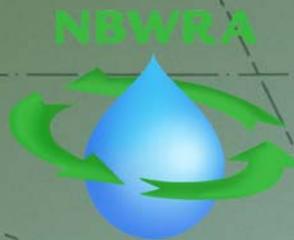


# Sonoma County Water Agency and Bureau of Reclamation

## Phase 3 Engineering and Economic/Financial Analysis Report North San Pablo Bay Restoration and Reuse Project

June 2008

Prepared in cooperation with:  
North Bay Water Reuse Authority



# DRAFT

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# List of Abbreviations

ABAG	Association of Bay Area Governments
ADWF	average dry weather flow
AF	acre-feet
AFY	acre-feet per year
AF/acre	acre-feet per acre
APE	Area of Potential Effect
ASA	Area of Sensitivity Assessment
ASR	aquifer storage and recovery
Authority	North Bay Water Reuse Authority
AVA	American Viticultural Area
AWWF	average wet weather flow
Basin Plan	San Francisco Bay Basin Plan
BARWRP	Bay Area Regional Water Recycling Program
BCDC	San Francisco Bay Conservation and Development Commission
BHP	peak brake horsepower
BMFZ	Burdell Mountain Fault zone
BMP	best management practice
CALFED	California Bay-Delta Authority
Caltrans	California Department of Transportation
CBC	California Building Code
CCR	California Code of Regulations
CCI	construction cost index
CDFG	California Department of Fish and Game
CDMG	California Department of Conservation, Division of Mines and Geology
CDPR	California Department of Pesticide Regulation
CE	Caneros East
cfs	cubic feet per second
CGS	California Geological Survey
CIMIS	California Irrigation Management Information System
CIP	capital improvement program
CNPS	California Native Plant Society
CW	Carneros West
CWA	Clean Water Act
DPH	California Department of Public Health
DWR	California Department of Water Resources
EIS/EIR	Environmental Impact Statement/Environmental Impact Report
ENR	Engineering News Record
EP	Effective Precipitation
ET	evapotranspiration
ET <sub>c</sub>	crop-specific evapotranspiration rate
ET <sub>o</sub>	reference evapotranspiration

ETAW	evapotranspiration of applied water
FP	State fully protected species
g	unit of acceleration
GIS	geographic information system
gpm	gallons per minute
HP	horsepower
ITA	Indian Trust Asset
JPA	joint powers authority
K <sub>c</sub>	crop coefficient
LCWD	Los Carneros Water District
LESA	Land Evaluation and Site Assessment model
LGVSD	Las Gallinas Valley Sanitary District
LS	lump sum
M&I	municipal and industrial
MG	million gallons
mgd	million gallons per day
mg/L	milligrams per liter
MG/Y	million gallons per year`
mL	milliliters
mmhos/cm	millimhos per centimeter
MMWD	Marin Municipal Water District
MOU	Memorandum of Understanding
MPN	most probable number
MSL	mean sea level
MST	Milliken-Sarco-Tulocay Creeks
NA	not available
Napa SD	Napa Sanitation District
NAWCA	North American Wetlands Conservation Act
NBA	North Bay Aqueduct
NBWA	North Bay Watershed Association
NMFS	National Marine Fisheries Service
NMWD	North Marin Water District
Novato SD	Novato Sanitation District
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NQ	not quantifiable
O&M	operations and maintenance
PGA	probabilistic ground acceleration
Project	North San Pablo Bay Restoration and Reuse Project
PRV	pressure reducing valves
PSV	pressure sustaining valves
psi	pounds per square-inch
RAS	return activated sludge
RCD	Resource Conservation District

RCF	Rodgers Creek Fault
RDI	Regulated Deficit Irrigation
Reclamation	U.S. Department of the Interior Bureau of Reclamation
Report	Phase 3 Engineering and Economic/Financial Analysis Report
RO	reverse osmosis
RUL	Rural Urban Limit
RWQCB	San Francisco Regional Water Quality Control Board
SC	Species of concern
SCWA	Sonoma County Water Agency
SSC	State species of special concern
SVCSD	Sonoma Valley County Sanitation District
SWP	State Water Project
SWRCB	State Water Resources Control Board
TAW	total applied water
TDH	total dynamic head
TDS	total dissolved solids
Title 22	California Code of Regulations, Title 22, Division 4, Chapter 3
TM	technical memorandum
TMDLs	total maximum daily loads
UBC	Uniform Building Code
UC	University of California
µg/L	micrograms per liter
URWP	Urban Recycled Water Project
USACE	U.S. Army Corps of Engineers
US EPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UWMP	Urban Water Management Plan
VOMWD	Valley of the Moon Water District
Water Project	Water Supply, Transmission, and Reliability Project
WNF	West Napa Fault
WWTP	wastewater treatment plant

# Executive Summary

Recognizing the growing need for an integrated and regional approach to water management, four wastewater utilities and one water agency in the North San Pablo Bay region of California have joined forces to plan a project that would considerably expand the use of recycled water region-wide.

The proposed North San Pablo Bay Restoration and Reuse Project (Project) would build on commitments to long-term inter-agency cooperation to address common needs related to reliable water supplies and enhanced environmental restoration. As implementation of the Project would likely require external funding assistance, the investigation and development of the Project is being carried out in conformance to the requirements of the U.S. Department of the Interior's Bureau of Reclamation Public Law 102-575, Title XVI, which provides a mechanism for Federal participation and cost-sharing in approved water reuse projects.

The five participating agencies have organized themselves under a Memorandum of Understanding (MOU) as the North Bay Water Reuse Authority (Authority). The Authority members include:

- The Las Gallinas Valley Sanitary District (LGVSD)
- The Novato Sanitary District (Novato SD)
- The Sonoma Valley County Sanitation District (SVCSD)
- The Napa Sanitation District (Napa SD)
- The Sonoma County Water Agency (SCWA).

North Marin Water District and Napa County are also providing technical and financial support to the Authority.

The Authority members undertook cooperative planning efforts over a 5-year period – including 19 technical workshops as well as monthly institutional workshops, with extensive outreach to potential Project stakeholders – to define shared issues and develop feasible alternatives toward definition of a region-wide recycled water project that would enable them to address those issues.

This report, representing part of the third phase of a three-phase planning effort, presents an engineering feasibility evaluation and economic and financial analysis of the proposed project. The report describes the Project area and the key water management problems and needs within the Project area, identifies water reuse opportunities in the Project area, develops and analyzes alternative measures that could address the identified water management needs, presents an overview of associated legal and institutional requirements, compares the alternatives, presents an

economic and financial analysis of the proposed Project, and discusses potential environmental effects of the Project.

In short, this report provides the engineering and economic studies that guide the Authority's selection of a recommended Project for funding and implementation. Along with the environmental documentation that is currently underway, these three elements will form the complete Project feasibility study report.

## **Project Setting and Future Conditions**

As shown in Figure ES-1, the initial study area encompasses approximately 318 square miles of land within Marin, Sonoma, and Napa Counties. This region extends some 10 to 15 miles inland of the tidal San Pablo Bay, with a total population of over 270,000 in the major urban centers of San Rafael, Novato, Petaluma, Sonoma, and Napa. The region supports agriculture, including predominantly some of the premier wine-grape growing land in North America, as well as light industry, commercial and institutional uses, parklands, and residential areas. It is an area of natural and cultivated appeal and productivity, all proximate to the additional cultural attractions of the greater San Francisco Bay Area.

The waterways of this region – the Napa River, Sonoma Creek, and Petaluma River, as well as smaller streams, some of which support only seasonal flows – are tributary to the San Pablo Bay estuary. Although threatened until recently by development, the remaining tidal wetlands of the San Pablo Bay estuary serve in a vital ecological role as nurseries for fisheries and wintering areas for migratory waterbirds.

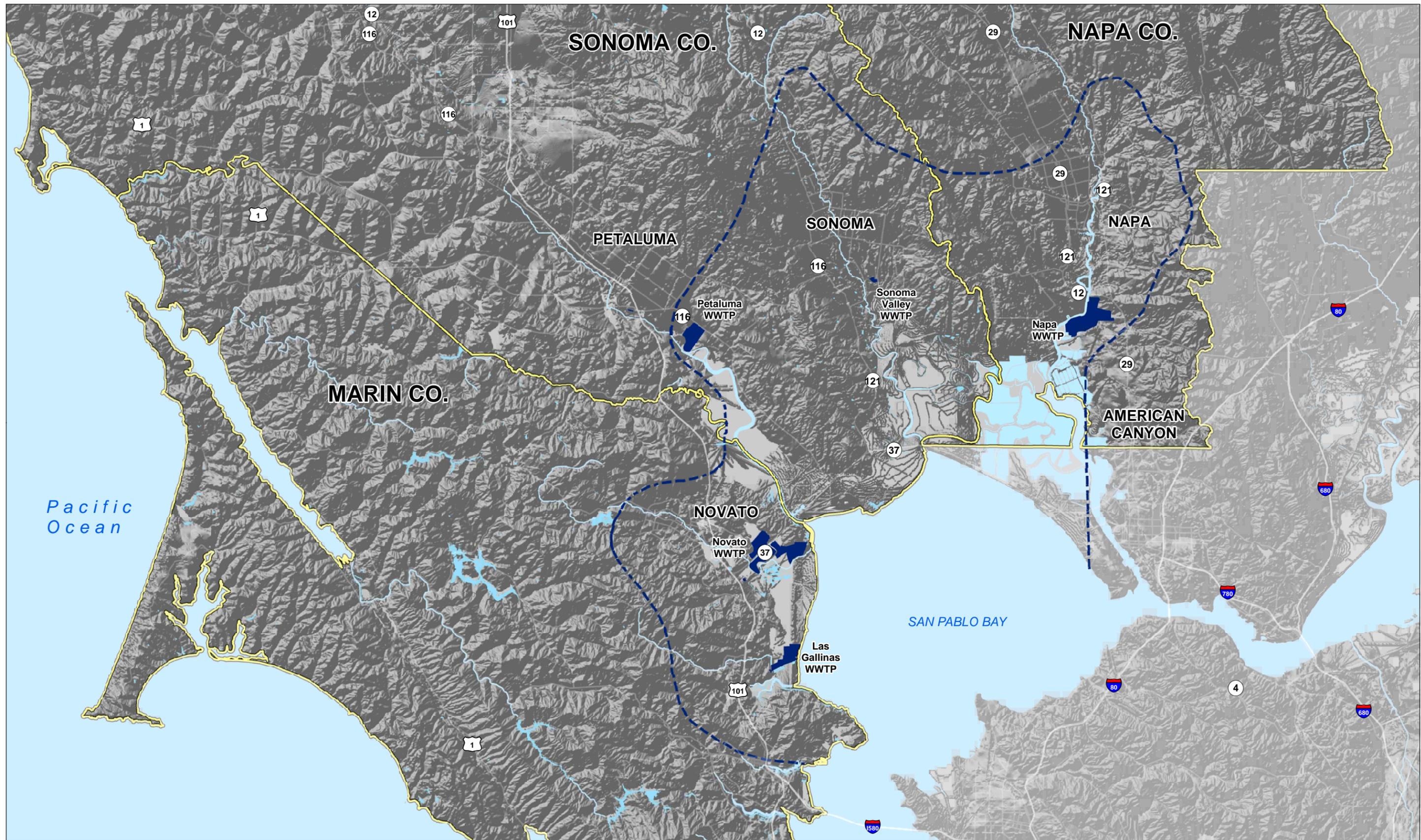
Local and regional planning projections indicate that there will be sustained pressures for residential growth in the study area, with estimates of 10-12 percent growth in most of the existing urban centers by the year 2020 (as compared to 2005 populations). Existing policies in principal cities will tend to favor concentrated rather than dispersed growth.

Agricultural land use is expected to remain relatively constant over a 20-year planning period, and all three County governments in the study area have explicit policies in place to protect agricultural lands. Given the high value of wine-grape culture, there is unlikely to be much change in the 75 percent of agricultural acreage committed to vineyards.

With the removal of Petaluma from the Project<sup>1</sup>, total urban water use – including both residential and non-residential uses – in the study area is projected to increase from the 2005 level of 63,700 acre-feet per year (AFY) to about 72,800 AFY in 2020. Total water use for irrigation of agricultural lands is estimated at approximately 23,300 AFY at present.

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<sup>1</sup> After initial evaluation was concluded for the Project, Petaluma decided not to participate in the Project. See Section 1.3 for a discussion of Petaluma's participation.



Basemap: U.S. Department of Agriculture, 2001

**Legend**

- - - Initial Study Area Boundary
- WWTPs



**Figure ES-1**  
Initial Study Area

Meeting these water demands are sources that include surface water supplies (both internal and external to the study area), groundwater, and recycled water. SCWA supplies much of the study area with *surface water* conveyed from the Russian River and its tributaries in central Sonoma County, external to the study area. SCWA's reliable supplies to customers in the study area are 87,970 AF during a dry year.

*Groundwater* serves many agricultural users (and some residential users) as a primary source of supply and serves as a secondary source of supply for some urban users as well, notably the City of Sonoma and Valley of the Moon Water District. Although the total quantity of groundwater in the study area is unknown, groundwater pumping has been measured. The vast (80 percent) increase in pumping of groundwater in the past 30 years to support agricultural irrigation has resulted locally in groundwater outflow exceeding inflow, some impacts on groundwater quality, and a lowering of groundwater levels in some parts of the study area that are dependent on groundwater supplies.

Existing treatment and distribution infrastructure in the study area currently produce about 7,300 AFY of *recycled water* for irrigation and wetlands restoration purposes, which could increase to 11,250 AFY by 2020.

At first glance, average year and wet season conditions appear to yield sufficient water to meet total annual demand in the study area. This conclusion gives a distorted – and inaccurate – picture of water use in this area, however. In fact, the seasonal availability of some water sources (against the strong seasonality of agricultural demand), the potential for overdraft of groundwater with impacts on quality and quantity, and the growth pressures on the area's urban centers all argue for an effective, coordinated, and regional approach to the increased use of recycled water.

## Problems and Needs

The water management concerns of the North San Pablo Bay study area can be summarized as follows:

- The agricultural economy, dominated by high-value vineyard agriculture, needs a highly reliable water supply to maintain and to expand its base.
- Urbanization of the greater San Francisco Bay area requires highly reliable water supplies.
- The vitally important estuarine ecosystem of the North San Pablo Bay area, which includes endangered species and vital wetlands, has been under intense pressure. Although protective and restorative measures are in place, the habitat requires a reliable supply of water.

- Surface waters are becoming less reliable sources of supply as they are already diverted by multiple users, have low flows in the summer (which coincides with the irrigation season), and can have low flows in dry years.
- Groundwater supplies are heavily pumped for agricultural and limited municipal uses and in some localities have marginal quality.

These concerns are all among those addressed in the planning issues originally agreed to by the participating agencies of the Authority.

## Water Reuse Opportunities

The principal governing document for regulating the use of recycled water in California is the California Code of Regulations Title 22, Division 4, Chapter 3, commonly referred to as Title 22. Title 22 defines four levels of recycled water quality standards, with the most stringent being disinfected tertiary recycled water, which is suitable for unrestricted use in agricultural and landscape irrigation, as well as for environmental (wetlands) restoration.

These high-order uses are in fact the intended uses of recycled water under the Project. Some 34,000 acres of land in the study area appear suitable for irrigation, 75 percent of it being vineyards and the remainder comprising urban landscaping, dairy/pasturelands, other irrigated farmland, and orchards. The estimated maximum water use for irrigation of these lands in the study area is about 23,300 AFY at present.

The potential sources of disinfected tertiary recycled water are the four wastewater treatment plants (WWTPs) in the study area. The dry-season (June through October) discharge flows (in million gallons per day [mgd]) for these WWTPs are:

<b>Recent WWTP Dry Weather Flows in North San Pablo Bay Study Area</b>		
<b>Wastewater Treatment Plant</b>	<b>2002 Average Dry Weather Flow</b>	<b>Existing or Currently Planned Tertiary Treatment Capacity</b>
LGVSD WWTP	2.1 mgd	2.0 mgd currently delivered to Marin Municipal Water District for tertiary treatment
Novato SD WWTP	5.0 mgd	Existing capability for 0.5 mgd Title 22 disinfected tertiary treatment
SVCSD WWTP	2.6 mgd	Existing capability for 16.0 mgd Title 22 disinfected tertiary treatment
Napa SD WWTP	6.2 mgd	Existing capability for 8.8 mgd Title 22 disinfected tertiary treatment

All of the WWTPs deliver recycled water during the dry season, when the Regional Water Quality Control Board imposes restrictions on discharge of secondary effluent to waterways. SVCSD and Napa SD have the most extensive infrastructure in place for conveyance, storage and distribution of recycled water to local users. All the WWTPs currently have the capability to produce disinfected tertiary recycled water conforming to Title 22 requirements for unrestricted use. All of the agencies have

projects in various stages of planning and implementation to increase treatment capacity or plan to increase the local use of recycled water, if funding is available. Full implementation of those individual local projects would result in WWTP discharge and beneficial reuse at the following levels in 2020:

<b>Potential Year 2020 WWTP Discharge and Beneficial Reuse Volumes in Study Area</b>		
<b>Wastewater Treatment Plant</b>	<b>WWTP Flow (AFY)</b>	<b>Beneficial Reuse (AFY)</b>
LGVSD WWTP	3,671	902
Novato SD WWTP	8,673	1,015
SVCSD WWTP	5,506	3,000
Napa SD WWTP	9,800	4,540
TOTAL	27,650	9,457

The potential for use of recycled water in the study area is not limited by demand but rather by the limited capacity for tertiary treatment and by the lack of regional conveyance and storage networks that would deliver disinfected tertiary recycled water where and as needed. Acting individually and locally, the districts have only a very limited ability to maximize their potential for water reclamation and reuse. Adopting a regional outlook and plan, however, greatly expands the potential for beneficial water reuse by the Authority.

For purposes of developing and evaluating alternatives for a regional water recycling project, it is assumed that the WWTPs will have developed, at a maximum, the following capacities for producing Title 22 tertiary recycled water (increased to reflect the peak daily dry weather flow demands of the anticipated local users supplied by the WWTP), as a part of the overall Project investment and implementation. These values reflect the maximum treatment needed to implement the largest recycled water system. Actual treatment capacity will depend upon the alternative chosen.

<b>Assumed Future Tertiary Treatment Capacity in WWTPs of the North San Pablo Bay Study Area</b>	
<b>Wastewater Treatment Plant</b>	<b>Assumed Maximum Tertiary Capacity for Project</b>
LGVSD WWTP	3.1 mgd
Novato SD WWTP	10.4 mgd
SVCSD WWTP	16.0 mgd
Napa SD WWTP	17.9 mgd
TOTAL	47.4 mgd

These recycled water production values are assumed in the development and evaluation of Project alternatives, as described in the following section.

## Formulation and Description of Project Alternatives

Working in close collaboration with the participating agencies of the Authority, the Project study team organized an array of Project options as characterized by existing, agency-identified, and potential recycled water projects in the study area; by the size of recycled water distribution network (basic regional, regional, and expanded regional) that would be involved; and by storage options (no new storage, partial storage, and full storage of recycled water supplies).

This process led to the formulation of six initial Project alternatives – one basic regional alternative, four expanded regional alternatives, and one interconnected regional system alternative. As each alternative had three possible storage options associated with it, there were a total of 18 alternatives considered.

Preliminary analysis indicated that the alternatives with “no new storage” would make insufficient use of recycled water to merit further consideration. Alternatives with “full storage”, on the other hand, would be prohibitively costly to implement. Consolidation and rationalization of the remaining six “partial storage” options left three action alternatives to be carried forward for feasibility analysis.

These three action alternatives are defined as follows:

- **Alternative 1 (Basic Regional System)** – The most basic regional system of the three Project action alternatives, putting first emphasis on the implementation of recycled water projects local to each WWTP. Under this alternative, no WWTPs are connected for joint treatment, storage, or distribution of combined recycled water. Area-wide, the recipients of recycled water include the urban users in Novato, the existing SVCSD reuse area, the Sonoma Valley Recycled Water Project, Carneros East area, the Napa Milliken-Sarco-Tulocay (MST) Creeks area, and the Napa Salt Marsh restoration area.
- **Alternative 2 (Regional System)** – A larger regional recycled water system that takes advantage of increased storage capacity and additional pipelines to distribute recycled water more widely throughout the Project area than could be achieved under Alternative 1. Interconnectivity between WWTPs occurs between SVCSD and Napa SD to serve the Napa Salt Marsh Restoration Area during the restoration period, and between Novato SD and LGVSD to serve the Sears Point Area. Area-wide, the recipients of recycled water include the Peacock Gap golf course, urban users in Novato, agricultural users in the Sears Point Area, the existing SVCSD reuse area, the Sonoma Valley Recycled Water Project, the Southern Sonoma area, Carneros East area, the Napa MST area, and the Napa Salt Marsh restoration area.
- **Alternative 3 (Interconnected Regional System)** – A regional system that connects all four wastewater treatment plants in the Project area, thereby maximizing reuse by potentially enabling recycled water from any WWTP to be delivered to any area that needs recycled water. In actual operation, each WWTP would put first priority on delivery of recycled water to local projects, with excess recycled water being sent into the regional recycled water delivery system for use in more distant

locations of the Project area. Areawide, the “local” recipients of recycled water would include the Peacock Gap golf course, urban users in Novato, the existing SVCSD reuse area, the Sonoma Valley Recycled Water Project, the Napa MST area, and the Carneros East area. The “regional” recipients would include the agricultural users in Sears Point, the Southern Sonoma Valley, and the Central Sonoma Valley areas, as well as the Napa Salt Marsh restoration area.

Within the alternatives described above, the Authority members have collectively prioritized the projects within their individual service areas to identify a phased implementation plan under any of the alternatives being considered. The first phase (Phase 1) of alternative implementation includes projects that each member agency has defined to a level of detail that allows both for project-level environmental review in other sections of the feasibility study, and short-term readiness for design, funding, and construction. Each treatment plant puts first priority on the delivery of recycled water to its local projects. Local projects include the Novato urban users, the Sonoma Valley Recycled Water Project, the Napa MST area, and the Napa Salt Marsh restoration area.

A fourth alternative, the “No Action Alternative”, assumes that there is no joint Project. It essentially represents the “current status” in which the potential need to develop additional potable water supplies continues to be a regional challenge, and additional treatment capacity and water recycling might occur strictly from the implementation of local plans for expansion, as funding is available.

Of the action alternatives, Alternative 1 has the lowest associated costs and provides the least recycled water supply; Alternative 3 has the highest costs and provides the greatest amount of recycled water. The differences in cost among the alternatives stems from the successively greater installation of pipelines, storage, treatment, and pumping facilities associated with each in turn.

The recycling benefits and costs of the alternatives are summarized below:

<b>Summary of Recycling Capacity and Associated Costs of Alternatives of the North San Pablo Bay Restoration and Reuse Project</b>					
<b>Action Alternative</b>	<b>New Recycled Water Demand (Beneficial Reuse) Developed by the Alternative<sup>(1)</sup></b>	<b>Total Recycled Water Demand in the Project Area (w/Project)</b>	<b>Discharge to Bay</b>	<b>Estimated Capital Costs (millions)</b>	<b>Estimated Annual Operations &amp; Maintenance Costs (millions)</b>
No Action Alternative	0 AF	4,944 AF	22,711 AF	\$270 M	--
Alternative 1 – Basic Regional System	6,455 AF	11,329 AF	16,256 AF	\$210 M	\$1.8 M
Alternative 2 – Regional System	11,215 AF	16,159 AF	11,496 AF	\$378 M	\$2.8 M
Alternative 3 – Interconnected Regional System	12,725 AF	17,669 AF	9,986 AF	\$414 M	\$3.1 M

<sup>(1)</sup> The new recycled water demand developed by the alternatives represents total beneficial reuse to customers. Additional recycled water is available from SVCSD and Napa SD for the Napa Salt Marsh which is not included in these totals, as the amount of water needed for the Napa Salt Marsh is unknown at this time. Supplying recycled water to the Napa Salt Marsh would further reduce discharges to San Pablo Bay.

## Legal and Institutional Requirements

The following issues define the principal legal and institutional framework of the Project.

- **Organizational structure** – For purposes of joint planning, the five participating entities of this Project have executed an MOU to work as the North Bay Water Reuse Authority, with SCWA acting as Administrative Agency on behalf of the Authority. The participants may agree to form a joint powers authority when the Project becomes operational.
- **Agency consultation** – The Authority has initiated informal “information discussions” with the federal, state, and local agencies that will be required to review Project plans for conformance to applicable laws and regulations, particularly with regard to environmental documentation. The Authority has also conducted outreach to water districts within whose service areas the Project would deliver recycled water, both for informational purposes and to determine their interest in participating in the Project.
- **Effects of recycled water use** – The Project would alter the disposition of recycled water by reducing discharge into the San Pablo Bay and its tributaries and instead providing increased recycled water supply to agricultural, urban, and habitat restoration uses. The main economic benefit of the Project, to be weighed against its estimated costs, would be to increase the reliability of water supplies for urban and agricultural irrigation. Environmental benefits include a reliable water supply for the Napa Salt Marsh and potentially improved water quality in San Pablo Bay and its tributaries for fisheries and wildlife habitat.
- **Water rights effects** – The Project will not affect the water rights of downstream water users, as water downstream of the participating communities is brackish and not suitable for most potable and irrigation purposes. Potential recipients of recycled water are protected by California Water Code from any loss of their existing rights to surface water supplies.
- **Regulatory requirements** – The study team has identified some 25 Federal, State, and local agencies as well as private utilities that must be contacted for purposes of Project review, coordination/consultation, and permitting. Federal and State regulatory requirements having greatest bearing on the Project include Title 22, the California Department of Fish & Game Code, and the California Water Code.

It is affirmed that the Project will not adversely affect any of the participating agencies’ contractual water supply obligations for recycled water; existing recycled water customers would continue to be served as they are now served.

## Recommended Alternative

Based on the analysis presented, the Authority believes Alternative 1 is the most viable based on implementability, storage issues, and costs.

- Alternative 1 requires the least amount of system storage of the action alternatives, making use of existing storage or land available at the WWTPs. Implementing the larger recycled water distribution systems would require 1,400 to 1,800 AF of more storage.
- The capital costs of both Phase 1 of Alternative 1 and a fully-developed Alternative 1 are lower than the respective capital costs of the other alternatives. The cost of delivering recycled water must be cost effective for the member agencies to implement any alternative. Larger alternatives may be too costly (in terms of construction and environmental documentation) for the agencies to pursue without additional external funding at this time.
- At this time, implementation of Alternative 1 would begin with the projects identified as Phase 1, due to current funding opportunities. These projects have been recognized as those most ready for implementation due to the level of detailed analysis already prepared.

## Economic and Financial Capability Analysis

The economic analysis evaluates whether the Project is cost-effective and would provide net economic benefits to the Authority region. The economic analysis uses the alternative cost method to determine water supply benefits of the Project. The Project's water supply benefits would occur by providing recycled water for urban landscape, agricultural, and environmental uses. The Project costs are compared to non-recycled projects that could potentially serve the same region and are indicative of new surface water supply costs for the region: the proposed Water Supply, Transmission, and Reliability Project (Water Project) for the Sonoma and Marin Counties portion of the Project area; and imported water to the MST area for the Napa County portion of the Project area<sup>2</sup>. Due to current funding opportunities, the Project costs evaluated are for the first set of projects implemented under Alternative 1, referred to as the Phase 1 set of projects. The following table summarizes the results.

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<sup>2</sup> Although these non-recycled water supply projects would not serve agricultural users in Sonoma Valley or environmental water needs in the Napa Salt Marsh, this analysis assumes that those non-recycled water projects are representative of water supply costs in the region. Therefore, the project costs are used as alternative cost measurements for agricultural and environmental water supplies.

<b>Phase 1 and Non-Recycled Projects Summary Cost Comparison</b>			
	<b>Alternative 1 Phase 1</b>	<b>Water Project (Sonoma and Marin Counties Portion of Project area)</b>	<b>Import Water to MST Area (Napa County portion of Project area)</b>
Total Capital Costs	\$121,000,000	\$174,479,487	\$95,700,000
Annual Capital Costs <sup>(1)</sup>	\$4,702,725	\$6,781,232	\$3,719,428
Annual O&M Costs	\$1,381,000	N/A <sup>(2)</sup>	N/A <sup>(2)</sup>
Total Annual Costs	\$6,083,725	\$6,781,232	\$3,719,428
Supply (AF)	4,645	3,613	1,937
<b>Dollar per acre-foot</b>	<b>\$1,307</b>	<b>\$1,877</b>	<b>\$1,920</b>

<sup>(1)</sup> Capital costs are annualized based on 50-year project life and 3 percent real discount rate.

<sup>(2)</sup> Not available

The Project would be less expensive to implement relative to both non-recycled water projects; therefore, it would have net economic benefits to the region. Based on the alternative cost method, the water supply benefits of the project would be between \$1,877 and \$1,920 per acre-foot. The Project would also provide various indirect benefits, including improved groundwater quality and levels and reduced operational costs for the member agencies. The economic analysis concludes that the Project would result in net benefits to the region.

The financial capability analysis discusses a preliminary funding plan for the local cost share of the Project. The Authority members have not yet developed a firm financing plan. The federal share of funding is expected to be \$25 million. Preliminary discussions have indicated Authority members would finance the local share through State and local grants, if available, and loans and revenue bonds. Loans and bonds would be repaid primarily through user fees, both for wastewater service and for recycled water supply deliveries. Through signing the MOU, completing this feasibility study, and developing an environmental impact statement/environmental impact report, the Authority members have shown a commitment in implementing the Project. A final cost-sharing plan and a more thorough analysis of financial capability will be developed before a construction funding agreement with the United States is executed.

# Section 1

## Introduction

This report, prepared in coordination with the North Bay Water Reuse Authority (Authority), presents an engineering evaluation and an economic and financial analysis of a proposed project for a regional approach to recycled water distribution in the North San Pablo Bay area of California.

The report has been prepared by the Authority's consultant, Camp Dresser & McKee Inc. in partial fulfillment of the requirements of the U. S. Department of the Interior's Bureau of Reclamation Public Law 102-575, Title XVI (the Reclamation Wastewater and Groundwater Study and Facilities Act of 1992, as amended). Title XVI provides a mechanism for Federal participation and cost-sharing in approved recycled water projects and provides general authority for appraisal and feasibility studies.

The Authority, established under a Memorandum of Understanding (MOU) in August 2005, is comprised of the Sonoma County Water Agency (SCWA), as Administrative Agency, together with four wastewater utilities as member agencies – the Las Gallinas Valley Sanitary District (LGVSD), the Novato Sanitary District (Novato SD), the Sonoma Valley County Sanitation District (SVCSD), and the Napa Sanitation District (Napa SD). North Marin Water District (NMWD) and Napa County are providing technical and financial support to the Authority.

Under the MOU and its amendment, the Authority is exploring “the feasibility of coordinating interagency efforts to expand the beneficial use of recycled water in the North Bay Region thereby promoting the conservation of limited surface water and groundwater resources.” The proposed North San Pablo Bay Restoration and Reuse Project (Project), the subject and intended outcome of the Authority's work, would alter the disposition of wastewater in the North Bay Region by reducing the volume of treated wastewater discharged into San Pablo Bay and its tributaries and instead providing increased recycled water supply to agricultural, urban, and environmental uses.

This report describes the proposed Project area and the key water management issues and needs within this Project area, identifies recycled water opportunities in the Project area, develops and analyzes alternative measures that could address the identified water management needs, presents an economic and financial analysis of the Project, and presents an overview of associated legal and institutional requirements.

This report is the product of the Phase 3 effort in a three-phase approach adopted by the Authority. The Phase 1 engineering foundation report, completed in March 2005, represented the submittal of initial results – preliminary information on demands in the study area, possible project configuration, and preliminary cost estimates. The Phase 2 report, completed in June 2006, presented a more detailed engineering

development and evaluation of best agreed alternatives. This Phase 3 report has refined the engineering evaluation, and includes the economic analysis of alternatives and documentation of the financial capability of the participating agencies. The Environmental Impact Statement/Environmental Impact Report (EIS/EIR) is underway and will be concluded in mid-2009, thereby completing the feasibility study report in fulfillment of Title XVI requirements.

## 1.1 Background

Four wastewater treatment agencies and one drinking water provider in the North San Pablo Bay area have joined together to investigate the use of recycled water for agricultural, environmental, and urban uses. The study area includes diked marsh, tidal marsh, and upland areas that rim the northern edge of San Pablo Bay. The complex area includes sensitive environmental areas, major urban areas, and one of the most prominent wine-producing regions in California.

As North San Pablo Bay area populations expand and environmental regulations grow more stringent, local municipalities are considering new ways to make use of recycled water. At the same time, urban and agricultural interests are searching for reliable water supplies.

In September 2002, SCWA entered into a cooperative agreement with the U.S. Department of the Interior Bureau of Reclamation (Reclamation) to prepare a feasibility study under the requirements of Reclamation's Title XVI program, which defines a program to investigate and identify opportunities for reclamation and reuse of municipal, industrial, domestic, and agricultural wastewater, and naturally impaired groundwater and surface waters.

From the beginning of the effort, local wastewater agencies were invited to attend meetings and provide input. Four of these agencies eventually joined SCWA as signatories to an MOU establishing the Authority, and provided a share of the local financial contribution toward completion of the Title XVI feasibility study.

The North San Pablo Bay Restoration and Reuse Project Phase 3 Engineering and Economic/Financial Analysis Report (Report) is being conducted under Section 1604 of Title XVI, which provides general feasibility study authority. The Report follows Reclamation's "Guidelines for Preparing, Reviewing, and Processing Water Reclamation and Reuse Project Proposals Under Title XVI of Public Law 102-575, as Amended" (Reclamation undated), and Reclamation Manual Directives and Standards WTR 11-01, "Title XVI Water Reclamation and Reuse Program Feasibility Study Review Process" (Reclamation 2008). The complete feasibility study report (a combination of this report and the EIS/EIR) will provide decision-makers with the information needed to make an informed choice regarding implementation of a recommended project.

The Project partners are completing the feasibility study in a phase approach, as shown below.



## 1.2 Project Purpose

The Project would create a regional wastewater reuse project to provide recycled water for agricultural, urban, and environmental uses as an alternative to discharging treated wastewater to San Pablo Bay and to developing other water supplies to meet current and future needs. The Project would also contribute to mitigation for groundwater basin overdraft in some portions of the study area. In this way, the wastewater discharge issues and water demand issues of the region can be addressed in an integrated and synergistic manner.

## 1.3 Participants

A regional program can provide broader benefits than individual projects, and multiple political representatives can provide a broad political base of support for the Project. With SCWA as the Administrative Agency, several wastewater treatment agencies in the North Bay are partners in the Project. The following agencies and wastewater treatment facilities, addressed from west to east, are participating in the feasibility analysis:

- **LGVSD** – The LGVSD wastewater treatment plant (WWTP) provides sanitation service to approximately 30,000 people within the area of Marinwood, Lucas Valley, Terra Linda, Santa Venetia, Los Ranchitos, and Smith Ranch Road (LGVSD 2005).
- **Novato SD** – The Novato WWTP provides service to approximately 60,000 residents within the City of Novato, an area of 28 square miles, and surrounding areas (Novato SD 2006).
- **SVCSD** – The SVCSD WWTP began operations in 1954 and provides service to approximately 34,000 residents around the City of Sonoma and unincorporated areas of Glen Ellen, Boyes Hot Springs, and Agua Caliente, within a 7-square-mile area (SVCSD 2006).
- **Napa SD** – The Napa SD’s Soscol water recycling facility treats wastewater from the City of Napa and surrounding unincorporated communities, an area of about 23 square miles, and serves about 33,000 connections (Napa SD 2006).

SCWA, which began the Title XVI process for investigating a recycled water distribution system under Cooperative Agreement with Reclamation, is a drinking water provider and continues to be an actively participating partner and the Administrative Agency for the Authority. NWMD and Napa County are providing technical and financial support to the Authority.

The City of Petaluma is not a signatory to the MOU establishing the Authority, but the City's participation in the regional recycled water system was initially evaluated in the early stages of the feasibility study (through Phase 2) prior to the Authority receiving notice that the City did not wish to participate.

The Marin Municipal Water District (MMWD) service area was also initially evaluated for inclusion in the Project. After Phase 2 of the Project analysis, MMWD indicated to the Authority it was no longer interested in having the Project serve recycled water within an expansion of its service area.

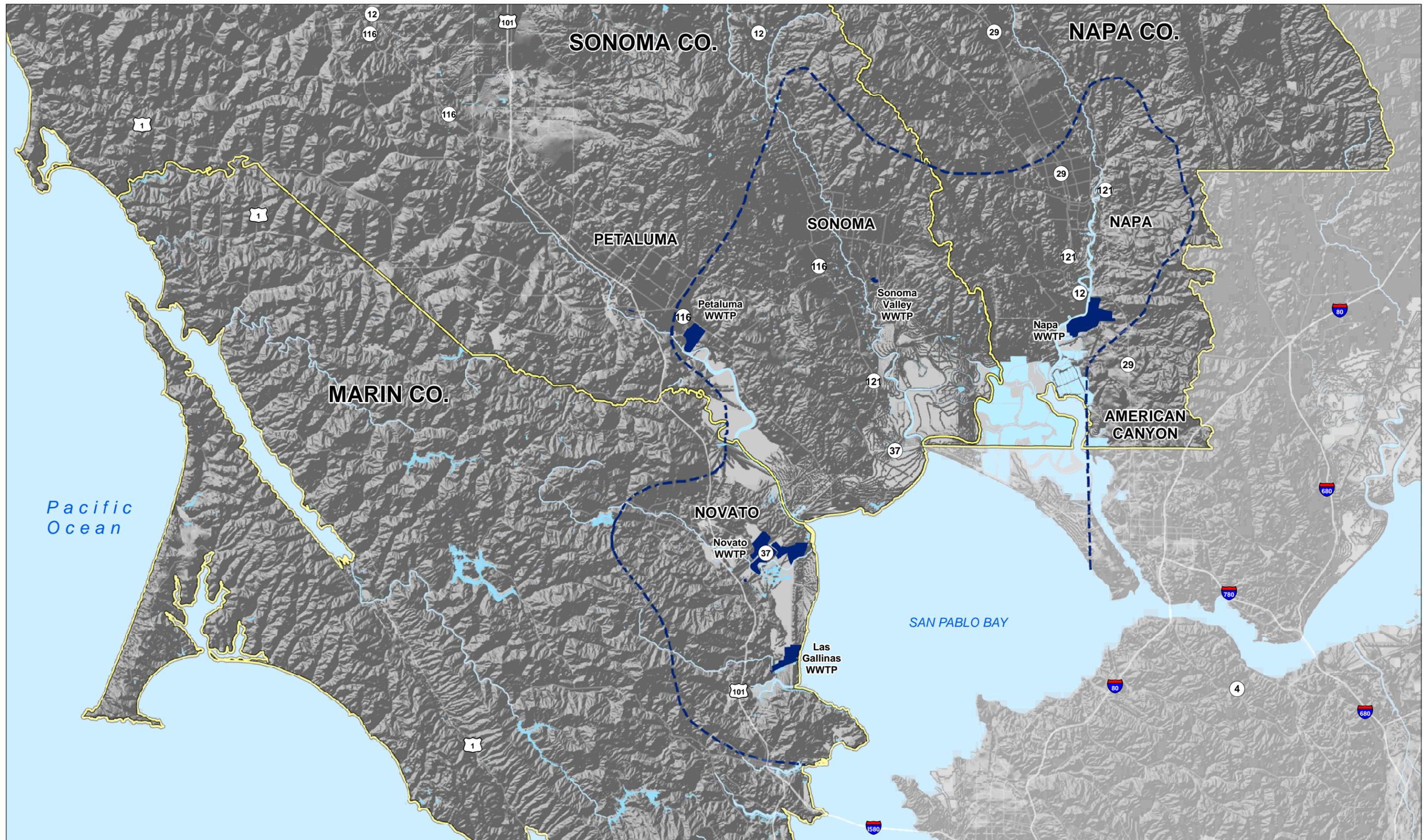
For the purposes of presenting a complete account of the Project's feasibility study process, Petaluma and MMWD remain included in the Report's discussions of the initial study area (see Sections 1.4, 2, and 3), water reuse opportunities (see Section 4), and initial alternatives screening (see Section 5). Section 5.4 presents the final selection of action alternatives, and discusses how Petaluma and MMWD have been removed from further evaluation.

## 1.4 Study Area

The initial study area, illustrated in Figure 1-1, extends approximately 10 to 15 miles inland from the San Pablo Bay within Marin, Sonoma, and Napa Counties. The study area extends as far south as Point San Pedro in Marin County, and as far north as Milliken Canyon located 28 miles to the northeast in eastern Napa County, and encompasses about 318 square miles of land. Urban centers in the study area are San Rafael (county seat) and Novato in Marin County, Petaluma and Sonoma Valley in Sonoma County, and Napa (county seat) in Napa County. The populations of San Rafael, Novato, Petaluma, Sonoma Valley, and Napa in 2005 were 69,000, 53,700, 57,700, 34,000, and 80,300, respectively.

The topography of the study area consists of gently sloping river valleys, separated by northwest trending mountain ranges with steep slopes and peaks exceeding elevations of 2,500 feet above mean sea level. Flat lying mudflats and marshland border San Pablo Bay. The majority of the study area is within Napa, Sonoma, Petaluma, and Novato Valleys and the foothills bounding these valleys.

The study area receives water from sources both inside and outside the region. Water sources within the region include the Napa River, Petaluma River and Sonoma Creek (used for agricultural supplies), and Stafford Lake on Novato Creek. Surface water sources outside the region include the Russian River Project (including Lake Mendocino, Lake Sonoma, and imports from the Eel River via Pacific Gas & Electric Company's Potter Valley Project), Lake Hennessey, Milliken Reservoir, MMWD's six



Basemap: U.S. Department of Agriculture, 2001

**Legend**

- - - Initial Study Area Boundary
- WWTPs



**Figure 1-1**  
Initial Study Area

Lagunitas Creek watershed reservoirs, Soulajule Reservoir, and the Sacramento-San Joaquin Delta via the State Water Project. The region relies on groundwater and recycled water as additional sources.

In undertaking the Project's Feasibility Study, the following features of the study area were taken into consideration:

- The five initial municipal wastewater agencies and their existing users of recycled water;
- Existing or future agricultural, urban, recreational, industrial, or environmental land uses that could benefit from the use of recycled water;
- Existing or future infrastructure that will be required for the treatment, conveyance, or storage of recycled water;
- Existing or planned local recycled water projects that would benefit from incorporation into the Project; and
- Land uses whose relative locations support an economically justifiable distribution system.

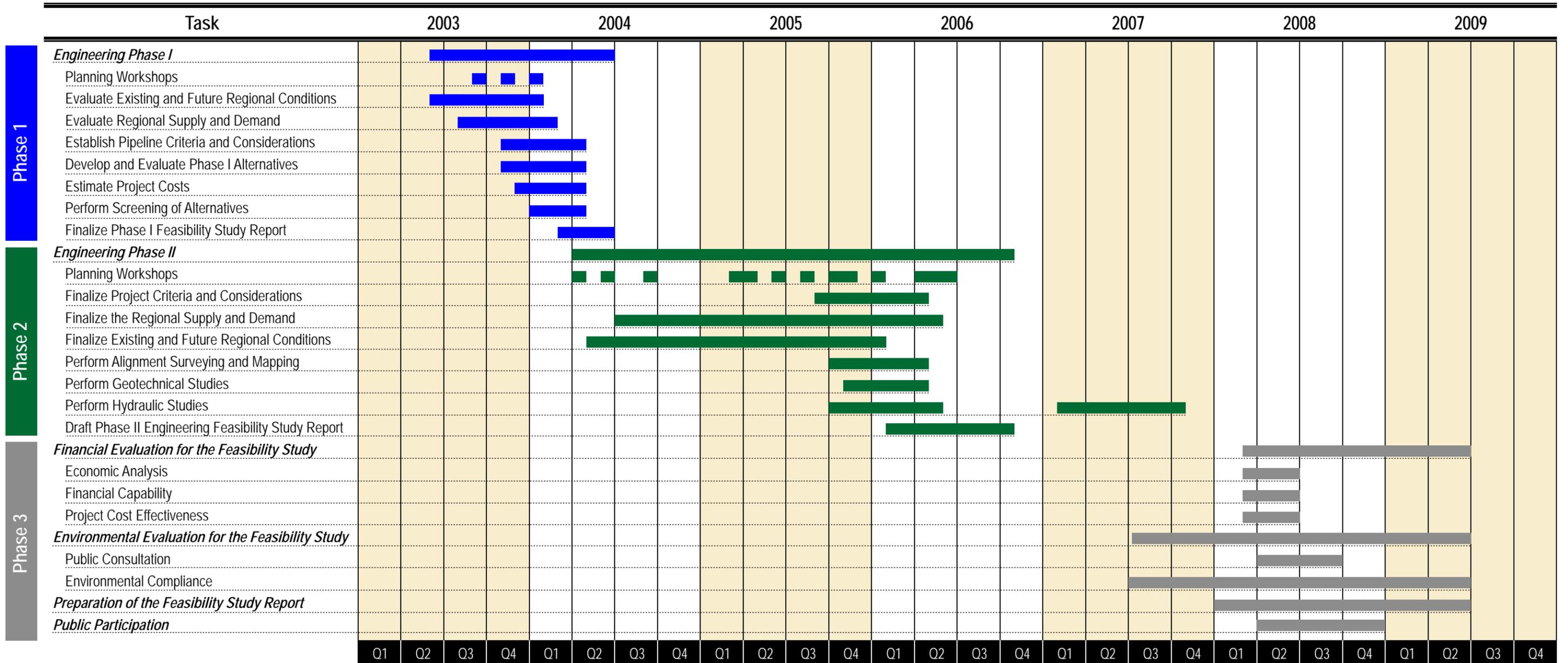
## **1.5 Planning Process**

### **1.5.1 Overview**

This Project is a regional program with multiple participants. Establishing a process to incorporate the thoughts and viewpoints of all participants was critical to the success of the Project. Additionally, the Project involves delivering recycled water to a wide range of potential customers whose concerns must be addressed throughout the planning process. Establishing a documented planning process gave each participant the opportunity to understand and contribute to each of the steps, allowing participants to better understand the outcome of the process. The Feasibility Study work schedule for 2003 through 2009 is detailed in Figure 1-2. The figure shows the tasks and schedule for each phase of the Project.

### **1.5.2 Workshops**

The participating agencies initiated a series of bi-monthly technical workshops. The first three workshops constituted Phase 1 while the 16 subsequent workshops fell under Phase 2. Table 1-1 summarizes the discussions at each of the technical workshops.



W:\REPORTS\SCWA\North San Pablo Bay Restoration and Reuse Project\Graphics\Figure 1-2\_Feasibility Study Work Plan Schedule.ai 04/30/08

<b>Table 1-1 Summary of Technical Workshops</b>		
<b>Workshop Number</b>	<b>Date</b>	<b>Discussion Progress</b>
1	September 2003	<ul style="list-style-type: none"> <li>• Identified the Project areas of concern including: institutional/regulatory, economic/financial, water supply, and natural resources</li> </ul>
2	November 2003	<ul style="list-style-type: none"> <li>• Discussed existing and future regional conditions</li> <li>• Discussed regional supplies and demands</li> <li>• Considered options for the Project, which included projects, programs, or policies that serve as building blocks for complete alternatives</li> </ul>
3	January 2004	<ul style="list-style-type: none"> <li>• Discussed the preliminary formulation of alternatives</li> <li>• Considered how the options from the last workshop fit together into alternatives</li> <li>• Formulated action alternatives</li> </ul>
4	April 2004	<ul style="list-style-type: none"> <li>• Discussed preliminary alternative costs</li> <li>• Presented methodology to narrow the potential storage and treatment options within each alternative</li> </ul>
5	June 2004	<ul style="list-style-type: none"> <li>• Distributed Draft Phase 1 Feasibility Report</li> <li>• Discussed schedule and message for future grower outreach meetings</li> <li>• Discussed scope of the No Project alternative and regional program examples</li> </ul>
6	September 2004	<ul style="list-style-type: none"> <li>• Update on institutional issues such as the MOU between participants and cost sharing methods for Phase 2 work</li> </ul>
7	December 2004	<ul style="list-style-type: none"> <li>• Presented revisions to the Draft Phase 1 Feasibility Report</li> <li>• Considered methods for cost share agreement and schedule of payments</li> <li>• Discussed activities related to Proposition 50 studies</li> </ul>
8	March 2005	<ul style="list-style-type: none"> <li>• Refined schedule and scope of work for Phase 2 activities</li> <li>• Discussed specifics of cost share agreement</li> </ul>
9	April 2005	<ul style="list-style-type: none"> <li>• Discussed existing recycled water projects underway in the study area</li> <li>• Considered various data sources for land use information</li> <li>• Identified potential recycled water supplies from the participating agencies</li> </ul>
10	June 2005	<ul style="list-style-type: none"> <li>• Considered cost allocation methodologies</li> <li>• Presented land use maps for review by participants</li> <li>• Discussed conceptual alternatives</li> </ul>
11	August 2005	<ul style="list-style-type: none"> <li>• Discussed refinements to the project alternatives, including storage options</li> <li>• Revisited evaluation criteria</li> </ul>
12	October 2005	<ul style="list-style-type: none"> <li>• Presented final alternatives and early pipeline layouts</li> <li>• Considered phasing of alternatives based on cost (or proximity to plants), readiness-to-proceed, and equity</li> </ul>
13	November 2005	<ul style="list-style-type: none"> <li>• Discussed details (service area, demand, cost) of locally-developed recycled water projects</li> <li>• Presented refined alternative pipeline layouts</li> </ul>
14	January 2006	<ul style="list-style-type: none"> <li>• Discussed initial hydraulic modeling activities</li> <li>• Distributed draft outline of the Phase 2 report</li> <li>• Reviewed storage options and construction cost curves</li> </ul>
15	April 2006	<ul style="list-style-type: none"> <li>• Distributed draft technical memorandum on supply/demand and geotechnical information for inclusion in the Phase 2 report</li> <li>• Discussed status of hydraulic modeling of the alternatives</li> <li>• Considered options for the No Project alternative</li> </ul>

16	May 2006	<ul style="list-style-type: none"> <li>• Distributed draft technical memorandum on hydraulic modeling and regional conditions for inclusion in the Phase 2 report</li> <li>• Discussed system operations assumed in modeling</li> </ul>
17	June 2006	<ul style="list-style-type: none"> <li>• Distributed draft Phase 2 Engineering Feasibility Study Report</li> </ul>
18	April 2007	<ul style="list-style-type: none"> <li>• Presented analysis of revised hydraulic modeling for one alternative</li> </ul>
19	July 2007	<ul style="list-style-type: none"> <li>• Discussed additional revisions to Alternative 1</li> </ul>

The early technical workshops focused on defining the stakeholder interests and concerns for the Project, establishing the existing conditions, and determining the recycled water supply and demand. An important early output was the agreed array of planning concerns and issues developed by the participating agencies, as shown in Figure 1-3. These consensus-based issues and concerns provided insights during the following analysis.

Parallel to the technical workshops, Project participants are attending monthly institutional workshops to:

- Determine levels of control allocated to each Project sponsor (agencies and WWTPs);
- Pursue funding opportunities; and
- Determine ownership of the recycled water.

