the costs of the ten alternative IRWP programs in the *IRWP Draft Recycled Water Master Plan* (November 2003).<sup>2</sup> The determination of this avoided cost is documented in Section II of this report.

The second study area was concerned with providing information on the potential financial impacts on wastewater rate payers if their user charges were increased to cover the cost of the ten alternative IRWP programs associated with existing users and if demand fees were increased to cover the costs attributable to growth. The financial impacts are covered in the remainder of this report in Sections III and IV. The report is intended to provide a preliminary approximation of the user charge and demand fee impacts of the ten Master Plan alternatives. The report is not a sufficient basis to establish user charges or demand fees. Each Subregional partner must establish its own rates based on more precise estimates of the cost of the selected Program and other factors (such as maintenance of the partner's sewage collection system) that were not considered in this analysis.

The economic and financial model used to develop the tables in this report is included as Appendix A. Supporting technical memoranda prepared by CH2M Hill are included as Appendix B.

## Avoided Cost of Potable Water

For those IRWP programs that include urban reuse, the development of recycled water will offset the demand for potable water. The cost savings resulting from the reduced need for potable water is a benefit created by substituting recycled water for potable water. The savings in potable water should be factored into the economic analysis of the cost of developing recycled water. This analysis does not capture all of the potential cost savings; recycling likely provides greater economic benefit than is described in this report. Agricultural reuse and possibly discharge could increase the supply of potable water that is available to SCWA, but the benefit ratio (i.e., the quantity of supply increase per quantity of recycled water reused or discharged) could not be estimated with sufficient certainty to include in this analysis.

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<sup>1</sup> These agencies include the City of Santa Rosa, the City of Rohnert Park, the City of Cotati, the City of Sebastopol, and the South Park County Sanitary District. Each of these agencies has capacity rights in the Subregional wastewater treatment system. For purposes of this study, South Park County Sanitation District was merged into the City of Santa Rosa because of the consolidation that is expected by 2011. A subsequent analysis identifying the individual impacts on South Park and Santa Rosa will be prepared and included in the final report.

<sup>2</sup> The economic analysis in the *Master Plan* was prepared by CH2M Hill.

## Methodology

Recycled water used for urban reuse is assumed to offset potable water supplied by SCWA. The 3,327 AF/Y<sup>3</sup> of urban reuse included in the Master Plan alternatives would be used by Santa Rosa, Rohnert Park, and Cotati, all of which are SCWA contractors. Rohnert Park and Santa Rosa currently use groundwater in addition to SCWA water to supply customers. Although groundwater is commingled with SCWA water in the Rohnert Park and Santa Rosa distribution systems, urban reuse was assumed to offset SCWA supply, not groundwater supply.

The avoided cost has an O&M and a capital component. The O&M avoided cost is realized because reductions in potable water purchases reduce variable costs (i.e., power and chemicals) that are directly related to the volume of water produced. The avoided capital cost is related to reductions in the size of facilities because less potable water is supplied. Each component was analyzed separately and combined for the total avoided cost.

### Avoided Current O&M Cost

The SCWA sets its current wholesale rates to fully recover its fixed and variable costs. A contractor that reduces its purchases from the SCWA reduces the SCWA's variable costs. However, because the fixed costs do not decrease, the wholesale rate increases because the remaining variable and fixed costs are denominated by less water. The result is that the contractor that reduces its purchases of SCWA water pays more per unit for fewer units, presumably with a net cost savings. The other contractors purchase the same water at a higher unit cost with a resulting cost increase.

The avoided O&M cost was calculated based on SCWA's current variable and fixed costs. Its budgeted costs were segregated into variable and fixed cost categories. The variable cost reduction and increased wholesale rate were derived and the net savings attributable to the development of recycled water was determined.

### Avoided Future Capital and O&M Costs

The SCWA has a long-term capital improvement program (CIP) that is required for it to increase its water sales from 75,000 AF/Y to 101,000 AF/Y. The CIP comprises a variety of transmission, storage, and other facilities. The SCWA's planning documents are not conducive to determining how much less it would build if its potable water sales were reduced by 3,327 AF/Y. A complex study would be required to make that determination. For the purposes of the present study, it was assumed that the cost of the CIP would be reduced in proportion to the reduction in the volume of water supply. This is clearly a speculative approach but is required in the absence of better data.

## Findings

The analysis yielded the following results based on demand projections and financial data for 2002:

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<sup>3</sup> 1,084 billion gallons per year.

1. **Reduced potable water savings.** The 3,327 AF/Y of recycled water that would replace potable water is 5.4% of the current 61,500 AF/Y of potable water. 3,327 AF/Y is 12.5% of Santa Rosa's, Rohnert Park's, and Cotati's current purchases from SCWA.
2. **Reduced SCWA costs.** SCWA's variable costs would be reduced by approximately \$316,000 per year out of a total of \$21,142,000 revenue requirement or about 1.5%. Power and chemical costs comprise the cost reduction; other variable costs that were not identifiable in the SCWA's documents may also be reduced. Hence, this is probably a low estimate.
3. **Increased O&M Charge.** SCWA's O&M Charge would increase from \$339.12/AF to \$353.07/AF or about 4.1%. The O&M Charge increases even though the total costs decrease, because potable water use decreases 5.4%, while the costs only decrease 1.5%. In other words, in calculating the rate, the reduction in the numerator is disproportionately small compared to the reduction in the denominator.
4. **O&M cost savings.** The three Subregional partners that are SCWA partners would pay approximately \$804,000 less in potable water purchases, which is a savings of about \$240/AF of recycled water. They pay less for potable water even though the O&M Charge increases because they are buying less potable water. This cost savings would be recovered by SCWA from the remaining contractors.
5. **Long-range cost savings.** A proportionate reduction in SCWA's long-range capital program, including capital costs and O&M costs, results in an avoided cost of about \$360/AF of recycled water.<sup>4</sup>
6. **Combined current and long-range cost savings.** The combined cost savings equals the reduced O&M savings in the current facilities (\$240/AF) plus the long-range O&M and capital cost savings in future facilities (\$360/AF) or approximately \$600/AF or \$1,840/million gallons.

The estimated value of these benefits has been understated because of the conservative assumptions that were made. In addition, the analysis did not include other potential benefits such as increased water supply availability, increased water supply reliability, improved planning and management, power revenues, recreation and aesthetic values, and species existence value. Quantifying these benefits is difficult because of the lack of available data and the subjective nature of the assumptions that are required. Hence, the \$600/AF avoided cost that is quantifiable may substantially understate the total benefit of replacing potable water with recycled water.

## IRWP Cost Allocations

The IRWP *Master Plan* identifies ten alternative programs and their respective construction and O&M costs, which are summarized in Figure I-1.

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<sup>4</sup> This estimate is based on the average unit cost of the SCWA's long-range capital program. Any of the long-range projects that are replaced by recycled water will presumably be SCWA's highest cost projects. Hence, this estimate is less than the actual savings that will occur.

**Figure I-1. Total IRWP Capital and O&M Costs**

	<b>Capital Costs</b> (in 2004 \$000,000)	<b>Capital Costs</b> (in future \$000,000)	<b>Debt Service Costs</b> (in future \$000,000)	<b>Total O&amp;M Costs</b> (in 2004 \$000,000)	<b>Total O&amp;M Costs</b> (in future \$000,000)
<b>IRWP Programs</b>					
<b><u>Just-In-Time Implementation</u></b>					
<b>I.A</b> - River Discharge	\$100.4	\$117.5	\$148.1	\$53.4	\$74.0
<b>I.B</b> - Indirect Discharge	168.7	201.2	253.8	57.7	80.1
<b>I.C</b> - Full Geysers	280.4	361.0	455.3	114.3	159.9
<b>I.D</b> - Geysers (19mgd) + Reuse	356.6	461.5	582.0	94.4	131.4
<b>I.E</b> - Reuse (no Geysers)	464.2	549.8	693.4	123.1	169.0
<b><u>Early Implementation</u></b>					
<b>II.A</b> - Early Reuse + River Discharge	124.3	143.0	180.4	48.1	66.5
<b>II.B</b> - Early Reuse + Indirect Discharge	172.8	205.9	259.7	50.6	69.9
<b>II.C</b> - Early Reuse + Full Geysers	284.0	361.6	456.0	81.6	115.0
<b>II.D</b> - Early Reuse + Geysers (19mgd) + Reuse	357.1	455.1	573.9	82.3	115.3
<b>II.E</b> - Early Reuse + Reuse (no Geysers)	469.1	558.5	704.3	118.4	163.8

Source for 2004 construction and O&M costs: CH2M Hill, *Santa Rosa Subregional Water Reclamation System: Incremental Recycled Water Program – Draft Recycled Water Master Plan of November 2003*.

The capital costs in 2004 and future dollars occur during the 2004 to 2020 period.

The debt service costs are the principal and interest payments on the capital costs in future dollars for the 20-year term of the debt, which extend beyond 2020.

The O&M costs are the cumulative, total costs during the 2004 to 2020 period.

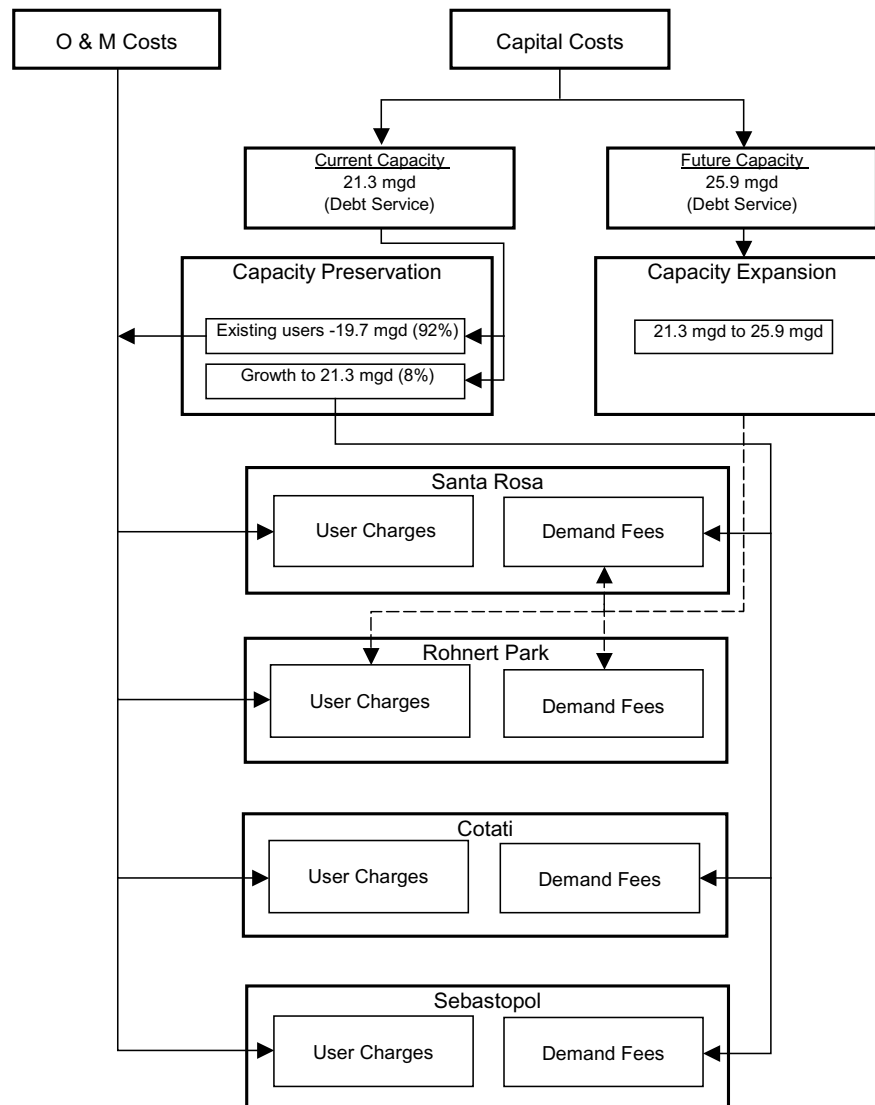
These costs were allocated to each of the Subregional partners as a precursor to estimating the potential impact on each Subregional partner's user charges and demand fees.

## Methodology

Capital costs were provided in the *Master Plan* as capital costs in 2004 dollars. These were converted in this study into future dollars at the time of construction and then into debt service payments under the presumption that all capital costs would be debt financed. O&M costs were also provided in 2004 dollars and were converted in this study into future annual costs.

A series of cost allocations was performed of the capital and O&M costs to derive the Subregional partners' respective shares. The flowchart in Figure I-2 indicates the steps.

**Figure I-2. Cost Allocation Flow Chart**



### Capital Cost Allocations

Capital costs were evaluated for two periods:

1. **Current capacity.** 2004 to 2010 - the period during which the current 21.3 MGD system capacity is projected to be fully used by all of the Subregional partners. These costs are referred to as “capacity preservation” costs.
2. **Future capacity.** 2011 to 2020 - the period during which the system is projected to be expanded from 21.3 MGD to 25.9 MGD for only Santa Rosa and Rohnert Park. These costs are referred to as “capacity expansion” costs.

A series of allocations determined the capital costs attributable to each Subregional partner. These steps resulted in cost allocations that could be subsequently allocated between user

charges and demand fees. In order to do this, the capacity preservation and expansion components of each IRWP program had to be identified.

1. **Allocation of costs to current and future capacity.** The capital costs for each component of each IRWP *Master Plan* program were allocated between current and future system capacity based on whether the component met the needs of the current 21.3 MGD system or provided benefits to the expanded 25.9 MGD system.
2. **Allocation to existing users and growth.** Current capacity (i.e., capacity preservation) was allocated between existing users and growth in proportion to how much capacity was used by existing users and how much remained for growth up to 21.3 MGD. All of the future capacity (i.e., capacity expansion) was allocated to growth, except for a portion of Rohnert Park's future capacity, which has been allocated to existing users because Rohnert Park is currently using more than its ownership share of the 21.3 MGD.
3. **Allocation to Subregional partners.** The capacity preservation costs for existing users were allocated to each Subregional partner in proportion to its respective ownership share of the capacity in the 21.3 MGD system. The capacity preservation costs for growth were allocated based on each Subregional partner's estimated flow at the time their combined flows equal 21.3 MGD system. The capacity expansion costs were allocated based on the ownership shares of the 4.6 MGD increment of expansion to 25.9 MGD.

These allocations had to account for the fact that Rohnert Park's wastewater discharges currently exceed its ownership share of the existing 21.3 MGD system. To account for this, an adjustment was made between Rohnert Park and Santa Rosa according to the agreement between the two cities that allows Rohnert Park to use some of Santa Rosa's ownership share. In addition, an adjustment was made to allocate more of the cost of capacity expansion in the 25.9 MGD system to Rohnert Park's existing users so that its demand fees do not include costs that should be borne by its existing users.

### O&M Cost Allocations

Only one step was required to allocate O&M costs to each Subregional partner. The allocation process follows the current Subregional practice. Annual O&M costs were allocated among the Subregional partners in proportion to their estimated annual wastewater discharges.

### Findings

Figure I-3 summarizes the allocation factors for capital costs.<sup>5</sup> In addition to showing the derivation of the allocation factors used to allocate costs among the Subregional partners, Figure I-3 also shows the allocation of capacity preservation costs between the existing users (19.66 MGD or 92%) and the increment of unused capacity up to 21.3 MGD (1.68 MGD or 8%).

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<sup>5</sup> The allocation factors are based on interpolated flow estimates based on general plans and other sources. The allocation factors will change if more recent flow data were used. Changes in the allocation factors will affect how costs are allocated among the Subregional partners and between user charges, but will not affect the amount of the capital costs for each IRWP Program to which they are applied.

**Figure I-3. Capital Cost (Debt Service) Allocation Factors**

	Cotati	Rohnert Park	Santa Rosa	Sebastopol	Total
<b>Current Capacity (Capacity Preservation)</b>					
<u><b>Existing Users (Allocated to User Charges)</b></u>					
Original Ownership Shares of 21.3 mgd Capacity	0.76	3.43	16.31	0.84	21.34
Adjustment per RP and SR Agreement	-	0.48	(0.48)	-	-
Adjusted Shares of 21.3 mgd	0.76	3.91	15.83	0.84	21.34
Factor A	3.56%	18.32%	74.18%	3.94%	100.00%
<u><b>Unused Capacity (Allocated to Demand Fees)</b></u>					
Ownership Shares of 21.3 mgd Capacity	0.76	3.43	16.31	0.84	21.34
Current Flows (2004 estimate)	0.61	3.91	14.43	0.71	19.66
Incremental Change	0.15	(0.48)	1.88	0.13	1.68
Basis for Allocations	0.15	-	1.88	0.13	2.16
Factor B	6.94%	0.00%	87.04%	6.02%	100.00%
<b>Future Capacity (Capacity Expansion)</b>					
21.3 to 25.9 mgd increment					
Current Ownership Shares	0.76	3.43	16.31	0.84	21.34
Future Ownership Shares	0.76	5.15	19.14	0.84	25.89
Growth Increment	0	1.72	2.83	0	4.55
% of Total	0.00%	37.80%	62.20%	0.00%	100.00%
<u><b>Existing Users (Allocated to User Charges)</b></u>					
Ownership Shares of 21.3 mgd Capacity	0.76	3.43	16.31	0.84	21.34
Flow when all 21.3 mgd Ownership Shares are Reached	0.76	3.91	16.31	0.84	21.82
Difference	-	0.48	-	-	0.48
Factor C	0.00%	10.55%	0.00%	0.00%	10.55%
<u><b>Growth Increment (Allocated to Demand Fees)</b></u>					
Flow when all 21.3 mgd Ownership Shares are Reached	0.76	3.91	16.31	0.84	21.82
Ownership Shares of Increased Plant Capacity (mgd)	0.76	5.15	19.14	0.84	25.89
Difference	-	1.24	2.83	-	4.07
Factor D	0.00%	27.25%	62.20%	0.00%	89.45%

Source 21.3 MGD and 25.9 MGD flows: CH2M Hill. *Technical Memorandum No. 1*, Table 5, Flow Comparison.  
June 19, 2002. Existing flows interpolated by HF&H.

Figure I-4 summarizes the capital cost allocations of each IRWP program to the Subregional partners. These amounts represent debt service on the capital costs through the term of the debt (which extends beyond 2020). The debt service is based on the capital costs escalated to the estimated date of construction.<sup>6</sup>

<sup>6</sup> Future dollars are used in this report so that rate impacts can be analyzed. This type of analysis is consistent with rate studies in which the analysis is intended to calculate the impact on rate payers in terms of how much their rates will have to increase to pay for future services. In doing so, growth in the customer base must be included to reflect the fact that there will be more customers in the future over which future costs can be spread. This type of an analysis is different from economic analysis in which it is customary to compare alternatives in terms of present values. Portions of the analysis in this study must compare alternatives in terms of their future financial impacts on future rate payers.

**Figure I-4. Capital Cost Allocations**  
(Through term of debt in \$000,000s)

IRWP Programs	Cotati				Total
	(Future\$)	(Future\$)	(Future\$)	(Future\$)	
I.A - River Discharge	\$0.4	\$54.0	\$93.3	\$0.4	\$148.1
I.B - Indirect Discharge	4.0	74.0	171.5	4.3	253.8
I.C - Full Geysers	3.9	150.7	296.5	4.2	455.3
I.D - Geysers (19mgd) + Reuse	7.9	177.0	388.7	8.4	582.0
I.E - Reuse (no Geysers)	17.0	169.2	489.0	18.2	693.4
II.A - Early Reuse + River Discharge	1.2	61.7	116.2	1.3	180.4
II.B - Early Reuse + Indirect Discharge	4.2	75.4	175.7	4.5	259.7
II.C - Early Reuse + Full Geysers	5.1	144.3	301.0	5.5	456.0
II.D - Early Reuse + Geysers (19mgd) + Reuse	8.7	169.4	386.5	9.3	573.9
II.E - Early Reuse + Reuse (no Geysers)	17.0	173.1	496.0	18.3	704.3

Figure I-5 summarizes the O&M cost allocations to the Subregional partners. These amounts represent the cumulative annual O&M costs from 2004 through 2020.

**Figure I-5. O&M Cost Allocations**  
(2004-2020 in \$000,000s)

IRWP Programs	Cotati				Total
	(Future\$)	(Future\$)	(Future\$)	(Future\$)	
I.A - River Discharge	\$2.3	\$14.6	\$54.5	\$2.6	\$74.0
I.B - Indirect Discharge	2.5	15.8	58.9	2.8	80.1
I.C - Full Geysers	5.0	31.7	117.8	5.5	159.9
I.D - Geysers (19mgd) + Reuse	4.1	26.0	96.8	4.6	131.4
I.E - Reuse (no Geysers)	5.3	33.4	124.4	5.9	169.0
II.A - Early Reuse + River Discharge	2.1	13.2	48.9	2.3	66.5
II.B - Early Reuse + Indirect Discharge	2.2	13.8	51.5	2.4	69.9
II.C - Early Reuse + Full Geysers	3.6	22.8	84.7	4.0	115.0
II.D - Early Reuse + Geysers (19mgd) + Reuse	3.6	22.8	84.9	4.0	115.3
II.E - Early Reuse + Reuse (no Geysers)	5.1	32.4	120.6	5.7	163.8

## User Charge and Demand Fee Incremental costs

User charges and demand fees are the two principal sources of funding for capital and O&M used currently by the Subregional partners. User charges and demand fees were assumed to also fund all of the IRWP program costs. No funding from other potential beneficiaries, such as the SCWA, Calpine, or agricultural water users, was factored in at this time. Contributions from parties other than rate payers and developers, however appropriate, depend on contractual arrangements that do not currently exist.

The Subregional partners have final authority as to how they share the funding burden between their individual user charges and demand fees. For purposes of this study, a common set of assumptions was applied to the Subregional partners to calculate the potential impacts on their

user charges and demand fees. Each Subregional partner will ultimately establish its own user charges and demand fees based on methodologies it chooses.

## Methodology

User charges fund all of the capacity preservation portions of the capital costs attributed to existing users as well as all O&M costs. Demand fees fund capital costs related to growth, which includes the growth portion of the current 21.3 MGD capacity plus all capacity expansion capital costs; no O&M costs are funded by demand fees.

The costs that were allocated to user charges were compared with the projected revenue from current rates to determine how much user charges would need to be increased to cover the incremental costs associated with the IRWP programs. The costs that were allocated to demand fees were divided by the projected growth for each Subregional partner to determine the incremental cost per EDU associated with the IRWP programs.

## Findings

### User Charge Incremental Costs

Figure I-6 summarizes the O&M and debt service costs that were allocated to user charges for each Subregional partner.

**Figure I-6. O&M and Capital Costs Funded by User Charges  
(2004 - 2020 in future \$000,000s)**

IRWP Programs	Cotati			Rohnert Park			Santa Rosa			Sebastopol			Totals		
	O&M	Debt	Total	O&M	Debt	Total	O&M	Debt	Total	O&M	Debt	Total	O&M	Debt	Grand
I.A - River Discharge	\$2.3	\$0.2	\$2.5	\$14.6	\$9.5	\$24.2	\$54.5	\$4.8	\$59.3	\$2.6	\$0.3	\$2.8	\$74.0	\$14.8	\$88.8
I.B - Indirect Discharge	\$2.5	\$2.1	\$4.6	\$15.8	\$18.6	\$34.4	\$58.9	\$42.9	\$101.8	\$2.8	\$2.3	\$5.0	80.1	65.8	145.9
I.C - Full Geysers	\$5.0	\$2.0	\$7.0	\$31.7	\$23.6	\$55.2	\$117.8	\$42.0	\$159.8	\$5.5	\$2.2	\$7.8	159.9	69.8	229.8
I.D - Geysers (19mgd) + Reuse	\$4.1	\$3.8	\$7.9	\$26.0	\$32.0	\$58.0	\$96.8	\$79.8	\$176.6	\$4.6	\$4.2	\$8.8	131.4	119.9	251.3
I.E - Reuse (no Geysers)	\$5.3	\$9.2	\$14.6	\$33.4	\$58.5	\$91.9	\$124.4	\$192.5	\$316.8	\$5.9	\$10.2	\$16.1	169.0	270.4	439.4
II.A - Early Reuse + River Discharge	\$2.1	\$0.7	\$2.8	\$13.2	\$13.0	\$26.2	\$48.9	\$15.6	\$64.5	\$2.3	\$0.8	\$3.1	66.5	30.2	96.7
II.B - Early Reuse + Indirect Discharge	\$2.2	\$2.2	\$4.4	\$13.8	\$19.2	\$33.0	\$51.5	\$45.4	\$96.9	\$2.4	\$2.4	\$4.8	69.9	69.2	139.1
II.C - Early Reuse + Full Geysers	\$3.6	\$2.6	\$6.2	\$22.8	\$25.5	\$48.3	\$84.7	\$54.8	\$139.5	\$4.0	\$2.9	\$6.9	115.0	85.8	200.8
II.D - Early Reuse + Geysers (19mgd) + R	\$3.6	\$4.3	\$7.9	\$22.8	\$34.1	\$56.9	\$84.9	\$89.1	\$174.0	\$4.0	\$4.7	\$8.7	115.3	132.2	247.5
II.E - Early Reuse + Reuse (no Geysers)	\$5.1	\$8.8	\$14.0	\$32.4	\$57.6	\$90.0	\$120.6	\$183.7	\$304.3	\$5.7	\$9.7	\$15.4	163.8	259.9	423.7

Figure I-7 summarizes the monthly user charges per residential dwelling unit in 2020. The baseline user charges are shown with the incremental monthly cost associated with each IRWP program.

