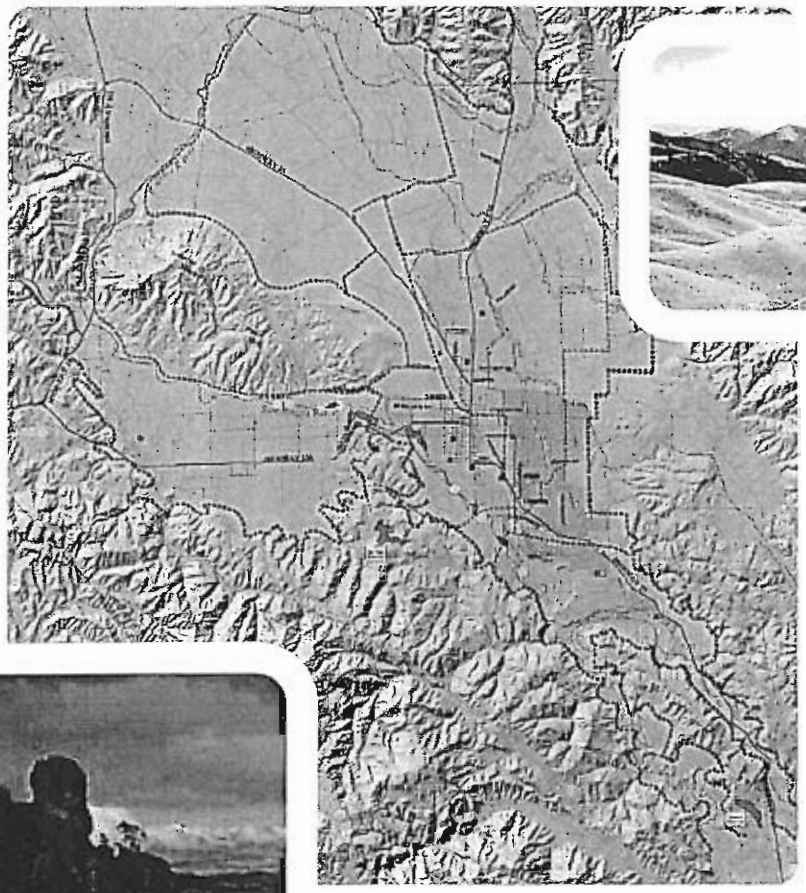
Exhibit 1.9

Groundwater Management Plan Update

Gilroy-Hollister Groundwater Basin in July 2003

Draft Final Report

Groundwater Management Plan Update for the San Benito County Part of the Gilroy-Hollister Groundwater Basin



Water Resources Association of San Benito County

K/J 025007.05
July 2003

Kennedy/Jenks Consultants

Engineers & Scientists

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Section 1: Introduction

The Groundwater Management Plan for the San Benito County Part of the Gilroy-Hollister Groundwater Basin (1998 GMP) was prepared in 1998 for a consortium of agencies including the Aromas Water District, the City of Hollister, the City of San Juan Bautista, San Benito County Water District, Sunnyslope County Water District, and Tres Pinos County Water District.

Since the preparation of the 1998 GMP, the Water Resources Association of San Benito County (WRA) was formed by the City of Hollister, the City of San Juan Bautista, San Benito County Water District (SBCWD), and the Sunnyslope County Water District. This plan is intended to be an update to the 1998 GMP. Alternatives for groundwater management were developed for this update of the 1998 GMP in the Draft Report Evaluation of Project Alternatives to Implement Groundwater Management Plan in San Benito County (June 2002 Draft Report). Detailed information regarding hydrogeology, water quality and water levels are found in the 1998 GMP and the Annual Groundwater Reports prepared by the SBCWD.

1.1 Purpose

The following problem statements regarding the quantity and quality of water in San Benito County are addressed in this Groundwater Management Plan Update (GMP Update):

Water Quantity

- Existing imbalance of areas of high and low groundwater
- Pending imbalance of supply and demand due to planned growth
- Existing and pending inability to adequately dispose of wastewater
- Frequent reduction of long-term imported water supplies and lower quality local supplies

Water Quality

- Increasing total dissolved solids (TDS) – salts are accumulating in the basin and constrain beneficial uses
- Hardness affects urban supplies and leads to water softeners that further add salts to the basin
- Nitrates have accumulated in some groundwater sub-basins, affecting beneficial uses
- Effective water quality protection is lacking

The purpose of this GMP Update is to build on the previous work in the further identification and evaluation of alternatives that will define coordinated basin-wide approaches to groundwater management and serve as the basis for the upcoming Program Environmental Impact Report (PEIR).

1.2 Approach

Keeping in mind these problems in the Gilroy-Hollister portion of the San Benito County groundwater basin, the approach that has been taken in this report is to:

- Further develop objectives and criteria by which alternatives will be evaluated.
- Further develop the toolbox of project elements identified in the 2001 Phase 2 effort.
- Use the toolbox of project elements to develop additional alternatives that bridge the 100% Local Supply and 100% Imported Supply alternatives developed in the 2001 Phase 2 effort.
- Evaluate the alternatives against the objectives and criteria that were developed.
- Estimate water supplies and water demands for present and future conditions for municipal/industrial and agricultural uses using existing analyses
- Using estimated water needs, identify potential projects that could be used to manage the groundwater basin in accordance with the identified alternatives.
- Prioritize and phase projects for implementation and develop planning-level estimates of the probable cost of construction for the projects.
- As part of the preparation of PEIR, identify mitigation measures for these projects that may cause or result in impacts through use or construction to air quality, biological resources, cultural resources, energy, geology or seismicity, hydrology and water quality, land-use, noise or visual and aesthetic resources.

Section 2: Condition of the Basin

2.1 Summary

The SBCWD has jurisdiction throughout San Benito County to support surface water management and groundwater replenishment activities as well as collecting and evaluating data related to water management. The SBCWD annually prepares a Groundwater Report that documents and evaluates surface water and groundwater use for the previous water year.

SBCWD operates and maintains facilities to import, distribute, and recharge surface water from the CVP's San Felipe Project (San Felipe) into the groundwater basin as well as to impound and percolate water from the Hernandez and Paicines Reservoirs. SBCWD has formed three zones of benefit to generate the necessary funds for the facilities:

- Zone 1 covers the entire county and provides the funding base for certain District administrative expenses.
- Zone 3, which covers the San Benito River Valley from the Willow Creek School gaging station to San Juan Bautista and Tres Pinos Creek Valley from Paicines to the San Benito River, provides the funding base for operation of Hernandez and Paicines Reservoirs and related percolation activities.
- Zone 6 includes the Pacheco, Bolsa Southeast, San Juan, Hollister West, Hollister East, and Tres Pinos groundwater sub-basins and provides the funding base for importation and distribution of San Felipe water. Zone 6 covers approximately 48,000 acres.

The groundwater sub-basin boundaries are shown on Figure 2-1. The physical characteristics have been detailed in many previous reports, and recent sub-basin water balance and water quality issues are summarized in this document.

As discussed in the 1998 GMP and other previous reports, prior to the introduction of imported San Felipe water, more groundwater was being extracted from the basin than was being recharged, resulting in overdraft over the long term. Since the first deliveries of imported San Felipe Water in 1987, most areas of the groundwater basin became full in as few as 4 to 5 years, and many sub-basins experience localized areas of high groundwater. Reductions and increases of water in storage within groundwater sub-basins occur annually, concurrent with hydrologic variability and each sub-basin's management practices. Overdraft could occur in a sub-basin if a net decrease in water levels takes place over the long term, as occurred prior to the delivery of San Felipe Water. Evaluation of overdraft within each sub-basin is beyond the scope of this report.

It has been estimated that the basin's groundwater storage capacity is approximately 500,000 AF within the first 200 feet of the ground surface. The basin's approximate average annual safe groundwater yield is estimated to be between 40,000 to 50,000 AF/yr (1998 GMP); for the purposes of this analysis, the yield is estimated at 54,000 AF. (J. Gregg, personal communication).

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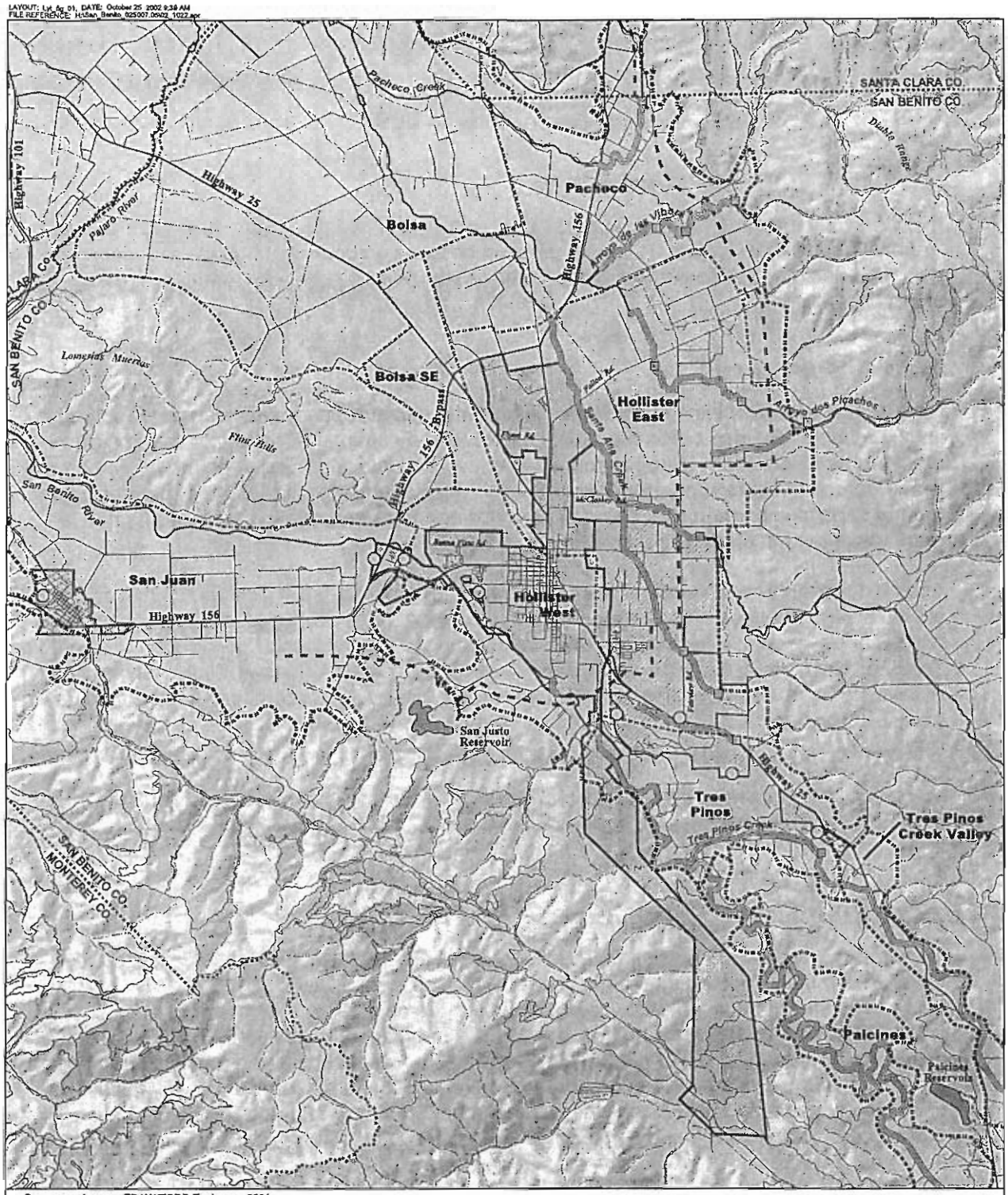

Basemap reference: EDAW/TODD Engineers, 2001

LEGEND

- Existing Wastewater Percolation Sites
- City of San Juan Bautista
- City of Hollister Water Service
- Sunnyslope County Water District
- Tres Pinos County Water District
- Hollister Conduit San Felipe Water System
- Discharge Point and Wetted Reach for Percolation of San Felipe/Local Surface Water
- Groundwater Basin Boundary
- Groundwater Subbasin Boundary

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GROUNDWATER MANAGEMENT PLAN UPDATE PROJECT AREA

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Figure 2-1

2.2 Sub-basin Conditions

More detailed information regarding individual sub-basins is found in the 1998 GMP and the Annual Groundwater Reports. The information below is a summary of current conditions for each sub-basin and is derived from information in the Water Year 2001 Annual Groundwater Report.

2.2.1 San Juan

High groundwater level is characteristic of the San Juan sub-basin. As imported CVP water was introduced and used in this sub-basin, percolation continued from applied water, and well pumping was insufficient to keep groundwater levels from rising. Soil structure in the sub-basin is another factor influencing groundwater level. Clay layers, existing at 3 to 12 feet below the ground surface in some areas, result in poor soil drainage. As a result, perched high groundwater saturated the root zone in some locations.

According to the Water Year 2001 Annual Groundwater Report, the San Juan sub-basin showed stable groundwater storage levels in the recent past. This appears to be the result of normal or below-normal rainfall and streamflow and the suspension of percolation of Zone 3 and Zone 6 water in the Hollister West and San Juan sub-basins. A review of the water balance indicates that land uses overlying the San Juan sub-basin are predominantly agricultural, with water supplies provided by both groundwater and imported surface water, depending on the location.

The groundwater quality in the San Juan sub-basin typically has an average TDS concentration of 1,200 parts per million (ppm), among the highest within the San Benito County groundwater basin.

2.2.2 Hollister West

A review of groundwater levels in the Hollister West sub-basin indicates that localized high groundwater levels occur adjacent to areas of the San Benito River. The SBCWD has discharged less surface water for percolation over the past 2 years to manage the high water levels. The water balance for the Hollister West sub-basin indicates a 1,300 AF reduction of water in storage in Water Year 2001, even though 2001 was considered a normal rainfall year. Inspection of the groundwater hydrograph over the last 2 years seems to confirm a gradual decline in groundwater levels, which are being monitored as part of the SBCWD's annual groundwater report. Land uses overlying the Hollister West sub-basin are predominantly M&I.

The 3 million gallons per day (MGD) Lessalt surface water treatment plant completed in November 2002 will reduce groundwater pumping between an estimated 2,300 –2,800 AF/yr for some of the M&I uses in the City of Hollister and Sunnyslope County Water District service areas. The Lessalt plant is expected to result in a net increase in in-lieu banking, which should moderate the overdraft previously experienced.

The groundwater in the Hollister West sub-basin has an average TDS concentration of 800 ppm and a hardness in excess of 400 ppm. The Lessalt plant should reduce the use of brine softeners used by many water customers to reduce the mineral hardness of the groundwater.

Brine softeners contribute salt to the wastewater stream during regeneration of the ion exchange membranes.

2.2.3 Hollister East

Hollister East is generally considered to be a "full" sub-basin. The hydrographs for the sub-basin indicate that its groundwater level is generally increasing over time. Although the amount of imported San Felipe surface water percolation was reduced in 2001 by changing water system management measures, groundwater in storage still increased by 3,000 AF. This sub-basin experiences high agricultural water use in rural areas and high M&I use in the urban areas.

The average concentration of TDS for the Hollister East sub-basin groundwater is approximately the same as the Hollister West sub-basin groundwater. Similar to Hollister West, the groundwater in this area also contains high mineral hardness. As a result, urban water customers use water softeners extensively. In addition to TDS and hardness in Hollister East, boron can be found in the 2 to 3 ppm range. For agricultural purposes, boron levels of less than 0.5 ppm are desirable.

2.2.4 Bolsa

Groundwater levels vary throughout the Bolsa sub-basin. High groundwater levels are present in the northeast, and an area of low groundwater exists in the south. During Water Year 2001, the water balance showed a net loss of water in storage of 2,000 AF/yr. The Bolsa sub-basin has experienced consistent reductions of water in storage, indicating that it is in overdraft. The Bolsa area is predominantly agricultural and does not receive imported surface water.

The average boron concentration in the Bolsa sub-basin is 2-3 ppm, with accompanying issues the same as those in the Hollister East sub-basin. The average TDS concentration is approximately 800 ppm.

2.2.5 Pacheco

In the Pacheco sub-basin, groundwater levels were stable for 2 years before Water Year 2001. Then in 2001, the water balance showed a slight increase of 400 AF per year of groundwater in storage. It appears that the Pacheco sub-basin has significant potential for groundwater banking. Similar to the Hollister East area, the SBCWD instituted water level management measures, and San Felipe water percolation was reduced.

TDS concentrations for the Pacheco sub-basin are on the order of 600 ppm, which is lower than the other sub-basins. This groundwater quality is adequate to support the mainly agricultural water usage in the Pacheco area.

2.2.6 Bolsa Southeast

Groundwater storage in the Bolsa Southeast sub-basin increased by 250 AF in 2001. Inspection of the hydrograph of average groundwater levels in this sub-basin indicates that they are rising due to the delivery of imported surface water. Based on a groundwater modeling

analyses, groundwater levels are starting to rise in the groundwater depression identified in the report *Groundwater Management Plan: Existing Conditions and Alternatives* (December, 2001).

2.2.7 Tres Pinos

In Water Year 2001, the Tres Pinos sub-basin water storage increased by an estimated 150 AF. Analysis of this sub-basin shows that the groundwater level is slightly higher than in the other sub-basins and that there are localized areas of even higher groundwater near the San Benito River. There may be some opportunities for groundwater banking in this sub-basin in areas away from the San Benito River.

2.3 Groundwater Monitoring Programs

The SBCWD has taken and maintained data related to groundwater levels and surface water flow measurements since the early 1920's for the San Benito County Portion of the Gilroy-Hollister Groundwater Basin and its principle tributaries, Pacheco Creek, Tres Pinos Creek and the San Benito River.

The early data was instrumental in supporting U.S. Geological Survey (USGS) and U.S. Bureau of Reclamation (USBR) studies which led to design and construction of the Hernandez Dam and Reservoir together with the necessary water rights for Hernandez and Paicines reservoirs and the eventual development of the San Felipe Project. The SBCWD has continued that early monitoring by measuring groundwater levels from a network of 80 to 100 wells. Levels have been measured on a semi-annual basis since 1976 and on a quarterly basis since 1991/92. The SBCWD has a cooperative agreement with the USGS for water measurement at a gaging station on Tres Pinos Creek and two gaging stations on the San Benito River. In addition, SBCWD personnel, and USGS personnel on a special study basis, conduct periodic surface water flow measurements to determine stream flows along the San Benito River and Tres Pinos Creek.

Since the 1991/92 time period the SBCWD has measured groundwater extraction at major wells (with discharge pipes) three (3) inches in diameter or greater and has assessed groundwater extraction from minor wells through a system of annual groundwater extraction reports. Groundwater extraction at major wells is measured directly or calculated semiannually by metering the number of hours of pump operation and multiplying by the average discharge rate. The pump discharge rate is measured and periodically updated using a velocity measurement device inserted into the discharge pipeline. Discharges from the San Felipe Distribution System for percolation in area streams are all directly metered.

Historically, there has not been systematic monitoring of groundwater quality in the basin. However, in 1997, the SBCWD initiated a Groundwater Monitoring Program. That program began with the measurement of nitrate concentrations and electrical conductivity at major irrigation wells and has expanded to include quarterly sampling for mineral content and inorganic chemicals from a network of 18 wells.

Potable water systems under the jurisdiction of the California Department of Health Services and/or the Department of Environmental Health Services of San Benito County must monitor and report certain water quality parameters to fulfill regulatory requirements.

The SBCWD seeks to expand and improve its Groundwater Quality Monitoring System for the basin, and has been awarded a $200,000 grant from the California Department of Water Resources (DWR) toward the development of a Basin Wide Groundwater Quality Monitoring Program. This program will include measurement of water quality directly, the collection of water quality data gathered by other agencies, and a system for data maintenance and presentation. The time schedule for the development of a basin wide Groundwater Quality Monitoring Program is fourteen months, beginning on November 1, 2002.

The SBCWD is systematically improving its groundwater and surface water measurement and water quality monitoring efforts and recently completed the installation of shallow groundwater monitoring wells in the San Juan and Hollister West sub basins.

The results of the SBCWD's water monitoring activities are presented and summarized in the Annual Groundwater Reports prepared by the SBCWD for the San Benito County Portion of Gilroy-Hollister Groundwater Basin and the Tres Pinos and Paicines Groundwater Basins.

Section 3: Current and Estimated Future Water Supplies and Demands

In order to estimate the order-of-magnitude size of future water management facilities, it is necessary to estimate demands and supplies. These demands and supply estimates are based on information provided in previous reports as well as by the SBCWD.

3.1 Water Supplies and Infrastructure

The majority of the information used to estimate water supplies potentially available to the County was derived from the Annual Groundwater Reports prepared by the San Benito County Water District. Additional information used to augment these reports is identified in the text below.

3.1.1 Water Year Classifications

The analysis of available water sources in this section required classification of water years into wet, normal, dry, and critically dry years. Long-term annual precipitation data from 1875 to 2001 for gages at Hollister and the SBCWD offices were evaluated to classify water year types based on deviations from average annual precipitation. Reliable groundwater water balance data were limited to water balances estimated from 1997 to the present. The review of average annual precipitation from water year 1997 through water year 2001 indicated that 1998 could be classified as a wet year, and 2001 could be classified as normal.

No dry or critically dry water years occurred in the 1997-2001 water year time period; therefore, estimates were calculated as described below. All supply values are shown in Table 3-2: Estimated Supply Availability. The supply components are further described in the following Sections 3.1.2 and 3.1.3. The water year classifications are used in developing the 20-year supply demand simulation in Section 3.3.

3.1.1.1 Wet Year

Supply values for the wet year summarized in Table 3-2 are taken from Table 9 of the Annual Groundwater Report for Water Year 1998. Although the value of 450 AF of Local Surface Water (Paicines and Hernandes percolation) appears low when compared to the value for a normal year (Water Year 2001), it is considered sufficient for the purposes of developing the illustrative example in Section 3.3.

3.1.1.2 Normal Year

Supply values for the normal year summarized in Table 3-2 are taken from Table 9 of the Annual Groundwater Report for Water Year 2001. The total local supply minus the Other Local Surface Supplies and Cienega is approximately 54,000 AF/yr which is consistent with the value for the average annual yield of the groundwater basin (J. Gregg, Personal Communication, July 2002).

3.1.1.3 Dry Year and Critically Dry Year

Because no reliable water balances were available using the methods used in water year 1998 and water year 2001 to estimate dry year and critically dry year supplies, it was assumed that all values, with the exception of deep percolation and recycled water, would be considerably less than normal years and were adjusted based on direction from SBCWD staff.

3.1.2 Local Supplies

Using Table 9 from the Annual Groundwater Reports, natural supplies from rainfall and stream percolation were calculated separately for Zone 6 only and the Bolsa, Paicines, and Tres Pinos Creek Valley by summing the components of: (1) total stream percolation from natural streamflow, (2) San Felipe releases, and (3) total deep percolation through the soils from rainfall for each area.

Local surface water supply represents stream percolation from Hernandez and Paicines releases summed with values for: (1) Zone 6 only and (2) the combined Bolsa, Paicines, and Tres Pinos Creek Valley area. Although there may be inconsistencies in local surface water values (Paicines and Hernandez percolation) between the 1998 and 2001 water years, the estimate of water sources remains valid for the purposes of developing the illustrative example in Section 3.3.

Potentially available water supplies from Pacheco Creek, Arroyo de Las Viboras and Arroyo dos Picachos were estimated using stream gauging data when available and otherwise using streamflow predictions prepared for the San Benito County Water District as part of the water balance analysis for the Annual Groundwater Reports. Gauged and predicted daily streamflow data were available for the 3 creeks from Water Year 1984 to Water Year 2001. Based on measured and predicted streamflow data, the estimated quantities of water that could be available are summarized below. These figures need to be corroborated with additional field measurements.

Table 3-1: Summary of Gauged/Predicted Streamflow from WY 1984 – WY 2001

	Pacheco Creek (AF/yr)	Arroyo de Las Viboras (AF/yr)	Arroyo dos Picachos (AF/yr)	Total (AF/yr)
Average	25,550	3,160	2,100	30,810
Minimum	800	150	100	1,050
Maximum	92,900	11,580	7,720	112,200

There are some existing water rights for the SBCWD and other rights holders for the Pacheco Creek, Arroyo de Las Viboras and Arroyo dos Picachos, therefore the availability of streamflows for diversion will be less than the predicted flows. A more detailed discussion of water rights occurs later in Section 5.5.

Cienega groundwater is another local supply that could be available the supply pipeline is repaired. The City of Hollister has a water rights decision for up to 489.41 AF/yr with a maximum of up to 40.78 AF/month. It is assumed that the maximum 489.41 AF/yr is available during wet

and most normal years but will be reduced during dry and critically dry years, as shown in Table 3-2.

The values in Table 3-2 for deep percolation of domestic/irrigation water are derived from Table 9 of the Annual Groundwater Reports and are for: (1) Zone 6 only, and (2) the combined Bolsa, Paicines, and Tres Pinos Creek Valley area.

The groundwater inflow value in Table 3-2 is extracted from Table 9 of the Annual Groundwater Reports. This value represents the total groundwater inflow for (1) Zone 6 only and (2) the combined Bolsa, Paicines, and Tres Pinos Creek Valley area.

The recycled water supply estimates shown in Table 3-2 are derived from the recycled water estimate in Table 9 of the Annual Groundwater Report. Where recycled water estimates were not available, a base-line estimate of 3,000 AF/yr was used. It should be noted that the recycled water supply is a function of population, and that additional recycled water will be available in the future. The recycled water could be percolated and indirectly reused, or, in the future, could be directly reused for irrigation of parks and golf courses.

3.1.3 Imported San Felipe Water

As shown in Table 3-2, both M&I and agricultural imported water supply estimates are based on recent evaluations of U.S. Bureau of Reclamation CVP contract entitlements compared to actual deliveries. The San Benito County imported San Felipe Water contract is for a total supply of 8,250 AF/yr for M&I supply and 35,550 AF/yr for agriculture. However, recent actions have resulted in reallocation of CVP supplies for legal and institutional purposes, such as meeting Bay-Delta Standards, minimum instream flows and those required under the CVP Improvement Act (CVPIA), and they have effectively reduced CVP contract allocations.

It is estimated that full contract entitlements will be delivered only in a "wet" year, as loosely defined for the CVP. Even in "normal" years, CVP deliveries are only expected to be 85% of M&I contract entitlements and 65% of agricultural contract entitlements. In "dry" and "critically dry" years, the deliveries are expected to be less. In "dry" years, CVP M&I deliveries are expected to be 75% of contract entitlements and 50% of agricultural contract entitlements. In "critically dry" years, CVP M&I deliveries are expected to be 35% of contract entitlements and 0% of agricultural contract entitlements. The resulting quantities of expected imported water deliveries are shown in Table 3-2.

3.1.4 Summary of Potential Water Supply Availability

Table 3-2 summarizes the various sources of water supply that could be available to San Benito County.

Table 3-2: Potential Supply Availability in Wet, Normal, Dry, and Critically Dry Years (AF)

	Wet Year (WY 1998)	Normal Year (WY 2001)	Estimated Dry Year	Estimated Critically Dry Year
Local Supplies				
Zone 6: Natural from rainfall, stream percolation, and San Felipe Releases	36,685 (1)	15,444 (1)	10,000	0
Bolsa, Paicines, Tres Pinos Natural from rainfall and stream percolation	11,536 (1)	4,791 (1)	4,000	0
Local Surface Water (Paicines and Hernandes percolation)	450 (1)	6,917 (1)	350	0
Deep Percolation of Domestic/Irrigation Water in Zone 6, Bolsa, Paicines and Tres Pinos	9,438 (1)	10,403 (1)	10,400	10,400
Groundwater Influent Flow	10,000 (1)	12,500 (1)	7,000	5,000
Recycled Water Recharge/Reuse	3,557 (1)	3,338 (1)	3,000	3,000
Other Local Surface Water(2)	112,200	30,810	1,050	0
Cienega Groundwater(3)	489	489	350	200
Total Local Supplies	**184,355**	**84,692**	**36,150**	**18,600**
Imported Surface Water Availability				
Imported M&I (% of contract entitlement)	8,250 (100%)	7,012 (85%)	6,188 (75%)	2,888 (35%)
Imported Ag (% of contract entitlement)	35,550 (100%)	23,108 (65%)	17,775 (50%)	0
Total Imported Surface Water	**43,800**	**30,120**	**23,963**	**2,888**
Combined Total				
Total Potential Local and Imported Supplies	228,155	114,812	60,113	21,488

(1) Estimates are based on Table 9 – Groundwater Balances from Annual Groundwater Reports for Water Year 1998 and Water Year 2001.
(2) Estimates are based on gauged/predicted stream flows for Pacheco Creek, Arroyo de Las Viboras, and Arroyo dos Picachos and will not be available until diversion facilities are constructed and water rights are resolved. Dry Years are assumed to have minimum flow, critically dry areas are assumed to have zero flow while wet and normal years correspond to maximum and average flows respectively.
(3) Cienega availability is contingent on construction/repair of the pipeline.

3.1.5 Water Delivery Infrastructure

A detailed discussion of existing water delivery infrastructure can be found in the 1998 Groundwater Management Plan Report and the Annual Groundwater Reports.

3.2 Current and Future Demand Projection

Future water demand projections for both M&I and agricultural uses were developed as described below. First, available information on past water usage was used to estimate demands for current conditions. Future M&I demand was estimated based on the Growth Management Ordinances currently in place in the cities and county. These ordinances are discussed in detail below. Future agricultural demand was estimated by SBCWD staff, and a report prepared for the District on Zone 6 irrigation.

3.2.1 Past Water Usage

Table 3-3 contains information regarding water usage in the past. The data summarize information contained in the Annual Groundwater Reports prepared by the SBCWD.

Table 3-3: Water Use in Hollister Groundwater Basin-Water Years 1991 - 2001

Water Year	Agricultural Imported SW Use [c] (AF/year)	M&I Imported SW Use [c] (AF/year)	Sub-total SW Use (AF/year)	Agricultural GW Use (AF/year)	M&I GW Use (AF/year)	Sub-total GW Use (AF/year)	Total SW + GW Use (AF/year)	Annual Rainfall (in) [e]
1991[a]	SW not available	SW not available	SW not available	46,640	7,631	54,271	54,271	10.94
1992[a]	SW not available	SW not available	SW not available	32,210	6,912	39,122	39,122	12.31
1993[a]	SW not available	SW not available	SW not available	38,878	5,066	43,944	43,944	18.29
1994[a]	SW not available	SW not available	SW not available	41,854	7,186	49,040	49,040	10.5
1995[a]	SW not available	SW not available	SW not available	36,744	5,895	42,639	42,639	22.42
1996[b]	18,325 52%	759 9%	19,084 44%	42,523	7,415	49,938	69,022	15.46
1997[b]	21,061 59%	838 10%	21,899 50%	40,569	10,277	50,846	72,745	15.47
1998[b]	12,335 35%	459 6%	12,794 29%	28,843	8,191	37,034	49,828	28.61
1999[b]	17,343 49%	695 8%	18,038 41%	38,717	9,415	48,132	66,170	10.61
2000[b]	17,656 50%	1,017 12%	18,673 43%	37,263	9,794	47,057	65,730	11.44
2001[b]	18,281 51%	1,254 15%	19,535 45%	33,715	9,433	43,148	62,683	14.09
Average[d]	17,500 49%	837 10%	18,337 42%	37,996	7,929	45,925	55,927	15.47
Maximum[d]	21,061 50%	1,254 15%	21,899 50%	46,640	10,277	54,271	72,745	28.61
Minimum[d]	12,335 35%	459 6%	12,794 29%	28,843	5,066	37,034	39,122	10.5

(a) Data were extracted from Water Year 1995 Annual Groundwater Report
(b) Data were extracted from the Annual Groundwater Reports for the Water Year reported
(c) 100% CVP Contract Entitlement for Agricultural Uses is 35,550 AF/yr, 100% CVP Contract Entitlement for M&I Uses is 8,250 AF/yr for a total of 43,800 AF/yr. M&I Entitlement has not been fully exercised.
(d) Average, Maximum, and Minimum of all surface water data for 1996 – 2001 and groundwater and precipitation for 1991 – 2001
(e) Hollister Station

3.2.2 M&I –Current and Future Demands

3.2.2.1 Estimated 2002 Demands

Information regarding 2002 M&I water demand for the incorporated cities of Hollister and San Juan Bautista and the unincorporated portions of the County were estimated as follows. Sunnyslope CWD serves customers in both the City of Hollister and in unincorporated San Benito County. Approximately 60% of Sunnyslope CWD's customers are in the City of Hollister; the remaining 40% are in unincorporated San Benito County.

However, because the California Department of Finance's information, which was used for developing the residential portion of the demand estimate, does not specifically subdivide Sunnyslope CWD's population between the incorporated and unincorporated portions of the County, it was assumed that Sunnyslope County Water District customers would fall under the City of Hollister, and that San Benito County Water District customers would be considered to be located in unincorporated areas. This assumption has limited impact on the total demands estimated and is considered valid for this estimate.

The 2002 demands were based on the Department of Finance population and persons per dwelling unit information for January 1, 2002. Population was divided by persons per dwelling unit to estimate the number of dwelling units. The number of dwelling units were then multiplied by an average demand of 420 gallons per day per dwelling unit which is consistent with the demands estimated for a relatively new residential development west of Fairview Road (Northeast Fairview Specific Plan draft EIR, April 1998).

The estimated demands were consistent with those in the 1999 Urban Water Management Plan (UWMP), Table 1-15, Hollister Urban Area – Projected Population and Water Demands With Implementation of Conservation Program and the City of San Juan Bautista General Plan, P. III-J.4.

Based on these sources, the total residential water demand for 2002 is 5,108 AF/year in urban areas and 2,789 AF/year in the unincorporated County. Non-residential demand of 2,790 AF/year for schools, parks, golf courses, industry, etc. was estimated by subtracting the residential demand of 5,108 AF/yr and 2,789 AF/yr from the total Domestic and Municipal water use of 10,687 AF for Water Year 2001 (Annual Groundwater Report, Table 1).

3.2.2.2 Estimated 2022 Demands

The following method was used to evaluate the effects on water demand of the Growth Management Ordinances in the Cities of Hollister and San Juan Bautista and the unincorporated portions of San Benito County.

- California Department of Finance (CDOF) population estimates for 2002 were used as the current condition and as the base for estimating future populations for the urban and unincorporated portions of the County.

- Estimated future water demand for the existing population was based on the assumption that for the 20 years from 2002 to 2022, conservation measures will result in a 1% annual decrease in water demand from each existing residential dwelling unit. Demand is expected to decrease from 420 gpd/du in 2002 to 344 gpd/du in 2022 for this sector of the urban service areas.

- Population increases in the City of Hollister/Sunnyslope County Water District were based on Ordinance 959, which limits growth to 244 residential units per year. An assumed density of 3.537 persons per household was used, based on CDOF estimates for City of Hollister for 1 January 2002.

- Population increases in the City of San Juan Bautista were based on the current ordinance that limits growth to 1% per year as set by the City of San Juan Bautista City Council in August 2002. An assumed density of 2.739 persons per household was used, based on CDOF estimates for City of San Juan Bautista for 1 January 2002.

- Population increases in the unincorporated County areas were based on Ordinance 751, which limits population increases to 1% per year. An assumed density of 3.034 persons per household was used, based on CDOF estimates for unincorporated San Benito County for 1 January 2002.

- Water demand associated with new growth is assumed to be 312 gpd/du which is consistent with the estimates used in the West of Fairview Water Supply Assessment. This assumes an interior demand of 230 gpd/du and exterior demand on a single family home of 92 gpd/du.

M&I demands and population are summarized in Table 3-4: Estimated Population and M&I and Agricultural Demands 2002-2022.

The estimated total residential demand for 2022 is estimated to be 8,675 AF/yr. The non-residential demand was assumed to continue to be 2,790 AF/yr since there is insufficient information available to predict future non-residential demands. The total M&I Demand is 11,465 AF/yr and is the sum of the residential and non-residential demands as shown in Table 3-4.

3.2.3 Agricultural – Current and Future Demands

The estimated total agricultural demand for 2002 is derived from the Annual Groundwater Report WY2001, Table 9, work done for the SBCWD by Ken Henneman, and from SBCWD staff. The 2001 Annual Groundwater Report estimated agricultural demand for 2000 to be 51,996 AF/yr. Henneman's estimates indicated that total agricultural demand for the irrigable acres in the Zone 6 groundwater basin is 54,000 AF/yr, and SBCWD staff estimated the other areas of the county to have total agricultural demand of 24,000 AF/yr, for a total of 78,000 AF/yr in 2025.

These agricultural demands assume an increase from 36,000 irrigable acres in 2002 to about 53,000 irrigable acres in 2022. They are also based on the assumption of 1.8 feet/year water duty, 0.4 feet of effective precipitation (ep) and 85% irrigation efficiency. The estimated 85%

agricultural irrigation efficiency is consistent with the CVP guidelines for its water supply contractors. The increase in agricultural irrigation is based on estimates of available acreage not currently irrigated that could be irrigated in the future.

25-year agricultural demand estimates were calculated assuming an evenly-distributed linear increase from a 2000 demand of 51,996 AF/yr to a 2025 demand of 78,000 AF/yr. The total agricultural demand is estimated at 66,000 AF/yr for 2002 and 74,880 AF/yr for 2022.

3.2.4 Other Demands

All other estimated water demands are taken and adjusted from Henneman (2000). These water demands include conveyance losses and other minor uses. For 2002 through 2022, this estimated demand is expected to remain at 3,000 AF/yr.

3.2.5 Summary of 2002 – 2022 M&I and Agricultural Demands

Table 3-4 summarizes the estimated 2002 and 2022 populations and water demand estimates. It should be noted that the agricultural demands far outweigh the M&I demands and changes in assumptions for in agricultural demands can greatly influence the water supply that is needed to meet future demands.

Table 3-4: Estimated Population and M&I and Agricultural Demands 2002-2022

	Demands 2002 (AF/yr)[a]	Population 2002[b]	Estimated Demands 2022 (AF/yr)[c]	Estimated Population 2022[d]
Municipal & Industrial				
City of Hollister	4,834	36,338	5,665	53,600
City of San Juan Bautista	274	1,597	270	1,949
Total M&I Urban Areas	5,108	37,935	5,934	55,549
Other Unincorporated County	2,789	17,986	2,741	21,946
Non-Residential Demand	2,790		2,790	
Total Municipal and Industrial Demands/Population	10,687	55,921	11,465	77,495
Agricultural				
Zone 6, Bolsa, Paicines and Tres Pinos Creek Valley	Estimate based on acres under irrigation		Estimate based on all irrigable acres	
Total Agricultural Demands	54,076		74,880	
Other				
Other Demands	3,000		3,000	
Total				
Total Municipal and Industrial and Agricultural	67,763		89,345	

(a) 2002 Estimated Demands were based on the assumption that the demand per dwelling unit is 420 gallons per day per dwelling unit. The number of persons per dwelling unit was adopted from California Department of Finance Table 1: County and State Population and Housing Estimate, Official State Estimates as of January 1, 2002 for San Benito County.

(b) Population data for 2002 were adopted from California Department of Finance Table 2: City and County Population and Housing Estimates, Official State Estimates as of January 1, 2002.

(c) Estimated Demands for 2022 are based on Estimated Demand for existing population and Estimated Demand for new growth. Further details are in the report.

(d) Estimated Population for 2022 are based on current Growth Management Ordinances and are described in the report.

3.3 Reliability and Sustainability

As discussed in the 1998 Groundwater Management Plan, the inherent variability of hydrologic cycles and the potential changes in regulation can reduce the reliability and hence the availability of many water supplies. However, through managed development and careful use of all of the potential supplies, the dry period demands should be able to be met reliably.

The sustainability of the local supplies needs to also be considered such that environmental needs are met in surface waterways, groundwater levels are managed to minimize groundwater overdraft, and high groundwater is lowered to acceptable levels. Diversity in supply through the development and prudent use of both local and imported water supplies provides both reliability and sustainability.

The following section describes the manner in which various supplies can be managed and used conjunctively to provide both a reliable and sustainable supply for San Benito County.

3.3.1 20-year Simulation of Groundwater Basin Operation

Using the demand estimates from Growth Management assumptions and water source availability estimates assembled above, an illustrative 20-year simulation of groundwater basin operation was prepared. By carefully using the range of supply sources available and the projected demands, a 3-year dry period can be bridged by using groundwater banking.

For the purposes of this illustrative example, a 3-year dry period was assumed to be sufficient, although dry periods can obviously extend beyond 3 years. A 3-year dry period is consistent with the multiple-dry-year analyses prepared for the Hollister area Urban Water Management Plan.

A 20-year period was selected for the illustrative example because it is the projected planning horizon for this groundwater management plan and 20-years will contain many normal, wet, dry, and critically dry years to illustrate groundwater banking operations. For the purposes of the simulation, the 20 years included 8 normal years, 6 wet years, 4 dry years, and 2 critically dry years. The distribution of types of years was randomly selected within the 20-year period, and the dry-critically dry years were placed in sequence.

Using the assumptions for M&I, agricultural and other demands from Section 3.2, future demands were calculated for the 20-year simulation period. Total demands for dry and critically dry years were decreased by 10% on the assumption that some additional conservation can be achieved in a drought.

Total imported surface water supplies available for the different types of years are shown in Table 3-2: Potential Supply Availability in Wet, Normal, Dry and Critically Dry Years.

For the simulation, the amount of local supply used to meet demand depended on the amount of imported surface water available. When imported surface water could not meet demand, increased amounts of local supply were used. Supplies from the Cienega and Arroyo dos Picachos projects were assumed to be available in 2005, and supplies from the Pacheco Creek

and Arroyo Las Viboras were assumed to be available in 2017. The amount of available local water included in the simulation was reduced from the figures in Table 3-2 to reflect meeting existing water rights.

When the total available supply was not sufficient to meet demand, the deficit was "withdrawn" from the groundwater/water bank. Conversely, when supplies were greater than demand, the excess supply was "deposited" into the bank. This assumption may overstate the true physical ability to bank excess water.

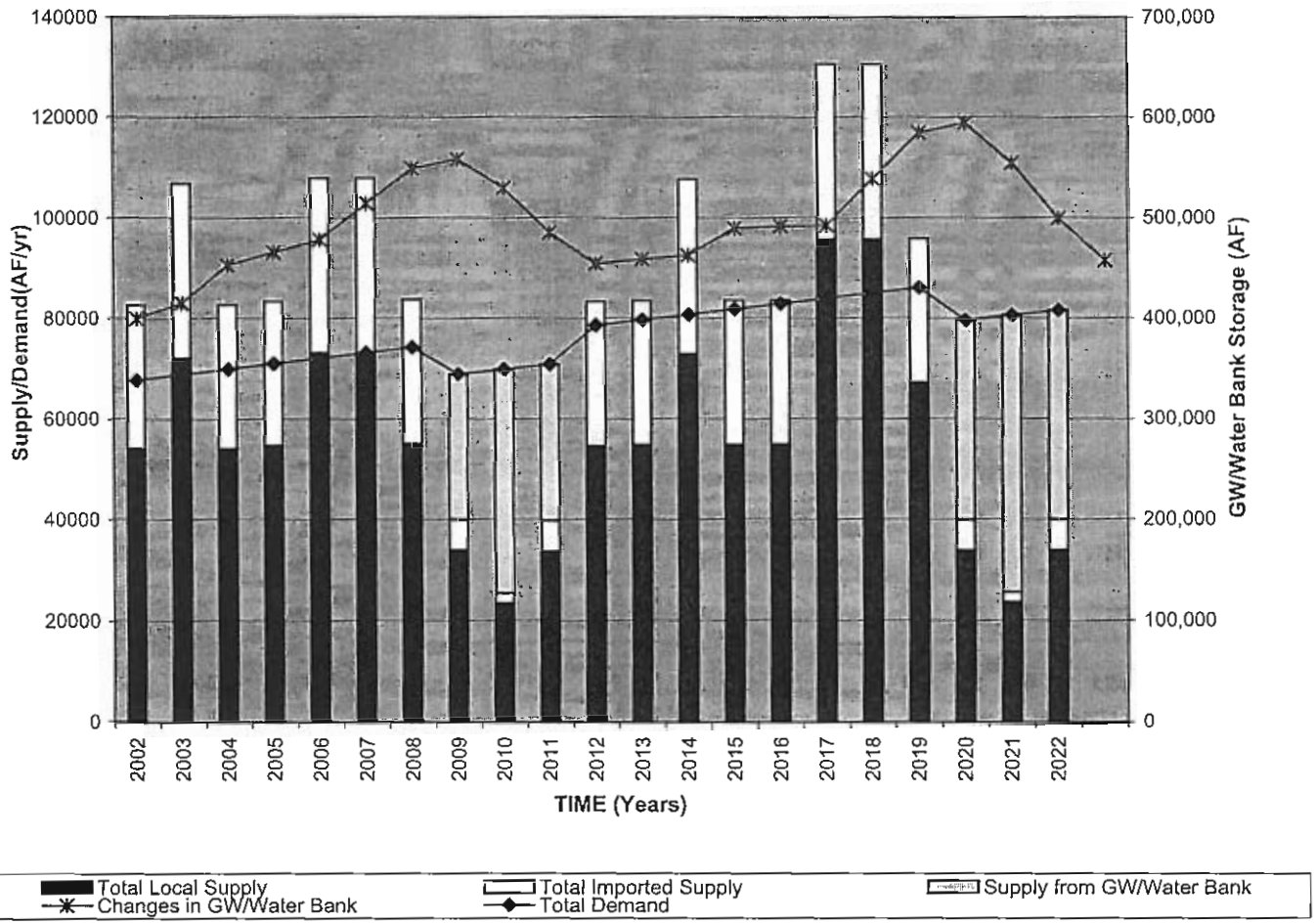
However, this assumption is sufficient for illustrative purposes and should be refined when developing a more detailed operations model and after further hydrogeologic studies. Calculations for the groundwater/water bank were based on the initial assumption that the beginning storage is 400,000 AF/yr.

Values for total demand, imported supply, local supply, supply from groundwater and surface water bank, and changes in groundwater/water bank are shown on Figure 3-1.

The 20-year simulation illustrates how a bank contributes to the reliability of a water supply system. Whether the bank occurs in a local groundwater bank, or a regional groundwater bank, the concept remains the same: when supplies are low, the bank will be used to make up shortfalls in demand.

The critical element of the bank is that contributions must be made to the bank when the water is available; otherwise, overdraft will result when too many withdrawals are made during times of low supply. It should also be noted that demand projections beyond 2025 may flatten and stabilize if land use plans and growth ordinances do not change significantly.

Figure 3 - 1 : Simulated Supply and Demand from 2002-2022 for San Benito County Groundwater Basin



Section 4: Objectives and Criteria for Groundwater Management Plan Implementation

The overall objective of the GWMP effort is to maintain and enhance the agricultural and economic productivity of San Benito County in an environmentally responsible manner. The objectives and criteria were initially developed in the 2001 Existing Conditions Report, and were expanded during the process of the preparation of the alternatives analysis presented in the Evaluation of Project Alternatives to Implement Groundwater Management Plan in San Benito County – Draft Report, June 2002 (June 2002 Draft Report). Specific criteria to achieve the overall goal are presented below.

4.1 Water Quantity Objectives and Criteria

- **Water Quantity Objective 1**: Maintain a reliable water supply for present and future users.

  Water Quantity Criterion 1-1: Deliver 100% of agricultural and M&I supply in normal and dry years, and in the first critically dry year of a drought.

  Water Quantity Criterion 1-2: Deliver at least 85% of M&I demands and 75% of agricultural demands in the second and subsequent critically dry years of a drought.

- **Water Quantity Objective 2:** Integrate the management of groundwater, surface water, and imported water, according to the following criteria:

  Water Quantity Criterion 2-1: Maximize efficient use of water supply by implementing water conservation programs for both M&I and agricultural uses. For existing M&I uses, it is assumed that over the next 20 years, water demand will decrease by 1% percent per year for existing residential dwelling units. Conservation will reduce demand from an estimated 420 gpd/du to 344 gpd/du. New development is assumed to have a demand of 312 gpd/du. Based on CVP guidelines, agricultural irrigation is assumed to be at 85% efficiency.

  Water Quantity Criterion 2-2: Provide new M&I water supplies to support planned growth within established urban (service) areas, in accordance with approved growth projections contained in the General Plans for San Benito County and the cities of Hollister and San Juan Bautista.

  Water Quantity Criterion 2-3: Manage groundwater levels to maintain groundwater storage for the protection of the water rights of the overlaying landowners and for emergency storage, limiting drawdown to the historic low levels of about 1977 to preclude and/or minimize the potential for ground settlement.

  Maintain groundwater levels, where practical, no higher than 20-30 feet below ground surface. In portions of the Bolsa, Pacheco, Hollister East and San Juan subbasins it will be impractical to achieve these groundwater levels and subsurface drainage systems

and other means of providing improved drainage conditions for the overlying uses will be required. In addition, higher groundwater levels will occur in areas adjacent to streams and where artificial percolation occurs outside of natural streams, such as in the vicinity of the percolation ponds of wastewater treatment plants, septic systems, and off stream groundwater recharge ponds.

Water Quantity Criterion 2-4: Optimize the use of groundwater storage.

4.2 Water Quality Objectives and Criteria

- **Water Quality Objective 1:** Provide water quality to meet both the needs of end users and the established objectives as described in the criteria below .

  Water Quality Criterion 1-1: Manage water resources to minimize imported salts and long-term levels of groundwater salinity to protect beneficial uses as set forth in the applicable revisions of the Regional Water Quality Control Board Basin Plan.

  Water Quality Criterion 1-2: Protect groundwater resources from infiltration of nitrates and salts, as well as other substances that could adversely affect groundwater quality.

  Water Quality Criterion 1-3: Deliver M&I water meeting primary and secondary drinking water quality objectives, with emphasis on achieving the "DHS's Recommended Limit for Consumer Acceptance" of not more than 500 mg/l of TDS and hardness of no greater than 120 mg/l as CaCO3. {It should be noted that there are no secondary standards for hardness; soft waters are typically considered to have 0-60 mg/l of hardness, moderately hard waters have 61-120 mg/l, hard waters have 121 - 180 mg/l, and very hard waters have over 180 mg/l of hardness.}

  Water Quality Criterion 1-4: Deliver agricultural water meeting established quality parameters. In order to optimize crop yield based on the available water sources, salinity (as measured by TDS), sodium hazard (as measured by Sodium Adsorption Ratio, or SAR); and boron have been selected as key indicator parameters. The following water quality objectives for these three water quality parameters have been developed.

  Salinity: <700 mg/L TDS

  SAR: <6.5

  Boron: <0.5 mg/L

  TDS: Levels that range from 480 - 1920 mg/L are considered marginal for irrigation, per Regional Water Quality Control Board Basin Plan.

- **Water Quality Objective 2:** Manage water resources to meet Regional Water Quality Control Board Basin Plan and Department of Health Services water quality objectives.

4.3 Other Objectives and Criteria

Additional criteria were developed to assist in evaluating other aspects of the implementation of groundwater management programs and projects.

4.3.1 Regional Criterion

The following regional criterion has been developed:

- **Regional Criterion 1**: The programs and projects of the groundwater management plan should be coordinated with regional water supply planning and projects to the extent that it is practical and feasible to do so.

4.3.2 Environmental Resources Objectives

The following environmental resources criteria have been considered in the selection of toolbox elements for the GMP Update.

- **Environmental Resources Objective 1:** Minimize adverse effects on biological and cultural resources, including riparian habitats, habitats supporting sensitive plant or animal species, and archaeological/historic sites.
- **Environmental Resources Objective 2:** Avoid or minimize construction impacts from the various projects contained in the GMP Update.
- **Environmental Resources Objective 3:** Minimize operational energy requirements for the projects contained in the GMP Update.

4.3.3 Institutional/Jurisdictional Objective

The following institutional/jurisdictional criterion has been developed.

- **Institutional/jurisdictional Objective 1**: The projects and programs in the groundwater management plan should be permittable and implementable, and shall be consistent with local and regional institutional constraints.

4.3.4 Cost Effectiveness/Affordability Objectives

The following cost effectiveness/affordability criteria have been developed:

- **Cost Effectiveness/Affordability Objective 1:** The programs and projects in the groundwater management plan should be affordable and financially feasible for urban and agricultural interests to implement over a predictable time period consistent with plan objectives. One measure of affordability will be the impact on water costs to urban and agricultural users over current and future baseline estimates.

- **Cost Effectiveness/Affordability Objective 2:** The programs and projects in the groundwater management plan should maximize the use of existing facilities.

Section 5: Elements of the Groundwater Management Plan Update

5.1 Development of the Project Elements

The Water Resources Association of San Benito County acknowledges the need to undertake programs and projects that improve the reliability and quality of the water available to its users. Many of these programs and projects are required to meet regulatory requirements, such as the primary and secondary drinking water standards, as well as wastewater effluent limits.

The programs and projects selected for the GMP Update have been derived from the preliminary evaluation of alternatives (June 2002 Draft Report) that compared the Project Toolbox Elements to the objectives and criteria. This comparison has resulted in the selection of Project Toolbox Elements that:

- Are practical and feasible (i.e. have no apparent fatal flaws and avoid sensitive environmental resources).
- Offer operational flexibility in the use of the various water resources available.
- Make creative use of opportunities/resources.
- Are cost-effective when compared to other Project Toolbox Elements that accomplish the same goal.

The selected Project Toolbox Elements are described below and include those in Alternative 4, with refinements as well as some additional project elements. Development of the programs and projects of the GMP Update are based on the following assumptions:

- Municipal and Industrial (M&I) water demands in the year 2022 are estimated to be 11,465 AF/yr.
- Agricultural and other water demands in the year 2022 are estimated to be 77,880 AF/yr.

5.2 Overview of Project Elements

The GWMP Update includes several types of water resource management programs that address:

- M&I Water Supply
- Agricultural Water Supply
- Groundwater Level Management

- Water Quality Management
- Agricultural
- M&I
- Wastewater Disposal

The following Project Toolbox Elements (Management Measures) have been selected for inclusion in the GMP Update. The Project Toolbox Elements can be divided into programs and projects/activities. Programs address issues such as water conservation, salt and nitrate education, ordinances, and economic incentives for water use. Projects/Activities will most likely result in capital infrastructure projects that will transport San Benito County water.

The programs and projects/activities contained in the Project Toolbox Elements have been divided into three general categories: 1) Institutional Programs; 2) Continuation of Existing Projects/Activities; and 3) New Projects/Activities.

1) Institutional Programs

- M&I Water Conservation
- Agricultural Water Conservation
- Salinity Education Program
- Water Softener Ordinance
- Industrial Salt Control in Municipal Wastewater Program
- Nitrate Education Program
- Well Construction and Abandonment Ordinance
- Maintain and Enhance Strategic Data Collection and Management Program
- Continue and Expand Economic/Regulatory Water Level Management Tools

These elements are ongoing, basin-wide programs that are the cornerstones of the GMP Update.

2) Continuation of Existing Projects/Activities

- Existing Groundwater Extraction Facilities
- Surface Water Importation
- Surface Water Treatment

- M&I Wastewater Effluent Percolation
- Water Transfers
- In-Basin Water Banking
- Natural Direct Percolation
- Artificial Direct Percolation of Imported Surface Water
- In-lieu Banking of Imported Surface Water

3) New Projects/Activities

- Development/Improvement of High Quality Local Groundwater and Surface Water Supplies
- Regional and Local Conveyance Facilities For Multiple Water Supply
- Out-of-Basin Water Banking
- In-Basin Water Banking
- Natural Direct Percolation
- Artificial Direct Percolation of Local Surface Water
- In-Lieu Banking of Local Surface Water
- Aquifer Storage and Recovery of Imported and/or Local Surface Water
- Groundwater Treatment and Concentrate* Disposal
- Groundwater/Surface Water Blending
- Recycled M&I Wastewater Effluent for Direct Reuse
- Tile Drains for Localized Groundwater Level Management
- Tree Belt Evapotranspiration for Localized Groundwater Level Management/Wastewater Disposal /Wastewater Disposal
- Groundwater Pumping for Water Level/Water Quality Management
- Out of Basin Export of wastewater effluent, concentrate, pumped groundwater and/or agricultural drainage by:
    - River Discharge

  - Evaporation of Concentrate and Trucking of Salts
  - Export Pipeline
- Constructed Wetlands for Treatment/Polishing of Wastewater Effluent/Stormwater/Agricultural Runoff

* Concentrate is the minerals/salts that remain after treatment of water through demineralization or desalting processes.

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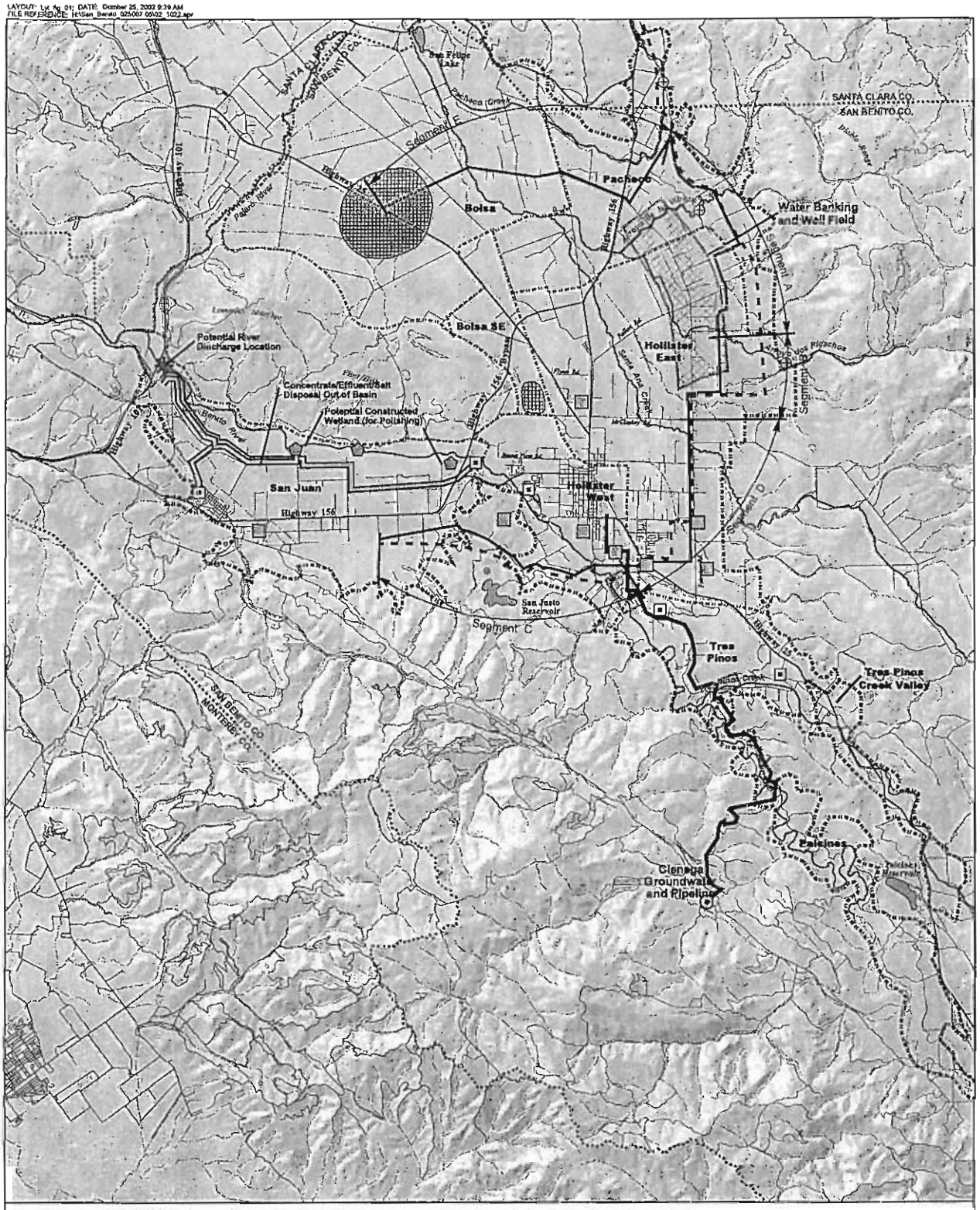

Basemap reference: EDAW/TODD Engineers, 2001

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LEGEND

- Proposed Effluent for Direct Reuse
- Proposed Groundwater/Surface Water Treatment Facilities
- Proposed Seasonal Local Surface Water Development
- Potential River Discharge Location
- Potential Constructed Wetland
- Proposed/on-going In-lieu Percolation
- In Basin Water Banking and Well Field
- Proposed Local Conveyance Pipeline
- Proposed Cienega Groundwater Pipeline
- Proposed Agricultural Drainage Pipeline
- Proposed Export Pipeline
- Hollister Conduit San Felipe Water System
- Groundwater Basin Boundary
- Groundwater Subbasin Boundary

Kennedy / Jenks Consultants

Water Resources Association of San Benito County

GROUNDWATER MANAGEMENT PLAN UPDATE PROJECT ELEMENTS

K/J 025007.05
July, 2003

Figure 5-1

Table 5-1: GMP Update Project Toolbox Elements and Program Matrix

Project Toolbox Element	M&I Water Supply	Agricultural Water Supply	GW Level Management	Water Quality Management		Wastewater Disposal
				Ag.	M&I	
Institutional Programs						
M&I Water Conservation	✓		✓			
Agricultural Water Conservation		✓	✓			
Salinity Education Program				✓	✓	
Water Softener Ordinance					✓	✓
Industrial Salt Control in Municipal Wastewater Program					✓	
Nitrate Education Program	✓	✓		✓	✓	
Well Construction and Abandonment Ordinance				✓	✓	
Maintain and Enhance Strategic Data Collection and Management Program	✓	✓	✓	✓	✓	✓
Continue and Expand Economic/Regulatory Water Level Management Tools	✓	✓	✓	✓	✓	
Continuation of Existing Projects/Activities						
Existing Groundwater Extraction Facilities	✓	✓	✓			
Surface Water Importation	✓	✓				
Surface Water Treatment	✓				✓	

Table 5-1: GMP Update Project Toolbox Elements and Program Matrix

Project Toolbox Element	M&I Water Supply	Agricultural Water Supply	GW Level Management	Water Quality Management		Wastewater Disposal
				Ag.	M&I	
Continuation of Existing Projects/Activities						
M&I Wastewater Effluent Percolation		✓		✓	✓	✓
Water Transfers	✓	✓	✓			
In-Basin Water Banking – Natural Direct Percolation[1]	✓	✓				
In-Basin Water Banking – Artificial Percolation of Imported and/or Local Surface Water[1]	✓	✓	✓	✓		
In-Basin Water Banking – In-lieu Banking of Imported and/or Local Surface Water[1]		✓	✓	✓		
New Projects/Activities						
Development/Improvement of High Quality Local Ground and Surface Water Supplies	✓	✓		✓	✓	✓
Regional and Local Conveyance Facilities for Multiple Water Supply Distribution	✓	✓	✓	✓	✓	
Out-of-Basin Water Banking	✓	✓	✓			
In-Basin Water Banking – Aquifer Storage and Recovery of Imported and/or Local Surface Water	✓	✓	✓	✓		
Groundwater Treatment and Concentrate Disposal	✓				✓	
Groundwater/Surface Water Blending	✓	✓	✓	✓	✓	
Recycled M&I Wastewater Effluent for Direct Reuse		✓	✓			✓

Table 5-1: GMP Update Project Toolbox Elements and Program Matrix

Project Toolbox Element	M&I Water Supply	Agricultural Water Supply	GW Level Management	Water Quality Management		Wastewater Disposal
				Ag.	M&I	
Tile Drains for Localized Groundwater Level Management			✓	✓		
New Projects/Activities						
Tree Belt Evapotranspiration for Localized Groundwater Level Management/Wastewater Disposal			✓	✓		
Groundwater Pumping for Water Level/Water Quality Management			✓	✓	✓	
Out-of-Basin Export - River Discharge of Wastewater Effluent, Concentrate, Pumped Groundwater, and/or Agricultural Drainage			✓	✓		✓
Out-of Basin Export –Evaporation and trucking of concentrate				✓		
Out-of-Basin Export – Export Pipeline for Wastewater Effluent, Concentrate, Pumped Groundwater, and/or Agricultural Drainage				✓	✓	✓
Constructed Wetlands for Treatment/Polishing of Wastewater Effluent, / Stormwater / Agricultural Runoff				✓	✓	✓

(a) Also applies to New Projects/Activities for Local Surface Water

Each Project Toolbox Element is described in further detail below and major issues and major benefits for each Element are identified. Those projects that can be identified with a general location are shown on Figure 5-1.

Table 5-2 shows the project toolbox elements and their applicability to the various sub-basins.

Table 5-2: Project Toolbox Elements and Sub-basin Applicability.

Project Toolbox Elements	Bolsa	Pacheco	Hollister East	Hollister West	Bolsa SE	San Juan	Tres Pinos
Institutional Programs							
M&I Water Conservation	✓	✓	✓	✓	✓	✓	✓
Agricultural Water Conservation	✓	✓	✓	✓	✓	✓	✓
Salinity Education Program	✓	✓	✓	✓	✓	✓	✓
Water Softener Ordinance			✓	✓		✓	
Industrial Salt Control in Municipal Wastewater Program			✓	✓		✓	
Nitrate Education Program	✓	✓	✓	✓	✓	✓	✓
Well Construction and Abandonment Ordinance	✓	✓	✓	✓	✓	✓	✓
Maintain and Enhance Strategic Data Collection and Management Program	✓	✓	✓	✓	✓	✓	✓
Continue and Expand Economic/Regulatory Water Level Management Tools		✓	✓	✓			
Continuation of Existing Projects Activities							
Existing Groundwater Extraction Facilities	✓	✓	✓	✓	✓	✓	✓
Surface Water Importation		✓	✓	✓	✓	✓	✓
Surface Water Treatment			✓	✓		✓	
M&I Wastewater Effluent Percolation			✓	✓		✓	✓
Water Transfers	✓	✓	✓	✓	✓	✓	✓
In-Basin Water Banking – Natural Direct Percolation[1]	✓	✓	✓	✓	✓	✓	✓
In-Basin Water Banking – Artificial Percolation of Imported and/or Local Surface Water[1]	✓		✓				✓
In-Basin Water Banking – In-lieu Banking of Imported and/or Local Surface Water[1]		✓			✓		

Project Toolbox Elements	Bolsa	Pacheco	Hollister East	Hollister West	Bolsa SE	San Juan	Tres Pinos
New Projects/Activities							
Development/Improvement of High Quality Local Ground and Surface Water Supplies	✓		✓				✓
Regional and Local Conveyance Facilities for Multiple Water Supply Distribution	✓	✓	✓	✓		✓	
Out-of-Basin Water Banking	✓	✓	✓	✓	✓	✓	✓
In-Basin Water Banking – Aquifer Storage and Recovery of Imported and/or Local Surface Water	✓		✓				
Groundwater Treatment and Concentrate Disposal			✓	✓		✓	
Groundwater/Surface Water Blending			✓	✓		✓	
Recycled M&I Wastewater Effluent for Direct Reuse			✓	✓		✓	
Tile Drains for Localized Groundwater Level Management						✓	
Tree Belt Evapotranspiration for Localized Groundwater Level Management / Wastewater Disposal						✓	
Groundwater Pumping for Water Level/Water Quality Management		✓	✓			✓	
Out-of-Basin Export - River Discharge of Wastewater Effluent, Concentrate, Pumped Groundwater, and/or Agricultural Drainage			✓	✓		✓	
Out-of Basin Export –Evaporation and Trucking of Concentrate			✓	✓		✓	
Out-of-Basin Export – Export Pipeline for Wastewater Effluent, Concentrate, Pumped Groundwater, and/or Agricultural Drainage			✓	✓		✓	
Constructed Wetlands for Treatment/Polishing of Wastewater Effluent, / Stormwater / Agricultural Runoff			✓	✓		✓	

(1) Also applies to New Projects/Activities for Local Surface Water

5.3 Institutional Programs

5.3.1 M&I Water Conservation

Description: The WRA members have joined to implement M&I Water Conservation by hiring an individual as a shared resource among the WRA members. For existing M&I uses, it is assumed that, over the next 20 years, water demand from existing residential units will decrease by 1% per year (J. Gregg, Personal Communication, 3 June 2002). At this rate of decrease of water demand, demands are expected to reduce from an estimated 420 gpd/du at present to 344 gpd/du in the future in existing residential units. Current ordinances for new residences in the city and county will restrict water use to approximately 312 gpd/du by using xeriscape landscaping and other water conservation measures. (Draft Environmental Impact Report for Northeast Fairview Specific Plan, October 1999).

Major Issues: The most important issue associated with this element is the implementation of water conservation programs and quantifying demand reductions over time.

Major Benefits: The most important benefit of this element is that it is an efficient use of the water supplies and represents a low-cost way to stretch water supplies.

5.3.2 Agricultural Water Conservation

Description: The conservation goal is to achieve 85% irrigation efficiency consistent with CVP water supply contract expectations. Agencies such as the Resource Conservation District and the San Benito County Farm Bureau assist agricultural water users in improving efficiency. It is expected that the efficiency improvements needed to meet the CVP guidelines for 85% efficiency will be achieved primarily by reducing evaporative losses during irrigation (J. Gregg, Personal Communication on 3 June 2002).

The SBCWD has developed a Water Management Program for M&I and agricultural supplies that is subject to review and approval by the USBR for all imported CVP water. The Best Management Practices identified under the Water Management Program include:

- Measurement of water to plus or minus 6% as required by the USBR.
- Designation of a water conservation coordinator. At present the SBCWD District Manager serves as the water conservation coordinator and for FY 02/03, the SBCWD Board has approved the addition of an agricultural/urban irrigation specialist.
- Provide or support water management services to water users. Services include providing:10 on-farm surveys per year and timely crop and water use information to each user; Irrigation scheduling and evapotranspiration information to water users; surface, ground, and drainage water quality data; and agricultural water management education programs and materials for farmers, staff, and the general public.
- Evaluation and improvement of SBCWD pump efficiencies.

- Other relevant items from the Best Management Practices include: facilitating use of recycled urban wastewater for crop use; facilitation of financing of capital improvements for on-farm irrigation systems; and optimize conjunctive use of surface and groundwater.

At present, the SBCWD does not have sufficiently detailed information (such as acreage by crop, including multi-cropping) to accurately estimate agricultural water use efficiency.

Major Issues: The most important issue associated with this element is implementation of the water conservation programs and tracking demand reductions over time.

Major Benefits: The most important benefit of this element is that it is an efficient use of the water supplies and represents a low-cost way to stretch water supplies.

5.3.3 Salinity Education Program

Description: Implementation of salinity education for both agricultural and M&I users will be crucial to managing salt loads to the groundwater basin. A preliminary salt balance that has been prepared as part of the San Benito County Water District's Annual Groundwater Report for Water Year 2001 indicates that imported CVP water, fertilizers from agricultural and urban users, and concentrate from water softeners from M&I users account for 20,941 tons per year or 53% of all of the salts entering the groundwater basin. Of the salts contributed, agricultural users account for 17,541 tons per year and urban users 3,400 tons per year.

Ongoing programs by agencies such as the Resource Conservation District and the San Benito County Farm Bureau assist agricultural water users in managing salt additions from fertilizers and other products to reduce salt infiltration to the local groundwater basin. Management of salinity, particularly from agricultural users, also reduces nitrate build-up in the groundwater. Salinity education of M&I users will occur primarily through implementation of the water softener ordinance described below.

Major Issues: The most important issue associated with this element is implementation of the salinity education program and tracking reductions in salt contributions over time.

Major Benefits: The most important benefit of this element is that it reduces salt input to the groundwater basin.

5.3.4 Water Softener Ordinance

Description: The salt balance in the Annual Groundwater Report for Water Year 2001 estimates that water softeners add 2,270 tons per year or 6 % of the total salt inputs to the groundwater basin. Although this source is small in comparison to other sources, it is a relatively easily controllable source of salts.

The urban water purveyors have implemented ordinances requiring new home water softeners to be the type that is regenerated offsite to prevent the introduction of salts into the sewer system. In addition, public education is ongoing regarding the need to regenerate softeners only when required. A retrofit ordinance applicable to resale of homes, and a grant program to

assist existing homeowners in achieving conversion at lower cost is also under consideration. Introduction of lower hardness water sources to the municipal water systems, such as the recently completed Lessalt Water Treatment Plant, will reduce the need for home water softeners.

Major Issues: The most important issue associated with this element is enforcement of the ordinance and implementation of the education program. Reductions in salt contributions over time will most easily be tracked in wastewater effluent samples.

Major Benefits: The most important benefit of this program is that it reduces a salt input that is relatively easy to control to the groundwater basin.

5.3.5 Industrial Salt Control in Municipal Wastewater Program

This program is intended to work cooperatively with food processors and other industrial dischargers whose operations contribute elevated levels of salts to municipal wastewater treatment plants.

5.3.6 Nitrate Education Program

This program is intended to work cooperatively with agricultural and municipal users on the use of soil amendments, fertilizers and other compounds that are applied to fields and landscaping to improve soil conditions and plant productivity.

5.3.7 Well Construction and Abandonment Ordinance

There are many wells in San Benito County that were not constructed to current standards and may be providing a means for vertical migration of poor quality water to deeper aquifers. These wells were most likely constructed with gravel pack seals to the ground surface and have not been properly abandoned so remain a threat to groundwater quality.

This program would include review of applicable current County well ordinances. The review would evaluate whether sufficient resources, processes, and procedures are available for enforcement of the ordinance. If necessary, additional ordinances or modifications to existing ordinances would be developed to be consistent with Department of Health Services and other standards for well construction and abandonment.

5.3.8 Maintain and Enhance Strategic Data Collection and Management Program

The San Benito County Water District currently gathers groundwater level and quality information and prepares an annual groundwater report. As practices such as groundwater banking and in-lieu percolation are expected to be practiced more intensively in the future, the need for groundwater data collection and analysis on a more frequent seasonal basis is expected to increase. This program is intended to further develop data collection and

management so that timely decisions can be made regarding which water source can be used in each area.

More detailed information regarding data collection and management is found in Section 2.2

5.3.9 Continue and Expand Economic/Regulatory Water Level Management Tools

The SBCWD has developed a regulation that limits transfer of additional imported water into the San Juan sub-basin. This regulation was established to manage the current high groundwater levels in the San Juan. At the present time, the regulation is reviewed on an annual basis and decisions are made regarding the need to implement the regulation based on groundwater level data.

The SBCWD envisions development of additional regulations, policies, and economic incentives/disincentives to better distribute water to the areas in overdraft and to encourage the use of wells in those areas of high groundwater.

5.4 Continuation of Existing Projects and Activities

5.4.1 Existing Groundwater Extraction Facilities

Description: There are approximately 1,000 wells currently in the County that serve agriculture, community water systems in San Juan Bautista and Hollister area, and rural home users. Groundwater is readily available and is considered to be the predominant supply in the basin as shown in Section 3.2.1. For community water systems that use groundwater for M&I supply, additional treatment to remove hardness and salts will be required in the future as described further in Section 5.5.5. For agricultural users that have access to surface water, groundwater can be blended with surface water to improve the quality of the delivered water.

Major Issues: Declining water quality is the most important issue associated with the continued use of existing groundwater extraction facilities for M&I and agricultural supply. The water quality can be improved through the treatment and/or blending described below.

Major Benefits: Continued use of groundwater serves as an important element in the prevention of elevated groundwater levels that can negatively impact agricultural and residential areas. The facilities to extract groundwater are already in place and will not require significant additional capital expenditures other than possible treatment to remove salts.

5.4.2 Surface Water Importation

Description: Existing CVP surface water contracts allow up to 43,800 AF/yr of contract entitlement to the SBCWD of which 8,250 AF/yr is for M&I and 35,550 AF/yr is for agriculture deliveries. However, the levels for M&I supplies are often reduced to 75% of entitlement, and agricultural supplies are often reduced to less than 60% and as low as 0% of entitlement in severe drought conditions. The long-term average annual delivery is expected to be closer to

30,000 AF of which 7,000 AF/yr is for M&I deliveries and 23,000 AF/yr is for agriculture deliveries. CVP deliveries of 2,100 AF/yr are estimated for M&I during critically dry years.

Actual CVP deliveries to San Benito County are shown in Table 3-2 above and have averaged about 18,400 AF/yr. However, only a small fraction of M&I use of CVP water has been realized.

Draft CVP reliability guidelines for M&I indicate that if agricultural supplies are converted to M&I supplies, they still maintain the lower reliability of an agricultural supply. For example, in severe drought conditions, no water may be delivered if the entitlement has been converted from agricultural to M&I uses. The GMP Update assumes that the available CVP surface water for M&I uses can range from 1.9 MGD (2,100 AF/yr) to 7.4 MGD (8,250 AF/yr). Delivery of CVP water for M&I uses will require treatment in a surface water treatment plant as described below.

Major Issues: Importation of surface water for M&I uses instead of use of local groundwater can result in higher groundwater levels. Wastewater effluent disposal issues associated with percolation of effluent are exacerbated in areas of high groundwater. Therefore, continued long-term use of imported surface water for M&I will require careful management of groundwater levels. The relatively low reliability of this supply and the insufficient supply to meet 2022 M&I demands will require additional sources of water to be developed for M&I uses.

Major Benefits: The high quality of the CVP water with respect to hardness and TDS will result in reduced use of water softeners and the resulting reduction in salt concentration in wastewater effluent. Reduced salts in wastewater effluent will make the recycled water more attractive for direct reuse.

5.4.3 Surface Water Treatment

Description: As described earlier, the availability of imported CVP water for M&I uses is likely to range from an average flow of 1.9 MGD (2,100 AF/yr) to 7.4 MGD (8,250 AF/yr) while the total average demand is up to 10.2 MGD (11,465 AF/yr). Since there is a high probability that local surface water to make up the 2.8 MGD (3,215 AF/yr) difference between the total M&I demand and the available CVP water is available, it has been assumed for the GMP Update that up to 10.2 MGD of surface water treatment capacity will be required on an average basis.

Providing sufficient capacity for peak summertime demands will require distribution storage. Some distribution storage already exists within the City of Hollister, Sunnyslope County Water District, and City of San Juan Bautista systems. The Water Master Plan Update for the City of Hollister (September 1996) recommended the addition of 7 MG of storage to the existing 6 MG of storage already in the Hollister and Sunnyslope system. Construction of distribution storage is a requirement of operations of the water distribution system and will be the responsibility of each individual water purveyor.

In those dry and critically dry years when surface water may not be available for treatment, more groundwater will be required to make up the difference.

Surface water must be treated by filtration and disinfection processes to remove particles and pathogens from the water and to meet Federal and State drinking water requirements. Filtration

alternatives for surface water treatment include conventional granular media filtration and microfiltration (MF) or ultrafiltration (UF) membrane filtration processes. Disinfection alternatives include the use of chlorine, ozone, or ultraviolet light (UV) to inactivate pathogens.

The recommended surface water treatment for San Luis Reservoir CVP water is MF or UF membrane filtration with chlorine or UV disinfection. This cost-effective process provides higher water quality, uses fewer chemicals, is easier to operate, and provides greater flexibility in meeting future water quality regulations than does the conventional treatment process.

The 3 MGD capacity Lessalt membrane filtration plant went into operation in November 2002 for the City of Hollister and Sunnyslope County Water District to deliver treated imported surface water in a portion of their service area. The Lessalt plant is expected to operate at full capacity most of the year. The City of San Juan Bautista has completed its California Environmental Quality Act (CEQA) document for a 1-MGD capacity membrane filtration plant. It is expected that it will take several years for the San Juan Bautista plant to have demands near full operational capacity.

Therefore, it is assumed for the GMP Update that up to 6.2 MGD, on average, of additional surface water treatment capacity would be required in the future to meet the projected M&I demands. Currently, Sunnyslope County Water District is in the early planning and design process for a 2 MGD capacity membrane filtration plant. If Sunnyslope's plant goes forward, then up to 4.2 MGD, on average, of additional treatment capacity will be required. The additional treatment capacity could be possibly economically achieved by expanding existing treatment plants with additional treatment units. However, in some cases, it may be desirable to locate a treatment plant in an area of development rather than constructing additional transmission pipelines. Up to five locations for surface water treatment plants have been identified and are shown conceptually on Figure 5-1. It should be noted that some of this capacity may not be required if groundwater demineralization facilities are constructed to meet the M&I demand.

Major Issues: The major issues associated with surface water treatment plants are with potential increases in water levels in the Hollister East and Hollister West sub-basins. The higher groundwater will be the result of: a) reduced groundwater pumping in the sub-basins because of the increased use of imported surface water and/or local surface water from another sub-basin and b) the additional wastewater effluent that is generated and disposed of in the wastewater percolation ponds.

Therefore, careful monitoring and management of groundwater levels in the Hollister East and Hollister West sub-basins will be required during the implementation of this Project Toolbox Element. It should be noted that the additional groundwater which will likely be developed to meet future M&I demands will offset, to some degree, the water level impacts of the use of imported water.

Major Benefits: The major benefits associated with the use of surface water and treatment through surface water treatment plants is the high quality of the CVP and/or local surface water with respect to hardness and TDS. The higher quality water will result in reduced use of water softeners and a resulting reduction in salt concentration in wastewater effluent. The reduced salt loading in the wastewater effluent will make it more attractive for direct reuse. In addition, the

use of local surface water for M&I uses will result in even further reductions in salt inputs to the groundwater basin when compared to the salt inputs from imported surface water.

5.4.4 M&I Wastewater Effluent Percolation

Description: This Project Toolbox Element involves disposing of and/or storing M&I wastewater effluent through existing or new percolation ponds. M&I wastewater effluent disposed of and/or stored in percolation ponds must be treated to a sufficiently high quality to meet local groundwater quality objectives mandated by the Regional Water Quality Control Board. Increased percolation capacity can be achieved through redevelopment of existing ponds to increase rate of percolation, creation of additional ponds, development of ponds in other locations with higher capacity, and/or reduction of local groundwater levels to improve vertical groundwater gradients and therefore increase percolation rates.

M&I wastewater effluent percolation is now the primary mechanism for wastewater effluent disposal. Even as water recycling becomes more widespread, it is expected that use of percolation ponds will continue to serve as an alternative wastewater disposal method to address seasonal variations in recycled water demand and the expected need for wastewater disposal in wintertime. For the purposes of the GMP Update, it is assumed that M&I wastewater effluent percolation will continue to serve as a method of wastewater disposal in the groundwater basin area.

Major Issues: One of the major issues of this Project Toolbox Element is the ongoing concern for groundwater quality degradation and localized high groundwater associated with M&I wastewater effluent percolation.

Major Benefits: One of the major benefits of this Project Toolbox Element is that as source water quality improves, so will the M&I wastewater effluent and therefore will improve the water quality of the groundwater.

5.4.5 Water Transfers

Description: Assuming that water management activities free some of the imported water, then short-term or long-term water transfers of the imported water from the basin to outside users could generate revenue to help implement the programs of the GMP Update. It is assumed that execution of short-term water transfers to other entities or to Out-of-Basin water banks as discussed in Section 5.5.3 has already been reviewed for environmental impacts through on-going Federal and State permitting and review processes.

Major Issues: One of the major issues associated with water transfers is the need to obtain buy-in from current users of imported water to take delivery of groundwater and/or blended water of higher TDS than the imported water alone. Only when users accept groundwater or blended water will the imported water become available for transfer. In addition, depending on the length and degree of permanence of the water transfer, the negotiations to complete a water transfer could be complex and protracted.

Major Benefits: Some of the major benefits associated with transferring the use of imported water out of the groundwater basin are: the generation of revenue that can be used to help implement programs; the lowering of high groundwater levels that will occur with decreased application of imported water and increased groundwater pumping; and the reduction in imported salts that results from importing less surface water.

5.4.6 In-basin Water Banking

Description: Local water banking in the groundwater aquifer is an important component of managing water resources in the basin and storing water to improve the reliability of the water supply.

As described in earlier sections, there are a number of sources that could be banked in the groundwater basin including imported surface water and/or high winter flows in local streams. The potential mechanisms for banking include:

- Natural direct percolation,
- Artificial direct percolation of imported and/or local surface water,
- In-lieu banking of imported and/or local surface water, and
- Injection of imported and/or local surface water into groundwater storage and extraction of water from Aquifer Storage and Recovery (ASR) wells.

These mechanisms are discussed in greater detail below.

Use of percolated water in river channels or recharge basins would require extraction wells, while ASR would provide injection and extraction in a single facility. In-basin water banking will also require Regional and Local Conveyance Facilities for Multiple Water Supply Distribution to effectively distribute the banked water.

Natural direct percolation is an on-going natural process and is discussed briefly below.

At the present time, the greatest opportunity for artificial direct percolation appears to be in the Pacheco and northern portion of the Hollister East Sub-basins where percolation of imported surface water has historically occurred. Some in-stream percolation sites along the San Benito River in the Hollister West and San Juan sub-basins have also been studied. Although percolation sites have been identified in the San Juan sub-basin, the sub-basin has limited hydraulic capacity for water banking because of existing high water levels, and is further limited by poor ambient groundwater quality.

Southern Bolsa sub-basin has capacity for in-lieu banking because of the presence of a large groundwater depression and the availability of imported water. In-lieu banking is currently occurring in the Bolsa Southeast sub-basin where imported surface water is now used for irrigation, thus allowing natural direct percolation to refill a groundwater depression that had previously been overdrafted.

ASR could occur in any number of locations depending on the availability of storage capacity in the aquifer.

Major Issues: The major issue associated with water banking in general is ensuring that there is sufficient information regarding water levels, water quality, available storage capacity of aquifers, etc. to be able to make informed decisions about where and when to recharge water.

Major Benefits: The major benefit of groundwater banking is the ability to store a variety of source waters with relatively few environmental impacts when compared to surface water reservoirs. Water in storage will increase the reliability of the overall water supply system during dry years when groundwater can be used to offset reductions in imported water.

A more detailed discussion of the various in-basin water banking options follows:

5.4.6.1 Natural Direct Percolation

Natural direct percolation is an on-going process in the existing fields and waterways. The high proportion of agricultural land uses in San Benito County result in high levels of natural direct percolation, especially when compared to more urbanized areas with higher proportions of impervious surfaces. As long as the agricultural land uses, which are highly valued in San Benito County remain, natural direct percolation will also continue to occur at levels close to current levels.

5.4.6.2 Artificial Direct Percolation of Imported and/or Local Surface Water

Description: Similar to the Project Toolbox Element of Development/Improvement of High Quality Local Ground and Surface Water Supplies, if sufficient groundwater storage space and unused imported and/or local surface water is available, then water could be percolated in high permeability river/drainage channels for storage in the groundwater basin. The SBCWD currently stores excess imported water in the groundwater basin through percolation in highly permeable channels. However, rising groundwater levels in some areas have required the SBCWD to curtail percolation in an effort to better manage groundwater levels.

The Pacheco and northern Hollister East sub-basins, as shown on Figure 5-1, have been identified as areas for potential banking and withdrawals. At the present time this area has high groundwater levels that would have to be pumped down to allow water to be stored. It is expected that extraction of water banked in these areas can occur primarily through existing wells. There are over a thousand wells in San Benito County; it is expected that wells that are in good condition close to use areas and/or regional and local conveyance pipelines can be identified and arrangements made with the well owners to lease the wells.

The Hollister Conduit and/or the proposed regional and local conveyance facility could be used to convey the pumped water to either the southern Bolsa sub-basin or to other potential use areas that could be accessed by SBCWD's extensive CVP water delivery system.

In the Hollister West and San Juan sub-basins, eight in-stream percolation sites were studied along the San Benito River as shown on Figure 5-1 (Zone 3 and Zone 6 Annual Percolation and Groundwater Recharge Program, San Benito River Detention Basins, March 1995). The

percolation facilities consisted of simple berms with culvert spillways and slide gates to control the flow. The berms reduce the flow rate, increase water depth, and allow more percolation than occurs through the natural river channel.

Although not specifically studied, there may be off-stream percolation facilities that can be constructed close to the in-stream percolation sites that would increase the area of percolation, and hence the volumes of water that could be percolated. Studies conducted by the SBCWD in cooperation with Granite Rock Incorporated indicate that in some locations, sustained percolation rates as high as 1 foot/day were observed (J. Gregg, Personal Communication, 28 August 2002). Off-stream percolation may also extend the length of time that percolation can occur and therefore the volume of water that could be percolated.

The San Benito River percolation sites would also benefit from development of a dedicated shallow well-field to extract the water. It is expected that water would be pumped out of the San Benito River gravels and into the Hollister Conduit and/or the regional and local conveyance pipelines to the use areas. Some existing deeper wells could also be used for extraction.

Major Issues: The major issue associated with artificial direct percolation is that all of the proposed artificial direct recharge locations have high groundwater levels as a result of the use of imported water in the area. In addition, Hollister West has the additional consideration of treated wastewater effluent percolation that impacts groundwater levels . Therefore, artificial direct recharge will require careful selection of recharge areas and monitoring and management of water levels.

SBCWD has been awarded an AB 303 grant to further develop and automate their on-going groundwater level and quality monitoring. Improved data will assist the SBCWD in identifying areas appropriate for groundwater banking and withdrawal and in evaluating local water quality. In addition, careful evaluation of the quality of the source and native waters will be required to minimize the potential for aquifer plugging and other negative impacts.

Major Benefits: The major benefit associated with imported surface water percolation is that it allows for the storage of high quality water when the water is available thus increasing the reliability of water supply to the San Benito County users.

5.4.6.3 In-lieu Banking of Imported and/or Local Surface Water

Description: As described earlier, in-lieu banking is currently occurring in the Bolsa Southeast sub-basin through the extension of the delivery system for imported water to the sub-basin. By using the imported water, groundwater is not being pumped and the groundwater recharge that is occurring remains in storage. Therefore, by providing imported water in-lieu of pumping groundwater, water banking is occurring.

It is expected that the in-lieu banking effort will result in mitigation of the groundwater depression that has formed by allowing direct natural percolation to recharge the sub-basin. Evidence of the decrease in the size and depth of the groundwater depression has been documented in the recent Annual Groundwater Reports.

In-lieu banking in Bolsa Sub-basin is described below in the New Projects/Activities section.

Major Issues: The major issues associated with in-lieu banking through the delivery of alternative water supplies is that careful monitoring of the water levels must occur. Prior to delivery of imported surface water to San Benito County, the entire groundwater basin was in overdraft. Since imported surface water deliveries began in 1997, the overdraft condition in those areas receiving imported surface water has largely been mitigated. In some cases, deliveries have resulted in oversupply and corresponding high groundwater levels.

Major Benefits: The major benefit associated with in-lieu banking is that it offers opportunities to increase the quantity of banked water, and thus increases the reliability of the overall groundwater system for use during droughts.

5.5 New Projects/Activities

5.5.1 Development/Improvement of High Quality Local Ground and Surface Water Supplies

Description: This Project Toolbox Element addresses underutilized, high-quality water resources in the groundwater basin. These consist either of previously-developed resources with facilities that have fallen into disrepair, or of resources with unexercised water rights. These water sources include:

- Redevelopment of City of Hollister's water right for additional local groundwater extraction at Cienega Valley.
- Development of groundwater resources in the Pacheco sub-basin for transfer to other sub-basins.
- Development of SBCWD's Arroyo Dos Picachos surface water right.
- Development of new surface water rights on Arroyo Los Viboras.
- Development of unused surface water on Pacheco Creek.

With the exception of the Cienega and Pacheco sub-basin groundwater supplies which are available year-round, most of the surface waters are only available in the winter and late spring. These surface water sources could be developed further using seasonal diversion dams. The water could then be percolated in-place if in-stream percolation and aquifer storage capacity are available, directed into surface water pipeline systems for conveyance to a banking area, or delivered directly to agricultural or M&I users.

Major Issues: The major issue associated with this Project Toolbox Element is the need to have sufficient storage available for use during the summer months. Banking of the surface waters in the groundwater aquifer will require careful management of the basin. Potential environmental impacts to riparian areas may be associated with seasonal diversion dams.

Major Benefits: One of the major benefits associated with this Project Toolbox Element is that it provides a relatively low-cost, high quality water source. Also, use of local surface waters

reduces importation of salts, and use of wet weather diversion may offer some measure of flood control. The Pajaro River Watershed Flood Management Authority has identified potential flood control opportunities on the San Benito River as it passes through Hollister; diversion on upstream waterways may offer similar benefits.

These specific proposed water sources are discussed in greater detail below

5.5.1.1 Cienega Valley Groundwater Source

Description: The Cienega Valley water source, located to the south of the City of Hollister as shown on Figure 5-1, is the historic water source for the City. However, landslides in 1983 damaged the pipeline that delivered the water and water rights adjudication that occurred soon thereafter reduced the quantity of water that the City could deliver. As a result, the project to rehabilitate and replace the damaged pipeline (shown on Figure 5-1) was economically infeasible and not pursued. The City made pipeline repairs to serve a limited number of customers close to the Cienega Valley source and continues to make pipeline repairs needed to serve those existing customers. Cienega Valley water is not currently delivered to customers within Hollister's city limits because that portion of the pipeline has not been repaired.

The water quality of Cienega Valley is excellent with TDS less than 200 mg/l. Extraction of Cienega Valley waters occurs through either of two shallow wells constructed adjacent to Pescadero Creek. The City's adjudicated water right No. 14797 from 1988 in Cienega Valley is for a maximum diversion of 489.41 AF/year with a monthly maximum diversion of 40.78 AF. In the past, water had been available from the Cienega Valley on a year-round basis. The proposed capacity of the pipeline from the Cienega Valley is 1.5 MGD (1,050 gpm or 1,679 AF/yr) (Cienega Pipeline – 1983 Damage Assessments, April 1983).

Because the wells are shallow and adjacent to Pescadero Creek, the water may be considered groundwater under the direct influence of surface water according to current drinking water regulations. As a result, use of Cienega Valley water for M&I supply may require treatment under the Surface Water Treatment Rule as a opposed to the disinfection-only that occurred previously. If the water is delivered to the Hollister Conduit as envisioned, the water could be treated at one of the existing or proposed surface water treatment plants.

It is envisioned that the Cienega Valley water could be brought to and commingled with CVP water at the downstream end of the CVP System in Tres Pinos. Connection of the San Felipe and Cienega systems would require about one mile of pipeline between the proposed Cienega Valley replacement pipeline and the Hollister Conduit. It appears that there would be sufficient head in the Cienega Valley pipeline such that a booster pump station would not be required.

The City's allocation of Cienega Valley water could then be exchanged with the SBCWD's CVP water and the City could take its allocation as CVP Water further upstream. The commingled Cienega Valley/CVP water would be delivered by SBCWD to downstream users.

Major Issues: The major issues with this source of water are the relatively low quantities available, and the potential costs of delivery.

Major Benefits: The major benefits of this source of water are its high quality and high reliability. Also, the presence of additional supply sources offers operational flexibility in serving water users.

5.5.1.2 Pacheco/Northern Hollister East Sub-basins Groundwater Pumping

Description: As a result of the delivery of CVP water, the Pacheco and Northern Hollister East sub-basins have an estimated surplus of 4,000 AF/yr of water that is banked in the local groundwater sub-basin (U.S.B.R., 1972). This surplus is in direct proportion to the amount of water that is imported. SBCWD is currently managing groundwater levels in the Pacheco and Northern Hollister East Sub-basins by limiting the amount of summertime percolation releases of CVP Water.

Banked water, which is discussed later in Section 5.5.4, could be pumped to the Hollister conduit and/or the proposed regional and local conveyance pipelines, as shown on Figure 5-1, for delivery either to the southern portion of Bolsa sub-basin where there is a historic overdraft, or to San Juan or other sub-basins.

The expected water quality from the Pacheco/Northern Hollister East sub-basins is on the order of 700 – 800 mg/l TDS and 2-3 ppm boron. It is likely that blending with local or imported water sources will be required to reduce boron concentrations to levels acceptable to agricultural and other users. Pacheco/Northern Hollister East sub-basin water could also be blended with the native San Juan groundwater to reduce local groundwater TDS concentrations.

Major Issues: The major issues with this source of water are the potential costs of delivery and the need for blending to reduce boron levels.

Major Benefits: The major benefits of this source of water are its high reliability and relatively high quality. Also, the presence of an additional supply source offers operational flexibility in serving water users.

5.5.1.3 Arroyo Dos Picachos Water Supply Development

Description: The SBCWD holds an existing water right to divert up to 4.75 cfs from 1 December of one year to 1 May of the subsequent year. If the 4.75 cfs were available for the full 151 day period, a total of up to 1,422 AF/yr may be available on Arroyo Dos Picachos. The water right is structured such that diversions from Arroyo Dos Picachos can occur when there is active flow from Arroyo Dos Picachos into Arroyo Los Viboras that occurs during the wet season. In the past, the water was percolated over 2 miles of the Arroyo Dos Picachos channel bed. More recently, much less channel length has been available for percolation as a result of changes in local land uses. The SBCWD considers this water right to be underutilized. Review of water rights Decision No. 409 indicates that the Pacheco Pass Irrigation District may also have the right to divert up to 45.25 cfs from Arroyo Dos Picachos.

As described earlier in Section 3.1.2, Arroyo Dos Picachos water supply availability estimates were made based on simulated stream flows as part of the preparation of the SBCWD Annual Groundwater Reports. Using the simulated stream flows for a period from water year 1984 through water year 2001, the average availability on Arroyo Dos Picachos ranges from a

minimum of 100 AF/yr to a maximum of 7,720 AF/yr with an average availability of 2,100 AF/yr. Based on a simulated stream flow, it appears that the 1,422 AF/yr water right held by the SBCWD could be available during most wet and normal years, provided that the Pacheco Pass Irrigation District does not exercise its water rights.

The water rights Decision No. 409 that apparently appropriate an additional 45.25 cfs to the Pacheco Pass Irrigation District should be reviewed carefully. It does not appear that an additional 45.25 cfs from Arroyo Dos Picachos would be available at any time.

An existing diversion structure that is sufficient for two 5'-wide slide gates is located on the Arroyo, as shown on Figure 5-1. It is envisioned that the existing diversion structure will require rehabilitation and improvement, and that some of the existing upstream channel will have to be reshaped to create a small impoundment. A small pump station would need to be constructed adjacent to the impoundment. The pump station would be used to pump water out of the impoundment and into a proposed 1.3 mile pipeline to the Hollister Conduit and/or proposed regional and local conveyance pipeline for delivery to either M&I or agricultural users or to water banking sites for percolation or ASR.

During the time that the Arroyo Dos Picachos water is available for M&I use, it would replace CVP water. If it is anticipated that the full CVP water allocation will not be used during a given water year, then the unused CVP water could be put onto the open market for a short-term sale or transfer, thus generating revenues to help fund projects.

The water quality of the Arroyo Dos Picachos is estimated to have electrical conductance of 30 (Kx 10^5 at 25C), 25 percent sodium, and boron at 0.15 ppm (Reconnaissance Report, Hollister Project, Pajaro River Basin, California, January 1954). This is approximately a TDS of 500 mg/l and/or EC of 800 umhos/cm and would be characterized as good quality water.

Major Issues: The major issues with this source of water are the potential costs of delivery facilities and the need for some construction in the channel of the arroyo and the associated environmental impacts that would require additional documentation and permitting.

Major Benefits: The major benefits of this source of water are its relatively high reliability and quality. In addition, having additional supply sources offers operational flexibility in serving the water users.

5.5.1.4 Arroyo Los Viboras Water Supply Development

Description: The Pacheco Pass Water District (PPWD) has an existing diversion on the Arroyo Los Viboras downstream of where the Hollister Conduit crosses the arroyo as shown on Figure 5-1. The PPWD diverts approximately 1.5 cfs to a small percolation pond nearby.

A review of water rights decisions for Arroyo Los Viboras indicates that up to 13.685 cfs or up to 1,781.7 AF/yr of water has been allocated. The estimate of water supply availability made in Section 3.1.2 indicates that a minimum of 149 AF/yr, a maximum of 11,583 AF/yr and an average of 3,159 AF/yr may be available from Arroyo Los Viboras. Accordingly, there may be up to 1,377 AF/yr of unadjudicated seasonal water rights available during an average year. It is

anticipated that additional diversions of excess flow would only occur after the Arroyo Las Viboras and downstream water ways have reached a predetermined level of flow.

In order to utilize the 1.9 cfs or 1,377 AF/yr water that is unajudicated, the diversion structure may have to be modified such that a small impoundment can be formed. A small pump station would be constructed adjacent to the impoundment. The pump station would be used to pump water out of the impoundment and into a proposed 3/4 mile pipeline to the Hollister Conduit and/or proposed regional and local conveyance pipeline for delivery to either M&I or agricultural users or to water banking sites for percolation or ASR.

As in the Arroyo Dos Picachos, during the time that the Arroyo los Viboras water is available for M&I use, it would replace CVP water. If the full CVP water allocation is anticipated not to be used during that wet year, then the unused CVP water could be put onto the open market for a short-term sale or transfer thus generating revenues to help fund projects.

The water quality of the Arroyo Los Viboras is estimated to have electrical conductance of 51 (Kx 10^5 at 25C), 24 percent sodium, and boron at 0.52 ppm (Reconnaissance Report, Hollister Project, Pajaro River Basin, California, January 1954). This is approximately a TDS of 360 mg/l and/or EC of 510 umhos/cm and would be characterized as good quality water.

Use of the unadjudicated wet season water would require coordination with PPWD and development of any institutional arrangements for the use of the existing diversion structure. A water right filing for the remaining 1.9 cfs or more will have to be filed.

Major Issues: The major issues with this source of water are the need to develop an institutional arrangement with PPWD, the potential costs of delivery facilities, and the need for some construction in the channel of the arroyo and the associated environmental documentation and permitting.

Major Benefits: The major benefits of this source of water are its relatively high reliability and quality. In addition, having additional supply sources offers operational flexibility in serving the water users.

5.5.1.5 Pacheco Creek Water Supply Development

Description: Pacheco Creek is estimated to have up to 7,200 AF/yr of safe yield for surface delivery based on a 61,000 AF storage reservoir after 6,800 AF/yr of percolation releases have been made (Reconnaissance Report, Hollister Project, Pajaro River Basin, California, January 1954). Although this quantity is not equivalent to the excess wet weather flows that may be available, it does provide an order of magnitude estimate of the available flows from Pacheco Creek. Water rights Decision No. 187 from 1928 indicates that the Hollister Irrigation District may have a water right for up to 11,000 AF/yr (15.19 cfs for 365 days) and the Pacheco Pass Irrigation District may have a water right to up to 16,000 AF/yr (22.10 cfs for 365 days).

The estimated water supply availability prepared as part of Section 3.1.2 indicates that Pacheco Creek may have a minimum of 800 AF/yr, a maximum of 92,887 AF/yr , and an average of 25,551 AF/yr water supply available.

There is an existing small dam on Pacheco Creek as shown on Figure 5-1. The ownership of the dam has not been determined at this time. It is envisioned that the dam could be modified, perhaps with an inflatable dam, resulting in the creation of a larger impoundment. A small pump station and approximately 1,000 feet of pipeline would be required to convey water from Pacheco Creek to the Hollister Conduit and/or the proposed regional and local conveyance pipeline for delivery to either M&I or agricultural users or to water banking sites for percolation or ASR.

As in the other surface water diversion locations, during the time that the Pacheco Creek water is available for M&I use, it would replace CVP water. If the full CVP water allocation is anticipated not to be used, then the unused CVP water could be put onto the open market for a short-term sale or transfer, thus generating revenues to help fund projects.

In the summertime, the PPWD releases water from Pacheco Dam for percolation. However, it is possible that these releases may be exacerbating high groundwater levels in San Benito County. Institutional arrangements could be made between San Benito County and PPWD to better manage those releases such that lower groundwater levels can be maintained.

The water quality of Pacheco Creek is estimated to have electrical conductance of 33.7 ($K \times 10^5$ at 25C), 22 percent sodium, and boron at 0.09 ppm (Reconnaissance Report, Hollister Project, Pajaro River Basin, California, January 1954). This is approximately a TDS of 235 mg/l and/or EC of 337 umhos/cm and would be characterized as good quality water.

Some institutional arrangements with PPWD should be made regarding releases. The Hollister Irrigation District water right will need to be reviewed and evaluated for transferability to the SBCWD. Based on review and analysis of the and estimated records for flows on Pacheco Creek, it appears that some additional wet weather flows could be recovered.

Major Issues: The major issues with this source of water are the need to develop an operational plan for summertime releases with PPWD, the potential costs of delivery facilities and the need for some construction in the channel of the arroyo and the associated environmental documentation and permitting.

Major Benefits: The major benefits of this source of water are its relatively high reliability and quality. In addition, having additional supply sources offers operational flexibility in serving the water users.

5.5.2 Regional and Local Conveyance Facilities for Multiple Water Supply Distribution

Description: Regional and local conveyance pipelines increase the operational flexibility of the water system by allowing movement of water either: a) to and from groundwater banking areas or b) from local surface water sources to use areas. Regional conveyance pipelines traverse longer distances and would be of larger diameter while local conveyance pipelines would be to connect facilities such as wells and surface water sources and would be of smaller diameter. For the purposes of the GMP Update, it is assumed that the backbone regional conveyance would include:

- Approximately 13.8-miles of 18-inch pipeline located approximately 10 – 15 feet away from and parallel to the existing Hollister Conduit or along existing County roads. The pipeline would extend from the Pacheco Sub-basin to the eastern edge of the San Juan Sub-basin. This pipeline could deliver a range of source waters including imported and/or local surface water and pumped groundwater or a blend of the above to users in Hollister East, Hollister West, and San Juan sub-basins.

- Approximately 7.5 miles of 18-inch pipeline extending from the northern end of the pipeline described above to the east along Shore Road and other county roads to the junction of Highway 25. This pipeline could deliver a range of source waters including imported and/or local surface water and pumped groundwater or a blend of the above to the areas in the Bolsa sub-basin where groundwater overdraft is currently occurring.

The pipeline segments are shown on Figure 5-1 and have been further sub-divided to facilitate phased construction for the purposes of preparing estimates of probable costs of construction (Section 6). Additional conveyance pipelines may be required in the future as source, use, and storage areas are further developed. Pump stations will also most likely be required, but they have not been sized or located at this time. Pump stations would be located adjacent to the pipeline. The first segment of the Regional and Local Conveyance Facilities for Multiple Water Supply Distribution will parallel the Hollister Conduit or along existing County roads and will be able to intertie, if desired, with the extensive imported water delivery system operated by the SBCWD. An intertie would allow delivery of a range of water to many users.

Major Issues: The major issue associated with development of Regional and Local Conveyance Facilities for Multiple Water Supply Distribution is to locate the facilities so that they have minimal impact to environmental resources such as wetlands and habitat areas. Most of the environmental impacts associated with Regional and Local Conveyance Facilities for Multiple Water Supply Distribution would likely be short-term during construction of the pipeline and appurtenant facilities, and should be mitigable.

Major Benefits: Operational flexibility is the primary benefit of regional and local conveyance pipelines. Other benefits include:

- Will allow efficient use of groundwater banking of either local or imported surface water.

- Can be used to move the higher quality groundwater found in the northern portions of the groundwater basin to the southern portions where water quality is not as good.

- Can be used to move groundwater for blending with surface water to improve water quality.

- Can be used to move local surface water available during wet weather periods to areas of groundwater banking or to M&I surface water treatment plant.

- Can be used to move recycled water to agricultural use areas or to an export pipeline, if appropriate.

5.5.3 Out-of-basin Water Banking

Description: Water banking can occur in a regional/statewide bank that would be under a contractual arrangement with a water bank operator such as the Kern Water Bank or the Semi-Tropic Water Bank. Excess CVP contract water from San Benito County, generated when other local surface waters such as described in Section 5.5.1 above are developed, could be stored in a regional/statewide bank; conversely, water owned by the regional/statewide water bank could be purchased by San Benito County agencies for delivery during dry years.

Major Issues: The major issues associated with out-of-basin water banking are the institutional arrangements that need to be made to store, extract and deliver the water when needed and the costs of water banking.

Major Benefits: The major benefits associated with out-of-basin water banking are that it offers additional operational flexibility and reliability. If excess CVP water is available but cannot be used or banked within San Benito County, then out-of-basin water banking allows San Benito County to retain the water for use in the future.

5.5.4 In-basin Water Banking

Description: As described above in the Continuation of Existing Projects/Activities section, local water banking in the groundwater basin is an important component of managing water resources in the basin and storing water to improve the reliability of the water supply.

The only difference with the activities that occurred as described above are:

- In-lieu banking would be added to the Bolsa sub-basin.
- ASR, which is not currently being practiced, is added as a project toolbox element.
- Local surface water could be added as a water source.

In-basin water banking will also require Regional and Local Conveyance Facilities for Multiple Water Supply Distribution to effectively distribute the banked water.

Natural direct percolation is an on-going natural process that has been previously discussed.

At the present time, the greatest opportunity for artificial direct percolation appears to be in the Pacheco and northern portion of the Hollister East Sub-basins where percolation of imported surface water has historically occurred. Some in-stream percolation sites along the San Benito River, in the Hollister West and San Juan sub-basins, have also been studied. Although percolation sites have been identified in the San Juan sub-basin, the sub-basin has limited hydraulic capacity for water banking because of its high water levels and is further limited by the poor quality of the groundwater that may be stored there.

Southern Bolsa sub-basin has capacity for in-lieu banking because of the presence of a large groundwater depression. Through the delivery of imported surface water, natural direct percolation would refill the groundwater depression that has historically occurred.

ASR could occur in any number of locations depending on the availability of storage capacity in the aquifer.

Major Issues: The major issue associated with water banking in general is ensuring that there is sufficient information regarding water levels, water quality, available aquifer storage capacity, etc. to be able to make informed decisions about where and when to recharge water.

Major Benefits: The major benefit of groundwater banking is the ability to store a variety of source waters with relatively few environmental impacts when compared to surface water reservoirs. Water in storage will increase the reliability of the overall water supply system during dry years.

A more detailed discussion of the various in-basin water banking options follows:

5.5.4.1 In-lieu banking of imported and/or local surface water

Description: As described earlier, in-lieu banking has been practiced in the Bolsa Southeast sub-basin since construction of the extension of the delivery system for imported water to the sub-basin. By using the imported water, groundwater is not being pumped and the groundwater recharge that is occurring remains in storage. Therefore, by providing imported water in-lieu of pumping groundwater, water banking is occurring.

There is also potential for in-lieu banking in the southern portion of the Bolsa sub-basin where a large groundwater depression has developed. The Bolsa sub-basin is not currently a part of Zone 6 of San Benito County that receives imported surface water. However, the proposed regional and local conveyance pipeline to the southern portion of the Bolsa sub-basin would allow delivery of local surface water or pumped groundwater to the area of groundwater depression for agricultural use, thus allowing direct natural percolation to recharge the sub-basin.

Major Issues: The major issues associated with in-lieu banking through the delivery of alternative water supplies is that careful monitoring of the water levels must occur. Prior to delivery of imported surface water to San Benito County, the entire groundwater basin was in overdraft. Since imported surface water deliveries were initiated in 1997, the overdraft condition in areas receiving imported surface water has largely been eliminated; in some cases, the practice has resulted in oversupply and correspondent high groundwater levels.

Major Benefits: The major benefit associated with in-lieu banking is that it offers opportunities to increase the quantity of banked water and thus increases the reliability of the overall groundwater system for use during drought periods.

5.5.4.2 Aquifer Storage and Recovery of imported and/or local surface water

Description: Aquifer storage and recovery (ASR) facilities are specially designed wells that operate as both injection wells and extraction wells. Potential well locations must be studied through evaluation of hydrogeologic data and field testing, so that appropriate locations with aquifer conditions allowing for injection and extraction can be selected.

In general, regardless of whether an imported or a local surface water is used for ASR, either coagulation or filtration of the source water is required so that large particles can be removed prior to injection. Failure to remove large particles can result in plugging of the well screen and even the aquifer; both of which will reduce injection and extraction rates. It is expected that local surface waters may be particularly high in particulates because they will be wet weather flows that result in higher rates of soil erosion than base flows. Therefore treatment of local surface waters prior to injection will be particularly critical.

A study conducted by SBCWD indicated that levels of suspended materials in San Felipe water are high enough that filtration is necessary prior to injection. As a result, it does not appear that ASR is practical/cost-effective for general purposes. However, if excess treated San Felipe water is available, it could be injected. ASR is most practical in an area close to planned surface water treatment facilities.

For the purposes of the groundwater management plan, ASR remains an option that could be used. However, alternative methods of recharge may prove more cost-effective at this time. If ASR facilities are to be developed, they will likely be located near the proposed regional and local conveyance pipeline or the imported surface water distribution system assuming that sites with the appropriate hydrogeology can be identified.

Major Issues: As with the other methods of water banking, one of the major issues is selection of appropriate sites for ASR based on water levels and aquifer characteristics. Careful evaluation of the quality of the source and native waters will be required to minimize the potential for aquifer plugging and other negative impacts. ASR is likely to be more energy intensive than other water banking methods because of a commonly occurring need to pump water into the aquifer. In some cases, ASR sites that allow gravity percolation may be found. However, if gravity percolation cannot occur, then pumping will be required. ASR may prove to be less cost-effective than other water banking methods because of the extensive investigation required and the extensive capital facilities including pumping, well, and treatment facilities required.

Major Benefits: One of the major benefits of ASR is that it requires a smaller footprint than percolation facilities. In addition, the same facility can be used for both injection and extraction and will be located close to conveyance facilities to be able to deliver the pumped water.

5.5.5 Groundwater Treatment and Concentrate Disposal

Description: As described in the June 2002 draft report, there are a number of alternative treatment methods for demineralization and softening to remove hardness and TDS from the groundwater to improve its quality for delivery to M&I users. Centralized demineralization or softening facilities would result in reduced salt loads to the basin; up to 2,270 tons/year of salt or 6% of the overall salt input.

For the purposes of the GMP Update, it is assumed that up to 7.5 MGD (8,365 AF/yr) of groundwater will require demineralization/softening. This assumes that:

- The M&I demand can be reduced from 11,465 to 10,465 AF/yr in a critically dry year, and that

- 2,100 AF/yr of imported/local surface water is available.

Initial estimates indicate that a demineralization/softening process would require approximately 9.0 MGD (10,100 AF/yr) of 800 mg/l TDS groundwater to be able to deliver 7.5 MGD (8,365 AF/yr) of 500 mg/l TDS water. The remaining 1.5 MGD (1050 gpm, 1,680 AF/yr) would be concentrate, or brine, with 2,600 mg/l of TDS which would require disposal.

For the purposes of the GMP Update, it is assumed that two to five groundwater demineralization/softening facilities would be required to serve the M&I users efficiently. The groundwater would be extracted from existing wells and the treatment facilities would most likely be located close to existing groundwater wells.