Section 7.1 discusses the MOU signed, and amended, by the member agencies and the potential future formation of a Joint Powers Authority. Under the Joint Exercise of Powers Act, California Government Code 6502, two or more public agencies by agreement may jointly exercise any power common to the contracting parties.

### **1.5.3 Public Outreach**

Concurrent with the technical workshops and feasibility study activities, the member agencies initiated public outreach efforts to collect grower or end user information at a broad scale within each member agencies' service area. Outreach meetings were conducted which identified potential Project participants, discussed grower concerns and needs, reviewed land use mapping for accuracy, and discussed projected future changes in the agricultural industry within each service area. The outreach efforts are developing agricultural reuse contacts and working towards securing commitments to use recycled water. As Project activities carry on, potential users will continue to be invited to periodically attend Authority meetings and meetings with other growers and local industry representatives, and review handouts or reports. Recent public outreach efforts include a series of stakeholder meetings in the study area to introduce the Project to the general public, and development of the Authority's Project website, to provide information to the public on the Authority and the status of the Title XVI feasibility study process.

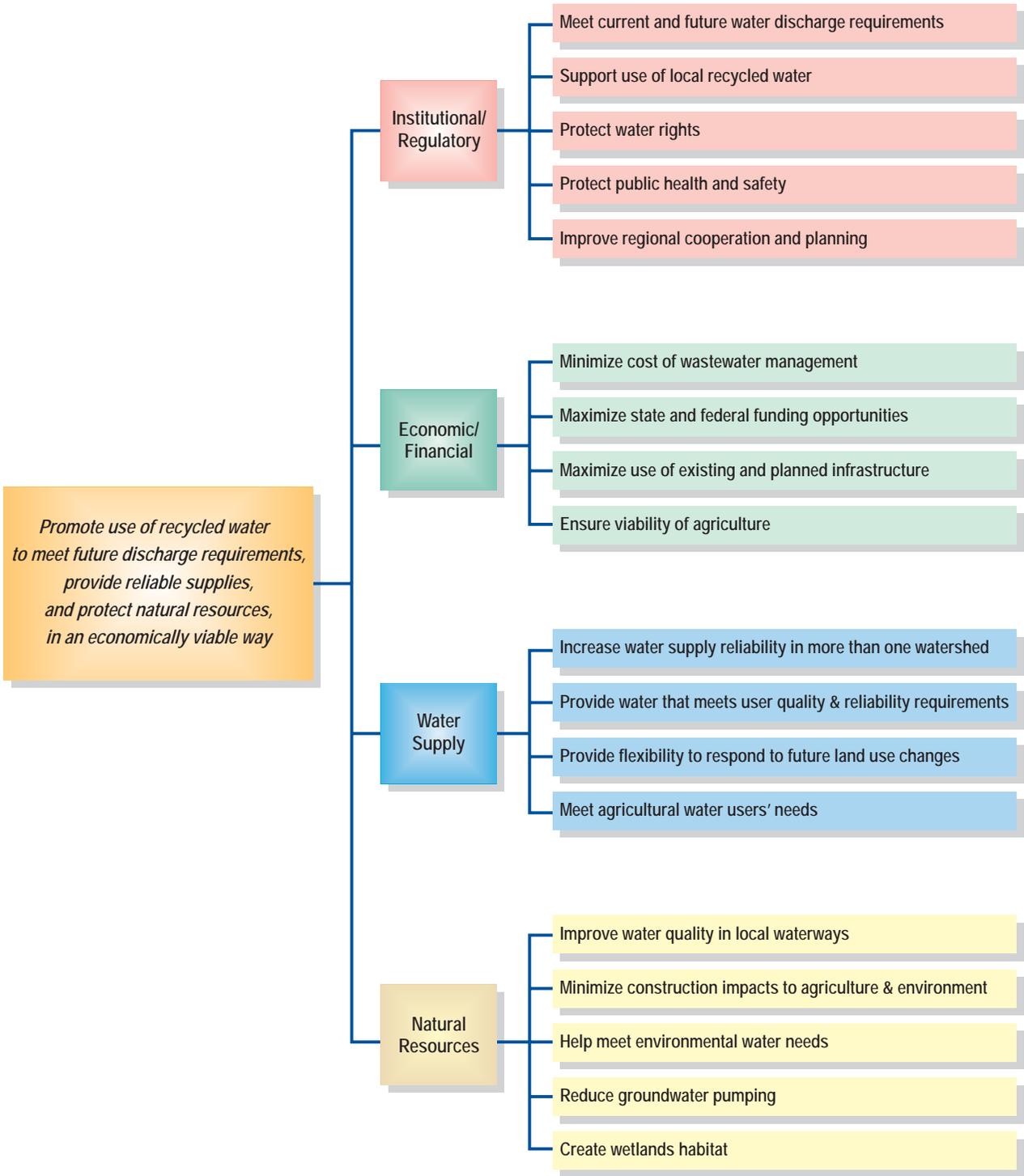


Figure 1-3

Planning Issues and Concerns

## 1.6 Document Organization

The Phase 3 report is organized into 12 sections:

- *Section 1* provides an introduction and background information on the Project.
- *Section 2 - Problems and Needs* identifies the fundamental issues that caused the agencies to pursue a regional recycled water project, and regional demands and supplies.
- *Section 3 - Existing and Future Regional Conditions* evaluates the existing physical and environmental conditions of the study area that would be potentially affected by the Project, and discusses the potential future of the region without the Project.
- *Section 4 - Recycled Water Opportunities* describes the WWTPs that will potentially contribute to the Project's recycled water supply.
- *Section 5 - Formulation of Initial Alternatives* discusses the method used to develop the Project alternatives.
- *Section 6 - Description of Alternatives* defines the Project alternatives, including a No Action alternative.
- *Section 7 - Legal and Institutional Requirements* presents the status of the agencies' working agreement, future consultation activities, and regulatory requirements.
- *Section 8 - Recommended Alternative* reviews the problems, needs, supplies, demands, costs, benefits, and tradeoffs of the alternatives, and presents the recommended Title XVI alternative.
- *Section 9 - Economic and Financial Analyses* provides the economic comparison of the recommended alternative to other water supply alternatives, the life-cycle cost analysis, and discusses the financial capability of the partner agencies.
- *Section 10 - Environmental Considerations* provides information potential environmental impacts from the Project.
- *Section 11* presents *Research Needs* for the Project.
- *Section 12 - References* identifies a list of the references used in the Phase 3 document.

The organization and content of the above sections has been prepared with the intent to meet the Feasibility Report Outline recommended by the Title XVI program. The EIS/EIR, the last element required by the Title XVI process, will be added to finalize the feasibility study following its completion in 2009.

# Section 2

## Problems and Needs

The agencies of the North Bay Water Reuse Authority (Authority) have undertaken this feasibility study of the North San Pablo Bay Restoration and Reuse Project (Project) because they recognize the need to address mounting environmental, regulatory, and water supply concerns. The first part of this section identifies the water management needs within the study area which have led the member agencies to investigate increased use of recycled water. The second part of this section elaborates on the water supply problem by describing water supplies and demands in the region.

### 2.1 Water Management Needs

The study area of the North San Pablo Bay is unique because of the mix of sensitive environmental areas, growing urban areas, and high-value agricultural areas. Each of these constituent areas is affected by existing water management needs and will be exposed to increasing challenges in the future.

The issues and needs can be summarized as follows:

- The agricultural economy, which is dominated by high-value vineyard culture, requires a highly reliable water supply to maintain and expand its crop base.
- Urbanization of the greater San Francisco Bay area requires highly reliable sources of water.
- The vitally important estuarine ecosystem of the North San Pablo Bay area, which includes endangered species and vital wetlands, has been under intense pressure. Although protective and restorative measures are in place, the habitat requires a reliable supply of water.
- Surface water supplies are less reliable sources of supply as they are already diverted by multiple users, have low flows in the summer (which coincides with the irrigation season), and can have low flows in dry years.
- Groundwater supplies are heavily pumped for agricultural and municipal uses and in some localities have marginal quality.

These topics are all among those addressed in the planning issues and concerns identified by the participating agencies (Section 1, Figure 1-3). The following pages present more detail on the water management needs of the North San Pablo Bay area.

#### 2.1.1 Water Supplies in the Study Area

The study area includes some of the premier wine grape-growing regions in North America and is part of the desirable and rapidly growing San Francisco Bay area. Both

of these factors exert pressure on water supplies; both need highly reliable water supplies to maintain and expand the economies in the region.

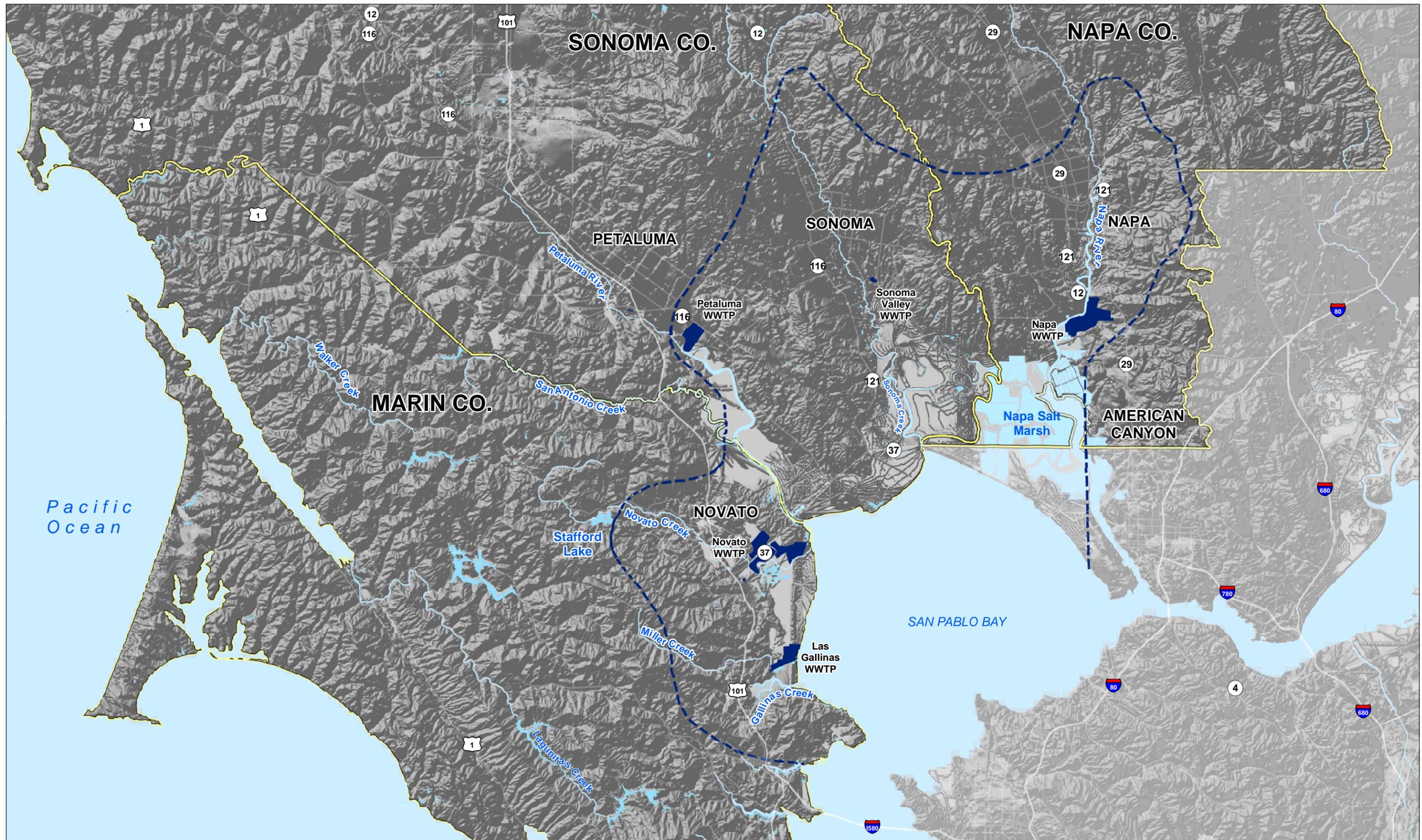
Water supplies in the study area are drawn from both surface water and groundwater sources. The region has three main waterways (Napa River, Sonoma Creek, and Petaluma River), shown in Figure 2-1, and many smaller tributaries to these waterways. Some agricultural users divert water from surface streams that are ephemeral or have very low flows during the summer. These supplies are not reliable during dry years. Current surface water supplies and quality are discussed further in Section 2.2.2.1.

Groundwater is a primary water supply for agricultural users and a supplemental supply for urban users. Groundwater yields vary depending on location, but yields in the foothills (where many new vineyards are being planted) are low. Additionally, the deteriorating quality of some groundwater sources is a concern. The groundwater aquifer in parts of Sonoma and Napa Counties, for example, has localized concentrations of boron and salinity that make the groundwater unusable for agricultural uses and in some cases for urban uses. Current groundwater supplies and quality are discussed further in Section 2.2.2.2.

Agricultural productivity and costs could be affected if groundwater becomes an unreliable water supply for farmers. In urban areas, water agencies would need to find another, potentially costly, water source to supplement surface water resources if groundwater resources were compromised. To address this problem, the region needs a reliable and supplemental source of water supply, such as recycled water, that agriculture can count on and that urban areas can employ to save valuable potable water for municipal users.

### **2.1.2 Water Quality**

Water quality is a problem for both groundwater and surface water in certain parts of the North Bay study area. These supplies serve environmental, agricultural, and urban water needs, yet neither source is a dependable option due to water quality concerns. Groundwater basins close to the San Francisco Bay, including Sonoma and Napa Counties, have areas of high total dissolved solids and chloride concentrations. Groundwater quality problems include high levels of boron and iron in the Napa and Sonoma Valleys and persistent nitrate concentrations in the shallow aquifer zone in the Petaluma Valley (California Department of Water Resources 2003). A 2003 study by the U.S. Geological Survey (USGS) found arsenic, boron, iron, and manganese in concentrations above drinking water standards in groundwater wells in southern Napa County (Farrar and Metzger 2003). These quality issues can affect the utility of this water, particularly for agricultural uses. Groundwater quality is discussed in more detail in Section 2.2.2.2.



Basemap: U.S. Department of Agriculture, 2001

**Legend**

- - - Initial Study Area Boundary
- WWTPs



**Figure 2-1**  
**Major Water Bodies in the North Bay Area**

Although water quality problems in surface waters can affect both urban and agricultural uses, these water quality problems primarily affect environmental uses in the North Bay area. The creation of a recycled water distribution system in the North San Pablo Bay could help improve water quality in the tributary water bodies, as agricultural users move from surface water diversions to recycled water and more surface water is allowed to flow to the Bay. Environmental water quality is regulated under Federal and State law. Under Section 303(d) of the 1972 Clean Water Act, states, territories, and authorized tribes are required to develop a list of water quality limited segments, known as the 303(d) List. States must develop total maximum daily loads (TMDLs) for the constituents that create water quality concerns in each water body. As the name indicates, TMDLs establish limits of each constituent that can enter the waterway every day, from all potential sources. The State Water Resources Control Board (SWRCB) develops the 303(d) List for California.

Table 2-1 identifies the waterways in the North Bay region on the approved 2006 303(d) List and the regulated constituents in each waterway. These water bodies are shown on Figure 2-1. To address water quality problems in the waterways, the San Francisco Regional Water Quality Control Board (RWQCB) has imposed limitations on point sources during summer months when the waterways are most seriously impaired. Future implementation of TMDLs, or other regulatory requirements, could impose additional limitations on point sources.

Water quality impairment can affect the beneficial uses of the waterways, which are defined by the RWQCB in the San Francisco Bay Basin Plan (Basin Plan). Table 2-2 lists the major waterways and wetland areas in the study area (also shown on Figure 2-1) and the existing and potential beneficial uses assigned to them (and, for the waterways, their tributaries) in the 2007 Basin Plan. These beneficial uses highlight the broad spectrum of uses, particularly environmental uses, which are affected by degraded water quality.

### **2.1.3 Environmental Quality**

San Pablo Bay was once bordered by more than 50,000 acres of highly-productive tidal wetlands. Those wetlands were an integral ecological complement to the open waters of the San Francisco Bay estuary, serving as a nursery grounds for fisheries, wintering areas for migratory waterbirds, and nutrient production factories for aquatic species.

Over the last century and a half, 75 percent of those wetlands were diked, drained, and disconnected from the estuary ecosystem. This process has decreased water flows and marsh habitat, including habitat for endangered or threatened species such as the California clapper rail and the salt marsh harvest mouse. The remaining marsh areas and recently restored marsh areas are providing some of these benefits, but these wetlands require a reliable water source to continue to provide value.

<b>Table 2-1 2006 303(d) Listed Surface Water Sources</b>		
<b>Surface Water Body</b>	<b>Pollutant(s)</b>	<b>Proposed TMDL Completion Date</b>
Gallinas Creek	Diazinon	2005
Lagunitas Creek	Nutrients	2019
	Sedimentation/Siltation	2009
Miller Creek	Diazinon	2005
Napa River	Nutrients	2008
	Pathogens	2006
	Sedimentation/Siltation	2006
Novato Creek	Diazinon	2005
Petaluma River	Diazinon (river and tidal portion)	2005
	Nickel (tidal portion)	2019
	Nutrients (river and tidal portion)	2019
	Pathogens (river and tidal portion)	2019
	Sedimentation/Siltation (river portion)	2019
San Antonio Creek	Diazinon	2005
San Pablo Bay	Chlordane	2008
	Dichloro-diphenyl-trichloroethane (DDT)	2008
	Dieldrin	2008
	Dioxin Compounds	2019
	Exotic species	2019
	Furan Compounds	2019
	Mercury	2006
	Nickel	2019
	Polychlorinated biphenyls (PCBs)	2006
	PCBs (dioxin-like)	2019
	Selenium	2019
	Sonoma Creek	Nutrients
Pathogens		2006
Sedimentation/Siltation		2008
Walker Creek	Mercury	2006
	Nutrients	2019
	Sedimentation/Siltation	2009

Source: SWRCB 2006

<b>Table 2-2</b>		
<b>2007 Basin Plan Beneficial Uses</b>		
<b>Water Body</b>	<b>Existing Beneficial Uses</b>	<b>Potential Beneficial Uses</b>
Gallinas Creek	Cold Freshwater Habitat; Preservation of Rare and Endangered Species; Noncontact Water Recreation; Warm Freshwater Habitat; Wildlife Habitat	
Napa River	Agricultural Supply; Cold Freshwater Habitat; Fish Migration; Municipal and Domestic Supply; Navigation; Preservation of Rare and Endangered Species; Water Contact Recreation; Noncontact Water Recreation; Fish Spawning; Warm Freshwater Habitat; Wildlife Habitat	
Novato Creek	Cold Freshwater Habitat; Municipal and Domestic Supply; Preservation of Rare and Endangered Species; Water Contact Recreation; Noncontact Water Recreation; Fish Spawning; Warm Freshwater Habitat; Wildlife Habitat	Cold Freshwater Habitat; Fish Migration; Water Contact Recreation; Noncontact Water Recreation; Fish Spawning; Warm Freshwater Habitat
Petaluma River	Cold Freshwater Habitat; Estuarine Habitat; Fish Migration; Navigation; Preservation of Rare and Endangered Species; Water Contact Recreation; Noncontact Water Recreation; Fish Spawning; Warm Freshwater Habitat; Wildlife Habitat	
San Pablo Bay	Ocean, Commercial, and Sport Fishing; Estuarine Habitat; Industrial Service Supply; Fish Migration; Navigation; Preservation of Rare and Endangered Species; Water Contact Recreation; Noncontact Water Recreation; Shellfish Harvesting; Fish Spawning; Wildlife Habitat	
Sonoma Creek	Cold Freshwater Habitat; Fish Migration; Preservation of Rare and Endangered Species; Water Contact Recreation; Noncontact Water Recreation; Fish Spawning; Warm Freshwater Habitat; Wildlife Habitat	
<b>Wetland Area</b>	<b>Potential Beneficial Uses</b>	
Gallinas Creek	Estuarine Habitat; Preservation of Rare and Endangered Species; Water Contact Recreation; Noncontact Water Recreation; Fish Spawning; Wildlife Habitat	
Napa	Estuarine Habitat; Fish Migration; Ocean, Commercial, and Sport Fishing; Preservation of Rare and Endangered Species; Water Contact Recreation; Noncontact Water Recreation; Fish Spawning	
Novato Creek	Estuarine Habitat; Fish Migration; Preservation of Rare and Endangered Species; Water Contact Recreation; Noncontact Water Recreation; Fish Spawning	
Petaluma	Estuarine Habitat; Fish Migration; Ocean, Commercial, and Sport Fishing; Preservation of Rare and Endangered Species; Water Contact Recreation; Noncontact Water Recreation; Fish Spawning; Wildlife Habitat	
San Pablo Bay	Estuarine Habitat; Fish Migration; Ocean, Commercial, and Sport Fishing; Preservation of Rare and Endangered Species; Water Contact Recreation; Noncontact Water Recreation; Fish Spawning; Wildlife Habitat	

Source: RWQCB 2007.

Additionally, the area just north of San Pablo Bay has many small creeks and streams that provide habitat for fisheries and riparian vegetation. Many of these waterways also serve as water supplies for local farmers, which can cause a conflict between environmental use and agricultural water supply in some areas.

## 2.2 Demands and Supplies

Urban and agricultural land uses broadly constitute the primary water demands in the study area. Major urban land uses in the study area include residential, commercial, public land, open space (such as parks), and industrial designations. The major agricultural uses include vineyards, dairies, and pasture lands.

Groundwater is the main water supply in the area for agriculture, with small amounts of existing supply from surface water and recycled water. In most years, adequate supplies exist to meet demands on an annual basis. Supplies are strained on a seasonal basis (e.g., surface water flows are lowest in the summer when demand is highest). Future urban growth will likely exacerbate this situation, and additional sources of supply to meet future demands are limited.

### 2.2.1 Demands

This section discusses urban, agricultural, and environmental demands in the initial study area. Each subsection first identifies the methods to obtain these demands, and then discloses the demand for each sector.

Table 2-3 summarizes the total water demand in the initial study area<sup>1</sup> by demand sector in acre-feet per year (AFY). Urban demands are derived from municipal planning documents.

Potential agricultural demands are derived from land use acreage data and crop specific water demand rates. Each of these demand sectors are discussed in the following subsections.

#### 2.2.1.1 Urban Demand

The Urban Water Management Planning Act (California Water Code, Section 10610 through 10656) requires all urban water purveyors serving more than 3,000 customers or supplying more than 3,000 acre-feet (AF) annually to complete an Urban Water Management Plan (UWMP) and update it every five years. These plans identify

<b>Demand Sector</b>	<b>2005 (AFY)</b>	<b>2020 (AFY)</b>
Urban <sup>(1)</sup>	75,684	86,722
Agriculture <sup>(2)</sup>	34,428	34,000
Environmental <sup>(3)</sup>	NQ	NQ
<b>Total Demand</b>	<b>109,780</b>	<b>120,722</b>

<sup>(1)</sup> See Section 2.2.1.1, Table 2-5 for details.

<sup>(2)</sup> Represents estimated maximum agricultural water use, assumes no change in future agricultural water use.

<sup>(3)</sup> NQ = Not quantifiable. Current and future environmental demands are not quantifiable at this time.

<sup>1</sup> As discussed in Section 1.3, Petaluma and Marin Municipal Water District were initially evaluated in the Project, but are no longer participating.

existing and future demands and supplies for 20 years. The following section on urban demands is based on information from these plans.

### 2.2.1.1.1 Recent Conditions

Table 2-4 presents water use for the year 2000 for each retail water supplier within the initial study area.

<b>Water Use Sectors</b>	<b>2000 Urban Water Use (AFY)</b>					
	<b>Napa<sup>(2)</sup></b>	<b>Petaluma<sup>(3)</sup></b>	<b>Sonoma<sup>(3)</sup></b>	<b>NMWD<sup>(3)</sup></b>	<b>MMWD<sup>(4)</sup></b>	<b>Total</b>
Single family residential	7,161	6,286	1,787 <sup>(5)</sup>	6,345	16,002	37,581
Multi-family residential	2,017	824	N/A	1,627	3,982	8,450
Commercial	2,026	2,473	227	1,675	3,449	9,850
Industrial, Institutional and Governmental	714	721	222	370 <sup>(6)</sup>	2,198	4,225
Landscape	529	N/A	156	N/A	2,613	3,298
Unaccounted-for losses	1,817	896	N/A	907	2,810 <sup>(7)</sup>	6,430
Miscellaneous Accounts/Unmetered Uses <sup>(8)</sup>	908	N/A	N/A	N/A	N/A	908
Raw Water Irrigation <sup>(9)</sup>	198	N/A	N/A	250	N/A	448
<b>Total</b>	<b>15,370</b>	<b>11,200</b>	<b>2,392</b>	<b>11,174</b>	<b>31,054</b>	<b>71,190</b>

<sup>(1)</sup> Each agency uses slightly varying accounting measures for total water use, as indicated in following footnotes.

<sup>(2)</sup> City of Napa 2006

<sup>(3)</sup> SCWA 2001a; NMWD = North Marin Water District

<sup>(4)</sup> MMWD = Marin Municipal Water District; MMWD 2003

<sup>(5)</sup> City of Sonoma combines single family and multi-family residential uses

<sup>(6)</sup> Includes Landscape uses

<sup>(7)</sup> Includes adjustments to water use

<sup>(8)</sup> Includes special accounts such as hydrants and the Napa State Hospital and unmetered uses such as main flushing, large main breaks, and water treatment plant de-sludging

<sup>(9)</sup> Raw water irrigation includes service to Indian Valley Golf Course and the County of Marin's Stafford Lake Park and interruptible service to customers outside of Napa city limits

N/A – Not available – Agency/Contractor did not define specific sector in water use calculations

The Sonoma County Water Agency (SCWA) is a wholesale water supplier. SCWA contracts with the following cities and municipal agencies to purchase water and deliver it to residential, commercial, and industrial customers: City of Petaluma; City of Sonoma; North Marin Water District (NMWD), serving Novato; Marin Municipal Water District (MMWD), serving San Rafael, Corte Madera, Tiburon, Sausalito, and smaller area communities; and Valley of the Moon Water District (VOMWD), serving the unincorporated Sonoma County communities of Fetter Hot Springs, Agua Caliente, Boyes Hot Springs, El Verano, Trinity Oaks, Glen Ellen, and Temelec.

### 2.2.1.1.2 Future Conditions

In their UWMPs, local water agencies project future water use. Changes in urban water demand are primarily driven by changes in population. Table 2-5 presents a summary of the initial study area's year 2005 use and projected water demands through 2020. The total projected urban water use in 2020 for the initial study area is

86,722 AF, which is about a 15 percent increase over year 2005 water use of 75,684 AF. The water use includes both residential and non-residential customers.

<b>Agency/Contractor</b>	<b>Total Urban Water Use (AFY)</b>			
	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>
Napa <sup>(1)</sup>	15,370	16,395	17,489	18,798
Petaluma <sup>(2)</sup>	11,996	12,798	13,361	13,958
Sonoma <sup>(2)</sup>	2,714	2,991	3,269	3,544
NMWD Service Area <sup>(2)</sup>	13,294	14,186	15,022	15,022
MMWD Service Area <sup>(3)</sup>	32,310	33,690	34,690	35,400
<b>Total</b>	<b>75,684</b>	<b>80,060</b>	<b>83,831</b>	<b>86,722</b>

<sup>(1)</sup> City of Napa 2006

<sup>(2)</sup> SCWA 2001a

<sup>(3)</sup> MMWD 2003

### 2.2.1.2 Agriculture/Irrigated Demand

Calculated agricultural demands within the study area did not exist prior to this study. Therefore, the participating agencies calculated existing demands based on land use patterns and crop water needs. The California Department of Water Resources (DWR) provided land use data for Marin County, Napa Sanitation District (Napa SD) and DWR provided information for Napa County, and SCWA provided data for Sonoma County (DWR 1999a and 1999b; Napa SD 2005; SCWA 2001b). Land use maps indicate that agricultural and urban landscaping acreage within the recycled water project areas considered in this study (see Section 5) totals about 40,500 acres. Out of this acreage, less than 1 percent is non-irrigated farmland (idle and dry farming lands).

Table 2-6 presents the acreage of each type of irrigated land described in the subsections below and the associated estimated water use rate in acre-feet per acre (AF/acre). Based on this data, a total maximum estimated water use is developed for agricultural lands considered for recycled water use in the initial study area.

<b>Table 2-6</b>			
<b>Irrigated Acreage and Water Use in the Initial Study Area</b>			
<b>Land Use Type</b>	<b>Water Use Rate (AF/acre)</b>	<b>Acres</b>	<b>Total Maximum Water Use (AFY)</b>
<b>Urban Landscaping</b>			
Marin County	2.234	1,335	2,982
Napa County	2.801	644	1,804
Sonoma County	3.250	333	1,083
<i>Total</i>		2,312	5,868
<b>Dairy &amp; Pasture</b>			
Marin County	2.502	0	0
Napa County		37	92
Sonoma County		4,721	11,811
<i>Total</i>		4,757	11,903
<b>Orchard</b>			
Marin County	2.971	0	0
Napa County		30	90
Sonoma County		0	0
<i>Total</i>		30	90
<b>Irrigated Farm</b>			
Marin County	1.339	0	0
Napa County		0	0
Sonoma County		2,924	3,915
<i>Total</i>		2,924	3,915
<b>Vineyard</b>			
Marin County	N/A	0	0
Napa County	0.250	10,289	2,572
Sonoma County	0.500	20,156	10,078
<i>Total</i>		30,445	12,650
<b>Totals</b>		<b>40,469</b>	<b>34,428</b>

N/A = Not applicable

Note: The Petaluma and MMWD service areas are included in this water use estimate.

It is worth noting that more than 75 percent of the land considered for recycled water use consists of vineyards. That area accounts for 37 percent of the water demand. Dairy/pasture land has the next highest water demand with 35 percent of the total water use.

#### 2.2.1.2.1 Recent Conditions

As there are no records *per se* on agricultural water demand, it is necessary to estimate agricultural water use by a balance of theoretical and observed information. The development of agricultural water demand totals drew upon theoretical demand information (measured as evapotranspiration of applied water (ETAW)) from the California Irrigation Management Information System (CIMIS), crop coefficients from the University of California (UC) at Davis, records of actual water use obtained from

the City of Santa Rosa's subregional wastewater treatment plant (WWTP), and local information obtained from each member agency of the Authority.<sup>2</sup>

This section summarizes demand calculations for each irrigated land use. Estimated total water use for irrigation in the study area is about 34,400 AFY, with the major demand exerted by vineyards (37 percent) and dairies/pastureland (35 percent).

### Urban Landscaping

Average theoretical total applied water (TAW) values from the Santa Rosa CIMIS station predicted that urban landscaping water use would be about 3.56 AF/acre annually, and that peak average monthly water use would occur in July at 0.61 AF/acre. Customers in Santa Rosa using recycled water for urban landscaping include individual businesses, business parks, and housing developments. Between 1998 and 2003, actual recycled water use for urban landscaping ranged from 1.62 AF/acre in 1998 to 2.81 AF/acre in 2001 with an average use of 2.23 AF/acre. This average actual use is about 1.33 AF/acre less than the theoretical water demand. Peak average monthly water use typically occurred in August (0.45 AF/acre), and little or no water use occurred during the months of December through March. In general, less water is applied throughout the year for this land use than would be expected.

After reviewing the actual and theoretical urban landscaping water demand values, additional information was obtained from SCWA and Napa SD. These agencies developed estimated water demands specific to their own service areas and microclimates. This study will use those rates for consistency with existing plans developed by the participating agencies.

Table 2-7 presents the urban landscaping demands used in this study. The SCWA values are the average of their landscaping water demand (3 AF/acre) and golf course water demand (3.5 AF/acre).

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<sup>2</sup> Water use of crops is measured as ETAW. This factor measures the amount of total applied (or irrigated) water (TAW) used by the plant for evaporation or transpiration. For each crop, water use per acre varies based on location and irrigation practices.

Theoretical demand information is available from CIMIS for a reference crop, typically grass. Crop coefficients, available from UC Davis, can translate the demand for a reference crop into demand for a specific crop. These factors derive a theoretical demand, but this information does not always reflect local practices. Theoretical demand results were compared to actual water use obtained from the City of Santa Rosa's subregional WWTP. The Santa Rosa subregional WWTP is one of the few facilities in the North Bay region that meters the use of recycled water by each of its customers. Santa Rosa currently has over 10 years of metered recycled water use data.

Each member agency obtained local information to reconcile the differences between theoretical and actual demand in their service area for agriculture.

**Table 2-7  
Urban Landscaping Water Demand**

<b>Month</b>	<b>Marin County<sup>(1)</sup> (AF/acre)</b>	<b>Napa County<sup>(2)</sup> (AF/acre)</b>	<b>Sonoma County<sup>(3)</sup> (AF/acre)</b>
Jan	0.002	0.000	0.000
Feb	0.002	0.000	0.000
Mar	0.018	0.000	0.000
Apr	0.157	0.243	0.281
May	0.195	0.398	0.461
Jun	0.376	0.533	0.618
Jul	0.439	0.573	0.664
Aug	0.452	0.509	0.591
Sep	0.309	0.369	0.428
Oct	0.242	0.178	0.206
Nov	0.030	0.000	0.000
Dec	0.012	0.000	0.000
<b>Total</b>	<b>2.234</b>	<b>2.801</b>	<b>3.250</b>

Source:

<sup>(1)</sup> Santa Rosa WWTP actual recycled water use.

<sup>(2)</sup> Napa SD 2005

<sup>(3)</sup> SCWA 2005

Pasture

Pasture land irrigated with recycled water from the Santa Rose WWTP used an average 1.84 AF/acre. Peak average water use typically occurred in July at 0.38 AF/acre. Between November and March, water use was negligible. Theoretical water demand for pasture was estimated to be 3.56 AF/acre, about 94 percent greater than actual water demand from the Santa Rosa WWTP.

The actual water demand values show that less water was applied than expected between February and November with the difference decreasing after May. During January and December, more water was applied than expected.

The SCWA and Napa SD studies both estimated pasture water demand to be about 2.5 AF/acre. The study will use this water demand value for all three counties in order to be consistent with existing plans developed by the participating agencies. Table 2-8 presents the monthly demand curve for dairy and pasture water demand.

**Table 2-8  
Dairy and Pasture Water Demand**

<b>Month</b>	<b>Study Area (AF/acre)</b>
January	0.000
February	0.000
March	0.000
April	0.217
May	0.355
June	0.476
July	0.511
August	0.455
September	0.330
October	0.158
November	0.000
December	0.000
<b>Total</b>	<b>2.502</b>

Sources: Napa SD 2005, SCWA 2005

Irrigated Farm

Irrigated farm property includes rice and field, truck, nursery, and berry crops. The water demand for these crops, presented in Table 2-9, was developed from Santa Rosa WWTP customer data and applied to all three counties where irrigated farmland exists.

Orchard

Water demand for orchards was estimated using TAW data from the Petaluma East CIMIS station, in combination with theoretical crop coefficients for orchards without crop cover<sup>3</sup>. Actual data for this crop category was not available from the participating agencies. The data presented in Table 2-10 is average water use for deciduous peach, apricot, pear, plum, almond, and pecan orchards, and apple and cherry orchards, without crop cover. This water demand for orchards was applied to all three counties where orchards exist.

Vineyards

Figure 2-2 presents the calculated TAW for vineyards and compares it to the demand pattern for vineyards using recycled water in Santa Rosa. In Santa Rosa, actual water use was much less than the calculated TAW. Regional irrigation specialists from the UC Davis Cooperative Extension indicate that regional vineyard operators widely practice Regulated Deficit Irrigation (RDI) (Smith 2003; Pritchard 2003). RDI is an agricultural practice in the wine industry that strategically decreases the quantity of applied water during periods of the growing season. This practice causes the plant to be slightly stressed during these periods and enhances characteristics such as berry size and color. Regional RDI practices reduce the actual evapotranspiration value to approximately 60 percent of the theoretical evapotranspiration value reported by CIMIS (Pritchard 2003). Decreased irrigation causes the plant to use more of the soil moisture, which also allows for more storage of rainfall in the soil. Vineyard water demand adjusted for RDI practices reduced the average yearly water use to 0.52 AF/acre.

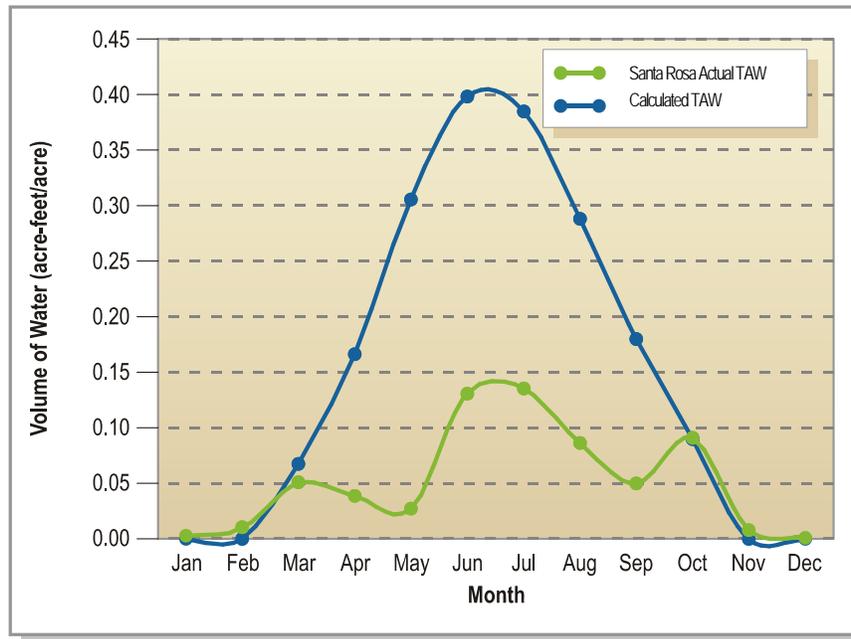
**Table 2-9**  
**Irrigated Farmland Water Demand**

<b>Month</b>	<b>Actual Water Use (AF/acre)</b>
January	0.008
February	0.001
March	0.021
April	0.063
May	0.135
June	0.222
July	0.281
August	0.305
September	0.208
October	0.086
November	0.009
December	0.001
<b>Total</b>	<b>1.339</b>

**Table 2-10**  
**Orchard Water Demand**

<b>Month</b>	<b>Theoretical Water Demand (AF/acre)</b>
January	0.000
February	0.017
March	0.174
April	0.315
May	0.497
June	0.602
July	0.514
August	0.401
September	0.289
October	0.144
November	0.018
December	0.000
<b>Total</b>	<b>2.971</b>

<sup>3</sup> Crop cover is low-lying vegetation or crops planted to cover the bare ground. It is often used to improve soil conditions and decrease weeds and pests in the orchard.



**Figure 2-2**  
Calculated and Actual TAW Vineyard Demands

After reviewing these actual and theoretical vineyard water demands, additional information was obtained from SCWA and Napa SD. In their recycled water plans, both agencies developed estimated vineyard water use rates specific to their service areas. The study used these rates for consistency with the existing plans developed by the participating agencies. The rates are presented in Table 2-11. A vineyard water demand was not developed for Marin County because no vineyard land use was identified in the Marin County portion of the study area.

<b>Month</b>	<b>Napa County<sup>(1)</sup> (AF/acre)</b>	<b>Sonoma County<sup>(2)</sup> (AF/acre)</b>
Jan	0.000	0.000
Feb	0.000	0.000
Mar	0.000	0.000
Apr	0.000	0.000
May	0.000	0.104
Jun	0.088	0.153
Jul	0.086	0.145
Aug	0.053	0.084
Sep	0.023	0.014
Oct	0.000	0.000
Nov	0.000	0.000
Dec	0.000	0.000
<b>Total</b>	<b>0.250</b>	<b>0.500</b>

Source:  
(1) Napa SD 2005  
(2) SCWA 2005

#### **2.2.1.2.2 Future Conditions**

Agricultural water use within the study area is anticipated to change in the future and be dependent on factors that influence the crop composition within the region. The two major factors that could change agricultural land use include urbanization and economic pressure to shift to different crops. Due to the uncertainty associated with these factors, calculating rigorous future agricultural water use is not currently possible.

Growing populations within the study area could cause urban areas to expand in the future. Sonoma, Marin, and Napa Counties have objectives and policies within their General Plans to protect conversion of agricultural land to non-agricultural uses. These objectives and policies try to focus urban development on infill, with only small extensions to urban boundaries. Based on land use data from DWR, Napa SD, and SCWA, there are about 375 acres of vineyard and about 170 acres of urban landscaping planted within urban growth boundaries in the study area (DWR 1999a and 1999b; Napa SD 2005; SCWA 2001b). That suggests that agricultural water use in the study area could decline by about 610 AFY (using averaged water use rates for each land use category) if those agricultural areas were converted to urban uses. Land use is discussed in detail in Section 3.

Crop prices and productivity are highly sensitive to weather conditions, the world market, and local and national economic conditions. These factors make forecasting changes very difficult. The Sonoma County Agricultural Commission indicates that conversions from hay to vineyards do not appear to be a continuing trend (Ramey 2003). Therefore, the effect of these factors would not likely have a large effect on future agricultural water use. Section 3.2 further discusses potential agricultural development in the study area.

Grape growers in the study area will most likely continue to irrigate their vineyards using the drip irrigation method and employ deficit irrigation practices, which is a growing management trend.

#### **2.2.1.3 Environmental Demand**

##### **2.2.1.3.1 Recent Conditions**

Environmental water demands include water for plant and animal uses throughout the watershed. Calculating environmental demands and projecting future demands requires knowledge of habitats, demands by habitat type, in-stream flow requirements, and groundwater-surface water interactions for areas with shallow groundwater. Some of this information is not yet available; therefore, rigorous demand calculations are not currently possible. These issues will be studied as a part of the Project's environmental documentation.

Environmental water uses within the region benefit multiple habitats: in-stream aquatic habitat, riparian vegetation, lake and reservoir aquatic habitat, and wetlands. Predominant riparian habitat in the study area includes maples, oaks, alders, willows, California wild grape, blackberry, poison oak, mugwort, and California rose (North

Bay Watershed Association [NBWA] 2003). Special status species are further discussed in Section 3.3.1.

Creeks and rivers within the region provide in-stream habitat for fish. Salmonid populations, including special status spring-run Chinook salmon and steelhead, inhabit the Petaluma River and its tributaries, Sonoma Creek and its tributaries, Corte Madera Creek, Arroyo Corte Madera, and several other creeks within the eastern Marin County watersheds (NBWA 2003). The watersheds support other fish species, including trout, sticklebacks, sculpin, suckers, shad, sunfish, and lampreys. U.S. Fish and Wildlife Service and Sonoma County have also found California freshwater shrimp, a special status species, in multiple locations in Sonoma Creek (NBWA 2003).

California Department of Fish and Game (CDFG) and National Marine Fisheries Service (NMFS) developed "2002 Guidelines for Maintaining In-Stream Flows to Protect Fisheries Resources Downstream of Water Diversions in Mid-California Coastal Streams (Guidelines)" to protect anadromous salmonids and habitat in mid-California streams (CDFG and NMFS 2002). The guidelines support environmental water uses by proposing limits on the maximum cumulative water that can be diverted in a watershed.

#### **2.2.1.3.2 Future Conditions**

Factors potentially affecting future environmental water uses include land use changes, government regulations, and increased environmental restoration and enhancement activities.

Land use changes, including urban development, could affect the amount and quality of terrestrial and aquatic habitats. Increased regulations and restoration activities could improve habitat and potentially increase environmental water uses. CDFG and NMFS Guidelines recommend flows in creeks and streams within the region to protect anadromous fisheries. CDFG and NMFS monitor in-stream habitat and will revise guidelines as necessary in the future to continue protection of fisheries resources.

Watershed restoration projects, such as increased fish passage programs and sediment removal projects, could increase base flows in streams. Wetland enhancement programs would also require additional water to support managed wetlands.

The Napa River Salt Marsh Restoration Project consists of the restoration of tidal wetlands and enhancement of managed ponds in the Napa Sonoma Marsh Wildlife Area. The project is sponsored by the California Coastal Conservancy, U.S. Army Corps of Engineers, and the CDFG. The approximately 9,500-acre Napa River Unit consists of 12 former salt evaporation ponds located on the west side of the lower Napa River. The project aims to create a mix of tidal habitat and managed pond habitat that services a broad range of wildlife, restore large areas of tidal habitats in a band along the Napa River ensuring connections between the patches of tidal marsh,

and improve the ability to manage water depths and salinity levels in the managed ponds to maximize feeding and resting habitat for migratory and resident waterfowl.

A water source is needed for habitat and flushing operations because annual evaporative water loss from the salt ponds substantially exceeds the water replaced by precipitation. Water intake and discharge of pond water through flow-through circulation is desired to prevent the salt ponds from becoming increasingly saline and only seasonally wet salt or bittern flats. Two water sources have been evaluated for habitat and flushing operations: Napa River diversions brought about by planned levee breaches, and construction of a recycled water pipeline from the Sonoma Valley County Sanitation District (SVCSD) WWTP and/or Napa SD WWTP. The use of recycled water for this restoration project continues to be evaluated. The recycled water delivery option calls for 8,000 to 9,000 AFY of recycled water for salinity reduction (flushing) and water level maintenance during the first six to eight years of the project (U.S. Army Corps of Engineers 2004). It is possible that an additional 2,500 to 3,000 AF of recycled water may be required for pond maintenance, to offset evaporation in the upper ponds, once flushing is complete.

## 2.2.2 Supplies

The study area receives water from sources both inside and outside the region. Water sources within the region include the Napa River, Petaluma River and Sonoma Creek (used for agricultural supplies), and Stafford Lake on Novato Creek. Surface water sources outside the region include the Russian River Project (including Lake Mendocino, Lake Sonoma, and imports from the Eel River via Pacific Gas & Electric Company's Potter Valley Project), Lake Hennessey, Milliken Reservoir, MMWD's six Lagunitas Creek watershed reservoirs, Soulajule Reservoir, and the Sacramento-San Joaquin Delta via the State Water Project (SWP). The region also relies on groundwater and recycled water as additional sources. Recent and future water supplies from these sources are described below. Table 2-12 summarizes the total water supply in the initial study area<sup>4</sup> by source.

<b>Supply Source</b>	<b>2005 (AFY)</b>	<b>2020 (AFY)</b>
Surface Water <sup>(1)</sup>	139,277	138,617
Groundwater <sup>(2)</sup>	10,167	1,234
Recycled Water <sup>(3)</sup>	9,667	15,075
<b>Total Supply</b>	<b>159,111</b>	<b>154,926</b>

<sup>(1)</sup> Surface water supply data represents the reliable (dry year) supply. Current supplies for the Petaluma River watershed are not quantifiable at this time. See Section 2.2.2.1, Table 2-13 for derivation.

<sup>(2)</sup> See Section 2.2.2.2, Table 2-15 for derivation. Values do not include agricultural pumping in Petaluma and Sonoma Valleys, which has not been quantified.

<sup>(3)</sup> See Section 2.2.2.3, Table 2-17 for derivation.

<sup>4</sup> As discussed in Section 1.3, Petaluma and MMWD were initially evaluated in the Project, but are no longer participating.

### 2.2.2.1 Surface Water

The main surface water bodies included in the initial study are San Pablo Bay, Novato Creek in Marin County, Petaluma River and Sonoma Creek in Sonoma County, and Napa River in Napa County. The locations of these water bodies are presented in Figure 2-1. Table 2-13 summarizes the reliable (dry year) supply from these surface sources. Smaller tributaries and sloughs also exist, such as Huichica Creek, Suscol Creek, Hudeman Slough, and Schell Slough.

<b>Watershed</b>	<b>2005 (AFY)</b>	<b>2020 (AFY)</b>
Russian River and Dry Creek <sup>(1)</sup>	87,970	84,970
Petaluma River and Sonoma Creek <sup>(2)</sup>	NQ	NQ
Lagunitas Creek and Walker Creek <sup>(3)</sup>	20,785	20,785
Stafford Lake <sup>(4)</sup>	1,982	1,982
Napa River Watershed <sup>(5)</sup>	23,000	23,000
SWP <sup>(5)</sup>	5,540	7,880
<b>Total Reliable Supply (low estimate<sup>2</sup>)</b>	<b>139,277</b>	<b>138,617</b>

<sup>(1)</sup> Source: SCWA 2001a

<sup>(2)</sup> NQ = Not quantifiable. Current supplies for the Petaluma River watershed are not quantifiable at this time.

<sup>(3)</sup> Source: Roxon 2005

<sup>(4)</sup> Source: NMWD 2002

<sup>(5)</sup> Source: City of Napa 2006, Jones & Stokes 2003

Surface water runoff creates the majority of freshwater flows within the rivers and streams. Consequently, streamflow in all of the creeks and rivers varies greatly by season and year depending on precipitation. Many smaller tributaries are naturally dry during the summer, while in others flows vary between wet and dry years. The withdrawal of water from streams for both agricultural and domestic uses has affected flow rates in the streams. Lower base flow rates occur in the streams as a result of water being held in reservoirs and directly withdrawn from the streams and aquifers. Bordering the study area is San Pablo Bay, the depth of which is highly dependent on inflow from its tributaries, including the Napa River, Sonoma Creek, and Petaluma River.

Table 2-14 presents the monthly mean streamflows in cubic feet per second (cfs) for Sonoma Creek, Napa River, Petaluma River, and Novato Creek. During the wet season, flows in these surface waters range from about 48 cfs (Novato Creek) to 257 cfs (Sonoma Creek), but each source's low mean flow is less than 1 cfs, occurring during the summer irrigation season.

**Table 2-14**  
**Maximum and Minimum Monthly Mean Stream Flows**

<b>Source</b>	<b>High Mean Flow Month</b>	<b>High Mean Flow (cfs)</b>	<b>Low Mean Flow Month</b>	<b>Low Mean Flow (cfs)</b>	<b>Measurement Time Period</b>
Sonoma Creek (at Agua Caliente)	January	257	September	0.78	1955-2002
Napa River (at Napa)	January	63.4	September	0.89	1970-1983
Petaluma River (at Petaluma)	February	64.2	July	0	1948-1963
Novato Creek (at Novato)	February	47.7	September	0.3 <sup>(1)</sup>	1946-2002

Source: USGS 2003

<sup>(1)</sup> Regulated flow released from Stafford Lake for fisheries.

Individual agricultural growers collect surface water in Napa and Sonoma Valleys via on-site ponds and reservoirs or other surface water diversion facilities. Agricultural water users in the baylands use water from on-site reservoirs. Some growers have applied for water rights to divert surface water, but typically this process has taken several years (Fry 2003).

#### **2.2.2.1.1 Russian River and Dry Creek**

SCWA provides water from the Russian River and its tributaries in central Sonoma County to NMWD, MMWD, VOMWD, and the Cities of Sonoma and Petaluma. SCWA's transmission system includes the pipelines, tanks, and pumps that deliver water from its Russian River diversion facilities to the Santa Rosa, Petaluma, and Sonoma Valleys. Major SCWA pipelines include the Santa Rosa Aqueduct, the Sonoma Aqueduct, the Petaluma Aqueduct, and the Russian River to Cotati Intertie. NMWD has its own aqueduct to take SCWA water from the Petaluma Aqueduct into Novato.