**Figure I-7. Monthly User Charge Incremental Costs Per Residential Dwelling Unit**

	Cotati		Rohnert Park		Santa Rosa		Sebastopol		Average	
	\$	%	\$	%	\$	%	\$	%	\$	%
<b>Baseline</b> (w/o IRWP, 2004\$)	\$46.38		\$34.73		\$35.73		\$44.37		\$40.30	
<b>Incremental IRWP Cost (2020\$)</b>										
<b>I.A</b> - River Discharge	\$5.81	12.5%	\$8.58	24.7%	\$5.32	14.9%	\$4.85	10.9%	\$6.14	15.2%
<b>I.B</b> - Indirect Discharge	9.47	20.4%	11.85	34.1%	8.18	22.9%	7.91	17.8%	9.35	23.2%
<b>I.C</b> - Full Geysers	17.10	36.9%	23.63	68.0%	15.25	42.7%	14.28	32.2%	17.57	43.6%
<b>I.D</b> - Geysers (19mgd) + Reuse	17.44	37.6%	23.50	67.6%	15.00	42.0%	14.56	32.8%	17.63	43.7%
<b>I.E</b> - Reuse (no Geysers)	26.80	57.8%	29.87	86.0%	22.88	64.0%	22.85	51.5%	25.60	63.5%
<b>II.A</b> - Early Reuse + River Discharge	5.99	12.9%	8.77	25.2%	5.37	15.0%	5.00	11.3%	6.28	15.6%
<b>II.B</b> - Early Reuse + Indirect Discharge	8.87	19.1%	11.21	32.3%	7.60	21.3%	7.41	16.7%	8.77	21.8%
<b>II.C</b> - Early Reuse + Full Geysers	15.17	32.7%	20.73	59.7%	13.29	37.2%	12.67	28.5%	15.46	38.4%
<b>II.D</b> - Early Reuse + Geysers (19mgd) + Reuse	17.59	37.9%	22.94	66.0%	15.02	42.0%	14.69	33.1%	17.56	43.6%
<b>II.E</b> - Early Reuse + Reuse (no Geysers)	27.50	59.3%	30.17	86.9%	22.99	64.3%	22.96	51.7%	25.91	64.3%

The incremental costs represent how much each IRWP program will cost per month by 2020. The percentages in Figure I-7 indicate how much the incremental costs are compared with the baseline monthly costs. The percentages represent the cumulative rate increases associated with the incremental cost as of 2020. The percentages will be achieved by 2020, through a series of periodic increases corresponding to each partner's share of the additional IRWP capital and O&M costs.

### Demand Fee Incremental Costs

Figure I-8 shows the Subregional partners' existing demand fees and the incremental cost per EDU associated with each IRWP program. The incremental cost equals the sum of all growth-related debt service (through the term of the debt service) divided by the growth to buildout in 2020.

**Figure I-8. IRWP Cost Increments and Current Demand Fees (\$/EDU)**

	Cotati	Rohnert Park	Santa Rosa	Sebastopol
<b>Baseline</b> (Current Fees, 2004\$)	\$12,468	\$6,797	\$4,117	\$6,360
<b>Incremental IRWP Cost (future\$)</b>				
<b>I.A</b> - River Discharge	\$54	\$5,858	\$3,377	\$50
<b>I.B</b> - Indirect Discharge	605	6,291	3,883	564
<b>I.C</b> - Full Geysers	589	14,908	8,806	550
<b>I.D</b> - Geysers (19mgd) + Reuse	1,186	15,895	9,650	1,106
<b>I.E</b> - Reuse (no Geysers)	2,562	10,538	7,229	2,390
<b>II.A</b> - Early Reuse + River Discharge	179	6,307	3,692	167
<b>II.B</b> - Early Reuse + Indirect Discharge	627	6,376	3,942	585
<b>II.C</b> - Early Reuse + Full Geysers	774	13,586	8,136	722
<b>II.D</b> - Early Reuse + Geysers (19mgd) + Reuse	1,312	14,629	8,985	1,224
<b>II.E</b> - Early Reuse + Reuse (no Geysers)	2,569	10,950	7,468	2,397

Figure I-9 shows the incremental IRWP costs as a percent of the current demand fees.

**Figure I-9. IRWP Cost Increments Compared to Current Demand Fees**

	Cotati	Rohnert Park	Santa Rosa	Sebastopol
<b>Incremental IRWP Cost (future\$)</b>				
<b>I.A</b> - River Discharge	0.4%	86.2%	82.0%	0.8%
<b>I.B</b> - Indirect Discharge	4.9%	92.6%	94.3%	8.9%
<b>I.C</b> - Full Geysers	4.7%	219.4%	213.9%	8.6%
<b>I.D</b> - Geysers (19mgd) + Reuse	9.5%	233.9%	234.4%	17.4%
<b>I.E</b> - Reuse (no Geysers)	20.5%	155.1%	175.6%	37.6%
<b>II.A</b> - Early Reuse + River Discharge	1.4%	92.8%	89.7%	2.6%
<b>II.B</b> - Early Reuse + Indirect Discharge	5.0%	93.8%	95.7%	9.2%
<b>II.C</b> - Early Reuse + Full Geysers	6.2%	199.9%	197.6%	11.4%
<b>II.D</b> - Early Reuse + Geysers (19mgd) + Reuse	10.5%	215.2%	218.2%	19.3%
<b>II.E</b> - Early Reuse + Reuse (no Geysers)	20.6%	161.1%	181.4%	37.7%

## Selected Program Analysis

After review of the preceding analyses and other considerations, the City of Santa Rosa's Board of Public Utilities developed and selected a program for implementation. Analysis of the selected program used three different methods for allocating capital costs between capacity preservation and capacity expansion, illustrated in Figure I-10. The three methods used to allocate capital costs are as follows<sup>7</sup>:

- **Method 1** – River discharge capacity of 4,500 MG and the associated cost is all attributable to preservation because it preserves the current ability to direct discharge. All reuse and conservation (2,200 MG) is attributable to capacity expansion, because it builds capacity above the existing 4,500 MG discharge allocation.
- **Method 2** – All capital costs for discharge, conservation and reuse are allocated by their ratio of annual recycled water volume. This allocation for 2020 conditions is 67% preservation and 33% expansion, corresponding to the respective percentages of the 6,700 MG capacity requirement (4,500 MG preservation and 2,200 MG expansion).
- **Method 3** – System improvements related to preserving treatment or reuse capacity to the level of 21.3 MGD (or 45,00 MG to total annual flow) are considered capital preservation items, so improvements prior to 2010 are considered preservation, and improvements after 2010 are considered expansion.

<sup>7</sup> As described in CH2M Hill's January 14, 2004 *Technical Memorandum – Santa Rosa Incremental Recycled Water Program – Allocation of IRWP Selected Program for Final Rate Analysis* (included in Appendix B).

**Figure I-10. Allocation Factors for Current and Future Capacity**

	<u>Allocation Method 1</u>		<u>Allocation Method 2</u>		<u>Allocation Method 3</u>	
	Capacity Preservation	Capacity Expansion	Capacity Preservation	Capacity Expansion	Capacity Preservation	Capacity Expansion
<b><u>Base Components</u></b>						
Conservation	0%	100%	67%	33%	100%	0%
River Discharge Relocation	100%	0%	100%	0%	100%	0%
Plant Expansion	0%	100%	0%	100%	0%	100%
I/I Pilot Program and Studies	67%	33%	67%	33%	67%	33%
<b><u>Program Components</u></b>						
Geysers to 12 mgd	0%	100%	67%	33%	100%	0%
Urban Reuse - Golf & Country Club	0%	100%	67%	33%	100%	0%
Urban Reuse - Santa Rosa	0%	100%	67%	33%	0%	100%
Ag Reuse - City Farms	0%	100%	67%	33%	100%	0%
Ag Reuse - East Rohnert Park	0%	100%	67%	33%	0%	100%
River Discharge	100%	0%	67%	33%	67%	33%

In addition, the analysis was expanded to show South Park County Sanitation District separate from the City of Santa Rosa. The analysis is documented in detail in a new Section V to this report; the model is included as Appendix A.

## Cost Allocations

The selected program comprises the same capital costs in the base components as the previous ten programs; the program-specific costs that were developed for the selected program are unique, although in total capital costs, the selected program is closest to Programs IB and IIB. Figures I-11 and I-12 show the capital and O&M costs allocated to each Subregional partner.

The capital cost allocations in Figure I-11 differ for each of the three allocation methods depending on how the base and program-specific costs are allocated between capacity preservation and capacity expansion. Of the three methods, Method 1 allocates the most capital costs to capacity expansion in general, and to Rohnert Park and Santa Rosa in particular. Method 1 also allocates the least capital cost of the three methods to Cotati, Sebastopol, and South Park, none of which projects additional expanded capacity beyond the current Subregional treatment and disposal capacity.

Method 2, on the other hand, yields the opposite effect: it allocates the most cost to capacity preservation, the least cost to Rohnert Park and Santa Rosa, and the most cost to Cotati, Sebastopol, and South Park.

Allocations made using Method 3 are generally slightly less than Method 2.

**Figure I-11. Capital Cost Allocations**  
(Through term of debt in \$000,000s)

Selected Program Allocation Method	Cotati	Rohnert Park	Santa Rosa	Sebastopol	South Park	Total
	(Future\$)	(Future\$)	(Future\$)	(Future\$)	(Future\$)	(Future\$)
Allocation Method 1	\$2.0	\$100.9	\$187.9	\$2.1	\$1.7	\$294.5
Allocation Method 2	5.4	82.7	196.1	5.7	4.6	294.5
Allocation Method 3	4.1	89.7	193.0	4.3	3.5	294.5

O&M costs are allocated based on annual flows rather than capacity preservation or capacity expansion; hence, there is no difference among the three allocation methods.

**Figure I-12. O&M Cost Allocations**  
(2004-2020 in \$000,000s)

<b>Selected Program Allocation Method</b>	<b>Cotati (Future\$)</b>	<b>Rohnert Park (Future\$)</b>	<b>Santa Rosa (Future\$)</b>	<b>Sebastopol (Future\$)</b>	<b>South Park (Future\$)</b>	<b>Total (Future\$)</b>
Allocation Method 1	\$3.1	\$19.4	\$69.5	\$3.4	\$2.8	\$98.2
Allocation Method 2	\$3.1	\$19.4	\$69.5	\$3.4	\$2.8	98.2
Allocation Method 3	\$3.1	\$19.4	\$69.5	\$3.4	\$2.8	98.2

**Figure I-13. Capital Costs Allocated To User Charges and Demand Fees**  
(2004 – 2020 for user charges and through the term of the debt for demand fees in future \$000,000s)

Selected Program Allocation Method	Cotati			Rohnert Park			Santa Rosa			Sebastopol			South Park			Totals		
	User Charges	Demand Fees	Total	User Charges	Demand Fees	Total	User Charges	Demand Fees	Total	User Charges	Demand Fees	Total	User Charges	Demand Fees	Total	User Charges	Demand Fees	Grand Total
Allocation Method 1	\$0.9	\$0.3	\$1.3	\$18.8	\$66.7	\$85.4	\$18.9	\$155.3	\$174.2	\$1.0	\$0.3	\$1.3	\$1.0	\$0.2	\$1.2	\$40.7	\$222.8	\$263.5
Allocation Method 2	\$2.4	0.9	3.3	\$21.5	43.1	64.6	\$47.5	107.0	154.5	\$2.6	0.8	3.4	\$2.6	0.5	3.1	\$76.7	152.2	228.9
Allocation Method 3	\$2.2	0.7	2.9	\$21.2	52.1	73.3	\$44.2	125.5	169.7	\$2.5	0.6	3.0	\$2.5	0.4	2.8	\$72.6	179.2	251.7

**Figure I-14. O&M and Capital Costs Funded by User Charges**  
(2004 – 2020 in future \$000,000s)

Selected Program Allocation Method	Cotati			Rohnert Park			Santa Rosa			Sebastopol			South Park			Totals		
	Debt			Debt			Debt			Debt			Debt			Debt		
	O&M	Service	Total	O&M	Service	Total	O&M	Service	Total	O&M	Service	Total	O&M	Service	Total	O&M	Service	Grand Total
Allocation Method 1	\$3.1	\$0.9	\$4.0	\$19.4	\$18.8	\$38.2	\$69.5	\$18.9	\$88.3	\$3.4	\$1.0	\$4.5	\$2.8	\$1.0	\$3.9	\$98.2	\$40.7	\$138.8
Allocation Method 2	\$3.1	\$2.4	5.5	\$19.4	\$21.5	40.9	\$69.5	\$47.5	116.9	\$3.4	\$2.6	6.0	\$2.8	\$2.6	5.4	\$98.2	76.7	174.8
Allocation Method 3	\$3.1	\$2.2	5.3	\$19.4	\$21.2	40.6	\$69.5	\$44.2	113.7	\$3.4	\$2.5	5.9	\$2.8	\$2.5	5.3	\$98.2	72.6	170.7

## User Charge and Demand Fee Impacts

The capital costs associated with user charges and demand fees are derived from Figure I-11, with a slight modification. The amounts in Figure I-11 are the total capital costs through the term of the debt. For purposes of comparing the incremental cost of the selected program with user charges, the capital costs in Figure I-11 were truncated at 2020. Hence, the capital costs for user charges in Figure I-13 are less than Figure I-11 by the amount of the debt service beyond 2020. The amounts for demand fees reflect debt service through the term of the debt.

### User Charge Incremental Costs

The costs funded by user charges in Figure I-14 are the combination of the O&M costs from Figure I-12 plus the capital costs allocated to user charges in Figure I-13.

The costs allocated to user charges translate into monthly incremental costs as shown in Figure I-15. Note that Method 1 produces the lowest incremental costs in percentages for all of the Subregional partners, and Method 2 the highest.

**Figure I-15. Monthly User Charge Incremental Costs Per Residential Dwelling Unit**

	Cotati		Rohnert Park		Santa Rosa		Sebastopol		South Park		Average	
	\$	%	\$	%	\$	%	\$	%	\$	%	\$	%
<b>Baseline</b> (w/o IRWP, 2004\$)	\$46.38		\$34.73		\$35.41		\$44.37		\$54.23		\$43.03	
<b>Incremental IRWP Cost (2020\$)</b>												
Allocation Method 1	\$8.51	18.4%	\$12.97	37.3%	\$7.57	21.4%	\$7.11	16.0%	\$7.57	14.0%	\$8.74	20.3%
Allocation Method 2	11.46	24.7%	13.87	39.9%	9.79	27.7%	\$9.57	21.6%	\$10.59	19.5%	11.05	25.7%
Allocation Method 3	10.34	22.3%	13.52	38.9%	8.94	25.3%	\$8.63	19.4%	\$9.43	17.4%	10.17	23.6%

### Demand Fee Incremental Costs

The dollar and percentage impacts on demand fees are shown in Figures I-16 and I-17.

**Figure I-16. IRWP Cost Increments and Current Demand Fees (\$/EDU)**

	Cotati	Rohnert Park	Santa Rosa	Sebastopol	South Park
<b>Baseline</b> (Current Fees, 2004\$)	\$12,468	\$6,797	\$4,117	\$6,360	\$2,000
<b>Selected Program Allocation Method</b>					
Allocation Method 1	\$345	\$10,321	\$6,715	\$312	\$343
Allocation Method 2	943	6,667	4,627	853	938
Allocation Method 3	715	8,061	5,424	646	711

In percentage terms, Method 1 yields the largest impacts on Rohnert Park's and Santa Rosa's demand fees, which is consistent with Figure I-15, in which Method 1 yielded the lowest user charge impacts on these two Subregional partners. Method 1, which also resulted in the lowest user charge impacts for Cotati, Sebastopol, and South Park, does not result in the highest demand fee impacts. In the case of these three Subregional partners,

which do not project growth beyond 21.3 MGD, Method 1 also produces the lowest demand fee increases because this Method 1 allocates the least costs to them.

**Figure I-17. IRWP Cost Increments Compared to Current Demand Fees**

<b>Selected Program Allocation Method</b>	<b>Cotati</b>	<b>Rohnert Park</b>	<b>Santa Rosa</b>	<b>Sebastopol</b>	<b>South Park</b>
Allocation Method 1	2.8%	151.9%	163.1%	4.9%	17.1%
Allocation Method 2	7.6%	98.1%	112.4%	13.4%	46.9%
Allocation Method 3	5.7%	118.6%	131.7%	10.2%	35.5%

**Appendix B**  
**Environmental Evaluation Memorandum**

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# ENVIRONMENTAL EVALUATION OF MASTER PLAN PROGRAMS

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**PREPARED FOR:** Project Team  
**PREPARED BY:** 3\$56216  
**DATE:** November 20, 2003

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The purpose of this technical memorandum is to facilitate review of the Draft Master Plan relative to environmental impacts.

Although this memorandum summarizes environmental impacts of the programs for the sake of this Master Plan, in no way does it substitute for the Final EIR which addresses each issue in much greater detail. Copies of the EIR are available for review or purchase at Santa Rosa City Hall, at local libraries, and on-line at the project website: [www.recycledwaterprogram.com](http://www.recycledwaterprogram.com).

The Final EIR for the IRWP was certified on November 6, 2003, and evaluated seven alternatives and 13 subalternatives. Several of these alternatives do not fulfill the entire Purpose and Need statement of the IRWP, because they are too small to provide the entire capacity needed for the program; that is, they do not supply enough reuse for 6,700 MG of recycled water. Therefore, the Master Plan combines these alternatives both sequentially and simultaneously to produce the ten programs outlined in this Draft Master Plan. During review of the Draft Master Plan, additional combinations of alternatives may be considered. After the review period is over, the City of Santa Rosa, as managing partner for the Subregional Water Reclamation System, will select an IRWP consisting of one or more of the alternatives in the EIR. That selection will rely upon environmental impact analysis contained in the EIR, not the partial summary included in this Master Plan.

The EIR contains Chapter 5, Combinations of Alternatives. Some of the Master Plan programs are similar to some of the 15 combinations of alternatives outlined and evaluated in the EIR Chapter 5. However, development of the Master Plan occurred after the completion of the Draft EIR and during preparation of the Final EIR, and therefore, Master Plan programs do not match up exactly with any of the combinations evaluated in the EIR. A review of the impacts identified for the combinations of alternatives in Chapter 5 of the EIR will, however, assist the reader in understanding the types of overlapping impacts which may occur from a variety of combinations.

Table 1, following, is a summary table reflecting some of the environmental impact evaluations in the EIR for each of the ten programs. The table summarizes approximately 70% of the impacts in the EIR and is not purported to summarize all of the impacts, or even the important impacts. The reasons that approximately 30% of the impacts have not been pulled forward into this environmental evaluation memorandum is that they are readily mitigated, or that they consist of such program-level analysis that impact evaluations are not very useful relative to selection. For example, impacts on cultural resources are not reflected in this table, because impacts to cultural resources are considered significant for all

alternatives at this program-level, because specific sites have not been identified and site-specific cultural evaluations have not occurred. Thus, at this time, an alternative's impact on cultural resources relative to the impact of other alternatives does not provide a useful basis to compare the environmental merits of the alternatives.

Table 1 also includes, at the bottom of the table, the number of significant and beneficial impacts associated with each program. Please note that the number of impacts in the bottom matrix is dependent upon the number of alternatives included in each program; e.g., Program 1C which is made up of 3 alternatives has fewer significant impacts than Program IIC which is made up of 5 alternatives. Therefore, larger numbers do not necessarily represent more severe impacts.

For a complete summary of impacts, refer to Table 1-3 in the Introduction and Summary of the EIR, as revised in the Final EIR.

**Table 1**

Environmental Evaluation of Programs<sup>1</sup>

Evaluation Criteria	I.A. Direct Discharge	I.B. Indirect Discharge	I.C. Geysers (25 mgd)	I.D. Geysers (19 mgd) + Urban/Ag Reuse	I.E. Urban/Ag Reuse)	II.A. Early Reuse + Direct Discharge	II.B. Early Reuse + Indirect Discharge	II.C. Early Reuse + Geysers (25 mgd)	II.D. Early Reuse + Geysers (19 mgd) + Urban/Ag Reuse	II.E. Early Reuse + Urban/Ag Reuse
Program includes EIR Alternative Numbers	1, 3, 4, 5, 6A, 6B	1, 3, 4, 5, 6A, 6C-E	1, 5, 6A	1, 3, 4, 5, 6A	1, 3, 4, 6A	1, 3, 4, 5, 6A, 6B	1, 3, 4, 5, 6A, 6C-E	1, 3, 4, 5, 6A	1, 3, 4, 5, 6A	1, 3, 4, 5, 6A
Temporary Construction Impacts	●	●	●	●	●	●	●	●	●	●
Permanent Loss of Farmland	●	●	●	●	●	●	●	●	●	●
Induced Seismicity Impacts	●	●	●	●	●	●	●	●	●	●
Water Quality Impacts	●	●	●	●	●	●	●	●	●	●
Permanent Loss of Natural Habitat	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙
Noise from Operations	●	●	●	●	●	●	●	●	●	●
Visual Impacts	●	●	●	●	●	●	●	●	●	●
<b>Level of Significance</b>										
●	370	554	156	219	153	370	554	219	219	219
⊙	431	648	176	330	252	431	648	330	330	330
+	5	8	3	4	3	5	8	4	4	4

Notes: 1. This top matrix presents only a portion of the impacts identified in the EIR. Refer to the Summary Table in Chapter 1 of the EIR for a complete list of impacts, and to the entire EIR for a full evaluation of impacts. The number of impacts in the bottom matrix is dependent upon the number of alternatives included in each program; e.g., Program 1C which is made up of 3 alternatives has fewer significant impacts than Program IIC which is made up of 5 alternatives.

- + Beneficial effect
- Significant adverse impact before and after mitigation (significant unavoidable impact)
- ⊙ Significant impact before mitigation, less than significant after mitigation

**Appendix C**  
**Water Balance Model – Summary Memorandum**  
**and Model Output**

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## APPENDIX C

# Water Balance Model – Summary Memorandum and Model Output

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Appendix C summarizes the water balance analysis and presents the model output tables. The full document is available for public viewing at the Santa Rosa City Manager's office and the IRWP website [[www.recycledwaterprogram.com/index.htm](http://www.recycledwaterprogram.com/index.htm)].

If you need better resolution for figures, or prefer not to download files from the internet, you can purchase hard copies or a CD with uncompressed files for the cost of copying. To purchase, you can place your order over the phone by calling Advanced Reproduction Center in Santa Rosa at 707/579-9096.