Major Issues: There are several major issues associated with groundwater treatment. The first is that demineralization has high energy costs as compared to development of other water sources. However, the relative energy use and comparative costs of the various water supplies including the true cost of imported CVP water should be developed and evaluated further. Another major issue associated with groundwater demineralization/softening is the need for concentrate disposal. As discussed in the June 2002 Draft Report, there are several options for concentrate disposal including:

- Fueled evaporation that can be located near the treatment facilities, takes a relatively small area, but will require significant energy resources to implement.

- Land evaporation can be a relatively cost-effective option, if a large, inexpensive area of suitable land is available for evaporation ponds. It is estimated that up to 300 acres may be required for evaporating 1,250 AF/yr of concentrate alone at an estimated evapotranspiration (ETo) rate of 50"/year (California Irrigation Management Information System database). The additional 12" – 16" of rainfall that falls annually in the area would also need to be accounted for when sizing evaporation ponds.

- Export pipeline for concentrate and other waters for disposal such as wastewater effluent, or pumped groundwater for water level management and salt removal. (See 5.3.13 below for additional description of the export pipeline)

- Deep well injection of concentrate in depths in excess of 1,500 feet that also takes a relatively small area but requires additional permitting and other elements of uncertainty. This alternative for concentrate disposal is probably the least likely option to be used.

Major Benefits: The major benefit of groundwater treatment for M&I use is that it adds a high measure of reliability to the water supply. In addition, use of the local groundwater will be an important part of the effort to manage groundwater levels and quality.

5.5.6 Groundwater/Surface Water Blending Facilities for Agricultural/M&I water users

Description: Blending of high quality imported or local surface water with local groundwater to adjust the TDS of the applied water is one way to achieve overall water quality suitable for agriculture or M&I supply. This type of project is most practical for locations where both sources of groundwater and surface water supplies are readily available.

This Project Toolbox Element would require development of operational criteria on timing, quality, and quantity of deliveries to customers. In addition, the physical facilities that would be required for agricultural users would include some additional piping metering and controls to connect to groundwater wells. Automatic controls could be connected to a telemetry system for remote operation. The facilities could be located on a concrete pad approximately 20' x 20' in size. Additional piping of blended water may be desirable so that the blended and unblended water can be segregated. Facilities for M&I users would be similar but would have to be carefully located so that surface water is filtered before being combined with groundwater.

The system could be operated by using flow meter information from the higher quality water to pace the pumping of groundwater into the pipeline at a rate appropriate for the desired TDS. If the distance from where the water sources are blended to the turnouts are short, a static, in-line mixer could be installed to facilitate full blending.

Since the groundwater quality is poorest in the San Juan sub-basin, it is likely that this Project Toolbox Element will be implemented mostly in the San Juan sub-basin and most likely for agricultural users. A review of the locations of wells and distribution pipelines and use areas would be required to evaluate the most cost-effective locations for blending stations. It is anticipated that no more than 2 – 3 blending stations will be required assuming that locations where groundwater and surface water facilities can be identified that are close together. Other agricultural and M&I blending locations can be developed relatively easily as it becomes practical to do so.

Major Issues: The major issue with groundwater/surface water blending facilities for agricultural water users may be with gaining acceptance by those agricultural users that are currently receiving imported water. The major issue with groundwater/surface water blending facilities for M&I users is locating the facilities so that groundwater is not filtered unnecessarily.

Major Benefits: The major benefits associated with groundwater/surface water blending facilities for agricultural users will be to those users who are currently irrigating with higher TDS groundwater since it will improve the water quality to those users. M&I users would derive the same benefits. In addition, by using less imported surface water, the overall salt input to the groundwater basin will be reduced. By pumping groundwater, this Project Toolbox Element can also function to manage water levels.

5.5.7 Recycled M&I Wastewater Effluent for Direct Reuse

Description: Reuse of recycled effluent from wastewater plants is practiced widely within California. Title 22 recycled water criteria govern the level of treatment and largely determine

the acceptable uses for recycled water. Several studies have been conducted regarding the markets for recycled water for direct reuse in San Juan Bautista and Sunnyslope. An evaluation for recycled water use is planned for Hollister. The studies also evaluated the wastewater treatment plant improvements and distribution systems necessary to deliver the recycled water to the potential users.

With regard to the potential supply of recycled water, at the present time there is approximately 3,300 AF/yr of wastewater effluent produced and indirectly reused through percolation in the entire groundwater basin (Water Year 2001 Annual Groundwater Report).

In the San Juan Bautista area, there is far more demand for recycled water than supply (San Juan Bautista Area Water Reclamation Study – Final, May 2002). In the Ridgemark area of the Sunnyslope County Water District service area, there appears to be sufficient demand for recycled water at the Ridgemark golf course to use the estimated 280,000 gpd (0.28 MGD, 314 AF/yr) of recycled water that could be produced. A recent study of recycled water for Ridgemark indicates that there is far more demand for recycled water than supply. (Sunnyslope County Water District – Recycled Water Study, Final- November 2001)

The estimated 2010 wastewater flows to the Hollister domestic wastewater treatment plant is 3.8 MGD (4,200 AF/yr) of average dry weather flow in the peak month. Although a specific recycled water demand analysis has not been prepared, the City of Hollister anticipates conducting a recycled water study in the near future.

Major Issues: The greatest limiting factor on the use of recycled water for direct reuse is the high levels of TDS in the recycled water. For example, the recycled water study for San Juan Bautista assumes a 1:1 blending ratio of imported surface water to recycled water to achieve a 700 mg/l TDS level. The availability of higher quality imported water has reduced the demand for the recycled water. As the quality of the potable water improves, so will the quality of the recycled water that will then improve the marketability of the recycled water.

Another major issue associated with direct reuse of recycled water is the imbalance between when the recycled water would be used, which is the late spring, summer, and early fall, and when most of the recycled water is available, which is in the winter. To be able to maximize the use of recycled water, storage of recycled water will be required.

Major Benefits: There are several benefits associated with direct reuse of recycled water which are that it is a beneficial use of a valuable water supply and it provides a disposal mechanism for recycled water, thereby reducing the impact on groundwater levels of effluent percolation.

5.5.8 Tile Drains for Localized Groundwater Level Management

Description: This Project Toolbox Element may be required if agricultural fields contain localized high water levels. As occurs in the San Juan sub-basin, shallow, impermeable clay layers produce localized perched high groundwater in some areas. Tile drains are perforated pipes that are installed above the shallow clay layer to allow the perched groundwater to flow into the perforated pipe, which typically drains to the surface, to a ditch, and possibly to the ocean.

In the northern portions of the Bolsa and Pacheco sub-basins, there are areas where groundwater surfaces near wellheads, creek channels, and faults. This is most likely caused by artesian conditions and/or high water tables. (Groundwater Management Plan for the San Benito County Part of the Gilroy-Hollister Groundwater Basin, 1998). Localized high groundwater conditions also occur in the northern portion of the Hollister East sub-basin. (Water Year 2001 Annual Groundwater Report)

The areas where this Project Toolbox Element will most likely be implemented is in the San Juan sub-basin, where tile drains have already been installed in some areas, and in the Bolsa, Pacheco and northern Hollister East sub-basins. For the most part, tile drains solve a localized problem by moving high groundwater into a ditch or creek, which then percolates into the groundwater, and can create a problem for downstream users.

In the San Juan sub-basin, where the high groundwater levels are most problematic, the SBCWD is initiating a study to develop of a master collection pipeline, as shown on Figure 5-1, to centralize collection of the agriculture drain water. As proposed, the pipeline could terminate in either a river discharge as described later in Section 5.5.11.1; a constructed wetland for polishing that could overflow into the river; as described in later in Section 5.5.12; or into the proposed export pipeline described later in Section 5.5.11.3.

Major Issues: The major issues associated with the use of tile drains for water level management are the expenses associated with remedying the localized high groundwater condition and the poor quality of the agricultural drainage. It is likely that the water is high in nutrients and TDS, some of which is from the high TDS of the local groundwater, and potentially high in herbicides and/or pesticides.

In addition, if river discharges were to occur, NPDES permits may be required for a point-source discharge from either the master collection pipeline or a constructed wetlands. Without a master collection pipeline, agricultural discharges are considered non-point sources that are often regulated through best management practices.

Major Benefits: The major benefit associated with the use of tile drains for agricultural effluent export is that it will result in lower localized groundwater levels, making some land with poor soil drainage and high groundwater levels more viable for agriculture. This can result in the net export of salt, if the agricultural effluent reaches a flowing stream or river.

5.5.9 Tree Belt Evapotranspiration for Localized Groundwater Level Management/Wastewater Disposal

Description: This Project Toolbox Element could be used to reduce localized high water levels in agricultural fields. Experimental research in Australia has indicated that high water-use trees such as eucalyptus can use up to 24 inches of water per year and generally lower local water levels. No work has been conducted to translate this water consumption to an AF-per-plant basis. Other high water-consuming vegetation may serve the same purpose. Within the Bay Area, eucalyptus and redwoods have been used on a small scale to take up wastewater effluent.

Similar to the use of tile drains, this Project Toolbox Element could be used in the areas of localized high groundwater described above. It is most likely to be used in conjunction with the constructed wetlands, described in 5.4.21 where trees could be planted with minimal encroachment on agricultural lands.

Major Issues: The major issues associated with this Project Toolbox Element is the highly experimental nature of this approach and the difficulty with quantifying the amount of water that could be removed and the resulting lowering of the water table. In addition, there are concerns with the use of eucalyptus trees, which are not native to the area, for this purpose. Finally, the costs of implementing a program with the accompanying lowering of the water table have not been quantified.

Major Benefits: The major benefit associated with this Project Toolbox Element is that if it can be demonstrated that vegetation is a effective means of managing water levels, the use of vegetation is arguably less intrusive than other more mechanical means of managing local high groundwater levels.

5.5.10 Groundwater Pumping for Water Level/Water Quality Management

Description: This Project Toolbox Element could help manage groundwater levels and salt balances in the San Juan, Pacheco, and northern portion of the Hollister East sub-basins where groundwater levels are particularly high. This Project Toolbox Element would use existing wells to the greatest extent possible and the groundwater could be pumped for discharge into an export pipeline if nearby or into the San Benito or Pajaro Rivers or their tributaries (as described later in 5.5.11) . Both of these options would export the water from the groundwater basin; depending on the location and quality of the pumped water; the water could also be used in another portion of the sub-basin by using the proposed regional and local conveyance rather than being exported.

A groundwater basin-wide water balance that evaluated the amount of groundwater in storage with and without imported surface water indicated from between water years 1990 – 1999, there was an estimated basin-wide increase of groundwater in storage of 11,466 AF/yr. (Groundwater Management Plan: Existing Conditions and Alternatives, December 2001)

Further analysis of the groundwater budget in the Water Year 2001 Annual Groundwater Report indicates that there was a net increase of about 2,400 AF/yr of groundwater in storage from 2000 - 2001. This net increase of water in storage has occurred even after the percolation of imported surface water by SBCWD was significantly reduced. This net increase is most likely the result of deep percolation of surface water applied for irrigation.

It should be noted that on a sub-basin basis in Water Year 2001, the Pacheco sub-basin was essentially in balance with an estimated net increase of 475 AF/yr in storage; the San Juan sub-basin was also essentially in balance with a net decrease of 11 AF/yr in storage; the Hollister East sub-basin had a net increase of 3,150 AF/yr of groundwater in storage; and the Bolsa sub-basin had a net decrease of 1,896 AF/yr. (Water Year 2001 Annual Groundwater Report).

Therefore, the necessity to manage groundwater levels varies widely between sub-basins and is further localized within each sub-basin.

For the purposes of the GMP Update, it is assumed that 2,500 AF/yr of groundwater would need to be removed from the problem areas of the selected sub-basins to manage high groundwater levels. Removal of 2,500 AF/yr would require pumping of 2.25 MGD or 1,560 gallons per minute (gpm) for 365 days a year. At an average production rate of 750 gpm per well, it could take as few as two wells to pump the entire amount. However, more wells at lower pumping rates could be required to effectively remove the groundwater.

Major Issues: The major issues associated with pumping groundwater and exporting it are that the practice permanently removes potentially valuable water from the groundwater system. If the water were used elsewhere in the groundwater system and not exported, this issue would be negated. There are also energy costs associated with pumping groundwater. Groundwater level management may be more cost-effectively achieved by managing the inputs to the groundwater system rather than removing water that has already entered the groundwater system. In addition, discharge to the Pajaro River would have to be timed to minimize the potential for flooding and impact to important downstream habitat.

Major Benefits: Some of the major benefits of pumping groundwater are that it can help to quickly lower high groundwater levels and can export salts out of the basin.

At a groundwater removal rate of 2,500 AF/yr, the magnitude of the salt removed could be as high as 4,100 tons/year if the TDS of the groundwater is 1,200 mg/l TDS as in the San Juan sub-basin or as low as 2,800 tons/year if the groundwater TDS is 800 mg/l TDS as in the Pacheco, and Hollister East sub-basins. The magnitude of the salt removed from groundwater pumping ranges from 7 to 10 percent of the current estimated salt input to the groundwater basin of 39,317 tons/year (Water Year 2001 Annual Groundwater Report). The benefit of the salt export only occurs when the salt is removed from the groundwater basin and discharged to the ocean.

5.5.11 Out-of-Basin Export of Wastewater Effluent/Concentrate/Pumped Groundwater/Agricultural Drainage

The project toolbox element of Out-of-Basin Export was developed to address the potential need to dispose of wastewater effluent, groundwater treatment concentrate, and/or pumped groundwater for water level and salt management. Three options for out-of-basin export were identified as follows:

- River Discharge of wastewater effluent, diluted concentrate, pumped groundwater, and/or agricultural drainage;
- Evaporation of concentrate and subsequent trucking of salts for disposal; and
- Export pipeline for wastewater effluent, concentrate, pumped groundwater, and/or agricultural drainage.

Each of these options are described below.

5.5.11.1 River Discharge

Description: This Project Toolbox Element is most likely the most-cost effective disposal mechanism for wastewater effluent, concentrate, pumped groundwater and/or agricultural drainage. However, any river discharges that are proposed would undergo extensive environmental review by local, state, and federal agencies. The Pajaro River Water Quality Management Plan indicates that the State Water Resources Control Board has identified the Pajaro River and several of its tributaries as having significant water quality impairments that can be attributable to non-point sources of pollution.

The Water Quality Control Plan for the Central Coast Region (September 8, 1994) has water quality limits of for the San Benito River of 1,400 mg/l TDS, 200 mg/l of chloride, 350 mg/l of sulfate, 1 mg/l of boron, and 250 mg/l of sodium. In addition, the California Regional Water Quality Board- Central Coast Region, has been reluctant to permit river discharges of wastewater effluent except during wet season emergencies and has encouraged beneficial reuse through recycled water use.

Although there is apparently no adopted Board of Supervisors policy, the County of Santa Cruz has spoken out against "actions which degraded [the] quality of water in the Pajaro River or increased potential for flooding" (County of Santa Cruz Health Services Agency, 19 June 2002).

It should be noted that the water quality of the San Benito River near the confluence with the Pajaro River is deteriorated in its natural state with TDS values up to 2,500 mg/l during the summer time . Wet weather TDS values are on the order of 300 - 700 mg/l. During periods of poor water quality and depending on the location in the San Benito River, discharge of wastewater effluent, diluted brine concentrate, and/or pumped groundwater could result in improvements to water quality.

If wastewater effluent is discharged, it would have to be a highly treated effluent and would most likely occur in the wintertime when dilution would be the greatest and the demand for recycled water is low. Discharge of recycled effluent near the Prescott Road Bridge where TDS levels have been observed in the 2,450 mg/l TDS range by the SBCWD could result in a net improvement to water quality. The recycled M&I wastewater effluent could be conveyed to this or other locations through the proposed export pipeline and a turnout constructed for discharge. Direct discharge of recycled M&I wastewater effluent will require issuance of a National Pollutant Discharge Elimination System permit to Sunnyslope and Hollister and will require the associated environmental reviews.

Groundwater treatment concentrate is estimated to be 4,000 mg/l TDS which is nearly double the high end of the San Benito River TDS concentration and unsuitable for discharge at that concentration. However, it could be diluted with either wastewater effluent, or pumped groundwater to reduce TDS levels.

Wastewater effluent from City of Hollister has an average TDS of 1,263 mg/l (City of Hollister Domestic Wastewater Treatment Plant 2001 Annual Monitoring Report). Effluent from Sunnyslope County Water District's Ridgemark facility has a TDS of 1,750 – 2,100mg/l that is

most likely the result of long detention times and the resulting evaporation and concentration of salts in the percolation ponds (Sunnyslope County Water District – Recycled Water Study, Final- November 2001). Effluent from the City of San Juan Bautista has an average TDS of 1,274 mg/l (City of San Juan Bautista 1999 Annual Monitoring Report). Assuming that most of the groundwater pumping would occur from the San Juan sub-basin, groundwater TDS levels are assumed to be about 1,200 mg/l TDS.

Depending on the source of dilution water, the dilution ratios would vary. It has been estimated that in order to achieve a resultant TDS concentration of 1,800 mg/l of TDS, San Juan sub-basin groundwater of 1,200 mg/l TDS would have to be blended in a nearly 4:1 ratio with concentrate. Therefore, disposal of 1.1 MGD (1,200 AF/yr) of concentrate is estimated to require approximately 3.9 MGD (4,400 AF/yr) of pumped groundwater for dilution. By strategically selecting the areas of groundwater pumping to coincide with areas of high groundwater, groundwater pumping can serve three purposes: 1) managing water levels, 2) providing concentrate dilution water, and 3) removing salt from the groundwater basin.

As discussed above, groundwater pumping could help manage groundwater levels and salt balances in the San Juan, Bolsa, and northern portion of the Hollister East sub-basins where groundwater levels are particularly high. This Project Toolbox Element would use existing wells to the greatest extent possible.

Major Issues: The major issues associated with river discharge of wastewater effluent, diluted brine concentrate, pumped groundwater, and/or agricultural drainage for conveyance to the ocean are the extensive environmental review, negotiation and permitting with the Regional Water Quality Control Board, National Marine Fisheries Service, California Department of Fish and Game, and other agencies that would be required.

Major Benefits: The major benefits of river discharge are that, if approved, it would be a relatively lower cost disposal alternative when compared to other options that results in the removal of salts from the groundwater basin. It can also reduce the groundwater levels in areas of high groundwater and near the percolation ponds.

5.5.11.2 Evaporation of Concentrate and Trucking of Salts

Description: As described earlier in the overview of the groundwater treatment Project Toolbox Element, disposal of concentrate from groundwater treatment is a major consideration in groundwater treatment and can be accomplished in several ways. This discussion focuses on evaporation methods which include

- Fueled evaporation that can be located near the treatment facilities, takes a relatively small area, but will require significant energy resources to implement.
- Land evaporation can be a relatively cost-effective option if a large, inexpensive area of suitable land is available for creation of evaporation ponds.

For either option, it is expected that the remaining salts would be in either a solid form or a highly concentrated brine. Brine solids could easily be trucked out of the basin and disposed of at a landfill or sold to a salt processor. Highly concentrated brines could be conveyed by a

tanker truck to the City of Watsonville Wastewater Treatment Plant for discharge through their outfall.

Major Issues: The major issue associated with fueled evaporation is that high energy cost required for implementation. The major issue associated with land evaporation is the large areas of land required. It is estimated that up to 300 acres may be required for evaporating 1,250 AF/yr of concentrate alone at an estimated evapotranspiration (ETo) rate of 50"/year (California Irrigation Management Information System database). The additional 12" – 16" of rainfall that falls annually in the area would also need to be accounted for in sizing evaporation ponds.

Major Benefits: The major benefit of evaporation of concentrate is that it will reduce the quantity of concentrate that requires disposal and put the remaining concentrate in a solid form that can be easily disposed of. Ultimate disposal of concentrate can be to a sanitary landfill or a salt/mineral company if in a solid form, or to the City of Watsonville ocean outfall if in a concentrated liquid form that meets Watsonville's requirements. This has the added benefit of removing salts from the groundwater basin.

5.5.11.3 Export Pipeline

Description: An export pipeline could have multiple uses with many benefits. An export pipeline could be used to export effluent, concentrate, pumped groundwater, and/or agricultural drainage. The potential sources of recycled M&I wastewater effluent for export are from the Sunnyslope County Water District's Ridgemark wastewater treatment plant that currently discharges to percolation ponds, the City of Hollister's domestic and industrial wastewater treatment plants that also currently discharge to percolation ponds, and the City of San Juan Bautista's wastewater treatment plant that discharges tertiary effluent to a ditch that flows to the San Benito River. The potential sources of concentrate are the proposed groundwater treatment plants that could generate up to 1.5 MGD of concentrate to deliver up to 7.5 MGD of average demand. As discussed above, groundwater that is pumped for water level/water quality management could also be exported as could the agricultural drainage that is proposed to be collected in the agricultural drainage collection pipeline.

A proposed export pipeline could be routed the 11.2 miles from Hollister to the Highway101/29 junction as shown on Figure 5-1 then join the route of and parallel the Pajaro Valley Water Management Agency (PVWMA) proposed CVP import pipeline for the 15 miles to the City of Watsonville's ocean outfall. The PVWMA pipeline project is currently in the process of developing CEQA and NEPA environmental documents, preliminary design documents, and permit applications for Pajaro River crossings.

Discussions with the City of Watsonville wastewater treatment manager indicate that the outfall has a capacity of 16 MGD, the current wastewater treatment plant has a treatment capacity of 12 MGD, and current flows are approximately 7 MGD with some recycled water being used for agricultural irrigation nearby. Therefore, there is outfall capacity of at least 4 MGD and perhaps up to 9 MGD.

The City of Watsonville currently accepts off-site concentrate discharge to its outfall on a permit basis and requires certification of the water quality constituents of the concentrate. The City of

Watsonville charges $0.07/gallon for concentrate disposal. Most concentrate dischargers bring concentrate in tanker trucks for discharge and the City of Watsonville can restrict concentrate disposal at any time. Long-term concentrate, wastewater effluent, or pumped groundwater discharge through the ocean outfall would require additional negotiations, development of contracts, and appropriate cost structures with the City of Watsonville.

Major Issues: The major issues associated the export pipeline are with the environmental impacts and need for documentation and permitting; the cost of construction; and the institutional arrangements required to provide a final disposal location in the ocean. Disposal through a pipeline to an ocean outfall would require construction of a pipeline to the ocean and would have several San Benito and Pajaro River crossings that could have major environmental impacts.

Major Benefits: The major benefits of an export pipeline for M&I wastewater effluent, concentrate, pumped groundwater, and/or agricultural drainage are that it results in the removal of salts from the groundwater basin and it provides operational flexibility for waste disposal.

5.5.12 Constructed Wetlands Treatment/Polishing of Agricultural Runoff, Stormwater and/or Wastewater Effluent

Description: This Project Toolbox Element includes construction of wetlands for treatment of agricultural runoff and stormwater, as well as municipal wastewater polishing. Constructed wetlands have demonstrated capacity to remove sediments and solids that are found in agricultural and stormwater runoff as well as providing for nutrient removal and denitrification of agricultural runoff and municipal wastewater.

The level of treatment or polishing that can be achieved in a constructed wetlands depends on factors such as the configuration of the ponds and the detention time that is achieved, the hydraulic loading, and the plant species that populate the wetlands.

For the purposes of the GMP Update, it has been assumed that constructed wetlands would be generally developed in areas where there would be minimal negative environmental impacts and where the potential for water quality improvement is great. One proposed area for a constructed wetland is adjacent to the San Benito River as shown on Figure 5-1 where there is an excavation from a gravel mining operation that could be the terminus for the agricultural drainage pipeline or an effluent discharge pipeline. The constructed wetland would offer polishing to these potential source waters by removing nutrients, in general, and nitrogen through denitrification if the appropriate species of plants are planted and sufficient detention time can be provided. Another potential area that would offer a similar benefit is in an area to the west of the City of Hollister Domestic Wastewater Treatment Plant.

Major Issues: One of the major issues associated with construction of wetlands is the need to purchase land that is both close to the water source to be treated and of sufficient area to achieve the treatment required. Depending on the level and type of treatment, considerable acreage can be required. In addition, constructed wetlands will percolate water and therefore should not be located in areas of high groundwater or permeability.

Major Benefits: Some of the major benefits associated with constructed wetlands are their relatively low construction cost; their low maintenance for treatment and polishing; the seasonal habitat that they provide for migratory birds; and the resulting aesthetic and recreational benefits for the public.

Section 6: Plan Implementation

6.1 Basis for Prioritization

The Groundwater Management Plan includes 36 different types of programs and projects for implementation. Some of the programs and projects have been further divided into sub-projects located in different parts of San Benito County. Based on current conditions, some the general locations for sub-projects such as the surface water treatment plants and pipeline segments have been identified while locations for others may not be identified for several years.

In order to implement the programs, projects and sub-projects, the 36 programs/projects have been placed into four categories as follows:

1. **Ongoing:** Programs/Projects that are currently in place that will need to be maintained and may require enhancement/modification
2. **High Priority:** Programs/Projects that most benefit the current Water Resource Associations members and/or are of relatively low complexity such that the project can be implemented within 3 – 5 years (i.e. by 2007)
3. **Medium Priority:** Programs/Projects that are of a moderate benefit to the current WRA members and/or are of moderate complexity such that the project can be implemented within 6 – 10 years (i.e. by 2012)
4. **Low Priority:** Programs/Projects that may be a more general benefit to San Benito County and/or are of a high complexity such that the project can be implemented within 11 – 20 years (i.e. by 2022).

The categorization of the programs/projects is based primarily on the steps that are necessary to implement the program/project which is also a function of the size and complexity of the program/project. Typical project timelines are discussed in more detail later in Section 6.2.

Those programs/projects that are smaller, less complex, and less controversial are more likely to be implemented in a shorter time frame than those that are larger, are more complex, and require more planning prior to implementation.

6.2 Typical Project Timelines

As indicated above, programs/projects can be categorized into smaller, less complex projects and larger, more complex projects. An example of a smaller, less complex project might be a groundwater/surface water blending station or development of the Cienega groundwater or Arroyo Dos Picachos surface water source.

An example of a larger, more complex project might be the development of the Pacheco Creek local water supply or an effluent/concentrate/groundwater pumping/agricultural drainage discharge pipeline. The following Tables 6-1 and 6-2 present a comparison of the relative

timeframes for implementation of the two types of projects and the steps that may be required for implementation.

Table 6-1: Small Project Implementation Schedule

Arroyo Dos Picachos Water Supply Development Example

Task	Estimated Time for Completion
Conceptual Planning/Feasibility Study	9 months – 1 year
Water Rights Acquisition	2 years
Environmental Documentation (CEQA/NEPA)/Permitting	1 year – 15 months
Pre-Design/Design	6 months
Construction	3 months
Total Elapsed Time (Some tasks may overlap)	**4 – 5 years**

Table 6-2: Large Project Implementation Schedule

Pacheco Creek Water Supply Development Example

Task	Estimated Time for Completion
Conceptual Planning	6 - 9 months
Feasibility Study	6 – 9 months
Environmental Documentation (CEQA/NEPA)	12 – 24 months
Negotiation with Other Agencies	12 – 24 months
Water Rights	3 years
Permitting	12 – 18 months
Pre-Design	6 months
Design	12 months
Construction	9 months
Total Elapsed Time (Some tasks may overlap)	**10 -12 years**

6.3 Projects and Priorities

Using the list of 36 programs and projects and the basis for prioritization above, the following tables have been developed. Table 6–3 shows the programs and projects in order presented in Section 5, while Table 6-4 shows the programs and projects in order of priority.

The priorities are based on the facts and circumstances that were available at the time of the GMP Update and are expected to be reviewed and revised during future updates to the GMP.

Table 6-3: Groundwater Management Plan Programs and Projects in Section 5 Order

Priority	Project Toolbox Elements
Institutional Programs	
A- On-going	M&I Water Conservation
A- On-going	Agricultural Water Conservation
A- On-going	Salinity Education Program
B- High Priority	Water Softener Ordinance
A- On-going	Industrial Salt Control in Municipal Wastewater Program
A- On-going	Nitrate Education Program
B- High Priority	Well Construction and Abandonment Ordinance
A- On-going	Maintain and Enhance Strategic Data Collection and Management Program
A- On-going	Continue and Expand Economic/Regulatory Water Level Management Tools
Continuation of Existing Projects Activities	
A- On-going	Existing Groundwater Extraction Facilities
A- On-going	Surface Water Importation
A- On-going	Surface Water Treatment Site A - Lessalt - 3 MGD
B- High Priority	Surface Water Treatment Site B - San Juan Bautista - 1 MGD
C- Medium Priority	Surface Water Treatment Site C - Location not determined at this time – Estimated Capacity 2 MGD
C- Medium Priority	Surface Water Treatment Site D - Location not determined at this time – Estimated Capacity 1.3 MGD
D- Low Priority	Surface Water Treatment Site E - Location not determined at this time – Estimated Capacity 1.2 MGD
A- On-going	M&I Wastewater Effluent Percolation
A- On-going	Water Transfers
A- On-going	In-Basin Water Banking - Natural Direct Percolation[1]
A- On-going	In-Basin Water Banking - Artificial Percolation of Imported and/or Local Surface Water[1] - San Benito River Wellfield
A- On-going	In-Basin Water Banking - In-lieu banking of imported and/or local surface water[1]
New Projects/Activities	
B- High Priority	Development/Improvement of High Quality Local Ground and Surface Water Supplies – Cienega
B- High Priority	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Pacheco/Northern Hollister East Sub-basins Groundwater Pumping

Table 6-3: Groundwater Management Plan Programs and Projects in Section 5 Order

Priority	Project Toolbox Elements
New Projects/Activities (cont.)	
B- High Priority	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Arroyo Dos Picachos
D- Low Priority	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Pacheco Creek
D- Low Priority	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Arroyo Las Viboras
B- High Priority	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment A
B- High Priority	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment B
C- Medium Priority	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment C
C- Medium Priority	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment D
D- Low Priority	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment E
B- High Priority	Out-of-Basin Water Banking
C- Medium Priority	In-Basin Water Banking - Aquifer Storage and Recovery of imported and/or local surface water
B- High Priority	Groundwater Treatment and Concentrate Disposal Site A - Hollister/Sunnyslope Area
B- High Priority	Groundwater Treatment and Concentrate Disposal Site B - Hollister/Sunnyslope Area
D- Low Priority	Groundwater Treatment and Concentrate Disposal Site C - Location not determined at this time
D- Low Priority	Groundwater Treatment and Concentrate Disposal Site D - Location not determined at this time
D- Low Priority	Groundwater Treatment and Concentrate Disposal Site E - Location not determined at this time
B- High Priority	Groundwater/Surface Water Blending w/ Pipeline A and B
B- High Priority	Recycled M&I Wastewater Effluent for Direct Reuse - SJB Recycled M&I Wastewater Effluent Project
C- Medium Priority	Recycled M&I Wastewater Effluent for Direct Reuse - Sunnyslope Ridgemark
C- Medium Priority	Recycled M&I Wastewater Effluent for Direct Reuse - Hollister Domestic
C- Medium Priority	Recycled M&I Wastewater Effluent for Direct Reuse - Hollister Industrial
B- High Priority	Tile Drains for Localized Groundwater Level Management
B- High Priority	Tree Belt Evapotranspiration for Localized Groundwater Level Management/Wastewater Disposal
B- High Priority	Groundwater Pumping for Water Level/Water Quality Management
B- High Priority	Out-of-Basin Export - River Discharge of wastewater effluent, concentrate, pumped groundwater, and/or agricultural drainage
New Projects/Activities (cont.)	

Table 6-3: Groundwater Management Plan Programs and Projects in Section 5 Order

Priority	Project Toolbox Elements
B- High Priority	Out-of Basin Export -Evaporation and trucking of concentrate
B- High Priority	Out-of-Basin Export - Export Pipeline for wastewater effluent, concentrate, pumped groundwater, and/or agricultural drainage
B- High Priority	Constructed Wetlands for Treatment/Polishing of Wastewater effluent/Stormwater/Agricultural Runoff

(1) Also applies to New Projects/Activities for Local Surface Water

Table 6-4: Groundwater Management Plan Programs and Projects in Priority Order

Priority	Program Type	Project Toolbox Elements
A - On-going	Institutional	M&I Water Conservation
A - On-going	Institutional	Agricultural Water Conservation
A - On-going	Institutional	Salinity Education Program
A - On-going	Institutional	Industrial Salt Control in Municipal Wastewater Program
A - On-going	Institutional	Nitrate Education Program
A - On-going	Institutional	Maintain and Enhance Strategic Data Collection and Management Program
A - On-going	Institutional	Continue and Expand Economic/Regulatory Water Level Management Tools
A - On-going	Existing	Existing Groundwater Extraction Facilities
A - On-going	Existing	Surface Water Importation
A - On-going	Existing	Surface Water Treatment Site A – Lessalt – 3 MGD
A - On-going	Existing	M&I Wastewater Effluent Percolation
A - On-going	Existing	Water Transfers
A - On-going	Existing	In-Basin Water Banking - Natural Direct Percolation[1]
A - On-going	Existing	In-Basin Water Banking - Artificial Percolation of Imported and/or Local Surface Water[1] - San Benito River Wellfield
A - On-going	Existing	In-Basin Water Banking - In-lieu banking of imported and/or local surface water[1]
B - High Priority	Institutional	Water Softener Ordinance
B - High Priority	Institutional	Well Construction and Abandonment Ordinance
B - High Priority	Existing	Surface Water Treatment Site B - San Juan Bautista – 1 MGD
B - High Priority	New	Development/Improvement of High Quality Local Ground and Surface Water Supplies – Cienega
B - High Priority	New	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Pacheco/Northern Hollister East Sub-basins Groundwater Pumping
B - High Priority	New	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Arroyo Dos Picachos
B - High Priority	New	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment A
B - High Priority	New	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment B

Table 6-4: Groundwater Management Plan Programs and Projects in Priority Order

Priority	Program Type	Project Toolbox Elements
B - High Priority	New	Out-of-Basin Water Banking
B - High Priority	New	Groundwater Treatment and Concentrate Disposal Site A - Hollister/Sunnyslope Area
B - High Priority	New	Groundwater Treatment and Concentrate Disposal Site B - Hollister/Sunnyslope Area
B - High Priority	New	Groundwater/Surface Water Blending w/ Pipeline A and B
B - High Priority	New	Recycled M&I Wastewater Effluent for Direct Reuse - SJB Recycled M&I Wastewater Effluent Project
B - High Priority	New	Tile Drains for Localized Groundwater Level Management
B - High Priority	New	Tree Belt Evapotranspiration for Localized Groundwater Level Management/Wastewater Disposal
B - High Priority	New	Groundwater Pumping for Water Level/Water Quality Management
B - High Priority	New	Out-of-Basin Export - River Discharge of wastewater effluent, concentrate, pumped groundwater, and/or agricultural drainage
B - High Priority	New	Out-of Basin Export -Evaporation and trucking of concentrate
B - High Priority	New	Out-of-Basin Export - Export Pipeline for wastewater effluent, concentrate, pumped groundwater, and/or agricultural drainage
B - High Priority	New	Constructed Wetlands for Treatment/Polishing of Wastewater effluent/Stormwater/Agricultural Runoff
C - Medium Priority	Existing	Surface Water Treatment Site C - Location not determined at this time – Expected Capacity 2 MGD
C - Medium Priority	Existing	Surface Water Treatment Site D - Location not determined at this time – Expected Capacity 1.8 MGD
C - Medium Priority	New	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment C
C - Medium Priority	New	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment D
C - Medium Priority	New	In-Basin Water Banking - Aquifer Storage and Recovery of imported and/or local surface water
C - Medium Priority	New	Recycled M&I Wastewater Effluent for Direct Reuse - Sunnyslope Ridgemark
C - Medium Priority	New	Recycled M&I Wastewater Effluent for Direct Reuse - Hollister Domestic
C - Medium Priority	New	Recycled M&I Wastewater Effluent for Direct Reuse - Hollister Industrial
D - Low Priority	Existing	Surface Water Treatment Site E - Location not determined at this time

Table 6-4: Groundwater Management Plan Programs and Projects in Priority Order

Priority	Program Type	Project Toolbox Elements
D - Low Priority	New	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Pacheco Creek
D- Low Priority	New	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Arroyo Las Viboras
D- Low Priority	New	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment E
D- Low Priority	New	Groundwater Treatment and Concentrate Disposal Site C - Location not determined at this time
D- Low Priority	New	Groundwater Treatment and Concentrate Disposal Site D - Location not determined at this time
D- Low Priority	New	Groundwater Treatment and Concentrate Disposal Site E - Location not determined at this time

(a) Also applies to New Projects/Activities for Local Surface Water

6.4 Project Cost Estimation Method

Very preliminary, conceptual-level cost estimates are provided for those infrastructure programs/projects/sub-projects that have been sufficiently defined at this time. However, not all facilities required to implement this plan have been identified, sized, or costed at this time. These other facilities include: pump stations for pipelines, and new wells, including pumping facilities and local conveyance pipelines.

As defined by the American Association of Cost Engineers, conceptual level (order of magnitude) estimates typically have an accuracy of plus 50% to minus 30%. For those projects for which studies have been conducted, cost estimates have been provided.

Costs for on-going programs and projects are indicated with 'Not Applicable" while those projects where there is insufficient information, or where information is in the process of being developed, the costs are indicated with "Not Available". A summary of the costs that have been developed is provided in Section 6.5.

These conceptual level probable costs of capital, operations and maintenance provided a starting point for evaluating funding needs. More detailed costs of capital and operations and maintenance should be prepared as more project details become known.

6.4.1 Capital Cost Components

The capital costs of the sub-projects have been grouped into broad categories of project construction, engineering and management, land acquisition, and specialty costs. The cost components for capital cost are as follows:

6.4.1.1 Project Construction Costs

The project construction cost includes the capital cost of constructing the project The construction costs will be based on cost curves and typical "rules of thumb", such as unit cost per gallon capacity for tanks or treatment plants, cost per diameter-inch/lineal foot for pipelines, cost per Acre-foot of water for reservoir projects, and are assumed to include contractor overhead and profit and contingency. etc.

6.4.1.2 Engineering, Construction Management Costs

These costs include the engineering design, construction management, administrative, legal, and simple environmental documentation (negative declarations) costs. This cost component is estimated at twenty-five percent of the construction cost.

6.4.1.3 Land Acquisition / Right-of-Way Acquisition Costs

This cost includes buying land and access to specific areas. For this conceptual level work, the cost of land will be based on a cost per acre for an urban or rural area. Urban Land is assumed to cost $100,000 per acre, smaller tracts of rural land is assumed to cost $10,000 per acre while larger tracts are assumed to cost $1,500 per acre.

These land costs have been corroborated with review of commercial land costs available on the Multiple Listings Service for San Benito County.

6.4.1.4 Special Environmental Documentation and Site Consideration Costs

This cost component includes preparing more detailed Environmental Impact Reports for special project circumstances such as work in a riparian corridor. This cost also accounts for any special site or location costs. Since these costs are project and site-specific, the project team will develop the cost on a per-project basis.

6.4.2 Annual O&M Cost Components

The annual O&M costs of the projects have been grouped into broad categories of water purchase cost, power cost, chemical cost, personnel cost and specialty costs. Not all O&M cost components will be applicable to each sub-project. Where other reports estimated annual O&M costs, those O&M costs were used. The general cost components for O&M include:

6.4.2.1 Water Purchase Costs

The cost of purchasing water for agricultural use or municipal treatment will be based on current and or foreseeable future water costs.

6.4.2.2 Power Costs

The cost of power for the project will be based on the kilowatts per unit of capacity required for pumping, desalting, etc. The systems will be assumed to operate year round. The cost of power is assumed to be $0.15 per kilowatt-hr.

6.4.2.3 Facility Maintenance Costs

Costs for maintenance for the sub-projects will be calculated as a percentage of the construction capital cost. The annual O&M cost will be estimated as a percentage of the construction cost as follows: 2% for treatment facilities, 1% of well facilities, 0.05% for pipelines, storage reservoirs, etc.

6.4.2.4 Chemical Costs

This cost will include the chemicals necessary for water treatment. The cost will be based on a unit cost per capacity of the specific sub-project.

6.4.2.5 Personnel Costs

The cost will be determined as a salary of $50,000 per year (including benefits) per person times the number of people necessary for the sub-project.

6.4.2.6 Specialty Costs

These costs are unique to the specific projects, such as membrane replacement for a water treatment plant, or special monitoring costs for discharge to the San Benito River.

6.4.2.7 Present Worth of 20-year Annual O&M Cost

The present worth of the annual O&M Costs has been calculated for 20-years using a 6% interest rate. The 6% interest rate is consistent with the rate that California Department of Water Resources uses in its Proposition 13 Grant Applications.

6.4.3 Capital Costs in the Future

Since many of the projects may not be constructed for many years in the future, the impact of inflation on capital costs has been calculated by estimating the capital costs 5 years in the future in 2007, 10 years in the future in 2012, and 20 years in the future in 2022. An inflation rate of 2.5% has been used to escalate the costs.

6.5 Estimated Costs of Implementation

Using the method of estimating costs described in Section 6.4 above, estimates of the probable cost of construction on a planning basis have been developed for the projects and sub-projects. The cost tables have been divided using the prioritization developed in Section 6.3 above and are presented in summary below.

6.5.1 On-Going Programs/Projects

Programs/projects that are on-going are shown in Table 6-5 as follows.

Table 6-5: Ongoing Programs/Projects

Program Type	Project Toolbox Elements	2002 Capital Costs	20-Year O&M Costs (2002 $)	2007 Capital Costs	2012 Capital Costs	2022 Capital Costs	Notes
Institutional	M&I Water Conservation	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Current WRA Program
Institutional	Agricultural Water Conservation	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Current SBCWD Program
Institutional	Salinity Education Program	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Current SBCWD Program
Institutional	Industrial Salt Control in Municipal Wastewater Program	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Current SBCWD Program
Institutional	Nitrate Education Program	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Current SBCWD Program
Institutional	Maintain and Enhance Strategic Data Collection and Management Program	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Current SBCWD Program
Institutional	Continue and Expand Economic/Regulatory Water Level Management Tools	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Current SBCWD Program
Existing	Existing Groundwater Extraction Facilities	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Existing	Surface Water Importation	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Existing	Surface Water Treatment Site A - Lessalt - 3 MGD	$4,300,000	$10,552,400	Not Applicable	Not Applicable	Not Applicable	Capital Cost based on 95% Cost estimate, In Operation November 2002, O&M Costs estimated

Table 6-5: Ongoing Programs/Projects

Program Type	Project Toolbox Elements	2002 Capital Costs	20-Year O&M Costs (2002 $)	2007 Capital Costs	2012 Capital Costs	2022 Capital Costs	Notes
Existing	M&I Effluent Percolation	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Existing	Water Transfers	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Existing	In-Basin Water Banking - Natural Direct Percolation1	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Existing	In-Basin Water Banking - In-lieu banking of imported and/or local surface water	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Additional in-lieu banking will require additional pipeline facilities.

6.5.2 High Priority Programs/ Projects: 3 – 5 Years to Implementation

Estimated probable costs for construction and operations and maintenance for High Priority programs/projects that are expected to be implemented within a 3-5 year timeframe are shown in Table 6-6 as follows.

Table 6-6: High Priority Programs/Projects: 3-5 Years to Implementation

Program Type	Project Toolbox Elements	2002 Capital Costs	20-Year O&M Costs (2002$)	2007 Capital Costs	2012 Capital Costs	2022 Capital Costs	Notes
Existing	In-Basin Water Banking - Artificial Percolation of Imported and/or Local Surface Water1 - San Benito River Wellfield	Not Available	Not Available	Not Available	Not Available	Not Available	Under Study by SBCWD in 2002 - 2003
Institutional	Water Softener Ordinance	Not Available	Not Applicable	Not Available	Not Available	Not Available	Will require WRA and County approval
Institutional	Well Construction and Abandonment Ordinance	Not Available	Not Applicable	Not Available	Not Available	Not Available	Under development by SBCWD
Existing	Surface Water Treatment Site B - San Juan Bautista - 1 MGD	$1,600,000	$4,014,500	$1,800,000	$2,000,000	$2,600,000	
New	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Cienega	$2,900,000	$344,100	$3,300,000	$3,700,000	$4,800,000	From 1983 Walters Engineering Report
New	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Pacheco/Northern Hollister East Sub-basins Groundwater Pumping	Not Available	Not Available	Not Available	Not Available	Not Available	Under Study by SBCWD in 2002 - 2003
New	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Arroyo Dos Picachos	$4,500,000	$802,900	$5,100,000	$5,800,000	$7,400,000	Assumed to be 40-foot long inflatable diversion dam, includes pump station
New	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment A	$4,800,000	$114,700	$5,400,000	$6,100,000	$7,900,000	Estimated Length -3.7 Miles conveyance and 1.6 miles collection pipeline

Table 6-6: High Priority Programs/Projects: 3-5 Years to Implementation

Program Type	Project Toolbox Elements	2002 Capital Costs	20-Year O&M Costs (2002$)	2007 Capital Costs	2012 Capital Costs	2022 Capital Costs	Notes
New	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment B	$2,100,000	$114,700	$2,400,000	$2,700,000	$3,400,000	Estimated Length -2.2 Miles conveyance and 0.24 miles collection pipeline
New	Out-of-Basin Water Banking	Not Available	Not Available	Not Available	Not Available	Not Available	Capital Cost based on 95% Cost estimate, In Operation November 2002
New	Groundwater Treatment and Concentrate Disposal Site A - Hollister/Sunnyslope Area	$5,800,000	$5,505,600	$6,600,000	$7,400,000	$9,500,000	Estimated Capacity 2.5 MGD, concentrate disposal through export pipeline
New	Groundwater Treatment and Concentrate Disposal Site B - Hollister/Sunnyslope Area	$5,800,000	$5,505,600	$6,600,000	$7,400,000	$9,500,000	Estimated Capacity 2.5 MGD, concentrate disposal through export pipeline
New	Groundwater/Surface Water Blending w/ Pipeline A and B	$180,000	$206,460	$204,000	$230,000	$295,000	Assumed 6 stations constructed
New	Recycled M&I Effluent for Direct Reuse - SJB Recycled M&I Effluent Project	$6,200,000	Not Provided	$7,000,000	$7,900,000	$10,200,000	Most expensive Alternative 2 selected for inclusion from SJB Recycled Water Study
New	Tile Drains for Localized Groundwater Level Management	Not Available	Not Available	Not Available	Not Available	Not Available	Under Study by SBCWD in 2002 - 2003
New	Tree Belt Evapotranspiration for Localized Groundwater Level Management/Wastewater Disposal	Not Available	Not Available	Not Available	Not Available	Not Available	
New	Groundwater Pumping for Water Level/Water Quality Management	Not Applicable	Not Available	Not Applicable	Not Applicable	Not Applicable	Implementation Expected Through Existing Facilities

Table 6-6: High Priority Programs/Projects: 3-5 Years to Implementation

Program Type	Project Toolbox Elements	2002 Capital Costs	20-Year O&M Costs (2002$)	2007 Capital Costs	2012 Capital Costs	2022 Capital Costs	Notes
New	Out-of-Basin Export - River Discharge of wastewater effluent, concentrate, pumped groundwater, and/or agricultural drainage	See Export Pipeline	See Export Pipeline	See Export Pipeline	See Export Pipeline	See Export Pipeline	River Discharge is expected to require use of portion of export pipeline, further feasibility study required
New	Out-of Basin Export - Evaporation and trucking of concentrate	$1,200,000	$1,147,000	$1,400,000	$1,500,000	$2,000,000	Based on use of 325 acres of land, no liner
New	Out-of-Basin Export - Export Pipeline for wastewater effluent, concentrate, pumped groundwater, and/or agricultural drainage	$23,600,000	$688,200	$26,700,000	$30,200,000	$38,700,000	Estimated Length - 26 miles, assumed 18-inch diameter
New	Constructed Wetlands for Treatment/Polishing of Wastewater effluent/Stormwater/Agricultural Runoff	$1,900,000	$802,900	$2,100,000	$2,400,000	$3,100,000	For 11 Acre wetlands for municipal polishing
Subtotal	High Priority Projects with Estimates	$60,580,000	$19,246,660	$68,604,000	$77,330,000	$99,395,000	

6.5.3 Medium Priority Programs/Projects: 6 – 10 Years to Implementation

Estimated probable costs for construction and operations and maintenance for Medium Priority programs/projects that are expected to be implemented within a 6-10 year timeframe are shown in Table 6-7 as follows.

Table 6-7: Medium Priority Programs/Projects: 6-10 Years to Implementation

Program Type	Project Toolbox Elements	2002 Capital Costs	20-Year O&M Costs (2002$)	2007 Capital Costs	2012 Capital Costs	2022 Capital Costs	Notes
Existing	Surface Water Treatment Site C - Location not determined at this time	$3,100,000	$6,996,700	$3,500,000	$4,000,000	$5,100,000	Estimated Capacity 2 MGD
Existing	Surface Water Treatment Site D - Location not determined at this time	$4,500,000	$10,093,600	$5,100,000	$5,800,000	$7,400,000	Estimated Capacity 3 MGD
New	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment C	$4,100,000	$114,700	$4,600,000	$5,200,000	$6,700,000	Estimated Length -5.5 Miles
New	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment D	$3,100,000	$114,700	$3,500,000	$4,000,000	$5,100,000	Estimated Length -3.5 Miles
New	In-Basin Water Banking - Aquifer Storage and Recovery of imported and/or local surface water	Not Available	Not Available	Not Available	Not Available	Not Available	
New	Recycled M&I Effluent for Direct Reuse - Sunnyslope Ridgemark	$4,600,000	$2,294,000	$5,200,000	$5,900,000	$7,500,000	Based on most expensive alternative from SCWD Recycled Water Study - Golf Course w/ storage
New	Recycled M&I Effluent for Direct Reuse - Hollister Domestic	$21,700,000	$14,222,800	$24,600,000	$27,800,000	$35,600,000	Based on most expensive alternative from HSE May 2002 Report

Table 6-7: Medium Priority Programs/Projects: 6-10 Years to Implementation

Program Type	Project Toolbox Elements	2002 Capital Costs	20-Year O&M Costs (2002$)	2007 Capital Costs	2012 Capital Costs	2022 Capital Costs	Notes
New	Recycled M&I Effluent for Direct Reuse - Hollister Industrial	Not Available	Not Available	Not Available	Not Available	Not Available	
Subtotal - Medium Priority Projects with Estimates		$41,100,000	$33,836,500	$46,500,000	$52,700,000	$67,400,000	
							Capital Cost based on 95% Cost estimate, In Operation November 2002

6.5.4 Low Priority Programs/Projects -11 – 20 Years to Implementation

Estimated probable costs for construction and operations and maintenance for Low Priority programs/projects that are expected to be implemented within a 11-20 year timeframe are shown in Table 6-8 as follows.

Table 6-8: Low Priority Programs/Projects: 11 to 20 Years to Implementation

Program Type	Project Toolbox Elements	2002 Capital Costs	20-Year O&M Costs (2002 $)	2007 Capital Costs	2012 Capital Costs	2022 Capital Costs	Notes
Existing	Surface Water Treatment Site E - Location not determined at this time	$1,900,000	$4,588,000	$2,100,000	$2,400,000	$3,100,000	Estimated Capacity 1.2 MGD
New	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Pacheco Creek	$5,000,000	$802,900	$5,700,000	$6,400,000	$8,200,000	Assumed to be 75-foot long inflatable diversion dam, includes pump station
New	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Arroyo Las Viboras	$4,500,000	$802,900	$5,100,000	$5,800,000	$7,400,000	Assumed to be 40-foot long inflatable diversion dam, includes pump station
New	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment E	$5,100,000	$114,700	$5,800,000	$6,500,000	$8,400,000	Estimated Length -6.1 Miles, Necessary for in-lieu banking in Bolsa
New	Groundwater Treatment and Concentrate Disposal Site C - Location not determined at this time	$5,800,000	$5,505,600	$6,600,000	$7,400,000	$9,500,000	Estimated Capacity 2.5 MGD, concentrate disposal through export pipeline

Table 6-8: Low Priority Programs/Projects: 11 to 20 Years to Implementation

Program Type	Project Toolbox Elements	2002 Capital Costs	20-Year O&M Costs (2002 $)	2007 Capital Costs	2012 Capital Costs	2022 Capital Costs	Notes
New	Groundwater Treatment and Concentrate Disposal Site D - Location not determined at this time	Not Available	Not Available	Not Available	Not Available	Not Available	Location May Not Be Required
New	Groundwater Treatment and Concentrate Disposal Site E - Location not determined at this time	Not Available	Not Available	Not Available	Not Available	Not Available	Location May Not Be Required
Subtotal	Low Priority Projects with Estimates	$22,300,000	$11,814,100	$25,300,000	$28,500,000	$36,600,000	*Capital Cost based on 95% Cost estimate, In Operation November 2002

6.5.5 Cost Summary

Table 6-9 below is a summary of all of the projects with estimates. The Lessalt Surface Water Treatment Plant is not included in this summary because the project has been completed.

Table 6-9: Summary of Costs for Programs/Projects With Estimates

	2002 Capital Costs	20-Year O&M Costs (2002 $)	2007 Capital Costs	2012 Capital Costs	2022 Capital Costs
Subtotal - High Priority Projects with Estimates	$60,580,000	$19,246,660	$68,604,000	$77,330,000	$99,395,000
Subtotal - Medium Priority Projects with Estimates	$41,100,000	$33,836,500	$46,500,000	$52,700,000	$67,400,000
Subtotal - Low Priority Projects with Estimates	$22,300,000	$11,814,100	$25,300,000	$28,500,000	$36,600,000
Total - All Projects with Estimates	**$123,980,000**	**$64,897,260**	**$140,404,000**	**$158,530,000**	**$203,395,000**

6.6 Near-Term Projects/Studies

Due to the uncertainties associated with some of the programs/projects identified in the Groundwater Management Plan update, additional study is recommended to reduce the uncertainty. The two areas that have been identified are associated with disposal of concentrate from demineralization/desalting of groundwater and the constraints related to the discharge of effluent/diluted concentrate/pumped groundwater to the San Benito River. These two areas are related and further study could narrow the options and further refine the costs associated with these aspects of the implementation of the Groundwater Management Plan.

6.6.1 Concentrate Disposal Strategy

As described earlier, there are a number of strategies that could be employed to dispose of concentrate from demineralization/desalting processes. Since treatment of groundwater for municipal and industrial use has been identified as a high-priority, it would be prudent to better define a number of issues, including: the quantity of concentrate that would require disposal; the availability of methodologies to achieve higher concentrations, thereby reducing the volume to be disposed of; and the current and future costs of disposal.

6.6.2 River Discharge Study

One of the least expensive means of disposal of concentrate, effluent, agricultural runoff, and pumped groundwater would be discharge to the San Benito River (and therefore to the Pajaro

River). However, earlier comments from a number of stakeholders have indicated that river discharge is of concern and may therefore be difficult to implement. Given the potential importance of discharging to the San Benito River, it would be prudent to better understand the concerns associated with river discharge and the probability that this method of disposal could be utilized.

The Pajaro River has been identified as an impaired water body for nutrients, sediments, and fecal coliform by the Regional Water Quality Control Board and is therefore undergoing a process to collect data and meet with stakeholders to establish a Total Mass Daily Loading (TMDL) for the parameters of concern. This stakeholder group could be used as a resource for better understanding the issues related to river discharge.

6.6.3 Effluent Percolation/Land Application Study

As discussed earlier in Section 5.4.4, M&I wastewater effluent percolation is an on-going mechanism for wastewater effluent disposal and indirect reuse especially since the high levels of TDS in the wastewater effluent makes direct reuse of effluent less marketable at this time. Implementation of the programs and projects in this GMP Update will improve the quality of the effluent such that direct reuse may be more practical. However, seasonal fluctuations in the demand for recycled water will require alternative wastewater disposal methods such as percolation and land application of effluent on unirrigated rangelands and other potentially available lands.

Therefore, a study of the various effluent percolation/land application alternatives that evaluates, on a regional basis, the sites that may be appropriate for effluent percolation/land application should be initiated. This study would include the short-term and long-term consideration of factors such as water balance; water level; water quality; application methods such as injection, spray irrigation, percolation; timing of application; proximity to wastewater treatment plants; land-ownership; necessity for environmental documentation; and monitoring.

Section 7: Program-Level Mitigation Measures for the GMP Update

Future projects implemented under the GWMP Update will incorporate the following program mitigation measures, as appropriate, to avoid or reduce potentially significant environmental impacts.

7.1 Air Quality

7.1.1 Dust Control Program

Prior to construction of evaporation ponds for groundwater treatment concentrate, an effective dust control program will be developed.

7.2 Biological Resources

7.2.1 Construction Impacts to Wetland Habitats

7.2.1.1 Avoidance and Minimization.

New projects will be designed, constructed, and operated in such a way as to avoid and/or minimize impacts to wetland habitats. If total avoidance is not possible, then wetland replacement will be completed.

7.2.1.2 Wetland Replacement.

The wetland habitat that will be lost under any new projects would be functionally replaced in conformance with mitigation requirements of the responsible regulatory agencies. In-kind (the same wetland type) and on-site replacement of lost wetland habitats will be done where possible.

The determination of wetland impacts and the subsequent location and design of potential mitigation sites would be determined by qualified biologists in coordination with resource agency personnel. Mitigation and habitat restoration plans would provide for the following:

a. Calculation and replacement of lost acreage and functions of wetland habitat

b. Location of restoration opportunities, complete with an analysis of the technical approach to create high quality wetlands.

c. Detailed plans will be prepared for wetland mitigation construction that includes excavation elevations, location of hydrologic connections, planting plans and soil amendments, if necessary. Maintenance and monitoring plans are to be prepared in consultation with a qualified habitat restoration specialist. Any mitigation wetlands will be monitored for a period of five years, during which the site will achieve the target jurisdictional acreage by Year 5. Specific performance criteria will be

determined and monitored for site success. Monitoring reports will be provided annually to the appropriate resource agencies.

d. *Permits.* Prior to construction of any project element that may impact wetland habitats, the project proponent will apply for a Section 404 permit and Water Quality Certification from the U.S. Army Corps of Engineers and the Regional Water Quality Control Board. The project proponent will comply with the conditions of required permits.

7.2.2 Construction Impacts to Riparian Habitats

7.2.2.1 Avoidance and Minimization.

New projects will be designed, constructed, and operated in such a way as to avoid and/or minimize impacts to riparian habitats. If avoidance is not possible, then riparian habitat replacement will be required.

7.2.2.2 Riparian Habitat Replacement.

Permanent impacts to vegetation within riparian habitats are typically mitigated at ratios based on the quality of the habitat to be impacted. Due to the complex mosaic of habitats often found within riparian corridors, impacts are typically assessed based on three habitat quality categories, described below. This methodology ensures that, regardless of the type of habitat impacted, its relative value is taken into account in quantifying impacts and necessary mitigation. As a result, the impact quantities are not calculated by habitat type, but rather by habitat quality category.

The three habitat quality categories are:

High quality – Native overstory with continuous understory or occurring in dense thickets; dense native overstory with sparse, non-native or no understory; and native willow thicket.

Medium quality – Sparse native overstory with sparse, non-native or no understory, non-native overstory with native understory, and dense non-native overstory with sparse, non-native or no understory.

Lower quality – Sparse non-native overstory with sparse, non-native or no understory. In addition, any areas not included in medium or high quality categories that will be covered with riprap, gabions, etc. (e.g., ruderal habitat and bare ground).

Mitigation ratios of 3:1, 2:1, and 1:1 (replacement acres:lost acres) will generally be applied for impacts to high, medium and low-quality habitats, respectively.

The assessment of riparian impacts and the subsequent location and design of potential mitigation sites will be determined by qualified biologists in coordination with resource agency personnel. These plans will include the following:

a. A description of how the restoration will replace the lost acreage, functions, and values of riparian habitat.

b. Site specific restoration design with a complete analysis of the technical approach to create high quality riparian habitat. The design will include an implementation plan that details site grading, soil amendments, irrigation, planting list, floodplain connectivity, geomorphic conditions and anticipated wildlife use. The restoration plan will also include an explanation of all required site maintenance. A monitoring plan will be developed that includes success criteria for all riparian plantings.

7.2.2.3 Consolidation of Riparian Mitigation.

If multiple smaller impact areas occur, it would be beneficial to consolidate mitigation into a larger habitat restoration area. Larger riparian restoration areas would provide greater functions and values than numerous small mitigation sites. The location and design of potential mitigation sites will be determined by qualified restoration biologists in coordination with resource agency personnel.

7.2.2.4 Encroachment Into Riparian Buffer Zones.

If a new project element would be located within 100 feet of the edge of a riparian corridor, and has encroachment impacts, mitigation in the form of habitat replacement or a functional equivalent will be completed. Mitigation ratios will be determined by a qualified biologist and will be based upon the type of development proposed and the quality and extent of indirect impacts to the riparian habitat.

7.2.2.5 Permits

Prior to construction within the bed and banks of creeks, rivers, or lakes, the project proponent will apply for and obtain a Streambed Alteration Agreement from the California Department of Fish and Game.

7.2.3 Construction Impacts to Aquatic Habitat and Species

7.2.3.1 Implementation of Best Management Practices For Work in Stream Channels.

Implementation of Best Management Practices described below will reduce potential impacts to aquatic species to a less-than-significant level. The following recommendations by the California Department of Fish and Game must be followed, regardless of whether any watercourse within project element footprints are dewatered or not, in order to comply with proper mitigation measures:

a. No equipment will be operated in the live stream channel.

b. When work in a flowing stream is unavoidable, any stream flow shall be diverted around the work area by a barrier, temporary culvert or a new channel capable of permitting upstream and downstream fish movement.

c. Construction of the barrier or the new channel shall normally begin in the downstream area and continue in an upstream direction and the flow shall be diverted only when construction of the diversion is completed.

d. No debris, soil, silt, sand, bark, slash, sawdust, cement, concrete, washings, petroleum products or other organic or earthen material shall be allowed to enter into or be placed where it may be washed by rainfall or runoff into waters of the State.

7.2.4 Potential Construction Impacts to Hairless Popcorn-flower

7.2.4.1 Determine Presence/Absence.

Before implementing any new project elements that could impact vernal marsh habitats within the Bolsa, Pacheco and Hollister East Subbasins, blooming season surveys for the hairless popcorn-flower will be completed. Between March and May prior to construction, areas to be impacted within the Bolsa, Pacheco and Hollister East Subbasin will be surveyed for hairless popcorn flower. If the surveys are negative, no further mitigation is warranted. If hairless popcorn flower populations are found in the construction area, avoidance will be necessary.

7.2.4.2 Avoidance.

Project element(s) will be redesigned to avoid impacts to hairless popcorn flower populations. The changes in design will be approved by a qualified biologist to insure that no impacts to the population will occur. If avoidance is not possible, additional environmental review and development of site specific mitigation measures will be required.

7.2.5 Construction Impacts to Steelhead

Steelhead could occur in the San Benito River, Pacheco Creek, and any other unobstructed tributary of the Pajaro River. Construction activities that will occur in stream habitat (e.g. those involving diversion structures) could directly impact steelhead. If channel diversions occur, steelhead could become stranded, and activities in channels could result in direct take of individuals. In addition, construction activities could result in degradation of water quality (e.g. through leaching cement altering stream pH or increasing sedimentation).

7.2.5.1 Construction Scheduling and Work in Channels Where Water is Present.

Construction in tributaries of the Pajaro River will be limited to the dry season (June 1 to October 31), when steelhead are least likely to be present. Most of the San Benito River and other tributaries are typically dry during this time period. If construction will occur in a live, flowing, stream channel, National Marine Fisheries Service (NMFS) will be consulted regarding measures necessary to prevent take. Because it is possible that juveniles could be moving downstream during any time of year, including the dry season, these measures should ensure that movement of steelhead is not prevented by any water diversion structures used during construction, regardless of when construction occurs. Ideally, the live stream channel will be maintained and protected (e.g. by a structure covering the channel, and coffer dams around construction areas). If the live channel cannot be maintained, water would be diverted through construction sites by way of an open ditch (rather than a pipe) connecting the portions of the channel immediately upstream and downstream from the site. This plastic-lined ditch should also be lined with cobble-sized stones to deter predation by making the steelhead less

conspicuous as they pass through the channel. Water within this ditch should be at least 30 centimeters (12 inches) deep, and no impediments to movement, such as high drop structures, will be present.

7.2.5.2 Implement Hazardous Materials Spill Prevention and Best Management Practices.

A hazardous material spill prevention plan will be developed and implemented for any work in or adjacent to the Pajaro River or its tributaries. Hazardous materials will be stored in secured structures with secondary spill containment features. Refueling of construction equipment and vehicles will not occur within 300 feet of any water body or anywhere that spilled fuel could drain to a water body. The contractors will check and maintain equipment and vehicles daily to prevent leaks of fuels, lubricants, or other fluids. The implementation of Best Management Practices (see *Implementation of Best Management Practices for Work in Stream Channels*, above) will also be required.

7.2.5.3 Reduce Barriers to Movement.

The placement of diversion structures or other hardscape within and immediately adjacent to the low flow channel of any tributary could cause an impediment to migration for steelhead. Potential in-stream structures will be designed in such a way as to not encroach upon the low flow channel and be designed to avoid hardscape that could result in significant eddies within the low flow channel.

7.2.5.4 Consultation with National Marine Fisheries Service

Consultation with National Marine Fisheries Service will be completed for any new project activities that could affect steelhead such as dewatering creeks or rivers, or any in-stream construction.

7.2.6 Construction Impacts to Red-legged Frogs and Other Aquatic Species

7.2.6.1 Avoidance.

To the greatest extent feasible, construction of project elements will be planned to avoid habitat for aquatic species such as the red-legged frog. If construction will occur adjacent to habitat for aquatic species, impacts will be avoided through the following measures.

a. Prior to any construction activities, the boundaries of construction areas will be clearly delineated with orange plastic construction fencing to prevent workers or equipment from inadvertently straying from the construction area. All construction personnel, equipment, and vehicle movement shall be confined to designated construction areas and connecting roadways. Movement of construction and personal vehicles shall be prohibited outside designated construction areas or off established roadways.

b. Prior to the onset of any ground disturbing activities, exclusion fencing will be established around areas of potentially occupied habitat, as determined by a qualified biologist. Exclusion fencing will consist of silt-fencing or similar material at

least 36 inches in height that is buried six inches in the ground to prevent incursion under the fence. Exclusion fencing may be installed at the base of the construction fencing described in A above. This fence will be surveyed each morning before construction, to verify that no frogs have entered the construction site.

c. Before any construction activities begin, a U.S. Fish and Wildlife Service approved biologist will conduct a training session with construction personnel to describe the California red-legged frog and its habitat, the specific measures being implemented to minimize effects to the species, and the boundaries of the construction area.

d. All food-related trash items will be enclosed in sealed containers and removed daily from a project site to discourage the concentration of potential predators in habitat potentially occupied by California red-legged frogs.

7.2.6.2 Implement Hazardous Materials Spill Prevention and Best Management Practices.

See *Implement Hazardous Material Spill Prevention and Implementation of Best Management Practices For Work in Stream Channels*, above)

7.2.6.3 Consultation with the USFWS

Take of California red-legged frogs is only permitted through consultation with the USFWS. Some project elements may involve a federal nexus and, therefore, Section 7 consultation will be required. Other project elements will lack a federal nexus, however, and take will only be authorized upon approval of a suitable Habitat Conservation Plan (HCP). The HCP will provide specific mitigation measures appropriate to the scale of take. Depending on the construction activities, these mitigation measures could range from presence of an on-site monitor to extensive habitat restoration. An HCP would be completed though consultation with the USFWS.

7.2.7 Construction Impacts to San Joaquin Kit Fox

7.2.7.1 Take Avoidance

Standard take-avoidance measures listed on the following pages will be implemented to avoid direct take of any individual kit fox that may wander onto the project site. To avoid direct take of any individual kit fox that may be present on a project site, preactivity surveys will be conducted if any habitat feature with the potential to be used by kit foxes (i.e. burrows, irrigation pipes, debris piles) is created or placed on site and is to be subsequently disturbed or moved. If kit foxes are detected, work in that area must cease and consultation with the USFWS is necessary to determine the appropriate course of action.

STANDARD RECOMMENDATIONS PUT FORTH BY UNITED STATES FISH AND WILDLIFE SERVICE FOR THE PROTECTION OF SAN JOAQUIN KIT FOX PRIOR TO OR DURING GROUND DISTURBANCE. 28 JUNE 1999.

Construction and Operational Requirements

Habitat subject to permanent and temporary construction disturbances and other types of project-related disturbances should be minimized. Project designs should limit or cluster permanent project features to the smallest area possible while still permitting project goals to be achieved. To minimize temporary disturbances, all project-related vehicle traffic should be restricted to established roads, construction areas, and other designated areas. These areas should also be included in preconstruction surveys and, to the extent possible, should be established in locations disturbed by previous activities to prevent further impacts.

1. Project-related vehicles should observe a 20-mph speed limit in all project areas, except on county roads and State and Federal highways; this is particularly important at night when kit foxes are most active. To the extent possible, night-time construction should be minimized. Off-road traffic outside of designated project areas should be prohibited.

2. To prevent inadvertent entrapment of kit foxes or other animals during the construction phase of a project, all excavated, steep-walled holes or trenches more than 2 feet deep should be covered at the close of each working day by plywood or similar materials, or provided with one or more escape ramps constructed of earth fill or wooden planks. Before such holes or trenches are filled, they should be thoroughly inspected for trapped animals. If at any time a trapped or injured kit fox is discovered, the procedures under number 13 of this section must be followed.

3. Kit foxes are attracted to den-like structures such as pipes and may enter stored pipe becoming trapped or injured. All construction pipes, culverts, or similar structures with a diameter of 4-inches or greater that are stored at a construction site for one or more overnight periods should be thoroughly inspected for kit foxes before the pipe is subsequently buried, capped, or otherwise used or moved in any way. If a kit fox is discovered inside a pipe, that section of pipe should not be moved until the Service has been consulted. If necessary, and under the direct supervision of the biologist, the pipe may be moved once to remove it from the path of construction activity, until the fox has escaped.

4. All food-related trash items such as wrappers, cans, bottles, and food scraps should be disposed of in closed containers and removed at least once a week from a construction or project site.

5. No firearms shall be allowed on the project site.

6. To prevent harassment, morality of kit foxes or destruction of dens by dogs or

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cats, no pets should be permitted on project sites.

7. Use of rodenticides and herbicides in project areas should be restricted. This is necessary to prevent primary or secondary poisoning of kit foxes and the depletion of prey populations on which they depend. All uses of such compounds should observe label and other restrictions mandated by the U.S. Environmental Protection Agency, California Department of Food and Agriculture, and other State and Federal legislation, as well as additional project-related restrictions deemed necessary by the Service. If rodent control must be conducted, zinc phosphate should be used because of proven lower risk to kit fox.

8. A representative shall be appointed by the project proponent who will be the contact source for any employee or contractor who might inadvertently kill or injure a kit fox or who finds a dead, injured or entrapped individual. The representative will be identified during the employee education program. The representative's name and telephone number shall be provided to the Service.

9. An employee education program should be conducted for any project that has expected impacts to kit fox or other endangered species. The program should consist of a brief presentation by persons knowledgeable in kit fox biology and legislative protection to explain endangered species concerns to contractors, their employees, and military and agency personnel involved in the project. The program should include the following: a description of the San Joaquin kit fox and its habitat needs; a report of the occurrence of kit fox in the project area; and explanation of the status of the species and its protection under the Endangered Species Act; and a list of measures being taken to reduce impacts to the species during project construction and implementation. A fact sheet conveying this information should be prepared for distribution to the above-mentioned people and anyone else who may enter the project site.

10. Upon completion of the project, all areas subject to temporary ground disturbances, including storage and staging areas, temporary roads, pipeline corridors, etc. should be re-contoured if necessary, and revegetated to promote restoration of the area to pre-project conditions. An area subject of "temporary" disturbance means any area that is disturbed during the project, but that after project completion will not be subject to further disturbance and has the potential to be revegetated. Appropriate methods and plant species used to revegetate such areas should be determined on a site-specific basis in consultation with the Service, California Department of Fish and Game (CDFG), and revegetation experts.

11. In the case of trapped animals, escape ramps or structures should be installed

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immediately to allow the animal(s) to escape, or the Service should be contacted for advice. 12. Any contractor, employee, or military or agency personnel who inadvertently kills or injures a San Joaquin kit fox shall immediately report the incident to their representative. This representative shall contact the CDFG immediately in case of a dead, injured or entrapped kit fox. The CDFG contact for immediate assistance is State Dispatch at (916) 445-0045. They will contact the local warden or biologist. The Sacramento Fish and Wildlife Office and CDFG will be notified in writing within three working days of the accidental death or injury to a San Joaquin kit fox during project related activities. Notification must include the date, time, and location of the incident or of the finding of a dead or injured animal and any other pertinent information. The Service contact is the Chief of the Division of Endangered Species, at the addresses and telephone numbers given below. The CDFG contact is Mr. Ron Schlorff as 1416-9th Street, Sacramento, California, (916) 654-4262.

7.2.8 Potential Construction Impacts to Vernal Pool Fairy Shrimp

Vernal pool fairy shrimp are reported to occur in San Benito County. Any construction that would directly impact vernal marsh habitat (including construction during the dry season) could negatively impact this species.

7.2.8.1 Avoid Habitat.

New projects should be designed, constructed, and operated in such a way as to avoid and/or minimize impacts to vernal marsh habitat. If construction is planned adjacent to vernal marsh habitat, prior to any construction activities, the boundaries of construction areas will be clearly delineated with orange plastic construction fencing to prevent workers or equipment from inadvertently straying from the construction area.

7.2.8.2 Protect Water Quality.

Refer to *Implement Hazardous Materials Spill Prevention,* above.

7.2.9 Construction Impacts to California Tiger Salamanders and Their Habitat

California tiger salamanders could occur in aquatic habitats, and in grassland and oak woodland habitats near aquatic habitat (including vernal marshes) in San Benito County. Construction activities in these habitats could impact California tiger salamanders. The following mitigation measures will reduce impacts to California tiger salamanders and their habitat to less-than-significant levels.

7.2.9.1 Determine Presence/Absence

Prior to construction, protocol-level surveys for California tiger salamanders will be conducted by a qualified biologist in any potential habitat for the species that could be affected by the Management Plan.

7.2.9.2 Avoidance.

Project elements that will impact California tiger salamanders or their habitat will be redesigned to avoid all impacts. If avoidance is not possible, then *Compensation for Habitat Loss* and consultation with CDFG will be necessary.

7.2.9.3 Compensation for Habitat Loss

Replacement of aquatic, wetland, and/or upland habitat that provides breeding or aestivation habitat for California tiger salamanders will provided commensurate with project impacts. Restoration of areas of temporary impacts will replace amphibian habitat impacted temporarily. Mitigation ratios to compensate for permanent impacts to aquatic, wetland and upland habitat must provide more than the existing breeding, foraging and aestivation habitat at the impact site and will be approved by CDFG.

7.2.10 Construction Impacts to Burrowing Owls

Raptors, including owls, and their nests are protected under both federal and state laws, including the Migratory Bird Treaty Act and California Fish and Game Code section 3503.5. Burrowing Owls could occur in grassland habitat and margins of agricultural areas where ground squirrels are present. Construction-related disturbance during the breeding season could result in the incidental loss of fertile eggs or nestlings or otherwise lead to nest abandonment. Disturbance that causes nest abandonment and/or loss of reproductive effort is considered take by CDFG.

7.2.10.1 Avoidance

Preconstruction surveys for Burrowing Owls will be completed in conformance with CDFG protocols, no more than 30 days prior to the start of construction in grassland habitat and margins of agricultural areas where habitat for Burrowing Owls is present. If no Burrowing Owls were located during these surveys, no additional action would be warranted. However, if breeding or resident owls were located on, or immediately adjacent to, the site, buffer zones will be established and/or resident owls will be relocated, as described below.

7.2.10.2 Buffer Zones

A 250-foot buffer, within which no new activity will be permissible, will be maintained between project activities and any nesting Burrowing Owls. This protected area will remain in effect until August 31, or at the CDFG's discretion and based upon monitoring evidence, until the young owls are foraging independently.

7.2.10.3 Relocation

If construction will directly impact occupied burrows, eviction outside the nesting season may be permitted pending evaluation of eviction plans and receipt of formal written approval from the CDFG authorizing the eviction. No burrowing owls will be evicted from burrows during the nesting season (February 1 through August 31).

7.2.11 Construction Impacts to Large Nesting Colonies of Tricolored Blackbirds

Large Tricolored Blackbirds nesting colonies are present in wetland habitats in northern San Benito County. This species could be impacted by construction activities during the nesting season (March 1 to July 1). Construction close to active colonies could result in desertion of nests.

7.2.11.1 Preconstruction Surveys and Avoidance

Prior to construction during the breeding season (March 1 to July 1) within 250 feet of potential nesting habitat for Tricolored Blackbirds (wetland habitat with tall vegetation nearby), preconstruction surveys will be conducted. If Tricolored Blackbirds are present, construction will be delayed until after the breeding season.

7.2.12 Tree Belt Plantings

7.2.12.1 Avoidance

Invasive, exotic tree species will not be used in tree belt plantings. Examples of invasive species include tree of heaven (*Ailanthus altissima*) and blue gum (*Eucalyptus globulus*). Tree selections will be made in consultation with the County of San Benito Agricultural Commissioner.

7.3 Construction Impacts

7.3.1 Dust Abatement Program

For new projects that exceed the threshold limits established by the Monterey Bay Unified Air Pollution Control District (currently 2.2 acres of disturbance, or 82 lb/day), a dust abatement program will be implemented in accordance with Air Pollution Control District requirements.

7.3.2 Noise Control of Construction Equipment

Construction equipment will be adequately muffled and maintained. Construction near sensitive noise receptors, such as residences, schools, medical facilities, libraries, churches, day care centers, and convalescent homes will be limited to weekdays (Monday-Friday) during daylight hours, between 7 A.M. and 6 P.M., except under emergency conditions.

7.3.3 Permitting of Well Drilling Operations

Well drilling operations will obtain necessary well permits and conform to specifications that include, at minimum, proper disposal of drilling fluids, proper disposal and/or treatment of water produced during well development and pumping tests, and site clean-up at the end of the project.

7.4 Cultural Resources

7.4.1 Project Site-Specific Archive and Literature Search

A site-specific archive and literature search would be conducted for project sites once they have been selected for construction. An archaeological and architectural field inventory of areas not previous surveyed would also be completed. Appropriate recordation or supplements to existing documentation would be placed on file with the California Historical Resources Information System, Northwest Information Center at California State University Sonoma, Rohnert Park.

7.4.2 Implementation of Measures to Avoid or Reduce Impacts

For cultural resources identified as eligible for the National Register of Historic Places/California Register of Historical Resources, measures to avoid or reduce impacts to a less-than-significant level would be implemented. Preferred mitigation is avoidance of areas of recorded or known significant or potentially significant cultural resources. Mitigation measures would include:

- Mitigation monitoring by a Professional Archaeologist of archaeologically sensitive areas during ground disturbing construction;
- Formal training of construction personnel to recognize, report and avoid cultural resources;
- The flagging and/or fencing of recorded cultural resources within 100 feet of a project for avoidance and protection;
- Construction contract language discussing the potential for significant subsurface archaeological resources and protocols for dealing with unexpected discoveries; and,
- The requirements for the identification, evaluation and treatment of significant unexpected discoveries in accordance with regulatory requirements.

7.4.3 Notification If Significant Cultural Materials Are Encountered

In the event any significant cultural materials are encountered, all construction within a radius of 100 feet of the find would be halted, the District Manager of the San Benito County Water District and appropriate City or County Planning Department personnel would be notified, and the archaeologist will examine the find and make appropriate recommendations regarding the significance of the find and the appropriate mitigation. Recommendations could include collection, recordation, and analysis of any significant cultural materials.

7.4.4 Notification if Human Skeletal Remains Are Encountered

In the event that human skeletal remains are encountered, the County Coroner will be notified immediately. Upon determination by the County Coroner that the remains are Native American, the coroner shall contact the California Native American Heritage Commission, pursuant to subdivision (c) of section 7050.5 of the Health and Safety Code and the County Coordinator of Indian Affairs. No further disturbance of the site may be made except as authorized by the County Coordinator of Indian Affairs in accordance with the provisions of State law and the Health and Safety Code. The District Manager of the San Benito County Water District and appropriate City or County Planning Department personnel will also be notified immediately, as appropriate, if human skeletal remains are found during development.

7.5 Energy

7.5.1 Energy Efficiency and Water Conservation

Energy and water conservation techniques and energy efficiency will be incorporated in all new building and equipment design and procurement, orientation and construction.

7.6 Geology and Seismicity

7.6.1 Design-Level Geotechnical Study And/Or Soil Foundation Report

A design-level geotechnical study and/or soil foundation report will be completed to develop specific design criteria for new projects that include the installation of structures, foundations, pipelines, or levees. Geotechnical studies will include site-specific evaluations of soil conditions, fault creep, ground shaking and the potential for liquefaction and lateral spreading. Mitigation measures to reduce geologic and seismic hazards to an acceptable level of risk will be included in new projects.

7.6.2 Post-Seismic Event Functionality for Critical Facilities

Critical facilities, such as water and wastewater treatment facilities and domestic water lines, will be designed and located in a manner that maximizes their ability to remain functional after a major earthquake.

7.6.3 Erosion Control Measures

Measures to minimize erosion, including grading during the dry season and reseeding of disturbed areas, will be incorporated in new water management or water treatment projects that require grading and/or tree removal. Erosion and sedimentation control practices are listed in Program Mitigation Measure 7.7.3.1 under *Hydrology and Water Quality.*

7.7 Hydrology and Water Quality

7.7.1 Flooding Impacts

7.7.1.1 Conformance to FEMA Flood Program Requirements and Local Floodplain Ordinance

At a minimum, all proposed GWMP facilities will conform will conform to FEMA Flood Program requirements and the appropriate local floodplain ordinance. Pipelines shall be buried, with excess spoils disposed of outside of the 100-year floodplain and pump stations shall be sited outside of the floodplain.

7.7.1.2 Flood analysis

A flood analysis will be completed as a part of the design of any constructed wetlands or other project elements located within the 100-year floodplain. The flood analysis will address, at minimum, flood conveyance, potential increases in flood elevation, and any impacts to neighboring properties. Measures to avoid flooding impacts will be included in the final design

of project elements. Berm heights of constructed wetlands or other facilities shall be sufficient to provide adequate freeboard above the 100-year flood event, and the outside surface of the berms shall be covered with riprap or other material to prevent erosion during peak flow events.

7.7.2 Impacts to Water Quality from Evaporation and Trucking of Salts

7.7.2.1 Avoidance

An impermeable barrier, that will prevent saline water from percolating into the groundwater, will be provided beneath any evaporation ponds for concentrate from groundwater demineralization or treatment.

Adequate freeboard to contain a 100-year storm event and drainage will be provided in evaporation ponds to prevent runoff from reaching surface waters.

7.7.3 Construction Impacts

7.7.3.1 Construction BMPs

Contractors shall be required to implement Best Management Practices (BMPs) for construction activities. The BMPs include measures guiding the management and operation of construction sites to control and minimize the potential contribution of pollutants to storm runoff from these areas. These measures address procedures for controlling erosion and sedimentation and managing all aspects of the construction process to ensure control of potential water pollution sources. Erosion and sedimentation control practices typically include:

- limiting construction to the dry-weather months;
- installation of silt fencing and/or straw wattle;
- soils stabilization;
- revegetation; and
- runoff control to limit increases in sediment in storm water runoff (e.g., straw bales, silt fences, check dams, geofabrics, drainage swales, and sand bag dikes).

7.7.3.2 Restriction On Stream Channel Construction Scheduling

Construction activities within stream channels (i.e., diversion structures on local streams) shall be confined to the dry, summer season in order to minimize adverse impacts to local water quality.

7.7.4 Water Conservation

7.7.4.1 Promote Water Conservation

Promote water conservation through public education and encouraging use of drought tolerant landscaping and water-saving appliances and irrigation techniques, as described in the current Hollister Area Urban Water Management Plan and San Benito County Water Conservation Plan.

7.8 Land Use (Agricultural Resources)

7.8.1 Site/Project Design to Minimize Impacts to Prime Farmland and Farmland of Statewide Importance

Site and project design will be used to minimize direct and indirect impacts to Prime Farmland and Farmland of Statewide Importance. Large ponds or facilities for evaporation of concentrate from groundwater treatment will not be sited on Prime Farmland or Farmland of Statewide Importance. Potential land use conflicts with agricultural operations from new project elements, such as modifying access to fields for farm equipment, will be avoided.

7.9 Noise and Land Use Compatibility

7.9.1 Minimize Nuisance of Noise Generating Equipment

Noise generating equipment, such as pumps and compressors, will be designed to avoid causing a nuisance or disturbance to nearby sensitive receptors, defined as residences, schools, medical facilities, libraries, churches, day care centers, and convalescent homes.

Noise levels at the property line will conform to the following guidelines, developed from federal and state standards:

Noise Standards for Noise Generating Equipment Hourly Equivalent (Leq)		
	Noise Level in Decibels at Property Line	
	7 AM - 7 PM	**7 PM -7 AM**
Noise generating equipment adjacent to or effecting a property used or zoned for residential or other defined sensitive purposes	60	50
Noise generating equipment adjacent to a property used or zoned for commercial purposes	65	65
Noise generating equipment adjacent to a property used or zoned for industrial or other than commercial or residential purposes or defined sensitive uses.	75	75

dBA = decibels, A-weighted scale

In addition, future projects with noise generating equipment will be sited and designed so that noise levels, using the 24-hour Day-Night Level (DNL) descriptor, will not exceed 60 dBA DNL in outdoor activity areas for noise sensitive uses. Noise levels will be reduced by incorporating noise reduction technology (acoustical treatments) such as acoustical enclosures and mufflers.

7.9.2 Noise Analysis for Existing and Future Conditions Near Noise Sensitive Receptors

A noise analysis that addresses existing and future conditions will be completed by a qualified acoustical consultant prior to the approval of noise generating projects located in the vicinity of noise sensitive receptors. The noise analysis will identify measures required to conform with the noise guidelines listed in Program Mitigation Measure 7.9.1.

7.10 Visual and Aesthetic Resources

7.10.1 Design of New Projects for Compatibility With Nearby Development

New projects will be designed to be compatible with the mass and scale of nearby development. Structures, such as water treatment facilities, will incorporate design features that reflect the character of nearby development.

7.10.2 Avoid Blocking View on Designated Scenic Roadways/Highways

New projects will be designed to avoid blocking views from State of California designated scenic roadways or highway corridors.

7.10.3 Avoid Substantial Alteration of View on Designated Scenic Roadways/Highways

New percolation ponds, evaporation ponds, and emergency storage facilities will be designed and sited to avoid substantially altering views from State of California designated scenic roadways or highway corridors. Landscaping and berms will be used to limit views of evaporation ponds.

7.10.4 Avoid Substantial New Light/Glare on Surrounding Land Uses

Lighting and building materials at new facilities will be designed to avoid the generation of substantial new light or glare on surrounding land uses.

References

Barry J. Miller, Planning Consultant, San Juan Bautista General Plan Update, Draft for Public Review, Environmental Impact Report Addendum, March-98

Barry J. Miller, Planning Consultant, San Juan Bautista General Plan Update, Final Environmental Impact Report Addendum, June-98

Bracewell Engineering, 1999 Annual Self-Monitoring Report - Permit CA 0047912 prepared for City of San Juan Bautista, January-00

California Irrigation Management Information System, Evaporation Data

California Regional Water Quality Control Board, Water Quality Control Plan for the Central Coast Basin, Sept-94

California State Department of Finance, Official State Estimates as of January 1, 2002. City/County Population and Housing Estimates. Jan-02

CH2M Hill, Preliminary Drawings for Import Pipeline Project, August-02

City of Hollister, City of Hollister Ordinance No. 959 (Growth Management), September-01

City of Hollister, Domestic Wastewater Treatment Plant 2001 Annual Monitoring Report, January 2000

Creegan & D'Angelo-McCandless Consulting Engineers, 1993- 1994 Water Year GW report 1995, March-95

Creegan & D'Angelo-McCandless Consulting Engineers, 1994- 1995 Water Year GW report 1996, March-96

EDAW Inc./Todd Engineers, Groundwater Management Plan *Existing Conditions and Alternatives*, December-01

Henneman, Kenneth. Draft Water Needs Assessment for Zone 6. 2000.

HydroScience Engineers. Long-Term Wastewater Management Plan for the Domestic Wastewater Treatment Plant - Prepared for City of Hollister - Administrative Draft Report. May-02.

Gregg, John. Personal Communications. 3 June, 2002, July 2002, 28 August, 2002.

Jones & Stokes, Final Annual Groundwater Report for the Year 2001, January-02

Jones & Stokes Associates, 1995- 1996 Water Year GW report, March-97

Jones & Stokes Associates, 1996- 1997 Water Year GW report, February-98

Jones & Stokes Associates, 1997- 1998 Water Year GW report, January-99

Jones & Stokes Associates, 1998- 1999 Water Year GW report, December-99

Jones & Stokes Associates, 1999- 2000 Water Year GW report, December-00

Jones & Stokes Associates and CH2MHill, Groundwater Management Plan for the San Benito County Part of the Gilroy/Hollister Groundwater Basin, April-98

Kennedy/Jenks Consultants, Draft Report: Evaluation of Project Alternatives to Implement Groundwater Management Plan in San Benito County, June-02

Kennedy/Jenks Consultants, Napa River Diversion Feasibility Study, May 92

Montgomery Watson. San Juan Bautista Area Water Reclamation Study, Final. May-02.

Montgomery Watson, Wastewater Treatment Facilities, Sunnyslope County Water District - Recycled Water Study, Final, November-02

San Benito County, Draft EIR Northeast Fairview Specific Plan (volume 1). April-98

San Benito County, Final EIR Northeast Fairview Specific Plan (EIR Addendum – Comments Received on Draft EIR, Responses to Comments), October-99

San Benito County, San Benito County Ordinance No. 751(Growth Management), April-02

San Benito County Water District. Summary of Growth Management Programs for San Benito County, Hollister, and San Juan Bautista. June-02

San Benito County Water District, Water Supply Assessment for West of Fairview Project, November-01

San Benito County Water District, Zone 3 and Zone 6 Annual Percolation and Groundwater Recharge Program, San Benito River Detention Berms, March-94

Santa Cruz Health Services Agency – Robert Kennedy, Subject: Draft Report on Evaluation of Project Alternatives to Implement Groundwater Management Plan in San Benito County, June-02

Schaaf & Wheeler and Jones & Stokes, Hollister Area Urban Water Management Plan 2000, July-99

State of California, Department of Finance., Revised Historical City: County, and State Population Estimates, 1991 - 2000, with 1990 and 2000 Census Counts, March-02

State Water Resources Control Board – Water Rights Division (State Water Rights Control Board). Water Rights Decision 187. March-28

State Water Resources Control Board – Water Rights Division (State Water Rights Control Board). Water Rights Decision 409. Oct-37

State Water Resources Control Board – Water Rights Division (State Water Rights Control Board). Water Rights Decision 885. January-59

State Water Resources Control Board – Water Rights Division (State Water Rights Control Board). Water Rights Decision 1436. June-74

Superior Court of San Benito County, Judgment No. 14797. December-88

U.S. Bureau of Reclamation, Reconnaissance Report, Hollister Project, Pajaro River Basin, CA, January-54

U.S. Bureau of Reclamation, San Felipe Division Environmental Statement V.1, March-76

U.S. Bureau of Reclamation, Table for USBR Feasibility Appendix - Estimate of Annual Safe Groundwater Supply. January 73

Walters Engineering, Cienega Pipeline – 1983 Damage Assessments. April-83

Walters Engineering, Water Master Plan Update prepared for City of Hollister, September-96

San Benito County General Plan Section Summaries, Various dates.

APPENDIX B-2

EVALUATION OF PROJECT ALTERNATIVES TO IMPLEMENT GROUNDWATER MANAGEMENT PLAN IN SAN BENITO COUNTY

Draft Report

Evaluation of Project Alternatives to Implement Groundwater Management Plan in San Benito County

Water Resources Association of San Benito County

K/J 025007.05
June 2002

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EVALUATION OF PROJECT ALTERNATIVES TO IMPLEMENT GROUNDWATER MANAGEMENT PLAN IN SAN BENITO COUNTY

12 June 2002

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Section 1: Executive Summary

1.1 Introduction and Background

The Water Resources Association of San Benito County (WRA) has previously developed two plans related to Groundwater Management in the northern San Benito County area. These plans are part of the process that the WRA is undertaking that will result in a set of programs and projects addressing groundwater management and a Programmatic Environmental Impact Report (PEIR) addressing those programs and projects.

The current assignment is to build on the previous work in the further identification and evaluation of alternatives that will define coordinated basin-wide approaches to groundwater management and be sufficient to carry over into the PEIR preparation effort.

The following problem statements have been developed:

Water Quantity

- Existing imbalance of areas of high and low groundwater
- Pending imbalance of supply and demand due to planned growth
- Existing and pending inability to adequately dispose of wastewater
- Long-term imported water supplies are frequently subject to reduction and local supplies are constrained in quantity

Water Quality

- Total dissolved solids (TDS) – salts are accumulating in the basin and constrain beneficial uses
- Hardness affects urban supplies and leads to water softeners that further add salts to the basin
- Nitrates have accumulated in some ground water subbasins, affecting urban supplies
- Effective water quality protection is lacking

Keeping in mind these problems in the Gilroy-Hollister portion of the San Benito County groundwater basin, the approach that has been taken in the current assignment is as follows:

1. Further develop objectives and criteria by which alternatives will be evaluated.
2. Further develop the toolbox of project elements identified in the 2001 Phase 2 effort.
3. Use the toolbox of project elements to develop additional alternatives that bridge the 100% Local Supply and 100% Imported Supply alternatives developed in the 2001 Phase 2 effort.
4. Evaluate the alternatives against the objectives and criteria that were developed.
5. Estimate water supplies and water demands for present and future conditions for municipal/industrial and agricultural uses using existing analyses
6. Using estimated water needs developed in 5. above, identify potential projects that could be used to manage the groundwater basin in accordance with the alternatives developed in step 3 above.

1.2 Objectives and Criteria

In order to be able to evaluate the alternatives against a common measure, objectives for water quantity and water quality were developed. Then, for each objective, a set of criteria were developed by which the alternatives could be judged. It is envisioned that as part of the PEIR effort, objectives and criteria may be modified and other objectives and criteria may be developed. The objectives and criteria used in this assignment are as follows:

Water Quantity Objective 1: Maintain a reliable water supply for present and future users
The following specific criteria were developed for this objective:

- Water Quantity Specific Criterion #1-1: Deliver 100% of Agricultural and Municipal/Industrial Supply in normal and dry years, and the initial critical year in a drought

- Water Quantity Specific Criterion #1-2: Deliver at least 85% of Municipal/Industrial Supply and 75% of agricultural supply in the second and subsequent critical years in a drought

Water Quantity Objective 2: Integrate management of groundwater, surface water, and imported water
The following specific criteria were developed for this objective.

- Water Quantity Specific Criterion #2-1: Maximize efficient use of water supply. For existing M&I uses, it is assumed that there will be a 1%/yr reduction in water demand per existing residential dwelling unit over the next twenty years. Conservation would result in a reduction from an estimated 450 gallons per day (gpd) per dwelling unit (du) to 368 gpd/du. New development would assume a demand of 330 gpd/du. Based on CVP guidelines, agricultural irrigation is assumed to be at 85% efficiency.

- Water Quantity Specific Criterion #2-2: Manage groundwater levels to protect overlying uses from impacts from high water levels and prevent drawdown below prior historic low levels.

- Water Quantity Specific Criterion #2-3: Optimize use of groundwater storage

Water Quality Objective: Provide water quality adequate for end-users

- Water Quality Specific Criterion #1-1: Manage water resources to minimize imported salts and groundwater salinity for beneficial uses

- Water Quality Specific Criterion #1-2: Protect groundwater resources from contamination with emphasis on nitrates and salts.

- Water Quality Specific Criterion #1-3 Deliver M&I water meeting primary and secondary water quality objectives with emphasis on achieving TDS and hardness objectives

- Water Quality Specific Criterion#1-4: Deliver agricultural water meeting established quality parameters.

Other criteria were developed to assist in evaluating tools, formulating alternatives, and evaluating alternatives.

Regional Criteria
The elements of an alternative should be consistent with regional water supply management objectives

Environmental Criteria
The environmental impacts of each element of an alternative should be mitigable to acceptable levels. The alternatives and should enhance the local environment and contribute to the long-term sustainability of agricultural and urban productivity of the basin.

Institutional/Jurisdictional Criteria
Each element of an alternative should be permittable and implementable, and shall be consistent with local and regional institutional constraints.

Cost Effectiveness/Affordability Criteria:

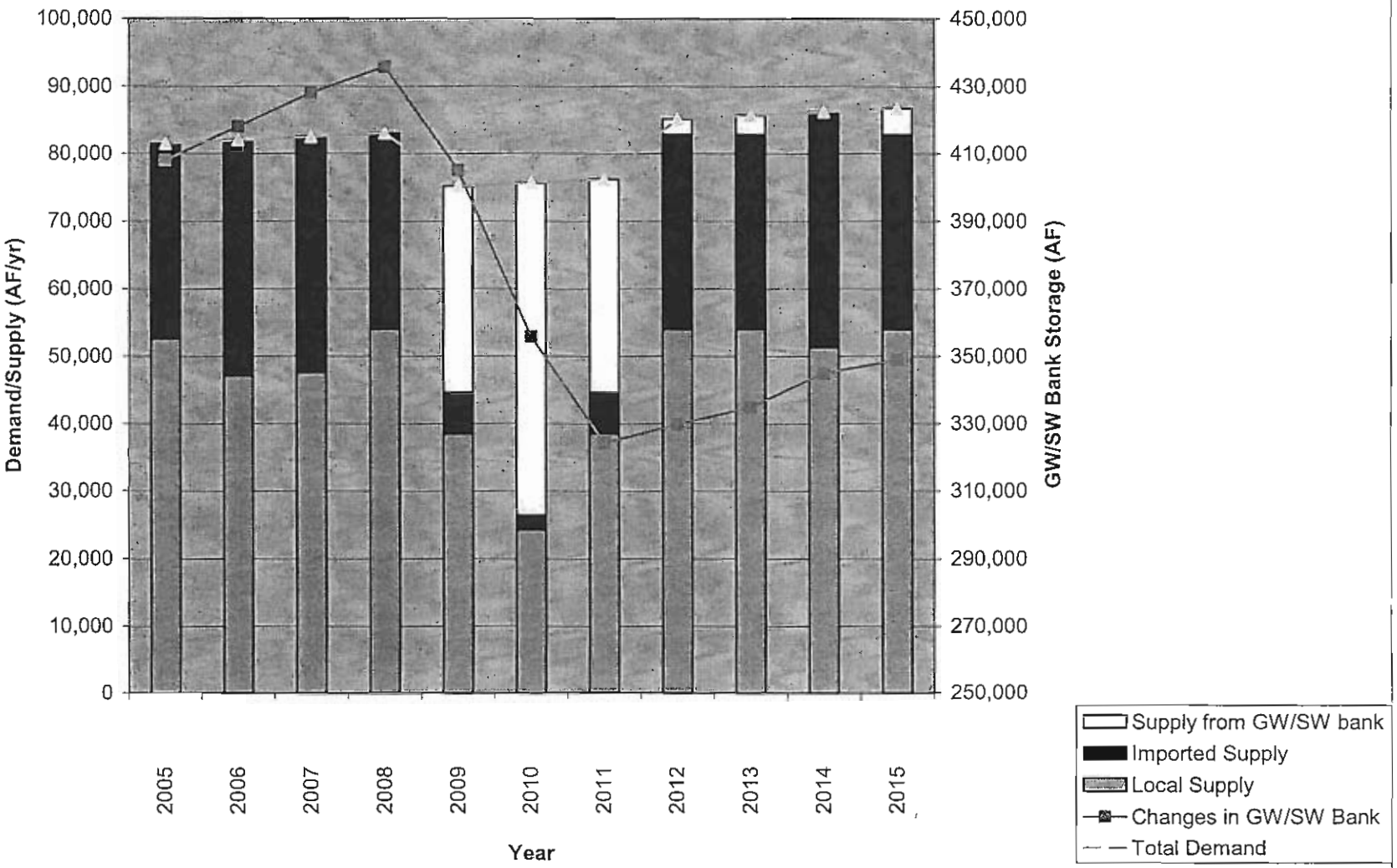
- Each alternative should be affordable and financially feasible for the urban and agricultural interest to implement over a predictable time period consistent with plan objectives. One measure of affordability will be the impact on water costs to urban and agricultural users over current and future baseline estimates.

- Each alternative should maximize use of existing facilities.

1.3 Demand and Supply Analysis

As part of developing projects for alternatives, an estimate of future demands and supplies was conducted in Section 5. The 2020 demands for M&I were ultimately based on an population estimate under City of Hollister, City of San Juan Bautista, and San Benito County Growth Management assumptions. Supplies are variable by hydrologic year and alternatives that incorporate imported San Felipe water must have sufficient storage to be able to provide enough water during dry periods. Imported San Felipe water can range from 2,000 – 6, 200 AF/yr for M&I supplies and from 0 – 22,600 AF/yr for Agricultural supplies. The attached Figures ES-1 is an illustrative example of how the groundwater system might operate during a future10-year period. The simulation includes imported surface water, groundwater within the safe yield of the basin, and surface water/groundwater banking. A more detailed explanation of the figure is found in Section 5 of the report.

Figure ES-1: Simulated 2005-2015 Demand and Supply



1.4 Alternative Development and Evaluation

The different alternatives that were developed reflect different philosophies to groundwater management. These different philosophies guide the selection of project toolbox elements to accomplish the water supply objectives. The four philosophies currently under consideration are:

- Alternative #1 = 100% Local Supply
- Alternative #2 = 100% Imported Supply
- Alternative #3 = Minimize Groundwater Quality Impacts
- Alternative #4 = Cost-Effective Mix of Local and Imported Supply

The development and evaluation of these alternatives does not preclude the development of other alternatives during the Programmatic Environmental Impact Report preparation process. As described earlier, the 2001 Existing Conditions report developed Alternatives 1 and 2 which frame the ends of the spectrum of 100% local supply and 100% imported supply. Alternatives 3 and 4 represent approaches to mixing local and imported supply.

1.4.1 Toolbox of Project Elements

As part of the development of the alternatives, a toolbox of project elements was developed that represented the range of types of projects that could be implemented to accomplish the goals and philosophies of the alternative and that could be judged against the objectives and criteria summarized above. The toolbox contains elements generally related to water supply, water quality, and water level management. The toolbox of elements is summarized below and are detailed in Section 8 of the report. They include:

- **Municipal and Industrial Water Conservation ***
- **Agricultural Water Conservation***
- **Salinity Education Program***
- **Water Softener Ordinance***
- **Maintain Existing Groundwater Extraction Facilities**
- **Maintain Surface Water Importation**
- **Local Surface Water Storage**
- **Local Groundwater Extraction Facilities**
- **Local Conveyance Facilities**
- **Additional Imported Surface Water**
- **Second Conduit to Pacheco Dam and Tunnel and Other Pipelines**
- **Imported Surface Water Storage Reservoirs**
- **Imported Surface Water Percolation**
- **Groundwater Banking**
- **Surface Water Treatment**
- **Groundwater Treatment**
- **Groundwater/Surface Water Blending**
- **Reclaimed M&I Effluent for Reuse**

- **Reclaimed M&I Effluent for Export**
- **Desalt Reclaimed M&I Effluent for Reuse**
- **M&I Effluent Percolation**
- **Agricultural Effluent for Export (Tile Drains)**
- **Tree Belt Evapotranspiration**
- **Groundwater Pumping for Export**
- **Deepen Drainage**
- **Water Transfers**

* Assumed to be a part of all alternatives

The first stage of alternative evaluation was to select project toolbox elements to meet the philosophies of the alternatives and to conduct a qualitative evaluation of the alternatives as documented in Section 9. After a demand and supply analysis was performed such that preliminary sizing of project facilities could be performed, each alternative was further developed to include illustrative examples of projects and sizes. Alternatives, their philosophies, the major toolbox elements, and preliminary estimates of cost of construction for selected elements are summarized below.

1.4.2 Alternative #1 – 100% Local Supply

The philosophy of this alternative is to, over time, eliminate the basin's dependence on imported water and the associated variations in availability. To achieve this objective, it is necessary to develop and manage additional local supplies and improve efficiencies. In order to meet the water quality objectives, reduction of the amount of salt being added to the basin occurs through use of local supplies and active salinity education of agricultural users and reduction of salt loads from municipal users. The major project toolbox elements in addition to the 4 common to all alternatives include:

- Use existing groundwater supplies and develop additional groundwater supplies and groundwater banks
- Demineralize/desalinate existing groundwater for potable use
- Develop local surface water reservoirs and treat for potable use
- Use reclaimed M&I effluent
- Use groundwater for agriculture with some potential blending with local surface water to improve water quality

This alternative may not be able to deliver 100% of the 2020 demands without overdrafting the aquifer.

An illustrative example of how this alternative could be implemented was prepared in section 11 in order to be able to compare alternatives. A preliminary estimate of the cost of construction only was prepared for selected project elements that had sufficient information to prepare a cost estimate. Costs of planning, environmental documentation, and permitting were not included at this time. The preliminary estimate of the cost of construction for Alternative #1 ranged from $145-$150 million.

1.4.3 Alternative #2 – 100% Imported Supply

Alternative #2 – 100% Imported Supply defines the other end of the spectrum within which to evaluate groundwater management. The philosophy of this alternative is to increase dependence on high quality imported water and to manage demand and increase groundwater and local storage to moderate the high variations in availability. The amount of storage required will be large, because: 1) agricultural users have high demands and 2) it can be expected that extended periods where full contract entitlements will not be delivered will continue to occur. In fact, it is possible that even less water than is currently being delivered will be available, particularly to agricultural users

The major project toolbox elements in addition to the 4 common to all alternatives include:

- Maintain existing and obtain additional imported surface water to meet demands
- Construct additional conveyance for additional imported surface water
- Develop surface water and groundwater banks to store imported water
- Treat surface water for potable use
- Export reclaimed M&I effluent for water level management
- Pump and export groundwater for water level management

This alternative may not be able to deliver 100% of the 2020 demands without significant storage because of the highly variable deliveries of imported surface water. This alternative requires complex institutional arrangements to obtain sufficient imported surface water to meet these demands reliably. It is not certain whether sufficient contract entitlement can be acquired in order to make this alternative feasible.

An illustrative example of how this alternative could be implemented was prepared in section 11 in order to be able to compare alternatives. A preliminary estimate of the cost of construction only was prepared for selected project elements that had sufficient information to prepare a cost estimate. Costs of planning, environmental documentation, and permitting were not included at this time. The preliminary estimate of the cost of construction for Alternative #2 was approximately $288 million including the cost of obtaining additional contract entitlement for additional imported surface water.

1.4.4 Alternative #3 – Minimize Groundwater Quality Impacts

The philosophy of this alternative is to manage water supplies with the goal of minimizing groundwater quality impacts of contaminants including salts. This objective would be accomplished through minimizing use of imported surface water since it accounts for more than 1/3 of the salt additions, reducing salts in source waters by using local precipitation (surface supplies) with the accompanying low salt content and, removing salts from the sub-basin. Imported supplies are used for blending and/or substitution for higher salt water sources. Water quality management will be accomplished in conjunction with management of basin water levels through balanced use of surface water and groundwater. The use of local storage moderates the variability of local surface water availability

- Maintain existing imported surface water to blend and substitute for poorer water quality

- Develop higher quality local surface reservoirs
- Develop groundwater banks to store local and imported water
- Use and demineralize/desalt groundwater for potable use
- Treat surface water for potable use
- Desalt reclaimed M&I effluent for local irrigation

Because of the range of supply options in this alternative, this alternative should be able to deliver 100% of the 2020 demands if sufficient storage is developed. If excess contract entitlement is available, it could be sold to partially fund some of the projects.

An illustrative example of how this alternative could be implemented was prepared in section 11 in order to be able to compare alternatives. A preliminary estimate of the cost of construction only was prepared for selected project elements that had sufficient information to prepare a cost estimate. Costs of planning, environmental documentation, and permitting were not included at this time. The preliminary estimate of the cost of construction for Alternative #3 ranged from $155 - $160 million.

1.4.5 Alternative #4 – Cost Effective Balance of Local and Imported Supplies

This alternative has as its philosophy to establish the most cost-effective balance of local and imported supplies. It would involve use of imported water when available to supplement local supplies and involve greater use of local groundwater/surface water to meet demands during dry/critically dry years. Some treatment and blending to provide water quality to meet beneficial uses will occur. Based on water balances in the 2001 Existing Conditions, some imported supply is necessary to minimize groundwater overdraft as occurred before the introduction of imported water.

The major toolbox elements for this alternative were selected to for their lower relative cost and include:

- Maintain existing imported surface water to blend and substitute for poorer water quality
- Develop groundwater banks to store local and imported water
- Treat surface water for potable use
- Use reclaimed M&I effluent for irrigation
- Blend surface water and groundwater for agricultural delivery where appropriate

Because of the range of supply options in this alternative, this alternative should be able to deliver 100% of the 2020 demands if sufficient storage is developed. If excess contract entitlement is available, it could be sold to partially fund some of the projects.

An illustrative example of how this alternative could be implemented was prepared in section 11 in order to be able to compare alternatives. A preliminary estimate of the cost of construction only was prepared for selected project elements that had sufficient information to prepare a

cost estimate. Costs of planning, environmental documentation, and permitting were not included at this time. The preliminary estimate of the cost of construction for Alternative #4 ranged from $55 - $70 million.

1.5 Preliminary Conclusions

Based on the first stage evaluation of alternatives and the development of projects and planning-level estimates of cost of construction, it appears at this time that Alternative #4 has the greatest probability of fulfilling the objectives and criteria that have been developed at the least cost. Additional analysis regarding the costs of the elements and the other potential impacts of the projects should be conducted during the PEIR process. The table below summarizes the cost comparisons of the alternatives and their ability to meet water quantity and water quality objectives.

Summary of Preliminary Estimated Costs of Constructions Project Alternatives

Alternative #	Planning-Level Estimate of Cost of Construction for Elements With Estimated Costs	Notes
1 – 100% Local Supply	$145 - $150 million	Not determined that Alternative can meet water quantity needs without overdraft, water quality for M&I should be met, agriculture may have more variable delivered water quality
2 – 100% Imported Supply	$288 million plus annual cost of additional water	Not determined that Alternative can meet water quantity needs reliably, high quality water delivered when available
3 – Minimize Groundwater Quality Impacts	$155 - 160 million	Alternative expected to meet water quantity needs, should result in improved delivered water quality over present conditions
4 – Most Cost Effective Mix of Imported and Surface Water	$55 - $70 million	Alternative expected to meet water quantity needs, should result in improved delivered water quality over present conditions

Section 2: Introduction and Approach

The Water Resources Association of San Benito County (WRA) has previously developed two plans related to Groundwater Management in the northern San Benito County area. These plans are part of the process that the WRA is undertaking that will result in a set of programs and projects addressing groundwater management and a Programmatic Environmental Impact Report (PEIR) addressing those programs and projects. The first previously developed plan is the Groundwater Management Plan (1998 GMP) for the San Benito County portion of the Gilroy-Hollister Groundwater Basin (Jones and Stokes and CH2M-Hill, 1998). The second is the Groundwater Management Plan – Existing Conditions and Alternatives (2001 Existing Conditions) Report (EDAW, Inc./Todd Engineers, 2001).

The current assignment is to build on the previous work in the further identification and evaluation of alternatives that will define coordinated basin-wide approaches to groundwater management and be sufficient to carry over into the PEIR preparation effort.

The 2001 effort presented the following problem statements, as edited for clarity:

Water Quantity

- Existing imbalance of areas of high and low groundwater
- Pending imbalance of supply and demand due to planned growth
- Existing and pending inability to adequately dispose of wastewater
- Long-term imported water supplies are frequently subject to reduction and local supplies are constrained in quantity

Water Quality

- Total dissolved solids (TDS) – salts are accumulating in the basin and constrain beneficial uses
- Hardness affects urban supplies and leads to water softeners that further add salts to the basin
- Nitrates have accumulated in some ground water subbasins, affecting urban supplies
- Effective water quality protection is lacking

Keeping in mind these problems in the Gilroy-Hollister portion of the San Benito County groundwater basin, the approach that has been taken in the current assignment is as follows:

7. Further develop objectives and criteria by which alternatives will be evaluated.
8. Further develop the toolbox of project elements identified in the 2001 Phase 2 effort.
9. Use the toolbox of project elements to develop additional alternatives that bridge the 100% Local Supply and 100% Imported Supply alternatives developed in the 2001 Phase 2 effort.
10. Evaluate the alternatives against the objectives and criteria that were developed.
11. Estimate water supplies and water demands for present and future conditions for municipal/industrial and agricultural uses using existing analyses
12. Using estimated water needs developed in 5. above, identify potential projects that could be used to manage the groundwater basin in accordance with the alternatives developed in step 3 above.

Public involvement during the current assignment has occurred through 2 public workshops that were held. The first public workshop on 28 May 2002 was held to present and obtain input on:

- Draft Objectives and Criteria that will be used to evaluate the alternatives,
- Draft toolbox of project elements; and
- Alternatives that comprise the range of potential alternatives.

The public response during the first public workshop did not indicate any need to change the approach.

The second public workshop was held on 12 June 2002 to present the draft report which contained the resulting evaluation and analyses.

Section 3: Background

There are a number of planning and regulatory documents that are relevant to the preparation of the alternatives evaluation and PEIR. The primary relevant documents have been summarized below.

3.1 1998 Groundwater Management Plan for the San Benito County Part of the Gilroy-Hollister Groundwater Basin

The 1998 GMP was prepared in recognition that although northern San Benito County has an apparent abundance of local and imported water, management of the resources needs to be improved. Groundwater management is important so that local imbalances of water quantity and resulting water level issues can be resolved, water quality can be improved for beneficial uses, and a sufficient, reliable supply can be provided for the agricultural and M&I users in the basin.