The total reliable surface water supply available for SCWA and its customers is 212,920 AF during an average year and 87,970 AF during a dry year (SCWA 2001a). SCWA's November 2004 staff report indicated that SCWA would be unable to meet seven-day peak demands because of capacity limitations of its transmission system. Prolonged peak demand periods would significantly reduce water levels in storage tanks in Sonoma and southern Petaluma (SCWA 2004).

#### **2.2.2.1.2 Petaluma River and Sonoma Creek Watersheds**

Petaluma River and Sonoma Creek provide water for agricultural uses, not for urban uses. Agricultural users in these areas do not use any Russian River supplies for irrigation purposes. A network of tributaries supplies water for agricultural uses in both watersheds. Many users divert water during winter or spring months and store it in local ponds for use during the summer irrigation season.

The Petaluma River watershed comprises about 146 square miles. The headwaters of the Petaluma River begin upstream of the city on Sonoma Mountain and multiple creeks join the river as it flows to the valley portion of the watershed. The lower 12 miles of the Petaluma River flow through Petaluma Marsh and drain into San Pablo

Bay. The U.S. Army Corps of Engineers dredges the river on a continual basis because of high siltation rates. With insufficient fresh water to flush the river during the summer months, temperature and salinity increase and reduce the ability of the water to hold oxygen (Southern Sonoma County Resource Conservation District [RCD] 1999). Inadequate dissolved oxygen not only contributes to an unfavorable environment for fish and other aquatic life, but can also result in objectionable odors from anaerobic decomposition (Southern Sonoma County RCD 1999).

The Sonoma Creek watershed is 170 square miles. Sonoma Creek begins on Sugarloaf Ridge and flows 31 miles to North San Pablo Bay. The creek has multiple tributaries. Sonoma Creek is the principal drainage for the Sonoma Valley sub-basin. The southern Napa and Sonoma Valley basins receive an average of 20 to 24 inches of precipitation a year and the highest runoff occurs shortly after rainfall. Levels of precipitation and soil permeability affect the volume of creek and river flow into the Bay (Jones and Stokes 2003).

#### ***2.2.2.1.3 Lagunitas Creek and Walker Creek Watersheds***

MMWD collects runoff from approximately 50,000 acres in Marin County, and has seven storage reservoirs in the Lagunitas Creek and Walker Creek watersheds to store and provide surface water to users. Reliable supply from these sources is approximately 20,785 AFY (Roxon 2005).

#### ***2.2.2.1.4 Stafford Lake Watershed***

Stafford Lake, owned and operated by NMWD, lies approximately five miles west of the study area in northern Marin County and receives runoff from the watershed land adjacent to the upper reaches of Novato Creek (NMWD 2002). The lake provides about 20 percent of the total water supply to the area of Novato. The watershed supplied approximately 1,982 AF of water to Novato in 2000.

#### ***2.2.2.1.5 Napa River Watershed***

Napa receives water from Lake Hennessey and Milliken Reservoir in the Napa River watershed. Reliable supply from these two facilities is approximately 11,117 AFY (City of Napa 2006). The long-term average discharge of the Napa River is approximately 66,000 AFY. Diversions from the Napa River for agricultural use in the County are 12,000 AFY (Jones & Stokes 2003). Although surface water flows vary according to precipitation, discharges from groundwater increase the surface water flow of the Napa River during dry years.

#### ***2.2.2.1.6 SWP***

Napa also receives water from the Sacramento-San Joaquin Delta through the North Bay Aqueduct (NBA). Napa could receive up to 18,800 AF from the SWP in 2021, but this quantity would typically only be available during wet years. The reliable supply for 2005 was estimated to be 5,540 AFY (City of Napa 2006). The SWP is currently only available to municipal and industrial users in the Napa County service area.

### 2.2.2.2 Groundwater

Agricultural users within the southern Sonoma, Petaluma, and Napa Valleys use groundwater as a water supply. Groundwater is also a supply for urban demands in the Sonoma and Petaluma Valleys. Groundwater supplies are summarized below in Table 2-15.

	<b>2005 (AFY)</b>	<b>2020 (AFY)</b>
City of Petaluma	3,585 <sup>(1)</sup>	0 <sup>(1)</sup>
City of Sonoma	448 <sup>(1)</sup>	450 <sup>(1)</sup>
VOMWD	784 <sup>(1)</sup>	784 <sup>(1)</sup>
Napa County – MST area <sup>(2)</sup>	5,350 <sup>(2)</sup>	N/A
Total <sup>(3)</sup>	10,167	1,234

<sup>(1)</sup> Source: Booker 2006, SCWA 2001a

<sup>(2)</sup> Values for Milliken-Sarco-Tulocay Creeks (MST) area are for agricultural and private drinking water pumping for 2000. Source: USGS 2003.

<sup>(3)</sup> Total does not include agricultural pumping in Petaluma and Sonoma Valleys, which has not been quantified.

#### 2.2.2.2.1 Groundwater Conditions

In the North Bay, the principle groundwater-bearing aquifer comprises alluvial deposits, which cover most of the valley areas in Sonoma, Napa, and Petaluma Valleys. These aquifers are largely continuous, with general flow towards San Pablo Bay. However, in the region adjacent to the Bay, local flow has been reversed. Groundwater levels in the alluvial deposits vary locally, but are generally between 5 and 75 feet below the ground surface. In southern Sonoma County, local variations are observed due to the presence of local impermeable layers, which create small semi-confined aquifers. Specific yield is a measure of aquifer productivity, and is defined as the ratio of the volume of water in a particular sample to the total volume of the sample. In alluvial deposits, the specific yield is moderate to high (8 to 17 percent), which illustrates that the aquifer can produce substantial amounts of water.

Some of the natural recharge into alluvial aquifers occurs from rivers and streams. In southern Napa County, local groundwater recharge originates from precipitation falling within the Milliken-Sarco-Tulocay Creeks (MST) drainage basins as well as alluvial deposits and volcanic rocks (USGS 2003). Generally, the alluvial deposits are not permeable enough to allow natural recharge from surface infiltration, although there is some limited recharge through surface infiltration due to precipitation. A layer of Bay mud, containing brackish water, covers the alluvial deposits in most areas. Groundwater pumping from some of these deposits has an adverse effect of drawing brackish water into the freshwater alluvial deposits, causing saltwater intrusion (DWR 1982a and 1982b).

As the land elevation ascends into the Huichica mountain range, the groundwater aquifer changes conditions due to previous volcanic deposits. The Huichica formation is composed of reworked volcanic sediments, with a low specific yield ranging from 3

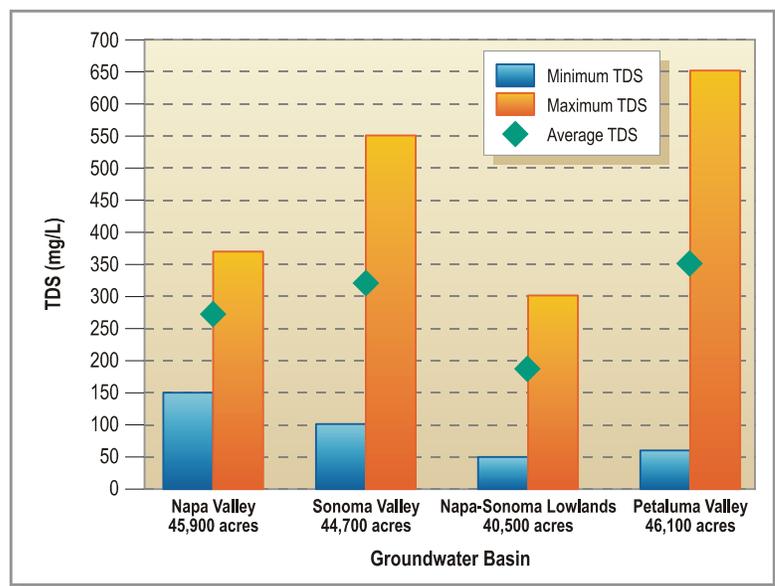
to 7 percent. The low specific yield illustrates that this aquifer has lower productivity than alluvial deposits. The Huichica formation produces limited amounts of groundwater, and the same soil conditions that limit productivity also limit recharge. The primary source of recharge is through infiltration, usually through outcrops of the formation in the higher mountainous areas.

A 2003 USGS study of the MST basins found that groundwater outflow in 2000 exceeded inflow by about 600 AFY. The drainage basin area sustained a population of about 16,500 in 2000, and 4,800 of those people relied solely on their own groundwater wells. In 2000, groundwater pumping (for drinking water, open-space irrigation, and agriculture) was estimated to range between 5,350 AFY and 7,100 AFY, an increase of at least 80 percent over 1975 pumping rates (Farrar and Metzger 2003).

Increased groundwater pumping has significantly changed the hydraulic gradient in the groundwater basin. Before 1975, groundwater flowed west from the mountains surrounding the MST area towards the Napa River. Now, three groundwater level depressions have formed the central and eastern part of the basin. The two deepest depressions show groundwater levels 50 to 125 feet lower in 2000 than in 1975. The third depression’s water levels declined 25 to 50 feet over the same time period. The study concludes that an additional water supply in the area is needed to stop the groundwater level decreases (Farrar and Metzger 2003).

**2.2.2.2.2 Groundwater Quality**

Figure 2-3 shows the summary of total dissolved solids (TDS) data from 1994 to 2000 for 485 public supply wells from the California Department of Public Health (DPH) water quality database. According to DPH, the recommended limit for TDS in domestic water is 500 milligrams per liter (mg/L) (DWR 1982a and 1982b). The maximum limit for TDS is 1,000 mg/L. Water with a TDS level higher than 500 mg/L may also be expected to contain other hazardous ions, which are usually high in sodium and salinity. The average TDS levels show that groundwater quality is good



Source: DWR 2003

**Figure 2-3**  
Groundwater Quality of Public Supply Wells, 1994-2000

according to the wells measured in Napa, Sonoma, Novato, and Petaluma Valleys (DWR 2003).

The 2003 USGS study found that groundwater in the study area is of an acceptable quality. Table 2-16 summarizes the groundwater quality sampling performed at 15 private wells in the MST basin. The study concluded that volcanic minerals or older and deeper rocks were likely responsible for the arsenic, boron, iron, and manganese found in the groundwater samples (Farrar and Metzger 2003).

<b>Constituent</b>	<b>Drinking Water Quality Standard</b>	<b>Number of Private Wells With Results Above the Standard <sup>(1)</sup></b>
Arsenic <sup>(2)</sup>	10 micrograms (µg)/L	5
Boron	1 mg/L	2
Iron	300 µg/L <sup>(3)</sup>	5
Manganese	50 µg/L <sup>(3)</sup>	12
TDS <sup>(4)</sup>	500 mg/L	1

<sup>(1)</sup> Source: Farrar and Metzger 2003

<sup>(2)</sup> Sample results ranged from 2-67 µg/L. Three wells had concentrations greater than 15 µg/L.

<sup>(3)</sup> Secondary drinking water standard.

<sup>(4)</sup> Sample results ranged from 144-732 mg/L.

#### 2.2.2.2.3 Supplies

The total quantity of groundwater supply available in the study area is unknown. Because this resource is underground, understanding the extent of this water supply would require extensive testing and would still only reflect estimated quantity. The only places where groundwater supplies are quantifiable are where they are limited by infrastructure development, such as urban areas with several wells.

Napa County's groundwater conservation ordinance, Ordinance 1162, prohibits groundwater extraction for wasteful and non-beneficial purposes. Agricultural developments in the groundwater-depleted MST area require a groundwater permit, unless specifically exempt. Permits issued for the MST area require that wells have meters installed and limit the user to 0.30 AFY, calculated as a three-year average. Groundwater wells serving agricultural areas outside the MST area do not require permitting. The county issues groundwater permits to single-family homes (with associated landscaping) with requirements for submittal of well meter readings twice yearly and use limited to 0.60 AFY (13 Napa County Code).

USGS has estimated that groundwater pumping in southeastern Napa County in 2000 was 5,350 AFY, an increase of approximately 80 percent since 1975. This increase in extraction has resulted in the general decline of groundwater levels and possibly changes in infiltration capacity caused by land use changes (USGS 2003). Low rainfall, saltwater intrusion from San Pablo Bay, and low soil permeability aggravate the

groundwater supply problem in the region. Although the clay content holds water in the soil, it restricts water percolation to the water table and effectively decreases the volume of groundwater available for irrigation. Most growers apply short, frequent irrigations to not exceed the infiltration rate of the soil. The irrigation season lasts from June to late September or early October (Carneros Wine Alliance 2003).

The Cities of Petaluma and Sonoma and VOMWD use groundwater to supplement SCWA surface water supplies. In addition, SCWA has three wells in the Santa Rosa Plain and seven in the lower Russian River that augment its Russian River water supplies.

Petaluma has 11 operational wells with a long-term reliable supply of 3,585 AFY. In 2000, groundwater provided approximately 9 percent of Petaluma’s water supply. Sonoma has three groundwater wells with a long-term reliable supply of 448 AFY. VOMWD has three wells with a long-term supply of 784 AFY. Groundwater provided less than 1 percent of Sonoma’s water supply and 27 percent of VOMWD supply in 2000 (Booker 2006, SCWA 2001a).

Groundwater use in the MMWD and NMWD service area is limited because they do not have substantial underlying groundwater aquifers. Groundwater use in the MMWD and NMWD service areas is also constrained by availability and quality. The City of Napa does not use groundwater for drinking water supplies.

**2.2.2.3 Recycled Water**

Table 2-17 summarizes the recent and planned recycled water production in the initial study area in the absence of this project. Las Gallinas Valley Sanitary District (LGVSD), Novato Sanitary District (Novato SD), the City of Petaluma, SVCSD, and Napa SD currently serve recycled water to agricultural and landscaping customers. The quantities included in this table reflect the amount of recycled water produced for customers (beneficial reuse) and agency spray irrigation.

<b>Table 2-17</b>				
<b>Recent and Planned Recycled Water Production in the Initial Study Area</b>				
<b>Agency</b>	<b>AFY</b>			
	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>
LGVSD <sup>1</sup>	615	902	902	902
Novato SD <sup>2</sup>	2,213	2,710	2,760	2,810
City of Petaluma <sup>3</sup>	2,389	3,823	3,823	3,823
SVCSD <sup>4</sup>	1,200	2,000	2,500	3,000
Napa SD <sup>5</sup>	3,250	3,680	4,110	4,540
<b>Total</b>	<b>9,667</b>	<b>13,115</b>	<b>14,095</b>	<b>15,075</b>

Sources:

(1) MMWD 2003

(2) James 2008

(3) City of Petaluma 2004

(4) Booker 2006

(5) Based on preferred alternative in Napa SD’s *Strategic Plan for Recycled water Use in the Year 2020* (Napa SD 2005).

The LGVSD Water Recycling Plant (in conjunction with MMWD) serves 275 customers. The recycled water is predominantly used for landscape irrigation, but also for toilet flushing at the county jail and nearby office buildings, and one car wash. Although 902 AFY is entitled to existing MMWD customers to offset potable demands, actual annual usage varies with the seasonal weather. In 2005, the recycling plant supplied about 615 AFY of recycled water for beneficial uses, though the users often meet or exceed their total entitlement in other years. Information on the LGVSD treatment plant, capacity, and operations is included in Section 4.2.1.

In 2005, the Novato SD WWTP provided about 2,213 AFY of recycled water for wildlife habitat and agricultural uses from May to October (James 2006). Because recycled water from Novato SD was not applied for any urban uses, it did not offset any potable demands. In 2008 Novato SD began operations of a recycled water facility, located east of its WWTP. The facility has a capacity of 0.5 million gallons per day (mgd), and is expandable to 1.0 mgd. The plant will provide 269 AFY to the local Stone Tree Golf Course as a potable water offset. Information on the Novato SD WWTP, capacity, and operations is included in Section 4.2.2.

The City of Petaluma uses recycled water for irrigation of crops and golf courses. In 2004, the city provided about 730 AFY of disinfected secondary effluent to the Rooster Run Golf Course, the Adobe Creek Golf Course, and a small vineyard (City of Petaluma 2004). Additional recycled water is applied to local pasture land during the summer months. Information on the Petaluma treatment plant, capacity, and operations is included in Section 4.2.3.

SCWA operates and manages the SVCSD treatment plant that provides tertiary disinfected treated recycled water for environmental purposes, dairies, and vineyard irrigation. The SVCSD supplies approximately 1,200 AF of recycled water on an annual basis (SCWA 2005). Because recycled water in the SCWA service area is not used for any urban uses, it does not offset any potable demands. Information on the SVCSD treatment plant, capacity, and operations is included in Section 4.2.4.

Napa SD operates the Soscol Water Recycling Facility near the City of Napa. Napa currently provides disinfected tertiary recycled water to vineyards, commercial landscaping, and golf courses, and to its own reclamation sites during the dry season. In 2005, Napa SD provided about 3,250 AF to customers and spray irrigation, based on the district's water use rates and irrigated acres (Napa SD 2005). Information on the Napa SD treatment plant, capacity, and operations is included in Section 4.2.5.

#### **2.2.2.4 Future Supply Conditions**

Increases in future water supplies to meet increased demands are constrained by a number of factors:

- Wholesale supplies from the Russian River and Dry Creek from SCWA – Sedimentation in Lake Mendocino and Lake Sonoma has gradually reduced storage capacity; modeling estimates approximately 1,000 AF of storage is lost every five years, resulting in a loss of about 3,000 AF by 2020 (NBWA 2005). Additionally, transmission limitations are preventing SCWA from meeting existing seven-day peak demands; this trend would likely worsen without additional conveyance capacity in the future. SCWA water delivery to MMWD is constrained by the transmission system between the Russian River and Marin.
- Napa supplies – The upper limit of Napa’s SWP supplies will increase into the future, but will be constrained by SWP statewide allocations. Napa projects that it can meet normal and dry year urban demands through 2020 with existing SWP and local surface water supplies. Napa’s estimated year 2020 reliable (dry year) supply from the SWP is 7,880 AFY (City of Napa 2006).
- MMWD local supplies – Water supply from the Lagunitas Creek and Walker Creek watersheds is not likely to change in the future. MMWD is in the planning stages for a local desalination facility. The plant is proposed to initially produce about 5,300 AFY. See Sections 2.3 and 6.1 for more information.
- NMWD supplies – Future supplies from Stafford Lake and the surrounding watershed will remain fairly consistent.
- Groundwater supplies – Under current conditions, the City of Petaluma expects to use no groundwater by 2020 because of quality and supply issues. The City of Sonoma expects future groundwater use to be minimal, about 450 AFY in 2020. VOMWD expects future groundwater use to be minimal, about 784 AFY in 2020 (Booker 2006, SCWA 2001a). In the MST area, it is likely that increases in areas of concentrated groundwater pumping to support agricultural needs will increase saltwater intrusion and decrease water quality (USGS 2003).
- Recycled water supplies – With existing infrastructure, future recycled water production in the study area could, with sufficient funding, increase from almost 9,700 AFY in 2005 to about 15,000 AFY in 2020. LGVSD and Novato SD’s production will increase over 2005 levels by about 900 AFY. Petaluma is currently constructing a tertiary recycled water plant. In 2025, Petaluma expects to produce about 3,000 AFY of tertiary water (City of Petaluma 2004). SVCSD is planning to increase recycled water production to 3,000 AFY in 2020 due to the Sonoma Valley Recycled Water Project (SCWA 2005). Napa SD estimates its recycled water production will increase to 4,540 AFY in 2020 for total reuse (Napa SD 2005).

In most years, adequate supplies exist to meet demands on an annual basis. Supplies are strained on a seasonal basis, e.g., surface water flows are lowest in the summer when demand is highest. Future urban growth will likely exacerbate this situation, and the additional sources of water supply to meet future demands are limited. Because of the obstacles to increasing the capacity of existing supplies, the

identification and development of new supplies will likely be required to meet future yearly and/or seasonal demands.

## 2.3 Supply Costs

In absence of the Project, the member agencies face the potential need to develop additional water supplies to meet future demand. There are a number of local and regional alternatives identified for regional water supply to primarily municipal and industrial users. However, few alternatives have been formulated in the study area to directly serve the primarily agricultural demands that would be met by the Project. This section briefly discusses these alternative water supplies, which are described in greater detail as the No Action Alternative in Section 6.1.

SCWA is currently evaluating the Water Supply, Transmission, and Reliability Project which proposes to increase releases from Lake Sonoma to expand diversions from the Russian River. The \$647 million project would deliver up to an additional 26,000 AFY and would serve municipal users in Sonoma and Marin Counties who receive water from SCWA (Booker 2008a).<sup>5</sup> NMWD, VOMWD, and City of Sonoma would share a portion of the total project cost.

Although no ocean desalination plants are currently being planned by water agencies within the study area, MMWD, which adjoins the study area, is considering such a plant. Given the uncertainties associated with other developable water supplies, it is possible that desalination may become an option in the study area. The MMWD Bay Water Desalination Project would treat diversions from San Rafael Bay to drinking water standards to increase MMWD's water supply reliability. The proposed project is a 5 mgd plant that could ultimately supply up to 15 mgd. The first phase, a 5 mgd facility, would provide supplemental water supply, particularly during drought years. The estimated project cost of the expandable 5 mgd desalination plant is \$121 million (2008 dollars). Operation and maintenance costs range from \$4.3 million in average conditions to \$7.1 million in drought conditions (MMWD 2007). MMWD assumes the plant will initially produce 5,300 AFY (Kennedy/Jenks Consultants 2007).

No alternative water supplies have been defined in previous studies for bringing water to the MST area of Napa County. The most feasible new water supply alternative, other than bringing recycled water into the area, is to import potable water to the area. Importing water to the MST area has several costs associated with it, including distribution infrastructure, new water supply costs, and a possible NBA expansion. The infrastructure construction costs for a potable water system designed to deliver 1,937 AFY of potable water to the MST area would be about \$40 million, similar to the recycled water distribution infrastructure costs. Napa County estimates an additional \$8 million in legal and bonding fees would be required to fund the new infrastructure. The City of Napa's future water supply plans do not include the MST

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<sup>5</sup> Costs are shown in 2008 dollars. All costs were escalated to April 2008 dollars using the Building Cost Index.

area; therefore, a new water supply would be needed at additional costs. A recent long-term transfer of water in the Central Valley was priced at \$4,000 per AF (Riesenberg 2008). These imported water supplies would likely be wheeled through the NBA, which is currently used at capacity. This option would likely require an increase in the capacity of the NBA, which is estimated at \$38 million to bring 1,937 AF to the MST area.

See Section 6.1 for more information on the projects investigated.

# Section 3

## Existing and Future Regional Conditions

As stated in earlier sections of the North San Pablo Bay Restoration and Reuse Project (Project) Engineering and Economic/Financial Analysis Report, the physical and environmental conditions of the North San Pablo Bay study area are unique. They deserve special understanding, as policies on water management in the region could influence future development of the area. The issues of greatest relevance to the Project feasibility study include the inherent tension between agricultural and urban land use, as well as the desire and need to protect and enhance valuable resources of the region's water environment.

This section evaluates the physical and environmental conditions of the Project's initial study area<sup>1</sup>, focusing on the region's land use, soil conditions, biological resources, and wetlands.

### 3.1 Land Use

The following section discusses the historical and existing land uses in the North San Pablo Bay study area, with a focus on the existing agricultural and urban uses. The description of agricultural land use includes an analysis of grape and hay production, and the discussion of urban land use includes policies to manage urban growth. This section also includes future land uses and policies and provides information on likely conditions during the implementation time frame. This information assumes that implementation of the Project would not change or direct land uses.

#### 3.1.1 Historical Land Use

The area surrounding San Pablo Bay includes parts of Marin, Napa, and Sonoma Counties, and the Cities of Napa, Novato, Petaluma, San Rafael, and Sonoma. San Pablo Bay also borders the southern ends of Napa, Petaluma, and Sonoma Valleys. Like much of California, this area was initially settled by Native Americans. By the 1800s, the North Bay was under the control of the Mexican government and dotted with towns developed through the mission system. In the 1830s, the region was split up by land grants to Mexican settlers or members of the Mexican Army and their families. Many of the land grants in the present Los Carneros region were then further divided and sold to settlers. The area supported farming as early as the 1850s and by the 1880s was known for its orchards, hay, cattle, sheep, and grapes. One of the earliest vineyards in the Los Carneros area was planted in the late 1830s. (Carneros Wine Alliance 2006, City of Novato 2006a)

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<sup>1</sup> The City of Petaluma is included in the initial study area. After initial evaluation was concluded, Petaluma decided not to participate in the Project. See Section 1.3 for a discussion of Petaluma's participation.

The area just north of San Pablo Bay historically consisted of tidal marshes. These marshes were diked in the late 1800s and early 1900s for hay and grain production and are known today as the diked baylands. Currently, very little intensive agricultural activity<sup>2</sup> takes place on the diked baylands; the most intensive farming occurs in the Los Carneros region between the Napa and Sonoma Valleys (San Francisco Bay Conservation and Development Commission [BCDC] 1999). Extensive agriculture<sup>3</sup> is the dominant land use on the diked baylands.

### 3.1.2 Existing Land Use

This section discusses the existing land uses in the study area and factors that may affect future changes in land use. Figure 3-1 shows the existing land uses, presented by the major categories of residential, commercial, industrial, irrigated farm property, dry farm property, dairy/pasture, orchard, vineyard, golf course/cemetery/parks/landscaping, government developed land, unimproved/vacant land, miscellaneous/unknown, and completed and planned wetlands restoration. Land use data for Marin County was obtained from the California Department of Water Resources (DWR), Napa Sanitation District (Napa SD) and DWR provided information for Napa County, and Sonoma County Water Agency (SCWA) provided data for Sonoma County (DWR 1999a and 1999b, Napa SD 2005, SCWA 2001b). A “windshield survey” was performed to verify the current land use of the larger parcels in the study area.

Individual land use designations from the three sources of land use data were grouped into the major categories mentioned above. The “orchard” category grouped deciduous fruits and nuts, and citrus and subtropical trees. “Irrigated farm property” includes rice and field, truck, nursery, and berry crops. “Dairy/pasture” consists of dairies, dairies with residences, and semi-agricultural areas. “Urban landscaping” is covered under the golf course/cemetery/ parks/landscaping designation. “Miscellaneous/unknown land” includes areas not surveyed or not allowed to be surveyed, utility-owned land, mining rights, private roads, and well and tank sites. “Government developed land” includes federal, state, and local buildings, military installations, hospitals, government utility property, state colleges and schools, and municipal shops and yards. “Unimproved/vacant lands” consist of vacant land, vacant municipal land, native vegetation, barren lands, and wasteland.

The following sections focus on agricultural land use and urban land use.

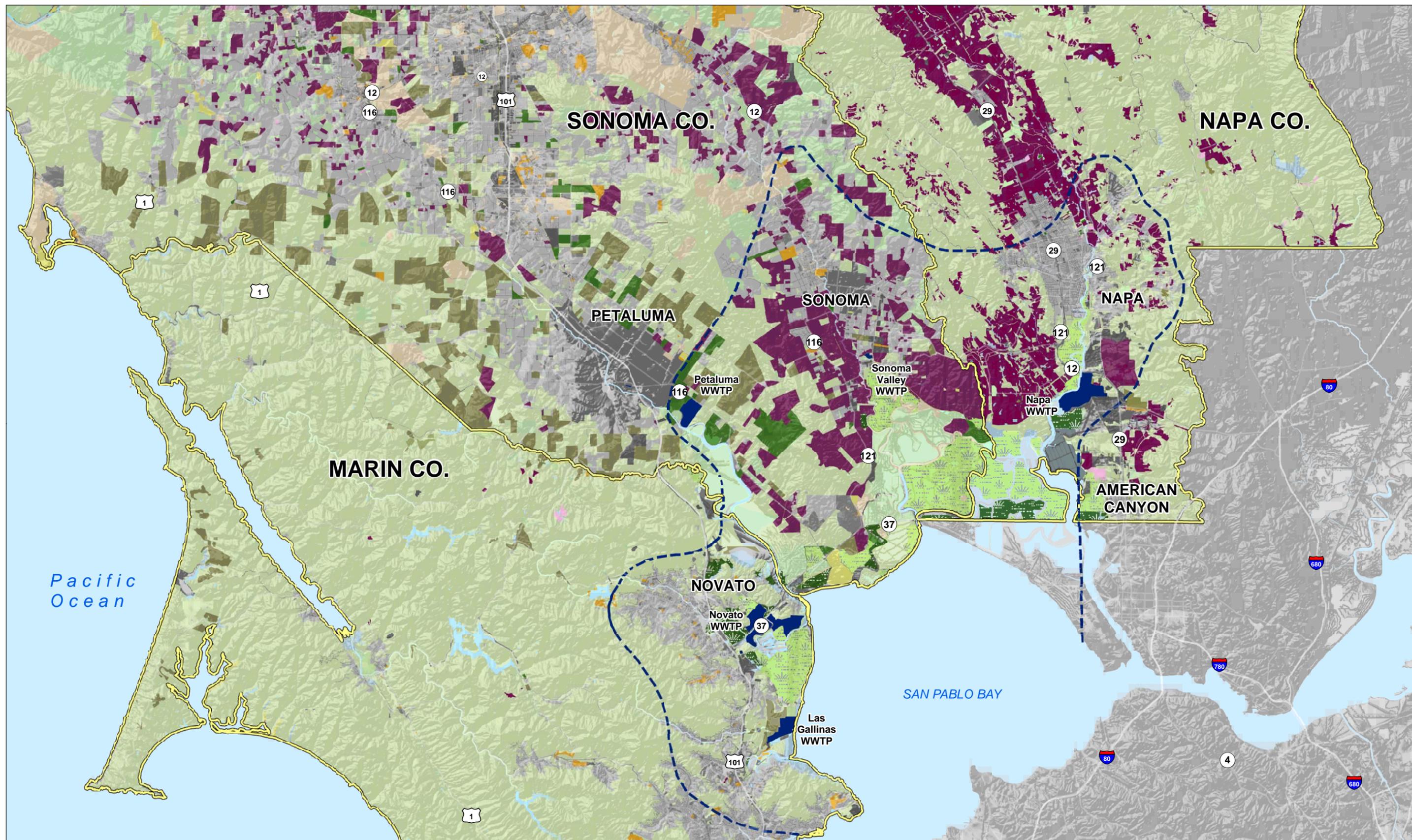
#### 3.1.2.1 Agricultural Land Use

Agricultural land uses constitute much of the study area. The primary agricultural land uses in the southern Sonoma, Napa, and Petaluma Valleys are vineyards and hay. Vineyards exist mainly in the hillside ranges and upland areas adjacent to the diked baylands. Oat hay exists mainly on the diked baylands, and some farmers double-crop their lands with beans. In the past, farmers have grown other crops such as barley and legumes, but changes in market conditions have decreased profitability

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<sup>2</sup> Intensive agricultural land is defined as irrigated land with high productivity per acre.

<sup>3</sup> Extensive agricultural land is defined as non-irrigated land with low productivity per acre.



Basemap: U.S. Department of Agriculture, 2001  
 Land Use Data: California Department of  
 Water Resources, 1999a and 1999b,  
 Napa Sanitation District 2005, SCWA 2001.

**Legend**

- |                             |                         |   |
|-----------------------------|-------------------------|---|
| Initial Study Area Boundary | Unimproved/Vacant Land  | Orchard                                       |
| WWTPs                       | Dry Farm Property       | Vineyard                                      |
| Completed Restoration       | Irrigated Farm Property | Golf Course, Cemetery, Parks, and Landscaping |
| Natural Restoration         | Residential             | Miscellaneous/Unknown                         |
| Planned Restoration         | Commercial              | Government Developed Land                     |
| Dairy, Pasture              | Industrial              | Water Body                                    |

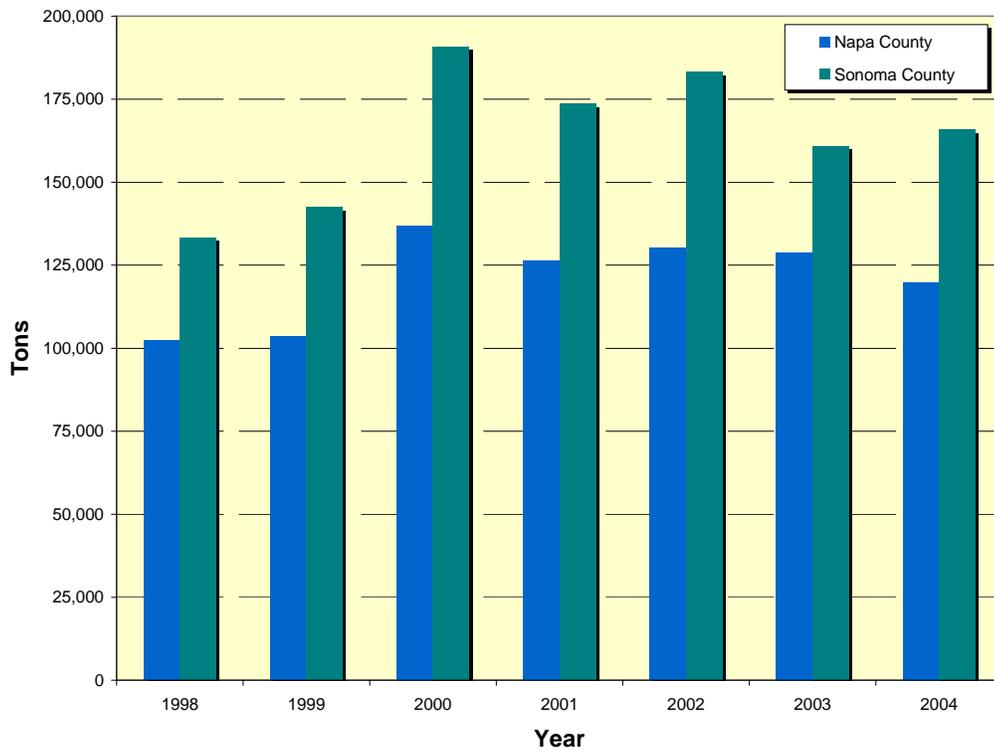


**Figure 3-1**  
**Land Uses in the Study Area**

for these crops given their high production costs (BCDC 1999). Secondary land uses include dairy farming, row crops, orchards, the farming of other livestock, and grassland, which includes irrigated pastureland. Figure 3-1 illustrates the location of these land uses.

**3.1.2.1.1 Grape Production**

Vineyards are the agricultural mainstay in the upland areas of the study area and in the Los Carneros region in Napa and Sonoma Counties. As shown in Figure 3-2, Napa and Sonoma Counties saw a sharp increase in wine grape production from 1998 through 2000, and a mild decline from 2000 through 2004 (California Agricultural Statistics Service 1999, 2000, 2001a, 2001b, 2002, 2003, 2005). Premium wine grape crops have replaced dairies, hay farms, and orchards in many parts of Napa and Sonoma Counties. It is generally thought that the “best” grape growing properties have been cultivated; therefore, the expansion of existing vineyards or development of new vineyards means growing grapes under more compromised conditions (BCDC 1999).

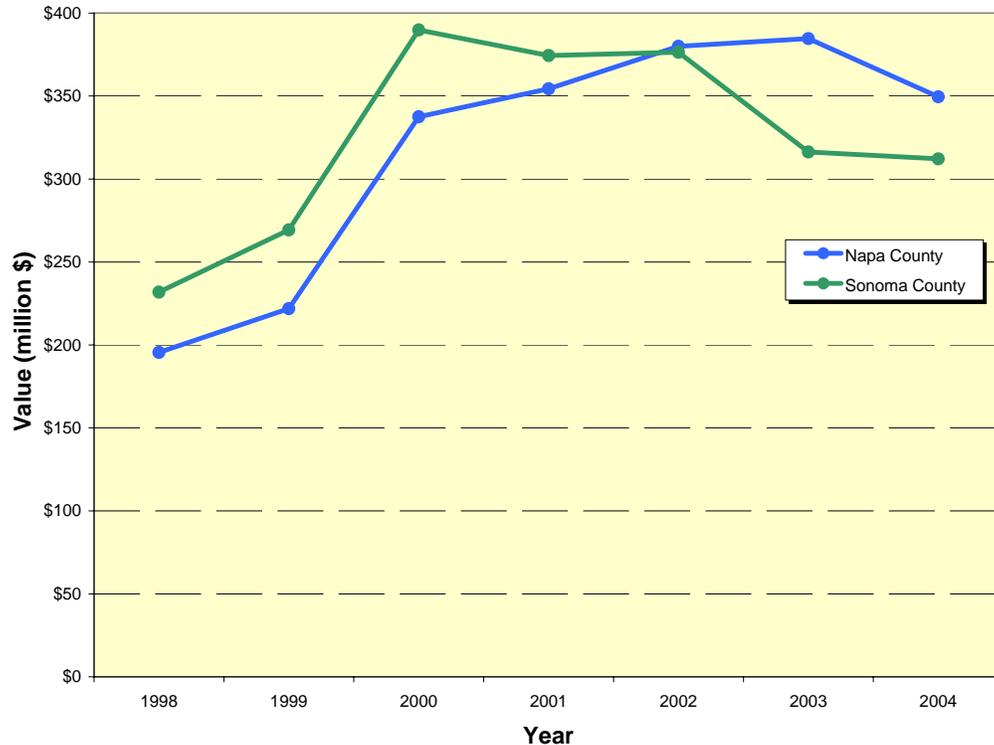


Source: California Agricultural Statistics Service 1999, 2000, 2001a, 2001b, 2002, 2003, 2005

**Figure 3-2**  
Wine Production

The year 2000 was a notable year for wine grape production in the study area. Napa County production increased about 33,000 tons over 1999 production, a gain of about 32 percent. In Sonoma County, the production increase in 2000 was about 48,000 tons, about a 34 percent gain.

As shown in Figure 3-3, total wine grape value also had a steep increase in the year 2000 for both counties. From 2001 through 2004, Sonoma County saw a decrease in crop value, but Napa County saw moderate gains through 2003.



Source: California Agricultural Statistics Service 1999, 2000, 2001a, 2001b, 2002, 2003, 2005

**Figure 3-3**  
Total Wine Grape Value in Napa and Sonoma Counties, 1998-2004

Wine grape value per ton in Napa County steadily increased from 1998, peaking at close to \$3,000 per ton in 2003. For Sonoma County, the peak value per ton occurred in 2001 at about \$2,100 per ton (California Agricultural Statistics Service 1999, 2000, 2001a, 2001b, 2002, 2003, 2005).

Mass plantings of grape vines in 1998 marked that year as an exceptionally strong season. In reaction to the growing economic strength of grape production in Napa and Sonoma, land prices were extremely high from 1999 to 2001 and more growers entered the market, while existing growers expanded operations (Hood 2003). This led to an over-saturation of the grape-growing market in subsequent years and since

2000 there has been a slow recovery. The economic downturn and wine surplus early this decade caused some grape growers to sell their parcels to larger growers; this especially occurred in Sonoma County (Hood 2003).

Marin County has a limited wine grape industry. From 1999 through 2004, the highest production was 228 tons of grapes, occurring in 2001. The value of that year's crop was about \$465,000. For the other years of that period, the average annual production was about 134 tons and the average annual production value was about \$257,000 (California Agricultural Statistics Service 1999, 2000, 2001a, 2001b, 2002, 2003, 2005).

#### **3.1.2.1.2 Hay Production**

The combination of soils and climate in the diked baylands provide a favorable environment for hay production. The soils are poorly drained with a high salt content, which allow for a restricted number of crops to grow, one of them being oat hay. On some parcels in the study area, farmers have grown hay for generations as forage for livestock.

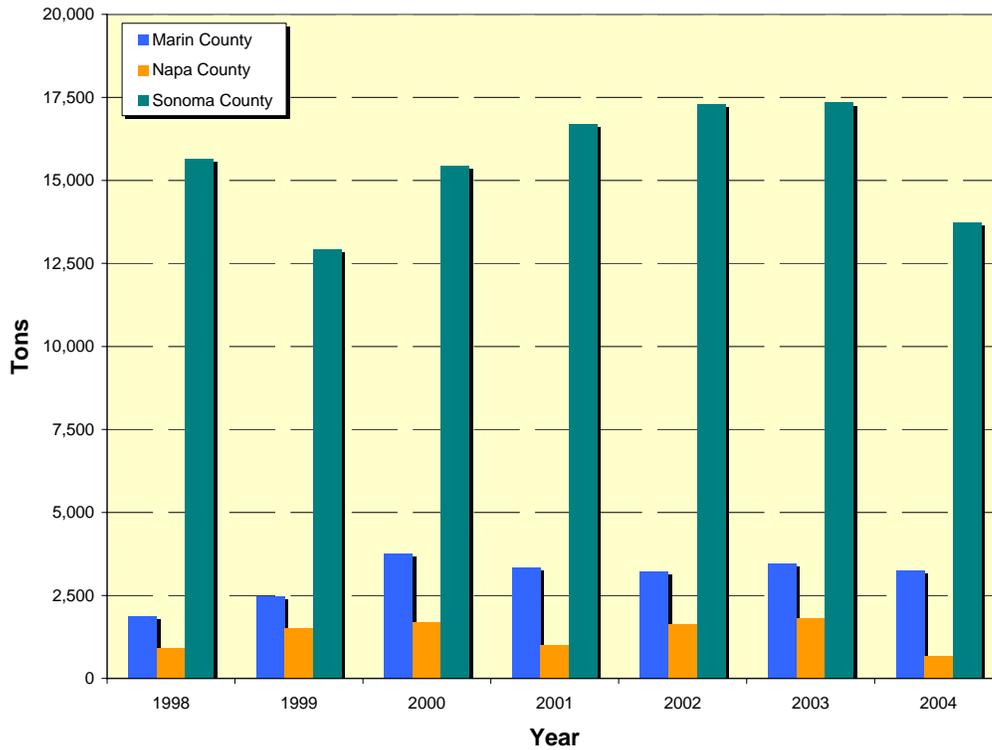
Oat hay production in Marin, Napa, and Sonoma Counties gradually increased from 1999 through 2003. All counties faced a decrease in production from 2003 to 2004, but that decrease varied by county – about 7 percent for Marin County, about 64 percent for Napa County, and 21 percent for Sonoma County (California Agricultural Statistics Service 1999, 2000, 2001a, 2001b, 2002, 2003, 2005). Figure 3-4 shows that Sonoma County produced on average 13 times more oat hay than Napa County over those 7 years (California Agricultural Statistics Service 1999, 2000, 2001a, 2001b, 2002, 2003, 2005).

#### **3.1.2.2 Urban Land Use**

Urban land uses in the initial study area include residential, commercial and light industry, public facilities, conservation areas, heavy industry, and undesignated urban land. Cities in the initial study area include Napa, Novato, Petaluma, San Rafael, and Sonoma.

The City of Napa, incorporated in 1872, has a land area of about 18 square miles (City of Napa 2003). Napa has numerous neighborhood, community, and regional parks, as well as wetlands and natural open areas. The preservation of historic neighborhoods and buildings are balanced with mixed-use areas of retail, office, and commercial spaces.

Incorporated in 1960, the City of Novato covers 28 square miles. In contrast to nearby cities, Novato's population density is low – one-half that of San Rafael and less than one-third that of Petaluma. This low density and the city's large segments of parks and open space create a rural character (City of Novato 2006b). In the study area portion of Novato, the commercial, manufacturing, and light industrial classifications include lands mostly near Highways 37 and 101.



Source: California Agricultural Statistics Service 1999, 2000, 2001a, 2001, 2002, 2003, 2005

**Figure 3-4**  
Total Oat Hay Production in Marin, Napa, and Sonoma Counties, 1998-2004

The City of Petaluma<sup>4</sup> covers approximately 14 square miles in the center of Sonoma County and was incorporated as a charter city in 1858. Rural and open space lands border the City, which lies within a flat plain separated by hills from the Sonoma Valley to the east. The City began as a center of produce shipping, supplying the San Francisco Bay Area with the harvests from the Petaluma River valley and coastal plain. Residential neighborhoods and traditional industries, such as agricultural and construction-related operations, characterize the city (City of Petaluma 2005).

Incorporated in 1874 and later as a charter city in 1913, the City of San Rafael is the county seat for Marin County and has the largest population in the county. The city covers 22 square miles, five of which are water and tidelands. San Rafael has set aside 3,285 acres of open space within the city limits and almost 7,300 acres in its planning area (City of San Rafael 2003).

<sup>4</sup> The City of Petaluma is included in the initial study area. After initial evaluation was concluded, Petaluma decided not to participate in the Project. See Section 1.3 for a discussion of Petaluma’s participation.

Originally recognized as a pueblo in 1835, the City of Sonoma became an incorporated city in 1881. The largest land use designation in the city is single-family residential, which amounts to about 44 percent of the land. Public lands, at almost 21 percent, constitute the next largest category (City of Sonoma 2005).

### **3.1.3 Future Land Use**

The following section discusses land use policies that may affect the future development of agricultural and urban land uses.

#### **3.1.3.1 Agricultural Land Use and Land Use Policies**

##### **3.1.3.1.1 Land Use**

General land use patterns within the study area are not expected to change in the next 20 years, and it is anticipated that the grape growing industry will continue to be the mainstay of the local and regional agricultural economy in the Napa and Sonoma Counties. Grape prices and productivity are highly sensitive to weather conditions, the world market, and local and national economic conditions. These factors make it difficult to forecast changes in the grape growing industry, but there are some expected future trends. Napa County trends show the incorporation of smaller grape growers (those holding between 10 and 20 acres) by larger growers (those holding 50 or more acres) and by vineyards that wish to consolidate production under one main company (Godoy 2003). Although some Sonoma County grape growers are selling parcels to other grape growers, this will not vastly change the total acreage for vineyard-designated land, at least in the near term (Vernon 2003, Ramey 2003).

Over a 20-year time horizon, it cannot be predicted how long hay will remain a major agricultural crop in Napa and Sonoma Counties. In Napa County, many of the sites used to plant hay crops have been switched to more permanent vineyards, which may be a continuing trend. Some hay land has been converted into vineyards in Sonoma County, but this does not appear to be a continuing trend (Vernon 2003, Ramey 2003). In Marin County, agricultural land for hay is expected to remain unchanged (City of Novato 2003).

##### **3.1.3.1.2 Land Use Policies**

Some cities and counties in the North Bay, such as Sonoma County, have adopted strong planning policies that preserve agricultural land from urban development. Land use policies do not preclude the possibility of changes among crop type; however, the economic value of grape production, in relation to other crops such as oat hay or pastureland, will remain a strong reason for grape crops to dominate areas where soils allow their growth. Each of the cities within the study area utilizes urban growth boundaries to restrict urbanization. These urban limits serve as growth management mechanisms to maintain a balance between land uses.

The following is a brief overview of objectives and policies to protect conversion of agricultural land to non-agricultural uses from planning documents for Marin, Napa, and Sonoma Counties.

Policies to protect agricultural land in Marin County include:

- “Maintain agricultural production as the principal use on agricultural lands by limiting residential development to that which is reasonably related to agriculture.”
- “Maintain very low-density agricultural zoning in the Inland Rural and Coastal Corridors to support land-extensive agricultural production and discourage conversion to non-agricultural uses.”
- “...Ensure that development standards preserve and enhance nearby agricultural uses.”
- “Encourage private and public land owners of lands that have traditionally been used for agriculture to keep land in agricultural use by continuing existing agricultural uses, developing compatible new agricultural uses, and/or leasing lands to agricultural operators.” (County of Marin 2005)

Land use policies for Napa County include:

- “The County will enact and enforce regulations which will retain agriculture as a major source of income and employment in Napa County.”
- “The County will initiate studies to evaluate means, methods, advantages and disadvantages of placing the existing agricultural preserve plus potential agricultural acreage under permanent land use protective controls. The County will develop additional types of Agricultural Preserves suitable for localized conditions in such places as Carneros, Coombsville and Congress, Foss, Gordon, Capell, Chiles and Pope Valleys, and hillside viticultural areas.”
- “The County will develop planning concepts and zoning standards designed to minimize conflicts arising from encroachment of urban uses into agricultural areas.”
- “The County will reserve prime agricultural lands for agricultural use.” (County of Napa 2002)

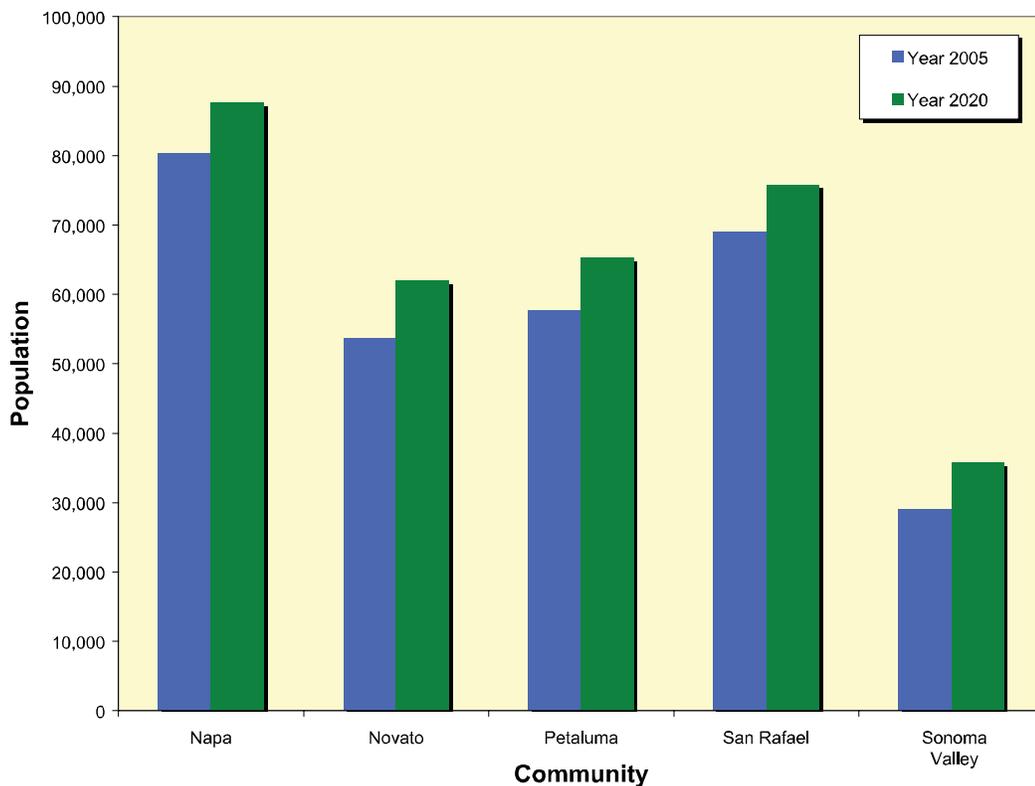
Policies to protect agricultural land in Sonoma County include:

- “Avoid conversion of lands currently used for agricultural production to non-agricultural use.”
- “Agricultural lands not currently used for farming but which have soils or other characteristics which make them suitable for farming shall not be developed in a way that would preclude future agricultural use.”
- “Discourage uses in agricultural areas that are not compatible with long term agricultural production.” (County of Sonoma 2006)

While the agricultural land use policies do not specifically address issues of water management in the region, they do clearly reflect a bias toward retaining the economic, social and environmental value of agriculture. Future water management policies, including those of the Project, must be supportive of these land use objectives.