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**Appendix D**  
**Summary of Capital and O&M Costs**

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## **Appendix D-1**

### **Base Components**

Base Components						Escalator for Oct 2001 to midpoint 2004			1.089	
Program No.:		Base								
Description:		Conservation								
Year	Component	Capacity (MG)	Cum Capacity (MG)	Cap Cost (\$000)	Cum Cap Cost (\$000)	PV Cap Cost (2004) (\$000)	O&M Cost/year (\$000)	PV O&M (2004) (\$000)	Cum. Capital Plus O&M Costs (\$M)	Total PV (\$000)
2004	Conservation	60	60	612	612	612	222	222	1	
2005		60	120	612	1224	594	444	431	2	
2006		60	180	612	1836	577	666	628	3	
2007		60	240	612	2448	560	889	813	5	
2008		60	300	612	3060	544	1111	987	6	
2009							1111	958	8	
2010							1111	930	9	
2011							1111	903	10	
2012							1111	877	11	
2013							1111	851	12	
2014							1111	827	13	
2015							1111	802	14	
2016							1111	779	15	
2017							1111	756	16	
2018							1111	734	18	
2019							1111	713	19	
2020							1111	692	20	
2021							1111	672		
2022							1111	652		
2023							1111	633		
2024							1111	615		
2025							1111	597		
2026							1111	580		
2027							1111	563		
2028							1111	546		
2029							1111	531		
2030							1111	515		
2031							1111	500		
2032							1111	485		
2033							1111	471		
2034							1111	458		
2035							1111	444		
TOTAL						2,887		21,169		24,056

<b>Program No.:</b>		<b>Base</b>								
<b>Description:</b>		<b>Laguna Discharge Modification</b>								
Year	Component	Capacity (MG)	Cum Capacity (MG)	Cap Cost (\$000)	Cum Cap Cost (\$000)	PV Cap Cost (2004) (\$000)	O&M Cost/year (\$000)	PV O&M (2004) (\$000)	Cum. Capital Plus O&M Costs (\$M)	Total PV (\$000)
2004	Delta Pond Discharge			1089	1089	1089	218	218	1	
2005							218	211	2	
2006							218	205	2	
2007							218	199	2	
2008							218	194	2	
2009							218	188	2	
2010							218	182	3	
2011							218	177	3	
2012							218	172	3	
2013							218	167	3	
2014							218	162	3	
2015							218	157	4	
2016							218	153	4	
2017							218	148	4	
2018							218	144	4	
2019							218	140	5	
2020							218	136	5	
2021							218	132		
2022							218	128		
2023							218	124		
2024							218	121		
2025							218	117		
2026							218	114		
2027							218	110		
2028							218	107		
2029							218	104		
2030							218	101		
2031							218	98		
2032							218	95		
2033							218	92		
2034							218	90		
2035							218	87		
<b>TOTAL</b>						1,089		4,574		5,663

<b>Program No.:</b>		<b>Base</b>								
<b>Description:</b>		<b>Laguna Plant Expansion/Capacity Preservation</b>								
Year	Component	Capacity (MG)	Cum Capacity (MG)	Cap Cost (\$000)	Cum Cap Cost (\$000)	PV Cap Cost (2004) (\$000)	O&M Cost/year (\$000)	PV O&M (2004) (\$000)	Cum. Capital Plus O&M Costs (\$M)	Total PV (\$000)
2004					0	0		0	0	
2005				0	0	0		0	0	
2006				0	0	0		0	0	
2007					0			0	0	
2008				0	0	0		0	0	
2009				58106	58106	50123	0	0	58	
2010					58106		283	237	58	
2011					58106		566	460	59	
2012					58106		849	671	60	
2013					58106		1133	868	61	
2014				1769	59875	1316	1416	1053	64	
2015					59875		1699	1227	66	
2016					59875		1982	1390	68	
2017					59875		2265	1542	70	
2018					59875		2548	1685	73	
2019				1769	61644	1135	2831	1817	77	
2020					61644		2831	1764	80	
2021							2831	1713		
2022							2831	1663		
2023							2831	1615		
2024							2831	1568		
2025							2831	1522		
2026							2831	1478		
2027							2831	1435		
2028							2831	1393		
2029							2831	1352		
2030							2831	1313		
2031							2831	1275		
2032							2831	1238		
2033							2831	1201		
2034							2831	1166		
2035							2831	1133		
<b>TOTAL</b>						52,575		33,780		86,354

**Appendix D-2**  
**Demand Combinations**

Program No.:		I.A											
Description:		River Discharge											
	Supply Year/Volume (MG)												
Year	Dry	Normal	Wet	Component	Capacity (MG)	Cum Capacity (MG)	Cap Cost (\$000)	Cum Cap Cost (\$000)	PV Cap Cost (2004) (\$000)	O&M Cost/year (\$000)	PV O&M (2004) (\$000)	Cum. Capital Plus O&M Costs (\$M)	Total PV (\$000)
2004													
2005	400	1200	2900			0		0				0	
2006	580	1380	3160			0		0				0	
2007	760	1560	3420			0		0				0	
2008	940	1740	3680			0		0				0	
2009	1120	1920	3940			0		0				0	
2010	1300	2100	4200	River Discharge		4200	28886	28886	24191			29	
2011	1470	2300	4420			4420		28886		1459	1187	30	
2012	1640	2500	4640			4640		28886		1459	1152	32	
2013	1810	2700	4860			4860		28886		1459	1118	33	
2014	1980	2900	5080			5080		28886		1459	1086	35	
2015	2150	3100	5300			5300		28886		1459	1054	36	
2016	2320	3300	5520			5520		28886		1459	1023	38	
2017	2490	3500	5740			5740		28886		1459	994	39	
2018	2660	3700	5960			5960		28886		1459	965	41	
2019	2830	3900	6180			6180		28886		1459	937	42	
2020	3000	4100	6400			6400		28886		1459	909	43	
2021										1459	883		
2022										1459	857		
2023										1459	832		
2024										1459	808		
2025										1459	784		
2026										1459	762		
2027										1459	739		
2028										1459	718		
2029										1459	697		
2030										1459	677		
2031										1459	657		
2032										1459	638		
2033										1459	619		
2034										1459	601		
2035										1459	584		
TOTAL									24,191		21,281		45,472

Program No.:		I.B											
Description:		Indirect Discharge											
	Supply Year/Volume (MG)												
						Cum				O&M		Cum. Capital	
Year	Dry	Normal	Wet	Component	Capacity (MG)	Capacity (MG)	Cap Cost (\$000)	Cum Cap Cost (\$000)	PV Cap Cost (2004) (\$000)	Cost/year (\$000)	PV O&M (2004) (\$000)	Plus O&M Costs (\$M)	Total PV (\$000)
2004													
2005	400	1200	2900			0		0				0	
2006	580	1380	3160			0		0				0	
2007	760	1560	3420			0		0				0	
2008	940	1740	3680			0		0				0	
2009	1120	1920	3940	Infiltration Basins	3200	3200	47598	47598	41058			48	
2010	1300	2100	4200	Infiltration Basins	1000	4200	15542	63140	13016			63	
2011	1470	2300	4420	Infiltration Basins	1000	5200	15542	78682	12637	1888	1535	81	
2012	1640	2500	4640			5200		78682		1888	1491	82	
2013	1810	2700	4860			5200		78682		1888	1447	84	
2014	1980	2900	5080	Infiltration Basins	1000	6200	15542	94225	11565	1888	1405	102	
2015	2150	3100	5300			6200		94225		1888	1364	104	
2016	2320	3300	5520			6200		94225		1888	1324	106	
2017	2490	3500	5740			6200		94225		1888	1286	107	
2018	2660	3700	5960	Infiltration Basins	200	6400	2914	97139	1927	1888	1248	112	
2019	2830	3900	6180			6400		97139		1888	1212	114	
2020	3000	4100	6400			6400		97139		1888	1177	116	
2021										1888	1142		
2022										1888	1109		
2023										1888	1077		
2024										1888	1046		
2025										1888	1015		
2026										1888	986		
2027										1888	957		
2028										1888	929		
2029										1888	902		
2030										1888	876		
2031										1888	850		
2032										1888	825		
2033										1888	801		
2034										1888	778		
2035										1888	755		
TOTAL									80,204		27,538		107,741

Program No.:		I.C											
Description:		Full Geysers Reuse											
	Supply Year/Volume (MG)												
Year	Dry	Normal	Wet	Component	Capacity (MG)	Cum Capacity (MG)	Cap Cost (\$000)	Cum Cap Cost (\$000)	PV Cap Cost (2004) (\$000)	O&M Cost/year (\$000)	PV O&M (2004) (\$000)	Cum. Capital Plus O&M Costs (\$M)	Total PV (\$000)
2004													
2005	400	1200	2900			0		0				0	
2006	580	1380	3160			0		0				0	
2007	760	1560	3420			0		0				0	
2008	940	1740	3680	Geysers to 16 mgd	1825	1825	16335	16335	14513	2831	2516	19	
2009	1120	1920	3940	Geysers to 19 mgd	1095	2920	16662	32997	14373	3017	2602	39	
2010	1300	2100	4200	Geysers to 25 mgd	2190	5110	47589	80586	39855	3387	2836	90	
2011	1470	2300	4420			5110		80586		3627	2949	93	
2012	1640	2500	4640	Storage Expansion	258	5368	25657	106243	20254	4455	3517	124	
2013	1810	2700	4860			5368		106243		4826	3698	128	
2014	1980	2900	5080	Storage Expansion	258	5626	25657	131900	19091	5653	4207	160	
2015	2150	3100	5300			5626		131900		6092	4401	166	
2016	2320	3300	5520	Storage Expansion	258	5884	25657	157557	17995	7037	4935	198	
2017	2490	3500	5740			5884		157557		7516	5118	206	
2018	2660	3700	5960	Storage Expansion	258	6142	25657	183213	16962	8412	5562	240	
2019	2830	3900	6180			6142		183213		8891	5707	249	
2020	3000	4100	6400	Storage Expansion	258	6400	25657	208870	15988	9788	6100	284	
2021										9788	5922		
2022										9788	5749		
2023										9788	5582		
2024										9788	5419		
2025										9788	5261		
2026										9788	5108		
2027										9788	4959		
2028										9788	4815		
2029										9788	4675		
2030										9788	4539		
2031										9788	4406		
2032										9788	4278		
2033										9788	4153		
2034										9788	4032		
2035										9788	3915		
TOTAL									159,032		126,964		285,996

Program No.:		I.D											
Description:		Geysers Reuse (19mgd) + Urban/Ag Reuse											
	Supply Year/Volume (MG)												
Year	Dry	Normal	Wet	Component	Capacity (MG)	Cum Capacity (MG)	Cap Cost (\$000)	Cum Cap Cost (\$000)	PV Cap Cost (2004) (\$000)	O&M Cost/year (\$000)	PV O&M (2004) (\$000)	Cum. Capital Plus O&M Costs (\$M)	Total PV (\$000)
2004													
2005	400	1200	2900			0		0				0	
2006	580	1380	3160			0		0				0	
2007	760	1560	3420			0		0				0	
2008	940	1740	3680	City Farm Irrigation	800	800	0	0	0	0	0	0	
2009	1120	1920	3940	NC Ag -- Increment 1 and 2	540	1340	32518	32518	28050	1015	876	34	
2010	1300	2100	4200	Geysers to 19 mgd	2920	4260	95723	128241	80167	4055	3396	133	
2011	1470	2300	4420	NC Ag -- Increment 3	240	4500	16422	144663	13353	4471	3635	154	
2012	1640	2500	4640	ERP Ag -- Increment 1 and 2	817	5317	19307	163970	15241	4066	3210	178	
2013	1810	2700	4860			5317		163970		4349	3333	182	
2014	1980	2900	5080			5317		163970		4689	3489	187	
2015	2150	3100	5300	Urban Increment 1	81	5398	24522	188492	17715	5118	3698	216	
2016	2320	3300	5520	Urban Increment 4	196	5594	8603	197095	6034	5014	3517	230	
2017	2490	3500	5740	Urban Increment 2	255	5849	14157	211252	9640	5127	3491	249	
2018	2660	3700	5960	Urban Increment 3 (78%)	551	6400	38224	249476	25271	5410	3577	293	
2019	2830	3900	6180			6400		249476		5722	3673	299	
2020	3000	4100	6400	Storage		6400	35567	285042	22164	6544	4078	341	
2021										6544	3959		
2022										6544	3844		
2023										6544	3732		
2024										6544	3623		
2025										6544	3518		
2026										6544	3415		
2027										6544	3316		
2028										6544	3219		
2029										6544	3126		
2030										6544	3035		
2031										6544	2946		
2032										6544	2860		
2033										6544	2777		
2034										6544	2696		
2035										6544	2618		
TOTAL									217,634		88,657		306,292

Program No.:		I.E											
Description:		Urban/Ag Reuse (no Geysers Reuse)											
	Supply Year/Volume (MG)												
Year	Dry	Normal	Wet	Component	Capacity (MG)	Cum Capacity (MG)	Cap Cost (\$000)	Cum Cap Cost (\$000)	PV Cap Cost (2004) (\$000)	O&M Cost/year (\$000)	PV O&M (2004) (\$000)	Cum. Capital Plus O&M Costs (\$M)	Total PV (\$000)
2004													
2005	400	1200	2900			0		0				0	
2006	580	1380	3160	City Farm Irrigation	800	800	0	0	0	0	0	0	
2007	760	1560	3420	NC Ag Increments 1,2,3	780	1580	46283	46283	42355	1440	1317	48	
2008	940	1740	3680	ERP Ag (all)	1600	3180	178930	225213	158977	5052	4489	232	
2009	1120	1920	3940	Urban (Increments 1 and 2)	336	3516	15246	240459	13151	5133	4428	252	
2010	1300	2100	4200	Urban (Increments 3 and 4)	899	4415	69587	310046	58278	4910	4112	327	
2011	1470	2300	4420	Storage		4415	20255	330301	16469	5813	4726	353	
2012	1640	2500	4640	NC Ag (18% of Increment 4)	496	4911	17939	348240	14161	5921	4674	377	
2013	1810	2700	4860			4911		348240		6042	4631	383	
2014	1980	2900	5080	NC Ag (18% of Increment 4)	496	5408	17939	366179	13348	6170	4591	407	
2015	2150	3100	5300	Storage		5408	10062	376241	7269	6506	4700	423	
2016	2320	3300	5520	NC Ag (18% of Increment 4)	496	5904	17939	394180	12582	6646	4661	448	
2017	2490	3500	5740	Storage		5904	10062	404243	6852	6982	4754	465	
2018	2660	3700	5960	NC Ag (18% of Increment 4)	496	6400	17939	422182	11860	7177	4745	490	
2019	2830	3900	6180	Storage		6400	11021	433202	7074	7704	4945	509	
2020	3000	4100	6400			6400		433202		7934	4944	517	
2021										7934	4800		
2022										7934	4660		
2023										7934	4525		
2024										7934	4393		
2025										7934	4265		
2026										7934	4141		
2027										7934	4020		
2028										7934	3903		
2029										7934	3789		
2030										7934	3679		
2031										7934	3572		
2032										7934	3468		
2033										7934	3367		
2034										7934	3269		
2035										7934	3173		
TOTAL									362,377		120,739		483,116

Program No.:		II.A											
Description:		Early Urban/Ag Reuse + River Discharge											
	Supply Year/Volume (MG)												
Year	Dry	Normal	Wet	Component	Capacity (MG)	Cum Capacity (MG)	Cap Cost (\$000)	Cum Cap Cost (\$000)	PV Cap Cost (2004) (\$000)	O&M Cost/year (\$000)	PV O&M (2004) (\$000)	Cum. Capital Plus O&M Costs (\$M)	Total PV (\$000)
2004													
2005	400	1200	2900	City Farm Irrigation	800	800	0	0	0	0	0	0	
2006	580	1380	3160	Urban (Increments 1 and 2)	336	1136	15246	15246	14371	187	176	15	
2007	760	1560	3420	Urban (Increment 4)	196	1332	8603	23849	7873	60	55	24	
2008	940	1740	3680			1332		23849		60	53	24	
2009	1120	1920	3940			1332		23849		60	52	24	
2010	1300	2100	4200	River Discharge		4200	28886	52735	24191	60	50	53	
2011	1470	2300	4420			4420		52735		892	725	54	
2012	1640	2500	4640			4640		52735		892	704	55	
2013	1810	2700	4860			4860		52735		892	683	56	
2014	1980	2900	5080			5080		52735		892	664	57	
2015	2150	3100	5300			5300		52735		892	644	58	
2016	2320	3300	5520			5520		52735		892	625	59	
2017	2490	3500	5740			5740		52735		892	607	59	
2018	2660	3700	5960			5960		52735		892	590	60	
2019	2830	3900	6180			6180		52735		892	572	61	
2020	3000	4100	6400			6400		52735		892	556	62	
2021										892	540		
2022										892	524		
2023										892	509		
2024										892	494		
2025										892	479		
2026										892	465		
2027										892	452		
2028										892	439		
2029										892	426		
2030										892	414		
2031										892	401		
2032										892	390		
2033										892	378		
2034										892	367		
2035										892	357		
TOTAL									46,435		13,391		59,827

Program No.:		II.B											
Description:		Early Urban/Ag Reuse + Indirect Discharge											
	Supply Year/Volume (MG)												
Year	Dry	Normal	Wet	Component	Capacity (MG)	Cum Capacity (MG)	Cap Cost (\$000)	Cum Cap Cost (\$000)	PV Cap Cost (2004) (\$000)	O&M Cost/year (\$000)	PV O&M (2004) (\$000)	Cum. Capital Plus O&M Costs (\$M)	Total PV (\$000)
2004													
2005	400	1200	2900	City Farm Irrigation	800	800	0	0	0	0	0	0	
2006	580	1380	3160	Urban (Increments 1 and 2)	336	1136	15246	15246	14371	187	176	15	
2007	760	1560	3420	Urban (Increment 4)	196	1332	8603	23849	7873	60	55	24	
2008	940	1740	3680			1332		23849		60	53	24	
2009	1120	1920	3940	Infiltration Basins	1500	2832	22767	46616	19639	60	52	47	
2010	1300	2100	4200	Infiltration Basins	1400	4232	21249	67865	17796	60	50	68	
2011	1470	2300	4420	Infiltration Basins	500	4732	7589	75454	6171	1136	924	77	
2012	1640	2500	4640			4732		75454		1136	897	78	
2013	1810	2700	4860	Infiltration Basins	500	5232	7589	83043	5816	1136	871	87	
2014	1980	2900	5080			5232		83043		1136	846	88	
2015	2150	3100	5300	Infiltration Basins	500	5732	7589	90632	5482	1136	821	97	
2016	2320	3300	5520			5732		90632		1136	797	98	
2017	2490	3500	5740	Infiltration Basins	500	6232	7589	98221	5168	1136	774	107	
2018	2660	3700	5960			6232		98221		1136	751	108	
2019	2830	3900	6180	Infiltration Basins	200	6432	3036	101257	1948	1136	729	112	
2020	3000	4100	6400			6432		101257		1136	708	113	
2021										1136	688		
2022										1136	667		
2023										1136	648		
2024										1136	629		
2025										1136	611		
2026										1136	593		
2027										1136	576		
2028										1136	559		
2029										1136	543		
2030										1136	527		
2031										1136	512		
2032										1136	497		
2033										1136	482		
2034										1136	468		
2035										1136	455		
TOTAL									84,264		16,958		101,222

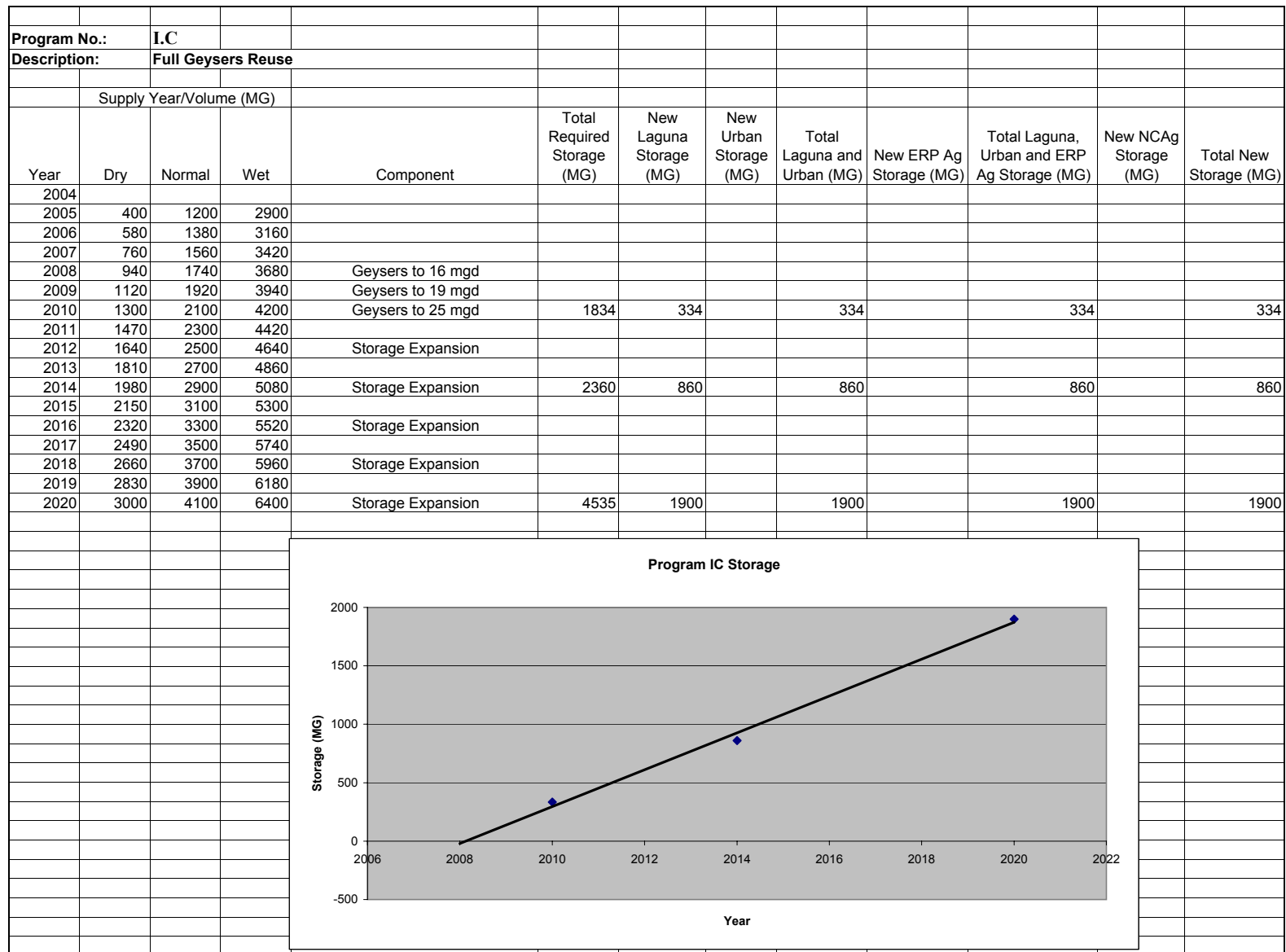
Program No.:		II.C											
Description:		Early Urban/Ag Reuse + Full Geysers Reuse											
	Supply Year/Volume (MG)												
Year	Dry	Normal	Wet	Component	Capacity (MG)	Cum Capacity (MG)	Cap Cost (\$000)	Cum Cap Cost (\$000)	PV Cap Cost (2004) (\$000)	O&M Cost/year (\$000)	PV O&M (2004) (\$000)	Cum. Capital Plus O&M Costs (\$M)	Total PV (\$000)
2004													
2005	400	1200	2900	City Farm Irrigation	800	800	0	0	0	0	0	0	
2006	580	1380	3160	Urban (Increments 1 and 2)	336	1136	15246	15246	14371	187	176	15	
2007	760	1560	3420	Urban (Increment 4)	196	1332	8603	23849	7873	60	55	24	
2008	940	1740	3680	Geysers to 16 mgd	1825	3157	16335	40184	14513	60	53	40	
2009	1120	1920	3940	Geysers to 19 mgd	1095	4252	16662	56846	14373	60	52	57	
2010	1300	2100	4200			4252		56846		60	50	57	
2011	1470	2300	4420	Geysers to 22 mgd	1095	5347	77809	134655	63266	2698	2193	138	
2012	1640	2500	4640			5347		134655		3009	2375	141	
2013	1810	2700	4860			5347		134655		3320	2545	144	
2014	1980	2900	5080			5347		134655		3632	2702	148	
2015	2150	3100	5300	Geysers to 25 mgd	1095	6442	23795	158450	17190	3943	2849	175	
2016	2320	3300	5520			6442		158450		4268	2993	180	
2017	2490	3500	5740			6442		158450		4601	3133	184	
2018	2660	3700	5960			6442		158450		4934	3262	189	
2019	2830	3900	6180			6442		158450		5286	3393	195	
2020	3000	4100	6400	Added storage		6442	54014	212464	33660	6700	4175	255	
2021										6700	4053		
2022										6700	3935		
2023										6700	3821		
2024										6700	3709		
2025										6700	3601		
2026										6700	3496		
2027										6700	3395		
2028										6700	3296		
2029										6700	3200		
2030										6700	3107		
2031										6700	3016		
2032										6700	2928		
2033										6700	2843		
2034										6700	2760		
2035										6700	2680		
TOTAL									165,245		79,849		245,094

Program No.:		II.D											
Description:		Early Urban/Ag Reuse + Geysers Reuse (19mgd) + Urban/Ag Reuse											
	Supply Year/Volume (MG)												
Year	Dry	Normal	Wet	Component	Capacity (MG)	Cum Capacity (MG)	Cap Cost (\$000)	Cum Cap Cost (\$000)	PV Cap Cost (2004) (\$000)	O&M Cost/year (\$000)	PV O&M (2004) (\$000)	Cum. Capital Plus O&M Costs (\$M)	Total PV (\$000)
2004													
2005	400	1200	2900	City Farm Irrigation	800	800	0	0	0	0	0	0	
2006	580	1380	3160	Urban (Increments 1 and 2)	336	1136	15246	15246	14371	187	176	15	
2007	760	1560	3420	Urban (Increment 4)	196	1332	8603	23849	7873	60	55	24	
2008	940	1740	3680			1332		23849		60	53	24	
2009	1120	1920	3940	Geysers to 16 mgd	1825	3157	16335	40184	14091	60	52	41	
2010	1300	2100	4200	Geysers to 19 mgd	1095	4252	95070	135254	79619	1628	1364	137	
2011	1470	2300	4420	North Co. Ag (Increments 1,2,3)	780	5032	29512	164766	23996	3072	2498	170	
2012	1640	2500	4640			5032		164766		3384	2671	173	
2013	1810	2700	4860			5032		164766		3695	2832	177	
2014	1980	2900	5080	ERP Ag (Increments 1 and 2)	817	5849	25098	189864	18675	3406	2535	205	
2015	2150	3100	5300			5849		189864		3718	2686	209	
2016	2320	3300	5520			5849		189864		4029	2826	213	
2017	2490	3500	5740	Urban (78% of Increment 3)	552	6401	69102	258966	47055	4467	3042	287	
2018	2660	3700	5960			6401		258966		4750	3140	291	
2019	2830	3900	6180			6401		258966		5061	3249	297	
2020	3000	4100	6400	Storage		6401	26550	285516	16545	5932	3697	329	
2021										5932	3589		
2022										5932	3485		
2023										5932	3383		
2024										5932	3285		
2025										5932	3189		
2026										5932	3096		
2027										5932	3006		
2028										5932	2918		
2029										5932	2833		
2030										5932	2751		
2031										5932	2671		
2032										5932	2593		
2033										5932	2517		
2034										5932	2444		
2035										5932	2373		
TOTAL									222,226		75,006		297,232