Nine priority groundwater management issues were identified in the 1998 GWMP:

1. Poor Groundwater Quality and Long-term Salt Buildup in the Groundwater Basin
2. Rising Groundwater Levels and Drainage Problems in the San Juan and Pacheco Subbasins
3. Competition for Limited Percolation Capacity in the Upper End of the San Juan Valley
4. Long-term Nitrate Buildup in the Groundwater Basin
5. Future Increases in Water Demand
6. Residual Overdraft in the Hollister West and Bolsa Southeast Subbasins
7. Coordination of Land Use and Water Supply Planning
8. Water Conservation
9. Information Management

For each of these priority groundwater management issues, specific actions were identified to address each issue.

3.2 Groundwater Management Plan: Existing Conditions and Alternatives (2001)

In 2001, a second effort was commissioned to further expand the GMP to be "broad-reaching and comprehensive in the coverage of information, issues and policies relevant to water resources and management in the County" and to include issues "not included in the 1998 GWMP ... for review and discussion" and to ultimately develop a programmatic EIR on the expanded GMP. The result of the 2001 effort was the Groundwater Management Plan: Existing Conditions and Alternatives Report that is intended to serve as the background portion of the PEIR. The existing conditions portion of the report was Phase 1 of the 2001 process and the Alternatives portion of the report was Phase 2 of the 2001 process.

The existing conditions of the groundwater basin were summarized including discussion of social conditions, physical conditions and presentation of basin water balances with and without imported water. Basin water balances between 1989 and 1999 indicated that if Central Valley

Project water from the San Felipe Project (San Felipe Water) had not been used in San Benito County, there would have been an estimated overdraft of 8,700 AF. However, the water balance during the same period with the use of San Felipe Water indicates estimated excess water of 11,500 AF resulting in high water levels in some portions of San Benito County.

Alternatives were developed that incorporated the suggestions and comments of the public that were intended to be sufficiently broad to encircle the largest range of groundwater management projects. The "end-member" alternatives that were identified in the Phase 2 portion of the report were:

- Alternative 1: 100% Local Supply – Improve Basin Water Quality
- Alternative 2: 100% Imported Supply – No Improvements to Basin Water Quality
- Alternative 3: 100% Imported Supply – Manage Basin for Groundwater Banking

The alternatives presented in Phase 2 were intended to "frame the range of possibilities such that decision-makers and the community can begin to:

- Establish a common ground for thinking about the problem
- Think conceptually about and understand cause and effect
- Define the "universe" of possibilities, and
- Understand the role of actions that may resolve current issues, while maintaining a longer-term perspective."

The 3 Alternatives contained 78 sub-projects that encompassed project "toolbox" elements such as:

- Municipal Groundwater Desalting
- Alternative Effluent Percolation Sites
- Surface Water Development
- New Wells
- Recharge Basins
- Effluent Desalters
- Agricultural Desalting
- Wells for Groundwater Drainage
- Agricultural Drains
- Deepening of Existing Drainage Facilities
- Imported Water Municipals Treatment Plants
- Additional Conveyance Facilities
- Groundwater Banking Facilities

3.3 Other Planning Documents

Many other documents related to this effort and the previous efforts are available. A list of these references is found in Appendix A. The documents include City and County General Plans, Regional Water Plans, permits, reports on wastewater and groundwater facilities, and water management plans.

Section 4: Overview of Physical Conditions/Issues by Sub-Basin

4.1 Introduction

As discussed in previous reports, prior to the introduction of imported surface water, the groundwater basin was in overdraft. Since the first deliveries of imported surface water in 1987, most areas of the basin have become full and many subbasins experience localized areas of high groundwater. It is estimated that the basin filled in as little as 4 – 5 years. It has been estimated that the groundwater storage in the basin is approximately 500,000 AF within the first 200' of the ground surface. The approximate average annual safe groundwater yield for the basin is approximately 54,000 AF. (J. Gregg, personal communication)

Zone 6 of the County, which are the areas that currently receive imported San Felipe water from Central Valley Project is divided into seven groundwater sub-basins: San Juan, Hollister West, Hollister East, Bolsa, Pacheco, Bolsa-Southeast and Tres Pinos. The overview of all groundwater sub-basins is shown on Figure 4-1. The physical characteristics have been detailed in many previous reports and recent sub-basin water balance and water quality issues are summarized here.

4.2 San Juan

One of the characteristics of the San Juan sub-basin is high groundwater level. As imported CVP water was introduced and used in this subbasin, there was continued percolation from applied water and insufficient pumping of the groundwater to keep groundwater levels well below the surface. The other factor that influences groundwater level is the soil structure in the sub-basin. Clay layers, existing at 3-12' below the ground surface, result in poor soil drainage. As a result there is perched high groundwater that can saturate the root zone.

The groundwater storage analysis (Water Year 2001 Annual Groundwater Report) for the San Juan sub-basin for water year 2001 is consistent with that of a wet year (J. Gregg, personal communication). According to Water Year 2001 Annual Groundwater Report, the San Juan sub-basin shows stable groundwater storage levels in the recent past indicating that the sub-basin overall is neither gaining nor losing water on an annual basis. A review of the water balance indicates that land uses overlying the the San Juan subbasin are predominantly agricultural, with water supplies being provided by both groundwater and imported surface water depending on the location.

The groundwater quality in the San Juan sub-basin typically has average total dissolved solids of 1,200 parts per million, among the highest within the San Benito County groundwater basin.

4.3 Hollister West

A review of ground water levels in the Hollister West sub-basin, indicates that there are localized high groundwater levels in the area of the San Benito River. There has been less surface water percolation in the last 2 years in order to manage the high water levels. The

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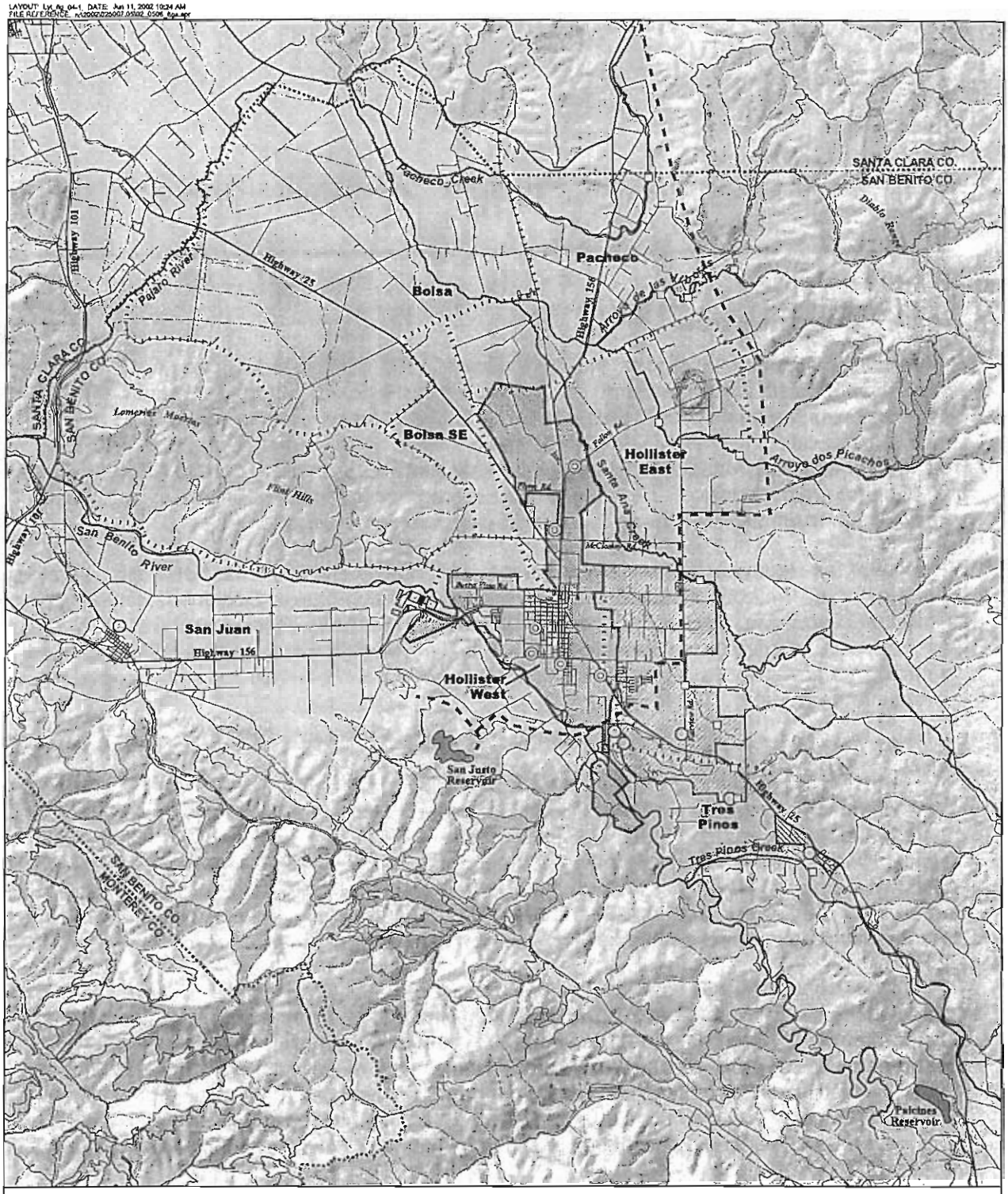

LEGEND

- San Benito River Percolation Sites (1971)
- Wastewater Percolation Sites
  Source: Hollister Area Urban Water Management Plan, 2000
- Hollister Municipal Wells
  Source: Hollister Master Plan
- City of Hollister Water Service
- Sunnyslope County Water District
- Tres Pinos County Water District
  Source: Groundwater management Plan for San ento County, April 1999, Figure 9
- Hollister Conduit San Felipe Water System
  Source: Hollister Water Management Master Plan & Groundwater Management Plan, April 1998
- Discharge Point and Wetted Reach for Percolation of San Felipe Water
  Source: Annual Groundwater Report, 1998-99

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Kennedy / Jenks Consultants

Water Resources Association of San Benito County

SUB-BASIN BOUNDARIES

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June, 2002

Basemap reference: EDAW/TODD Engineers, 2001

Figure 4-1

water balance for the Hollister West sub-basin indicates a 1,300 AF overdraft in Water Year 2001 even though 2001 was considered a wet year. There appears to be a general decreasing trend in Inspection of the groundwater hydrograph over the last two years seems to confirm a gradual decline in groundwater levels. Land uses overlying the Hollister West sub-basin are predominantly municipal and industrial.

The construction of the 2 MGD Lessalt I surface water treatment plant for some of the M&I uses in the City of Hollister and Sunnyslope County Water District will result in about a 2,200 AF/yr reduction in groundwater demand and a net increase in wastewater percolation which should moderate the overdraft previously experienced..

From a water quality perspective, the groundwater in the Hollister West sub-basin has an average TDS of 800 parts per million. Another significant water quality issue in the Hollister West sub-basin is the high hardness of the groundwater in excess of 400 ppm. As a result of the high hardness, the users use the brine softening method to reduce the mineral hardness of the groundwater. Brine softeners contribute salt to the wastewater stream during the regeneration of the ion exchange membranes (see Section 7 for more information on softening/demineralization)

4.4 Hollister East

Analysis of the hydrographs, for the Hollister East sub-basin indicates that the groundwater level is generally increasing over time. Although the amount of imported San Felipe surface water percolation was reduced in 2001 by changing the water system management, there was an increase of groundwater in storage of 3,000 acre-feet. Hollister East is generally considered to be a "full" sub-basin. This sub-basin is an area with high agricultural water use in the rural areas and a high municipal and industrial usage in the urban areas. The average amount of total dissolved solids for the Hollister East sub-basin groundwater is the same as the Hollister West sub-basin groundwater. Similar to Hollister West, the groundwater in this area also has high mineral hardness. High hardness levels in the urban water supply also add to the use of water softeners in Hollister East. In addition to TDS and hardness, boron in the 2 –3 ppm range can be found in the water in Hollister East. For agricultural purposes, boron less than 0.5 ppm is desirable.

4.5 Bolsa

The levels of the groundwater in the Bolsa sub-basin vary through the whole area. Examination of the groundwater level shows areas of high groundwater level to the northeast and an area of low groundwater level to the south. During the year 2001, the water balance showed a net loss (overdraft) of water in storage of 2,000 AF/yr. The Bolsa area is predominantly agricultural and does not receive imported surface water.

The quality of the groundwater in the Bolsa sub-basin indicates that the average Boron concentration is 2-3 parts per million with accompanying issues the same as those in the Hollister East sub-basin. The average value for the total dissolved solids is approximately 800 parts per million.

4.6 Pacheco

In the Pacheco sub-basin, the groundwater levels have been stable for the two years before Water Year 2001. The water balance showed a slight increase of 400 acre-foot per year of groundwater in storage during Water Year 2001. It appears that the Pacheco sub-basin has significant potential for groundwater banking.

Similar as Hollister East area, the percolation of the San Felipe water was reduced by changing the groundwater management. Total dissolved solids for the Pacheco sub-basin are on the order of 600 parts per million, which is lower than the other sub-basins. This groundwater quality is adequate to support the mainly agricultural water usage for Pacheco area.

4.7 Bolsa Southeast

Groundwater storage in the Bolsa Southeast sub-basin increased by 250 acre-feet in 2001. Inspection of the hydrograph of average groundwater levels in this sub-basin indicate that they are rising due to the delivery of imported surface water. Based on groundwater modeling analyses, a groundwater depression that had developed in the Bolsa Southeast that was identified in the 2001 Existing Conditions report appears to be filling in.

4.8 Tres Pinos

In Water Year 2001 in the Tres Pinos subbasin, there was an estimated increase in water in storage of 150 acre-foot per year. The groundwater level analysis of this sub-basin shows that the level of the ground water is slightly elevated compared to the other sub-basins. There are areas of localized high groundwater near the San Benito River in this sub-basin. There may be some opportunities for groundwater banking in this sub-basin.

Section 5: Current and Estimated Future Water Demands and Supplies

5.1 Introduction

In order to estimate the size of future water management facilities, it is necessary to estimate demands and supplies. These demands and supplies are based on information provided in previous reports as well as provided by the San Benito County Water District.

5.2 Demand Projection

Two methods were used to project future demands. The first method used population assumptions from the current Urban Water Management Plan and other water planning documents that reference the AMBAG population estimates. The second method used population estimates based on the Growth Management Ordinances currently in place in the Cities and County.

5.2.1 Municipal and Industrial

5.2.1.1 Estimated 2000 Demands

Information regarding 2000 water demands for City of Hollister, Sunnyslope County Water District, and San Benito County Water District were taken from the 1999 Urban Water Management Plan (UWMP), Table 1-15, Hollister Urban Area – Projected Population and Water Demands With Implementation of Conservation Program. Water demand for 2000 for City of San Juan Bautista is based on the City of San Juan Bautista General Plan, P. III-J.4. All water demands are derived from AMBAG population estimates. Estimated demands for the unincorporated portions of the County were developed based on California Department of Finance 2000 population and household size estimates and an estimated water demand of 450/gallons per day per dwelling unit.

Based on these sources, the total Municipal and Industrial water demands for 2000 is 7,944 AF/year in the urban areas with an additional 2,870 AF/year for the unincorporated County. The total estimated 2000 M&I demand is 10,814 AF/yr.

5.2.1.2 Estimated 2020 Demands – Method 1

For City of Hollister and Sunnyslope County Water District estimated demands for 2020 were calculated as follows:

- Estimated water demand for the existing population was based on the assumption that the water demand from each existing residential dwelling unit decreases by 1% each year for 20 years from 2020 to 2000 due to conservation. The demand is expected to decrease from 450 gallons per day per dwelling unit (gpd/du) in 2000 to 368 gpd/du in 2020 for this sector of the urban service areas.

- Estimated water demand for new population was based on the growth of population from 2000 to 2020. This sector of the population is expected to have a very low water use of approximately 330 gpd/du, incorporating conservation measures upon completion of construction.

For San Benito County Water District and City of San Juan Bautista, the information regarding the 2020 population was not available. Therefore the water demands for 2020 are adopted from the 1999 UWMP, Table 1-15, Hollister Urban Area – Projected Population and Water Demands With Implementation of Conservation Program for San Benito County and from City of San Juan Bautista General Plan, P. III-J.4 for City of San Juan Bautista. The assumption is made that conservation will reduce the water demand by another 10% over that assumed in the planning documents. The resulting urban M&I demand was estimated to be 9,400 AF/yr.

Estimated demands for the unincorporated portions of the County were developed based on California Department of Finance (CDOF) 2000 population and household size estimates and an estimated water demand of 450/gallons per day per dwelling unit. The estimate of 7,000 AF/yr of demand for 2020 was prepared based on a Draft Water needs Study conducted by Kenneth Henneman (2000) for the San Benito County Water District. The 7,000 AF/yr was reduced further by 10% for additional conservation for a net demand of 6,300 AF/yr in the unincorporated county areas.

The estimated total municipal and industrial demand for 2020 is estimated as 15,900 AF/yr and can be found in Table 5-1.

5.2.1.3 Estimated 2020 Demands – Method 2

In order to evaluate the effects of the Growth Management Ordinances in the Cities of Hollister and San Juan Bautista and the unincorporated portions of San Benito County, an alternative method of estimating 2020 demands was used as follows.

- The population estimates from the CDOF for 2000 were used for the urban and unincorporated portions of the county.

- As in Method 1 above, the estimated water demand for the existing population was based on the assumption that the water demand from each existing residential dwelling unit decreases by 1% each year for 20 years from 2020 to 2000 due to conservation. The demand is expected to decrease from 450 gallons per day per dwelling unit (gpd/du) in 2000 to 368 gpd/du in 2020 for this sector of the urban service areas.

- The increases in population in the City of Hollister/Sunnyslope County Water District urban are were based on Ordinance 959 that limits growth to 244 residential units per year. An assumed density of 3.168 person/household was used.

- The increases in population in the City of San Juan Bautista were based on the current Ordinance that limits growth to 3%/year. An assumed density of 3.168 person/household was used.

Table 5-1: Estimated Municipal and Industrial and Agricultural Demands 2000-2020

	Demands 2000, (1) (AF/yr)	Total Estimated 2020 Demands – Modified UWMP Method (2) (AF/yr)	Total Estimated 2020 Demands – Growth Mgmt. Method (3) (AF/yr)
Municipal and Industrial			
City of Hollister	4,125	4,190	3,580
Sunnyslope County Water District	3,040	4,150	2,650
San Benito County Water District	377	520	580
City of San Juan Bautista	403	700	930
Total M&I Urban Areas	7,944	9,560	7,740
Other Unincorporated County	2,870 (3)	6,300	3,300
Total Municipal and Industrial	10,814	15,890	11,040
Agricultural			
Zone 6, Bolsa, Paicines and Tres Pinos Creek Valley	Estimate based on acres under irrigation	Estimate based on all irrigable acres	Estimate based on all irrigable acres
Total	64,961	78,000	78,000
Other Demands	3,000	3,000	3,000
Total Municipal and Industrial and Agricultural	75,905	96,890	92,040

(1): 2000 Estimated Municipal and Industrial demands for City of Hollister, Sunnyslope County Water District and San Benito County Water District are based on 1999 Urban Water Management Plan (UWMP) which were derived from AMBAG population estimates. Demands for City of San Juan Bautista are based on 1998 San Juan Bautista General Plan Update.

(2): 2020 Calculated Municipal and Industrial demands for City of Hollister and Sunnyslope County Water District are based on 1999 UWMP, derived from AMBAG population estimates, and adjusted for existing and future per capita demands as described in the report. 2020 demands for San Benito County Water District and City of San Juan Bautista are based on 1999 UWMP.

(3): 2020 Calculated Municipal and Industrial demands for City of Hollister, Sunnyslope County Water District, City of San Juan Bautista, and unincorporated county are based 2000 California Department of Finance population estimates with growth to 2020 based on Growth Management Ordinances and Policies in place for the Cities and County areas. Further details are in report.

- The increases in population in the unincorporated County areas were based on Ordinance 751 which allows population increases of 1%/year. An assumed density of 3.034 persons/household was used.

- The water demand associated with new growth is assumed to be 330 gpd/du.

A summary of municipal and industrial demands is found in Table 5-1 Estimated Municipal and Industrial and Agricultural Demands 2000-2020.

5.2.2 Agricultural

Estimated total agricultural demand for 2000 is from Annual Groundwater Report WY2001, Table 9,. Total agricultural demand for 2000 is estimated as 65,000 AF/yr. The 2020 estimate was based on the Henneman work (2000), which indicated that the total agricultural demand is 78,000 AF/yr for the irrigable acres in the County. There was an assumed increase from 36,000 irrigable acres in 2000 to 50,000 irrigable acres in 2020. This is based on current irrigable acres and available irrigable acreage not currently irrigated. These demands are based on the assumption that there is 1.8 feet/year of applied water, 0.4 feet of ep and that there is 85% efficiency in irrigation. 85% efficiency in agricultural irrigation is consistent with the Central Valley Project (CVP) guidelines for agricultural efficiencies for its water supply contractors.

5.2.3 Other Demands

All other estimated water demands are taken from Henneman (2000) with adjustments. Other water demands include conveyance losses and other minor uses. For both 2000 and 2020, estimated demand is 3,000 AF/yr.

5.3 Supply Availability

The analysis for the supply availability is done for different type of years: wet year, normal year, dry year, critically dry year. The wet and normal year values are adopted from the Annual Groundwater Report for Water Years 1998 and 2001, Table 9: Estimated Subbasin Groundwater Budgets for Water Year 1998 and 2001. All supply values are shown in Table 5-2: Estimated Supply Availability 2000-2020. An explanation of the supply components is found below.

Natural supplies from rainfall and stream percolation were calculated for separately for the Zone 6 only and the Bolsa, Paicines, Tres Pinos Creek Valley by summing the components of 1) total stream percolation for natural streamflow, 2) San Felipe releases and 3) total deep percolation through the soils for rainfall for each of those areas.

Local Surface Water supply represents stream percolation for Hernandez and Paicines releases and are summed for Zone 6 only and for the combined Bolsa, Paicines, Tres Pinos Creek Valley area.

Table 5-2: Estimated Supply Availability 2000 – 2002 (Acre-feet)

	Wet Year (WY 1998) (1)	Normal Year (WY 2001) (1)	Estimated Dry Year	Estimated Critically Dry Year
Local Supplies				
Zone 6: Natural from rainfall, stream percolation, and San Felipe Releases	36,685	15,444	10,000	7,500
Bolsa, Paicines, Tres Pinos Natural from rainfall and stream percolation	11,536	4,791	4,000	3,500
Local Surface Water (Paicines and Hernandes percolation)	450	6,917	350	200
Deep Percolation of Domestic/Irrigation Water in Zone 6, Bolsa, Paicines and Tres Pinos	9,438	10,403	8,000	3,000
Groundwater Influent Flow	10,000	12,500	7,000	5,000
Reclaimed Water	3,557	3,338	3,000	3,000
Assumed Imported Surface Water Availability				
Imported M&I	8,250	6,200	2,600	2,100
Imported Ag	26,663	22,600	3,500	
Total Imported Surface Water	34,913	28,800	6,100	2,100
Total Average Annual Supply Estimate	106,579	82,193	38,450	24,300
Assumed additions to groundwater bank for 10-year simulation	10,000	8,000	0	0

(1) Estimates are based on Table 9 – Groundwater Balances from Annual Groundwater Reports for Water Year 1998 and Water Year 2001

Deep percolation of Domestic/Irrigation Water represents deep percolation through soils for irrigation water for Zone 6 only and for the combined Bolsa, Paicines, Tres Pinos Creek Valley area.

The groundwater inflow value is extracted from the Table 9 from the Annual Groundwater Report. This value represents the total groundwater inflow for Zone 6 only and for the combined Bolsa, Paicines, Tres Pinos Creek Valley area.

Reclaimed water supply is estimated from the reclaimed water estimate in Table 9 from the Annual Groundwater Report. Where reclaimed water estimates were not available a base-line estimate of 3,000 AF/yr was used. It should be noted that reclaimed water supply is a function of population and additional reclaimed water supplies will be available in the future.

Both Municipal and Industrial and Agricultural Imported water supply estimates are based on recent evaluations of U.S. Bureau of Reclamation Central Valley Project Contract Entitlements as compared to actual deliveries as shown in Table 5-2.

5.3.1 Wet Year

Supply values for the wet year are taken from the 1998 Annual Groundwater Report for Water Year 1998. The assumption that water year 1998 was a wet year was provided by San Benito County Water District.

5.3.2 Normal Year

Supply values for the wet year are taken from the 2001 Annual Groundwater Report for Water Year 2001. The assumption that water year 2001 was a normal year was provided by San Benito County Water District.

5.3.3 Dry Year and Critically Dry Year

Since there were no reliable water balances using the methods used in water year 1998 and water year 2001 to estimate what dry year and critically dry year supplies might be, it was assumed that they would be considerably less than normal years and were adjusted accordingly.

5.4 10-year Simulation of Groundwater Basin Operation

Using the demand under Growth Management assumptions and supply data assembled above, an illustrative 10-year simulation of groundwater basin operation was prepared. By showing the range of supply sources available and the demands, a three-year dry period can be bridged by using groundwater/surface water banking operations. A ten-year period was selected because it is likely that in a ten-year period, there will be normal, wet, dry, and critically dry years. For the purposes of the simulation, there were 4 normal years, 3 wet years and 3 dry years within the 10 year period.

For the purposes of this simulation the period from 2005 to 2015 was selected to estimate demands. Municipal, Industrial, Agricultural and Other demands are calculated for simulation period based on estimated demand for 2000 and calculated demand for 2020/ 2025 from above. Total demands for dry and critically dry years were decreased by 10%on the assumption that some additional conservation can be achieved in a drought.

For total imported surface water supplies values used in the simulation for different type years (critically dry, dry, normal, wet) are shown in table 5-2 Estimated Supply Availability 2000-2020.

For local supply values, it was assumed that the maximum value for the local supply is 54,000 AF/yr which is equivalent to the groundwater yield in the basin. The amount of local supply used to be able to meet the demand depended on the amount of imported surface water available. When demands cannot be meet by imported surface water, then varying amounts of local supply were used.

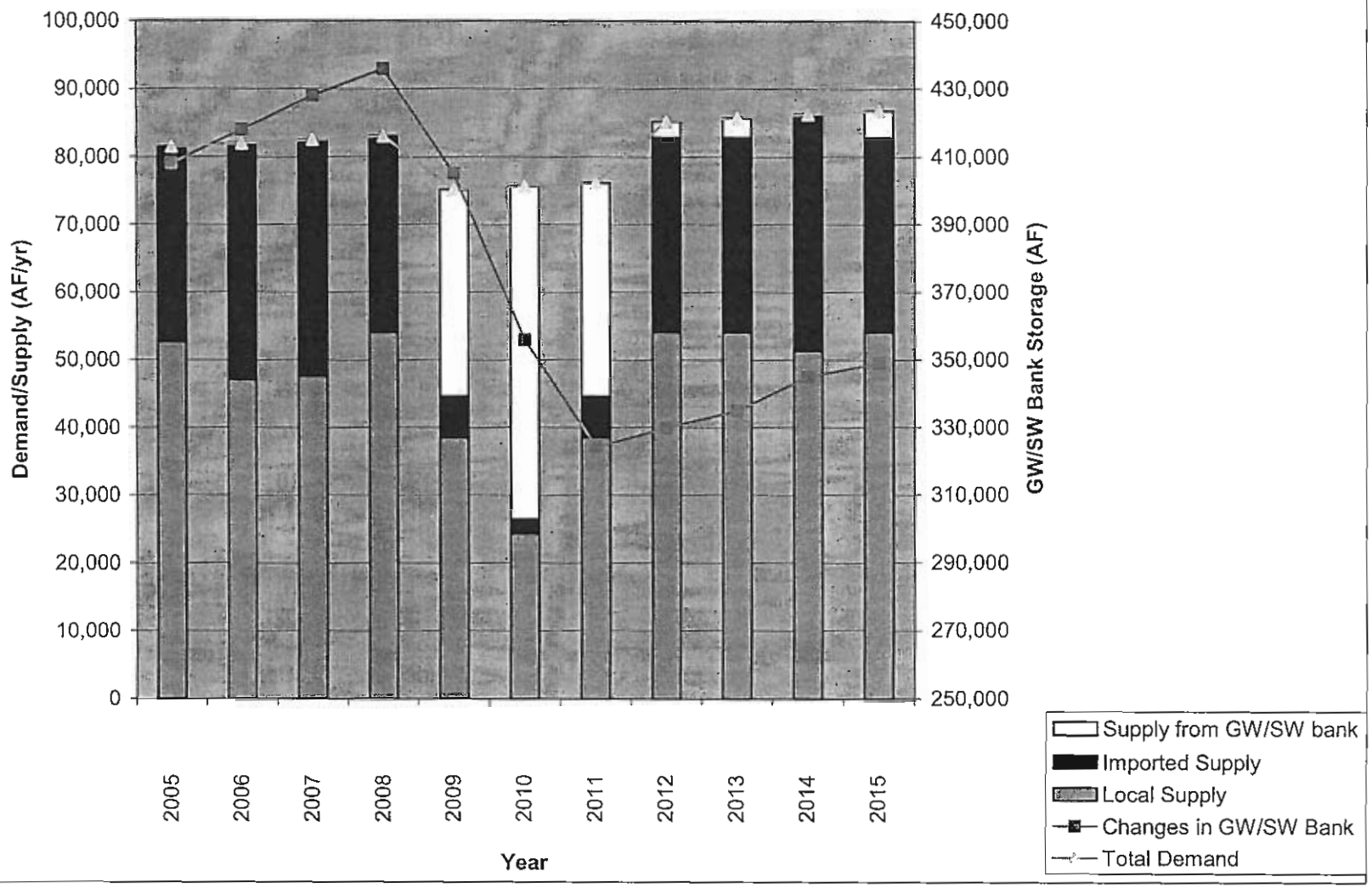
When the entire 54,000 AF/yr of local supply plus imported supply were not sufficient to meet demands, then supplies were "withdrawn" from the groundwater and surface water bank.

Calculations for the groundwater/surface water bank were based on the initial assumption that the beginning storage is 400,000 AF/yr. For a normal year, it was assumed that contributions to the bank of 8,000 AF/yr could be made and for wet years, the contribution to the bank of 10,000 AF/yr could be made. For both dry and critically dry years, there were no contributions to the bank. The net storage in the bank was calculated based on the beginning storage (400,000 AF/yr). These estimates for bank operations are purely illustrative and not based on hydrologic data. They may in fact underestimate the quantity of water going into the bank when compared to real values.

Values for total demand, imported supply, local supply, supply from ground water and surface water bank and changes in groundwater and surface water bank are show on Figure 5-1.

The 10-year simulation illustrates how a bank will contribute to the reliability of a water supply system. Whether the bank occurs in a surface water reservoir, a local groundwater bank, or a regional groundwater bank, the concepts remain the same: when the supplies are low, then the bank can be used to make up the demands. However, as can be seen in years 2012 through 2015, it appears that banked water is being used to meet "normal" and "wet year" demands. The critical element of the bank is that contributions need to be made to the bank when the water is available, otherwise, when too many withdrawals are made, an overdraft condition results.

Figure 5-1: Simulated 2005-2015 Demand and Supply



Section 6: Objectives and Criteria for Evaluation of Alternatives for Groundwater Management Plan Implementation

The objectives and criteria were initially developed in the 2001 Existing Conditions Report. In this current report, these objectives and criteria have been expanded for performing a qualitative evaluation of alternatives. The objectives and criteria are still considered to be in draft form. As further evaluation and analysis occurs, it is anticipated that the objectives may be further refined.

6.1 Water Quantity Objectives And Criteria

Water Quantity Objective 1: Maintain a reliable water supply for present and future users
The first General Criterion from the 2001 Existing Conditions Report stated: Maximize ability to respond to changing social and physical conditions in the basin. From this statement, the following specific criteria were developed:

Water Quantity Specific Criterion #1-1: Deliver 100% of Agricultural and Municipal/Industrial Supply in normal and dry years, and the initial critical year in a drought

Water Quantity Specific Criterion #1-2: Deliver at least 85% of Municipal/Industrial Supply and 75% of agricultural supply in the second and subsequent critical years in a drought
Water Quantity Objective 2: Integrate management of groundwater, surface water, and imported water
The following specific criteria were developed from the objective.
Water Quantity Specific Criterion #2-1: Maximize efficient use of water supply. For existing M&I uses, it is assumed that there will be a 1%/yr reduction in water demand per existing residential dwelling unit over the next twenty years. Conservation would result in a reduction from an estimated 450 gallons per day (gpd) per dwelling unit (du) to 368 gpd/du. New development would assume a demand of 330 gpd/du. Based on CVP guidelines, agricultural irrigation is assumed to be at 85% efficiency.

Water Quantity Specific Criterion #2-2: Manage groundwater levels to protect overlying uses from impacts from high water levels and prevent drawdown below prior historic low levels.

Water Quantity Specific Criterion #2-3: Optimize use of groundwater storage

6.2 Water Quality Objectives And Criteria

Some of the water quality criteria were combined from those presented in draft form during the 5/28/02 workshop to simplify them for the alternatives evaluation. The revised criteria are found below. In considering water quality of basin outflow, it is a given that basin outflow meet Regional Water Quality Control Basin Plan water quality objectives. Therefore, it has removed as a specific water quality criterion.

6.2.1 Water Quality Objective: Provide water quality adequate for end-users

- Water Quality Specific Criterion #1-1: Manage water resources to minimize imported salts and groundwater salinity for beneficial uses

- Water Quality Specific Criterion #1-2: Protect groundwater resources from contamination with emphasis on nitrates and salts.

- Water Quality Specific Criterion #1-3 Deliver M&I water meeting primary and secondary water quality objectives with emphasis on achieving TDS and hardness objectives

- Water Quality Specific Criterion#1-4: Deliver agricultural water meeting established quality parameters.

6.3 OTHER CRITERIA

Other criteria were developed to assist in evaluating tools, formulating alternatives, and evaluating alternatives. The criteria are presented in more brief form in Table 9-1 through 9-5 later in this report.

6.3.1 Regional Criteria

The elements of an alternative should be consistent with regional water supply management objectives

6.3.2 Environmental Criteria

The environmental impacts of each element of an alternative should be mitigable to acceptable levels. The alternatives and should enhance the local environment and contribute to the long-term sustainability of agricultural and urban productivity of the basin.

6.3.3 Institutional/Jurisdictional Criteria

Each element of an alternative should be permittable and implementable, and shall be consistent with local and regional institutional constraints.

6.3.4 Cost Effectiveness/Affordability Criteria:

- Each alternative should be affordable and financially feasible for the urban and agricultural interest to implement over a predictable time period consistent with plan objectives. One measure of affordability will be the impact on water costs to urban and agricultural users over current and future baseline estimates.

- Each alternative should maximize use of existing facilities.

Section 7: Toolbox of Project Elements

7.1 Summary of Project Toolbox Elements

The project toolbox elements comprise projects and water management techniques that can be used to manage groundwater resources in San Benito County. This summary of project toolbox elements is intended to encompass the kinds of projects that can be used to implement the philosophies associated with the various alternatives. It is intended that the list may change over time as additional alternatives may be considered. The toolbox elements are described in greater detail below as applicable.

- **Municipal and Industrial Water Conservation** – Develop and implement a conservation program focused on municipal and industrial users.
- **Agricultural Water Conservation** – Develop and implement a conservation program focused on agricultural users. The conservation goal would be to achieve 85% irrigation efficiency consistent with CVP water supply contract expectations.
- **Salinity Education Program** - Develop and implement a salinity education program focused on agricultural users to reduce salt additions to the local groundwater basin.
- **Water Softener Ordinance** – Create an ordinance to require any new home water softeners to be the type that are regenerated offsite so salts are not introduced into the sewer system or septic systems; consider a retrofit ordinance applicable to resale homes, and a grant program to assist existing homeowners achieve the conversion at lower cost.
- **Maintain Existing Groundwater Extraction Facilities**- Maintain current groundwater extraction up to the estimated safe yield of 54,000 Af/yr for the groundwater basin.
- **Maintain Surface Water Importation** – Maintain current surface water importation up to the contract allocation in accordance with CVP delivery capabilities.
- **Local Surface Water Storage**– Develop on-stream or off-stream reservoirs to capture and utilize more local precipitation.
- **Local Groundwater Extraction Facilities**– Develop additional groundwater wells to provide relatively high quality groundwater for agriculture and/or municipal use and manage groundwater levels.
- **Local Conveyance Facilities** – construct new pipelines and other water distribution facilities to better distribute available local and imported supplies within the basin.
- **Additional Imported Surface Water** – Contract for additional imported water through water transfers or other means. Contracted water can be wheeled through the CVP project facilities.
- **Second Conduit to Pacheco Dam and Tunnel and Other Pipelines** – Construct a new pipeline and other pipeline facilities to distribute water to other use areas.
- **Imported Surface Water Storage Reservoirs** – Construct local reservoirs to store imported water.
- **Imported Surface Water Percolation** – Percolate imported surface water in high permeability river/drainage channels

- **Groundwater Banking** – Store percolated imported surface water and/or local wet weather high flows in the groundwater basin through aquifer storage and recovery (ASR) or recharge basins/flooded fields for in-basin use during periods of CVP water cutbacks.
- **Surface Water Treatment** – Construct surface water treatment plant(s) to supply low TDS, low hardness, high quality water for municipal and industrial use.
- **Groundwater Treatment** – Treat groundwater to reduce hardness, salts, and other constituents to supply low TDS, high quality water for municipal and industrial use. Dispose of salts through an acceptable mechanism that precludes redirected impacts.
- **Groundwater/Surface Water Blending** – Blend local higher TDS groundwater with imported lower TDS surface water to provide water that meets the water quality criteria for agriculture and/or municipal and industrial use.
- **Reclaimed M&I Effluent for Reuse** – Treat effluent from wastewater plants for reuse for irrigation and other beneficial uses within the basin.
- **Reclaimed M&I Effluent for Export** – Treat and export effluent from wastewater plants from the basin.
- **Desalt Reclaimed M&I Effluent for Reuse** – Reduce salts in reclaimed M&I effluent in order to increase the potential uses for the effluent and to remove salts.
- **M&I Effluent Percolation** – Percolate M&I effluent in existing or new/additional percolation ponds
- **Agricultural Effluent for Export (Tile Drains)** – Install additional tile drains to remedy localized high water levels due to poor soil drainage.
- **Tree Belt Evapotranspiration** – Plant belts of high water using trees or other vegetation to remedy localized high water levels.
- **Groundwater Pumping for Export** – Install wells and pump groundwater for discharge into the San Benito or Pajaro Rivers to lower groundwater levels.
- **Deepen Drainage** – Mine sand and gravel out of the lower reaches of the San Benito River to permit high groundwater levels to discharge to the river. Widen the Miller Canal to permit more flow to the Pajaro River
- **Water Transfers** – Pursue water transfers to balance supply and demand in varying hydrologic conditions, to implement an alternative involving 100% surface water supplies, and to generate revenue from contracted San Felipe CVP supplies to help implement an all-local-water supply alternative.

7.2 Types of Projects for Selected Project Toolbox Elements

7.2.1 Elements Applicable to All Alternatives

7.2.1.1 Municipal and Industrial Water Conservation

Municipal and Industrial (M&I) Water Conservation is a common element to all alternatives. The WRA members have joined together to implement M & I Water Conservation by hiring an individual who is a shared resource to the WRA members. For existing M&I uses, it is assumed that there will be a 1%/yr reduction in water demand from existing residential units over the next twenty years. Conservation would result in a reduction from an estimated 450 gallons per day (gpd) per dwelling unit (du) to 368 gpd/du. For new developments, current ordinances in the

City and County that restrict water use to approximately 330 gpd/du by using xeriscape landscaping and other water conservation measures.

7.2.1.2 Agricultural Water Conservation

Agricultural water conservation is a common element to all alternatives. The conservation goal would be to achieve 85% irrigation efficiency consistent with CVP water supply contract expectations. Agencies such as the Resource Conservation District and the San Benito County Farm Bureau assist agricultural water users with improving efficiency. Based on CVP guidelines, agricultural irrigation is assumed to eventually reach 85% efficiency. It is expected that efficiency improvements will be achieved primarily by reducing evaporative losses during irrigation. (J. Gregg, Personal Communication)

7.2.1.3 Salinity Education Program

Salinity Education is a common element to all alternatives. Ongoing programs by agencies such as the Resource Conservation District and the San Benito County Farm Bureau assist agricultural water users with managing salt additions from fertilizers and other products to reduce salt additions to the local groundwater basin.

7.2.1.4 Water Softener Ordinance

Implementation of a water softener ordinance is a common element to all alternatives. The urban water purveyors have implemented an ordinance that requires any new home water softeners to be the type that are regenerated offsite so salts are not introduced into the sewer system. In addition, public education is on-going regarding the need to only regenerate softeners when required. An additional element of this tool is consideration of a retrofit ordinance applicable to resale homes, and a grant program to assist existing homeowners achieve the conversion at lower cost.

7.2.2 Existing Toolbox Elements

7.2.2.1 Maintain Existing Groundwater Extraction Facilities

There are currently approximately 1, 000 wells that serve both community water systems in San Juan Bautista and Hollister as well as agricultural and rural home users. Groundwater is considered to be the predominant supply in the basin and these facilities are available for use.

7.2.2.2 Maintain Surface Water Importation

Existing CVP surface water contracts allow up to 43,800 AF/yr of contract entitlement to the SBCWD. However, the levels for M&I supplies are often reduced to 75% of entitlement, and agricultural supplies are often reduced to less that 60%. The long-term average is closer to 29,000 AF for both M&I and agriculture. It is assumed that most alternatives will require some surface water importation to meet demands and achieve water quality requirements.

7.2.3 Potential New Toolbox Elements

7.2.3.1 Local Surface Water Storage

There are limited opportunities for additional local surface water storage in the basin. One location that had been studied by the U.S. Bureau of Reclamation (USBR) in 1954 is a reservoir

on Pacheco Creek. Estimates at that time indicate that the 61,000 AF reservoir could provide a yield of approximately 6,600 AF/yr as well as flood storage. USBR estimated the cost of construction to be $8.6 million in 1951. Escalated to present day costs, the construction cost is estimated to be $100 million.

The San Benito River watershed does not lend itself to additional surface water storage because there are limited flows available that are not already captured as percolation or in Hernandez or Paicines reservoirs (J. Gregg, personal communication). The water available for capture is peak wet weather flows which are intermittent and not highly reliable.

7.2.3.2 Local Groundwater Extraction Facilities

Additional groundwater wells in selected sub-basins are considered to be an important element of groundwater management in the basin. When used in conjunction with groundwater banking and local conveyance facilities, local groundwater wells can pump stored water to areas where it is needed.

7.2.3.3 Local Conveyance Facilities

As mentioned above, local conveyance facilities can be used to move local surface water, pumped groundwater, and other water throughout the basin. At present, it is assumed that the backbone local conveyance would include an approximately 13.8 mile 24-inch pipeline parallel to the existing Hollister Conduit from the Pacheco Sub-basin to the eastern edge of the San Juan Sub-basin. Pump stations will most likely also be required but have not been sized at this time.

7.2.3.4 Additional Imported Surface Water

One of the alternatives increases the County's reliance on imported surface water. This toolbox element is to contract for additional imported water through water transfers or other means. It is assumed that contracted water can be wheeled through the CVP project facilities and through the existing Hollister Conduit system. Additional imported surface water may require additional conveyance as described below.

7.2.3.5 Second Conduit to Pacheco Dam and Tunnel and Other Pipelines

Depending on the quantities of additional imported surface water that may be acquired, a second conduit parallel to the existing Hollister Conduit to Pacheco Dam and Tunnel may be required. Other pipeline facilities to deliver water to other areas not currently served may be required.

7.2.3.6 Imported Surface Water Storage Reservoirs

In order to increase the reliability of imported surface water, additional local reservoirs to store imported water may be required. Reservoir location evaluations have occurred on a limited number of locations (see Local Surface Water Storage above). A proposed Pacheco Creek reservoir of 61,000 AF of storage may be the best studied location. However, this reservoir capacity can not store one years worth of 2020 M&I and agricultural demand of 88,740 AF. Other storage facilities would be required to increase the reliability of the using imported surface water.

7.2.3.7 Imported Surface Water Percolation

If sufficient groundwater storage space is available, imported surface water could be percolated in high permeability river/drainage channels to be stored in the groundwater basin. This method of storage is closely linked to the groundwater banking concept described below. Use of surface water percolation would require close management of the groundwater basins.

7.2.3.8 Groundwater Banking

Groundwater banking is an important component of managing the groundwater resources in the basin. As described above, imported surface water and/or local wet weather high flows in the groundwater basin could be stored in the groundwater basin through percolation, aquifer storage and recovery (ASR) wells, or recharge basins/flooded fields for in-basin use. Use of percolated water in river channels or recharge basins would require extraction wells while ASR would provide injection and extraction in a single facility. Groundwater banking will also require local conveyance and extraction facilities.

7.2.3.9 Surface Water Treatment

Surface water must be treated by filtration and disinfection processes to remove particles and pathogens in the water and to meet Federal and State drinking water requirements. Filtration alternatives for surface water treatment include conventional granular media filtration and microfiltration (MF) or ultrafiltration (UF) membrane filtration processes. Disinfection alternatives include the use of chlorine, ozone, or ultraviolet light (UV) to inactivate pathogens.

The recommended surface water treatment process for the San Luis Reservoir water is MF or UF membrane filtration with chlorine or UV disinfection. This cost-effective process provides a higher quality water, uses fewer chemicals, is easier to operate and provides greater flexibility in meeting future water quality regulations than does the conventional treatment process.

Currently, the 2 MGD Lessalt I membrane filtration plant is under construction for the City of Hollister to deliver treated imported surface water to portions of the City's customers. The City of San Juan Bautista has completed its CEQA document for a 1 MGD membrane filtration plant.

7.2.3.10 Groundwater Treatment

Local groundwater contains sufficient hardness and TDS that many local residents use individual water softeners that contribute salt to the basin. In order to reduce the salt loads to the basin, more centralized treatment of groundwater could be provided to reduce hardness, salts, and other constituents to supply low TDS, high quality water for municipal and industrial use. Softening and demineralization are common methods to reduce TDS and/or hardness but both require disposal of salts that must also be consistent with the objectives and criteria described above. The various methods of groundwater treatment and brine disposal are summarized below.

7.2.3.10.1 Softening

Softening is used to reduce the amount of calcium and magnesium in water. The more calcium and magnesium cations dissolved in the water the "harder" the water. Softening typically reduces the hardness of water but does not necessarily reduce the TDS of the water.

Hard water is a concern because it leaves a scale on surfaces and causes fouling of pipes. Calcium carbonate precipitates readily at high temperatures and pH values. If water is heated such as in water heaters and hot-water pipes, the units may become fouled from calcium carbonate precipitation.

Treatment processes effective in removing hardness include:

- Ion Exchange
- Chemical Softening (with Pellet Softening being a subset)

Ion Exchange

Ion exchange refers to using a medium such as plastic beads with "exchange sites." These sites preferentially remove hardness ions and replace them with sodium, a "soft" ion when water passes through the media. Ion exchange process replaces hardness ions in the water with sodium ions. The hardness of the water is reduced considerably but the overall TDS of the water is not reduced. *(is it at all? Thought it increased tds overall)* The softened water may still have a high TDS.

The systems typically include a brine tank to provide a source of sodium to regenerate the ion exchange bed and flush out the hardness ions. If the treatment facility is centralized, then the brine that is generated is disposed through methods of brine disposal described below. Individual home treatment units usually discharge brine to sanitary sewers that eventually reaches the wastewater treatment and disposal facility.

Chemical Softening (Pellet Softening)

The chemical softening process raises the pH of the water to precipitate out calcium and magnesium in the form of calcium carbonate and magnesium hydroxide. Caustic soda and lime are typically used to raise the pH and add alkalinity if needed. The hardness of the water is reduced considerably but sodium is added to the water in the process and the overall TDS of the water will not be reduced as much. The softened water may still have a high TDS.

In the pellet softening process, a pellet reactor uses upward water flow to keep granular material in a fluidized bed. Prior to upward flow, caustic soda is added to the water to raise the pH to precipitate out calcium carbonate. The granular material, typically sand, collects calcium carbonate deposits. The softened water is obtained at the upper part of the reactor and is diverted to a filtration system. In chemical softening, a filtration system is necessary to prevent calcium carbonate precipitates from entering the distribution system.

The hardness precipitates onto the sand pellets in the reactor. Periodically, the coated pellets are removed and disposed of in a landfill. New pellets are loaded into the reactors to collect more hardness. There is no brine disposal but there are costs associated with replacing and disposing of the spent pellet media.

7.2.3.10.2 Desalting

Membrane technologies are often used to desalt water and decrease the amount of hardness and "Total Dissolved Solids" (TDS). TDS refers to the total amount of mineral and salt ions, including hardness ions, dissolved in water. Processes that remove TDS will also remove hardness.

Processes that are effective in decreasing TDS and hardness include:
- Nanofiltration (NF)
- Reverse Osmosis (RO)

Both nanofiltration and reverse osmosis are pressure-driven membrane technologies. In both processes, water passes through membranes which act a selective barriers to salts. The membrane produces a high quality, low TDS, low hardness product water and a concentrated brine stream. For the Hollister groundwater the membranes could operate at 80 to 85 percent recovery (product water divided by total feed water).

Nanofiltration removes divalent ions, such as calcium and magnesium (hardness ions) while it allows a majority of monovalent ions such as sodium and chloride to pass. This process is very effective in targeting the removal of hard ions and calcium salts. Nanofiltration membranes can typically remove more than 99% of the hardness and about 90% of feed water's TDS.

In contrast, reverse osmosis removes monovalent salts and multivalent ions (calcium and magnesium). Reverse osmosis is capable of TDS and hardness rejection rates exceeding 99 percent.

Because the RO and NF product water is so low in TDS and hardness, it is common to blend the product water with groundwater in order to achieve desired level of hardness and TDS at the minimum cost. With both RO and NF membrane technologies, the brine that is generated must be disposed through methods of brine disposal described below.

7.2.3.10.3 Brine Disposal

The ion exchange, nanofiltration, and reverse osmosis treatment processes produce a liquid brine concentrate. Methods to dispose of brine include:

- Fueled evaporation – evaporating brine via fuel energy to concentrate the salt and minerals (Crystallizers are used to reduce the concentrate to dry solids that can be disposed or reused.)

- Land evaporation – using shallow, evaporation ponds to evaporate water and retain salt for disposal or reuse

- Deep well injection – injecting brine into deep confined aquifers.

- Brine pipelines – piping the brine to an ocean outfall.

- Dilution of the brine and discharge to a suitable water body, such as a river with a naturally high TDS level.

7.2.3.11 Groundwater/Surface Water Blending

One way to achieve an overall water quality suitable for agriculture and/or municipal and industrial use is to blend imported lower TDS surface water with higher TDS groundwater to lower the TDS of the applied water.. This type of project may be most practical for agricultural uses where there are both groundwater supplies and surface water supplies readily available. The practice could benefit those users that are using higher TDS groundwater, reduce the overall salt returned to the groundwater and be used as part of a water level management measure by pumping groundwater where levels are higher than desired.

7.2.3.12 Reclaimed M&I Effluent for Reuse

Reuse of reclaimed effluent from wastewater plants for is practiced widely within California as a highly reliable water supply. Title 22 reclamation criteria govern the level of treatment and largely determine the acceptable uses for reclaimed water. There are several sources of reclaimed M&I effluent in the basin that currently percolate effluent that could be considered a part of the overall future water supply portfolio. If a Title 22 Disinfected Secondary,2.2 Reclaimed water is produced, the reclaimed M&I effluent in the basin can be reused for landscape irrigation and for certain types of agricultural irrigation. Reuse also offers alternatives for disposal of effluent.

7.2.3.13 Reclaimed M&I Effluent for Export

Some of the alternatives have philosophies that may require reclaimed M&I effluent to be exported either to manage water levels and/or to remove salts from the basin. Effluent export could be accomplished, consistent with the Regional Board's Basin Plan objectives, through discharge through natural waterways using a National Pollutant Discharge Elimination System (NPDES) permit, or through a constructed conveyance. If a brine line for groundwater treatment brine is constructed, it may be prudent to increase the capacity of the brine line in order to provide for the option of effluent export in the future.

7.2.3.14 Desalt Reclaimed M&I Effluent for Reuse

Additional treatment of reclaimed M&I effluent may be required depending on the level of potential public contact to meet Title 22 requirements. Desalting membrane processes such as microfiltration, ultrafiltration, nanofiltration and reverse osmosis meet the definition of filtration for wastewater under Title 22. The result is a highly treated effluent for unrestricted use of reclaimed effluent on parks, golf courses, food crops, etc. Non-membrane filtration at a wastewater treatment plant can also be achieved through a bed of filter media to meet the same Title 22 requirements. However, non-membrane processes will not remove TDS or hardness. Desalting of effluent will result in a brine stream that needs to be disposed of. If an alternative requires both groundwater desalting and desalting of reclaimed effluent, a single brine line could be used.

7.2.3.15 M&I Effluent Percolation

This toolbox element involves disposing of M&I effluent through percolation ponds as currently occurs. Reduced percolation capacity may require redeveloping the existing percolation ponds or moving them to other locations with higher capacity.

7.2.3.16 Agricultural Effluent for Export (Tile Drains)

This toolbox element may be required if there are localized high water levels in agricultural fields. Shallow clay layers results in localized perched high groundwater in some areas. Tile drains are perforated pipes that are installed above the shallow clay layer. Shallow groundwater flows into the perforated pipe which ultimately drains to surface drains.

7.2.3.17 Tree Belt Evapotranspiration

This toolbox element could be used to reduce localized high water levels in agricultural fields. Experimental research has occurred in Australia that indicates high water use trees such as eucalyptus trees can use up to 24" of water per year and generally lower local water levels. No work has been to translate the water consumption to acre-foot per plant basis. Other high water consuming vegetation may serve the same purpose.

7.2.3.18 Groundwater Pumping for Export

This toolbox element could help manage groundwater levels and salt balances in some sub-basins. Wells would be installed and the groundwater pumped for discharge into the San Benito or Pajaro Rivers to lower groundwater levels over a larger area.

7.2.3.19 Deepen Drainage

Another means of facilitating groundwater discharge to the surface waters to reduce water levels is to lower the elevation of the river channel by mining sand and gravel. This toolbox element is most applicable in the lower reaches of the San Benito River or in the Miller Canal in the Bolsa sub-basin to permit more groundwater inflow to the Pajaro River.

7.2.3.20 Water Transfers

Water transfers are an important toolbox element that could result in additional imported surface water if the local users purchase/transfer water and bring it into the basin. If water management frees up some of the San Felipe imported water, then water transfers from the basin to outside users could generate revenue from contracted San Felipe CVP supplies to help implement an all-local-water supply alternative or balance water supplies in wet years.

Section 8: Alternatives Development

The different alternatives that were developed reflect different philosophies to groundwater management. These different philosophies guide the selection of toolbox elements to accomplish the water supply objectives. The four philosophies currently under consideration are:

- Alternative #1 = 100% Local Supply
- Alternative #2 = 100% Imported Supply
- Alternative #3 = Minimize Groundwater Quality Impacts
- Alternative #4 = Cost-Effective Mix of Local and Imported Supply

The development and evaluation of these alternatives does not preclude the development of other alternatives during the Programmatic Environmental Impact Report preparation process. As described earlier, the 2001 Existing Conditions report developed Alternatives 1 and 2 which frame the ends of the spectrum of 100% local supply and 100% imported supply. Alternatives 3 and 4 represent approaches to mixing local and imported supply.

8.1 Alternative #1 – 100% Local Supply:

8.1.1 Philosophy/Objectives

The philosophy of this alternative is to, over time, eliminate the basin's dependence on imported water and the associated variations in availability. To achieve this objective, it is necessary to develop and manage additional local supplies and improve efficiencies. In order to meet the water quality objectives, reduction of the amount of salt being added to the basin occurs through use of local supplies and active salinity education of agricultural users and reduction of salt loads from municipal users.

The end result of this alternative is a groundwater basin that is being managed to maximize its use in supporting local demands and a quality of delivered water that is sufficient for beneficial uses.

The major concern with this alternative is that even with aggressive conservation and careful groundwater management, unless significant local resources are developed (2001 Existing Conditions), the groundwater basin will result in constant overdraft as occurred before the introduction of imported surface water.

8.1.2 Major Toolbox Elements

The major toolbox elements that are associated with Alternative #1 – 100% Local Supply are:

<u>M&I and Agricultural Conservation</u>
All of the alternatives rely on an aggressive water conservation program; however, conservation is a particularly critical element of this alternative because of its reliance on a limited local supply.

Salinity Education Program
Because of the high reliance on local supply, particularly from groundwater, salinity education for agricultural users is also an important element in order to protect the water quality of the groundwater. Additions of salt from agricultural uses will threaten groundwater quality regardless of source.

Water Softener Ordinance
Reduction of salts from municipal and industrial users is especially important in this alternative since the salts from brine regenerating softeners result in increased salts wastewater effluent that will be used for irrigation reuse. In addition, providing a lower hardness water will reduce overall softener use.

Additional Local Groundwater Extraction and Surface Water Storage
This toolbox element is the most important element of this alternative because it increases the yield of the local supplies. This alternative includes capture of as much local runoff as possible through more active recharge of local surface water through percolation (see below), development of local surface water reservoir(s), and active management of the groundwater basin. Groundwater extraction wells will be required to utilize the stored supplies.

Groundwater Banking
As discussed above, storage will be a requirement of development of additional local water supplies. Groundwater banking could be accomplished in portions of the basin in conjunction with groundwater level management.

Surface Water and Groundwater Treatment
In order to provide potable water quality sufficient to meet the objectives and criteria, both surface water and groundwater treatment will have to be provided. Surface water from local surface water reservoirs will have to be treated for removal of sediments and microorganisms. Groundwater may have to be treated to remove TDS and hardness.

Local Conveyance Facilities
In order to fully utilize the various surface water and groundwater bank facilities, additional local conveyance to move the water between sub-basins will be required. The intent will be to move water from sub-basins with high water storage to sub-basins where water supplies are needed.

Reclaimed Effluent for Reuse
Reuse of reclaimed effluent is an important element of this alternative because of the high reliability of reclaimed effluent. Irrigation demands for potable water can be met through the use of reclaimed effluent.

Water Transfers
Water transfers from the San Benito County basin to users outside of the basin will be critical to funding the projects necessary to accomplish this alternative.

8.2 Alternative #2 – 100% Imported Supply:

8.2.1 Philosophy/Objectives

Alternative #2 – 100% Imported Supply defines the other end of the spectrum within which to evaluate groundwater management. The philosophy of this alternative is to increase dependence on high quality imported water and to manage demand and increase groundwater and local storage to moderate the high variations in availability. The amount of storage required will be large, because: 1) agricultural users have high demands and 2) it can be expected that extended periods where full contract entitlements will not be delivered will continue to occur. In fact, it is possible that even less water than is currently being delivered will be available, particularly to agricultural users.

Full imported surface water contract entitlements are currently being met in only the wettest of years. Allocations for environmental and other waters has resulted in approximately 75% of contract entitlement being delivered for M&I supplies and 65% delivered for agricultural supplies in normal years. The Bureau of Reclamation estimates of past performance indicates that dry and critically dry year M&I supplies may be further reduced to 35% and 25% of contract entitlements while agricultural deliveries may be reduced from 10% to 0% of contract entitlements.

One important outcome of this alternative is that basin water levels will need to be managed. As discussed in 2001 Existing Conditions, the introduction of imported surface water resulted in sufficient deep percolation recharge of the groundwater basin that an overdraft condition was essentially resolved over 4- 5 years. Therefore, not only must overall basin water levels be managed, but localized areas of perched water will also require drainage.

8.2.2 Alternative #2 – 100% Imported Supply: Major Toolbox Elements

M&I and Agricultural Conservation
All of the alternatives rely on an aggressive water conservation program; however, conservation is a critical element of this alternative because of its reliance on a highly variable supply.

Maintain Surface Water Importation
This alternative maintains the level of imported water deliveries to the maximum available of the contract entitlements.

Additional Imported Supply
Considerable additional imported supply will have to be acquired whether through contracts and transfers to the County or through purchase of land with a transferable water supply contract entitlement. Because of the high variability of imported surface water, large contract entitlements will have to be held in order to provide reliability when supplies are reduced during dry periods. Imported supplies could also be stored during wetter years to be available in drought periods. Some mix of increased contractual supplies and storage would be required to provide the most cost-effective method of implementing this alternative.

Second Conduit to Pacheco Dam and Tunnel and Other Pipelines

Depending on the quantities of additional imported surface water that may be acquired, a second conduit parallel to the existing Hollister Conduit to Pacheco Dam and Tunnel may be required. Since the Hollister Conduit is not receiving the full contract entitlement of water most years, there may be some additional capacity.

Imported Surface Water Storage Reservoirs
In order to increase the reliability of imported surface water, additional local reservoirs to store imported water may be required.

Surface Water Treatment
In order to provide potable water quality sufficient to meet the objectives and criteria, surface water treatment will be required to remove sediments and microorganisms.

Groundwater Banking/Imported Surface Water Percolation
As discussed above, storage will be a requirement of development of additional imported water supplies to improve the reliability. Groundwater banking of percolated imported surface water, when available, could be accomplished in portions of the basin in conjunction with aggressive groundwater level management. It is possible that the variability of the imported supply will be sufficiently high that there is not sufficient storage for the water.

Local Conveyance Facilities
In order to fully utilize the groundwater bank facilities, additional local conveyance to move the water between sub-basins will be required. The intent will be to move water from sub-basins with high water storage to sub-basins where water supplies are needed.

Water Transfers
Water transfers from the San Benito County basin to users outside of the basin will be critical to funding the projects necessary to accomplish this alternative.

Water Level Management Elements
Because of the high quantities of imported water that will be used in the basin, active water level management will be required including the use of:

- Reclaimed M&I Effluent for Export,
- Deepen Drainage, and/or
- Groundwater Pumping for Export

8.3 Alternative #3 –Minimize Groundwater Quality Impacts

8.3.1 Philosophy/Objectives

The philosophy of this alternative is to manage water supplies with the goal of minimizing groundwater quality impacts of contaminants including salts. This objective would be accomplished through minimizing use of imported surface water since it accounts for more than 1/3 of the salt additions, reducing salts in source waters by using local precipitation (surface supplies) with the accompanying low salt content and, removing salts from the sub-basin. Imported supplies are used for blending and/or substitution for higher salt water sources. It is

similar to Alternative #1 except that some import of water is included and export of salt is encouraged. Water quality management will be accomplished in conjunction with management of basin water levels through balanced use of surface water and groundwater. The use of local storage moderates the variability of local surface water availability.

8.3.2 Alternative #3 – Minimize Groundwater Quality Impacts: Major Toolbox Elements

The major toolbox elements that were selected for Alternative #3 were those that either remove salts and/or prevent the addition of salts to the basin. The elements are:

Salinity Education Program
Because of the high reliance on local supply, particularly from groundwater, salinity education for agricultural users is also an important element in order to maintain the water quality of the groundwater. Although local surface waters may provide the lowest salt source water, additions of salt from agricultural uses will threaten groundwater quality.

Water Softener Ordinance
Reduction of salts from municipal and industrial users is especially important in this alternative since the salts from brine regenerating softeners result in increased salts wastewater effluent that will be used for irrigation reuse. Lower salt potable water will reduce the need for softeners.

Maintain Surface Water Importation
This alternative maintains some level of imported water deliveries for blending and substitution. Any imported surface water not used can either be sold/transferred or banked in the groundwater bank.

Additional Surface Water Storage and Groundwater Banking
This toolbox element is the most important element of this alternative because it better develops the high water quality local surface supplies. This alternative includes capture of as much local runoff as possible through more active recharge of local surface water through percolation, development of local surface water reservoir(s), and active management of the groundwater basin. Groundwater extraction wells will be required to utilize the stored supplies.

Surface Water and Groundwater Treatment
In order to provide potable water quality sufficient to meet the objectives and criteria, both surface water and groundwater treatment will have to be provided. Surface water from local surface water reservoirs will have to be treated for removal of sediments and microorganisms. Groundwater may have to be treated to remove TDS and hardness.

Local Conveyance Facilities
In order to fully utilize the various surface water and groundwater bank facilities, additional local conveyance to move the water between sub-basins will be required. The intent will be to move water from sub-basins with high water storage to sub-basins where water supplies are needed.

Water Transfers
Water transfers from the San Benito County basin to users outside of the basin will be employed in wetter years when local supplies provide sufficient water. Thus transfers would provide some funding for the projects necessary to accomplish this alternative.

Salt Export/Water Level Management Elements
Export of salts and management of water levels can be accomplished through the use of:

- Reclaimed M&I Effluent for Export,
- Deepen Drainage, and/or
- Groundwater Pumping for Export

8.4 Alternative #4 –Cost-Effective Balance of Local and Imported Supplies

8.4.1 Philosophy/Objectives

This alternative has as its philosophy to establish the most cost-effective balance of local and imported supplies. It would involve use of imported water when available to supplement local supplies and involve greater use of local groundwater/surface water to meet demands during dry/critically dry years. Some treatment and blending to provide water quality to meet beneficial uses will occur. Based on water balances in the 2001 Existing Conditions, some imported supply is necessary to minimize groundwater overdraft as occurred before the introduction of imported water.

Storage will have to be developed although it will more likely be in the groundwater basin because of the lower costs of the facilities for groundwater banking than for surface reservoirs. In order to effectively use stored groundwater, additional conveyance may be necessary. During dry/critically dry periods stored groundwater will have to be used to meet demands which helps to moderate the variability of surface supplies. Because both surface water and groundwater will be used; through careful management basin water levels can be balanced so that excessively high or low groundwater levels do not occur.

8.4.2 Alternative #4 –Cost-Effective Balance of Local and Imported Supplies: Major Toolbox Elements

The major toolbox elements to implement Alternative #4 were selected to use the, where a choice was available, the lowest relative cost toolbox element that could meet with the water quantity and water quality goals. The elements include:

Groundwater Banking
This alternative includes capture of as much local runoff as possible through more active recharge of local surface water through percolation and active management of the groundwater basin. Groundwater extraction wells will be required to utilize the stored supplies.

Surface Water and Groundwater Treatment

In order to provide potable water quality sufficient to meet the objectives and criteria, both surface water and groundwater treatment will have to be provided. Surface water from local surface water reservoirs will have to be treated for removal of sediments and microorganisms. Groundwater may have to be treated to remove TDS and hardness.

Local Conveyance Facilities

In order to fully utilize the various surface water and groundwater bank facilities, additional local conveyance to move the water between sub-basins will be required. The intent will be to move water from sub-basins with high water storage to sub-basins where water supplies are needed.

Groundwater/Surface Water Blending

Blending of groundwater and surface water can result in improved water quality in some portions of the basin such as the San Juan sub-basin as well as using groundwater supply that will result in reduced water levels in the sub-basin.

Water Transfers

Because all of the imported surface water use may not be fully used in every year, water transfers from the San Benito County basin to users outside of the basin may be made in wetter years to better balance water supplies and assist in funding the projects necessary to accomplish this alternative.

Section 9: Alternatives Evaluation

9.1 Approach to First Stage Evaluation

The first step evaluation was to qualitatively consider each alternative and the major toolbox elements that would be used to implement the alternative and compare those against the objectives and criteria. For the water quality and water quantity criteria, the approach was to evaluate the degree (High, Moderate, or Low) that the toolbox element directly or indirectly helps to meet the criteria for the alternative. In this case, High indicates that the element helps in a high degree to meet the criteria and Low indicates that the element helps in a low degree to meet the criteria. Moderate is either in between or indeterminate.

In some instances, a toolbox element could provide a high degree if viewed in one way and a low degree if viewed in another way. The resulting degree in these instances was "moderate". An example of this is the toolbox element of Groundwater Banking for Alternative #2 – 100% Imported Supply and Water Quality Criterion #1-3 – Deliver M&I water meeting primary and secondary water quality objectives with emphasis on TDS and hardness. In this case, if imported water were to be banked in the groundwater basin, it is not certain whether the high quality of the water will be maintained because of the characteristics of the aquifer matrix. Therefore, the degree to which this toolbox element helps to meet the criteria for the alternative is moderate.

For the other general criteria, the criteria presented in Section 6.3 have been shortened to the following form for purposes of completing the matrix:

- Degree to which the element/alternative is consistent with other water management plans in the region.
- Degree to which element/alternative would have no have significant adverse environmental impacts
- Relative ease with which the element/alternative is permittable and implementable
- Relative affordability of the element and/or alternative (high/medium/low)

Table 9-1 shows all of the toolbox elements and all of the objectives and the criteria and an evaluation of how well the element meets the criteria. Then, toolbox elements were selected based on general guidance from Section 8 for each alternative philosophy and evaluations are found in Tables 9-2 through 9-5 for Alternatives 1 through 4. Additional toolbox elements may be added to balance effects of other toolbox elements. Some modifications to the Table 9-1 evaluations were made as applicable to each alternative philosophy.

9.2 Summary Results of First Stage Evaluation

While Tables 9-2 through 9-5 are useful for evaluating individual toolbox elements and their level of impact on each of the alternative philosophies, it is difficult to compare the overall

Table 9 - 1
Preliminary Summary Matrix of Toolbox Elements and Objectives and Criteria

Criteria Categories	Water Quantity					Water Quality				Other Criteria			
	Water Quantity Objective 1		Water Quantity Objective 2			Water Quality Objective 1							
Degree to which this toolbox element directly or indirectly helps to meet the criteria for the alternative	Water Quantity Specific Criterion #1-1	Water Quantity Specific Criterion #1-2	Water Quantity Specific Criterion #2-1	Water Quantity Specific Criterion #2-2	Water Quantity Specific Criterion #2-3	Water Quality Specific Criterion #1-1	Water Quality Specific Criterion #1-2	Water Quality Specific Criterion #1-3	Water Quality Specific Criterion #1-4	Regional Criteria	Environmental Criteria	Institutional/Jurisdictional Criteria	Cost Effectiveness/Affordability Criteria
Criteria Summary:	Deliver 100% of Agricultural and Municipal/Industrial Supply in normal, dry, and initial critical year in a drought	Deliver at least 85% of Municipal/Industrial Supply and 75% of agricultural supply in the second and subsequent critical years in a drought	Maximize efficient use of water supply	Manage groundwater levels to protect overlying uses from impacts from high water levels and prevent drawdown below prior historic low levels	Optimize use of groundwater storage	Manage water resources to minimize imported salts and groundwater salinity for beneficial uses	Protect groundwater resources from contamination with emphasis on nitrates and salts	Deliver M&I water meeting primary and secondary water quality objectives with emphasis on TDS and hardness	Deliver agricultural water meeting established quality parameters	Degree to which the element/alternative is consistent with other water management plans in the region	Probability that this toolbox element would have no significant adverse environmental impacts	Relative ease with which the element/alternative is permittable and implementable	Relative affordability of the element and/or alternative
Tool Box Elements													
Municipal and Industrial Water Conservation	High	High	High	High	Low	High	Low	Low	Low	High	High	High	High
Agricultural Water Conservation	Depends on Alt	Moderate	High	High	Low	High	Low	Low	Low	High	High	Moderate	High
Salinity Education Program	Low	Low	Moderate	Low	Low	High	High	Moderate	Low	High	High	High	High
Water Softener Ordinance	Low	Low	Moderate	Low	Low	High	High	Moderate	Moderate	High	High	High	High
Maintain Existing Groundwater Extraction Facilities	High	High	High	High	High	Moderate	Low	Low	Low	Moderate	High	High	High
Develop Local Surface Water Storage	High	High	High	Moderate	Low	High	High	High	High	High	Low	Low	Low
Develop Additional Local Groundwater Extraction Facilities	High	High	High	High	High	Moderate	Low	Low	Low	Moderate	High	High	High
Construct Local Conveyance Facilities	Moderate	Moderate	High	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	High	High	Moderate
Groundwater Banking (ASR/Recharge Basins)	High	High	High	Moderate	High	Moderate	Moderate	Moderate	Moderate	Moderate	High	High	High/Moderate
Surface Water Treatment	Moderate	Moderate	High	Moderate	Low	Low	Low	High	Low	Low	High	High	Moderate
Groundwater Treatment	Moderate	Moderate	High	Moderate	Moderate	High	High	High	Low	Low	Moderate	High	Low
Groundwater/Surface Water Blending	Moderate	Moderate	High	High	High	Moderate	Low	Low	High	Moderate	High	High	High
Reclaimed M&I Effluent for Reuse	High	High	High	Moderate	Moderate	Low	Low	Low	Moderate	High	Moderate	Moderate	Moderate
Desalt Reclaimed M&I Effluent for Reuse	High	High	High	Moderate	Moderate	High	High	Moderate	High	High	High	Moderate	Low
Agricultural Effluent for Export (Tile Drains)	Low	Low	Low	Moderate	Low	Moderate	High	Moderate	Moderate	Low	Moderate	Moderate	Moderate
Tree Belt Evapotranspiration	Low	Low	Low	Moderate	Low	Moderate	High	Moderate	Moderate	Low	High	High	High
Water Transfers	Depends on Alt	Depends on Alt	Depends on Alt	Depends on Alt	Low	Moderate	Low	Moderate	High	Moderate	Low	Moderate	High
Maintain Surface Water Importation	Low	Low	Low	Moderate	Low	Low	Low	High	High	Moderate	High	High	High
Additional Imported Surface Water	Low	Low	Low	Moderate	Low	Low	Low	High	High	Moderate	Moderate	Low	Low
Second Conduit to Pacheco Dam and Tunnel and Other Pipelines	Low	Low	Low	Moderate	Low	Low	Low	High	High	High	Moderate	Moderate	Low
Imported Surface Water Storage Reservoirs	High	High	Moderate	High	Low	Low	Low	High	High	High	Low	Low	Low
Imported Surface Water Percolation	High	High	Moderate	Moderate	High	Low	Low	High	Moderate	High	High	High	High
Reclaimed M&I Effluent for Export	Low	Low	Low	Moderate	Low	High	High	Low	Low	Moderate	Moderate	Moderate	Moderate
M&I Effluent Percolation	Moderate	Moderate	Moderate	Moderate	Moderate	Low	Low	Low	Moderate	Low	Moderate	High/Moderate	High
Groundwater Pumping for Export	Low	Low	Low	Moderate	Low	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Deepen Drainage	Low	Low	Low	Moderate	Low	High	High	Moderate	Moderate	Low	Low	Moderate	Low/Moderate

Table 9-2
Alternative #1 - 100% Local Supply
First Stage Qualitative Evaluation of Toolbox Elements

Criteria Categories	Water Quantity					Water Quality				Other Criteria			
	Water Quantity Objective 1		Water Quantity Objective 2			Water Quality Objective 1							
Degree to which this toolbox element directly or indirectly helps to meet the criteria for the alternative	Water Quantity Specific Criterion #1-1	Water Quantity Specific Criterion #1-2	Water Quantity Specific Criterion #2-1	Water Quantity Specific Criterion #2-2	Water Quantity Specific Criterion #2-3	Water Quality Specific Criterion #1-1	Water Quality Specific Criterion #1-2	Water Quality Specific Criterion #1-3	Water Quality Specific Criterion #1-4	Regional Criteria	Environmental Criteria	Institutional/Jurisdictional Criteria	Cost Effectiveness/Affordability Criteria
Criteria Summary:	Deliver 100% of Agricultural and Municipal/Industrial Supply in normal, dry, and initial critical year in a drought	Deliver at least 85% of Municipal/Industrial Supply and 75% of agricultural supply in the second and subsequent critical years in a drought	Maximize efficient use of water supply	Manage groundwater levels to protect overlying uses from impacts from high water levels and prevent drawdown below prior historic low levels	Optimize use of groundwater storage	Manage water resources to minimize imported salts and groundwater salinity for beneficial uses	Protect groundwater resources from contamination with emphasis on nitrates and salts	Deliver M&I water meeting primary and secondary water quality objectives with emphasis on TDS and hardness	Deliver agricultural water meeting established quality parameters	Degree to which the element/alternative is consistent with other water management plans in the region	Probability that this toolbox element would have no significant adverse environmental impacts	Relative ease with which the element/alternative is permittable and implementable	Relative affordability of the element and/or alternative
Tool Box Elements													
Municipal and Industrial Water Conservation	High	High	High	High	Low	Moderate	Low	Low	Low	High	High	High	High
Agricultural Water Conservation	Moderate	High	High	High	Low	Moderate	Low	Low	Low	High	High	Moderate	High
Salinity Education Program	Low	Low	Moderate	Low	Low	High	High	Moderate	Low	High	High	High	High
Water Softener Ordinance	Low	Low	Moderate	Low	Low	High	High	Moderate	Moderate	High	High	High	High
Maintain Existing Groundwater Extraction Facilities	High	High	High	High	High	Moderate	Low	Low	Low	Moderate	High	High	High
Develop Local Surface Water Storage	High	High	High	Moderate	Low	High	High	High	High	High	Low	Low	Low
Develop Additional Local Groundwater Extraction Facilities	High	High	High	High	High	Moderate	Low	Low	Low	Moderate	High	High	Moderate
Construct Local Conveyance Facilities	Moderate	High	High	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	High	High	Moderate
Groundwater Banking (ASR/Recharge Basins)	High	High	High	Moderate	High	Moderate	Moderate	Moderate	Moderate	Moderate	High	High	High/Moderate
Surface Water Treatment	Moderate	Moderate	High	Moderate	Low	Low	Low	High	Low	Low	High	High	Moderate
Groundwater Treatment	Moderate	Moderate	High	Moderate	Moderate	High	High	High	Low	Low	Moderate	High	Low
Groundwater/Surface Water Blending	Moderate	High	High	High	High	Moderate	Low	Low	High	Moderate	High	High	High
Reclaimed M&I Effluent for Reuse	High	High	High	Moderate	Moderate	Low	Low	Low	Moderate	High	Moderate	Moderate	Moderate
Desalt Reclaimed M&I Effluent for Reuse	High	High	High	Moderate	Moderate	High	High	Moderate	High	High	High	Moderate	Low
Agricultural Effluent for Export (Tile Drains)	Low	Low	Low	Moderate	Low	High	High	Moderate	Moderate	Low	Moderate	Moderate	Moderate
Tree Belt Evapotranspiration	Low	Low	Low	Moderate	Low	High	High	Moderate	Moderate	Low	High	High	High
Water Transfers	Low	Low	Moderate	Low	Low	Moderate	Low	Low	Low	Moderate	Low	Moderate	High

Table 9 -3
Alternative #2 - 100% Imported Supply
First Stage Qualitative Evaluation of Toolbox Elements

Criteria Categories	Water Quantity					Water Quality				Other Criteria			
	Water Quantity Objective 1		Water Quantity Objective 2			Water Quality Objective 1							
Degree to which this toolbox element directly or indirectly helps to meet the criteria for the alternative	Water Quantity Specific Criterion #1-1	Water Quantity Specific Criterion #1-2	Water Quantity Specific Criterion #2-1	Water Quantity Specific Criterion #2-2	Water Quantity Specific Criterion #2-3	Water Quality Specific Criterion #1-1	Water Quality Specific Criterion #1-2	Water Quality Specific Criterion #1-3	Water Quality Specific Criterion #1-4	Regional Criteria	Environmental Criteria	Institutional/Jurisdictional Criteria	Cost Effectiveness/Affordability Criteria
Criteria Summary:	Deliver 100% of Agricultural and Municipal/Industrial Supply in normal, dry, and initial critical year in a drought	Deliver at least 85% of Municipal/Industrial Supply and 75% of agricultural supply in the second and subsequent critical years in a drought	Maximize efficient use of water supply	Manage groundwater levels to protect overlying uses from impacts from high water levels and prevent drawdown below prior historic low levels	Optimize use of groundwater storage	Manage water resources to minimize imported salts and groundwater salinity for beneficial uses	Protect groundwater resources from contamination with emphasis on nitrates and salts	Deliver M&I water meeting primary and secondary water quality objectives with emphasis on TDS and hardness	Deliver agricultural water meeting established quality parameters	Degree to which the element/alternative is consistent with other water management plans in the region	Probability that this toolbox element would have no significant adverse environmental impacts	Relative ease with which the element/alternative is permittable and implementable	Relative affordability of the element and/or alternative
Tool Box Elements													
Municipal and Industrial Water Conservation	High	High	High	High	Low	High	Low	Low	Low	High	High	High	High
Agricultural Water Conservation	Moderate	Moderate	High	High	Low	High	Low	Low	Low	High	High	Moderate	High
Salinity Education Program	Low	Low	Moderate	Low	Low	High	High	Moderate	Low	High	High	High	High
Water Softener Ordinance	Low	Low	Moderate	Low	Low	High	High	Moderate	Moderate	High	High	High	High
Maintain Existing Groundwater Extraction Facilities	High	High	High	High	High	Moderate	Low	Low	Low	Moderate	High	High	High
Construct Local Conveyance Facilities	Moderate	Moderate	High	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	High	High	Moderate
Groundwater Banking (ASR/Recharge Basins)	High	High	High	Moderate	High	Moderate	Moderate	Moderate	Moderate	Moderate	High	High	High/Moderate
Surface Water Treatment	Moderate	Moderate	High	Moderate	Low	Low	Low	High	Low	Low	High	High	Moderate
Agricultural Effluent for Export (Tile Drains)	Low	Low	Low	Moderate	Low	Moderate	High	Moderate	Moderate	Low	Moderate	Moderate	Moderate
Tree Belt Evapotranspiration	Low	Low	Low	Moderate	Low	Moderate	High	Moderate	Moderate	Low	High	High	High
Water Transfers	High	High	Low	Low	Low	Moderate	Low	Moderate	High	Moderate	Low	Moderate	High
Maintain Surface Water Importation	Low	Low	Low	Moderate	Low	Low	Low	High	High	Moderate	High	High	High
Additional Imported Surface Water	Low	Low	Low	Moderate	Low	Low	Low	High	High	Moderate	Moderate	Low	Low
Second Conduit to Pacheco Dam and Tunnel and Other Pipelines	Low	Low	Low	Moderate	Low	Low	Low	High	High	High	Moderate	Moderate	Low
Imported Surface Water Storage Reservoirs	High	High	Moderate	High	Low	Low	Low	High	High	High	Low	Low	Low
Imported Surface Water Percolation	High	High	Moderate	Moderate	High	Low	Low	High	Moderate	High	High	High	High
Reclaimed M&I Effluent for Export	Low	Low	Low	Moderate	Low	High	High	Low	Low	Moderate	Moderate	Moderate	Moderate
Groundwater Pumping for Export	Low	Low	Low	Moderate	Low	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Deepen Drainage	Low	Low	Low	Moderate	Low	High	High	Moderate	Moderate	Low	Low	Moderate	Low/Moderate

Table 9 - 4
Alternative # 3 - Minimize Groundwater Quality Impacts
First Stage Qualitative Evaluation of Toolbox Elements

Criteria Categories	Water Quantity					Water Quality				Other Criteria			
	Water Quantity Objective 1		Water Quantity Objective 2			Water Quality Objective 1							
Degree to which this toolbox element directly or indirectly helps to meet the criteria for the alternative	Water Quantity Specific Criterion #1-1	Water Quantity Specific Criterion #1-2	Water Quantity Specific Criterion #2-1	Water Quantity Specific Criterion #2-2	Water Quantity Specific Criterion #2-3	Water Quality Specific Criterion #1-1	Water Quality Specific Criterion #1-2	Water Quality Specific Criterion #1-3	Water Quality Specific Criterion #1-4	Regional Criteria	Environmental Criteria	Institutional/Jurisdictional Criteria	Cost Effectiveness/Affordability Criteria
Criteria Summary	Deliver 100% of Agricultural and Municipal/Industrial Supply in normal, dry, and initial critical year in a drought	Deliver at least 85% of Municipal/Industrial Supply and 75% of agricultural supply in the second and subsequent critical years in a drought	Maximize efficient use of water supply	Manage groundwater levels to protect overlying uses from impacts from high water levels and prevent drawdown below prior historic low levels	Optimize use of groundwater storage	Manage water resources to minimize imported salts and groundwater salinity for beneficial uses	Protect groundwater resources from contamination with emphasis on nitrates and salts	Deliver M&I water meeting primary and secondary water quality objectives with emphasis on TDS and hardness	Deliver agricultural water meeting established quality parameters	Degree to which the element/alternative is consistent with other water management plans in the region	Probability that this toolbox element would have no significant adverse environmental impacts	Relative ease with which the element/alternative is permittable and implementable	Relative affordability of the element and/or alternative
Tool Box Elements													
Municipal and Industrial Water Conservation	High	High	High	High	Low	High	Low	Low	Low	High	High	High	High
Agricultural Water Conservation	Moderate	Moderate	High	High	Low	High	Low	Low	Low	High	High	Moderate	High
Salinity Education Program	Low	Low	Moderate	Low	Low	High	High	Moderate	Low	High	High	High	High
Water Softener Ordinance	Low	Low	Moderate	Low	Low	High	High	Moderate	Moderate	High	High	High	High
Maintain Existing Groundwater Extraction Facilities	High	High	High	High	High	Moderate	Low	Low	Low	Moderate	High	High	High
Maintain Surface Water Importation	Low	Low	Low	Moderate	Low	Low	Low	High	High	Moderate	High	High	High
Develop Local Surface Water Storage	High	High	High	Moderate	Low	High	High	High	High	High	Low	Low	Low
Develop Additional Local Groundwater Extraction Facilities	High	High	High	High	High	Moderate	Low	Low	Low	Moderate	High	High	High
Construct Local Conveyance Facilities	Moderate	Moderate	High	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	High	High	Moderate
Groundwater Banking (ASR/Recharge Basins)	High	High	High	Moderate	High	Moderate	Moderate	Moderate	Moderate	Moderate	High	High	High/Moderate
Surface Water Treatment	Moderate	Moderate	High	Moderate	Low	Low	Low	High	Low	Low	High	High	Moderate
Groundwater Treatment	Moderate	Moderate	High	Moderate	Moderate	High	High	High	Low	Low	Moderate	High	Low
Groundwater/Surface Water Blending	Moderate	Moderate	High	High	High	Moderate	Low	Low	High	Moderate	High	High	High
Desalt Reclaimed M&I Effluent for Reuse	High	High	High	Moderate	Moderate	High	High	Moderate	High	High	High	Moderate	Low
Agricultural Effluent for Export (Tile Drains)	Low	Low	Low	Moderate	Low	Moderate	High	Moderate	Moderate	Low	Moderate	Moderate	Moderate
Tree Belt Evapotranspiration	Low	Low	Low	Moderate	Low	Moderate	High	Moderate	Moderate	Low	High	High	High
Water Transfers	Low	Low	Low	Low	Low	Moderate	Low	Moderate	High	Moderate	Low	Moderate	High
Reclaimed M&I Effluent for Export	Low	Low	Low	Moderate	Low	High	High	Low	Low	Moderate	Moderate	Moderate	Moderate
Groundwater Pumping for Export	Low	Low	Low	Moderate	Low	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Deepen Drainage	Low	Low	Low	Moderate	Low	High	High	Moderate	Moderate	Low	Low	Moderate	Low/Moderate

Table 9 - 5
Alternative # 4 - Least Cost Mix of Local and Imported Water
First Stage Qualitative Evaluation of Toolbox Elements

Criteria Categories	Water Quantity					Water Quality				Other Criteria			
	Water Quantity Objective 1		Water Quantity Objective 2			Water Quality Objective 1							
Degree to which this toolbox element directly or indirectly helps to meet the criteria for the alternative	Water Quantity Specific Criterion #1-1	Water Quantity Specific Criterion #1-2	Water Quantity Specific Criterion #2-1	Water Quantity Specific Criterion #2-2	Water Quantity Specific Criterion #2-3	Water Quality Specific Criterion #1-1	Water Quality Specific Criterion #1-2	Water Quality Specific Criterion #1-3	Water Quality Specific Criterion #1-4	Regional Criteria	Environmental Criteria	Institutional/Jurisdictional Criteria	Cost Effectiveness/Affordability Criteria
Criteria Summary:	Deliver 100% of Agricultural and Municipal/Industrial Supply in normal, dry, and initial critical year in a drought	Deliver at least 85% of Municipal/Industrial Supply and 75% of agricultural supply in the second and subsequent critical years in a drought	Maximize efficient use of water supply	Manage groundwater levels to protect overlying uses from impacts from high water levels and prevent drawdown below prior historic low levels	Optimize use of groundwater storage	Manage water resources to minimize imported salts and groundwater salinity for beneficial uses	Protect groundwater resources from contamination with emphasis on nitrates and salts	Deliver M&I water meeting primary and secondary water quality objectives with emphasis on TDS and hardness	Deliver agricultural water meeting established quality parameters	Degree to which the element/alternative is consistent with other water management plans in the region	Probability that this toolbox element would have no significant adverse environmental impacts	Relative ease with which the element/alternative is permittable and implementable	Relative affordability of the element and/or alternative
Tool Box Elements													
Municipal and Industrial Water Conservation	High	High	High	High	Low	High	Low	Low	Low	High	High	High	High
Agricultural Water Conservation	High	Moderate	High	High	Low	High	Low	Low	Low	High	High	Moderate	High
Salinity Education Program	Low	Low	Moderate	Low	Low	High	High	Moderate	Low	High	High	High	High
Water Softener Ordinance	Low	Low	Moderate	Low	Low	High	High	Moderate	Moderate	High	High	High	High
Maintain Existing Groundwater Extraction Facilities	High	High	High	High	High	Moderate	Low	Low	Low	Moderate	High	High	High
Develop Additional Local Groundwater Extraction Facilities	High	High	High	High	High	Moderate	Low	Low	Low	Moderate	High	High	High
Construct Local Conveyance Facilities	Moderate	Moderate	High	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	High	High	Moderate
Groundwater Banking (ASR/Recharge Basins)	High	High	High	Moderate	High	Moderate	Moderate	Moderate	Moderate	Moderate	High	High	High/Moderate
Surface Water Treatment	Moderate	Moderate	High	Moderate	Low	Low	Low	High	Low	Low	High	High	Moderate
Groundwater Treatment	Moderate	Moderate	High	Moderate	Moderate	High	High	High	Low	Low	Moderate	High	Low
Groundwater/Surface Water Blending	Moderate	Moderate	High	High	High	Moderate	Low	Low	High	Moderate	High	High	High
Reclaimed M&I Effluent for Reuse	High	High	High	Moderate	Moderate	Low	Low	Low	Moderate	High	Moderate	Moderate	Moderate
Agricultural Effluent for Export (Tile Drains)	Low	Low	Low	Moderate	Low	Moderate	High	Moderate	Moderate	Low	Moderate	Moderate	Moderate
Tree Belt Evapotranspiration	Low	Low	Low	Moderate	Low	Moderate	High	Moderate	Moderate	Low	High	High	High
Water Transfers	Low	Low	Low	Low	Low	Moderate	Low	Moderate	High	Moderate	Low	Moderate	High
Maintain Surface Water Importation	Low	Low	Low	Moderate	Low	Low	Low	High	High	Moderate	High	High	High
M&I Effluent Percolation	Moderate	Moderate	Moderate	Moderate	Moderate	Low	Low	Low	Moderate	Low	Moderate	High/Moderate	High

impacts of each alternative to each other. Therefore, the following summaries are prepared that describe the bigger picture of each alternative.

9.3 Alternative #1 – 100% Local Supply

9.3.1 Water Quantity

From a water quantity perspective, the 100% local supply alternative will not be able to reliably deliver the full 2020 demands for agriculture and M&I without overdrafting the aquifer even with the additional reclaimed water, surface water and groundwater supplies being developed locally. There are also significant impacts associated with development of a surface water reservoir locally as well as the high costs. For the purposes of the analysis in section 11, the surface water reservoir is considered a source for M&I supply. However, it could also be used for agricultural supply. There are some potential benefits from a flood control perspective with development of a local surface water reservoir on Pacheco Creek which will have to be explored further.

9.3.2 Water Quality

The water quality elements which are included in this alternative provide for delivery of M&I that meets the primary and secondary drinking water quality objectives. The resulting M&I water should be lower in TDS and hardness than current supplies because the source will be from a surface water source. Demineralization/desalination of groundwater will improve the delivered water quality from groundwater sources to M&I users. Through blending, potential use of local surface water, and moving of higher quality groundwater from sub-basin to sub-basin, the quality of the water delivered to agricultural users can be maintained and potentially improved depending on the location.

9.4 Alternative #2 – 100% Imported Supply

9.4.1 Water Quantity

From a water quantity perspective, the 100% imported supply alternative will be subject to high variability unless significant amounts of local and/or regional storage can be developed to improve the reliability of this alternative. Given the scarcity of water within California, imported water supplies are not only variable, but in high demand which results in extremely high costs. Although quantities of water may be available, acquisition of contract entitlements will be institutionally challenging because of the number of parties involved including local, state, and federal agencies as well as the water entitlement holders.

There are significant impacts associated with development of surface water reservoirs as well as the high costs. As a result of importing additional water, this alternative will require development of extraction and export facilities in order to manage rising water levels.

9.4.2 Water Quality

The water quality elements which are included in this alternative provide for delivery of M&I that meets the primary and secondary drinking water quality objectives through the use of low TDS/hardness imported water. The lower TDS and lower boron levels associated with the imported water will meet the water quality needs of the agricultural users.

9.5 Alternative #3 – Minimize Groundwater Quality Impacts

9.5.1 Water Quantity

From a water quantity perspective, the minimize groundwater quality impacts alternative should be able to reliably deliver the full 2020 demands for agriculture and M&I without overdrafting the aquifer. This alternative relies on the range of supply alternatives including existing imported supplies, desalted reclaimed water, local surface water and local groundwater supplies which increases overall reliability. However, there are significant impacts associated with development of a surface water reservoir locally as well as the high costs. For the purposes of the analysis in section 11, the surface water reservoir is considered a source for M&I supply. However, it could also be used for agricultural supply. There are some potential benefits from a flood control perspective with development of a local surface water reservoir on Pacheco Creek which will have to be explored further.

9.5.2 Water Quality

The water quality elements which are included in this alternative provide for delivery of M&I that meets the primary and secondary drinking water quality objectives. The resulting M&I water should be lower in TDS and hardness than current supplies because the source will be from a surface water source. Demineralization/desalination of groundwater will improve the delivered water quality for groundwater sources to M&I users. Through blending, use of imported surface water, and moving of higher quality groundwater from sub-basin to sub-basin, the quality of the water delivered to agricultural users can be maintained and potentially improved depending on the location. Export of salts through pumping of groundwater and deepening of drainages as well as reduction of additional salts through salinity education of the agricultural community and water softener ordinances are an important part of the philosophy of this alternative.

9.6 Alternative #4 – Most Cost-Effective Balance of Local and Imported Supplies

9.6.1 Water Quantity

Similar to Alternative #3, the most cost-effective balance of local and imported supplies alternative should be able to reliably deliver the full 2020 demands for agriculture and M&I without overdrafting the aquifer. This alternative relies on the range of supply alternatives including existing imported supplies, reclaimed water, and local groundwater supplies which increases overall reliability. By not developing a local surface water reservoir, the associated impacts and costs are eliminated.

9.6.2 Water Quality

The water quality elements which are included in this alternative provide for delivery of M&I that meets the primary and secondary drinking water quality objectives. The resulting M&I water should be lower in TDS and hardness than current supplies because the source will be from a surface water source. Demineralization/desalination of groundwater will improve the delivered water quality for groundwater sources to M&I users. Through blending, use of imported surface water, and moving of higher quality groundwater from sub-basin to sub-basin, the quality of the water delivered to agricultural users can be maintained and potentially improved depending on the location. Export of salts through pumping of groundwater and deepening of drainages as well as reduction of additional salts through salinity education of the agricultural community and water softener ordinances are an important part of the philosophy of this alternative.

Section 10: Estimated Future Water Needs for Facility Sizing

10.1.1 Municipal and Industrial Water Needs

10.1.1.1 Assumptions

In order to size potential projects to meet municipal and industrial demands, estimates of the future water needs need to be made. For the purposes of sizing potential projects, the 2020 future demand condition has been selected. For the alternatives that may use imported water, it has been further assumed that the dry – critically dry period when CVP imported water availability is at a minimum will be the deciding factor as to how much additional water will have to be developed and treated. For the alternatives, that do not use imported water, the full demand amounts will need to be provided.

10.1.1.2 Estimated Municipal and Industrial Water Needs

Based on estimates in Section 5 using the Growth Management assumption for population estimates, approximately 7,740 AF (6.9 MGD) of Municipal and Industrial Supply will be required for the San Juan Bautista– Hollister urban areas in 2020. For alternatives that use imported supplies, it is estimated that from 340 AF/yr (0.3MGD) to 5,400 AF/yr (4.8 MGD) of alternative supply will be needed to augment the 2,000 – 6,200 AF/yr of imported surface water that may be delivered in a dry – critically dry period to the Hollister - San Juan Bautista urban areas. For alternatives that do not use imported supply, the full 7,740 AF/yr of demand will need to be provided.

These estimates do not include the estimated 3,300 AF/yr of M&I demand that is not on a community water system within the unincorporated portions of San Benito County. Serving the unincorporated portions of San Benito County with community water would require treatment, storage, and distribution facilities sufficient to serve 2.9 MGD. Therefore, if the unincorporated areas of the County are to be included, the groundwater supply need increases to up to 11,040 AF/yr (9.8 MGD).

For the purposes of the alternatives analysis, it is assumed that only the current urban areas of Hollister and San Juan Bautista will be served with additional municipal and industrial water supply since the unincorporated areas of the County are likely to be on large parcels with individual wells.

10.2 Agricultural and Other Demands

10.2.1 Assumptions

In order to size potential projects to meet agricultural demands, estimates of the future water needs need to be made. For the purposes of sizing potential projects, the 2020 future demand condition has been selected. For the alternatives that may use imported water, it has been further assumed that the dry – critically dry period when CVP imported water availability is at a minimum will be the deciding factor as to how much additional water will have to be developed

and treated. For the alternatives, that do not use imported water, the full demand amounts will need to be provided.

10.2.2 Estimated Agricultural and Other Water Needs

Based on estimates in Section 5, approximately 78,000 AF of demand for agriculture in the Zone 6 and Bolsa, Paicines, and Tres Pinos areas for agricultural uses has been estimated For alternatives that use imported supplies, it is estimated that from 74,400 to 78,000 AF/yr of alternative supply will be needed to augment the 0 AF to 3,600 AF/yr of imported surface water that may be delivered in a dry – critically dry period. For alternatives that do not use imported supply, the full 78,000 AF/yr of demand will need to be provided.

During a dry - critically dry period, it is assumed that other demands for water such as conveyance losses and special agricultural water quality purposes is about 3,000 AF/yr.

10.3 Total Estimated Water Needs

Therefore, the total water needs from the water system will be up to 7,740 AF/yr for Estimated 2020 Municipal and Industrial needs and up to 81,000 AF/yr for Estimated 2020 Agricultural and Other needs. For alternatives using imported water during a dry – critically dry period, the range of water needs will be from 340 AF/yr to 5,400 AF/yr for municipal and industrial supply and from 79,000 AF/yr to 81,000 AF/yr for agricultural and other needs.

10.4 Groundwater/Surface Water Bank Sizing

For the purposes of this alternatives analysis, it has been estimated that a 3-year critically dry period similar to that which occurred during 1990 – 1992 is illustrative of how groundwater/surface water bank facilities can be sized. In addition, 2020 demands are assumed for the sizing of the banking facilities. Demands and expected supplies are described below.

10.4.1 Demand

The annual agricultural demand is estimated to be 78,000 AF/yr and the annual other demands is estimated to be 3,000 AF/yr for a total of 81,000 AF/yr. For a 3-year period, this would be a total demand of 243,000 AF.

The annual municipal and industrial demand for the City of Hollister, Sunnyslope County Water District, City of San Juan Bautista, and unincorporated San Benito County is estimated to be 11,040 AF/yr. For a 3-year period, this would be a total demand of 33,120 AF.

The demands are summarized in Table 10-1 below.

10.4.2 Supply with Imported Water at Current Contract Allocations

It is assumed that there is 54,000 AF/yr of groundwater safe yield (i.e. available local water) for the Zone 6, Bolsa, Paicines, and Tres Pinos groundwater basins for a total supply over 3 years of 162,000 AF.

Imported Agricultural Supply is limited to 0- 3,600 AF/yr (average of 1,800 AF/yr) for a 3 year total of 5,400 AF.

Imported M&I Supply is limited to 2,000 – 3,000 AF/yr (average of 2,500 AF/yr) for a 3-year total of 7,500 AF.

Reclaimed water supply is assumed to be approximately 50% of municipal and industrial water demand (J. Gregg, Personal Communication). For 2020, the urban water demand that is in areas that discharges to community wastewater systems is 9,400 AF; 4,500 AF/yr is approximately 50% of the demand and has been used. 4,500 AF for 3 years equals a total of 13,500 AF.

The supplies are summarized in Table 10-1 below.

10.4.3 Supply without Imported Water

It is assumed that there is 54,000 AF/yr of groundwater safe yield (i.e. available local water) for the Zone 6, Bolsa, Paicines, and Tres Pinos groundwater basins for a total supply over 3 years of 162,000 AF.

Reclaimed water supply is assumed to be approximately 50% of municipal and industrial water demand (J. Gregg, Personal Communication). For 2020, the urban water demand that is in areas that discharges to community wastewater systems is 7,740 AF; 3,500 AF is approximately 50% of the demand and has been used. 3,500 AF for 3 years equals a total of 10,500 AF.

10.4.4 Summary of Estimated Water Banking Needs for 3-year Dry Period

The demand and supply estimates from above have been summarized below to provide an estimate of the quantity of water that a Water Bank would have to provide to provide sufficient water during a 3-year dry-critically dry period.

Table 10-1 – Estimated Water Banking Needs

	3-Year Expected Demand at 2020 Demand Conditions		3-Year Expected Supply with Imported Water	3-Year Expected Supply without Imported Water
Agricultural and Other	243,000 AF	Available local water	162,000 AF	162,000 AF
Municipal and Industrial	33,120 AF	Imported Supply	Agricultural: 5,400 AF Municipal and Industrial: 7,500 AF	None
		Reclaimed Water at 2020 Demand Conditions	10,500 AF	10,500 AF
		Groundwater/ Surface Water Bank	90,700 AF	103,620 AF
Total Demand	276,120 AF	Total Supply	276,120 AF	276,120 AF

The size of a water bank with or without imported water does not appreciably change because of the low levels of imported water that are expected to be delivered in dry and critically dry years. The values of 90,700 AF to 103,620 AF provided an order of magnitude estimate on the amount of storage that may be required in the future and the amount of water that must be available in normal and wet years to be stored so that the water banks do not get overdrawn.

Section 11: Potential Projects to Implement Alternatives

In order to provide an illustration of how each alternative could be implemented with some specific projects derived from the project elements, potential projects were identified within each alternative that would meet the projected 2020 demands from Section 10. Treatment was provided as appropriate for each alternative for each use. The assumptions used for sizing projects within alternatives are provided. Tables and figures have been prepared that illustrate how the alternative would meet the water quantity and water quality objectives and criteria of the alternatives.

For project elements that have been sized sufficiently, planning-level estimated costs of construction (accuracy of –30% to + 50%) only have been provided where available at this time. Operations and Maintenance costs of facilities were not available at this time. Costs of preparation of environmental documents, permits and other documents, which in some instances could be significant, are not included in the estimate. Although the planning-level costs have not been obtained for each project element, the total of construction costs provides an order of magnitude range of costs sufficient to complete a preliminary comparison between alternatives.

11.1 Alternative #1 – 100% Local Supply

As described earlier, this alternative is attractive because of its reliance on high reliability local water supplies. However, it has not been determined whether there are sufficient quantities to meet the demands. An additional surface water reservoir and the large groundwater basin can be managed for groundwater banking which produces considerable storage. The relatively low quality of the groundwater requires treatment for M&I supply.

11.1.1 Demand and Supply Assumptions

For the purposes of identifying potential supplies to meet the philosophy of the alternative, the following summary is provided.

Estimated 2020 Demands	Potential Supplies to Meet Demands For Alternative
Municipal and Industrial = 7,740 AF	Groundwater yield = 54,000 AF/yr
Agricultural and Other Supplies = 81,000 AF	Reclaimed Effluent = 3,500 AF/yr
	New Local Surface Water Reservoir = 6,600 AF/yr
	Local Groundwater Bank* = 24,140 AF/yr
Total = 88,740 AF	**Total = 88,740 AF/yr**

* Based on water balance estimates prior to 1987 when impacted San Felipe water was introduced, the long term recharge to the groundwater bank will be less than the extraction resulting in overdraft.

11.1.2 Potential Facilities for Alternative

As shown in Table 11-1 and on Figure 11-1, the potential facilities that could used to implement for Alternative #1 are:

For Municipal and Industrial Supply,

- Additional Local Groundwater Supply from the Cienega area has been developed which requires wells and pipelines.
- Reclaimed M&I Effluent for Reuse – 1000 AF/yr of the total 3,500 AF/yr that is estimated to be available has been allocated to M&I irrigation
- Develop Local Surface Storage at Pacheco = 6,600 AF/yr. As discussed earlier, estimates of storage, yield, and construction costs were made for a dam on Pacheco Creek. Estimates of planning, environmental documentation, and design are not reflected in the construction costs.
- Surface Water Treatment – 2.8 MGD (3,200 AF) Treatment in addition to 3 MGD (3,400 AF) that is under construction or planned in City of Hollister and City of San Juan Bautista.
- Groundwater Treatment- up to 4 MGD of Demineralization or desalting will be required to provide up to 3,500 AF of produced water for some irrigation uses

Agricultural Supply

- Reclaimed M&I Effluent for Reuse – 2,500 AF/yr of the 3,500 AF/yr that may be produced is allocated to Agricultural supply
- Utilize Existing Groundwater within Safe Yield -54,000 AF/yr
- Groundwater Banking (ASR/Recharge Basins) – 24,800 AF/yr

Table 11-1
Alternative 1-100% Local Supply
Potential Project Elements and Sizes

Project Element	Agricultural Supplies (AF)	Municipal and Industrial Supplies(AF)	Facilities Required	Estimated Constr. Cost (10^6)	Notes
Municipal and Industrial Water Conservation	not applicable	In-place	None		To achieve 1%/yr reduction in M&I demands
Agricultural Water Conservation	In-place	not applicable	None		To achieve 85% efficiency
Salinity Education Program	In-place	In-place	None		
Water Softener Ordinance	not applicable	not applicable	None		
Maintain Existing Groundwater Facility					
Additional Local Groundwater Extraction Facilities		500 AF from Cienega	7 mile 6" pipeline, Wells	$5 for pipeline and well	
Develop Local Surface Water Storage		6,600 AF in Pacheco Creek Watershed	Dam	$100	Based on 1954 USBR estimate, could also be used for agriculture
Reclaimed M&I Effluent for Reuse	2,860 AF	640 AF	Title 22 Reclaimed and Conveyance	$15 - $25 for 4 MGD treatment	Do not need to desalt because of high quality M&I supply
Surface Water Treatment		2.8 MGD	surface water treatment facilities	$5 for 3 MGD	
Construct Local Conveyance Facilities	not quantified at this time		24" Pipeline parallel to Hollister Conduit up to 13.8 miles	$15	24" pipeline provides up to 15 MGD (16,000 AF) of capacity
Utilize Existing Groundwater within Safe Yield	54,000 AF		Existing facilities		Yield is allocated proportional to demand as required (up to 10% M&I and up to 90% agricultural)
Groundwater Banking (ASR/Recharge Basins)	24,140 AF		6 - 2,500 gpm wells, 21.5 MGD	$5 + treatment (no cost estimate)	Extracted groundwater not necessarily of high quality
Groundwater/Surface Water Blending	not quantified at this time				
Water Transfers					Required to fund improvements
Agricultural Effluent for Export (Tile Drains)	may be required, not quantified at this time				
Total Potential Supply	81,000 AF	7,740 AF		Range: $145 - $150 for elements that have estimated costs	
Assumptions					
Estimated 2020 Agricultural and Other Demand = 81,000 AF					
Estimated 2020 Municipal & Industrial Demand = 7,740 AF					
Imported Supply =0 AF					

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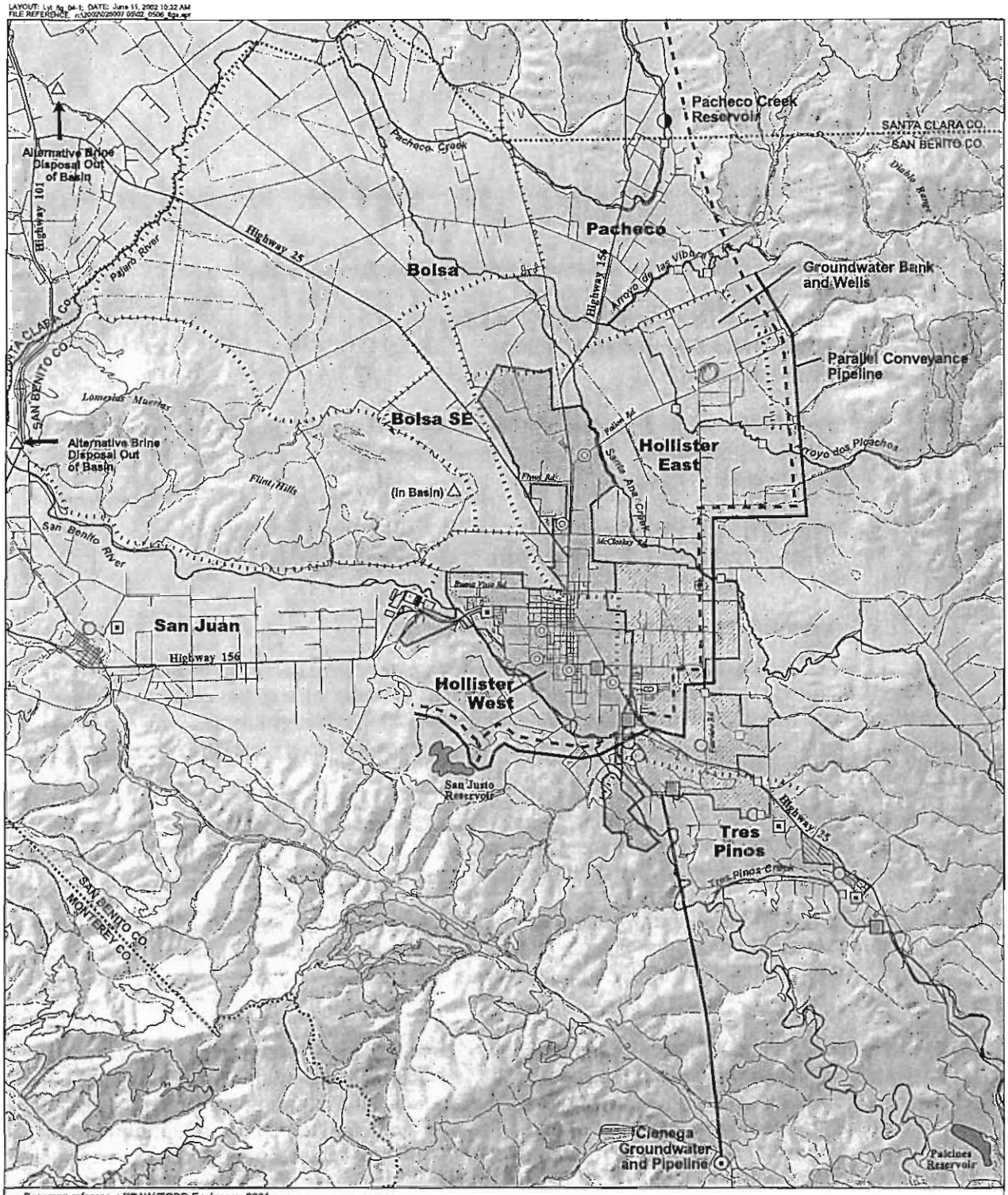

Basemap reference: EDAW/TODD Engineers, 2001

LEGEND

- San Benito River Percolation Sites (1971)
- Wastewater Percolation Sites
  Source: Hollister Area Urban Water Management Plan, 2000
- Hollister Municipal Wells
  Source: Hollister Master Plan
- Effluent for Reuse
- Brine Disposal
- Surface Water Reservoir
- Groundwater Treatment Facilities
- City of Hollister Water Service
- Sunnyslope County Water District
- Tres Pinos County Water District
  Source: Groundwater management Plan for San enito County, April 1996, Figure 9
- Hollister Conduit San Felipe Water System
  Source: Hollister Water Management Master Plan & Groundwater Management Plan, April 1996
- Discharge Point and Wetted Reach for Percolation of San Felipe Water
  Source: Annual Groundwater Report, 1998-99

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Figure 11-1

It should be noted that sustained withdrawals from the groundwater bank at this rate may not be feasible without causing significant groundwater overdraft.

Additional Facilities That Are Not Quantified At This Time That May Be Required To Manage Water Levels

- Agricultural Effluent for Export (Tile Drains)
- Groundwater Pumping for Export
- Deepen Drainage

It is uncertain at this time whether groundwater levels will be sufficiently high to require groundwater level management. If required, these additional project elements may have to be implemented at additional cost.

Other Necessary Toolbox Elements

- Water Transfers to provide portion of funding for projects

11.1.3 Summary of Issues/Benefits/Costs

As noted earlier in Section 8, the main issues with this alternative is that it may require extractions from the groundwater supply in excess of the safe yield of the groundwater basin to meet the 2020 demand. Even with the additional yield derived from a local surface supply and development of additional groundwater banking, it is expected to be insufficient to meet the estimated future demands.

Development of a local surface supply is going to be extremely costly and involve extensive environmental review and permitting. However, there may be some flood management benefits resulting from development of local surface storage

High levels of treatment of groundwater are assumed to meet M&I water quality needs with the associated treatment and brine disposal costs. Agricultural water quality needs may be more challenging to meet without imported surface water because the quantity of local surface water is limited.

The preliminary estimated cost of construction of this alternative for those elements that have been sufficiently quantified is in the range of $145 - $150 million. At this time, it has not been determined whether water level management is required. If it is, then additional costs will be incurred. Other items that have not been sufficiently quantified to cost include treatment for injection of water for aquifer storage and recovery (ASR), groundwater/surface water blending facilities and the potential income from water transfers. Estimates for acquisition of long-term contract entitlements are in the range of $1,000 ±/acre-foot, therefore it can be expected that potential income could be in the same order of magnitude.

11.2 Alternative #2 – 100% Imported Supply

As described earlier, this alternative is attractive because of the high quality imported surface water. However, it is not certain whether the quantities required to meet the demands are available to be purchased. In addition, the reliability of this supply is low relative to local supplies resulting in large volumes of storage to meet dry periods. Finally, imported surface

water causes water levels to rise requiring groundwater level management which will add to the cost of the alternative.