### 3.1.3.2 Urban Land Use and Land Use Policies

Based on city and county land use goals, it is assumed that urban growth in the study area will occur mainly in or near the existing urban areas. Areas zoned as urban land generally apply to residential, commercial, industrial, public land, and open space (such as parks) categories. Future urban growth largely will not be seen on the rural diked baylands, which are primarily designated for agricultural use. Figure 3-5 presents the 2005 and 2020 projected population for the cities within the study area.



Sources: Association of Bay Area Governments 2004, SCWA 2001a

**Figure 3-5**  
Projected Urban Residential Population Growth in the Study Area

In order to maintain a balance between population growth and decreasing available land, each city has adopted land use policies and strategies. One such growth mechanism is an urban limit line, or urban growth boundary, which geographically defines a separation from open space and agricultural lands surrounding each city in

the study area. The data in Figure 3-5 represents the population within each city's sphere of influence, the entire area to which they are allowed to provide city services.

Under the City of Napa's General Plan, the Rural Urban Limit (RUL) encompasses all land envisioned for urban development through the year 2020 (City of Napa 2003). The RUL ultimately limits growth to approximately 85,000 residents (Napa Valley Economic Development Corporation 2002). The General Plan provides for the maintenance of the city's surrounding open space/agriculture to separate Napa from other communities in the future (City of Napa 2003).

The City of Novato's General Plan designates concentrated clusters of commercial development to service the increasing number of households. The City expects buildout to occur later than 2015 (City of Novato 2003). The General Plan supports clustering of development for continued protection of agricultural and open space land uses such as areas that border San Pablo Bay and along the Petaluma River, which forms the northeast border of Novato's sphere of influence.

The City of Petaluma plans to maintain city-centered development and prevent urban growth onto agriculturally viable lands through the urban limit line, which remains effective until 2018. The City of Petaluma has a growth policy that restricts single-family home construction to no more than 500 units per year (City of Petaluma 2005).

The City of San Rafael expects that the amount and type of urban areas will remain essentially the same in 2020 as they are today because few vacant parcels remain (City of San Rafael 2003). The City expects growth to occur mainly through infill and redevelopment.

In 2000, population estimates for the City of Sonoma and the Valley of the Moon Water District (VOMWD) service area were 9,282 and 20,580, respectively. Population projections for the year 2020 for the Sonoma and VOMWD are 13,482 and 22,810, respectively. The population figures for Sonoma are based on information from the City's Planning Department. The figures for VOMWD are based upon a 0.5 percent annual growth rate, determined by VOMWD staff projections (SCWA 2001a).

The City of Sonoma is expecting an increase in population of approximately 45 percent and VOMWD is expecting one of about 10 percent. Overall, Sonoma Valley expects an increase in population of approximately 21 percent by 2020.

## 3.2 Soil Conditions

This section discusses the suitability of soils in the study area for intensive agriculture. This information is presented to identify potential future agricultural growth in the study area.

The Storie Index rating system is one factor used by Land Evaluation and Site Assessment (LESA) Models to evaluate agricultural land value. LESA is designed to provide an objective rating of the agricultural suitability of land compared to

demands for nonagricultural uses of lands. LESA uses the Storie Index in conjunction with Land Capability Classifications to determine the land evaluation portion of the LESA-based score.

The Storie Index is a 100-point scale (with 100 as the highest score) rating the relative degree of suitability or value of a given soil for intensive agriculture, based only on soil characteristics and qualities. Profile characteristics, texture of the surface layer, slope, and other factors such as drainage and salinity are the four factors represented in the Storie Index rating (California Department of Conservation 1997). Soils are grouped and rated primarily on the basis of their capability to produce common cultivated crops and pasture plants without deteriorating over a long period of time.

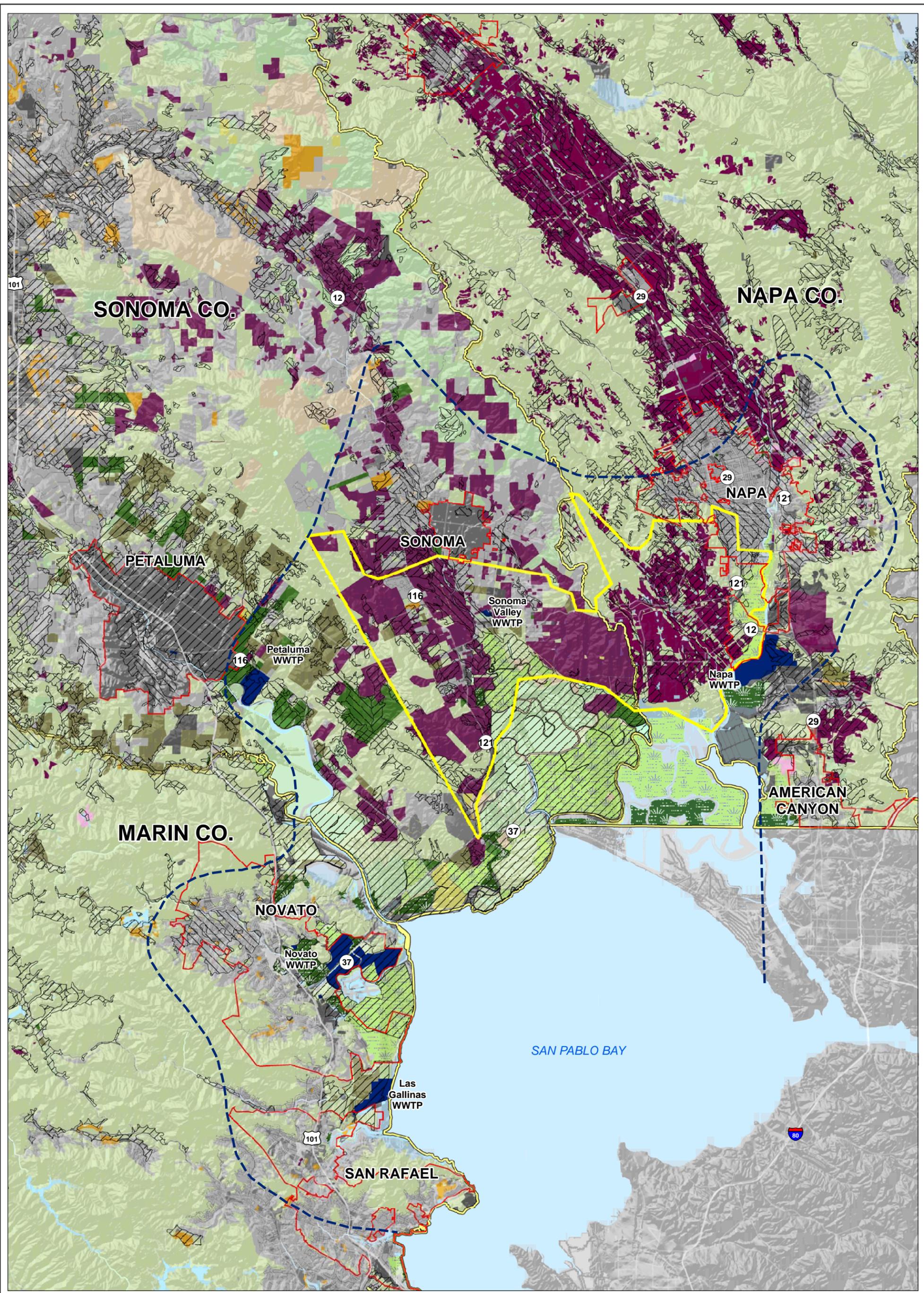
The U.S. Department of Agriculture prepares lists of Storie ratings for soils in Marin, Napa, and Sonoma Counties corresponding to the soil abbreviations used on soil survey maps. Figure 3-6 presents soils in the study area with moderate to high Storie Index ratings, grouped as 40 to 60 points and 61 to 100 points (U.S. Department of Agriculture 2005a, 2005b, and 2005c).

As shown in Figure 3-6, the majority of the study area's agricultural soils have a Storie Index rating of 40 or higher, indicating the soils are suitable for intensive agriculture. Much of the land around the City of Napa has a high Storie Index rating; however, most of the land which is not used for agriculture is already urbanized. There are some pockets of soils with a Storie Index greater than 60 on the northeastern edges of Napa that are currently unimproved or vacant land. In the Sonoma area, there is only one area of non-farmed, non-urbanized, highly suitable land remaining, which is east of Sonoma's urban growth boundary. It is currently dotted with vineyards, and is just outside the Los Carneros American Viticultural Area. South of the Sonoma Valley County Sanitation District wastewater treatment plant, there are a few areas of moderate Storie Index (40-60) parcels that are currently vacant or unimproved. The areas southwest of Petaluma have the greatest amount of vacant moderate to high Storie Index-rated soils, but much of that land is in the hills, which makes intensive agriculture more difficult to implement.

Compared to the overall acreage of the study area, there are few non-urbanized areas not already under agricultural use that have moderate to high rated soils. It appears that much of the desirable agricultural land area has already been developed. There is a low probability of new growth of high quality agriculture in the study area.

### **3.3 Biological Resources**

Wildlife habitat areas in the study area include riparian areas, mudflats, salt evaporation ponds, levees, vegetated and unvegetated tidal marsh, disturbed marsh/leveed baylands, seasonal wetlands, human-made structures, and grassland (Jones and Stokes 2003). These areas host some species that exist almost exclusively in these ecosystems, such as the California black rail and the clapper rail. The Project's environmental analysis will include a more detailed analysis of biological resources in the study area and potential effects of the project.

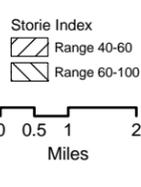


Baseemap: U.S. Department of Agriculture, 2001  
 Land Use Data: California Department of Water Resources, 1999a and 1999b,  
 Napa Sanitation District 2005, SCWA 2001.  
 Storie Index Data: US Department of Agriculture 2005 a, 2005b, and 2005c.  
 Los Carneros AVA Data: Carneros Wine Alliance 2006.

**Legend**

- Initial Study Area Boundary
- Los Carneros American Viticultural Area
- Completed Restoration
- Natural Restoration
- Planned Restoration

- Dairy, Pasture
- Unimproved/Vacant Land
- Dry Farm Property
- Irrigated Farm Property
- Residential
- Commercial
- Industrial
- Orchard
- Vineyard
- Golf Course, Cemetery, Parks, and Landscaping
- Miscellaneous/Unknown
- Government Developed Land
- Water Body



**Figure 3-6**  
**Soil Suitability in**  
**the Study Area**

### 3.3.1 Local Native Species

Most agricultural baylands in the study area support shallow, seasonally ponded wetlands and some upland plants. Agricultural baylands are important as roosting and feeding habitat for wintering shorebirds. Within agricultural baylands, areas of shallow seasonal ponds, typically less than six inches deep, are the most important habitats for shorebirds and waterfowl. Diked marshland usually occurs in low areas adjacent to levees or ditches that have no or poor drainage. In areas where they are near tidal marshes, they can be particularly valuable as high tide refuge for small mammals and roosting habitat for shorebirds and waterfowl (U.S. Environmental Protection Agency [EPA] 1999). The baylands in the study area provide some form of shelter, food, or other ecological benefit to over 500 species of fish, amphibians, reptiles, birds, and mammals (US EPA 1999).

Many special-status species exist or have the potential to exist in habitat areas found in the study area. The CNPS designation helps explain the status of species existing in the study area, but the designation does not carry legal status under the National Environmental Policy Act. CNPS designations serve primarily as a source of baseline information on species potentially existing in the study area.

### 3.3.2 Wetlands Programs

Since the population of the San Francisco Bay area began to grow 150 years ago, approximately 95 percent of the tidal wetlands have been destroyed. These wetlands have been filled-in primarily for residential, commercial, and agricultural purposes. Wetlands provide many essential uses, including:

- Habitat for many species of wildlife, including threatened and endangered animals;
- Flood control by storing rainfall and then slowly releasing it;
- Pollutant filtration; and
- Recreational and educational opportunities.

The study area includes areas of coastal wetlands, both tidal and non-tidal, that serve as important estuarine habitats. Tidal wetlands include marshes and swamps that are flooded by the tides. Non-tidal wetlands occur along rivers and lakes and exist at sea level, but are too far inland to be tidally influenced.

Table 3-1 presents existing and completed wetlands programs near the study area, along with the acreage, the sponsors involved, and the type of wetland. The largest planned wetlands project in the study area is the restoration of the Napa Salt Ponds, which involves 4,347 acres. Skaggs Island, a former tidal wetland converted into a now abandoned military site, is also another large wetland restoration project. The Bay Institute is working to incorporate the island into the San Pablo Bay National Wildlife Refuge (The Bay Institute 2003).

The Napa Salt Ponds restoration is specifically included as one of the project areas that will receive recycled water under the Project (see Section 6 for more details). The implementation of the Project will provide future opportunities for the study area agencies to provide recycled water for wetlands restoration uses.

<b>Programs</b>	<b>Acres</b>	<b>Sponsors <sup>(1)</sup></b>	<b>Status</b>	<b>Type</b>
Camp Two	608	CDFG; Ducks Unlimited; NAWCA	Planned	Nontidal
Cullinan Ranch	1,564	USFWS; CALFED; Ducks Unlimited	Planned	Tidal
Napa River - Pond 8	102	Ducks Unlimited; CDFG	Planned	Tidal
Napa River Flood Control Project	722	Napa County; Napa County Land Trust; CALFED; USACE	Planned	Tidal
Napa Salt Ponds	720	CDFG; USACE; SCWA; State Coastal Conservancy	Planned	Nontidal
Petaluma Marsh Expansion	172	Marin Audubon Society; State Coastal Conservancy; CALFED	Planned	Tidal
Ringstrom Bay Enhancement	207	Ducks Unlimited; CDFG; NAWCA	Planned	Nontidal
Schellville Restoration and Flood Control Project	387	Southern Sonoma County Resource Conservation District	Planned	Mixed
Sears Point Wetlands	2,300	Sonoma Land Trust	Planned	Mixed
Simmons Slough Corridor	186	Marin Audubon Society; RWQCB; CDPR	Planned	Nontidal
Skaggs Island - Navy	3,084	USFWS; Caltrans	Planned	Tidal
<b>Completed Projects</b>			<b>Year Completed</b>	<b>Type</b>
Viansa Winery	94	Viansa Winery; Ducks Unlimited	1993	Nontidal
Petaluma River Marsh	46	Sonoma Land Trust; CDFG	1994	Tidal
Rush Creek/Cemetery Marsh Enhancement	272	Marin Audubon Society; Marin Community Fund; State Coastal Conservancy	1999	Nontidal
Sonoma Baylands	303	Sonoma Land Trust; State Coastal Conservancy; Port of Oakland	1996	Nontidal
Tolay Creek	400	USFWS; CALFED; CDFG; Ducks Unlimited	1999	Tidal
Guadalcanal Village	56	Caltrans	2001	Tidal
Tubbs Island Levee Setback	68	Ducks Unlimited; NAWCA; USFWS	2002	Tidal
North Parcel - Leonard Ranch Tidal Wetlands Restoration	331	Sonoma Land Trust; State Coastal Conservancy; NRCS; NAWCA	2003	Nontidal
Napa Salt Ponds	4,347	CDFG; State Coastal Conservancy; USACE; SCWA	2007	Tidal
Napa River Flood Control Project	218	Napa County; Napa County Land Trust; CALFED; USACE	Not Available	Nontidal

Source: Holmes 2008

<sup>(1)</sup> CALFED = California Bay-Delta Authority, CDFG = California Department of Fish & Game, CDPR = California Department of Pesticide Regulation, Caltrans = California Department of Transportation, NAWCA = North American Wetlands Conservation Act, NRCS = Natural Resources Conservation Service, RWQCB = San Francisco Bay Regional Water Quality Control Board, USACE = U.S. Army Corps of Engineers, USFWS = U.S. Fish and Wildlife Service

# Section 4

## Water Reuse Opportunities

As a result of population increases throughout California, many communities are approaching, or have already reached, the limits of their available water supplies. Water reuse in these areas has already become necessary for conserving and extending available water supplies, and presents communities with an alternate wastewater disposal method, providing pollution abatement by diverting effluent discharge away from sensitive surface waters.

Water reuse in California is an accepted and growing practice. With 590,000 acre-feet (AF) of recycled water used in California in 2002, California has set forth a statutory goal to recycle 1,000,000 AF of water per year by 2010.

As discussed in this section, recycled water is also an accepted and growing practice in the North San Pablo Bay Restoration and Reuse Project (Project) initial study area, with 9,667 AF of water reused in 2005 and current, local plans underway to deliver about 15,000 acre-feet per year (AFY) in 2020.

This section describes the regulatory guidelines governing the treatment and distribution of recycled water in California and discusses the potential for generating and delivering recycled water within the study area.

### 4.1 Recycled Water Use Regulations in California

The regulations that pertain to recycled water use in California can be found in a collection of documents commonly referred to as the “Purple Book,” which includes excerpts from the following:

- *Health and Safety Code* – Division 104 (Environmental Health Services), Part 12 (Drinking Water), Chapter 4 (California Safe Drinking Water Act);
- *Water Code* – Division 7 (Water Quality), Chapters 2, 6, 7, 7.5, & 22;
- *California Code of Regulations (CCR) Title 17* – Division 1 (State Department of Health Service), Chapter 5 (Sanitation), Group 4 (Drinking Water Supplies); and
- *CCR Title 22* – Division 4 (Environmental Health), Chapters 1, 2, & 3. (California Department of Public Health 2001)

Of the documents listed above, the governing document for regulating recycled water use in California is CCR Title 22, Division 4, Chapter 3 (Title 22).

According to Title 22, recycled water can be used for irrigation, wetlands, restricted and non-restricted recreational impoundments, landscape impoundments, industrial or commercial cooling or air conditioning, toilet flushing, and industrial and construction applications.

Title 22 establishes quality and treatment standards for the beneficial use of recycled water. The four recycled water quality standards (organized with the highest level of treatment first and the lowest level of treatment last) are as follows:

Disinfected tertiary recycled water: A filtered and subsequently disinfected wastewater that meets the following criteria:

- The filtered wastewater has been disinfected by either:
  - A chlorine disinfection process following filtration that provides a contact time (the product of total chlorine residual and modal contact time measured at the same point) value of not less than 450 milligram-minutes per liter at all times with a modal contact time of at least 90 minutes, based on peak dry weather design flow; or
  - A disinfection process that, when combined with the filtration process, has been demonstrated to inactivate and/or remove 99.999 percent of the plaque-forming units of F-specific bacteriophage MS2, or polio virus in the wastewater. A virus that is at least as resistant to disinfection as polio virus may be used for purposes of the demonstration.
- The median concentration of total coliform bacteria measured in the disinfected effluent does not exceed [a most probable number (MPN)] of 2.2 per 100 milliliters [mL] utilizing the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed an MPN of 23 per 100 mL in more than one sample in any 30-day period. No sample shall exceed an MPN of 240 total coliform bacteria per 100 mL.

Disinfected secondary-2.2 recycled water: Recycled water that has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed an MPN of 2.2 per 100 mL utilizing the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed an MPN of 23 per 100 mL in more than one sample in any 30-day period.

Disinfected secondary-23 recycled water: Recycled water that has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed an MPN of 23 per 100 mL utilizing the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed an MPN of 240 per 100 mL in more than one sample in any 30-day period.

Undisinfected secondary recycled water (also known as oxidized wastewater): Wastewater in which the organic matter has been stabilized, is non-putrescible, and contains oxygen.

Table 4-1 summarizes the water quality standards set by Title 22 for agricultural and urban uses of recycled water. The table is organized with the highest level of treatment at the top and the lowest level of treatment at the bottom.

<b>Table 4-1 Title 22 Standards and Uses of Recycled Water</b>	
<b>Treatment Standard</b>	<b>Use</b>
Disinfected tertiary recycled water	<ul style="list-style-type: none"> <li>• Food crops, including all edible root crops, where the recycled water comes into contact with the edible portion of the crop</li> <li>• Parks and playgrounds</li> <li>• School yards</li> <li>• Residential landscaping</li> <li>• Unrestricted access golf courses</li> <li>• Any other irrigation not prohibited by other sections of the CCR</li> </ul>
Disinfected secondary-2.2 recycled water	<ul style="list-style-type: none"> <li>• Food crops where the edible portion is produced above ground and not contacted by the recycled water</li> </ul>
Disinfected secondary-23 recycled water	<ul style="list-style-type: none"> <li>• Cemeteries</li> <li>• Freeway landscaping</li> <li>• Restricted access golf courses</li> <li>• Ornamental nursery stock and sod farms where access by the general public is not restricted</li> <li>• Pasture for animals producing milk for human consumption</li> <li>• Any non-edible vegetation where access is controlled so that the irrigated area cannot be used as if it were part of a park, playground, or school yard</li> </ul>
Undisinfected secondary recycled water	<ul style="list-style-type: none"> <li>• Orchards where the recycled water does not come into contact with the edible portion of the crop,</li> <li>• Vineyards where the recycled water does not come into contact with the edible portion of the crop</li> <li>• Non-food-bearing trees</li> <li>• Fodder and fiber crops and pasture for animals not producing milk for human consumption</li> <li>• Seed crops not eaten by humans</li> <li>• Food crops that must undergo commercial pathogen-destroying processing before being consumed by humans</li> <li>• Ornamental nursery stock and sod farms provided no irrigation with recycled water occurs for a period of 14 days prior to harvesting, retail sale, or allowing access by the general public</li> </ul>

Source: 22 CCR

As described in Section 5.2.1, the Project is proposing to use recycled water for agricultural irrigation, urban landscaping, and environmental restoration in the study area. All the water used in this Project will therefore be treated to meet disinfected tertiary recycled water standards<sup>1</sup>. The potential demands for these uses are discussed in Section 2.2.1.

## 4.2 Potential Supplies of Recycled Water

Five wastewater treatment plants (WWTPs) were initially evaluated to determine their viability as sources of recycled water for the proposed Project<sup>2</sup>. The Napa Sanitation District (Napa SD) is in Napa County, the Sonoma Valley County Sanitation District (SVCSD) and City of Petaluma WWTPs are in Sonoma County, and the Novato Sanitary District (Novato SD) WWTP and Las Gallinas Valley Sanitary District (LGVSD) WWTP are in Marin County (see Figure 1-1 for locations).

Each of these agencies has been encouraged by state regulators to reduce the volume of treated wastewater discharged to San Pablo Bay and its tributaries in order to improve the quality of these water bodies. During the dry season, the San Francisco Bay Regional Water Quality Control Board (RWQCB) does not allow the discharge of treated wastewater to receiving water bodies.

Several of the agencies have developed recycled water use agreements with local vineyards, dairies, hay growers, golf courses, and parks. During the dry season, the agencies send treated wastewater that is in excess of their agreed recycled water commitments to holding ponds, wetlands, or rely upon the spreading and evapotranspiration of recycled water on local grassland.

Implementing the Project would allow increased beneficial use of recycled water. New recycled water users would then no longer be entirely dependent on surface or groundwater, thereby reducing the demand, potential water quality degradation, and groundwater level declines caused by use of these supplies.

The following sections describe the five wastewater agencies and their wastewater treatment facilities, including existing and future recycled water supplies available for the purposes of this Project.

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<sup>1</sup> The only exception occurs in initial Alternative 1, as described in Section 5, in which the pasture reuse areas south of the Petaluma wastewater treatment plant would receive disinfected secondary recycled water under a plan developed by the City of Petaluma. That local project is now no longer included in the Project (see Sections 1.3 and 5.4).

<sup>2</sup> As discussed in Section 1.3, Petaluma was initially evaluated in the Project, but is no longer participating.

## 4.2.1 Las Gallinas Valley Sanitary District

The LGVSD WWTP provides sanitation service to approximately 32,000 people within the area of Marinwood, Lucas Valley, Terra Linda, Santa Venetia, Los Ranchitos, and Smith Ranch Road (Williams 2008b).

Treatment capacities for the LGVSD WWTP are as follows:

- Preliminary Treatment: 24 million gallons per day (mgd)
- Primary Treatment: 20.5 mgd
- Secondary Treatment: 8 mgd (Williams 2008a)

During the wet season (November 1 through May 31), treated wastewater is discharged to the tidal portion of Miller Creek and ultimately to San Pablo Bay. During the non-discharge dry season (June 1 through October 31), treated wastewater is stored in ponds and used to irrigate local pasture and maintain wetlands. LGVSD also provides secondary treated wastewater to the Marin Municipal Water District (MMWD) for further treatment prior to reuse, as described below.

### 4.2.1.1 Recycled Water System

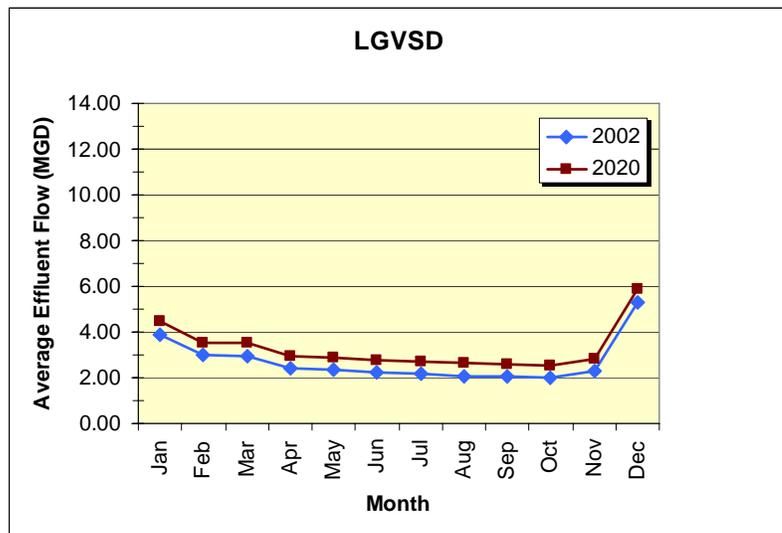
During the dry season, LGVSD sends approximately 1.0 to 1.5 mgd (3.1 to 4.6 AF per day) of its secondary effluent to an MMWD facility on-site where it is treated to Title 22 disinfected tertiary levels (Williams 2003). MMWD distributes the recycled water for use in local car washes, laundries, and cooling towers, and the irrigation of ballparks, business parks, and residences. LGVSD applies the remainder of the secondary treated effluent to 385 acres of adjacent land, which includes 20 acres of wildlife marsh, 40 acres of storage ponds, 10 acres of salt marsh, 20 acres of irrigated landscaping, and 200 acres of irrigated pasture (LGVSD 2005).

### 4.2.1.2 WWTP Flows

Because LGVSD has no raw water storage available on site, its daily influent flow pattern is effectively equal to its daily discharge flow pattern. The facility has a permitted average dry weather discharge flow of 2.92 mgd. Typical average dry and wet weather flows (ADWF and AWWF) for 2002 were 2.1 mgd and 3.2 mgd, respectively.

LGVSD's *Wastewater Treatment Plant Capital Improvement Plan* (Nute Engineering 2001) includes projections for wastewater generation at buildout. This plan approximates that ADWF and AWWF would be 3.9 mgd and 6.7 mgd at full buildout (estimated to be 2040).

Discussions with the LGVSD General Manager indicated that the anticipated future flow rates at buildout will likely be lower than those stated in the 2001 plan due to an aggressive local water conservation and collection system rehabilitation plan currently being developed and implemented. As a result of these measures, ADWF at buildout is expected to be 2.65 mgd (Petrie 2004). Figure 4-1 presents the LGVSD WWTP monthly average flow rates for 2002 operations, and the anticipated flows for 2020.



**Figure 4-1**  
Average Current and Projected Monthly Flow  
Las Gallinas Valley Sanitary District

#### 4.2.1.3 Potential for WWTP Expansion and Upgrade

LGVSD's *Wastewater Treatment Plant Capital Improvement Program* includes the following goals for future upgrades (Nute Engineering 2001):

- Improve effluent quality during dry and wet weather to continue meeting National Pollutant Discharge Elimination System (NPDES) requirements;
- Meet peak wet weather flows; and
- Provide effluent volume and quality satisfactory for MMWD's production of Title 22 tertiary recycled water.

In addition to its plans for water conservation and collection system rehabilitation, LGVSD plans to implement WWTP system improvements to eliminate wet weather flow blending. This will be addressed with a new secondary clarification process, additional process piping, and process reconfiguration (Nute 2008).

During the summer of 2008, LGVSD will be increasing the WWTP's primary treatment from 20.05 mgd to 23.5 mgd. LGVSD will also be completing additional testing during the 2008/2009 winter to explore increasing secondary treatment capacity to at least 10 mgd (Williams 2008a).

## 4.2.2 Novato Sanitary District

The Novato SD WWTP provides service to about 60,000 residents within the City of Novato, an area of 28 square miles, and surrounding areas (Novato SD 2006). The WWTP discharges an average annual flow of 6.3 mgd, and can treat up to 6.55 mgd during the dry season. The RWQCB does not permit effluent discharge to San Pablo Bay between June 1 and August 31. Discharge during May and September is subject to lower limits for biochemical oxygen demand and suspended solids.

As specified in the district's NPDES permit, the Novato WWTP treats flows up to 9.0 mgd with primary clarification, activated sludge, secondary clarification, nitrification, gravity filtration, and disinfection with hypochlorite (James 2003). Flows between 9.0 and 16.0 mgd receive primary treatment followed by gravity filtration and disinfection. Flows above 16.0 mgd receive gravity filtration followed by disinfection.

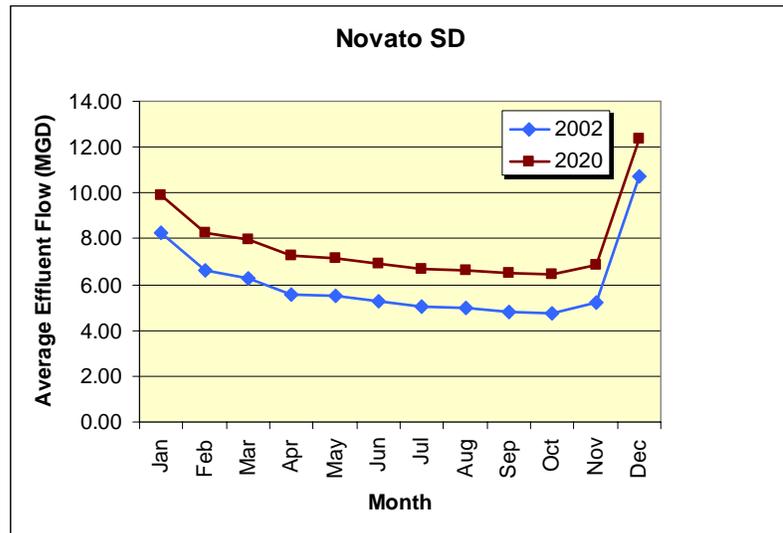
### 4.2.2.1 Recycled Water System

During the dry season, the Novato SD sends secondary effluent to three District-owned irrigation parcels (totaling approximately 820 acres), two treated water storage ponds, and 15 acres of wildlife habitat. These parcels are on Route 37, approximately 1 mile northeast of the Ignacio pump station. The discharge pipe passes through the reclamation area to the San Pablo Bay mudflats where treated flow is discharged. In 2008, Novato SD began operating a new 0.5 mgd (1.5 AF per day) facility east of the Novato WWTP that is able to provide treatment to Title 22 tertiary levels. The facility is operational and is expandable to 1.0 mgd. The facility is located near the WWTP's discharge pipeline in the current irrigation fields and is designed to supply approximately 269 AFY of recycled water to the local Stone Tree Golf Course and other users (James 2003).

Novato SD is conducting a joint study with the North Marin Water District (NMWD) to identify additional future recycled water users in the City of Novato. If the local project were fully funded and implemented in the North and Central service areas, it could deliver an additional 177 million gallons per year (MG/Y) (542 AFY) of recycled water to urban users, primarily for landscaping irrigation (NMWD and Novato SD 2006).

#### 4.2.2.2 WWTP Flows

In early 2008, Novato SD consolidated treatment operations from two WWTPs to one WWTP. Novato SD provided historical flow and water quality data for the Novato WWTP and former Ignacio WWTP for July 1, 2000 through June 30, 2003. Figure 4-2 presents monthly average flow rates that were derived from the total daily combined effluent flow rates. Because neither of Novato SD's WWTPs had raw water storage available on site, its daily influent flow pattern is effectively equal to its daily discharge flow pattern. The 2002 ADWF and AWWF flows for the combined facilities were 5.0 and 6.9 mgd, respectively.



**Figure 4-2**  
Average Current and Projected Monthly Flow  
Novato Sanitary District

The *Novato Sanitary District Strategic Plan* (Larry Walker & Associates 2001) includes projected flows for 2020. Because a range of possible future ADWF was provided in the plan (6.06 to 7.17 mgd for 2020), the average of these values was used as the target ADWF for modeling purposes. The resulting flow curves for 2002 and 2020 are presented in Figure 4-2.

#### 4.2.2.3 Potential for WWTP Expansion and Upgrade

The *Novato Sanitary District Strategic Plan* was developed to address district growth, new regulatory requirements, more stringent discharge enforcement, and facility upgrades. The Strategic Plan projected a population of 71,180 residents in 2020 using the Association of Bay Area Government's (ABAG) population projections from 2000 and the City of Novato's 1996 General Plan<sup>3</sup>. The Strategic Plan predicted future ADWF for the projected population using six methods, which resulted in the range of flows identified in Section 4.2.2.2. Novato SD plans to complete future facility upgrades within the next five to six years. The District is constructing an upgraded treatment plant that will have an average dry weather capacity of 7.05 mgd and will be capable of providing full secondary treatment and disinfection for wet weather

<sup>3</sup> ABAG's Projections 2005 forecasts a population of 61,900 for Novato's sphere of influence (ABAG 2004).

flows up to 40 mgd. The Strategic Plan discusses in detail the construction of the recycled water facility and identification of recycled water users.

### 4.2.3 City of Petaluma

The City of Petaluma<sup>4</sup> provides wastewater collection and treatment services to approximately 57,700 customers within the city limits and for the unincorporated Sonoma County community of Penngrove.

The existing treatment plant has an ADWF design capacity of 5.2 mgd, and is able to achieve secondary treatment levels. The plant presently discharges an ADWF of 4.5 mgd and annual average flow of about 5.2 mgd. During the period from October 21 through April 30, treated wastewater is discharged to the Petaluma River. As is the case for the other WWTPs in the region, the RWQCB does not permit the Petaluma WWTP to discharge to the Petaluma River during the dry season (May 1 through October 20). During this time, treated wastewater is reused for agricultural irrigation.

The regional planning agency forecasts a 2020 population of 65,300 for Petaluma and its sphere of influence (ABAG 2004). Because the existing treatment facility does not have adequate capacity for the future wastewater flows, the City plans to construct a new Water Recycling Facility; the new facility will be able to treat flows up to 6.7 mgd at secondary levels, and flows up to 5.2 mgd at tertiary levels.

#### 4.2.3.1 Recycled Water System

The Petaluma WWTP annually supplies the Adobe Creek Golf Course with approximately 100 MG (317 AF) of secondary recycled water (City of Petaluma 2004). In the summer of 2004, Petaluma WWTP supplied the Rooster Run Golf Course with approximately 138 MG (424 AF) of secondary recycled water (City of Petaluma 2004). One small vineyard utilizes approximately 4 MG (12.3 AF) per dry weather season. Depending upon wet weather season precipitation levels and length, 533 to 822 MG (1,636 to 2,524 AF) is currently applied to approximately 800 acres of local pasture land to meet the no-discharge requirement during the summer months. Once tertiary recycled water becomes available through the new Water Recycling Facility, the City of Petaluma will provide approximately 485 MG (1,489 AF) of tertiary and 515 MG (1,581 AF) of secondary recycled water to both urban and agricultural customers. The City's calculations indicate that all the water generated from the Ellis Creek Recycling Facility during the dry season can be locally reused through the secondary and tertiary recycling programs.

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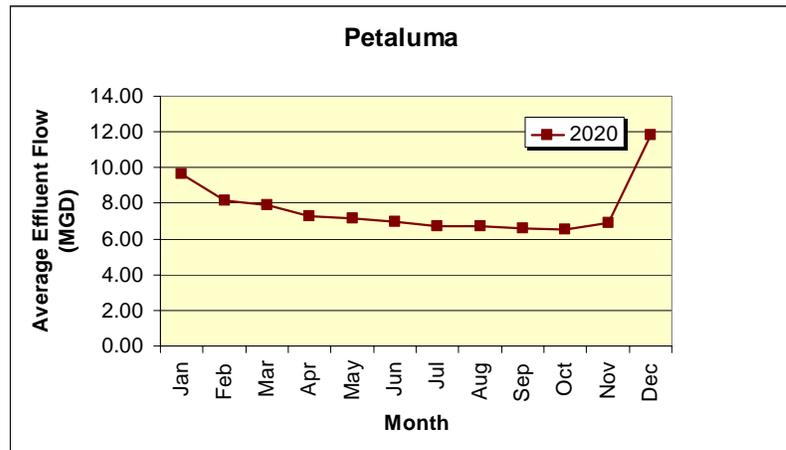
<sup>4</sup> As discussed in Section 1.3, Petaluma was initially evaluated in the Project, but is no longer participating.

#### 4.2.3.2 WWTP Flows

The Petaluma WWTP's average annual discharge flow was 7.2 mgd and average annual secondary recycled water flow was 3.5 mgd for 2003. The maximum discharge season flow was 14 mgd and the maximum recycled flow was 7.7 mgd for 2003. The current facilities are permitted for an ADWF of 5.2 mgd and the new facilities are being designed for an ADWF of 6.7 mgd. Because data was not available from

Petaluma, daily flow patterns from the neighboring Novato WWTP (serving an area of similar population and extent) was used as a surrogate to develop the 2020 Petaluma WWTP flow curves.

Figure 4-3 presents the anticipated flow rates for the City of Petaluma WWTP in 2020, which simulate a flow pattern with an ADWF of 6.7 mgd.



**Figure 4-3**  
Average Projected Monthly Flow  
City of Petaluma

#### 4.2.3.3 Potential for WWTP Expansion and Upgrade

The new Ellis Creek Water Recycling Facility will allow the plant to treat 5.2 mgd to Title 22 tertiary standards and 6.7 mgd to secondary treatment standards for agricultural reuse. The City plans on using all of its tertiary recycled water for customers within the City of Petaluma and its secondary recycled water for customers that irrigate agricultural land adjacent to the new water recycling facility.

In 2007, the City indicated it did not want to be included in the Project, but would continue to develop its local projects on its own.

#### 4.2.4 Sonoma Valley County Sanitation District

The SVCSD WWTP began operations in 1954 and provides service to 17,027 equivalent single-family dwellings within a 7-square-mile area (SVCSD 2006). The service area includes the City of Sonoma and incorporated areas of Glen Ellen, Boyes Hot Springs, and Agua Caliente, which has approximately 13,450 residents. The facility has the capacity to treat 16 mgd to a tertiary treatment level (Booker 2008c).

Between May 1 and October 31, the RWQCB does not permit the WWTP to discharge to local water bodies; therefore, SVCSD recycles the water for local irrigation and habitat projects. Between November 1 and April 30, SVCSD discharges treated

wastewater into Schell Slough and Hudeman Slough, which ultimately flow into San Pablo Bay.

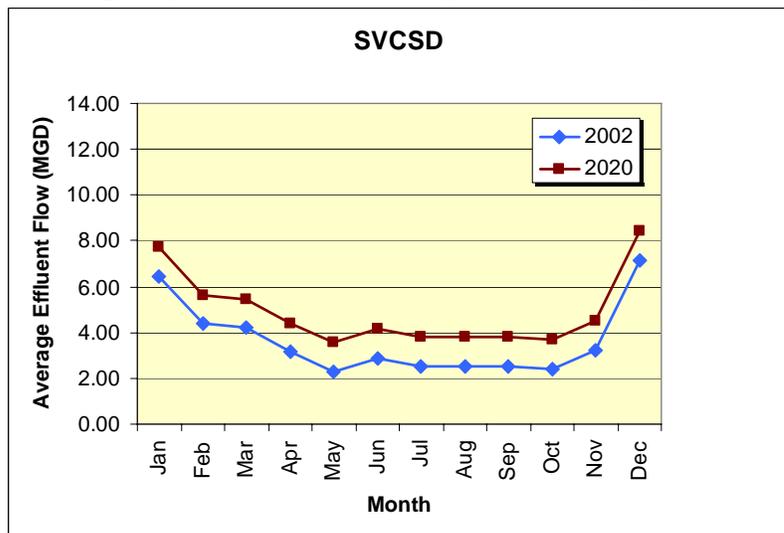
**4.2.4.1 Recycled Water System**

SVCS D has a well-established system and significant infrastructure for the conveyance, storage, and distribution of recycled water to local users. SVCS D delivers approximately 1,200 AF of recycled water to local users annually. Existing recycled water users are along Highway 121 and Highway 12, Thiodoro Road, Millerick Lane, Ramal Road, and Skaggs Island Road in the western part of the Los Carneros American Viticultural Area. The remaining treated wastewater discharges to wetlands owned by SVCS D and the California Department of Fish and Game. The discharge wetlands are approximately 3.5 miles southeast of the treatment plant.

**4.2.4.2 WWTP Flows**

SVCS D provided flow and water quality data for 1996 through 2002. During this period, the WWTP ADWF and AWWF flows were approximately 2.75 and 5.06 mgd, respectively.

SVCS D modeled its system to determine potential future flows. These calculations indicate the future plant ADWF flows at buildout, which may not occur until after 2020, will be 3.85 mgd (HDR 2002). The WWTP flow data from 2002 and the projected 2020 flow volumes are presented in Figure 4-4.



**Figure 4-4**  
Average Current and Projected Monthly Flow  
Sonoma Valley County Sanitation District

**4.2.4.3 Potential for WWTP Expansion and Upgrade**

SVCS D has upgraded its facility to add filtration as a tertiary treatment process element. The new tertiary element has a design capacity of 16 mgd (HDR 2002). Several mechanical components of the current plant limit the discharge capacity to 12 mgd and would require upgrades in the future.

## 4.2.5 Napa Sanitation District

The Napa SD treats wastewater from the City of Napa and surrounding unincorporated communities, and includes approximately 33,000 service connections (Napa SD 2006). Napa SD's WWTP has an average annual discharge of between 9.5 and 11.0 mgd, and a dry weather design capacity of 15.4 mgd.

Napa SD distributes recycled water for irrigation between May 1 and October 31. The RWQCB permits Napa SD to discharge to the Napa River between November 1 and April 30. As a result of plant upgrades completed in 2001, the facility is capable of generating 8.8 mgd of recycled water at a quality that meets the requirements of Title 22 disinfected tertiary levels for unrestricted use (Healy 2003).

### 4.2.5.1 Recycled Water System

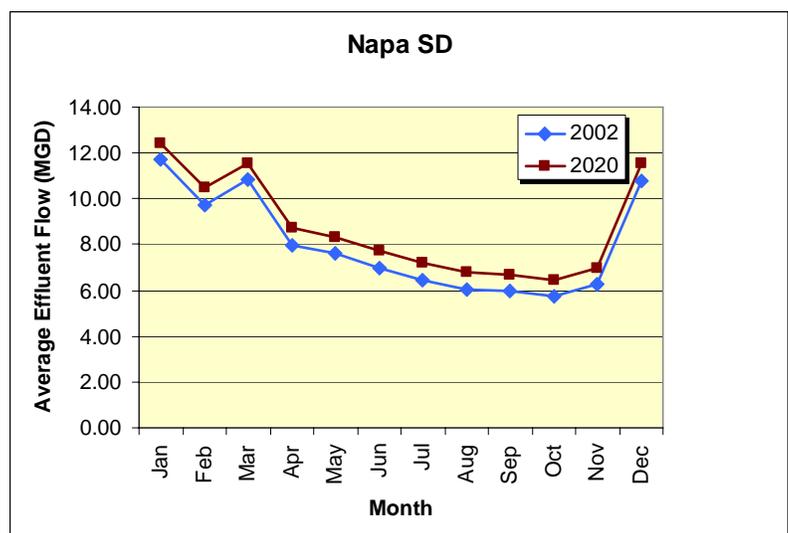
The Napa SD Water Recycling Facility has two 10-AF recycled water reservoirs on-site. The adjacent WWTP includes four oxidation ponds that total 344 acres. Napa SD typically stores raw water in these ponds and then treats the water immediately before distribution. It may be possible for Napa SD to adjust its operations at the WWTP and use these ponds to store an additional 501 MG (1,540 AF) of recycled water for the project.

Existing Napa SD recycled water users include Chardonnay Golf Course and Vineyards, Somsy Ranch, Jameson Canyon Reclamation Site, Napa Airport, Hakusan Sake Factory, and Napa Corporate Park (Napa SD 2005). Recycled water users are along the discharge pipeline at Highway 29 and Jameson Canyon Road and further north along the Napa Valley Highway. In 2005, recycled water customers received 426 MG per year (1,307 AFY) (Napa SD 2005). Napa SD has identified potential future recycled water users including Kennedy Golf Course, Napa Valley College Ballfield, and Napa State Hospital.

### 4.2.5.2 WWTP Flows

Napa SD provided flow and water quality data for the years 1998 through 2002. Figure 4-5 presents effluent flows from 2002 and estimated 2020 flow data.

The projected discharge flow rate in 2020 was obtained from Napa SD's



**Figure 4-5**  
Average Current and Projected Monthly Flow  
Napa Sanitation District

report *Strategic Plan for Recycled Water Use in the Year 2020* (Napa SD 2005). The report predicts that the Napa SD service area will grow to include 35,650 service connections by the year 2020, which will increase total annual flows to 3,548 MG/yr. However, incorporating pond evaporation and treatment process losses, it is anticipated that only 3,192 MG/yr (9,800 AFY) would remain for distribution to recycled water customers.

#### 4.2.5.3 Potential for WWTP Expansion and Upgrade

Napa SD does not currently have a timeframe for future upgrades at the WWTP following the addition of the DynaSand filtration system and extension of the chlorination basin in 2001 (Healy 2003). The facility upgrade included allowances for future addition of four DynaSand filtration cells, extension of the chlorination basin, and addition of a third 3.2-MG recycled water reservoir. The addition of four DynaSand cells would allow the capacity of the filters to be increased to 17.6 mgd (twice the current flow); however, the facility's tertiary capabilities may then be limited by the treatment capacity of the chlorination basin.

Napa SD is currently developing an additional 4.1 miles of recycled water delivery pipelines. Pipeline alignments currently include: a segment north toward the Napa State Hospital, a segment south to the Napa County Airport, and a segment southeast to the Napa Valley Gateway Business Park. Napa SD's *Strategic Plan for Recycled Water Use in the Year 2020* expands upon these current development plans by evaluating the potential to extend the recycled water distribution system further north along the Silverado Trail and west across the Napa River into the Carneros region. The report also includes the addition of a proposed 1.5-MG reservoir in the vicinity of the Napa State Hospital (Napa SD 2005).

#### 4.2.6 Summary of Existing WWTP Conditions

Table 4-2 summarizes the capacity and level of both existing and future anticipated treatment (combination of secondary and tertiary) at each of the WWTPs presented in Sections 4.2.1 through 4.2.5<sup>5</sup>.

	<b>LGVS D WWTP</b>	<b>Novato WWTP</b>	<b>Petaluma<sup>(1)</sup> WWTP</b>	<b>SVCS D WWTP</b>	<b>Napa SD WWTP</b>
Current NPDES Dry Season Discharge Limit	2.92	6.55	5.2	3.0	15.4
ADWF (2002)	2.1	5.0	4.4	2.6	6.2
AWWF (2002)	3.2	6.9	6.2	4.4	9.3
ADWF (2020) <sup>(2)</sup>	2.7	6.6	6.7	3.9	7.0
AWWF (2020) <sup>(2)</sup>	3.7	8.6	8.4	5.7	10.0

Notes:

1: Petaluma volumes are assumed.

2: 2020 flows are projected.

<sup>5</sup> As discussed in Section 1.3, Petaluma was initially evaluated in the Project, but is no longer participating.

As can be viewed in Table 4-2, the existing dry weather discharge capacity at the Novato SD, Petaluma, and SVCSD WWTPs does not appear to be sufficient to handle the anticipated ADWFs in 2020; these WWTPs are currently undergoing capacity improvements. LGVSD and Napa SD appear to have ADWF adequate capacity until at least 2020.

### 4.3 WWTP Water Quality

Recycled water is used for numerous agricultural applications throughout California and the United States. In addition to the filtration and disinfection requirements that recycled water must meet for agricultural use, discussed in Section 4.1, additional water quality parameters should also be reviewed relative to a given plant's tolerance to certain constituents sometimes found in recycled water. The chemical constituents to consider for agricultural irrigation are salinity, sodium, trace elements, excessive chlorine residual, and nutrients. Recycled water may have higher concentrations of these constituents than the groundwater or surface water sources from which the water supply is drawn.

The types and concentrations of constituents in recycled water depend upon the municipal water supply, the influent waste streams (i.e., domestic and industrial contributions), amount and composition of infiltration in the wastewater collection system, the wastewater treatment process, and type of storage facilities. A description of these constituents is provided below.

Salinity: Salinity is the single most important parameter in determining the suitability of the water to be used for irrigation. It is important to review the salinity of irrigation water because high levels of salinity could reduce growth and production of grapevines and other plants. As the salt concentration of the water in the root zone increases above a threshold level the plant must expend more energy to absorb water, and both the growth rate and ultimate size of the crop progressively decrease. However, the threshold and the rate of growth reduction vary widely among different crop species. Crops must be chosen carefully to ensure that they can tolerate the salinity of their irrigation water (USEPA 2004).

Sodium: Excessive sodium in irrigation water could contribute to soil dispersion and structural breakdown, where the finer soil particles fill many of the smaller pore spaces, sealing the surface and greatly reducing water infiltration rates (USEPA 2004).

Trace elements: Nickel and zinc have visible adverse effects in plants at lower concentrations than the levels harmful to animals and humans. Cadmium, copper, and molybdenum, however, can be harmful to animals at concentrations too low to impact plants. Although boron is an essential element required for plant growth, it is nonetheless potentially harmful in the soil should the concentrations become too high. Grapes are particularly sensitive to boron in irrigation water and can develop injury to leaves and shoots if concentrations exceed certain limits (USEPA 2004).

Chlorine Residual: Free chlorine residual at concentrations of less than 1 milligram per liter (mg/L) usually poses no problem to plants. However, some sensitive crops may be damaged at levels as low as 0.05 mg/L. Some woody crops may accumulate chlorine in the tissue to toxic levels. Excessive chlorine has a similar leaf-burning effect as sodium and chloride when sprayed directly on foliage (USEPA 2004).

Nutrients: The nutrients most important to a crop's needs are nitrogen, phosphorus, potassium, zinc, boron, and sulfur. Recycled water usually contains enough of these nutrients to supply a large portion of a crop's needs. The most beneficial nutrient is nitrogen. Both the concentration and form of nitrogen need to be considered in irrigation water. While excessive amounts of nitrogen stimulate vegetative growth in most crops, it may also delay maturity and reduce crop quality and quantity. The nitrogen in recycled water may not be present in concentrations great enough to produce satisfactory crop yields, and some supplemental fertilizer may be necessary. In addition, excessive nitrate in forages can cause an imbalance of nitrogen, potassium, and magnesium in grazing animals. This could be an issue if the forage is used as a primary feed source for livestock; however, such high concentrations are usually not expected with municipal recycled water (USEPA 2004).