<b>Program No.:</b>		<b>II.E</b>											
<b>Description:</b>		<b>Early Urban/Ag Reuse + Urban/Ag Reuse (No Geysers Reuse)</b>											
	Supply Year/Volume (MG)												
Year	Dry	Normal	Wet	Component	Capacity (MG)	Cum Capacity (MG)	Cap Cost (\$000)	Cum Cap Cost (\$000)	PV Cap Cost (2004) (\$000)	O&M Cost/year (\$000)	PV O&M (2004) (\$000)	Cum. Capital Plus O&M Costs (\$M)	Total PV (\$000)
2004													
2005	400	1200	2900	City Farm Irrigation	800	800	0	0	0	0	0	0	
2006	580	1380	3160	Urban (Increments 1 and 2)	336	1136	15246	15246	14371	187	176	15	
2007	760	1560	3420	Urban (Increment 3 and 4)	899	2035	84615	99861	77435	1062	972	101	
2008	940	1740	3680	NC Ag (Increments 1,2,3)	780	2815	51074	150935	45379	2211	1965	154	
2009	1120	1920	3940	ERP Ag (Increments 1,2)	817	3632	65478	216414	56482	3488	3009	223	
2010	1300	2100	4200	ERP Ag (Increment 3)	783	4415	75725	292138	63418	4946	4142	304	
2011	1470	2300	4420	Storage		4415	34739	326878	28246	5755	4680	345	
2012	1640	2500	4640	NC Ag (25% of Increment 4)	662	5077	26572	353449	20976	5865	4630	377	
2013	1810	2700	4860			5077		353449		5980	4583	383	
2014	1980	2900	5080			5077		353449		6102	4540	389	
2015	2150	3100	5300	NC Ag (25% of Increment 4)	662	5739	43342	396791	31311	6572	4747	439	
2016	2320	3300	5520			5739		396791		6712	4707	446	
2017	2490	3500	5740			5739		396791		6846	4662	453	
2018	2660	3700	5960	NC Ag (25% of Increment 4)	662	6401	45738	442529	30238	7391	4886	506	
2019	2830	3900	6180			6401		442529		7731	4962	513	
2020	3000	4100	6400			6401		442529		7999	4985	521	
2021										7999	4840		
2022										7999	4699		
2023										7999	4562		
2024										7999	4429		
2025										7999	4300		
2026										7999	4175		
2027										7999	4053		
2028										7999	3935		
2029										7999	3821		
2030										7999	3709		
2031										7999	3601		
2032										7999	3496		
2033										7999	3395		
2034										7999	3296		
2035										7999	3200		
TOTAL									367,856		117,158		485,014

**Appendix D-3**  
**Storage by Program**

Program No.:		I.A										
Description:		River Discharge										
	Supply Year/Volume (MG)											
					Total Required Storage (MG)	New Laguna Storage (MG)	New Urban Storage (MG)	Total Laguna and Urban (MG)	New ERP Ag Storage (MG)	Total Laguna, Urban and ERP Ag Storage (MG)	New NCAG Storage (MG)	Total New Storage (MG)
Year	Dry	Normal	Wet	Component								
2004												
2005	400	1200	2900		NONE REQUIRED							
2006	580	1380	3160									
2007	760	1560	3420									
2008	940	1740	3680									
2009	1120	1920	3940									
2010	1300	2100	4200	River Discharge								
2011	1470	2300	4420									
2012	1640	2500	4640									
2013	1810	2700	4860									
2014	1980	2900	5080									
2015	2150	3100	5300									
2016	2320	3300	5520									
2017	2490	3500	5740									
2018	2660	3700	5960									
2019	2830	3900	6180									
2020	3000	4100	6400									
Program No.:		I.B										
Description:		Indirect Discharge										
	Supply Year/Volume (MG)											
					Total Required Storage (MG)	New Laguna Storage (MG)	New Urban Storage (MG)	Total Laguna and Urban (MG)	New ERP Ag Storage (MG)	Total Laguna, Urban and ERP Ag Storage (MG)	New NCAG Storage (MG)	Total New Storage (MG)
Year	Dry	Normal	Wet	Component								
2004												
2005	400	1200	2900		NONE REQUIRED							
2006	580	1380	3160									
2007	760	1560	3420									
2008	940	1740	3680									
2009	1120	1920	3940	Infiltration Basins								
2010	1300	2100	4200	Infiltration Basins								
2011	1470	2300	4420	Infiltration Basins								
2012	1640	2500	4640									
2013	1810	2700	4860									
2014	1980	2900	5080	Infiltration Basins								
2015	2150	3100	5300									
2016	2320	3300	5520									
2017	2490	3500	5740									
2018	2660	3700	5960	Infiltration Basins								
2019	2830	3900	6180									
2020	3000	4100	6400									



Program No.:		I.D												
Description:		Geysers (19mgd) + Urban/Ag Reuse												
	Supply Year/Volume (MG)													
								</						



Program No.:		II.A										
Description:		Early Urban/Ag Reuse + River Discharge										
	Supply Year/Volume (MG)											
					Total Required Storage (MG)	New Laguna Storage (MG)	New Urban Storage (MG)	Total Laguna and Urban (MG)	New ERP Ag Storage (MG)	Total Laguna, Urban and ERP Ag Storage (MG)	New NCAG Storage (MG)	Total New Storage (MG)
Year	Dry	Normal	Wet	Component								
2004												
2005	400	1200	2900	City Farm Irrigation	NONE REQUIRED							
2006	580	1380	3160	Urban -- G&CC + Phase 1								
2007	760	1560	3420	Urban -- 170 MG (of Phase 2)								
2008	940	1740	3680									
2009	1120	1920	3940									
2010	1300	2100	4200	River Discharge								
2011	1470	2300	4420									
2012	1640	2500	4640									
2013	1810	2700	4860									
2014	1980	2900	5080									
2015	2150	3100	5300									
2016	2320	3300	5520									
2017	2490	3500	5740									
2018	2660	3700	5960									
2019	2830	3900	6180									
2020	3000	4100	6400									
Program No.:		II.B										
Description:		Early Urban/Ag Reuse + Indirect Discharge										
	Supply Year/Volume (MG)											
					Total Required Storage (MG)	New Laguna Storage (MG)	New Urban Storage (MG)	Total Laguna and Urban (MG)	New ERP Ag Storage (MG)	Total Laguna, Urban and ERP Ag Storage (MG)	New NCAG Storage (MG)	Total New Storage (MG)
Year	Dry	Normal	Wet	Component								
2004												
2005	400	1200	2900	City Farm Irrigation	NONE REQUIRED							
2006	580	1380	3160	Urban -- G&CC + Phase 1								
2007	760	1560	3420	Urban -- 170 MG (of Phase 2)								
2008	940	1740	3680									
2009	1120	1920	3940	Infiltration Basins								
2010	1300	2100	4200	Infiltration Basins								
2011	1470	2300	4420	Infiltration Basins								
2012	1640	2500	4640									
2013	1810	2700	4860	Infiltration Basins								
2014	1980	2900	5080									
2015	2150	3100	5300	Infiltration Basins								
2016	2320	3300	5520									
2017	2490	3500	5740	Infiltration Basins								
2018	2660	3700	5960									
2019	2830	3900	6180	Infiltration Basins								
2020	3000	4100	6400									







**Appendix E**  
**Selected Program Water Balance**

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## MEMORANDUM

TO: File

FROM: Mike Deas/Merritt Smith Consulting

COPIES: Doug Smith/CH2M HILL  
Dave Smith/Merritt Smith Consulting  
Anne Kernkamp/CH2M HILL

DATE: Version Date: 1-27-04

SUBJECT: IRWP Recycled Water Master Plan – Selected Program Water Balance Program

### ***PROGRAM DESCRIPTIONS AND SIMULATION SUMMARY***

The selected program was analyzed with the Incremental Recycled Water Program (IRWP) water balance model. The simulations consist of each component of the selected program as follows:

- Conservation (300 million gallons [MG]).
- Agricultural reuse (1,000 MG). City Farm and east Rohnert Park are assumed for illustrative purposes in this analysis, but agricultural irrigation could also or instead include the North County Area.
- Urban reuse (500 MG).
- Increased Geysers reuse (400 MG).
- Discharge (4,500 MG). No distinction between indirect and direct river discharge is made in this memorandum, because these two subalternatives are identical from a water balance perspective. Discharge to the Laguna was restricted in this simulation to 10 percent of Laguna flow. Previous simulations (see Master Plan Appendix C) demonstrated the capability of the Geysers Pipeline to convey all IRWP flows to the River for discharge, so river discharge without Laguna discharge was not simulated again.

These components are assumed to be implemented incrementally, scheduled from 2005 to 2020, and locations are shown for illustrative purposes. These assumptions do not imply any particular recommendation regarding program implementation. Table 1

identifies the individual program components and an example implementation schedule with supply volumes for the identified driest, normal, and wettest years; annual average dry weather flow (ADWF) volumes; and capacity and cumulative capacity of the combined program components. A discussion of the individual years simulated in each analysis follows the presentation of each program summary table. This memorandum documents that the selected program can be successfully operated and describes the facilities and operational considerations necessary to successfully implement the selected program.

## ***ASSUMPTIONS AND ANALYSIS***

Several assumptions are made for these analyses, most of which are addressed within the discussion of timeline for implementing individual components (below). However, a few assumptions do not fall readily into these discussions and are addressed herein.

The Geysers Pipeline is assumed to have a capacity of 40 mgd through 2009. In 2010, the capacity is increased to 80 mgd. Throughout the analysis period (2005 through 2020), it is assumed that discharge to the Laguna is limited to 10 percent of total Laguna flow, with the balance discharged directly or indirectly to the Russian River. The 10 percent discharge to the Laguna is not part of the description of the selected program; rather, it is an estimate of the discharge rate resulting in compliance with water quality regulations. Conservation is deducted from the total system volume at 300 MG annually in all types of water years. Finally, river discharge is assumed to occur between November 1 and May 14.

Future discharge is presumed to be a maximum of 5 percent of the flow in the Russian River, as measured at Hacienda Bridge. This is the same as the existing maximum allowable discharge.

The existing storage volume is 1,481 MG at a 2-foot freeboard level from the overflows, and existing storage is 1,641 MG at the overflow level. Therefore, any storage requirement identified by the model that exceeds 1,480 MG is assumed to require new storage.

The water balance model uses storage operational rule curves, which are consistent throughout the 67 years of record analyzed in the model. Output tables and the system conditions during each year simulated are discussed to indicate how the system might be managed in a specific water year condition to avoid an otherwise unnecessary capacity expansion.

Table 1 presents the schedule of component implementation, and is followed by a discussion of the simulation results.

**Table 1. Program: Selected Program**

<b>Program No.:</b>		<b>Selected Program</b>					
		<u>Supply Year/Volume (MG)</u>			Component	Capacity (MG)	Cumul. Capacity (MG)
Year	Driest	Normal	Wettest	ADWF (MG)			
2004							
2005	400	1,200	2,900	18.0	Baseline Run		0
2006	580	1,380	3,160	18.7	Geysers to 12.1 mgd	400	400
2007	760	1,560	3,420	19.3	Urban Reuse	80	480
2008	940	1,740	3,680	20.0	Ag-Reuse – City Farms	800	1,280
2009	1,120	1,920	3,940	20.6			1,280
2010 <sup>a</sup>	1,300	2,100	4,200	21.3	Direct Discharge (river)	4,500	5,780
2011	1,470	2,300	4,420	21.8			5,780
2012	1,640	2,500	4,640	22.2	Ag Reuse – ERP Ag	200	5,980
2013	1,810	2,700	4,860	22.7			5,980
2014	1,980	2,900	5,080	23.1	Urban Reuse – Santa Rosa	420	6,400
2015	2,150	3,100	5,300	23.6			6,400
2016	2,320	3,300	5,520	24.1			6,400
2017	2,490	3,500	5,740	24.5			6,400
2018	2,660	3,700	5,960	25.0			6,400
2019	2,830	3,900	6,180	25.4			6,400
2020	3,000	4,100	6,400	25.9			6,400

<sup>a</sup>Geysers Pipeline capacity increase to 80 mgd in 2010

General note: These components are assumed to be implemented in particular amounts, scheduled from 2005 to 2020, and locations are shown for illustrative purposes. These assumptions do not imply any particular recommendation for program implementation.

## ***SIMULATION SUMMARY***

**Year 2005:** Baseline conditions (Table 2) (ADWF 18 mgd)

**Table 2. Storage Summary (MG): 2005**

	Driest	Normal	Wettest
Laguna	1,471	1,008	1,357
Urban	0.0	0.0	0.0
Rohnert Park	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sum:	1,471	1,008	1,357

**Year 2006:** Geysers Reuse to 400 MG (ADWF 18.7 mgd)

The Geysers delivery schedule was set to 12.1 mgd for the months of October through April and 12.0 from May through September, which translates to 400 MG annually. This delivery to The Geysers reduced recycled water availability for Laguna agriculture in normal years by approximately 140 MG (from approximately 1,728 MG to 1,572 MG). This shortfall diminishes as ADWF increases in subsequent years. Table 3 summarizes storage requirements for 2006. Table 4 shows total storage for 2005 and 2006.

**Table 3. Storage Summary (MG): 2006**

	Driest	Normal	Wettest
Laguna	1,339	859	1,242
Urban	0.0	0.0	0.0
Rohnert Park	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sum:	1,339	859	1,242

**Table 4. Total Storage History (MG): 2005-2006**

	Driest	Normal	Wettest
2005	1,471	1,008	1,357
2006	1,339	859	1,242

**Year 2007:** Urban Reuse to 80 MG (ADWF 19.3 mgd)

Urban demand was added to the model according to the schedule outlined in Table 5. Urban storage was set to 0 MG at this time because the demand is modest compared to available recycled water.

**Table 5. Urban Demand Schedule for 80-MG Annual Delivery (mgd)**

<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>
0.26	0.11	0.04	0.02	0.02	0.06	0.15	0.25	0.39	0.46	0.45	0.40

Model simulation results indicate that 80 MG can be delivered in wettest and driest years, but the normal year experiences a 20-MG shortfall – mostly in the spring when Laguna storage (driven by storage rule curves) is being filled for summer irrigation. This is similar to conditions in 2006. Laguna storage in the driest year is 1,486 MG – coincident with existing storage with a 2-foot freeboard. This storage volume is within the range capable of managing this minor shortfall. Therefore, water will be available for the urban system in a normal year without a shortfall for the new urban reuse demand. Table 6 summarizes storage volumes for 2007. Table 7 shows projected 2005 through 2007 storage volumes under the spectrum of water year types.

**Table 6. Storage Summary (MG): 2007**

	Driest	Normal	Wettest
Laguna	1,486	914	1,269
Urban	0.0	0.0	0.0
Rohnert Park	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sum:	1,486	914	1,269

**Table 7. Total Storage History (MG): 2005-2007**

	Driest	Normal	Wettest
2005	1,471	1,008	1,357
2006	1,339	859	1,242
2007	1,486	914	1,269

**Year 2008:** Ag Reuse (City Farms) to 800 MG (ADWF 20.0 mgd)

Baseline Laguna irrigation uses 2,184 MG/yr. City Farm irrigation re-growth requires adding acreage to the agricultural reuse system to increase irrigation demand by 800 MG/yr (i.e., City Farm irrigation would increase to roughly 2,984 MG/yr for the driest year, an increase of approximately 37 percent). For this exercise, the driest year was used to estimate size of the acreage because normal and wet years experienced reduction in agricultural demand as a result of spring rainfall events.

At this level of ADWF, re-growth to 800 MG of demand is a challenge in the driest year. Thus, the re-growth acreage to meet demand is a function of the year during which this particular component is implemented. Increasing acreage to 4,730 acres produces an increase in City Farm irrigation demand of 2,711 MG – somewhat short of the desired 2,984 MG. Insufficient water is available to support this level of City Farm irrigation re-growth in 2008. However, as ADWF increases, conditions may allow the full acreage to be irrigated and the demand to be met. Median year irrigation use was 2,007 MG/yr, and wettest year use was 2,507 MG/yr.

Urban storage was added during this year to improve delivery reliability in the driest and normal years; without additional storage, the Urban Reuse Program would be underserved by 50 to 80 percent in these years. A volume of 50 MG of storage was added, all of which was used in the driest and normal years.

Table 8 summarizes 2008 storage volumes. Table 9 shows storage volumes for 2005 through 2008.

**Table 8. Storage Summary (MG): 2008**

	Driest	Normal	Wettest
Laguna	1,300	960	1,240
Urban	50	50	50
Rohnert Park	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Sum:	1,350	1010	1,290

**Table 9. Total Storage History (MG): 2005-2008**

	Driest	Normal	Wettest
2005	1,471	1,008	1,357
2006	1,339	859	1,242
2007	1,486	914	1,269
2008	1,350	1,010	1,290

**Year 2010:** Direct Discharge to 4,500 MG (ADWF 21.3 mgd)

In 2010, river discharge up to 4,500 MG is specified as a program component. Laguna discharge is limited to 10 percent of base flow; the balance is delivered through the Geysers Pipeline to the Russian River. Total discharge for the driest, normal, and wettest year is 108 MG, 1,886 MG, and 3,083 MG, respectively (Laguna discharge is maintained at 10 percent of base flow). Wet year discharge is projected to be less than 4,500 MG in this example wet year because other reuse (1,373 MG) has been implemented. City Farm irrigation in the driest year reached 2,948 MG – close to fulfilling the 800-MG demand specified in 2008. Maximum Laguna storage in the driest, normal, and wettest year is 1,549 MG, 1,011 MG, and 1,376 MG, respectively, indicating that, in the driest year storage in spring will exceed the 2-foot freeboard but will not exceed total existing Laguna capacity. However, the model’s output summarizing operations each day in the driest year indicates that approximately 400 MG could be discharged to the river while remaining within the 5 percent discharge criterion. Such releases would reduce storage to approximately 1,050 MG, well below the 2-foot freeboard level. Likewise, storage curve refinements are possible that would increase river discharge percentages (but remain within the 5 percent criterion) and dry-year Laguna storage demand, thereby, would be decreased. Alternatively, opting to fill Urban storage in March, April, or May could alleviate some or all the modest dry-year Laguna storage shortage.

As presented in the spreadsheet summaries (Attachment 2), Laguna discharge does not exceed 10 percent of Laguna flow and river discharge does not exceed 5 percent of Russian River flow. Table 10 summarizes 2010 storage volumes. Table 11 shows storage volumes for 2005 through 2010.

**Table 10. Storage Summary (MG): 2010**

	Driest	Normal	Wettest
Laguna	1,549	1,011	1,376
Urban	50	50	50
Rohnert Park	0	0	0
Sum:	1,599	1,061	1,426
Tabulated values in storage summary reflect the spreadsheet values and not the post-processed analysis			

**Table 11. Total Storage History (MG): 2005-2010**

	Driest	Normal	Wettest
2005	1,471	1,008	1,357
2006	1,339	859	1,242
2007	1,486	914	1,269
2008	1,350	1,010	1,290
2010	1,599	1,061	1,426
Tabulated values in storage summary reflect the spreadsheet values and not the post-processed analysis			

**Year 2012:** Ag Reuse in East Rohnert Park (ERP) to 200 MG (ADWF 22.2 mgd)

Using 380 acres of irrigation in Rohnert Park (200 MG demand) and associated storage of 200 MG, a demand of 197 MG is realized (median year). Because the model assumes that Rohnert Park storage is filled in winter and used in summer, there is approximately a 1:1 relationship between diversion and use. Because no carryover storage is permitted in the model assumptions (i.e., the storage curve in the model requires storage be nearly empty at the end of each irrigation season), the modeled Rohnert Park agricultural demand of 21 MG is rarely met in the fall months (October) at lower ADWF values.

Total Laguna storage exceeds 2-foot freeboard volume in the driest and wettest years, but is less than maximum capacity. Maximum Laguna storage in the driest, normal, and wettest year is 1,564 MG, 1,055 MG, and 1,533 MG, respectively. Both occurrences of exceeding 2-foot freeboard in May. As noted in the discussion of Year 2010, Laguna storage can be managed within the 2-foot freeboard through river discharge up to 5 percent, as well as through Laguna storage curve refinement (e.g., year-type-dependent Laguna storage rules) or opting to fill Urban and/or east Rohnert Park storage in March, April, or May.

An additional finding of this simulation is that, as ADWF increases, the urban storage component is diminished in importance – only the normal year draws on storage and only for about 10 MG. As ADWF increases, conversion of this storage to another use may be possible. Alternatively, refinements to the order in which reuse and storage are constructed could be considered, which may avoid this.

Laguna discharge does not exceed 10 percent of Laguna flow and River discharge does not exceed 5 percent of Russian River flow. Table 12 summarizes 2012 storage volumes. Table 13 shows storage volumes for 2005 through 2012.

**Table 12. Storage Summary (MG): 2012**

	Driest	Normal	Wettest
Laguna	1,571	1,046	1,467
Urban	50	50	50
Rohnert Park	<u>200</u>	<u>200</u>	<u>200</u>
Sum:	1,821	1,296	1,717
Tabulated values in storage summary reflect the spreadsheet values and not the post-processed analysis			

**Table 13. Total Storage History (MG): 2005-2012**

	Driest	Normal	Wettest
2005	1,471	1,008	1,357
2006	1,339	859	1,242
2007	1,486	914	1,269
2008	1,350	1,010	1,290
2010	1,599	1,061	1,426
2012	1,821	1,296	1,717
Tabulated values in storage summary reflect the spreadsheet values and not the post-processed analysis			

**Year 2014:** Urban Reuse to 500 MG (420 MG + 80 MG) (ADWF 23.1 mgd)

Urban demand was added to the model according to the schedule outlined in Table 14..

**Table 14. Urban Demand Schedule for 500 MG Annual Delivery (mgd)**

<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>
1.62	0.66	0.22	0.15	0.15	0.38	0.92	1.59	2.46	2.87	2.82	2.52

Urban delivery in the driest, normal, and wettest year is 476 MG, 335 MG, and 500 MG, respectively. Urban storage was not increased in this simulation. Other model simulations were completed to assess increased urban reuse storage capacity up to 250 MG, and normal and wet year delivery reached around 470 MG. (Incidentally, in 2020, 50 MG of urban reuse storage is sufficient to meet full delivery). Total Laguna storage exceeds 2-foot freeboard volume only in the wettest year, but is less than maximum capacity. Maximum Laguna storage in the driest, normal, and wettest year is 1,436 MG, 1,033 MG, and 1,459 MG, respectively. Because of the need to provide a full 500 MG supply to the new urban reuse system in 2014, it will be necessary to add approximately 200 MG of storage capacity to that included in this simulation, for a total of 250 MG of storage identified for urban reuse. This storage will become useful for other purposes under the 2020 flow scenario (see following paragraphs related to this condition).

Laguna discharge does not exceed 10 percent of Laguna flow, and River discharge does not exceed 5 percent of Russian River flow. Table 15 summarizes 2014 storage volumes. Table 16 shows storage volumes for 2005 through 2014.

**Table 15. Storage Summary (MG): 2014**

	Driest	Normal	Wettest
Laguna	1,602	1,033	1,459
Urban	50	50	50
Rohnert Park	<u>200</u>	<u>200</u>	<u>200</u>
Sum:	1,852	1,283	1,709
Tabulated values in storage summary reflect the spreadsheet values and not the post-processed analysis			

**Table 16. Total Storage History (MG): 2005-2014**

	Driest	Normal	Wettest
2005	1,471	1,008	1,357
2006	1,339	859	1,242
2007	1,486	914	1,269
2008	1,350	1,010	1,290
2010	1,599	1,061	1,426
2012	1,821	1,296	1,717
2014	1,852	1,283	1,709
Tabulated values in storage summary reflect the spreadsheet values and not the post-processed analysis			

### **Year 2020:** Buildout (ADWF 25.9)

In this program, no additional components were added between 2014 and 2020. Each component will be addressed individually.

#### *Geysers Delivery*

Geysers delivery of 12.1 mgd (4,400 MG/yr) was met in the driest, normal, and wettest years

#### *Laguna Irrigation*

Full Laguna irrigation demand of 2,984 MG was met in the driest year. In the normal and wettest year, the full demand was not required because of rainfall contributions during the spring months: normal and wettest year deliveries were 2,769 MG and 2,573 MG, respectively.

#### *Urban Reuse*

Urban reuse demand of 500 MG was met in every year type. The normal year required 50 MG of storage to provide full demand.

### *East Rohnert Park Agriculture*

Full delivery was supplied to east Rohnert Park agriculture in all year types.