11.2.1 Demand and Supply Assumptions

For the purposes of identifying potential supplies to meet the philosophy of the alternative, the following summary is provided.

Estimated 2020 Demands	Potential Supplies to Meet Demands for Alternative
Municipal and Industrial = 7,740 AF	Imported Surface Water = 2,000 – 28,000 AF/yr
Agricultural and Other Supplies = 81,000 AF	Additional* Imported Surface Water = 59,940 – 86,740 AF/yr
Total = 88, 740 AF	**Total = 88,740 AF/yr**

* Annual cost of additional imported surface water estimated to be $300 –$500/AF in addition to initial cost of $1000/AF. This alternative will require groundwater pumping to lower water levels

11.2.2 Potential Facilities for Alternative

As shown in Table 11-2 and on Figure 11-2, the potential facilities that could used to implement for Alternative #2 are:

Municipal and Industrial Supply

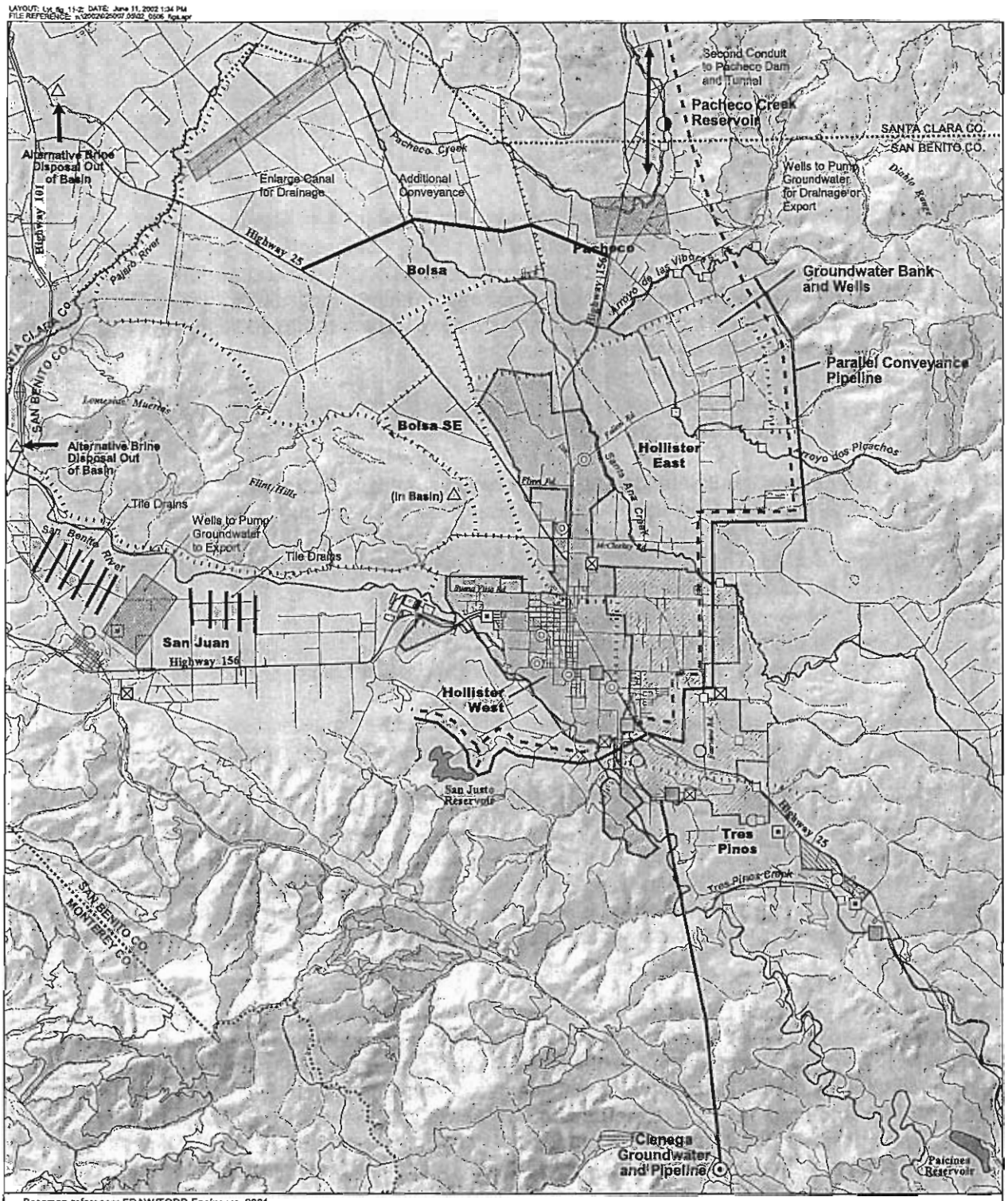
- Maintain Surface Water Importation – 2,000 – 6,200 AF
- Additional Imported Surface Water – 1,540- 5,740 AF – this quantity is relatively small and could likely be acquired
- Surface Water Treatment - 5 MGD Treatment in addition to planned 3 MGD at City of Hollister and City of San Juan Bautista

Agricultural Supply

- Maintain Surface Water Importation – 0 – 22,600 AF
- Additional Imported Surface Water - 58,400 - 81,000 AF – this quantity will be quite difficult and costly to acquire. As agricultural supply, it will be subject to the same restrictions in delivery during dry/critically dry years as current imported supplies.
- Second Conduit to Pacheco Dam and Tunnel and Other Pipelines – To deliver the additional imported surface water, additional facilities may be required. The size of the facility would depend on the additional supply acquired.

Table 11-2
Alternative 2 - 100% Imported Supply
Potential Project Elements and Sizes

Project Element	Agricultural Supplies (AF)	Municipal and Industrial Supplies(AF)	Facilities Required	Estimated Constr. Cost (10^6)	Notes
Municipal and Industrial Water Conservation		In place			
Agricultural Water Conservation		In place			
Salinity Education Program		In place			
Water Softener Ordinance		In place			
Maintain Surface Water Importation	0 - 22,600 AF	2,000 - 6,200 AF	Existing Facilities		Subject to cutback during dry year
Additional Imported Surface Water	58,400 - 81,000 AF	1,540 - 5,740 AF		$87 + cost of water @ ($200 - $500)/AF	Subject to cutback during dry year
Surface Water Treatment		5 MGD Additional Treatment	Surface water treatment facility	$10	Facilities planned for Hollister and San Juan Bautista have 3 MGD total capacity (3,400 AF/yr)
Second conduit to Pacheco Dam and Tunnel and other pipelines				$60 for second conduit + $15 for other pipes	
Imported Surface Water Storage Reservoir	not quantified at this time	not quantified at this time	61,000 AF Pacheco Reservoir	$100	Would not supply full storage required
Imported Surface Water Percolation	not quantified at this time	not quantified at this time	Existing Facilities		Imported water storage will be required to improve reliabilty
Groundwater Banking (ASR/Recharge)	not quantified at this time	not quantified at this time	ASR wells and/or recharge basins		Imported water storage will be required to improve reliabilty, goundwater not necessarily of high quality
Construct Local Conveyance Facilities	not quantified at this time	not quantified at this time	24" Pipeline parallel to Hollister conduit up to 13.8 miles	$16	24" pipeline provides up to 15 MGD (16,000 AF) of capacity
Water Transfers	will be required to acquire additional imported surface water				
Agricultural Effluent for Export (Tile Drains)	May be required but not quantified at this time				
Reclaimed M&I Effluent for Export	2,500 AF	1,000 AF	Effluent export will result in less percolation and will remove salt from basin		
Groundwater Pumping for Export	May be required but not quantified at this time				
Deepen Drainage	May be required but not quantified at this time				
Total Potential Supply	81,000 AF	7,740 AF		$288 for elements with estimated costs + annual cost of water	
Assumptions					
Estimated 2020 Agricultural and Other Demand = 81,000 AF					
Estimated 2020 Municipal & Industrial Demand = 7,740 AF					
Imported Supply = 2,000 - 28,000 AF					



Basemap reference: EDAW/TODD Engineers, 2001

LEGEND

- San Benito River Percolation Sites (1971)
- Wastewater Percolation Sites — Source: Hollister Area Urban Water Management Plan, 2000
- Hollister Municipal Wells — Source: Hollister Master Plan
- Effluent for Export
- Surface Water Treatment Facilities
- Brine Disposal
- Surface Water Reservoir
- Groundwater Treatment Facilities
- City of Hollister Water Service
- Sunnyslope County Water District
- Tres Pinos County Water District — Source: Groundwater management Plan for San enito County, April 1998, Figure 9
- Hollister Conduit San Felipe Water System — Source: Hollister Water Management Master Plan & Groundwater Management Plan, April 1998
- Discharge Point and Wetted Reach for Percolation of San Felipe Water — Source: Annual Groundwater Report, 1998-99

Note:
Water level management may be required.

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June, 2002

Figure 11-2

Additional Facilities That Are Not Quantified At This Time to Meet Reliability Goals

- Imported Surface Water Storage Reservoirs – although the Pacheco Creek Reservoir has been identified as a potential 61,000 AF storage facility, it is apparent that additional storage will be required to meet dry/critically dry years. However, insufficient information exists at this time to estimate the additional surface storage that may be available in the basin.
- Imported Surface Water Percolation
- Groundwater Banking (ASR/Recharge Basins)
- Construct Local Conveyance

In order to provide the dry/critically dry year supplies, additional storage inside or outside of the basin will be required. The size of these facilities has not been quantified at this time.

Additional Facilities That Are Not Quantified At This Time To Manage Water Levels

- Agricultural Effluent for Export (Tile Drains)
- Reclaimed M&I Effluent for Export
- Groundwater Pumping for Export
- Deepen Drainage in San Benito River and Miller Canal

The importation of additional surface water will cause water levels to rise and will hence require water level management. The size of these facilities has not been quantified at this time.

11.2.3 Summary of Issues/Benefits/Costs

As noted earlier in Section 8, the main issues with this alternative is that it will be institutionally challenging and expensive to meet the full 2020 demands with imported supply, if it is indeed possible. In addition, to provide adequate reliability of this alternative, extensive storage/banking facilities will have to be developed. Finally, high groundwater will be an issue that will require active management because the imported water will result in high groundwater levels.

Development of a surface storage for imported supplies is going to be extremely costly and involve extensive environmental review and permitting. Development of sufficient groundwater capacity necessary to provide high levels of reliability has not been quantified. However, it is uncertain if imported surface water that is banked in the local groundwater basin will retain the low TDS and boron levels. Use of banked water from entities such as the Kern Water Bank may be possible, but will require arrangements not only for the supply but for the conveyance as well, assuming that conveyance capacity in the facilities are available. Additional imported supplies will also require additional conveyance into the County that is also costly and may require extensive environmental review and permitting.

The high source water quality of imported surface water will reduce salt loads to the basin as water softening will be significantly reduced. Agricultural water quality needs will be met with the imported surface water.

The preliminary estimated cost of construction of this alternative for those elements that have been sufficiently quantified is approximately $288 million which the acquisition of long-term contract entitlements at a cost of $1,000 ±/acre-foot. Additional costs for water management

will be incurred but have not been quantified at this time. Other items that have not been sufficiently quantified to cost include treatment for injection of water for aquifer storage and recovery (ASR).

There are many facets of this alternative that make it expensive and difficult to implement.

11.3 Alternative #3 – Minimize Groundwater Quality Impacts

As described earlier, this alternative is attractive because of its focus on water quality improvements. To reduce salt loads to the basin, local surface water is a critical element of this alternative. It has not been determined whether there is sufficient quantity to meet the water quantity needs of this alternative. An additional surface water reservoir and the large groundwater basin can be managed for groundwater banking which produces considerable storage. The relatively low quality of the groundwater requires treatment for M&I supply.

11.3.1 Demand and Supply Assumptions

For the purposes of identifying potential supplies to meet the philosophy of the alternative, the following summary is provided.

Estimated 2020 Demands	Potential Supplies to Meet Demands for Alternative
Municipal and Industrial = 7,740 AF	Local Groundwater Yield = 54,000 AF/yr
Agricultural and Other Supplies = 81,000 AF	Imported Surface Water = 2,000 – 28,800 AF/yr
	Desalted Reclaimed Effluent = 3,500 AF/yr
	Additional Local Groundwater = 500 AF/yr
	New Local Surface Water Reservoir = 6,600 AF/yr
	Local Groundwater Bank* = 0 – 22,140 AF/yr
Total = 88,740 AF	**Total = 88,740 AF/yr**

* Groundwater Banking will require careful management of the groundwater basin.

11.3.2 Potential Facilities for Alternative

As shown in Table 11-3 and on Figure 11-3, the potential facilities that could used to implement for Alternative #3 are:

Municipal and Industrial Supply

- Additional Local Groundwater Supply at Cienega = 500 AF
- Develop Local Surface Storage at Pacheco = 6,600 AF/yr
- Surface Water Treatment – 2.7 MGD (3,000 AF) Treatment in addition to planned 3 MGD (3,400 AF) at City of Hollister and City of San Juan Bautista
- Utilize Existing Groundwater within Safe Yield – 1,500 AF/yr
- Groundwater Treatment – 1.8 MGD for 1,500 AF of produced water
- Desalt Reclaimed M&I Effluent for Reuse – 800 AF/yr of 4,500 AF/yr estimated supply. Desalting is for reducing salts.

Agricultural Supply

- Utilize Existing Groundwater within Safe Yield – 52,500 AF/yr
- Groundwater Banking (ASR/Recharge Basins) – 24,800 AF/yr
- Desalt Reclaimed M&I Effluent for Reuse – 3,700 AF/yr of 4,500 AF/yr estimated supply. Desalting is for reducing salts.

It should be noted that sustained withdrawals from the groundwater bank at this rate may not be feasible without causing significant groundwater overdraft.

Additional Facilities That Are Not Quantified At This Time That May Be Required To Manage Water Levels

- Agricultural Effluent for Export (Tile Drains)
- Groundwater Pumping for Export
- Deepen Drainage

It is uncertain at this time whether groundwater levels will be sufficiently high to require groundwater level management. If required, these additional project elements may have to be implemented at additional cost.

Other Necessary Toolbox Elements

- Water Transfers to provide funding for portion of funding for projects

11.3.3 Summary of Issues/Benefits/Costs

As noted earlier in Section 8, the diverse supply of this alternative, that includes some imported surface water, reclaimed water, local surface water, and groundwater, is expected to reliably meet the 2020 demand without overdraft conditions.

However, notwithstanding the water quality benefits, development of a local surface supply is going to be extremely costly and involve extensive environmental review and permitting. There may be some flood management benefits resulting from development of local surface storage. Desalting of reclaimed water improves the effluent quality such that it may be possible for reuse in a broader range of irrigation uses.

Table 11-3
Alternative 3 - Minimize Groundwater Quality Impacts
Potential Project Elements and Sizes

Project Element	Agricultural Supplies (AF)	Municipal and Industrial Supplies(AF)	Facilities Required	Estimated Constr. Cost ($10^6)	Notes
Municipal and Industrial Water Conservation	not applicable	In place			
Agricultural Water Conservation	In place	not applicable			
Salinity Education Program	In place	In place			
Water Softener Ordinance	In place	not applicable			
Maintain Existing Imported Supply	0 - 22,600 AF	2,000 - 6,200 AF	Existing facilites	none	water to be used for blending and substitution to meet philosophy of alternative
Additional Local Groundwater Extraction Facilities	not applicable	500 AF from Cienaga	Pipeline, wells	$5 for pipeline and wells	High quality water, does not require treatment
Develop Local Surface Water Storage		6,600 AF in Pacheco Creek Watershed	Dam	$100	Local water is lower in salt than imported water
Construct Local Conveyance Facilities	not quantified at this time		24" Pipeline parallel to Hollister Conduit up to 13.8 miles	$15	24" pipeline provides up to 15 MGD of capacity
Utilize Existing Groundwater within Safe Yield	52,500 AF	1,500 AF	Existing facilites		For reliabilty and blending, yield is allocated proportional to demand as required (up to 10% M&I and up to 90% agricultural)
Groundwater Banking (ASR/Recharge Basins)	0 - 22,140 AF		ASR / Extraction Wells and/or recharge basins	$5 - $10 for wells only + treatment (no cost estimate)	Water may vary in quality
Groundwater Treatment		1.8 MGD	Demineralization / softening	$5 for treatment + $10 for brine disposal	Brine export will remove salt from basin
Surface Water Treatment		2.7 MGD Additional Treatment	Surface water treatment facilities	$5 for 3 MGD	Facilities planned for Hollister and San Juan Bautiste have 3 MGD total capacity, 2.7 MGD additional
Groundwater/Surface Water Blending	not quantified at this time				
Desalt Reclaimed M&I Effluent for Reuse	2,700 AF	800 AF	Desalting facility	$10 for treatment + use same brine disposal as groundwater treatment	Alternative to effluent export, Desalting results in 80% product water, remaining 20% concentrated brine export will remove salt from basin
Water Transfers					Required to Fund Improvements
Reclaimed M&I Effluent for Export	-2,500	-1,000			Alternative to effluent desalting - Effluent export will remove salt from basin and remove potential water source if this project element is used
Groundwater Pumping for Expor	not quantified at this time				
Deepen Drainage	not quantified at this time				
Agricultural Effluent for Export (Tile Drains)	not quantified at this time				
Total Potential Supply	81,000 AF	7,740 AF		$155 - $160 for elements that have estimated costs	
Assumptions					
Estimated 2020 Agricultural and Other Demand = 81,000 AF					
Estimated 2020 Municipal & Industrial Demand = 7,740 AF					
Imported Supply = up to 22,800 AF					

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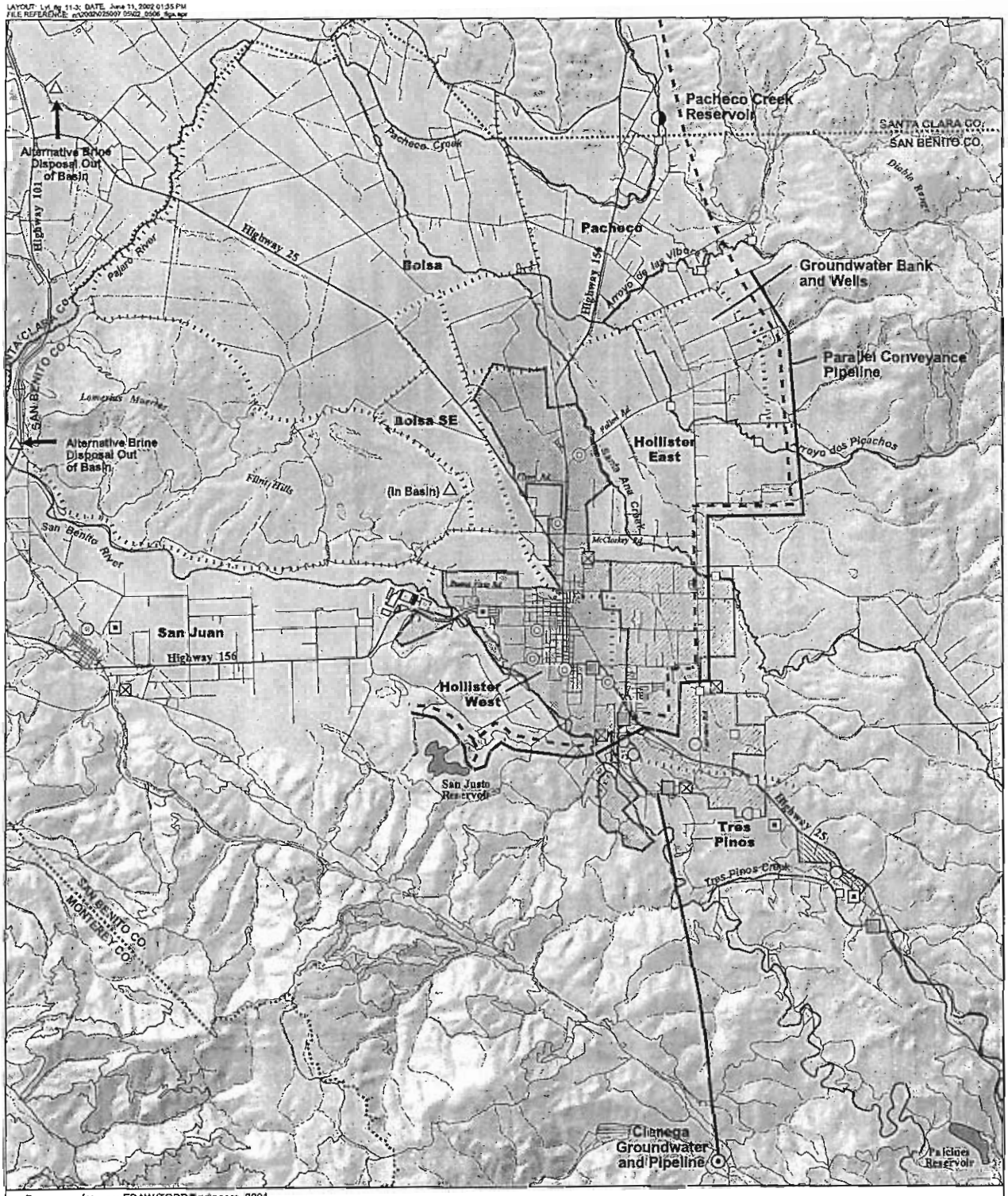

Basemap reference: EDAW/TODD Engineers, 2001

LEGEND

- San Benito River Percolation Sites (1971)
- Wastewater Percolation Sites
  Source: Hollister Area Urban Water Management Plan, 2000
- Hollister Municipal Wells
  Source: Hollister Master Plan
- Effluent Desalters for Irrigation
- Surface Water Treatment Facilities
- Brine Disposal
- Surface Water Reservoir
- Groundwater Treatment Facilities
- City of Hollister Water Service
- Sunnyslope County Water District
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  Source: Groundwater management Plan for San ecito County, April 1998, Figure 9
- Hollister Conduit San Felipe Water System
  Source: Hollister Water Management Master Plan & Groundwater Management Plan, April 1998
- Discharge Point and Wetted Reach for Percolation of San Felipe Water
  Source: Annual Groundwater Report, 1998-99

Note:
Water level management may be required.

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Kennedy / Jenks Consultants

Water Resources Association of San Benito County

ALTERNATIVE NO. 3
MINIMIZE GROUNDWATER QUALITY IMPACTS
EXAMPLE PROJECT ELEMENTS

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June, 2002

Figure 11-3

Some treatment of groundwater is included to meet M&I water quality and reliability needs with the associated treatment and brine disposal costs. Agricultural water quality needs should be met with the availability of imported surface water for blending with groundwater and for substitution in some areas.

The preliminary estimated cost of construction of this alternative for those elements that have been sufficiently quantified is in the range of $155 - $160 million. At this time, it has not been determined whether water level management is required. If it is, then additional costs will be incurred. Other items that have not been sufficiently quantified to cost include treatment for injection of water for aquifer storage and recovery (ASR), groundwater/surface water blending facilities and the potential income from water transfers if not all of the contract entitlement is used. Estimates for acquisition of long-term contract entitlements are in the range of $1,000 ±/acre-foot, therefore it can be expected that potential income could be in the same order of magnitude.

11.4 Alternative #4 – Least Cost Alternative

As described earlier, this alternative is attractive because of its focus on least cost facilities. It appears that there is sufficient quantity between the imported surface water and groundwater to meet the water quantity needs of this alternative. The large groundwater basin can be managed for groundwater banking which produces considerable storage. The relatively low quality of the groundwater requires treatment for M&I supply.

11.4.1 Demand and Supply Assumptions

For the purposes of identifying potential supplies to meet the philosophy of the alternative, the following summary is provided.

Estimated 2020 Demands	Potential Supplies to Meet Demands for Alternative
Municipal and Industrial = 7,740 AF	Local Groundwater Yield = 54,000 AF/yr
Agricultural and Other Supplies = 81,000 AF	Imported Surface Water = 2,000 – 28,800 AF/yr
	Reclaimed Effluent = 3,500 AF/yr
	Local Groundwater Bank* = 6,140 – 24,540 AF/yr
Total = 88, 740 AF	**Total = 88,740 AF/yr**

* Groundwater Banking will require careful management of the groundwater basin.

11.4.2 Potential Facilities for Alternative

As shown in Table 11-4 and on Figure 11-4, the potential facilities that could used to implement for Alternative #4 are:

Municipal and Industrial Supply

- Additional Local Groundwater Supply from Cienega= 500 AF
- Maintain Surface Water Importation – 2,000 – 6,200 AF
- Surface Water Treatment – 2.7 MGD (3,000 AF) Treatment in addition to planned 3 MGD (3,400 AF) at City of Hollister and City of San Juan Bautista
- Reclaimed M&I Effluent for Reuse – 1,000 AF/yr of 4,500 AF/yr estimated supply
- Utilize Existing Groundwater within Safe Yield – 3,700 – 5,900 AF/yr
- Groundwater Treatment – 4.1 MGD to 6.0 MGD (for 3,700 -5,900 AF of produced water)
- Brine Disposal

Agricultural Supply

- Utilize Existing Groundwater within Safe Yield – 48,100 - 50,300 AF
- Groundwater Banking (ASR/Recharge Basins) – 4,600 - 29,400 AF
- Reclaimed M&I Effluent for Reuse – 3,500 AF/yr of 4,500 AF/yr estimated supply

Additional Facilities That Are Not Quantified At This Time to Better Manage Basin

- Groundwater Banking (ASR/Recharge Basins)
- Construct Local Conveyance

Table 11-4
Alternative 4-Most Cost Effective Mix of Local and Imported Water Supplies
Potential Project Elements and Sizes

Project Element	Agricultural Supplies (AF)	Municipal and Industrial Supplies(AF)	Facilities Required	Estimated Constr. Cost ($10^6)	Notes
Municipal and Industrial Water Conservation	not applicable	in place			
Agricultural Water Conservation	In place	not applicable			
Salinity Education Program	In place	in place			
Water Softener Ordinance	not applicable	not applicable			
Maintain Surface Water Importation	0 - 22,600 AF	2,000 to 6,200 AF	none required		High quality water requires treatment
Additional Local Groundwater Extraction Facilities		500 AF from Cienega	Pipeline, wells	$5 for pipeline and wells	High quality water does not require treatment
Reclaimed M&I Effluent for Reuse	2,500 AF	1,000 AF	Title 22 Reclaimed and Conveyance	$15.5 - $25 for 4 MGD treatment	Estimated supply in 2020. Do not need to desalt because of high M&I Supply. Proportional between Ag and M&I can vary
Construct Local Conveyance Facilities	not quantified at this time		24" Pipeline parallel to Hollister conduit up to 13.8 miles	$15	24" pipeline provides up to 15 MGD (16,000 AF) of capacity
Utilize Existing Groundwater within Safe Yield	49,760 - 53,960 AF	40 - 4,240 AF	7 - 2,600 gpm wells (29,400 AF)	no cost, use existing facilities	
Groundwater Banking (ASR/Recharge Basins)	4,600 - 29,400 AF		ASR/Extraction Wells and/or recharge basins	$5 - $10 for wells only + treatment	Water may vary in quality
Groundwater Treatment		up to 4 MGD	Demineralization/ softening	$10 for treatment + $10 for brine disposal	Alternative to export, desalting results in 80% product water, remaining 20% concentrated brine export will remove salt from basin, water will remain in basin for use
Surface Water Treatment		2.7 MGD (3,000 AF) additional treatment	Surface water treatment	$5 for 3 MGD	Facilities planned for Hollister and San Juan Bautista have 3 MGD total capacity, 2.7 MGD additional treatment
Groundwater/Surface Water Blending	not quantified at this time				Blending to help improve delivered water quality
Water Transfers					Required to fund improvements
Deepen Drainage	not quantified at this time				
Agricultural Effluent for Export (Tile Drains)	not quantified at this time				
Tree Belt Evapotranspiration	not quantified at this time				
Total Potential Supply	81,000 AF	7,740 AF		Range: $55 to $70 for elements that have estimated costs	
Assumptions					
Estimated 2020 Agricultural and Other Demand = 81,000 AF					
Estimated 2020 Municipal & Industrial Demand = 7,740 AF					
Imported Supply = up 28,800 AF					
Develop Local Surface Water Storage					

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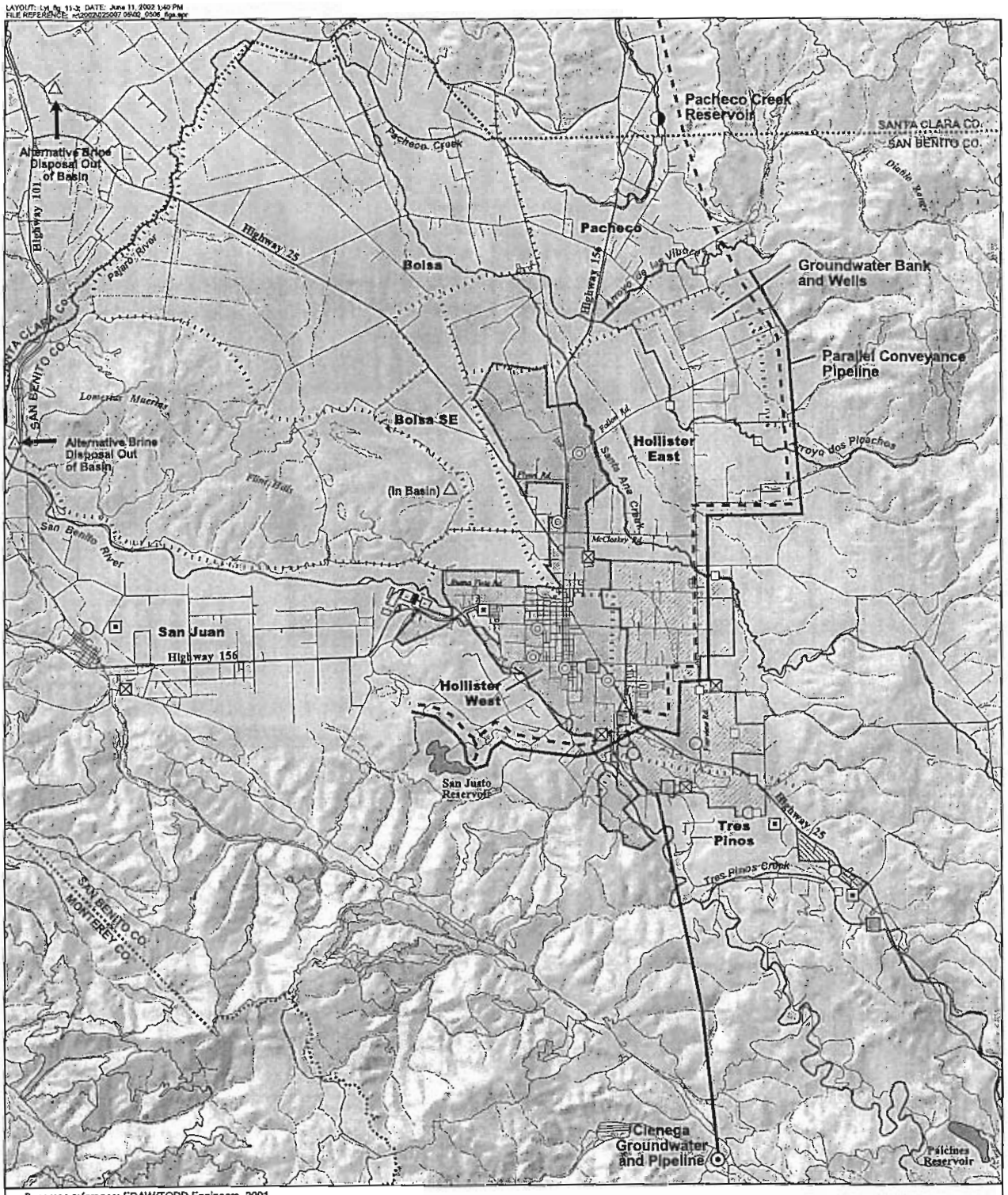

Basemap reference: EDAW/TODD Engineers, 2001

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LEGEND

- San Benito River Percolation Sites (1971)
- Wastewater Percolation Sites
  Source: Hollister Area Urban Water Management Plan, 2000
- Hollister Municipal Wells
  Source: Hollister Master Plan
- Effluent for Reuse
- Surface Water Treatment Facilities
- Brine Disposal
- Surface Water Reservoir
- Groundwater Treatment Facilities
- City of Hollister Water Service
- Sunnyslope County Water District
- Tres Pinos County Water District
  Source: Groundwater management Plan for San enito County, April 1998, Figure 9
- Hollister Conduit San Felipe Water System
  Source: Hollister Water Management Master Plan & Groundwater Management Plan, April 1998
- Discharge Point and Wetted Reach for Percolation of San Felipe Water
  Source: Annual Groundwater Report, 1998-99

Note:
Water level management may be required.

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Water Resources Association of San Benito County

ALTERNATIVE NO. 4
MOST COST EFFECTIVE
MIX OF LOCAL/IMPORTED SUPPLY
EXAMPLE PROJECT ELEMENTS

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June, 2002

Figure 11-4

Additional Facilities That Are Not Quantified At This Time That May Be Required To Manage Water Levels

- Agricultural Effluent for Export (Tile Drains)
- Groundwater Pumping for Export
- Deepen Drainage

It is uncertain at this time whether groundwater levels will be sufficiently high to require groundwater level management. If required, these additional project elements may have to be implemented at additional cost.

Other Necessary Toolbox Elements

- Water Transfers to provide for portion of funding for projects if all imported water contracts are not utilized

11.4.3 Summary of Issues/Benefits/Costs

As noted earlier in Section 8, this alternative, has quite a diverse supply that includes some imported surface water, reclaimed water, and groundwater, that are in total expected to reliably meet the 2020 demand without overdraft conditions.

Some treatment of groundwater is included to meet M&I water quality and reliability needs with the associated treatment and brine disposal costs. Agricultural water quality needs should be met with the availability of imported surface water. Groundwater/surface water blending is considered a means of maximizing the use of the water supply while at the same time improving the water quality to some users.

Operation of a groundwater bank is also an important element of this alternative because of the added reliability gained from groundwater banking. As part of groundwater banking and groundwater management in general, it is expected that water level management will occur such that additional facilities, except to manage localized drainage issues, will not be required.

The preliminary estimated cost of construction of this alternative for those elements that have been sufficiently quantified is in the range of $55 - $70 million. Other items that have not been sufficiently quantified to cost include treatment for injection of water for aquifer storage and recovery (ASR), groundwater/surface water blending facilities and the potential income from water transfers if not all of the contract entitlement is used. Estimates for acquisition of long-term contract entitlements are in the range of $1,000 ±/acre-foot, therefore it can be expected that potential income could be in the same order of magnitude.

11.5 Summary of Planning-Level Estimate of Cost of Construction for Selected Elements for All Alternatives

Once again, the intent of this section is to illustrate how each of these alternatives could be implemented. Other balances between project toolbox elements
Table 11-5 below summarizes the range of costs for the alternatives.

Table 11–5: Summary of Preliminary Estimated Costs of Constructions Project Alternatives

Alternative #	Planning-Level Estimate of Cost of Construction for Elements With Estimated Costs	Notes
1 – 100% Local Supply	$145 - $150 million	Not determined that Alternative can meet water quantity needs without overdraft, water quality for M&I should be met, agriculture may have more variable delivered water quality
2 – 100% Imported Supply	$288 million plus annual cost of additional water	Not determined that Alternative can meet water quantity needs reliably, high quality water delivered when available
3 – Minimize Groundwater Quality Impacts	$155 - 160 million	Alternative expected to meet water quantity needs, should result in improved delivered water quality over present conditions
4 – Most Cost Effective Mix of Imported and Surface Water	$55 - $70 million	Alternative expected to meet water quantity needs, should result in improved delivered water quality over present conditions

The principal difference between the first 3 alternatives and the 4th alternative is that the 4th alternative does not include the construction of the local surface water reservoir near Pacheco Creek. The cost of the reservoir at $100 million is sufficiently large it overshadows other cost elements. In order to fully develop comparative costs for the alternatives, additional analysis regarding operation of the basin at the sub-basin level must be conducted.

However, there is a dividing line between Alternatives 1, 2, and 3 and Alternative 4 with respect to cost, and reliability.

Section 12: Preliminary Conclusions

Based on the first stage evaluation of alternatives and the development of projects and planning-level estimates of cost of construction, it appears at this time that Alternative #4 has the greatest probability of fulfilling the objectives and criteria that have been developed at the least cost. Additional analysis regarding the costs of the elements and the other potential impacts of the projects should be conducted during the PEIR process.

Appendix A

Summary of References

Summary of References

Applied Science and Engineering, Inc., Pajaro River Watershed Water Quality Management Plan, prepared for Association of Monterey Bay Area Governments, June-99

Barry J. Miller, Planning Consultant, San Juan Bautista General Plan Update, Draft for Public Review, Environmental Impact Report Addendum, March-98

Barry J. Miller, Planning Consultant, San Juan Bautista General Plan Update, Final Environmental Impact Report Addendum, June-98

Bracewell Eng., City of Hollister, Industrial Treatment Plant, 1999 Annual Self Monitoring Report, January-00

Bracewell Eng., City of Hollister, Domestic Treatment Plant, 1999 Annual Self Monitoring Report,

Bracewell Engineering, Master Plan Update for Domestic WWTP prepared for City of Hollister, April-97

Bracewell Engineering, 1999 Annual Self-Monitoring Report - Permit CA 0047912 prepared for City of San Juan Bautista, January-00

California Regional Water Quality Control Board, WDR for Sunnyslope County Water District, Ridgemark Estates Subdivision - No. 89-58, April-89

California Regional Water Quality Control Board, Staff Report for Regular Meeting of February 4, 2002, Item 8, Reissuance of Waste Discharge Requirements, National Pollutant Discharge Elimination System Permit No. CA0047902 prepared for City of San Juan Bautista, November-99

California Regional Water Quality Control Board, Revised Waste Discharge Requirements Order No. 00-020; City of Hollister Industrial Wastewater Treatment Facility, San Benito County, September-00

California Water Quality Control Board, Status Report on Hollister Treatment Plants and San Benito County Groundwater Management Plan Update, February-02

CDWR, Investigation of Effects of Hollister Industrial Waste upon Underlying Groundwater 1965-66, July-66

CH2M Hill, Draft Program - Environmental Impact Report for the Consolidated and Conformed Place of Use, December-97

Chabot Kilburn, Ground-water Hydrology of the Hollister and San Juan Valleys, San Benito County, California 1913-1968, August-72

City of Hollister, City of Hollister Ordinance No. 959 (Growth Management), September-01

City of Hollister, Final EIR, Domestic to Industrial WWTP Diversion Project, December-99

City of Hollister, General Plan North County Inset, 1993

City of Hollister, Draft Environmental Impact Report Dom. WWTP to Industrial WWTP Diversion Project, October-99

City of San Juan Bautista, San Juan Bautista General Plan Update Environmental Impact Report, March-98

CM Analytical, Inc., Wastewater Treatment Facilities, Exhibit B,General Mineral &Physical, & Inorganic Chemical Analysis prepared for Sunnyslope County Water District, December-02

Creegan & D'Angelo-McCandless Consulting Engineers, Draft Environmental Impact Report, San Felipe Project, Public Law I 30 Loan Application, Formation of Zone 6 Benefit Area, July-77

Creegan & D'Angelo-McCandless Consulting Engineers, Draft Master Report, San Felipe Project, Public Law I 30 Loan Application, Formation of Zone 6 Benefit Area, July-77

Creegan & D'Angelo-McCandless Consulting Engineers, Application for Loan Under Public Law I 30 to Construct Distribution Facilities for the San Felipe Division of the Central Valley Project, May-79

Creegan & D'Angelo-McCandless Consulting Engineers, Groundwater Report 1990, March-90

Creegan & D'Angelo-McCandless Consulting Engineers, Groundwater Report 1992, March-92

Creegan & D'Angelo-McCandless Consulting Engineers, 1991- 1992 Water Year GW report 1993, March-93

Creegan & D'Angelo-McCandless Consulting Engineers, 1992- 1993 Water Year GW report 1994, March-94

Creegan & D'Angelo-McCandless Consulting Engineers, 1993- 1994 Water Year GW report 1995, March-95

Creegan & D'Angelo-McCandless Consulting Engineers, 1994- 1995 Water Year GW report 1996, March-96

CSO International, Associated Engineers-Surveying Services, Inc., A Wastewater Treatment and Disposal System for Ridgemark Estates Subdivision, San Benito County, April-73

Department of Health Services - Drinking Water Field Operations Branch, Sunnyslope County Water District - Water System # 3510003 Annual Inspection,

Dickson, Bonneau, and Kenneth D. Schmidt and Associates, Effluent Handling Capacity Study prepared for City of Hollister, June-98

Dickson, Bonneau, and Kenneth D. Schmidt and Associates, Report on Stress Testing of Infiltration Beds, Domestic Wastewater Treatment Plant prepared for City of Hollister], January-99

Duncan and Jones, Hearing Draft General Plan (planning analysis and development) prepared for City of Hollister, December-93

Duncan and Jones, et al., General Plan 1995 - 2010 prepared for City of Hollister, November-95

E.J. Helley, Data for Observation Wells in San Benito County, CA - USGS Open File Report, May-65

Earth Systems Consultants Northern California, Percolation and Permeability Test Results, Santa Ana Creek Master Storm Drain Plan, December-96

EDAW, Draft Groundwater Management Plan and Programmatic EIR Existing Conditions, January-02

Environmental Science Associates, City of San Juan Bautista Infrastructure Improvements Program, April-02

Henneman, Kenneth. Draft Water Needs Assessment for Zone 6. 2000.

Hem, John D, Study and Interpretation of the Chemical Characteristics of Natural Water - USGS WS-Paper 2254, 1985

G. W. Kapple, Digital Model of the Hollister Valley Ground-Water Basin, San Benito County, California - USGS WRI 79-32, March-79

Jones & Stokes, Final Annual Groundwater Report for the Year 2001, January-02

Jones & Stokes Associates, 1995- 1996 Water Year GW report, March-97

Jones & Stokes Associates, 1996- 1997 Water Year GW report, February-98

Jones & Stokes Associates, 1997- 1998 Water Year GW report, January-99

Jones & Stokes Associates, 1998- 1999 Water Year GW report, December-99

Jones & Stokes Associates and CH2MHill, Groundwater Management Plan for the San Benito County Part of the Gilroy/Hollister Groundwater Basin, April-98

Kennedy/Jenks Consultants, Wastewater Treatment Facilities, Exhibit C, Tech Memo - Salts Loading Reduction to Wastewater Treatment Facilities as a Resut of Changing from Groundwater to Memebrane Filtered Surface Water prepared for Sunnyslope County Water District, March-02

Kern County Water Agency and San Luis Delta - Mendota Water Authority, A Study of the Performance of the State Water Project and the Central Valley Project During a Repeat of the 1987-1992 Drought, October-99

L.I. Rosenberg, Final Technical Report, Liquefaction Susceptibility of the Hollister Area, San Benito County, CA, February-98

Local Agency Formation Commission, Inventory of Local Agencies Monterey County, CA, June-05

Luhdorff & Scalmanini Consulting Engineers, San Benito County Groundwater Investigation, October-91

Luhdorff & Scalmanini Consulting Engineers, Evaluation of Ground-Water Conditions Aromas Area, San Benito County, April-92

Metcalf & Eddy, Groundwater Surface Maximum Planning Elevations, Hollister and San Juan Valleys, December-92

Meyers, Nave, Riback, Silver & Wilson, Responses to DEIR Comments, San Juan Bautista General Plan Update, June-98

Monterey Bay National Marine Sanctuary, Action Plan IV: Agriculture and Rural Lands, October-99

Monterey County, 21st Century Monterey County General Plan, Draft, December-01

Montgomery Watson, Wastewater Treatment Facilities, Sunnyslope County Water District - Recycled Water Sturdy, Final, November-02

Norris Udell, San Benito County Water Conservation and Flood Control District, Hernandez and Paicines Project Report, May-56

Regional Water Quality Control Board, California Regional Water Quality Control Board - WDR 87-47, City of Hollister Domestic WW Treatment Facility,

Robert E. Faye, Mathematical Model of the San Juan Valley Ground-water Basin, San Benito California - USGS WRI 58-73, August-74

San Benito County, San Benito County Ordinance No. 751(Growth Management), April-02

San Benito County Water District, Pilot Study for Groundwater Inject Well Program - Initial Study, January-95

San Benito County Water District, Zone 3 and Zone 6 Annual Percolation and Groundwater Recharge Program, San Benito River Detention Berms, March-94

San Benito County Water District, Zone 3 Report, Zone 6 Operations and Water Supply, Percolation Report for July 2000, August-00

San Benito Engineering & Surveying, Inc., Sunnyslope County Water District - Salt Management Program, recent

San Benito Engineering & Surveying, Inc., Wastewater Treatment Facilities, February 2001 prepared for Sunnyslope County Water District, February-02

San Benito Engineering & Surveying, Inc., Wastewater Treatment Facilities, Exhibit A, Well Data Sheet prepared for Sunnyslope County Water District, February-02

Santa Clara County, Santa Clara County General Plan 1995 - 2010, December-94

Schaaf & Wheeler, Stormwater Management and Improvement Plan, Santa Anna Creek - San Felipe Lake Area, July-99

Schaaf & Wheeler and Jones & Stokes, Hollister Area Urban Water Management Plan 2000, July-99

Schmidt & Associates, Groundwater Conditions and Infiltration Rates, September-97

State of California, Department of Finance., Revised Historical City: County, and State Population Estimates, 1991 - 2000, with 1990 and 2000 Census Counts, March-02

State Water Resources Control Board, Agreement No. 9-141-250-0, Agreement for Scope of Work SWRCB-EXA (2/2/98) for a comprehensive groundwater monitoring program, August-00

State Water Resources Control Board, Draft EIR for the Consolidated and Conformed Place of Use, December-97

Sunnyslope County Water District, Ridgemark Estates Wastewater Treatment Facilities-Report of Waste Discharge Renewal Application, June-00

Todd Engineers, Paicines Ranch Groundwater Resources for Ridgemark Corporation, May-94

Todd Engineers, Southside Lake GW Monitoring Study prepared for Granite Rock Company, July-94

Todd Engineers, GW resources study for Sunnyslope, Ph 2, November-94

U.S Bureau of Reclamation, San Felipe Division Environmental Statement V.1, March-76

U.S. Bureau of Reclamation, Reconnaissance Report, Hollister Project, Pajaro River Basin, CA, January-54

USDA, Soil Survey, San Benito County, California, November-69

Walters Eng. And Kennedy, Jenks, Chilton Consulting Engineers, Comparative Costs of Service Versus Groundwater Service from the San Felipe Supply for the City of Hollister and the Sunnyslope County Water District, May-89

Walters Engineering, Draft Results for San Felipe Road - McClosky Road Test Bore and Test Well, and San Felipe Road - Wright Road Test Bore and Recommended Completion of City Well No. 1 at the NW Corner San Felipe Rd. and Wright Rd., January-94

Walters Engineering, Summary, City of Hollister, CA Results of 1993-94 Test Boring and Well Program, May-94

Walters Engineering, City of Hollister Results of 1992-94 Test Boring and Well Program, May-94

Walters Engineering, Water Master Plan Update prepared for City of Hollister, September-96

Walters Engineering, Draft Preliminary Engineering Report for Water prepared for Tres Pinos County Water District, June-99

Water for San Benito County, Report and Recommendations, 1968

California Regional Water Quality Control Board - WDR 00-020, City of Hollister Industrial WW Treatment Facility, May-00

San Benito County General Plan Section Summaries, Various dates.

APPENDIX C

AIR QUALITY MANAGEMENT PLAN CONSISTENCY DETERMINATION

AMBAG
ASSOCIATION OF MONTEREY BAY AREA GOVERNMENTS

June 30, 2003

JUL 2003
RECEIVED
San Benito County
Water District

John Gregg
District Manager - Engineer
San Benito County Water District
P.O. Box 899
Hollister, CA 95024-0899

Dear Mr. Gregg:

This letter is in response to your June 5, 2003 request for a determination of consistency of the Ground Water Management Plan Update for the San Benito County part of the Gilroy-Hollister Groundwater Basin (GWMP Update) with the *2000 Air Quality Management Plan for the Monterey Bay Region* (AQMP).

During our June 25 phone conversation, you stated the GWMP Update is designed to meet the needs of population growth allowed for in each jurisdiction's General Plan. Table 2 attached to you letter, lists the GWMP Update's estimates for the 2022 population for Hollister, San Juan Bautista and unincorporated San Benito County based on growth management ordinances enacted by each jurisdiction. The estimated 2022 population used in the GWMP Update (77,495) is less than the population forecasted for San Benito County by 2020 (80,653) from the *AMBAG 1997 Regional Population and Employment Forecast*.

Since the GWMP Update supports jurisdiction's existing land use policies that are expected to limit population growth to less then the population forecasted for San Benito County in the *AMBAG 1997 Regional Population and Employment Forecast*, the GWMP Update is **consistent** with the AQMP.

Please feel free to contact Todd Muck of our staff if you have any questions about this determination.

Sincerely,

Todd A Muck

for Nicolas Papadakis
Executive Director

cc: Janet Brennan, MBUAPCD

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APPENDIX D

ESTIMATED OUT-OF-BASIN EXPORT-WATER QUANTITIES AND WATER QUALITY

Kennedy/Jenks Consultants

2191 East Bayshore Road, Suite 200
Palo Alto, California 94303
650-852-2800
650-856-8527 (Fax)

Final Technical Memorandum Estimating Water Quantity and Quality for Export from Hollister Area of San Benito County

25 July 2003

REGISTERED PROFESSIONAL ENGINEER
SACHIKO ITAGAKI
C 50221
Exp. 6/30/05
CIVIL
STATE OF CALIFORNIA
7/26/03

Prepared for

Water Resources Association of San Benito County
30 Mansfield Road, P.O. Box 899
Hollister, CA 95024-0899

K/J Project No. 025007.05

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Section 1: Introduction and Summary

Information regarding the individual and composite flow and concentration of potential waste discharges was required as part of the preparation of the Program Environmental Impact Report (PEIR) under preparation for the Groundwater Management Plan Update for the San Benito Portion of the Gilroy-Hollister Basin (GMP Update). The GMP Update includes project options such as river discharge or pipeline export of: wastewater effluent, groundwater treatment concentrate, agricultural drainage, and/or groundwater for water level control projects.

The flow and concentration for each the four waste streams above over the 20-year planning horizon were initially developed during a group working session on 1 April 2003. During the working session, total dissolved solids (TDS) was identified as the representative constituent for the analysis since salts were a major concern and TDS data are readily available for the four waste streams. The flow and concentration assumptions were further refined during discussions with WRA agency staff as well as with discussions with consultants to the various WRA member agencies. This technical memorandum serves to document the final results of the assumptions regarding flow and TDS concentration for each of the four waste streams.

1.1 Summary of Results

Table 1 below summarizes the flow and TDS concentration for the wastewater effluent, groundwater treatment concentrate, agricultural drainage, and groundwater for water level control projects over the near-term (3 to 5 years), mid-term (6 to 10 years), and far-term (11 to 20 years). Within each of these time periods, the estimates were divided between winter and summer, and then further sub-divided, as appropriate based on potential variations in hydrologic cycle (i.e. wet, average, or dry year types).

Table 2 below summarizes the estimated salt mass loadings from the various sources and the totals. These tables also appear in the Hydrology and Water Quality Section – Impacts section of the PEIR.

Table 1: Summary of Estimated Flows and TDS Concentration

			Wastewater Effluent		Groundwater Desalting Concentrate		Groundwater Pumping		Agricultural Drains		Blended Flows	
Years in Future	Season	Hydrologic year type	Flow (MGD)	TDS Concentration (mg/L)	Flow (MGD)	TDS Concentration (mg/L)	Flow (MGD)	TDS Concentration (mg/L)	Flow (MGD)	TDS Concentration (mg/L)	Total Flow (MGD)	TDS Concentration (mg/L)
3-5 (Near-term)	Winter	Dry	0.95	1,000	0.00	-	3.57	1,250	2.20	2,000	6.7	1,500
		Wet	0.95	1,000	0.00	-	3.57	1,250	4.20	1,400	8.7	1,300
		Average	0.95	1,000	0.00	-	3.57	1,250	4.20	1,800	8.7	1,500
	Summer	Dry	0.95	1,200	0.00	-	3.57	1,250	0.78	2,000	5.3	1,400
		Wet	0.95	1,200	0.00	-	3.57	1,250	1.49	1,400	6.0	1,300
		Average	0.95	1,200	0.00	-	3.57	1,250	0.78	1,800	5.3	1,300
6-10 (Mid-term)	Winter	Dry	1.29	800	1.50	2,600	2.23	1,250	2.20	2,000	7.2	1,700
		Wet	1.29	800	0.50	2,600	2.23	1,250	4.20	1,400	8.2	1,300
		Average	1.29	800	1.00	2,600	2.23	1,250	4.20	1,800	8.7	1,600
	Summer	Dry	0	0	1.50	2,600	2.23	1,250	0.78	2,000	4.5	1,800
		Wet	0	0	1.50	2,600	2.23	1,250	1.49	1,400	5.2	1,700
		Average	0	0	1.50	2,600	2.23	1,250	0.78	1,800	4.5	1,800
11-20 (Far-term)	Winter	Dry	1.49	800	1.50	2,600	0.89	1,250	2.20	2,000	6.1	1,700
		Wet	1.49	800	0.50	2,600	0.89	1,250	4.20	1,400	7.1	1,300
		Average	1.49	800	1.00	2,600	0.89	1,250	4.20	1,800	7.6	1,600
	Summer	Dry	0	0	1.50	2,600	0.89	1,250	0.78	2,000	3.2	2,100
		Wet	0	0	1.50	2,600	0.89	1,250	1.49	1,400	3.9	1,800
		Average	0	0	1.50	2,600	0.89	1,250	0.78	1,800	3.2	2,000

Table 2: Summary of Estimated Salt Mass Loading

			Wastewater Effluent		Groundwater Desalting Concentrate		Groundwater Pumping		Agricultural Drain		
Years in Future	Season	Hydrologic year type	Tons of Salt/Six Months	Tons/ yr	Tons of Salt/Six Months	Tons/ yr	Tons of Salt/Six Months	Tons/yr	Tons of Salt/Six Months	Tons/yr	Blended Tons/yr
3-5 (Near-term)	Winter	Dry	700	1,600	-	–	3,400	6,800	3,300	4,500	12,900
		Wet	700	–	-	–	3,400	–	4,500	6,100	14,500
		Average	700	–	-	–	3,400	–	5,700	6,800	15,200
	Summer	Dry	900	–	-	–	3,400	–	1,200	–	–
		Wet	900	–	-	–	3,400	–	1,600	–	–
		Average	900	–	-	–	3,400	–	1,100	–	–
6-10 (Mid-term)	Winter	Dry	800	800	3,000	6,000	2,100	4,200	3,300	4,500	15,500
		Wet	800	–	1,000	4,000	2,100	–	4,500	6,100	15,100
		Average	800	–	2,000	5,000	2,100	–	5,700	6,800	16,800
	Summer	Dry	0	–	3,000	–	2,100	–	1,200	–	–
		Wet	0	–	3,000	–	2,100	–	1,600	–	–
		Average	0	–	3,000	–	2,100	–	1,100	–	–
11-20 (Far-term)	Winter	Dry	900	900	3,000	6,000	800	1,600	3,300	4,500	13,000
		Wet	900	–	1,000	4,000	800	–	4,500	6,100	12,600
		Average	900	–	2,000	5,000	800	–	5,700	6,800	14,300
	Summer	Dry	0	–	3,000	–	800	–	1,200	–	–
		Wet	0	–	3,000	–	800	–	1,600	–	–
		Average	0	–	3,000	–	800	–	1,100	–	–

Section 2: Wastewater Effluent

The basis for estimating each of the components of flow and concentration are described in greater detail below and summarized in the table found in Section 2.3.

2.1 Flow Estimate Development

2.1.1 General Approach

Wastewater effluent flow quantities are estimated based on 20-year water demand projections that are derived from population estimates and per capita water demand factors, as is described in the GMP Update, Section 3. Sunnyslope County Water District (SCWD) is not expected to contribute any wastewater discharge to the river and/or the export pipeline during the 20-year planning horizon, therefore is not included in this technical memorandum.

The water demands are multiplied by factors that reflect the proportion of the water that is used that is discharged into the sanitary sewer system. Variability of flows between winter and summer for this component of flow reflects the initiation of summer-time direct reuse of the wastewater effluent in water recycling programs that are expected to occur in the mid-term (6 – 10 years). No significant variation in wastewater effluent flow is expected as a result of hydrologic variation, therefore this topic is not included in this discussion.

2.1.2 Near-term Flow Estimates

The water demand for the City of Hollister (COH) and the City of San Juan Bautista (CSJB) during year 5 of the 20-year planning horizon was used as the initial basis for the near-term flow estimates. Based on information provided by Gus Yates, the COH wastewater flow was estimated to be 60% of the water demand. A factor of 90% multiplied by the water demand to estimate wastewater flows was used for CSJB. The total estimated wastewater flow that is produced is the sum of the COH and CSJB wastewater flows.

The total wastewater flow was then adjusted by subtracting 2 MGD of percolation from the COH wastewater treatment plant which would not be discharged directly to the river or to the pipeline. This 2 MGD of percolation was assumed to occur throughout the 20-year planning horizon. In addition, in the near-term, the CSJB flow of 250,000 gpd was also subtracted from the total wastewater flow estimate since it is assumed that it would not be discharged directly to the river or to the pipeline in the near-term.

No variation in wastewater flow is expected between the winter and summer, and between, wet, average, and dry years.

2.1.3 Mid-term and Far-term Flow Estimates

As in the near-term, the water demand within the 20-year planning horizon for the City of Hollister (COH) and the City of San Juan Bautista (CSJB) were used as the initial basis for estimating wastewater flows. Year 10 water demands were used for the mid-term flow

estimates and year 20 water demands were used for the far-term flow estimates. As in the near-term flow estimates, the COH wastewater flow was estimated to be 60% of the water demand and the CSJB wastewater flow was estimated to be 90% of the water demand. The total estimated wastewater flow that is produced is the sum of the COH and CSJB wastewater flows.

For winter time flows to the river or pipeline, the total wastewater flow was then adjusted by subtracting 2 MGD of percolation from the COH wastewater treatment plant since this flow would not be discharged to the river or to the pipeline. In the mid-term and far-term the CSJB flow of 250,000 gpd was not subtracted from the total wastewater flow estimate since it is expected that CSJB will discharge the wastewater to either the San Benito River or to the pipeline if the opportunity were available in the winter. No variation in wastewater flow is expected between, wet, average, and dry years in the winter time.

In the summer time, it is expected that by the mid-term and into the far-term, direct recycled water use is occurring from all sources and no flows will be discharged to the river or to the pipeline.

2.2 Concentration Estimate Development

2.2.1 General Approach

The TDS concentration in wastewater is expected to decrease over time since efforts are currently underway to improve the quality of the source water used in the service area and consequently reduce the use of brine generating water softeners. The wastewater TDS concentrations were based on local source water TDS concentrations with additions for typical municipal activities and for brine generating softeners.

2.2.2 Near-term Concentration Estimates

The COH and SCWD brought the Lessalt water filtration plant on-line in November 2002 to deliver 300 mg/L TDS San Felipe CVP surface water to portions of the COH and SCWD water service area. As a consequence, the wastewater flow to the COH wastewater treatment plant has in its source water, a blend of San Felipe CVP surface water and local groundwater. COH staff provided information regarding the proportion of San Felipe CVP surface water and local groundwater as summarized below.

Table 3: Seasonal Proportions of Groundwater and Surface Water Use in Hollister

Season	Groundwater (mgd/% of total)	Surface Water (mgd/% of total)
Summer	5.02 mgd/68% of total	2.4 mgd/32% of total
Winter	1.23 mgd/34% of total	2.4 mgd/66% of total

The TDS concentration of San Felipe CVP surface water is estimated to be 300 mg/L and the native groundwater in the COH and SCWD area is 800 mg/L. Using the flow proportions and TDS concentration of the two source waters, a composite summertime source water TDS concentration of 640 mg/L and a wintertime source water TDS of 470 mg/L was calculated.

In addition, municipal uses and water softeners contribute salts to wastewater. An estimate of 300 mg/L of TDS addition from municipal uses was used. An estimate of 250 mg/L of TDS addition from softeners was used (Schmidt, 1999).

Therefore, the total estimated TDS in the wastewater effluent in the summertime is : 650 mg/L + 300 mg/L +250 mg/L or 1,190 mg/L. A value of 1,200 mg/L was used for this analysis.

The total estimated TDS in the wastewater effluent in the wintertime is : 470 mg/L + 300 mg/L +250 mg/L or 1,020 mg/L. A value of 1,000 mg/L was used for this analysis.

2.2.3 Mid-term and Far-term Concentration Estimates

Source waters in the mid-term and far-term are expected to be a blend of treated groundwater and San Felipe CVP surface water that will achieve the GWMP Update water quality goal of delivering potable water with TDS of 500 mg/L. In addition to the delivery of higher quality source water, public outreach to eliminate the use of brine generating water softeners will be initiated thus eliminating the 250 mg/L of TDS addition from water softeners. Therefore, the estimated municipal effluent TDS is 800 mg/L which is the source water TDS of 500 mg/L with the addition of 300 mg/L of TDS from municipal uses.

2.3 Summary of Estimates of Wastewater Effluent Flows, TDS Concentrations, and Salt Mass

Based on the combinations of timing, flow, and TDS concentration for the near-term (3 – 5 years), mid-term (6 – 10 years) and far-term (11 – 20 years), the table below summarizes the estimated values of flow, TDS concentration and Tons of Salt/six months.

Table 4: Summary of Estimates of Wastewater Effluent Flows, TDS Concentrations, and Salt Mass

Years in Future	Season	Hydrologic year type	Flow (MGD)	TDS Concentration (mg/L)	Tons of Salt/Six Months
3-5	Winter	Dry	0.95	1,000	700
3-5	Winter	Wet	0.95	1,000	700
3-5	Winter	Average	0.95	1,000	700
3-5	Summer	Dry	0.95	1,200	900
3-5	Summer	Wet	0.95	1,200	900
3-5	Summer	Average	0.95	1,200	900
6-10	Winter	Dry	1.29	800	800
6-10	Winter	Wet	1.29	800	800
6-10	Winter	Average	1.29	800	800
6-10	Summer	Dry	0	0	0
6-10	Summer	Wet	0	0	0
6-10	Summer	Average	0	0	0
11-20	Winter	Dry	1.49	800	900
11-20	Winter	Wet	1.49	800	900
11-20	Winter	Average	1.49	800	900
11-20	Summer	Dry	0	0	0
11-20	Summer	Wet	0	0	0
11-20	Summer	Average	0	0	0

Section 3: Groundwater Desalting Concentrate

The basis for estimating each of the components of flow and concentration are described in greater detail below and summarized in the table found in Section 3.3.

3.1 Flow Estimate Development

The need for the groundwater desalting facilities varies with the availability of other less expensive water supplies. In order to reduce the need to decommission and recommission desalting facilities, it is assumed that they are operated year-round with summer flow rates being higher than winter flow rates as described in greater detail below.

Desalting concentrate flow estimates are based on 80% recovery (i.e. 80% of the volume of the water that is passed through the desalting membranes can be recovered for use, the remaining 20% is the concentrate). Therefore, the maximum concentrate production of 1.5 MGD is associated with a potable water production rate of 7.5 MGD and the minimum concentrate production of 0.5 MGD is associated with a potable water production rate of 2.5 MGD. The maximum production rate is based on an assumption that CVP Municipal and Industrial water deliveries will be significantly curtailed and therefore, more treated groundwater will be needed.

3.1.1 Winter Flow Estimates

Winter-time desalting concentrate flows are assumed to vary by hydrologic year with a minimum of 0.5 MGD of concentrate production during the wet hydrologic years when it is expected that more surface water is available for treatment and delivery. During an average hydrologic year, it has been assumed that 1.0 MGD of concentrate will be produced (5 MGD of potable water production) and during a dry hydrologic year, 1.5 MGD of concentrate will be produced.

3.1.2 Summer Flow Estimates

Desalting concentrate production in the summer-time is assumed to be at the full production rate of 1.5 MGD (7.5 MGD of potable water production) which is the estimated capacity of the groundwater treatment facility.

3.2 Concentration Estimate Development

The TDS concentration of the concentrate is estimated to be 2,600 mg/L. This is based on an influent TDS concentration of 800 mg/L, a potable water delivered TDS concentration of 500 mg/L, and the 80% recovery rate for the desalting process.

3.3 Summary of Estimates of Groundwater Desalting Concentrate Flows, TDS Concentrations, and Salt Mass

Based on the combinations of timing, flow, and TDS concentration for the near-term (3 – 5 years), mid-term (6 – 10 years) and far-term (11 – 20 years), the table below summarizes the estimated values of flow, TDS concentration and Tons of Salt/six months

Table 5: Summary of Estimates of Groundwater Desalting Concentrate Flows, TDS Concentrations, and Salt Mass

Years in Future	Season	Hydrologic year type	Flow (MGD)	TDS Concentration (mg/L)	Tons of Salt/Six Months
3-5	Winter	Dry	0.00	-	-
3-5	Winter	Wet	0.00	-	-
3-5	Winter	Average	0.00	-	-
3-5	Summer	Dry	0.00	-	-
3-5	Summer	Wet	0.00	-	-
3-5	Summer	Average	0.00	-	-
6-10	Winter	Dry	1.50	2,600	3,000
6-10	Winter	Wet	0.50	2,600	1,000
6-10	Winter	Average	1.00	2,600	2,000
6-10	Summer	Dry	1.50	2,600	3,000
6-10	Summer	Wet	1.50	2,600	3,000
6-10	Summer	Average	1.50	2,600	3,000
11-20	Winter	Dry	1.50	2,600	3,000
11-20	Winter	Wet	0.50	2,600	1,000
11-20	Winter	Average	1.00	2,600	2,000
11-20	Summer	Dry	1.50	2,600	3,000
11-20	Summer	Wet	1.50	2,600	3,000
11-20	Summer	Average	1.50	2,600	3,000

Section 4: Groundwater Pumping for Export

The basis for estimating each of the components of flow and concentration are described in greater detail below and summarized in the table found in Section 4.3.

4.1 Flow Estimate Development

4.1.1 Near-term Flow Estimates

The flow estimates for groundwater pumping in the San Juan Sub-basin are the same for near-term, mid-term, and far-term because groundwater pumping is most likely part of long-term water level management. Groundwater pumping is expected to occur year-round and in specific areas.

In the San Juan Sub-basin, high groundwater occurs in less than half of the area of the Sub-basin. Most of the high groundwater is the result of shallow, low permeability soils which have been remedied with agricultural drains. In a small fraction of the Sub-basin, estimated at less than 5%, artesian conditions that could benefit from groundwater pumping exist. In order to remedy artesian conditions, it has been estimated that an average pumping rate of 0.89 mgd (1,000 AF/yr) is necessary. (G. Yates, personal communications, 13 May 2003).

In the western part of the Hollister West Sub-basin adjacent to the San Juan Sub-basin, groundwater pumping at a rate of 2.68 MGD (3,000 AF/yr) is necessary to manage high groundwater levels resulting from wastewater percolation that cannot be directly reused through recycling or cannot be redistributed to areas where it can be beneficially reused because of a lack of infrastructure.

For the purposes of this analysis, no variation in groundwater pumping rates are assumed to occur as a result of hydrologic variability.

4.1.2 Mid-term Flow Estimates

As in the near-term, groundwater pumping from the San Juan Sub-basin will occur at a rate of 0.89 mgd (1,000 AF/yr). It is expected that groundwater pumping from the western part of the Hollister West Sub-basin will be reduced from 2.68 mgd (3,000 AF/yr) in the near-term to 1.34 mgd (1,500 AF/yr) in the mid-term as projects for recycled water for direct reuse and/or infrastructure to redistribute water are constructed. Recycled water for direct reuse becomes more viable in the mid-term as the quality of the wastewater effluent improves as a result of projects to improve source water quality.

For the purposes of this analysis, no variation in groundwater pumping rates are assumed to occur as a result of hydrologic variability.

4.1.3 Far-term Flow Estimates

As in the near-term and mid-term, groundwater pumping from the San Juan Sub-basin will occur at a rate of 0.89 mgd (1,000 AF/yr). It is expected that groundwater pumping from the western part of the Hollister West Sub-basin will be reduced from 1.34 mgd (1,500 AF/yr) in the mid-term to 0 mgd in the far-term as all projects for recycled water for direct reuse and/or infrastructure to redistribute water are constructed and all water resources within San Benito County are coordinated and managed for use.

For the purposes of this analysis, no variation in groundwater pumping rates are assumed to occur as a result of hydrologic variability.

4.2 Concentration Estimate Development

4.2.1 Near-term, Mid-term and Long-term Concentration Estimates

For the purposes of this analysis, it has been assumed that TDS concentrations for pumped groundwater in the San Juan Sub-basin or the western portion of the Hollister West Sub-basin is 1,250 mg/L.

4.3 Summary of Estimates of Groundwater Pumping Flows, TDS Concentrations, and Salt Mass

Based on the combinations of timing, flow, and TDS concentration for the near-term (3 – 5 years), mid-term (6 – 10 years) and far-term (11 – 20 years), the table below summarizes the estimated values of flow, TDS concentration and Tons of Salt/six months.

Table 6: Summary of Estimates of Groundwater Pumping Flows, TDS Concentrations, and Salt Mass

Years in Future	Season	Hydrologic year type	Flow (MGD)	TDS Concentration (mg/L)	Tons of Salt/Six Months
3-5	Winter	Dry	3.57	1,250	3,400
3-5	Winter	Wet	3.57	1,250	3,400
3-5	Winter	Average	3.57	1,250	3,400
3-5	Summer	Dry	3.57	1,250	3,400
3-5	Summer	Wet	3.57	1,250	3,400
3-5	Summer	Average	3.57	1,250	3,400
6-10	Winter	Dry	2.23	1,250	2,100
6-10	Winter	Wet	2.23	1,250	2,100
6-10	Winter	Average	2.23	1,250	2,100
6-10	Summer	Dry	2.23	1,250	2,100
6-10	Summer	Wet	2.23	1,250	2,100
6-10	Summer	Average	2.23	1,250	2,100
11-20	Winter	Dry	0.89	1,250	800
11-20	Winter	Wet	0.89	1,250	800
11-20	Winter	Average	0.89	1,250	800
11-20	Summer	Dry	0.89	1,250	800
11-20	Summer	Wet	0.89	1,250	800
11-20	Summer	Average	0.89	1,250	800

Section 5: Agricultural Drain Flows

The basis for estimating each of the components of flow and concentration are described in greater detail below and summarized in the table found in Section 5.3. The development of flow and concentration estimates for agricultural drain flows is based on a draft Technical Memorandum of 27 April 2003 entitled, "Flow and Salt Content of Groundwater and Drain Water Discharges in the San Juan Valley" by Gus Yates, a consultant to the San Benito County Water District.

5.1 Flow Estimate Development

The flow estimates for agricultural drain flows are based on eleven measurements of flow and salinity between June 1999 and October 2002 in San Juan Creek at Anzar Road and the San Benito River at Y Road. The flow data are summarized below.

Table 7: Summary of Flows in San Juan Creek at Anzar Road and San Benito River at Y Road

	cfs	gpm	MGD
Anzar Summer	1.10	494	0.71
Anzar Winter	3.50	1571	2.26
Anzar Average	2.20	987	1.42
Y Road Summer	0.10	45	0.06
Y Road Winter	3.00	1346	1.94
Y Road Average	1.20	539	0.78

San Juan Creek flows include agricultural drain flows since no surface runoff or tributary inflow was observed during the data collection effort. San Benito River flows include shallow groundwater discharge that is assumed to contain agricultural drainage components as well. It has been assumed that because of the relative locations of the monitoring locations that the two flows can be added together to arrive at the total flow into the San Benito River/Pajaro River System.

5.1.1 Summer Flow Estimates

5.1.1.1 Dry and Average Hydrologic Years

In the summertime, it was assumed that for dry and average hydrologic years, the total flow would be the sum of the summer flows at Anzar Road and Y Road.

5.1.1.2 Wet Hydrologic Years

In the summertime in wet hydrologic years, it was assumed that the total flow would be the sum of the summer flow at Anzar Road and the average flow at Y Road for a slightly higher

summertime flow. During wet hydrologic years, it is expected that groundwater levels will be higher and therefore more flow will occur even in the summertime.

5.1.2 Winter Flow Estimates

5.1.2.1 Dry Hydrologic Years

During dry hydrologic years in the wintertime, the total estimated flow is calculated as the sum of the average flow at Anzar Road and the average flow at Y Road. This would reflect a lower flow than might usually occur during an average or wet hydrologic year in the wintertime.

5.1.2.2 Wet and Average Hydrologic Years

During wet and average hydrologic years, the total estimated flow was calculated as the sum of the winter flows at Anzar Road and at Y Road.

5.2 Concentration Estimate Development

As with the flow estimates, the concentration estimates are based on eleven measurements between June 1999 and October 2002. The concentrations were initially measured as electrical conductivity (EC) in uS/cm. A conversion, based on a regression analysis from a number of samples where both salinity and TDS were measured was used. The conversion is TDS = 0.721* EC-125. (Yates, personal communication 1 May 2003). The values in uS/cm and TDS (mg/L) are summarized below.

Table 8: Summary of Electrical Conductivity and TDS in San Juan Creek at Anzar Road and San Benito River at Y Road

Location	EC (uS/cm)	TDS (mg/L)
Anzar Low Salinity	2,300	1,533
Anzar High Salinity	3,100	2,110
Anzar Average Salinity	2,800	1,894
Y Road Low Salinity	1,600	1,029
Y Road High Salinity	3,600	2,471
Y Road Average Salinity	2,600	1,750

5.2.1 Near-term, Mid-term and Long-term Concentration Estimates

For the purposes of this analysis, the data in Table 5 were evaluated and the following estimates used in the near-term, mid-term and long-term.:

Dry Year Salinity for both sources = 2,000 mg/LTDS

Wet Year Salinity for both sources = 1,400 mg/L TDS

Average Year Salinity for both sources = 1,800 mg/L TDS

5.3 Summary of Estimates of Agricultural Drain Flows, TDS Concentrations, and Salt Mass

Based on the combinations of timing, flow, and TDS concentration for the near-term (3 – 5 years), mid-term (6 – 10 years) and far-term (11 – 20 years), the table below summarizes the estimated values of flow, TDS concentration and Tons of Salt/six months

Table 9: Summary of Estimates of Agricultural Drain Flows, TDS Concentrations, and Salt Mass

Years in Future	Season	Hydrologic year type	Flow (MGD)	TDS Concentration (mg/L)	Tons of Salt/Six Months
3-5	Winter	Dry	2.20	2,000	3,300
3-5	Winter	Wet	4.20	1,400	4,500
3-5	Winter	Average	4.20	1,800	5,700
3-5	Summer	Dry	0.78	2,000	1,200
3-5	Summer	Wet	1.49	1,400	1,600
3-5	Summer	Average	0.78	1,800	1,100
6-10	Winter	Dry	2.20	2,000	3,300
6-10	Winter	Wet	4.20	1,400	4,500
6-10	Winter	Average	4.20	1,800	5,700
6-10	Summer	Dry	0.78	2,000	1,200
6-10	Summer	Wet	1.49	1,400	1,600
6-10	Summer	Average	0.78	1,800	1,100
11-20	Winter	Dry	2.20	2,000	3,300
11-20	Winter	Wet	4.20	1,400	4,500
11-20	Winter	Average	4.20	1,800	5,700
11-20	Summer	Dry	0.78	2,000	1,200
11-20	Summer	Wet	1.49	1,400	1,600
11-20	Summer	Average	0.78	1,800	1,100

References

Schmidt, Kenneth D., Letter to Jim Perrine regarding the DWTP – IWTP Diversion Project. August 16, 1999.

Yates, Gus. draft Technical Memorandum "Flow and Salt Content of Groundwater and Drain Water Discharges in the San Juan Valley". 23 April 2003.

Yates, Gus. Personal Communication. 1 May 2003 and 13 May 2003.

APPENDIX E

BIOLOGICAL RESOURCES REPORT

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SAN BENITO GROUNDWATER MANAGEMENT PLAN BIOTIC RESOURCES SECTION PROGRAMMATIC ENVIRONMENTAL IMPACT REPORT

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1.0 ENVIRONMENTAL SETTING

1.1 PROJECT DESCRIPTION

The proposed project is the adoption and implementation of a San Benito County Groundwater Management Plan, hereafter called the Management Plan, which includes goals and objectives for short-term and long-term management of water resources in Northern San Benito County within the Gilroy-Hollister Groundwater Basin (Figure 1). The Management Plan addresses surface and groundwater management as well as wastewater treatment discharges and use of reclaimed water supplies. The proposed project is intended to provide reliable, sustainable, good quality water for existing and future agricultural, municipal and industrial (M&I) uses in accordance with the goals and objectives of the Plan.

The Management Plan combines existing water resources programs and new project elements and activities into an integrated strategy for managing the surface and groundwater resources within the area and imported surface water from the San Felipe Project. The plan addresses management of resources on a sub-basin basis. Existing programs and activities of local agencies in the groundwater Management Plan include: water conservation, salinity education, existing groundwater extraction facilities, surface water importation, continuation of wastewater effluent percolation, and in-basin water banking. New programs include: development and improvement of high quality local ground and surface water supplies, water banking, surface water treatment, groundwater treatment, use of reclaimed wastewater effluent, regional and local conveyance pipelines for water supply distribution, groundwater pumping for groundwater level and water quality management, and out-of basin export of effluent, concentrate, groundwater or agricultural drainage water and discharge to the San Benito River or Monterey Bay.

The Management Plan is intended to address the following issues related to water quantity and water quality in the Basin:

Water Quantity

- Existing imbalance of areas with high and low groundwater
- Pending imbalance of supply and demand due to planned growth
- Existing and pending inability to adequately dispose of wastewater
- Frequent reduction of long-term imported water supplies and lower quality local supplies

Water Quality

- Increasing total dissolved solids (TDS) — salts are accumulating in the Basin and constrain beneficial uses
- Hardness affects urban supplies and leads to water softeners that further add salts to the Basin
- Nitrates have accumulated in some groundwater sub-basins, affecting beneficial uses
- Effective water quality protection is lacking

1.1.1 New Projects and Activities

The proposed Groundwater Management Plan Update outlines a number of new projects and activities that may be used to manage water supplies, groundwater levels, water quality, and/or wastewater effluent disposal. The possible locations of some of these new projects and activities are shown on Figure 2. An overview of possible new projects used to manage water supplies, groundwater levels, water quality and/or wastewater effluent disposal and activities is provided below.

1.1.1.1 Regional and Local Conveyance Facilities for Water Supply Distribution

The Groundwater Management Plan Update proposes a system of regional and local water conveyance pipelines that would extend from State Route (SR) 25 east to the existing Hollister Conduit in the Pacheco subbasin and southerly to the eastern edge of the San Juan subbasin (refer to Figure 2). The 18-inch pipeline could be used to move a range of source waters between subbasins. These waters could include imported and/or local surface water, pumped groundwater or a blend of these waters.

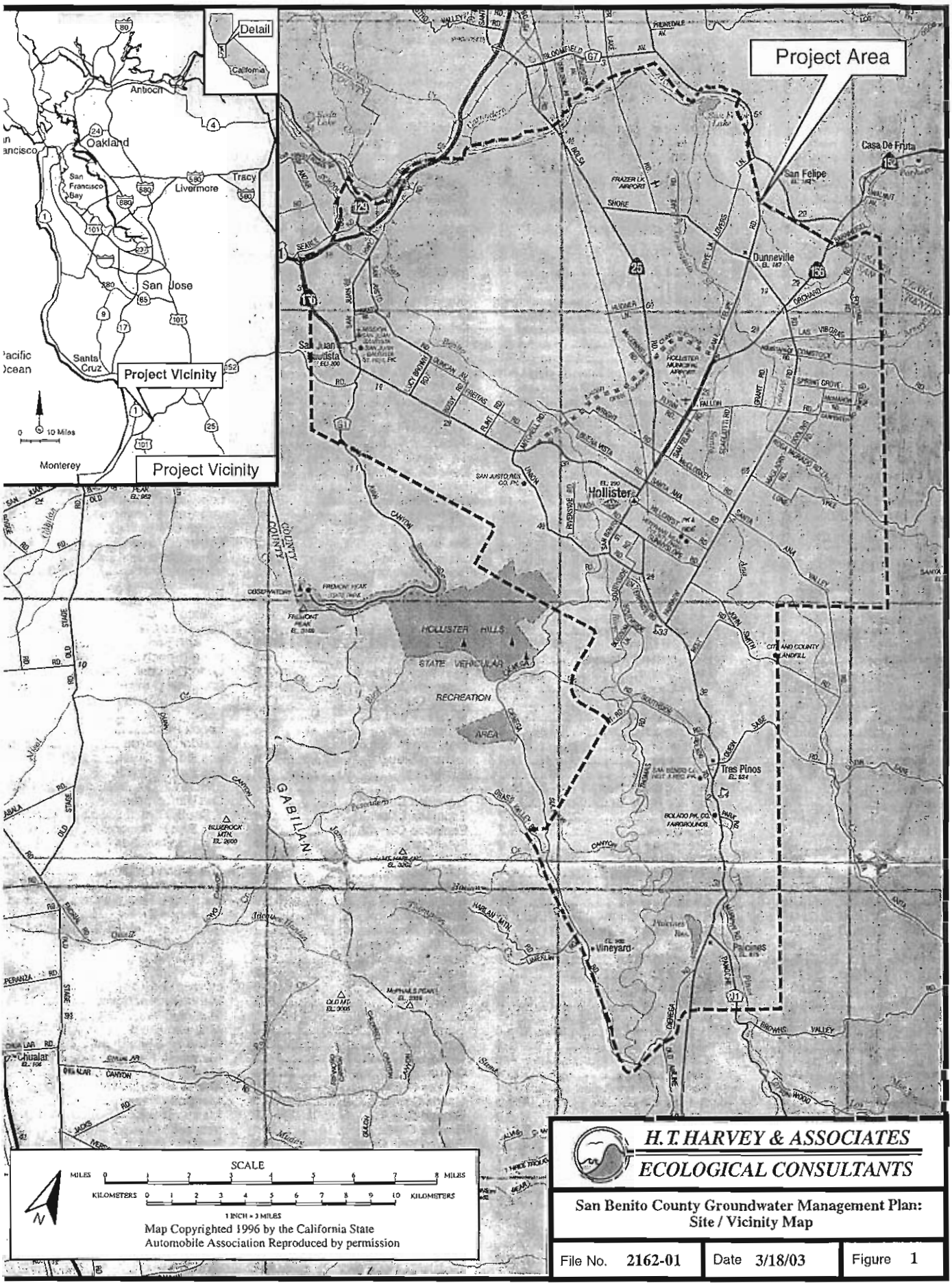
While the exact alignments have not yet been determined, Segments A-D of the conveyance facilities would consist of approximately 13.8 miles of pipeline located approximately 10-15 feet away from and parallel to the existing Hollister Conduit or along existing roads. Segment A could also include an intertie with the imported (San Felipe) water delivery system operated by the San Benito County Water District. Segment E would consist of approximately 7.5 miles of pipeline along Shore Road and other roads to SR 25. Pump stations and additional local conveyance pipelines may also be required as a part of the water conveyance system.

1.1.1.2 In-Basin Water Banking

In-lieu water banking involves the use of imported or surface water as a water supply rather than pumped groundwater. The groundwater that is not pumped remains in storage. Local, in-basin water banking would be a component of water resources management for both water supply and groundwater levels.

In addition to the continuation of existing in-basin water banking, the Groundwater Management Plan Update includes increased local water banking in the groundwater aquifer, including use of local surface water as a source. Possible mechanisms for increased local water banking include the following:

- *In-lieu banking of imported and/or local surface water* (Figure 2). Currently, local surface water is not used directly as part of an in-lieu banking program. This would be a new activity.
- *Injection of imported and/or local surface water into groundwater storage and extraction of water from wells.* A technique known as Aquifer Storage and Recovery (ASR) facilities are specially designed wells that can be used to inject and extract water from groundwater aquifers.



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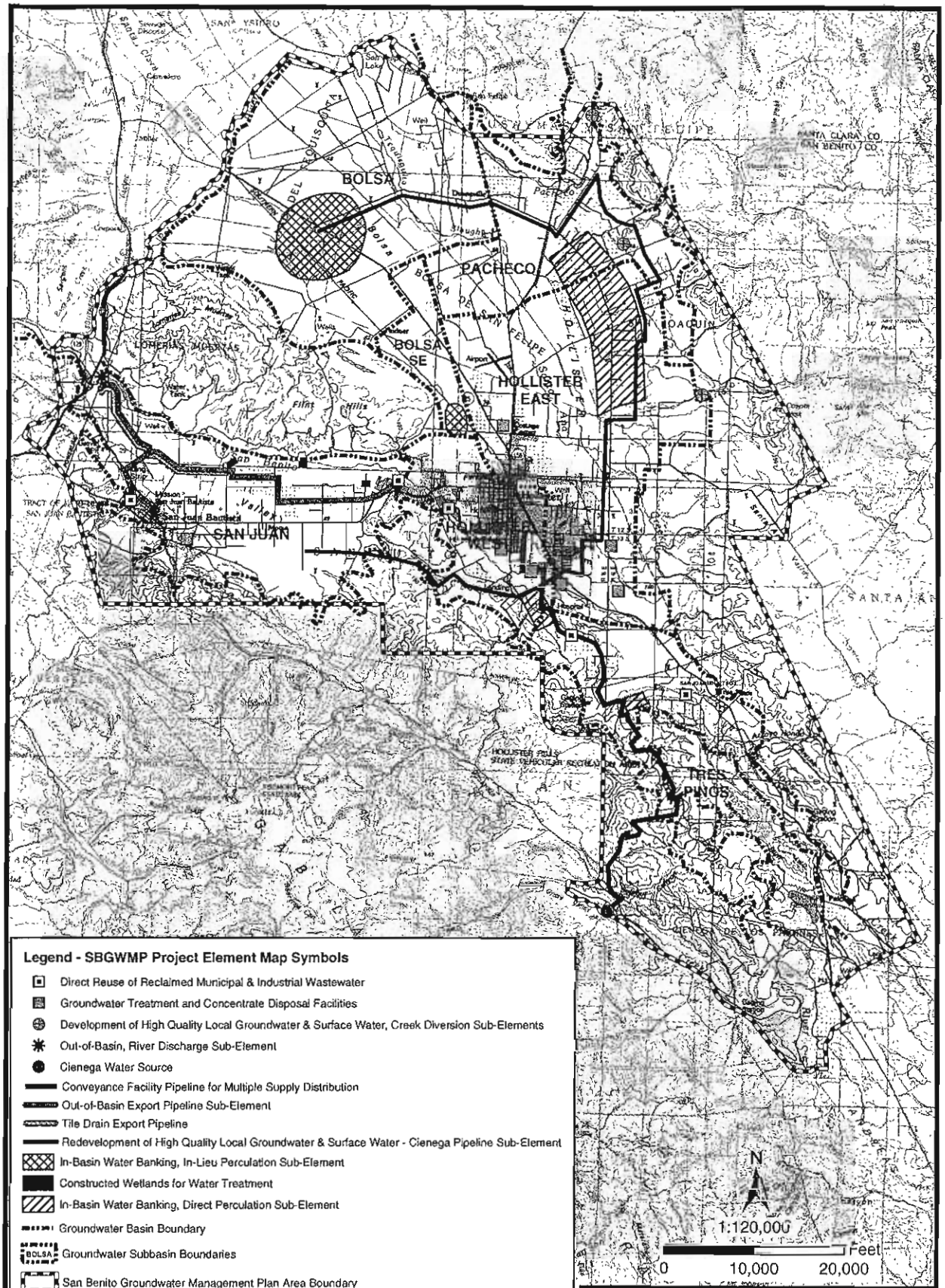
San Benito County Groundwater Management Plan: Site / Vicinity Map

File No. 2162-01	Date 3/18/03	Figure 1



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San Benito County Groundwater Management Plan: Project Toolbox Elements

File No. 2162-01	Date 6/20/03	Figure 2

- *Artificial direct percolation of imported and/or local surface water* This technique involves the percolation of water in high permeability river or drainage channels for storage in the groundwater basin. Existing and possible new percolation sites are shown on Figure 2.

1.1.1.3 Development or Redevelopment of High Quality Local Groundwater and Surface Water Supplies

Possible new local water sources within the Basin include:

- Redevelopment of the City of Hollister's groundwater well and pipeline at Cienega Valley (Figure 2);
- Development of groundwater resources in the Pacheco subbasin and Hollister East subbasin for transfer to other subbasins;
- Development of surface water on Arroyo Dos Picachos, Arroyo Los Viboras, and Pacheco Creek using seasonal diversion dams (Figure 2).

Water from these sources could be percolated in-place, if in-stream percolation and storage capacity is available in the groundwater aquifer, it could be directed into surface water pipeline systems for conveyance to a water banking area or it could be delivered directly to agricultural or municipal and industrial water users.

1.1.1.4 Groundwater/Surface Water Blending Facilities

The Groundwater Management Plan Update proposes the use of blending facilities for groundwater and surface water to provide water of suitable water quality for agricultural and municipal and industrial users. Blending facilities could be used to regulate the concentration of total dissolved solids in agricultural water or municipal and industrial water.

Blending facilities could be located on a concrete pad approximately 20 feet by 20 feet in size. Facilities could include meters and controls to connect to groundwater wells. An inline mixer could be required to facilitate full blending. Additional piping for blended and unblended water may be required.

1.1.1.5 Groundwater Treatment

Two to five facilities for the demineralization and softening of water to remove hardness (primarily calcium and magnesium) and total dissolved solids could be used to treat groundwater for municipal and industrial water users. The purpose of using centralized demineralization or softening facilities would be to reduce salt loads from individual water softener systems to the wastewater treatment system, and ultimately the groundwater basin. The exact location and capacity of these facilities has not been determined though certain areas have been proposed close to existing groundwater wells (Figure 2).

The salt concentrate generated by the groundwater treatment process could be evaporated and subsequently trucked to a landfill or salt processor, or highly concentrated brines could be

conveyed by tanker truck to the City of Watsonville Wastewater Treatment Plan for discharge through their ocean outfall (refer to *Out-of Basin Export,* below).

1.1.1.6 Direct Reuse of Reclaimed Municipal and Industrial Wastewater

The Groundwater Management Plan Update identifies opportunities for the reuse of reclaimed wastewater effluent from the City of Hollister, San Juan Bautista and Sunnyslope County Water District service area (Figure 2). Possible uses of reclaimed water in the Basin include commercial, residential, park and golf course irrigation, agriculture, construction and other traditional uses. New pipelines would be required to distribute reclaimed water to possible users.

1.1.1.7 Tile Drains for Groundwater Level Management

Shallow, impermeable clay layers produce locally perched groundwater in some areas of the San Juan subbasin. Tile drains could be used to drain agricultural fields with locally high water levels. Tile drains are perforated pipes, installed above the impermeable clay layer that allows groundwater to drain to the surface or a drainage ditch.

A master collection pipeline, as shown on Figure 2, could be used to centralize collection of the agricultural drainage water and convey it away from downstream properties. The pipeline could terminate at a river discharge point or an export pipeline, as discussed under Out-of Basin Export of Wastewater/Concentrate/Pumped Groundwater or Agricultural Drainage Water, below. Alternatively, water from tile drains could be conveyed to constructed wetlands for treatment, prior to discharge to a creek or river (refer to the discussion under Constructed Wetlands for Water Treatment).

1.1.1.8 Tree Belt Evapotranspiration for Groundwater Level Management or Wastewater Disposal

High water-use trees, such as eucalyptus and coast redwood, generally lower local groundwater levels. One technique that could be used to reduce localized high water levels in agricultural fields is the planting of high water-consuming trees. This approach could also be used on a small scale to take up land-applied wastewater effluent.

1.1.1.9 Groundwater Pumping for Water Level/Water Quality Management

Groundwater pumping could be used to manage groundwater levels and water quality (salt balances) in the San Juan, Pachecho and Hollister East subbasins where groundwater levels are high. Extracted groundwater could be used in another portion of the subbasin by using the proposed regional and local conveyance pipeline or pumped for discharge into an export pipeline (Figure 2; refer to Out-of Basin Export, below). Approximately 2,500 acre-feet of groundwater would need to be removed per year from selected areas of the Basin to manage high groundwater levels.

1.1.1.10 Out-of-Basin Export of Wastewater/Concentrate/Pumped Groundwater or Agricultural Drainage Water

A possible approach for managing groundwater levels and salt buildup is the export of pumped groundwater and/or salt-laden water outside of the Gilroy-Hollister Groundwater Basin. The following types of waters could be transferred out-of basin:

- wastewater effluent;
- the concentrate from groundwater desalination or softening;
- pumped groundwater; and/or
- agricultural drainage water

Export of these waters could include: discharge to the San Benito River; construction of a 26.2 mile export pipeline from Hollister to the City of Watsonville's Wastewater Treatment Plant ocean outfall; and trucking of concentrate or salt out of the basin. These options are discussed briefly, below.

River Discharge. This possible disposal mechanism could be used for the disposal of wastewater effluent, concentrate from groundwater treatment, pumped groundwater from the San Juan, Bolsa, and Hollister East subbasins, and/or agricultural drainage. A constructed pipeline would discharge to the San Benito River, near its confluence with the Pajaro River (refer to Figure 2). Discharges will need to meet the requirements of the federal National Pollutant Discharge Elimination System, the Water Quality Control Plan for the Central Coastal Basin, and State of California Clean Water regulations.

Export Pipeline. Like *River Discharge,* an export pipeline could be used for the disposal of wastewater effluent, concentrate from groundwater treatment, pumped groundwater from the San Juan, Bolsa, and Hollister East subbasins, and/or agricultural drainage. An export pipeline could be routed for 11.2 miles from Hollister to US 101/SR129 junction (refer to Figure 2). It could then parallel the approved Pajaro Valley Water Management Agency Central Valley Project import pipeline for 15 miles to the City of Watsonville wastewater treatment plant, for discharge via the plant's ocean outfall. The City of Wastonville wastewater treatment plant outfall currently has excess capacity of four to nine million gallons per day.

Evaporation and Trucking of Salts. This disposal mechanism could be used for the disposal of concentrate from groundwater treatment (desalination or softening). Evaporation of the salt concentrate from groundwater treatment could be evaporated using either fueled evaporation or land evaporation using evaporation ponds. The remaining salts would be in either a solid form or a highly concentrated salt solution (brine). Brine solids could be trucked out of the basin and disposed of at a landfill or sold to a salt processor. Highly concentrated salt solutions could be conveyed by a tanker truck to the City of Watsonville wastewater treatment plant, for discharge via the plant's ocean outfall.

1.1.1.11 Constructed Wetlands for Water Treatment

The Groundwater Management Plan Update considers the use of constructed wetlands for the treatment of water prior to discharge to a waterway. Constructed wetlands can be used to remove

sediments, solids, and nutrients (including nitrogen). Possible locations of constructed wetlands, at an excavation from a gravel mining operation and near the City of Hollister Domestic Wastewater Treatment Plant, are shown on Figure 2.

Constructed wetlands could be used for the treatment of agricultural drainage runoff, stormwater, and municipal wastewater effluent from treatment plants. The level of treatment or polishing that can be achieved in constructed wetlands depends on factors including the configuration of the ponds, the detention time of water prior to discharge, the amount of water in the system, and plant species in the wetlands.

1.2 GENERAL PROJECT AREA DESCRIPTION

The Management Plan area is located in northwest San Benito County, California and includes 120,153 acres encompassing the Hollister and San Juan Valleys and associated municipalities, the Flint Hills, and the Tres Pinos and Paicines areas (Figure 1). Watercourses transecting the Management Plan area include the Pajaro and San Benito Rivers, and the Arroyo de las Viboras, Arroyo dos Picachos, Pacheco, Santa Ana, and Tres Pinos creeks, and Tequisquita Slough. Waterbodies (lakes and reservoirs) within the Management Plan area include San Felipe Lake, and San Justo and Paicines Reservoirs. The northwest boundary of the Management Plan area follows the Pajaro River, but the remaining boundaries are mostly arbitrary. The entire Management Plan area is located on the San Jose and Monterey U.S. Geological Survey (USGS) Quadrangle maps (1:100,000).

The Management Plan area is underlain by 5 soil associations (Soil Conservation Service, 1969). These include 3 associations found on terraces, alluvial fans, and floodplains, which are the Sorrento-Yolo-Mocho, Clear Lake-Pacheco-Willows, and Rincon-Antioch-Cropley associations. These associations occur on the valley floors of the Management Plan area, mostly northwest and west of Hollister, and are characterized by medium- to fine-textured soils that are well- to poorly-drained, depending on elevation. Two other associations underlie the rolling to very steep uplands surrounding the valleys within the Management Plan area including the Flint Hills and the hills east and southeast of Hollister. These soils are the Diablo-Soper, and San Benito-Gazos-Linne associations, and are moderately coarse-to-fine textured, and well- to excessively-drained. None of the soils are reported to have serpentine materials associated with them. Elevations within the Management Plan area range from approximately 140 to 1,543 feet MLS. Average annual precipitation within the Hollister Valley ranges from 12 to 16 inches, and the mean annual temperature is 60°F.

2.0 BIOTIC SURVEYS

The Geographic Approach to Planning program (GAP Analysis) created by the USGS was used to identify biotic habitats, evaluate botanic and wildlife resources, and assess the suitability of the study area to support special-status plant and animal species within the 120,153 acre San Benito Groundwater Management Plan area (Figure 2). Reconnaissance-level field visits were conducted to gain an overview of the habitats within the San Juan and Hollister Valleys. However, regulated resources and protocol-level surveys for special-status plant or wildlife species were not conducted during these visits. Survey personnel included an H. T. Harvey & Associates' project manager, Eric Webb, Ph.D., plant ecologist, Andrew Dilworth, B.S., and wildlife ecologist, Laird Henkel, M.S..

2.1 BIOTIC HABITATS

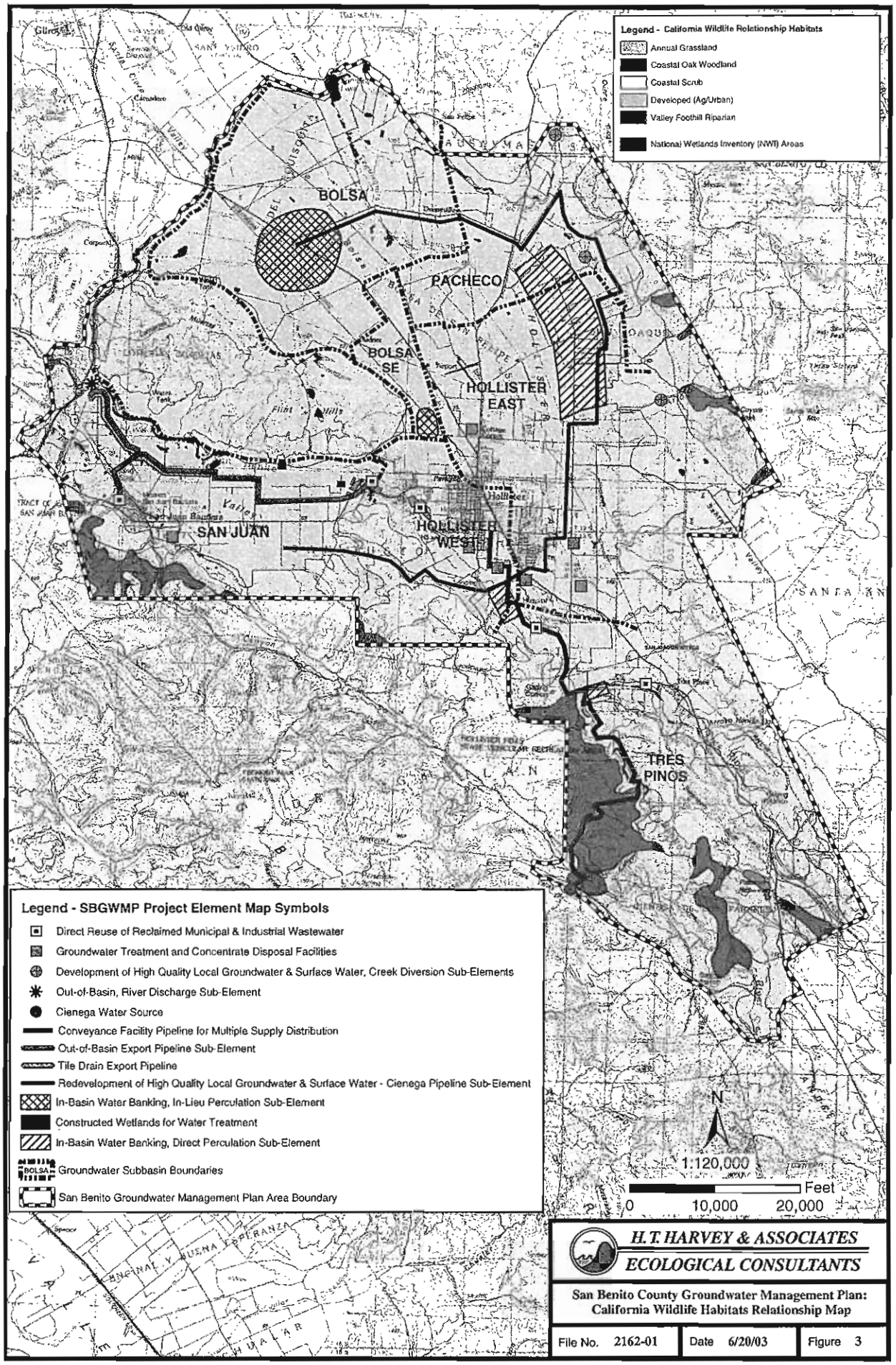
Eight biotic habitats are identified by the GAP Analysis within the Management Plan area, including developed, annual grassland, coastal oak woodland, valley oak woodland, coastal scrub, riverine, valley foothill riparian, and freshwater emergent wetland. Plant communities were identified based on the GAP Analysis database, which utilizes the California Wildlife Habitat Relationship (WHR) system of classification (Mayer and Laudenslayer, 1998). The extent of riverine, riparian, and wetland resources within the Management Plan area was based upon mapping of such resources under the National Wetland Inventory (NWI, 1994), rather than GAP analysis, which assesses landscapes on a larger scale. However, the NWI coverage of these resources is incomplete for the Management Plan area and therefore the acreage of riverine, riparian, and wetland resources is expected to be higher than that presented in this study. Finally, a very small amount of chaparral and blue oak woodland habitat occurs within the Management Plan area but no impacts to these habitats are expected to occur and therefore do not warrant further discussion.

The GAP Analysis and NWI habitats were overlain onto a USGS topographic quadrangle along with the Management Plan area boundary (scale = 1:100,000) for presentation here. Table 1 summarizes the size of these WHR habitats and Figure 2 illustrates them. The WHR habitats within the Management Plan area are described briefly here; for further descriptions, please refer to the Guide to Wildlife Habitats of California (Mayer and Laudenslayer, 1998).

Table 1. Acreage Summary of Habitats within the San Benito Groundwater Management Plan Project Area.

Habitat Type	Acres	Percent of Total
Developed (including agricultural and urban settings)	65,476	54%
Annual Grassland (includes areas of potential vernal marshes)	47,913	40%
Coastal Oak Woodland	4,675	4%
Coastal Scrub	499	< 1%
Valley Oak Woodland	583	< 1%
Riverine, Valley Foothill Riparian, and Freshwater Emergent Wetland combined	1,007*	< 1%
TOTAL =	120,153	100%

*Acreage based on extent of these resources as partially mapped by the NWI within the project area.



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San Benito County Groundwater Management Plan: California Wildlife Habitats Relationship Map

File No. 2162-01	Date 6/20/03	Figure 3

2.1.1 Developed

Vegetation. Most of the Management Plan Area consists of agricultural lands, vineyards, orchards, ranches, homesteads, and the municipal areas of Hollister and San Juan Bautista. All such areas are regarded as developed according to WHR criteria. Cropland and rangeland comprise the majority of this portion of the Management Plan area. These settings are typically located on the flat to gently rolling terrain of the Hollister and San Juan Valleys and are regularly manipulated as crops are planted, harvested, rotated, and irrigated (Mayer and Laudenslayer, 1998). Low elevation areas that are cultivated within this seasonally hot region of California may also be characterized by high salt and alkali levels at the soil surface. Vegetation in these areas does not conform to natural habitat stages but are instead regulated by the crop cycles of the region. In addition to the various crops, grapes, and orchard species grown within the area, the natural vegetation occurring in these areas consists primarily of non-native species adapted to disturbance such as wild oats (*Avena* spp.), bromes (*Bromus* spp.), mustards (*Brassica* spp.), mallows (*Malva* spp.), filarees (*Erodium* spp.), and others.

Wildlife. Developed habitats can support certain wildlife species adapted to the unique nesting and foraging opportunities found there, but wildlife abundance and diversity is generally low in this habitat. Striped skunks (*Mephitis mephitis*), raccoons (*Procyon lotor*), and Virginia opossums (*Didelphis virginiana*) occur regularly in urban habitats. Birds adapted to the urban landscape include House Finches (*Carpodacus mexicanus*), Northern Mockingbirds (*Mimus polyglottos*), Mourning Doves (*Zenaida macroura*), and non-native European Starlings (*Sturna vulgaris*), House Sparrows (*Passer domesticus*), and Rock Doves (*Columba livia*). Agricultural lands generally support few wildlife species, because of the lack of diversity in vegetation and foraging opportunities. California ground squirrels often occur along margins of cropland, and raptors such as Red-tailed Hawks (*Buteo jamaicensis*) often forage for ground squirrels over this habitat. Fallow fields can attract other foraging birds, including Brewer's Blackbirds (*Euphagus cyanocephalus*), and Killdeer (*Charadrius vociferus*).

2.1.2 Annual Grassland

Vegetation. Annual gasslands within the Management Plan area mostly occupy the foothills above the valley floor areas, including the Flint Hills, the hills southwest and due east of Hollister, and the hills between Tres Pinos and Paicines. This habitat is typically used as rangeland throughout the Management Plan area. This habitat also intergrades with cultivated areas, and can be found as understory of oak woodlands and orchards. As its name implies, this habitat is composed of primarily annual grass species, most of which are non-native, though species composition is greatly influenced by seasonal weather patterns. The most common grass species in this habitat are ripgut brome (*Bromus diandrus*), softchess brome (*Bromus hordeaceus*), wild oats, and wild barley (*Hordeum murinum*). Common forbs include filarees, bur clover (*Medicago polymorpha*), and wildflowers such as popcorn-flower (*Plagiobothrys* spp.) and California poppy (*Eschscholzia californica*). Grazing within this habitat favors the growth of summer-flowering annual forbs including tarweeds (*Hemizonia* spp.), and turkey mullein (*Eremocarpus setigerus*).

Vernal marsh habitat may also occur within grassland areas where high water tables affect surface saturation and/or ponding, depending on elevation. Vernal marshes are related to vernal pools in terms of their character and plant composition, though vernal pools are typically supported by hardpan soil layers which are not characteristic in the soils underlying the basin floors of the Management Plan area. Nevertheless, ephemerally saturated and/or ponded areas within the Management Plan area are commonly referred to as vernal pools. Downingia (*Downingia* spp.), and coyote thistle (*Eryngium* spp.) are common vernal marsh species.

Wildlife. Annual grassland provides little cover for wildlife, yet numerous species do forage, and several species breed, in this habitat. Small mammals such as deer mice (*Peromyscus maniculatus*), California ground squirrels (*Spermophilus beecheyi*), and Botta's pocket gophers (*Thomomys bottae*) are common residents in annual grasslands in San Benito County. Larger mammals such as coyotes (*Canis latrans*) and bobcats (*Lynx rufus*) occasionally forage in this habitat as well, and San Joaquin kit fox (*Vulpes microti muitca*) are known to occur here. A variety of birds use annual grasslands as foraging habitat, including Savannah Sparrows (*Passerculus sandwichensis*), Horned Larks (*Eremophila alpestris*), Western Meadowlarks (*Sturnella neglecta*), Lesser Goldfinches (*Carduelis psaltria*), and Barn Swallows (*Hirundo rustica*). Raptors, such as Red-tailed Hawks and Northern Harriers (*Circus cyaneus*) commonly forage over grasslands as well. Where ground squirrel burrows are present, Burrowing Owls (*Athene cunicularia*) may nest in annual grasslands in San Benito County, and California tiger salamanders (*Ambystoma californiense*) may be present if temporary freshwater is present for breeding. Western fence lizards (*Sceloporus occidentalis*), western rattlesnakes (*Crotalus viridis*), and other snakes are also likely to occur in this habitat.

2.1.3 Coastal Oak Woodland

Vegetation. Coastal oak woodlands within the Management Plan area are confined to the hills southwest of Tres Pinos, and west of the San Benito River. This habitat occurs in a mosaic of coastal scrub and annual grasslands, which often serves as its understory (described above). The density of trees and associated shrubs in this habitat varies with moisture and therefore north-facing slopes are typically more dense and favor shrubby understories (Mayer and Laudenslayer, 1998). Coastal oak woodlands in the San Benito County region are dominated by coast live oak (*Quercus agrifolia*) with additional species associated with interior climates including valley oak (*Quercus lobata*), blue oak (*Quercus douglasii*), and foothill pine (*Pinus sabiniana*). Aside from grassy understory species, typical understory includes shrubs such as California blackberry (*Rubus ursinus*), toyon (*Heteromeles arbutifolia*), and forbs such as miner's lettuce (*Claytonia perfoliata*), and brakenfern (*Pteridium aquilinum*).

Wildlife. Oak woodlands in San Benito County support a considerable diversity of wildlife species. Mammals likely to be found here include western gray squirrels (*Sciurus griseus*) and dusky-footed woodrats (*Neotoma fuscipes*), and well as other small rodents. Mule deer (*Odocoileus hemionus*) also occur in oak woodlands. Several avian species rely heavily on acorns for food, including Acorn Woodpeckers (*Melanerpes formicivorous*), Western Scrub-jays (*Aphelocoma californica*), and California Quail (*Callipepla californica*). Chestnut-backed Chickadees (*Poecile rufescens*), Oak Titmice (*Baeolophus inornatus*), Hutton's Vireos (*Vireo huttoni*), Dark-eyed Juncos (*Junco hyemalis*), Ash-throated Flycatchers (*Myiarchus tuberculifer*), and Nuttall's Woodpeckers (*Picoides nuttallii*) are among other birds that nest in this habitat.

Several species of amphibians, such as the arboreal salamander (*Aneides lugubris*), can be found in oak woodlands, in which moisture is retained under fallen wood and in crevices in oaks. Reptiles may include the ringneck snake (*Diadophis punctatus*) and western skink (*Eumeces skiltonianus*).

2.1.4 Coastal Scrub

Vegetation. Coastal scrub habitat within the Management Plan area occurs as a narrow strip within the floodplain of the San Benito River west of Paicines and is relatively undisturbed. While this habitat typically occurs closer to the coast, river floodplains often provide mesic conditions capable of supporting this habitat in interior regions such as the San Benito River valley. Coastal scrub is associated with annual grassland and coastal oak woodland with which it intergrades across changing slope aspects, particularly in inland settings. Plant composition in coastal scrub habitat varies greatly throughout California (Mayer and Laudenslayer, 1998), as does the density of vegetation in this habitat which typically includes coyote brush (*Baccharis pilularis*), lupines (*Lupinus* spp.), California lilac (*Ceanothus* spp.), and California sagebrush (*Artemisia californica*). Herbaceous understory plants might include indian paintbrush (*Castilleja* spp.), monkeyflower (*Mimulus aurantiacus*), and yerba buena (*Satureja douglasii*), and a host of annual grassland species.

Wildlife. Coastal scrub supports wildlife adapted to the drier, less complex habitats. Western fence lizards, gopher snakes (*Pituophis melanoleucus*), western rattlesnakes, and coast horned lizards (*Phrynosoma coronatum*) are expected to occur in coastal scrub in San Benito County. Mammals could include coyote, black-tailed jackrabbit (*Lepus californicus*), brush rabbit (*Sylvilagus bachmani*), deer mouse, California vole (*Microtus californicus*), and other rodents. Birds expected in this habitat include Anna's Hummingbird (*Calypte anna*), Western Scrub Jay, Wrentit (*Chamaea fasciata*), Bushtit (*Psaltriparus minimus*), California Thrasher (*Toxostoma redivivum*), Bewick's Wren (*Thryomanes bewickii*), and Song Sparrow (*Melospiza melodia*).

2.1.5 Valley Oak Woodland

Vegetation. The valley oak woodlands within the Management Plan area are restricted to the hills southwest of Hollister, and in the upper Arroyo dos Picachos watershed area northeast of Hollister. As with coastal oak woodlands, this habitat intergrades with annual grassland (described above), which often serves as its understory, particularly in interior areas. This habitat is dominated by valley oaks which typically grow in deep alluvial soils both in level upland areas and along natural drainages. The trees can form savanna as well as forest-like stands (Mayer and Laudenslayer, 1998). Understory shrubs in this habitat include poison oak (*Toxicodendron diversilobum*), and California coffeeberry (*Rhamnus californica*) among others. Foothill pine and coast live oak are the principal associate tree species.

Wildlife. The wildlife community in valley oak woodland habitat is similar to that found in coastal oak woodland. The valley oak woodland in the project area borders annual grassland. Several species of bird, such as Western Bluebirds (*Sialia mexicana*) and Western Kingbirds (*Tyrannus verticalis*) are likely to nest in oak woodland habitat and forage at nearby grasslands. Valley oaks could provide nesting habitat for a number of raptor species as well, such as White-tailed Kites (*Elanus leucurus*).

2.1.6 Riverine (Aquatic)

Vegetation. The bed and banks of the San Benito and Pajaro Rivers, Tres Pinos Creek, Santa Ana Creek, Arroyo Dos Picachos, Arroyo de la Vibora, and Pacheco Creek all support riverine habitat. This habitat includes both upper elevation stream with higher velocity and lower volume waters, and lower elevation rivers with lower velocity and larger volume waters (Mayer and Laudenslayer, 1998). These riverine habitats between high and low elevations typically transition from having cooler, clear-running, oxygenated water, to warmer, turbid, more stagnant waters. Riverine habitats can support diverse riparian habitats, however the extent of vegetation along and within any given corridor varies greatly depending on current and past adjacent land uses, topography, and variations in riverine hydrology. In addition to riparian vegetation (described below), freshwater emergent wetland habitats (described below) can also be found contiguous and/or within riverine habitats, particularly where river corridors develop shallow banks and bottoms with very slow moving waters and/or intercept high groundwater.