The University of California (UC) Division of Agriculture and Natural Resources completed a study in 2006 which examined the quality of Napa SD's recycled water and its appropriateness for vineyard applications. The study concluded that Napa SD recycled water is satisfactory for vineyards with respect to salinity, chloride, sodium, boron, calcium to magnesium ratio, phosphorus, and potassium. The study also concluded that long-term salinity accumulation should not occur when using Napa SD recycled water. Nitrogen levels in recycled water can be beneficial for vineyards and other crops. For vineyards that do not currently fertilize with nitrogen additives, the use of appropriate cover crops and additional irrigation sources can offset the low amount of nitrogen present in recycled water. The study also stated that recycled water use is consistent with the National Organic Program standards for certified organic vineyards (UC Division of Agriculture and Natural Resources 2006).

Table 4-3 summarizes water quality data for the participating WWTPs' effluent from 2000 to 2003<sup>6</sup>. The table also presents the water quality guidelines for the use of recycled water by the U.S. Environmental Protection Agency (USEPA), the 2006 study by the UC Division of Agriculture, and from the North Bay Watershed Association (NBWA).

Based on the data from 2000 to 2003, in almost all cases the effluent of the participating WWTPs meets the water quality recommended levels for each of the constituents listed in Table 4-3 for agricultural application. Only the constituents of chlorine residual, sodium, and specific conductance (as measured at Napa SD for chlorine residual, and SVCSD and Napa SD for sodium and specific conductance) are present at levels higher than those recommended by the NBWA study; however,

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<sup>6</sup> Water quality data from Petaluma WWTP was not available.

these constituents have no recommended maximum level by USEPA or the UC Division of Agriculture. It is likely that as the tertiary treatment capacity of each WWTP is increased, the constituent levels in the participating WWTPs will also be reduced due to the improved filtration requirements of Title 22 tertiary treated recycled water.

#### **4.4 Summary of Current and Potential Future Recycled Water Supplies**

As discussed in Sections 4.2.1 through 4.2.5, and Section 2.2.2.3, several of the WWTPs in the initial study area<sup>7</sup> supply recycled water to local customers. The Project assumes that the WWTPs will continue to honor these commitments as they each continue to develop local projects for additional recycled water use.

Table 4-4 summarizes the volume of water utilized by each WWTP in 2005 for beneficial reuse (recycled water served to customers) and the projected increase in WWTP flows and beneficial reuse, assuming the full implementation of local projects.

Each of the Project participants agrees that the Project must be able to deliver high quality water to potential users in order to be an attractive and effective regional solution. All the WWTPs except Petaluma are able to treat to Title 22 tertiary levels. As discussed in the Project's Hydraulic Studies Technical Memorandum, the hydraulic modeling performed assumes that the WWTPs will treat both daily and stored secondary treated effluent to tertiary levels only as required to meet daily user demands, or to prepare for upcoming user demands. The tertiary treatment capacity of each WWTP is assumed to increase under the Project to reflect the peak daily dry weather flow demands of the anticipated local users supplied by the WWTP. Tables 4-5 and 4-6 summarize the level of treatment (in units of mgd and AF per day, respectively) available at each treatment plant, in both their current and future plans for upgrades. See Section 6 for a discussion of how much additional tertiary treatment capacity is needed at each WWTP under the Project alternatives.

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<sup>7</sup> As discussed in Section 1.3, Petaluma was initially evaluated in the Project, but is no longer participating.

**Table 4-3  
WWTP Effluent Water Quality**

Constituent	Units	Water Quality Guidelines					LGVSD <sup>(4)</sup>			Novato SD <sup>(6)</sup>			SVCSD <sup>(7)</sup>			Napa SD <sup>(11)</sup>			
		Recommended Maximum Level for Vineyard Water Quality Needs <sup>(1)</sup>	Recommended Constituent Limits in Recycled Water for Irrigation <sup>(2)</sup>	NBWA Values, Degree of Restrictions on Use <sup>(3)</sup>			Minimum	Average	Maximum	Minimum	Average	Maximum	Desired Range <sup>(8)</sup>	Minimum	Average	Maximum	Minimum	Average	Maximum
				None	Slight to Moderate	Severe													
Aluminum	mg/L	5.0	5.0									None	< 0.05	0.16833	0.59	0.030	0.170	0.480	
Arsenic	mg/L	0.1	0.10				0.001 <sup>(5)</sup>	0.0005	0.0018	0.0040	None	< 0.002	0.002	0.0024	< 0.0005	0.0008	0.0012		
Beryllium	mg/L	0.1	0.10								None	< 0.001 <sup>(9)</sup>							
Bicarbonate <sup>4</sup>	mg/L			<90	90 - 500	>500					75	72	119	160	70	157	290		
Boron	mg/L	1	0.75	<0.7	0.7 - 3.0	>3.0					< 0.5	0.40	0.49	0.65	0.3	0.4	0.6		
Cadmium	mg/L	0.01	0.01				0.0001	0.0004	0.0006	0.0000	0.0001	0.0002	None	< 0.001 <sup>(9)</sup>		< 0.1 <sup>(9)</sup>			
Chloride	mg/L	262		<140	140 - 350	>350							30	55	78	100	110	162	220
Chlorine residual <sup>4</sup>	mg/L			<1.0	1.0 - 5.0	>5.0										8.0	9.2	10.8	
Chromium	mg/L	0.1	0.1				0.0008	0.0013	0.0022	0.0005	0.0042	0.0222	None	< 0.002 <sup>(9)</sup>		0.0003	0.0006	0.0010	
Cobalt	mg/L	0.05	0.05										None	< 0.02 <sup>(9)</sup>		< 0.0005	0.0006	0.0006	
Copper	mg/L	0.2	0.2				0.007	0.012	0.019				None	0.0020	0.0072	0.0370	< 0.0005	0.0027	0.0110
Dissolved Solids	mg/L			<450	450 - 2000	>2000							< 500	378	447	510			
Fluoride	mg/L	1.0	1.0										None	< 0.1	0.18	0.34			
Iron	mg/L		5.0	<0.1	0.1 - 1.5	>1.5							None	< 0.1	0.12	0.21	< 0.05	0.08	0.10
Lead	mg/L	5.0	5.0				0.0004	0.0011	0.0050	0.0003	0.0013	0.0030	None	< 0.002 <sup>(9)</sup>		< 0.0001	N/A	< 0.0003	
Lithium	mg/L	2.5	2.5										None	0.0128	0.0169	0.021	0.009	0.011	0.012
Manganese	mg/L	0.2	0.2	<1.0	1.0 - 5.0	>5.0							None	< 0.02	0.025	0.038	0.012	0.047	0.083
Molybdenum	mg/L	0.01	0.01										None	< 0.02 <sup>(9)</sup>		0.0008	0.0019	0.0041	
Nickel	mg/L	0.2	0.2				0.0026	0.0043	0.0073	0.0023	0.0043	0.0073	None	0.0020	0.0031	0.0055	0.0029	0.0041	0.0056
pH				6.5 - 8.4			6.53	7.26	8.10				6.5 - 8.0	6.86	8.17	9.95	6.67	7.34	8.40
Selenium	mg/L	0.02	0.02				0.0008	0.0010	0.0012	0.0004	0.0009	0.0010	None	< 0.005 <sup>(9)</sup>		< 0.001 <sup>(9)</sup>			
Sodium	mg/L			<3	3 - 9	>9							< 30	58	66	80	94	124	150
Sodium Adsorption Ratio	units	3											< 6.0	2.05	2.21	2.63	3.1	4.0	4.8
Specific Conductance	mmhos/cm <sup>(12)</sup>			<0.7	0.7 - 3.0	>3.0							< 750	421	710	910			
Vanadium	mg/L	0.1	0.2										None	< 0.1 <sup>(9)</sup>		< 0.0005 <sup>(9)</sup>			
Zinc	mg/L	2.0	2.0				0.061	0.091	0.110	0.0160	0.0318	0.0500	None	0.013	0.051	0.140	0.002	0.012	0.027

(1) Source: University of California Division of Agriculture and Natural Resources 2006.

(2) Source: Guidelines for Water Reuse, USEPA, 2004

(3) North Bay Watershed Association (NBWA) Recycled Water Characterization.

(4) Values are a compilation of sampling data for 2000-2003.

(5) Only one value was reported for arsenic.

(6) Values are a compilation of combined effluent data for July 2000-June 2003.

(7) pH data is a compilation from SVCSD Reclamation Reservoirs taken between 2000 and 2004. All other constituent data is compiled from SVCSD WWTP effluent taken between 2000 and 2002.

(8) Desired range as defined by SVCSD.

(9) All sampling events were non-detect less than the value specified.

(10) Only two samples were taken for Zirconium from 1999-2004. Both results were under laboratory testing limits.

(11) Values are a compilation of sampling data from May 2002 through November 2004.

(12) mmhos/cm = millimhos per centimeter

N/A = Not available

	<b>2005 Conditions (AFY)</b>		<b>2020 Conditions (AFY)</b>	
	<b>WWTP Flow</b>	<b>Beneficial Reuse</b>	<b>WWTP Flow</b>	<b>Beneficial Reuse</b>
LGVSD	3,063	613	3,671	902
Novato SD	6,813	269	8,673	1,015
City of Petaluma	6,076	2,389	8,630	3,823
SVCSD	4,076	1,173	5,506	3,000
Napa SD	8,974	1,307	9,800	4,540
<b>Total</b>	<b>29,002</b>	<b>5,753</b>	<b>36,280</b>	<b>13,280</b>

	<b>LGVSD WWTP</b>	<b>Novato SD WWTP</b>	<b>Petaluma WWTP</b>	<b>SVCSD WWTP</b>	<b>Napa SD WWTP</b>
Existing & (Future) Capacity for Secondary Treatment	8.0 (N/A)	13.0 (N/A)	5.2 (6.7)	11.5 (11.5)	15.4 (15.4)
Existing & (Future) Capacity for Title 22 Tertiary Treatment	2.0 (2.0)	0.5 (0.5)	0.0 (5.2)	16.0 (16.0)	8.8 (8.8)

Notes:

- 1: Flow rates indicate WWTP potential capacity, which may be higher than either the permitted or normal operating capacities.
- 2: Future capacity is result of WWTP improvements, assumed complete by 2010.
- 3: N/A = Information currently not available.

	<b>LGVSD WWTP</b>	<b>Novato SD WWTP</b>	<b>Petaluma WWTP</b>	<b>SVCSD WWTP</b>	<b>Napa SD WWTP</b>
Existing & (Future) Capacity for Secondary Treatment	24.5 (N/A)	39.9 (N/A)	16.0 (20.6)	35.3 (35.3)	47.3 (47.3)
Existing & (Future) Capacity for Title 22 Tertiary Treatment	6.1 (6.1)	1.5 (1.5)	0.0 (16.0)	49.1 (49.1)	27.0 (27.0)

Notes:

- 1: Flow rates indicate WWTP potential capacity, which may be higher than either the permitted or normal operating capacities.
- 2: Future capacity is result of WWTP improvements, assumed complete by 2010.
- 3: N/A = Information currently not available.

# Section 5

## Formulation of Initial Alternatives

Taking into account the complex setting of the North San Pablo Bay Restoration and Reuse Project (Project) area, and the multiple and diverse interests that must be considered in development of a successful plan, the member agencies of the North Bay Water Reuse Authority (Authority) undertook a comprehensive planning process that first identified a wide range of preliminary alternatives for the Project and then screened this array for selection of the most promising alternatives for detailed analysis. This section describes (1) the planning process used to develop the preliminary alternatives, (2) the options and components used to characterize the alternatives, and (3) the rationale used to select three Project action alternatives for further study. The detailed evaluation of the selected Project alternatives is presented in Section 6.

### 5.1 Development Process

For the initial development of alternatives, the study team and the technical workshop participants worked through a structured planning process, as described in Section 1.5. The development of initial alternatives was a subset of the overall planning process.

The first step was to identify the broad characteristics that could be used to formulate alternatives. These characteristics fell into three categories:

- Recycled water projects – existing, identified, and potential – in the study area
- Extent of the recycled water distribution network – basic, partially connected, fully connected
- Storage options to increase use of recycled water – no new storage, partial storage, and full storage of recycled water supplies

These options were combined to form the initial alternatives.

The next step in the process was to screen the initial alternatives. The study team examined the characteristics to verify that they were technically, environmentally, politically, and legally feasible. The screening of initial alternatives led to the final step in the process: identification of three to four Project action alternatives to move forward for more detailed feasibility analysis.

## 5.2 Formulation of Initial Project Alternatives

The initial Project alternatives were formed as combinations of options under the following characteristics: recycled water projects in the study area, extent of the recycled water distribution network, and storage options to increase use of recycled water. The 15 identified recycled water projects were grouped in various combinations into six recycled water distribution systems. Each of the six distribution systems was then evaluated under the three different storage options, creating a total of 18 initial alternatives. Each of the alternative characteristics is described below.

### 5.2.1 Recycled Water Projects

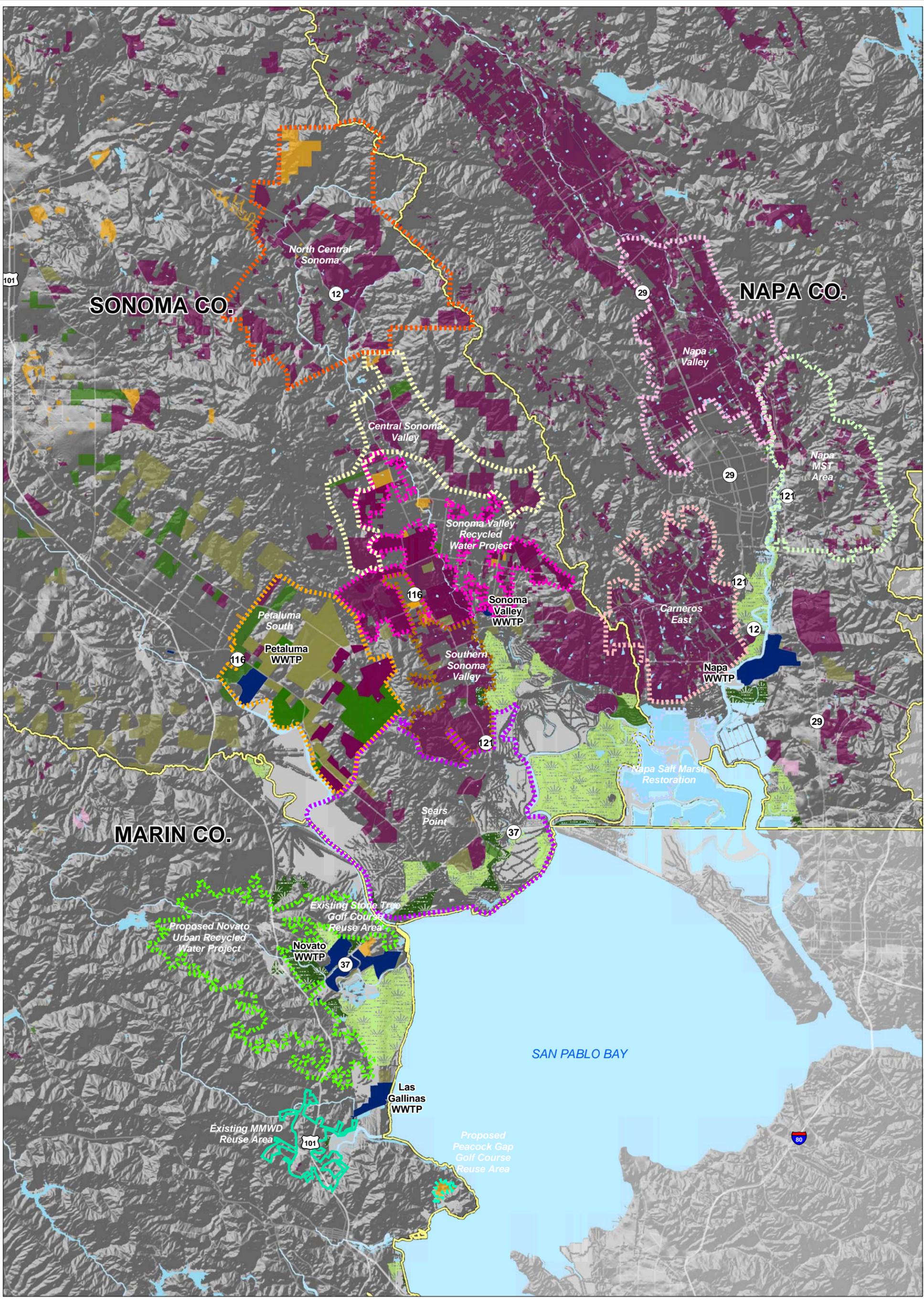
In order to form candidate recycled water projects, the study team reviewed land use data (see Section 3) and the participating agencies' recycled water planning documents. Water and wastewater agencies in the study area have developed several existing recycled water projects and identified recycled water projects for future implementation. The study team identified additional potential recycled water project areas by grouping land uses either in major agricultural or landscaping areas or in areas between existing and proposed projects. These existing, agency-identified, and new potential project areas, summarized in Table 5-1, are described below.

<b>Existing Projects</b>	<b>Agency-Identified Projects</b>	<b>New Potential Reuse Areas</b>
Sonoma Valley County Sanitation District Reuse Area	Peacock Gap Golf Course	Petaluma South
Marin Municipal Water District Reuse Area	North Marin Water District Urban Reuse Project	Southern Sonoma Valley
Stone Tree Golf Course Reuse Area	Sonoma Valley Recycled Water Project	Sears Point
	Carneros East	Central Sonoma Valley
	Milliken-Sarco-Tulocay Creeks Area	North Central Sonoma
	Napa Salt Marsh Restoration	Napa Valley

#### 5.2.1.1 Existing Projects

Each participating agency generates some amount of recycled water for use on its own property or as a small-scale reuse project. These small-scale efforts are not included as part of the Project.

In addition, there are currently four existing recycled water projects underway in the study area, shown in Figure 5-1. Although these projects are outside the scope of planning and construction for this Project, they were taken into account for hydraulic modeling purposes because their facilities and infrastructure could potentially be used in conjunction with the Project. These projects are:



Basemap: U.S. Department of Agriculture, 2001  
 Land Use Data: California Department of Water Resources, 1995a and 1999b  
 Napa Sanitation District 2005, SCWA 2001.  
 Boundaries are approximate and for study purposes only.

**Legend**

- |                            |   |                |
|----------------------------|---|----------------|
| WWTPs                      | Irrigated Farm Property                       | Dairy, Pasture |
| Napa_Ponds_from_LU_extract | Golf Course, Cemetery, Parks, and Landscaping | Orchard        |
| Completed Restoration      | Vineyard                                      |                |
| Planned Restoration        |   |                |



**Figure 5-1**  
**Potential Project Recycled Water Use Areas**

- **Existing Sonoma Valley County Sanitation District (SVCS D) Reuse Area** – SVCS D currently provides about 1,200 acre-feet per year (AFY) of recycled water in the Sonoma County portion of the Los Carneros American Viticultural Area (AVA) (SCWA 2005). To reach more potential users for the purposes of this project, the study team assumed an increase in the size of the existing SVCS D reuse area to a total of 4,470 acres (160 acres of dairy/pasture land, 322 acres of irrigated farm land, and 3,988 acres of vineyard). Based on the water demands developed in Section 2, the maximum estimated water use for the existing SVCS D reuse area is about 2,286 AFY.
- **Existing Marin Municipal Water District (MMWD) Reuse Area** – Las Gallinas Valley Sanitary District (LGVSD) provides about 900 AFY of recycled water to MMWD for urban landscaping demands around the City of San Rafael (Castle 2005).
- **Existing Stone Tree Golf Course Reuse Area** – The Stone Tree golf course is adjacent to the Novato Sanitary District (Novato SD) wastewater treatment plant (WWTP). The project uses about 270 AFY to irrigate the golf course and a few nearby urban landscaping customers (James 2008).
- **Existing Napa Reuse Area** – Existing Napa Sanitation District (Napa SD) recycled water users include Chardonnay Golf Course and Vineyards, Somsky Ranch, Jameson Canyon Reclamation Site, Napa Airport, Hakusan Sake Factory, and Napa Corporate Park (Napa SD 2005). Recycled water users are along the discharge pipeline at Highway 29 and Jameson Canyon Road and further north along the Napa Valley Highway. In 2005, recycled water users received 1,307 AFY (Napa SD 2005).

### 5.2.1.2 Agency-Identified Projects

There are six recycled water projects currently identified by the participating agencies. These projects are at different phases of development, independent of the planning underway under the Project. Each of these project areas is shown in Figure 5-1. The agency-identified projects are:

- **Peacock Gap Golf Course** – LGVSD proposes to serve recycled water to the Peacock Gap Golf Course at the eastern end of San Rafael. In 2006, the golf course and neighboring facilities was estimated to use about 437 AFY (Castle 2006).
- **North Marin Water District (NMWD) Urban Reuse Project** – Under the originally proposed NMWD Urban Reuse Project, Novato SD was estimated to provide 1,312 AFY of recycled water for urban landscaping in the City of Novato (NMWD and Novato SD 2004). This recycled water service would be a potable water offset.
- **Sonoma Valley Recycled Water Project** – SVCS D is developing the Sonoma Valley Recycled Water Project, which identified about 1,015 acres of dairy/pasture land, 234 acres of urban landscaping, 2 acres of irrigated farm land, and 6,249 acres of

vineyards, for a total of about 7,680 acres. Sonoma County Water Agency (SCWA), Valley of the Moon Water District, and the City of Sonoma are partnering with SVCSD for this project. The objectives of the project are to offset potable water demands, reduce discharge, and reduce groundwater pumping associated with increases in vineyard lands (SCWA 2005). Using the acreage listed above and the water demands discussed in Section 2, the Sonoma Valley Recycled Water Project could use a maximum of about 6,520 AFY of recycled water. The potable water offset would be 147 AFY.

- **Carneros East** – Napa SD’s *Strategic Plan for Recycled Water Use in the Year 2020* develops alternatives for a recycled water system to serve two areas of southern Napa County (Napa SD 2005). Napa SD’s goals are to recycle water to augment water supplies, prevent overdraft of groundwater resources, ensure that highest quality water is reserved for potable uses, and increase its ability to comply with summer discharge requirements (Napa SD 2005). According to the land use data developed for the Project, Napa SD’s Carneros East reuse area consists of about 6,654 acres of vineyards in the Napa County portion of the Los Carneros AVA. Based on the vineyard demand developed for Napa County in Section 2, the Carneros East area would use a maximum of about 1,663 AFY of recycled water.
- **Milliken-Sarco-Tulocay Creeks (MST) Area** – Napa SD’s *Recycled Water Expansion Hydraulic and Preliminary Engineering Analysis: Phase 1 Report – Milliken-Sarco-Tulocay Area* indicates that Napa SD’s MST area potentially consists of 4,335 acres (3,856 acres of vineyards, 389 acres of urban landscaping, and 90 acres of golf course/cemeteries) (Napa SD 2007a). Assuming less than full participating in the program, it is anticipated that the MST area would use about 1,937 AFY of recycled water. Additional expansion of the MST area to the north, using the demand data and land use methods developed in Section 3, could develop an additional 690 AFY of use.
- **Napa Salt Marsh Restoration Project** – As described in Section 2, the Napa River Salt Marsh Restoration Project consists of restoration of tidal wetlands and enhancement of managed ponds in the Napa Sonoma Marsh Wildlife Area. Two water sources have been evaluated for habitat and flushing operations: river diversions brought about by planned levee breaches, and construction of a recycled water pipeline from the SVCSD WWTP and/or Napa SD WWTP. The use of recycled water for this restoration project continues to be evaluated. The recycled water delivery option calls for 8,000 to 9,000 AFY of recycled water for salinity reduction (flushing) and water level maintenance during the first six to eight years of the project (U.S. Army Corps of Engineers 2004). It is possible that an additional 2,500 to 3,000 acre-feet (AF) of recycled water may be required for pond maintenance, to offset evaporation in the upper ponds, once flushing is complete.

### 5.2.1.3 New Potential Reuse Areas

Land use maps of the study area and the greater North Bay region were reviewed to develop additional areas where recycled water could be applied. Six new areas were

identified, as briefly described below. Each potential project area is shown in Figure 5-1. The new potential reuse areas are:

- ***Petaluma South***<sup>1</sup> – The Petaluma WWTP is surrounded by some large parcels of dairy/pasture land and irrigated farm properties, which would be desirable candidates for recycled water service. The potential Petaluma South project area consists of 3,163 acres of dairy/pasture land, 2,239 acres of irrigated farm land, and 1,569 acres of vineyards, for a total of 6,971 acres, based on land use data developed for this study. Using the water demands developed in Section 2, the Petaluma South area would use up to 11,696 AFY of recycled water.
- ***Southern Sonoma Valley*** – The area south of the City of Sonoma is dedicated predominantly to vineyard uses and is close to the SVCSD WWTP. The Southern Sonoma Valley reuse area includes 55 acres of dairy/pasture land, 48 acres of urban landscaping, and 4,005 acres of vineyards, for a total area of 4,136 acres. Using the water demand estimation developed in Section 2, the total recycled water demand for the Southern Sonoma Valley reuse area could be a maximum of 2,334 AFY.
- ***Sears Point*** – The land in the vicinity of Sears Point lies in between Petaluma WWTP, SVCSD WWTP, and Novato SD WWTP, but is not served with recycled water. This area could act as a convenient link between these treatment plants. The Sears Point reuse area encompasses 326 acres of dairy/pasture land, 76 acres of irrigated farm land, and 1,236 acres of vineyards. The estimated maximum recycled water demand in this area is 1,534 AFY.
- ***Central Sonoma Valley*** – The Central Sonoma Valley reuse area is located north of the proposed Sonoma Valley Recycled Water Project, and includes additional vineyard areas in the valley still relatively close to the SVCSD WWTP. It encompasses 51 acres of urban landscaping, 258 acres of irrigated farm land, and 2,929 acres of vineyards, for a total area of 3,237 acres. Using the water demand estimation developed in Section 2, the estimated maximum recycled water demand in the Central Sonoma Valley reuse area would be 1,974 AFY.
- ***North Central Sonoma*** – The potential North Central Sonoma reuse area is located along the northern stretch of Highway 12, another major grape-growing region for Sonoma County. The reuse project contains 5,616 acres of vineyards and has a total area of 6,388 acres. The maximum water demand for the North Central Sonoma reuse area is estimated to be 5,311 AFY.
- ***Napa Valley*** – The potential Napa Valley reuse area stretches from the Napa city limits north on Highway 29 to the Town of Yountville, along significant grape-growing areas of Napa County. The area contains 7,365 acres of vineyards, with a total area of 7,412 acres. The maximum water demand in the Napa Valley reuse area is estimated to be 1,950 AFY.

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<sup>1</sup> As discussed in Section 1.3, Petaluma was initially evaluated in the Project, but is no longer participating.

## **5.2.2 Service Area Approaches**

Recycled water projects were grouped into alternatives based on different sizes and different connections of the future recycled water system. The distribution system options ranged from virtually independent operation of each WWTP to all WWTPs operating jointly, serving demand throughout the entire study areas. Each of the six potential distribution system approaches is described below.

### **5.2.2.1 Basic Regional Systems**

This approach would put greatest emphasis on recycled water projects near to each WWTP with few interconnections among the facilities. This concept would likely be the least expensive, but would also use the least recycled water.

### **5.2.2.2 Regional Systems**

This approach would link several of the local systems to allow multiple treatment plants to provide and share recycled water to two primary focus areas, Petaluma/Novato and Napa/Sonoma. This strategy would provide partial backup for each plant to balance any changes in recycled water production and would allow distribution to a larger area.

### **5.2.2.3 Regional Systems with Ponds**

This approach would create regional systems that connect several WWTPs and would expand the area served under the Regional Systems alternative by adding the ponds associated with the Napa Salt Marsh Restoration Project as an additional demand point.

### **5.2.2.4 Expanded Regional Systems without Petaluma**

This regional recycled water system approach would provide a larger agricultural area and the Napa Salt Marsh with recycled water. It would emphasize environmental benefits of recycled water for the marsh before the water is fully used for agriculture, in addition to expanding beneficial reuse north into Sonoma and Napa Counties. Petaluma and its associated demand area would not be served.

### **5.2.2.5 Expanded Regional Systems with Petaluma<sup>2</sup>**

This approach is the same as the preceding option, but with addition of the Petaluma WWTP and the Petaluma South reuse area.

### **5.2.2.6 Interconnected Regional System**

The regional system approach would connect all five WWTPs. This alternative would maximize reuse by allowing water from any plant to be delivered to any area that needs recycled water. Because much of the demand is found near Sonoma and Napa, this interconnection is helpful as it allows the other treatment plants to help satisfy the

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<sup>2</sup> As discussed in Section 1.3, Petaluma was initially evaluated in the Project, but is no longer participating.

demands in these areas. This alternative would supply the most recycled water, but it would also be the most expensive to implement.

### 5.2.3 Storage Options

The study team developed three options for water storage for purposes of formulating initial alternatives – No New Storage, Partial Storage, and Full Storage. Each storage concept is described below.

#### 5.2.3.1 No New Storage

Under the No New Storage concept, reuse projects were grouped with WWTPs that would supply recycled water. The only storage available in the recycled water system would be existing storage at the WWTPs and a portion of existing individual landowner storage ponds. This storage option assumed that Novato SD and Petaluma have no storage, LGVSD has 400 AF (320 AF from storage ponds and 80 AF of wildlife marsh), SVCSD has 640 AF, and Napa SD has 1,079 AF of storage available for use by the Project (a portion of the Napa SD's oxidation ponds).

#### 5.2.3.2 Partial Storage

The Partial Storage concept assumed that existing WWTP storage and some existing individual landowner storage ponds would still be available, as well as new, low-impact storage. It was assumed that Novato SD, Petaluma, and SVCSD would not add any storage over the No New Storage option levels. It was further assumed that LGVSD would add 2,310 AF of storage on an adjacent property, bringing LGVSD's total storage up to 2,710 AF, and that Napa SD would have 10,079 AFY available through the addition of 9,000 AF of aquifer storage and recovery (ASR).

ASR is a method used to store recycled water during low-use periods within a local groundwater aquifer. Aquifer storage is typically accomplished by injecting water via multiple wells to the target aquifer zones. ASR operations can be similar to that of a recycled water surface basin with little or no change in its quality or quantity. A separate set of extraction wells withdraw water from the aquifer. Napa SD initiated a study to evaluate the viability of aquifer storage by assessing the potential capacity, benefits, and drawbacks of aquifer storage for local recycled water projects. Groundwater storage typically has fewer disturbances to local land uses and existing habitats than other types of storage, but physical and regulatory constraints can make this a challenging option.

#### 5.2.3.3 Full Storage

Under the Full Storage approach, the recycled water system would include as much storage as needed to reuse all available recycled water supplies. A new surface storage reservoir would be considered if necessary. A surface water storage facility could store recycled water during the wet season (when supply is higher) until the dry season (when demands are higher). Creating a central surface storage facility would allow storage of recycled water from most participating WWTPs, and many of the possible sites for such a facility would allow gravity feed to the potential recycled

water users. Implementation of surface storage facilities can be problematic, however, as there are often significant associated land use and environmental effects to mitigate.

### 5.2.4 Summary of Initial Alternatives

For purposes of screening the initial alternatives, the 15 existing, agency-identified, and new potential project areas were grouped in various combinations of service areas into 6 initial recycled water distribution systems. Table 5-2 presents the 6 initial action alternatives and their associated reuse project areas. Each alternative is described below. The initial alternatives were then evaluated under the three different storage options, bringing the total number of initial alternatives to 18.

	<b>Alternative 1 Basic Regional Systems</b>	<b>Alternative 2 Regional Systems</b>	<b>Alternative 3 Regional Systems with Ponds</b>	<b>Alternative 4 Expanded Regional Systems without Petaluma</b>	<b>Alternative 5 Expanded Regional Systems with Petaluma</b>	<b>Alternative 6 Interconnected Regional System</b>
<b>Reuse Project Areas</b>						
Existing SVCSD Reuse Area	✓	✓	✓	✓	✓	✓
Existing MMWD Reuse Area	✓	✓	✓	✓	✓	✓
Existing Stone Tree Golf Course Reuse Area	✓	✓	✓	✓	✓	✓
Peacock Gap Golf Course	✓	✓	✓	✓	✓	✓
NMWD Urban Reuse Project	✓	✓	✓	✓	✓	✓
Sonoma Valley Recycled Water Project	✓	✓	✓	✓	✓	✓
Carneros East Area	✓	✓	✓	✓	✓	✓
MST Area	✓	✓	✓	✓	✓	✓
Napa Salt Marsh Restoration			✓	✓	✓	✓
Petaluma South	✓	✓	✓		✓	✓
Southern Sonoma Valley	✓	✓	✓	✓	✓	✓
Sears Point Area	✓	✓	✓	✓	✓	✓
Central Sonoma Valley		✓	✓	✓	✓	✓
Napa Valley Area				✓	✓	✓
North Central Sonoma				✓	✓	✓

#### 5.2.4.1 Alternative 1 – Basic Regional Systems

LGVS D and Novato SD would be connected in this localized alternative, taking advantage of their proximity. Both districts require new treatment facilities to produce tertiary treated recycled water for unrestricted use. Under this initial configuration, LGVS D and Novato SD would jointly treat their wastewater streams and send the recycled water to the Peacock Gap Golf Course area, Novato urban users, and agricultural users in the Sears Point area.

Petaluma would treat its wastewater and send the recycled water to local urban uses, local agricultural uses, and agricultural uses within the Petaluma South area. SVCSD would similarly treat wastewater at its existing plant and distribute recycled water to local uses within the Southern Sonoma Valley reuse project and the Sonoma Valley Recycled Water Project.

Napa SD would treat its wastewater at the existing facility. Napa SD would prioritize delivery of recycled water to the MST area because of the existing groundwater concerns. The increased delivery of recycled water for irrigation would help reduce groundwater pumping in the region. Napa SD would deliver its remaining recycled water to the Carneros East area.

#### **5.2.4.2 Alternative 2 – Regional Systems**

LGVSD and Novato SD would have the same facilities as in Alternative 1. Local projects, such as Peacock Gap Golf Course area and Novato urban reuse, would have first priority for recycled water. These facilities would also be linked to Petaluma by a pipeline. The three treatment plants would provide recycled water to the Sears Point area and Petaluma South.

A pipeline would also link SVCSD and Napa SD to deliver recycled water to uses in the Carneros area. SVCSD would prioritize delivering recycled water to the Sonoma Valley Recycled Water Project and would send the remaining recycled water to the Central Sonoma Valley and Carneros East areas. Napa SD would prioritize the delivery of recycled water to the MST area and would send the remaining recycled water to the Carneros East and Southern Sonoma Valley areas.

#### **5.2.4.3 Alternative 3 – Regional Systems with Ponds**

This alternative would include joint tertiary treatment facilities for LGVSD and Novato SD. The primary recycled water users would be local users near the plants, including the Peacock Gap Golf Course area and Novato urban users. A pipeline would convey the remaining water north and connect with Petaluma's recycled water supply. These joint supplies would provide recycled water to agricultural and landscape uses in Petaluma South and Sears Point.

A pipeline would also be constructed to connect SVCSD and Napa SD. SVCSD would prioritize delivering recycled water to the Sonoma Valley Recycled Water Project, and Napa SD would prioritize delivering recycled water to the MST Area. The Napa Salt Marsh would receive any remaining supply during the restoration period (less than 10 years). After the restoration period has been completed, it is possible that additional recycled water may be required for Napa Salt Marsh pond maintenance. The remaining recycled water would be available to agricultural users in the Carneros East, Southern Sonoma Valley, and Central Sonoma Valley.

#### **5.2.4.4 Alternative 4 – Expanded Regional Systems without Petaluma**

Similar to Alternative 3, LGVSD and Novato SD would be connected by a pipeline system. Local projects would first receive their supply of recycled water, and the remaining supply would be available to agricultural users in the Sears Point and Southern Sonoma Valley areas. Petaluma and its associated demand area would not be served under this alternative.

Another pipeline system would link SVCSD and Napa SD. These facilities would prioritize delivering recycled water to local projects (Sonoma Valley Recycled Water Project and the MST area). The Napa Salt Marsh would receive any remaining supply during the restoration period (less than 10 years). After the restoration period has been completed, it is possible that additional recycled water may be required for Napa Salt Marsh pond maintenance. The remaining recycled water would be available to agricultural users in the Carneros East, Southern Sonoma Valley, Central Sonoma Valley, Napa Valley, and North Central Sonoma areas.

#### **5.2.4.5 Alternative 5 – Expanded Regional Systems with Petaluma**

Similar to Alternative 4, this alternative would include joint tertiary treatment facilities for LGVSD and Novato SD. The primary recycled water uses would be local users near the plants, including the Peacock Gap Golf Course area and Novato urban users. A pipeline would convey the remaining water north and connect with Petaluma's recycled water supply<sup>3</sup>. These joint supplies would provide recycled water to agricultural and landscape uses in Petaluma South, Sears Point, and Southern Sonoma Valley areas.

Another pipeline system would link SVCSD and Napa SD. These facilities would prioritize delivering recycled water to local projects (Sonoma Valley Recycled Water Project and the MST area). After the restoration period has been completed, it is possible that additional recycled water may be required for Napa Salt Marsh pond maintenance. The remaining recycled water would be available to agricultural users in the Carneros East, Central Sonoma Valley, Napa Valley, and North Central Sonoma areas.

#### **5.2.4.6 Alternative 6 – Interconnected Regional System**

A series of pipelines would connect all five treatment plants. Each treatment plant would prioritize the delivery of recycled water to local projects and then send remaining recycled water into the interconnected pipeline system. Local projects include Peacock Gap Golf Course area, Novato urban recycled users, the Sonoma Valley Recycled Water Project, and the MST area. The system would deliver any remaining supply of recycled water to users in the Petaluma South, Sears Point, Southern Sonoma Valley, Central Sonoma Valley, North Central Sonoma, Carneros East, and Napa Valley areas.

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<sup>3</sup> As discussed in Section 1.3, Petaluma was initially evaluated in the Project, but is no longer participating.

## 5.3 Screening of Initial Alternatives

The goal of alternative screening was to identify three to four alternatives from the 18 initial action alternatives to move forward for more detailed feasibility analysis. This initial screening was based on:

- Quantity of recycled water served,
- Quantity of WWTP discharge reduced,
- Amount of storage required, and
- Planning-level cost estimates.

### 5.3.1 Screening Factors

For each of the 18 initial alternatives (that is, six system alternatives times 3 possible storage options for each alternative), the study team completed preliminary calculations of recycled water served, wastewater discharged, and planning-level estimated capital costs. To calculate the demand served, the study team first used preliminary data for the acreage of irrigated land uses and initial water demand rates for the different land uses included in the reuse areas to determine the total potential demand of an alternative. If the total potential demand exceeded the supply of recycled water for that alternative, the expected participation rate of the potential reuse areas (the percentage of landowners in the reuse area who agree to use recycled water for their irrigation) was reduced until demand matched supply. The amount of wastewater discharged for an alternative was simply the total recycled water supply for the alternative less the demand served.

The comparison of preliminary opinion of construction costs included preliminary computations of conveyance infrastructure, pumping facilities, required wastewater treatment plant upgrades, and additional storage (improvements to existing diked storage, groundwater storage, and/or surface water storage). The initial costs did not include contingencies, engineering costs, and land costs. These preliminary costs were meant only to compare and select alternatives for further study.

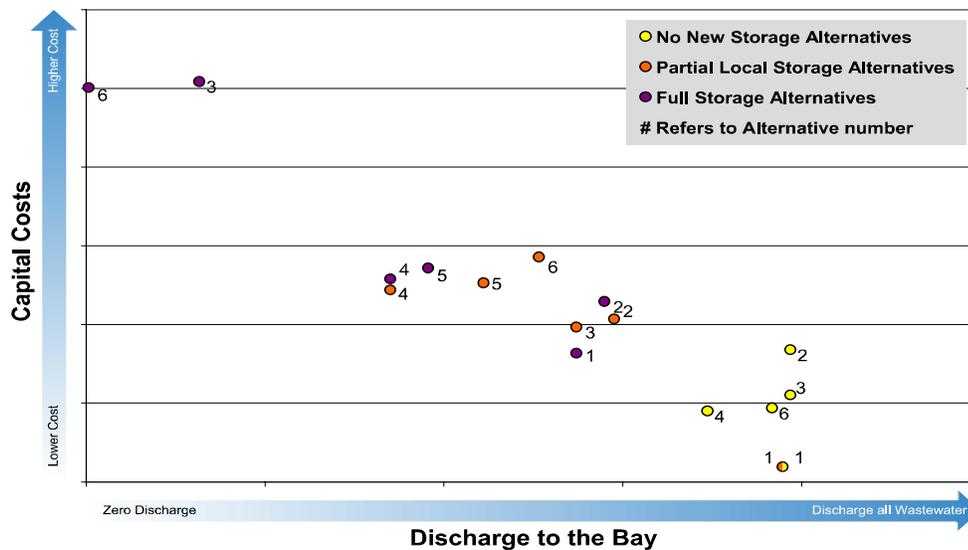
All of these factors have been further refined for the final alternatives presented later in Section 6.

### 5.3.2 Initial Alternative Comparison

After determining the preliminary estimate of capital costs, demand served, and wastewater discharged for each of the alternatives, the study team compared the 18 initial action alternatives. Figure 5-2 presents the alternatives, grouped by storage option, plotted by the volume rate of discharge to San Pablo Bay (x-axis) and relative capital cost (y-axis).

The participating agencies reviewed Figure 5-2 to screen alternatives for further consideration. As discussed in the following paragraphs (and summarized in Table 5-3), the agencies decided to eliminate some alternatives based upon consideration of:

- storage options
- cost
- regional partnership opportunities, and
- system logistics.



**Figure 5-2**  
Comparison of Initial Action Alternatives

<b>Storage Option</b>	<b>Alternative Name</b>	<b>Selected</b>	<b>Not Selected</b>	<b>Comments</b>
No New Storage	1 – Basic Regional Systems		✓	Insufficient use of recycled water
	2 – Regional Systems		✓	
	3 – Regional Systems with Ponds		✓	
	4 – Expanded Regional Systems w/out Petaluma		✓	
	5 – Expanded Regional Systems w/Petaluma		✓	
	6 – Interconnected Regional System		✓	
Partial Storage	1 – Basic Regional Systems	✓		Allows for evaluation of smaller distribution systems
	2 – Regional Systems		✓	Too similar to Alternative 3 due to addition of Napa Salt Marsh Restoration
	3 – Regional Systems with Ponds	✓		Balance of WWTP connections with appropriate demand areas
	4 – Expanded Regional Systems w/out Petaluma		✓	Does not include Petaluma
	5 – Expanded Regional Systems w/Petaluma		✓	Includes demand areas that cannot be served without significant storage
	6 – Interconnected Regional System	✓		Allows for evaluation of large regional system
Full Storage	1 – Basic Regional Systems		✓	Prohibitive costs
	2 – Regional Systems		✓	
	3 – Regional Systems with Ponds		✓	
	4 – Expanded Regional Systems w/out Petaluma		✓	
	5 – Expanded Regional Systems w/Petaluma		✓	
	6 – Interconnected Regional System		✓	

### 5.3.2.1 Storage Options

Figure 5-2 demonstrates that the “No New Storage” options are very limiting. These alternatives use the least amount of recycled water, as shown by their high wastewater discharge rates. Further, as existing system storage is not efficiently located throughout the region, the WWTPs cannot serve much demand when operating independently. For these reasons, the “No New Storage” alternatives were removed from consideration.

The “Partial Storage” alternatives allowed flexibility in the amount of new storage that would be required. This additional storage could be obtained from additional WWTP ponds, landowner ponds, tanks, or ASR facilities.

### 5.3.2.2 Cost

The “Full Storage” alternatives were removed from consideration due to their substantially higher costs compared to other alternatives. From the preliminary analysis, it appeared that building sufficient storage to facilitate minimal discharge throughout the study area is cost prohibitive.

### 5.3.2.3 System Logistics

After reviewing preliminary demand and supply calculations for Alternative 5, it was apparent that the Napa Valley and North Central Sonoma potential reuse areas could only be served with the addition of significant storage (under “Full Storage” options). Since Alternative 3 offers the same WWTP connections as Alternative 5 without these inefficient demand areas, Alternative 5 was removed from consideration. Napa Valley and North Central Sonoma were also removed from Alternative 6 for the same reason.

### 5.3.2.4 Regional Partnership Opportunities

At the time of alternative screening, the participating agencies agreed that it was important to keep the City of Petaluma as a potential partner to demonstrate the region’s coordinated efforts at water reuse. Therefore, Alternative 4 was removed from consideration. The agencies also wanted to evaluate an alternative that recognized the possibility of smaller distribution systems, so Alternative 1 was chosen for further study over Alternative 2.

The agencies added the Napa Salt Marsh Restoration project to Alternative 1 so that project area would be included in all alternatives carried forward for further consideration.

## 5.4 Action Alternatives Carried Forward

Based on the decision-making process outlined above, the participating agencies chose the following initial Project alternatives, with some refinements, to carry forward for further feasibility analysis:

- Alternative 1 - Partial Storage option, with the addition of the Napa Salt Marsh Restoration project and removal of Southern Sonoma Valley.
- Alternative 3 - Partial Storage option, with removal of Central Sonoma Valley
- Alternative 6 - Partial Storage option, with removal of North Central Sonoma and Napa Valley areas.

After this stage of the feasibility study process, the City of Petaluma and MMWD informed the Authority they did not wish to participate further in the Project. At that point, Petaluma WWTP facilities and the Petaluma South service area were removed from all three action alternatives. MMWD is no longer interested in having the Project provide recycled water for an expansion of their current service area. However, the MMWD general manager indicated MMWD will allow the Project to use one of its backbone recycled water pipelines for service from LGVSD to the Peacock Gap Golf Course Reuse Area.

These Project alternatives are further defined and evaluated in Section 6, where they are presented as Alternatives 1, 2, and 3, respectively. The No Action Alternative, a requirement for environmental analysis under the National Environmental Policy Act and the California Environmental Quality Act, is also evaluated in Section 6.

# Section 6

## Description of Alternatives

From the screening of 18 initial alternatives for the North San Pablo Bay Restoration and Reuse Project (Project), described in Section 5, three preferred Project action alternatives emerged for further development and evaluation, together with the No Action alternative.

In this section, more information is provided on the three action alternatives (which underwent additional refinement and are now re-numbered as Alternatives 1, 2, and 3), plus a phased implementation of each action alternative, and on the No Action alternative. The service area, demand, supply, discharge, storage requirements, and preliminary cost estimates for each action alternative are discussed below.

As part of the additional refinement, detailed hydraulic modeling was performed on each action alternative to provide a quantitative characterization of flows and system requirements.

A geologic review was conducted to identify potential hazards along the proposed pipeline alignments which would result in higher construction costs to avoid or mitigate.

Table 6-1 summarizes the projects incorporated into the three action alternatives, including those that would be part of implementation Phase 1, the counties in which the projects are located, and the wastewater treatment plants (WWTPs) providing service to each local project area.

<b>Area Name</b>	<b>County</b>	<b>WWTP Serving Area</b>	<b>Alternatives in which Area Appears <sup>(2)</sup></b>
Peacock Gap Golf Course Reuse Area	Marin	LGVSD	Alt 2 & 3
MMWD Reuse Area (existing) <sup>(3)</sup>	Marin	LGVSD	Phase 1; Alt 1 & 2 & 3
Hamilton Field (in the southern part of the MMWD Urban Recycled Water Project)	Marin	LGVSD	Phase 1, Alt 1 & 2 & 3
NMWD Urban Recycled Water Project, North & Central Areas <sup>(4)</sup>	Marin	Novato SD	Phase 1, Alt 1 & 2 & 3
NMWD Urban Recycled Water Project, West Area	Marin	Novato SD	Alt 2 & 3
Sears Point Area	Sonoma	Novato SD	Alt 2 & 3
Southern Sonoma Valley	Sonoma	SVCSO/Novato SD <sup>(5)</sup>	Alt 2 & 3
Central Sonoma Valley	Sonoma	SVCSO	Alt 3 only
Sonoma Valley Recycled Water Project <sup>(6)</sup>	Sonoma	SVCSO	Phase 1; Alt 1 & 2 & 3
SVCSO Reuse Area (existing)	Sonoma	SVCSO	Phase 1; Alt 1 & 2 & 3
Carneros East	Napa	Napa SD	Alt 1 & 2 & 3
Napa MST Area	Napa	Napa SD	Phase 1; Alt 1 & 2 & 3
Napa Salt Marsh Restoration	Napa	SVCSO/Napa SD <sup>(7)</sup>	Phase 1; Alt 1 & 2 & 3

<sup>(1)</sup> LGVSD = Las Gallinas Valley Sanitary District; MMWD = Marin Municipal Water District; NMWD = North Marin Water District; Novato SD = Novato Sanitary District; SVCSO = Sonoma Valley County Sanitation District; MST = Milliken-Sarco-Tulocay Creeks area; Napa SD = Napa Sanitation District

<sup>(2)</sup> Note that availability of water storage may preclude some areas from being completely developed.

<sup>(3)</sup> Although not included in the Project alternatives, the MMWD Reuse Area was included in the modeling to account for any capacity and distribution pressure impacts to other areas.

<sup>(4)</sup> Includes Novato SD WWTP and existing Stone Tree Golf Course reuse area,

<sup>(5)</sup> Southern Sonoma Valley served by only SVCSO in Alternative 2 and served by only Novato SD and LGVSD in Alternative 3.

<sup>(6)</sup> Approximately 75% of the Sonoma Valley Recycled Water Project components appear in Phase 1, with full development in Alternatives 1, 2, & 3.

<sup>(7)</sup> Napa Salt Marsh is served only by SVCSO in implementation Phase 1, and jointly served by SVCSO and Novato SD in fully developed Alternatives 1, 2, & 3.

The action alternatives were designed to provide a balance among four characteristics important to the North Bay Water Reuse Authority (Authority):

- Quantity of recycled water served,
- Quantity of WWTP discharge reduced,
- Amount of storage required, and
- Planning-level cost estimates.

Regional partnership opportunities and system logistics were also factors considered in refining the alternatives. Section 5.3 describes the initial alternatives screening process and why Alternatives 1, 2, and 3 were chosen for further evaluation.

## 6.1 No Action Alternative

The “No Action Alternative” assumes that there is no joint Project. It represents the reasonably foreseeable actions taken by the members of the Authority, and other

agencies involved in the study area's water supply, in absence of the Project. The current water supplies in the region, including groundwater and imported surface water, are not reliable in the long-term, and could result in water shortages to agriculture, including the region's renowned vineyards. Therefore, the agencies would not take "no action," but would implement other water supply projects to improve reliability and meet future demands. Because of the limited water supply options in the region, agencies would have difficulty in meeting all future water needs without the Project. The potential need to develop additional potable water supplies, and limit demand on existing potable supplies, would continue to be a regional challenge under the No Action Alternative.

Additional wastewater treatment capacity and water recycling might occur strictly from the implementation of local plans for expansion. Planned treatment improvements are discussed for each WWTP in Section 4.2, and potential future recycled water production is discussed in Section 2.2.2. However, given local funding constraints, it is unlikely these plans could be implemented without the Project.