### *Laguna Storage*

Laguna storage in the driest, normal, and wettest year is 1,442 MG, 1,065 MG, and 1,707 MG, respectively. Reduction in Laguna storage in the driest year between 2014 and 2020 is a function of the timing of when storage reaches elevated storage volumes. In 2014, storage levels do not approach the 2-foot freeboard until after the discharge season, thus providing no remedy for reducing storage via Laguna or river discharge. In 2020, 2-foot freeboard volumes were approached during the discharge season, and more water could be discharged (see River Discharge, below). Laguna storage in the wettest year indicates that additional storage of approximately 225 MG is required to operate within the 2-foot freeboard volume.

### *Discharge*

In this simulation, discharge to the Laguna is limited to 10 percent of Laguna base flow and equals a total of 3,770 MG during the wettest year. The balance of discharge is discharged to the Russian River and totaled 1,468 MG during the wettest year. Combined discharge was 4,558 MG, approximately the target volume. Further, during the driest year, simulations indicate approximately 50 days during which discharge exceeded 5 percent of Russian River discharge. Examination of the daily data suggests that if discharge were maintained at the 10 percent limit to the Laguna and the 5 percent limit to the River, only about 720 MG could be discharged in the driest year, while 1,003 MG was identified model simulation. Thus, an additional 300 MG of storage capacity would be required to avoid river discharges in excess of 5 percent in the driest years. This is approximately equal to the 225 MG of additional Laguna storage identified above as necessary to operate within the 2-foot freeboard volume; thus, an additional 250 MG of storage would accommodate both wettest and driest year storage and discharge requirements.

### *Summary*

Geysers delivery, Laguna irrigation, urban reuse and ERP agriculture, and river discharge are at the specified program capacities. The 50 MG of urban reuse storage specified in 2008 is still required to fulfill the urban program in 2020, and the ADWF has increased to the point where the full 500 MG of demand is met. Further, river discharge exceeds program capacity in the wettest year by approximately 60 MG. Additional storage capacity is required to address this excess river discharge, as well as to accommodate driest year and wettest year discharges. Combined with the Urban and Rohnert Park reuse components, the storage summary is as follows:

- Existing Laguna Storage: 1,481 MG (2-foot freeboard)

- Additional/New Laguna Storage: 360 MG (60 MG to accommodate excessive river discharge and 300 to accommodate driest and wettest year river discharge in excess of 5 percent)
- New Urban Reuse Storage: 50 MG
- New Rohnert Park Reuse Storage: 200 MG

Total new storage capacity required is 610 MG.

Table 17 summarizes storage volumes in 2020. Table 18 shows storage volumes in 2005 through 2020.

**Table 17. Storage Summary (MG): 2020**

	Driest	Normal	Wettest
Laguna	1,442	1,065	1,707
Urban	50	50	50
Rohnert Park	200	200	200
Sum:	1,692	1,315	1,957

Tabulated values in storage summary reflect the spreadsheet values and not the post-processed analysis

**Table 18. Total Storage History (MG): 2005-2020**

	Driest	Normal	Wettest
2005	1,471	1,008	1,357
2006	1,339	859	1,242
2007	1,486	914	1,269
2008	1,350	1,010	1,290
2010	1,599	1,061	1,426
2012	1,821	1,296	1,717
2014	1,852	1,283	1,709
2020	1,692	1,315	1,957

Tabulated values in storage summary reflect the spreadsheet values and not the post-processed analysis

## ***SUMMARY***

In 2020, Geysers delivery (at 12.1 mgd) is at capacity (target flow or volume specified in the description of the program), City Farm irrigation is essentially at capacity (with the exception of reductions attributable to rainfall), and Urban reuse and ERP agriculture are at capacity. Estimated river discharge volume differs from the specified maximum (4,500 MG) only by the amount of water in storage.

This evaluation provides further information about Geysers Pipeline capacity, storage management, and storage volume.

### ***Geysers Pipeline Capacity***

Starting in 2010, the additional pipeline size will be required to provide necessary capacity for discharge, and by 2020, most of the 80-mgd capacity will be necessary to provide the flexibility to operate the Laguna discharge at a 10 percent maximum while providing the constant flow of 12.1 mgd to The Geysers and fill any storage reservoirs located in the North County agricultural reuse area. A summary of the assessment identifying capacity is included in Attachment 1.

### ***Storage Management***

A particular storage management curve has been used as the basis for this simulation. Refinements to the storage curve can be developed to manage the timing and location of discharge to minimize storage demand and/or to avoid particular discharge impacts as needed.

### ***Storage Volume***

This evaluation establishes that 250 MG minimum additional storage is needed for successful program implementation as follows:

- Urban storage – 50 MG
- Agricultural storage – In this example, agricultural demand in the ERP (200 MG) and City Farm (800 MG) areas was assumed. These irrigation volume assumptions produced a storage requirement of 200 MG for ERP.

This evaluation also indicates that additional storage capacity should be included in the program. Flexibility to include additional storage capacity is recommended to account for the following factors:

- Discharge. The exact parameters of discharge management to meet regulatory requirements are uncertain at this time. This analysis indicated that up to 360 MG of additional storage capacity would be required to manage storage below the 2-foot freeboard level while maintaining river discharge at or below 5 percent of base flow in the wettest and driest years.
- Several additional factors require consideration in the assessment of necessary storage for the selected program to function with sufficient flexibility and reliability. These include:
  - R The ability to efficiently and fully utilize the Laguna and river discharges to 10 and 5 percent of base flow, respectively. The model and analyses assume that all discharges can be managed precisely to these discharge percentages. Real-time operations will not likely realize this level of efficiency.

- R Conveyance capacity limits between the Laguna Plant and Delta Pond are a concern. Currently, the capacity to convey water to Delta Pond is 25 mgd. Simulations indicate that sustained flows exceeding this quantity may be required, thus limiting discharge capability if a significant portion of the discharge has to occur at Delta Pond in the future.
- R River discharge assumptions are based on flows at Hacienda Bridge. If discharge occurs at upstream locations in the river (e.g., Healdsburg), lower base flows could result in lower discharge volumes and greater storage requirements
- R The analysis is based on the assumption that the capacity of the Geysers Pipeline will be increased to 80 mgd. The flexibility to store water rather than convey it in the Geysers pipeline during periods of peak production is desirable. Currently, it is unknown whether expansion of the Geysers Pipeline (e.g., to 80 mgd) or expansion of storage capacity is the desired approach. Further, the final selected discharge point may have an impact on the desirability of expanding the Geysers Pipeline capacity because discharge location will affect the amount of facilities necessary and, thus, the cost of expansion.

There is a direct relationship between the Geysers Pipeline capacity and the amount of operational/pipeline contingency storage capacity constructed. Expanding the Geysers Pipeline to the full 80-mgd capacity will significantly reduce the need for the contingency storage. But in actual implementation of the IRWP, it may be determined that it is more desirable to use storage rather than put the higher flows into the pipeline. This decision will be made in response to factors that likely will become more apparent as the IRWP is implemented, such as size and availability of storage locations, actual location of the river discharge point, future cost of power for pumping, and actual location and size of booster pump facilities to convey the water to the river. For the purposes of providing a dependable system as described above, the most robust system would have both the contingency storage capacity and the increased pipeline capacity available to accommodate operational uncertainties.

The sum of the storage capacities identified above by the model is approximately 600 MG. Professional judgment and awareness of the relationship between actual operational uncertainties and the water balance assumptions indicate that 600 MG of contingency storage capacity should be provided in addition to the 600 MG the model predicts.

Given these circumstances, to provide the level of storage necessary to support a dependable and robust program, 1,200 MG of additional storage capacity (urban – 50 MG, agriculture – 200 MG, discharge contingency – 360 MG, operational/pipeline contingency – 590 MG) is recommended.

Summary spreadsheets supporting the analysis are included in Attachment 2.

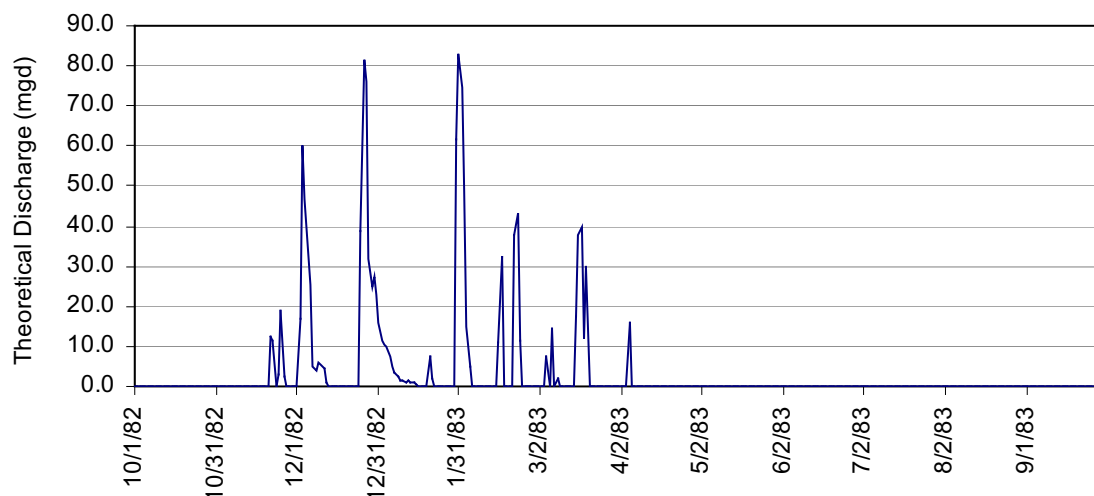
## ***ATTACHMENT 1: GEYSERS PIPELINE CAPACITY – DAILY ANALYSIS***

A brief analysis of daily pipeline flows for the selected program was completed to assess capacity of the Geysers Pipeline in 2008 (40 mgd), and 2010 and 2020 (80 mgd).

The expansion of the Geysers Pipeline capacity from 40 mgd to 80 mgd in 2010 is critical, as illustrated in Table 1. In 2008 four events exceed Geysers Pipeline capacity of 40 mgd for a total of 9 days. The 7-day average flow is also calculated for each event, with the maximum being just over 40 mgd for the 4-day event. This 7-day average renders insight into the duration of the elevated discharges, which are generally short-lived (Figure 1). These results indicate that operators could readily manage such flows using foresight and operational flexibility within the system. In most cases, Geysers delivery of 12.1 mgd could also be accommodated. However, there may be times when delivery cannot be made (duration of 1 to 4 days), and this may happen more than once during the year. Although there is sufficient storage capacity in the Laguna in 2008 during this critical period, the results indicate, that for purposes of discharge requirements and potential storage limitations in the Laguna, it may be necessary for Geysers delivery to be abated for a few days per year.

**Table 1. Maximum Discharge Events 2008 (Geysers Pipeline 40 mgd)**

<b>Date</b>	<b>Discharge* (mgd)</b>	<b>Description</b>
12/3/1982	72.3	Two-day event: 7-day average: 28.2 mgd (average calculated as 3-days prior, 2-day event, and 2-days post)
12/4/1982	70.0	
12/26/1982	81.4	Two-day event: 7-day average: 36.1 mgd (average calculated as 3-days prior, 2-day event, and 2-days post)
12/27/1982	76.0	
1/30/1983	61.6	Four-day event: 7-day average: 40.4 mgd (average calculated as 2-days prior, 4-day event, and 1-day post)
1/31/1983	82.8	
2/1/1983	74.7	
2/2/1983	48.7	
2/22/1983	43.4	Single-day event: 7-day average is 13.3 mgd (average calculated as 3-days prior, 1-day event, and 3-days post)
* Discharge does not include Geysers delivery (12.1 mgd)		

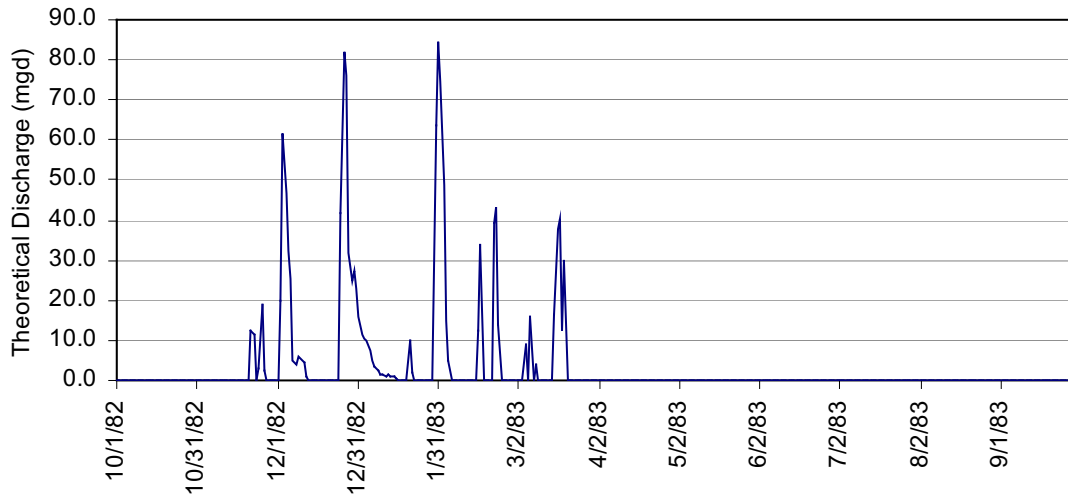


**Figure 1. Simulated Russian River Discharge – 2008 (Geysers Pipeline capacity = 40 mgd)**

In 2010, with the pipeline capacity increased to 80 mgd, there are only two single-day events when discharge exceeds Geysers Pipeline capacity. These events are isolated and occur when there is sufficient Laguna storage to provide flexibility necessary to provide conveyance for discharge as well as Geysers delivery. Table 2 summarizes discharge events that exceed 80 mgd and Figure 2 illustrates discharge for the wettest year in 2010. In 2020, ADWF has increased, but only modestly. These two, single-day events can likewise be addressed through managed operations and use of Laguna storage. Table 3 summarizes discharge events that exceed 80 mgd and Figure 3 illustrates discharge for the wettest year in 2020.

**Table 2. Maximum Discharge Events 2010 (Geysers Pipeline 80 mgd)**

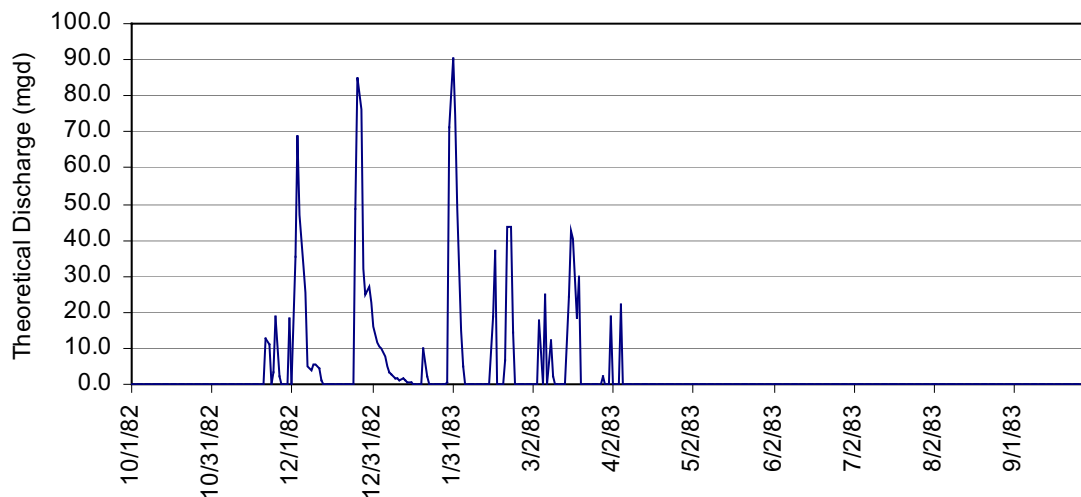
Date	Discharge* (mgd)	Description
12/26/1982	82.2	Single-day event: 7-day average is 36.6 mgd (average calculated as 3-days prior, 1-day event, and 3-days post)
1/31/1983	84.4	Single-day event: 7-day average is 40.9 mgd (average calculated as 3-days prior, 1-day event, and 3-days post)
* Discharge does not include Geysers delivery (12.1 mgd)		



**Figure 2. Simulated Russian River Discharge – 2010 (Geysers Pipeline capacity = 80 mgd)**

**Table 3. Maximum Discharge events 2020 (Geysers Pipeline 80 mgd)**

Date	Discharge* (mgd)	Description
12/26/1982	85	Single-day event: 7-day average is 38.0 mgd (average calculated as 3-days prior, 1-day event, and 3-days post)
1/31/1983	90.6	Single-day event: 7-day average is 43.0 mgd (average calculated as 3-days prior, 1-day event, and 3-days post)
* Discharge does not include Geysers delivery (12.1 mgd)		



**Figure 3. Simulated Russian River Discharge – 2020 (Geysers Pipeline capacity = 80 mgd)**

## ***ATTACHMENT 2: SPREADSHEET SUMMARIES***

**Selected Alternative-2005: Baseline (ADWF 18.0)**

**Basic Control Parameters**

ADWF 18 mgd  
Geyser PL Cap 40 mgd  
Laguna Ag 3553 acres

**Alternatives**

Geysers 11 mgd  
Urban no  
RP Ag no  
North County no MG

**Maximum Storage Summary (MG)**

	Dry	Normal	Wet
Laguna	1470.6	1007.8	1356.6
Urban	0.0	0.0	0.0
Rohnert Park	0.0	0.0	0.0
North County	0.0	0.0	0.0
Sum:	1471	1008	1357

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**99% Exceedance (1977) - Dry**

-----DEMANDS-----																	Sum		1977		1980	
---Exist. Demands---   ---Potential Demands---																	Laguna				Russian River	
Month	WW Prod.	Geysers Delivery	Irrigation	River/NC Divers.	Temp Storage	Temp Sto Chg	Geys. Altern.	Geysers Total	Existing Storage	Urban Use	Urban Diversion	Urban Storage	RP Ag Use	RP Ag Diversion	RP Ag Storage	Laguna Flow	Laguna Disch.	Delta Pnd Back Flw	RR at Hacienda	RR Disch.		
Oct	18.0	11.7	7.6	0.0	0.0	0.0	0.0	11.7	388.4	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	61.4	0.0		
Nov	18.0	12.1	0.0	0.0	0.0	0.0	0.0	12.1	458.9	0.0	0.0	0.0	0.0	0.0	0.0	7.9	0.0	0.0	71.1	0.0		
Dec	18.0	12.1	0.0	0.0	0.0	0.0	0.0	12.1	627.7	0.0	0.0	0.0	0.0	0.0	0.0	7.9	0.6	0.0	59.3	0.0		
Jan	18.0	12.1	0.0	0.0	0.0	0.0	0.0	12.1	785.8	0.0	0.0	0.0	0.0	0.0	0.0	14.4	0.7	0.0	69.2	0.0		
Feb	18.0	12.0	0.0	0.0	0.0	0.0	0.0	12.0	948.5	0.0	0.0	0.0	0.0	0.0	0.0	14.4	0.6	0.0	59.8	0.0		
Mar	18.1	10.5	0.0	0.0	0.0	0.0	0.0	10.5	1125.1	0.0	0.0	0.0	0.0	0.0	0.0	19.9	1.0	0.0	118.7	0.2		
Apr	18.0	9.0	0.0	0.0	0.0	0.0	0.0	9.0	1352.0	0.0	0.0	0.0	0.0	0.0	0.0	9.3	0.2	0.0	33.6	0.0		
May	18.0	9.0	9.6	0.0	0.0	0.0	0.0	9.0	1470.6	0.0	0.0	0.0	0.0	0.0	0.0	8.4	0.0	0.0	58.9	0.0		
Jun	18.0	10.1	12.2	0.0	0.0	0.0	0.0	10.1	1393.5	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0	40.3	0.0		
Jul	18.0	11.0	15.5	0.0	0.0	0.0	0.0	11.0	1193.3	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	31.4	0.0		
Aug	18.0	11.0	15.5	0.0	0.0	0.0	0.0	11.0	928.2	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0	32.8	0.0		
Sep	18.0	11.0	10.8	0.0	0.0	0.0	0.0	11.0	740.8	0.0	0.0	0.0	0.0	0.0	0.0	5.3	0.0	0.0	29.1	0.0		
AVG:	18.0	11.0	5.9	0.0	0.0	0.0	0.0	11.0	951.1	0.0	0.0	0.0	0.0	0.0	0.0	8.6	0.3	0.0	55.5	0.0		
TOTAL:	6580	4004	2184	0			0	4004								3147	91	0	20296	9		

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**50% Exceedance (1962) - Median (Normal)**

-----DEMANDS-----																					
---Exist. Demands---										---Potential Demands---											
Month	WW Prod.	Geysers Delivery	Irrigation	River/NC Divers.	Temp Storage	Temp Sto Chg	Geys. Altern.	Geysers Total	Existing Storage	Urban Use	Urban Diversion	Urban Storage	RP Ag Use	RP Ag Diversion	RP Ag Storage	Laguna			Russian River		
																Laguna Flow	Laguna Disch.	Delta Pnd Back Flw	RR at Hacienda	RR Disch.	
Oct	18.0	11.7	7.6	0.0	0.0	0.0	0.0	11.7	326.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.9	0.0	0.0	108.1	0.0
Nov	18.7	12.1	0.0	0.0	0.0	0.0	0.0	12.1	397.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.8	0.8	0.0	323.0	0.2
Dec	21.2	12.1	0.0	0.0	0.0	0.0	0.0	12.1	418.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	142.2	7.6	0.0	1191.9	3.3
Jan	19.6	12.1	0.0	0.0	0.0	0.0	0.0	12.1	447.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.3	4.5	0.0	662.6	2.1
Feb	28.5	12.0	0.0	0.0	0.0	0.0	0.0	12.0	465.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	787.8	19.5	5.7	7106.5	10.6
Mar	25.6	9.9	0.0	0.0	0.0	0.0	0.0	9.9	282.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	333.5	7.3	2.4	3621.7	6.2
Apr	18.9	9.0	0.0	0.0	0.0	0.0	0.0	9.0	523.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	47.2	0.0	0.0	576.4	0.0
May	18.0	9.0	0.0	0.0	0.0	0.0	0.0	9.0	801.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.7	0.0	0.0	212.9	0.0
Jun	18.0	9.6	6.9	0.0	0.0	0.0	0.0	9.6	1007.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.6	0.0	0.0	126.4	0.0
Jul	18.0	11.0	15.5	0.0	0.0	0.0	0.0	11.0	842.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0	97.9	0.0
Aug	18.0	11.0	15.5	0.0	0.0	0.0	0.0	11.0	577.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0	100.5	0.0
Sep	18.0	11.0	10.8	0.0	0.0	0.0	0.0	11.0	389.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.0	104.9	0.0
AVG:	20.0	10.9	4.7	0.0	0.0	0.0	0.0	10.9	540.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	124.7	3.3	0.7	1186.1	1.9
TOTAL:	7304	3971	1728	0			0	3971									44098	1177	236	420543	668

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**1% Exceedance (1983) - Wet**

		-----DEMANDS-----																								
		---Exist. Demands---							---Potential Demands---												Laguna				Russian River	
Month	WW	Geysers	Irrigation	River/NC	Temp	Temp	Geys.	Geysers	Existing	Urban	Urban	Urban	RP Ag	RP Ag	RP Ag	Laguna	Laguna	Delta Pnd	RR at	RR						
Prod.	Delivery	Divers.	Storage	Sto	Chg	Altern.	Total	Storage	Use	Diversion	Storage	Use	Diversion	Storage	Flow	Disch.	Back Flw	Hacienda	Disch.							
Oct	18.6	11.7	6.1	0.0	0.0	0.0	0.0	11.7	542.8	0.0	0.0	0.0	0.0	0.0	0.0	49.8	0.0	0.0	256.8	0.0						
Nov	22.2	12.1	0.0	0.0	0.0	0.0	0.0	12.1	626.6	0.0	0.0	0.0	0.0	0.0	0.0	374.8	11.1	0.0	1951.6	2.1						
Dec	28.4	12.1	0.0	0.0	0.0	0.0	0.0	12.1	365.5	0.0	0.0	0.0	0.0	0.0	0.0	958.9	15.2	10.1	6639.8	17.0						
Jan	27.0	12.1	0.0	0.0	0.0	0.0	0.0	12.1	348.5	0.0	0.0	0.0	0.0	0.0	0.0	1108.5	14.2	13.3	5971.3	6.8						
Feb	31.5	12.0	0.0	0.0	0.0	0.0	0.0	12.0	429.7	0.0	0.0	0.0	0.0	0.0	0.0	1464.6	20.1	11.0	9309.2	9.6						
Mar	35.4	10.5	0.0	0.0	0.0	0.0	0.0	10.5	529.4	0.0	0.0	0.0	0.0	0.0	0.0	1886.5	35.1	12.1	12786.4	4.6						
Apr	26.1	9.0	0.0	0.0	0.0	0.0	0.0	9.0	701.2	0.0	0.0	0.0	0.0	0.0	0.0	592.1	0.6	0.0	4929.2	0.4						
May	24.8	9.0	2.6	0.0	0.0	0.0	0.0	9.0	1225.9	0.0	0.0	0.0	0.0	0.0	0.0	373.9	0.0	0.0	2598.5	0.0						
Jun	20.7	10.1	11.0	0.0	0.0	0.0	0.0	10.1	1356.6	0.0	0.0	0.0	0.0	0.0	0.0	122.3	0.0	0.0	643.1	0.0						
Jul	18.1	11.0	15.5	0.0	0.0	0.0	0.0	11.0	1213.7	0.0	0.0	0.0	0.0	0.0	0.0	41.8	0.0	0.0	231.5	0.0						
Aug	18.0	11.0	15.5	0.0	0.0	0.0	0.0	11.0	948.8	0.0	0.0	0.0	0.0	0.0	0.0	18.1	0.0	0.0	162.3	0.0						
Sep	18.0	11.0	10.8	0.0	0.0	0.0	0.0	11.0	761.3	0.0	0.0	0.0	0.0	0.0	0.0	18.8	0.0	0.0	148.4	0.0						
AVG:	24.1	11.0	5.1	0.0	0.0			11.0	754.2	0.0	0.0	0.0	0.0	0.0	0.0	584.2	8.0	3.9	3802.3	3.4						
TOTAL:	8780	4004	1883	0			0	4004								212181	2915	1411	1381193	1227						