Wildlife. The San Benito River, Pajaro River, Pacheco Creek, and other streams provide habitat for several species of fish, including steelhead (*Onchorhynchus mykiss*), Monterey roach (*Hysperculus symmetricus*), speckled dace (*Rhinichthys osculus*), Sacramento sucker (*Catostomus occidentalis*), and mosquitofish (*Gambusia affinis*). Amphibians, such as California red-legged frogs (*Rana aurora draytoni*) and foothill yellow-legged frogs (*Rana boylii*) occur in this habitat as well.

2.1.7 Valley and Foothill Riparian

Vegetation. The bed and banks of the San Benito and Pajaro Rivers, Tres Pinos Creek, Santa Ana Creek, Arroyo Dos Picachos, Arroyo de la Vibora, and Pacheco Creek all support Valley and Foothill riparian habitat. However, this habitat was not identified in the GAP Analysis extracted for the Groundwater Management Plan area, probably due to its narrow occurrence along watercourses. Nevertheless, this habitat is common where valleys, terraces, and foothills are dissected by riverine habitats. High quality riparian habitat is present along Pacehco Creek, the lower San Benito River and upper reaches of Arroyo Dos Picachos and Arroyo de la Vibora. Riparian habitat is also present along much of the San Benito River, Tres Pinos and Santa Ana Creeks and Tesquista Slough. However, the riparian habitat along these channel reaches is more highly disturbed. The transition between riparian and the predominantly agricultural setting in the Management Plan area is often abrupt. Dominant tree species in this habitat include Fremont cottonwood (*Populus fremontii*), California sycamore (*Platanus racemosa*), and valley oak with subcanopies of boxelder (*Acer negundo*), alder (*Ulnus* sp.), and willows (*Salix* spp.) often occurring. Numerous shrubs, herbs, and vines also occur in the understory of this habitat including mulefat (*Baccharis salicifolia*), poison hemlock (*Conium maculatum*) and blackberries (*Rubus* spp.).

Wildlife. Riparian vegetation provides habitat for a great diversity of wintering and migrating birds, such as Ruby-crowned Kinglets (*Regulus calendula*) and Yellow-rumped Warblers (*Dendroica coronata*), and breeding habitat for migrants including Warbling Vireos (*Vireo glivus*), Orange-crowned Warblers (*Vermivora celata*), and Wilson's Warblers (*Wilsonia pusilla*). Downy Woodpeckers (*Picoides pubescens*), Black Phoebes (*Sayornis nigricans*), Spotted Towhees (*Pipilo maculatus*), and Black-headed Grosbeaks (*Pheuticus melanocephalus*)

are other birds typically found in mature riparian habitats. The mixed understory in this habitat supports a variety of mammals and reptiles, including raccoons (*Procyon lotor*), brush rabbits, dusky-footed woodrats (*Neotoma fuscipes*), deer mice, and garter snakes (*Thamnophis* spp.).

2.1.8 Freshwater Emergent Wetland

Vegetation. Freshwater emergent wetlands occur frequently thoughout the riverine habitats (described above) transecting the Management Plan area including the Pajaro and San Benito Rivers, and the Arroyo de las Viboras, Arroyo dos Picachos, Pacheco, Santa Ana, and Tres Pinos creeks, and Tequisquita Slough (Figures 1 and 3). Extensive freshwater emergent wetlands are also known to occur around San Felipe Lake and in more isolated areas where water is ponded in either man-made features or natural depressions, such as those used as stock ponds or for irrigation. Vernal pool seasonal wetlands (described above under Annual Grassland) occur in the upper Hollister Valley where they have been documented by the CDFG California Vernal Pool Assessment Preliminary report (1998). While most of the wetland habitats occur at the lower elevations within the Management Plan area, this habitat may occur anywhere basins or depressions are saturated or periodically flooded. Freshwater emergent wetland is often overwhelmingly dominated by cattails (*Typha* spp.), bulrushes (*Scirpus* spp.), and sedges (*Cyperus* spp.), and rushes (*Juncus* spp.). In disturbed areas, ruderal (disturbance-loving) hydrophytic species often occur along the margins of wetlands, and sometimes are regarded as wetland indicators. These species include poison hemlock, smilo grass (*Piptatherum miliaceum*), shining peppergrass (*Lepidium latifolium*), saltgrass (*Distichlis spicata*), canary grass (*Phalaris* spp.), and barnyard grass (*Echinochloa crus-galli*), among others.

Wildlife. Freshwater wetlands provide habitat for a wide variety of animal species. Wetlands in San Benito County support western pond turtles (*Clemmys marmorata*) and various amphibians, including Pacific treefrogs (*Hyla regilla*) and California red-legged frogs. Several species of birds forage in aquatic habitats, including Snowy Egrets (*Egretta thula*) and other waders, American White Pelicans (*Pelecanus erythrorhynchos*), and many species of waterfowl. Red-winged Blackbirds (*Agelaius phoeniceus*) and Common Yellowthroats (*Geothlypis trichas*) are among bird species that nest in vegetation surrounding wetlands. Small mammals, such raccoons and striped skunks, are likely to be found near wetlands, as well as several reptile species, especially garter snakes. Vernal pools could provide habitat for California tiger salamanders and several species of fairy shrimp (branchiopods).

2.2 SPECIAL-STATUS PLANT AND WILDLIFE SPECIES

2.2.1 Special-Status Species Regulations Overview

Federal and state endangered species legislation gives several plant and animal species known to occur in the vicinity of the project site special status. In addition, state resource agencies and professional organizations, whose lists are recognized by agencies when reviewing environmental documents, have identified as sensitive some species occurring in the vicinity of the project site. Such species are referred to collectively as "species of special status" and include: plants and animals listed, proposed for listing, or candidates for listing as threatened or endangered under the Federal Endangered Species Act (FESA) or the California Endangered Species Act (CESA), animals listed as "fully protected" under the California Fish and Game

Code, animals designated as "Species of Special Concern" by the California Department of Fish and Game (CDFG), and plants listed as rare or endangered by the California Native Plant Society (CNPS) in the *Inventory of Rare and Endangered Plants of California* (2001).

Federal Endangered Species Act provisions protect federally listed threatened and endangered species and their habitats from unlawful take. "Take" under FESA includes activities such as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any of the specifically enumerated conduct." The USFWS's regulations define harm to mean "an act which actually kills or injures wildlife." Such an act "may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering" (50 CFR § 17.3). Activities that may result in "take" of individuals are regulated by the USFWS. The USFWS produced an updated list of candidate species September 19, 1997 (USFWS 1997; 50 CFR Part 17). Candidate species are not afforded any legal protection under FESA; however, candidate species typically receive special attention from federal and state agencies during the environmental review process.

Provisions of CESA protect state-listed threatened and endangered species. CDFG regulates activities that may result in "take" of individuals (i.e., "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill"). Habitat degradation or modification is not expressly included in the definition of "take" under the California Fish and Game Code. The CDFG, however, has interpreted "take" to include the "killing of a member of a species which is the proximate result of habitat modification . . . " Additionally, the California Fish and Game Code contains lists of vertebrate species designated as "fully protected" (California Fish & Game Code §§ 3511 [birds], 4700 [mammals], 5050 [reptiles and amphibians], 5515 [fish]). Such species may not be taken or possessed without a permit.

The CDFG has also produced three lists (amphibians and reptiles, birds, and mammals) of "species of special concern" that serve as "watch lists." Species on these lists either are of limited distribution or the extent of their habitats has been reduced substantially, such that threat to their populations may be imminent. Thus, their populations should be monitored. They may receive special attention during environmental review, but do not have statutory protection.

Vascular plants listed as rare or endangered by the California Native Plant Society (2001), but which have no designated status under state endangered species legislation, are defined as follows:

- List 1A. Plants considered by the CNPS to be extinct in California.
- List 1B. Plants rare, threatened, or endangered in California and elsewhere.
- List 2. Plants rare, threatened, or endangered in California, but more numerous elsewhere.
- List 3. Plants about which we need more information - A review list.
- List 4. Plants of limited distribution - A watch list.

2.2.2 Special-Status Plant Species

This preliminary assessment of special-status plant species occurrence within the Management Plan area was limited to identifying listed state and/or federal plant species that, if present within a specific project element area, would present a potentially significant impact. The only additional species considered included those documented in the California Natural Diversity Database (CNDDB 2002) within a nine-quadrangle area centered about the Hollister quadrangle. The query results for specific quadrangles were reviewed for the project elements in as far as their general locations were identified in Figure 2. All habitats identified within the CNDDB were specified in the query, including valley and foothill grasslands which dominate the Hollister and San Juan Valleys where development and agriculture have not displaced such habitat. In addition, the California Native Plant Society's (CNPS) *Inventory of Rare and Endangered Plants of California* (CNPS 2001) was used to identify and assess the potential occurrence of listed state and/or federal plant species occurring in similar habitats throughout San Benito County. Special-status species identified in the CNPS inventory but not otherwise state and/or federally listed were not considered in this assessment.

A total of 12 listed special-status plant species were identified in these queries, of which only 6 are regarded as potentially occurring within the project element areas (Table 2). These include alkali milk vetch (*Astragalus tener* var. *tener*), San Joaquin saltbush (*Atriplex joaquiniana*), Congdon's tarplant (*Centromadia parryi* ssp. *congdonii*), round-leaved filaree (*Erodium macrophyllum*), Indian Valley bush mallow (*Malacothamnus aboriginum*), and hairless popcorn-flower (*Plagiobothrys glaber*). These species occur mostly in valley and foothill grassland habitat, particularly those with alkaline substrates. However, while some of these species are hydrophytic (water-loving), none of them are considered endemic to vernal marsh or pool habitats.

None of these species are state and/or federally listed, but all are documented as occurring within the CNDDB query area. The remaining species (Appendix B), which included 3 listed plants, were presumed absent based primarily on the absence of suitable microhabitats, and/or edaphic and elevation requirements in the Hollister and San Juan Valleys. Further assessment of potentially occurring special-status plant species may be warranted for any project element, which is given additional consideration in the CEQA process. The legal status of all potentially occurring species is presented in Table 2; expanded descriptions are included below.

Table 2. Special-status Species, Their Status and Potential for Occurrence in the San Benito Groundwater Management Plan Project Area.

NAME	STATUS*	HABITAT	LOCAL OCCURRENCE
Federal or State Endangered or Threatened Species			
Invertebrates			
Vernal Pool Fairy Shrimp (*Branchinecta lynchi*)	FT	Ephemeral freshwater vernal pools.	Distribution poorly known. Occurs in southern San Benito County, could occur in vernal pools in northern San Benito County.
Fish			
Steelhead south/central California ESU (*Onchorhynchus mykiss*)	FT, CSSC	Free-flowing coastal rivers and streams. Spawning habitat: clear, cool streams with overhanging vegetation.	Distribution in San Benito County poorly known. Could occur in any tributary of the Pajaro River with unobstructed access.
Amphibians			
California Red-legged Frog (*Rana aurora draytoni*)	FT, SP, CSSC	Streams, freshwater pools and ponds with overhanging vegetation. Requires pools of 1 m depth for breeding.	Found in a variety of freshwater habitats throughout San Benito County.
Birds			
Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*)	FC, SE	Breeds in mature riparian forests, primarily in Sierra Nevada foothills.	Not found in San Benito County since 1899. Presumed absent.
California Condor (*Gymnogyps californianus*)	FE, SE	Forages for carrion over a variety of open habitats.	Reintroduction program recently initiated at Pinnacles NM. Foraging individuals could occur in south San Benito County.
American Peregrine Falcon (*Falco peregrinus*)	FD, SE	Forages for other birds over a variety of habitats. Breeds primarily on rocky cliffs.	Could breed in southern portion of project area. Foraging individuals could occur throughout San Benito County.
Bald Eagle (*Haliaeetus leucocephalus*)	FD, SE	Forages in rivers and lakes for large fish. Does not breed locally.	Wintering birds forage at local reservoirs.
Southwestern Willow Flycatcher (*Empidonax trailii extimus*)	FE, SE	Breeds in mature riparian habitat. Now extirpated from coastal California.	No recent records of breeding birds west of the San Joaquin Valley. Migrant Willow Flycatchers in San Benito County would almost certainly be the northern, unlisted, subspecies. Presumed absent.
Least Bell's Vireo (*Vireo bellii pusillus*)	FE, SE	Breeds in thick willow riparian groves. Range, once thought to be limited to southern California, is expanding.	Historic record of a nesting pair at the Pajaro River and Highway 101. No recent records for the Hollister area. Probably absent, however, range is expanding. Could occur in suitable habitat.
Bank Swallow (*Riparian riparia*)	ST	Nests in colonies in sandy banks along riparian habitat.	No recent nesting records in San Benito County. Assumed absent during nesting season. Could forage at site during migration.
Mammals			
San Joaquin kit fox (*Vulpes macrotis mutica*)	FE, ST	Occurs in grasslands and scrublands in the San Joaquin Valley and coastal valleys in central California.	Historic records around Hollister (CNDDB). No recent local records, but could occur.
Federal or State Candidate Species			
Mountain Plover (*Charadrius montanus*)	FC, CSSC	Breeds in great plains, winters in Central Valley and other flat open habitats in California.	Rare winter visitor to San Benito County. Could occur on agricultural fields and other open habitats.
California Tiger Salamander (*Ambystoma californiense*)	FC, CSSC, SP	Vernal or temporary pools in annual grasslands, or open stages of woodlands. Typically burrows in ground squirrel burrows.	Found in grasslands and aquatic habitats throughout San Benito County.

Table 2. Special-status Species, Their Status and Potential for Occurrence in the San Benito Groundwater Management Plan Project Area.

NAME	STATUS*	HABITAT	LOCAL OCCURRENCE
State Species of Special Concern			
Fish			
Monterey roach (*Lavinia symmetricus subditus*)	CSSC	Small, warm intermittent streams and isolated pools.	Occurs in San Benito River and other tributaries of the Pajaro River.
Reptiles and Amphibians			
Western Pond Turtle (*Clemmys marmorata*)	CSSC, SP	Permanent or nearly permanent water in a variety of habitats.	Found in a variety of freshwater habitats throughout San Benito County.
California Legless Lizard (*Anniella pulchra*)	CSSC	Sandy or loose loamy soils, including stream terraces and coastal dunes.	Could occur in San Benito River channel and similar habitats.
California Horned Lizard (*Phynosoma coronatum frontale*)	CSSC	Exposed gravely -sandy substrates usually containing scattered shrubs, clearings in riparian woodlands.	Could occur in San Benito River channel and similar habitats.
San Joaquin Whipsnake (*Masticophis flagellum ruddocki*)	CSSC	A variety of dry open habitats.	Records from San Benito River channel near Hollister, and south of Hollister. Could occur elsewhere in similar habitats.
Western Spadefoot (*Scaphiopus hammondii*)	CSSC	Requires temporary rain pools for breeding. During most of the year, burrows in loose soil., primarily in grasslands.	Records from aquatic habitats south of Hollister.
Foothill Yellow-legged Frog (*Rana boylii*)	CSSC	Small to moderate-sized streams and rivers with some cobble substrate.	No local records, but could occur in the southern San Benito River, Pacheco Creek, and similar habitats.
Coast Range Newt (*Taricha torosa*)	CSSC	Ponds, reservoirs, and slow-moving streams, and adjacent terrestrial habitat.	One local record southwest of Hollister. Could occur elsewhere in San Benito County.
Birds			
American White Pelican (*Pelecanus erythrorhynchos*)	CSSC	Breeds primarily in Great Basin, summer visitor to the Central Valley and coastal California.	Summer visitor to local reservoirs and wetlands.
Burrowing Owl (*Athene cunicularia*)	CSSC	Grassland habitat with ground squirrel burrows (used for nesting).	Breeding records in Flint Hills and northern margin of Flint Hills. Could occur elsewhere in suitable habitat.
Northern Harrier (*Circus cyaneus*)	CSSC	Forages in open to herbaceous stages of many habitats. Breeds in marshes and prairies.	Could breed in undisturbed grasslands. Likely to forage over a variety of open habitats.
Cooper's Hawk (*Accipiter cooperii*)	CSSC	Breeds in riparian woodlands and wooded canyons.	Unlikely to breed near project sites. Could occasionally forage throughout San Benito County.
Osprey (*Pandion haliaetus*)	CSSC	Forages and breeds near rivers and lakes.	Not known to breed locally. Could forage at local reservoirs.
Golden Eagle (*Aquila chrysaetos*)	CSSC, SP	Breeds on cliffs or in large trees or structures.	Could breed in southern San Benito County, and forage over entire county. Not likely to nest near project sites.
Ferruginous Hawk (*Buteo regalis*)	CSSC	Forages in grasslands and occasionally in other open habitats during migration and winter.	Uncommon winter visitor. Forages over grasslands and other open habitats.
Prairie Falcon (*Falco mexicanus*)	CSSC	Resident in dry open country, additional migrants in winter.	Could breed in southern San Benito County, and forage over entire county. Not likely to nest near project sites.
Sharp-shinned Hawk (*Accipiter striatus*)	CSSC	Nests in woodlands, forages in many habitats in winter and migration.	Winter visitor. Forages primarily over riparian and vegetated habitats.
Merlin (*Falco columbarius*)	CSSC	Uses many habitats in winter and migration.	Winter visitor. Could forage over a variety of habitats throughout county.
Vaux's Swift (*Chaetura vauxi*)	CSSC	Nests in snags in coastal coniferous forests or, occasionally, in chimneys; forages aerially.	Likely to be present only during migration (spring and fall). Uncommon.

Table 2. Special-status Species, Their Status and Potential for Occurrence in the San Benito Groundwater Management Plan Project Area.

NAME	STATUS*	HABITAT	LOCAL OCCURRENCE
California Horned Lark (*Eremophila alpestris actia*)	CSSC	Short-grass prairie, annual grasslands, coastal plains, and open fields.	Nesting records from east and south of Hollister. Could occur in other grassland habitats as well.
Tricolored Blackbird (*Agelaius tricolor*)	CSSC	Breeds near freshwater in dense emergent vegetation.	Nesting colonies could be present throughout San Benito County.
Black Swift (*Cypseloides niger*)	CSSC	Nests on wet cliffs, often behind waterfalls. Forages aerially.	Likely to be present only during migration (spring and fall). Uncommon.
California Gull (*Larus californicus*)	CSSC	Nests in the Great Basin and San Francisco Bay area. Winters along the Pacific Coast and the Central Valley.	Common winter visitor in many habitats.
California Yellow Warbler (*Dendroica petechia brewsteri*)	CSSC	Breeds in riparian woodland and meadow edges.	Uncommon breeder in mature riparian areas.
Yellow-breasted Chat (*Icteria virens*)	CSSC	Breeds in extensive riparian woodland habitat.	Uncommon breeder in mature riparian areas.
Loggerhead Shrike (*Lanius ludovicianus*)	CSSC	Resident in dry open grasslands.	Common resident throughout San Benito County.
Mammals			
Big-eared Kangaroo Rat (*Dipodomys elephantinus*)	CSSC	Resident in chaparral habitat and dry oak woodland habitat.	Nearly endemic to San Benito County. Not likely to occur in lowland habitats that will be affected by the Management Plan.
California mastiff bat (*Eumops perotis californicus*)	CSSC	Forages over many habitats; requires tall cliffs or buildings for roosting sites.	Likely present in southern San Benito County.
Townsend's big-eared bat (*Plecotus townsendii*)	CSSC	Roosts in caves and mine tunnels in a variety of habitats.	Likely present in southern San Benito County.
Pallid bat (*Antrozous pallidus*)	CSSC	Forages over many habitats.	Likely present in much of San Benito County.
State Protected Species or CNPS Species			
Plants			
alkali milk vetch (*Astragalus tener* var. *tener*)	CNPS 1B	Alkaline soils in playas, vernal pools, and adobe clay areas in valley and foothill grassland	The project site is within the known range of this species and suitable habitat is present within the San Benito Groundwater Management Plan Area.
San Joaquin saltbush (*Atriplex joaquiniana*)	CNPS 1B	Chenopod scrub, meadow, playa, and valley and foothill grassland habitats, particularly in areas with alkaline substrates	The project site is within the known range of this species and suitable habitat is present within the San Benito Groundwater Management Plan Area.
Congdon's tarplant (*Centromadia parryi* ssp. *congdonii*)	CNPS 1B	Valley and foothill grassland habitat, particularly in areas with alkaline substrates, and in sumps or disturbed areas where water collects	The project site is within the known range of this species and suitable habitat is present within the San Benito Groundwater Management Plan Area.
round-leaved filaree (*Erodium macrophyllum*)	CNPS 2	Clay soils in cismontane woodland and valley and foothill grassland habitats.	The project site is within the known range of this species and suitable habitat is present within the San Benito Groundwater Management Plan Area.
Indian Valley bush mallow (*Malacothamnus aboriginum*)	CNPS 1B	Rocky areas in chaparral and cismontane woodland habitats; often found on burned areas.	The project site is within the known range of this species and suitable habitat is present within the San Benito Groundwater Management Plan Area.
hairless popcorn-flower (*Plagiobothrys glaber*)	CNPS 1A	Wet, alkaline soils in meadows and coastal salt marshes and swamps	The project site is within the known range of this species and suitable habitat is present within the San Benito Groundwater Management Plan

Table 2. Special-status Species, Their Status and Potential for Occurrence in the San Benito Groundwater Management Plan Project Area.

NAME	STATUS*	HABITAT	LOCAL OCCURRENCE
			Area.
Birds			
White-tailed Kite (*Elanus leucurus*)	SP	Resident of river valleys, riparian woodlands, and adjacent fields.	Could breed locally, and forage over a variety of habitats.
Mammals			
Ringtail (*Bassariscus astutus*)	SP	Prefers riparian and heavily wooded habitats near water.	Range poorly known. Could occur in suitable riparian habitat.

***SPECIAL STATUS CODE DESIGNATIONS**

FE = Federally listed Endangered
FT = Federally listed Threatened
FC = Federal Candidate. Sufficient biological information to support a proposal to list the species as Endangered or Threatened
SE = State listed Endangered
ST = State listed Threatened
SR = State listed as Rare
CSSC = California Species of Special Concern
CNPS 1A = Plants considered by the CNPS to be extinct in California.
CNPS 1B = Plants rare, threatened, or endangered in California and elsewhere.
CNPS 2 = Plants rare, threatened, or endangered in California, but more numerous elsewhere.
SP = State Protected Species

2.2.2.1 Special-status Plant Species Identified in CNDDB

Alkali Milk-vetch (*Astragalus tener* var. *tener*). Federal listing status: None; State listing status: None; CNPS List 1B. This annual herb occurs in alkaline soils in playas, vernal pools, and adobe clay areas in valley and foothill grasslands. The blooming period extends from March to June. The reported range of this species currently includes Alameda, Merced, Solano, and Yolo counties, and has been reported as extirpated from 10 others including San Benito County. Populations have been reported at elevations up to 60 meters (CNPS 2001). Although listed in the CNPS Inventory as extirpated from San Benito County, occurrences of this species were reported in the CNDDB within the Hollister quadrangle area in 1988 and 1993 and could be present within the Management Plan area.

San Joaquin Spearscale (*Atriplex joaquiniana*). Federal Listing Status: None; State Listing Status: None; CNPS List 1B. This annual herb occurs in chenopod scrub, meadows, playas, and valley and foothill grasslands, particularly those with alkaline substrates. The blooming period extends from April through October. The range of this species includes Alameda, Contra Costa, Colusa, Glenn, Merced, Monterey, Napa, Sacramento, San Benito, Santa Clara, San Joaquin, Solano, Tulare, and Yolo counties. Populations have been reported at elevations up to 320 meters (CNPS 2001). Four occurrences of this species have been reported in the CNDDB within the Hollister and San Felipe quadrangle areas between 1897 and 1995, all of which are currently presumed extant.

Congdon's Tarplant (*Centromadia parryi* ssp. *congdonii*). Federal Listing Status: None; State Listing Status: None; CNPS List 1B. This annual herb occurs in valley and foothill grassland habitat, particularly in areas with alkaline substrates, and in sumps or disturbed areas where water collects. The blooming period extends from June through November. The range of this species has been reduced to Monterey, San Luis Obispo, and Santa Clara counties. Populations have been reported at elevations up to 230 meters (CNPS 2001). Three occurrences of this species were reported in the CNDDB within the Natividad quadrangle area in 1998, all of which are currently presumed extant.

Round-leaved filaree (*Erodium macrophyllum*). Federal Listing Status: Species of Special Concern; State Listing Status: None; CNPS 2. This annual herb occurs in clay soils in cismontane woodland and valley and foothill grassland habitats. The blooming period extends from March to May. The range of this species includes portions of twenty-six counties, including San Benito, Monterey, and San Luis Obispo counties. Populations have been reported at elevations ranging from 15 to 2,000 meters (CNPS 2001). One occurrence of this species was reported in the CNDDB within the Hollister quadrangle area in 1999, and is currently presumed extant.

Indian Valley bush mallow (*Malacothamnus aboriginum*). Federal Listing Status: Species of Special Concern; State Listing Status: None; CNPS 1B. This deciduous shrub occurs in rocky areas in chaparral and cismontane woodland habitats and is often found on burned areas. The blooming period extends from April to October. The range of this species includes portions of Fresno, Monterey, and San Benito counties. Populations have been reported at elevations raging from 150 to 1,700 meters (CNPS 2001). Two occurrences of this species were reported in

the CNDDB within the Tres Pinos and Hollister quadrangle areas between 1917 and 1963, and are currently presumed extant.

Hairless popcorn-flower (*Plagiobothrys glaber*). Federal listing status: None; State listing status: None; CNPS List 1A. This annual forb occurs in wet alkaline soils of meadows and coastal salt marshes and swamps. The blooming period ranges from March to May. The historic range of this species included Alameda, Merced, Marin, San Benito, and Santa Clara counties. Populations have been reported at elevations raging from 15 to 180 meters (CNPS 2001). Three occurrences of this species were reported in the CNDDB within the San Felipe quadrangle area between 1938 and 1954, and these populations are currently regarded as extant by the CNDDB, though this species is now presumed extinct by the CNPS.

2.2.3 Special-Status Animal Species

Special status wildlife species that are likely to occur in the vicinity of the project sites are listed in Table 2. This list includes federally and state listed species, species of special concern, candidate species, and state protected species. These species are described below, but expanded accounts are provided only for species that are of highest concern.

Several special status bird species could pass through San Benito County during migration, occur as uncommon visitors, or breed in San Benito County outside of the Management Plan area, but would be unaffected by water development activities. These include American White Pelican (*Pelecanus erythrorhynchos*), Double-crested Cormorant (*Phalacrocorax auritus*), Bald Eagle (*Haliaeetus leucocephalus*), Osprey (*Pandion haliaetus*), Ferruginous Hawk (*Buteo regalis*), Sharp-shinned Hawk (*Accipiter striatus*), Peregrine Falcon (*Falco peregrinus*), Merlin (*Falco columbarius*), California Gull (*Larus californicus*), Mountain Plover (*Charadrius montanus*), Vaux's Swift (*Chaetura vauxi*), and Black Swift (*Cyseloides niger*). In addition, several of these species do not breed in San Benito County (e.g. White Pelican), but have special status only at nesting colonies. Golden Eagles (*Aquila chrysaetos*) and Prairie Falcons (*Falco mexicanus*) could forage at the site year-round, but are not likely to be affected by the projects.

Bank Swallows (*Riparia riparia*) nest in Monterey County, but are not known to nest in San Benito County. Breeding colonies of Bank Swallows, in sandy or gravelly banks, are very localized. Eggs were collected from a nest near the Highway 101 crossing of the Pajaro River in 1931 (CNDDB 2002), but there have been no recent local nesting records. Similarly, Southwestern Willow Flycatchers (*Empidonax trailii extimus*) and Western Yellow-billed Cuckoos (*Coccyzus americanus occidentalis*) do not currently breed west of the San Joaquin Valley. These species are presumed absent from San Benito County.

Although a CNDDB record exists for Coast Range newt (*Taricha torosa torosa*; CNDDB 2002), this species is only considered a species of special concern from Monterey County south. The species is common north of the Salinas River, and has no special status in San Benito County. Big-eared kangaroo rats (*Dipodomys elephantinus*) occur in chaparral habitat in San Benito County, but probably do not occur within the Management Plan area.

Species that are likely to breed at the site, are likely to be affected by the project, or are of higher concern to state and federal agencies, are described below.

2.2.3.1 Federal or State Endangered or Threatened Species

Vernal Pool Fairy Shrimp (*Branchinecta lynchi*). Federal Status: Threatened; State Status: None. The vernal pool fairy shrimp is a member of the aquatic crustacean order Anostraca, endemic to ephemeral fresh water vernal pools. Vernal pool fairy shrimp mature rapidly, allowing them to persist in pools filled for short periods. The active period for vernal pool fairy shrimp extends from early December to early May (USFWS 1994). Populations survive through the dry summer months as diapaused eggs in the pool sediment. The pools that vernal pool fairy shrimp inhabit typically have low total dissolved solids, alkalinity, and chloride levels. These pools are typically clear to tea-colored and occur most commonly in grass or mud bottomed swales, or basalt-lava-flow depressions in unplowed grasslands. The present distribution of this species is restricted to vernal pools within a geographic range extending fom Shasta County south through the Central Valley into Tulare County, and along the Central Coast Range from northern Solano County south into San Benito County (USFWS 1994).

Vernal pool fairy shrimp were listed by the USFWS in 1994 as threatened, and critical habitat for this and other vernal pool species was proposed in 2002 (USFWS 2002). Critical habitat unit 28 encompasses vernal pool habitats south and east of Pinnacles National Monument, outside of the Project area. There is no data available on the species' occurrence in northern San Benito County, although CDFG data indicate that vernal pool habitat occurs here. A similar species, the California linderiella (*Linderiella occidentalis*) has been found near Hollister (ESA 1995), but the vernal pool fairy shrimp has never been reported in the Project area (Eriksen and Belk 1999, CNDDB 2003, R. Hill pers. comm.). Although there are no records of the vernal pool fairy shrimp, they could occur in the Project area.

Steelhead (*Oncorhynchus mykiss*), South/Central Coast ESU. Federal Status: Threatened; State Status: Species of Special Concern. The steelhead is an anadromous form of rainbow trout that migrates upstream from the ocean to spawn. Steelhead usually migrate upstream to spawning areas in late fall or early winter, when flows are sufficient to allow them to reach suitable habitat in far upstream areas. Spawning occurs between December and June. Steelhead eggs remain in gravel depressions, known as redds, for one and one-half to four months before hatching. After hatching, young steelhead use the deeper reaches of streams as rearing areas, and will remain in freshwater for one to four years before migrating to the ocean. After migration, steelhead typically grow rapidly for two to three years before returning to freshwater streams to spawn. Unlike other salmonids, steelheads do not necessarily die after spawning. Many adults survive and return to the ocean after spawning, coming back to spawn for one or more additional seasons.

Steelhead usually spawn in clear, cool, perennial sections of relatively undisturbed streams. Preferred streams typically support dense canopy cover that provides shade, woody debris, and organic matter. Streams in which spawning occurs are usually free of rooted or aquatic vegetation. Gravel substrates are the optimum spawning habitat. Steelhead usually cannot survive long in pools or streams with water temperatures above 70°F. Despite their general requirement for cool water, steelhead can use warmer habitats if food is available, such as at fast water riffles where fish can feed on drifting insects.

Steelhead populations have declined due to degradation of spawning habitat, introduction of barriers to upstream migration, over-harvesting by the recreational fisheries, and reduction in winter flows due to damming and spring flows due to water diversion. Steelhead and other salmonids have been categorized into subpopulations, or Evolutionarily Significant Units (ESUs). In 1997, NMFS published a final rule to list the South-Central California Coast ESU of the steelhead as threatened under the FESA. This ESU includes all steelhead spawning from the Pajaro River south to (but not including) the Santa Maria River. In 2000, NMFS proposed critical habitat for this and other ESUs as accessible reaches of all rivers within the range of each listed ESU, although this critical habitat designation has since been vacated (rescinded). Ecology of southern steelhead (including the South/Central California Coast ESU) differs slightly from northern steelhead. Southern steelhead can cope with higher water temperatures, but because southern coastal streams may become very warm, Southern steelhead probably spend more time at-sea than their northern counterparts.

There have been few studies of steelhead in the San Benito River, and no records of steelhead occurring there (Smith 1982, Titus et al. in prep.). Steelhead have been observed in two tributaries of the San Benito River, circa 1995. Juveniles were found in Bird Creek (downstream of Hollister Hills SVRA) and dead adults were found in Pescadero Creek (J. Smith, pers. comm.). Because the San Benito River is contiguous with the Pajaro River, NMFS assumes that steelhead could occur there (Rosemary Laird, NMFS, pers. comm.). "Rainbow trout" have also been documented in upper Pacheco Creek, upper Clear Creek, and upper Arroyo Dos Picachos (Smith 1982). It is unclear whether these fish are anadromous steelhead or resident trout. In high flow years, steelhead could occur in any accessible tributary of the Pajaro River.

California Red-legged Frog (*Rana aurora draytonii*). Federal Status: Threatened; State Status: Species of Special Concern. The red-legged frog is a medium-sized frog with reddish-colored legs. The species is generally restricted to riparian and lacustrine habitats in California and northern Baja California. Red-legged frogs prefer deep, quiet pools (more than 0.7 meters deep) in creeks, rivers, or lakes below 1500 meters in elevation (Jennings and Hayes 1994). Habitat requirements include fresh emergent or dense riparian vegetation, especially willows adjacent to shorelines. Red-legged frogs can survive in seasonal bodies of water that are dry for short periods if a permanent water body or dense vegetation stands are nearby.

Adult red-legged frogs are normally active at night and breed in still water during the late winter or early spring after waters recede. Females attach eggs in a single cluster to a vegetation brace just under the surface of the water. The eggs hatch in just over a week and the resulting larvae feed on plant and animal material on the bottom of the pond. It takes at least four months for the larvae to metamorphose into juvenile frogs. On rare occasions, larvae overwinter.

The USFWS listed the California red-legged frog as threatened in 1996. Several records for this species exist for San Benito County (CNDDB 2002), and red-legged frogs could occur in aquatic habitat throughout the county.

California Condor (*Gymnogyps californianus*). Federal listing status: Endangered; State listing status: Endangered. With a wingspan of greater than 9 ft. (3 m), the California Condor is the largest North American raptor. Condors nest primarily on cliffs, and forage on carrion in

grasslands and other open habitats. The small population of condors in California declined throughout the 20th century, as a result of hunting and poisoning (intentional and unintentional). In 1987 the last wild California Condor was caught for captive rearing. Reintroduction efforts are now underway in southern California and Big Sur (Monterey County). A new reintroduction effort is planned near Pinnacles National Monument, in San Benito County. California Condors are extremely rare, but could occur in small numbers in San Benito County in the future.

Least Bell's Vireo (*Vireo bellii pusillus*). Federal listing status: Endangered; State listing status: Endangered. Prior to 1920, the California population of Least Bell's Vireo was common and considered abundant in dense riparian thickets, especially in upper Salinas Valley (Roberson 1985). By 1930 however, declines were widespread mostly due to parasitism by Brown-headed cowbirds (*Molothrust ater*). The species was thought to be extinct in northern California by 1970. In 1980, the species was listed by the State of California as Endangered. In 1986, the species was federally listed as Endangered, and critical habitat for the species was designated in 1994. Isolated and infrequent sightings of singing males in northern and central California have raised hope that the species may eventually recolonize historic habitat in northern California. In 1972, and again in 1982, lone singing males were found in riparian habitat in Pinnacles National Park, in San Benito County (Roberson 1985). In 1983, three singing males were found on the Salinas River in southern Monterey County. Since that time, there have been only two local records. In the spring of 1997, a pair was breeding on Llagas Creek, in southern Santa Clara County (Steve Rottenborn, pers. comm.) and on May 17, 2001, two Least Bell's Vireo males were observed singing in the same reach of Llagas Creek (Douglas Padley, pers. comm).

Least Bell's Vireos are migratory, occurring in California primarily during the breeding season (March to August). There have been no recent reports of this species in San Benito County or northern Monterey County. Although it is unlikely that this species currently breeds in San Benito County, it could occur in the future in suitable riparian habitat.

San Joaquin Kit Fox (*Vulpes macrotis mutica*). Federal Status: Endangered; State Status: Threatened. San Joaquin kit foxes inhabit grasslands and scrublands in California. The species' range currently includes much of the San Joaquin Valley and adjacent foothills, and interior valleys in San Luis Obispo, Monterey, and San Benito Counties. Loss of habitat from urban, agricultural, and industrial development are the principal factors in the decline of the San Joaquin kit fox. The species was listed as endangered by the USFWS in 1967 and by the State of California in 1971. Critical habitat has not been designated for the species.

The San Joaquin kit fox typically occurs in annual grassland or mixed shrub/grassland habitats throughout low, rolling hills and in the valleys. The diet of kit foxes varies geographically, seasonally, and annually, but throughout most of its range the diet consists primarily of rodents, ground nesting birds, and insects. Kit foxes forage nocturnally. Breeding occurs from December through February, with pups usually born in February or March. One litter per year is typical, with an average of four pups per litter. The pups remain with the parents until June or July, at which time the juveniles usually disperse distances of up to five miles. Kit foxes may be solitary from mid-summer through late fall, and then occur in family groups from late fall through early summer.

Kit foxes require underground dens for temperature regulation, shelter, reproduction, and predator avoidance. Kit foxes commonly modify and use dens constructed by other animals and human-made structures. Dens are usually located on loose-textured soils on slopes less than 40 degrees (O'Farrell et al. 1980), but the characteristic of San Joaquin kit fox dens varies across the fox's geographic range. Kit foxes change dens often, using up to 70 dens each year, apparently primarily to avoid depredation by coyotes.

Kit foxes have been reported near Hollister as recently as 1992 (CNDDB 2002). There have not been any recent reports, and the species may no longer occur in the county. However, there have been no focused efforts to census kit foxes in San Benito County, and the species could occur throughout the county in suitable habitat.

2.2.3.2 Federal Candidate Species

California Tiger Salamander (*Ambystoma californiense*). Federal Status: Candidate; State Status: Species of Special Concern. California tiger salamander's preferred breeding habitat is temporary ponded environments (e.g., vernal pool, ephemeral pool, or human-made ponds lasting for at least three months) surrounded by uplands that support small mammal burrows. The species will utilize permanent ponds provided that aquatic vertebrate predators are not present. Such ponds provide the breeding and larval habitat, while small mammal burrows (e.g., ground squirrel and pocket gopher) in the upland habitats support juvenile and adult salamanders during the dry season.

The range of the California tiger salamander is restricted to the Central Valley and the South Coast Range of California from Butte County south to Santa Barbara County. They have disappeared from a significant portion of their range due to habitat loss from agriculture and urbanization and the introduction of non-native aquatic predators.

Several records exist for this species in San Benito County (CNDDB 2002), in the grassland habitat surrounding the Bolsa Valley.

2.2.3.3 State Species of Special Concern

Monterey Roach (*Lavinia symmetricus subditus*). Federal listing status: None; State listing status: Species of Special Concern. This small fish is one of several subspecies of California roach that occur throughout northern California. The Monterey roach occurs in tributaries entering Monterey Bay, including the Salinas, Pajaro, and San Lorenzo drainages. Monterey roach are found in warm, small to moderate-sized streams and isolated pools. They feed primarily on filamentous algae, and spawn in shallow areas with gravel substrate. The subspecies is likely declining due to habitat alteration. Smith (1982) found the subspecies at several sites on the San Benito River, Pacheco Creek, and other tributaries of the Pajaro River.

Western Pond Turtle (*Clemmys marmorata*). Federal listing status: None; State listing status: Species of Special Concern. The western pond turtle is an aquatic turtle that usually leaves the aquatic site to reproduce, to aestivate, and to overwinter. This turtle requires some slack or slow water, although it will occur where enough food resources occur in faster moving

water. Nesting areas usually occur in upland areas from March to July, in hard-packed clay soil. Hatchlings disperse from the nest with winter rains. The species is known to occur in aquatic habitat at several sites in San Benito County (CNDDB 2002).

California Legless Lizard (*Anniella pulchra*). Federal listing status: None; State listing status: Species of Special Concern. Legless lizards are fossorial animals that construct burrows in loose soil with a high sand content. California legless lizards occur in areas with sandy or loose loamy soils under sparse vegetation on beaches, in chaparral, and on stream terraces. They are often found under or in the close vicinity of surface objects such as logs, rock, old boards and compacted debris. Soil moisture is also essential for legless lizards. Although no records exist for San Benito County, this species is usually located only through detailed surveys. Legless lizards could occur in sandy soils along the San Benito River.

California Horned Lizard (*Phyrnosoma coranatum frontale*). Federal Status: None; State Status: Species of Special Concern. California horned lizards occupy loose sandy loam and alkaline soils in a variety of habitats including chaparral, grasslands, saltbush scrub, coastal scrub, and clearings in riparian woodlands. They primarily eat insects such as ants and beetles. They once inhabited much of the Central Valley but have disappeared from much of their former range. Their population decline is mainly attributed to conversion of land for agricultural purposes. The human introduction of non-native Argentine ants, which are inedible to horned lizards and tend to displace the native carpenter ants, is another factor in their decline. Horned lizards are expected to occur in sandy soils along the San Benito River.

San Joaquin Whipsnake (*Masticophis flagellum ruddocki*). Federal Status: Species of Special Concern; State Status: Species of Special Concern. The San Joaquin whipsnake is a fairly large (ca. 1 m) slender snake found in open, dry habitats. The subspecies occurs in the western San Joaquin Valley and the Coast Ranges of central and southern California. Little is known of the life history of the taxon. One record of a San Joaquin whipsnake exists from dry channel of the San Benito River near Hollister (CNDDB 2002). The species likely occurs in similar habitat at other locations in the county.

Western Spadefoot (*Scphiopus hammondi*). Federal Status: None; State Status: Species of Special Concern. The western spadefoot is a toad that inhabits grassland habitats of central California and the southern California coast. It requires temporary pools of water, lacking predators such as fish, bullfrogs, or crayfish, for egg laying. Several records exist for this species in the Project Area, south of Hollister (CNDDB 2002).

Foothill Yellow-legged Frog (*Rana boylii*). Federal Status: None; State Status: Species of Special Concern. The foothill yellow-legged frog is a moderate-sized frog that occurs in aquatic habitats in Pacific drainages in Oregon and California. Foothill yellow-legged frogs prefer shallow flowing water with at least some cobble-sized substrate, in which they lay their eggs. Like other frogs, they feed on insects and aquatic invertebrates. This species is fairly common in suitable habitat in southern San Benito County.

California Burrowing Owl (*Athene cunicularia*). Federal listing status: None; State listing status: Species of Special Concern. The Burrowing Owl is a small, terrestrial owl of open

country. Burrowing Owls favor flat, open grassland or gentle slopes and sparse shrubland ecosystems. In California, Burrowing Owls are found in close association with California ground squirrels. Ground squirrels provide nesting and refuge burrows, and maintain areas of short vegetation height, which provide foraging habitat and allow for visual detection of avian predators by Burrowing Owls. Burrowing Owls are semi-colonial nesters, and group size is one of the most significant factors contributing to site constancy by breeding Burrowing Owls. The nesting season, as recognized by the California Department of Fish and Game, runs from February 1 through August 31. Several records exist for this species in the vicinity of the Flint Hills (CNDDB 2002).

Northern Harrier (*Circus cyaneus*). Federal Status: None; State Status: Species of Special Concern. The Northern Harrier is commonly found in open grasslands, agricultural areas, and marshes. Nests are built on the ground in areas where long grasses or marsh plants provide cover and protection. Harriers hunt for a variety of prey, including rodents, birds, frogs, reptiles, and insects by flying low and slow in a traversing manner utilizing both sight and sound to detect prey items. Northern Harriers are common during winter in San Benito County, and could nest in spring and summer throughout the county.

Cooper's Hawk (*Accipiter cooperii*). Federal listing status: None; State listing status: Species of Special Concern. The Cooper's Hawk preys upon medium-sized birds (e.g., jays, doves, and quail) and occasionally takes small mammals and reptiles. Cooper's Hawks prefer landscapes where wooded areas occur in patches and groves, which facilitates the ambush hunting tactics employed by the species. Breeding pairs in California prefer nest sites within dense stands of live oak woodland or riparian areas, and prey heavily on young birds during the nesting season. Cooper's Hawks could occur as uncommon nesters in suitable habitat throughout the county.

California Horned Lark (*Eremophila alpestris*). Federal listing status: None; State listing status: Species of Special Concern. Horned Larks are songbirds common in grasslands and deserts throughout California. They resident in most habitats, and breed from March through July, with peak activity in May. Horned Larks build grass-lined nests directly on the ground. Several nesting records exist for the species east of Hollister (CNDDB 2002), and Horned Larks could nest in suitable grassland throughout the county.

Tricolored Blackbird (*Agelaius tricolor*). Federal listing status: None; State Listing Status: Species of Special Concern. Tricolored Blackbirds are found almost exclusively in the Central Valley and central and southern coastal areas of California. In 1992, surveys by the California Department of Fish and Game determined that the population of this species was much larger than previously believed. Thus, the concern for the species lessened considerably.

The Tricolored Blackbird is highly colonial and forms dense breeding colonies of up to tens of thousands of pairs. This species typically nests in tall, dense, stands of cattails or tules, but also nests in blackberry, wild rose bushes and tall herbs. Nesting colonies are typically located near standing or flowing freshwater. Tricolored Blackbirds form large, often multi-species, flocks during the non-breeding period and range more widely than during the reproductive season. During statewide surveys conducted in 1997, a colony of greater than 7,500 birds was reported at

San Felipe Lake (Beedy and Hamilton 1997). Several other CNDDB (2002) records exist, although location data is suppressed as "sensitive." This species could nest at a variety of emergent wetland sites throughout the county.

California Yellow Warbler (*Dendroica petechia brewsteri*); Federal status: None; State status; Species of Special Concern. Yellow Warblers prefer deciduous, riparian habitats consisting of alders, cottonwoods, willows and other trees and shrubs. Most Yellow Warblers migrate to Mexico and South America in the fall and return to California to breed in April. Some birds spend winter in southern California lowlands. Nesting Yellow Warblers are likely to be found in suitable riparian habitat throughout the county.

Yellow-breasted Chat (*Ictera virens*); Federal listing status: None; State listing status; Species of Special Concern. Yellow-breasted Chats are migratory songbirds that favor dense riparian thickets for nesting. Population declines in the species are thought to be due to loss of nesting habitat and Brown-headed Cowbird parasitism of their nests. One record exists of a nesting Chat near Paicines Reservoir (CNDDB 2002), but other nesting birds probably occur in suitable habitat in San Benito County.

Loggerhead Shrike (*Lanius ludovicianus*). Federal listing status: None; State Listing Status: Species of Special Concern. Loggerhead Shrikes are year-round residents in grassland and scrub habitats in California, where they forage primarily on large insects, lizards, and small mammals. Shrikes generally build their nests in shrubs in fairly open areas. This species is fairly common and widespread throughout the year in San Benito County.

California Mastiff Bat (*Eumops perotis californicus*). Federal listing status: Federal Species of Concern; State listing status: Species of Special Concern. California mastiff bats are the largest of all of North America species of bats with a forearm length of 73 - 83 mm and weighing up to 100 grams. *Eumops* can forage at 600 to 700 meters above ground level and may forage for 7 hours and 15 miles from their roost. This species roosts primarily in cliffs or high buildings where there is a minimum of 3 meters of vertical drop at the entrance to roosts. This species is found in the central and south coastal California, the San Joaquin Valley, the southern half of the Sierra foothills, and throughout desert regions. This species may utilize bridges or buildings as night roosts, day roosts or maternity roosts. Occurrence in San Benito County is poorly known.

Townsend's big-eared bat (*Corynorhinus townsendii*). Federal listing status: none; State listing status: Species of Special Concern. California has two subspecies, *C. t. townsendii* and *C. t. pallescens*, and intergrades occur at the boundaries of the two subspecies. Townsend's big-eared bat is a colonial species and females aggregate in the spring at nursery sites known as maternity colonies. Although Townsend's big-eared bat is usually a cave dwelling species, many colonies are found in anthropogenic structures such as the attics of buildings or old abandoned mines. Radiotracking studies suggest that movement from a colonial roost during the maternity season is confined to within 15 km of the nursery. This species is easily disturbed while roosting in buildings, and females are known to completely abandon their young when disturbed. Occurrence of this species in the Management Plan area is poorly known.

Pallid Bat (*Antrozous pallidus*). Federal Status: None; State Status: Species of Special Concern. Pallid bats are pale to light brown in color, and, at about 24 grams, the Pacific race is one of the state's largest bats. Coastal colonies commonly roost in deep crevices in rocky outcroppings, in buildings, under bridges, and in hollow trees. Colonies can range from a few individuals to over a hundred and are non-migratory. Some female/young colonies (typically the coastal subspecies) use their day roost for their nursery as well as hibernacula. Pallid bats can breed from March 15 through August 15. Although crevices are important for day roosts, night roosts often include porches, garages, barns, and highway bridges. Pallid bats may travel up to several miles for water or foraging sites if roosting sites are limited. Pallid bats prefer foraging on terrestrial arthropods in dry open grasslands near water and rocky outcroppings or old structures. Occurrence in San Benito County is poorly known.

2.2.3.4 State Protected Species

White-tailed Kite (*Elanus caeruleus*). Federal Status: None; State Status: Fully Protected. White-tailed Kites forage for small rodents and other prey primarily in open grassy or scrubby areas. They nest in large shrubs or trees adjacent to this habitat. Kites are expected to nest in oak woodlands in San Benito County, and to be found foraging in a variety of habitats throughout the county.

Ringtail (*Bassariscus astutus*). Federal status: None; State Status: Fully Protected.
The ringtail is a small member of the raccoon family, occurring in California in or near riparian habitats with some forest or brush cover. They are nocturnal animals, and nest in hollow trees, logs, snags, rock recesses, and abandoned burrows or woodrat nests. Ringtails are uncommon and rarely seen, but the species could occur in riparian habitats in San Benito County.

2.3 IDENTIFICATION OF REGULATED HABITATS

2.3.1 United States Army Corps of Engineers Jurisdiction

Brief reconnaissance-level field surveys were conducted within the Management Plan area boundaries for potentially regulated habitats, including wetland and aquatic channel (tributary water) habitats. Activities conducted within such areas are potentially under the regulatory jurisdiction of the U.S. Army Corps of Engineers (USACE). Areas of potential wetlands are those identified by guidelines outlined in the "Routine Determination Method" in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987). Tributary waters (i.e. incised seasonal or perennial drainages devoid of wetland vegetation) are those areas extending to the ordinary high water (OHW) mark between opposing channel banks. The OHW mark is typically indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in character of soil, destruction of vegetation, exposed roots on the bank, deposition of leaf litter and other debris materials or lower limit of moss growth on channel banks.

Results. Numerous known wetland resources exist within the Management Plan area including natural emergent wetland and riverine resources, and aquatic habitats excavated in uplands. These include the San Benito and Pajaro Rivers, and Tres Pinos and Pacheco Creeks, and areas along their lengths where the National Wetland Inventory (NWI) has identified wetlands. Other

watercourses within the Management Plan area expected to fall within USACE jurisdiction include Arroyo de las Viboras, Arroyo dos Picachos, Santa Ana Creeks, and Tequisquita Slough. Potentially jurisdictional lacustrine areas include San Felipe Lake, and Paicines Reservoir. The NWI has also identified various excavated wetland resources, particularly in the area of the proposed agricultural drainage pipeline (Figure 3).

In addition, the CDFG California Vernal Pool Assessment Preliminary Report (1998) identifies the valley areas of San Benito County (also extending into adjacent counties) as a vernal pool region. While plant species commonly associated with vernal pools have been documented within northern San Benito County, no distinct communities have been identified within the larger Management Plan area. Furthermore, the NWI does not identify any particular areas of vernal pool habitat in northern San Benito County, presumably because most of the area is under regular cultivation. As mentioned above, any vernal pools encountered within the basin floor areas of the Hollister region are expected to be more closely related to vernal marsh habitat in terms of their supporting hydrology, though plant composition between the two is highly similar.

2.3.2 California Department of Fish and Game Jurisdiction

Brief field surveys were also conducted within the Management Plan area for habitats potentially under the regulatory jurisdiction of the CDFG as described under Division 2, Chapter 6, Section 1600-1607 of the Fish and Game Code of California. The CDFG potentially extends the definition of stream to include "intermittent and ephemeral streams, rivers, creeks, dry washes, sloughs, blue-line streams (U.S. Geological Service), and watercourses with subsurface flows. Canals, aqueducts, irrigation ditches, and other means of water conveyance can also be considered streams if they support aquatic life, riparian vegetation, or stream-dependent terrestrial wildlife" (California Department of Fish and Game 1994). Such areas are further described in *A Field Guide to Lake and Streambed Alteration Agreements, Sections 1600-1607* (CDFG 1994).

Activities that result in the diversion or obstruction of the natural flow of a stream, or substantially change its bed, channel or bank, or utilize any materials (including vegetation) from the streambed require that the project applicant enter into a Streambed Alteration Agreement with CDFG, under sections 1600-1603 of the California Fish and Game Code. Impacts requiring a Streambed Alteration Agreement are not necessarily significant unless aquatic or riparian vegetation habitats are impacted.

Results. The bed and banks of the San Benito River, Tres Pinos Creek, Santa Ana Creek, Arroyo Dos Picachos, Arroyo de la Vibora, Tequisquita Slough, and Pacheco Creek are potentially subject to the regulatory jurisdiction of the CDFG. The boundary of CDFG jurisdiction along water courses is typically wider than that defined for most of the USACE jurisdictional areas since the top-of-bank is usually well-beyond the ordinary high water mark. While the CDFG typically claims jurisdiction in native watercourses with riparian vegetation, they can choose to exert jurisdiction in excavated (agricultural) watercourses, which are numerous in the project region, if certain criteria are met as described above.

2.3.3 County and City Tree Ordinances

No information regarding ordinances in the County of San Benito and the City of Hollister could be obtained, and therefore it is assumed that any trees to be impacted under the project elements are not afforded any protection. However, ecologically significant trees are expected to occur within the Management Plan area.

3.0 IMPACTS AND MITIGATION

The proposed project will have a number of effects on the biological resources of the project site. The California Environmental Quality Act (CEQA) and the CEQA Guidelines provide guidance in evaluating project impacts and determining which impacts will be significant. CEQA defines "significant effect on the environment" as "a substantial adverse change in the physical conditions which exist in the area affected by the proposed project." Under CEQA Guidelines section 15065 and Appendix G, a project's effects on biotic resources may be significant when the project would:

- "Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service."

- "Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or U.S. Fish and Wildlife Service."

- "Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act" (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means."

- "Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites."

- "Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance."

- "Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan."

- "Have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory.

3.1 IMPACT ASSESSMENT OVERVIEW

This Program EIR analyzes impacts to biological resources at a programmatic-level of detail and is based on the current Management Plan toolbox elements. More detailed impact analyses and new or more detailed mitigation measures for biological resources will occur with subsequent

project-specific environmental review including a reanalysis of project impacts to species that have had a change in listing status or population distribution (e.g. Least Bell's Vireo).

The exact location and construction features of proposed project elements are not known, and project element-specific impacts to biological resources cannot be fully characterized or quantified at this time. However, the proposed project includes many components that have the potential independently or collectively to impact biological resources and are assessed herein at the programmatic-level. Table 3 shows the primary project elements and their potential effects, based on a "worst case" scenario (e.g. construction or operation of new facilities in a biologically sensitive habitat). However, it is likely that many of these elements involve using existing facilities, and construction of most new facilities is expected to take place primarily in upland settings (Figure 2). Operation of the elements could have a variety of impacts to biological resources because plan implementation involves many actions for which details are not known, the approach to impact assessment is based on broad physical changes brought about by independent and collective project element implementation. Therefore, all potential impacts to biological resources from the Management Plan elements fall into four categories, described below.

Table 3. San Benito Groundwater Management Plan Project Element Impact Assessment Matrix

					Impacts to Wetland and Riparian Habitats due to:				Impacts to Special-status Species due to:	
		Project Element	Component / Sub-Element	Map Symbol	Changes in Groundwater Levels	Changes in Stream Flow	Degradation of Ground/ Surface Water Quality	Direct Construction Impacts	Loss/Degradation of Aquatic Habitat	Direct Construction Impacts
B	Banking	In Basin Water Banking	In Lieu Banking	Blue Shaded	L	L	L	L	L	L
			Artificial Direct Percolation	Green Shaded	L	L	L	L	L	L
			Injection of surface water into, and extraction of well water out of aquifer	None	L	L	L	L	L	L
C		Development or Redevelopment of High Quality Local Groundwater and Surface Water Supplies	Pacheco/Northern Hollister East groundwater Pumping for redistribution (not export)	None	U	U	L	L	U	L
			Redevelop Cienega Water Source	Red Pipeline	L	L	L	M	L	M
			Diversions on Arroyo Dos Picachos, Arroyo las Viboras for redistribution	Orange Circles	L	L	L	L	M	M
D		Regional and Local Conveyance	New Pipeline	Black Line	L	L	L	M	L	M
J		Groundwater Pumping for Water Level/Water Quality Management	Redistribute or Pump Poor Quality Water out of Hollister basin	None	U	U	L	L	U	L
E	Blending	Groundwater Treatment & Concentrate Disposal	Construction of Treatment and Storage Facilities for demineralization & softening of water	Orange/Brown Squares	U	U	L	L	M	M
F		Groundwater/Surface Water Blending Facilities (for agricultural water uses)	Construction of Blending Facilities for combination of surface and ground water	None	U	L	L	L	L	M
G	Out of Basin Discharge	Direct Reuse of Reclaimed Municipal and Industrial Wastewater	Disposal mechanism for reclaimed water	Yellow/Black Squares	L	L	L	L	L	M
H		Tile Drains for Groundwater Level Management	Construction of Drainage Pipeline to collect agricultural effluent from tile drains for export	Orange Line	L	U	M	L	L	M
I		Tree Belt Evapotranspiration for Level Management or Wastewater Disposal	Plant Trees for Evapotranspiration	None	L	L	L	L	L	L
K		River Discharge	River Discharge	Purple Asterisk	U	U	M	M	U	M

Table 3. San Benito Groundwater Management Plan Project Element Impact Assessment Matrix

					Impacts to Wetland and Riparian Habitats due to:				Impacts to Special-status Species due to:	
		Project Element	**Component / Sub-Element**	**Map Symbol**	Changes in Groundwater Levels	Changes in Stream Flow	Degradation of Ground/ Surface Water Quality	Direct Construction Impacts	Loss/Degradation of Aquatic Habitat	Direct Construction Impacts
L		Export Pipeline	Export Pipeline, Ocean Discharge Through Watsonville	None	L	L	L	L	L	M
M		Evaporation and Trucking of Salts	Evaporation Ponds and Trucking	Green Line	L	L	L	M	L	M
N		Constructed Wetlands for Water Treatment	Wetland Construction for Polishing	Yellow Rectangle	L	L	L	L	L	M
	Legend:	L	Less than Significant							
		M	Less than Significant with Mitigation Incorporated							
		U	Potentially Significant, Unmitigable Impacts							
	Note: This matrix considers any potentially significant impact. In addition, special-status species could be affected by impacts such as conversion of grassland to agriculture as a result of increased water availability. This could occur from any combination of project components.									

Changes in Groundwater Levels. A primary objective of the proposed project is to manage groundwater levels. Groundwater levels that are currently close to the surface will be lowered, particularly in the Bolsa, Pacheco, and Hollister East subbasins. Groundwater levels will be lowered from current levels at or near the surface, to 25 to 30 feet below the ground surface. These changes could significantly alter existing habitats. For example, surface waters in the lower San Benito River, Pacheco Creek and Tequisquita Slough in summer are currently supported by very high groundwater levels. This aquatic habitat, and associated wetland and riparian habitat, could be lost or degraded if groundwater levels were significantly lowered. The role of individual project elements in changing groundwater levels cannot currently be assessed with accuracy. Groundwater levels will change primarily as a cumulative effect of implementation of many different project elements. Project elements that could contribute to changes in groundwater levels are:

- *In-Basin Water Banking (B).* The in-lieu banking and direct percolation sub-elements are expected to maintain or raise groundwater levels through the use of existing facilities or incorporation of other project element facilities. The redistribution of groundwater through a single injection and/or extraction well (aquifer storage and recovery sub-element) will not raise or lower ground water levels substantially from the managed levels of 25 to 30 feet below the ground surface. .
- *Ground/surface Water Blending Facilities for Agricultural Usage (F).* This project element would combine groundwater and surface water supplies within close proximity of each other in the San Juan sub-basin (high groundwater levels) for agricultural usage. Little is known about the volume of groundwater extraction in the San Juan sub-basin or the source of surface water to be used in this project element and therefore specific impacts regarding effects on groundwater levels cannot be addressed.
- *Groundwater Pumping for Water Level/Water Quality Management (J).* This project element involves exporting poor quality water out of the San Juan, Pacheco, and Hollister East sub-basins where groundwater levels are highest. It is expected that this would be accomplished using existing facilities and wells, and may be combined with either the regional & local conveyance, and/or export project elements. The redistribution and/or export of groundwater under this element may have unknown effects on ground water levels in the Pacheco and Hollister-east sub-basins.
- *Tile Drains of Local Groundwater Management (H).* This project element entails the construction of a drainage pipeline to collect agricultural effluent in the San Juan sub-basin and centralize discharge, incorporating either the constructed wetland (for polishing), river discharge, or export project elements. This project will reduce groundwater levels in certain areas.
- *Development or Redevelopment of High Quality Local Groundwater and Surface Water Supplies (C).* The development of the pumping sub-element in the Pacheco and Hollister-east subbasins for transfer of groundwater to other subbasins may have effects on groundwater levels in these areas.
- *Tree Belt Evapotranspiration for Groundwater Level Management and Wastewater Disposal (I).* The planting of high water-use trees is intended to reduce groundwater levels in certain areas.

Changes in Stream Flow. Through reduction of groundwater levels, diversion of surface water, or additional discharge of treated water, the proposed project could alter stream flows. These alterations, determined by the elements implemented, include both increasing and/or decreasing stream flows. Reductions in stream flows could negatively affect aquatic organisms and riparian habitat. Increased stream flows could channel scour and reduce water quality. All of the project elements that could affect groundwater levels (above) could indirectly lead to changes in stream flow. In addition, the following project element could reduce stream flow:

- *Development or Redevelopment of High Quality Local Groundwater and Surface Water Supplies (C).* The proposed diversion project elements on the Arroyo Dos Picachos and Arroyo las Viboras, and Pacheco creek (Figure 2) will only occur where there are existing structures and under existing water rights. This element may be combined with the regional & local conveyance project element. Furthermore, diversions will only remove water above what is necessary to maintain flows in these channels and will not result in dry stream channels. However, stream flow is likely to be reduced by this project element.

Degradation of Ground or Surface Water Quality. The proposed project could result in degradation of ground or surface water quality as a result of discharge of treated water, and several other project elements. Degradation of water quality could result in impacts to native habitats or special-status species. Project elements that could affect water quality are:

- *Tile Drains for Local Groundwater Management (H).* This project element entails the construction of a drainage pipeline to collect agricultural effluent in the San Juan sub-basin and centralize discharge, incorporating constructed wetlands (for polishing), river discharge, or export project elements. The construction of the pipeline is expected to take place in uplands and is not expected to impact surface water dependent habitats. However, poor quality water discharged into streams may have an adverse affect on the character of such downstream habitats.

- *Direct Reuse of Reclaimed Municipal and Industrial Wastewater (G).* This project element would use reclaimed water instead of groundwater for municipal purposes in the San Juan Bautista area, thereby lowering high groundwater levels caused by direct effluent percolation. It is not known how this project element would affect water quality.

- *Constructed Wetlands for Water Treatment (N).* The construction of wetlands along the San Benito River is proposed to take place in an area of upland excavation formerly used for gravel mining. Water quality within the constructed wetlands could be affected by discharges of poor quality water, which subsequently could affect special-status animal species using the constructed wetlands for breeding and foraging.

- *Out of Basin Discharge (K,L,M).* This project element may cause increases in stream flow, and result in degradation of water quality. Specifically, the discharge of wastewater effluent, diluted brine concentrate, and pumped groundwater and/or agricultural drainage into the San Benito River (purple asterisk, Figure 2) may significantly alter downstream water quality, and downstream habitats.

Direct Construction Impacts. Construction of pipelines, water pumping and treatment facilities, and other project elements could have direct effects on biotic resources. Almost every project element could result in direct construction impacts. The only project elements that are unlikely to have direct construction impacts are in-lieu water banking and groundwater pumping for water quality/water level management. Construction could result in loss of regulated and sensitive habitats, and direct loss of special-status flora and fauna. Specific location of project elements will play a large role in direct construction impacts. Most impacts can be avoided through proper planning to avoid sensitive resources. Project elements that could involve direct construction impacts are shown in Table 3.

More specific impacts and mitigation measures are discussed below. Because details are not available for a number of project elements, mitigation measures are necessarily general. More specific mitigation measures will be developed for individual project elements in subsequent project-specific environmental review.

3.2 EFFECTS FOUND TO BE LESS-THAN-SIGNIFICANT

Project elements with less than significant impacts to biological resources are described below. Full project element descriptions are described above. See Table 3 for a summary of these impacts.

3.2.1 Loss of Annual Grassland, Oak Woodland and Coastal Scrub Habitats within the San Benito Groundwater Management Plan Area

Most of the project elements will be developed in the urban or agricultural portions of the Management Plan area. For those aspects of project elements occurring in non-developed areas such as annual grasslands, oak woodlands, and coastal scrub, any displacement of these habitats is expected to be minimal. In general, these habitats within the Management Plan area are regionally abundant and the majority of the biotic resources associated with these habitats will continue to be abundant following development, although special status species may be affected (see *Impacts to Special-Status Animal Species*, below). Therefore, the loss of annual grassland, oak woodland and coastal scrub habitats will be a less-than-significant impact.

3.2.2 Impacts to and Loss of Habitat for Various Special-Status Plant Species

To determine the potential for impacts to special status plant species within the Management Plan area, the rarity of each species, quality of habitat, and proximity of known populations were evaluated. Project elements which involve the use or expansion of existing facilities, changes in management strategy (without infrastructure improvement), or occur in areas that are too degraded to support special status plants will not affect special status plant species. Those project elements which will require new facilities in otherwise undeveloped areas where special-status plant species are expected or known to occur but are also known to be common elsewhere in the region will have a less-than-significant impact to the following plants: alkali milk-vetch, San Joaquin spearscale, Congdon's tarplant, and round-leaved filaree. However, other special status plant species which are more limited in distribution may be significantly impacted by project elements in undeveloped areas (see Impacts to Special-status Plant Species below).

3.2.3 Impacts to Certain Special-status Animal Species from Reductions in Groundwater Levels

Reductions in groundwater levels resulting from many different project elements could lead to a loss of aquatic, wetland and riparian habitats. Although loss of aquatic habitat will be significant for some species, the Monterey roach, a special-status fish, is not expected to be significantly impacted. This species survives in shallow, warm, aquatic environments, and populations are not critically declining. Loss of riparian habitat as a result of a reduction in groundwater levels is not expected to significantly impact any special-status animal species. Least Bell's Vireo's are not currently known to occur in San Benito County and therefore will not be impacted by changes in groundwater levels. Furthermore, a loss of riparian habitat will not significantly reduce available nesting habitat for California Yellow Warblers or Yellow-breasted Chats.

3.2.4 Construction Impacts to Certain Special-Status Animal Species

Construction related to the implementation of various elements of the Management Plan could impact several special-status animal species. However, some of these species are unlikely to be significantly impacted by construction activities, in part because they are not at critically low population levels. Species that are not expected to be significantly impacted by construction activities include the Monterey roach, legless lizard, San Joaquin whipsnake, California horned lizard, Northern Harrier, Cooper's Hawk, California Horned Lark, California Yellow Warbler, Loggerhead Shrike, White-tailed Kite, any special-status bat species, and ringtail. These species could be impacted, but not significantly impacted, by the Management Plan implementation.

3.2.5 Conversion of Native Habitats to Agriculture

The Project as a whole will improve water quality and supply in San Benito County, potentially leading indirectly to an increase in agriculture. It is not anticipated, however, that significant portions of native habitat (wetlands, riparian, grassland and oak woodland habitats) will be converted to agriculture. The Project will primarily affect water quality and availability in areas that are already used for agriculture, in the Bolsa Hollister East and San Juan Subbasins.

3.2.6 Impacts to Marine Habitat and Species from Ocean Disposal

One option for disposal of excess water high in TDS (high salinity) is marine disposal, potentially in coordination with City of Watsonville wastewater discharge. Water exported from San Benito County will be of lower salinity than seawater, and will not contain toxins or other pollutants. Discharge of this water into the marine environment will not affect marine species or marine water quality. The discharge of additional wastewater effluent or concentrate from groundwater treatment, in conformance with waste discharge requirements for the Watsonville outfall, would not substantially affect marine species or water quality.

3.2.7 Impacts to Burrowing Owl Habitat

Several project elements will lead to the loss of a small amount of annual grassland habitat that could provide both breeding and foraging habitat for Burrowing Owls. However, annual grasslands are regionally abundant and the loss of a small area of annual grasslands that could

support Burrowing Owls is not a significant impact (however, impacts to breeding Burrowing Owls is considered a significant impact, see below).

3.2.8 Impacts to Riparian and Aquatic Habitat from Surface Water Diversions

The project proposes to reconstruct and improve surface water diversions on Arroyo Dos Picachos, Arrroy Las Viboras and Pacheco Creek. Surface waters would only be removed from these channels during winter and late spring. Flows will only be extracted above minimum levels. These alterations to stream flow may have some negative affect on the recruitment of riparian plant species on these three channels. However, the riparian and aquatic habitat of these streams is already highly impacted, receives very little surface flow for much of the year, and is primarily supported by groundwater at the lower reaches within the Hollister East and Pacheco subbasins. Therefore these habitats may be impacted but not significantly impacted from surface water diversions.

3.2.9 Impacts to Special-status Animal Species Using Constructed Wetlands for Breeding and Foraging

The project proposes to construct wetlands along the San Benito River in areas of upland excavation formerly used for gravel mining. The constructed wetlands will be used to treat poor quality ground and surface water prior to discharging into the San Benito River. Water quality within the constructed wetlands could be affected by the discharges of poor quality water. Contaminants, such as metals, microorganisms, herbicides and pesticides, will likely be present in the surface water and sediments of the constructed wetlands. These contaminants could affect breeding and foraging animal species (e.g. via decreased reproductive success), including special-status animal species such as red-legged frogs. However, these animal species are likely being exposed to similar levels of contaminants under existing conditions. Currently, poor quality groundwater is being pumped into the agricultural drainage channels, natural drainage channels and wetlands in the San Juan subbasin. Under the proposed project condtions the same poor quality groundwater will be pumped into the constructed wetlands. These animal species will not be exposed to substantially greater levels of contaminants in the constructed wetlands than they presently are exposed to in other, nearby aquatic habitats. Additionally, the constructed wetlands will assist in the treatment of the poor quality groundwater before being discharged to the San Benito River, potentially improving water quality in both the San Benito and Pajaro Rivers. Therefore, special-status animal species may be impacted but not significantly impacted, by poor water quality in constructed wetlands along the San Benito River.

3.3 EFFECTS CONSIDERED LESS THAN SIGNIFICANT WITH MITIGATION INCORPORATION

The biological resources listed below are considered sufficiently sensitive that on a programmatic level, impacts to them from the Management Plan implementation would be considered significant, or local, state and federal laws otherwise protect them. With mitigation measures, these impacts will be reduced to a less-than significant level.

3.3.1 Construction Impacts to Wetland Habitats

The exact size, location, construction techniques and footprint of facilities that will be developed by several of the project toolbox elements are not known. However, if the footprint of these project elements was placed over wetland resources, the construction of these facilities would cause the loss of wetland resources. Significant impacts to wetland habitats include direct removal and filling, as well as creating hydrological interruption. In addition, while some wetland features may be artificial in origin, have ephemeral hydrology, and otherwise may be partially maintained, their loss may also constitute a significant impact.

The implementation of the following mitigation measures would either eliminate expected losses to wetlands or reduce them to a less-than-significant impact through replacement.

Mitigation 1. Habitat Survey. Prior to the construction of any project element, a detailed habitat survey will be conducted by a qualified biologist. If wetland habitats are present within the area that will be potentially impacted by project construction then Mitgation 2 and possibly 3 will be necessary.

Mitigation 2. Avoidance and Minimization. As described in the County of San Benito General Plan, the City of Hollister General Plan and the City of San Juan Bautista General Plan the project elements should be redesigned, constructed, and operated in such a way as to avoid and/or minimize impacts to wetland habitats. If total avoidance is not possible, then Mitigation 3 would be warranted.

Mitigation 3. Replacement. The wetland habitat that will be lost under any given project element would be functionally replaced. In-kind and on-site replacement of lost wetland habitats must be done where possible.

Given the current programmatic level of planning, the exact area of impact and location and need for wetland mitigation sites has not yet been determined. It is likely that, if successful, the Management Plan will reduce the opportunities (due to a drawdown of groundwater) for wetland mitigation sites within the Management Plan area. If multiple impacts to wetlands occur from the construction of facilities, larger wetland mitigation areas will be created that provide greater functions and values than numerous small mitigation sites. The determination of wetland impacts and the subsequent location and design of potential mitigation sites would be determined by qualified biologists in coordination with resource agency personnel. Mitigation and habitat restoration plans would provide the following:

1. Replacement of lost acreage and functions of wetland habitat

2. Location of restoration opportunities, complete with an analysis of the technical approach to create high quality wetlands.

3. Prior to construction of any project element that may impact wetland habitats, the project proponent will apply for permits from the USACE and RWQCB. The project proponent will comply with the conditions of the permit.

4. Detailed plans will be prepared for wetland mitigation construction that includes excavation elevations, location of hydrologic connections, planting plans and soil amendments, if necessary. Maintenance and monitoring plans are to be prepared in consultation with a qualified habitat restoration specialist. Any mitigation wetlands will be monitored for a period of 5 years, during which the site will achieve the target jurisdictional acreage by Year 5. Specific performance criteria will be determined and monitored for site success. Monitoring reports will be provided annually to the appropriate resource agencies.

3.3.2 Construction Impacts to Riparian Habitats

The exact location and alignment of all project elements are not known at this time. However, the construction of several project elements has the potential to directly impact riparian habitats (e.g. pipeline construction) within the Management Plan area. Significant impacts to riparian habitats include the disturbance or removal of riparian vegetation, the filling, alteration or disturbance of stream channel bed and banks, the encroachment into riparian setback (buffer) areas and the disruption of stream channel flows.

The implementation of the following mitigation measures would either eliminate expected losses to riparian habitat or reduce them to a less-than-significant impact through replacement.

Mitigation 1. Habitat Survey. Prior to the construction of any project element, a detailed habitat survey will be conducted by a qualified biologist. If riparian habitats are present within the area that will be potentially impacted by project construction (including impacts to riparian buffer zones) then Mitgation 2 and possibly 3 will be necessary.

Mitigation 2. Avoidance and Minimization. As described in the County of San Benito General Plan, the City of Hollister General Plan and the City of San Juan Bautista General Plan the project elements should be redesigned, constructed, and operated in such a way as to avoid and/or minimize impacts to riparian habitats. If avoidance is not possible, then Mitigation 3 would be warranted.

Mitigation 3. Replacement. Permanent impacts to vegetation within riparian habitats are typically mitigated at ratios based on the quality of the habitat to be impacted. Due to the complex mosaic of habitats often found within riparian corridors, impacts are typically assessed based on three habitat quality categories, described below. This methodology ensures that, regardless of the type of habitat impacted, its relative value is taken into account in quantifying

impacts. As a result, the impact quantities are not provided by habitat type, but rather by habitat quality category.

The habitat quality categories are based on observed vegetation characteristics that correspond to fish and wildlife habitat values such as the presence/absence and the density of the overstory vegetation, the presence or absence of native species, and the complexity of vegetation structure (e.g. presence of tree, shrub and herbaceous layers). The three habitat quality categories are:

High quality – Native overstory with continuous understory or occurring in dense thickets; dense native overstory with sparse, non-native or no understory; and native willow thicket.

Medium quality – Sparse native overstory with sparse, non-native or no understory, non-native overstory with native understory, and dense non-native overstory with sparse, non-native or no understory.

Lower quality – Sparse non-native overstory with sparse, non-native or no understory. In addition, any areas *not* included in medium or high quality categories that will be covered with riprap, gabions, etc. (e.g., ruderal habitat and bare ground).

Impact ratios of 3:1, 2:1, and 1:1 (replacement:loss) should be applied for impacts to high, medium and low-quality habitats, respectively.

Furthermore, impacts from encroachment into riparian buffer zones are a significant impact. Appropriate development setbacks from riparian corridors can be as great as 100 feet and will need to be individually assessed for each project element. If a project element has encroachment impacts, mitigation in the form of habitat replacement or a functional equivalent will be done. Mitigation ratios will be determined by a qualified biologist and will be based upon the type of development proposed and the quality and extent of influence of the riparian habitat.

Given the current programmatic-level of planning, the exact location and need for riparian mitigation sites has not yet been determined. Although opportunities for riparian mitigation are currently plentiful within or along any of the watercourses throughout the management plan area, after the Management Plan implementation and groundwater lowering, riparian mitigation sites may be more difficult to find. If multiple smaller impact areas occur, it would be beneficial to consolidate mitigation into a larger habitat restoration area. Larger riparian restoration areas would provide greater functions and values than numerous small mitigation sites. The location and design of potential mitigation sites would be determined by qualified restoration biologists in coordination with resource agency personnel. These plans would provide the following:

1. A description of how the restoration will replace the lost acreage, functions, and values of riparian habitat.

2. Site specific restoration design with a complete analysis of the technical approach to create high quality riparian habitat. The design must include an implementation plan that details site grading, soil amendments, irrigation, planting list, floodplain

connectivity, geomorphic conditions and anticipated wildlife use. Furthermore the restoration plan must include an explanation of all required site maintenance. A monitoring plan will be developed that includes success criteria for all riparian plantings.

3. Prior to construction the project proponent may need to apply for and obtain a Streambed Alteration Agreement from CDFG.

3.3.3 Impacts to Aquatic Species Due to Degradation of Water Quality During Construction

Various project elements may result in disturbance of riverine habitats thereby adversely affecting aquatic species (Table 3). Such disturbance within riverine habitats could have a significant adverse effect on water quality downstream of the project due to increased turbidity, siltation, and water temperature, resulting from erosion during and after construction of particular project element facilities. Degradation of water quality downstream resulting from construction constitutes a potentially significant impact to steelhead and other aquatic species. The following mitigation will reduce these impacts to less-than-significant levels.

Mitigation 1. Implementation of Best Management Practices. Implementation of Best Management Practices described below will reduce this potential impact to aquatic species to a less-than-significant level. The following recommendations by the CDFG must be followed regardless if any watercourse within project element footprints are dewatered or not in order to comply with proper mitigation measures:

1) No equipment will be operated in the live stream channel.

2) When work in a flowing stream is unavoidable, any stream flow shall be diverted around the work area by a barrier, temporary culvert or a new channel capable of permitting upstream and downstream fish movement.

3) Construction of the barrier or the new channel shall normally begin in the downstream area and continue in an upstream direction and the flow shall be diverted only when construction of the diversion is completed.

4) No debris, soil, silt, sand, bark, slash, sawdust, cement, concrete, washings, petroleum products or other organic or earthen material shall be allowed to enter into or be placed where it may be washed by rainfall or runoff into waters of the State.

If these measures are implemented, then potentially adverse effects to aquatic species from degradation of water quality will be reduced to a less-than-significant level. If these measures fail, however, the project applicant is to consult with local representatives of the CDFG and USFWS to develop contingency mitigation measures.

3.3.4 Impacts to Special-Status Plants

Construction activities associated with several project elements could impact the hairless popcorn-flower (CNPS 1A species). This species may occur in vernally moist grassland areas with an alkaline influence as well as vernal marsh habitat at lower elevations within grassland habitat. As such, changes in groundwater levels may also affect the distribution of this species, if present. However, the cumulative effect of implementation of many different project elements in changing groundwater levels cannot currently be assessed. While the hairless popcorn-flower is presumed extinct, any impacts to re-discovered populations or individuals of this species would be a significant impact. The potential for such an occurrence is unknown at this time.

Mitigation 1. Determine Presence/Absence. Before implementing any project elements that could impact vernal marsh habitats (these habitats are located in the Bolsa, Pacheco and Hollister East subbasins), blooming season surveys for the hairless popcorn-flower populations are necessary. Between March and May prior to construction, areas to be impacted within the Bolsa, Pacheco and Hollister East subbasin will be surveyed for hairless popcorn flower. If the surveys are negative no further mitigation is warranted. If hairless popcorn flower populations are found in the construction area, Mitigation 2 and possibly 3 are necessary.

Mitigation 2. Avoidance. Project element(s) will be redesigned to avoid impacts to hairless popcorn flower populations. The changes in design will be approved by a qualified biologist to insure that no impacts to the populations will occur. If avoidance is not possible, Mitigation 3 will be necessary.

Mitigation 3. Replace/Protect Population. If the project cannot be redesigned to avoid impacts to the population(s) then a Site Restoration Plan will be developed for the hairless popcorn flower. The objective of this plan will be to replace any hairless popcorn flower plants or habitat that is lost during project implementation. The proposed restoration project, detailed in the plan, will be monitored for a period of five years to ensure success of the restored population. The restoration plan should contain at a minimum the following information:

1. The location of areas to restore lost plant populations;
2. A description of propagation and planting techniques to be employed in the restoration effort. Plants to be impacted should have their seeds collected so that the seeds can be planted within the restoration areas;
3. A time table for implementation of the restoration plan, including pilot-phase studies;
4. A monitoring plan and performance criteria;
5. A description of remedial measures to be performed in the event that initial restoration measures are unsuccessful in meeting the performance criteria; and,
6. A description of the site maintenance activities to follow restoration activities. These may include weed control, irrigation and control of herbivory by livestock and wildlife.

3.3.5 Construction Impacts to Steelhead

Steelhead could occur in the San Benito River, Pacheco Creek, and any other unobstructed tributary of the Pajaro River. Construction activities that will occur in or immediately adjacent to steelhead habitat have the potential to negatively impact the species. Construction activities that

will occur in stream habitat (e.g. those involving diversion structures) could directly impact steelhead. If channel diversions occur, steelhead could become stranded, and activities in channels could result in direct take of individuals (e.g. crushing with machinery). In addition, construction activities could result in degradation of water quality (e.g. through leaching cement altering stream pH or increasing sedimentation). With the following mitigations, these impacts will be reduced to a less-than-significant level. Consultation with NMFS will be required for any activities that could affect steelhead such as dewatering creeks or rivers, or any in-stream construction.

Mitigation 1. Avoid Direct Impacts. Construction in tributaries of the Pajaro River will occur during the dry season (June 1 to October 31), when steelhead are least likely to be present. Most of the San Benito River and other tributaries are typically dry during this time period. If construction will occur in a live stream channel, NMFS will be consulted regarding measures necessary to prevent take. Because it is possible that juveniles could be moving downstream during any time of year, including the dry season, these measures should ensure that movement of steelhead is not prevented by any water diversion structures used during construction, regardless of when construction occurs. Ideally, the live stream channel will be maintained and protected (e.g. by a structure covering the channel, and coffer dams around construction areas). If the live channel cannot be maintained, water could be diverted through construction sites by way of an open ditch (rather than a pipe) connecting the portions of the channel immediately upstream and downstream from the site. This plastic-lined ditch should also be lined with cobble-sized stones to deter predation by making the steelhead less conspicuous as they pass through the channel. Water within this ditch should be at least 30 centimeters (12 inches) deep, and no impediments to movement, such as high drop structures, should be present. A Habitat Conservation Plan (HCP) will be required if potential take is unavoidable during construction.

Mitigation 2. Minimize Impacts to Water Quality. A hazardous material spill prevention plan will be developed and implemented. Hazardous material will be stored in secured structures with secondary spill containment features. Refueling of construction equipment and vehicles will not occur within 300 feet of any water body or anywhere that spilled fuel could drain to a water body. The contractors will check and maintain equipment and vehicles daily to prevent leaks of fuels, lubricants, or other fluids. The implementation of Best Management Practices (section 3.3.3 above) will reduce construction-related impacts to water quality to a less-than-significant level.

Mitigation 3. Reduce Barriers to Movement. The placement of diversion structures or other hardscape within and immediately adjacent to the low flow channel of any tributary could cause an impediment to migration for steelhead. Potential in-stream structures will be designed in such a way as to not encroach upon the low flow channel and be designed to avoid hardscape that could result in significant eddies within the low flow channel.

3.3.6 Construction Impacts to Red-legged Frogs and Other Aquatic Species

California red-legged frogs, foothill yellow-legged frogs, western spadefoots, and southwestern pond turtles occur in aquatic habitats throughout San Benito County. Construction in and around aquatic habitat could result in direct take of individuals (e.g. through getting crushed by heavy machinery), and loss of habitat by changing vegetation composition or causing additional

ponding which could support bullfrogs. To determine if red-legged frogs or other special-status aquatic species would be affected by any given project element, surveys should be conducted at the specific project site (following standard USFWS protocol in the case of red-legged frogs). If it is determined that any of these special-status species are present, one or more of the following mitigation measures will be required to reduce impacts to a less-than-significant level.

Mitigation 1. Avoidance. If possible, construction of project elements should be planned to avoid habitat for aquatic species such as the red-legged frog. If construction will occur adjacent to habitat, impacts can be avoided through the following measures.

A. Prior to any construction activities, the boundaries of construction areas will be clearly delineated with orange plastic construction fencing to prevent workers or equipment from inadvertently straying from the construction area. All construction personnel, equipment, and vehicle movement shall be confined to designated construction areas and connecting roadways. Movement of construction and personal vehicles shall be prohibited outside designated construction areas or off established roadways.

B. Prior to the onset of any ground disturbing activities, exclusion fencing will be established around areas of potentially occupied habitat, as determined by a qualified biologist. Exclusion fencing will consist of silt-fencing or similar material at least 36 inches in height that is buried six inches in the ground to prevent incursion under the fence. Exclusion fencing may be installed at the base of the construction fencing described in A above. This fence will be surveyed each morning before construction, to verify that no frogs have entered the construction site.

C. Before any construction activities begin, the USFWS-approved biologist will conduct a training session with construction personnel to describe the California red-legged frog and its habitat, the specific measures being implemented to minimize effects to the species, and the boundaries of the construction area.

D. All food-related trash items will be enclosed in sealed containers and removed daily from Project site to discourage the concentration of potential predators in habitat potentially occupied by California red-legged frogs.

Mitigation 2. Protect Water Quality. A hazardous material spill prevention plan will be developed and implemented. Hazardous material will be stored in secured structured with secondary spill containment features. Refueling of construction equipment and vehicles will not occur within 300 feet of any water body or anywhere that spilled fuel could drain to a water body. The contractors will check and maintain equipment and vehicles daily to prevent leaks of fuels, lubricants, or other fluids.

These mitigation measures will be sufficient to reduce most impacts to less-than-significant levels. If construction must occur directly in red-legged frog habitat, or could otherwise result in take of individuals, Mitigation Measure 3 (below) will be required.

Mitigation 3. Consultation with the USFWS. Take of California red-legged frogs is only permitted through consultation with the USFWS. Some project elements may involve a federal nexus and therefore Section 7 consultation will be required. However, other project elements will lack a federal nexus therefore take will only be authorized upon approval of a suitable HCP.

The HCP will provide specific mitigation measures appropriate to the scale of take. Depending on the construction activities, these mitigation measures could range from presence of an on-site monitor to extensive habitat restoration. An HCP would be completed though consultation with the USFWS.

3.3.7 Construction Impacts to San Joaquin Kit Fox

San Joaquin Kit foxes could occur in the Management Plan area. Very little data is available on the current distribution of this species in San Benito County, however, kit foxes could occur throughout the county. Construction activities could result in take of kit foxes through inadvertent harm to individuals denning in burrows, pipes, culverts, or similar structures.

Mitigation 1. Take Avoidance. Standard take-avoidance measures (Appendix A) will be implemented to avoid direct take of any individual kit fox that may wander onto the project site. To avoid direct take of any individual kit fox that may be present on a project site, preactivity surveys must be conducted if any habitat feature with the potential to be used by kit foxes (*i.e.* burrows, irrigation pipes, debris piles) is created or placed on site and is to be subsequently disturbed or moved. If kit foxes are detected, work in that area must cease and consultation with the USFWS is necessary to determine the appropriate course of action. Implementation of the measures in Appendix A will reduce potential impacts to a less-than-significant level.

3.3.8 Construction Impacts to Vernal Pool Fairy Shrimp

It is not known if vernal pool fairy shrimp occur in northern San Benito County. Any construction that would directly impact vernal marsh habitat (including construction during the dry season) could negatively impact this species. The following mitigation measure will reduce impacts to vernal pool fairy shrimp to less-than-significant levels.

Mitigation 1. Avoid Habitat. No construction activities will occur in vernal marsh habitat. If construction is planned adjacent to vernal marsh habitat, prior to any construction activities, the boundaries of construction areas will be clearly delineated with orange plastic construction fencing to prevent workers or equipment from inadvertently straying from the construction area.

Mitigation 2. Protect Water Quality. A hazardous material spill prevention plan will be developed and implemented. Hazardous material will be stored in secured structured with secondary spill containment features. Refueling of construction equipment and vehicles will not occur within 300 feet of any water body or anywhere that spilled fuel could drain to a water body. The contractors will check and maintain equipment and vehicles daily to prevent leaks of fuels, lubricants, or other fluids.

3.3.9 Construction Impacts to California Tiger Salamanders and Their Habitat

California tiger salamanders could occur in aquatic habitats, and in grassland and oak woodland habitats near aquatic habitat (including vernal marshes) in San Benito County. Construction activities in these habitats could impact California tiger salamanders. The following mitigation measures will reduce impacts to California tiger salamanders and their habitat to less-than-significant levels.

Mitigation 1. Determine Presence/Absence. Prior to construction, protocol-level surveys for California tiger salamanders will be conducted by a qualified biologist in any potential habitat for the species that could be affected by the Management Plan. If California tiger salamanders are found then mitigation 2 and/or 3 will be necessary.

Mitigation 2. Avoidance. Project elements that will impact California tiger salamanders or their habitat will be redesigned to avoid all impacts. If avoidance is not possible then Mitigation 3 and immediate consultation with CDFG will be necessary.

Mitigation 3. Compensation for Habitat Loss. Replacement of aquatic, wetland, and/or upland habitat that provides breeding or aestivation habitat for California tiger salamanders is necessary. Restoration of areas of temporary impacts will replace amphibian habitat impacted temporarily. Mitigation ratios to compensate for permanent impacts to aquatic, wetland and upland habitat must provide more than the existing breeding, foraging and aestivation habitat at the impact site and will be approved by CDFG.

3.3.10 Construction Impacts to Burrowing Owls

Raptors, including owls, and their nests are protected under both federal and state laws, including the Migratory Bird Treaty Act and California Fish and Game Code section 3503.5. Burrowing Owls could occur in grassland habitat and margins of agricultural areas where ground squirrels are present. Construction-related disturbance during the breeding season could result in the incidental loss of fertile eggs or nestlings or otherwise lead to nest abandonment. Disturbance that causes nest abandonment and/or loss of reproductive effort is considered take by CDFG. Any loss of Burrowing Owls or fertile eggs, any activities resulting in nest abandonment, or the destruction of occupied Burrowing Owl burrows would constitute a significant impact. Preconstruction surveys for Burrowing Owls will be completed in conformance with CDFG protocols, no more than 30 days prior to the start of construction. If no Burrowing Owls were located during these surveys, no additional action would be warranted. However, if breeding or resident owls were located on, or immediately adjacent to, the site, the following mitigation measures will be implemented, reducing impacts to a less-than-significant level.

Mitigation 1. Buffer Zones. A 250-foot buffer, within which no new activity will be permissible, will be maintained between project activities and nesting Burrowing Owls. This protected area will remain in effect until August 31, or at the CDFG's discretion and based upon monitoring evidence, until the young owls are foraging independently.

Mitigation 2. Relocation. If construction will directly impact occupied burrows, eviction outside the nesting season may be permitted pending evaluation of eviction plans and receipt of formal written approval from the CDFG authorizing the eviction. No burrowing owls will be evicted from burrows during the nesting season (February 1 through August 31).

3.3.11 Construction Impacts to Large Nesting Colonies of Tricolored Blackbirds

Large Tricolored Blackbirds nesting colonies are present in wetland habitats in northern San Benito County. This species could be impacted by construction activities during the nesting season (March 1 to July 1). Construction close to active colonies could result in desertion of

nests. Loss of individual birds, including chicks, or loss of active nests would be a significant impact. The following mitigation measure will reduce this impact to a less-than-significant level.

Mitigation 1. Preconstruction Surveys and Avoidance. Prior to construction during the breeding season (March 1 to July 1) within 250 feet of potential nesting habitat for Tricolored Blackbirds (wetland habitat with tall vegetation nearby), preconstruction surveys will be conducted. If Tricolored Blackbirds are present, construction will be delayed until after the breeding season.

3.4 PROJECT IMPACTS THAT CANNOT BE MITIGATED TO A LESS-THAN-SIGNIFICANT LEVEL

3.4.1 Loss of Aquatic, Wetland or Riparian Habitat from Reduced Groundwater Levels/Reduced Stream Flows

The loss of aquatic, wetland and riparian habitat from a reduction in groundwater levels would be a significant impact. High groundwater levels currently support aquatic, wetland and riparian habitats within the Pacheco, Hollister East and San Juan subbasins. Summer flows within many stream channels in these basins are caused solely by high groundwater levels. Furthermore, isolated wetlands dominated by cattails occur in slight depressions within uplands throughout the Pacheco subbasin. All of these habitats are at risk from project induced lowering of groundwater levels. At this time it is impossible to quantify the total area of habitat that will be lost by lowering groundwater 25 to 30 feet below the ground surface. However, any loss of these habitats is a significant impact. Furthermore, as groundwater is lowered, opportunities for habitat restoration and creation (as mitigation for those losses) decrease. It is likely that lost functions from the impacts to these habitats cannot be replaced on-site or in-kind after groundwater levels are substantially lowered. Therefore the loss of aquatic, wetland and riparian habitats from the reduction in groundwater levels is a significant unmitigatible impact.

3.4.2 Impacts to Steelhead from Reduced Groundwater Levels/Reduced Stream Flow

Steelhead could occur in the San Benito River, Pacheco Creek, and any other unobstructed tributary of the Pajaro River. Changes in groundwater levels could lead to reduced flow in these streams, a significant alteration of steelhead habitat. For example, portions of Tequisquita Slough, Pacheco Creek and the San Benito River have year-round flows as a result of very high groundwater in these areas. Juvenile steelhead could be present in isolated habitats such as this, and could be negatively impacted by reductions in stream flow. In addition, winter flows are fairly low in streams in San Benito County, and reduced flows could prevent steelhead passage to potential spawning areas upstream. Flows could also be reduced through increased water diversion. Reduced stream flow from the reduction in groundwater levels and stream diversions would be a significant unmitigable impact.

3.4.3 Impacts to Steelhead from Degradation of Surface Water Quality.

Water quality in tributaries of the Pajaro River could be negatively affected by Management Plan implementation. Surface water could be degraded through the introduction of increased dissolved solids and increased salinity. In addition, if water from outside the Pajaro River system

(e.g. Central Valley Project water) is introduced to the system, the qualities of local water that allow salmonids to locate natal streams when returning from the ocean may be compromised. River discharge is the only project element that would likely result in the degradation of surface water quality in tributaries to the Pajaro River. However, any negative impacts to water quality that would affect steelhead would be an unmitagable significant impact.

3.4.4 Impacts to Special-status Species from Loss of Wetland Habitat.

Changes in groundwater levels associated with project implementation could lead to the permanent loss of freshwater emergent wetlands and associated aquatic habitat. California red-legged frogs, southwestern pond turtles, western spadefoots, California tiger salamanders, and Tricolored Blackbirds utilize this habitat in San Benito County. The loss of permanent breeding and foraging habitat for these species due to the loss of wetland habitats from groundwater lowering is a significant impact. Due to a reduction in groundwater, these habitats cannot be replaced in the subbasin of impact. Therefore there is no feasible mitigation for this significant impact.

4.0 CUMULATIVE IMPACTS

No other projects are currently proposed that will affect biotic resources cumulatively with the Management Plan.

LITERATURE CITED

[CDFG] California Department of Fish & Game. 1994. A Field Guide to Lake and Streambed Alteration Agreements, Sections 1600-1607. Environmental Services Division.

[CDFG] California Department of Fish and Game. 2000. The status of rare, threatened, and endangered animals and plants in California, California Black Rail. California Department of Fish and Game.

[CNDDB] California Natural Diversity Data Base. 2001. Rarefind. California Department of Fish and Game.

[CNPS] California Native Plant Society. 2001. Inventory of Rare and Endangered Plants of California (6th edition). Rare Plant Scientific Advisory Committee, David P. Tibor, Convening Editor. California Native Plant Society. Sacramento, California.

Dennis, B. 1989. Allee effects: population growth, critical density, and the chance of extinction. Natural Resource Modeling 3:481-538.

DW Alley & Associates. 2002. Comparison of juvenile steelhead densities, 1997 through 2001, in the San Lorenzo River and tributaries, Santa Cruz County, California; with an estimate of juvenile population size and an index of adult returns. Unpubl. Rep.

Eriksen, C., and D. Belk. 1999. Fairy shrimps of California's Puddles, Pools, and Playas. Eureka, CA: Mad River Press.

ESA. 1995. Hollister area water treatment plant environmental impact report. Prepared for City of Hollister, July 1995.

Gilpin, M. E., and M. E. Soule. 1986. Minimum viable populations: processes of species extinction. pp. 19-34 *In* M. E. Soule, editor. Conservation Biology: The Science of Scarcity and Diversity. Sinauer Associates, Sunderland, MA.

Grinnell, J., J. S. Dixon, and J. M. Linsdale. 1937. Furbearing Mammals of California: Their natural history, systematic status, and relations to man. University of California Press.

Grinnell, J., and A. H. Miller. 1944. The Distribution of the Birds of California. Cooper Ornithological Club. Pacific Coast Avifauna: No. 27.

Hickman, J. C. 1993. The Jepson Manual: Higher Plants of California. University of California Press.

Holland, R. F. 1986. Preliminary Description of the Terrestrial Natural Communities of California. California Department of Fish & Game.

Mayer, K. E., and W. F Laudenslayer Jr., editors. 1988. A Guide to Wildlife Habitats of

California. California Department of Forestry and Fire Protection. Sacramento, California, USA.

Roberson, D. 2003. Monterey Birds. Status and Distribution of Birds of Monterey County, California. Monterey Peninsula Audubon Society. Carmel, California.

Scrivner, J. H., T. P. O'Farrell, T. T. Kato, and M. K. Johnson. 1987. Dispersal of San Joaquin kit foxes, *Vulpes macrotis mutica*, on Naval Petroleum Reserve #1, Kern County, California, 1980-184. Rep. No. EGG 10282-2168, EG&G Energy Measurements, Goleta, CA. 32 pp.

Smith, J.J. 1982. Fishes of the Pajaro River system. Pp. 83-170 *in* P.B. Moyle, J.J. Smith, R.A. Daniels, T.L. Taylor, D.G. Price, and D.M. Baltz (eds.), Distribution and Ecology of Stream Fishes of the Sacramento-San Joaquin Drainage System, California. Univ. Cal. Publ. Zool. 115.

Titus, R.G, D.C. Erman, and W.M. Snider. In Prep. History and status of steelhead in California coastal drainages south of San Francisco Bay. CA Dept. Fish and Game.

U.S. Fish and Wildlife Service (USFWS). 1967. Native fish and wildlife. Endangered species. Fed. Register 32:4001.

U.S. Fish and Wildlife Service (USFWS). 1994. Determination of endangered status for the conservancy fairy shrimp, longhorn fairy shrimp, and the vernal pool fairy shrimp; Final Rule. Federal Register 59(180): 48136.

U.S. Fish and Wildlife Service (USFWS). 1996. Endangered and threatened wildlife and plants: determination of threatened status for the California red-legged frog. Federal Register 61(101):25813-25833.

U.S. Fish and Wildlife Service (USFWS). 1998. Recovery plan for upland species of the San Joaquin Valley, California. Region 1, Portland, OR. 319 pp.

U.S. Fish and Wildlife Service (USFWS). 2002. Critical habitat designation for four vernal pool crustaceans and eleven vernal pool plants in California and southern Oregon; Proposed Rule. Federal Register 67(185): 59884.

PERSONAL CONTACTS

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APPENDIX A:
STANDARD RECOMMENDATIONS PUT FORTH BY UNITED STATES FISH AND WILDLIFE SERVICE FOR THE PROTECTION OF SAN JOAQUIN KIT FOX PRIOR TO OR DURING GROUND DISTURBANCE. 28 JUNE 1999.

Construction and Operational Requirements

Habitat subject to permanent and temporary construction disturbances and other types of project-related disturbances should be minimized. Project designs should limit or cluster permanent project features to the smallest area possible while still permitting project goals to be achieved. To minimize temporary disturbances, all project-related vehicle traffic should be restricted to established roads, construction areas, and other designated areas. These areas should also be included in preconstruction surveys and, to the extent possible, should be established in locations disturbed by previous activities to prevent further impacts.

1. Project-related vehicles should observe a 20-mph speed limit in all project areas, except on county roads and State and Federal highways; this is particularly important at night when kit foxes are most active. To the extent possible, night-time construction should be minimized. Off-road traffic outside of designated project areas should be prohibited.
2. To prevent inadvertent entrapment of kit foxes or other animals during the construction phase of a project, all excavated, steep-walled holes or trenches more than 2 feet deep should be covered at the close of each working day by plywood or similar materials, or provided with one or more escape ramps constructed of earth fill or wooden planks. Before such holes or trenches are filled, they should be thoroughly inspected for trapped animals. If at any time a trapped or injured kit fox is discovered, the procedures under number 13 of this section must be followed.
3. Kit foxes are attracted to den-like structures such as pipes and may enter stored pipe becoming trapped or injured. All construction pipes, culverts, or similar structures with a diameter of 4-inches or greater that are stored at a construction site for one or more overnight periods should be thoroughly inspected for kit foxes before the pipe is subsequently buries, capped, or otherwise used or moved in any way. If a kit fox is discovered inside a pipe, that section of pipe should not be moved until the Service has been consulted. If necessary, and under the direct supervision of the biologist, the pipe may be moved once to remove it from the path of construction activity, until the fox has escaped.
4. All food-related trash items such as wrappers, cans, bottles, and food scraps should be disposed of in closed containers and removed at least once a week from a construction or project site.
5. No firearms shall be allowed on the project site.
6. To prevent harassment, morality of kit foxes or destruction of dens by dogs or cats, no pets should be permitted on project sites.
7. Use of rodenticides and herbicides in project areas should be restricted. This is necessary to prevent primary or secondary poisoning of kit foxes and the depletion of prey populations on which they depend. All uses of such compounds should observe label and other restrictions mandated by the U.S. Environmental Protection Agency, California Department of Food and Agriculture, and other State and Federal legislation, as well as additional project-related restrictions deemed necessary by the Service. If rodent control must be conducted, zinc phosphate should be used because of proven lower risk to kit fox.

8. A representative shall be appointed by the project proponent who will be the contact source for any employee or contractor who might inadvertently kill or injure a kit fox or who finds a dead, injured or entrapped individual. The representative will be identified during the employee education program. The representative's name and telephone number shall be provided to the Service.
9. An employee education program should be conducted for any project that has expected impacts to kit fox or other endangered species. The program should consist of a brief presentation by persons knowledgeable in kit fox biology and legislative protection to explain endangered species concerns to contractors, their employees, and military and agency personnel involved in the project. The program should include the following: a description of the San Joaquin kit fox and its habitat needs; a report of the occurrence of kit fox in the project area; and explanation of the status of the species and its protection under the Endangered Species Act; and a list of measures being taken to reduce impacts to the species during project construction and implementation. A fact sheet conveying this information should be prepared for distribution to the above-mentioned people and anyone else who may enter the project site.
10. Upon completion of the project, all areas subject to temporary ground disturbances, including storage and staging areas, temporary roads, pipeline corridors, etc. should be re-contoured if necessary, and revegetated to promote restoration of the area to pre-project conditions. An area subject of "temporary" disturbance means any area that is disturbed during the project, but that after project completion will not be subject to further disturbance and has the potential to be revegetated. Appropriate methods and plant species used to revegetate such areas should be determined on a site-specific basis in consultation with the Service, California Department of Fish and Game (CDFG), and revegetation experts.
11. In the case of trapped animals, escape ramps or structures should be installed immediately to allow the ainimal(s) to escape, or the Service should be contacted for advice.
12. Any contractor, employee, or military or agency personnel who inadvertently kills or injures a San Joaquin kit fox shall immediately report the incident to their representative. This representative shall contact the CDFG immediately in case of a dead, injured or entrapped kit fox. The CDFG contact for immediate assistance is State Dispatch at (916) 445-0045. They will contact the local warden or biologist.

The Sacramento Fish and Wildlife Office and CDFG will be notified in writing within three working days of the accidental death or injury to a San Joaquin kit fox during project related activities. Notification must include the date, time, and location of the incident or of the finding of a dead or injured animal and any other pertinent information. The Service contact is the Chief of the Division of Endangered Species, at the addresses and telephone numbers given below. The CDFG contact is Mr. Ron Schlorff as 1416-9th Street, Sacramento, California, (916) 654-4262.

APPENDIX F

CULTURAL RESOURCES SETTING

January 25, 2003
(Revised June 9, 2003)

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RE: *Cultural Resources Review*
Northern San Benito County Groundwater Management Plan
Program Environmental Impact Report (EIR), California

Dear Ms. Monette,

Please let this letter report stand as Basin Research Associates' cultural resources review for the above project. This review was requested in order to fulfill the various mandates of the California Environmental Quality Act (CEQA) and cultural resources and planning directives of the counties of San Benito and Santa Clara County. The review provides the results of an archaeological records search of the Plan area, a review of pertinent literature, prehistoric and historic contexts, and presents recommendations for future program environmental compliance documents.

PROJECT LOCATION AND DESCRIPTION

The San Benito County Water District (SBCWD) will prepare an Environmental Impact Report (EIR) on the implementation of a Northern San Benito County Groundwater Management Plan (SBCGMP, Plan) within its service area (including a small portion of Santa Clara County). The proposed project consists of the adoption and implementation of a groundwater management plan with goals and objectives for short-term and long-term management of water resources[1] in order to provide good quality water and adequate water supplies for existing and future agricultural, municipal, and industrial uses.

1. Surface and groundwater management as well as wastewater treatment discharges an use of reclaimed water supplies.

The Plan would result in an integrated strategy for managing groundwater resources and imported surface water from the San Felipe Project.[2] The existing as well as new programs, elements, and activities include: water conservation, existing groundwater extraction facilities, surface water importation, development and improvement of high quality local ground and surface water supplies, water banking, surface water treatment, reclaimed wastewater effluent, continuation of wastewater effluent percolation, groundwater pumping for groundwater level and water quality management, and out-of-basin export of effluent, concentrate or agricultural drainage.

The Project Groundwater Subbasins consist of San Juan, Hollister West, Tres Piños, Hollister East, Bolas SE, Bolsa, and Pacheco. The Preferred Alternative Project Elements consist of: 16 non-pipeline components; four Effluent for Direct Use [Facilities] (EDU); four Surface Water Treatment Facilities (SWTF); five Groundwater Treatment and Concentrate Storage Facilities (GT&CSF); and, three Seasonal Local Surface Water Development (SLSWD) and four pipelines: Local Conveyance Pipeline; Export Pipeline; Agricultural Drainage Pipeline; and, the Proposed Cienega Valley Water Pipeline (David J. Powers and Associates (hereafter DJP) 2002-2003) [Figs. 1-2].

The Plan area, with the exception of a Plan component located on Pacheco Creek in Santa Clara County, covers San Benito County south of Pacheco Creek in the vicinity of Dunneville, Hollister, San Juan Bautista, west of Tres Piños, and northwest of Paicines (USGS quadrangle maps: Chittenden, Calif. 1980; Hollister, Calif. 1993; Paicines, Calif. 1984; San Felipe, Calif. 1971; San Juan Bautista, Calif. 1980; Three Sisters, Calif. 1971; Tres Pinos, Calif. 1971 in portions of Township No. 11 South, Range No. 4 East, 5 East; Township No. 12 South, Range No. 4 East, 5 East, 6 East; Township No. 13 South, Range No. 4 East, 5 East, 6 East; and, Township No. 14 South, Range No. 6 East).

APPLICABLE LAWS AND REGULATIONS

This section is consistent with both federal and state regulatory requirements for cultural resources pursuant to Sections 106 and 110 of the National Historic Preservation Act (NHPA) of 1966 (as amended) (16 U.S.C. Section 470f) and its implementing regulations 36 CFR Part 800 and the California Environmental Quality Act (CEQA). Cultural resources include prehistoric and historic archaeological sites;[3] districts and objects; standing historic structures,

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2. Also known as the "San Felipe Division" of the Central Valley Project (CVP). The SBCGMP area is situated entirely within the "Hollister Subarea" of the CVP (e.g., King and Hickman 1973:6, Map 2/S-5222 [report number assigned by the CHRIS/NWIC].

3. "Site" - "the location of a significant event, a prehistoric or historic occupation or activity, or a building or structure ... where the location itself possesses historic, cultural, or archeological value" (USNPS-IRD 1991:15).

buildings, districts and objects, and, locations of important historic events, or sites of traditional/cultural importance to various groups.[4]

FEDERAL

The NHPA of 1966 (as amended) established the federal government's policy on historic preservation and the programs, including the National Register of Historic Properties, through which that policy is implemented. Under the NHPA, historic properties include ". . . *any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places*" (16 U.S.C. Section 470w (5)).[5] The NHPA of 1966 (as amended) and its implementing regulations (16 U.S.C. Section 470 et seq., 36 CFR Part 800, 36 CFR Part 60, and 36 CFR Part 63) require the agency(ies) to consider the effect of the undertaking on historic properties and to afford the Advisory Council on Historic Preservation (ACHP) and the State Historic Preservation Officer (SHPO) a reasonable opportunity to comment on any undertaking that could adversely affect cultural properties listed or eligible for listing on the NRHP.

If a Clean Water Act (CWA) Section 404 permit is required for construction (wetland fills or crossings), the NHPA of 1966 (as amended) and its implementing regulations (16 U.S.C. Section 470 et seq., 36 CFR Part 800, 36 CFR Part 60, and 36 CFR Part 63) also apply. The

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4. The "federal" definitions of *cultural resource*, *historic property* or *historic resource*, *traditional use area*, and *sacred resources* are reviewed below and are typically also applied to non-federal projects.

   A *cultural resource* may be defined as a phenomenon associated with prehistory, historical events or individuals or extant cultural systems. These include archaeological sites, districts and objects; standing historic structures, districts and objects; locations of important historic events; and, places, objects and living or non-living things that are important to the practice and continuity of traditional cultures. Cultural resources may involve *historic properties*, *traditional use areas* and *sacred resource areas*.

   Historic property or *historic resource* means any prehistoric district, site, building, structure or object included in, or eligible for, inclusion in the National Register of Historic Places. The definition also includes artifacts, records and remains which are related to such a district, site, building, structure or object.

   Traditional use area refers to an area or landscape identified by a cultural group to be necessary for the perpetuation of the traditional culture. The concept can include areas for the collection of food and non-food resources, occupation sites and ceremonial and/or sacred areas.

   Sacred resources applies to traditional sites, places or objects that Native American tribes or groups, or their members, perceive as having religious significance.

5. The National Register criteria for evaluation include: (1) is at least 50 years old; (2) retains integrity of location, design, setting, materials, workmanship, feeling, and association; and (3) has one or all of the following characteristics of association: (a) ". . . with events that have made a significant contribution to the broad patterns of our history;" (b) ". . . with the lives of persons significant in our past;" (c) ". . . that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction;" or, (d) ". . . have yielded, or may be likely to yield, information important in prehistory or history."

U.S. Army Corps of Engineers (USACE), as lead federal agency for issuing the CWA Section 404 permit, would be the lead agency for NHPA Section 106 compliance and consultation with the SHPO and ACHP would be required.

CALIFORNIA
Historical Resources

CEQA equates a substantial adverse change in the significance of a historical resource with a significant effect on the environment (Section 21084.1 of the Public Resources Code) and defines substantial adverse change as demolition, destruction, relocation, or alteration that would impair historical significance (Section 5020.1). Section 21084.1 stipulates that any resource listed in, or eligible for listing in, the California Register of Historical Resources (CRHR)[6] is presumed to be historically or culturally significant.

Resources listed in a local historic register or deemed significant in a historical resource survey (as provided under Section 5024.1g) are presumed historically or culturally significant unless the preponderance of evidence demonstrates they are not. A resource that is not listed in, or determined to be eligible for listing in, the CRHR, is not included in a local register of historic resources, or is not deemed significant in a historical resource survey may nonetheless be considered historically significant by the lead agency for purposes of CEQA (Section 21084.1; see Section 21098.1).

Archaeological Resources

CEQA requires a Lead Agency to identify and examine environmental effects that may result in significant adverse effects. Where a project may adversely affect a unique archaeological resource, Section 21083.2 requires the Lead Agency to treat that effect as a significant environmental effect. When an archaeological resource is listed in or is eligible to be listed in the CRHR, Section 21084.1 requires that any substantial adverse effect to that resource be considered a significant environmental effect. Sections 21083.2 and 21084.1 operate independently to ensure that potential effects on archaeological resources are considered as part of a project's environmental analysis. Either of these benchmarks may indicate that a project may have a potential adverse effect on archaeological resources.

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6. A historical resource may be listed in the CRHR if it meets one or more of the following criteria: "(1) it is associated with events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States; (2) it is associated with the lives of persons important to local, California or national history; (3) it embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of a master or possesses high artistic values; or (4) it has yielded or has the potential to yield information important in the prehistory or history of the local area, California or the nation." Automatic listings include properties listed in the National Register, determined eligible for the National Register either by the Keeper of the National Register or through a consensus determination on a project review, or State Historical Landmarks from number 770 onward. In addition Points of Interest nominated from January 1998 onward will be jointly listed as Points and in the California Register. Landmarks prior to 770 and Points of Historical Interest may be listed through an action of the State Historical Resources Commission (CAL/OHP ca. 1999).