This section addresses non-recycled water supply projects which are options in absence of the proposed Project. The Project would generally serve urban landscape areas in Marin County and urban and agricultural users in Sonoma and Napa Counties. A number of previous and ongoing water supply studies were reviewed to develop these non-recycled water options to the proposed Project. These projects had been developed for primarily municipal and industrial users and have not focused on agricultural users. Few options have been formulated in the study area to directly serve the demands that would be met by the Project. The sections below summarize the non-recycled water projects.

### **6.1.1 Sonoma and Marin County Projects**

Under the No Action Alternative, potable water customers in the Sonoma and Marin Counties portion of the Project's service area (including the City of Sonoma, Valley of the Moon Water District [VOMWD], and NMWD), would receive water from Sonoma County Water Agency's (SCWA's) Water Supply, Transmission, and Reliability Project (Water Project). Agricultural water users in Sonoma Valley would continue to use local surface waters and pump groundwater under the No Action Alternative.

#### **6.1.1.1 Potable Water Users**

SCWA is currently evaluating the Water Project, which proposes to release and use additional water currently stored in Lake Sonoma and divert and re-divert the water from the Russian River. Releases from Lake Sonoma would be increased by up to 26,000 acre-feet per year (AFY) as necessary so that the total authorized amount of diversions and re-diversions would increase from the current limit on transmission system diversions of 75,000 AFY to a maximum of 101,000 AFY (Booker 2008b). The proposed Water Project would also expand the existing transmission system to alleviate system constraints, meet existing and future demands, and improve existing and future system reliability. The Water Project would serve SCWA water contractors,

including the Cities of Santa Rosa, Sonoma, Rohnert Park, Cotati, and Petaluma, the Town of Windsor, VOMWD, and NMWD. The project is currently in the environmental review stage.

The current estimated capital costs of the proposed Water Project are \$647 million, in 2008 dollars. Depending on the project components, only a portion of this cost would apply to providing water to users in Sonoma, VOMWD, and NMWD. The incremental cost per acre-foot to expand the Water Project can be used for comparison to the components of this feasibility study that would offset the need for additional SCWA potable water in Sonoma and Marin Counties. Section 9 describes preliminary costs allocated to the three districts for purposes of this report; these allocations will change as SCWA refines project cost estimates. The proposed Water Project is anticipated to provide incremental increases of 2,294 AFY to NMWD, 629 AFY to VOMWD, and 690 AFY to Sonoma over 2005-2006 Russian River deliveries. After Water Project implementation, Russian River water supplies from SCWA would total 13,000 AFY for NMWD, 3,730 AFY for VOMWD, and 3,000 AFY for Sonoma. (Booker 2008b)

The Water Project delivers water supply to these contractors, which would then need to deliver the water to customers at additional costs. These additional costs are described in Section 9.

Although no ocean desalination plants are currently being planned by water agencies in the Authority, MMWD which adjoins the study area, is considering such a plant. Given the uncertainties associated with other developable water supplies, it is possible that desalination may become an option in the study area. The MMWD Bay Water Desalination Project would treat diversions from San Rafael Bay to drinking water standards to increase MMWD's water supply reliability. The proposed project is a 5 million gallon per day (mgd) plant that could ultimately supply up to 15 mgd. The first phase, a 5 mgd facility, would provide supplemental water supply, particularly during drought years. The estimated project capital cost of the expandable 5 mgd desalination plant in 2008 dollars is \$121 million. Operation and maintenance (O&M) costs range from \$4.3 million in average conditions to \$7.1 million in drought conditions (MMWD 2007). MMWD assumes the plant will initially produce 5,300 AF per year (Kennedy/Jenks Consultants 2007).

#### **6.1.1.2 Agricultural Water Users**

Currently, the agricultural users in the Project's service area rely on stored runoff from small local streams and local groundwater. The proposed Water Project would not serve agricultural users in the Sonoma Valley. Under the No Action Alternative, agricultural users would rely on current supplies for irrigation. Groundwater pumping in Sonoma Valley groundwater basins is increasing. It was estimated that from 1975 to 2000, 17,300 AF were lost from total groundwater storage. Projected increases in demands are estimated to result in a further reduction of approximately 16,000 to 22,000 AF from storage in the groundwater basin (SCWA 2007). Declining

groundwater levels could result in potential adverse effects of increased salinity intrusion, potential land subsidence, losses in stream flows, environmental damages, and increasing extraction, well deepening, and replacement costs.

The Sonoma Valley Groundwater Management Plan identifies potential activities to increase groundwater sustainability, including storm water recharge, groundwater banking, recycled water use, and conservation/demand reduction (SCWA 2007). Under the No Action Alternative, the Stormwater Capture Project and Groundwater Banking Project could be implemented to sustain groundwater levels for irrigation. Stormwater captured could be used for direct irrigation or groundwater recharge. Additional agricultural conservation measure would also be implemented, though the majority of grape growers employ intense conservation practices. Costs for these projects have not yet been identified.

Many agencies in California are implementing similar groundwater recharge and banking projects. San Joaquin County has estimated capital costs for groundwater banking projects range from \$53 to \$65 million and conjunctive use projects with surface water diversion and recharge range from \$86 to \$250 million, depending on the size of diversion and/or recharge (Northeastern San Joaquin Groundwater Basin Authority 2007). These prices are likely indicative of the costs of a groundwater banking or recharge project in the Sonoma Valley.

### 6.1.2 Napa County Projects

The Project would serve recycled water to the MST area, which is an unincorporated portion of Napa County due east of the City of Napa named after the three creeks that run through the area. The area consists of a mix of rural residential, vineyard, a golf course, and unimproved open space. Current water supplies consist of groundwater and small surface water diversions. Continuing current groundwater pumping patterns would severely affect the sustainability of the MST groundwater basin, which is in a current state of groundwater overdraft (Farrar and Metzger 2003).

No alternative water supplies have been defined in previous studies for bringing water to the MST area of Napa County. Several options have been identified and are listed below; however, several of these have significant implementation issues. The most feasible new water supply alternative, other than bringing recycled water into the area, is to import potable water to the area.

- Direct recharge to aquifers – The MST groundwater basin has a low hydraulic conductivity throughout most of its area, which greatly restricts the feasibility of artificial recharge through wells or from surface water retention facilities (Farrar and Metzger 2003). USGS notes that “encouraging reductions in groundwater pumping by supplying imported water or reclaimed water to users in and near the pumping depressions might hold the greatest promise of reducing groundwater level declines” (Farrar and Metzger 2003).

- Divert water from Napa River – Napa River water rights are fully allocated and it is unlikely there is additional supply for the MST area.
- Construct new surface storage – New surface storage would be costly and could have significant environmental concerns. The implementation timeframe could also take many years.
- Wheeling agreements – Wheeling agreements are typically short-term and must be negotiated on an annual basis, which does not represent a reliable water supply. Long-term wheeling agreements are difficult to obtain because of current water shortage concerns and environmental issues in the Delta. If negotiated, water would be expensive and the North Bay Aqueduct (NBA) would need to be expanded. New infrastructure would be necessary to deliver water to the MST area.
- Import potable water to the MST area – This is the most feasible water supply option and was chosen as the alternate water supply under the No Action Alternative. However, this option also has implementation concerns, as discussed below.
- Recycled water to the MST area – This is the proposed Project.

The No Action Alternative assumes that, in absence of the Project, imported water would be brought to the MST area for potable water users and some conjunctive use would occur for agricultural users to maintain groundwater levels. This option is a potential alternative to recycled water; however, it would be extremely expensive and there would be substantial legal, environmental, regulatory and political hurdles to overcome.

It is assumed that 1,937 AF of imported potable water would be needed annually, which is the same amount of recycled water the Project would provide to the MST area. This amount is thought to be enough to provide sufficient groundwater offset to help improve the groundwater table in the basin. The City of Napa's Water Master Plan and General Plan do not identify plans to provide water service to this unincorporated area of the County and their existing supplies and estimated demands do not show excess available water supplies during future dry year conditions. Therefore, the water supplies needed to provide potable water for the MST area would need to be imported.

Importing water to the MST area has several costs associated with it, including distribution infrastructure, new water supply costs, legal costs, and a possible NBA expansion. The infrastructure construction costs for a potable water system designed to deliver 1,937 AF of potable water annually to the MST area would be about \$40 million, similar to the recycled water distribution infrastructure costs for the MST area. The overall pipeline lengths may be less relative to recycled water pipelines due to closer proximity of tie-ins to existing City of Napa water mains, but the City of

Napa specifies ductile iron pipelines, which cost more than the polyvinyl chloride system proposed for the recycled water system. There may also be a need to install a storage tank somewhere in the area to provide adequate pressure and flow conditions. Napa County estimates an additional \$8 million in legal and bonding fees would be required to fund the new infrastructure.

The City of Napa's future water supply plans do not include the MST area; therefore, a new water supply would be needed at additional costs. A recent long-term transfer of water in the Central Valley was priced at \$4,000 per AF. The price of water in California continues to escalate, so it is assumed for this discussion that by the time a long-term water deal could be worked out, the price would be \$5,000 per AF. Therefore, the cost to obtain 1,937 AF is estimated to be about \$9.7 million. It should also be noted that there would be a substantial effort required to prepare environmental documents and receive regulatory approval, which could take several years. Litigation would also be a very real possibility, which would drive up costs further.

These imported water supplies would likely be wheeled through the NBA, which is currently used at capacity. It is possible the City of Napa could use some of its share of the pipeline capacity to serve the MST area, but this would have to be negotiated. Therefore, this option would likely require an increase in the capacity of the NBA. Preliminary costs for an NBA expansion to serve all NBA customers are estimated to be about \$269 million. This discussion assumes Napa County would be responsible for the portion of NBA expansion costs based on the share of capacity of new intake, pump stations, and pipelines needed to serve the MST area. Under this alternative, Napa County would receive 1,937 AF from the NBA for the purposes of delivering water to the MST area. The NBA expansion costs for Napa County would be approximately \$38 million – the majority would be new or parallel pipelines, about \$36 million. The NBA expansion costs would be in addition to the new potable water distribution system to the MST area and the long-term water supply costs. Based on the above preliminary estimates, total costs to import water to the MST area would be about \$96 million.

## 6.2 Alternative 1

Alternative 1 is the most basic regional system of the three Action alternatives. It places greatest emphasis on the implementation of recycled water projects close to each wastewater treatment plant. Under this alternative, no WWTPs are connected for joint treatment, storage, or distribution of combined recycled water. Alternative 1 is estimated to be the least expensive of the Action alternatives, in terms of implementation costs, but it would also provide the least amount of recycled water.

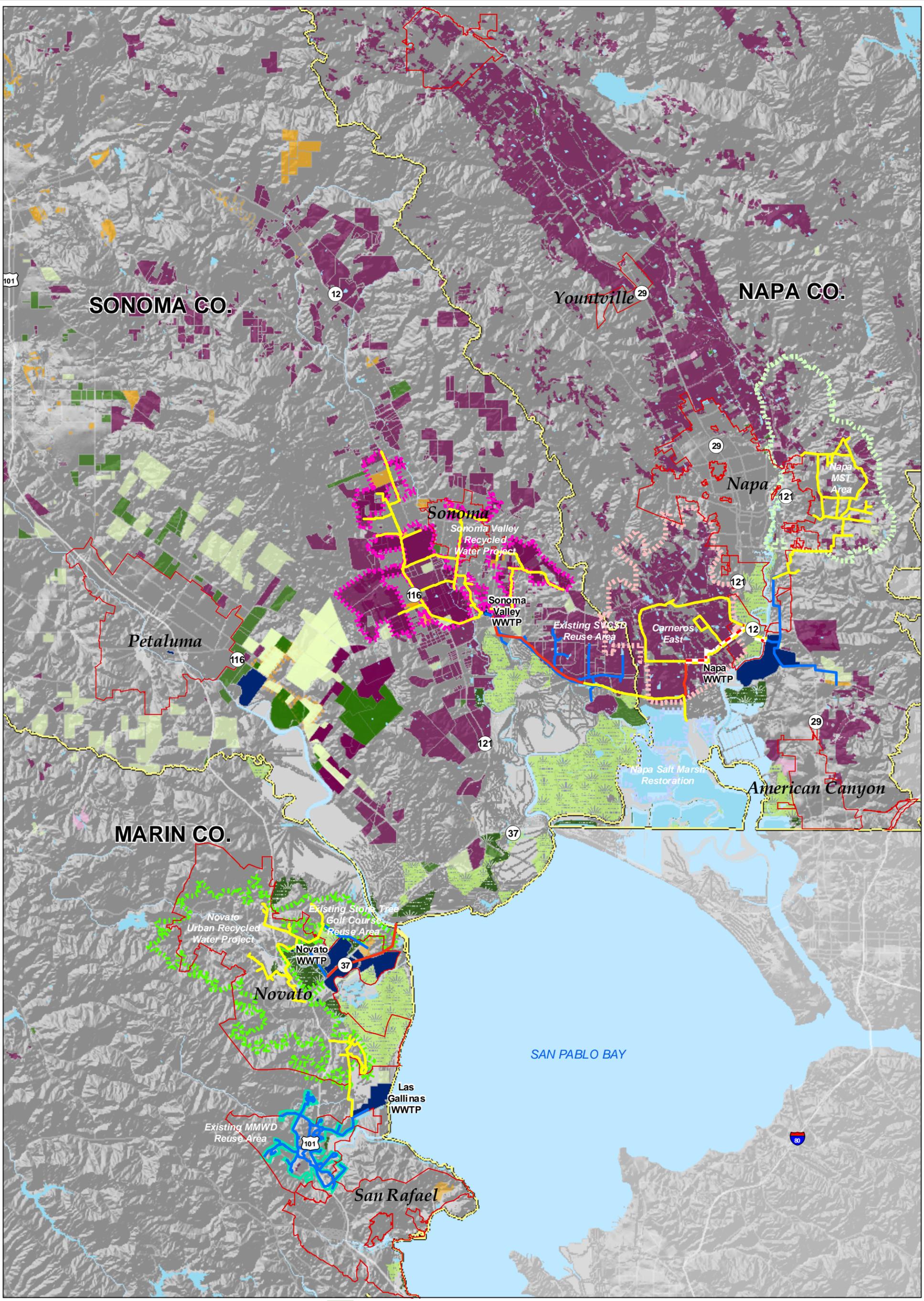
## 6.2.1 Description

This section describes the service area, projects, supply, demand, and infrastructure required for Alternative 1. Also discussed are the recycled water system's effect on existing water supplies and potential barriers to recycled water use in the study area.

### 6.2.1.1 Service Area and Projects

Figure 6-1 illustrates the proposed sharing of recycled water, resources, and delivery areas among the participating WWTPs in Alternative 1. The defining features of Alternative 1 are:

- Each treatment plant would put first priority on the delivery of recycled water to its local projects. Local projects include the NMWD Urban Recycled Water Project (URWP), the Sonoma Valley Recycled Water Project, Napa MST, and the Carneros East areas.
- All WWTP treatment and distribution systems would be sized and designed to serve their respective local users. Interconnectivity between WWTPs would only occur between SVCSD and Napa SD to serve the Napa Salt Marsh Restoration Area during the restoration period (less than 10 years); however, the two WWTPs do not plan to size or coordinate their facilities to share recycled water in other areas. After the restoration period has been completed, it is possible that additional recycled water may be required for Napa Salt Marsh pond maintenance.
- LGVSD would require either new or expanded treatment facilities to produce tertiary treated recycled water for unrestricted use, since the existing tertiary facility at the WWTP is currently operating at maximum capacity to meet existing MMWD user demands. Recycled water from LGVSD would be supplied to users at Hamilton Field, in the southern portion of the NMWD URWP Area. Existing available storage at the WWTP would be used, and one 0.5-million gallon (MG) drinking water reservoir near Hamilton Field would be rehabilitated for recycled water use.
- Novato SD would require either new or expanded treatment facilities to produce additional tertiary treated recycled water for unrestricted use. Recycled water from Novato SD would be supplied to users in the northern and central portions of the NMWD URWP Area, which includes the existing Stone Creek Golf Course. Existing available storage at the WWTP would be used, and one 0.5-MG drinking water reservoir in the northern portion of the NMWD URWP area would be rehabilitated for recycled water use.
- SVCSD would treat wastewater at its existing plant and distribute recycled water to local users within its existing SVCSD Reuse Area (Carneros West) in addition to the Sonoma Valley Recycled Water Project and Napa Salt Marsh Restoration Areas. This alternative would include construction of a new recycled water storage pond near the SVCSD WWTP, and assumes potential user ponds in the Carneros West



Basemap: U.S. Department of Agriculture, 2001  
 Land Use Data: California Department of Water Resources, 1999a and 1999b,  
 Napa Sanitation District 2005, SCWA 2001.  
 Boundaries are approximate and for study purposes only.

**Legend**

- Urban Growth Boundary
- Completed Restoration
- Planned Restoration
- WWTPs

- Irrigated Farm Property
- Golf Course, Cemetery, Parks, and Landscaping
- Vineyard
- Dairy, Pasture
- Orchard

- Local Project Pipelines (Increased Capacity)
- Local Project Pipelines
- New Project Pipeline
- Existing Pipeline



**Figure 6-1  
 Alternative 1**

and Sonoma Valley Recycled Water Project Areas would also be used for recycled water storage prior to local use.

- Napa SD would treat wastewater at its existing reclamation facility and focus on delivering recycled water to the Napa MST and Carneros East Areas. Napa SD would deliver any remaining recycled water to the Napa Salt Marsh Restoration Area. It is assumed existing ponds at the WWTP would be reconfigured for recycled water storage and potential user ponds in the Napa MST and Carneros East Areas would be used for recycled water storage prior to local use. Napa SD performed an operational analysis and determined their ponds could be used to provide peak storage for the delivery of 4,540 AF to recycled water users over the course of a year (Napa SD 2005). All Napa SD recycled water demand above 4,540 AFY is assumed to require user ponds for storage.

### 6.2.1.2 Recycled Water Supply, Demand, and Discharge

Table 6-2 summarizes the recycled water demand, supply, and discharge to San Pablo Bay for each treatment plant service area under Alternative 1 in 2020. Each of the WWTPs currently serves some recycled water customers. Table 6-2 presents this existing demand for each service area, the additional demand created by Alternative 1, and the total recycled water demand in the study area with the addition of Alternative 1.

<b>WWTP Service Area</b>	<b>2020 WWTP Inflow (AFY)</b>	<b>Existing Recycled Water Demand (AFY)</b>	<b>New Recycled Water Demand (Beneficial Reuse) Developed for Alternative 1 (AFY)</b>	<b>Total Recycled Water Demand in Project Area (AFY)</b>	<b>Discharge to San Pablo Bay (AFY)</b>
LGVSD WWTP	3,670	902	202	1,104	2,566
Novato SD WWTP	8,677	270	542	812	7,865
SVCSD WWTP	5,508	1,174	2,719	3,893	1,615
Napa WWTP	9,800	2,598	2,992	5,590	4,210
<b>Total</b>	<b>27,655</b>	<b>4,944</b>	<b>6,455</b>	<b>11,399</b>	<b>16,256</b>

The Alternative 1 demand shown in Table 6-2 represents recycled water use by customers (beneficial reuse). Urban landscaping uses would receive approximately 2,345 AF and agricultural uses would receive approximately 4,110 AF of recycled water. SVCSD and Napa SD could provide additional recycled water to the Napa Salt Marsh Restoration Area during non-peak irrigation periods. This area's demand was considered secondary to customer demands during the peak irrigation season. The Napa Salt Marsh Restoration Area may require up to 3,000 AFY during its maintenance period, depending upon the service agreement reached with California Department of Fish and Game (CDFG). The total discharge to San Pablo Bay under

Alternative 1 (16,256 AFY) would be reduced by any deliveries of recycled water to the Napa Salt Marsh.

### 6.2.1.3 System Requirements

Table 6-3 summarizes the pipeline requirements for Alternative 1. Pipeline diameters, pipeline length by diameter, and total pipeline length are presented.

<b>Pipeline Diameter</b>	<b>Length (Miles)</b>
4"	5
6"	16
8"	15
10"	9
12"	11
14"	2
16"	2
18"	11
20"	0
24"	5
30"	5
36"	4
<b>Total</b>	<b>83</b>

Table 6-4 presents figures on treatment upgrades required to implement Alternative 1. All WWTPs currently have some tertiary treatment capability; however, all but SVCSD would need to increase their treatment capacity to meet the demands of Alternative 1.

<b>Facility</b>	<b>Tertiary Treatment Capacity without the Project (mgd)</b>	<b>Tertiary Treatment Capacity Required for Alternative 1 (mgd)</b>	<b>Tertiary Treatment Capacity Increase (mgd)</b>
LGVSD	2.0	2.3	0.3
Novato SD	0.5	1.7	1.2
SVCSD	16.0	9.9	0.0
Napa SD	8.8	14.3	5.5
<b>Total</b>	<b>27.3</b>	<b>28.2</b>	<b>7.0</b>

Table 6-5 summarizes the additional recycled water storage needs (i.e., the volume in excess of existing available storage), which would be required under Alternative 1. The local project areas being served separately by LGVSD and Novato SD would require less water during all months than would be treated at the two WWTPs; therefore, no storage of water is required to accommodate peak month demands, only as necessary for operational interests and system pressure management. The local project areas being served by SVCSD and Napa SD would require more water during the peak summer months than each of the WWTPs would be treating; additional water storage at the WWTPs, as anticipated by these Agencies' local project reports,

would be required to accommodate peak month demands. SVCSD would require additional new storage at the WWTP, and Napa SD would need to modify existing water storage basins for recycled water system use. Individual landowner ponds would be used throughout the project areas to help offset the system storage required to serve users during peak-use periods.

<b>Type</b>	<b>Location</b>	<b>Volume (AF)</b>	<b>Comments</b>
WWTP Storage	LGVSD WWTP	0	
	Novato WWTP	0	
	SVCSD WWTP	1,020	Requires land purchase
	Napa WWTP	950	Existing storage ponds to be used
	<i>Total</i>	<i>1,970</i>	
System Storage Ponds	SVCSD Reuse Area	625	Existing storage ponds
	SVCSD Reuse Area	0	
	<i>Total</i>	<i>625</i>	
Reservoir Storage	Hamilton Field (LGVSD)	1.5	Rehabilitate existing reservoir
	NMWD Project Areas	1.5	Rehabilitate existing reservoir
	Novato WWTP	0	
	Peacock Gap	0	
	<i>Total</i>	<i>3.0</i>	
<b>Total</b>		<b>2,598</b>	

Pump stations would be needed throughout the system for distribution and to boost pressures to higher pressure zones. Alternative 1 would make use of some existing pumps at the WWTPs or project areas, and would require additional pump stations. The locations of these pump stations are summarized below in Table 6-6.

<b>Location (WWTP or Reuse Area)</b>	<b>Horsepower (HP)</b>	<b>Comments</b>
LGVSD WWTP	71	
Novato WWTP	258	
SVCSD WWTP	872	
Napa WWTP	663	New Pump
Napa WWTP	1,989	Existing Pumps
Carneros East	0	
Central Sonoma Valley	0	
Existing SVCSD Reuse Area (Carneros West)	0	New Pumps
Existing SVCSD Reuse Area (Carneros West)	218	Existing Pumps
Napa MST Area	244	
Peacock Gap Golf Course	0	
Southern Sonoma Valley	0	
Sonoma Valley Recycled Water Project	238	
<b>Total</b>	<b>4,553</b>	

#### **6.2.1.4 Effect on Existing Water Supplies**

Alternative 1 would provide 893 AF of Russian River water offset in the study area: 147 AF in the Sonoma Valley Recycled Water Project and 746 AF in the NMWD URWP Area. This represents drinking water that would no longer be used for non-potable uses, thus ensuring the highest quality water is reserved for potable uses. This potable offset reduces the need for new supplies to be developed to serve the study area, which is discussed above regarding the No Action Alternative (Section 6.1).

#### **6.2.1.5 Barriers to Recycled Water Use**

Public acceptance, water quality, and cost are potential barriers to implementing recycled water use under Alternative 1. In other parts of the San Francisco Bay Area, public concerns about the use of recycled water have included potential unknown health impacts, potential negative impact on property values, and citizen choice versus public mandate on infrastructure when recycled water systems were approved without sufficient public information. The Authority is continuing outreach activities to educate the public and potential users about recycled water use in order to help facilitate more effective implementation.

As described in Section 4.3, recycled water quality must be reviewed for potential chemical constituents related to agricultural irrigation, such as salinity, sodium, trace elements, excessive chlorine residual, and nutrients. Recycled water produced by the member agencies' WWTPs was compared to water quality guidelines for the use of recycled water by the U.S. Environmental Protection Agency (US EPA), a 2006 study by the University of California (UC) Division of Agriculture, and from the North Bay Watershed Association (NBWA). Based on the data presented in Table 4-3, the member agencies' recycled water meets the water quality recommendations for agricultural application.

Cost is another potential barrier to recycled water use in the study area. Without recycled water, other water supplies would have to be developed, likely with similar costs as the construction of a recycled water system. Outreach activities to educate the public and potential users about these avoided potable water development costs will help facilitate more effective implementation.

### **6.2.2 Costs**

Table 6-7 summarizes the opinion of probable total project capital costs for Alternative 1 in 2008 dollars. O&M costs are estimated to be about \$1.8 million per year.

<b>Major Project Component</b>	<b>Cost (\$ Million)</b>
Pipelines	\$129.6
Treatment Improvements	\$29.6
Storage	\$40.6
Pumping	\$10.1
<b>Probable Total Project Capital Costs</b>	<b>\$209.9</b>

## 6.3 Alternative 2

Alternative 2 involves development of a larger regional recycled water system, taking advantage of increased storage capacity and additional pipelines to distribute recycled water more extensively throughout the study area than could be achieved under Alternative 1.

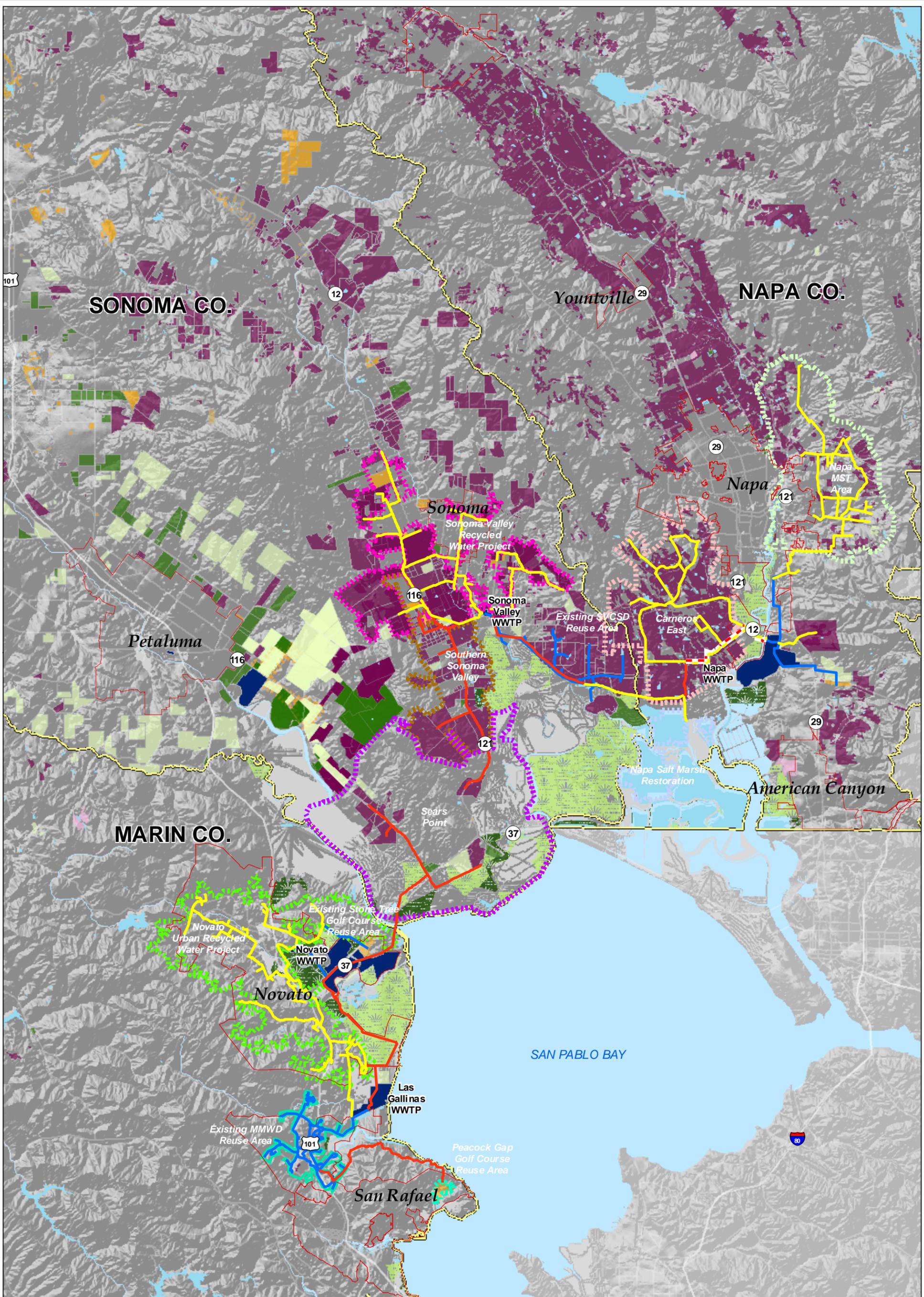
### 6.3.1 Description

This section describes the service area, projects, supply, demand, and infrastructure required for Alternative 2. Also discussed are the recycled water system's effect on existing water supplies, and potential barriers to recycled water use in the study area.

#### 6.3.1.1 Service Area and Projects

Figure 6-2 illustrates the proposed sharing of recycled water, resources, and delivery areas among the participating WWTPs in Alternative 2. The defining features of Alternative 2 are:

- Each treatment plant would put first priority on the delivery of recycled water to its local projects. Local projects include the Peacock Gap Golf Course area, NMWD URWP, the Sonoma Valley Recycled Water Project, Napa MST, and the Carneros East areas.
- Interconnectivity between WWTPs would occur between SVCSD and Napa SD to serve the Napa Salt Marsh Restoration Area during the restoration period (less than 10 years), and between Novato SD and LGVSD to serve the Sears Point Area.
- LGVSD would require either new or expanded treatment facilities to produce tertiary treated recycled water for unrestricted use, since the existing tertiary facility at the WWTP is currently operating at maximum capacity to meet existing MMWD user demands. Recycled water from LGVSD would be supplied to users at Hamilton Field, in the southern portion of the NMWD URWP Area, and to the Peacock Gap Golf Course Area. The distribution to the Peacock Gap Golf Course Area would require both a new pipeline and use of additional conveyance capacity in the existing MMWD recycled water distribution system, and rehabilitation of an



Basemap: U.S. Department of Agriculture, 2001  
 Land Use Data: California Department of Water Resources, 1999a and 1999b,  
 Napa Sanitation District 2005, SOWA 2001.  
 Boundaries are approximate and for study purposes only.

**Legend**

- Urban Growth Boundary
- Completed Restoration
- Planned Restoration
- WWTPs

- Irrigated Farm Property
- Golf Course, Cemetery, Parks, and Landscaping
- Vineyard
- Dairy, Pasture
- Orchard

- Local Project Pipelines (Increased Capacity)
- Local Project Pipelines
- New Project Pipeline
- Existing Pipeline



**Figure 6-2  
 Alternative 2**

existing 0.5-MG drinking water reservoir near the Peacock Gap Golf Course. Existing available storage at the WWTP would be used, and one 0.5-MG drinking water reservoir near Hamilton Field would be rehabilitated for recycled water use.

- Novato SD would require either new or expanded treatment facilities to produce additional tertiary treated recycled water for unrestricted use. Recycled water from Novato SD would be supplied to users in the northern, western, and central portions of the NMWD URWP Area, which includes the existing Stone Creek Golf Course. An added recycled water pipeline from LGVSD would extend north to join a recycled water pipeline from Novato SD; the combined flow would continue east to jointly serve the Sears Point Area, although most of this flow is anticipated to originate from Novato SD. Existing available storage at the WWTP would be used, and two 0.5-MG drinking water reservoirs in each of the northern and western portions of the NMWD URWP area would be rehabilitated for recycled water use.
- SVCSD would treat wastewater at its existing plant and distribute recycled water to local uses within its existing recycled water service area (Carneros West) in addition to the Sonoma Valley Recycled Water Project, Southern Sonoma Valley Service Area, and Napa Salt Marsh Restoration Area. This alternative would include construction of a new recycled water storage pond near the SVCSD WWTP and additional system storage in the Carneros West Area. In addition, this alternative assumes potential user ponds in the Carneros West, Sonoma Valley Recycled Water Project, and Southern Sonoma Valley Service Areas would also be used for recycled water storage prior to local use.
- Napa SD would treat wastewater at its existing reclamation facility and focus on delivering recycled water to an expanded Napa MST Area (compared to Alternative 1), an expanded Carneros East Area (compared to Alternative 1), and potential new recycled water users in southeast Napa. Napa SD would deliver any remaining recycled water to the Napa Salt Marsh Restoration Area. It is assumed that existing ponds at the WWTP would be reconfigured for recycled water storage and potential user ponds in the Napa MST and Carneros East Areas would be used for recycled water storage prior to local use. Napa SD performed an operational analysis and determined their ponds could be used to provide peak storage for the delivery of 4,540 AF to recycled water users over the course of a year (Napa SD 2005). All Napa SD recycled water demand above 4,540 AFY is assumed to require user ponds for storage.
- Aquifer Storage and Recovery (ASR) Basins, previously reviewed during development of the initial alternatives for recycled water storage, are no longer considered necessary in Alternative 2. All anticipated storage for Alternative 2 would occur in surface storage ponds or reservoirs.

### 6.3.1.2 Recycled Water Supply, Demand, and Discharge

Table 6-8 summarizes the recycled water demand, supply, and 2020 discharge to San Pablo Bay for each treatment plant service area that would be achieved under Alternative 2. Each of the WWTPs currently serves some recycled water customers. Table 6-8 presents this existing demand for each service area, the additional demand created by Alternative 2, and the total recycled water demand in the study area with the addition of Alternative 2.

<b>WWTP Service Area</b>	<b>2020 WWTP Inflow (AFY)</b>	<b>Existing Recycled Water Demand (AFY)</b>	<b>New Recycled Water Demand (Beneficial Reuse) Developed for Alternative 2 (AFY)</b>	<b>Total Recycled Water Demand in the Project Area (AFY)</b>	<b>Discharge to San Pablo Bay (AFY)</b>
LGVSD WWTP	3,670	902	574	1,476	2,194
Novato SD WWTP	8,677	270	2,114	2,384	6,293
SVCSD WWTP	5,508	1,174	4,306	5,480	28
Napa WWTP	9,800	2,598	4,221	6,819	2,981
<b>Total</b>	<b>27,655</b>	<b>4,944</b>	<b>11,215</b>	<b>16,159</b>	<b>11,496</b>

The Alternative 2 demand shown in Table 6-8 represents recycled water use by customers (beneficial reuse). Urban landscaping uses would receive approximately 3,966 AF and agricultural uses would receive approximately 7,249 AF of recycled water. SVCSD and Napa SD could provide additional recycled water to the Napa Salt Marsh Restoration Area during non-peak irrigation periods. This area's demand was considered secondary to customer demands during the peak irrigation season. The Napa Salt Marsh Restoration Area may require up to 3,000 AFY during its maintenance period, depending upon the service agreement reached with CDFG. The total discharge to San Pablo Bay under Alternative 2 (11,496 AFY) would be reduced by any deliveries of recycled water to the Napa Salt Marsh.

### 6.3.1.3 System Requirements

Table 6-9 summarizes the pipeline requirements for Alternative 2. Pipeline diameters, pipeline length by diameter, and total pipeline length are presented.

Table 6-10 presents figures on treatment upgrades required to implement Alternative 2. All WWTPs currently have some tertiary treatment capability; however, all but SVCSD would need to increase their treatment capacity to meet the demands of Alternative 2. These treatment upgrades are the same as are required under Alternative 1.

**Table 6-9**  
**Summary of Pipeline Sizes and Lengths for Alternative 2**

<i>Pipeline Diameter</i>	<i>Length (Miles)</i>
4"	5
6"	31
8"	26
10"	13
12"	22
14"	3
16"	7
18"	19
20"	1
24"	5
30"	5
36"	4
Total	140

**Table 6-10**  
**Treatment Improvement Requirements for Alternative 2**

<i>Facility</i>	<i>Tertiary Treatment Capacity without the Project (mgd)</i>	<i>Tertiary Treatment Capacity Required for Alternative 2 (mgd)</i>	<i>Tertiary Treatment Capacity Increase (mgd)</i>
LGVSD	2.0	3.1	1.1
Novato SD	0.5	5.6	5.1
SVCSD	16.0	15.9	0.0
Napa SD	8.8	17.9	9.1
<b>Total</b>	<b>27.3</b>	<b>42.5</b>	<b>15.3</b>

Table 6-11 summarizes the additional recycled water storage needs required under Alternative 2. The addition of the Peacock Gap Golf Course to the areas served by LGVSD, compared to Alternative 1, would increase the summer water demand to slightly above the flow treated at the WWTP during this season; therefore, LGVSD would need to use existing water storage basins at the WWTP for recycled water system use during the summer.

The local project areas being served separately by Novato SD would require less water during all months than would be treated at the WWTP; therefore, no storage of water would be required to accommodate peak month demands, only as necessary for operational interests and system pressure management.

The local project areas being served by SVCSD and Napa SD would require more water during the peak summer months than each of the WWTPs is treating; additional water storage at the WWTPs, as anticipated by these Agencies' local project reports, would be required to accommodate peak month demands. SVCSD would require additional new storage at the WWTP, as well as additional pond storage within the system to accommodate users added in the Southern Sonoma Valley Area.

It is anticipated this additional pond storage would occur either at the WWTP or in the Carneros West area. Napa SD would need to modify existing storage ponds at the WWTP for recycled water system use.

**Table 6-11**  
**Additional Storage Requirements for Alternative 2**

<b>Type</b>	<b>Location</b>	<b>Volume (AF)</b>	<b>Comments</b>
WWTP Storage	LGVSD WWTP	200	Existing storage ponds to be used
	Novato WWTP	0	
	SVCSD WWTP	1,020	Requires land purchase
	Napa WWTP	950	Existing storage ponds to be used
	<i>Total</i>	<i>2,170</i>	
System Storage Ponds	SVCSD Reuse Area	625	Existing storage ponds
	SVCSD Reuse Area	1,200	New storage ponds. Requires land purchase.
	<i>Total</i>	<i>1,825</i>	
Reservoir Storage	Hamilton Field	1.5	Rehabilitate existing reservoir
	NMWD Project Areas	3.1	Rehabilitate existing reservoirs
	Novato WWTP	3.1	Locate at existing WWTP
	Peacock Gap	1.5	Rehabilitate existing reservoir
	<i>Total</i>	<i>9.2</i>	
<b>Total</b>		<b>4,004</b>	

Individual landowner ponds would be used throughout the project areas.

Pump stations would be needed throughout the system for distribution and to boost pressures to higher pressure zones. Alternative 2 would make use of some existing pumps at the WWTPs or project areas, and would require additional pump stations. The locations of these pump stations are summarized below in Table 6-12.

#### 6.3.1.4 Effect on Existing Water Supplies

Alternative 2 would provide 1,085 AF of Russian River water offset in the study area: 147 AF in the Sonoma Valley Recycled Water Project and 938 AF in the NMWD URWP Area. This represents drinking water that would no longer be used for non-potable uses, thus ensuring the highest quality water is reserved for potable uses. This potable offset reduces the need for new supplies to be developed to serve the study area, which is discussed above regarding the No Action Alternative (Section 6.1).

<b>Table 6-12 Pump Stations Required for Alternative 2</b>		
<b>Location (WWTP or Reuse Area)</b>	<b>Horsepower (HP)</b>	<b>Comments</b>
LGVSD WWTP	91	
Novato WWTP	584	
SVCSD WWTP	1,315	
Napa WWTP	673	New Pump
Napa WWTP	2,020	Existing Pumps
Carneros East	105	
Central Sonoma Valley	0	
Existing SVCSD Reuse Area (Carneros West)	52	New Pumps
Existing SVCSD Reuse Area (Carneros West)	218	Existing Pumps
Napa MST Area	382	
Peacock Gap Golf Course	246	Existing MMWD Pumps
Sonoma Valley Recycled Water Project	192	
Southern Sonoma Valley	260	
<b>Total</b>	<b>6,138</b>	

### 6.3.1.5 Barriers to Recycled Water Use

The potential barriers for recycled water implementation under Alternative 2 are the same as Alternative 1: public acceptance, water quality, and cost. In other parts of the San Francisco Bay Area, public concerns about the use of recycled water have included potential unknown health impacts, potential negative impact on property values, and citizen choice versus public mandate on infrastructure when recycled water systems were approved without sufficient public information. The Authority is continuing outreach activities to educate the public and potential users about recycled water use in order to help facilitate more effective implementation.

As described in Section 4.3, recycled water quality must be reviewed for potential chemical constituents related to agricultural irrigation, such as salinity, sodium, trace elements, excessive chlorine residual, and nutrients. Recycled water produced by the member agencies' WWTPs was compared to water quality guidelines for the use of recycled water by the US EPA, a 2006 study by the UC Division of Agriculture, and from the NBWA. Based on the data presented in Table 4-3, member agencies' recycled water meets the water quality recommendations for agricultural application.

Cost is another potential barrier to recycled water use in the study area. Without recycled water, other water supplies would have to be developed, likely with similar costs as the construction of a recycled water system. Outreach activities to educate the public and potential users about these avoided potable water development costs will help facilitate more effective implementation.

### 6.3.2 Costs

Table 6-13 summarizes the opinion of probable total project capital costs for Alternative 2. O&M costs are estimated to be about \$2.8 million per year.

<b>Major Project Component</b>	<b>Cost (\$ million)</b>
Pipelines	\$198.0
Treatment Improvements	\$64.7
Storage	\$98.6
Pumping	\$16.2
<b>Probable Total Project Capital Costs</b>	<b>\$377.5</b>

## 6.4 Alternative 3

Alternative 3 creates an interconnected regional system that links all four wastewater treatment facilities in the study area. This alternative maximizes water reuse by allowing recycled water from any WWTP to be delivered to any area that needs recycled water. With much of the demand for recycled water coming from the area near Sonoma and Napa, the regional interconnection achieved under Alternative 3 is helpful as it allows the other treatment plants to help satisfy the demand in this area. This alternative would provide the greatest use of recycled water, but it would also have the highest implementation costs.

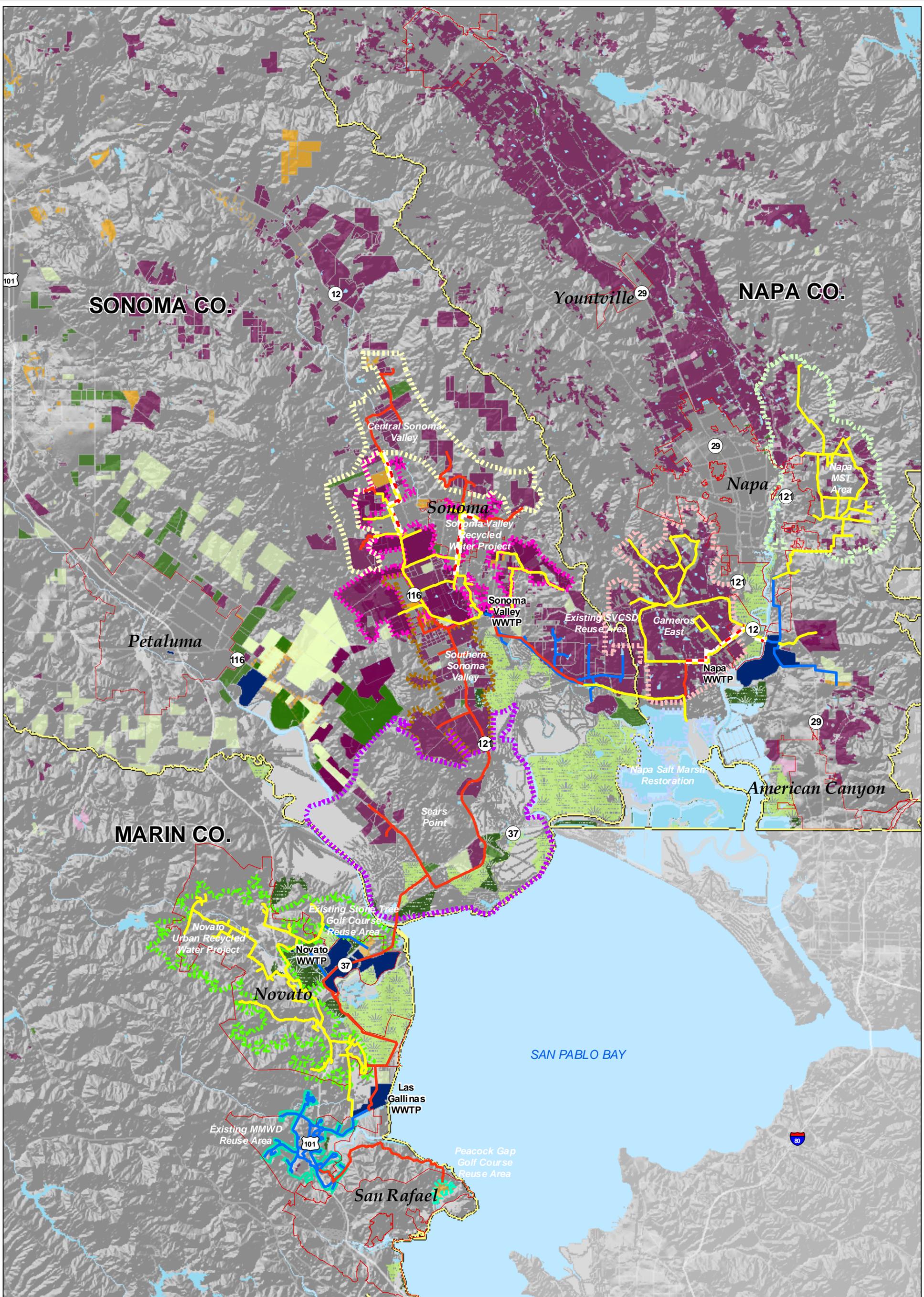
### 6.4.1 Description

This section describes the service area, projects, supply, demand, and infrastructure required for Alternative 3. Also discussed are the recycled water system's effect on existing water supplies and potential barriers to recycled water use in the study area.

#### 6.4.1.1 Service Area and Projects

Figure 6-3 illustrates the proposed sharing of recycled water, resources, and delivery areas among the participating WWTPs in Alternative 3. The defining features of Alternative 3 are:

- A series of pipelines would connect all four treatment plants to allow for potential maximum distribution and use of recycled water.
- Each treatment plant would put first priority on the delivery of recycled water to its local projects. Local projects include the Peacock Gap Golf Course area, NMWD URWP, the Sonoma Valley Recycled Water Project, Napa MST, and the Carneros East areas.
- LGVSD would require either new or expanded treatment facilities to produce tertiary treated recycled water for unrestricted use, since the existing tertiary facility at the WWTP is currently operating at maximum capacity to meet existing MMWD user demands. Recycled water from LGVSD would be supplied to users at



Basemap: U.S. Department of Agriculture, 2001  
 Land Use Data: California Department of Water Resources, 1999a and 1999b,  
 Napa Sanitation District 2005, SCWA 2001.  
 Boundaries are approximate and for study purposes only.

**Legend**

- Urban Growth Boundary
- Completed Restoration
- Planned Restoration
- WWTPs

- Irrigated Farm Property
- Golf Course, Cemetery, Parks, and Landscaping
- Vineyard
- Dairy, Pasture
- Orchard

- Local Project Pipelines (Increased Capacity)
- Local Project Pipelines
- New Project Pipeline
- Existing Pipeline



**Figure 6-3  
 Alternative 3**

Hamilton Field, in the southern portion of the NMWD URWP Area, and to the Peacock Gap Golf Course Area. The distribution to the Peacock Gap Golf Course Area would require both a new pipeline and use of additional conveyance capacity in the existing MMWD recycled water distribution system, and rehabilitation of an existing 0.5-MG drinking water reservoir near the Peacock Gap Golf Course. Existing available storage at the WWTP would be used, and one 0.5-MG drinking water reservoir near Hamilton Field would be rehabilitated for recycled water use.

- Novato SD would require either new or expanded treatment facilities to produce additional tertiary treated recycled water for unrestricted use. Recycled water from Novato SD would be supplied to users in the northern, western, and central portions of the NMWD URWP Area, which includes the existing Stone Creek Golf Course. An added recycled water pipeline from LGVSD would extend north to join a recycled water pipeline from Novato SD; the combined flow would continue east to jointly serve the Sears Point Area and the Southern Sonoma Valley Area, although most of this flow is anticipated to originate from Novato SD. Existing available storage at the WWTP would be used, and two 0.5-MG drinking water reservoirs in each of the northern and western portions of the NMWD URWP area would be rehabilitated for recycled water use.
- SVCSD would treat wastewater at its existing plant and distribute recycled water to local uses within its existing recycled water service area (Carneros West) in addition to the Sonoma Valley Recycled Water Project, Central Sonoma Valley Area, and Napa Salt Marsh Restoration Area. This alternative would include construction of a new recycled water storage pond near the SVCSD WWTP and additional surface reservoir system storage in the Carneros West Area. In addition, this alternative assumes potential user ponds in the Carneros West, Sonoma Valley Recycled Water Project, and Central Sonoma Valley Service Areas would also be used for recycled water storage prior to local use.
- Napa SD would treat wastewater at its existing reclamation facility and focus on delivering recycled water to an expanded Napa MST Area (compared to Alternative 1), an expanded Carneros East Area (compared to Alternative 1), and new potential recycled water users in southeast Napa. Napa SD would deliver any remaining recycled water the Napa Salt Marsh Restoration Area. It is assumed existing ponds at the WWTP would be reconfigured for recycled water storage and potential user ponds in the Napa MST and Carneros East Areas would be used for recycled water storage prior to local use. Napa SD performed an operational analysis and determined their ponds could be used to provide peak storage for the delivery of 4,540 AF to recycled water users over the course of a year (Napa SD 2005). All Napa SD recycled water demand above 4,540 AFY is assumed to require user ponds for storage.
- ASR basins, previously reviewed during development of the initial alternatives for recycled water storage, are no longer considered necessary in Alternative 3. All

anticipated storage for Alternative 3 would occur in surface storage ponds or reservoirs.

#### 6.4.1.2 Recycled Water Supply, Demand, and Discharge

Table 6-14 summarizes the recycled water demand, supply, and discharge to San Pablo Bay for each treatment plant service area under Alternative 3 in 2020. Each of the WWTPs currently serves some recycled water customers. Table 6-14 presents this existing demand for each service area, the additional demand created by Alternative 3, and the total recycled water demand in the study area with the addition of Alternative 3.