**Selected Alternative-2006: Geysers = 400 MG (ADWF 18.0)**

**Basic Control Parameters**

ADWF 18.7 mgd  
Geyser PL Cap 40 mgd  
Laguna Ag 3553 acres

**Alternatives**

Geysers 11 mgd  
Urban no  
RP Ag no  
North County no MG

**Maximum Storage Summary (MG)**

	Dry	Normal	Wet
Laguna	1,339	859	1,242
Urban	0	0	0
Rohnert Park	0	0	0
North County	0	0	0
<b>Sum:</b>	<b>1,339</b>	<b>859</b>	<b>1,242</b>

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**99% Exceedance (1977) - Dry**

-----DEMANDS-----																			Sum		1,000		12.12			
---Exist. Demands---   ---Potential Demands---																			Laguna				Russian River			
Month	WW Prod.	Geysers Delivery	Irrigation	River/NC Divers.	Temp Storage	Temp Sto Chg	Geys. Altern.	Geysers Total	Existing Storage	Urban Use	Urban Diversion	Urban Storage	RP Ag Use	RP Ag Diversion	RP Ag Storage	Laguna Flow	Laguna Disch.	Delta Pnd Back Flw	RR at Hacienda	RR Disch.						
Oct	18.7	12.1	7.6	0.0	0.0	0.0	0.0	12.1	309.3	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	61.4	0.0						
Nov	18.7	12.1	0.0	0.0	0.0	0.0	0.0	12.1	395.1	0.0	0.0	0.0	0.0	0.0	0.0	7.9	0.0	0.0	71.1	0.0						
Dec	18.7	12.1	0.0	0.0	0.0	0.0	0.0	12.1	585.0	0.0	0.0	0.0	0.0	0.0	0.0	7.9	0.6	0.0	59.3	0.0						
Jan	18.8	12.1	0.0	0.0	0.0	0.0	0.0	12.1	764.7	0.0	0.0	0.0	0.0	0.0	0.0	14.4	0.7	0.0	69.2	0.0						
Feb	18.7	12.1	0.0	0.0	0.0	0.0	0.0	12.1	946.5	0.0	0.0	0.0	0.0	0.0	0.0	14.4	0.6	0.0	59.8	0.0						
Mar	18.8	12.1	0.0	0.0	0.0	0.0	0.0	12.1	1116.6	0.0	0.0	0.0	0.0	0.0	0.0	19.9	1.0	0.0	118.7	0.2						
Apr	18.7	12.1	0.0	0.0	0.0	0.0	0.0	12.1	1292.6	0.0	0.0	0.0	0.0	0.0	0.0	9.3	0.2	0.0	33.6	0.0						
May	18.7	12.0	9.6	0.0	0.0	0.0	0.0	12.0	1339.1	0.0	0.0	0.0	0.0	0.0	0.0	8.4	0.0	0.0	58.9	0.0						
Jun	18.7	12.0	12.2	0.0	0.0	0.0	0.0	12.0	1208.5	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0	40.3	0.0						
Jul	18.7	12.0	15.5	0.0	0.0	0.0	0.0	12.0	985.8	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	31.4	0.0						
Aug	18.7	12.0	15.5	0.0	0.0	0.0	0.0	12.0	711.2	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0	32.8	0.0						
Sep	18.7	12.0	10.8	0.0	0.0	0.0	0.0	12.0	514.3	0.0	0.0	0.0	0.0	0.0	0.0	5.3	0.0	0.0	29.1	0.0						
AVG:	18.7	12.1	5.9	0.0	0.0	0.0	0.0	12.1	847.4	0.0	0.0	0.0	0.0	0.0	0.0	8.6	0.3	0.0	55.5	0.0						
TOTAL:	6836	4404	2184	0			0	4404								3147	91	0	20296	9						

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**50% Exceedance (1962) - Median (Normal)**

-----DEMANDS-----																									
		---Exist. Demands---										---Potential Demands---									Laguna			Russian River	
Month	WW	Geysers	Irrigation	River/NC	Temp	Temp	Geys.	Geysers	Existing	Urban	Urban	Urban	RP Ag	RP Ag	RP Ag	Laguna	Laguna	Delta Pnd	RR at	RR					
	Prod.	Delivery		Divers.	Storage	Sto Chg	Altern.	Total	Storage	Use	Diversion	Storage	Use	Diversion	Storage	Flow	Disch.	Back Flw	Hacienda	Disch.					
Oct	18.7	12.1	7.6	0.0	0.0	0.0	0.0	12.1	230.3	0.0	0.0	0.0	0.0	0.0	0.0	5.9	0.0	0.0	108.1	0.0					
Nov	19.5	12.1	0.0	0.0	0.0	0.0	0.0	12.1	315.8	0.0	0.0	0.0	0.0	0.0	0.0	56.8	0.8	0.0	323.0	0.2					
Dec	22.0	12.1	0.0	0.0	0.0	0.0	0.0	12.1	380.9	0.0	0.0	0.0	0.0	0.0	0.0	142.2	7.1	0.0	1191.9	3.2					
Jan	20.3	12.1	0.0	0.0	0.0	0.0	0.0	12.1	433.4	0.0	0.0	0.0	0.0	0.0	0.0	80.3	4.5	0.0	662.6	2.1					
Feb	29.7	12.1	0.0	0.0	0.0	0.0	0.0	12.1	471.2	0.0	0.0	0.0	0.0	0.0	0.0	787.8	19.7	5.6	7106.5	10.8					
Mar	26.6	12.1	0.0	0.0	0.0	0.0	0.0	12.1	278.4	0.0	0.0	0.0	0.0	0.0	0.0	333.5	7.4	2.3	3621.7	6.3					
Apr	19.6	12.1	0.0	0.0	0.0	0.0	0.0	12.1	456.4	0.0	0.0	0.0	0.0	0.0	0.0	47.2	0.0	0.0	576.4	0.0					
May	18.7	12.1	0.0	0.0	0.0	0.0	0.0	12.1	661.8	0.0	0.0	0.0	0.0	0.0	0.0	21.7	0.0	0.0	212.9	0.0					
Jun	18.7	12.1	1.7	0.0	0.0	0.0	0.0	12.1	858.7	0.0	0.0	0.0	0.0	0.0	0.0	7.6	0.0	0.0	126.4	0.0					
Jul	18.7	12.0	15.5	0.0	0.0	0.0	0.0	12.0	766.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0	97.9	0.0					
Aug	18.7	12.0	15.5	0.0	0.0	0.0	0.0	12.0	491.4	0.0	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0	100.5	0.0					
Sep	18.7	12.0	10.8	0.0	0.0	0.0	0.0	12.0	294.6	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.0	104.9	0.0					
AVG:	20.8	12.1	4.3	0.0	0.0		0.0	12.1	469.9	0.0	0.0	0.0	0.0	0.0	0.0	124.7	3.3	0.7	1186.1	1.9					
TOTAL:	7588	4410	1572	0			0	4410								44098	1169	230	420543	669					

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**1% Exceedance (1983) - Wet**

		-----DEMANDS-----																			Laguna			Russian River	
		---Exist. Demands---				---Potential Demands---																			
Month	WW	Geysers	Irrigation	River/NC	Temp	Temp	Geys.	Geysers	Existing	Urban	Urban	Urban	RP Ag	RP Ag	RP Ag	Laguna	Laguna	Delta Pnd	RR at	RR					
	Prod.	Delivery		Divers.	Storage	Sto Chg	Altern.	Total	Storage	Use	Diversion	Storage	Use	Diversion	Storage	Flow	Disch.	Back Flw	Hacienda	Disch.					
Oct	19.3	12.1	6.1	0.0	0.0	0.0	0.0	12.1	381.5	0.0	0.0	0.0	0.0	0.0	0.0	49.8	0.0	0.0	256.8	0.0					
Nov	23.1	12.1	0.0	0.0	0.0	0.0	0.0	12.1	486.3	0.0	0.0	0.0	0.0	0.0	0.0	374.8	9.4	0.0	1951.6	1.6					
Dec	29.5	12.1	0.0	0.0	0.0	0.0	0.0	12.1	354.1	0.0	0.0	0.0	0.0	0.0	0.0	958.9	14.4	10.3	6639.8	16.7					
Jan	28.1	12.1	0.0	0.0	0.0	0.0	0.0	12.1	362.5	0.0	0.0	0.0	0.0	0.0	0.0	1108.5	14.9	13.1	5971.3	6.9					
Feb	32.7	12.1	0.0	0.0	0.0	0.0	0.0	12.1	437.8	0.0	0.0	0.0	0.0	0.0	0.0	1464.6	20.7	10.7	9309.2	9.7					
Mar	36.8	12.1	0.0	0.0	0.0	0.0	0.0	12.1	529.8	0.0	0.0	0.0	0.0	0.0	0.0	1886.5	35.1	12.1	12786.4	4.6					
Apr	27.1	12.1	0.0	0.0	0.0	0.0	0.0	12.1	692.6	0.0	0.0	0.0	0.0	0.0	0.0	592.1	0.0	0.0	4929.2	0.0					
May	25.7	12.0	2.6	0.0	0.0	0.0	0.0	12.0	1160.7	0.0	0.0	0.0	0.0	0.0	0.0	373.9	0.0	0.0	2598.5	0.0					
Jun	21.5	12.0	11.0	0.0	0.0	0.0	0.0	12.0	1242.1	0.0	0.0	0.0	0.0	0.0	0.0	122.3	0.0	0.0	643.1	0.0					
Jul	18.8	12.0	15.5	0.0	0.0	0.0	0.0	12.0	1078.4	0.0	0.0	0.0	0.0	0.0	0.0	41.8	0.0	0.0	231.5	0.0					
Aug	18.7	12.0	15.5	0.0	0.0	0.0	0.0	12.0	803.9	0.0	0.0	0.0	0.0	0.0	0.0	18.1	0.0	0.0	162.3	0.0					
Sep	18.7	12.0	10.8	0.0	0.0	0.0	0.0	12.0	607.1	0.0	0.0	0.0	0.0	0.0	0.0	18.8	0.0	0.0	148.4	0.0					
AVG:	25.0	12.1	5.1	0.0	0.0		0.0	12.1	678.1	0.0	0.0	0.0	0.0	0.0	0.0	584.2	7.9	3.8	3802.3	3.3					
TOTAL:	9122	4405	1883	0			0	4405								212181	2864	1402	1381193	1199					

**Selected Alternative-2007: Geysers (400) + Urban (80) (ADWF 19.3)**

**Basic Control Parameters**

ADWF 19.3 mgd  
 Geyser PL Cap 40 mgd  
 Laguna Ag 3553 acres

**Alternatives**

Geysers 12.1 mgd  
 Urban 80  
 RP Ag no  
 North County no MG

**Maximum Storage Summary (MG)**

	Dry	Normal	Wet
Laguna	1,486	914	1,269
Urban	0	0	0
Rohnert Park	0	0	0
North County	0	0	0
Sum:	1,486	914	1,269

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**99% Exceedance (1977) - Dry**

-----DEMANDS-----																	Sum		7,100		7,100	
---Exist. Demands---   ---Potential Demands---																	Laguna				Russian River	
Month	WW Prod.	Geysers Delivery	Irrigation	River/NC Divers.	Temp Storage	Temp Sto Chg	Geys. Altern.	Geysers Total	Existing Storage	Urban Use	Urban Diversion	Urban Storage	RP Ag Use	RP Ag Diversion	RP Ag Storage	Laguna Flow	Laguna Disch.	Delta Pnd Back Flw	RR at Hacienda	RR Disch.		
Oct	19.3	12.1	7.6	0.0	0.0	0.0	0.0	12.1	348.3	0.3	0.3	0.0	0.0	0.0	0.0	6.0	0.0	0.0	61.4	0.0		
Nov	19.3	12.1	0.0	0.0	0.0	0.0	0.0	12.1	446.8	0.1	0.1	0.0	0.0	0.0	0.0	7.9	0.0	0.0	71.1	0.0		
Dec	19.3	12.1	0.0	0.0	0.0	0.0	0.0	12.1	652.8	0.0	0.0	0.0	0.0	0.0	0.0	7.9	0.6	0.0	59.3	0.0		
Jan	19.4	12.1	0.0	0.0	0.0	0.0	0.0	12.1	850.2	0.0	0.0	0.0	0.0	0.0	0.0	14.4	0.7	0.0	69.2	0.0		
Feb	19.3	12.1	0.0	0.0	0.0	0.0	0.0	12.1	1049.1	0.0	0.0	0.0	0.0	0.0	0.0	14.4	0.6	0.0	59.8	0.0		
Mar	19.4	12.1	0.0	0.0	0.0	0.0	0.0	12.1	1235.7	0.1	0.1	0.0	0.0	0.0	0.0	19.9	1.0	0.0	118.7	0.2		
Apr	19.3	12.1	0.0	0.0	0.0	0.0	0.0	12.1	1426.9	0.2	0.2	0.0	0.0	0.0	0.0	9.3	0.2	0.0	33.6	0.0		
May	19.3	12.0	9.6	0.0	0.0	0.0	0.0	12.0	1485.5	0.3	0.3	0.0	0.0	0.0	0.0	8.4	0.0	0.0	58.9	0.0		
Jun	19.3	12.0	12.2	0.0	0.0	0.0	0.0	12.0	1363.5	0.4	0.4	0.0	0.0	0.0	0.0	3.4	0.0	0.0	40.3	0.0		
Jul	19.3	12.0	15.5	0.0	0.0	0.0	0.0	12.0	1146.0	0.5	0.5	0.0	0.0	0.0	0.0	2.8	0.0	0.0	31.4	0.0		
Aug	19.3	12.0	15.5	0.0	0.0	0.0	0.0	12.0	875.9	0.5	0.5	0.0	0.0	0.0	0.0	3.9	0.0	0.0	32.8	0.0		
Sep	19.3	12.0	10.8	0.0	0.0	0.0	0.0	12.0	684.4	0.4	0.4	0.0	0.0	0.0	0.0	5.3	0.0	0.0	29.1	0.0		
AVG:	19.3	12.1	5.9	0.0	0.0	0.0	0.0	12.1	963.8	0.2	0.2	0.0	0.0	0.0	0.0	8.6	0.3	0.0	55.5	0.0		
TOTAL:	7056	4404	2184	0			0	4404		80	80					3147	91	0	20296	9		

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**50% Exceedance (1962) - Median (Normal)**

-----DEMANDS-----																					
		---Exist. Demands---										---Potential Demands---									
Month	WW	Geysers	Irrigation	River/NC	Temp	Temp	Geys.	Geysers	Existing	Urban	Urban	Urban	RP Ag	RP Ag	RP Ag	Laguna			Russian River		
	Prod.	Delivery		Divers.	Storage	Sto Chg	Altern.	Total	Storage	Use	Diversion	Storage	Use	Diversion	Storage	Laguna Flow	Laguna Disch.	Delta Pnd Back Flw	RR at Hacienda	RR Disch.	
Oct	19.3	12.1	7.6	0.0	0.0	0.0	0.0	12.1	269.7	0.3	0.3	0.0	0.0	0.0	0.0	5.9	0.0	0.0	108.1	0.0	
Nov	20.1	12.1	0.0	0.0	0.0	0.0	0.0	12.1	367.9	0.1	0.1	0.0	0.0	0.0	0.0	56.8	0.8	0.0	323.0	0.2	
Dec	22.7	12.1	0.0	0.0	0.0	0.0	0.0	12.1	438.9	0.0	0.0	0.0	0.0	0.0	0.0	142.2	7.4	0.0	1191.9	3.3	
Jan	21.0	12.1	0.0	0.0	0.0	0.0	0.0	12.1	510.0	0.0	0.0	0.0	0.0	0.0	0.0	80.3	4.5	0.0	662.6	2.1	
Feb	30.6	12.1	0.0	0.0	0.0	0.0	0.0	12.1	502.7	0.0	0.0	0.0	0.0	0.0	0.0	787.8	22.1	4.3	7106.5	10.8	
Mar	27.5	12.1	0.0	0.0	0.0	0.0	0.0	12.1	291.0	0.0	0.0	0.0	0.0	0.0	0.0	333.5	7.7	2.3	3621.7	6.3	
Apr	20.2	12.1	0.0	0.0	0.0	0.0	0.0	12.1	489.1	0.0	0.0	0.0	0.0	0.0	0.0	47.2	0.0	0.0	576.4	0.0	
May	19.3	12.1	0.0	0.0	0.0	0.0	0.0	12.1	712.9	0.0	0.0	0.0	0.0	0.0	0.0	21.7	0.0	0.0	212.9	0.0	
Jun	19.3	12.1	3.6	0.0	0.0	0.0	0.0	12.1	914.4	0.1	0.1	0.0	0.0	0.0	0.0	7.6	0.0	0.0	126.4	0.0	
Jul	19.3	12.0	15.5	0.0	0.0	0.0	0.0	12.0	786.6	0.5	0.5	0.0	0.0	0.0	0.0	3.8	0.0	0.0	97.9	0.0	
Aug	19.3	12.0	15.5	0.0	0.0	0.0	0.0	12.0	516.5	0.5	0.5	0.0	0.0	0.0	0.0	4.2	0.0	0.0	100.5	0.0	
Sep	19.3	12.0	10.8	0.0	0.0	0.0	0.0	12.0	325.0	0.4	0.4	0.0	0.0	0.0	0.0	5.1	0.0	0.0	104.9	0.0	
AVG:	21.5	12.1	4.4	0.0	0.0	0.0	0.0	12.1	510.4	0.2	0.2	0.0	0.0	0.0	0.0	124.7	3.5	0.6	1186.1	1.9	
TOTAL:	7831	4410	1628	0			0	4410		58	58					44098	1255	193	420543	676	

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**1% Exceedance (1983) - Wet**

		-----DEMANDS-----																		
		---Exist. Demands---							---Potential Demands---											
Month	WW Prod.	Geysers	Irrigation	River/NC	Temp	Temp	Geys.	Geysers	Existing	Urban	Urban	Urban	RP Ag	RP Ag	RP Ag	Laguna			Russian River	
		Delivery		Divers.	Storage	Sto Chg	Altern.	Total	Storage	Use	Diversion	Storage	Use	Diversion	Storage	Laguna Flow	Laguna Disch.	Delta Pnd Back Flw	RR at Hacienda	RR Disch.
Oct	19.9	12.1	6.1	0.0	0.0	0.0	0.0	12.1	441.1	0.3	0.3	0.0	0.0	0.0	0.0	49.8	0.0	0.0	256.8	0.0
Nov	23.8	12.1	0.0	0.0	0.0	0.0	0.0	12.1	558.0	0.1	0.1	0.0	0.0	0.0	0.0	374.8	10.5	0.0	1951.6	1.9
Dec	30.5	12.1	0.0	0.0	0.0	0.0	0.0	12.1	367.4	0.0	0.0	0.0	0.0	0.0	0.0	958.9	15.0	9.2	6639.8	17.0
Jan	28.9	12.1	0.0	0.0	0.0	0.0	0.0	12.1	375.7	0.0	0.0	0.0	0.0	0.0	0.0	1108.5	15.2	12.8	5971.3	7.1
Feb	33.8	12.1	0.0	0.0	0.0	0.0	0.0	12.1	440.8	0.0	0.0	0.0	0.0	0.0	0.0	1464.6	20.7	9.7	9309.2	9.9
Mar	38.0	12.1	0.0	0.0	0.0	0.0	0.0	12.1	534.6	0.1	0.1	0.0	0.0	0.0	0.0	1886.5	35.8	11.8	12786.4	4.9
Apr	28.0	12.1	0.0	0.0	0.0	0.0	0.0	12.1	687.3	0.0	0.0	0.0	0.0	0.0	0.0	592.1	0.6	0.0	4929.2	0.3
May	26.6	12.0	2.6	0.0	0.0	0.0	0.0	12.0	1175.2	0.2	0.2	0.0	0.0	0.0	0.0	373.9	0.0	0.0	2598.5	0.0
Jun	22.2	12.0	11.0	0.0	0.0	0.0	0.0	12.0	1268.9	0.4	0.4	0.0	0.0	0.0	0.0	122.3	0.0	0.0	643.1	0.0
Jul	19.4	12.0	15.5	0.0	0.0	0.0	0.0	12.0	1111.9	0.5	0.5	0.0	0.0	0.0	0.0	41.8	0.0	0.0	231.5	0.0
Aug	19.3	12.0	15.5	0.0	0.0	0.0	0.0	12.0	841.9	0.5	0.5	0.0	0.0	0.0	0.0	18.1	0.0	0.0	162.3	0.0
Sep	19.3	12.0	10.8	0.0	0.0	0.0	0.0	12.0	650.4	0.4	0.4	0.0	0.0	0.0	0.0	18.8	0.0	0.0	148.4	0.0
AVG:	25.8	12.1	5.1	0.0	0.0	0.0	0.0	12.1	704.4	0.2	0.2	0.0	0.0	0.0	0.0	584.2	8.1	3.6	3802.3	3.4
TOTAL:	9415	4405	1883	0			0	4405		75	75					212181	2963	1321	1381193	1244

**Selected Alternative-2008: Geysers (400) + Urban (80) (ADWF 20.0)**

**Basic Control Parameters**

ADWF 20 mgd  
Geysers PL Cap 40 mgd  
Laguna Ag 4730 acres

**Alternatives**

Geysers 12.1 mgd  
Urban 80  
RP Ag no  
North County no MG

**Maximum Storage Summary (MG)**

	Dry	Normal	Wet
Laguna	1,300	960	1,240
Urban	50	50	50
Rohnert Park	0	0	0
North County	0	0	0
Sum:	1,350	1,010	1,290

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**99% Exceedance (1977) - Dry**

-----DEMANDS-----																	Sum		1976		1978					
---Exist. Demands---																	---Potential Demands---									
Month	WW Prod.	Geysers		Irrigation	River/NC Divers.		Temp Storage	Temp Sto Chg	Geys. Altern.	Geysers Total	Existing Storage	Urban Use	Urban Diversion	Urban Storage	RP Ag Use	RP Ag Diversion	RP Ag Storage	Laguna			Russian River					
		Delivery																	Laguna Flow	Laguna Disch.	Delta Pnd Back Flw	RR at Hacienda	RR Disch.			
Oct	20.0	12.1	7.9	0.0	0.0	0.0	0.0	0.0	12.1	120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	61.4	0.0				
Nov	20.0	12.1	0.0	0.0	0.0	0.0	0.0	0.0	12.1	194.7	0.1	0.1	45.4	0.0	0.0	0.0	0.0	7.9	0.0	0.0	71.1	0.0				
Dec	20.0	12.1	0.0	0.0	0.0	0.0	0.0	0.0	12.1	417.4	0.0	0.0	50.0	0.0	0.0	0.0	0.0	7.9	0.6	0.0	59.3	0.0				
Jan	20.1	12.1	0.0	0.0	0.0	0.0	0.0	0.0	12.1	636.6	0.0	0.0	50.0	0.0	0.0	0.0	0.0	14.4	0.7	0.0	69.2	0.0				
Feb	20.0	12.1	0.0	0.0	0.0	0.0	0.0	0.0	12.1	856.2	0.0	0.0	50.0	0.0	0.0	0.0	0.0	14.4	0.6	0.0	59.8	0.0				
Mar	20.2	12.1	0.0	0.0	0.0	0.0	0.0	0.0	12.1	1063.5	0.1	0.1	50.0	0.0	0.0	0.0	0.0	19.9	1.0	0.0	118.7	0.2				
Apr	20.0	12.1	0.0	0.0	0.0	0.0	0.0	0.0	12.1	1276.1	0.2	0.2	50.0	0.0	0.0	0.0	0.0	9.3	0.2	0.0	33.6	0.0				
May	20.0	12.0	13.1	0.0	0.0	0.0	0.0	0.0	12.0	1300.0	0.3	0.3	50.0	0.0	0.0	0.0	0.0	8.4	0.0	0.0	58.9	0.0				
Jun	20.0	12.0	16.7	0.0	0.0	0.0	0.0	0.0	12.0	1077.4	0.4	0.4	50.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0	40.3	0.0				
Jul	20.0	12.0	21.2	0.0	0.0	0.0	0.0	0.0	12.0	725.7	0.5	0.5	50.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	31.4	0.0				
Aug	20.0	12.0	19.3	0.0	0.0	0.0	0.0	0.0	12.0	327.6	0.5	0.7	46.7	0.0	0.0	0.0	0.0	3.9	0.0	0.0	32.8	0.0				
Sep	20.0	12.0	10.1	0.0	0.0	0.0	0.0	0.0	12.0	146.3	0.4	0.8	34.5	0.0	0.0	0.0	0.0	5.3	0.0	0.0	29.1	0.0				
AVG:	20.0	12.1	7.4	0.0	0.0	0.0	0.0	0.0	12.1	678.5	0.2	0.3	43.9	0.0	0.0	0.0	0.0	8.6	0.3	0.0	55.5	0.0				
TOTAL:	7312	4404	2711	0			0	0	4404		72							3147	91	0	20296	9				