Definitions

Public Resources Code 21083.2 (g) defines a unique archaeological resource to be: An archaeological artifact, object, or site, about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria: (1) contains information needed to answer important scientific research questions and there is a demonstrable public interest in that information; (2) has a special and particular quality such as being the oldest of its type or the best available example of its type; or, (3) is directly associated with a scientifically recognized important prehistoric or historic event or person.

Section 21084.1 requires treatment of any substantial adverse change in the significance of a historical resource listed in, or eligible to be listed in, the CRHR as a significant effect on the environment. The definition of "historical resource" includes archaeological resources listed in or formally determined eligible for listing in the CRHR and by reference, the NRHP, California Historical Landmarks, Points of Historical Interest, and local registers.

Public Resources Code Sections 5020.1 and 5024.1 provide the following definitions:

- *Historic district* means a definable unified geographic entity that possesses a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development.

- *Historical landmark* means any historical resource that is registered as a state historical landmark pursuant to Section 5021.

- *Historical resource* includes, but is not limited to, any object, building, structure, site, area, place, record, or manuscript which is historically or archaeologically significant, or is significant in the architectural, engineering, scientific, economic agricultural, educational, social, political, military, or cultural annals of California.

- *Local register of historic resources* means a list of properties officially designated or recognized as historically significant by a local government pursuant to a local ordinance or resolution.

- *Substantial adverse change* means demolition, destruction, relocation, or alteration such that the significance of an historical resource would be impaired.

A resource identified as significant in a historical resource survey may be listed in the CRHR if the survey meets all of the following criteria:

- The survey has been or will be included in the State Historic Resources Inventory.

- The survey and the survey documentation were prepared in accordance with Office of Historic Preservation procedures and requirements.

- The resource is evaluated and determined by the Office of Historic Preservation to have a significance rating of Category 1 to 5 on Department of Parks and Recreation Form 523.

- If the survey is five or more years old at the time of its nomination for inclusion in the CRHR, the survey is updated to identify historical resources that have become eligible or ineligible due to changed circumstances or further documentation and those that have been demolished or altered in a manner that substantially diminishes the significance of the resource.

OTHER CALIFORNIA LAWS AND REGULATIONS

Other requirements for cultural resources management appear in the California Public Resources Code Chapter 1.7, Section 5097.5 (Archaeological, Paleontological, and Historical Sites), and Chapter 1.75, beginning at Section 5097.9 (Native American Historical, Cultural, and Sacred Sites) for lands owned by the state or a state agency.

The disposition of Native American burials is governed by Section 7050.5 of the California Health and Safety Code and Sections 5097.94 and 5097.98 of the Public Resources Code, and falls within the jurisdiction of the Native American Heritage Commission (NAHC). If human remains are discovered, the County Coroner must be notified within 48 hours and there should be no further disturbance to the site where the remains were found. If the remains are determined by the coroner to be Native American, the coroner is responsible for contacting the NAHC within 24 hours. The NAHC, pursuant to Section 5097.98, will immediately notify those persons it believes to be most likely descended from the deceased Native American so they can inspect the burial site and make recommendations for treatment or disposal.

RESEARCH SOURCES CONSULTED AND RESULTS

A prehistoric and historic site record and literature search of the Plan area and adjacent areas was completed by the California Historical Resources Information System, Northwest Information Center at California State University Sonoma, Rohnert Park (CHRIS/NWIC File No. 02-319 dated 11/08/02; 02-X-57 dated 11/14/02; 02-463 dated 1/03/03; 02-X-69 dated 1/08/03; and, 02-X-74 dated 1/10/03).[7] Limited reference material from the Bancroft Library, University of California, Berkeley and Basin Research Associates, San Leandro was also consulted.[8]

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7. 02-X-57, -69 and -74 for reports, site forms, and most recent *Historic Properties Directory* (HPD) copied as a result of the CHRIS/NWIC records searches 02-319 and revised configuration records search 02-463.

8. Specialized listings consulted include the *Historic Properties Directory* for San Benito County (CAL/OHP 2003a) that includes the most recent updates for the National Register of Historic Places, California Historical Landmarks, and California Points of Historical Interest, as well as other properties reviewed by the State of

ENVIRONMENTAL SETTING

The Plan area includes the Hollister and San Juan valleys, the San Benito River, and numerous creeks - Ortega Creek, Pacheco Creek, Tequisquita Slough, *Arroyo de las Víbora*, *Arroyo dos Picachos*, Santa Ana Creek, and *Tres Piños* Creek (e.g., USGS quadrangle maps). The area including the Hollister and San Juan valleys and the *Bolsa de San Felipe*, from Pajaro Gap to the Diablo Range and from the Pajaro River to the vicinity of Tres Piños is drained by the southern tributaries of the Pajaro River, Pacheco Creek and the San Benito River. San Felipe Lake at the foot of the Diablos in the northern part of the general study area is the source of the Pajaro River and flows southwest to Pajaro Gap or Chittenden Pass. The Pajaro River continues through this gap/canyon between the Santa Cruz Mountains and the Galibans west to the coastal plain into Monterey Bay (King and Hickman 1973:3-5, 7). Lake San Benito is believed to have occupied the area from slightly south of Hollister north to the present location of Morgan Hill at the end of the Pleistocene, ca. 10,000 B.C.. Movement on the San Andreas fault after 10,000 may have "caused a massive break at the western shore of the lake", resulting in marshes and seasonal wetlands (Elsasser 1986:7-8 after Jenkins 1973).

NATIVE AMERICAN RESOURCES
PREHISTORIC

Native American occupation and use of the general area appears to extend over 5000-7000 years and may be longer. As a result of the environmental context, the general study area would have provided a favorable environment with both riparian, lacustrine and inland resources available to the aboriginal population. Prior to about 5000 to 7000 years ago, Native American occupation of central California and the San Francisco Bay Area was intermittent and sparse. Evidence for early occupation along the bayshores was hidden by rising sea levels from about 15,000 to 7,000 years ago, or was buried under sediments caused by bay marshland infilling along estuary margins from about 7,000 years onward (see Moratto 1984). Early occupants concentrated on hunting and gathering various plant foods and collecting shellfish.

Archaeologists theorize that the population of prehistoric central California slowly increased from the Early to the Late Horizon time periods (see below). The population increase and change from hunter-collectors to a more sedentary lifestyle is thought to reflect more efficient resource procurement, an increasing focus on permanent settlements, a focus on staple food exploitation, an increased ability to store food at semi-permanent/permanent village locations, and the development of increasing complex social and political systems including long-distance trade networks.

California Office of Historic Preservation. Other sources consulted include: the *Archeological Determinations of Eligibility* (CAL/OHP 2003b); the *California History Plan* (CAL/OHP 1973); *California Inventory of Historic Resources* (CAL/OHP 1976); *Five Views: An Ethnic Sites Survey for California* (CAL/OHP 1988); *Historic Civil Engineering Landmarks of San Francisco and Northern California* (American Society of Civil Engineers 1977). Other local and regional surveys/inventories and lists which concentrate on the built environment were not consulted for this report.

Archaeological research in central California has been interpreted using several chronological schemes based on stratigraphic differences and cultural traits. A three-part cultural chronological sequence, the Central California Taxonomic System (CCTS) was developed by archaeologists to document and explain local and regional cultural change in prehistoric central California from about 4,500 years ago to the time of European contact (see Lillard, Heizer, and Fenenga, 1939 and Beardsley 1948, 1954). This classification scheme, using Early, Middle and Late "horizons" to designate both chronological periods and social change was modified by Beardsley (1948, 1954) and further modified in the late 1960s (i.e., Fredrickson's 1994 cultural periods model; see Table 1). Recent chronological placement of the divisions suggests that the Early Horizon dated to ca. 2500-1500/1000 B.C., the Middle Horizon to ca. 1500 B.C. - A.D. 500, and the Late Horizon to ca. A.D. 500-1850 (see Moratto 1984:184).

Moratto (1984) suggests that the Early Horizon dated to ca. 4,500 to 3,500/3,000 years ago with the Middle Horizon dating to ca. 3,500 to 1,500 years ago and the Late Horizon dating to ca. 1,500 to 250 years ago. The Early Horizon is the most poorly known of the period with relatively few sites known or investigated. Early Horizon traits include hunting, fishing, use of milling stones to process plant foods, use of a throwing board and spear ("atlatl"), relative absence of culturally affected soils (midden) at occupation sites, and elaborate burials with numerous grave offerings.

Middle Horizon sites are more common and usually have deep stratified deposits that contain large quantities of ash, charcoal, fire-altered rocks, and fish, bird and mammal bones. Significant numbers of mortars and pestles signal a shift to plant foods from reliance on hunted animal foods. Middle Horizon peoples generally buried their dead in a fetal position and only small numbers of graves contain artifacts (and these are most often utilitarian). Increased violence is suggested by the number of burials with projectile points embedded in the bones or with other marks of violence.

The Late Horizon emerged from the Middle Horizon with continued use of many early traits and the introduction of several new traits. Late Horizon sites are the most common and are noted for their greasy soils (midden) mixed with bone and fire-altered rocks. The use of the bow-and-arrow, fetal-position burials, deliberately damaged ("killed") grave offerings and occasional cremation of the dead are the best known traits of this horizon. Acorn and seed gathering dominated the subsistence pattern with short and long-distance trade carried out to secure various raw materials. Compared to earlier peoples, Late Horizon groups were short in stature with finer bone structure; evidence perhaps of the replacement of original Hokan speaking settlers by Penutian speaking groups by circa 1,500 years ago.

Most recently, Mark Hylkema in Allen et al. (1999) has presented a four-period local chronological framework for the Northern Santa Clara Valley/Southern San Francisco Bay Region that is applicable to the Plan area using the Bennyhoff and Hughes (1987) taxonomy as revised by Milliken and Bennyhoff (1993) and Fredrickson (1994) (see Table 2).

Minimal archaeological excavation has been undertaken in San Benito County. For exceptions see King and Hickman (1973/S-5222), Denny (1973, Hardesty (1973), Fritz and Smith (1978), Spanney (1978), ESCA-Tech Corporation (1980), Bourdeau (1989:9/S-11378), Cartier et al (1993/S-14736), Cartier et al. (1996/S-18967), and Cartier (1999/S-22160). General overviews

and perspectives on the regional prehistory including chronological sequences can be found in Elsasser (1978), C. King (1978a-b), Moratto (1984), and Allen et al. (1999).

The Plan area includes zones of low, moderate, and high archaeological sensitivity (King and Hickman 1973:94, Map 15). Historic accounts of the distribution of the Native American tribelets and villages in the 1770s-1790s and the results of archaeological efforts in the area suggest that the Native Americans may have had temporary camps in the general vicinity of the project area throughout the prehistoric period and into the Hispanic Period (Kroeber 1925; T. King 1973; King and Hickman 1973).

TABLE 1
Hypothesized Characteristics of Cultural Periods in California

1800 A.D. Upper Emergent Period Phase 2, Late Horizon	Clam disk bead money economy appears. More and more goods moving farther and farther. Growth of local specializations relative to production and exchange. Interpenetration of south and central exchange systems.
1500 A.D. Lower Emergent Period Phase 1, Late Horizon	Bow and arrow introduced, replace atlatl and dart; south coast maritime adaptation flowers. Territorial boundaries well established. Evidence of distinctions in social status linked to wealth increasingly common. Regularized exchanges between groups continue with more material put into the network of exchanges.
1000 A.D. Upper Archaic Period Middle Horizon Intermediate Cultures	Growth of sociopolitical complexity; development of status distinctions based on wealth. Shell beads gain importance, possibly indicators of both exchange and status. Emergence of group-oriented religious organizations; possible origins of Kuksu religious system at end of period. Greater complexity of exchange systems; evidence of regular, sustained exchanges between groups; territorial boundaries not firmly established.
500 B.C. Middle Archaic Period Middle Horizon Intermediate Cultures	Climate more benign during this interval. Mortars and pestles and inferred acorn economy introduced. Hunting important. Diversification of economy; sedentism begins to develop, accompanied by population growth and expansion. Technological and environmental factors provide dominant themes. Changes in exchange or in social relations appear to have little impact.
3000 B.C. Lower Archaic Period Early Horizon Early San Francisco Bay Early Milling Stone Cultures	Ancient lakes dry up as a result of climatic changes; milling stones found in abundance; plant food emphasis, little hunting. Most artifacts manufactured of local materials; exchange similar to previous period. Little emphasis on wealth. Social unit remains the extended family.
6000 B.C. Upper Paleo-Indian Period San Dieguito Western Clovis 8000 B.C.	First demonstrated entry and spread of humans into California; lakeside sites with a probable but not clearly demonstrated hunting emphasis. No evidence for a developed milling technology, although cultures with such technology may exist in state at this time depth. Exchange probably ad hoc on one-to-one basis. Social unit (the extended family) not heavily dependent on exchange; resources acquired by changing habitat.

ETHNOGRAPHIC

The aboriginal inhabitants of the Plan area belonged to a group known as the "Costanoan", derived from the Spanish word *Costanos* ("coast people" or "coastal dwellers") who occupied

the central California coast as far east as the Diablo Range (Kroeber 1925:462; Hart 1987:112-113). The descendants of these Native Americans now prefer to be called Ohlone. In 1770 the Costanoan lived in approximately 50 separate and politically autonomous tribelets with each group having one or more permanent villages surrounded by a number of temporary camps. Physiographic features usually defined the territory of each group which generally supported a population of approximately 200 persons with a range of between 50-500 individuals (Levy 1978:485, 487).

TABLE 2
Comparison of California Cultural Period with Temporal Phases of Central California (Allen et al. 1999)

Cultural Periods (Fredrickson 1994)	Dating Scheme B1 (Bennyhoff and Hughes 1987)	
	Year	Time Period
EMERGENT PERIOD		Historic Period
	AD 1800	
		Late Period Phase 2-B
	AD 1700	
		Late Period Phase 2-A
	AD 1500	
		Late Period Phase 1-C
	AD 1300	
		Late Period Phase 1-B
	AD 1100	
		Late Period Phase 1-A
UPPER ARCHAIC PERIOD	AD 900	
		Middle/Late Period Transition
	AD 700	
		Middle Period Terminal Phase
	AD 500	
		Middle Period Late Phase
	AD 300	
		Middle Period Intermediate Phase
	AD 100	
		Middle Period Early Phase
	200 BC	
		Early/Middle Period Transition
MIDDLE ARCHAIC PERIOD	500 BC	
		Early Period
	3000 BC	
LOWER ARCHAIC PERIOD		
	6000 BC	
PALEOINDIAN PERIOD		
	8000 BC	

Tribelet boundaries and village locations are inexact due to incomplete historic records, and they remain a subject of anthropological contention and debate. The aboriginal inhabitants of the Plan area and region were situated within the territory of the *Mutsun* tribelet of the Costanoan Indians (Kroeber 1925:465, Fig. 42; Levy 1978:485, Fig. 1 also known as the *Ohlone* (Galvan 1967/68; Margolin 1978). Kroeber (1925:465, Fig. 42) places a number of settlements in the study area: the *Mutsu-n* at Mission San Juan Bautista, the settlement of *Ausai-ma* northeast along Pacheco Creek, and the *Paisin-n* to the southeast along the San Benito River. Following Levy (1978) the settlement known as *xumontwas* was at San Juan Bautista (Levy #30), *kotetak* appears to have been located in the general vicinity of Hollister (#29), and *paxsin* (#31) to its south along the San Benito River (e.g., between Tres Piños and Paicines; King and Hickman 1973:33, Map 7 *pagsin* (e.g., Paicines vicinity; Gudde 1998:276]).

Alternatively, the tribelets in the study area were known as the *Motsum* (or *Mottsum*) located west of San Juan Bautista and closest to the mission (main village of *Risca*); *Tamarron* (or *Tamarox*) located east of Mission San Juan Bautista and south of the *Ausaima* on the east side of the San Felipe sink on Pacheco Creek (including the Rancho Ausaimas of San Felipe); and, the *Pagssin* (or *Pagsin*) area southeast of the San Juan Mission, probably within the area surrounding the modern Paicines including the land grant called *Cienega de Los Paicines* (King and Hickman 1973:33, Map 7; King 1973:I-2 - I-5; C. King 1978b:437-438, Fig. 54/S-5281; Milliken 1994:166, Fig. 5.1).

Several major aboriginal trails passed through the general study area (e.g., Davis 1961; Elsasser 1986). One trail to the north proceeded from Elkhorn Slough at Monterey Bay up the Pajaro River, San Juan Creek to San Juan Bautista, then to Pacheco Creek and through Pacheco Pass. A more southerly trail went from San Juan Bautista, to the San Benito River, to Tres Piños Creek, to *Quien Sabe* Valley and to Los Banos Creek (Elsasser 1986:48-49, Fig. 10).

Unfortunately, extensive ethnographic data on the Costanoans are lacking and the aboriginal lifeway apparently disappeared by approximately 1810 due to introduced diseases, a declining birthrate, the cataclysmic impact of the mission system and the later secularization[9] of the missions by the Mexican government. The Fages-Crespi Expedition of 1772 noted three or four villages in the *Bolsa de San Felipe* area (Hollister Valley) while Danti and Sal in 1795 appear to have reported extant and abandoned villages in both the San Juan and Hollister valleys (King and Hickman 1973:31). Reportedly, a total of 276 *Ausaima* were baptized at Mission San Juan Bautista between 1797 through 1806.[10] Following Milliken, the *Ausaima*

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9. The program which involved the release of Indian neophytes from mission jurisdiction and the conversion of Mission property. The 1826 decree in California was ineffective and followed by proclamation in 1834 (Hart 1987:322, 464).

10. Note this total differs from King and Hickman (1973:32, Table 1.)

village, *Poytoquix*, became the Mission San Juan Bautista ranch and chapel of San Felipe (Milliken 1995:236 after Merriam [1966-]1967:391).[11] See also Hispanic Period below.

Reviews of the Costanoan/Ohlone are provided by Kroeber (1925:462-473), Harrington (1942), Galvan (1967/1968), T. King (1973), King and Hickman (1973 and after Milliken n.d.), Levy (1978), Milliken (1994, 1995), and Bean (1994).

HISTORIC ERA RESOURCES

HISPANIC PERIOD

Spanish explorers in the 1770s were the first Europeans to traverse inland from Monterey Bay. Various parties through the general study area include an expedition led by Pedro Fages in 1770 with a return by Fages and Father Crespi in 1772; Juan Bautista de Anza and Father Pedro Font in early 1776; Danti and Sal in 1795; Alferez Gabriel Moraga with Father Pedro Muñoz in 1806; and, Father José Viader accompanied by Moraga in 1810. Still later, Jose Dolores Pico in 1815 and 1826, Sebastian Rodrigues in 1828 proceeded through the study area (Cook 1960:247-248, 254, 268; King and Hickman 1973:4, Map 1, 23-27, 31, 82, Table 7; Beck and Haase 1974:#17, #20-22; Hornbeck 1983:40).

The Spanish philosophy of government in northwestern New Spain was directed at the founding of presidios, missions, and secular towns with the land held by the Crown (1769-1821). The later Mexican policy stressed individual ownership of the land (1822-1848). After the secularization of the missions by Mexico in 1833, vast tracts of the mission lands were granted to individual citizens (Hart 1987). The Plan area was probably used for grazing cattle as the export of tallow and hides was a major economic pursuit in California during the Hispanic Period.

Mission San Juan Bautista (St. John the Baptist), founded on June 24, 1797, is one of seven missions located within Costanoan/*Mutsun* territory. This mission, the 15th of the 21 missions founded in California, would have been the mission with the greatest impact on the aboriginal population in the study area (Hoover et al. 1966:309-311; King and Hickman 1973:49-54; Hart 1987:324; Gudde 1998:338).

The "San Juan Bautista Historic District" is listed on the *California Plan* (CAL/OHP 1973:133) and the San Juan Bautista Historic District is on the *California Inventory of Historic Places* (CAL/OHP 1976:156, 252). The "Mission San Juan Bautista and Plaza" is a State of California Landmark (CAL/OHP 1990:175, #195) and the mission plaza, the Plaza Hotel, Castro Breen Adobe and other nearby buildings are within a State Historic Park (CAL/OHP 2002:316). The "San Juan Bautista Plaza Historic District" is a listed National Register district[12] (USNPS

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11. Milliken notes that Levy mislocated the *Ausaima* to the west of the San Felipe sink (Levy 1978:485, Fig. 1, #25 *?awsayma*).

12. Assigned P-35-87/CA-SBn-86H (Primary Number/Trinomial) by CHRIS/NWIC.

2002a) and a National Historic Landmark (CAL/OHP 2002a:code 1S;[13] USNPS, Ms. Heather Cushman, NPS, National Register of Historic Places).[14]

The mission had over 1,000 neophytes in the 1820s. After the mission was secularized in 1835, 63 Native American families were released, provided payments, and rapidly left resulting in a number of non-rancho related post-secularization Indian settlements throughout the study area. By 1846 about 50 Spanish and Mexicans were living at San Juan de Castro, the subsequent name of the mission and by 1872, only about 15-20 Native Americans remained at the mission. Large Native American settlements were situated at the mouth of San Juan Canyon near the cement plant,[15] in the foothills of the Flint Ranch, on Pacheco Creek, and probably the mountains [*sic*]. Most were located in the northern part of the San Juan Valley near the Pajaro Gap, reportedly near Sargent's Station, La Brea, near the Sanchez adobe, and *El Paredon*, located about two miles north of San Juan overlooking the Pajaro River. *Paredon* was notable for its occupation during the Mission Period and after secularization. The settlement was impacted by a 1868 smallpox epidemic (Hoover et al. 1966:310; King and Hickman 1973:48, Map 10, 52-54 after Milliken n.d.; Schuyler 1978:73).

Ranchos, Tracts, and Roads

During the Hispanic Period (ca. 1804-1848), the Plan area was located within the sphere of influence of *Mission San Juan Bautista*, and included a number of ranchos as well as ungranted lands.

Rancho Ausaymas y San Felipe includes the northeast portion of the Plan area. The *Ausaymas* tract, named after a Native American tribelet, was granted by Governor Figueroa to Francisco Perez Pacheco on November 21, 1833. Pacheco petitioned for additional land he called *Guadalaxarita* but was known to the Mission San Juan padres as *San Felipe*. Both tracts appear to have been part of the larger grant made to Pacheco on April 1, 1836 by Governor Gutierrez and patented to him April 18, 1859. In addition, Paceco also secured *Rancho San Justo*, *Bolsa de San Felipe*, and *San Luis Gonzaga*. Pacheco was noted for his ". . . bravery and success in quelling Indian revolts" and in spite of a raid by Indians in 1838, the rancho prospered. The Pacheco Adobe was located on the south bank of Pacheco Creek west of Highway 156 (T 11S R 5E, Lot 37) while the Pacheco Workers Rancheria was on the north bank of the creek (United States Surveyor General (USSG) 1870:N.D.#232;[16] Washington

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13. Code 1S, listed in the National Register as an individual property [sic] and not as a district.

14. As the "San Juan Bautista Pueblo (and Plaza)" (approximately 6 acres) on the single page National Survey of Historic Sites and Buildings form under the theme of Spanish Settlement and Exploration (Snell 1963).

15. Located on the west bank of San Juan Creek Section 4 of T13S R4E (USGS San Juan Bautista 1940). Probably P-35-36/CA-SBN-35/H, San Juan Bautista #3 (Fitzgerald 1999; King et al. n.d. after King 1973:7, Map 3/S-5222 Part II; Halley and Edwards 1979).

16. Northern District Map number assigned.

1858:N.D.#233; Hoover et al. 1966:312; King and Hickman 1973:48, Map 10, #4-5; Perez 1996:54, 243).

Rancho Llano del Tequisquita[17] (alkali flat or flats) located west of *Rancho Ausaymas y San Felipe* and north of *Rancho San Justo* was granted to Jose Maria Sanchez by Governor Castro on October 10, 1835. He and Thomas Oliver Larkin, had an early soap-making enterprise located near San Felipe Lake (formerly Soap Lake)[18] into which Tesquisquite Slough flows. The rancho was claimed by Don Jose Maria Sanchez along with *Rancho Las Animas* (in Santa Clara County) and patented to his heirs in December 29, 1871 (Terrell 1867:N.D.#230; Hoover et al. 1966:312-313; Pierce 1976:87-88, 98; Perez 1996:72, 245; Terhorst and Krase 1991a:5/S-16192).

The *Rancho Bolsa de San Felipe* ("pocket" of St. Philips) is nearly enclosed by a swamp, a willow grove, and a ravine known as *Sanjon de Tesquisquite*. The fathers at Mission San Juan Bautista allowed Francisco Perez Pacheco to settle on this rancho prior to 1833. Pacheco allowed the family of the mayordomo of the mission as well as some of the mission Indians on the rancho to remain (see also *Ausaymas y San Felipe*). The rancho was granted to Francisco Perez Pacheco on November 14, 1840 and patented January 1871. James Dunne and two partners purchased over 25,000 acres of the rancho in 1857, establishing the San Felipe Ranch. In 1870 James Hudner[19] purchased part of the rancho from Mariano Malarin, husband of Pacheco's daughter Lola Pacheco (Thompson 1865/1870:N.D.#231; Hoover et al. 1966:312; Pierce 1976:89-90; Perez 1996:56; Terhorst and Krase 1991a:7/S-16192; Gudde 1998:333-334).

The *Rancho San Joaquin* (St. Joachim) or *Rosa Morada* (*rosa*, red, red spot; *morada*, residence) was east of the *Bolsa de San Felipe* which was located northeast of Hollister. It was granted April 1, 1836 to Cruz Cervantes by Governor Gutierrez and patented to him January 1, 1874. Prior to receiving the patent, the rancho was transferred to Flint-Bixby [Flint Bixby and Company] (Dr. Thomas Flint, Benjamin Flint, and Llewelyn Bixby; USSG 1870:N.D.#232; Hoover et al. 1966:312, 314; Pierce 1976:91; Perez 1996:91; Gudde 1998:337).

Rancho Cienega de Gabilan, (*cienega*, marsh, miry place, swamp, morass; *gabilan* or *gavilan*, hawk) located on the south side of Los Justos, includes a small part of the Proposed Cienega Valley Water Pipeline along the San Benito River. This rancho was granted by Governor Micheltorena on October 26, 1843 to Antonio Chavez (Chavis), a tax collector at Monterey and

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17. *Llano*, level field or flat ground (Perez 1996:245). *Quixquitl*, efflorescent and *tetl*, rock - Aztec for "saltpeter" or "Lake of the Alkali" (Pierce 1976:98).

18. Located in San Benito County, but is listed on the *California Inventory of Historic Places* (CAL/OHP 1976:111, 267) as in Santa Clara County. The *Santa Clara Heritage Resource Inventory* places it on the southside of Pacheco Pass Highway (State Highway 152) between Frazier Lake Road and Lovers Lane, Gilroy (Pace 1975:7, #11; SClCoHHC 1999:80 [location]; USGS San Felipe 1971; Coy 1973; Terhorst and Krase 1991a:5/S-16192).

19. A stop along the railroad tracks in the study area (e.g., USGS San Felipe 1971).

a lieutenant under Jose Antonio Castro in 1846. In 1853, Jose Y. Limantour filed a claim for this rancho, but it was confirmed to Thomas O. Larkin. Jesse D. Carr secured the rancho from Larkin shortly after it was patented to Carr on October 15, 1867 (Thompson 1865:N.D.#250; Hoover et al. 1966:233; Perez 1996:62, 244-245).

Rancho San Justo (St. Justus),was granted to Rafael Gonzales in 1836 who abandoned it and it was granted later to General Jose Castro on April 15, 1839. The rancho was conveyed to Francisco Perez Pacheco (also owner of *Rancho Ausaymas and San Felipe*) in July 1844 and patented to his heirs December 6, 1865 (Terrell 1859a:N.D.#238; Hoover et al. 1966:312; King and Hickman 1973:56, 60; Pierce 1976:48-57; Hart 1987:221; Perez 1996:93; Gudde 1998:339).

The *Tract of Land near Mission San Juan Bautista* was granted to Jose Castro on April 13, 1846 and patented to Patrick Breen on January 22, 1877. This tract was located northeast of Mission San Juan. Its southwest corner was contiguous to the orchard of the mission (Terrell 1859b:N.D.#248; Reade 1882:N.D.#247A; Perez 1996:92).

El Camino Real, or the Royal Road, ran between forts, towns, and missions from Guatemala to Mexico City and as far north as Sonoma County (Hoover et al. 1966). King and Hickman (1973:48, Map 10) place the road to the west of Mission San Juan Bautista proceeding north along the west side of the Plan area. It is listed in *The California History Plan*, the *California Inventory of Historic Resources*, and is also a State of California landmark - "El Camino Real (As Father Serra Knew It and Helped Blaze It)" (CAL/OHP 1973:150; CAL/OHP 1976:257; CAL/OHP 1990:204-205, #784). As a landmark designated after #770, it is automatically on the California Register of Historical Resources (CRHR) (CAL/OHP ca. 1999) [Note: the *Historic Properties Directory* lists *El Camino Real* on "Polk Street" in San Juan Bautista as code 5S, "eligible for Local Listing only" (CAL/OHP 2002a)].

AMERICAN PERIOD[20]

In the mid-19th century, the majority of the rancho and pueblo lands and some of the ungranted land in California were subdivided as the result of population growth, the American takeover, and the confirmation of property titles. Growth can be attributed to the Gold Rush (1848), followed by the completion of the transcontinental railroad (1869) and local railroads. Still later, the development of the refrigerator railroad car (ca. 1880s) used for the transport of agricultural produce to distant markets, had a major impact on California agriculture. The agricultural land-use pattern throughout the Plan area has been rapidly replaced by urban and suburban development since post-World War II (Hart 1987) although San Benito County is still primarily rural.

Rancho San Justo was sold by Francisco Perez Pacheco in 1855 to the firm of Colonel William Wells Hollister and Flint, Bixby and Company (Dr. Thomas Flint, Benjamin Flint, and Llewelyn Bixby). Colonel Hollister was notable for driving sheep across the continent in 1853,

20. The summary context concentrates on San Benito County; a small portion of the Plan area is situated in Santa Clara County.

for his ownership of the *Rancho San Justo*, and his sheep ranch on the property. In 1868, 21,000 acres in the eastern part of the rancho was purchased by a group of 50 farmers who formed the San Justo Homestead Association and reserved 100-acres in the center for the town of "Hollister"[21] named by the San Justo Homestead Association of Farmers for Colonel Hollister. The Hollister post office was established soon after in January 1869. The City of Hollister was incorporated in 1872 and selected as county seat when the County of San Benito, named after its namesake, San Benito Creek, was formed from Monterey County in February 1874. Hollister remains the county seat and service center for ranching/farming and mining products and is a focus of contemporary urban growth in the study area (Hoover et al. 1966:309; Hart 1987:221; Patera 1991:95; Gudde 1998:167-168; Terhorst and Krase 1991a:6/S-16192).

Towns throughout California grew up along major transportation vectors such as the *El Camino Real* between towns and missions such as Mission San Juan Bautista (San Juan). In the 1850s and 1860s, San Juan was an exchange station/stopping place on the route between San Francisco and Los Angeles and, slightly later, was along the route between Monterey and Los Banos. San Felipe at the foot of Pacheco Pass was also on the road to Los Banos. In contrast, Hollister was not on a main stage line. Nonetheless, when the Southern Pacific "Coast Line" arrived in the Plan area in 1870, a flag stop was established at Hudner north of Hollister and then continued just to the east of Hollister. A railroad spur was built shortly thereafter to Hollister and in 1873 the tracks were extended to and terminated at Tres Piños. The town of Paicines[22] located about 2.5 miles east/southeast of the southern Proposed Cienega Valley Water Pipeline was noted for quicksilver mining. The Paicines post office was established in October 1874 and named for the *Rancho Cienga de los Paicines*. It was originally known as Tres Piños which moved northwest to the terminus of the proposed Gilroy to San Joaquin Valley railroad line (13 miles southeast of Hollister; Hoover et al. 1966:311; King and Hickman 1973:56; Pierce 1976:90; Hart 1987:221; Patera 1991:160; Gudde 1998:276; USGS/Corps Gonzales 1941).

By 1870, cattle and sheep ranching was replaced by wheat and later by more intensive farming and stock raising. Cattle baron Henry Miller constructed a large canal from the Pajaro River to Soap Lake in the third quarter of the 19th century which drained the marsh area in the vicinity of Soap Lake (San Felipe Lake). Alfalfa was grown and dairy farms were established with three small settlements clusters: San Felipe, a stage stop along Pacheco Pass Road; Dunneville Corners, named for the Dunne family; and, Pacheco Corners. Vegetable seed production was also important in the study area. "Seed Pioneer" Waldo Rohnert lived and had an orchard and experimental gardens and a complex where seeds were processed, graded, packed, and shipped in the Dunneville area. The Sun Seeds Company complex (formerly known as the Waldo

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21. The Downtown Hollister Historic District bounded by Fourth, East, South, and Monterey Streets is a listed National Register of Historic Places District (USNPS 2002a).

22. Attributed to the Mutsun *paysen* "to get pregnant" and/or village known as *Paisin* on the San Benito River (Gudde 1998:276). See Ethnographic above for other variants.

Rohnert Seed Company)[23] was reportedly the largest in the world and at the time of Rohnert's death in 1933 the largest independent vegetable seed company in the United States.

The more intensive farming - including orchards in the 1880s and horticulture by 1900, and later row crops - required capital investment for irrigation from the 1890s onward along with machinery, fertilizer, and more efficient transportation as well as more agricultural laborers. The planting, cultivating, harvesting, and packing required a large labor force. This was initially provided by single white "blanket men" (tramps) and later migrant/immigrant labors: initially former Chinese railroad laborers from ca. 1869 onward; Japanese from ca. 1890s to prior to 1913; Portuguese from the Azores and Canary Islands; Hindus; Italians and other Southern Europeans prior to 1924; Mexicans, especially 1914-1930; Filipinos in the late 1920s-1930s; and, "Okies" from the Dust Bowl in the late 1930s. Hollister is still a ranching center and county seat and the focus of increasing urban growth in the general study area (Hoover et al. 1966:309, 311; Gudde 1998:167-168; Outland 1973; King and Hickman 1973:56-58, 60-65; Hart 1987:221; Patera 1991:95; Terhorst and Krase 1991a:7-9/S-16192; Terhorst and Krase 1991d/form; Walker 1994:13, 23; Laffey in Breschini and Haversat 1980:7, 13).

Goddard's 1857 *Map of the State of California* shows "San Juan" on *El Camino Real*, the "Pachecos", and "Tres Pinos" as well as various major rivers and creeks in the study area. For the most part, no early American period buildings, sheep corrals, etc. were situated in or adjacent to the various Plan area elements (US/BLM v.d.). An exception, the "Domingo Oliantes" [spelling?] residence? was present by 1865 in the *Rancho Cienega de Gabilan* near the south/west bank of San Benito River possibly in, near or adjacent to the southern part of the Local Conveyance Pipeline in the Tres Pinos Subbasin (Thompson 1865:N.D.#250).

FINDINGS

The intent of this report is to identify historic properties (archaeological, Native American, and/or architectural properties) which may be listed, determined or potentially eligible for inclusion on the California Register of Historical Resources (CRHR) in or adjacent to the SBCWD Plan elements.

AGENCIES, GROUPS AND INDIVIDUALS CONSULTED

A prehistoric and historic site record and literature search of the Plan area and adjacent areas was completed by the California Historical Resources Information System, Northwest Information Center at California State University Sonoma, Rohnert Park (CHRIS/NWIC File No. 02-319, 02-X-57, 02-463, 02-X-69, and 02-X-74).

In addition, the Bureau of Land Management (BLM) was contacted for rancho plats and the National Register of Historic Places (NRHP), Washington D.C. was contacted for copies of National Register forms pertinent to the Plan area. No other agencies, groups, or individuals were consulted for this report.

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23. Assigned P-35-229.

Cultural Resources Assessment Northern San Benito County Groundwater Management Plan Revised June 9, 2003

ADMINISTRATIVELY CONFIDENTIAL: Because the remainder of this report discusses the location of specific archaeological and historic sites, it is considered administratively confidential. The entire report can be made available for review at the San Benito County Water District Office by authorized personnel.

APPENDIX G

AIR RESOURCES SETTING REPORT

AIR QUALITY SETTING FOR THE SAN BENITO COUNTY PART OF THE GILROY-HOLLISTER GROUNDWATER BASIN

Prepared for

David J. Powers & Associates

Prepared by

Donald Ballanti
Certified Consulting Meteorologist

1424 Scott Street/El Cerrito, California 94530/ (510) 234-6087/ Fax: (510) 232-7752

EXISTING CONDITIONS

Air Pollution Climatology

The project is within the North Central Coast Air Basin (NCCAB), which is comprised of Santa Cruz, San Benito and Monterey Counties. A semi-permanent high pressure in the eastern Pacific is the controlling factor in the climate of the air basin. In late spring and summer, the high pressure system is dominant and causes persistent west and northwesterly winds over the entire California Coast. The onshore air currents pass over cool ocean waters to bring fog and relatively cool air into the coastal valleys. Warmer air aloft creates elevated inversions that restrict dilution of pollutants vertically, and mountains forming the valleys restrict dilution horizontally.

In the fall, the surface winds become weak, and the marine layer grows shallow, dissipating altogether on some days. The air flow is occasionally reversed in a weak offshore movement, and the relatively stagnant conditions allow pollutants to accumulate over a period of days. It is during this season that the north or east winds develop that transport pollutants from either the San Francisco Bay Area or the Central Valley into the NCCAB.

During winter and early spring the Pacific High migrates southward and has less influence on the air basin. Wind direction is more variable, but northwest winds still dominate. The general absence of deep, persistent inversions and occasional storm passages usually result in good air quality for the basin as a whole.

The project area extends from Hollister Valley southward to along the San Benito River drainage to Paicines Reservoir. This area is ventilated by winds building up the Pajaro River and San Benito River drainages. When the wind has a more northwesterly component transport of pollutants from the Santa Clara Valley occurs.

Ambient Air Quality Standards

Both the U. S. Environmental Protection Agency and the California Air Resources Board have established ambient air quality standards for common pollutants. These ambient air quality standards are levels of contaminants which represent safe levels that avoid specific adverse health effects associated with each pollutant. The ambient air quality standards cover what are called "criteria" pollutants because the health and other effects of each pollutant are described in criteria documents.

The federal and California state ambient air quality standards are summarized in Table 1 for important pollutants. The federal and state ambient standards were developed

TABLE 1
FEDERAL AND STATE AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	Federal Primary Standard	State Standard
Ozone	1-Hour 8-Hour	0.12 ppm 0.08 ppm	0.09 ppm --
Carbon Monoxide	8-Hour 1-Hour	9.0 ppm 35.0 ppm	9.0 ppm 20.0 ppm
Nitrogen Dioxide	Annual 1-Hour	0.05 ppm --	-- 0.25 ppm
Sulfur Dioxide	Annual 24-Hour 1-Hour	0.03 ppm 0.14 ppm --	-- 0.05 ppm 0.25 ppm
PM_{10}	Annual 24-Hour	50 ug/m^3 150 ug/m^3	20 ug/m^3 50 ug/m^3
$PM_{2.5}$	Annual 24-Hour	15 ug/m^3 65 ug/m^3	12 ug/m^3 --
Lead	30-Day Avg. 3-Month Avg.	-- 1.5 ug/m^3	1.5 ug/m^3 --

ppm = parts per million
ug/m^3 = Micrograms per Cubic Meter

independently with differing purposes and methods, although both processes attempted to avoid health-related effects. As a result, the federal and state standards differ in some cases. In general, the California state standards are more stringent. This is particularly true for ozone and PM_{10}.

In addition to the criteria pollutants discussed above, Toxic Air Contaminants (TACs) are another group of pollutants of concern. Toxic Air Contaminants (TACs), are injurious in small quantities and are regulated despite the absence of criteria documents. The identification, regulation and monitoring of TACs is relatively recent compared to that for criteria pollutants. Unlike criteria pollutants, TACs are regulated on the basis of risk rather than specification of safe levels of contamination.

Ambient Air Quality

The Monterey Bay Unified Air Pollution Control District (MBUAPCD) operates a network of monitoring sites throughout the District. The District operates a site measuring ozone and PM10 in Hollister. In addition, the National Park Service operates a site measuring ozone in Pinnacles National Monument located roughly ten miles south of the project boundary.

During the 3-year period 2000-2002 no violations of the federal ambient air quality standards for ozone or PM_{10} were recorded. During the same period, the more stringent state ozone standard was exceeded on 11 days at Pinnacles National Monument and 5 days at Hollister. The state PM_{10} standard was exceeded on 1 day during this period at Hollister.

Attainment Status and Regional Air Quality Plans

The Monterey Bay Unified Air Pollution Control District (MBUAPCD) shares responsibility with the California Air Resources Board (CARB) for ensuring that the State and national ambient air quality standards are met within Santa Cruz County and the North Central Coast Air Basin. State law assigns local air districts the primary responsibility for control of air pollution from stationary sources while reserving to the CARB control of mobile sources. The District is responsible for developing regulations governing emissions of air pollution, permitting and inspecting stationary sources, monitoring air quality and air quality planning activities.

Under the Federal Clean Air Act the NCCAB is designated a maintenance area for the federal 1-hour ozone standard. The NCCAB was re-designated from a moderate non-attainment area to a maintenance area in 1997 after meeting the federal 1-hour standard in 1990. The NCCAB is designated as an attainment area for the federal 8-hour ozone standard.

Under the California Clean Air Act (CCAA), the basin is a moderate non-attainment area for the State 1-hour ozone standard. The air basin is also designated non-attainment for the state PM_{10} standard.

Thresholds of Significance

The Monterey Bay Unified Air Pollution Control District has established recommended thresholds of significance during construction and operation of a project, to be used to evaluate air quality impacts in environmental documents.[1] The recommended threshold of significance for construction is PM_{10} emissions of 82 pounds per day or greater. For operational direct and indirect emissions, the following thresholds are recommended:

Volatile Organic Compounds (VOC)	137 pounds/day (direct + indirect)
Nitrogen Oxides (NO_x)	137 pounds/day (direct + indirect)
PM_{10}	82 pounds/day (direct only)
Carbon Monoxide (CO)	550 pounds/day (direct only)
Sulfur Oxides (SO_x)	150 pounds/day (direct only)

Direct emissions refer to pollutants onsite from equipment or stationary engines. These types of sources typically are found at industrial or manufacturing facilities. MBUAPCD

[1] Monterey Bay Unified Air Pollution Control District, CEQA Air Quality Guidelines, September 2000.

guidelines provide that exceeding the above thresholds for PM_{10}, CO or SO_x, is not a significant impact if district-approved air quality modeling indicates that the source would not result in a violation of the corresponding state and federal ambient air quality standards.

Indirect emissions are those related to vehicle traffic attracted or generated by a project. Indirect source emissions are to be compared to the thresholds for VOC and NO_x. District guidelines additionally identify several traffic-related thresholds related to the potential for high carbon monoxide concentrations. If any of these traffic thresholds are exceeded, carbon monoxide modeling should be undertaken to determine if indirect source emissions would cause an exceedance of state or national standards. If modeling demonstrates that the project would not cause or substantially contribute to an exceedance of CO standards under project or cumulative scenarios, the project would not have a significant impact.

Exhaust emissions from construction equipment and vehicles emit precursors of ozone (VOC and NO_x) as well as PM_{10} but emissions from these sources are assumed to be accommodated in the emission inventories of the State- and federally-required air plans and would not have a significant impact on the attainment and maintenance of the ozone standards.

MBUAPCD CEQA Guidelines provide that a consistency analysis and determination serves as an assessment of the cumulative impacts of a project on regional air quality. If emissions from a project are determined to be inconsistent with or not accommodated by the AQMP, it is considered to have a significant cumulative air quality impact. MBUAPCD Rule 216 requires that new or modified wastewater treatment facilities be consistent with the adopted AQMP. Consistency of wastewater treatment facilities is determined by comparing project forecasts for the proposed service area with the applicable AQMP forecasts.

APPENDIX H

NOTICE OF PREPARATION (NOP) AND RESPONSES TO THE NOP

STATE OF CALIFORNIA

Governor's Office of Planning and Research

State Clearinghouse

Gray Davis
Governor

Tal Finney
Interim Director

Notice of Preparation

December 2, 2002

To: Reviewing Agencies

Re: Groundwater Management Plan for the San Benito County Part of the Hollister-Gilroy Groundwater Basin
SCH# 2002121003

Attached for your review and comment is the Notice of Preparation (NOP) for the Groundwater Management Plan for the San Benito County Part of the Hollister-Gilroy Groundwater Basin draft Environmental Impact Report (EIR).

Responsible agencies must transmit their comments on the scope and content of the NOP, focusing on specific information related to their own statutory responsibility, within 30 days of receipt of the NOP from the Lead Agency. This is a courtesy notice provided by the State Clearinghouse with a reminder for you to comment in a timely manner. We encourage other agencies to also respond to this notice and express their concerns early in the environmental review process.

Please direct your comments to:

John Gregg
San Benito County Water District
P.O. Box 899
30 Mansfield Road
Hollister, CA 95024

with a copy to the State Clearinghouse in the Office of Planning and Research. Please refer to the SCH number noted above in all correspondence concerning this project.

If you have any questions about the environmental document review process, please call the State Clearinghouse at (916) 445-0613.

Sincerely,

Becky Frank
Project Analyst, State Clearinghouse

Attachments
cc: Lead Agency

DEC 2 02

1400 TENTH STREET P.O. BOX 3044 SACRAMENTO, CALIFORNIA 95812-3044
(916)445-0613 FAX(916)323-3018 www.opr.ca.gov

NOTICE OF PREPARATION

OF A PROGRAM ENVIRONMENTAL IMPACT REPORT

San Benito County, California
December 2002

As the Lead Agency, the San Benito County Water District will prepare an Environmental Impact Report (EIR) for the project identified below and would like your views regarding the scope and content of the environmental information to be addressed in the EIR. This EIR will be used by the City of Hollister, City of San Juan Bautista, and Sunnyslope County Water District (Responsible Agencies) and may be used by your agency when considering approvals for this project.

We have prepared an Initial Study that identifies areas of potential environmental effects. These probable environmental effects are listed below. The Initial Study is included as Attachment A.

According to State law, the deadline for your response is 30 days after receipt of this notice; however, we would appreciate an earlier response, if possible. Please identify a contact person, and send your response to:

San Benito County Water District
Attention: John Gregg
P.O. Box 899
Hollister, California 95024-0899
(831) 637-8218

PROJECT TITLE: Groundwater Management Plan for the San Benito County Part of the Hollister-Gilroy Groundwater Basin

PROJECT LOCATION: The project area is located in Northern San Benito County. It encompasses the Hollister and San Juan Valleys and includes the communities of Hollister, San Juan Bautista, and Tres Pinos. The regional location of the area covered by the proposed plan is shown in Figure 1. Elements of the proposed plan are shown in Figure 2.

PROJECT SPONSOR: Water Resources Association of San Benito County (WRA); an association of the City of Hollister, City of San Juan Bautista, Sunnyslope County Water District, and San Benito County Water District .

PROJECT DESCRIPTION: The WRA and San Benito County Water District will prepare an environmental impact report on implementation of a Groundwater Management Plan (Plan) within their service areas. A copy of the section describing the elements of the Plan is attached as Attachment B.

The proposed project is the adoption and implementation of a groundwater management plan that includes goals and objectives for short-term and long-term management of water resources in Northern San Benito County within the Hollister-Gilroy Groundwater Basin. The proposed plan will address surface and groundwater management as well as wastewater treatment discharges and use of reclaimed water supplies. The proposed project is intended to provide reliable, sustainable, good

quality water for existing and future agricultural, municipal and industrial uses in accordance with the goals and objectives of the Plan.

The proposed plan would incorporate existing water resources programs and new project elements and activities into an integrated strategy for managing imported surface water from the San Felipe Project and the surface and groundwater resources within the area. The plan will address management of resources on a subbasin basis. Existing programs of local agencies and new elements in the groundwater management plan include: water conservation, existing groundwater extraction facilities, surface water importation, development and improvement of high quality local ground and surface water supplies, water banking, surface water treatment, groundwater treatment, use of reclaimed wastewater effluent, continuation of wastewater effluent percolation, groundwater pumping for groundwater level and water quality management, and out-of-basin export of effluent, concentrate, groundwater, or agricultural drainage water and discharge to the San Benito River or Monterey Bay.

POTENTIAL ENVIRONMENTAL EFFECTS OF THE PROJECT: It is anticipated that the proposed project may have the following environmental effects: impacts to hydrology and water quality (groundwater and surface water resources), land use, agricultural resources, biological resources (including special status species), geology and seismicity (including liquefaction), construction impacts, cultural resources, utilities and service systems, and energy.

Community Scoping Meeting

A Community Scoping Meeting will be held in the project area. The community and agency representatives are invited to attend. Information will be provided about the project and the California Environmental Quality Act (CEQA) review process. Both the public and agency representatives are encouraged to comment on the scope of the environmental review for the proposed water supply project. The meeting will be held on December 11, 2002 at the following time and location:

COMMUNITY SCOPING MEETING **December 11, 2002**
7:00 P.M to 8:30 P.M. Hollister City Council Chambers 375 Fifth Street Hollister, CA 95023 -3832

John Gregg
District Manager

Date: 11/26/02

INITIAL STUDY AND ENVIRONMENTAL REVIEW CHECKLIST

California Environmental Quality Act (CEQA)

1. Project Title: Groundwater Management Plan for the San Benito County part of the Gilroy-Hollister Groundwater Basin

2. Lead Agency Name and Address:

   San Benito County Water District
   P.O. Box 899
   Hollister, CA 95024-0899

3. Contact Person and Phone Number:

   John Gregg
   (831) 637-8218

4. Project Location: The project area is located in Northern San Benito County. It encompasses the San Juan Valley and the Hollister Valley and includes the communities of Hollister, San Juan Bautista, and Tres Pinos. The regional location of the area covered by the proposed plan is shown in Figure 1.

5. Project Sponsor's Name and Address:

   Water Resources Association of San Benito County
   P.O. Box 899
   Hollister, CA 95024

6. Description of Project: The proposed project is the adoption and implementation of a groundwater management plan that includes goals and objectives for short-term and long-term management of water resources in the San Benito County part of the Gilroy-Hollister Groundwater Basin in Northern San Benito County. The proposed plan will address surface and groundwater management as well as urban (Municipal and Industrial) water treatment, wastewater treatment discharges and use of reclaimed water supplies. The proposed project is intended to provide good quality water and adequate water supplies for existing and future agricultural, municipal and industrial uses in the area in accordance with the goals and objectives of the Groundwater Management Plan.

   The proposed plan would incorporate existing water resources programs and new project elements and activities into an integrated strategy for managing imported surface water from the San Felipe Project and groundwater resources within the area. The plan will address management of resources on a subbasin basis. Existing programs of

local agencies and new elements in the groundwater management plan include: water conservation, existing groundwater extraction facilities, surface water importation, development and improvement of high quality local ground and surface water supplies, water banking, surface and ground water treatment, reclaimed wastewater effluent, continuation of wastewater effluent percolation, groundwater pumping for groundwater level and water quality management, and out-of-basin export of effluent, concentrate or agricultural drainage to the San Benito River or Monterey Bay.

7. Other Public Agencies Whose Approval Is Required: None

8. Discretionary Approvals: Discretionary approvals by the San Benito County Water District as lead agency and by City of Hollister, Sunnyslope County Water District, City of San Juan Bautista as responsible agencies include without limitation:

   - Adoption of a Groundwater Management Plan

EVALUATION OF ENVIRONMENTAL IMPACTS

CEQA requires that an explanation of all answers except "No Impact" answers be provided along with this checklist, including a discussion of ways to mitigate any significant effects identified. As defined here, a significant effect is considered a substantial adverse effect.

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
I. AESTHETICS -- Would the project:				
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☒	☐
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☒	☐	☐	☐
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☒	☐	☐	☐

Comments to Questions I a, b and c:
Portions of State Route (SR) 25 and SR 156 are designated as State Scenic Highways. SR 25 is designated as a scenic route from SR 198 in Monterey County north to its junction with SR 156. SR 156 is designated as a scenic highway from SR 1 near Castroville to its junction with SR 152. New project elements of the proposed Plan include pipelines and water treatment facilities. Pipelines would be installed underground and would not substantially change the visual character or scenic resources along a State Scenic Highway. Water treatment facilities, which have an industrial character, could degrade the quality of scenic views if placed in a prominent position or close to scenic roadways. Implementation of the proposed plan could result in the construction of facilities along a scenic highway that could substantially degrade existing visual quality. The Programmatic EIR will address, at a program-level, the visual and aesthetic impacts of the proposed Groundwater Master Plan.

Source:
Draft Groundwater Management Plan
California Department of Transportation Scenic Highways website

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
I. AESTHETICS, cont. Would the project:				
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☐	☒	☐

Comments to Question I d:
Implementation of the proposed Groundwater Management Plan could result in the construction of pipelines, water treatment facilities, pump stations, and other similar facilities. While there may be lighting provided at water treatment facilities, the new project elements addressed in the proposed plan are not anticipated to be substantial sources of nighttime light or glare. As per standard policy and practice of the cities and County within the Management Plan area, individual project proponents will be required to submit an exterior lighting plan to the respective City or County Building and Planning Divisions for review and approval prior to installation of any such exterior lighting. For these reasons, the proposed project will not generate significant new light or glare for surrounding land uses or sensitive areas.

Source:
Draft Groundwater Management Plan

II. AGRICULTURAL RESOURCES -- Would the project:

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to non-agricultural use?	☒	☐	☐	☐
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒
c) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of farmland to non-agricultural use?	☐	☐	☒	☐

Comments to Questions II a, b, and c:
Implementation of the proposed Groundwater Management Plan would generally reduce the likelihood of the conversion of farmland to urban uses by managing for adequate, good quality water supplies for agricultural uses in the San Juan and Hollister Valleys. Physical improvements, such as pipelines, could result in minor impacts to farmland where pumps or vaults are installed. If constructed outside areas designated for urban uses, the construction of new water treatment facilities could result in the conversion of Prime Farmland to a non-agricultural use.

The proposed Groundwater Management Plan would manage water resources for both agricultural and urban uses. The Plan would not involve other changes which could result in the conversion of

farmland. Out of basin water banking could result in conversion of farmland to non-agricultural use, however, it is assumed that the existing out of basin water banks that the County might use will have undergone separate environmental review.

The Programmatic EIR will address, at a program-level, impacts of the proposed Groundwater Master Plan on conversion of farmland to non-agricultural use.

Source:
San Benito County General Plan: Land Use Element, April 7, 1998
San Benito County General Plan: Open Space and Conservation Element Update, February 7, 1995
Field Survey
Draft Groundwater Management Plan

III. AIR QUALITY -- Would the project:

a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☒	☐
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☒	☐	☐
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☐	☒	☐	☐
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☒	☐
e) Create objectionable odors affecting a substantial number of people?	☒	☐	☐	☐

Comments to Questions III a - e:
Implementation of the proposed Groundwater Management Plan could result in short-term air quality impacts during construction of new project elements. To the extent additional farmland could be cultivated in the Bolsa subbasin as a result of the development of additional water supply, there could be an increase in regional particulate matter emissions associated with the operation of farm equipment.

Implementation of the Groundwater Management Plan could result in the construction of water treatment facilities. Operation of these facilities will involve chemical treatments, however, they would not involve the emission of substantial pollutant concentrations. In addition, conformance with local, state and federal regulations on hazardous material use, transport, and storage would reduce risks of accidental release and exposure of sensitive receptors to a less than significant level.

The existing operation of several wastewater treatment facilities in the Hollister area have generated complaints regarding objectionable odors. Additional water treatment facilities, including percolation ponds, could also generate odor impacts, if situated near sensitive receptors.

Implementation of the proposed Groundwater Management Plan may result in air quality impacts during to construction. The EIR will analyze potential air quality impacts during construction of Plan elements and the potential for the Plan elements to result in odor impacts. Implementing

agencies will be required to comply with all applicable City and County regulations and operating procedures prior to and as part of the issuance of building and/or grading permits, including standard dust control measures.

Source:
Monterey Bay Unified Air Pollution Control District, CEQA Guidelines.
Draft Groundwater Management Plan

IV. BIOLOGICAL RESOURCES - - Would the project:

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☒	☐	☐	☐
b)Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☒	☐	☐	☐
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act? (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☐	☐	☒
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☐	☐	☒
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☒	☐
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☒

Comments to Questions III a, b, c, d, e, and f:

Implementation of the proposed Groundwater Management Plan could result in effects on wetlands, riparian habitat and special status species due to changes in groundwater levels, changes in stream flow, degradation of surface water quality and direct construction impacts. The project could also introduce invasive non-native tree species as part of tree belt plantings.

Threatened and endangered species (including federal candidate species) that could be effected by implementation of the elements of the proposed Groundwater Management Plan include steelhead, California tiger salamander, California red-legged frog, and San Joaquin kit fox. Additional California Species of Special Concern or California Native Plant Society List 1A and 1B species,

such as hairless popcorn-flower, Monterey roach, and Western pond turtle, could also be impacted by implementation of elements of the plan.

The Programmatic EIR will address, at a program-level, biological resources impacts of the proposed Groundwater Master Plan.

Source:
Draft Groundwater Management Plan
California Natural Diversity Data Base, 2001

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
V. CULTURAL RESOURCES -- Would the project?				
a) Cause a substantial adverse change in the significance of a historical resource as defined in δ15064.5?	☒	☐	☐	☐
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to δ15064.5?	☐	☒	☐	☐
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☒	☐
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☒	☐	☐

Comments to Questions V a, b, c, and d:

Hokan and Ohlone tribal groups lived within San Benito County area. Tribal groups are known to have inhabited San Juan Canyon, Hollister, San Juan Valley, and Diablo Range areas. Historic resources from the Mission Period and the Early American Period are reported in Hollister, San Juan Bautista, and other portions of the County within the project area.

Implementation of the Groundwater Management Plan would involve construction within archeologically and historically sensitive areas. Modifications in the vicinity of former Native American occupation sites could impact buried archaeological resources. Therefore, the EIR will analyze the potential cultural and historic resource impacts of the proposed Plan.

Source:
Draft Groundwater Management Plan
County of San Benito Environmental Resources and Constraints Inventory, July 26, 1994

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
VI. GEOLOGY AND SOILS -- Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map for the area or based on other substantial evidence of a known fault?	☐	☒	☐	☐
ii) Strong seismic ground shaking?	☐	☒	☐	☐

VI. GEOLOGY AND SOILS, cont.
Would the project:

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
iii) Seismic-related ground failure, including liquefaction?	☒	☐	☐	☐
iv) Landslides?	☒	☐	☐	☐
b) Result in substantial soil erosion or the loss of topsoil?	☐	☒	☐	☐

Comments to Questions VI a(i), a(ii), a(iii), a(iv) and b:

San Benito County is in an active seismic area of Central California. The San Andreas Fault system runs diagonally through the County, passing immediately east of San Juan Bautista. Variations in intensity of ground shaking occur within the area due to local variations in geologic and soil conditions. In the areas around Hollister and San Juan Bautista, alluvial soils vary in thickness, consolidation, grain size, sorting and water saturation.

Implementation of the proposed Groundwater Management Plan could result in hazards to pipelines and other improvements associated with rupture of a known earthquake fault, strong ground shaking, and seismic related ground failure. Possible increases in groundwater levels in some areas could result in increased liquefaction and lateral spreading hazards. Prolonged decreases in groundwater levels could result in ground subsidence.

Implementation of elements of the Groundwater Management Plan, especially projects near waterways and on steep slopes, could result in substantial erosion.

Source:

Draft Groundwater Management Plan
Alquist-Priolo Geologic Hazards Zone Act Special Studies Zone Map
County of San Benito Environmental Resources and Constraints Inventory, July 26, 1994.
Soil Survey, San Benito County California, USDA-Soil Conservation Service, 1969.

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?	☒	☐	☐	☐

d) Be located on expansive soil creating substantial risks to life or property?	☐	☒	☐	☐

Comments to Questions VI c and d:

Implementation of the proposed Groundwater Management Plan could result in increases in groundwater levels due to effluent percolation, in-basin water banking, and construction of wetlands. Increases in groundwater levels, in areas with soils susceptible to liquefaction and lateral spreading, could result in ground failures during a seismic event.

Soil conditions at some locations within then Northern San Benito County area could require special foundations or conditioning prior to construction of buildings, percolation ponds, or water treatment facilities. In hillside areas, such as near the proposed redevelopment of the Cienega water source, landslides could be a hazard.

Source:
Draft Groundwater Management Plan
County of San Benito Environmental Resources and Constraints Inventory, July 26, 1994
Alquist-Priolo Geologic Hazards Zone Act Special Studies Zone Map

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?	☐	☒	☐	☐

Comments to Question VI e:
New percolation ponds, direct percolation, and additional use of reclaimed effluent could be affected by underlying soil conditions. Future design will need to consider the capability of underlying soils to percolate discharges from wastewater treatment.

As noted above, implementation of the Plan could result in higher groundwater levels in some areas. To the extent this could affect the functioning of existing septic systems, this could be a significant impact.

The Programmatic EIR will address, at a program-level, the geologic impacts of the proposed Groundwater Management Plan.

Source:
Draft Groundwater Management Plan
Soil Survey, San Benito County California, USDA-Soil Conservation Service, 1969

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
VII. HAZARDS AND HAZARDOUS MATERIALS-- Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☒	☐	☐

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
VII. HAZARDS AND HAZARDOUS MATERIALS, cont. – Would the project:				
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☒	☐	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☒	☐	☐
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☒	☐	☐

Comments to Question VII a, b, c and d:
Implementation of the proposed Groundwater Management Plan could include construction of water treatment facilities that use and store chemicals for water purification. The specific locations and properties where project elements would be constructed is not known at this time. It is also possible that hazardous materials contamination could be present on some sites proposed for construction of Plan elements. The Programmatic EIR will address, at a program-level, the hazardous materials impacts of the proposed Groundwater Management Plan.

Source:
Draft Groundwater Management Plan

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area? ☐	☐	☐	☒	
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☒	☐

h) Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☒	☐

Comments to Question VII e, f, g and h:
Hollister Airport is located north of Hollister. Implementation of the Groundwater Master Plan is not anticipated to introduce any structures within the vicinity of the airport that would result in a safety hazard.

Implementation of the proposed Plan would not impair implementation of an adopted emergency response plan or emergency evacuation.

Implementation of the Plan would not result in the introduction of critical facilities, such as water treatment facilities, into high fire hazard zones, as identified in the County of San Benito General Plan. The Cienega pipeline would cross a high fire hazard zone and redeveloped impoundments on Arroyo de los Vibroras and Arroyo Dos Picachos would be located in a very high fire hazard zone.

Source:
Draft Groundwater Management Plan
County of San Benito Environmental Resources and Constraints Inventory, July 26, 1994

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
VIII. HYDROLOGY AND WATER QUALITY - - Would the project:				
a) Violate any water quality standards or waste discharge requirements?	☐	☒	☐	☐
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☒	☐
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?	☐	☒	☐	☐
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	☐	☒	☐	☐
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☒	☐

f) Otherwise substantially degrade water quality?	☐	☒	☐	☐

Comments to Questions VIII a-f:

Implementation of the proposed Plan may require measures to avoid violation of water quality standards or waste discharge requirements. The Plan will result in direct additions and withdrawals to groundwater quantity. The goal of the Plan is to prevent excess lowering of local groundwater tables.

Implementation of the Plan would result in a change in adsorption rates in the vicinity of new percolation ponds or in areas where groundwater levels increase near the ground surface. Expanded use of Pacheco Creek, Arroyo Dos Picachos and Arroyo de las Viboras for percolation or impoundments would change local drainage patterns. For the reasons described above, the project could have a significant drainage impact. Therefore, the Program EIR will analyze the potential hydrology and water quality impacts of the proposed Plan.

Source:
Draft Groundwater Management Plan.
County of San Benito Environmental Resources and Constraints Inventory, July 26, 1994
Flood Insurance Rate Map (FIRM) Floodplain Map, Federal Emergency Management Administration (FEMA), effective date, 1991.

VIII. HYDROLOGY AND WATER QUALITY, cont. Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☒
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	☐	☒	☐	☐
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☒	☐	☐
j) Result in inundation by seiche, tsunami, or mudflow?	☐	☐	☒	☐

Comments to Questions VIII g, h, i and j:
Flood hazard areas in northern San Benito County are confined, for the most part, to agricultural, mineral and open space uses. The flood season generally lasts from November through April when most precipitation falls.

According to the Flood Insurance Rate Map (FIRM) Floodplain Maps, existing and proposed percolation ponds are located within 100 year flood zones. Therefore, the Program EIR will analyze the potential flooding impacts of the proposed Plan.

Source:
Draft Groundwater Management Plan

Flood Insurance Rate Map (FIRM) Floodplain Map, Federal Emergency Management Administration (FEMA)
County of San Benito Environmental Resources and Constraints Inventory, July 26, 1994

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
IX. LAND USE AND PLANNING -- Would the project:				
a) Physically divide an established community?	☐	☐	☐	☒
b) Conflict with applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to, the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☒	☐	☐
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☒

Comments to Questions IX a - c:
The proposed project is the adoption and implementation of a groundwater management plan. The project would not divide an established community.

A habitat conservation plan for San Joaquin Kit is being prepared by San Benito County. The proposed project area is not governed by any adopted habitat conservation plan or natural community conservation plan. Therefore, the proposed project would not conflict with any applicable habitat conservation plan or natural community conservation plan affecting the area.

The Programmatic EIR will address, at a program-level, the land use impacts of the proposed Groundwater Management Plan and the project's conformance with applicable plans and policies.

Sources:
Draft Groundwater Management Plan
County of San Benito Environmental Resources and Constraints Inventory, July 26, 1994.
County of San Benito Open Space and Conservation Element Update of the San Benito County General Plan, February 7, 1995.

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
X. MINERAL RESOURCES -- Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☒	☐	☐	☐
b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?	☒	☐	☐	☐

Comments to Questions X a and b:
The proposed Plan includes areas designated as special mineral resource zones for aggregates. The Programmatic EIR will address, at a program-level, the mineral resources impacts of the proposed Groundwater Management Plan.

Source:
Draft Groundwater Management Plan
County of San Benito Environmental Resources and Constraints Inventory, July 26, 1994

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
XI. NOISE -- Would the project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☒	☐	☐
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☒	☐	☐
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☒	☐
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☒	☐	☐
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☒	☐
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☒	☐

Comments to Questions XI a-f:

Implementation of the proposed Groundwater Management Plan could result in short-term noise impacts during construction of new project elements. Implementation of the Plan is not anticipated to result in substantial permanent increases in noise levels, or exposure persons to excessive groundborne vibration or airport noise levels. The Programmatic EIR will address, at a program-level, the construction noise impacts of the Groundwater Management Plan.

Sources:
County of San Benito Environmental Resources and Constraints Inventory, July 26, 1994.
Noise Element, Hollister General Plan
Draft Groundwater Management Plan

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
XII. POPULATION AND HOUSING -- Would the project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☒	☐	☐	☐
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☒	☐
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☒	☐

Comments to Questions XII a, b and c:
Implementation of the Groundwater Management Plan would provide increased, good quality water supplies for municipal, industrial, and agricultural uses. The availability of more water may induce housing and population growth. The Plan will not displace housing or persons. The Programmatic EIR will address, at a program-level, the population and housing impacts of the proposed Groundwater Management Plan.

Source:
Draft Groundwater Management Plan

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
XIII. PUBLIC SERVICES - - Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, or the need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the following public services:				
a) Fire protection?	☐	☐	☒	☐
b) Police protection?	☐	☐	☒	☐
c) Schools?	☐	☐	☒	☐
d) Parks?	☐	☐	☒	☐
e) Other public facilities?	☐	☐	☐	☐

Comments to Questions XIII a, b, c, d and e:

Implementation of the proposed Plan, including construction of water treatment facilities, could result in an incremental increase in the demand for fire and police services. The increased demand

would not result in the need for any new facilities, however, and is considered a less than significant impact.

Source:
Draft Groundwater Management Plan

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
XIV. RECREATION - - Would the project:				
a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☒	☐
b) Include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☐	☒

Comments to Questions XIV a and b:
The proposed Plan would not increase the use of parks and does not include or require the construction or expansion of recreational facilities.

Source:
Draft Groundwater Management Plan

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
XV. TRANSPORTATION/TRAFFIC - - Would the project:				
a) Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections)?	☐	☐	☒	☐
b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?	☐	☐	☒	☐
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	☒
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☒	☐
e) Result in inadequate emergency access?	☐	☐	☒	☐

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
XV. TRANSPORTATION/TRAFFIC, cont.				
Would the project:				
f) Result in inadequate parking capacity?	☐	☐	☐	☒
g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	☐	☐	☐	☒

Comments to XV a - f:
Implementation of the Plan could result in an incremental increase in vehicle traffic associated with the operation and maintenance of new water treatment or extraction facilities. Employee densities at these types of facilities are low. Implementation of the Plan would not result in a substantial impact to roads or highways. While construction of Plan elements may result in temporary disruptions to traffic, implementation of the Plan would have a less than significant long term impact on transportation and circulation.

he proposed Plan does not propose any design features or incompatible uses that would substantially increase transportation hazards. Nor will the project result in inadequate emergency access.

Source:
Draft Groundwater Management Plan

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
XVI. UTILITIES AND SERVICE SYSTEMS - - Would the project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☒	☐	☐	☐
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☒	☐	☐	☐
c) Require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☒	☐
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☒	☐	☐	☐

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
XVI. UTILITIES AND SERVICE SYSTEMS, cont. Would the project:				
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☒	☐
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☒	☐

Comments to Questions XVI a, b, c, d, e, f, and g:
Implementation of the proposed Plan involves the construction of new water and wastewater treatment facilities and distribution pipelines that could have physical effects on the environment. The Programmatic EIR will address, at a program-level, the utilities impacts of the proposed Groundwater Management Plan.

Source:
Draft Groundwater Management Plan.

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
XVII. MANDATORY FINDINGS OF SIGNIFICANCE				
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory?	☒	☐	☐	☐
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	☒	☐	☐	☐
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☒	☐

Comments to Questions XVII.
Implementation of the proposed Plan could result in impacts to special status species, wildlife movement, and historic resources. The Programmatic EIR will address, at a program-level, impacts to biological and historic resources and cumulative impacts of the proposed Groundwater Management Plan

Source:
Draft Groundwater Management Plan
County of San Benito Environmental Resources and Constraints Inventory, July 26, 1994

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED

The environmental factors checked below would be potentially affected by this program (a Groundwater Management Plan), involving at least one impact that is a "Potentially Significant Impact" or "Potentially Significant Unless Mitigation Incorporated" as indicated by the checklist on the preceeding pages. The factors that are checked below will be further studied in an environmental impact report. In addition, the environmental impact report will also examine water supply impacts.

☒ Aesthetics	☒ Agricultural Resources	☒ Air Quality
☒ Biological Resources	☒ Cultural Resources	☒ Geology/Soils
☒ Hazards/Hazardous Materials	☒ Hydrology/Water Quality	☒ Land Use/Planning
☒ Mineral Resources	☒ Noise	☒ Population/Housing
☐ Public Services	☐ Recreation	☐ Transportation/Traffic
☒ Utilities/Service Systems	☒ Mandatory Findings of Significance	

DETERMINATION

On the basis of this initial evaluation:

I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared. ☐

I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because mitigation measures have been added to the project. A MITIGATED NEGATIVE DECLARATION will be prepared. ☐

I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required. ☒

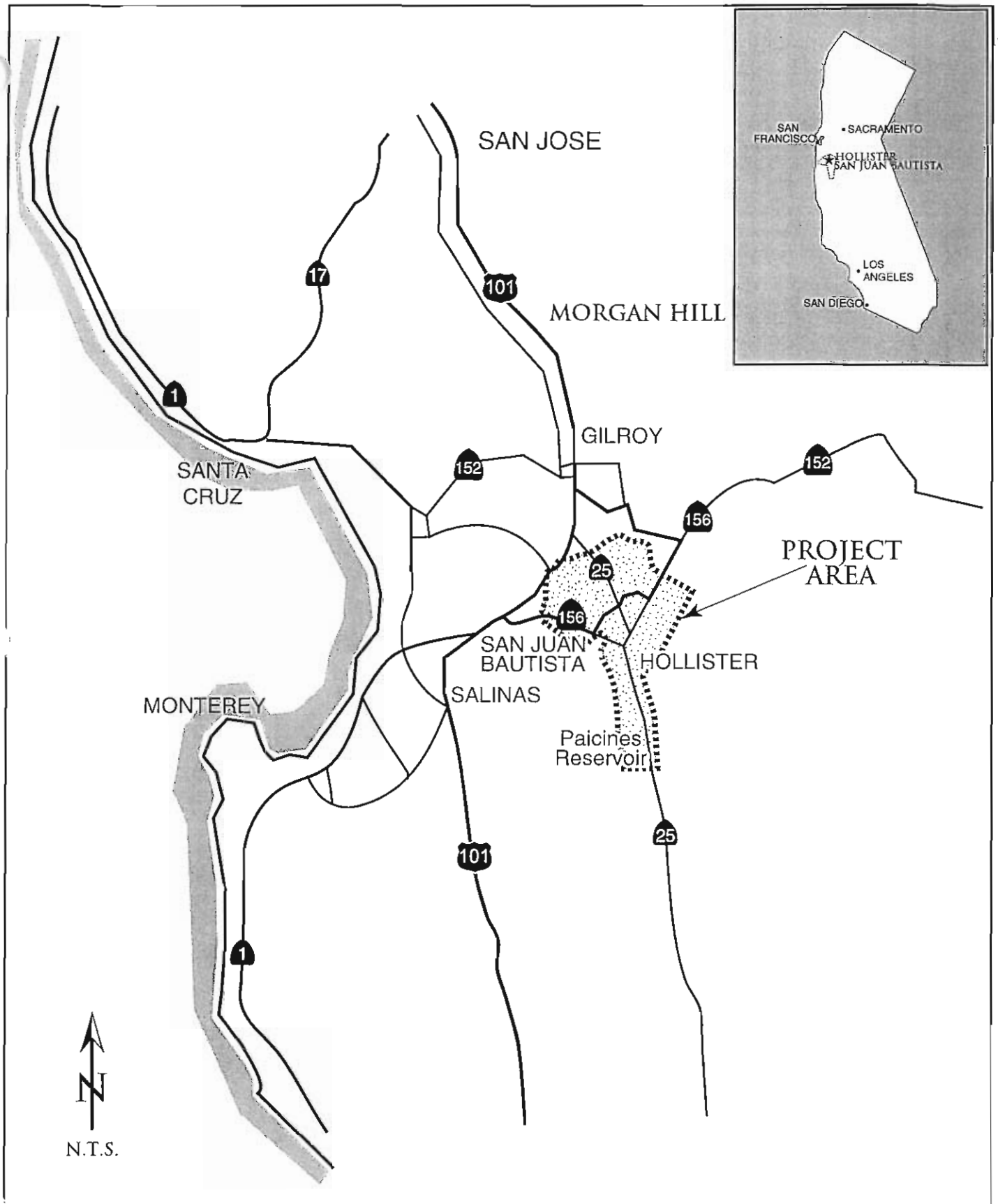
I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed. ☐

I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required. ☐

11/26/02

Signature Date Signature Date

John Gregg
District Manager



REGIONAL LOCATION MAP FIGURE 1

Elements of the Groundwater Management Plan Update

1.1 Development of the Project Elements

The Water Resources Association of San Benito County acknowledges the need to undertake programs and projects that improve the reliability and water quality of the water available to its users. Many of these programs and projects are required to meet regulatory requirements such as primary and secondary drinking water standards as well as wastewater effluent limits.

The programs and projects selected for the GMP Update have been derived from the preliminary evaluation of alternatives (June 2002 draft Report) that compared the Project Toolbox Elements to the objectives and criteria. This comparison has resulted in the selection of Project Toolbox Elements that:

- Are practical/feasible (i.e. have no fatal flaws and avoid sensitive environmental resources).
- Offer operational flexibility in the use of the variety of water resources available.
- Make creative use of opportunities/resources.
- Are cost-effective when compared to other Project Toolbox Elements that accomplish the same goal.

The selected Project Toolbox Elements are described below and include those in Alternative 4 with refinements as well as some additional project elements. Development of the programs and projects of the GMP Update are based on the following assumptions:

- M&I water demands in the year 2020 are estimated to be 11,000 AF/yr.
- Agricultural and other water demands in the year 2020 are estimated to be 81,000 AF/yr.

1.2 Overview of Project Elements

The GWMP Update addresses/includes several types of water resource management programs as follows.

- M&I Water Supply
- Agricultural Water Supply
- Groundwater Level Management
- Water Quality Management
- Agricultural

- M&I
- Wastewater Disposal

The following Project Toolbox Elements (Management Measures) have been selected for inclusion in the GMP Update. The Project Toolbox Elements can be divided into programs and projects/activities. Programs include activities such as water conservation, salt and nitrate education, ordinances, and economic incentives for water use. Projects/Activities will most likely result in capital infrastructure projects that will bring water into San Benito County.

The programs and projects/activities contained in the Project Toolbox Elements have been divided into three general categories, 1) Institutional Programs; 2) Continuation of Existing Projects/Activities; and 3) New Projects/Activities.

1) Institutional Programs

- M&I Water Conservation
- Agricultural Water Conservation
- Salinity Education Program
- Water Softener Ordinance
- Industrial Salt Control in Municipal Wastewater Program
- Nitrate Education Program
- Well Construction and Abandonment Ordinance
- Maintain and Enhance Strategic Data Collection and Management Program
- Continue and Expand Economic/Regulatory Water Level Management Tools

These elements are on-going, basin-wide programs that are cornerstones to the GMP Update.

2) Continuation of Existing Projects/Activities

- Existing Groundwater Extraction Facilities
- Surface Water Importation
- Surface Water Treatment
- M&I Effluent Percolation
- Water Transfers

- In-Basin Water Banking
- Natural direct percolation
- Artificial direct percolation of imported surface water
- In-lieu banking of imported surface water

3) New Projects/Activities

- Development/Improvement of High Quality Local Ground and Surface Water Supplies
- Regional and Local Conveyance Facilities for Multiple Water Supply Distribution
- Out-of-Basin Water Banking
- In-Basin Water Banking
- Natural direct percolation
- Artificial direct percolation of local surface water
- In-lieu banking of local surface water
- Aquifer Storage and Recovery of imported and/or local surface water
- Groundwater Treatment and Concentrate* Disposal
- Groundwater/Surface Water Blending
- Reclaimed M&I Effluent for Direct Reuse
- Tile Drains for Localized Groundwater Level Management
- Tree Belt Evapotranspiration for Localized Groundwater Level Management/Wastewater Disposal /Wastewater Disposal
- Groundwater Pumping for Water Level/Water Quality Management
- Out of Basin Export of wastewater effluent, concentrate, pumped groundwater and/or agricultural drainage by:
- River discharge;
- Evaporation of concentrate and trucking of salts; and/or
- Export Pipeline.

- Constructed Wetlands for Treatment/Polishing of Wastewater Effluent/Stormwater/Agricultural Runoff

* Concentrate is the minerals/salts that remain after treatment of water through demineralization or desalting processes.

Table 5-1 GMP Update Project Toolbox Elements and Program Matrix

Project Toolbox Element	M&I Water Supply	Agricul-tural Water Supply	GW Level Manage-ment	Water Quality Manage-ment Ag.	Water Quality Manage-ment M&I	Waste-water Disposal
Institutional Programs						
M&I Water Conservation	X		X			
Agricultural Water Conservation		X	X			
Salinity Education Program				X	X	
Water Softener Ordinance					X	X
Industrial Salt Control in Municipal Wastewater Program					X	
Nitrate Education Program	X	X		X	X	
Well Construction and Abandonment Ordinance				X	X	
Maintain and Enhance Strategic Data Collection and Management Program	X	X	X	X	X	X
Continue and Expand Economic/Regulatory Water Level Management Tools	X	X	X	X	X	
Continuation of Existing Projects/Activities						
Existing Groundwater Extraction Facilities	X	X	X			
Surface Water Importation	X	X				
Surface Water Treatment	X				X	
M&I Effluent Percolation		X		X	X	X
Water Transfers	X	X	X			
In-Basin Water Banking – Natural Direct Percolation[1]	X	X				

ATTACHMENT B

Project Toolbox Element	M&I Water Supply	Agricul-tural Water Supply	GW Level Manage-ment	Water Quality Manage-ment Ag.	Water Quality Manage-ment M&I	Waste-water Disposal
In-Basin Water Banking – Artificial Percolation of Imported and/or Local Surface Water[1]	X	X	X	X		
In-Basin Water Banking – In-lieu banking of imported and/or local surface water[1]		X	X	X		
New Projects/Activities						
Development/Improvement of High Quality Local Ground and Surface Water Supplies	X	X		X	X	X
Regional and Local Conveyance Facilities for Multiple Water Supply Distribution	X	X	X	X	X	
Out-of-Basin Water Banking	X	X	X			
In-Basin Water Banking – Aquifer Storage and Recovery of imported and/or local surface water	X	X	X	X		
Groundwater Treatment and Concentrate Disposal	X				X	
Groundwater/Surface Water Blending	X	X	X	X	X	
Reclaimed M&I Effluent for Direct Reuse		X	X			X
Tile Drains for Localized Groundwater Level Management			X	X		
Tree Belt Evapotranspiration for Localized Groundwater Level Management/Wastewater Disposal			X	X		
Groundwater Pumping for Water Level/Water Quality Management			X	X	X	
Out-of-Basin Export - River Discharge of wastewater effluent, concentrate, pumped groundwater, and/or agricultural drainage			X	X		X

ATTACHMENT B

Project Toolbox Element	M&I Water Supply	Agricul-tural Water Supply	GW Level Manage-ment	Water Quality Manage-ment Ag.	Water Quality Manage-ment M&I	Waste-water Disposal
Out-of Basin Export – Evaporation and trucking of concentrate				X		
Out-of-Basin Export – Export Pipeline for wastewater effluent, concentrate, pumped groundwater, and/or agricultural drainage				X	X	X
Constructed Wetlands for Treatment/Polishing of Wastewater effluent,/Stormwater/Agricul-tural Runoff				X	X	X

[1] *Also applies to New Projects/Activities for Local Surface Water*

Each Project Toolbox Element is described in further detail below and major issues and major benefits for each Element are identified. Those projects that can be identified with a general location are shown on Figure 5-1.

Table 5-2 shows the project toolbox elements and their applicability to the various sub-basins

Table 5-2 – Project Toolbox Elements and Sub-basin Applicability.

Project Toolbox Elements	Bolsa	Pacheco	Hollister East	Hollister West	Bolsa SE	San Juan	Tres Pinos
Institutional Programs							
M&I Water Conservation	X	X	X	X	X	X	X
Agricultural Water Conservation	X	X	X	X	X	X	X
Salinity Education Program	X	X	X	X	X	X	X
Water Softener Ordinance			X	X		X	
Industrial Salt Control in Municipal Wastewater Program			X	X		X	
Nitrate Education Program	X	X	X	X	X	X	X
Well Construction and Abandonment Ordinance	X	X	X	X	X	X	X
Maintain and Enhance Strategic Data Collection and Management Program	X	X	X	X	X	X	X
Continue and Expand Economic/Regulatory Water Level Management Tools		X	X	X			
Continuation of Existing Projects Activities							
Existing Groundwater Extraction Facilities	X	X	X	X	X	X	X
Surface Water Importation		X	X	X	X	X	X
Surface Water Treatment			X	X		X	
M&I Effluent Percolation			X	X		X	X
Water Transfers	X	X	X	X	X	X	X
In-Basin Water Banking – Natural Direct Percolation[1]	X	X	X	X	X	X	X
In-Basin Water Banking – Artificial Percolation of Imported and/or Local Surface Water[1]	X		X				X
In-Basin Water Banking – In-lieu Banking of Imported and/or Local Surface Water[1]		X			X		
New Projects/Activities							

ATTACHMENT B

Project Toolbox Elements	Bolsa	Pacheco	Hollister East	Hollister West	Bolsa SE	San Juan	Tres Pinos
Development/Improvement of High Quality Local Ground and Surface Water Supplies	X		X				X
Regional and Local Conveyance Facilities for Multiple Water Supply Distribution	X	X	X	X		X	
Out-of-Basin Water Banking	X	X	X	X	X	X	X
In-Basin Water Banking – Aquifer Storage and Recovery of Imported and/or Local Surface Water	X		X				
Groundwater Treatment and Concentrate Disposal			X	X		X	
Groundwater/Surface Water Blending			X	X		X	
Reclaimed M&I Effluent for Direct Reuse			X	X		X	
Tile Drains for Localized Groundwater Level Management						X	
Tree Belt Evapotranspiration for Localized Groundwater Level Management / Wastewater Disposal						X	
Groundwater Pumping for Water Level/Water Quality Management		X	X			X	
Out-of-Basin Export - River Discharge of Wastewater Effluent, Concentrate, Pumped Groundwater, and/or Agricultural Drainage			X	X		X	
Out-of Basin Export – Evaporation and Trucking of Concentrate			X	X		X	
Out-of-Basin Export – Export Pipeline for Wastewater Effluent, Concentrate, Pumped Groundwater, and/or Agricultural Drainage			X	X		X	

Project Toolbox Elements	Bolsa	Pacheco	Hollister East	Hollister West	Bolsa SE	San Juan	Tres Pinos
Constructed Wetlands for Treatment/Polishing of Wastewater Effluent, / Stormwater / Agricultural Runoff			X	X		X	

[1] Also applies to New Projects/Activities for Local Surface Water

1.3 Institutional Programs

1.3.1 M&I Water Conservation

Description: The WRA members have joined to implement M&I Water Conservation by hiring an individual as a shared resource among the WRA members. For existing M&I uses, it is assumed that, over the next 20 years, water demand from existing residential units will decrease by 1% per year (J. Gregg, Personal Communication, 3 June 2002). At this rate of decrease of water demand, demands are expected to reduce from an estimated 420 gpd/du at present to 344 gpd/du in the future in existing residential units. Current ordinances for new residences in the city and county will restrict water use to approximately 308 gpd/du by using xeriscape landscaping and other water conservation measures. (Draft Environmental Impact Report for Northeast Fairview Specific Plan, October 1999).

Major Issues: The most important issue associated with this element is implementation of the water conservation programs and quantifying demand reductions over time.

Major Benefits: The most important benefit of this element is that it is an efficient use of the water supplies and represents a low cost water supply.

1.3.2 Agricultural Water Conservation

Description: The conservation goal is to achieve 85% irrigation efficiency consistent with CVP water supply contract expectations. Agencies such as the Resource Conservation District and the San Benito County Farm Bureau assist agricultural water users in improving efficiency. Based on CVP guidelines, agricultural irrigation will eventually reach 85% efficiency. It is expected that efficiency improvements will be achieved primarily by reducing evaporative losses during irrigation (J. Gregg, Personal Communication on 3 June 2002).

The SBCWD has developed a Water Management Program for urban and agricultural supplies that is subject to review and approval by the Bureau of Reclamation (Bureau) for all imported CVP water. The Best Management Practices identified under the Water Management Program include:

- Measurement of water to plus or minus 6% as required by the Bureau
- Designation of a water conservation coordinator. At present the SBCWD District Manager serves as the water conservation coordinator and for 2002 – 2003, the SBCWD Board has approved the addition of an agricultural/urban irrigation specialist.

- Provide or support water management services to water users. Services include: 10 on-farm surveys per year and timely crop and water use information to each user; Irrigation scheduling and evapotranspiration information to water users; surface, ground, and drainage water quality data; agricultural water management education programs and materials for farmers, staff, and public.

- Evaluation and improvement of SBCWD pump efficiencies.

- Other relevant items from the Best Management Practices include: facilitating use of recycled urban wastewater for crop use; facilitation of financing of capital improvements for on-farm irrigation systems; and optimize conjunctive use of surface and groundwater.

At present, the SBCWD does not have sufficiently detailed information such as acreage by crop including multi-cropping to estimate agricultural water use efficiency.

Major Issues: The most important issue associated with this element is implementation of the water conservation programs and tracking demand reductions over time.

Major Benefits: The most important benefit of this element is that it is an efficient use of the water supplies and represents a low cost water supply.

1.3.3 Salinity Education Program

Description: Implementation of salinity education for both agricultural and M&I sources will be crucial to managing salt loads to the groundwater basin. A preliminary salt balance that has been prepared as part of the San Benito County Water District's Annual Groundwater Report for Water Year 2001 indicates that imported CVP water, fertilizers from agricultural and urban users, and concentrate from water softeners from M&I users account for 20,941 tons per year or 53% of all of the salts entering the groundwater basin. Of the salts contributed, agricultural users account for 17,541 tons per year and urban users 3,400 tons per year.

Ongoing programs by agencies such as the Resource Conservation District and the San Benito County Farm Bureau assist agricultural water users in managing salt additions from fertilizers and other products to reduce salt infiltration to the local groundwater basin. Management of salinity, particularly from agricultural users, also reduces nitrate build-up in the groundwater. Salinity education of M&I sources will occur primarily through implementation of the water softener ordinance described below.

Major Issues: The most important issue associated with this element is implementation of the salinity education program and tracking reductions in salt contributions over time.

Major Benefits: The most important benefit of this element is that it reduces salt input to the groundwater basin.

1.3.4 Water Softener Ordinance

Description: The salt balance in the Annual Groundwater Report for Water Year 2001 estimates that water softeners add 2,270 tons per year or 6 % of the total salt inputs to the

groundwater basin. Although this source is small in comparison to other sources, it is a relatively easily controllable source of salts.

The urban water purveyors have implemented an ordinance requiring new home water softeners to be the type that is regenerated offsite to prevent the introduction of salts into the sewer system. In addition, public education is ongoing regarding the need to regenerate softeners only when required. A retrofit ordinance applicable to resale of homes, and a grant program to assist existing homeowners in achieving conversion at lower cost is also under consideration. Introduction of lower hardness water sources to the municipal water systems will reduce the need for home water softeners.

Major Issues: The most important issue associated with this element is enforcement of the ordinance and implementation of the education program. Reductions in salt contributions over time will most easily be tracked in wastewater effluent samples.

Major Benefits: The most important benefit of this program is that it reduces a salt input that is relatively easy to control to the groundwater basin.

1.3.5 Industrial Salt Control in Municipal Wastewater Program

This program is to work with industrial food processors and other dischargers to the municipal wastewater treatment plants that contribute salts from their operations.

1.3.6 Nitrate Education Program

This program is to work with agricultural and urban users on the use of soil amendments, fertilizers and other compounds that are applied to fields and landscaping to improve soil conditions and plant productivity.

1.3.7 Well Construction and Abandonment Ordinance

There are many wells in San Benito County that were not constructed to current standards that may be providing a means for vertical migration of poor quality water to deeper aquifers. These wells were most likely constructed with gravel pack seals to the ground surface and have not been properly abandoned so remain a threat to groundwater quality.

This program would include review of current County Ordinances and identify and assure that the resources, processes, and procedures are available for enforcement of the ordinance. If necessary, additional ordinances or modification of the existing ordinance to be consistent with Department of Health Services and other standards for well construction and abandonment would be developed.

1.3.8 Maintain and Enhance Strategic Data Collection and Management Program

The San Benito County Water District currently gathers groundwater level and quality information and prepares an annual groundwater report. As practices such as groundwater banking and in-lieu percolation are expected to be practiced more intensively in the future, the needs for groundwater data collection and analysis on a more frequent seasonal basis is expected to increase. This program is intended to further develop data collection and management so that timely decisions regarding what water source can be used in what area can be readily made.

More detailed information regarding data collection and management is found in Section 2.2

1.3.9 Continue and Expand Economic/Regulatory Water Level Management Tools

The SBCWD has developed a regulation that limits transfer of additional imported water into the San Juan sub-basin. This regulation was established to manage the high groundwater levels in the San Juan. At the present time, the regulation is reviewed on an annual basis and decisions are made regarding the need to implement the regulation based on groundwater level data.

The SBCWD envisions development of additional regulation, policies, and economic incentives/disincentives to better distribute water to the areas in overdraft and to encourage pumping in those areas of high groundwater.

1.4 Continuation of Existing Projects and Activities

1.4.1 Existing Groundwater Extraction Facilities

Description: Approximately 1, 000 wells currently serve community water systems in San Juan Bautista and Hollister and agricultural and rural home users. Groundwater is readily available and is considered to be the predominant supply in the basin as shown on in Section 3.2.1 above. For community water systems that would use groundwater for M&I supply, additional treatment to remove hardness and salts would be required which is described further in Section 5.5.5 below. For agricultural supplies, groundwater can be blended with surface water to improve the quality of the delivered water.

Major Issues: Poor water quality is the most important issue associated with the continued use of existing groundwater extraction facilities for M&I and agricultural supply. The water quality can be improved through the treatment and blending described below.

Major Benefits: Continued use of groundwater is an important element of preventing high groundwater levels that negatively impact agricultural and residential areas. The facilities to extract groundwater are already in place and will not require additional capital expenditures.

1.4.2 Surface Water Importation

Description: Existing CVP surface water contracts allow up to 43,800 AF/yr of contract entitlement to the SBCWD of which 8,250 AF/yr is for M&I and 35,550 AF/yr is for agriculture deliveries. However, the levels for M&I supplies are often reduced to 75% of entitlement, and agricultural supplies are often reduced to less than 60% and as low as 0% of entitlement in severe drought conditions. The long-term average delivery is expected to be closer to 30,000 AF of which 7,000 AF/yr is for M&I deliveries and 23,000 AF/yr is for agriculture deliveries. 2,100 AF/yr is the estimated CVP M&I Delivery during critically dry years.

Actual CVP deliveries to San Benito County are shown on Table 3-2 above and have averaged about 18,400 AF/yr. However, M&I use of CVP water has not yet been fully realized because treatment facilities are in the process of construction.

Draft CVP M&I reliability guidelines indicate that if agricultural supplies are converted to M&I supplies, the reliability of the agricultural supplies which is lower than for M&I supplies is maintained. For example, in severe drought conditions, no water may be delivered if the entitlement has been converted from agricultural to M&I uses. The GMP Update assumes that the available CVP surface water for M&I uses can range from 1.9 MGD (2,100 AF/yr) to 7.4 MGD (8,250 AF/yr). Delivery of CVP water for M&I uses will require treatment in a surface water treatment plant as described further below.

Major Issues: Importation of surface water for M&I uses instead of use of local groundwater can result in high water levels. Wastewater effluent disposal issues are exacerbated in areas of high groundwater. Therefore, continued long-term use of imported surface water for M&I will require careful management of groundwater levels. The relatively low reliability of this supply and the insufficient supply to meet 2020 M&I demands will require additional sources of water to be developed for M&I uses.

Major Benefits: The high quality of the CVP water with respect to hardness and TDS will result in reduced use of water softeners and the resulting reduction in salt addition to the wastewater effluent. The reduced salt in the wastewater effluent will make it more attractive for direct reuse.

1.4.3 Surface Water Treatment

Description: As described earlier, the availability of imported CVP water for M&I uses is likely to range from an average flow of 1.9 MGD (2,100 AF/yr) to 7.4 MGD (8,250 AF/yr) while the total average demand is up to 9.8 MGD (10,953 AF/yr). Since there is a high probability that local surface water to make up the 2.5 MGD (3,750 AF/yr) difference between the total M&I demand and the available CVP water is available, it has been assumed for the GMP Update that up to 9.8 MGD of surface water treatment capacity will be required on an average basis.

Providing sufficient capacity for peak summertime demands will require distribution storage. Some distribution storage already exists within the City of Hollister, Sunnyslope County Water District, and City of San Juan Bautista systems. The Water Master Plan Update for the City of Hollister (September 1996) recommended addition of 7 MG of distribution storage to the existing 6 MG of storage already in the Hollister and Sunnyslope system. Construction of distribution

storage is a requirement of operations of the water distribution system and will be the responsibility of the individual water purveyors.

In those dry and critically dry years where surface water may not be available for treatment, more groundwater will be required to make up the difference.

Surface water must be treated by filtration and disinfection processes to remove particles and pathogens from the water and to meet Federal and State drinking water requirements. Filtration alternatives for surface water treatment include conventional granular media filtration and microfiltration (MF) or ultrafiltration (UF) membrane filtration processes. Disinfection alternatives include the use of chlorine, ozone, or ultraviolet light (UV) to inactivate pathogens.

The recommended surface water treatment for San Luis Reservoir CVP water is MF or UF membrane filtration with chlorine or UV disinfection. This cost-effective process provides higher water quality, uses fewer chemicals, is easier to operate, and provides greater flexibility in meeting future water quality regulations than does the conventional treatment process.

The 3 MGD capacity Lessalt membrane filtration plant went into operation in November 2002 for the City of Hollister and Sunnyslope County Water District to deliver treated imported surface water to portions of their customers. The Lessalt plant is expected to operate at full capacity. The City of San Juan Bautista has completed its California Environmental Quality Act (CEQA) document for a 1-MGD capacity membrane filtration plant. It is expected that it will take several years for the San Juan Bautista plant to have demands near the full operational capacity.

Therefore, it is assumed for the GMP Update that up to 5.8 MGD, on average, of additional surface water treatment capacity would be required in the future to meet the projected M&I demands. Currently, Sunnyslope County Water District is in the early planning and design process for a 2 MGD capacity membrane filtration plant so it is expected that up to 3.8 MGD, on average, of additional treatment capacity will be required. The additional treatment capacity could be economically achieved by expanding existing treatment plants with additional treatment units. In some cases, it may be geographically desirable to locate a treatment plant in an area of development rather than constructing additional pipelines. Up to five locations for surface water treatment plants have been identified and are shown conceptually on Figure 5-1. It should be noted that some of this capacity may not be required if groundwater demineralization facilities are constructed to meet the M&I demand.

Major Issues: The major issues associated with surface water treatment plants are with potential increases in water levels in the Hollister East and Hollister West sub-basins. The increased water levels will be the result of: a) reduced groundwater use in the sub-basins because of the increased use of imported surface water and/or local surface water from another sub-basin and b) the additional wastewater effluent that is generated and disposed of in the wastewater percolation ponds.

Therefore, careful monitoring and management of water levels in the Hollister East and Hollister West sub-basins will be required during the implementation of this Project Toolbox Element. It should be noted that in order to meet the future M&I demands, some groundwater will likely be used which will balance, to some degree, the water level impacts of the use of imported water.

Major Benefits: The major benefits associated with the use of surface water and treatment through surface water treatment plants is the high quality of the CVP and/or local surface water with respect to hardness and TDS. The higher quality water will result in reduced use of water softeners and the resulting reduction in salt addition to the wastewater effluent. The reduced salt in the wastewater effluent will make it more attractive for direct reuse. In addition, the use of local surface water for M&I uses will result in even further reductions in salt inputs to the groundwater basin when compared to the salt inputs from imported surface water.

1.4.4 M&I Effluent Percolation

Description: This Project Toolbox Element involves disposing of and/or storing M&I effluent through existing or new percolation ponds. M&I effluent disposed of and/or stored in percolation ponds must be treated to a sufficiently high quality to meet local groundwater quality objectives mandated by the Regional Water Quality Control Board. Reduced percolation capacity may require redeveloping the existing percolation ponds, adding additional ponds, moving them to other locations with higher capacity, or reducing local groundwater levels to improve vertical groundwater gradients and therefore increase percolation rates.

M&I Effluent Percolation is an on-going mechanism for wastewater effluent disposal and seasonal fluctuations in demand for M&I reclaimed effluent will require an on-going alternative wastewater disposal method. For the purposes of the GMP Update, it is assumed that some M&I Effluent Percolation will remain in the groundwater basin as a method of wastewater disposal.

Major Issues: One of the major issues of this Project Toolbox Element is the on-going concern for groundwater quality degradation and localized high groundwater associated with M&I Effluent Percolation.

Major Benefits: One of the major benefits of this Project Toolbox Element is that as source water quality improves, so will the M&I effluent and therefore will improve the water quality of the groundwater.

1.4.5 Water Transfers

Description: Assuming that water management activities free some of the imported water, then short-term or long-term water transfers of the imported water from the basin to outside users could generate revenue to implement the programs of the GMP Update. It is assumed that execution of short-term water transfers to other entities or to Out-of-Basin water banks as discussed in Section 5.5.3 has already been reviewed for environmental impacts through on-going federal and state permitting and review processes.

Major Issues: One of the major issues associated with water transfers are to obtain buy-in from the users to take delivery of groundwater and/or blended water of higher TDS than the imported water alone. Only when users accept groundwater or blended water will the imported water become available for transfer. In addition, depending on the length and degree of permanence of the water transfer, the negotiations to complete a water transfer could be complex and protracted.

Major Benefits: Some of the major benefits associated with transferring the use of imported water out of the groundwater basin are the generation of revenue to implement programs, the reduction in groundwater levels that occurs from applying less imported water and pumping more groundwater; and the reduction in imported salts that results from importing less surface water.

1.4.6 In-basin Water Banking

Description: Local water banking in the groundwater aquifer is an important component of managing water resources in the basin and storing water to improve the reliability of the water supply.

As described in earlier sections, there are a number of sources that could be banked in the groundwater basin including imported surface water and/or local wet weather high flows. The potential mechanisms for banking include:

- Natural direct percolation,
- Artificial direct percolation of imported and/or local surface water,
- In-lieu banking of imported and/or local surface water, and
- Injection of imported and/or local surface water into groundwater storage and extraction of water from Aquifer Storage and Recovery (ASR) wells.

Use of percolated water in river channels or recharge basins would require extraction wells, while ASR would provide injection and extraction in a single facility. In-basin water banking will also require Regional and Local Conveyance Facilities for Multiple Water Supply Distribution to effectively distribute the banked water.

Natural direct percolation is an on-going natural process and is discussed briefly below.

At the present time, the greatest opportunity for artificial direct percolation appears to be in the Pacheco and northern portion of the Hollister East Sub-basins where percolation of imported surface water has historically occurred. Some in-stream percolation sites along the San Benito River in the Hollister West and San Juan sub-basins have also been studied. Although percolation sites have been identified in the San Juan sub-basin, the sub-basin has limited hydraulic capacity for water banking because of high water levels and is further limited by the poor quality of the groundwater that may be stored there.

Southern Bolsa sub-basin has capacity for in-lieu banking because of the presence of a large groundwater depression. In-lieu banking is currently occurring in the Bolsa Southeast sub-basin through the delivery of imported surface water, thus allowing natural direct percolation to refill a groundwater depression that has historically occurred.

ASR could occur in any number of locations depending on the availability of storage capacity in the aquifer.

Major Issues: The major issue associated with water banking in general is ensuring that there is sufficient information regarding water levels, water quality, available storage, etc. to be able to make informed decisions about where and when to recharge water.

Major Benefits: The major benefit of groundwater banking is the ability to store a variety of source waters with relatively few environmental impacts when compared to surface water reservoirs. Water in storage will increase the reliability of the overall water supply system during dry years.

A more detailed discussion of the various in-basin water banking options follows:

1.4.6.1 Natural Direct Percolation

Natural direct percolation is an on-going process in the existing fields and waterways. The high proportion of agricultural land uses in San Benito County result in high levels of natural direct percolation, especially when compared to more urbanized areas with higher proportions of impervious surfaces. As long as the agricultural land uses, which are highly valued in San Benito County remain, natural direct percolation will also continue to occur at levels close to current levels.

1.4.6.2 Artificial direct percolation of imported and/or local surface water

Description: Similar to the Project Toolbox Element of Development/Improvement of High Quality Local Ground and Surface Water Supplies, if sufficient groundwater storage space and unused imported and/or local surface water is available, then water could be percolated in high permeability river/drainage channels for storage in the groundwater basin. The SBCWD currently stores excess imported water in the groundwater basin through percolation in highly permeable channels. However, rising groundwater levels in some areas have required the SBCWD to curtail percolation in an effort to better manage groundwater levels.

The Pacheco and northern Hollister East sub-basins, as shown on Figure 5-1, have been identified as areas for potential banking and withdrawals. At the present time this area has high groundwater levels that would have to be pumped down to allow water to be stored. It is expected that extraction of water banked in these areas can occur primarily through existing wells. There are over a thousand wells in San Benito County; it is expected that wells that are in good condition close to use areas and/or local conveyance pipelines can be identified and arrangements made with the well owners to lease the wells.

The Hollister Conduit and/or the proposed local conveyance facility could be used to convey the pumped water to either the southern Bolsa sub-basin or to other potential use areas that could be accessed by SBCWD's extensive CVP water delivery system.

In the Hollister West and San Juan sub-basins, eight in-stream percolation sites were studied along the San Benito River as shown on Figure 5-1 (Zone 3 and Zone 6 Annual Percolation and Groundwater Recharge Program, San Benito River Detention Basins, March 1995). The percolation facilities consisted of simple berms with culvert spillways and slide gates to control the flow. The berms would slow the flow down and allow more percolation to occur than occurs through the natural river channel.

Although not specifically studied, there may be off-stream percolation facilities that can be constructed close to the in-stream percolation sites that would increase the area of percolation, and hence the volumes of water that could be percolated. Studies conducted by the SBCWD in cooperation with Granite Rock Incorporated indicate that in some locations, sustained percolation rates as high as 1 foot/day were observed (J. Gregg, Personal Communication, 28 August 2002). Off-stream percolation may also extend the length of time that percolation can occur and therefore the volume of water that could be percolated.

The San Benito River percolation sites would also benefit from development of a dedicated shallow well-field to extract the water. It is expected that water would be pumped out of the San Benito River gravels and into the Hollister Conduit and/or the local conveyance pipelines to the use areas. Some existing deeper wells exist that could also be used for extraction.

Major Issues: The major issue associated with artificial direct percolation is that all of the proposed artificial direct recharge locations have historically had high groundwater levels as a result of the use of imported water in the area. In addition, Hollister West has the additional consideration of wastewater percolation that impacts groundwater levels . Therefore, artificial direct recharge will require careful selection of recharge areas and monitoring and management of water levels.

SBCWD has been awarded an AB 303 grant to further develop and automate their on-going groundwater level and quality monitoring. Improved data will assist the SBCWD in identifying areas appropriate for groundwater banking and withdrawal and in evaluating local water quality. In addition, careful evaluation of the quality of the source and native waters will be required to minimize the potential for aquifer plugging and other negative impacts.

Major Benefits: The major benefit associated with imported surface water percolation is that it allows storage of high quality water when the water is available thus increasing the reliability of water supply to the San Benito County users.

1.4.6.3 In-lieu banking of imported and/or local surface water

Description: As described earlier, in-lieu banking is currently occurring in the Bolsa Southeast sub-basin through the extension of the delivery system for imported water to the sub-basin. By using the imported water, groundwater is not being pumped and the groundwater recharge that is occurring remains in storage. Therefore, by providing imported water in-lieu of pumping groundwater, water banking is occurring.

It is expected that the in-lieu banking effort will result in mitigation of the groundwater depression that has formed by allowing direct natural percolation to recharge the sub-basin. Evidence of the decrease in the size and depth of the groundwater depression has been documented in the recent Annual Groundwater Reports.

In-lieu banking in Bolsa Sub-basin is described below in the New Projects/Activities section.

Major Issues: The major issues associated with in-lieu banking through the delivery of alternative water supplies is that careful monitoring of the water levels must occur. Prior to delivery of imported surface water to San Benito County, the entire groundwater basin was in

overdraft. Since imported surface water deliveries were begun in 1997, the overdraft condition in those areas receiving imported surface water has largely been mitigated and in fact have resulted in an oversupply and resulting high groundwater levels.

Major Benefits: The major benefit associated with in-lieu banking is that it offers opportunities to increase the quantity of banked water and thus increases the reliability of the overall groundwater system for use during

1.5 New Projects/Activities

1.5.1 Development/Improvement of High Quality Local Ground and Surface Water Supplies

Description: This Project Toolbox Element includes underutilized water resources in the groundwater basin of high quality that have either been developed before and have facilities that have been allowed to fall into disrepair or are for unexercised water rights. These water sources include:

- Redevelopment of City of Hollister's water right for additional local groundwater extraction at Cienega Valley.
- Development of groundwater resources in the Pacheco sub-basin for transfer to other sub-basins.
- Development of SBCWD's Arroyo Dos Picachos surface water right.
- Development of new surface water rights on Arroyo Los Viboras.
- Development of unused surface water on Pacheco Creek.

With the exception of the Cienega and Pacheco sub-basin groundwater supplies that are available year-round, most of the surface waters are available in the winter and late spring and could be developed using seasonal diversion dams. The water could then be percolated in-place if in-stream percolation and aquifer storage capacity are available, or directed into surface water pipeline systems for conveyance to banking areas if groundwater bank space is available, or delivered directly to agricultural or M&I users.

Major Issues: The major issues associated with this Project Toolbox Element are with having sufficient storage of the waters for use during the summer months and availability for use in the high demand summer periods. Banking of the surface waters in the groundwater aquifer will require careful management of the basin. Potential environmental impacts to riparian areas may be associated with seasonal diversion dams.

Major Benefits: The major benefits associated with this Project Toolbox Element are that it provides a relatively low cost, high quality water source. Use of local surface waters reduces importation of salts. Use of wet weather diversion may offer a small measure of flood control benefit. The Pajaro River Watershed Flood Management Authority has identified potential flood

control opportunities on the San Benito River as it passes through Hollister; diversion on upstream waterways may offer similar benefits.

These specific proposed water sources are discussed in greater detail below

1.5.1.1 Cienega Valley Groundwater Source

Description: The Cienega Valley water source, located to the south of the City of Hollister as shown on Figure 5-1, is the historic water source for the City. However, landslides in 1983 damaged the pipeline that delivered the water and water rights adjudication that occurred soon thereafter reduced the quantity of water that the City could deliver. As a result, the project to rehabilitate and replace the damaged pipeline (shown on Figure 5-1) was economically infeasible and not pursued. The City made pipeline repairs to serve a limited number of customers close to the Cienega Valley source and continues to make pipeline repairs on an on-going basis to serve those existing customers. Cienega Valley water is not currently delivered to customers within the City of Hollister city limits because the pipeline has not been repaired.

The water quality of Cienega Valley is excellent with TDS less than 200 mg/l. Extraction of Cienega Valley waters occurs through either of two shallow wells constructed adjacent to Pescadero Creek. The City's adjudicated water right No. 14797 from 1988 in Cienega Valley is for a maximum diversion of 489.41 AF/year with a monthly maximum diversion of 40.78 AF. In the past, water has been available from the Cienega Valley on a year-round basis. The proposed capacity of the pipeline from the Cienega Valley is 1.5 MGD (1,050 gpm or 1,679 AF/yr) (Cienega Pipeline – 1983 Damage Assessments, April 1983).

Because the wells are shallow and adjacent to Pescadero Creek, the water may be considered groundwater under the direct influence of surface water under current drinking water regulations. As a result, use of Cienega Valley water for M&I supply may require treatment under the Surface Water Treatment Rule as a opposed to the disinfection-only that occurred previously. If the water is delivered to the Hollister Conduit as envisioned, the water could be treated at one of the existing or proposed surface water treatment plants.

It is envisioned that the Cienega Valley water could be brought to and commingled with CVP water at the downstream end of the CVP System in Tres Pinos. Intertie of the San Felipe and Cienega systems would require about one mile of pipeline to connect the proposed Cienega Valley replacement pipeline with the Hollister Conduit. It is envisioned that there will be sufficient head in the Cienega Valley pipeline such that a booster pump station would not be required.

The City's allocation of Cienega Valley water could then be exchanged with the SBCWD's CVP water and the City could take its allocation as CVP Water further upstream. The commingled Cienega Valley/CVP water would be delivered by SBCWD to downstream users.

Major Issues: The major issues with this source of water are its relatively low quantity available and the potential costs of delivery.

Major Benefits: The major benefits of this source of water are its high quality and high reliability. In addition, having additional supply sources offers operational flexibility in serving the water users.

1.5.1.2 Pacheco/Northern Hollister East Sub-basins Groundwater Pumping

Description: As a result of the delivery of CVP water, the Pacheco and Northern Hollister East sub-basins have an estimated surplus of 4,000 AF/yr of water that is banked in the local groundwater sub-basin (U.S.B.R., 1972). This surplus is in direct proportion to the amount of water that is imported. SBCWD is currently managing groundwater levels in the Pacheco and Northern Hollister East Sub-basins by limiting the amount of summertime percolation releases of CVP Water.

Banked water, which is discussed in greater detail in Section 5.5.4 below, could be pumped to the Hollister conduit and/or the proposed local conveyance pipelines, as shown on Figure 5-1, for delivery either to the southern portion of Bolsa sub-basin where there is a historic overdraft, or to San Juan or other sub-basins.

The expected water quality from the Pacheco/Northern Hollister East sub-basins is in the order of 700 – 800 mg/l TDS and of 2-3 ppm boron. Depending on the resultant uses of the water it will likely have to be blended to reduce boron concentrations with local or imported surface water. It could also be used to adjust the local groundwater TDS concentrations by blending with the native San Juan groundwater.

Major Issues: The major issues with this source of water are the potential costs of delivery and the need for blending to reduce boron levels.

Major Benefits: The major benefits of this source of water are its high reliability and relatively high quality. Blending will likely be required to reduce boron levels to be appropriate for agricultural uses. In addition, having additional supply sources offers operational flexibility in serving the water users.

1.5.1.3 Arroyo Dos Picachos Water Supply Development

Description: The SBCWD holds an existing water right to divert up to 4.75 cfs from 1 December of one year to 1 May of the subsequent year. If the 4.75 cfs were available for the full 151 day period, a total of up to 1,422 AF/yr may be available on Arroyo Dos Picachos. The water right is structured such that diversions from Arroyo Dos Picachos can occur when there is active flow from Arroyo Dos Picachos into Arroyo Los Viboras that occurs during the wet season. In the past, the water was percolated over 2 miles of the Arroyo Dos Picachos channel bed. More recently, much less channel length has been available for percolation as a result of changes in local land uses. The SBCWD considers this water right to be underutilized. Review of water rights Decision No. 409 indicates that the Pacheco Pass Irrigation District may also have the right to divert up to 45.25 cfs from Arroyo Dos Picachos.

As described earlier in Section 3.1.2, Arroyo Dos Picachos water supply availability estimates were made based on simulated stream flows as part of the preparation of the SBCWD Annual Groundwater Reports. Using the simulated stream flows for a period from water year 1984 through water year 2001, the average availability on Arroyo Dos Picachos ranges from a minimum of 100 AF/yr to a maximum of 7,720 AF/yr with an average availability of 2,100 AF/yr. Based on a simulated stream flow, it appears that the 1,422 AF/yr water right held by the SBCWD could be available during most wet and normal years.

The water rights Decision No. 409 that apparently appropriate an additional 45.25 cfs should be reviewed carefully. It does not appear that an additional 45.25 cfs from Arroyo Dos Picachos would be available at any time.