<b>WWTP Service Area</b>	<b>2020 WWTP Inflow (AFY)</b>	<b>Existing Recycled Water Demand (AFY)</b>	<b>New Recycled Water Demand (Beneficial Reuse) Developed for Alternative 3 (AFY)</b>	<b>Total Recycled Water Demand in the Project Area (AFY)</b>	<b>Discharge to San Pablo Bay (AFY)</b>
LGVSD WWTP	3,670	902	574	1,476	2,194
Novato SD WWTP	8,677	270	3,701	3,971	4,706
SVCSD WWTP	5,508	1,174	4,229	5,403	105
Napa WWTP	9,800	2,598	4,221	6,819	2,981
<b>Total</b>	<b>27,655</b>	<b>4,944</b>	<b>12,725</b>	<b>17,669</b>	<b>9,986</b>

The Alternative 3 demand shown in Table 6-14 represents recycled water use by customers (beneficial reuse). Urban landscaping uses would receive approximately 4,092 AF and agricultural uses would receive approximately 8,633 AF of recycled water. SVCSD and Napa SD could provide additional recycled water to the Napa Salt Marsh Restoration Area during non-peak irrigation periods. This area's demand was considered secondary to customer demands during the peak irrigation season. The Napa Salt Marsh Restoration Area may require up to 3,000 AFY during its maintenance period, depending upon the service agreement reached with CDFG. The total discharge to San Pablo Bay under Alternative 3 (9,986 AFY) would be reduced by any deliveries of recycled water to the Napa Salt Marsh.

#### 6.4.1.3 System Requirements

Table 6-15 summarizes the pipeline requirements for Alternative 3. Pipeline diameters, pipeline length by diameter, and total pipeline length are presented.

<b>Pipeline Diameter</b>	<b>Length (Miles)</b>
4"	4
6"	32
8"	24
10"	13
12"	34
14"	5
16"	8
18"	20
20"	1
24"	5
30"	5
36"	4
<b>Total</b>	<b>155</b>

Table 6-16 presents figures on treatment upgrades required to implement Alternative 3. All WWTPs currently have some tertiary treatment capability; however, all but SVCSD would need to increase their treatment capacity to meet the demands of Alternative 3.

<b>Facility</b>	<b>Tertiary Treatment Capacity without the Project (mgd)</b>	<b>Tertiary Treatment Capacity Required for Alternative 3 (mgd)</b>	<b>Tertiary Treatment Capacity Increase (mgd)</b>
LGVSD	2.0	3.1	1.1
Novato SD	0.5	10.4	9.9
SVCSD	16.0	15.5	0.0
Napa SD	8.8	17.9	9.1
<b>Total</b>	<b>27.3</b>	<b>46.9</b>	<b>20.1</b>

The increased recycled water demands reflected in Alternative 3 require that all WWTPs provide some amount of secondary effluent storage for treatment and use during the peak summer period. Table 6-17 summarizes the additional recycled water storage needs (i.e., the volume in excess of existing available storage), which would be required under Alternative 3.

The addition of the Peacock Gap Golf Course to the areas served by LGVSD, compared to Alternative 1, would increase the summer water demand to slightly above the flow treated at the WWTP during this season; therefore, LGVSD would need to use existing water storage basins at the WWTP for recycled water system use during the summer.

<b>Type</b>	<b>Location</b>	<b>Volume (AF)</b>	<b>Comments</b>
WWTP Storage	LGVSD WWTP	200	Existing storage ponds to be used
	Novato WWTP	437	Existing storage ponds to be used
	SVCSD WWTP	1,020	Requires land purchase
	Napa WWTP	950	Existing storage ponds to be used
	<i>Total</i>	<i>2,607</i>	
System Storage Ponds	SVCSD Reuse Area	625	Existing storage ponds
	SVCSD Reuse Area	1,200	New storage ponds. Requires land purchase
	<i>Total</i>	<i>1,825</i>	
Reservoir Storage	Hamilton Field	1.5	Rehabilitate existing reservoir
	NMWD Project Areas	3.1	Rehabilitate existing reservoirs
	Novato WWTP	3.1	Locate at existing WWTP
	Peacock Gap	1.5	Rehabilitate existing reservoir
	<i>Total</i>	<i>9.2</i>	
<b>Total</b>		<b>4,441</b>	

The addition of the Sears Point and Southern Sonoma Valley Areas, compared to Alternatives 1 & 2, would increase the summer water demand above the flow treated at the WWTP during this season; therefore, Novato SD would need to use existing water storage basins for recycled water system use during the summer.

The local project areas being served by SVCSD and Napa SD would require more water during the peak summer months than each of the WWTPs is treating; additional water storage at the WWTPs, as anticipated by these Agencies' local project reports, would be required to accommodate peak month demands. SVCSD would require additional new storage at the WWTP, as well as additional pond storage within the system to accommodate users added in the Central Sonoma Valley Area. It is anticipated this additional pond storage would occur either at the WWTP or in the Carneros West area. Napa SD would need to modify existing water storage basins for recycled water system use.

Individual landowner ponds would be used throughout the project areas.

Pump stations would be needed throughout the recycled water system for distribution and to boost pressures to higher pressure zones. Alternative 3 would make use of some existing pumps at the WWTPs or project areas, and would require additional pump stations. The locations of these pump stations are summarized below in Table 6-18.

<b>Location (WWTP or Reuse Area)</b>	<b>Horsepower (HP)</b>	<b>Comments</b>
LGVSD WWTP	203	
Novato WWTP	704	
SVCSO WWTP	1,649	
Napa WWTP	672	New Pump
Napa WWTP	2,016	Existing Pumps
Carneros East	105	
Central Sonoma Valley	409	
Existing SVCSO Reuse Area (Carneros West)	61	New Pumps
Existing SVCSO Reuse Area (Carneros West)	218	Existing Pumps
Napa MST Area	382	
Peacock Gap Golf Course	246	Existing MMWD Pumps
Sonoma Valley Recycled Water Project	575	
Southern Sonoma Valley	260	
<b>Total</b>	<b>7,500</b>	

#### 6.4.1.4 Effect on Existing Water Supplies

Alternative 3 provides 1,085 AF of Russian River water offset in the study area: 147 AF in the Sonoma Valley Recycled Water Project and 938 AF in the NMWD URWP Area. This represents drinking water that would no longer be used for nonpotable uses, thus ensuring the highest quality water is reserved for potable uses. This potable offset reduces the need for new supplies to be developed to serve the study area, which is discussed above regarding the No Action Alternative (Section 6.1).

#### 6.4.1.5 Barriers to Recycled Water Use

The potential barriers for recycled water implementation under Alternative 3 are the same as Alternatives 1 and 2: public acceptance, water quality, and cost. In other parts of the San Francisco Bay Area, public concerns about the use of recycled water have included potential unknown health impacts, potential negative impact on property values, and citizen choice versus public mandate on infrastructure when recycled water systems were approved without sufficient public information. The Authority is continuing outreach activities to educate the public and potential users about recycled water use in order to help facilitate more effective implementation.

As described in Section 4.3, recycled water quality must be reviewed for potential chemical constituents related to agricultural irrigation, such as salinity, sodium, trace elements, excessive chlorine residual, and nutrients. Recycled water produced by the member agencies' WWTPs was compared to water quality guidelines for the use of recycled water by the US EPA, a 2006 study by the UC Division of Agriculture, and from the NBWA. Based on the data presented in Table 4-3, the member agencies' recycled water meets the water quality recommendations for agricultural application.

Cost is another potential barrier to recycled water use in the study area. Without recycled water, other water supplies would have to be developed, likely with similar

costs as the construction of a recycled water system. Outreach activities to educate the public and potential users about these avoided potable water development costs will help facilitate more effective implementation.

### 6.4.2 Costs

Table 6-19 summarizes the opinion of probable total project capital costs for Alternative 3 in 2008 dollars. O&M costs are estimated to be about \$3.1 million per year.

<b>Major Project Component</b>	<b>Cost (\$ millions)</b>
Pipelines	\$216.7
Treatment Improvements	\$85.2
Storage	\$90.7
Pumping	\$21.4
<b>Probable Total Project Capital Costs</b>	<b>\$414.0</b>

## 6.5 Alternative Implementation – Phase 1

Within the Alternatives described above, the Authority members have collectively prioritized the projects within their individual service areas to identify a phased implementation plan under any of the alternatives being considered. The first phase (Phase 1) of alternative implementation includes projects that each member agency has defined to a level of detail that allows both for project-level environmental review in other sections of the feasibility study, and short-term readiness for design, funding, and construction.

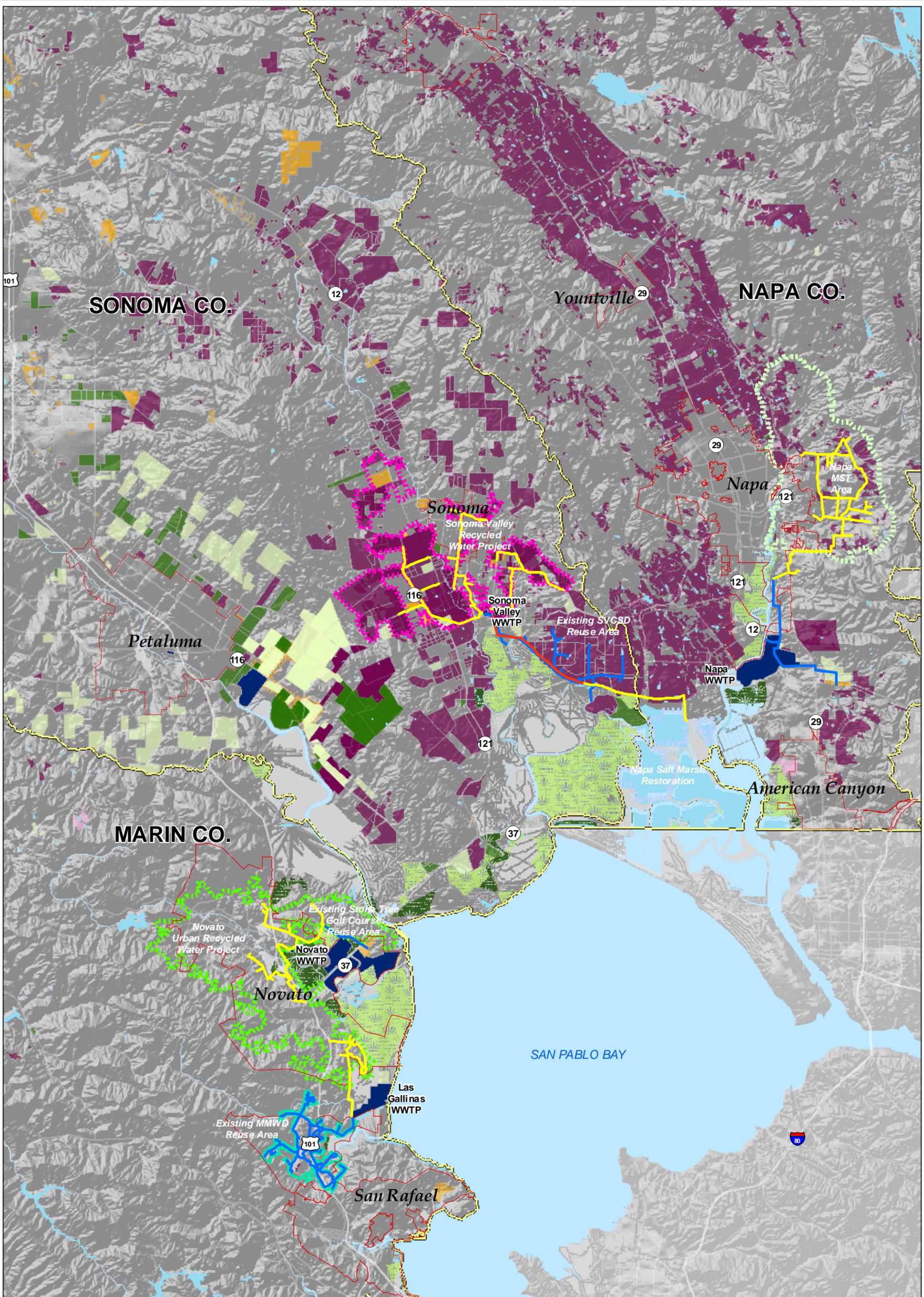
The modular nature of the design and construction of the primary project components (e.g., WWTP treatment improvements, pump stations, storage basins) results in the Phase 1 elements of larger components appearing similar under any alternative. Only the project pipelines installed under Phase 1 would need to be sized to anticipate the future full development of the preferred project alternative.

### 6.5.1 Description

This section describes the service area, projects, supply, demand, and infrastructure included in implementation Phase 1.

#### 6.5.1.1 Service Area and Projects

Figure 6-4 illustrates the anticipated construction components and delivery areas associated with implementation Phase 1 under any of Alternatives 1, 2, or 3. The defining features of Phase 1 are:



Basemap: U.S. Department of Agriculture, 2001  
 Land Use Data: California Department of Water Resources, 1999a and 1999b,  
 Napa Sanitation District 2005, SCWA 2001.  
 Boundaries are approximate and for study purposes only.

**Legend**

- Urban Growth Boundary
- Completed Restoration
- Planned Restoration
- WWTPs

- Irrigated Farm Property
- Golf Course, Cemetery, Parks, and Landscaping
- Vineyard
- Dairy, Pasture
- Orchard

- Local Project Pipelines (Increased Capacity)
- Local Project Pipelines
- New Project Pipeline
- Existing Pipeline



**Figure 6-4  
Phase 1**

- Each treatment plant would put first priority on the delivery of recycled water to its local projects. Local projects include the NMWD URWP, the Sonoma Valley Recycled Water Project, and the Napa MST areas.
- LGVSD would require either new or expanded treatment facilities to produce tertiary treated recycled water for unrestricted use, since the existing tertiary facility at the WWTP is currently operating at maximum capacity to meet existing MMWD user demands. Recycled water from LGVSD would be supplied to users at Hamilton Field, in the southern portion of the NMWD URWP Area. Existing available storage at the WWTP would be used, and one 0.5-MG drinking water reservoir near Hamilton Field would be rehabilitated for recycled water use.
- Novato SD would require either new or expanded treatment facilities to produce additional tertiary treated recycled water for unrestricted use. Recycled water from Novato SD would be supplied to users in the northern and central portions of the NMWD URWP Area, which includes the existing Stone Creek Golf Course. Existing available storage at the WWTP would be used, and one 0.5-MG drinking water reservoir in the northern portion of the NMWD URWP area would be rehabilitated for recycled water use.
- SVCSD would treat wastewater at its existing plant and distribute recycled water to local users within its existing SVCSD Reuse Area (in Carneros West) in addition to the Sonoma Valley Recycled Water Project and Napa Salt Marsh Restoration Areas. This alternative includes construction of a new recycled water storage pond near the SVCSD WWTP, and assumes potential user ponds in the Carneros West and Sonoma Valley Recycled Water Project Areas would also be used for recycled water storage prior to local use.
- Napa SD would treat wastewater at its existing reclamation facility and focus on delivering recycled water to the Napa MST Area. The increased delivery of recycled water for irrigation would help reduce groundwater pumping in the MST region. It is assumed that existing ponds at the WWTP would be reconfigured for recycled water storage and potential user ponds in the Napa MST Area would be used for recycled water storage prior to local use.

#### **6.5.1.2 Recycled Water Supply, Demand, and Discharge**

Table 6-20 summarizes the recycled water demand, supply, and discharge to San Pablo Bay for each treatment plant service area under implementation Phase 1 in 2020. Each of the WWTPs currently serves some recycled water customers. Table 6-20 presents this existing demand for each service area, the additional demand created by implementation Phase 1, and the total recycled water demand included in the Phase 1 use areas.

**Table 6-20**  
**Recycled Water Supply, Demand, and Discharge for Implementation Phase 1**

<b>WWTP Service Area</b>	<b>2020 WWTP Inflow (AFY)</b>	<b>Existing Recycled Water Demand (AFY)</b>	<b>New Recycled Water Demand (Beneficial Reuse) Developed for Implementation Phase 1 (AFY)</b>	<b>Total Recycled Water Demand in the Project Area (AFY)</b>	<b>Discharge to San Pablo Bay (AFY)</b>
LGVSD WWTP	3,670	902	202	1,104	2,566
Novato SD WWTP	8,677	270	542	812	7,865
SVCSD WWTP	5,508	1,174	1,972	3,146	2,362
Napa WWTP	9,800	2,598	1,937	4,535	5,265
<b>Total</b>	<b>27,655</b>	<b>4,944</b>	<b>4,653</b>	<b>9,597</b>	<b>18,058</b>

The Phase 1 demand shown in Table 6-20 represents recycled water use by customers (beneficial reuse). Urban landscaping uses would receive approximately 2,021 AF and agricultural uses would receive approximately 2,633 AF of recycled water. SVCSD and Napa SD could provide additional recycled water to the Napa Salt Marsh Restoration Area during non-peak irrigation periods. This area's demand was considered secondary to customer demands during the peak irrigation season. The Napa Salt Marsh Restoration Area may require up to 3,000 AFY during its maintenance period, depending upon the service agreement reached with CDFG. The total discharge to San Pablo Bay under Phase 1 (18,058 AFY) would be reduced by any deliveries of recycled water to the Napa Salt Marsh.

### 6.5.1.3 System Requirements

Table 6-21 summarizes the pipeline requirements for implementation Phase 1. Pipeline diameters, pipeline length by diameter supporting each full Alternative, and total pipeline length are presented.

**Table 6-21**  
**Summary of Pipeline Sizes and Lengths for Implementation Phase 1**

<b>Pipeline Diameter</b>	<b>Length (Miles) Under Alternative 1</b>	<b>Length (Miles) Under Alternative 2</b>	<b>Length (Miles) Under Alternative 3</b>
4"	4	4	3
6"	8	8	7
8"	12	12	12
10"	6	6	6
12"	9	9	9
14"	2	1	2
16"	2	2	4
18"	8	8	8
20"	0	1	1
24"	5	5	5
30"	0	0	0
36"	4	4	4
<b>Total</b>	<b>59</b>	<b>59</b>	<b>59</b>

Table 6-22 presents figures on treatment upgrades required for implementation Phase 1. All WWTPs currently have some tertiary treatment capability; however, all but SVCSD would need to increase their treatment capacity to meet Phase 1 demands.

<b>Facility</b>	<b>Tertiary Treatment Capacity without the Project (mgd)</b>	<b>Tertiary Treatment Capacity Required for Implementation Phase 1 (mgd)</b>	<b>Tertiary Treatment Capacity Increase (mgd)</b>
LGVSD	2.0	2.3	0.3
Novato SD	0.5	1.7	1.2
SVCSD	16.0	9.5	0.0
Napa SD	8.8	10.8	2.0
<b>Total</b>	<b>27.3</b>	<b>24.3</b>	<b>3.5</b>

Table 6-23 summarizes the existing and additional recycled water storage needs (i.e., the volume in excess of existing available storage), which would be required under implementation Phase 1. The local project areas being served separately by LGVSD and Novato SD would require less water during all months than would be treated at the two WWTPs; therefore, no storage of water would be required to accommodate peak month demands, only as necessary for operational interests and system pressure management. The local project areas being served by SVCSD and Napa SD would require more water during the peak summer months than each of the WWTPs is treating; additional water storage at the WWTPs, as anticipated by these Agencies' local project reports, would be required to accommodate peak month demands. SVCSD would require additional new storage at the WWTP, and Napa SD would need to modify existing water storage basins for recycled water system use. Individual landowner ponds would be used throughout the project areas to help offset the system storage required to serve users during peak-use periods.

<b>Type</b>	<b>Location</b>	<b>Volume (AF)</b>	<b>Comments</b>
WWTP Storage	LGVSD WWTP	0.0	
	Novato WWTP	0.0	
	SVCSD WWTP	195	Requires land purchase
	Napa WWTP	950	Existing storage ponds to be used
	<i>Total</i>	<i>1,145</i>	
System Storage Ponds	SVCSD Reuse Area	625	Existing storage ponds
	SVCSD Reuse Area	0	
	<i>Total</i>	<i>625</i>	
Reservoir Storage	Hamilton Field	1.5	Rehabilitated reservoir
	NMWD Project Areas	1.5	Rehabilitated reservoir
	Novato WWTP	0	
	Peacock Gap	0	
	<i>Total</i>	<i>3.0</i>	
<b>Total</b>		<b>1,773</b>	

Additional pump stations would be needed throughout the system for distribution and to boost pressures to higher pressure zones. The locations of these pump stations are summarized below in Table 6-24.

<b>Location (WWTP or Reuse Area)</b>	<b>Horsepower (HP)</b>	<b>Comments</b>
LGVSD WWTP	72	
Novato WWTP	259	
SVCSD WWTP	662	
Napa WWTP	636	New Pump
Napa WWTP	1,907	Existing Pumps
Carneros East	0	
Central Sonoma Valley	0	
Existing SVCSD Reuse Area (Carneros West)	0	New Pumps
Existing SVCSD Reuse Area (Carneros West)	218	Existing Pumps
Napa MST Area	244	
Peacock Gap	0	
Southern Sonoma Valley	0	
Sonoma Valley Recycled Water Project	96	
<b>Total</b>	<b>4,094</b>	

#### 6.5.1.4 Effect on Existing Water Supplies

Implementation Phase 1 provides 833 AF of Russian River water offset in the study area: 87 AF in the Sonoma Valley Recycled Water Project and 746 AF in the NMWD URWP Area. This represents drinking water that would no longer be used for non-potable uses, thus ensuring the highest quality water is reserved for potable uses. This potable offset reduces the need for new supplies to be developed to serve the study area, which is discussed above regarding the No Action Alternative (Section 6.1).

#### 6.5.2 Costs

Table 6-25 summarizes the opinion of probable total project capital costs for implementation Phase 1 in 2008 dollars. O&M costs are estimated to be about \$1.4 million per year.

<b>Major Project Component</b>	<b>Cost (\$ million) under Alternative 1</b>	<b>Cost (\$ million) under Alternative 2</b>	<b>Cost (\$ million) under Alternative 3</b>
Pipelines	\$89.3	\$90.0	\$92.4
Treatment Improvements	\$14.9	\$14.9	\$14.9
Storage	\$8.3	\$8.3	\$8.3
Pumping	\$8.5	\$8.5	\$8.5
<b>Probable Total Project Capital Costs</b>	<b>\$121.0</b>	<b>\$121.7</b>	<b>\$124.1</b>

# Section 7

## Legal and Institutional Requirements

Throughout development of the North San Pablo Bay Restoration and Reuse Project (Project), legal and institutional requirements have influenced the planning process. This section describes the Project's institutional framework, interactions with other agencies, and legal requirements. The Project's effects on the environment, study area economy, and water rights are also discussed.

### 7.1 Memorandum of Understanding

The Project participants agreed early in the planning process that they should operate within a jointly established, formal structure. They considered two ways to organize themselves: through a joint powers authority (JPA), or through a memorandum of understanding (MOU).

An MOU can be used to form an organization for any purpose within the authority of a member agency, and such an organization is easily formed through signature of the MOU contract by member agencies. Under an MOU, the signatory agencies can adopt an organizational structure that allows them to pursue a common purpose, but limits the entity formed by the MOU from contracting, incurring debt, or employing staff directly.

A JPA is a stronger organization structure than an MOU, serving as a coordinating tool for separate parties with common interests as defined under Government Code Section 6500 *et seq.* Parties administer the purpose and goals of the agreement through a range of powers, including but not limited to: entering into contracts; employing agents and employees; bond issuance; and acquiring, constructing, managing, or operating facilities. Authority available under a JPA is in addition to the power inherent in the individual member agencies.

#### 7.1.1 Formation Activities

The member agencies agreed that when the Project becomes operational, they may want to work together under a JPA, as the JPA entity would be able to undertake the actions necessary to implement this type of project. Establishing a JPA requires extensive legal and political discussion within each participating agency, however, and these discussions could take many months. The member agencies determined that an MOU could meet their organizational needs during the planning process by establishing a joint process and effective structure while not yet establishing a formal entity to implement the Project.

The member agencies discussed this issue at a series of workshops starting in Fall 2003. The MOU created the North Bay Water Reuse Authority (Authority) and was signed by the five member agencies (Sonoma County Water Agency, Napa Sanitation District, Sonoma Valley County Sanitation District, Novato Sanitary District, and Las Gallinas Valley Sanitary District) by August 24, 2005, and amended in January 2008.

### **7.1.2 Responsibilities**

The MOU establishes the Authority and outlines the purposes of this group, including exploring “the feasibility of coordinating interagency efforts to expand the beneficial use of recycled water in the North Bay Region thereby promoting the conservation of limited surface water and groundwater resources.”

The MOU created a “Coordination Committee,” consisting of one member of each signatory agency, to conduct the business of the Authority. The MOU also identifies that the MOU participants shall designate an “Administrative Agency,” currently the Sonoma County Water Agency (SCWA), to enter into contracts and perform administrative duties on behalf of the Authority. Members split the costs of any Authority actions with one half of the costs evenly divided among all signatories, and the other half divided in proportion to the agencies’ operating budgets (except for SCWA, which contributes five percent of its annual transmission system operating budget).

## **7.2 Agency Consultation Activities**

As part of the Title XVI process, the member agencies must consult with other Federal, state, and local agencies as required by laws and regulations. The member agencies have begun informal discussions with several of these agencies to keep them informed of the Project’s progress and to seek their assistance in moving the Project forward. The formal consultation process is largely related to the environmental documentation effort, and the member agencies will complete this consultation as part of the Environmental Impact Statement/Environmental Impact Report (EIS/EIR) process in 2008 and 2009. Formal consultation will include the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and the California Department of Fish and Game (CDFG) as required by the federal and state Endangered Species Acts, the Fish and Wildlife Conservation Act, and the Natural Community Conservation Planning Act.

The member agencies began communicating with local agencies during the Phase 1 feasibility study efforts and have continued to do so throughout Phases 2 and 3. An important local issue is that the Project may involve serving water to areas that are outside of the Project partners’ official boundaries. To address this institutional constraint, the member agencies initiated discussions with the Local Agency Formation Commissions to understand the process that the Project partners need to follow in order to deliver recycled water outside of statutory boundaries.

The Project would also involve the delivery of recycled water service to areas that are within the service areas of other water purveyors. Agency consultation efforts include reaching out to these purveyors, including the North Marin Water District (NMWD), Marin Municipal Water District (MMWD), and Los Carneros Water District (LCWD), both to keep them informed and to determine if they are interested in greater levels of participation in the Project. As discussed in Section 1, NMWD is contributing financial

and technical support to the Authority. MMWD declined to participate and LCWD is still considering joining the Authority.

## 7.3 Effects of Recycled Water Use

The Project would alter the disposition of recycled water by reducing discharge into the San Pablo Bay and its tributaries and instead providing increased recycled water supply to agricultural, urban, and environmental uses. This shift results in economic and environmental changes within the region. Environmental considerations of the alternatives are discussed in Section 10, and more detail will be available in the EIS/EIR currently under development. The costs and benefits of the Project are discussed in Section 9, Economic/Financial Analysis. The sections below briefly summarize the basis for each analysis.

### 7.3.1 Economic Effects

The Project's main economic benefit is associated with the increased reliability of water supply within the study area. The recycled water would increase the reliability of supplies for urban landscaping irrigation, agricultural irrigation, and restoration of the Napa Salt Marsh. Agricultural water supply would be primarily delivered for high-value vineyard production. Reliable water supplies for these uses are more cost efficient to purchase than intermittent supplies, so any project that increases the reliability of water supplies has real and quantifiable economic benefit to users.

An additional reliable water supply in the area would alleviate concerns that surround the potential of future drought conditions. During times of drought, or as area population increases, use of recycled water for irrigation of landscape and crops would help reduce demand on existing potable water supplies.

### 7.3.2 Environmental Effects

The Project would reduce discharges of treated wastewater effluent to San Pablo Bay and its tributaries by providing recycled water for use in landscape and agricultural irrigation and as an environmental water supply for the Napa Salt Marsh. As discussed in Section 4, the recycled water produced under this Project will meet Title 22 standards for unrestricted use. It is recognized, however, that some members of the public may have concerns about the use of recycled water on parks or other high-use public areas. Section 7.4 discusses some of the regulatory requirements currently in place for managing the design and operation of recycled water systems in order to safeguard the health and safety of the public and environment. The environmental analysis of alternatives in the EIS/EIR will analyze these impacts in more detail and will include recommended mitigation measures, as necessary.

Outreach to the public and to stakeholder groups, as a means of engaging them in understanding of the Project's alternatives and their relative merits, will be conducted as part of the Authority's general public outreach and the EIS/EIR process. Early public engagement of this type helps to build a solid foundation for public acceptance and endorsement in later phases of actual implementation.

The EIS/EIR will also include consideration of the other impacts associated with construction and operation of the pipelines, pump stations, and storage facilities included in each alternative.

### 7.3.3 Water Rights Effects

In many recycled water programs, decreased discharge of effluent to waterways has the potential to affect the water rights of downstream users. In this Project, however, there is little likelihood of such an impact, as the water downstream is generally brackish and there are no users of the water. Therefore, the Project will not affect water rights of downstream water users.

Some potential recipients of recycled water may be concerned that decreasing use of their existing surface water supplies may jeopardize their surface water rights. Legal investigation into this issue has shown, however, that shifting from surface water to recycled water will not create the potential to lose the initial surface water right.

California Water Code Section 1010 asserts that no claim of water right (riparian, pre-1914 appropriative, post-1914 appropriative) will be reduced or lost as a result of the use of recycled water. The use of recycled water in lieu of surface water is equivalent to maintaining that right and will be a beneficial use. Section 1010 states,

“(a)(1) The cessation of, or reduction in, the use of water under any existing right regardless of the basis of right, as the result of the use of recycled water, desalinated water, or water polluted by waste to a degree which unreasonably affects the water for other beneficial uses, is deemed equivalent to, and for purposes of maintaining any right shall be construed to constitute, a reasonable beneficial use of water to the extent and in the amount that the recycled, desalinated, or polluted water is being used not exceeding, however, the amount of such reduction.

(2) No lapse, reduction, or loss of any existing right shall occur under a cessation of, or reduction in, the use of water pursuant to this subdivision, and, to the extent and in the amount that recycled, desalinated, or polluted water is used in lieu of water appropriated by a permittee pursuant to Chapter 6 (commencing with Section 1375) of Part 2, the board shall not reduce the appropriation authorized in the user's permit.” (California Water Code §1010(a))

California Water Code Section 13551 establishes that potable water shall not be used for nonpotable uses if suitable recycled water is available. The use of recycled water constitutes beneficial use under any existing water right. Section 13551 states,

“A person or public agency, including a state agency, city, county, city and county, district, or any other political subdivision of the state, shall not use water from any source of quality suitable for potable domestic use for nonpotable uses, including cemeteries, golf courses, parks, highway

landscaped areas, and industrial and irrigation uses if suitable recycled water is available as provided in Section 13550; however, any use of recycled water in lieu of water suitable for potable domestic use shall, to the extent of the recycled water so used, be deemed to constitute a reasonable beneficial use of that water and the use of recycled water shall not cause any loss or diminution of any existing water right.” (California Water Code §13551)

## 7.4 Regulatory Requirements

Several State and Federal agencies have regulatory power over projects that affect water quality and sources of supply, and implementation of the Project will require coordination with such agencies, as well as with a number of county, city, municipal, and private agencies. Table 7-1 lists the federal, state, local, and private agencies that need to be contacted for permits or special coordination in order for the Project to progress. Federal and state regulatory requirements applicable to the Project are described following the table.

<b>Table 7-1 Jurisdictional and Stakeholder Agencies</b>	
<b>Agency Name</b>	<b>Permits or Special Coordination</b>
<b>Federal Agencies</b>	
US Bureau of Reclamation	Title XVI Funding for Recycled Water Project
US Army Corps of Engineers	Nationwide 12 and 18 Pre-construction Notification State Historic Preservation Office – Programmatic Agreement Section 404 of Clean Water Act Section 10 of Rivers and Harbor Act
USFWS	Section 7 Consultation – Endangered Species Act
NMFS	Endangered Species Act Consultation
<b>State Agencies</b>	
California Department of Public Health (DPH)	Title 22 – Recycled Water Regulations Drinking Water Monitoring and Regulations
California Environmental Protection Agency	Drinking Water Standards delegated to DPH
CDFG	Lake or Streambed Alteration Agreement
California Department of Transportation	Encroachment Permit
San Francisco Bay Regional Water Quality Control Board	401 Certification or Waiver Water Reclamation Permit Modification to Basin Plan
State Lands Commission	California Planning, Zoning, & Development Law
State Water Resources Control Board	Water Rights Permit Place of Use Approval

<b>Table 7-1                      Jurisdictional and Stakeholder Agencies</b>	
<b>Agency Name</b>	<b>Permits or Special Coordination</b>
<b>Local Agencies</b>	
Association of Bay Area Governments	Consistency Determination
Carneros Wine Alliance	Potential Users
City of Napa	Development Permit
City of Novato	Development Permit
City of San Rafael	Development Permit
City of Sonoma	Development Permit
Marin County	Grading/Riparian/Building Permits
Napa County	Encroachment Permit Grading/Riparian/Building Permits
Sonoma County	Encroachment Permit Grading/Riparian/Building Permits
Southern Sonoma County Resource Conservation District	Outreach Group for Potential Users
<b>Private Agencies</b>	
Pacific Gas & Electric	Infrastructure Review
Cable providers	Infrastructure Review
Telephone providers	Infrastructure Review
Railroad	Infrastructure Review

### 7.4.1 Title 22 California Code of Regulations

According to Title 22 of the California Code of Regulations (CCR), recycled water can be used for irrigation, wetlands, restricted and non-restricted recreational impoundments, landscape impoundments, industrial or commercial cooling or air conditioning, toilet flushing, and industrial and construction applications (22 CCR). As discussed in Section 4, all recycled water served by the Project will be treated to disinfected tertiary recycled water standards. Treatment to tertiary standards can be readily achieved using a variety of filtration and disinfection methods that are both reliable and relatively common to the wastewater treatment industry.

Title 22 also sets use requirements for the separation of areas irrigated with recycled water from domestic groundwater supply wells. The domestic well guidelines are as follows:

- 50 feet for disinfected tertiary recycled water unless additional conditions are met;
- 100 feet for impoundments of disinfected tertiary recycled water;
- 100 feet for irrigation or impoundments of disinfected secondary-2.2 or disinfected secondary-23 recycled water; and
- 150 feet for non-disinfected secondary recycled water (22 CCR).

Additional use requirements include the following:

- “Any irrigation runoff shall be confined to the recycled water use area, unless the runoff does not pose a public health threat and is authorized by the regulatory agency.”
- “Spray, mist, or runoff shall not enter dwellings, designated outdoor eating areas, or food handling facilities.”
- “Drinking water fountains shall be protected against contact with recycled water spray, mist, or runoff.”
- “No spray irrigation of any recycled water, other than disinfected tertiary recycled water, shall take place within 100 feet of a residence or a place where public exposure could be similar to that of a park, playground, or school yard.”
- “All use areas where recycled water is used that are accessible to the public shall be posted with signs that are visible to the public...that include the following wording: ‘RECYCLED WATER - DO NOT DRINK’.”
- “Except as allowed under section 7604 of Title 17, California Code of Regulations, no physical connection shall be made or allowed to exist between any recycled water system and any separate system conveying potable water.”
- “The portions of the recycled water piping system that are in areas subject to access by the general public shall not include any hose bibs. Only quick couplers that differ from those used on the potable water system shall be used on the portions of the recycled water piping system in areas subject to public access.” (22 CCR)

#### **7.4.2 California Fish & Game Code**

Sections 1601-1616 of the California Fish and Game Code (also known as the Lake or Streambed Alteration Agreement Program) refer to any projects that affect the flow, channel, or banks of rivers, streams, and lakes. Section 1602 states that public agencies and private individuals must notify the CDFG before construction begins for any projects that will have the following elements and effects:

- Divert, obstruct, or change the natural flow or the bed, channel, or bank of any river, stream, or lake designated by the department in which there is at any time an existing fish or wildlife resource or from which these resources derive benefit;
- Use material from the streambeds designated by the department;
- Result in the disposal or deposition of debris, waste, or other material containing crumbled, flaked, or ground pavement that can pass into any river, stream, or lake designated by the department; and

- An entity may not substantially divert or obstruct the natural flow of, or substantially change or use any material from the bed, channel, or bank of, any river, stream, or lake, or deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it may pass into any river, stream (CDFG 2003).

If any effects to waterways were determined during the environmental analysis phase, these Sections would require a streambed alteration agreement.

### **7.4.3 California Water Code**

Division 7 of the California Water Code is designated the Porter-Cologne Water Quality Control Act, which includes the permitting of wastewater treatment plants and water recycling facilities, as well as other water quality-related provisions. The Porter-Cologne Water Quality Control Act establishes the State Water Resources Control Board and each Regional Water Quality Control Board as the principal State agencies with primary responsibility for coordinating and controlling water quality and water rights in California. The Porter-Cologne Act is the primary implementation tool for California's responsibilities to regulate pollutant discharge as established under the Clean Water Act.

Division 7, Chapter 7.5 of the California Water Code, also known as the Water Recycling Act of 1991, recognizes the interest to develop water recycling facilities to supplement existing surface water and groundwater supplies in order to meet the State's future water needs. The Code authorizes each regional board, after consulting with and receiving recommendations from DPH, to set requirements which may be placed on the person reclaiming water, the user, or both, for water that will be used as recycled water. The Code establishes reporting and permitting requirements for the regional boards, which must work collaboratively with DPH. Additionally, it generally defines conditions under which recycled water may be used. The conditions for use include:

- If the source of recycled water is of adequate quality, which is determined by DPH criteria, and does not harm plants, wildlife, and the public health;
- If recycled water may be furnished at a reasonable cost to the user; and
- If the use of recycled water will not adversely affect water rights (DPH 2001).

Assembly Bill No. 1481, passed in October of 2007, added Section 13552.5 to the Water Code, requiring the state board to adopt a general permit for landscape irrigation uses of recycled water by July 31, 2009, for which DPH has established uniform statewide recycling criteria pursuant to Section 13521. The bill would require the state board to establish a reasonable schedule of fees to reimburse the state board for the costs it incurs in implementing, developing, and administering these provisions.

## 7.5 Other Obligations and Constraints

It is the intent of the member agencies that the Project would not adversely affect any of the agencies' contractual water supply obligations for recycled water. The agencies' existing recycled water customers would continue to be served as they are now and existing customers have been accounted for in the calculations of future recycled water supplies. Implementation of the Project would likely increase the reliability of drinking water supplies in the study area because recycled water would be provided to meet a portion of the nonpotable demand, thus freeing more potable supply for potable uses and emergency situations.

Indian Trust Assets (ITAs) are legal interests in property held in trust by the U.S. for federally-recognized Indian tribes or individual Indians. ITAs can include land, minerals, federally-reserved hunting and fishing rights, federally-reserved water rights, and in-stream flows associated with a reservation or rancheria. Beneficiaries of the Indian trust relationship are federally-recognized Indian tribes with trust land. There are no federal or state-recognized Indian reservations or rancherias in the study area. Indian lands and ITAs will be analyzed as appropriate in the environmental documentation.

# Section 8

## Recommended Alternative

This section presents a summary of the issues discussed to this point, a comparison of the alternatives, and a selection of the recommended alternative for the North San Pablo Bay Restoration and Reuse Project (Project).

### 8.1 Issue Summary

The Project provides a regional approach for the use of recycled water in the North San Pablo Bay area. This feasibility report describes the Project area, the key water management problems and needs within the Project area, identifies water reuse opportunities, and develops and analyzes alternative measures that could address the identified water management needs.

#### 8.1.1 Summary of Problems and Needs

The member agencies of the North Bay Water Reuse Authority (Authority) are conducting this feasibility study because they recognize the need to address mounting environmental, regulatory, and water supply concerns in their service areas and in the North San Pablo Bay area in general. The North San Pablo Bay is unique because of the mix of sensitive environmental areas, growing urban areas, and high-value agricultural areas. Each of these sectors is affected by existing water management needs and will be exposed to increasing water management challenges in the future.

The problems and needs include:

- The agricultural economy, dominated by high-value vineyard agriculture, requires a highly reliable water supply to maintain and expand its crop base.
- Urbanization of the greater San Francisco Bay Area requires highly reliable water sources.
- The vitally important estuarine ecosystem of the North San Pablo Bay area, which includes endangered species and vital wetlands, has been under intense pressure. Although protective and restorative measures are in place, the habitat requires a reliable supply of water.
- Surface waters are becoming less reliable sources of supply as they are already diverted by multiple users, have low flows in the summer (which coincides with the irrigation season), and can have low flows in dry years.
- Groundwater supplies are heavily pumped for agricultural and limited municipal uses and in some localities have marginal quality.

The participating agencies developed planning issues and concerns (see Figure 1-2) to define the reasons for undertaking the Study.

## 8.1.2 Summary of Supplies and Demands

Urban and agricultural land uses broadly constitute the primary water demands in the study area. Major urban land uses in the study area include residential, commercial, public land, open space (such as parks), and industrial designations. The major agricultural uses include vineyards, dairies, and pasture lands.

Table 8-1 summarizes the total water demand in the study area by demand sector in acre-feet per year (AFY)<sup>1</sup>. Urban demands are derived from municipal planning documents. Agricultural demands are derived from land use acreage data and crop specific water demand rates. Section 2.2.1 describes each of the demand sectors in greater detail.

<b>Demand Sector</b>	<b>2005 (AFY)</b>	<b>2020 (AFY)</b>
Urban <sup>(1)</sup>	63,668	72,764
Agriculture <sup>(2)</sup>	23,283	23,283
Environmental <sup>(3)</sup>	NQ	NQ
<b>Total Demand</b>	<b>86,951</b>	<b>96,047</b>

<sup>(1)</sup> See Section 2.2.1.1 Table 2-5 for details. Data for the Petaluma area has been removed from the urban demand data since Petaluma is no longer participating in the Project.

<sup>(2)</sup> Represents estimated maximum agricultural water use, assumes no change in future agricultural water use. Data for the Petaluma area has been removed from the agriculture demand data since Petaluma is no longer participating in the Project.

<sup>(3)</sup> NQ = Not quantifiable. Current and future environmental demands are not quantifiable at this time.

The study area receives water from sources both inside and outside the region. Water sources within the region include the Napa River watershed, Petaluma River watershed, and Sonoma Creek watershed (used for agricultural supplies), and Stafford Lake on Novato Creek. Surface water sources outside the region include the Russian River Project (including Lake Mendocino, Lake Sonoma, and imports from the Eel River via Pacific Gas & Electric Company's Potter Valley Project), Lake Hennessey, Milliken Reservoir, Marin Municipal Water District's six Lagunitas Creek watershed reservoirs, Soulajule Reservoir, and the Sacramento-San Joaquin Delta via the State Water Project. The region also relies on groundwater and some existing recycled water as additional sources. Table 8-2 summarizes the total water supply in the study area by source<sup>2</sup>. Section 2.2.2 contains more information about current and future water supplies from these sources.

<sup>1</sup> Data for the City of Petaluma is not included in Table 8-1.

<sup>2</sup> Data for the City of Petaluma is not included in Table 8-2.

<b>Supply Source</b>	<b>2005 (AFY)</b>	<b>2020 (AFY)</b>
Surface Water <sup>(1)</sup>	139,277	138,617
Groundwater <sup>(2)</sup>	6,585	1,234
Recycled Water <sup>(3)</sup>	7,278	11,252
<b>Total Supply</b>	<b>159,457</b>	<b>154,733</b>

<sup>(1)</sup> Surface water supply data represents the reliable (dry year) supply. See Section 2.2.2.1, Table 2-13 for details.

<sup>(2)</sup> See Section 2.2.2.2, Table 2-15 for details. Values do not include agricultural pumping in Sonoma Valley, which has not been quantified. Data for the Petaluma area has been removed from since Petaluma is no longer participating in the Project.

<sup>(3)</sup> See Section 2.2.2.3, Table 2-17 for details. Values include all recycled water use, which exceeds the demands of current recycled water customers. Data for the Petaluma area has been removed since Petaluma is no longer participating in the Project.

In most years, adequate supplies exist to meet demands on an annual basis. Supplies are strained on a seasonal basis, e.g., surface water flows are lowest in the summer when demand is highest. Future urban growth will likely exacerbate this situation, and the additional sources of water supply to meet future demands are limited. Because of the obstacles to increasing the capacity of existing supplies, the identification and development of new supplies will likely be required to meet future yearly and/or seasonal demands. There are a number of local and regional alternatives identified for regional water supply to primarily municipal and industrial users in Marin, Sonoma, and Napa Counties. However, few alternatives have been formulated in the study area to directly serve the demands that would be met by the Project.

## 8.2 Comparison of Alternatives

The feasibility study evaluates the three action alternatives, plus a phased implementation of each action alternative, and the No Action alternative.

The No Action Alternative assumes that there is no joint Project. It represents the reasonably foreseeable actions taken by the members of the Authority, and other agencies involved in the study area's water supply, to supply users in absence of the Project. The potential need to develop additional potable water supplies, and limit demand on existing potable supplies, would continue to be a regional challenge. Additional wastewater treatment capacity and water recycling might occur strictly from the implementation of local plans for expansion. It is anticipated that the implementation of several of these projects would be required to meet the needs of the Project area. This alternative is discussed in greater detail in Section 6.1.

Alternative 1 would prioritize the importance of recycled water projects local to each wastewater treatment plant (WWTP) and would not attempt to connect any of the WWTPs. This basic regional alternative would be the least expensive alternative, but would ultimately produce less recycled water than larger alternatives. The recycled

water projects included in Alternative 1 are the North Marin Water District (NMWD) Urban Recycled Water Project (including the Stone Tree Golf Course), existing Sonoma Valley County Sanitation District (SVCSD) reuse area, Sonoma Valley Recycled Water Project, Carneros East, Milliken-Sarco-Tulocay (MST) Area, and the Napa Salt Marsh Restoration Project. This alternative is discussed in greater detail in Section 6.2.

Alternative 2 would create a larger regional system and expand the area served in Alternative 1. Pipelines would connect the east side facilities (Napa Sanitation District and SVCSD) and the west side facilities (Las Gallinas Valley Sanitary District [LGVSD] and Novato Sanitary District [Novato SD]), but the two sides would not be connected. The recycled water projects included in Alternative 2 are Peacock Gap Golf Course, NMWD Urban Recycled Water Project (URWP), Sears Point, existing SVCSD reuse area, Sonoma Valley Recycled Water Project, Southern Sonoma Valley, Carneros East, MST Area, and Napa Salt Marsh Restoration Project. This alternative is discussed in greater detail in Section 6.3.

Alternative 3 would create an interconnected regional system that links all four wastewater treatment facilities. This alternative would maximize reuse by potentially allowing water from any plant to be delivered to any area that needs recycled water. Because much of the demand is near Sonoma and Napa, this interconnectivity would allow all of the Project WWTPs to help satisfy the demands in these areas. The recycled water projects included in Alternative 3 are Peacock Gap Golf Course, NMWD URWP, Sears Point, existing SVCSD reuse area, Sonoma Valley Recycled Water Project, Southern Sonoma Valley, Central Sonoma Valley, Carneros East, MST Area, and Napa Salt Marsh Restoration Project. This alternative is discussed in greater detail in Section 6.4.

The Authority member agencies have prioritized the projects within their individual service areas to identify a phased implementation plan for each of the alternatives. This first phase (Phase 1) includes projects that each member agency has defined to a level of detail that allows for both project-level environmental review and short-term readiness for design, funding, and construction. The recycled water projects included in Phase 1 of Alternative 1 are the NMWD URWP, existing SVCSD reuse area, Sonoma Valley Recycled Water Project, MST Area, and the Napa Salt Marsh Restoration Project. This phase of implementation is discussed in greater detail in Section 6.5.

Table 8-3 summarizes the proposed strategy, demand, wastewater discharge, cost, benefits, and challenges of the No Action alternative and the three action alternatives. Comparing the alternatives illustrates the following tradeoffs:

- Alternative 1 would minimize costs, but would also enable reuse of the least amount of recycled water of the action alternatives.

- Alternative 2 would provide a middle ground of costs, recycled water use, and environmental benefits and impacts; however, costs would be 80 percent more than Alternative 1.
- Alternative 3 would maximize use of recycled water, but would have the highest costs (almost twice as much as Alternative 1 and 10 percent more than Alternative 2).
- Alternative 3 would have the greatest environmental benefits associated with reduced treated wastewater discharge to the Bay and increased instream flows; however, it may have increased environmental impacts associated with construction of a greater amount of storage and more pipelines and associated facilities.
- Alternative 3 would maximize regional flexibility by interconnecting all WWTPs and would require substantial cooperation and flexibility between the member agencies to work together to direct supplies.

Based on the analysis presented, the Authority believes Alternative 1 is the most viable based on implementability, storage issues, and costs.

- Alternative 1 requires the least amount of system storage of the action alternatives, making use of existing storage or land available at the WWTPs. Implementing the larger recycled water distribution systems would require 1,400 to 1,800 AF of additional storage.
- Alternative 1 has the lowest capital cost of the alternatives. The cost of delivering recycled water must be cost effective for the member agencies to implement any alternative. Larger alternatives may be too costly (in terms of construction and environmental documentation) for the agencies to pursue at this time without additional external funding.
- At this time, implementation of Alternative 1 would begin with the projects identified as implementation Phase 1 (see Section 6.5), due to current funding opportunities. These projects have been recognized as those most ready for implementation due to the level of detailed analysis already prepared.

Section 9 presents more detail regarding the cost effectiveness of the Project, the economic analysis of the non-recycled water supply options, and the financial capability of the member agencies to implement the Project.

Table 8-3  
Summary of Alternatives

Alternative	New Recycled Water Demand (Beneficial Reuse) Developed by the Alternative (AFY) <sup>(1)</sup>	Total Recycled Water Demand in the Project Area (w/Project) (AFY)	Wastewater Discharged to San Pablo Bay (AFY)	New Storage Required (AF)	New Potable Water Offset (AFY)	Opinion of Probable Total Project Capital Costs (millions) <sup>(2)</sup>	Benefits/Drawbacks
No Action	0	4,944	22,711	<100 <sup>(3)</sup>	0	\$270 <sup>(4)</sup>	<p>Benefits:</p> <ul style="list-style-type: none"> <li>Requires minimum regional agency coordination.</li> </ul> <p>Drawbacks:</p> <ul style="list-style-type: none"> <li>Reduces the likelihood of Federal or state funding opportunities</li> <li>Requires additional, expensive potable water projects to supply the demand served by the Project.</li> <li>May lead to increased degradation of groundwater quality and groundwater levels.</li> </ul>
1 – Basic Regional System	6,455	11,329	16,256	2,598	893	\$210	<p>Benefits:</p> <ul style="list-style-type: none"> <li>Least costly alternative.</li> <li>Maximizes use of existing and easily developed storage locations.</li> <li>Allows for greatest potential Federal and state funding opportunities for all Project stakeholders, compared to No Action Alternative.</li> <li>Reduces need to develop new potable supplies.</li> </ul> <p>Drawbacks:</p> <ul style="list-style-type: none"> <li>Utilizes no recycled water from the high supply area of LGVSD/Novato</li> <li>SD in the high demand area of Sonoma/Napa.</li> </ul>
2 – Expanded Regional System	11,215	16,159	11,496	4,004	1,085	\$378	<p>Benefits:</p> <ul style="list-style-type: none"> <li>Allows for greater volume of recycled water use, compared to Alternative 1.</li> <li>Allows for greater cost sharing opportunities by all Project stakeholders, compared to No Action Alternative.</li> </ul> <p>Drawbacks:</p> <ul style="list-style-type: none"> <li>Requires new large storage locations to be identified.</li> </ul>
3 – Interconnected Regional System	12,725	17,669	9,986	4,441	1,085	\$414	<p>Benefits:</p> <ul style="list-style-type: none"> <li>Allows for maximum volume of recycled water use.</li> <li>Allows for greater cost sharing opportunities by all Project stakeholders, compared to No Action Alternative.</li> </ul> <p>Drawbacks:</p> <ul style="list-style-type: none"> <li>Requires new storage locations, larger than Alternative 2, to be identified.</li> <li>Most costly alternative.</li> </ul>

<sup>(1)</sup> The new recycled water demand developed by the alternatives represents total beneficial reuse to customers. Additional recycled water is available for the Napa Salt Marsh restoration which is not included in these totals, as the amount of water needed for the Napa Salt Marsh is unknown at this time. Supplying recycled water to the Napa Salt Marsh would further reduce discharge to San Pablo Bay.