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**50% Exceedance (1962) - Median (Normal)**

-----DEMANDS-----																				
---Exist. Demands---										---Potential Demands---										
Month	WW Prod.	Geysers	Irrigation	River/NC	Temp	Temp	Geys.	Geysers	Existing	Urban	Urban	Urban	RP Ag	RP Ag	RP Ag	Laguna			Russian River	
		Delivery		Divers.	Storage	Sto Chg	Altern.	Total	Storage	Use	Diversion	Storage	Use	Diversion	Storage	Laguna Flow	Laguna Disch.	Delta Pnd Back Flw	RR at Hacienda	RR Disch.
Oct	20.0	12.1	7.9	0.0	0.0	0.0	0.0	12.1	120.0	0.0	0.0	0.0	0.0	0.0	0.0	5.9	0.0	0.0	108.1	0.0
Nov	20.8	12.1	0.0	0.0	0.0	0.0	0.0	12.1	194.5	0.1	0.1	45.4	0.0	0.0	0.0	56.8	0.8	0.0	323.0	0.2
Dec	23.6	12.1	0.0	0.0	0.0	0.0	0.0	12.1	372.6	0.0	0.0	50.0	0.0	0.0	0.0	142.2	6.6	1.9	1191.9	3.2
Jan	21.7	12.1	0.0	0.0	0.0	0.0	0.0	12.1	468.5	0.0	0.0	50.0	0.0	0.0	0.0	80.3	4.5	0.0	662.6	2.1
Feb	31.7	12.1	0.0	0.0	0.0	0.0	0.0	12.1	498.9	0.0	0.0	50.0	0.0	0.0	0.0	787.8	21.5	4.3	7106.5	11.0
Mar	28.5	12.1	0.0	0.0	0.0	0.0	0.0	12.1	302.2	0.1	0.1	49.9	0.0	0.0	0.0	333.5	8.4	2.2	3621.7	6.4
Apr	20.9	12.1	0.0	0.0	0.0	0.0	0.0	12.1	519.7	0.2	0.4	47.0	0.0	0.0	0.0	47.2	0.0	0.0	576.4	0.0
May	20.0	12.1	0.0	0.0	0.0	0.0	0.0	12.1	771.2	0.3	0.6	40.8	0.0	0.0	0.0	21.7	0.0	0.0	212.9	0.0
Jun	20.0	12.1	7.8	0.0	0.0	0.0	0.0	12.1	959.5	0.4	0.6	34.1	0.0	0.0	0.0	7.6	0.0	0.0	126.4	0.0
Jul	20.0	12.0	21.2	0.0	0.0	0.0	0.0	12.0	678.3	0.5	0.9	32.1	0.0	0.0	0.0	3.8	0.0	0.0	97.9	0.0
Aug	20.0	12.0	18.3	0.0	0.0	0.0	0.0	12.0	320.9	0.5	0.9	19.1	0.0	0.0	0.0	4.2	0.0	0.0	100.5	0.0
Sep	20.0	12.0	10.1	0.0	0.0	0.0	0.0	12.0	146.3	0.4	0.8	6.1	0.0	0.0	0.0	5.1	0.0	0.0	104.9	0.0
AVG:	22.3	12.1	5.4	0.0	0.0	0.0	0.0	12.1	446.1	0.2	0.4	35.4	0.0	0.0	0.0	124.7	3.5	0.7	1186.1	1.9
TOTAL:	8115	4409	2007	0			0	4409		72						44098	1238	250	420543	678

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**1% Exceedance (1983) - Wet**

		-----DEMANDS-----																			
		---Exist. Demands---								---Potential Demands---											
Month	WW Prod.	Geysers Delivery	Irrigation	River/NC Divers.	Temp Storage	Temp Sto Chg	Geys. Altern.	Geysers Total	Existing Storage	Urban Use	Urban Diversion	Urban Storage	RP Ag Use	RP Ag Diversion	RP Ag Storage	Laguna			Russian River		
																	Laguna Flow	Laguna Disch.	Delta Pnd Back Flw	RR at Hacienda	RR Disch.
Oct	20.6	12.1	6.4	0.0	0.0	0.0	0.0	12.1	120.6	0.1	0.1	6.9	0.0	0.0	0.0	0.0	49.8	0.0	0.0	256.8	0.0
Nov	24.7	12.1	0.0	0.0	0.0	0.0	0.0	12.1	245.6	0.1	0.1	50.0	0.0	0.0	0.0	0.0	374.8	6.7	3.3	1951.6	1.6
Dec	31.6	12.1	0.0	0.0	0.0	0.0	0.0	12.1	349.2	0.0	0.0	50.0	0.0	0.0	0.0	0.0	958.9	13.9	10.2	6639.8	16.4
Jan	30.0	12.1	0.0	0.0	0.0	0.0	0.0	12.1	394.2	0.0	0.0	50.0	0.0	0.0	0.0	0.0	1108.5	15.4	12.3	5971.3	7.4
Feb	35.0	12.1	0.0	0.0	0.0	0.0	0.0	12.1	449.6	0.0	0.0	50.0	0.0	0.0	0.0	0.0	1464.6	21.7	9.4	9309.2	10.0
Mar	39.4	12.1	0.0	0.0	0.0	0.0	0.0	12.1	539.3	0.1	0.1	50.0	0.0	0.0	0.0	0.0	1886.5	36.6	11.5	12786.4	5.2
Apr	29.0	12.1	0.0	0.0	0.0	0.0	0.0	12.1	695.0	0.2	0.3	48.4	0.0	0.0	0.0	0.0	592.1	1.0	0.0	4929.2	0.5
May	27.5	12.0	3.6	0.0	0.0	0.0	0.0	12.0	1207.4	0.3	0.3	49.4	0.0	0.0	0.0	0.0	373.9	0.0	0.0	2598.5	0.0
Jun	23.0	12.0	15.0	0.0	0.0	0.0	0.0	12.0	1240.1	0.4	0.4	50.0	0.0	0.0	0.0	0.0	122.3	0.0	0.0	643.1	0.0
Jul	20.2	12.0	21.2	0.0	0.0	0.0	0.0	12.0	956.0	0.5	0.5	50.0	0.0	0.0	0.0	0.0	41.8	0.0	0.0	231.5	0.0
Aug	20.0	12.0	21.2	0.0	0.0	0.0	0.0	12.0	532.0	0.5	0.5	50.0	0.0	0.0	0.0	0.0	18.1	0.0	0.0	162.3	0.0
Sep	20.0	12.0	14.4	0.0	0.0	0.0	0.0	12.0	216.1	0.4	0.4	50.0	0.0	0.0	0.0	0.0	18.8	0.0	0.0	148.4	0.0
AVG:	26.7	12.1	6.8	0.0	0.0	0.0	0.0	12.1	578.8	0.2	0.2	46.2	0.0	0.0	0.0	0.0	584.2	7.9	3.9	3802.3	3.4
TOTAL:	9756	4405	2507	0			0	4405		73	80						212181	2887	1419	1381193	1246

**Selected Alternative-2010: Geysers (400)+Urban (80)+Ag Re-growth (800 MG)+River Discharge (4850): ADWF 21.3**

**Basic Control Parameters**

ADWF	21.3 mgd
Geysers PL Cap	80 mgd
Laguna Ag	4730 acres

**Alternatives**

Geysers	12.1 mgd
Urban	80
RP Ag	no
North County	no MG

**Maximum Storage Summary (MG)**

	Dry	Normal	Wet
Laguna	1,549	1,011	1,376
Urban	50	50	50
Rohnert Park	0	0	0
North County	0	0	0
Sum:	1,599	1,061	1,426

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**99% Exceedance (1977) - Dry**

-----DEMANDS-----																					
---Exist. Demands---										---Potential Demands---											
Month	WW Prod.	Geysers Delivery	Irrigation	River/NC Divers.	Temp Storage	Temp Sto Chg	Geys. Altern.	Geysers Total	Existing Storage	Urban Use	Urban Diversion	Urban Storage	RP Ag Use	RP Ag Diversion	RP Ag Storage	Laguna			Russian River		
																Laguna Flow	Laguna Disch.	Delta Pnd Back Flw	RR at Hacienda	RR Disch.	
Oct	21.3	12.1	9.2	0.0	0.0	0.0	0.0	12.1	120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	61.4	0.0
Nov	21.3	12.1	0.0	0.0	0.0	0.0	0.0	12.1	214.0	0.1	0.1	46.2	0.0	0.0	0.0	0.0	7.9	0.0	0.0	71.1	0.0
Dec	21.3	12.1	0.0	0.0	0.0	0.0	0.0	12.1	477.2	0.0	0.0	50.0	0.0	0.0	0.0	0.0	7.9	0.6	0.0	59.3	0.0
Jan	21.4	12.1	0.0	0.0	0.0	0.0	0.0	12.1	736.8	0.0	0.0	50.0	0.0	0.0	0.0	0.0	14.4	0.7	0.0	69.2	0.0
Feb	21.3	12.1	0.0	0.0	0.0	0.0	0.0	12.1	994.7	0.0	0.0	50.0	0.0	0.0	0.0	0.0	14.4	0.6	0.0	59.8	0.0
Mar	21.5	12.1	0.0	0.0	0.0	0.0	0.0	12.1	1240.6	0.1	0.1	50.0	0.0	0.0	0.0	0.0	19.9	1.0	0.0	118.7	0.2
Apr	21.3	12.1	0.0	0.0	0.0	0.0	0.0	12.1	1489.2	0.2	0.2	50.0	0.0	0.0	0.0	0.0	9.3	0.3	0.0	33.6	0.1
May	21.3	12.0	13.1	0.0	0.0	0.0	0.0	12.0	1549.4	0.3	0.3	50.0	0.0	0.0	0.0	0.0	8.4	0.0	0.0	58.9	0.0
Jun	21.3	12.0	16.7	0.0	0.0	0.0	0.0	12.0	1366.4	0.4	0.4	50.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0	40.3	0.0
Jul	21.3	12.0	21.2	0.0	0.0	0.0	0.0	12.0	1054.4	0.5	0.5	50.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	31.4	0.0
Aug	21.3	12.0	21.2	0.0	0.0	0.0	0.0	12.0	670.5	0.5	0.5	50.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0	32.8	0.0
Sep	21.3	12.0	14.7	0.0	0.0	0.0	0.0	12.0	393.9	0.4	0.4	50.0	0.0	0.0	0.0	0.0	5.3	0.0	0.0	29.1	0.0
AVG:	21.3	12.1	8.0	0.0	0.0	0.0	0.0	12.1	858.9	0.2	0.2	45.5	0.0	0.0	0.0	0.0	8.6	0.3	0.0	55.5	0.0
TOTAL:	7787	4404	2948	0	0	0	0	4404		72							3147	94	0	20296	14

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**50% Exceedance (1962) - Median (Normal)**

-----DEMANDS-----																					
		---Exist. Demands---										---Potential Demands---									
Month	WW	Geysers	Irrigation	River/NC	Temp	Temp	Geys.	Geysers	Existing	Urban	Urban	Urban	RP Ag	RP Ag	RP Ag	Laguna			Russian River		
	Prod.	Delivery		Divers.	Storage	Sto Chg	Altern.	Total	Storage	Use	Divers	Storage	Use	Divers	Storage	Laguna Flow	Laguna Disch.	Delta Pnd Back Flw	RR at Hacienda	RR Disch.	
Oct	21.3	12.1	9.2	0.0	0.0	0.0	0.0	12.1	120.0	0.0	0.0	0.0	0.0	0.0	0.0	5.9	0.0	0.0	108.1	0.0	
Nov	22.2	12.1	0.0	0.0	0.0	0.0	0.0	12.1	214.1	0.1	0.1	46.2	0.0	0.0	0.0	56.8	0.8	0.0	323.0	0.2	
Dec	25.1	12.1	0.0	0.0	0.0	0.0	0.0	12.1	406.5	0.0	0.0	50.0	0.0	0.0	0.0	142.2	6.7	1.0	1191.9	3.2	
Jan	23.2	12.1	0.0	0.0	0.0	0.0	0.0	12.1	544.9	0.0	0.0	50.0	0.0	0.0	0.0	80.3	4.5	0.0	662.6	2.1	
Feb	33.8	12.1	0.0	0.0	0.0	0.0	0.0	12.1	550.8	0.0	0.0	50.0	0.0	0.0	0.0	787.8	25.1	3.8	7106.5	11.3	
Mar	30.3	12.1	0.0	0.0	0.0	0.0	0.0	12.1	321.6	0.1	0.1	49.9	0.0	0.0	0.0	333.5	9.9	2.0	3621.7	6.5	
Apr	22.3	12.1	0.0	0.0	0.0	0.0	0.0	12.1	568.9	0.2	0.4	47.2	0.0	0.0	0.0	47.2	0.0	0.0	576.4	0.0	
May	21.3	12.1	0.0	0.0	0.0	0.0	0.0	12.1	860.3	0.3	0.6	41.0	0.0	0.0	0.0	21.7	0.0	0.0	212.9	0.0	
Jun	21.3	12.0	11.5	0.0	0.0	0.0	0.0	12.0	1011.4	0.4	0.5	42.8	0.0	0.0	0.0	7.6	0.0	0.0	126.4	0.0	
Jul	21.3	12.0	21.2	0.0	0.0	0.0	0.0	12.0	714.3	0.5	0.5	50.0	0.0	0.0	0.0	3.8	0.0	0.0	97.9	0.0	
Aug	21.3	12.0	20.6	0.0	0.0	0.0	0.0	12.0	336.0	0.5	0.6	48.9	0.0	0.0	0.0	4.2	0.0	0.0	100.5	0.0	
Sep	21.3	12.0	11.4	0.0	0.0	0.0	0.0	12.0	146.3	0.4	0.8	38.4	0.0	0.0	0.0	5.1	0.0	0.0	104.9	0.0	
AVG:	23.7	12.1	6.2	0.0	0.0	0.0	0.0	12.1	482.9	0.2	0.3	42.9	0.0	0.0	0.0	124.7	3.9	0.6	1186.1	1.9	
TOTAL:	8643	4408	2271	0			0	4408		72						44098	1391	197	420543	693	

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**1% Exceedance (1983) - Wet**

		-----DEMANDS-----																		
		---Exist. Demands---							---Potential Demands---											
Month	WW	Geysers	Irrigation	River/NC	Temp	Temp	Geys.	Geysers	Existing	Urban	Urban	Urban	RP Ag	RP Ag	RP Ag	Laguna			Russian River	
		Delivery		Divers.	Storage	Sto Chg	Altern.	Total	Storage	Use	Divers	Storage	Use	Divers	Storage	Laguna Flow	Laguna Disch.	Delta Pnd Back Flw	RR at Hacienda	RR Disch.
Oct	22.0	12.1	7.8	0.0	0.0	0.0	0.0	12.1	128.4	0.3	0.4	48.3	0.0	0.0	0.0	49.8	0.0	0.0	256.8	0.0
Nov	26.3	12.1	0.0	0.0	0.0	0.0	0.0	12.1	312.3	0.1	0.1	50.0	0.0	0.0	0.0	374.8	7.3	1.0	1951.6	1.6
Dec	33.6	12.1	0.0	0.0	0.0	0.0	0.0	12.1	364.0	0.0	0.0	50.0	0.0	0.0	0.0	958.9	14.3	8.8	6639.8	16.7
Jan	31.9	12.1	0.0	0.0	0.0	0.0	0.0	12.1	423.9	0.0	0.0	50.0	0.0	0.0	0.0	1108.5	16.0	10.9	5971.3	7.6
Feb	37.3	12.1	0.0	0.0	0.0	0.0	0.0	12.1	454.5	0.0	0.0	50.0	0.0	0.0	0.0	1464.6	22.4	7.4	9309.2	10.2
Mar	41.9	12.1	0.0	0.0	0.0	0.0	0.0	12.1	543.0	0.1	0.1	50.0	0.0	0.0	0.0	1886.5	37.4	10.4	12786.4	5.3
Apr	30.9	12.1	0.0	0.0	0.0	0.0	0.0	12.1	718.6	0.2	0.3	48.7	0.0	0.0	0.0	592.1	1.8	0.0	4929.2	0.0
May	29.3	12.0	3.6	0.0	0.0	0.0	0.0	12.0	1295.2	0.3	0.3	49.9	0.0	0.0	0.0	373.9	0.0	0.0	2598.5	0.0
Jun	24.5	12.0	15.0	0.0	0.0	0.0	0.0	12.0	1375.9	0.4	0.4	50.0	0.0	0.0	0.0	122.3	0.0	0.0	643.1	0.0
Jul	21.5	12.0	21.2	0.0	0.0	0.0	0.0	12.0	1134.5	0.5	0.5	50.0	0.0	0.0	0.0	41.8	0.0	0.0	231.5	0.0
Aug	21.3	12.0	21.2	0.0	0.0	0.0	0.0	12.0	750.8	0.5	0.5	50.0	0.0	0.0	0.0	18.1	0.0	0.0	162.3	0.0
Sep	21.3	12.0	14.7	0.0	0.0	0.0	0.0	12.0	474.1	0.4	0.4	50.0	0.0	0.0	0.0	18.8	0.0	0.0	148.4	0.0
AVG:	28.5	12.1	7.0	0.0	0.0			12.1	664.6	0.2	0.2	49.7	0.0	0.0	0.0	584.2	8.3	3.2	3802.3	3.5
TOTAL:	10389	4404	2558	0			0	4404		80	90					212181	3005	1177	1381193	1255

**Selected Alternative-2012: Geysers (400)+Urban (80)+Ag Re-growth (800 MG)+River Discharge (4850)+ERP (200): ADWF 22.2**

**Basic Control Parameters**

ADWF 22.2 mgd  
Geyser PL Cap 80 mgd  
Laguna Ag 4730 acres

**Alternatives**

Geysers 12.1 mgd  
Urban 80  
RP Ag 200  
North County no MG

**Maximum Storage Summary (MG)**

	Dry	Normal	Wet
Laguna	1,571	1,046	1,467
Urban	50	50	50
Rohnert Park	200	200	200
North County	0	0	0
Sum:	1,821	1,296	1,717

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**99% Exceedance (1977) - Dry**

-----DEMANDS----->																				
---Exist. Demands---										---Potential Demands--->										
Month	WW Prod.	Geysers Delivery	Irrigation	River/NC Divers.	Temp Storage	Temp Sto Chg	Geys. Altern.	Geysers Total	Existing Storage	Urban Use	Urban Diversion	Urban Storage	RP Ag Use	RP Ag Diversion	RP Ag Storage	Laguna			Russian River	
																Laguna Flow	Laguna Disch.	Delta Pnd Back Flw	RR at Hacienda	RR Disch.
Oct	22.2	12.1	10.4	0.0	0.0	0.0	0.0	12.1	120.0	0.3	0.6	46.1	0.3	0.6	2.2	6.0	0.0	0.0	61.4	0.0
Nov	22.2	12.1	0.0	0.0	0.0	0.0	0.0	12.1	135.3	0.1	0.1	50.0	0.0	6.6	131.1	7.9	0.0	0.0	71.1	0.0
Dec	22.2	12.1	0.0	0.0	0.0	0.0	0.0	12.1	360.8	0.0	0.0	50.0	0.0	0.0	200.0	7.9	0.6	0.0	59.3	0.0
Jan	22.3	12.1	0.0	0.0	0.0	0.0	0.0	12.1	648.4	0.0	0.0	50.0	0.0	0.0	200.0	14.4	0.7	0.0	69.2	0.0
Feb	22.2	12.1	0.0	0.0	0.0	0.0	0.0	12.1	932.9	0.0	0.0	50.0	0.0	0.0	200.0	14.4	0.6	0.0	59.8	0.0
Mar	22.4	12.1	0.0	0.0	0.0	0.0	0.0	12.1	1205.3	0.1	0.1	50.0	0.0	0.0	200.0	19.9	1.0	0.0	118.7	0.2
Apr	22.2	12.1	0.0	0.0	0.0	0.0	0.0	12.1	1482.4	0.2	0.2	50.0	0.0	0.0	200.0	9.3	0.3	0.0	33.6	0.1
May	22.2	12.0	13.1	0.0	0.0	0.0	0.0	12.0	1570.7	0.3	0.3	50.0	0.7	1.4	188.7	8.4	0.0	0.0	58.9	0.0
Jun	22.2	12.0	16.7	0.0	0.0	0.0	0.0	12.0	1415.1	0.4	0.4	50.0	1.4	2.8	156.4	3.4	0.0	0.0	40.3	0.0
Jul	22.2	12.0	21.2	0.0	0.0	0.0	0.0	12.0	1130.5	0.5	0.5	50.0	1.7	3.4	108.7	2.8	0.0	0.0	31.4	0.0
Aug	22.2	12.0	21.2	0.0	0.0	0.0	0.0	12.0	774.5	0.5	0.5	50.0	1.6	3.2	56.7	3.9	0.0	0.0	32.8	0.0
Sep	22.2	12.0	14.7	0.0	0.0	0.0	0.0	12.0	525.3	0.4	0.4	50.0	1.0	2.0	14.3	5.3	0.0	0.0	29.1	0.0
AVG:	22.2	12.1	8.1	0.0	0.0	0.0	0.0	12.1	858.4	0.2	0.2	49.7	0.6	1.7	138.2	8.6	0.3	0.0	55.5	0.0
TOTAL:	8116	4404	2985	0	0	0	0	4404		80						3147	93	0	20296	13

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**50% Exceedance (1962) - Median (Normal)**

-----DEMANDS----->																				
		---Exist. Demands---										---Potential Demands--->								
Month	WW Prod.	Geysers	Irrigation	River/NC	Temp	Temp	Geys.	Geysers	Existing	Urban	Urban	Urban	RP Ag	RP Ag	RP Ag	Laguna			Russian River	
		Delivery		Divers.	Storage	Sto Chg	Altern.	Total	Storage	Use	Diversion	Storage	Use	Diversion	Storage	Laguna Flow	Laguna Disch.	Delta Pnd Back Flw	RR at Hacienda	RR Disch.
Oct	22.2	12.1	10.1	0.0	0.0	0.0	0.0	12.1	120.0	0.0	0.1	0.1	0.0	0.0	0.0	5.9	0.0	0.0	108.1	0.0
Nov	23.1	12.1	0.0	0.0	0.0	0.0	0.0	12.1	126.2	0.1	0.1	46.6	0.0	6.6	102.8	56.8	0.6	1.1	323.0	0.2
Dec	26.1	12.1	0.0	0.0	0.0	0.0	0.0	12.1	364.6	0.0	0.0	50.0	0.0	0.0	200.0	142.2	6.0	2.6	1191.9	3.2
Jan	24.1	12.1	0.0	0.0	0.0	0.0	0.0	12.1	534.5	0.0	0.0	50.0	0.0	0.0	200.0	80.3	4.5	0.0	662.6	2.1
Feb	35.2	12.1	0.0	0.0	0.0	0.0	0.0	12.1	557.8	0.0	0.0	50.0	0.0	0.0	200.0	787.8	26.1	3.7	7106.5	11.4
Mar	31.6	12.1	0.0	0.0	0.0	0.0	0.0	12.1	331.3	0.1	0.1	49.9	0.0	0.0	200.0	333.5	11.2	1.9	3621.7	6.6
Apr	23.2	12.1	0.0	0.0	0.0	0.0	0.0	12.1	593.8	0.2	0.4	47.2	0.0	0.0	200.0	47.2	0.0	0.0	576.4	0.0
May	22.2	12.1	0.0	0.0	0.0	0.0	0.0	12.1	924.1	0.3	0.6	41.0	0.7	0.7	188.7	21.7	0.0	0.0	212.9	0.0
Jun	22.2	12.0	14.4	0.0	0.0	0.0	0.0	12.0	1046.4	0.4	0.5	46.6	1.4	2.6	156.4	7.6	0.0	0.0	126.4	0.0
Jul	22.2	12.0	21.2	0.0	0.0	0.0	0.0	12.0	762.7	0.5	0.5	50.0	1.7	3.4	108.7	3.8	0.0	0.0	97.9	0.0
Aug	22.2	12.0	21.2	0.0	0.0	0.0	0.0	12.0	406.7	0.5	0.5	50.0	1.6	3.2	56.7	4.2	0.0	0.0	100.5	0.0
Sep	22.2	12.0	14.1	0.0	0.0	0.0	0.0	12.0	164.7	0.4	0.6	49.0	1.0	1.7	14.3	5.1	0.0	0.0	104.9	0.0
AVG:	24.7	12.1	6.8	0.0	0.0	0.0	0.0	12.1	494.4	0.2	0.3	44.2	0.5	1.5	135.6	124.7	4.0	0.8	1186.1	2.0
TOTAL:	9008	4408	2485	0			0	4408		73						44098	1426	277	420543	698