An existing diversion structure that is sufficient for 2-5' wide slide gates is located on the Arroyo as shown on Figure 5-1. It is envisioned that the existing diversion structure will require rehabilitation and improvement and some of the existing upstream channel will have to be reshaped to create a small impoundment. A small pump station will be constructed adjacent to the impoundment. The pump station will be used to pump water out of the impoundment and into a proposed 1.3 mile pipeline to the Hollister Conduit and/or proposed local conveyance pipeline for delivery to either M&I or agricultural users or to water banking sites for percolation or ASR.

During the time that the Arroyo Dos Picachos water is available for M&I use, the CVP water will not be used and is essentially stored "out-of-basin' within each water year. If the CVP water allocation is anticipated not to be used during that water year, then the CVP water can be put onto the open market for a short-term sale or transfer thus generating revenues to fund projects.

The water quality of the Arroyo Dos Picachos is estimated to have conductance of 30 (Kx 10^5 at 25C), 25 percent sodium, and boron at 0.15 ppm (Reconnaissance Report, Hollister Project, Pajaro River Basin, California, January 1954). This is approximately a TDS of 500 mg/l and/or EC of 800 umhos/cm and would be characterized as good quality water.

Major Issues: The major issues with this source of water are the potential costs of delivery facilities and the need for some construction in the channel of the arroyo and the associated environmental impacts that would require additional documentation and permitting.

Major Benefits: The major benefits of this source of water are its relatively high reliability and quality. In addition, having additional supply sources offers operational flexibility in serving the water users.

1.5.1.4 Arroyo Los Viboras Water Supply Development

Description: The Pacheco Pass Water District (PPWD) has an existing diversion on the Arroyo Los Viboras downstream of where the Hollister Conduit crosses the arroyo as shown on Figure 5-1. The PPWD diverts approximately 1.5 cfs to a small percolation pond nearby.

A review of water rights decisions for Arroyo Los Viboras indicates that up to 13.685 cfs or up to 1,781.7 AF/yr of water has been allocated. The estimate of water supply availability made in Section 3.1.2 indicates that a minimum of 149 AF/yr, a maximum of 11,583 AF/yr and an average of 3,159 AF/yr may be available from Arroyo Los Viboras which indicates that there may be up to 1,377 AF/yr unadjudicated seasonal water rights available during an average year. It is anticipated that additional diversions would occur after the Arroyo Las Viboras has established flow and hydraulic continuity to the downstream waterways and only excess flows would be diverted..

In order to utilize the 1.9 cfs or 1,377 AF/yr water that is estimated to be underused, the diversion structure may have to be modified such that a small impoundment can be formed. A

small pump station will be constructed adjacent to the impoundment. The pump station will be used to pump water out of the impoundment and into a proposed 3/4 mile pipeline to the Hollister Conduit and/or proposed local conveyance pipeline for delivery to either M&I or agricultural users or to water banking sites for percolation or ASR.

As in the Arroyo Dos Picachos, during the time that the Arroyo los Viboras water is available for M&I use, the CVP water will not be used and is essentially stored "out-of-basin' within each water year. If the CVP water allocation is anticipated not to be used during that wet year, then the CVP water can be put onto the open market for a short-term sale or transfer thus generating revenues to fund projects.

The water quality of the Arroyo Los Viboras is estimated to have conductance of 51 (Kx 10^5 at 25C), 24 percent sodium, and boron at 0.52 ppm (Reconnaissance Report, Hollister Project, Pajaro River Basin, California, January 1954). This is approximately a TDS of 360 mg/l and/or EC of 510 umhos/cm and would be characterized as good quality water.

Use of the unadjudicated wet season water would require coordination with PPWD and development of any institutional arrangements for the use of the existing diversion structure. A water right filing for the remaining 1.9 cfs or more will have to be filed.

Major Issues: The major issues with this source of water are the need to develop an institutional arrangement with PPWD, the potential costs of delivery facilities, and the need for some construction in the channel of the arroyo and the associated environmental documentation and permitting required.

Major Benefits: The major benefits of this source of water are its relatively high reliability and quality. In addition, having additional supply sources offers operational flexibility in serving the water users.

1.5.1.5 Pacheco Creek Water Supply Development

Description: Pacheco Creek is estimated to have up to 7,200 AF/yr of yield for surface delivery based on a 61,000 AF storage reservoir after 6,800 AF/yr of percolation releases have been made (Reconnaissance Report, Hollister Project, Pajaro River Basin, California, January 1954). Although this quantity is not equivalent to the excess wet weather flows that may be available, it does provide an order of magnitude estimate on the available flows from Pacheco Creek. Water rights Decision No. 187 from 1928 indicates that the Hollister Irrigation District may have a water right for up to 11,000 AF/yr (15.19 cfs for 365 days) and the Pacheco Pass Irrigation District may have a water right to up to 16,000 AF/yr (22.10 cfs for 365 days).

The estimated water supply availability prepared as part of Section 3.1.2 indicates that Pacheco Creek may have a minimum of 800 AF/yr, a maximum of 92,887 AF/yr , and an average of 25,551 AF/yr water supply available.

There is an existing small dam on Pacheco Creek as shown on Figure 5-1. The ownership of the dam has not been determined at this time. It is envisioned that the dam could be modified, perhaps with an inflatable dam, such that a small impoundment can be created. A small pump station will be located next to the impoundment. Approximately 1,000 feet of pipeline will be

required to convey water from Pacheco Creek to the Hollister Conduit and/or the proposed local conveyance pipeline for delivery to either M&I or agricultural users or to water banking sites for percolation or ASR.

As in the other surface water diversion locations, during the time that the Pacheco Creek water is available for M&I use, the CVP water will not be used and is essentially stored "out-of-basin' within each water year. If the CVP water allocation is anticipated not to be used, then the CVP water can be put onto the open market for a short-term sale or transfer thus generating revenues to fund projects.

In the summertime, the PPWD releases water from Pacheco Dam for percolation. However, it is possible that these releases may be exacerbating high groundwater levels in San Benito County. Institutional arrangements could be made between San Benito County and PPWD to better manage those releases such that lower water levels can be maintained.

The water quality of Pacheco Creek is estimated to have conductance of 33.7 (K x 10^5 at 25C), 22 percent sodium, and boron at 0.09 ppm (Reconnaissance Report, Hollister Project, Pajaro River Basin, California, January 1954). This is approximately a TDS of 235 mgl and/or EC of 337 umhos/cm and would be characterized as good quality water.

Some institutional arrangements with PPWD should be made regarding releases. The Hollister Irrigation District water right will need to be reviewed and evaluated for transferability to the SBCWD. Based on review and analysis of the gaged and estimated records for flows on Pacheco Creek, it appears that some additional wet weather flows could be recovered.

Major Issues: The major issues with this source of water are need to develop an operational plan for summertime releases with PPWD, the potential costs of delivery facilities and the need for some construction in the channel of the arroyo and the associated environmental documentation and permitting required.

Major Benefits: The major benefits of this source of water are its relatively high reliability and quality. In addition, having additional supply sources offers operational flexibility in serving the water users.

1.5.2 Regional and Local Conveyance Facilities for Multiple Water Supply Distribution

Description: Regional and local conveyance pipelines increase the operational flexibility of the water system by allowing movement of water either: a) to and from groundwater banking areas or b) from local surface water sources to use areas. Regional conveyance pipelines traverse longer distances and would be of larger diameter while local conveyance pipelines would be to connect facilities such as wells and surface water sources and would be of smaller diameter. For the purposes of the GMP Update, it is assumed that the backbone regional conveyance would include:

- Approximately 13.8-mile, 18-inch pipeline approximately 10 – 15 feet away from and parallel to the existing Hollister Conduit or along existing County roads. The pipeline

would extend from the Pacheco Subbasin to the eastern edge of the San Juan Subbasin. This pipeline could deliver a range of source waters including imported and/or local surface water and pumped groundwater or a blend of the above to users in Hollister East, Hollister West, and San Juan sub-basins.

- Approximately 7.5 miles of 18-inch pipeline extending from the northern end of the pipeline described above to the east along Shore Road and other county roads to the junction of Highway 25. This pipeline could deliver a range of source waters including imported and/or local surface water and pumped groundwater or a blend of the above to the areas in the Bolsa sub-basin where groundwater overdraft is currently occurring.

The pipeline segments are shown on Figure 5-1 and have been further sub-divided to facilitate phased construction for the purposes of preparing estimates of probable costs of construction (Section 6). Additional conveyance pipelines may be required in the future as source, use, and storage areas are further developed. Pump stations will also most likely be required, but they have not been sized or located at this time. Pump stations would be located adjacent to the pipeline. The first segment of the Regional and Local Conveyance Facilities for Multiple Water Supply Distribution will parallel the Hollister Conduit or along existing County roads and will be able to intertie, if desired, with the extensive imported water delivery system operated by the SBCWD. An intertie would allow delivery of a range of water to many users.

Major Issues: The major issue associated with development of Regional and Local Conveyance Facilities for Multiple Water Supply Distribution is to locate the facilities so that they have minimal impact to environmental resources such as wetlands and habitat areas. Most of the environmental impacts associated with Regional and Local Conveyance Facilities for Multiple Water Supply Distribution will be with the construction of the pipeline and appurtenant facilities and should be mitigable.

Major Benefits: The major benefits of regional and local conveyance pipelines are that they provide operational flexibility and:

- Will allow efficient use of groundwater banking of either local or imported surface water;
- Can be used to move the higher quality groundwater found in the northern portions of the groundwater basin to the southern portions where water quality is not as good;
- Can be used to move groundwater for blending with surface water to improve water quality;
- Can be used to move local surface water available during wet weather periods to areas of groundwater banking or to M&I surface water treatment plant; and
- Can be used to move reclaimed water to agricultural use areas or to an export pipeline, if appropriate.

1.5.3 Out-of-basin Water Banking

Description: Water banking can occur in a regional/statewide bank that would be under a contractual arrangement with a water bank operator such as the Kern Water Bank or the Semi-Tropic Water Bank. Excess CVP contract water from San Benito County, such as generated when other local surface waters such as described in Section 5.5.1 above are developed, could

be stored in a regional/statewide bank or water owned by the regional/statewide water bank can be purchased by San Benito County agencies for delivery during dry years.

Major Issues: The major issues associated with out-of-basin water banking are the institutional arrangements that need to be made to store, extract and deliver the water when needed and the costs of water banking.

Major Benefits: The major benefits associated with out-of-basin water banking are that it offers additional operational flexibility and reliability. If excess CVP water is available but cannot be used or banked within San Benito County, then out-of-basin water banking allows San Benito County to retain the water for use in the future.

1.5.4 In-basin Water Banking

Description: As described above in the Continuation of Existing Projects/Activities section, local water banking in the groundwater basin is an important component of managing water resources in the basin and storing water to improve the reliability of the water supply.

The only difference with the activities that occurred as described above are:

- In-lieu banking would be added to the Bolsa sub-basin.
- ASR, which is not currently being practiced, is added as a project toolbox element.
- Local surface water could be added as a water source.

In-basin water banking will also require Regional and Local Conveyance Facilities for Multiple Water Supply Distribution to effectively distribute the banked water.

Natural direct percolation is an on-going natural process and is discussed briefly above..

At the present time, the greatest opportunity for artificial direct percolation appears to be in the Pacheco and northern portion of the Hollister East Sub-basins where percolation of imported surface water has historically occurred. Some in-stream percolation sites along the San Benito River in the Hollister West and San Juan sub-basins have also been studied. Although percolation sites have been identified in the San Juan sub-basin, the sub-basin has limited hydraulic capacity for water banking because of high water levels and is further limited by the poor quality of the groundwater that may be stored there.

Southern Bolsa sub-basin has capacity for in-lieu banking because of the presence of a large groundwater depression. Through the delivery of imported surface water, natural direct percolation would refill the groundwater depression that has historically occurred.

ASR could occur in any number of locations depending on the availability of storage capacity in the aquifer.

Major Issues: The major issue associated with water banking in general is ensuring that there is sufficient information regarding water levels, water quality, available storage, etc. to be able to make informed decisions about where and when to recharge water.

Major Benefits: The major benefit of groundwater banking is the ability to store a variety of source waters with relatively few environmental impacts when compared to surface water reservoirs. Water in storage will increase the reliability of the overall water supply system during dry years.

A more detailed discussion of the various in-basin water banking options follows:

1.5.4.1 In-lieu banking of imported and/or local surface water

Description: As described earlier, in-lieu banking is currently occurring in the Bolsa Southeast sub-basin through the extension of the delivery system for imported water to the sub-basin. By using the imported water, groundwater is not being pumped and the groundwater recharge that is occurring remains in storage. Therefore, by providing imported water in-lieu of pumping groundwater, water banking is occurring.

There is also potential for in-lieu banking in the southern portion of the Bolsa sub-basin where a large groundwater depression has developed. The Bolsa sub-basin is not currently a part of Zone 6 of San Benito County that receives imported surface water. However, the proposed local conveyance pipeline to the southern portion of the Bolsa sub-basin will allow delivery of local surface water or pumped groundwater to the area of groundwater depression for agricultural use, thus allowing direct natural percolation to recharge the sub-basin.

Major Issues: The major issues associated with in-lieu banking through the delivery of alternative water supplies is that careful monitoring of the water levels must occur. Prior to delivery of imported surface water to San Benito County, the entire groundwater basin was in overdraft. Since imported surface water deliveries were begun in 1997, the overdraft condition in those areas receiving imported surface water has largely been mitigated and in fact have resulted in an oversupply and resulting high groundwater levels.

Major Benefits: The major benefit associated with in-lieu banking is that it offers opportunities to increase the quantity of banked water and thus increases the reliability of the overall groundwater system for use during drought periods.

1.5.4.2 Aquifer Storage and Recovery of imported and/or local surface water

Description: Aquifer storage and recovery (ASR) facilities are specially designed wells that operate as both injection wells and extraction wells. Well locations must be studied through evaluation of hydrogeologic data and conduct of field testing so that locations that have aquifer conditions that will allow for injection and extraction can be selected.

In general, regardless of whether an imported or a local surface water is used for ASR, either coagulation or filtration of the source water is required so that large particles can be removed prior to injection. Failure to remove the particles can result in plugging of the well screen and even the aquifer; both of which will reduce injection and extraction rates. It is expected that local

surface waters may be particularly high in particulates because they will be wet weather flows that result in higher rates of soil erosion than base flows. Therefore treatment of local surface waters prior to injection will be particularly critical.

A study conducted by SBCWD indicated that suspended materials in San Felipe water is high enough that filtration is necessary prior to injection. As a result, it does not appear that ASR is practical/cost-effective for general purposes. However, if excess treated San Felipe water is available, it could be injected. ASR is most practical in an area close to planned surface water treatment facilities.

For the purposes of the groundwater management plan, ASR remains an option that could be used. However, alternative methods of recharge may prove more cost-effective at this time. If ASR facilities are to be developed, they will likely be located near the proposed local conveyance pipeline or the imported surface water distribution system assuming that sites with the appropriate hydrogeology can be identified.

Major Issues: As with the other methods of water banking, one of the major issues is selection of appropriate sites for ASR based on water levels and aquifer characteristics. Careful evaluation of the quality of the source and native waters will be required to minimize the potential for aquifer plugging and other negative impacts. ASR is likely to be more energy intensive than other water banking methods because of the need to inject the water in. In some cases, ASR sites that allow gravity percolation may be found. However, if gravity percolation cannot occur, then pumping will be required. ASR may prove to be less cost-effective than other water banking methods because of the extensive investigation required and the extensive capital facilities including pumping, well, and treatment facilities required.

Major Benefits: One of the major benefits of ASR is that it requires a smaller footprint than percolation facilities. In addition, the same facility can be used for both injection and extraction and will be located close to conveyance facilities to be able to deliver the pumped water.

1.5.5 Groundwater Treatment and Concentrate Disposal

Description: As described in the June 2002 draft report, there are a number of alternative methods of demineralization and softening to remove hardness and TDS from the groundwater to improve the quality for delivery to M&I users. Centralized demineralization or softening would result in reduced salt loads to the basin; up to 2,270 tons/year of salt or 6% of the overall salt input is estimated to be associated with home water softeners.

For the purposes of the GMP Update, it is assumed that up 7.1 MGD (7,900 AF/yr) of groundwater will require demineralization/softening. This assumes that:

- The M&I demand can be reduced from 11,000 to 10,000 AF/yr in a critically dry year, and that
- 2,100 AF/yr of imported/local surface water is available.

Initial estimates indicate that to be able to deliver 7.1 MGD (7,900 AF/yr) of 500 mg/l TDS water would require pumping 8.2 MGD (9,200 AF/yr) of 800 mg/l TDS groundwater. 1.1 MGD (770 gpm, 1250 AF/yr) of highly concentrated (4,000 mg/l TDS) concentrate would be generated from the demineralization/softening process that would require disposal.

For the purposes of the GMP Update, it is assumed that two to five groundwater demineralization/softening facilities would be required to serve the M&I users efficiently. The groundwater would be extracted from existing wells and the treatment facilities would most likely be located close to existing groundwater wells.

Major Issues: There are several major issues associated with groundwater treatment, the first is that demineralization is a relatively high energy use technology as compared to other technologies and use of other water sources. However, the relative energy use and comparative costs of the various water supplies including the true cost of imported CVP water should be developed and evaluated further. Another major issue associated with groundwater demineralization/softening is the need for concentrate disposal. As discussed in the June 2002 Draft Report, there are several options for concentrate disposal including:

- Fueled evaporation that can be located near the treatment facilities, takes a relatively small area, but will require important energy to implement.
- Land evaporation can be a relatively inexpensive option if land is available inexpensively because of the need for a large area for evaporation ponds. It is estimated that up to 300 acres may be required for evaporating 1,250 AF/yr of concentrate alone at an estimated evapotranspiration (ETo) rate of 50"/year (California Irrigation Management Information System database). The additional 12" – 16" of rainfall that falls annually in the area would also need to be accounted for in sizing evaporation ponds.
- Export pipeline for concentrate and other waters for disposal such as wastewater effluent, or pumped groundwater for water level management and salt removal. (See 12.3.13 below for additional description of the export pipeline)
- Deep well injection of concentrate in depths in excess of 1,500 feet that also takes a relatively small area but requires additional permitting and other elements of uncertainty. This alternative for concentrate disposal is probably the least likely option to be used.

Major Benefits: The major benefit of groundwater treatment for M&I use is that it adds a high measure of reliability to the water supply. In addition, use of the local groundwater will be an important part of the effort to manage groundwater levels.

1.5.6 Groundwater/Surface Water Blending Facilities for Agricultural/M&I water users

Description: Blending of high quality imported or local surface water with local groundwater to adjust the TDS of the applied water is one way to achieve overall water quality suitable for

agriculture. This type of project is most practical for locations where both groundwater and surface water supplies are already located close together.

This Project Toolbox Element would require development of operational criteria on timing, quality, and quantity of deliveries to customers. In addition, the physical facilities that would be required for agricultural users would include some additional piping to connect to groundwater wells, valves, metering, and manual or automatic controls. Automatic controls could also be connected to a telemetry system for remote operation. The facilities could be located on a concrete pad approximately 20' x 20' in size. Additional piping of blended water may be desirable so that the blended and unblended water can be segregated. Facilities for M&I users would be similar but would have to be carefully located so that groundwater is not filtered unnecessarily.

The system could be operated by using flow meter information from the higher quality water to pace the pumping of groundwater into the pipeline at a rate appropriate for the desired TDS and flow. If the distance from where the water sources are blended to the turnouts are short, a static, in-line mixer could be installed to facilitate full blending.

Since the groundwater quality is poorest in the San Juan sub-basin, it is likely that this Project Toolbox Element will be implemented mostly in the San Juan sub-basin and most likely for agricultural users. A review of the locations of wells and distribution pipelines and use areas would be required to evaluate the most cost-effective locations for blending stations. It is anticipated that no more than 2 – 3 blending stations will be required assuming that locations where groundwater and surface water facilities can be identified that are close together. Other agricultural and M&I blending locations can be developed relatively easily as it becomes practical to do so.

Major Issues: The major issue with groundwater/surface water blending facilities for agricultural water users may be with gaining acceptance by those agricultural users that are currently receiving imported water. The major issue with groundwater/surface water blending facilities for M&I users is locating the facilities so that groundwater is not filtered unnecessarily.

Major Benefits: The major benefits associated with groundwater/surface water blending facilities for agricultural users will be to those users who are currently irrigating with higher TDS groundwater since it will improve the water quality to those users. M&I users would derive the same benefits. In addition, by using less imported surface water, the overall salt input to the groundwater basin will be reduced. By pumping groundwater, this Project Toolbox Element can also function to manage water levels.

1.5.7 Reclaimed M&I Effluent for Direct Reuse

Description: Reuse of reclaimed effluent from wastewater plants is practiced widely within California. Title 22 reclamation criteria govern the level of treatment and largely determine the acceptable uses for reclaimed water. Several studies have been conducted regarding the markets for reclaimed water for direct reuse in San Juan Bautista and Sunnyslope. An evaluation for reclaimed water use is underway for Hollister. The studies also evaluated the wastewater treatment plant improvements and distribution systems necessary to deliver the reclaimed water to the potential users.

At the present time there is approximately 3,300 AF/yr of wastewater effluent produced and percolated in the entire groundwater basin (Water Year 2001 Annual Groundwater Report). In the San Juan Bautista area, there is far more demand than supply (San Juan Bautista Area Water Reclamation Study – Final, May 2002).

In the Ridgemark area of the Sunnyslope County Water District service area, there appears to be sufficient demand at the Ridgemark golf course to use the estimated 280,000 gpd of reclaimed water that could be produced. A recent study of recycled water for Ridgemark indicates that there is far more demand for recycled water than supply. (Sunnyslope County Water District – Recycled Water Study, Final- November 2001)

The estimated 2010 wastewater flows to the Hollister domestic wastewater treatment plant is 3.8 MGD (4,200 AF/yr) of average dry weather flow in the peak month. Although a specific recycled water demand analysis has not been prepared, the City of Hollister anticipates conducting a recycled water study in the near future.

Major Issues: The greatest limiting factor on the use of reclaimed water for direct reuse is the high levels of TDS in the reclaimed water. For example, the reclaimed water study for San Juan Bautista assumes a 1:1 blending ratio of imported surface water to reclaimed water to achieve a 700 mg/l TDS level. The availability of higher quality imported water has reduced the demand for the reclaimed water. As the quality of the potable water improves, so will the quality of the reclaimed water that will then improve the marketability of the reclaimed water.

Another major issue associated with direct reuse of reclaimed water is the imbalance between when the reclaimed water would be used, which is the late spring, summer, and early fall, and when most of the reclaimed water is available, which is in the winter. To be able to maximize the use of reclaimed water, storage of reclaimed water will be required.

Major Benefits: There are several benefits associated with direct reuse of reclaimed water which are that it is a beneficial use of a valuable water supply and it provides a disposal mechanism for reclaimed water, thereby reducing the impact on groundwater levels of effluent percolation.

1.5.8 Tile Drains for Localized Groundwater Level Management

Description: This Project Toolbox Element may be required if agricultural fields contain localized high water levels. As occurs in the San Juan sub-basin, shallow clay layers produce localized perched high groundwater in some areas. Tile drains are perforated pipes installed above the shallow clay layer to allow shallow groundwater to flow into the perforated pipe, which drains to surface, to the rivers and ultimately to the ocean.

In the northern portions of the Bolsa and Pacheco sub-basins, the areas of groundwater seepage occur near wellheads, creek channels and near faults and is most likely caused by artesian conditions and/or high water tables. (Groundwater Management Plan for the San Benito County Part of the Gilroy-Hollister Groundwater Basin, 1998). Localized high groundwater conditions also occur in the northern portion of the Hollister East sub-basin. (Water Year 2001 Annual Groundwater Report)

The areas where this Project Toolbox Element will most likely be implemented is in the San Juan sub-basin, where tile drains have already been installed in some areas and in the Bolsa,

Pacheco, and northern Hollister East sub-basins. For the most part, tile drains solve a localized problem by moving high groundwater into a ditch or creek to percolate slightly downstream and create a problem for a downstream user.

In the San Juan sub-basin, where the high groundwater levels are most problematic, the SBCWD is initiating a study to develop of a master collection pipeline, as shown on Figure 5-1, to centralize collection of the agriculture drain water. As proposed, the pipeline could terminate in either a river discharge as described in Section 5.5.11.1 below; a constructed wetland for polishing that could overflow into the river; as described in Section 5.5.12 below; or into the proposed export pipeline described in Section 5.5.11.3 below.

Major Issues: The major issues associated with tile drains for water level management are the expense associated with remedying the localized high groundwater condition and the poor quality of the agricultural drainage. It is likely that the water is high in nutrients and TDS, some of which is from the high TDS of the local groundwater, and potentially high in herbicides/pesticides.

In addition, if river discharges were to occur, NPDES permits may be required for a point-source discharge from either the master collection pipeline or a constructed wetlands. Without a master collection pipeline, agricultural discharges are considered non-point sources that are often managed through best management practices.

Major Benefits: The major benefit associated with tile drains for agricultural effluent export is that it will result in lower localized groundwater levels making some lands with poor soil drainage more viable for agriculture and that it can result in the net export of salt depending on the disposal mechanism.

1.5.9 Tree Belt Evapotranspiration for Localized Groundwater Level Management/Wastewater Disposal

Description: This Project Toolbox Element could be used to reduce localized high water levels in agricultural fields. Experimental research in Australia has indicated that high water-use trees such as eucalyptus can use up to 24 inches of water per year and generally lower local water levels. No work has been conducted to translate this water consumption to an AF-per-plant basis. Other high water-consuming vegetation may serve the same purpose. Within the Bay Area, eucalyptus and redwoods have been used on a small scale to take up wastewater effluent.

Similar to the use of tile drains, this Project Toolbox Element could be used in the areas of localized high groundwater described above. It is most likely to be used in conjunction with the constructed wetlands, described in 12.4.21 where trees could be planted with minimal encroachment on agricultural lands.

Major Issues: The major issues associated with this Project Toolbox Element is the highly experimental nature of this approach and the difficulty with quantifying the amount of water that could be removed and the resulting lowering of the water table. In addition, there are concerns with the use of eucalyptus trees, which are not native to the area, for this purpose. Finally, the

costs of implementing a program with the accompanying lowering of the water table have not been quantified.

Major Benefits: The major benefit associated with this Project Toolbox Element is that if it can be demonstrated that vegetation is a effective means of managing water levels, the use of vegetation is arguably less intrusive than other more mechanical means of managing local high groundwater levels.

1.5.10 Groundwater Pumping for Water Level/Water Quality Management

Description: This Project Toolbox Element could help manage groundwater levels and salt balances in the San Juan, Pacheco, and northern portion of the Hollister East sub-basins where groundwater levels are particularly high. This Project Toolbox Element would use existing wells to the greatest extent possible and the groundwater could be pumped for discharge into the export pipeline if nearby or into the San Benito or Pajaro Rivers or their tributaries (as described in 12.4.19 below) . Both of these options would export the water from the groundwater basin; depending on the location and quality of the pumped water; the water could also be used in another portion of the sub-basin by using the proposed local conveyance rather than being exported.

A groundwater basin-wide water balance that evaluated the amount of groundwater in storage with and without imported surface water indicated from between water years 1990 – 1999, there was an estimated basin-wide increase of groundwater in storage of 11,466 AF/yr. (Groundwater Management Plan: Existing Conditions and Alternatives, December 2001)

Further analysis of the groundwater budget in the Water Year 2001 Annual Groundwater Report indicates that there was a net increase of about 2,400 AF/yr of groundwater in storage from 2000 - 2001. This net increase of water in storage has occurred after the percolation of imported surface water by SBCWD was significantly reduced.

It should be noted that on a sub-basin basis in Water Year 2001, the Pacheco sub-basin was essentially in balance with an estimated net increase of 475 AF/yr in storage; the San Juan sub-basin was also essentially in balance with a net decrease of 11 AF/yr in storage; the Hollister East sub-basin had a net increase of 3,150 AF/yr of groundwater in storage; and the Bolsa sub-basin had a net decrease of 1,896 AF/yr. (Water Year 2001 Annual Groundwater Report). Therefore, the necessity to manage groundwater levels varies widely between sub-basins and is further localized within sub-basins.

For the purposes of the GMP Update, it is assumed that 2,500 AF/yr of groundwater would need to be removed from the problem areas of the selected sub-basins to manage high groundwater levels. Removal of 2,500 AF/yr would require pumping of 2.25 MGD or 1,560 gallons per minute (gpm) for 365 days a year. At an average production rate of 750 gpm per well, it would take two wells to pump the entire amount.

Major Issues: The major issues associated with pumping groundwater and exporting it are that the practice permanently removes potentially valuable water from the groundwater system. If

the water were used elsewhere in the groundwater system and not exported, this issue would be negated. There are also energy costs associated with pumping groundwater. Groundwater level management may be more cost-effectively achieved by managing the inputs to the groundwater system rather than removing water that has already entered the groundwater system. In addition, discharge to the Pajaro River would have to be controlled to minimize the potential for flooding and impact to important downstream habitat.

Major Benefits: Some of the major benefits of pumping groundwater are that it can help to quickly lower high groundwater levels and can result in the export of salts.

At a groundwater removal rate of 2,500 AF/yr, the magnitude of the salt removed could be as high as 4,100 tons/year if the TDS of the groundwater is 1,200 mg/l TDS as in the San Juan sub-basin or as low as 2,800 tons/year if the groundwater TDS is 800 mg/l TDS as in the Pacheco, and Hollister East sub-basins. The magnitude of the salt removed from groundwater pumping ranges from 7 to 10 percent of the current estimated salt input to the groundwater basin of 39,317 tons/year (Water Year 2001 Annual Groundwater Report). The benefit of the salt export only occurs when the salt is removed from the groundwater basin and discharged to the ocean.

1.5.11 Out-of-Basin Export of Wastewater Effluent/Concentrate/Pumped Groundwater/Agricultural Drainage

The project toolbox element of Out-of-Basin Export was developed to address the potential need to dispose of wastewater effluent, groundwater treatment concentrate, and/or pumped groundwater for water level and salt management. Three options for out-of-basin export were identified as follows:

- River Discharge of wastewater effluent, diluted concentrate, pumped groundwater, and/or agricultural drainage;
- Evaporation of concentrate and subsequent trucking of salts for disposal; and
- Export pipeline for wastewater effluent, concentrate, pumped groundwater, and/or agricultural drainage.

Each of these options are described in greater detail below.

1.5.11.1 River Discharge

Description: This Project Toolbox Element is most likely the most-cost effective disposal mechanism for wastewater effluent, concentrate, pumped groundwater and/or agricultural drainage. However, any river discharges that are proposed would undergo extensive environmental review by local, state, and federal agencies. The Pajaro River Water Quality Management Plan indicates that the State Water Resources Control Board has identified the Pajaro River and several of its tributaries as having significant water quality impairments that can be attributable to non-point sources of pollution.

The Water Quality Control Plan for the Central Coast Region (September 8, 1994) has water quality limits of for the San Benito River of 1,400 mg/l TDS, 200 mg/l of chloride, 350 mg/l of sulfate, 1 mg/l of boron, and 250 mg/l of sodium. In addition, the California Regional Water Quality Board- Central Coast Region, has been reluctant to permit river discharges of wastewater effluent except during wet season emergencies and has encouraged beneficial reuse through reclamation.

Although there is apparently no adopted Board of Supervisors policy, the County of Santa Cruz has spoken out against "actions which degraded [the] quality of water in the Pajaro River or increased potential for flooding" (County of Santa Cruz Health Services Agency, 19 June 2002).

It should be noted that the water quality of the San Benito River near the confluence with the Pajaro River is deteriorated in its natural state with TDS values up to 2,500 mg/l during the summer time . Wet weather TDS values are on the order of 300 - 700 mg/l. During periods of poor water quality and depending on the location in the San Benito River, discharge of wastewater effluent, diluted brine concentrate, and/or pumped groundwater could result in improvements to water quality.

If wastewater effluent is discharged, it would most likely be a highly treated effluent and would most likely occur in the wintertime when dilution would be the greatest and the demand for reclaimed water is low. Discharge of reclaimed effluent near the Prescott Road Bridge where TDS levels have been observed in the 2,450 mg/l TDS range by the SBCWD could result in a net improvement to water quality. The reclaimed M&I effluent could be conveyed to this or other locations through the proposed export pipeline and a turnout constructed for discharge. Direct discharge of reclaimed M&I effluent will require issuance of a National Pollutant Discharge Elimination System permit to Sunnyslope and Hollister and will require the associated environmental reviews.

Groundwater treatment concentrate is estimated to be 4,000 mg/l TDS which is nearly double the high end of the San Benito River TDS concentration and unsuitable for discharge at that concentration. However, it could be diluted with either wastewater effluent, or pumped groundwater to reduce TDS levels.

Wastewater effluent from City of Hollister has an average TDS of 1,263 mg/l (City of Hollister Domestic Wastewater Treatment Plant 2001 Annual Monitoring Report). Effluent from Sunnyslope County Water District's Ridgemark facility has a TDS of 1,750 – 2,100mg/l that is most likely the result of long detention times and the resulting evaporation and concentration of salts in the percolation ponds (Sunnyslope County Water District – Recycled Water Study, Final- November 2001). Effluent from the City of San Juan Bautista has an average TDS of 1,274mg/l (City of San Juan Bautista 1999 Annual Monitoring Report). Assuming that most of the groundwater pumping would occur from the San Juan sub-basin, groundwater TDS levels are assumed to be about 1,200 mg/l TDS.

Depending on the source of dilution water, the dilution ratios would vary. It has been estimated that in order to achieve a resultant TDS concentration of 1,800 mg/l of TDS, San Juan sub-basin groundwater of 1,200 mg/l TDS would have to be blended in a nearly 4:1 ratio with concentrate. Therefore, disposal of 1.1 MGD (1,200 AF/yr) of concentrate is estimated to require approximately 3.9 MGD (4,400 AF/yr) of pumped groundwater for dilution. By strategically

selecting the areas of groundwater pumping to coincide with areas of high groundwater, then the groundwater pumping serves three purposes: 1) managing water levels, 2) providing concentrate dilution water, and 3) removing salt from the groundwater basin.

As discussed above, groundwater pumping could help manage groundwater levels and salt balances in the San Juan, Bolsa, and northern portion of the Hollister East sub-basins where groundwater levels are particularly high. This Project Toolbox Element would use existing wells to the greatest extent possible.

Major Issues: The major issues associated with river discharge of wastewater effluent, diluted brine concentrate, pumped groundwater, and/or agricultural drainage for conveyance to the ocean are the extensive environmental review, negotiation and permitting with the Regional Water Quality Control Board, National Marine Fisheries Service, California Department of Fish and Game, and other agencies that would be required.

Major Benefits: The major benefits of river discharge are that it may be a relatively lower cost disposal alternative when compared to other options that results in the removal of salts from the groundwater basin, and can reduce the groundwater levels in areas of high groundwater and near the percolation ponds.

1.5.11.2 Evaporation of Concentrate and Trucking of salts

Description: As described earlier in the overview of the groundwater treatment Project Toolbox Elements, disposal of concentrate from groundwater treatment is a major consideration in groundwater treatment and can be accomplished in several ways. This discussion focuses on evaporation methods which include

- Fueled evaporation that can be located near the treatment facilities, takes a relatively small area, but will require important energy to implement.
- Land evaporation can be a relatively inexpensive option if land is available inexpensively because of the need for a large area for evaporation ponds

In either option, the salts that are remaining would be expected to be in a solid form that could easily be trucked out of the basin and disposed of at a landfill or sold to a salt processor.

Major Issues: The major issue associated with fueled evaporation is that high energy cost required for implementation. The major issue associated with land evaporation is the large areas of land required. It is estimated that up to 300 acres may be required for evaporating 1,250 AF/yr of concentrate alone at an estimated evapotranspiration (ETo) rate of 50"/year (California Irrigation Management Information System database). The additional 12" – 16" of rainfall that falls annually in the area would also need to be accounted for in sizing evaporation ponds.

Major Benefits: The major benefit of evaporation of concentrate is that it will reduce the quantity of concentrate that requires disposal and put the concentrate in a form that is readily easily disposed of. Ultimate disposal of concentrate can be to a sanitary landfill or a salt/mineral

company if in a solid form, or to the City of Watsonville ocean outfall if in a concentrated liquid form that meets Watsonville's requirements.

1.5.11.3 Export Pipeline

Description: An export pipeline could have multiple uses with many benefits. An export pipeline could be used to export effluent, concentrate, pumped groundwater, and/or agricultural drainage. The potential sources of reclaimed M&I effluent for export are from the Sunnyslope County Water District's Ridgemark wastewater treatment plant that currently discharges to percolation ponds, the City of Hollister's domestic and industrial wastewater treatment plants that also currently discharge to percolation ponds, and the City of San Juan Bautista's wastewater treatment plant that discharges tertiary effluent to a ditch that flows to the San Benito River. The potential sources of concentrate are the proposed groundwater treatment plants that could generate up to 1.1 MGD of concentrate to deliver up to 7.1 MGD of average demand. As discussed above, groundwater that is pumped for water level/water quality management could also be exported as could the agricultural drainage that is proposed to be collected in the agricultural drainage collection pipeline.

A proposed export pipeline could be routed the 11.2 miles from Hollister to the Highway101/29 junction as shown on Figure 5-1 then join the route of and parallel the Pajaro Valley Water Management Agency (PVWMA) CVP import pipeline for the 15 miles to the City of Watsonville's ocean outfall. The PVWMA pipeline project is currently in the process of developing CEQA and NEPA environmental documents, preliminary design documents, and permit applications for Pajaro River crossings.

Discussions with the City of Watsonville wastewater treatment manager indicate that the outfall has a capacity of 16 MGD, the current wastewater treatment plant has a treatment capacity of 12 MGD, and current flows are approximately 7 MGD with some reclaimed water being used for agricultural irrigation nearby. Therefore, there is outfall capacity of at least 4 MGD and perhaps up to 9 MGD.

The City of Watsonville currently accepts off-site concentrate discharge to its outfall on a permit basis and requires certification of the water quality constituents of the concentrate. The City of Watsonville charges $0.07/gallon for concentrate disposal. Most concentrate dischargers bring concentrate in tanker trucks for discharge and the City of Watsonville can restrict concentrate disposal at any time. Long-term concentrate, wastewater effluent, or pumped groundwater discharge through the ocean outfall would require additional negotiations, development of contracts, and appropriate cost structures with the City of Watsonville.

Major Issues: The major issues associated the export pipeline are with the environmental impacts and need for documentation and permitting; the cost of construction; and the institutional arrangements required to provide a final disposal location in the ocean. Disposal through a pipeline to an ocean outfall would require construction of a pipeline to the ocean and would have several San Benito and Pajaro River crossings that could have major environmental impacts.

Major Benefits: The major benefits of an export pipeline for M&I effluent, concentrate, pumped groundwater, and/or agricultural drainage are that it results in the removal of salts from the groundwater basin and it provides operational flexibility for waste disposal.

1.5.12 Constructed wetlands treatment/polishing of agricultural runoff, stormwater and/or wastewater effluent

Description: This Project Toolbox Element includes construction of wetlands for treatment of agricultural runoff and stormwater, as well as municipal wastewater polishing. Constructed wetlands have demonstrated capacity to remove sediments and solids that are found in agricultural and stormwater runoff as well as providing for nutrient removal and denitrification of agricultural runoff and municipal wastewater.

The level of treatment or polishing that can be achieved in a constructed wetlands depends on factors such as the configuration of the ponds and the detention time that is achieved, the hydraulic loading, and the plant species that populate the wetlands.

For the purposes of the GMP Update, it has been assumed that constructed wetlands would be generally developed in areas where there would be minimal negative environmental impacts and where the potential for water quality improvement is great. One proposed area for a constructed wetland is adjacent to the San Benito River as shown on Figure 5-1 where there is an excavation from a gravel mining operation that could be the terminus for the agricultural drainage pipeline or an effluent discharge pipeline. The constructed wetland would offer polishing to these potential source waters by removing nutrients, in general, and nitrogen through denitrification if the appropriate species of plants are planted and sufficient detention time can be provided. Another potential area that would offer a similar benefit is in an area to the west of the City of Hollister Domestic Wastewater Treatment Plant.

Major Issues: One of the major issues associated with construction of wetlands is locating sufficient space to achieve the treatment required near the water source that needs to be treated. Depending on the level and type of treatment, considerable space can be required. In addition, constructed wetlands will percolate water and therefore should not be located in areas of high groundwater.

Major Benefits: Some of the major benefits associated with constructed wetlands are the relatively low-cost, low maintenance approach to treatment and polishing they provide; the seasonal habitat that they provide for migratory birds and the resulting aesthetic and recreational benefit that the habitat can provide the public.

Responses to the Notice of Preparation

MONTEREY BAY
Unified Air Pollution Control District
serving Monterey, San Benito, and Santa Cruz counties

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December 3, 2002

John Gregg
San Benito County Water District
P.O. Box 899
Hollister, CA 95024-0899

SUBJECT: NOP OF EIR FOR GROUNDWATER MANAGEMENT PLAN

Dear Mr. Gregg:

Staff has reviewed the referenced document and has the following recommendations for the air quality analysis:

1. Direct and indirect source emissions (ROG and NO_x) from all proposed operational activities should be quantified and assessed. ROG and NO_x emissions need not be quantified for "typical" construction activity. Staff should consulted regarding potential construction equipment to be used on the project.

2. If project <u>or</u> cumulative traffic would cause LOS to decline from D or better to E or F, dispersion modeling should be undertaken to determine if carbon monoxide concentrations would violate ambient air quality standards at sensitive receptor locations.

3. Project operational and construction PM_{10} emissions should be quantified. If emissions would exceed 82 lb/day, the project would have a significant impact on air quality. However, PM_{10} modeling could be undertaken to verify or dispute this finding per the District's CEQA Air Quality Guidelines.

4. If the project might expose sensitive receptors in adjacent land uses to air quality problems such as odors or toxic air contaminants (e.g., diesel exhaust), the DEIR should include an assessment of these impacts.

5. The EIR should address the secondary growth-inducing impact of the project and incorporate the results into the air quality analysis. In particular, subsequent growth in population should be addressed in the context of ozone precursor emissions.

6. The EIR should state whether stationary sources associated with the project would require permits from the District. If so, the District should be identified as a responsible agency.

7. Mitigation measures should be identified for any significant impacts on air quality. The EIR should quantify the emission reduction effectiveness of each measure, identify agencies responsible for implementation and monitoring, and conclude whether mitigation measures would reduce impacts below significance levels.

8. Project consistency with the 2000 Air Quality Management Plan for the Monterey Bay Region should be addressed. Consistency is used by the District to determine a project's cumulative impact on regional air quality (i.e., ozone levels). AMBAG should be contacted for a formal consistency determination, which should be included in the DEIR.

9. If federal funds are to be used for project funding, the EIR should discuss the applicability of the federal General Conformity rule. We recommend that the document include a draft conformity determination or reference a separate determination.

The District's CEQA Air Quality Guidelines can be used to help prepare the air quality analysis. The Guidelines were recently amended, and an updated copy is available at the District's website - www.mbuapcd.org. Please do not hesitate to call if you have any questions.

Sincerely,

Janet Brennan

Janet Brennan
Supervising Planner
Planning and Air Monitoring Division

Santa Clara Valley
Water District

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DAVID J. POWERS
& ASSOCIATES, INC.

December 23, 2002

San Benito County Water District
Attention: John Gregg
P.O. Box 899
Hollister, CA 95024-0899

Subject: Groundwater Management Plan for San Benito County Part of the Hollister-Gilroy Groundwater Basin – Notice of Preparation Comments

Dear Mr. Gregg:

Thank you for the opportunity to comment on the subject plan. The following comments are brief; however, we feel that they are consistent with comments we submited on June 21, 2002 regarding the Draft Evaluation of Project Alternatives to Implement Groundwater Management Plan in San Benito County.

1. Re: NOP Section VIII "Hydrology and Water Quality", item (a). The Initial Study indicates that one proposed activity could include continuation or expansion of treated wastewater. If this were to occur within the groundwater basin, the project could result in *potential significant impacts* on groundwater quality as opposed to *potential significant impacts unless mitigation* is incorporated. The basis for our concern isthe fact that the Bolsa and Llagas groundwater subbasins are hydraulically connected potentially resulting in groundwater quality impacts in the Llagas subbasin.

2. Recent groundwater management legislation (SB1938) requires that groundwater management plans incorporate specific elements (basin management objectives and monitoring protocols, etc.) if an agency wishes to apply for grants under DWR's local groundwater assistance fund. We recommend that you consider adding such elements into this plan so that San Benito County can benefit from this new legislation.

3. Re: Initial Study, pg. 19, last sentence. Please make the following change: Pajaro River Watershed Flood ~~Management~~ *Prevention* Authority.

We look forward to working with the Water Resources Association of San Benito County and the San Benito County Water District as it moves forward with its Groundwater Management Plan.

Sincerely,

Marc A. Lucca, P.E

xc: B. Ahmadi, H.Ashktorab, L. Jaimes, J. Maher, S. Wilson

recycled paper

Sunnyslope County Water District

3416 Airline Highway
Hollister, California 95023-9702

Phone (831) 637-4670
Fax (831) 637-1399

December 30, 2002

DEC 2002
RECEIVED

San Benito County Water District
Attention: John Gregg
P. O. Box 899
Hollister, CA 95023

RE: NOTICE OF PREPARATION OF PROGRAM ENVIRONMENTAL IMPACT REPORT

Dear John,

Upon review of the Notice of Preparation of the Program Environmental Impact Report, please find the following comments:

- VI – E: Provide specific future design considerations for wastewater percolation for capability of underlying soils to percolate discharges from wastewater treatment.
- XVI – C: With TMDL regulations, what impact will have on construction of new storm water drainage facilities?
- XVI – F: Significant Surface and Groundwater treatment projects noted in Appendix B, mention sludge and brine disposal. Study environmental impact and permitting process for local solid waste site as a major disposal site option.
- 1.5.11.3 – Typo correction: 101/29, should be 101/129.

If you have any questions or need further information, please do not hesitate to contact this office.

Sincerely,

Bryan Yamaoka
General Manager

Dec 31 02 01:02p San Benito Cnty H2o Dist. (831) 637-7267 p.2

State of California—Health and Human Services Agency
Department of Health Services

California Department of Health Services

DIANA M. BONTÁ, R.N., Dr. P.H.
Director

GRAY DAVIS
Governor

December 30, 2002

Mr. John Gregg
San Benito County Water District
P.O. Box 899
Hollister, CA 95024

Schedule No. 2002121003

Title: Notice of Preparation for the Groundwater Management Plan for the San Benito County Part of the Hollister-Gilroy Groundwater Basin

The Department of Health Services, Drinking Water Field Operations Branch, Monterey District office has received and reviewed the above-cited document. The Initial Study and Environmental Review Checklist documented the need for an Environmental Impact Report for the proposed project. We offer the following comments:

Initial Study, Section VIII, Hydrology and Water Quality:

The project includes the proposal for direct beneficial reuse of recycled wastewater in the project area. This may have a direct impact on shallow groundwater quality and existing shallow domestic water supply wells, depending on the degree of treatment of the wastewater. This was not identified in the Initial Study.

Attachment B, Elements of the Groundwater Management Plan Update:

Section 1.4.3, Surface Water Treatment. This section identifies ultraviolet light (UV) as an appropriate method for disinfection of filtered surface water prior to domestic use. The use of UV for meeting the disinfection requirements of the Surface Water Treatment Regulation (SWTR) has not yet been approved in California. If approved, there will be a mandatory requirement for a disinfectant residual to be carried in the distribution system to meet the requirements of the SWTR, thus requiring additional disinfectant treatment facilities.

Section 1.5.4.2. Aquifer Storage and Recovery of Imported and/or Local Surface Water. Complete treatment in accordance with the Surface Water Treatment Regulation will be required either prior to injection or following recovery of the surface water before any domestic use of that water occurs.

Section 1.5.7. Reclaimed M&I Effluent for Direct Reuse. The EIR should identify the specific use sites for recycled wastewater in order to identify the degree of treatment necessary, the

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Northern California Drinking Water Field Operations Branch
1 Lower Ragsdale, Building 1, Suite 120, Monterey, CA 93940-5741
(831) 655-6939; Fax (831) 655-6944
Internet Address: http://www.dhs.ca.gov/ps/ddwem/

impacts to surrounding areas, and the locations of any recycled water pipelines needed to transport the recycled water to the use site.

We thank you for the opportunity to comment on the Initial Study. If you have any questions regarding these comments, please contact me at (831) 655-6933.

Sincerely,

Betsy S. Lichti, P.E.
District Engineer, Monterey District
DRINKING WATER FIELD OPERATIONS BRANCH

BSL/bl
021230 SanBenitoCWD GWMngmtPlan.doc

cc: SDWSRF Environmental Coordinator

State Clearinghouse (SCH)
P.O. Box 3044
Sacramento, CA 95812-3044
SCH No. 2002121003

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404-6528

JAN - 2 2003

In Response refer to:
151422SWR02SR8533:BLS

John Gregg
San Benito County Water District
P.O. Box 899
Hollister, California 95024-0899

Dear Mr. Gregg:

Thank you for the opportunity to review the November 2002 Initial Study (IS) in Preparation of a Program Environmental Impact Report (EIR) (received December 3, 2002) submitted by the Water Resources Association of San Benito County (WRA) to the National Marine Fisheries Service (NOAA Fisheries). WRA is an association of the City of Hollister, City of San Juan Bautista, Sunnyslope County Water District, and San Benito County Water District, San Benito County, California. The WRA and San Benito County Water District will prepare an EIR on implementation of a Groundwater Management Plan (Plan) within their services areas.

The proposed project is the adoption and implementation of the Plan in northern San Benito County within the Hollister-Gilroy Groundwater Basin. The proposed Plan will address surface and groundwater management as well as wastewater treatment discharges and use of reclaimed water supplies. According to the IS, it is anticipated that the proposed Plan may have environmental impacts to hydrology, water quality, biological resources (including special status species), and other public resources.

The Pajaro River watershed lies within San Benito County and the area covered under the plan. The Pajaro River contains populations of South-Central California Coast (S-CCC) Evolutionarily Significant Unit (ESU) steelhead trout (*Oncorhynchus mykiss*). S-CCC ESU steelhead trout were listed as a threatened species on August 18, 1997 (62 FR 43937) pursuant to the Federal Endangered Species Act (ESA) of 1973, as amended. Critical habitat for steelhead trout was designated on February 16, 2000 (65 FR 7764). However, the critical habitat designation for S-CCC ESU steelhead trout was recently vacated by NOAA Fisheries and is currently undergoing further review. Regulations deemed necessary and advisable for their conservation were adopted under section 4(d) of the ESA and went into effect on September 8, 2000. Populations of steelhead trout within this ESU are at critically low levels. Being at a high risk of extinction, any adverse impacts to the Pajaro River steelhead stock must be avoided.

The NOAA Fisheries' review of the IS is focused primarily on the adequacy of proposed mitigations to protect S-CCC ESU steelhead trout throughout all stages of their life history and the sufficiency of information provided to fully evaluate potential impacts to this species. The following comments are expressed relative to the Pajaro River watershed since all streams within the Plan area flow into the Pajaro River. The comments are expressed in general categories and not as levels or ranking of concern by NOAA Fisheries.

Fish barriers, construction activities, water diversion, and runoff may affect S-CCC ESU steelhead trout. Whether impacts to steelhead result from a particular activity is entirely dependent upon the facts and circumstances of each case. These types of activity are, however, those that may be most likely to adversely affect steelhead and must be minimized to reduce take under the ESA.. The following paragraphs describe the potential effects. NOAA Fisheries recommends the EIR address these potential impacts.

Fish barriers

As cited in NOAA Fisheries' harm rule 64 FR 215 (November 8, 1999), "constructing or maintaining barriers that eliminate or impede a listed species' access to habitat or ability to migrate" may result in 'take'. Seasonal diversion dams, and the modification of an existing dam, may create barriers to fish passage.

Construction activities

Depending on the locations, the physical act of constructing a treatment facility, pipeline, or pump station may affect S-CCC ESU steelhead trout. These activities may result in substantially increased sediment input into streams. Riparian disturbances may retard or prevent the development of certain habitat characteristics upon which these fish depend.

Water diversion

Flow studies are needed to determine if excess winter flows are available for diversion. Hydraulic studies need to be conducted in order to conclude there is no connectivity between wells and streams. Removing water or otherwise altering streamflow when it significantly impairs spawning, migration, feeding or other essential behavioral patterns may cause harm to S-CCC ESU steelhead trout. Water rights should also be clarified.

The effects of discharged water to receiving water needs to be addressed. S-CCC ESU steelhead trout may be affected by discharged water (e.g., honing abilities effected, exposure to disease, release of non-indigenous species).

Runoff

Discharging pollutants into a listed species' habitat may result in harm. Agricultural runoff via tile drains or other channels needs to be addressed. Water pollution and erosion control measures for all of the proposed activities should also be addressed in the EIR.

The NOAA Fisheries appreciates the opportunity to comment on the IS. If you have any questions concerning the above comments please contact Mr. Bill Stevens at (707) 575-6016 or via e-mail at William.Stevens@noaa.gov.

Sincerely,

Miles M. Croom

for Patrick J. Rutten
Northern California Supervisor
Protected Resources Division

cc: J. Lecky - NOAA Fisheries
K. Urquhart - CDFG, Monterey
G. Liu - Corps, San Francisco
M. Hill - CDFG, Monterey

COUNTY OF SAN BENITO

3224 SOUTHSIDE ROAD
HOLLISTER, CA 95023-9174
831-637-5313 • Fax 831-637-9015

PLANNING DEPARTMENT
BUILDING DEPARTMENT

JAN 2003

January 3, 2003

Mr. John Gregg
San Benito County Water District
P. O. Box 899
Hollister, California 95023

Subject: Response to Notice of Preparation for 'Groundwater Management Plan for the San Benito County Part of the Hollister-Gilroy Groundwater Basin'

Dear Mr. Gregg:

San Benito County appreciates the opportunity to respond to the Notice of Preparation for 'Groundwater Management Plan for the San Benito County Part of the Hollister-Gilroy Groundwater Basin'. There are some issues where additional detail and information will provide a basis for better disclosure of potential environmental impacts, mitigation measures and good long-term strategies for groundwater management.

General Comments:

The project description in the EIR needs to clearly articulate the precise location, dimensions (acreage, width, depth etc.) of the projects in the tool box. The project description in the Notice of Preparation is vague.

The process of programmatic EIR is not well understood and the use needs to be clearly described to the decision-makers and the public.

IV. Biological Resources

1. The potential effects on wetland and riparian habitat need to be clearly quantified for each affected area in the EIR. The potential effects of wetland/riparian loss on migratory species threatened and endangered habitat and California Species of Special Concern to be disclosed with any necessary strategies for mitigation.

2. The EIR should evaluate alternatives to tree belt plantings with 'invasive non native tree species'. The feasibility of using less invasive native plant species should be evaluated in the EIR. Please consult with the County Agricultural Commissioner's Office to develop a list species for tree belt plantings.

3. San Benito County is preparing a countywide habitat conservation plan. Many of the toolbox elements could affect listed species that have been included on a preliminary basis. An issue identified during three workshops with scientific experts is the a lack of available data documenting the extent and range of

covered species in the plan. Many of the tool box elements could result in direct or indirect impacts to drainage courses, waterways and groundwater basins that could affect species. Potential impacts need to be clearly quantified in the environmental review.

VIII Hydrology:

1. The EIR needs to address the potential water quality impacts of percolation plans on existing and future septic systems in the north county area. The implementation plan suggests expanded use of Pacheco Creek, Arroyo Dos Picachos and Arroyo de las Vibras for percolation impoundments. Figure 2 of the project description shows a 'water banking and well field' in the northeast part of San Benito County between Los Viboras Road and Lone Tree Road. This area has concentrations of five-acre ranchettes and could be developed in the future for additional five-acre ranchettes. All of the residences rely on septic systems for wastewater disposal. There are existing water quality concerns in localized areas where existing residences overly areas with high groundwater tables. The EIR needs to evaluate the impacts of water banking in an area with a concentration of septic systems.

2. The Schaaf & Wheeler, Consulting Civil Engineers 1999 Storm Water Management and Improvement Plan Santa Ana Creek – San Felipe Lake Area recommends a FEMA study to add lands between Arroyo de las Viboras and Santa Ana Creek to the 100 year flood plain (see Attachment 1). San Benito County has used the Schaaf & Wheeler study for review of development projects in this area. The proposed water bank and well field in Figure 2 of the project description is located within the newly identified flood hazard area. The EIR needs to disclose the potential flood hazard effects with water banking. The EIR needs to evaluate the compatibility and feasibility of the proposed groundwater management plan with recommendations in the Schaaf & Wheeler 1999 plan.

3. A four-county joint power authority (JPA) has also been established to study flooding at the downstream end of the Pajaro River. The EIR needs to evaluate the compatibility of the proposed project with the findings and mission of the JPA. An alternative analysis in the EIR should explore the feasibility of toolbox elements that could serve dual purposes of flood control with the Schaaf & Wheeler study and the JPA and groundwater management alternatives.

IX Land Use and Planning:

1. Particular attention should be given in the Programatic EIR to the following general plan goals, objectives and policy in the San Benito County Open Space and Conservation Element - San Benito County Open Space and Conservation Element including goal 3, objective 9, 11, 12, 13, 14, 18 and policies 25, 27, and 29. Please note that Policy 25 of the 1995 San Benito County General Plan Open Space and Conservation Element Update requires the use of tertiary wastewater treatment as defined by Title 22 for domestic wastewater treatment systems (Open Space and Conservation Element attached). San Benito County has required new development in the unincorporated area served by public wastewater systems to provide tertiary treatment of wastewater and requested local agencies providing wastewater treatment

to convert to tertiary treatment when updgrading and/or expanding their treatment systems. Action 3 of Policy 27 requires the use of reclaimed water irrigation systems wherever possible.

2. Reclaimed M&I Effluent for Export (1.5.11 Project Description) is potentially inconsistent with San Benito County General Plan Open Space and Conservation Element goals, polices and actions to conserve and reclaim groundwater resources in the unincorporated area.

3. The EIR needs to address the consistency of the tool box elements with San Benito County programs such as Ordinance 664, An Ordinance of the San Benito County Board of Supervisors, Chapter 7C of the San Benito County Code Groundwater and Aquifer Protections.

Figure 2 of the Initial Study: The graphic is confusing. It is difficult to discern the difference between local conveyance pipelines, export pipelines and agricultural drainage pipelines on the map. It also appears that some existing domestic and industrial wastewater disposal facilities are omitted from the graphic.

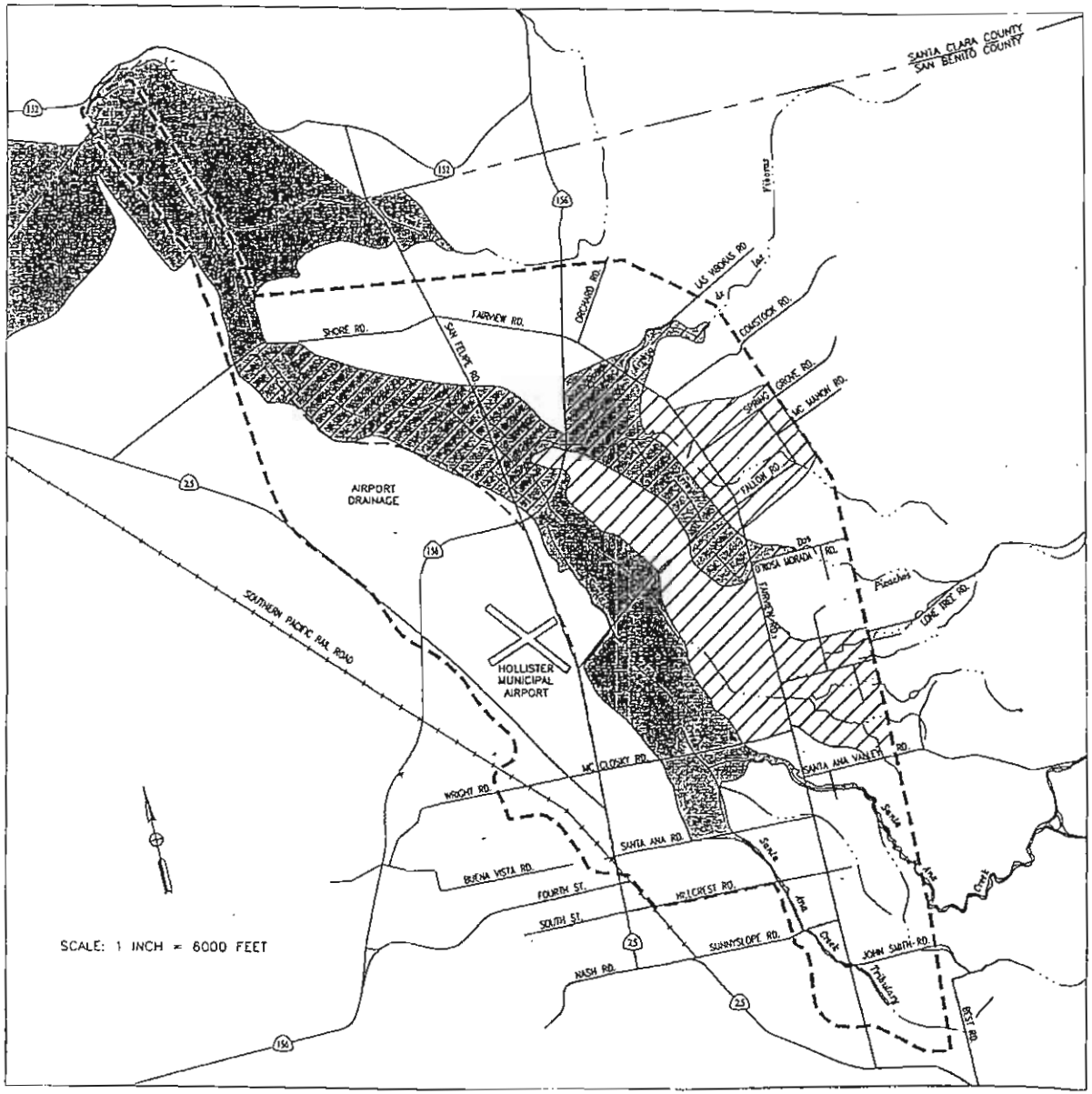
San Benito County appreciates the opportunity to provide input on the Notice of Preparation for the groundwater management plan.

Sincerely,

Rob Mendiola
Director of Planning
San Benito County

ATTACHMENT 1

Figure 8



POTENTIAL FLOODPLAINS

LEGEND

- STUDY AREA
- DRAINAGE BOUNDARY
- FEMA 100-YEAR FLOODPLAIN
- REQUEST FEMA STUDY
- REQUEST FEMA RESTUDY

Schaaf & Wheeler
CONSULTING CIVIL ENGINEERS
100 N. WINCHESTER BLVD, STE. 200
SANTA CLARA, CA 95050
(408) 246-4848

STORMWATER MANAGEMENT AND IMPROVEMENT PLAN
SAN FELIPE LAKE - SANTA ANA CREEK AREA

AMBAG
ASSOCIATION OF MONTEREY BAY AREA

January 9, 2003

Mr. John Gregg
San Benito County Water District
P.O. Box 899
Hollister, CA 95024

Re: MCH # 120215 – Notice of Preparation of a Program Environmental Impact Report for Groundwater Management Plan for the San Benito County Part of the Hollister-Gilroy Groundwater Basin

Dear Mr. Gregg:

AMBAG's Regional Clearinghouse circulated a summary of notice of your environmental document to our member agencies and interested parties for review and comment.

The AMBAG Board of Directors considered the project on **January 8, 2003**, and has no comments at this time.

Thank you for complying with the Clearinghouse process.

Sincerely,

Nicolas Papadakis
Executive Director

JAN 2003

SERVING OUR REGIONAL COMMUNITY SINCE 1968
445 RESERVATION ROAD, SUITE G ✦ P. O. BOX 809 ✦ MARINA, CA 93933-0809
(831) 883-3750 ✦ FAX (831) 883-3755 ✦ www.ambag.org

Jan 13 03 12:26p San Benito Cnty H2o Dist. (831) 637-7267 p.1

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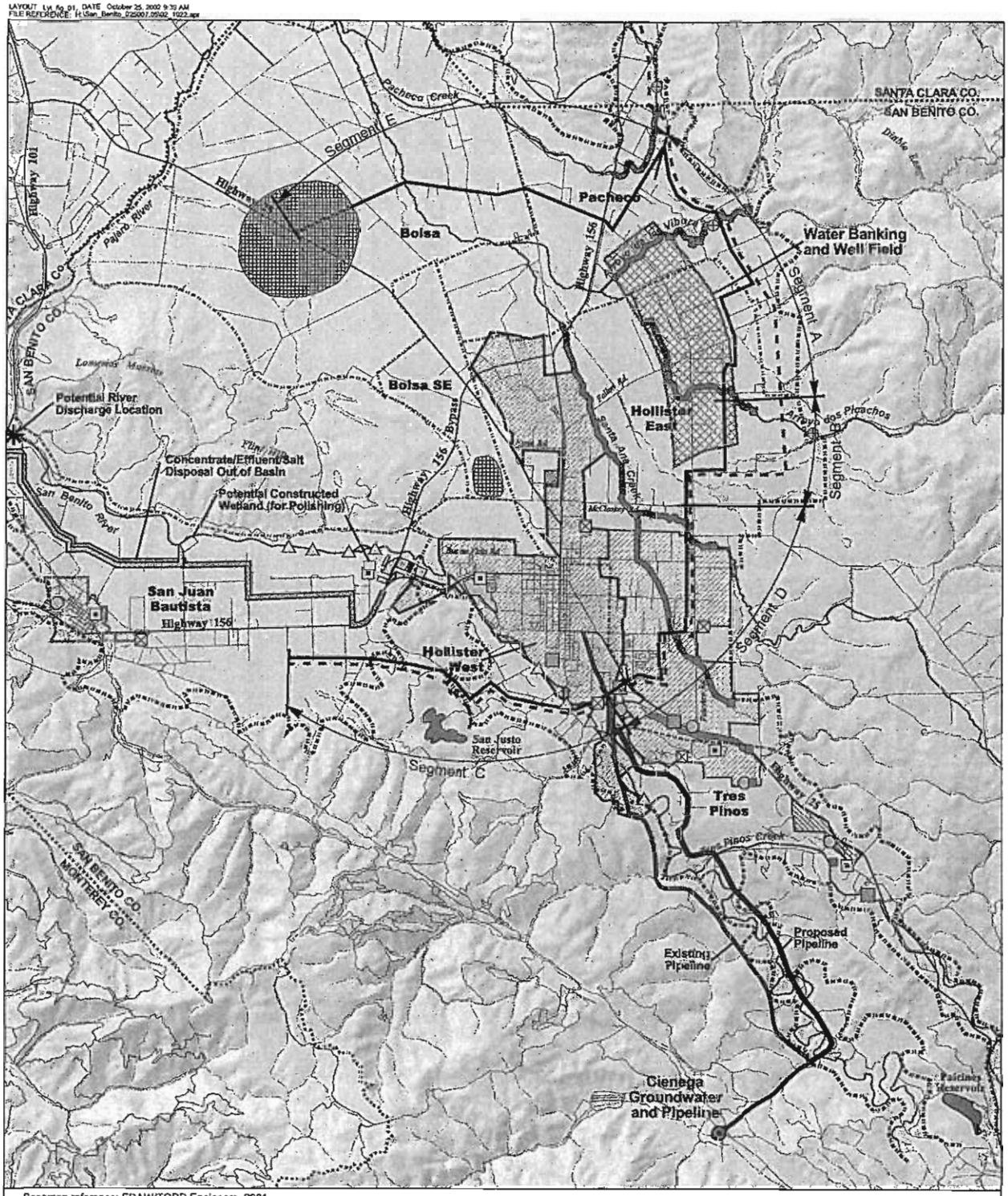

Basemap reference: EDAW/TODD Engineers, 2001

LEGEND

- San Benito River Percolation Sites (1971)
- Existing Wastewater Percolation Sites
  Source: Hollister Area Urban Water Management Plan, 2000
- Proposed Effluent for Direct Reuse
- Proposed Surface Water Treatment Facilities
- Proposed Groundwater Treatment and Concentrate Storage Facilities
- Proposed Seasonal Local Surface Water Development
- Potential Seasonal Instream Percolation Facilities
- Proposed/on-going In-lieu Percolation
- City of San Juan Bautista
- City of Hollister Water Service
- Sunnyslope County Water District
- Tres Pinos County Water District
  Source: Groundwater management Plan for San anito County, April 1998, Figure 9
- Hollister Conduit San Felipe Water System
  Source: Hollister Water Management Master Plan & Groundwater Management Plan, April 1998
- Proposed Local Conveyance Pipeline
- Proposed Export Pipeline
- Proposed Agricultural Drainage Pipeline
- Discharge Point and Wetted Reach for Percolation of San Felipe Water
  Source: Annual Groundwater Report, 1998-99
- Groundwater Basin Boundary
- Groundwater Subbasin Boundary

N

4000 0 4000 Feet

Figure 2

Exhibit 1.10

Revised Basin Management Plan

Pajaro Valley Water
Management Agency

Revised
Basin Management Plan

February 2002

RMC
Raines, Melton & Carella, Inc.
Consulting Engineers/Project Managers

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Abbreviations

Abbreviation	Definition
$M	Million Dollars
Act	California State Statute establishing the Pajaro Valley Water Management Agency
AF	Acre-foot (feet)
AFY	Acre-feet per year
Agency	Pajaro Valley Water Management Agency
AMBAG	Association of Monterey Bay Area Governments
A/P	Capital Recovery Factor
ASR	Aquifer Storage and Recovery
Basin	Pajaro Valley Ground Water Basin
BMP	Basin Management Plan
Board	Board of Directors of the Pajaro Valley Water Management Agency
BOD	Biochemical Oxygen Demand
Bolsa	Bolsa de San Cayetano
Caltrans	California Department of Transportation
CCRWQCB	(Central Coast) Regional Water Quality Control Board
CDS	Coastal Distribution System
CEQA	California Environmental Quality Act
cfs	Cubic feet per second
CIMIS	California Irrigation Management Information Service
City	City of Watsonville
CPUC	California Public Utilities Commission
CVP	Central Valley Project
CVPIA	Central Valley Project Improvements
CWC	California Water Commission
CY	Cubic Yards
DFG	(California) Department of Fish and Game
DMS	Data Management System
DOHS/DHS	(California) Department of Health Services
DWR	(California) Department of Water Resources
EC_w	Electrical Conductivity
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
Ft	Foot (feet)
GIS	Geographic Information Systems
gpm	Gallons per minute
H:V	Horizontal-to-vertical
IDS	Inland Distribution System
LIA	Local-Import Alternative
LOA	Local-Only Alternative
MCFC & WCD	Monterey County Flood Control and Water Conservation District
MCL	Maximum Contaminant Level
MCWRA	Monterey County Water Resources Agency
meq/L	milliequivalents per liter
mg/L	milligrams per liter
MG	Million Gallons
MGD	Millions of gallons per day
MPN	Most Probable Number (bacteriological quality)
MPWMD	Monterey Peninsula Water Management District
NA	Not Applicable
ND	No Data
NEPA	National Environmental Policy Act

Abbreviation	Definition
NETWK	Network Model (Modeling program developed by CH2M Hill and Utah State University)
NH_4 – N	Ammonia as Nitrogen
NMFS	National Marine Fisheries Service
NO_3	Nitrate
NO_3 – N	Nitrate as Nitrogen
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Units
O & M	Operation and Maintenance
OSHA	(California) Occupational Safety and Health Administration
PG&E	Pacific Gas and Electric Company
psi	Pounds per square inch
PVIGSM	Pajaro Valley Integrated Groundwater - Surface Water Model
PVWMA	Pajaro Valley Water Management Agency
RO	Reverse Osmosis
SAR	Sodium Adsorption Ratio
SBCWD	San Benito County Water District
SCCEPD	Santa Cruz County Environmental Planning Department
SCCFC & WCD	Santa Cruz County Flood Control and Water Conservation District
SCVWD	Santa Clara Valley Water District
SCWD	Soquel Creek Water District
SDWA	Safe Drinking Water Act
SPRR	Southern Pacific Railroad
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	(California) State Water Resources Control Board
TAC	Technical Advisory Committee
TDS	Total Dissolved Solids
TM	Technical Memorandum
TOC	Total Organic Carbon
TSS	Total Suspended Solids
TU_a	Turbidity Units
µg	micrograms
USBR	United States Bureau of Reclamation
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
USSCS	U.S. Soil and Conservation Service
Valley	Pajaro Valley
WC 2000	Water Conservation Plan 2000
WWTF	(City of) Watsonville Wastewater Treatment Facility
Yr	Year

Executive Summary

This Revised Basin Management Plan (BMP) identifies a Recommended Alternative to balance the groundwater basin and eliminate seawater intrusion in the Pajaro Valley.

The Recommended Alternative includes the following elements:

- Completion of Harkins Slough Project;
- Water Conservation efforts of 5,000 acre-feet per year (AFY);
- Completion of the remainder of the Coastal Distribution System (CDS);
- Construction of an import water pipeline to convey 13,400 (AFY) of Central Valley Project (CVP) water plus five supplemental wells;
- Acquisition of 22,300 AFY of Central Valley Project (CVP) water (to allow reliable delivery of 13,400 AFY);
- Development of out-of-basin banking for assigned CVP water;
- Development of 4,000 AFY of recycled water from the Watsonville Wastewater Treatment Plant; and
- Watershed management programs that would include water resources monitoring, water metering, nitrate management, wells management, and recharge area protection.

These improvements would be implemented by 2007. The imported water volume stated above includes an allowance for potential water sales to users along the pipeline alignment.

The annualized cost of the Recommended Alternative is $13.9 million.

The estimated capital cost of the Recommended Alternative is $130.6 million, in Spring 2001 dollars. The annual O&M cost is estimated to be $4.4 million. The cost estimate includes annual administration costs and annual average water banking costs for out-of-basin banking. On an annualized basis, the cost of the Recommended Alternative is $13.9 million.

These costs are expressed in 2001 dollars. Inflation, which will occur between 2001 and actual project construction will increase these costs.

Table ES-1: Recommended Alternative Cost Estimate (Phase 1 and 2)

Project Element	Cost Estimate ($ Millions)
Coastal Distribution System	$34.4
Conservation and Watershed Management Programs	$1.7
Harkins Slough Project with Harkins Slough Recharge Basin and Supplemental Wells and Connection[a]	$6.6
Recycled Water Project (4,000 AFY)	$19.2
54-inch Import Water Project with Out-of-Basin Banking	$87.3
Construction Cost Subtotal	**$149.1[b]**
Financial & Bond Sale Cost @ 1.0%	$1.5
Recycled Water Grant (Title XVI)	($20.0)
Total Capital Cost	**$130.6**
Annualized Capital Cost at 6% for 30 years	$9.5
Annual Operations & Maintenance Costs	$4.4
Total Annual Cost	**$13.9**

Footnotes:
a. Includes $460,000 CalFed Grant. This project is complete except for three supplemental wells and associated piping.
b. Subtotal reflects sum of individual project elements before rounding.

Notes:
1. Spring 2001 construction cost.
2. Capital recovery factor (A/P) for 6% at 30 years is 0.07265.
3. Cost estimates include a Construction Contingency of 20%, Engineering/Legal/Admin/Permits Contingency of 17.5%, and Environmental and Permitting Contingency of 5%.

To recover the $13.9 million in annualized costs, a differentiated flat rate is recommended, with one rate for users that pump groundwater and a higher rater for users that receive delivered water.

California law requires that charges for water and other services be based on the cost of the service being provided. For the Recommended Alternative, the recommended basis for establishing the cost of service for delivered project water and for augmented groundwater is:

1. Recipients of delivered project water will pay the incremental cost of providing delivered project water to their properties as established by the incremental cost of constructing, operating and maintaining the Distribution System,

2. All water users, including recipients of delivered project water, pay a proportionate share of all remaining costs associated with the Recommended Alternative.

Based on the estimated costs of the Recommended Project, as presented in Section 6, the proposed rate structure would be:

Augmentation Charge	$158/AF
Delivered Water Charge	$316/AF

Rate increases would be gradual over the next six years.

The Augmentation Charge would be increased on an incremental basis, assuming a successful election in March 2002. On this basis, the Augmentation Charge would be increased gradually from its current level of $50/AF to $158/AF[1].

Upon completion of the project and delivery of project water, in approximately six years, the Delivered Water Charge would be applied to those water users receiving delivered water. That is, those water users who stop pumping and receive delivered water would move to the higher rate when they receive delivered water.

The Recommended Alternative was developed from a range of alternatives that represent a diversity of approaches.

Development of a Recommended Alternative was originally undertaken in the Draft BMP 2000, published in May 2000. However, public review of that draft document indicated the need to investigate a wider range of alternatives for basin management, and in particular, to focus on strategies with a greater reliance upon development of local water supplies.

This Revised BMP was prepared in response to those concerns. Four separate basin management strategies are presented in this document, including one that relies entirely on development of local water supplies, and another that relies heavily on imported supplies. The remaining two strategies include the original management alternative presented in the Draft BMP 2000 and a modified version of that alternative which reduces its scope and cost. These four strategies are:

- **BMP 2000 Alternative**. This strategy is similar to the one identified in the draft BMP 2000 document published in May 2000. Modifications to this Alternative between the BMP 2000 document and this Revised BMP were limited to updating individual cost estimates.
- **Local-Only Alternative.** This strategy demonstrates the costs and implications associated with developing *only* local water supplies and storage projects within the Pajaro basin. The Local-Only Alternative was developed based on recommendations from local stakeholders, and information about this alternative is extracted from *Local-Only Water Supply Alternative Evaluation* (RMC, 2001).
- **Modified Local Alternative.** This strategy builds upon the projects that comprise the Local-Only Alternative and maximizes potentially feasible local projects. It supplements the local projects with the minimum quantity of imported water needed to balance supply with current demand. The concept behind this alternative was developed based on recommendations from local stakeholders.

[1] These rates are expressed in current dollars and would increase in the future with the overall rate of inflation.

- **Modified BMP 2000 Alternative**. This strategy presents a modification of the BMP 2000 alternative that reduces the size of the import pipeline. The size reduction is accommodated through in-basin storage with groundwater injection/extraction and elimination of the inland distribution system. Other project components were also modified from the original BMP 2000 alternative to maximize their cost effectiveness.

All four of these strategies have a common basis that includes increased levels of water conservation and development of Harkins Slough, recycled water, supplemental wells, and the Coastal Distribution System (CDS). Each of the four strategies builds upon these common elements and includes project elements necessary to balance the groundwater basin and eliminate seawater intrusion.

The Recommended Alternative and associated rate structure were developed with extensive public involvement.

In May 2000 the Draft BMP 2000 document was published outlining a range of alternatives to balance the groundwater basin and stop seawater intrusion. Public comment on that document indicated that a wider range of alternatives should be considered before recommendations were made. The wider range of alternatives needed to include strategies that used a greater degree of local water supplies. In response to this concern, PVWMA prepared the Draft Revised Basin Management Plan, which was released for public and stakeholder review in August 2001.

From August to December 2001 public workshops and public hearings were held to present, discuss and receive comments on the range of alternatives and rate structures that should be implemented. In addition, written comments from the public at large and regulatory agencies were received. With these comments and feedback available, the PVWMA Board of Directors developed the above-described Recommended Alternative and recommended rate structure to fund the improvements.

The Recommended Alternative uses the Modified BMP Alternative as a basis and adds several enhancements to address the concerns and issues raised by water users, the public at large, and regulatory agencies. The enhancements include an allowance of imported CVP water for potential water sales to interested users along the import pipeline alignment, and the use of out-basin water banking in the near term rather than the ASR wells provided in the Modified BMP Alternative. It was found to be more cost effective in the near term to use out-of-basin banking than meet the regulatory treatment requirements associated with ASR.

The Recommend Alternative also includes potential future development of several local water supply projects. Although these projects do not appear viable at this time, future conditions may make them more attractive. These potential projects include Watsonville Slough, College Lake, and Murphy Crossing projects.

The need for the project is due to the adverse impacts of excessive groundwater pumping in the Pajaro Valley.

Numerous studies conducted over the past fifty years have documented that the Pajaro Valley groundwater basin is in an overdraft condition, i.e., the amount of water withdrawn exceeds the amount of water replenishing the basin. Today, groundwater pumping provides approximately 69,000 AFY toward

the total PVWMA area water demand of 71,500 AFY. Existing well data maintained by the United States Geological Survey (USGS) and the PVWMA indicate that areas of depressed groundwater levels are expanding in the Pajaro Valley groundwater aquifers and that the groundwater elevations regularly fall below sea level.

This trend has caused seawater intrusion in the PVWMA service area because the ocean pushes seawater inland to raise the water table until equilibrium is reached at sea level. Well data collected since 1998 indicate that seawater intrusion (evidenced by chloride levels exceeding 100 mg/L) is more extensive than previously reported, and chloride levels ranging from 200 mg/L to 8,500 mg/L have been observed in a number of deeper wells. The extent of seawater intrusion is illustrated on the following page in Figure ES-1.

Future increases in water demand will make current situation worse.

Overdraft of the groundwater basin and seawater intrusion are problematic at the current level of water demand. Projected increases in urban and agricultural water use will cause further problems if this situation is not rectified. Urban water use has increased by 86% in since 1964, and the current urban water use of 12,200 AFY is projected to increase an additional 32% (3,900 AFY) to approximately 16,100 AFY by the year 2040. If the current trend in cropping patterns continues towards more water-intensive crops such as strawberries and raspberries, agricultural water use could increase from 59,300 AFY to 64,400 AFY by the year 2040.

Solving this situation will require a combination of management practices and additional water sources.

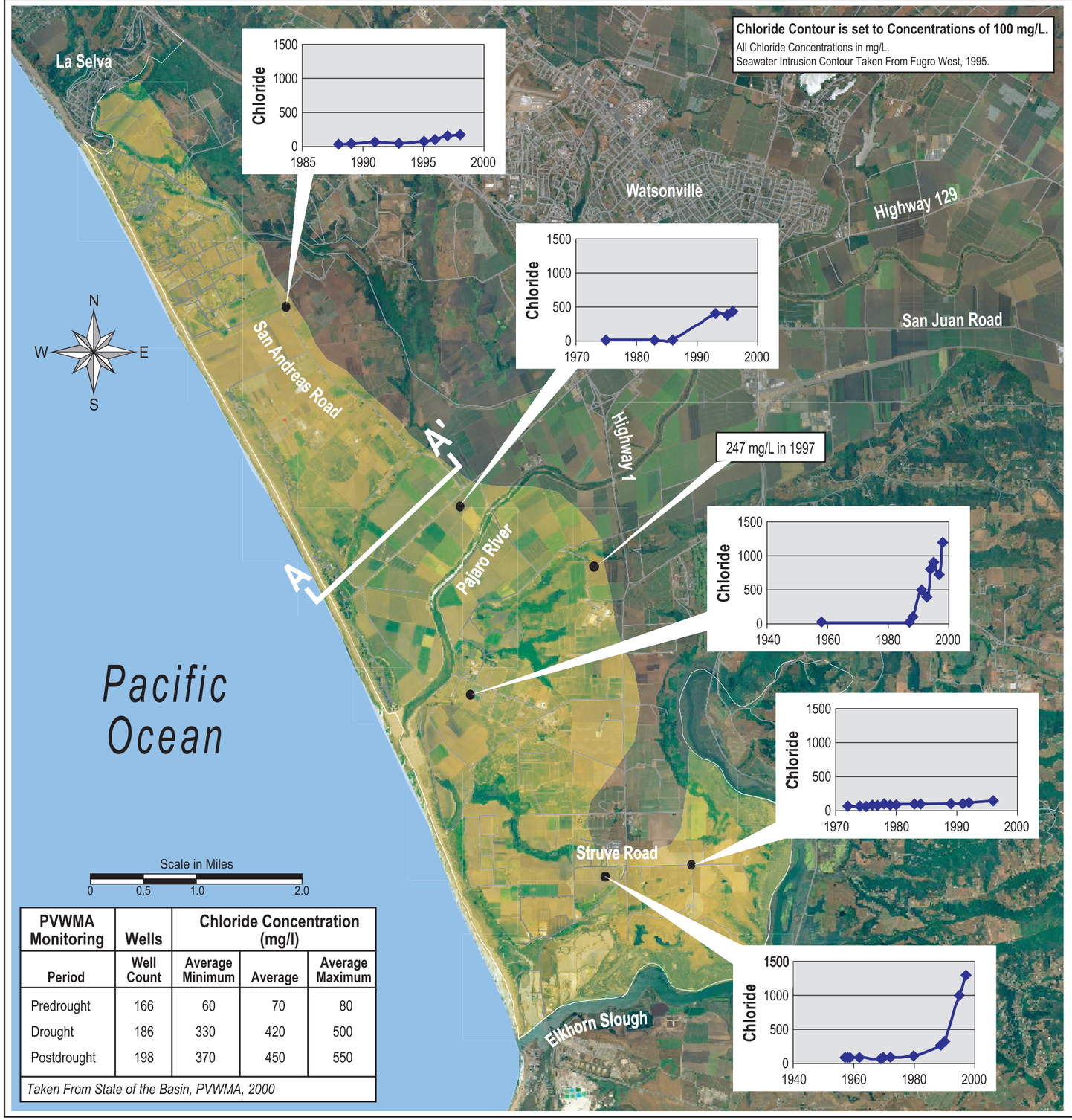
To eliminate the overdraft conditions and seawater intrusion, water demand must be brought into balance with sustainable water supplies. This balancing of demand with sustainable supply will require a combination of water conservation, modified pumping practices and development of new water sources.

To develop and assess a range of scenarios, the magnitude of the problem was defined.

By modeling current ‘baseline’ conditions, the sustainable yield of the basin (the maximum amount of groundwater that can be extracted from the aquifer system without causing adverse effects) can be estimated. With this estimate in hand, alternative strategies to balance the basin can be developed.

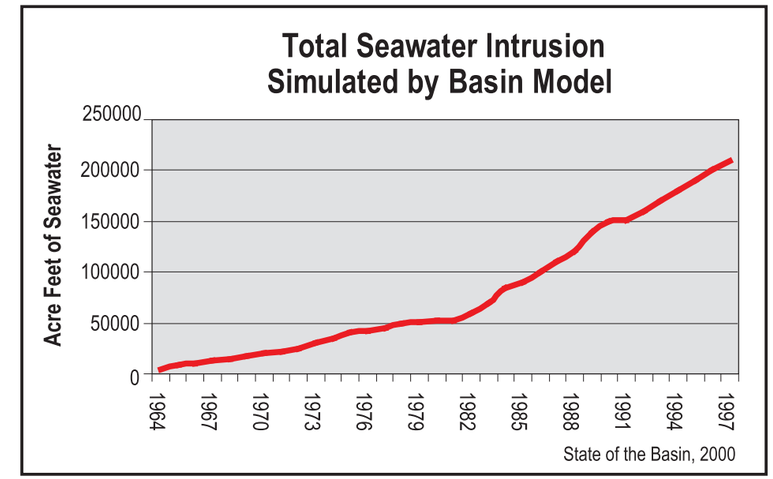
The sustainable yield of the Pajaro Valley groundwater basin was estimated using the Pajaro Valley Integrated Ground and Surface Water Model (PVIGSM). This complex model simulates groundwater conditions in the Pajaro Valley groundwater basin using geologic and hydrologic conditions, current pumping conditions, and other basin characteristics. The modeling approach involved incremental reductions of groundwater pumping estimates until stable groundwater levels were observed (i.e., recharge = demand) and seawater intrusion was eliminated.

Summary of Seawater Intrusion Within PVWMA Boundaries



PVWMA Monitoring	Wells	Chloride Concentration (mg/l)		
Period	Well Count	Average Minimum	Average	Average Maximum
Predrought	166	60	70	80
Drought	186	330	420	500
Postdrought	198	370	450	550

Taken From State of the Basin, PVWMA, 2000



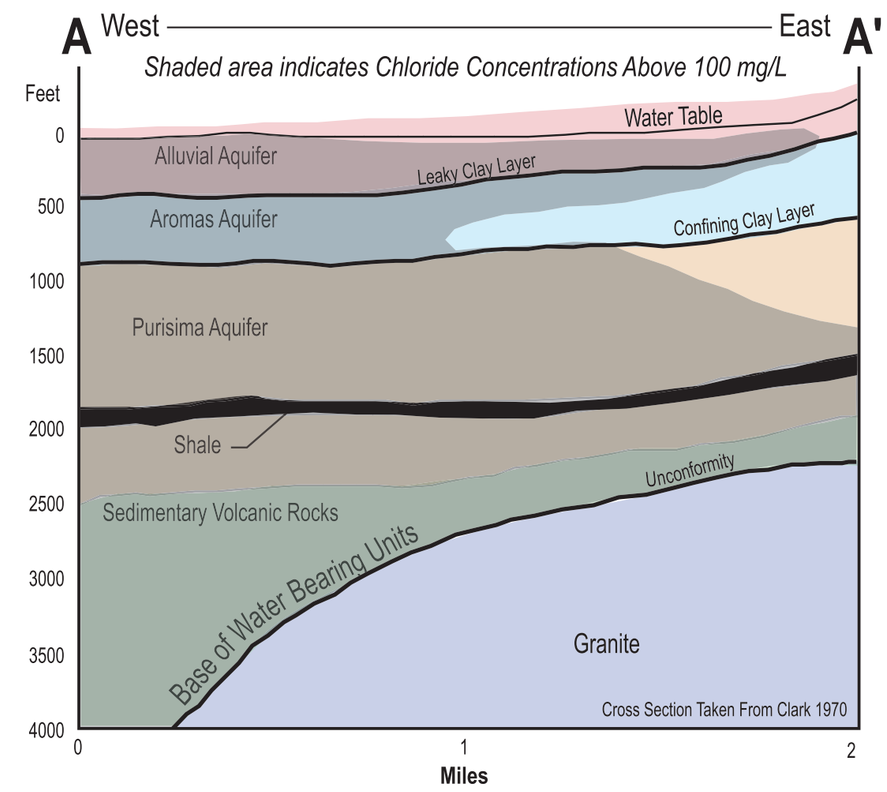


Figure ES-1: Location of Area Impacted by Seawater Intrusion

Source: Modified from PVWMA, July 2001.

Model results indicate that, under current pumping practices, a 65% reduction in *basin-wide* groundwater pumping (45,000 AFY) is necessary to eliminate seawater intrusion. Under this scenario, the sustainable yield of the groundwater basin is approximately 24,000 AFY (69,000 AFY – 45,000 AFY), or approximately one third of the current average annual demand on groundwater supplies.

However, the basin sustainable yield could be doubled if pumping in the coastal areas was eliminated. Therefore, every proposed solution considered in this document includes stopping groundwater pumping at the coast and replacing it with water that would originate from other areas. The PVIGSM showed that this modification to current pumping practices would create a hydrostatic barrier that would prevent seawater intrusion. This scenario necessitates a dependable supplemental water supply and construction of a coastal distribution system to provide coastal agricultural users with water. The basin sustainable yield estimated for this scenario is 48,000 AFY. This estimate assumes a 100 percent reliable supply with very little variation in year-to-year availability of water.

The basin yield would be less if the total irrigation demand were reduced because there would be less basin recharge. Thus, the Local-Only alternative, which would significantly reduce total irrigation, would result in a lower sustainable yield from groundwater. As a result of this influence, the actual basin yield would be approximately 42,000 AFY for the Local-Only alternative.

Management measures that do not involve the construction of new projects can deliver significant benefits.

The following management measures have been identified to reduce water demand, increase the yield of the groundwater basin, and maintain optimal water quality:

- Demand management options to reduce water demand;
- Pumping management options to increase the sustainable yield of the groundwater basin; and
- Watershed management options to protect water resources.

Demand Management. Demand management measures include options such as water conservation, water pricing, and land retirement. The PVWMA developed Water Conservation 2000 (WC 2000) to serve as a guidance document for achieving cost effective increases in water conservation. This plan identified cost-effective opportunities that would result in the conservation of approximately 4,500 AFY in agriculture water use and 500 AFY in urban water use. Water pricing is one of the options considered in WC 2000 for promoting water conservation. The PVWMA could either increase its current flat rate charge of $50/AF, or implement a tiered water pricing system in which the price of water increases as the amount of water consumed exceeds certain threshold values. A third option available is land fallowing. This option involves the acquisition, or leasing of agricultural land and elimination of irrigated agriculture on that land. It should be noted that the latter two options have extensive socioeconomic impacts and would have to be investigated in greater detail before they could be implemented.

Pumping Management. As stated previously, the PVIGSM simulation of groundwater levels and seawater intrusion in the Pajaro Valley groundwater basin indicates that coastal groundwater pumping reductions would be more effective at preventing seawater intrusion than basin-wide pumping reductions. Provided that a supplemental water supply is available to coastal users, elimination of coastal pumping would nearly double the basin sustainable yield.

Watershed Management. Groundwater quality and stability could be enhanced by implementing watershed management measures that would monitor water resources, reduce nitrate pollution, protect key areas of recharge, meter water use, and specify a well management protocol. These management plans would help to preserve water resources in the Pajaro Valley and would provide data for future evaluation of basin conditions.

Additional water supply, storage and distribution projects will be required in order to balance the basin and eliminate seawater intrusion.

As shown in Table ES-2, water conservation and pumping management alone will not satisfy the water demand within the Pajaro Valley, and development of additional water supplies is essential to balancing the groundwater basin. Although basin balance would be achieved by developing 16,000 AFY of supplemental supply, PVIGSM results indicate that elimination of approximately 18,500 AFY of pumping along the coast is required to eliminate seawater intrusion.

Table ES-2: Required Additional Water Supplies, Assuming Water Conservation

Optimization Option	Balancing Current Conditions (AFY)	Balancing 2040 Conditions (AFY)
Agricultural Demand	59,300	64,400
Urban Demand	12,200	16,100
Total Demand	**71,500**	**80,500**
Corralitos Filter Plant	(1,100)	(1,100)
Other Surface Water Diversions	(1,000)	(1,000)
Total Groundwater Demand[a]	**69,000 (rounded)**	**78,000 (rounded)**
Current Basin Sustainable Yield	(24,000)	(24,000)
Future Increased Yield Due to Pumping Management at Coast and Reliable Supplemental Supply Projects[b]	(24,000)	(24,000)
Water Demand without Conservation	**21,000**	**30,000**
Increased Agricultural Conservation (Achieved by 2010)[c]	(4,500)	(4,500)
Increased Urban Conservation (Achieved by 2010)[c]	(500)	(660)
Required Additional Supply[d]	**16,000**	**25,000 (rounded)**

Footnotes:

a. Values rounded to two significant figures or to the nearest thousand to represent the values significant accuracy.
b. The amount achieved if supply is 100% reliable. With less reliable supply, the amount of increased yield would be lower. The amount of increased groundwater yield of the Alternatives (except Local-Only Alternative) developed in Section 5 would be 24,000 AFY given their level reliability.
c. Conservation to be achieved over several years, but is included in both Current Conditions and 2040 Conditions to show impact on levels of demand for both conditions.
d. This value represents the supplemental supplies required to meet the overall water balance in the basin assuming 100% supply reliability. However, PVIGSM results indicate that elimination of approximately 18,500 AFY of pumping along the coast is required to eliminate seawater intrusion.

The quality of the additional water supplies is also important.

Although Table ES-2 provides a breakdown of the *quantity* of additional water supplies required to balance the basin, it does not address the water *quality* requirements for these supplies. The water supplied to balance the basin must be suitable for its intended uses. Specific water quality parameters of concern for agricultural irrigation include:

- Salinity,
- Sodium hazard,
- Chloride and sodium toxicity, and
- Pathogens (such as *Phytophthora).*

The tolerance of crops to various water quality constituents can vary by crop and soil type, and different varieties of the same crop can exhibit markedly different growth responses to waters of similar quality. Crop tolerance to (1) constituents in the irrigation water, (2) soil conditions, and (3) prevailing climate are important factors in assessing the suitability of a particular water for irrigation. In order to minimize health impacts and optimize crop yield, the stated water quality objectives are 500 mg/L TDS, 140 mg/L chloride, and an adjusted SAR of 3.0. Only water supplies that meet these standards, or can be treated or blended to meet these standards, are considered viable supplies in the Revised BMP.

The Revised BMP identified and assessed a wide range of additional water supply sources.

Listed below are the projects that were analyzed in the Revised BMP. They were combined in various ways to develop the range of alternatives presented above. Analysis of these projects allowed an exhaustive assessment of the role that local water and out of basin supplies could play in an overall strategy to balance the groundwater basin and stop seawater intrusion. Table ES-3 identifies which water supply projects were selected for the given strategies and reiterates the issues associated with each project. Locations of these project components are shown in Figure ES-2, and brief descriptions of each project are provided below:

Coastal Distribution System (CDS). This project is necessary to eliminate coastal pumping and optimize the basin without affecting current agricultural practices in coastal areas. The CDS will deliver water to those areas where coastal pumping will be eliminated, and will consist of nearly 26 to 30 miles of pipeline delivering water to over 200 agricultural parcels. (See Figure 4-2).

Harkins Slough Project w/ Supplemental Wells and Connection. This project involves seasonal percolation of diverted Harkins Slough water into the Harkins Slough recharge basin for storage until the irrigation season, when it will be extracted and delivered to the CDS for distribution. This project also includes the construction of additional water supply wells to supplement the deliveries of extracted Harkins Slough water. The construction of the Harkins Slough diversion structure and recharge basin was completed in Fall 2001. The expected yield from Harkins Slough is approximately 1,100 AFY, with additional water being provided by the supplemental wells. (See Figure 4-1).

Murphy Crossing with Recharge Basins. The Murphy Crossing Project involves the diversion of water from the Pajaro River between December and May for direct irrigation use and for storage in

the underlying aquifer at four recharge basins. During the summer irrigation season, the stored water would be extracted and used for irrigation purposes. The expected yield for the Murphy Crossing Project is approximately 1,600 AFY, including both direct use and underground storage. However, this project cannot be implemented until environmental concerns brought forth by the Department of Fish and Game (DFG) and the National Marine Fisheries Service (NMFS) are addressed. (See Figure 4-6).

Watsonville Slough with North Dunes Recharge Basin. The Watsonville Slough Project would expand on the Harkins Slough Project by diverting water from Watsonville Slough between December and May for storage in the groundwater aquifer. Diverted water would be filtered and stored in the shallow groundwater aquifer at the proposed North Dunes Recharge Basin. The expected yield for the Watsonville Slough Project is approximately 1,200 AFY. Implementation of this project will require the PVWMA to obtain a water rights permit, and a likely mitigation measure for this permit could be restoration of Watsonville Slough. (See Figure 4-7).

College Lake, Pinto Lake Diversion. The College Lake Project would increase the total storage capacity of the lake from approximately 1,400 AF to approximately 2,000 AF via construction of a new headgate/weir structure. Diversion of water to the lake from the Pinto Lake drainage channel would increase total flow into the lake. Water would remain in College Lake until needed to meet irrigation demands. (See Figure 4-8).

The expected yield for the College Lake Project is approximately 1,800 AFY. Although the PVWMA submitted a water rights application for the College Lake Project to the SWRCB in 1995 and completed CEQA evaluation in May 1999, protests by DFG and NMFS have slowed the permitting process. This project cannot be implemented until the concerns regarding steelhead trout raised by these agencies are addressed and a water rights permit for the Pinto Lake diversion is secured.

Expanded College Lake Project w/ Pinto Lake, Corralitos Creek, Harkins Slough, and Watsonville Slough Diversions, and Aquifer Storage and Recovery. This project would build upon the College Lake project discussed above, and would increase the total storage capacity of College Lake to 4,600 AFY via construction of an earthen dam and saddle dam and additional diversions from Corralitos Creek, Harkins Slough and Watsonville Slough. This project would also involve the use of Aquifer Storage and Recovery (ASR), injecting surface water through wells into the groundwater aquifers for later extraction and delivery for irrigation purposes. (See Figure 4-9).

The expected yield for the Expanded College Lake Project is approximately 6,700 AFY. In order to implement this project, the PVWMA would have to (1) coordinate with DFG and NMFS to address environmental concerns, (2) coordinate with the Division of Safety of Dams to secure the necessary permits for dam construction, (3) secure a water rights permit for Corralitos Creek, and (4) coordinate with the Regional Water Quality Control Board (RWQCB) to establish water quality requirements for use of ASR.

Recycled Water (4,000 AFY) with Blending Facility. This project involves the construction of additional treatment processes and a blending facility at the Watsonville Wastewater Treatment Facility (WWTF) for production of recycled water suitable for irrigation purposes. Water quality data indicate that the recycled water salinity concentrations and TDS values exceed irrigation water quality objectives; therefore, a blending facility or additional treatment will be required to reduce these concentrations. The expected yield of the Recycled Water Project is approximately 4,000 AFY. Implementation of this project will require continued coordination efforts between the PVWMA and the City of Watsonville, as well as additional permits for the WWTF operations. (See Figure 4-3).

Recycled Water Project, Southeast Dunes Recharge Basin (6,000 AFY). This project includes the construction of the recycled water treatment facilities and blending facility described above, along with the Southeast Dunes Recharge Basin for underground storage of recycled water in the shallow groundwater aquifer during low irrigation demand periods. Stored water would then be extracted during the irrigation season. Water quality concerns are as described in the previous project; however, the Regional Water Quality Control Board may impose additional levels of treatment due to concerns over recharge consisting of recycled water. The expected yield of this project is 6,000 AFY. Implementation of this project will require various funding mechanisms and coordination with jurisdictional agencies. (See Figure 4-4).

Recycled Water Project, Harkins Slough Recharge Basin, North Dunes Recharge Basin (7,700 AFY). This project combines the Recycled Water Project and blending facility with the Harkins Slough and North Dunes Recharge Basins to provide underground storage of recycled water in the shallow groundwater aquifer. Water would then be extracted during the irrigation season via extraction wells constructed at both recharge basins. Water quality concerns are the same as described for the other recycled water projects. The expected yield of this project is approximately 7,700 AFY. Funding and permitting will also be the main implementation issues for construction of this project. (See Figure 4-5).

Inland Distribution System. This project involves construction of the Inland Distribution System (IDS) to provide a supplemental supply of water to agricultural users located east of Highway 1. The purpose of the larger distribution system is to provide a greater reduction in overall groundwater pumping during periods of high availability of supplemental water supplies, providing a greater reduction in total basin pumping, and thus allowing a greater amount of groundwater to remain in storage. The increased amount of groundwater left in storage is then pumped during periods of time when the surface supplies are less than adequate to meet the irrigation needs of the IDS, with the pumped groundwater serving to supplement the available surface supplies. The IDS will deliver water to those areas where coastal pumping will be eliminated, and will consist of nearly 20 miles of pipeline. (See Figure 4-11).

Import Water Project. This project involves the construction of a 23-mile import pipeline for transport of CVP water to the proposed CDS. The PVWMA currently has a future CVP entitlement of 19,900 AFY and an existing contract for 6,260 AFY (acquired from Mercy Springs Water District) from the United States Bureau of Reclamation (USBR). Additional CVP water could be purchased as needed from other water contractors (See Figure 4-10).

However, contracting for the entitlement of 19,900 AFY requires resolution of issues relating to Title 34 – Central Valley Project Improvement Act (CVPIA). The CVPIA restricted the USBR from entering into new long-term water supply contracts until it fulfills various environmental requirements. Since the USBR is not expected to fulfill these requirements for several years, negotiations for a new CVP contract for PVWMA's 19,900 AFY entitlement have been delayed. Alternatively, the PVWMA could purchase additional supplies similar to its purchase of the Mercy Springs Water District CVP contract.

The Draft BMP 2000 evaluated three alternatives for construction of the import pipeline: 42", 54" and 60"- diameter pipelines. These projects and an Out-of-Basin Water Banking program are discussed below:

60-inch Import Water Project w/ Inland Distribution System (IDS) and Supplemental Wells. This project would involve the construction of a 60" import pipeline to support an initial maximum

flow rate of 75 cfs, along with an IDS and supplemental wells to provide in-lieu recharge and dry weather supply, respectively. The larger diameter pipeline provides greater flexibility to adapt to potential increases in future water needs. The expected yield for this project is approximately 10,300 AFY.

54-inch Import Water Pipeline with Aquifer Storage and Recovery. This project would involve the construction of a 54" import pipeline to support a maximum flow rate of 75 cfs, and would use ASR (injection/extraction wells) to store and recover CVP water from underground aquifers in the basin. Prior to injection, the CVP water would be filtered for compliance with water quality requirements. The expected yield for this project is approximately 11,900 AFY.

42-inch Import Water Pipeline with Aquifer Storage and Recovery. This project is similar to the 54" pipeline project described above except that the smaller pipeline diameter would only support a maximum flow rate of 40 cfs. The expected yield for this project is approximately 6,900 AFY.

Out-of-Basin Banking Option. An Out-of-Basin Water Banking program would establish a basis for the PVWMA to partner with another CVP contractor to allow PVWMA CVP water supplies to be delivered to another CVP contractor during wet years, and during dry years, the CVP contractor would provide a portion of their CVP water to the PVWMA. This option increases the reliability of the CVP supply, and minimizes the need for additional local storage facilities and the size of delivery pipelines. Out-of-Basin Banking is contingent on developing and negotiating an agreement with one or several CVP contractors/agencies. The expected yield for an Out-of-Basin banking option could be equivalent to either the in-basin in-lieu recharge or the in-basin ASR options.

Bolsa de San Cayetano, Pajaro River Diversion. This project would provide surface storage of 5,000 AF for Pajaro River diversions and would capture limited runoff from a 723-acre drainage area. The expected yield of this project is 5,000 AFY; however, there are significant seismic hazards associated with this project and implementation would require considerable effort with regard to permitting and environmental coordination. (See Figure 4-12).

Seawater Desalination. This project would involve the construction of a desalination (reverse osmosis) plant for treatment of Monterey Bay seawater to provide agricultural irrigation water. The quality of water and yield of this plant would be dependent on the design of the treatment system. Although this project would produce a highly reliable water supply, implementation of this project is inhibited by its high cost of operation, particularly the cost of energy, and the difficulty in securing a discharge permit for the brine discharge.

Table ES-3: Projects Selected for Each Basin Management Strategy

Project	BMP 2000	Local-Only	Modified Local	Modified BMP	Issues and Comments
5,000 AF Water Conservation	..	..	..	..	To be achieved by 2007
Harkins Slough Project	..	..	..	..	Nearly complete.
Coastal Distribution System	..	..	..	..	Necessary to eliminate coastal pumping to maximize groundwater yield.
Recycled Water Project (4,000 AFY)	..			..	Blending facility required to meet water quality requirements; additional permits required.
Recycled Water Project (6,000 AFY)			..		Blending facility required to meet water quality requirements; additional permits required; additional treatment for recharge of recycled water.
Recycled Water Project (7,700 AFY)		..			Blending facility required to meet water quality requirements; additional permits required; additional treatment for recharge of recycled water.
Murphy Crossing Project	..				Protests from DFG; additional studies requested by NMFS.
Watsonville Slough Project		..	..		Water rights permit; restoration of the slough probably required.
College Lake Project			..		Protests by DFG and NMFS; water rights permit required.
Expanded College Lake Project		..			Same issues as above two projects; plus water rights permit required for Corralitos Creek. Injection may require reverse osmosis treatment.
60” Import Water Project	..				Implementation requires resolution of Measures D and K and acquisition of CVP contracts.
54” Import Water Project				..	Implementation requires resolution of Measures D and K and acquisition of CVP contracts; requires filtration for injection.
42” Import Water Project			..		Implementation requires resolution of Measures D and K and acquisition of CVP contracts; requires filtration for injection.
Additional 5,000 AFY Water Conservation via Land Fallowing		..			Requires the equivalent of 2,200 acres of basin-wide land fallowing, or approximately 800 to 1,000 acres of fallowing near the coast.
Bolsa de San Cayetano Project					Significant seismic, environmental and cost issues eliminated this component.
Seawater Desalination					Permitting difficulties for disposal of brine; cost-prohibitive.

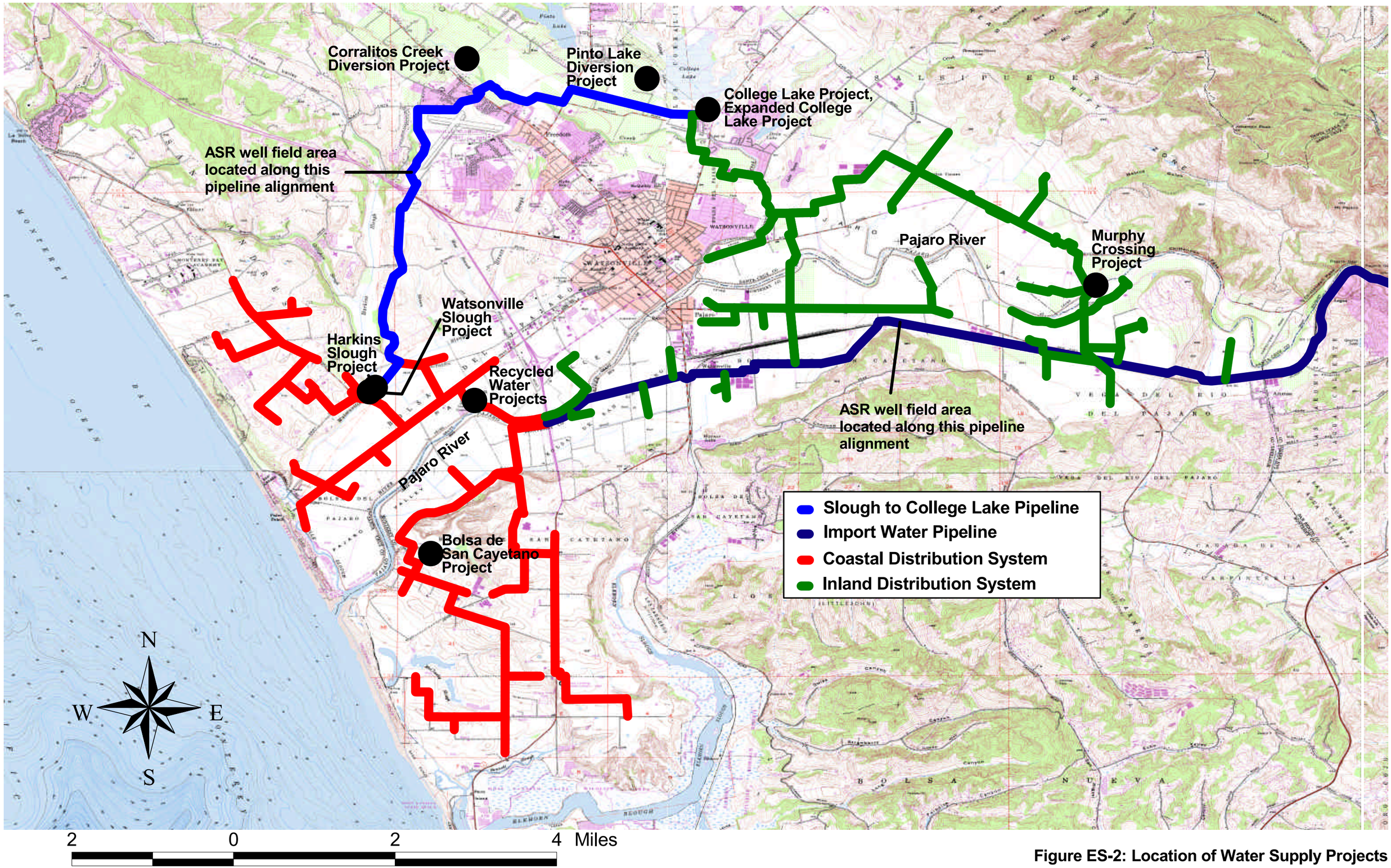


Figure ES-2: Location of Water Supply Projects

Several criteria were used to assess each basin management strategy.

To further differentiate between the four basin management strategies, each alternative was evaluated based on the following non cost criteria:

- **Can Meet Existing and Future Water Needs**. This criterion evaluates the ability of the selected alternative to provide the infrastructure and water supply needed to meet existing and future demands. This is a key element for a given strategy because population growth and agricultural crop changes in the Pajaro Valley are expected to significantly increase water demand.
- **Limited Dependence on Out-of-Basin Water Supplies**. This criterion evaluates the dependence of the selected alternative on out-of-basin supplies. Strategies that mainly rely on the development of water supplies that will be directly controlled by the PVWMA are considered to be 'locally sustainable,' although the effects of a drought may be greater than for an import alternative.
- **Minimizes Regulatory Hurdles.** This criterion evaluates the likelihood of being able to implement the selected alternative without having to overcome significant regulatory or permitting hurdles. An example of such a hurdle would be obtaining a permit for percolation of recycled water since it is unclear whether the RWQCB and other regulatory agencies would allow recycled water percolation without advanced treatment (e.g. reverse osmosis) beyond Title 22 levels.
- **Meets Water Quality Goals**. This criterion evaluates the ability of the selected alternative to provide a water supply of suitable quality for its intended users. For example, alternative strategies that rely heavily on recycled water are expected to have the lowest water quality while alternative strategies that rely more on CVP water are expected to have the highest water quality.
- **Economic Impact**. This criterion evaluates the impact to the local economy that would result from the selected alternative. For example, strategies that have higher costs or require fallowing of significant amounts of farmland would have the greatest economic impacts.

Cost was another criterion used to compare the four basin management strategies. In terms of cost per acre-foot to meet current water demands, the Modified BMP 2000 alternative was found to be the most cost-effective with estimated cost of $198/AF. The Local-Only alternative has the highest unit cost at $259/AF. Furthermore, the Local-Only alternative has significantly higher cost risks than the Modified BMP alternative. These costs risks are related to the cost of meeting regulatory requirements for groundwater recharge with recycled effluent and for the surface water diversions that comprise the Local-Only alternative. For example, if the Department of Health Services requires higher levels of treatment for groundwater recharge with recycled effluent, the unit cost of the Local-Only Alternative could rise by as much as $30/AF, which would result in a cost of $289/AF. (The unit costs in this paragraph assume a uniform flat water rate.)

The unit costs presented in the previous paragraph relate to the cost of meeting today's water demand in the PVWMA service area. The costs of meeting future demands would inherently be greater since additional supplies would have to be developed. The costs for meeting future demands need further development, but would include additional projects to provide increased supply, as well as a pro rata share of the project costs to balance the groundwater basin at today's conditions. As do existing water users, future water users benefit from the projects that balance the basin at today's conditions.

A summary comparison of each basin management strategy with respect to the criteria identified above is provided in Table ES-4.