<sup>(2)</sup> The Opinion of Probable Total Project Capital Costs include construction costs (pipelines, treatment improvements, storage, pumping) plus a 20% contingency, 15% allowance, and 25% allowance for non-contract costs. The allowance for non-contract costs includes: preliminary and final design engineering, preparation of construction plans and specifications (11%); construction services including construction management, construction inspection, engineering support during construction, construction surveying, start-up services, and as-built drawings (13%); and project administration and legal support (1%).

<sup>(3)</sup> Additional elevated storage tanks are anticipated to be required within the potable water system for storage and to sustain system pressure.

<sup>(4)</sup> Capital costs are estimated to be a minimum of \$270 million. See Section 6.1 for more information.



# Section 9

## Economic and Financial Capability Analysis

The purposes of the economic and financial capability analysis are to determine whether the North San Pablo Bay Restoration and Reuse Project (Project) is cost-effective and would provide net economic benefits to the North Bay Water Reuse Authority (Authority) region, and to identify a preliminary funding plan for the local cost share of the Project. The economic and financial capability analysis is prepared according to the U.S. Department of the Interior Bureau of Reclamation (Reclamation) Title XVI Water Reclamation and Reuse Program Feasibility Study Directives and Standards WTR 11-01 (Reclamation 2008). This section presents three analyses for the Project:

- Life Cycle Cost Analysis - enables comparison of the three recycled water Project action alternatives to determine the most cost-effective alternative. The life cycle costs analysis calculates annual capital costs of implementation Phase 1 of Alternatives 1, 2, and 3 over a 50-year period of analysis using a 3 percent real discount rate and adds annual operations and maintenance (O&M) costs.
- Economic Analysis - evaluates the economic benefits of Phase 1 of Alternative 1 relative to the No Action Alternative. Water supply benefits are calculated using the alternative cost method in which the benefits of the least cost alternative would be the costs of the next least cost alternative. The economic analysis discusses environmental and other indirect benefits qualitatively.
- Financial Capability Analysis - discusses preliminary plans to fund implementation Phase 1, including non-Federal cost sharing and funding options.

The above analyses focus on Phase 1 of the alternatives because the Authority members have identified these components as the most ready for funding and construction. The Authority members are only requesting federal cost-sharing for Phase 1 at this time, and the above analyses are required to support federal decision-making for Phase 1 funding. The remaining components in the alternatives are planned for longer-term, phased implementation.

### 9.1 Life Cycle Cost Analysis

This section presents the life cycle costs for Phase 1 of Alternatives 1, 2, and 3. Section 6 describes features and total construction and O&M costs of the three alternatives (see Sections 6.2, 6.3, and 6.4). Section 6.5 includes detail on implementation of Phase 1. The Authority members have selected Phase 1 of Alternative 1 as the recommended Title XVI project for implementation (see Section 8.2). Phase 1 of Alternatives 2 and 3 would deliver a similar amount of water as Phase 1 of Alternative 1, but would be sized slightly larger to accommodate added deliveries in the future (i.e., full implementation of Alternative 2 or 3).

Table 9-1 summarizes total, annual, and per acre-foot costs of Phase 1 of Alternatives 1, 2, and 3, along with the supply (in acre-feet [AF]) provided by each alternative’s Phase 1. Life cycle costs are calculated over a 50-year period of analysis using a 3 percent real discount rate. All Phase 1 facilities are expected to have a service life of at least 50 years with proper maintenance; costs incurred after 50 years would be significantly discounted and were not considered in this analysis. Use of a real (inflation-adjusted) discount rate alleviates the need to project future cost levels.

Phase 1 of Alternative 1 would provide water at \$1,307 per acre-foot, which is slightly lower relative to the per unit costs for Phase 1 of Alternatives 2 and 3. The life cycle and per acre-foot costs for Phase 1 of Alternative 1 (hereafter referred to simply as “Phase 1”) will be compared to other non-recycling projects in Section 9.2.1 to determine its cost-effectiveness for providing agricultural and urban water supplies in the region.

	<b>Alternative 1</b>	<b>Alternative 2</b>	<b>Alternative 3</b>
	<b>Phase 1</b>	<b>Phase 1</b>	<b>Phase 1</b>
Total Capital Costs	\$121,000,000	\$121,600,000	\$124,000,000
Annual Capital Costs	\$4,702,725	\$4,726,044	\$4,819,321
Annual O&M Costs	\$1,381,000	\$1,383,000	\$1,392,000
Total Annual Costs	\$6,083,725	\$6,109,044	\$6,211,321
Supply (AF)	4,654	4,654	4,654
<b>\$ per acre-foot</b>	<b>\$1,307</b>	<b>\$1,313</b>	<b>\$1,335</b>

## 9.2 Economic Analysis

The economic analysis estimates benefits of the Project relative to future conditions if the Project were not implemented. It is expected that the Project would result in direct benefits to urban and agricultural water supply and environmental quality.

The Project’s water supply benefits would occur by providing recycled water for urban landscape and agricultural uses, thus relieving demand pressure on future developable potable water supplies. The Project would also provide high quality water to the Napa Salt Marsh to sustain habitat for many species, including threatened and endangered species. This improved habitat would be an environmental water supply benefit of the Project.

Water supply benefits are measured by comparing the Project costs (Table 9-1) to the costs of a feasible non-recycling project that would provide similar water supplies to the member agencies’ service areas (these potential projects are described in Section 6.1). If Project costs are less than the non-recycled water supply, the Project would be considered cost-effective and provide a net economic water supply benefit to the region. Use of alternative costs to compute water supply benefits is a technique

frequently used in evaluating federally developed water supplies, and it is recommended in Reclamation's Directives and Standards WTR 11-01 for economic analysis of Title XVI projects (Reclamation 2008).

The Project would also result in various indirect benefits to the study area, including water quality improvements, increased groundwater levels, and operational cost reductions. These indirect benefits are described qualitatively in Section 9.2.2.

### **9.2.1 Water Supply Benefits**

Phase 1 is expected to provide about 4,654 AF of water for urban landscape and agricultural customers during peak demands. Urban landscape would receive approximately 2,021 AF of recycled water and agricultural users would receive about 2,634 AF, with 90 percent of the recycled water going to vineyards. During non-peak periods, Sonoma Valley County Sanitation District (SVCSD) could potentially provide up to 2,362 AF of recycled water to the Napa Salt Marsh during its maintenance operations. The amount of water required at the Napa Salt Marsh still needs to be coordinated between SVCSD and appropriate regulatory agencies. Water deliveries are further described in Section 6. The following analysis estimates the economic benefits of the recycled water supply.

As indicated above, this analysis uses costs of developing and operating non-recycled water supplies to measure water supply benefits of the Project. Section 6.1 describes alternative non-recycled water projects under the No Action Alternative. Because of the various counties and jurisdictions involved in the Project, several non-recycling projects were identified to serve users in the study area. These projects are briefly described below; Section 6.1 contains more detailed descriptions.

Similar to the Project costs, the costs of the non-recycling water supply projects are discounted over a 50-year period of analysis using a real interest rate of 3 percent. Costs are then converted to a dollar per acre-foot based on the quantity of water the non-recycling project is expected to provide. At this time, all costs for the non-recycling water supply projects are preliminary. This section presents all costs in 2008 dollars.

After dollar per acre-foot costs are identified for the non-recycling water supply projects, they are compared to the dollar per acre-foot costs of the Project. The least cost project would be the most cost effective.

#### **9.2.1.1 Water Supply, Transmission, and Reliability Project**

The Sonoma County Water Agency (SCWA) is proposing the Water Supply, Transmission, and Reliability Project (Water Project) to increase potable water supplies to Valley of the Moon Water District (VOMWD), City of Sonoma (Sonoma), and North Marin Water District (NMWD) in the study area. The project proposes to release and use additional water currently stored in Lake Sonoma, and divert and re-divert the water from the Russian River. The proposed Water Project would also

expand the existing transmission system and includes a conservation component. The project is currently in the environmental review stage.

The proposed Water Project is projected to provide an additional 26,000 AF per year (AFY) of Russian River water to the SCWA contractors. VOMWD, Sonoma, and NMWD would receive water supply from the Water Project. Table 9-2 shows the 2005-2006 Russian River water deliveries and the projected deliveries under the Water Project to VOMWD, Sonoma, and NMWD.

<b>Service Area</b>	<b>Delivered Water 2005-06 (AFY)</b>	<b>Water Project Annual Delivery Limit (AFY)</b>	<b>Projected Increase in Annual Water Supply (AFY)</b>
NMWD	10,706	13,000	2,294
VOMWD	3,101	3,730	629
Sonoma	2,310	3,000	690
<b>Total</b>	<b>16,117</b>	<b>19,730</b>	<b>3,613</b>

SCWA estimates that the total capital costs of the Water Project are about \$647 million (2008 dollars) (Booker 2008b). Operation and maintenance costs have not yet been estimated. SCWA contractors would share the total costs of the project; therefore, VOMWD, Sonoma, and NMWD would be responsible for a portion of the Water Project costs. SCWA has not yet completed the cost sharing for the Water Project; however, if costs are apportioned based on 2005-2006 water deliveries, NMWD, VOMWD, and Sonoma would be responsible for about \$174.5 million in capital costs.<sup>1</sup> Table 9-3 summarizes NMWD, VOMWD, and Sonoma's capital, present value, and per acre-foot costs for the proposed Water Project. Operation and maintenance costs, which are not yet estimated, would add annually to the project costs.

Total Capital Costs	\$174,479,487
Annual Capital Costs <sup>(1)</sup>	\$6,781,232
Annual O&M Costs	N/A
Total Annual Costs	\$6,781,232
Supply (AF)	3,613
<b>\$ per acre-foot</b>	<b>\$1,877</b>

<sup>(1)</sup> The capital costs were discounted based on a 50-year period of analysis using a 3 percent real discount rate.

<sup>1</sup> The costs are preliminary and subject to change, and were developed solely for comparison to recycled water costs.

The Water Project would deliver water to Sonoma, VOMWD, and NMWD, which would then need to deliver the water to customers at additional costs for a complete comparison to Phase 1 project costs. For example, NMWD's treatment, distribution and delivery cost is about \$1,000 per acre-foot, which would be in addition to NMWD's portion of Water Project costs for a new water supply (McIntyre 2008). This analysis recognizes that these additional costs exist, but does not add them to the Water Project costs because the Water Project costs are preliminary and not disaggregated by retail district. Also, because the \$1,877 per acre-foot cost for the Water Project is already higher than the Project costs, local treatment and delivery costs were not necessary to show the cost effectiveness of the Project.

### **9.2.1.2 Groundwater Recharge in Sonoma Valley**

Without the Project, agricultural users in Sonoma Valley would continue to rely on groundwater and small surface diversions for irrigation. As described in Section 2.2.2.2, groundwater would not be a sustainable supply in the future if current pumping patterns continue.

To prevent further reductions in groundwater storage, SCWA is investigating potential groundwater recharge projects. Groundwater banking would require an imported water source and recharge facilities, either percolation ponds or injection wells. Stormwater and rainfall recharge would require a collection system and recharge facilities. These projects would serve agricultural water users in Sonoma Valley.

Costs have not yet been developed for these projects. The analysis assumes the Water Project costs would be indicative of these costs because it would serve other users in the same region of Sonoma County. However, the proposed Water Project is not planned to serve agricultural users in Sonoma Valley.

### **9.2.1.3 Import Water to the Milliken-Sarco-Tulocay Creeks Area**

This project would serve potable water and agricultural users in the Milliken-Sarco-Tulocay Creeks (MST) area of Napa County who currently rely on groundwater. The groundwater levels in the MST area are decreasing and groundwater would not likely be a reliable supply in the future (see Section 2.2.2.2.1). There are no other usable local water supplies for the MST area; therefore, importing water appears to be the only alternative to supply users who would be served by the Project. For the alternative cost analysis, the non-recycled water supply project would bring imported water to the MST area for potable water users. These imported water supplies would likely be wheeled through the State Water Project's North Bay Aqueduct (NBA), which would need to be expanded to accommodate new water supplies.

Costs for this project would include costs for water purchases, the distribution system, and expansion of the NBA. This analysis assumes that Napa County would import 1,937 AF to serve the MST area, which is the same amount of recycled water the Project would provide to MST under Phase 1. Long-term water supply is assumed

to cost about \$9.7 million, a new distribution system about \$40 million (Riesenberg 2008), and the NBA expansion to accommodate Napa's water supply about \$38 million.<sup>2</sup> Napa County also assumes legal and administrative fees to implement this alternative would be about \$8 million. Therefore, total costs would be about \$95.7 million, which does not include annual operating and maintenance costs. Section 6.1.2 further describes these features and potential costs. Table 9-4 summarizes the assumed total, annualized, and per acre-foot costs to import potable water to the MST area. The costs to import about 1,937 AF of water to the MST area would be about \$1,920 per acre-foot.

Total Capital Costs	\$95,700,000
Annual Capital Costs <sup>(1)</sup>	\$3,719,428
Annual O&M Costs	N/A
Total Annual Costs	\$3,719,428
Supply (AF)	1,937
<b>Dollar per acre-foot</b>	<b>\$1,920</b>

<sup>(1)</sup> The capital costs were discounted based on a 50-year period of analysis using a 3 percent real discount rate.

#### 9.2.1.4 Summary Cost Comparison

This section compares the Project costs with the non-recycling project costs to determine the cost-effectiveness of the Project. Table 9-5 summarizes the life cycle costs and per acre-foot costs of the Project and non-recycling water supply projects. The table also presents the annual quantity of water delivered under each water supply option.

The Project would cost \$1,307 per acre-foot to serve about 4,654 AF to agricultural and urban users in the study area and to the Napa Salt Marsh. Preliminary costs for the Water Project indicate that it would be more expensive than the Project to serve urban users in Sonoma Valley and NMWD, about \$1,877 per acre-foot. The Water Project would not serve agriculture in the Sonoma Valley, but this analysis assumes the Water Project's costs are indicative of delivering a new water supply to the region. Planning cost estimates for importing water to the MST area are about \$1,920 per acre-foot, which is also more expensive than the Project costs to provide the same amount of water to the MST area. No water supply projects have been planned for specific water deliveries to the Napa Salt Marsh, so alternative costs have not been included as a quantitative measure of benefits in this report. However, costs of both the Water Project and importing water to Napa County are indicative of the high costs of developing environmental water supplies in the study area.

<sup>2</sup> Costs are preliminary and for planning purposes only.

	<b>Alternative 1 Phase 1</b>	<b>Water Project (Sonoma and Marin Counties Portion of Project area)</b>	<b>Import Water to MST Area (Napa County portion of Project area)</b>
Annual Capital Costs	\$4,702,725	\$6,781,232	\$3,719,428
Annual O&M Costs	\$1,381,000	N/A	N/A
Total Annual Costs	\$6,083,725	\$6,781,232	\$3,719,428
Supply (AF)	4,654	3,613	1,937
<b>Dollar per acre-foot</b>	\$1,307	\$1,877	\$1,920

Based on the cost estimates in Table 9-5, the Project would be the most cost-effective to implement relative to other water supply projects in the region. The benefits of Phase 1 Alternative 1 would be the alternative costs, which are \$1,877 per acre-foot for Sonoma and Marin County users and \$1,920 per acre-foot for Napa County users. Recycled water would also provide an important offset to potable water use that could then be delivered to meet potable water needs. The economic benefits of this offset would be even larger during a dry year or drought conditions.

### 9.2.2 Other Project Benefits

The Project would serve environmental needs of the Napa Salt Marsh. The Project would also result in various indirect benefits to the Authority's region, including water quality improvements, increased groundwater levels, and operational cost reductions. These benefits are described qualitatively and would add to the economic justification for pursuing a recycled water project.

Groundwater basins close to the San Francisco Bay, including those in Sonoma and Napa Counties, have areas of high total dissolved solids, largely from saline intrusion from the Bay. Saline groundwater is unusable for either urban drinking water needs or for irrigating crops and threatens the long-term sustainability of the basin. The Project would offset groundwater pumping by delivering recycled water to agricultural and urban users that currently rely on groundwater. Decreasing groundwater pumping would increase groundwater storage and potentially decrease saline migration in the basin.

In addition to improving groundwater quality, the Project could potentially improve the long-term sustainability of the basin by reducing groundwater overdraft. The Project would provide a consistent annual source of recycled water to agricultural and urban users. This water source could offset groundwater pumping each year and the basin would benefit from an increased amount of from natural recharge. Increasing groundwater storage would also reduce groundwater pumping costs and may

prevent expenses for well deepening or replacement. These groundwater quality and groundwater storage improvements would be indirect benefits of the Project.

Providing a water use for the treated wastewater would decrease discharges into North San Pablo Bay and would reduce operation costs of the sanitation districts during the no-discharge period. For example, Las Gallinas Valley Sanitary District (LGVSD) currently pumps unused effluent to pasture fields. LGVSD estimates that the average annual cost to pump effluent to the pasture lands from June 1 to October 31 is about \$11,000 (Moore 2008). By delivering recycled water to the Project area, LGVSD would not incur these costs. Napa Sanitation District (Napa SD) and Novato Sanitary District (Novato SD) have similar practices and would also avoid these operations costs if the Project were implemented.

### **9.3 Financial Capability Analysis**

The following section presents information on the financial status of the four participating wastewater districts, provides a preliminary cost allocation of Phase 1 construction and operation costs among the United States and the districts, and describes potential ways the districts may fund and repay their respective share of costs. A final cost-sharing plan and a more thorough analysis of financial capability will be developed before a construction funding agreement with the United States is executed. It is anticipated that construction will begin in late 2009.

This section focuses on the four participating wastewater districts (LGVSD, Novato SD, SVCSD, and Napa SD), although as subsequently addressed, local potable water supply agencies may provide cost-sharing assistance, and formation of a single regional cost-sharing entity may be pursued in the future. To the extent either of these possibilities is reflected in the final cost-sharing plan, supplemental financial information will be developed.

#### **9.3.1 Financial Status of the Districts**

Table 9-6 displays selected financial data extracted from the most recent audited district financial statements, dated June 30, 2007. This information is provided for background purposes and general comparison to the costs to be incurred for Phase 1.

For all districts, the largest component of asset value is their existing capital assets, mainly the wastewater collection, treatment, and disposal systems. Capital assets range from 76 percent to 86 percent of total assets, depending on the district. All districts had recently completed capital improvements and/or had construction in progress as of June 30, 2007. The remaining asset values for all districts primarily consist of cash, cash equivalents, and investments.

**Table 9-6**  
**Selected Financial Parameters, by District, as of June 30, 2007**

<b>Item</b>	<b>LGVS D</b>	<b>Novato SD</b>	<b>SVCSD</b>	<b>Napa SD</b>
Total Assets	\$47,593,657	\$140,917,038	\$79,916,179	\$169,473,959
--Capital Assets	\$39,964,402	\$106,973,161	\$69,090,776	\$145,408,177
Total Liabilities	\$10,534,333	\$32,854,805	\$18,199,241	\$41,976,582
--Long-Term Debt	\$9,655,000	\$30,152,853	\$15,770,713	\$39,644,965
Unrestricted Net Assets	\$3,863,632	\$31,022,492	\$5,025,850	\$9,161,483
Revenues	\$5,305,423	\$12,808,228	\$9,666,975	\$14,925,426
--Sewer Service Fees	\$3,937,800	\$9,573,338	\$8,234,343	12,003,390
Expenses	\$5,108,164	\$8,724,100	\$7,798,020	\$14,360,596

Source: LGVS D 2007; Novato SD 2007; SVCSD 2007; Napa SD 2007b.

Long-term debt comprises between 86 and 95 percent of total liabilities. The long-term debt of LGVS D and SVCSD consists almost entirely of revenue bonds issued to develop their wastewater facilities. The long-term debt of Novato SD reflects a revolving line of credit which was drawn on to begin their Wastewater Facilities Upgrade Project; the district intends to roll this debt into a loan from the State Revolving Fund. Napa SD's largest long-term debts are 1998 Certificates of Participation and a 1993 loan from the Water Reuse Association.

As of June 30, 2007, the financial statements of all districts except Novato SD reflected unrestricted net assets between 5 percent and 8 percent of total asset value. Unrestricted net assets are those assets in excess of liabilities which can be utilized to pay for operating expenses and capital improvements. Novato SD unrestricted net assets were 22 percent of total asset value. The large percentage of unrestricted net assets for Novato SD on June 30, 2007, represented cash advances from their line of credit that were subsequently expended on the Wastewater Facilities Upgrade Project.

Customer sewer service fees represent the largest revenue source for all districts, between 74 and 85 percent. Most of the additional operating revenues for LGVS D and Novato SD were property tax receipts; SVCSD reported insignificant property tax revenues and Napa SD did not report any. Most of Napa SD's revenues aside from sewer charges were connection fees to developers. Most of SVCSD's revenues aside from sewer charges were investment earnings.

Although not separately disclosed in Table 9-6, the major operating expenses for all districts were salaries and benefits, materials and supplies, and depreciation.

### 9.3.2 Preliminary Cost Allocation and Federal Cost-Share

Table 9-7 displays a preliminary allocation of Phase 1 facility construction costs among the four participating wastewater districts. Each facility included in the Phase 1 cost estimate relates solely to one of the districts; therefore, there was no need to allocate costs of any single facility among the districts.

It is expected that the Federal cost-share on Phase 1 will be \$25 million. In December of 2007, the U.S. House of Representatives passed the North Bay Water Reuse Program Act (HR236), and identical legislation is currently under consideration by the U.S. Senate (S1472). The legislation specifies that the authorized appropriation for Federal share of the total cost of Phase 1 shall not exceed 25 percent of the total cost or \$25 million, whichever is less. Since the Project cost currently exceeds \$100 million, the federal share would be \$25 million.

Table 9-7 shows the federal and non-federal cost share tentatively allocated among the four wastewater agencies in proportion to their respective total project cost. The table shows each agency's preliminary portion of the Project infrastructure costs, including pump stations, storage, and pipelines. Contingencies were added based on Reclamation's cost estimating guidance. For this preliminary allocation, LGVSD would be responsible for \$6.3 million, Novato SD would pay \$15.9 million, SCVSD would pay \$44.6 million, and Napa SD would pay \$29.2 million after the federal funding share is allocated.

Table 9-8 displays the allocation of estimated annual O&M expenses among the four districts. Total O&M for each of four facility categories (distribution pipelines, pump stations storage, and WWTP treatment upgrades) was allocated to each district in the same proportion as each district's construction cost displayed in Table 9-7. In accordance with the legislation, no Federal cost-sharing is provided for O&M expenses.

**Table 9-7  
Summary of Construction Costs by Member Agency for Phase 1 of Alternative 1 <sup>(1)</sup>**

Agency	Distribution Pipelines	Pump Stations	Storage	WWTP Upgrades	Subtotal	Plus Allowances and Contingencies (15%+20%)	Total Field Cost	Plus Non-Contract Costs (25%)	Total Construction Costs	Less Federal Share	Non-Federal Share
<b>LGVSD</b>	\$3,274,977	\$376,481	\$183,100	\$871,847	\$4,706,000	\$1,647,000	\$6,353,000	\$1,588,000	<b>\$7,941,000</b>	\$1,641,000	<b>\$6,300,000</b>
<b>Novato SD</b>	\$7,750,539	\$910,844	\$205,072	\$3,009,840	\$11,876,295	\$4,157,000	\$16,033,000	\$4,008,000	<b>\$20,041,000</b>	\$4,141,000	<b>\$15,900,000</b>
<b>SVCSD</b>	\$26,447,492	\$2,334,173	\$4,529,655	\$0	\$33,311,319	\$11,659,000	\$44,970,000	\$11,243,000	<b>\$56,213,000</b>	\$11,614,000	<b>\$44,599,000</b>
<b>Napa SD</b>	\$15,449,334	\$1,399,230	\$0	\$4,962,239	\$21,810,803	\$7,634,000	\$29,445,000	\$7,361,000	<b>\$36,806,000</b>	\$7,605,000	<b>\$29,201,000</b>
<b>Total</b>	\$52,922,342	\$5,020,728	\$4,917,827	\$8,843,925	\$71,704,417	\$25,097,000	\$96,801,000	\$24,200,000	<b>\$121,000,000</b>	\$25,000,000	<b>\$96,000,000</b>

<sup>(1)</sup> Total values may not add correctly due to rounding.

**Table 9-8**  
**Summary of Local Projects for Phase 1 of Alternative 1 - Annual O&M Costs by District (May 2008)**

<b>Agency</b>	<b>Distribution Pipelines</b>	<b>Pump Stations</b>	<b>Storage</b>	<b>WWTP Upgrades</b>	<b>Total O&amp;M Costs</b>	<b>Total O&amp;M Costs (rounded)</b>
<b>LGVSD</b>	\$20,483	\$24,502	\$1,154	\$68,218	\$114,358	<b>\$114,000</b>
<b>Novato SD</b>	\$48,475	\$59,280	\$1,293	\$235,507	\$344,555	<b>\$345,000</b>
<b>SVCSD</b>	\$165,414	\$151,913	\$28,553	\$0	\$345,880	<b>\$346,000</b>
<b>Napa SD</b>	\$96,627	\$91,065	\$0	\$388,274	\$575,966	<b>\$576,000</b>
<b>Total</b>	\$331,000	\$326,759	\$31,000	\$692,000	\$1,380,759	<b>\$1,381,000</b>

### 9.3.3 Preliminary Non-Federal Funding Plan

A firm plan for funding the non-Federal share of Phase 1 construction costs has not yet been developed among the four wastewater districts and their potential partners. A complete, detailed financial capability analysis will be provided to Reclamation prior to construction, in advance of the federal cost share. A potential partner for sharing in costs allocated to LGVSD and Novato SD is NMWD. Costs allocated to SVCSD could be shared by SCWA, the City of Sonoma, and VOMWD. Napa SD costs may be shared by Napa County. The wastewater districts are currently working with these partners to develop a funding plan. Preliminary discussions among these entities have included the possibility of forming a single regional authority to fund and administer the project.

There are several possible funding sources being considered by the wastewater districts and potable water agencies for their nonfederal share of construction costs. Some level of cash contribution from district reserves could be made, although this would likely be a low percentage of the total required. Various state or local grants are currently being sought. In addition, loans may be taken, notably in the form of Certificates of Participation or the State Revolving Fund, which have been used by some districts for past projects. Finally, any construction funds not covered by district reserves, grants, or loans will probably be raised through issuance of revenue bonds. It is likely that the final funding plan will include some combination of the above measures.

It is expected that any debt instruments (loans and bonds) acquired to fund construction would be repaid primarily through user fees, both for wastewater service and for recycled water supply deliveries. It is possible that rates for all users in the wastewater and water agencies, not just the users receiving the recycled water supply, could be raised for debt service of this project. In addition, tax assessments could be used to retire project debt, although assessments are not now a large portion of district revenues. The annual O&M expenses for Phase 1 will probably be collected in the same manner as the annual debt service.

### *Willingness to Pay*

Although formal resolutions to pay for their share of the construction costs will not be made by the wastewater districts and their local partners until the cost-sharing plan is finalized prior to construction, all entities support the Project. The Memorandum of Understanding (MOU) to create the Authority, the legislative collaboration on HR236 and S1472, and the local funding for the feasibility analyses are all indicative of continuing Project support by the wastewater districts and their partners.

## **9.4 Summary and Conclusions**

The economic analysis evaluated the water supply, environmental, and indirect benefits of the Project. Water supply benefits are based on alternative costs of a non-recycling water supply for the region. Napa, Sonoma, and Marin Counties have limited water supply alternatives available to meet future water demands. The few alternatives that exist would be more expensive to implement than the Project. The economic analysis estimated that the Project would cost about \$1,307 per acre-foot and would have benefits between \$1,877 and \$1,920 per acre-foot. The Project would also provide a water supply to the Napa Salt Marsh to help restore its tidal wetlands and would offset groundwater pumping to improve groundwater conditions in the Napa and Sonoma Valley basins. The economic analysis concludes that the Project would result in net benefits to the region.

The Authority members have not developed a firm financing plan for the Project. The federal share of funding is expected to be \$25 million. Preliminary discussions have indicated Authority members would finance the local share through State and local grants, if available, and loans and revenue bonds. Loans and bonds would be repaid primarily through user fees, both for wastewater service and for recycled water supply deliveries. Through signing the MOU, completing this feasibility study, and developing an environmental impact statement/environmental impact report, the Authority members have shown a commitment in implementing the Project. A final cost-sharing plan and a more thorough analysis of financial capability will be developed before a construction funding agreement with the United States is executed.

# Section 10

## Environmental Considerations and Potential Effects

This section provides an overview of anticipated potential environmental effects from the North San Pablo Bay Restoration and Reuse Project (Project). Anticipated regulatory requirements and compliance measures are also discussed. As noted in Sections 8 and 9, Alternative 1 is the recommended alternative; therefore, the following discussion focuses on the impacts related to that alternative. For comparative purposes and where appropriate, a discussion of impacts related to each alternative is also provided. Detailed environmental analysis will be completed and available in the Environmental Impact Statement/Environmental Impact Report (EIS/EIR) currently under development.

### 10.1 Potential Environmental Effects

Potential environmental impacts from the Project are anticipated to occur during construction and operation. Construction would involve activities such as site preparation, grading, excavation, and site restoration and would have short-term, temporary impacts. The activities, and thus the extent of impact for each alternative, would vary with the project components (e.g., treatment upgrades, pipelines, storage facilities, and pump stations). Project operation would involve supply of recycled water for urban and agricultural irrigation. A brief discussion of the nature of anticipated construction and operational impacts is provided below. Section 10.2 provides a discussion of potential impacts for each of the issue areas identified in the Reclamation Manual, Standards and Directives, Section 4.B.7, Environmental Considerations and Potential Effects (Reclamation 2008).

#### 10.1.1 Project Construction

Project construction impacts will be consistent with those of any construction project and are anticipated to include short-term impacts to hydrology and water quality, biological resources, cultural resources, land use and agriculture, traffic and transportation, air quality, noise, utilities, and temporary access to recreational facilities. Because the proposed facilities would mostly lie on existing wastewater treatment plant (WWTP) sites (e.g., pump stations and storage facilities) or along roadways (e.g., pipelines), the impacts are anticipated to be minimal.

#### 10.1.2 Project Operation

Project operation would include the distribution and use of recycled water for urban, agricultural, and environmental uses. The Project would be consistent with the state, regional, and local policies that encourage recycled water use. The recycled water would be treated at a level stipulated under California Code of Regulations (CCR) Title 22 requirements and will be protective of the environment and public health. Section 4.1 describes California recycled water use regulations. Overall, the Project

will increase recycled water use thereby offsetting potable water use and reducing the amount of treated wastewater released into San Pablo Bay and its tributaries.

## 10.2 Endangered and Threatened Species

Based on a review of California Natural Diversity Database, U.S. Fish and Wildlife Service (USFWS) species lists, relevant scientific literature, and field reconnaissance surveys, state or federally listed species are known to occur or may occur in the project area based on suitability of habitat and range of occurrence. However, field reconnaissance of proposed facilities indicates that the potential for sensitive species habitat to occur on existing treatment plant facilities or pipeline routes within existing roadways is low.

Pipeline routes that are located along potential sensitive species habitat, such as that of the clapper rail and salt marsh harvest mouse, occurring in the Napa Salt Marsh and in the Peacock Gap Golf Course area would have greater potential to directly or indirectly affect sensitive species habitat. Any impacts to California clapper rail and California black rail would be minimized by avoiding work near salt marsh habitat during the breeding season for these two species. Mitigation measures will be established to avoid or minimize direct and indirect impacts on special-status species that have the potential to occur within the project area. Impacts to the salt marsh harvest mouse would be minimized by avoidance and establishment of barriers. Direct impacts to salt marsh habitats that cannot be avoided may require restoration or compensatory mitigation.

Rare plants with the potential to occur within the project area may be found in grassland, vernal pools, woodland, coastal salt marsh, chaparral and scrub habitats. Potential impacts to special-status plant species would be minimized through pre-construction surveys to clear pipeline disturbance areas, avoidance where feasible, and restoration as appropriate. Compensatory mitigation may be required for those locations where impacts cannot be avoided.

Impacts to fish species and California freshwater shrimp would be minimized by using trenchless technology at stream crossings to avoid direct impacts to waters of the United States. Certain impacts may be minimized by restricting work on a seasonal basis. For instance, impacts to conservancy fairy shrimp and vernal pool fairy shrimp could be minimized by scheduling any project activities in the summer months when seasonal wetlands and vernal pools are dry. Impacts to state and federally listed species and locations of potential habitat will be addressed in the Biological Assessment for the proposed project, and consultation with USFWS and California Department of Fish and Game (CDFG), as appropriate.

### 10.2.1 Alternative 1

Implementation of Alternative 1 would include construction of 83 miles of pipeline, the majority of which would be located within existing roadways. Additionally, treatment plant upgrades of 7.0 million gallons per day of tertiary capacity, 4,553 horsepower in pump stations, and 2,598 acre-feet of storage would be implemented.

The majority of these improvements would be onsite at existing treatment plants, or at sites that have been examined in previous EIRs. Pipeline installation would include crossing of approximately 83 jurisdictional features, with pipeline installation using trenchless technology. Portions of the pipeline not occurring within existing roadways present a higher potential for impacts to special status plants, wetlands, and certain wildlife species. Approximately 10 miles of pipeline are located outside of roadways, or are located along areas considered sensitive, and may require some level of mitigation previously discussed (avoidance, minimization, scheduling, pre-construction clearance, compensation). These reaches are described below:

- Milliken-Sarco-Tulocay Creeks (MST) Service Area: A 0.7-mile portion adjacent to Napa State Hospital passes through annual grassland, seasonal wetland, ruderal and a hardwood woodland fragment. Species that have the potential to occur only in the Napa MST Service Area include giant garter snake and valley elderberry longhorn beetle.
- Carneros East Service Area: The pipeline route follows paved roads except for the crossing of the Napa River and wetlands east and west of the river.
- Napa Salt Marsh Service Area: The pipeline follows a levee for approximately 2.3 miles, with brackish marsh on both sides of the levee. Adjacent habitat has the potential to support California black rail, California clapper rail, western snowy plover, and salt marsh harvest mouse.
- Existing Sonoma Valley County Sanitation District reuse area: The pipeline route follows railroad tracks for the majority of the route, and crosses agricultural land for a portion.
- North Marin Water District Urban Recycled Water Project Service Area: A 0.6-mile portion follows railroad tracks; 2.2 miles are off-road through agricultural fields; a 280-foot section follows a paved path through oak woodland with scattered oaks and an understory of annual grasses; and a 0.9-mile portion is off-road, 0.75 miles of which crosses freshwater and brackish marsh, until it ends at the Petaluma River. This portion of the pipeline has nine stream crossings.
- Sonoma Valley Recycled Water Project: An approximately one-mile portion of the route is off-road and is situated within riparian corridor of Arroyo Seco. An approximately two-mile portion is off-road and crosses annual grassland and agricultural fields as well as three streams. This portion of the pipeline has 24 stream crossings.
- Southern Sonoma Valley Service Area: The route follows a paved road and runs parallel to Champlin Creek.

## 10.2.2 Alternative 2

Alternative 2 would include construction of 140 miles of pipeline, as well as treatment, pumping and storage improvements on or adjacent to treatment facilities. Pipeline installation would include approximately 49 additional jurisdictional features compared to Alternative 1, for a total of 132 crossings. Pipeline installation would use trenchless technology to avoid or minimize impacts to jurisdictional features and sensitive habitat. Portions of the pipeline not occurring within existing roadways present a higher potential for impacts to special status plants, wetlands and certain wildlife species. Compared to Alternative 1, Alternative 2 has approximately 7 additional miles of pipeline that are located outside of existing roadways or adjacent to areas considered sensitive. Therefore, Alternative 2 has approximately 17 miles of pipeline that may require some level of mitigation previously discussed (avoidance, minimization, scheduling, pre-construction clearance, compensation). These reaches are described below:

- Peacock Gap Service Area: A portion of the pipeline gap pipeline runs through China Camp State Park along North San Pablo Avenue. Salt marsh adjacent to this portion of the route has the potential for salt marsh harvest mouse, California black rail, and California clapper rail to occur.
- Novato Service Area: A 1.5-mile portion of the pipeline follows a path/levee with freshwater wetlands on both sides. Another section of the route follows a levee for three miles and is adjacent to water treatment ponds, and salt marsh habitat (for a portion of these three miles) with the potential for California black rail, California clapper rail and salt marsh harvest mouse to occur. A 0.3-mile section passes off-road through ruderal and annual grassland habitat; and a 0.5-mile section runs adjacent to a pond within Beverly Ehreth Ecological Reserve and through a patch of scattered oaks with an understory of annual grasses.
- Sears Point Service Area: The majority of the pipeline route follows paved roads with agriculture (predominately grazed) being the dominant adjacent habitat. There are two off-road portions of the route: a 1-mile portion of it is also off-road and crosses Petaluma River as well as the associated brackish marsh habitat north of the river, and 0.8 miles of the route follows railroad tracks with crop fields adjacent.
- Southern Sonoma Valley Service Area: The majority of the pipeline follows paved roads while the off-road portion is approximately 1.1 miles in length and runs adjacent to a row of eucalyptus, several vineyards, and an oak woodland patch.

## 10.2.3 Alternative 3

Alternative 3 would include the 140 miles of pipeline described in Alternative 2 as well as an additional 15 miles of pipeline, for a total of 155 miles of pipeline. Treatment, pumping, and storage improvements would also be implemented at treatment facilities. Pipeline installation would include crossing of approximately 21 additional jurisdictional features compared to Alternative 2, for a total of 153

crossings. Pipeline installation would use trenchless technology to avoid or minimize impacts to jurisdictional features and sensitive habitat. Portions of the pipeline not occurring within existing roadways present a higher potential for impacts to special status plants, wetlands and certain wildlife species. Compared to Alternative 2, Alternative 3 has approximately 6 additional miles of pipeline that are located outside of existing roadways or are adjacent to areas considered sensitive. Therefore, Alternative 3 has approximately 23 miles of pipeline that may require some level of mitigation previously discussed (avoidance, minimization, scheduling, pre-construction clearance, compensation). These reaches are described below:

- Carneros East Service Area: Includes 1.7 miles of pipeline that are off-road. As currently mapped, this portion is situated within the riparian corridor of Suscol Creek and adjacent habitat outside of the riparian habitat is annual grassland.
- Sears Point Service Area: A 1.1-mile portion follows railroad tracks through agricultural fields while the remaining 1.5-mile portion follows paved road adjacent to the Napa-Sonoma marshes, which have the potential to support special status rail species and salt marsh harvest mouse.
- Central Sonoma Valley Service Area: Within Central Sonoma Valley's western portion of the Project pipelines, a portion approximately one mile in length is off-road and crosses through an annual grassland. Within Central Sonoma Valley's eastern portion of the pipeline approximately one mile is off-road through dense mixed hardwood woodland.

### 10.3 Public Health and Safety

Project construction would increase vehicular and truck traffic in the project area. Short-term air emissions and increase in noise levels would occur in and around the construction corridors. Construction activities would involve use of hazardous materials during construction; however implementation of best management practices (BMPs) related to fueling, vehicle washing and handling, use, and storage of chemicals would minimize any risk to either workers or the public. Project implementation would incrementally increase the use of chemicals commonly used the treatment of wastewater. All treatment chemicals would be handled and stored in compliance with federal, state and local requirements.

As noted in Section 4.1 and 4.3, the use of recycled water is highly regulated in California by CCR Title 22. Project operation would include distribution and use of recycled water for urban, agricultural, and environmental uses. The project would be consistent with the state, regional, and local policies that encourage recycled water use. The recycled water would be treated at a level stipulated under Title 22 requirements and will be protective of the environment and public health.

### 10.4 Regulated Waters

Based on database review and field reconnaissance surveys, pipelines would cross jurisdictional stream features and would occur adjacent to potentially

jurisdictional agricultural ponds, freshwater marshes, seasonal wetlands and brackish marshes. As previously noted in Section 10.2, Alternative 1 is anticipated to cross 83 jurisdictional features; Alternative 2 is anticipated to cross an additional 49 jurisdictional features, for a total of 132 crossings; and Alternative 3 is anticipated to cross an additional 21 jurisdictional features, for a total of 153 crossings.

It is anticipated that stream crossings would use trenchless technology to avoid direct impacts to waters of the United States.; therefore, it is anticipated that these impacts would be largely avoided or minimized. By constraining work to the right-of-way of existing roadways, whenever possible, most wetland and pond features would be avoided. Depending on the methods used, pipeline crossings of streams and wetlands may be subject to the Clean Water Act, including the acquisition of appropriate US Army Corps of Engineers and Regional Water Quality Control Board permits, and USFWS consultation as appropriate. Additionally, permits will be required by CDFG for all stream crossings, regardless of crossing method.

## 10.5 Cultural Resources

Based on previous survey efforts, initial current field reconnaissance, and a database review at the Northwest Information Center of the California Historical Resources Information System at Sonoma State University, 142 cultural resources are known to occur in within the Area of Sensitivity Assessment (ASA) for Alternatives 1, 2, and 3 of the project. The ASA includes the Areas of Direct Impact (pipeline segments and other areas of ground-disturbance) with an additional 500 feet from pipeline centerline or treatment plant fence line. The ASA is useful for determining areas of archaeological sensitivity within the project area. The Area of Potential Effect (APE) will be used for impact analysis, and includes all areas of ground-disturbing activity within 25 feet from centerline to account for potential staging areas and spoil piles.

Cultural resources in the ASA are comprised of prehistoric archaeological sites (including but not limited to concentrations of obsidian and chert flaked-stone tools [e.g., projectile points, knives, scrapers] or toolmaking debris; culturally darkened soil ["midden"] containing heat-affected rocks, artifacts, or shellfish remains; stone milling equipment [e.g., mortars, pestles, handstones, or milling slabs]; and battered stone tools, such as hammerstones and pitted stones), historic-period archaeological resources (including but not limited to stone walls; filled wells or privies; deposits of metal, glass, and/or ceramic refuse; and out-of-use transportation features such as railroad berms and roads), and historic-period architectural/structural properties (standing structures, bridges, and in-use railroads or other transportation features). In general, the nature of this project will not have an adverse impact on architectural resources with the exception of some structural features such as bridges. Structural properties such as bridges will be addressed appropriately. A clear statement for no adverse impact to architectural properties that exist adjacent to the project alignment will be included in the EIS. A Phase I Cultural Resources Report will be prepared to support Section 106 Consultation. For comparison purposes, a breakdown of the number of sites identified within the ASA, which provides 500 foot buffer, is provided

below. It should be noted that the potential for Project facilities to directly impact the majority of these sites is considered low.

### **10.5.1 Alternative 1**

Forty-eight cultural resources have been recorded within the ASA for Alternative 1. Twenty-one of these resources are located within the APE. These resources include ten prehistoric sites (lithic concentrations, shellmounds, and a basalt quarry), two historic-period artifact deposits, a stone-lined ditch, a railroad, two historic-period railroad grades, a stone wall, and four small stream-crossing bridges.

### **10.5.2 Alternative 2**

An additional 67 cultural resources have been recorded within the ASA for Alternative 2 compared to Alternative 1, resulting in a total of 115 sites within the Alternative 2 ASA. These resources have not yet been quantified, but include both prehistoric and historic-period archaeological sites as well as architectural/structural properties. It appears that 28 of these resources were recorded within the APE for Alternative 2 (exact locations have not yet been verified). These resources include prehistoric shellmounds and lithic concentrations some with burials, bedrock milling stations, two bridges, a historic-period railroad, and a dam.

### **10.5.3 Alternative 3**

An additional 27 cultural resources have been recorded within the ASA for Alternative 3 when compared to Alternative 2, resulting in a total of 142 sites within the Alternative 3 ASA. These resources have not yet been quantified, but include both prehistoric and historic-period archaeological sites as well as architectural/structural properties. Eleven of these resources have been recorded within proximity of the APE for Alternative 3 (exact locations have not yet been verified). Resource types include shellmounds, lithic scatters, and bedrock milling stations; a stone wall; a foundation and dam; and a historic-period railroad grade.

Avoidance of existing cultural resource sites would be the first strategy in Project implementation. The Project is not anticipated to affect historic properties given the likely locations of Project facilities (existing WWTP sites for facilities and roadway rights-of-way for pipelines); however, Project construction activities such as excavation may cause inadvertent discovery of unknown or unrecorded cultural resources. In the event of such accidental discovery, the Project will comply with applicable regulations and implement mitigation measures such as stopping work, creating a buffer area around the discovery, and contacting an archaeologist or a cultural resource expert.

## **10.6 Significant Environmental Effects**

It is anticipated that potentially significant environmental effects will be identified for all of the alternatives identified, primarily relating to construction impacts associated with facility installation. Issue areas where significant short term impacts and corresponding mitigation relating to construction are anticipated include: geology

and soils, water resources, cultural resources, biological resources, land use, aesthetics, traffic, hazardous materials, noise, public services and utilities. It is also anticipated that mitigation measures, including avoidance, minimization, implementation of BMPs, are available to reduce these potentially significant environmental effects to a less than significant level.

Long-term operational impacts will relate to the long-term treatment, distribution, and use of recycled water for irrigation within the service area. These impacts would include increased pumping and corresponding electrical demand for distribution, and increased chemical use at WWTPs for treatment. Additional potential impacts to surface and groundwater quality due to salt loading could also be related to project implementation; however, as noted in Section 4.3, water quality has been reviewed and is appropriate for agricultural uses.

## 10.7 Unique or Undefined Environmental Risks

Unique or undefined environmental risks of the Project include the potential for spread of pathogens that infect woody plants, during the course of construction of pipeline routes. This is common to all construction projects that are located within areas currently infested with these types of pathogens, which include *Phytophthora cinnamomi* and Sudden Oak Death. The pipeline route within the Peacock Gap Golf Course Area, for Alternative 2, includes 6.6 miles of pipeline. A portion of the pipeline runs through China Camp State Park along North San Pablo Avenue. The pipeline route crosses through China Camp along a dirt road through mixed hardwood habitat, dominated by coast live oak, madrone, toyon (*Heteromeles arbutifolia*), bay (*Umbellularia californica*) and mazanita (*Arctostaphylos* sp.). Habitat adjacent to this portion of the pipeline is currently infested with *Phytophthora cinnamomi*, a soil-borne fungal pathogen that infects woody plants. Steps will need to be taken to minimize the projects contribution to the spread of this pathogen.

## 10.8 Status of Compliance Measures or Other Available Information

A combined EIS/EIR is being prepared to comply with the California Environmental Quality Act and the National Environmental Policy Act. It is anticipated that the Project would be required to comply with Sections 401 and 404 of the Clean Water Act for potential discharges to the waters of the U.S., California Department of Health recycled water requirements (Title 22), Section 7 of the Endangered Species Act, Section 106 of the National Historic Preservation Act, the National Pollutant Discharge Elimination System requirements, and the CDFG Code. Encroachment permits will also be obtained from local and state agencies as applicable. Other regulatory requirements are discussed in Section 7.4.

Two EIR/EIS documents were previously prepared for components of the Project: the 2003 Napa River Salt Marsh Restoration Project EIR/EIS and the 2006 Sonoma Valley Recycled Water Project EIR. These will be incorporated by reference in the Project's EIR/EIS.

## 10.9 Regional Water Supply and Water Quality

In terms of hydrology, water quality, and hazardous materials impacts, implementation of BMPs would minimize any potential impacts to receiving waters and groundwater. Typical BMPs include scheduling or limiting activities to certain times of the year based on hydrologic considerations, installing sediment barriers such as silt fence and fiber rolls, and maintaining equipment and vehicles used for construction in good condition.

The Project would provide an increased recycled water supply to urban, agricultural, and environmental uses in the study area. The recycled water would increase the reliability of supplies for both urban landscaping irrigation and agricultural irrigation. This reliable water supply would alleviate concerns that surround the potential of future drought conditions. During times of drought, or as area population increases, use of recycled water for irrigation of landscape and crops would help reduce demand on existing potable water supplies and save that potable water for municipal users.

As described in Section 7.3, the Project would reduce treated wastewater discharge into the San Pablo Bay and its tributaries. The recycled water produced by the member agencies will meet Title 22 standards for unrestricted use. Sections 4.1 and 7.4 discuss some of the regulatory requirements currently in place for managing the design and operation of recycled water systems in order to safeguard the health and safety of the public and environment. The environmental analysis of alternatives in the EIS/EIR will analyze these impacts in more detail and will include recommended mitigation measures, as necessary.

## 10.10 Public Involvement

As described in Section 1.5.3, the member agencies initiated public outreach efforts during early phases of the feasibility study report process to collect grower and end user information at a broad scale within each member agencies' service area. Outreach meetings were conducted which identified potential Project participants, discussed grower concerns and needs, reviewed land use mapping for accuracy, and discussed projected future changes in the agricultural industry within each service area. The outreach efforts are developing agricultural reuse contacts and working towards securing commitments to use recycled water. As Project activities carry on, potential users will continue to be invited to periodically attend Authority meetings and review information distributed by the Authority. Recent public outreach efforts include a series of stakeholder meetings to introduce the Project to the interested stakeholders, and development of the Authority's Project website, to provide information to public on the Authority and the status of the Title XVI feasibility study process. An additional round of public outreach meetings will occur during the scoping phase of the EIS/EIR development.

## 10.11 Historical Properties

Because the alignments would be placed underground mostly along existing roads, no buildings or structures are anticipated to be affected by proposed Project facilities, directly or indirectly. Proposed improvements at treatment plants, including treatment and pump stations, are not anticipated to affect historical properties. However, recycled pipeline construction within the City of Sonoma has the potential to affect historical resources within the City Center. The APEs for individual facilities associated with the pipeline (e.g., operational storage reservoir, capacity storage reservoir, booster pump station, and distribution pump station) would be limited to the physical effects of the construction. Any auditory or visual impacts posed by facilities to historic properties will be assessed on a site-by-site basis as part of the Cultural Resources Phase I Report.

# Section 11

## Research Needs

The North San Pablo Bay Restoration and Reuse Project (Project) will not require additional research to proceed with planning, design, construction, and implementation. The Project will use proven tertiary treatment technologies and conventional system components, which are in use for other recycled water projects in California and the United States.

# Section 12

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