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**1% Exceedance (1983) - Wet**

		-----DEMANDS----->																						
		---Exist. Demands---							---Potential Demands--->															
Month	WW Prod.	Geysers Delivery	Irrigation	River/NC Divers.	Temp Storage	Temp Sto Chg	Geys. Altern.	Geysers Total	Existing Storage	Urban Use	Urban Diversion	Urban Storage	RP Ag Use	RP Ag Diversion	RP Ag Storage	Laguna			Russian River					
																	Laguna Flow	Laguna Disch.	Delta Pnd Back Flw	RR at Hacienda	RR Disch.			
Oct	22.9	12.1	8.3	0.0	0.0	0.0	0.0	12.1	126.2	0.3	0.5	47.8	0.6	7.6	177.5	49.8	0.0	0.0	256.8	0.0				
Nov	27.4	12.1	0.0	0.0	0.0	0.0	0.0	12.1	304.5	0.1	0.1	50.0	0.0	0.0	200.0	374.8	7.2	1.0	1951.6	1.6				
Dec	35.0	12.1	0.0	0.0	0.0	0.0	0.0	12.1	370.5	0.0	0.0	50.0	0.0	0.0	200.0	958.9	14.5	7.9	6639.8	16.8				
Jan	33.3	12.1	0.0	0.0	0.0	0.0	0.0	12.1	447.8	0.0	0.0	50.0	0.0	0.0	200.0	1108.5	16.4	10.3	5971.3	7.7				
Feb	38.9	12.1	0.0	0.0	0.0	0.0	0.0	12.1	464.2	0.0	0.0	50.0	0.0	0.0	200.0	1464.6	23.7	7.2	9309.2	10.4				
Mar	43.7	12.1	0.0	0.0	0.0	0.0	0.0	12.1	547.6	0.1	0.1	50.0	0.0	0.0	200.0	1886.5	37.9	9.2	12786.4	5.7				
Apr	32.2	12.1	0.0	0.0	0.0	0.0	0.0	12.1	736.2	0.2	0.3	49.1	0.0	0.0	200.0	592.1	1.9	0.0	4929.2	0.0				
May	30.6	12.0	3.6	0.0	0.0	0.0	0.0	12.0	1353.4	0.3	0.3	50.0	0.2	0.4	199.0	373.9	0.0	0.0	2598.5	0.0				
Jun	25.5	12.0	15.0	0.0	0.0	0.0	0.0	12.0	1467.2	0.4	0.4	50.0	1.3	2.5	174.9	122.3	0.0	0.0	643.1	0.0				
Jul	22.4	12.0	21.2	0.0	0.0	0.0	0.0	12.0	1255.3	0.5	0.5	50.0	1.7	3.4	129.0	41.8	0.0	0.0	231.5	0.0				
Aug	22.2	12.0	21.2	0.0	0.0	0.0	0.0	12.0	899.5	0.5	0.5	50.0	1.6	3.2	77.0	18.1	0.0	0.0	162.3	0.0				
Sep	22.2	12.0	14.7	0.0	0.0	0.0	0.0	12.0	650.3	0.4	0.4	50.0	1.1	2.2	34.5	18.8	0.0	0.0	148.4	0.0				
AVG:	29.7	12.1	7.0	0.0	0.0	0.0	0.0	12.1	718.6	0.2	0.2	49.7	0.5	1.6	166.0	584.2	8.5	3.0	3802.3	3.5				
TOTAL:	10829	4404	2573	0	0	0	0	4404		80	90					212181	3078	1080	1381193	1280				

**Selected Alternative-2014: Geysers (400)+Urban (500)+Ag Re-growth (800 MG)+River Discharge (4850)+ERP (200): ADWF 23.1**

**Basic Control Parameters**

ADWF 23.1 mgd  
Geyser PL Cap 80 mgd  
Laguna Ag 4730 acres

**Alternatives**

Geysers 12.1 mgd  
Urban 500  
RP Ag 200  
North County no MG

**Maximum Storage Summary (MG)**

	Dry	Normal	Wet
Laguna	1,602	1,033	1,459
Urban	50	50	50
Rohnert Park	200	200	200
North County	0	0	0
Sum:	1,852	1,283	1,709

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**99% Exceedance (1977) - Dry**

-----DEMANDS----->																	Sum		1,632	1,225	17,153	
---Exist. Demands---   ---Potential Demands--->																	Laguna				Russian River	
Month	WW Prod.	Geysers Delivery	Irrigation	River/NC Divers.	Temp Storage	Temp Sto Chg	Geys. Altern.	Geysers Total	Existing Storage	Urban Use	Urban Diversion	Urban Storage	RP Ag Use	RP Ag Diversion	RP Ag Storage	Laguna Flow	Laguna Disch.	Delta Pnd Back Flw	RR at Hacienda	RR Disch.		
Oct	23.1	12.1	10.4	0.0	0.0	0.0	0.0	12.1	120.0	0.6	0.6	0.0	0.0	0.0	0.0	6.0	0.0	0.0	61.4	0.0		
Nov	23.1	12.1	0.0	0.0	0.0	0.0	0.0	12.1	126.6	0.7	0.7	46.8	0.0	6.7	106.2	7.9	0.0	0.0	71.1	0.0		
Dec	23.1	12.1	0.0	0.0	0.0	0.0	0.0	12.1	340.7	0.2	0.2	50.0	0.0	0.0	200.0	7.9	0.6	0.0	59.3	0.0		
Jan	23.2	12.1	0.0	0.0	0.0	0.0	0.0	12.1	651.4	0.2	0.2	50.0	0.0	0.0	200.0	14.4	0.7	0.0	69.2	0.0		
Feb	23.1	12.1	0.0	0.0	0.0	0.0	0.0	12.1	958.6	0.2	0.2	50.0	0.0	0.0	200.0	14.4	0.6	0.0	59.8	0.0		
Mar	23.3	12.1	0.0	0.0	0.0	0.0	0.0	12.1	1250.8	0.4	0.4	50.0	0.0	0.0	200.0	19.9	1.0	0.0	118.7	0.2		
Apr	23.1	12.1	0.0	0.0	0.0	0.0	0.0	12.1	1527.7	0.9	0.9	50.0	0.0	0.0	200.0	9.3	0.4	0.0	33.6	0.6		
May	23.1	12.0	13.1	0.0	0.0	0.0	0.0	12.0	1602.4	1.6	1.6	50.0	0.7	1.4	188.7	8.4	0.0	0.0	58.9	0.0		
Jun	23.1	12.0	16.7	0.0	0.0	0.0	0.0	12.0	1422.1	2.5	2.5	50.0	1.4	2.8	156.4	3.4	0.0	0.0	40.3	0.0		
Jul	23.1	12.0	21.2	0.0	0.0	0.0	0.0	12.0	1096.4	2.9	2.9	50.0	1.7	3.4	108.7	2.8	0.0	0.0	31.4	0.0		
Aug	23.1	12.0	21.2	0.0	0.0	0.0	0.0	12.0	694.3	2.8	2.8	50.0	1.6	3.2	56.7	3.9	0.0	0.0	32.8	0.0		
Sep	23.1	12.0	14.7	0.0	0.0	0.0	0.0	12.0	404.1	2.5	2.5	50.0	1.0	2.0	14.3	5.3	0.0	0.0	29.1	0.0		
AVG:	23.1	12.1	8.1	0.0	0.0	0.0	0.0	12.1	849.6	1.3	1.3	45.6	0.5	1.6	135.9	8.6	0.3	0.0	55.5	0.1		
TOTAL:	8445	4404	2985	0			0	4404		467						3147	98	0	20296	28		

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**50% Exceedance (1962) - Median (Normal)**

-----DEMANDS----->																				
---Exist. Demands---										---Potential Demands--->										
Month	WW Prod.	Geysers	Irrigation	River/NC	Temp	Temp	Geys.	Geysers	Existing	Urban	Urban	Urban	RP Ag	RP Ag	RP Ag	Laguna			Russian River	
		Delivery		Divers.	Storage	Sto Chg	Altern.	Total	Storage	Use	Diversion	Storage	Use	Diversion	Storage	Laguna Flow	Laguna Disch.	Delta Pnd Back Flw	RR at Hacienda	RR Disch.
Oct	23.1	12.1	10.4	0.0	0.0	0.0	0.0	12.1	120.0	0.6	0.6	0.0	0.0	0.0	0.0	5.9	0.0	0.0	108.1	0.0
Nov	24.0	12.1	0.0	0.0	0.0	0.0	0.0	12.1	128.1	0.7	0.7	46.8	0.0	6.7	106.2	56.8	0.6	1.0	323.0	0.2
Dec	27.2	12.1	0.0	0.0	0.0	0.0	0.0	12.1	382.2	0.2	0.2	50.0	0.0	0.0	200.0	142.2	6.2	2.5	1191.9	3.2
Jan	25.1	12.1	0.0	0.0	0.0	0.0	0.0	12.1	576.6	0.2	0.2	50.0	0.0	0.0	200.0	80.3	4.5	0.0	662.6	2.1
Feb	36.6	12.1	0.0	0.0	0.0	0.0	0.0	12.1	584.3	0.2	0.2	50.0	0.0	0.0	200.0	787.8	28.5	3.4	7106.5	11.5
Mar	32.9	12.1	0.0	0.0	0.0	0.0	0.0	12.1	338.1	0.4	0.4	49.9	0.0	0.0	200.0	333.5	11.1	0.9	3621.7	6.6
Apr	24.2	12.1	0.0	0.0	0.0	0.0	0.0	12.1	639.7	0.9	1.8	34.6	0.0	0.0	200.0	47.2	0.0	0.0	576.4	0.0
May	23.1	12.1	0.6	0.0	0.0	0.0	0.0	12.1	1019.5	0.7	1.4	4.3	0.7	0.7	188.7	21.7	0.0	0.0	212.9	0.0
Jun	23.1	12.0	16.7	0.0	0.0	0.0	0.0	12.0	1032.5	2.5	2.5	25.3	1.4	2.8	156.4	7.6	0.0	0.0	126.4	0.0
Jul	23.1	12.0	21.2	0.0	0.0	0.0	0.0	12.0	682.2	2.9	2.9	50.0	1.7	3.4	108.7	3.8	0.0	0.0	97.9	0.0
Aug	23.1	12.0	21.2	0.0	0.0	0.0	0.0	12.0	321.2	1.9	3.5	17.9	1.6	3.0	56.7	4.2	0.0	0.0	100.5	0.0
Sep	23.1	12.0	13.8	0.0	0.0	0.0	0.0	12.0	146.3	0.0	0.0	0.0	1.0	1.0	14.3	5.1	0.0	0.0	104.9	0.0
AVG:	25.7	12.1	7.0	0.0	0.0	0.0	0.0	12.1	497.6	0.9	1.2	31.6	0.5	1.5	135.9	124.7	4.2	0.7	1186.1	2.0
TOTAL:	9373	4407	2571	0			0	4407		335						44098	1497	235	420543	699

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**1% Exceedance (1983) - Wet**

		-----DEMANDS----->																		
		---Exist. Demands---						---Potential Demands--->												
														Laguna				Russian River		
Month	WW	Geysers	Irrigation	River/NC	Temp	Temp	Geys.	Geysers	Existing	Urban	Urban	Urban	RP Ag	RP Ag	RP Ag	Laguna	Laguna	Delta Pnd	RR at	RR
Prod.	Delivery	Divers.	Storage	Sto Chg	Altern.	Total	Storage	Use	Diversion	Storage	Use	Diversion	Storage	Flow	Disch.	Back Flw	Hacienda	Disch.		
Oct	23.9	12.1	8.3	0.0	0.0	0.0	12.1	120.0	1.6	2.4	39.6	0.6	3.2	19.1	49.8	0.0	0.0	256.8	0.0	
Nov	28.5	12.1	0.0	0.0	0.0	0.0	12.1	185.5	0.7	0.7	50.0	0.0	4.5	177.5	374.8	6.1	4.6	1951.6	1.6	
Dec	36.5	12.1	0.0	0.0	0.0	0.0	12.1	371.8	0.2	0.2	50.0	0.0	0.0	200.0	958.9	13.9	6.6	6639.8	16.7	
Jan	34.7	12.1	0.0	0.0	0.0	0.0	12.1	454.6	0.2	0.2	50.0	0.0	0.0	200.0	1108.5	16.8	9.5	5971.3	7.7	
Feb	40.5	12.1	0.0	0.0	0.0	0.0	12.1	471.4	0.2	0.2	50.0	0.0	0.0	200.0	1464.6	24.5	7.0	9309.2	10.5	
Mar	45.5	12.1	0.0	0.0	0.0	0.0	12.1	553.1	0.4	0.4	50.0	0.0	0.0	200.0	1886.5	39.1	9.1	12786.4	6.1	
Apr	33.5	12.1	0.0	0.0	0.0	0.0	12.1	741.0	0.9	1.5	43.9	0.0	0.0	200.0	592.1	2.4	0.0	4929.2	0.4	
May	31.8	12.0	3.6	0.0	0.0	0.0	12.0	1364.3	1.6	1.6	50.0	0.2	0.4	199.0	373.9	0.0	0.0	2598.5	0.0	
Jun	26.6	12.0	15.0	0.0	0.0	0.0	12.0	1458.9	2.5	2.5	50.0	1.3	2.5	174.9	122.3	0.0	0.0	643.1	0.0	
Jul	23.3	12.0	21.2	0.0	0.0	0.0	12.0	1208.0	2.9	2.9	50.0	1.7	3.4	129.0	41.8	0.0	0.0	231.5	0.0	
Aug	23.1	12.0	21.2	0.0	0.0	0.0	12.0	806.0	2.8	2.8	50.0	1.6	3.2	77.0	18.1	0.0	0.0	162.3	0.0	
Sep	23.1	12.0	14.7	0.0	0.0	0.0	12.0	515.8	2.5	2.5	50.0	1.1	2.2	34.5	18.8	0.0	0.0	148.4	0.0	
AVG:	30.9	12.1	7.0	0.0	0.0	0.0	12.1	687.5	1.4	1.5	48.6	0.5	1.6	150.9	584.2	8.6	3.1	3802.3	3.6	
TOTAL:	11268	4404	2573	0	0	0	4404		500							212181	3108	1117	1381193	1303

**Selected Alternative-2020: Geysers (400)+Urban (500)+Ag Re-growth (800 MG)+River Discharge (4850)+ERP (200): ADFW 25.9**

**Basic Control Parameters**

ADWF 25.9 mgd  
Geysers PL Cap 80 mgd  
Laguna Ag 4730 acres

**Alternatives**

Geysers 12.1 mgd  
Urban 500  
RP Ag 200  
North County no MG

**Maximum Storage Summary (MG)**

	Dry	Normal	Wet
Laguna	1,442	1,065	1,707
Urban	50	50	50
Rohnert Park	200	200	200
North County	0	0	0
Sum:	1,692	1,315	1,957

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**99% Exceedance (1977) - Dry**

		---DEMANDS---																			
		---Exist. Demands---					---Potential Demands---														
Month	WW Prod.	Geysers Delivery	Irrigation	River/NC Divers.	Temp Storage	Temp Sto Chg	Geys. Altern.	Geysers Total	Existing Storage	Urban Use	Urban Diversion	Urban Storage	RP Ag Use	RP Ag Diversion	RP Ag Storage	Laguna Flow	Laguna Disch.	Delta Pnd Back Flw	RR at Hacienda	RR Disch.	
Oct	25.9	12.1	10.4	0.0	0.0	0.0	0.0	12.1	120.0	1.6	1.6	50.0	0.7	4.4	98.1	6.0	0.0	0.0	61.4	0.0	
Nov	25.9	12.1	0.0	0.0	0.0	0.0	0.0	12.1	244.2	0.7	0.7	50.0	0.0	2.9	191.8	7.9	0.0	0.0	71.1	0.0	
Dec	25.9	12.1	0.0	0.0	0.0	0.0	0.0	12.1	632.3	0.2	0.2	50.0	0.0	0.0	200.0	7.9	0.6	0.0	59.3	0.0	
Jan	26.0	12.1	0.0	0.0	0.0	0.0	0.0	12.1	1030.1	0.2	0.2	50.0	0.0	0.0	200.0	14.4	0.7	0.0	69.2	0.0	
Feb	25.9	12.1	0.0	0.0	0.0	0.0	0.0	12.1	1408.9	0.2	0.2	50.0	0.0	0.0	200.0	14.4	0.9	0.0	59.8	2.8	
Mar	26.1	12.1	0.0	0.0	0.0	0.0	0.0	12.1	1429.3	0.4	0.4	50.0	0.0	0.0	200.0	19.9	2.0	0.0	118.7	21.6	
Apr	25.9	12.1	0.0	0.0	0.0	0.0	0.0	12.1	1301.1	0.9	0.9	50.0	0.0	0.0	200.0	9.3	0.6	0.0	33.6	3.5	
May	25.9	12.0	13.1	0.0	0.0	0.0	0.0	12.0	1441.7	1.6	1.6	50.0	0.7	1.4	188.7	8.4	0.0	0.0	58.9	0.0	
Jun	25.9	12.0	16.7	0.0	0.0	0.0	0.0	12.0	1346.8	2.5	2.5	50.0	1.4	2.8	156.4	3.4	0.0	0.0	40.3	0.0	
Jul	25.9	12.0	21.2	0.0	0.0	0.0	0.0	12.0	1106.5	2.9	2.9	50.0	1.7	3.4	108.7	2.8	0.0	0.0	31.4	0.0	
Aug	25.9	12.0	21.2	0.0	0.0	0.0	0.0	12.0	791.1	2.8	2.8	50.0	1.6	3.2	56.7	3.9	0.0	0.0	32.8	0.0	
Sep	25.9	12.0	14.7	0.0	0.0	0.0	0.0	12.0	586.4	2.5	2.5	50.0	1.0	2.0	14.3	5.3	0.0	0.0	29.1	0.0	
AVG:	25.9	12.1	8.1	0.0	0.0	0.0	0.0	12.1	953.2	1.4	1.4	50.0	0.6	1.7	151.2	8.6	0.4	0.0	55.5	2.3	
TOTAL:	9468	4404	2985	0			0	4404		500			218			3147	146	0	20296	857	

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**50% Exceedance (1962) - Median (Normal)**

		---DEMANDS---																					
		---Exist. Demands---					---Potential Demands---											Laguna				Russian River	
Month	WW	Geysers	Irrigation	River/NC	Temp	Temp	Geys.	Geysers	Existing	Urban	Urban	Urban	RP Ag	RP Ag	RP Ag	Laguna	Laguna	Delta Pnd	RR at	RR			
	Prod.	Delivery		Divers.	Storage	Sto Chg	Altern.	Total	Storage	Use	Diversion	Storage	Use	Diversion	Storage	Flow	Disch.	Back Flw	Hacienda	Disch.			
Oct	25.9	12.1	10.4	0.0	0.0	0.0	0.0	12.1	120.0	1.6	1.6	50.0	0.7	4.0	87.5	5.9	0.0	0.0	108.1	0.0			
Nov	26.9	12.1	0.0	0.0	0.0	0.0	0.0	12.1	236.5	0.7	0.7	50.0	0.0	3.3	189.4	56.8	0.8	0.0	323.0	0.2			
Dec	30.5	12.1	0.0	0.0	0.0	0.0	0.0	12.1	523.3	0.2	0.2	50.0	0.0	0.0	200.0	142.2	7.4	0.0	1191.9	3.3			
Jan	28.1	12.1	0.0	0.0	0.0	0.0	0.0	12.1	807.0	0.2	0.2	50.0	0.0	0.0	200.0	80.3	4.5	0.0	662.6	2.1			
Feb	41.1	12.1	0.0	0.0	0.0	0.0	0.0	12.1	737.3	0.2	0.2	50.0	0.0	0.0	200.0	787.8	35.8	0.0	7106.5	12.6			
Mar	36.9	12.1	0.0	0.0	0.0	0.0	0.0	12.1	372.4	0.4	0.4	50.0	0.0	0.0	200.0	333.5	15.2	0.0	3621.7	7.3			
Apr	27.1	12.1	0.0	0.0	0.0	0.0	0.0	12.1	698.0	0.9	1.8	35.7	0.0	0.0	200.0	47.2	0.0	0.0	576.4	0.0			
May	25.9	12.1	6.1	0.0	0.0	0.0	0.0	12.1	1064.9	0.9	1.6	5.5	0.7	0.9	188.7	21.7	0.0	0.0	212.9	0.0			
Jun	25.9	12.0	16.7	0.0	0.0	0.0	0.0	12.0	1059.8	2.5	2.5	41.4	1.4	2.8	156.4	7.6	0.0	0.0	126.4	0.0			
Jul	25.9	12.0	21.2	0.0	0.0	0.0	0.0	12.0	810.9	2.9	2.9	50.0	1.7	3.4	108.7	3.8	0.0	0.0	97.9	0.0			
Aug	25.9	12.0	21.2	0.0	0.0	0.0	0.0	12.0	495.6	2.8	2.8	50.0	1.6	3.2	56.7	4.2	0.0	0.0	100.5	0.0			
Sep	25.9	12.0	14.7	0.0	0.0	0.0	0.0	12.0	290.8	2.5	2.5	50.0	1.0	2.0	14.3	5.1	0.0	0.0	104.9	0.0			
AVG:	28.8	12.1	7.5	0.0	0.0	0.0	0.0	12.1	601.4	1.3	1.4	44.4	0.6	1.6	150.2	124.7	5.3	0.0	1186.1	2.1			
TOTAL:	10509	4407	2769	0			0	4407		479			218			44098	1878	0	420543	757			

MONTHLY AVERAGE (all values in million gallons per day or million gallons)

**1% Exceedance (1983) - Wet**

		---DEMANDS---																				
		---Exist. Demands---					---Potential Demands---															
Month	WW Prod.	Geysers	Irrigation	River/NC	Temp	Temp	Geys.	Geysers	Existing	Urban	Urban	Urban	RP Ag	RP Ag	RP Ag	Laguna			Russian River			
		Delivery		Divers.	Storage	Sto Chg	Altern.	Total	Storage	Use	Diversion	Storage	Use	Diversion	Storage	Laguna Flow	Laguna Disch.	Delta Pnd Back Flw	RR at Hacienda	RR Disch.		
Oct	26.7	12.1	8.3	0.0	0.0	0.0	0.0	12.1	445.9	1.6	1.6	50.0	0.6	7.0	196.7	49.8	0.0	0.0	256.8	0.0		
Nov	31.9	12.1	0.0	0.0	0.0	0.0	0.0	12.1	715.0	0.7	0.7	50.0	0.0	0.0	200.0	374.8	11.5	0.0	1951.6	2.7		
Dec	40.9	12.1	0.0	0.0	0.0	0.0	0.0	12.1	522.3	0.2	0.2	50.0	0.0	0.0	200.0	958.9	21.4	2.5	6639.8	18.4		
Jan	38.8	12.1	0.0	0.0	0.0	0.0	0.0	12.1	533.5	0.2	0.2	50.0	0.0	0.0	200.0	1108.5	19.4	7.9	5971.3	8.1		
Feb	45.3	12.1	0.0	0.0	0.0	0.0	0.0	12.1	501.6	0.2	0.2	50.0	0.0	0.0	200.0	1464.6	28.1	6.2	9309.2	11.0		
Mar	51.0	12.1	0.0	0.0	0.0	0.0	0.0	12.1	568.9	0.4	0.4	50.0	0.0	0.0	200.0	1886.5	41.2	5.8	12786.4	6.9		
Apr	37.5	12.1	0.0	0.0	0.0	0.0	0.0	12.1	765.6	0.9	1.0	49.9	0.0	0.0	200.0	592.1	3.0	0.0	4929.2	1.4		
May	35.6	12.0	3.6	0.0	0.0	0.0	0.0	12.0	1510.4	1.6	1.6	50.0	0.2	0.4	199.0	373.9	0.0	0.0	2598.5	0.0		
Jun	29.8	12.0	15.0	0.0	0.0	0.0	0.0	12.0	1707.3	2.5	2.5	50.0	1.3	2.5	174.9	122.3	0.0	0.0	643.1	0.0		
Jul	26.1	12.0	21.2	0.0	0.0	0.0	0.0	12.0	1548.5	2.9	2.9	50.0	1.7	3.4	129.0	41.8	0.0	0.0	231.5	0.0		
Aug	25.9	12.0	21.2	0.0	0.0	0.0	0.0	12.0	1233.3	2.8	2.8	50.0	1.6	3.2	77.0	18.1	0.0	0.0	162.3	0.0		
Sep	25.9	12.0	14.7	0.0	0.0	0.0	0.0	12.0	1028.5	2.5	2.5	50.0	1.1	2.2	34.5	18.8	0.0	0.0	148.4	0.0		
AVG:	34.6	12.1	7.0	0.0	0.0	0.0	0.0	12.1	923.4	1.4	1.4	50.0	0.5	1.6	167.6	584.2	10.4	1.9	3802.3	4.0		
TOTAL:	12634	4404	2573	0			0	4404		500	501		197			212181	3770	679	1381193	1468		