Table ES-4: Summary Comparison of the Basin Management Strategies

Comparison Criteria	BMP 2000	Local - Only	Modified Local	Modified BMP
Total Yield (AFY)	64,000	56,000	64,000	64,000
Capital Costs ($ Million)[a]	$162	$128	$148	$138
Adjusted Total Annualized Costs ($ Million)[b]	$14.5	$14.6	$13.7	$12.6
Cost per AF[c] ($/AF)	$226	$259	$215	$198
Cost per AF + PVWMA Delivery Charge to Those Receiving Delivered Water ($/AF) [d]	$318	$351	$307	$290
Can Meet Future Water Demands?	Ö		Ö	Ö
Limited dependence on out-of-basin supplies?		Ö	Ö	
Minimizes significant regulatory/implementation hurdles?	Ö			Ö
Meets Water Quality Goals?	Ö		Ö[e]	Ö
Requires Land Fallowing or Other Measures with Significant Economic Impact?		Ö		

Footnotes:

a. Includes pro rata share of costs to balance basin at today's conditions and costs of additional water supplies
b. Annualized costs included annualized capital cost, operation & maintenance costs
c. Unit cost is applied to all water users based on first quarter, 2001 construction costs (assumes uniform flat rate)
d. Includes delivery charge of $92/AF for those customers receiving delivered water
e. Water quality goals are met only during certain times of the year

Conclusions

Conclusions that can be drawn from the comparison of Basin Management Strategies presented in Table ES-4 include:

- The Local-Only alternative has the lowest capital cost, but high operations costs, does not meet water quality goals, does not provide the ability to meet future water needs, and is the most costly alternative on a cost per acre foot basis.
- The BMP 2000 alternative has the highest capital cost and is the second most costly alternative on a cost per acre-foot basis.
- The Modified Local alternative is the second least expensive on a cost per acre-foot basis, relies heavily on local supplies, but cannot consistently meet water quality objectives.

- The Modified BMP alternative is the least costly on a cost per acre-foot basis, meets the water quality goals, and provides flexibility to meet future demands. For these reasons it formed the basis of the Recommended Alternative.

In developing the Recommended Alternative, the Modified BMP alternative was enhanced to include additional CVP water supply to allow greater flexibility in stopping seawater intrusion and balancing water demands during peak conditions. (These changes are described in Section 6.)

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1 Purpose of the Revised BMP

Pumping of groundwater to meet water demand within the Pajaro Valley Water Management Agency's (PVWMA) service area has caused a significant drop in groundwater elevations, resulting in seawater intrusion. These impacts indicate that current groundwater pumping practices are in excess of the sustainable yield of the groundwater basin, and must be corrected. Continued over pumping of the groundwater basin will lead to continued seawater intrusion, rendering an ever increasing portion of the groundwater basin unusable for agricultural irrigation and potable uses.

The purpose of the Revised Basin Management Plan (BMP) is to present and evaluate basin management strategies and to select a Recommended Alternative that will enable the PVWMA to:

- Balance water demand within the PVWMA service area with sustainable water supplies;
- Prevent seawater intrusion in the area served by the PVWMA; and
- Initiate long-range programs to protect water supply and quality within the basin.

The management strategies evaluated in this plan include a range of potential projects dealing with development of local surface water supplies, recycling of treated water from Watsonville Wastewater Treatment Facility (WWTF), storage of water in the groundwater aquifers (groundwater banking) for dry years, storage of water for delivery during irrigation demand, and importation of water from the Central Valley Project (CVP). Also included are possible non-structural projects such as demand management measures, modification of pumping practices, and land fallowing.

Each strategy was developed as a concept initiated by the public and/or the PVWMA. A full evaluation of all potential projects was conducted, both inside and outside the PVWMA service area. The resulting strategies are presented in this document, and are considered to be the best scenarios for each concept.

- **BMP 2000 Alternative.** A recommended alternative was previously identified in the original draft BMP 2000 document. This strategy involved the implementation of several projects, including importation of water, storage of water in the groundwater aquifers (banking) via in-lieu recharge, development of local water supplies, and water conservation. However, public review of that document indicated the need to further assess the merits of other management alternatives. This strategy is included in the Revised BMP for comparison purposes.

- **Local-Only Alternative.** This strategy focuses solely on the development of local water supplies and implementation of demand reduction measures to balance the basin. It does not include any projects that involve importation of water from outside sources, but does develop storage of local supplies in both College Lake and in the groundwater aquifers through percolation and aquifer storage and recovery[1] (ASR).

- **Modified Local Alternative.** This strategy consists of a small import water project (42-inch pipeline) with ASR and local water supply projects including the Harkins Slough Project, a Watsonville Slough Project with North Dunes Recharge Basin, a College Lake Project with Pinto Lake Diversion, and a Recycled Water Project with the Southeast Recharge Basin. This alternative is a modification of the Local-Only Alternative eliminating land retirement and incorporating a minimum diameter import pipeline.

[1] Aquifer storage and recovery consists of injection and extraction wells used to bank water during above normal water years and provide supplemental supply during below normal water years.

- **Modified BMP Alternative**. This strategy consists of an import water project with ASR and local water supply projects including the Recycled Water Project and the Harkins Slough Project. This alternative is a modification of the BMP 2000 Alternative eliminating the Murphy Crossing Project and the Inland Distribution System. This alternative evaluates ASR in conjunction with CVP supply and a reduced import pipeline size.

These strategies build upon the 1993 BMP and incorporate several of the local water supply projects that were recommended in that Plan. Since completion of the 1993 BMP, the PVWMA has conducted studies and evaluations of local water supply projects, published a number of studies, including the draft BMP 2000, and is completing construction of the Harkins Slough Project. In addition, the PVWMA has completed extensive groundwater evaluations and modeling that have been used to quantify the extent, magnitude, and character of the overdraft situation. This information was used in the development and assessment of the strategies presented herein.

Following completion of the Draft Revised BMP, the PVMWA proceeded with public workshops and outreach effort to engage the public and stakeholders of the considered strategies. The public was encouraged to comment on the proposed projects and strategies so that the PVWMA could finalize a recommended strategy that is responsive to the concerns and needs of its water users. A companion draft Environmental Impact Report (EIR) was also completed in September 2001 and was available for public review and comment. The Final EIR is scheduled for certification by the PVWMA Board of Directors in February 2002.

The Modified BMP 2000 Alternative was selected as the basis for the Recommended Alternative based on guidance from the PVMWA Board of Directors. The PVWMA Board of Directors identified the Modified BMP 2000 Alternative with minor enhancements as the Recommended Alternative after taking into account the public and stakeholder input, engineering and cost evaluations, environmental impacts, and direction from PVWMA staff. The Recommended Alternative is summarized below and is described in detail in Section 6.

- **Recommended Alternative**. This alternative consists of an import water project with out-of-basin banking, and local water supply projects that include the Recycled Water Project and the Harkins Slough Project. In addition, five supplemental wells are to be constructed along the import pipeline alignment. Flexibility is provided to allow sale of imported water to users along the pipeline alignment, if there is interest by these growers. This alternative also includes recommendations to enhance and develop existing and new watershed management programs.

The Revised BMP includes an implementation section (Section 7) identifying schedules and important tasks, and a water rate section (Section 8) describing the recommended funding plan. Following completion, the Revised BMP will be presented to the PVWMA Board of Directors for approval and adoption of a Recommended Alternative strategy. The Final EIR will also be presented to the Board of Directors for its certification.

1.1 Organization of the Revised BMP

The Revised BMP is organized into eight major sections as follows:

Section 1 – Purpose of the Revised BMP. This section describes the purpose of the Revised BMP and its relationship to the 1993 BMP and the draft BMP 2000. Section 1 also presents the organization of this report.

Section 2 – State of the Basin. This section describes the current state of the groundwater basin that provides nearly all of the water used in the PVWMA service area. It describes the degree of overdraft that has occurred in the basin and how this has caused seawater intrusion. This section also describes the sustainable yield of the groundwater basin under current irrigation, pumping, and water demand conditions.

Section 3 – Management Measures. This section describes the options available to minimize water demand as well as options than can be used to increase the sustainable yield of the groundwater basin. These options include water conservation and land retirement. This section also describes watershed management programs that could be implemented to protect water resources in the Pajaro basin.

Section 4 – New Water Supply Projects. This section describes the new water supply projects that could be used in conjunction with measures from Section 3 to balance the basin. These projects include new surface water supplies, recycled water, importation of water from outside the basin, and water storage options.

Section 5 – Basin Management Strategies. This section combines the projects described in Sections 3 and 4 in different combinations to develop alternative Basin Management Plans. The alternatives presented range from total reliance on local water supplies to major reliance on imported water supplies. A total of four strategies are presented and compared on non-cost and cost bases.

Section 6 – Recommended Alternative. This section details the Recommended Alternative including water conservation, import water project with out-of-basin banking, water recycling project, Harkins Slough Project, and various watershed management programs. The Recommended Alternative was identified based upon guidance from the PVWMA Board of Directors and public input. In addition, this section includes a discussion of the selection process and the outreach efforts completed by the PVMWA during development of the Revised BMP.

Section 7 – Implementation. This section identifies schedules and outlines important implementation tasks of the Recommended Alternative.

Section 8 – Potential Rate Plan for Recommended Alternative. This section identifies a differential flat rate structure as the recommended potential rate structure to be implemented to recover project costs for the Recommended Alternative. This section also includes discussion on rate limitations, other potential rate structures, and the public process utilized to identify the recommend rate plan.

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2 State of the Basin

This section of the Revised BMP summarizes the groundwater basin conditions within the PVWMA service area. The purpose of this section is to present:

1. The current state of the basin;
2. Underlying assumptions for the Pajaro Valley Integrated Groundwater Surface Water Model (PVIGSM) development; and
3. Results of the basin sustainable yield analyses for existing and future conditions.

Most of the data, references, and conclusions are taken from the PVWMA State of the Basin Report distributed by the Agency in April 2001 and the PVIGSM Technical Memoranda (TM) finalized in June 2000 (Montgomery Watson/AT Associates, 1999-2000). The State of the Basin Report and the PVIGSM Technical Memoranda provide a more thorough presentation of the Pajaro Valley groundwater basin geology, hydrology, and hydrogeology.

As documented in numerous groundwater studies conducted over the past 55 years, the Pajaro Valley groundwater basin is in an overdraft condition. An overdraft condition occurs when the amount of water withdrawn exceeds the amount of water replenishing the basin. The rate of seawater intrusion in the groundwater basin has also been increasing recently. In general, a combination of both overdraft conditions and seawater intrusion has limited the fresh groundwater supply needed to sustain the long-term agricultural and urban economy of the Pajaro Valley.

The first step in developing and assessing scenarios to alleviate the basin overdraft and seawater intrusion is to develop an understanding of the magnitude of the problem. By modeling the current 'baseline' conditions, the sustainable yield of the basin (the maximum amount of water that can be extracted from a groundwater basin without causing adverse effects) can be estimated. With this estimate of sustainable yield in hand, alternative strategies to balance the basin can be developed.

The PVIGSM was developed to assess the behavior of the groundwater basin under current baseline conditions and to assess the merits of alternative strategies to balance the basin. It is a dynamic finite element model that simulates the balance of groundwater in the Pajaro Valley basin using geologic and hydrologic conditions, current pumping conditions, water supply and demand conditions, and other basin characteristics. The model uses numerical algorithms to solve coupled differential equations and creates a mass balance within the model grid. The PVIGSM was developed to assist in:

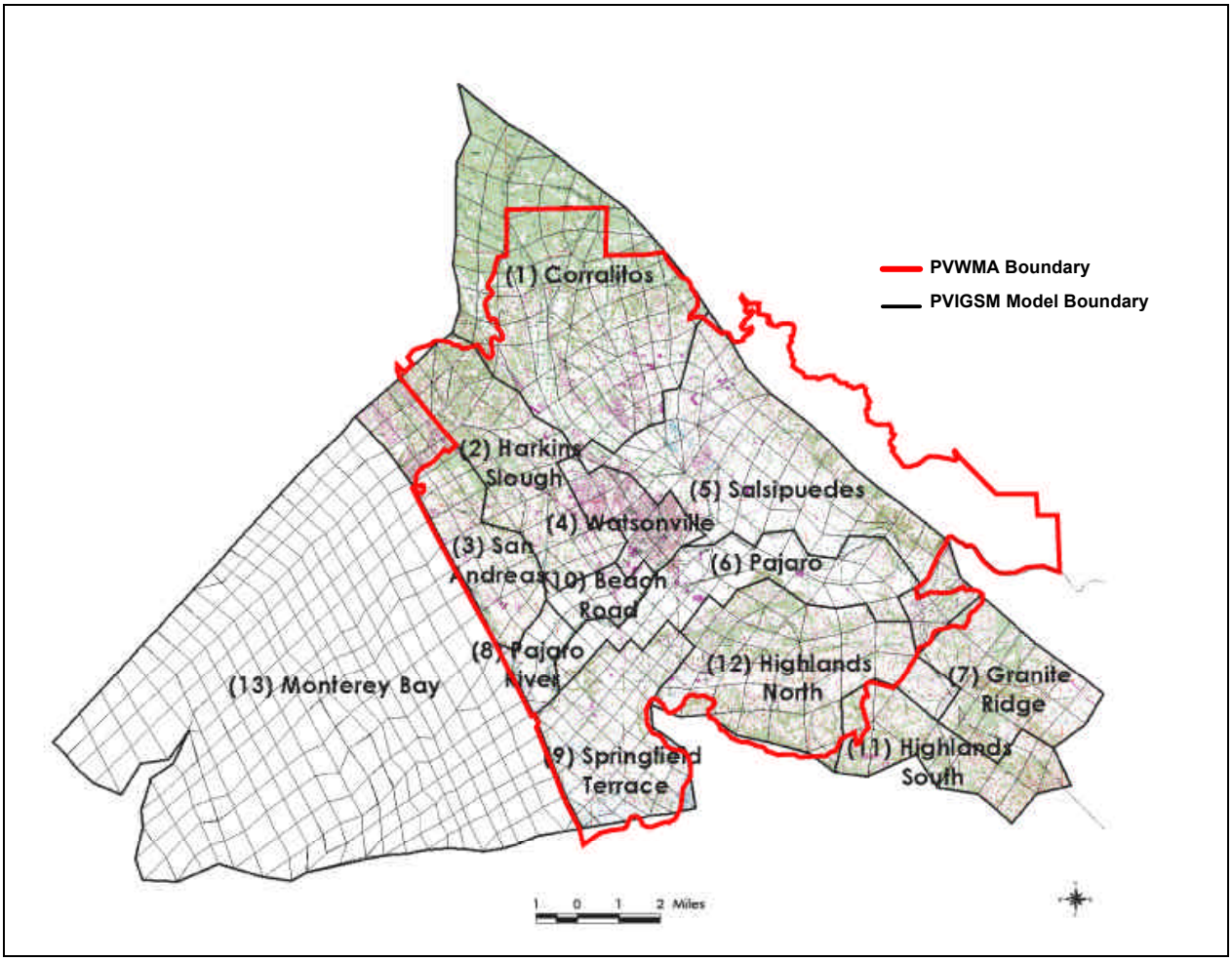
- Gaining knowledge of the historical conditions of the groundwater basin;
- Evaluating the present state of the groundwater basin;
- Estimating the sustainable yield of the basin; and
- Evaluating the impact of potential alternative water supply scenarios on the integrated surface water and groundwater system.

2.1 Basin Boundaries

This section describes the hydrologic boundaries of the Pajaro Valley groundwater basin used in the development of the PVIGSM, the political boundaries of the PVWMA, and the relationship between the two. The boundaries of the PVIGSM model area were generally drawn along the lines of hydrogeologic features in order to make the model as accurate as possible. These boundaries are not exactly the same as

the boundaries of the PVWMA. Figure 2-1 shows the boundaries of both the model and the PVWMA service area.

Figure 2-1: PVWMA Service Area and PVIGSM Model Area



Notes:
1. Total Model Area (less Monterey Bay) = 96,500 Acres
2. PVWMA Area = 79,600 Acres

Results from the model were adjusted to account for the area of the model outside of the PVWMA service area. Because of the high degree of overlap between the two areas, the adjustments were modest and did not affect the validity of the model results.

The total model area is approximately 146,700 acres, of which 96,500 acres are on-shore lands. The PVWMA service area of 79,600 acres lies generally within the on-shore model area except for a mountainous area on the eastern boundary that has little arable land and is of little consequence to the hydrogeology of the service area.

Political and model boundaries are described below:

Westerly Boundary: The western boundary of the Pajaro Valley groundwater basin extends far offshore under the Pacific Ocean. There are no known faults or other physical boundaries that prevent seawater intrusion when groundwater levels are low. The boundary condition was set to simulate constant head uniformly increasing from the coast to offshore, thereby simulating the density gradient due to seawater intrusion.

The PVWMA jurisdictional boundary follows the coastline and parallels the Pajaro Valley groundwater basin.

Easterly Boundary: The San Andreas Fault trends along the eastern edge of the Pajaro Valley. Impermeable rocks east of the fault act as a barrier to groundwater flow into or out of the Pajaro Valley groundwater basin, creating a well-defined geologic boundary for the model. The boundary condition for modeling purposes was set to no groundwater flow and a small amount of simulated surface flow from small watersheds.

The PVWMA jurisdictional boundary parallels the fault line following the Santa Clara and Santa Cruz County border. Although the PVWMA jurisdictional boundary was politically based, it reasonably follows the Pajaro Valley groundwater basin.

Northerly Boundary: The northern boundary is set at the watershed divide. Boundary conditions for the model were set to general head conditions from the Soquel-Aptos basin.

In general, the northern PVMWA boundary is a political boundary. At this boundary, the groundwater basin is shared with areas outside of PVMWA jurisdiction. There is no definitive geologic basis for the northern PVWMA jurisdictional boundary except for those areas where it follows the watershed divide.

Southerly Boundary: The relatively impermeable clays found in Elkhorn Slough to the south of the Pajaro Valley prevent north-south groundwater flows, creating a well-defined geologic barrier. Inland of the Slough, the groundwater can move either north or south depending on the pumping or hydrologic conditions; the groundwater boundary is not well-defined. Boundary conditions for the model were set to general head in the North Monterey County area and constant head at the Elkhorn Slough area.

The PVWMA jurisdictional boundary has both a physical and political basis extending up Elkhorn Slough and to the south of Carneros Creek. In the Elkhorn Slough area, the PVWMA jurisdictional boundary was drawn to follow the groundwater divide. Inland of the slough, the boundary follows the surface water divide.

2.2 Basin Geology

This section describes the shape and structure of the Pajaro Valley groundwater basin and water-bearing formations. A basic understanding of the local basin geology is necessary to appreciate how the Pajaro Valley groundwater basin, although quite complex and composed of many hydrogeologic units, is geologically interconnected and functions as a single groundwater basin. The basin geology will dictate how current groundwater pumping and irrigation practices affect groundwater levels throughout the basin.

The fundamental understanding of the geologic structure of the basin has not changed significantly since the State Water Resources Control Board (SWRCB) first evaluated the basin in 1953, although the amount of information available regarding basin geology has increased in the past 48 years. As part of

the development of the State of the Basin Report, recent well logs and geophysical data were reviewed, and a Geographical Information System (GIS) was used to prepare visual representations of the available geologic data, including cross sections of the basin and maps of the aquifer and aquicludes. This was done to confirm that the model accurately represents the basin geology of the Pajaro Valley.

The water-bearing units in the Pajaro Valley include the alluvial, dune sand, terrace deposits, and the various layers of the Aromas sands and Purisima formation. Table 2-1 summarizes the sediment layers underlying the Pajaro Valley and briefly describes their water-bearing characteristics. Figure 2-2 shows the geologic units exposed at the surface in the Pajaro Valley.

Table 2-1: Water Bearing Units of the Pajaro Valley (Youngest to Oldest)

Formation	General Character	Water-Bearing Properties
Dune Deposits	Unconsolidated, well sorted, fine to medium grained quartzose sand. In part, actively drifting.	Largely unsaturated, but where saturated yields water to wells in small quantity, unconfined.
Alluvium	Unconsolidated gravel, sand, silt, and clay. Underlies the alluvial plain and extends into adjoining stream canyons.	Permeable; yields moderate quantities of water to wells.
Terrace and Pleistocene Eolian Deposits	Cross-bedded gravel, sand, silt, and clay. Marine origin near La Selva Beach. Non-marine elsewhere.	Permeable where sufficiently thick; yields moderate quantities of water to wells.
Aromas Red Sands	Semi-consolidated, quartzose brown to red sand with some clay layers. Deposited in an eolian environment and by meandering and braided streams.	Permeable; yields moderate quantities of water to wells. Main producing aquifer.
Purisima Formation	Poorly indurated sand, silt, clay, and shale; some gravel. Extensive shale beds in lower part of formation. Mostly marine in origin, three subunits locally: upper member is a poorly indurated fine sand with silt and clay layers, some gravel; middle member is a poorly indurated medium to fine sand with silt and clay layers, some gravel; lower member is a poorly indurated sand with and shale layers.	Moderately permeable. Lies at considerable depth beneath the valley area, so tapped by few wells. Water bearing properties are largely unknown, but upper and middle members probably will yield moderate quantities of water.

The majority of wells producing usable water have been developed in the Alluvium and Aromas sands formations in the upper 1,000 feet of the groundwater basin. The geology in this upper stratum is quite complex and is composed of a variety of alluvial materials that mix and intersperse with the Aromas sands. These alluvial materials generally comprise the upper 100 to 200 feet of the basin and vary greatly in composition.

The upper part of the Aromas sands formation is found beneath the alluvium, roughly 100 to 200 feet below sea level, and is the most intensively pumped. The lower part of the Aromas sands formation extends to approximately 900 feet below sea level near the mouth of the Pajaro River. The Aromas sands formation slopes upward to the north, and both its lower and upper parts can be observed at the surface to the north in the Soquel-Aptos area. The Aromas sands thin out toward the northern part of the Pajaro

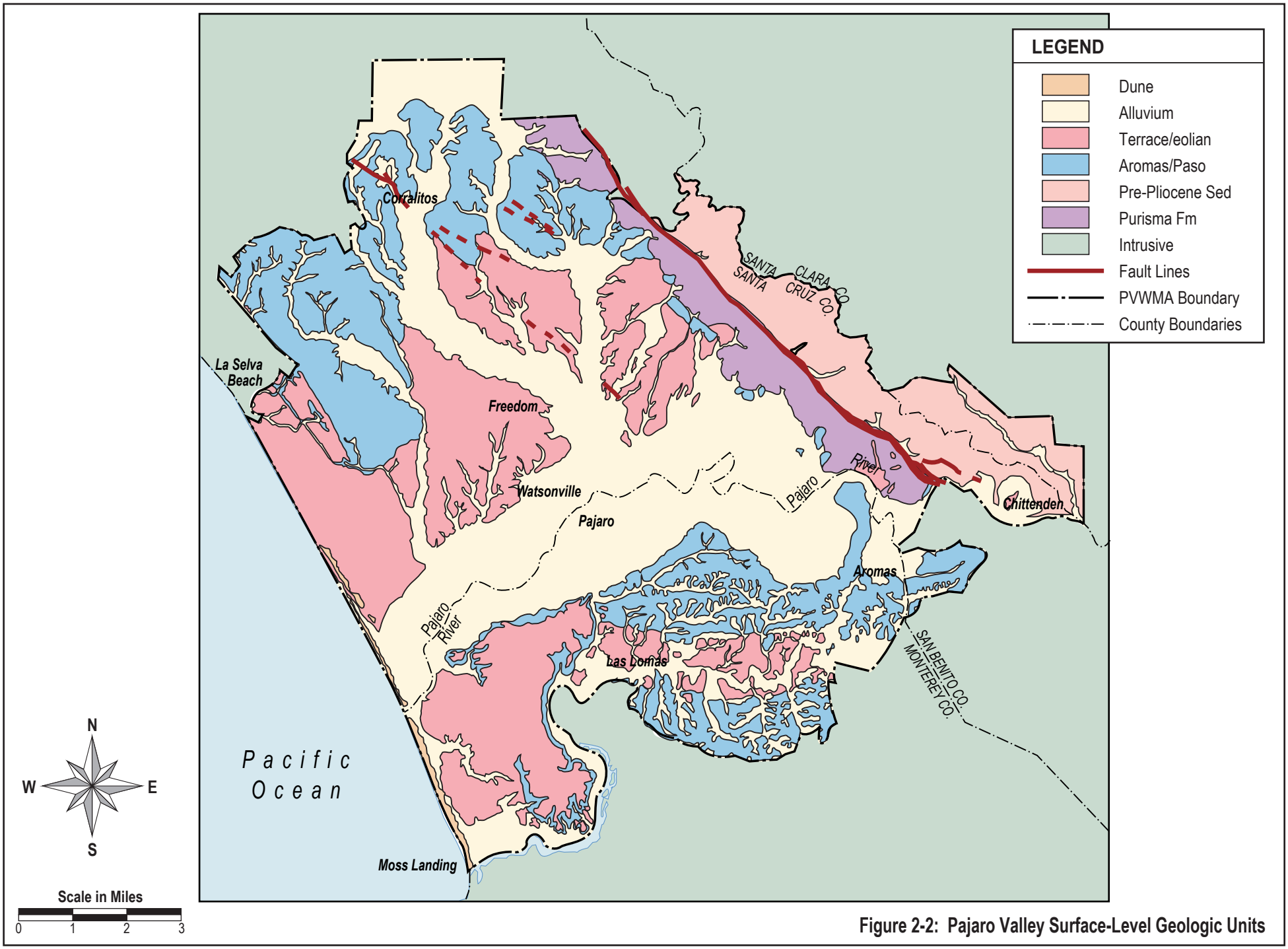


Figure 2-2: Pajaro Valley Surface-Level Geologic Units

Valley and interlace with terrace deposits and other more recent sediments. The Aromas sands formation contains aquifers separated vertically by layers of discontinuous clays that reduce the flow of water both vertically and horizontally. The water-producing zones within the Aromas sands formation can vary greatly in their ability to transmit water. The clay layers between the alluvial material and Aromas aquifers tend to be thin, however thick clay layers are present between the Aromas and Purisima, which account for the significant age difference of water in these two formations (Hanson, 1999).

The primary confining clays are thickest in the middle of the Pajaro Valley and trend roughly parallel to the Pajaro River; they thin inland toward Watsonville and the mountains. As one moves into the Corralitos area, the clay layers become thinner and discontinuous. It should be noted that in the upper part of the aquifers in and around Corralitos, one continuous clay layer creates a perched water region. This perched water table is above the main aquifer, as indicated by water level data. Near the coast, in both the San Andreas and Springfield Terrace areas, these clays are either absent, thinly layered, or discontinuous. Therefore, recharge from streamflow or deep percolation of rainfall can still reach the primary aquifer units in the Aromas sand layers through breaches in the clay, but is constrained by the presence of these less permeable layers.

2.3 Basin Hydrology

This section describes the hydrologic state of the basin and summarizes the hydrological data set that was used to develop the PVIGSM.

2.3.1 Basin Surface Waters

The Pajaro River is the largest coastal stream, measured by annual flows, between San Francisco Bay and the Salinas River. It contributes substantial surface inflow in the Pajaro Valley groundwater basin. The total drainage area of the Pajaro River above the Chittenden gauging station is approximately 1,200 square miles. Annual stream flow, as recorded at the Chittenden gauging station averaged 124,640 AF, with a minimum of only 766 AF in 1997 and a maximum of more than 653,889 AF in 1983 (PVWMA, April 2001).

Salsipuedes Creek is the largest tributary of the Pajaro River within the PVWMA. Salsipuedes Creek receives 11,350 AF of flow from Corralitos Creek and 4,700 AF from the College Lake Watershed. Corralitos Creek drains the northern region of PVWMA through a network of streams, which include Brown, West Branch, Rider Creeks, and an unnamed tributary that drains Pleasant Valley and the eastern side of the Calabasas Hills. The College Lake Watershed drains the northeastern region of the PVWMA service area through a network of streams, which include Green Valley, Casserly, and Hughes Creeks. Together Corralitos Creek and the College Lake Watershed drain approximately 57 miles, which is approximately half of the PVWMA service area.

The small streams that drain the Pajaro Valley have two distinct areas that contribute to flow in the surface water system. In mountainous regions, the streams are underlain by the Purisima formations, while in the lowlands streams are underlain by the Aromas or younger alluvial material. The Purisima is more consolidated and contains more fine-grained sediments than the Aromas or the alluvial fill. Therefore, the mountain and lowland reaches of the streams are distinguished by a ten to twenty-fold difference in mean amounts of runoff, which they contribute to the surface water system (AMBAG, July 1984). A single drainage can contain flow in the mountain region and be completely dry in the lowland region. The lowland region does not contribute flow to the surface water system except in large storm events or winter storm patterns that deliver frequent precipitation over a short amount of time.

College Lake is a seasonal water body in a natural depression created by the Zayante Fault located to the north of the intersection of Holohan Road and Highway 152, near the St. Francis Cemetery. The Lake captures runoff from an 11,000-acre watershed (CH2M Hill, February 1999). The College Lake Reclamation District was formed in the early 1900s by landowners impacted by the flooding of the natural depression. The Reclamation district owns and operates the existing pumps that drain the lake. Under existing conditions pumping commences in April and is completed by May. The lakebed is then planted with 2 to 3 rotations of row crops before it fills with winter runoff.

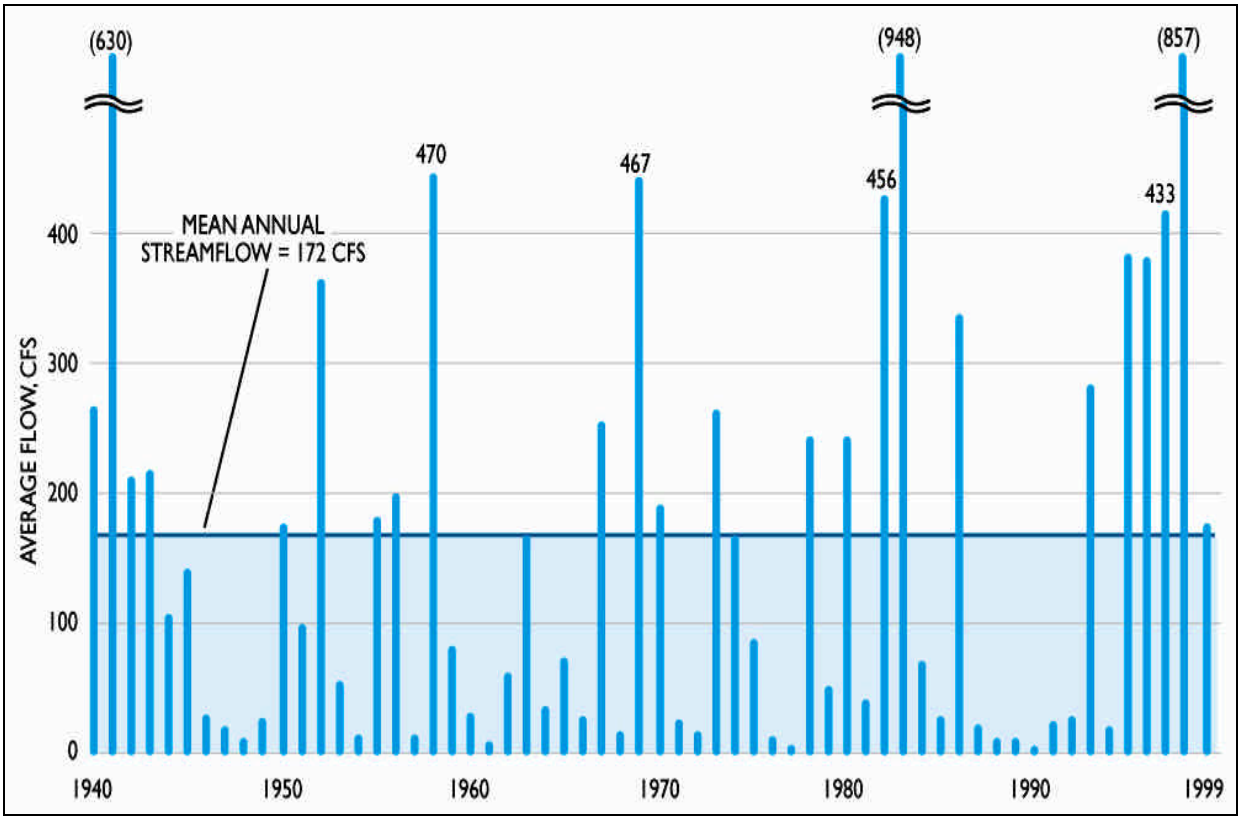
A network of sloughs drains the northwestern region of the PVWMA service area. These sloughs include Harkins, Hansens, West Branch, Galligans, Struve, and Watsonville Sloughs. Harkins Slough has the largest drainage area of all the sloughs and therefore has the largest annual average flux of 3,000 AF. The upper reaches of Harkins Slough originate in Larkin Valley and remain dry throughout most of the year only flowing during and following storm events. In this region of the sloughs, the channel is heavily overgrown and is mostly contained within a ditch along Larkin Valley Road. The lower portions of Harkins Slough are flat with wide flood planes that are mainly contained in a north-south trending valley located in the western region of the PVWMA service area.

Watsonville Slough has an annual average flux of 2,000 AF and receives flow from the Hansens, Struve, and West Branch Slough. Just before Shell Road, Harkins Slough enters Watsonville Slough as a tributary. In this area, the sloughs are generally shallow, open channels with broad floodplains that store, convey, and drain precipitation and irrigation. Slough bottomlands typically contain water year-round, but the slough system experiences great seasonal variation. Water balance indicates that monthly outflows to the Pajaro River Lagoon may range from 1,800 AF in January to less than 100 AF in July with the yearly total averaging 5,000 AF (AMBAG, June 1999).

Carneros Creek enters the southeastern boundary of the PVWMA service area and flows on an east-west trend through the area south of the Pajaro River and discharges into Elkhorn Slough. In large part, this creek and Elkhorn Slough define the southern boundary of the PVWMA service area. Carneros Creek has an annual average discharge of 2,800 AF, which is the largest source of freshwater to the Elkhorn Slough Watershed.

Historic streamflow data for the Pajaro River show wide fluctuations from year to year. Records are available from 1940 to the present. Figure 2-3 shows annual streamflow values at Chittenden gage on the Pajaro River. Flow on the Pajaro can be used as a proxy for the variation of flows in the local streams because the same storm events are also providing inputs to the local surface water system. The annual average surface runoff through these streams and sloughs, excluding the Pajaro River, is 24,070 AF (AMBAG, July 1984).

Figure 2-3: Annual Streamflow Pajaro River at Chittenden



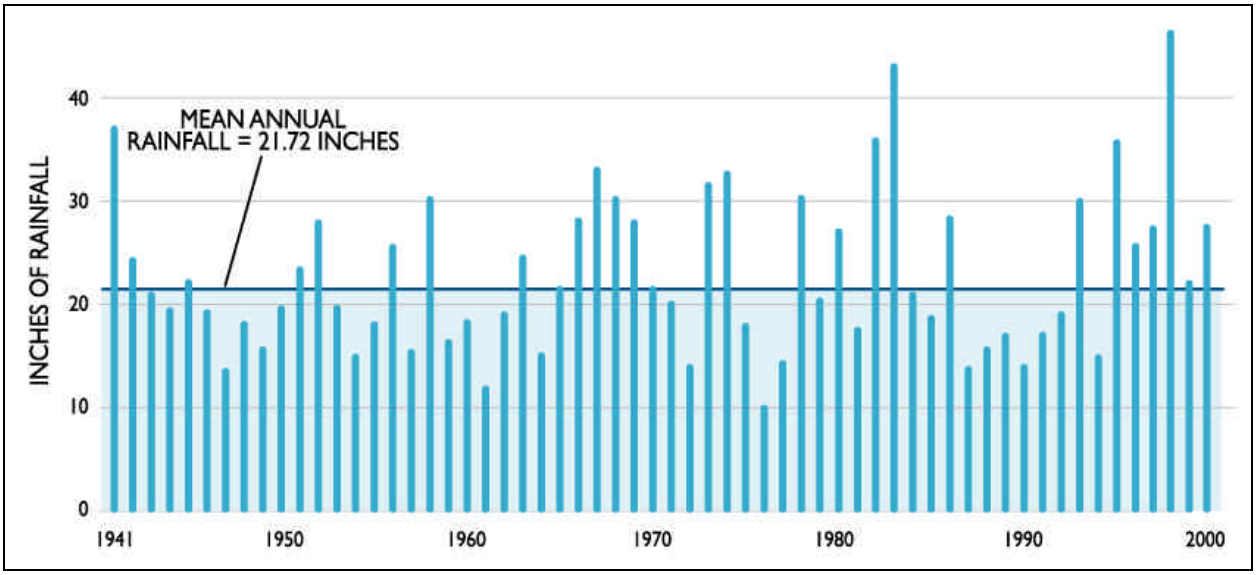
Source: USGS website, http://www.usgs.gov.

2.3.2 Basin Rainfall

The mean annual precipitation varies significantly within the Pajaro Valley, primarily due to the influence of the coastal mountain range. Rainfall is greater at higher elevations and generally decreases from north to south, from the Corralitos area to the area around Elkhorn Slough in northern Monterey County. Mean annual precipitation in the Santa Cruz Mountains on the northern and eastern boundaries of the PVWMA ranges from about 35 to 40 inches. The mean annual precipitation within the Valley itself ranges from more than 40 inches in the foothills of the Santa Cruz Mountains to 16 inches near the coast. The average rainfall for the City of Watsonville is approximately 21.7 inches for a 60-year period of record.

Long-term hydrology data reveal a wide variation in the annual total rainfall. Like streamflow, precipitation records are available from 1879 to the present. The streamflow and precipitation data sets were used in the State of the Basin report to describe the long-term climatic trends and to evaluate the hydrologic parameters used in the PVIGSM. Figure 2-4 shows that the annual precipitation values at the Watsonville precipitation gage vary significantly from year to year.

Figure 2-4: Annual Rainfall in Watsonville, CA



Source: USGS website, http://www.usgs.gov

The model includes data from five rainfall monitoring stations and four streamflow gauging stations. Figure 2-4 indicates that the hydrologic period 1964–75 was relatively normal, followed by the 1976-77 drought. The 1978–81 hydrology appears to be normal, while the 1982–86 hydrology appears to be above normal. The period 1987–92 was dry and the basin was undergoing an extended drought of approximately similar magnitude to the 1976–77 drought, but longer in duration.

2.3.3 Basin Recharge

The primary sources of recharge to the Pajaro Valley groundwater basin are 1) infiltration of rainfall, 2) seepage of streamflow from the Pajaro River and its tributaries, and 3) percolation of irrigation water. The variation in precipitation and streamflow influences how and when the Pajaro Valley groundwater basin is recharged. Groundwater recharge in winter is the result of complex interactions between soils, geology, land cover, land slope, land use, and other physical conditions.

Early season rains and crop irrigation saturate the soil with water, making late-season storms more effective in recharging groundwater supplies. Generally, mild storms of extended duration or relatively frequent storms provide the greatest opportunity for groundwater recharge. Conversely, intense or infrequent storms do little to recharge groundwater. Intense storms result in high runoff while infrequent, widely distributed storms are utilized by native vegetation and soils do not become saturated, preventing deep percolation into the aquifers.

Because Pajaro River and other local streamflows are not regulated, the majority of groundwater recharge associated with streamflow typically occurs only during the winter or when streams are flowing. Runoff from a large storm event can flow through the Pajaro River and its tributaries relatively quickly, limiting the opportunity for groundwater recharge.

Although there is a large amount of groundwater storage in the Pajaro Valley groundwater basin, the amount of water that can recharge the aquifer is limited by the Valley's geologic conditions. Even in very wet years, the Pajaro River and creeks such as the Corralitos and Salsipuedes provide only a limited

percentage of water to groundwater storage in the basin because of the presence of the clay layers. Recharge to the aquifers beneath the clay layers generally takes place in the eastern portions of the Basin, where clay layers are not so prominent.

2.3.4 Modeling Approach and Results

In order to define the present state of the basin, a long-term hydrologic period that contains a sequence of various rainfall conditions is required. This provides a good basis to evaluate the state of the basin during critical drought conditions, when water supplies are stressed to the limit, as well as wet conditions, when water supplies are more available and may operate under less stressful conditions.

The hydrologic period used for PVIGSM model calibration was 1964 – 1997. This hydrologic period was selected due to the availability of a complete set of data, including rainfall, streamflow, groundwater level, and cropping/land use data. Although hydrologic data are available after 1997, 1997 is the latest year that complete land use and cropping information are available. This hydrologic period contains a reasonable distribution of normal, above normal, and below normal conditions. This same hydrologic period was also used to evaluate current conditions, referred to as baseline conditions, and the effects of alternative management and project strategies on the groundwater system. The model runs for these evaluations are initiated with the existing conditions, and the 1964 – 1997 monthly hydrologic cycle is repeated once to create a 68-year hydrologic record for use in evaluating project scenarios.

Although the model period is represented by the 1964 to 1997 hydrologic data, the PVWMA is able to extrapolate the model results to provide estimates of water use for water years 1998, 1999, and 2000. Such extrapolations of the model results assume the cropping and land use, as well as cultural practices such as irrigation efficiencies and numbers of crop rotations, are the same as was experienced in 1997.

2.3.5 Key Points

Key points of this section include:

- Primary sources of recharge to the Pajaro Valley groundwater basin are: 1) infiltration from rainfall, 2) seepage of streamflow from the Pajaro River and its tributaries, and 3) percolation of irrigation water.

- The Pajaro River is the most substantial source of surface inflow to the Pajaro Valley groundwater basin.

- The period of rainfall data used to calibrate the model was 1964 to 1997 because this period contained a representative distribution of normal, wet, and dry years.

- The mean annual precipitation within the Pajaro Valley varies significantly with location. Areas near the coast receive notably less rainfall than inland areas near the mountains.

2.4 Basin Groundwater Levels

This section describes the groundwater levels of the Pajaro Valley groundwater basin, building on discussions of geology, hydrology, and water use in the preceding sections. Information on long-term and recent groundwater levels simulated in the PVIGSM is confirmed with water-level data from the PVWMA database. The groundwater levels are used to describe patterns of groundwater flow, changes in groundwater storage, and the potential for seawater intrusion in the Pajaro Valley aquifers.

2.4.1 Background Groundwater Level Information

Groundwater levels in the basin vary annually depending on weather conditions, recharge, groundwater pumping, and other factors. However, the Pajaro Valley groundwater levels have generally been in a decreasing trend due to excessive groundwater pumping. The decrease in groundwater levels is not uniform since hydrologic conditions and other factors affect groundwater levels. This is confirmed by existing well data maintained by the PVWMA.

Historically, groundwater levels were higher than today in inland areas, and artesian conditions existed at the coast. That is, groundwater levels were high enough in past years that groundwater surfaced in some of the coastal areas. Under such conditions seawater intrusion was prevented. By the 1940s, following the major development of groundwater resources to support a growing agricultural industry, some wells were still artesian, but only during winter months. By the 1970s, water levels west of Watsonville were consistently below sea level from approximately May to December, often never recovering to levels above sea level, once again documenting the conditions necessary for the occurrence of seawater intrusion.

The trend has been for water to move from the unconfined recharge areas near the Agency's northern boundary, east of Watsonville, and north Monterey County, toward the large pumping trough that forms in the center of the valley near Watsonville, or toward the coast at the north end of the basin. In the south, water typically moves from north Monterey County northeastward toward Pajaro Valley and westward toward the coast. In the northern part of Pajaro Valley, water moves southeast from the Soquel/Aptos area into the north part of the Pajaro Valley area, then south toward Watsonville and southwest toward Monterey Bay.

Unfortunately, the trend has also been for a significant flow, over the entire observed period, of seawater from the ocean toward the inland pumping trough that forms in the center of the valley.

2.4.2 Modeling Approach and Results

Well log data was used to create contour maps of simulated groundwater levels. Groundwater level contours for fall 1987, 1992, and 1998 are shown in Figure 2-5; a contour elevation of 0 indicates mean sea level. All three of these contour maps show a trough of low water levels extending from the coast, inland to the mountains, centered on the Pajaro River channel. The groundwater levels in the southeast region of the Basin decreased significantly between 1987 and 1998. Comparing these contour maps indicates that the zones of suppressed groundwater levels have generally expanded.

2.4.3 Key Points

Key points of this section include:

- Groundwater levels in inland wells are declining over time, indicating that more water is removed annually from the basin than is replaced.
- Declining groundwater levels is a recent trend. Historically, coastal areas of the Pajaro Valley were artesian and inland areas maintained higher groundwater levels.
- Well data indicate depressed groundwater levels are expanding in the Pajaro Valley groundwater aquifers and regularly fall below sea level, resulting in seawater intrusion.
- Current wells levels at the coast are consistent with historic levels, but water in many wells is becoming increasingly salty due to seawater intrusion.

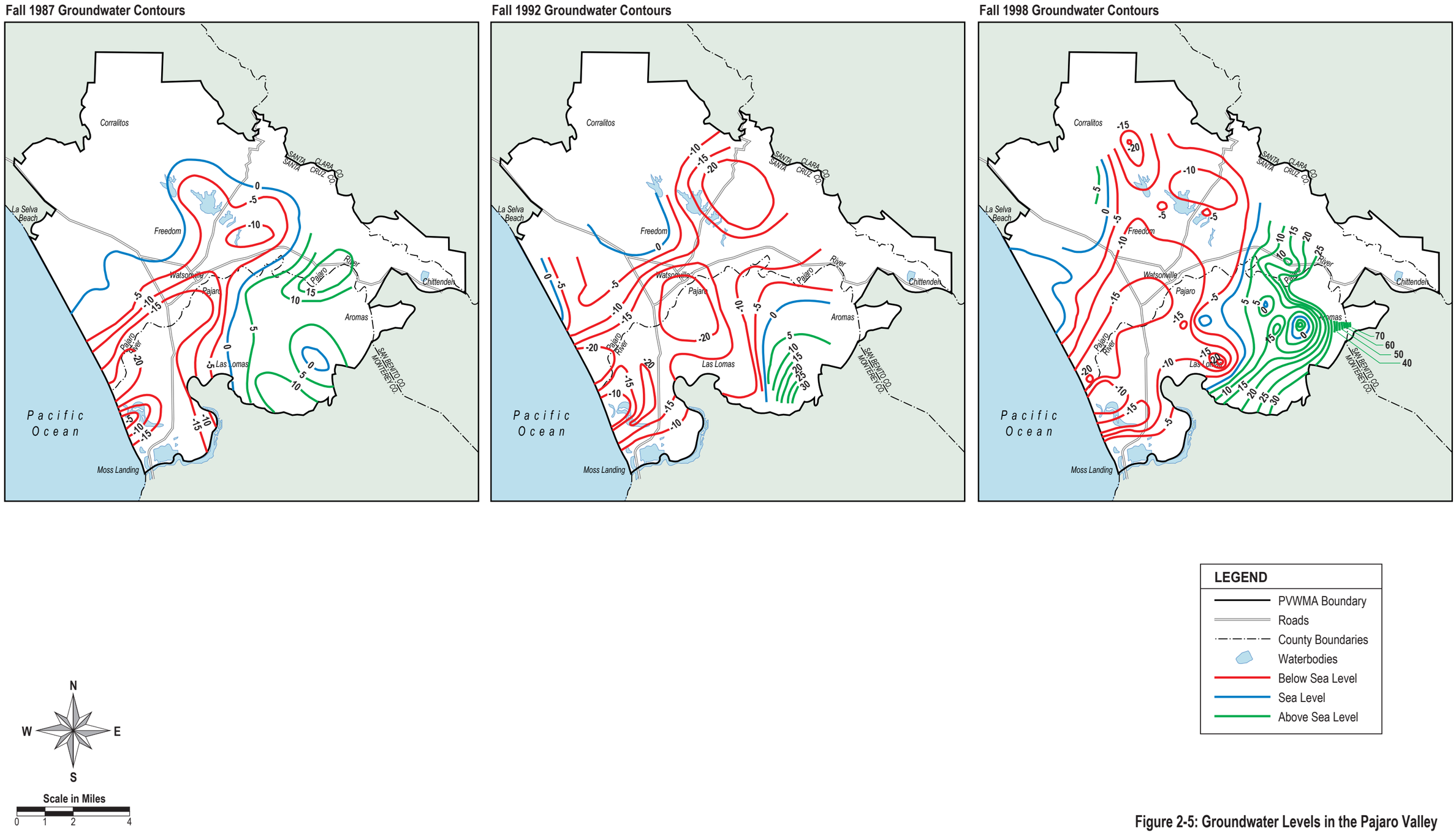


Figure 2-5: Groundwater Levels in the Pajaro Valley

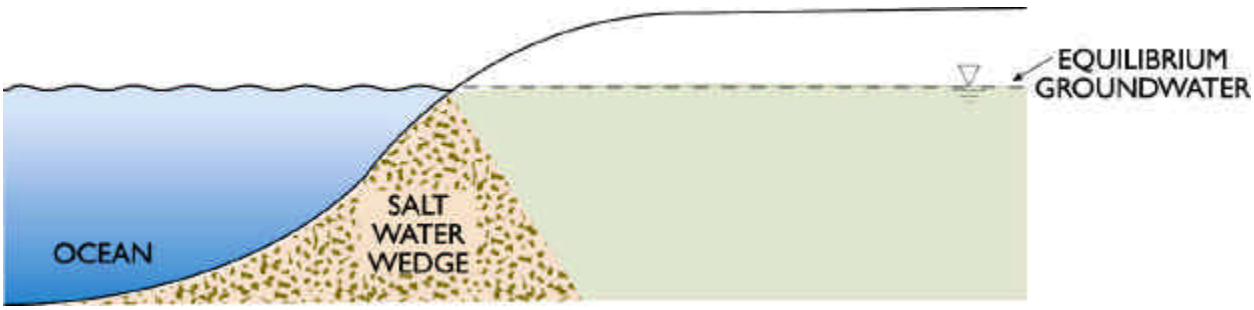
2.5 Seawater Intrusion

This section presents an introduction to the principles of seawater intrusion and their relevance to the Pajaro Valley.

2.5.1 Principles of Seawater Intrusion

When groundwater levels near the coast fall below mean sea level, there is a natural physical tendency for seawater to penetrate into the groundwater basin. The ocean pushes the more dense seawater inland to raise the water table until it is equal to mean sea level. This is depicted in Figure 2-6.

Figure 2-6: Seawater Intrusion



Note: Modified from Environmental Engineering by Peavy, Rowe, and Tchobanoglous 1985.

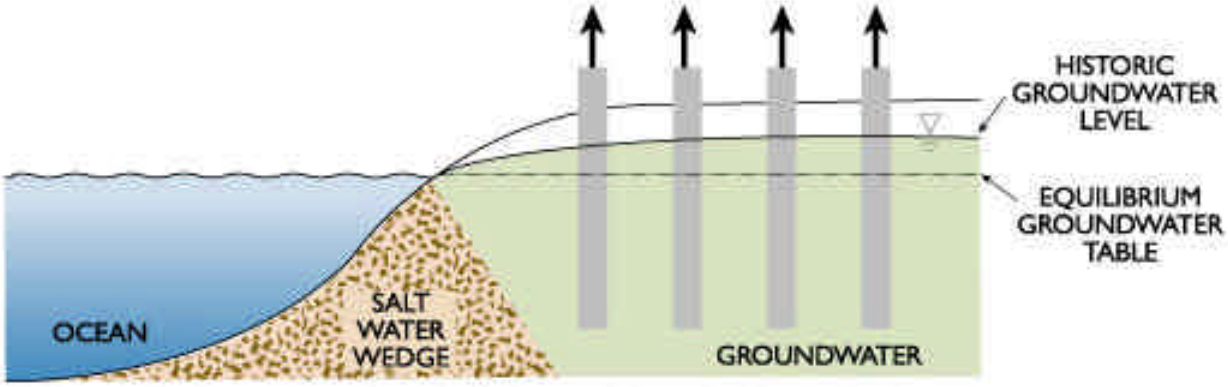
Groundwater pumping in excess of groundwater recharge can enhance this natural tendency. As seawater encroaches into the fresh groundwater basin, water quality is degraded and wells have to be abandoned. This is depicted in Figure 2-7. If fresh water is not available for recharge, or if the groundwater table is reduced to elevations below sea level, seawater will be drawn inland until equilibrium is restored. Unlike freshwater levels in the groundwater basin that vary with the season and climatic trends, the ocean is a constant source of recharge and the elevation varies only marginally with the tide. When inland pumping causes the water level to drop (see Figure 2-7a), pressure throughout the aquifer decreases (see Figure 2-7b) and equilibrium is restored via seawater intrusion (see Figure 2-7c). Thus, pumping throughout the basin causes seawater intrusion along the coast.

2.5.2 Seawater Intrusion in the Pajaro Valley

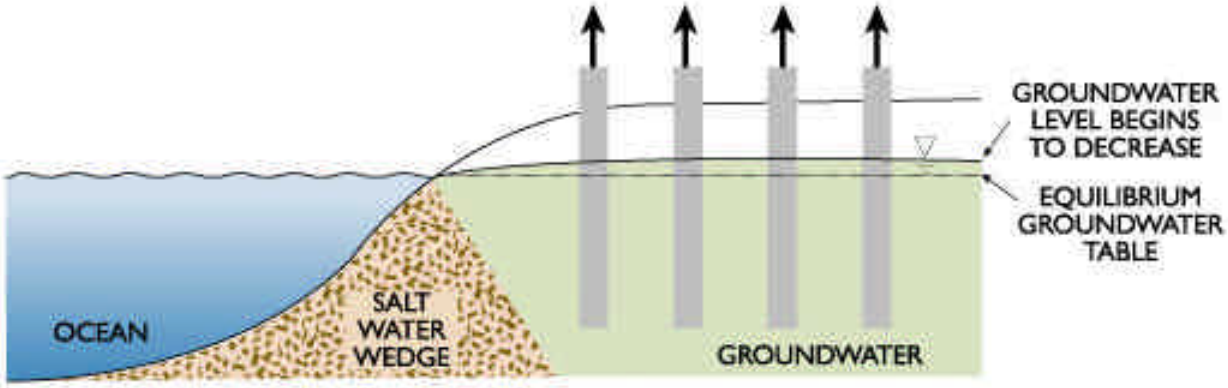
The Pajaro Valley groundwater basin includes confined and unconfined aquifers and semi-confined transition zones between the two, as described in the basin geology section. In the Pajaro Valley, groundwater levels and pressure in confined aquifers is influenced both by the ocean and by the groundwater level in inland areas. The Pajaro Valley groundwater basin is connected to the ocean, and there are no seismic faults or barriers to prevent seawater intrusion.

The average concentration of chloride in seawater is 19,000 mg/L. Chloride levels exceeding 142 mg/L will likely result in increasing problems for agricultural irrigation (California Regional Water Quality Control Board, 1995). Increasing chloride concentration in groundwater well samples is an indication of seawater intrusion. Chloride is useful for monitoring seawater intrusion because it is chemically stable

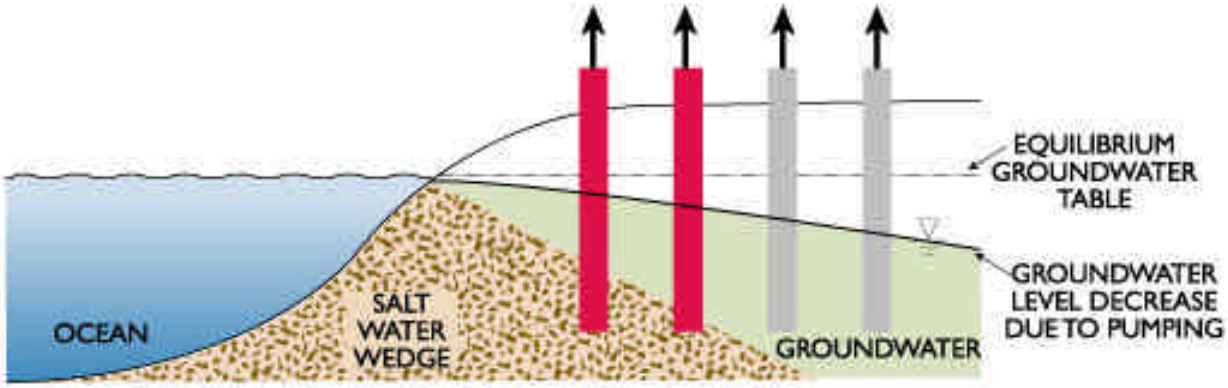
Figure 2-7: Seawater Intrusion Equilibrium



a) Historic Conditions: groundwater levels above equilibrium level. No wells and no seawater intrusion.



b) Initial stage: excessive pumping results in long-term decreases in groundwater levels. Wells are not yet impacted by seawater intrusion.



c) Current stage: continued pumping above sustainable yield decrease groundwater levels and the salt wedge expands inland trying to reach equilibrium. Wells closest to coast are impacted by seawater intrusion.

and moves at the same rate as the intruding water. The horizontal migration of seawater occurs slowly over time as seawater mixes with the fresh water as it moves inland. Initially, chloride concentrations increase gradually. However, as the bulk of the seawater plume moves inland, chloride concentrations can rise rapidly. Other chemical changes also occur over this mixing zone, and can assist in interpreting the sources of the observed chlorides. Based on background chloride concentrations in groundwater from inland groundwater recharge areas, it has been determined that chloride levels exceeding 100 mg/L in coastal wells indicate seawater intrusion (U.S. Geological Survey, 1974).

Well data from 1998 generally indicate that inland seawater intrusion is more extensive than previously reported. In the La Selva Beach area, the size of the existing intruded area has tripled compared to conditions in late 1979. The intruded area extends approximately 0.75 miles inland and is 2 miles wide. The intrusion zone near the mouth of the Pajaro River extends inland approximately 1.5 miles and is approximately 3 miles wide. Figure 2-8 shows the coastal area that has been impacted by seawater intrusion, along with the changes in chloride concentrations versus time for selected wells.

A number of deeper wells have shown substantial increases in chloride concentrations in recent years indicating that the volume of fresh water displaced in the intruded area is increasing. Chloride levels are generally highest in the deeper confined aquifers consisting of Aromas Sand and the Purisima, with values ranging from 200 to 8,500 mg/L. In contrast, shallow wells tend to have lower chloride levels (50 to 500 mg/L), and a number of neighboring shallow wells show marked differences in chloride levels.

The data indicate that seawater is intruding along the coast in the middle and lower portions of the Aromas sands and that poor-quality water is present in the deeper zones. This implies that as intrusion moves inland and wells are lost to seawater impacts, the option of drilling deeper for better water is probably not a viable option.

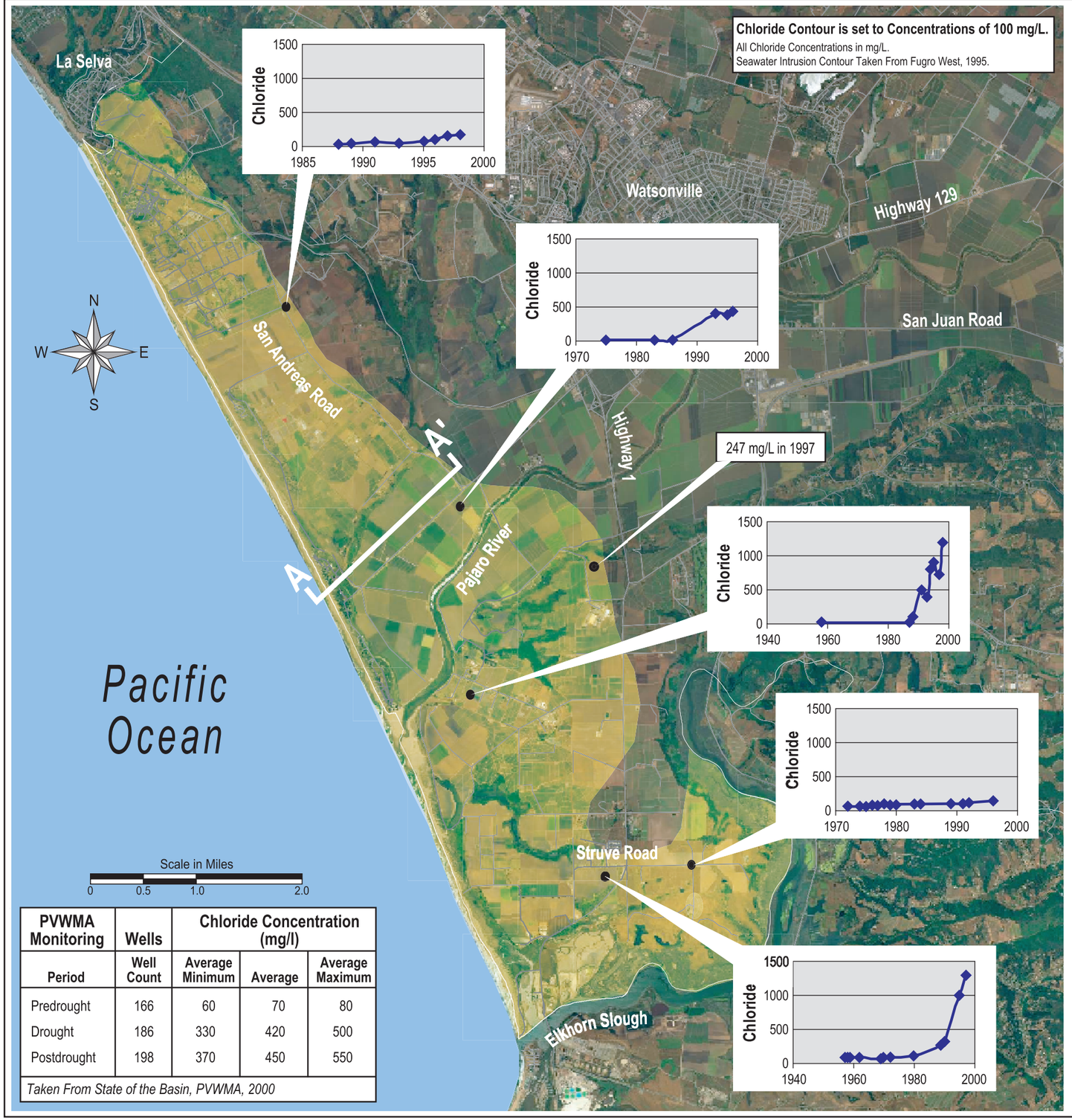
Water quality impacts due to seawater intrusion and other groundwater contaminants are discussed in Section 2.9.

2.5.3 Key Points

Key points of this section include:

- In those areas that have relatively stable water levels, the stability is provided in part by seawater intrusion, the inland migration of seawater that replaces freshwater. The relative stability of the groundwater levels near the coast masks the overdraft conditions.

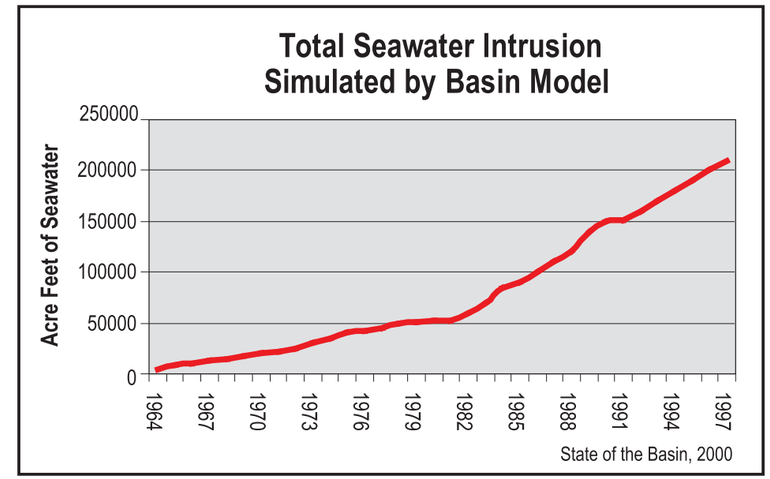
- The chloride levels in groundwater wells indicate the extent of seawater intrusion in the Pajaro Valley groundwater basin is expanding.



PVWMA Monitoring	Wells	Chloride Concentration (mg/l)		
Period	Well Count	Average Minimum	Average	Average Maximum
Predrought	166	60	70	80
Drought	186	330	420	500
Postdrought	198	370	450	550

Taken From State of the Basin, PVWMA, 2000

Summary of Seawater Intrusion Within PVWMA Boundaries



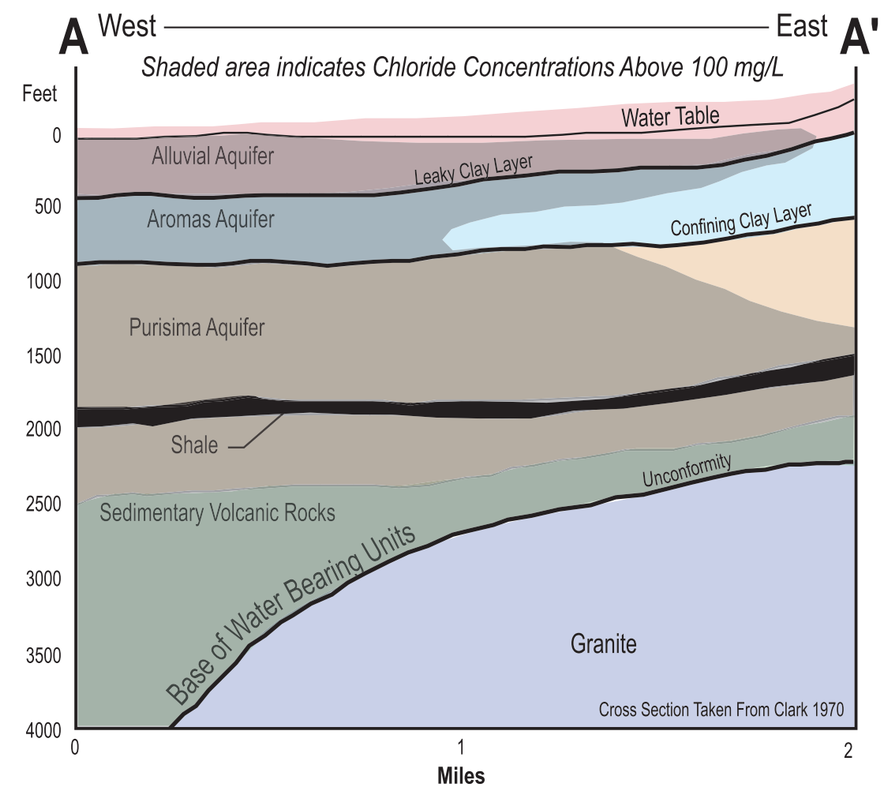


Figure 2-8: Location of Area Impacted by Seawater Intrusion

Source: Modified from PVWMA, July 2001.

2.6 Land Use

The primary land uses within the Pajaro Valley are agricultural, native vegetation, native riparian and urban land uses such as commercial, industrial, and residential. Native vegetation and agricultural land are the major designations throughout the basin, while urban use is primarily located within or adjacent to the City of Watsonville.

2.6.1 Historic Land Use

The Department of Water Resources (DWR) conducts land use surveys for all California counties. Surveys are typically performed approximately every seven years and consist of aerial surveys followed by field verification. Data from these surveys were collected for Monterey and Santa Cruz Counties for 1966, 1975, 1982, 1989, and 1997. Data within the PVWMA boundary are presented in Table 2-2.

Table 2-2: Summary of Land Use (Model Area)

Land Use Type	Acreage				
	1966	1975	1982	1989	1997
Total Agricultural Acreage	30,448	33,409	31,516	34,463	34,650
Urban Acreage	4,757	6,688	8,018	8,384	12,860
Native Vegetation	61,301	56,409	56,972	53,659	48,996

Source: Modified from PVIGSM Technical Memoranda (Montgomery Watson/AT Associates, 1999-2000).
Note: Acreages shown are for modeled area, which is greater than the PVWMA service area. In 1997, approximately 30,200 acres of irrigated agricultural land were within the PVWMA service area.

Historic Urban Land Use:

Urban land use increases shown in Table 2-2 have generally resulted from the conversion of native vegetation land, not agricultural land. As shown, urban land use increases consistently from only 4,800 acres in 1966 to nearly 12,900 acres in 1997. This increase reflects general population growth trends throughout the State of California over the last several decades.

Historic Agricultural Land Use:

DWR land use data were analyzed to determine historical land use changes in the basin. As shown in Table 2-2, between 1966 and 1975, agricultural land use increased by approximately 3,000 acres in the Pajaro Basin area. From 1975 to 1989, agricultural land use in the Basin increased by approximately 1,100 acres. However, from 1989 to 1997, agricultural land use in the Pajaro Basin increased by less than 200 acres (Montgomery Watson/AT Associates, 1999-2000).

An understanding of the historical land use conditions and cropping patterns is necessary to develop an understanding of the historic water use patterns. These data are also utilized to develop and calibrate the PVIGSM. Table 2-3 shows how total acreage breaks down by crop type, and the changes in crop types planted in the Pajaro Valley Model Area over the last 30 years. Since the PVIGSM requires crop mix acreage for each year of the historic record utilized in the model, the annual crop mix acreage has been estimated by linear interpolation between each survey year.

Table 2-3: Summary of Agricultural Land Use (Model Area)

Crop Type	Acreage				
	1966	1975	1982	1989	1997
Strawberry	1,754	4,372	5,974	6,514	7,004
Irrigated Fallow	4,384	3,911	3,133	3,906	4,182
Vine (bushberries, grape, etc)	22	0	505	1,512	1,652
Vegetable Row Crops	14,612	13,038	10,442	13,020	13,940
Field Crops	647	1,170	1,724	908	644
Deciduous	7,516	8,578	7,434	5,729	3,892
Pasture	1,175	1,780	1,004	894	1,227
Nursery	237	392	910	1,386	1,476
Nursery-indoor	101	168	390	594	633
Total Agricultural Acreage	**30,448**	**33,409**	**31,516**	**34,463**	**34,650**

Source: Modified from PVIGSM Technical Memoranda (Montgomery Watson/AT Associates, 1999-2000).
Note: Acreages shown are for modeled area, which is greater than the PVWMA service area. In 1997, approximately 30,200 acres of irrigated agricultural land were within the PVWMA service area.

2.6.2 Current Land Use

Land use within the Pajaro Valley is primarily agricultural. Figure 2-9 shows the 1997 breakdown for the land uses within the PVWMA service area. The 1997 data were used as input parameters for the PVIGSM Baseline Conditions.

2.6.3 Future Land Use

Future land use in the PVMWA service area is under the jurisdiction of County and City planning documents. The adopted Santa Cruz County General Plan, Local Coastal Plan, and the City of Watsonville General Plan presents limited information on the future land use within the PVMWA area. The Monterey County General Plan expired in 2000, and is presently being updated. Regions of native vegetation are potential areas for urban or agriculture development. According to topographic maps, a majority of the designated native vegetation areas include steep sloped terrain, which is likely to be unsuitable for agriculture.

Future Urban Land Use:

As shown in Table 2-2, urban land use in the Pajaro Valley has increased from approximately 4,800 acres in 1966 to 12,900 acres in 1997. Native vegetation, however, still remains the predominant land use, and the amount of native vegetation represents potential land for urban build-out, except as constrained by the General Plans of Monterey, Santa Cruz and San Benito Counties, and the City of Watsonville. Additionally, agricultural land could be rezoned for urban development. However, considering current policies to protect agricultural land it is assumed that minimal agricultural acreage would be rezoned to urban land use.

Urban population growth will affect the Pajaro Valley by causing the conversion of more native vegetation to urban land (new development) and/or by increasing population density on existing urban land (infill). While studies have been undertaken to project the urban population of the Pajaro Valley in the future, it is undetermined whether the majority of the growth will be infill or new development. Without this correlation between population growth and urban land use increase, and in the absence of an updated General Plan for Monterey County, a projected urban land use cannot be determined. Population studies are discussed in Section 2.7.3 “Future Water Use.”

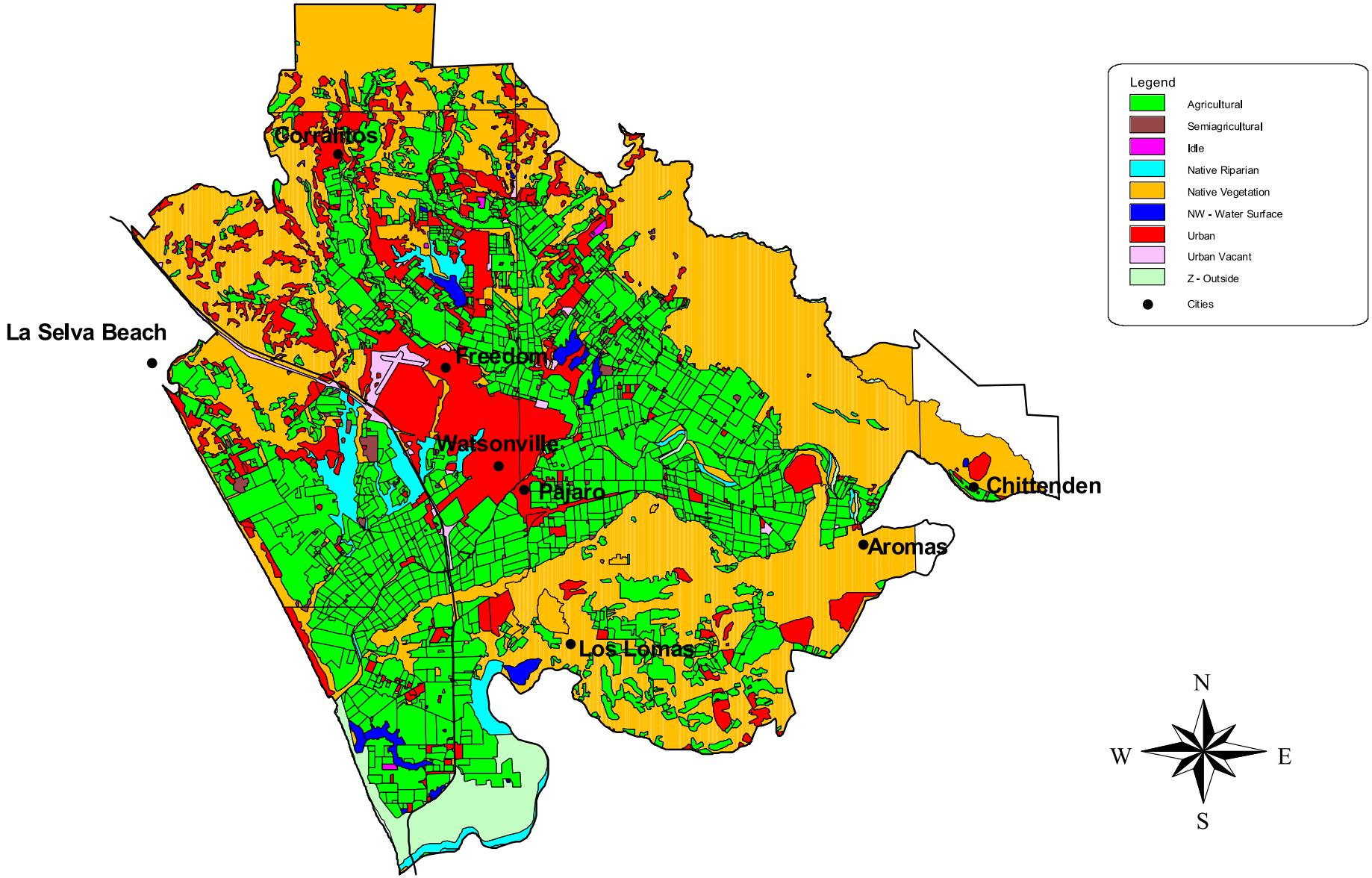


Figure 2-9. Land Use in the PVWMA Service Area

Future Agricultural Land Use:

Based on the historic data in Table 2-3 and Section 2.6.1, the total agricultural land area has remained relatively constant from 1989 onward. For the purposes of land use projections, it is assumed that agricultural land use will remain constant. However, there have been significant shifts in the types of crops grown in the valley. Most apparent are the increases in nursery, strawberry, and vine crops. Detailed economic and marketing surveys have not been conducted and therefore it is not certain whether the shift to high water use crops will continue. For the purposes of the Revised BMP, it is assumed that approximately 2,000 acres of deciduous crops will be converted to berry crops by 2040, equally distributed between strawberry and raspberry crops.

2.6.4 Key Points

- Land use surveys indicate that both agricultural and urban land use increased significantly in the past 30 years.
- Agricultural development has leveled off in recent years, but urban acreage has increased.
- Urban development has come primarily from conversion of native vegetation land, with a small increase due to conversion of agricultural land. However, future urban growth due to conversion of agricultural land is expected to be low.
- Over the past three decades, there has been a shift in the agricultural crop mixes planted in the Pajaro Valley. There has been a general increasing trend in growing strawberries, vines, and bushberries (all relatively high users of water), with a corresponding decrease in deciduous crops.

2.7 Water Use

The purpose of this section is to describe the methodology used for estimating the amount and location of current and projected water use. There are two main categories of water use. Agricultural water use consists of irrigation water only. Urban water use, for the purposes of this document, includes all household water consumption as well as commercial and industrial water use. Because agriculture is the main source of livelihood within the Pajaro Valley, commercial and industrial water use is relatively low. Therefore, urban water use is considered to be a function of population.

2.7.1 Historic Water Use

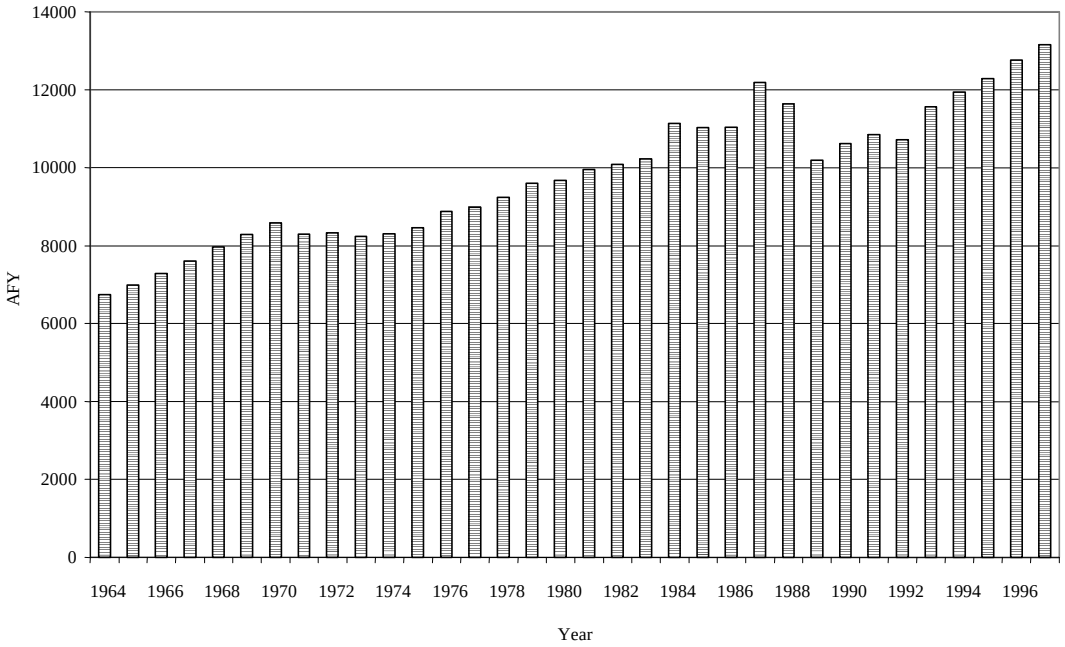
The water use within the PVWMA service area is made up of both urban and agricultural water use. Historic urban water use is based heavily on historic data, while historic agricultural water use is based on PVIGSM model simulations.

Historic Urban Water Use:

The urban water use in the Pajaro Valley consists of the municipal, commercial, and industrial water use within the City of Watsonville service area and the unincorporated and rural areas (i.e. all non-agricultural water use).

The urban water use estimates are taken from City of Watsonville groundwater production records plus historic urban acreage multiplied by average water duties for unincorporated areas. Figure 2-10 is a plot of historic urban water use, indicating a steady increase from approximately 7,000 AF in 1964 to an estimated 13,000 AF in 1997, an increase of approximately 86 percent over 34 years.

Figure 2-10: Pajaro Valley Historic Urban Water Use



Source: Modified from PVIGSM Technical Memoranda, Montgomery Watson/AT Associates, 1999-2000.

Historic Agricultural Water Use:

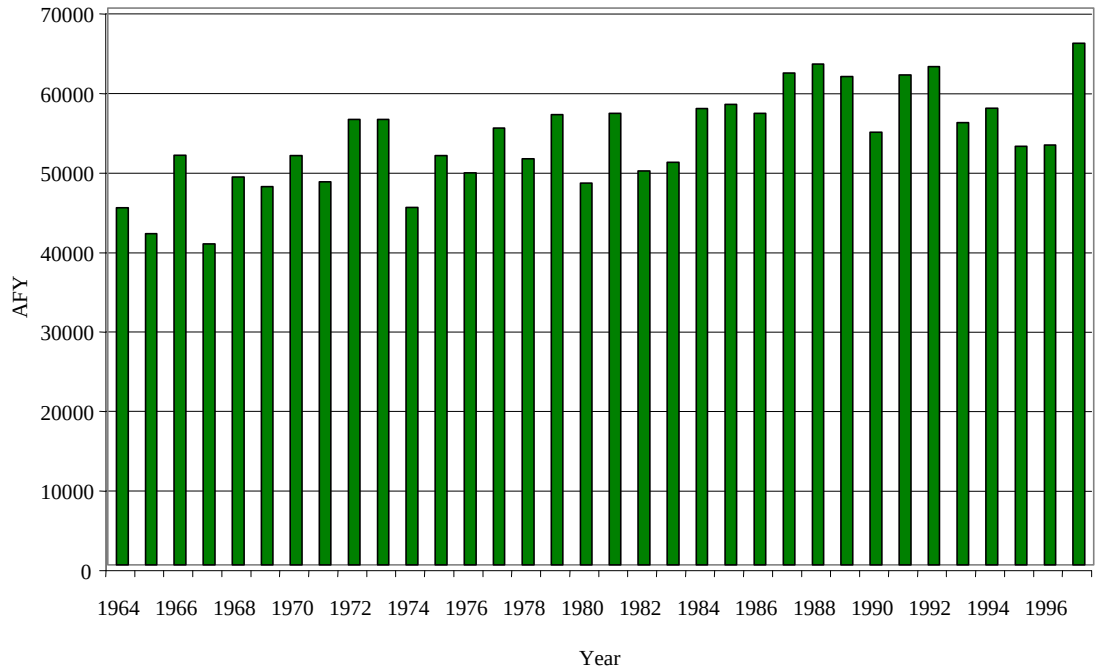
In the past, it was not required that wells in the PVWMA service area be metered. A metering program was established by the PVWMA in 1993, with actual metering being initiated in 1995. Since historical groundwater pumping records from the metering program are not available prior to 1995, the PVIGSM was used to estimate historic agricultural water use. In order to simulate water use patterns, historic crop type data were collected from the DWR crop surveys for the PVIGSM model area. Each agricultural acre was assigned a total demand based upon the approximate water application rates for its crop type, from low water use for deciduous crops to high water use for berry crops.

Water use factors were estimated by the consumptive use methodology. This method uses irrigated acreage, effective rainfall, minimum soil moisture, crop evapotranspiration, irrigation efficiency, cultural practices, and marketing factors to estimate the agricultural water use requirements. The crop water use factors were applied to the historic land use and cropping acreages to estimate the historic annual agricultural demand for the model period.

The model was then run with current (1997) cropping and irrigation patterns and historic hydrologic data records. The location, capacity, and depth of agricultural production wells were also simulated in the model based on the cropping patterns and geology described in the previous sections and from PVWMA well information. Figure 2-11 shows the model-simulated annual variation of the agricultural water pumped during the historic hydrologic period of 1964-97.

As indicated in the figure, there has been an increasing trend in the agricultural water use estimates, due to the buildup in the irrigated acreage and crop changes. The agricultural water use is estimated to have been approximately 45,000 AF in 1964, and 66,000 AF in 1997. A shift in the cropping patterns is likely the primary cause for the increase in groundwater use, but higher irrigation efficiencies and increasing awareness of conservation programs have helped to reduce the unit water use during recent years. The net effect, however, has been an increase in the volume of groundwater being pumped for irrigation purposes.

Figure 2-11: Pajaro Valley Historic Annual Agricultural Water Use



Source: Modified from PVIGSM Technical Memoranda, Montgomery Watson/AT Associates, 1999-2000.

2.7.2 Current Water Use

With the exception of approximately 1,000 AFY of surface water diversion by farmers and 1,100 AFY of surface water diversion at the Corralitos Creek Filter Plant (1997-2000 average) for City of Watsonville water users, the water needs of the Pajaro Valley are met by groundwater pumping. Estimated average current water use is within the PVWMA service area is approximately 71,500 AFY.

Current Urban Water Use:

Current urban water use is assumed to be consistent with recent estimates. The urban water use for the baseline condition is based on the monthly average urban water use during the 1994 – 97 hydrologic period (see Figure 2-10). The baseline urban water use is estimated to be approximately 12,200 AFY.

Current Agricultural Water Use:

The agricultural water use for the baseline condition was determined by a method similar to that used for historic estimations. Existing land use patterns and cultural practices such as crop rotations and conservation practices were held constant. The historic hydrologic data were used in the model to

determine how much of the agricultural water demand was provided by the natural hydrologic cycle and how much groundwater pumping would have been required to meet the crop water needs. This analysis forms the basis for understanding the agricultural water pumping required for existing cropping patterns, assuming a replication of historic hydrologic conditions. The selected hydrologic data set accounts for average, wet, and dry years, as discussed in Section 2.7.1. The average water use resulting from this simulation, 59,300 AFY, is the baseline agricultural water use in the PVIGSM model.

2.7.3 Future Water Use

Future water use was determined based on available and adopted land use data, historic trends, and growth projections. All water use was projected to the year 2040.

Future Urban Water Use:

Future urban water use was estimated on the basis of population projections. The PVWMA service area population is largely concentrated in the City of Watsonville, which had a 2000 population of 44,300 (U.S. Census Bureau website). Unincorporated areas of the PVWMA service area include the communities of Pajaro, Aromas, Freedom, Corralitos, and Los Lomas. These unincorporated communities have a combined estimated 2000 population of 38,700 (Montgomery Watson, November 1993). Hence, the total population in the PVWMA service area was estimated to be 82,900 in 2000.

The PVWMA service area spans parts of Monterey and Santa Cruz counties. County General Plans are the preferred source for population projections. However, it is difficult to use these as a source of population projections for the Pajaro Valley. The Monterey County General Plan was last updated in 1982 and contained population projections through the year 2000, whereas the Santa Cruz County General Plan was last updated in 1994 and only included population estimates through 1995. Given the above-described shortcomings in the General Plans, population was projected using Association of Monterey Bay Area Governments (AMBAG) projections. AMBAG projects population to 2020 for urban centers, including Watsonville. Although the 2000 AMBAG population for the City of Watsonville is a forecast from 1997, it is very close to the actual 2000 Census data.

Table 2-4 shows the method by which PVWMA population was projected to the year 2040. The baseline urban population described above (82,900) was projected forward using the percent growth estimated by AMBAG for Watsonville. The PVWMA growth rate from 2000 to 2005 was assumed to be consistent with AMBAG 2005 to 2010 estimates as AMBAG population projections for 2005 to 2010 included annexation of lands by the City of Watsonville. The growth rate from 2020 to 2040 was assumed to remain consistent with the AMBAG projected growth from 2015 to 2020. According to the analysis, the total urban population could increase by approximately 49 percent to 109,600 people in 2040. However, this does not consider potential PVWMA measures, such as water pricing, which could limit urban growth through economic pressure.

Although future population increases will be guided by adopted land use, potential future urban water use was determined as a function of future urban population. The existing Pajaro Valley population (82,900) and the existing urban water use (12,200 AFY) yield a water use of 131 gpd per capita[1]. Using this water use estimate, a projected population of 109,600 people in 2040 could result in an urban water use of approximately 16,100 AFY, which is an increase of 3,900 AFY.

[1] 131 gpd per capita is an equivalent per person water use including commercial and industrial use. Future projections using this value assume that commercial and industrial water use is scaled uniformly with population growth.

Table 2-4: PVWMA Population Projections and Urban Water Use

Year	AMBAG Watsonville[a]	PVWMA Population[b,c,d]	Urban Water Use[e]
2000	43,620	82,921	**12,200**
2005	50,495	85,197	12,535
2010	51,881	87,536	12,879
2015	53,816	90,800	13,359
2020	55,875	94,274	13,870
2025	No data	97,881	14,401
2030	No data	101,626	14,952
2035	No data	105,514	15,524
2040	No data	109,551	**16,118**

Footnotes:

a. Watsonville population projections taken from AMBAG website: http://www.ambag.org/popchart.html
b. The annual growth rate was calculated based on AMBAG projections and applied to the projected PVWMA population. Growth rate for 2020 to 2040 was assumed to be equivalent to the change from 2015 to 2020.
c. The year 2000 PVWMA population estimate was based on 2000 Census Data from the U.S. Census Bureau and estimated population of unincorporated areas from the 1993 Basin Management Plan (Montgomery Watson, 1993).
d. The relatively large increase in AMBAG population estimate from 2000 to 2005 is a result of annexed areas by the City of Watsonville. Therefore the 5-year growth rate of the PVWMA population from 2000 to 2005 was estimated according to the AMBAG 2005 to 2010 growth rate.
e. Urban water use factor of 131 gpd per capita was used to determine urban water use.

Future Agricultural Water Use:

Future agricultural water use was determined based upon the projected future agricultural land use as described in Section 2.6.3. As stated previously, this Revised BMP assumes that approximately 2,000 acres of deciduous crops will be converted to berry crops by 2040. The water demands for these crops are higher, approximately 2.8 AF/acre for strawberries and 3.7 AF/acre for raspberries, compared to approximately 0.7 AF/acre for deciduous crops (Bogenholm, 1998). Assuming conversion of 1,000 acres each to strawberry and raspberry crops, a 5,100 AFY increase in water use is estimated based on water application rates for these crops. On this basis, the projected agricultural water demand within PVWMA's service area increases from 59,300 AFY to 64,400 AFY by 2040. The impact of demand management measures on agricultural water use is discussed in Section 3.1.

2.7.4 Key Points

Key points of this section are summarized in Table 2-5.

Table 2-5: Current and Future Water Demand and Groundwater Pumping

Water Usage	Current Demand (AFY)	2040 Demand (AFY)
Agricultural	59,300	64,400
Urban	12,200	16,100
Total Demand	**71,500**	**80,500**
Corralitos Filter Plant	(1,100)	(1,100)
Other Surface Water Diversions	(1,000)	(1,000)
Total Groundwater Pumping[a]	**69,000 (rounded)**	**78,000 (rounded)**

Footnotes:

a. Total Groundwater Pumping values are rounded to two significant figures or to the nearest thousand to represent significant accuracy.

- Water use in the PVWMA area is expected to increase by 9,000 AFY by 2040. This is a significant increase considering the current basin imbalance and water issues. Even if future water use were to increase by only half of this projection, the PVMWA would still face a significant increase of 4,500 AFY.

- The Pajaro groundwater basin extends beyond the PVMWA boundary and is a shared basin with other local water agencies. Therefore, PVWMA groundwater supply is impacted by water use outside of the PVMWA boundary but within the Pajaro groundwater basin. The Soquel Creek Water District is once such agency that draws water from the Pajaro groundwater basin. Therefore, increases in groundwater pumping by the Soquel Creek Water District could impact the PVWMA groundwater supply.

2.8 Basin Sustainable Yield

Previous sections described the current and historical conditions in the Pajaro Valley groundwater basin and how the basin operates as an integrated system that includes geology, hydrology, and groundwater. Building on those basin conditions, this section presents results of the PVIGSM analysis of the basin sustainable yield, also referred to as "safe yield." Basin sustainable yield is defined as the long-term amount of groundwater, which can be extracted from the aquifer system without causing an adverse impact on the quantity and/or quality of the groundwater basin.

2.8.1 Discussion

The available data and technical analyses presented in previous sections confirm that suppressed groundwater levels and seawater intrusion have adversely impacted the quantity and quality of Pajaro Valley groundwater. Therefore, the sustainable yield of the Pajaro Valley groundwater basin must not only balance supply with demand, but must also eliminate seawater intrusion and long-term decreases in groundwater levels.

2.8.2 Determination of Sustainable Yield

Yield with Current Pumping Practices:

Modeling has shown that seawater intrusion is not uniform and that some areas along the coast are more impacted than others. These results indicate that, under current pumping practices, a 65 percent reduction in basin-wide groundwater pumping (45,000 AFY) is necessary to eliminate seawater intrusion throughout the coastal area. This pumping reduction would also cause groundwater levels to rise throughout the basin. Therefore, with basin-wide pumping reductions, the sustainable yield of the groundwater basin is approximately 24,000 AFY (69,000 – 45,000 AFY). This yield is only one third of the current average annual demand on groundwater supplies.

Yield with Modified Pumping Practices and Dependable Supplemental Supplies:

The PVIGSM was also used to investigate how pumping patterns could be modified to increase the sustainable yield of the basin. One alternative evaluated by the model was the elimination of coastal pumping. In this coastal scenario, the same volume of groundwater is extracted as with the basin-wide reduction scenario, but all pumping would be eliminated at the coast. Without pumping at the coast, recharge would eventually restore the groundwater table to its equilibrium at mean sea level, between the inland pumping zone and Monterey Bay.

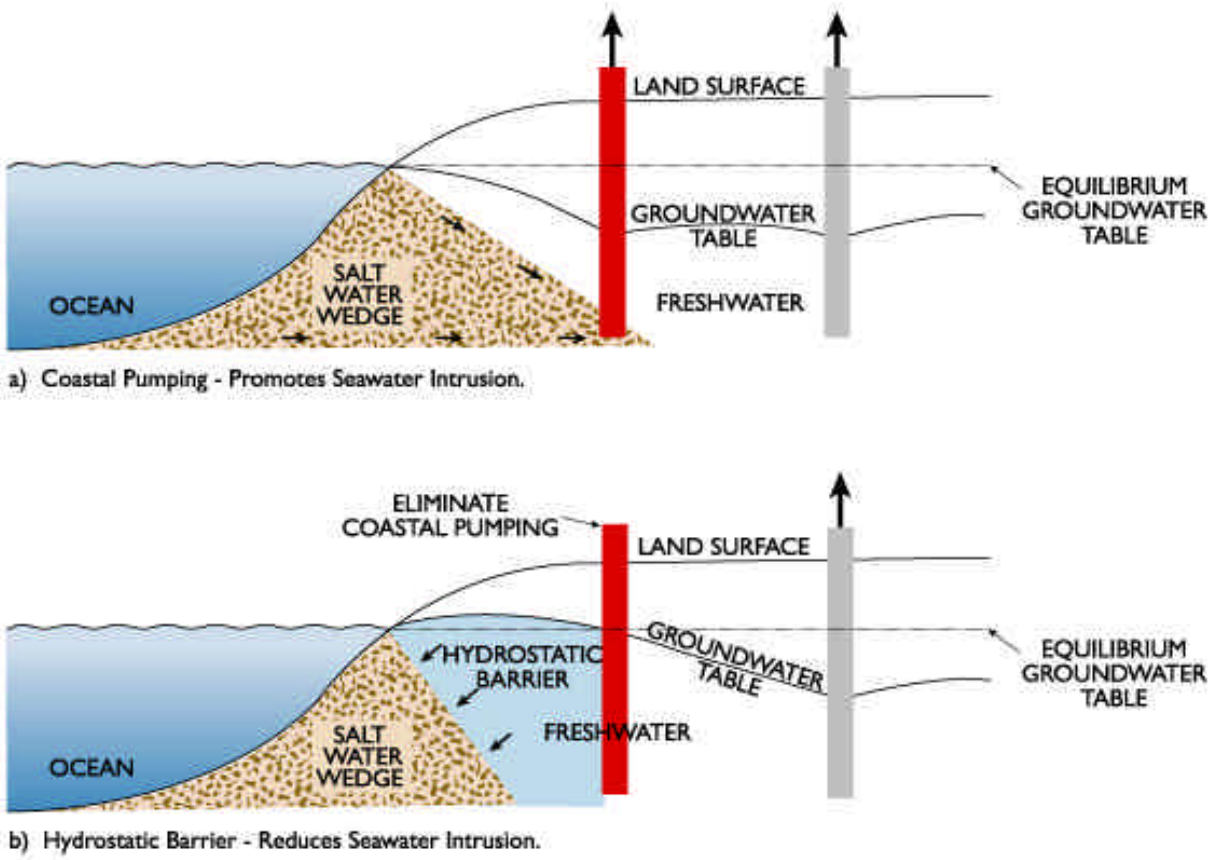
The presence of the hydrostatic barrier, as shown in Figure 2-12 (b), reduces seawater intrusion. This barrier would also result in an overall increase in the basin sustainable yield to 48,000 AFY, if a 100% dependable supplemental water supply is used to meet water demand. Should highly variable sources be used, sustainable yield would decrease because supplemental pumping would be required to provide reliability to users in dry weather years. Extremely dependable sources, on the other hand, will result in a higher basin sustainable yield because they minimize the need for supplemental pumping in dry weather years.

Recommended Pumping Practices:

Because the sustainable yield of the basin with the elimination of coastal pumping is double that of the basin-wide reduction scenario, this Revised BMP assumes that coastal pumping will be eliminated as part of the PVWMA Basin Management Strategy. However, this necessitates a supplemental water supply and the construction of a distribution network to supply coastal agricultural users with water. The supplemental water supply projects and coastal distribution system are discussed in Section 4.

With the current groundwater demand of 69,000 AFY and a basin sustainable yield of 48,000 AFY, 21,000 AFY would still be needed to balance the basin. With a projected future groundwater demand of 78,000 AFY, 30,000 AFY would still be needed to balance the basin. This is summarized in Table 2-6.

Figure 2-12: Seawater Intrusion with Coastal Versus Inland Pumping



Note: Modified from Environmental Engineering by Peavy, Rowe, and Tchobanoglous 1985.

2.8.3 Key Points

Key points of this section include:

- A 65% basin-wide pumping reduction would result in a sustainable yield of approximately 24,000 AFY. Eliminating groundwater pumping at the coast with 100% reliable supplemental supplies would result in a sustainable yield of approximately 48,000 AFY.

- This report assumes coastal pumping will be eliminated, and this necessitates a supplemental water supply and coastal distribution network.

- The current PVWMA groundwater pumping demand of 69,000 AFY requires additional supplies totaling 21,000 AFY. The projected demand for the year 2040 requires additional supplies totaling 30,000 AFY.

Table 2-6: Identification of Required Supplemental Supplies

Optimization Option	Current Conditions (AFY)	2040 Conditions (AFY)
Agricultural Demand	59,300	64,400
Urban Demand	12,200	16,100
Total Demand	**71,500**	**80,500**
Corralitos Filter Plant	(1,100)	(1,100)
Other Surface Water Diversions	(1,000)	(1,000)
Total Groundwater Pumping[a]	**69,000 (rounded)**	**78,000 (rounded)**
Basin Sustainable Yield with Coastal Pumping Reductions and Reliable Supplemental Supply[b]	(48,000)	(48,000)
Required Additional Supplies	**21,000**	**30,000**

Footnote:

a. Total Groundwater Pumping values are rounded to two significant figures or to the nearest thousand to represent significant accuracy.

b. This value represents a 100% reliable supplemental supply. If supplemental supply projects were hydrologically dependent, the basin sustainable yield would be less due to increased groundwater pumping during below normal water years.

2.9 Water Quality

Water resources in the Pajaro Valley include both surface waters and groundwater. Currently, groundwater is the predominant source for users. However, since surface waters are potential sources in the future, it is important to understand the current state of general water quality in the Basin.

2.9.1 Constituents of Concern

Previous studies and surveys have identified the following as primary parameters of concern for irrigation water quality in the Pajaro Valley (RMC, May, 2001):

- Nitrates;
- Salinity;
- Sodium;
- Toxicity from chloride and sodium; and
- Crop pathogens, primarily *Phytophthora*.

CCRWQCB Irrigation Water Quality Guidelines. The Central Coast Regional Water Quality Control Board (CCRWQCB) Basin Plan has developed water quality objectives for irrigation supplies. The guidelines for the parameters of concern are shown in Table 2-7.

Agricultural practices in the Pajaro Valley may diverge somewhat from these guidelines through the use of different indicators or slightly modified ranges of acceptability. Overall, however, the Pajaro Valley growers are in general agreement regarding the water quality required to sustain agricultural production in the Pajaro Valley. The following sections summarize the identified parameters of concern and associated adverse impacts, as they are relevant to the Pajaro Valley.

Nitrates. Nitrate contamination is a major concern in drinking water sources in the Pajaro Valley groundwater basin. Water high in nitrates is a threat to human and animal health, as it can cause acute illness and can have adverse long-term health impacts resulting from prolonged exposure. Nitrate is generally expressed as NO_3 (nitrate) or NO_3-N (nitrate-nitrogen). The EPA has set a Maximum Contaminant Level (MCL) at 10mg/l NO_3-N (EPA website). Because nitrates are contained in fertilizers in relatively high quantities and agriculture is the main source of livelihood in the Pajaro Valley, nitrates are routinely added to Basin soils. Nitrates are highly soluble and can easily leach into groundwater. They may also be found in surface waters due to agricultural runoff. The transport of nitrates in groundwater is generally limited by aquitards that separate the various aquifers.

Salinity. Electrical conductivity (EC_w) and total dissolved solids (TDS) are measures of the total salt content of the irrigation water. The salt tolerance of an agricultural crop is normally expressed as the decrease in yield associated with a given level of soil salinity. The University of California and others have studied crop salt tolerance and developed general relationships between irrigation water salinity, soil salinity and crop yield. In general, irrigation water with a salinity value of less than 500 mg/L TDS is the objective for delivery to local farmers. Some crops, such as strawberries, have a lower salt tolerance and may require additional on-site water management measures to reduce salinity-related crop impacts.

Table 2-7: CCRWQCB Irrigation Water Quality Guidelines

	Water Quality Guidelines			
Problem and Related Constituent	**Units**	**No Problem**	**Increasing Problems**	**Severe**
Salinity				
EC of irrigation water	mmho/cm	<0.75	0.75 - 3.0	>3.0
Permeability				
EC of irrigation water	mmho/cm	>0.5	<0.5	<0.2
SAR, adjusted	-	<6.0	6.0 – 9.0	>9.0
Specific ion toxicity from root absorption				
Sodium (evaluate by adjusted SAR)	-	<3	3.0 – 9.0	>9.0
Chloride	mg/L	<142	142 - 355	>355
Boron	mg/L	<0.5	0.5 – 2.0	2.0 – 10.0
Specific ion toxicity from foliar absorption (sprinklers)				
Sodium	mg/L	<69	>69	--
Chloride	mg/L	<106	>106	--
Miscellaneous				
NH_4 – N	mg/L	<5	5 – 30	>30
NO_3 – N	mg/L	<5	5 – 30	>30
HCO_3 (only with overhead sprinklers)	mg/L	<90	90 – 520	>520
PH	-	Normal range	6.5 – 8.4	--

Source: Regional Water Quality Control Board, 1994.

Sodium. The adjusted Sodium Adsorption Ration (SAR) is a measure of the sodium hazard to crops and soils due to irrigation water. In addition to sodium concentrations, the adjusted SAR considers the impact of irrigation water salinity and bicarbonates. Bicarbonates in irrigation water are potentially harmful to the soils because they may precipitate calcium from the cation exchange complex in the form of relatively insoluble calcium carbonate. As exchangeable calcium is lost from the soil, the relative proportion of sodium is increased with a corresponding increase in the sodium hazard.

Irrigation water that is high in sodium may also lead to a reduction in soil permeability, especially when applied to fine-textured (clayey) soils that already experience drainage problems. Soils of this type are found along the Pajaro River near the ocean. Applying irrigation water with an adjusted SAR below 6.0 does not usually affect the permeability of a soil.

Chloride and Sodium Toxicity. Irrigation water supplied with high levels of chloride and sodium can cause root and foliar absorption.

Crop yield may be impacted from root absorption when the adjusted SAR exceeds 3.0, or when the chloride concentration exceeds 142 mg/L. The toxic affects from these constituents usually occur on woody perennial plants. Annual crops are usually tolerant to these constituents, except for strawberries which, based on limited data, are considered to be relatively sensitive. Soil conditions and irrigation management may affect these threshold levels. Even though few data exist to fully assess the potential impact, these threshold levels should be considered when considering the potential hazard to crop production from root absorption of these constituents.

Crop damage can occur from foliar absorption of sodium and chloride associated with sprinkler irrigation. Irrigation with impact heads allows the irrigation water to come into contact with the crop foliage whereas

drip irrigation applies water directly to the soil. As with root absorption, annual crops are generally tolerant to foliar absorption, but strawberries would be considered somewhat sensitive. Because drip irrigation is the prevalent method of irrigating strawberries in the Pajaro Valley, potential crop damage from foliar absorption is not expected to be an issue. Additionally, the water quality guidelines to minimize potential root absorption impacts are similar in nature to the guidelines that minimize foliar absorption; therefore, any measures implemented to protect crops from root absorption will simultaneously reduce the potential for foliar absorption.

Pathogens. Current agricultural practices in the Pajaro Valley include the use of the soil fumigant methyl bromide to control weeds and pathogens, including *Phytophthora*. *Phytophthora* are of concern because it can cause crown rot and root rot, which greatly reduce the plants' ability to absorb water and nutrients (CH2M Hill, April 1999). *Phytophthora* has been eliminated from commercial strawberries, raspberries, and apple orchards in the Pajaro Valley through the use of methyl bromide. However, it is expected that this fumigant will be banned by the year 2005.

Phytophthora can be readily controlled by crop cultural/management approaches, such as:

- Planting crops on well drained soils and using raised beds to facilitate drainage;
- Periodic land leveling to avoid low areas within the field where drainage may become a problem;
- Using resistant varieties/rootstocks;
- Planting disease-free nursery stock;
- Careful irrigation management to avoid excessively wet soil conditions and plant moisture stress; and
- Maintenance of soil pH above 7.0.

Vegetable row crops produced in the Pajaro Valley do not seem to be impacted by Phytophthora-related production problems, and PVWMA vegetable crop growers have not identified Phytophthora contamination as a concern.

Pajaro Water Quality Guidelines. Due to the adverse impacts associated with poor water quality discussed above, it is important that Pajaro citizens have access to water that meets certain standards. For optimal crop yield and minimal health impacts, water must not exceed the threshold values of 10 mg/L NO_3-N, 500 mg/L TDS, 142 mg/L chloride, or an adjusted SAR of 3.0. Although measured in different units, these standards are similar to the guidelines put forth by the CCRWQCB.

2.9.2 Current Water Quality in the Pajaro Valley

Following is a description of water quality in the Pajaro Valley as it relates to the parameters of concern discussed in the previous section. The surface waters described below are generally of usable quality for irrigation and, in some instances, are of higher quality than groundwater supplies. However, most of the surface waters within then Pajaro Valley do experience seasonal water quality concerns. Unless otherwise noted, the source of this information is the 1999 AMBAG Watershed Water Quality Management Plan. Brief discussions are provided for:

- The Pajaro River;
- Corralitos Creek;
- Harkins/Watsonville Slough;
- College Lake; and
- Pajaro Valley Groundwater.

Pajaro River. Pajaro River water is a potential usable water supply. However, seasonal water quality concerns include nitrates, salinity, chloride, and *Phytophthora*. Nitrate concentrations vary depending upon location. The lowest nitrate levels are consistently at the furthest upstream monitoring stations, while nitrate levels near the coast have been measured at very high levels. Nitrates also vary seasonally from 0.5 to 10.2 mg-N/L, with the highest concentrations occurring in the late spring through summer months. Thus, in low flow conditions, nitrates level can approach the health related maximum of 10 mg-N/L. High salinity is indicated by elevated TDS levels in the lower Pajaro River, where the waters are subject to tidal flux. Salinity levels further upstream can also be quite high, particularly during low flow conditions. The Pajaro River at the Chittenden gauging station has reported higher levels of sodium than other surface water streams within the Pajaro River watershed. Chloride concentration is a potential problem as chloride is the constituent most likely to increase with growing urbanization. *Phytophthora* are also present in the Pajaro River.

Corralitos Creek. Corralitos Creek water is a potential usable water supply that has some seasonal water quality concerns. Like the Pajaro River, nitrate concentrations in Corralitos Creek vary seasonally, ranging from 0.5 to 9.7 mg-N/L. Higher salinity is suggested by slightly elevated TDS values. Adjusted SAR is generally acceptable. *Phytophthora* are present in Corralitos Creek.

Harkins/Watsonville Slough. Water quality parameters of concern for Watsonville and Harkins Slough water include nitrates and the presence of *Phytophthora*. Elevated levels of nutrients, including nitrates, are found in the slough system, and are suspected to contribute to the eutrophication problems that the sloughs experience. In addition, water flow and circulation have been modified through channelization, and construction of dikes and roads. This creates stagnant and slow-moving circulation conditions that can exacerbate the existing water quality issues. Conductivity and adjusted SAR are generally acceptable during winter months. *Phytophthora* are present in the Watsonville Slough System. However, similar to other surface waters with the basin, these water quality concerns are seasonal in nature. Therefore, diversions for the slough would provide usable supply for irrigation.

College Lake. Although College Lake water quality data are limited, available data suggest that contaminant concentrations vary seasonally. During the first storm events of the season, runoff collected in College Lake exhibits the highest values of TDS, nitrates, and other pollutants. Nitrate concentrations and salinity have exceeded the MCL and target delivery concentrations, respectively, during this initial flush. Dilution occurs through the rainy season. College Lake water is a potential useable supply as seasonal dilution typically improves water quality to meet the irrigation water quality objective. *Phytophthora* are present in College Lake.

Pajaro Valley Groundwater. Groundwater quality within the major aquifers of the Pajaro Valley is influenced by factors related to hydrology, geochemistry, well construction, groundwater pumping, and land use. Seawater intrusion leads to high levels of salinity within some of the coastal groundwater aquifers. Well data generally indicate that regions of high salinity have been expanding over the past decades. High chlorides are found at the deepest levels of the Aromas sands formation at the coast. This limits the ability to drill to the deeper Purisima formations to obtain fresh water as seawater intrusion degrades the upper aquifers. Also of concern is groundwater quality in the Murphy Crossing area, which is of relatively poor water quality as TDS concentrations and other constituents exceed the irrigation water quality objective.

Nitrate contamination has been identified as a problem in areas of high residential septic-tank density and in some areas recharged by the Pajaro River. In addition, since nitrate contamination is generally associated with surface sources of pollutants, areas with shallow perched water table aquifers or

unconfined aquifers are generally more susceptible to long-term increases in nitrate levels. Nitrate concentrations in excess of drinking-water standards have been observed from a large number of irrigation wells.

Phytophthora are not present in the groundwater. Infiltration testing suggests that percolation of water into the groundwater basin is an efficient *Phytophthora* removal mechanism (CH2M Hill, April 1999).

In summary, the water quality in the Pajaro Valley is highly variable. However, taking into account these variations, and in conjunction with varying levels of treatment, most of these water sources could be used as irrigation water sources in the future.

2.10 Watershed Management Issues

Water quality is not a static problem. Hydrologic processes cycle water through various media, from precipitation to surface water to groundwater. Poor quality water is not necessarily contained within boundaries; often, water is the mechanism through which pollutants are transported. Applied irrigation water may be transported as runoff to surface waters or may percolate to groundwater. Groundwater may move into surface water bodies, and seawater may intrude into the fresh groundwater aquifers. Water is rarely confined to a single location. Thus, water quality issues that affect one water body also become a threat to neighboring water bodies.

Although the Pajaro Valley groundwater basin contains numerous aquifer layers that are generally separated by clay layers, water transport between these layers is still feasible. Groundwater in different confined aquifer layers is under varying amounts of pressure and groundwater will move from areas of high pressure, to areas of lower pressure. Water can move vertically between aquifers, through naturally occurring gaps in intervening clays, or along the casings of wells that penetrate more than one aquifer zone. Additionally, abandoned wells with perforations at multiple aquifer elevations provide a transport channel through which water can move. Thus, poor-quality water may migrate between formations. This increases the concerns associated with seawater intrusion, as aquifers that underlie intruded aquifers can be affected.

Due to poor water quality, the Pajaro River and several tributaries have been listed by the State Water Resource Control Board as water quality-impaired streams for a number of different parameters, including nutrients, sediment, and pesticides (AMBAG, June 1999). Section 303(d) of the Clean Water Act requires the development of a Total Maximum Daily Load (TMDL) for any water body that is listed as water quality-impaired. A TMDL is a maximum value of pollutant loading to a water body, determined on a source-by-source basis. High priority TMDLs are set to be completed in 2001 and the medium priority TMDLs are to be established by 2003 (AMBAG, June 1999). The TMDLs will be used to initiate basin-wide corrective actions.

2.11 Description of Problem to be Solved

The major problem in the Pajaro Valley is an imbalance of water use and sustainable water supplies. This imbalance then results in a decrease in groundwater elevations, which causes seawater intrusion in the coastal region.

2.11.1 Current and Future Basin Deficit

Under current basin management conditions (i.e. rate of well pumping, well locations, and irrigation practices), the basin sustainable yield is approximately 24,000 AFY. With average groundwater use

estimated to be approximately 69,000 AFY, the basin deficit is 45,000 AFY as shown in Table 2-8. Under projected 2040 future water use and assuming current sustainable yield, the basin deficit would increase to 54,000 AFY. To balance the basin and eliminate seawater intrusion, this deficit must be eliminated. There are three strategies that can be implemented to attain basin balance:

1. Optimize current water supplies by increasing their yield, or by decreasing demand for them;
2. Develop new, additional water supplies to meet total demand; or
3. Use a combination of the above to balance demand and supply.

Table 2-8: Current and Future Basin Water Use and Current Sustainable Supply

Demand	Current Conditions (AFY)	Future Conditions (AFY)
Agricultural Demand	59,300	64,400
Urban Demand	12,200	16,100
Total Demand	**71,500**	**80,500**
Corralitos Filter Plant	(1,100)	(1,100)
Other Surface Water Diversions	(1,000)	(1,000)
Total Groundwater Pumping[a]	**69,000 (rounded)**	**78,000 (rounded)**
Current Basin Sustainable Yield[b]	(24,000)	(24,000)
Current Basin Deficit[c]	**45,000**	**54,000**

Footnotes:

a. Total Groundwater Pumping Demand values are rounded to two significant figures or to the nearest thousand to represent significant accuracy.
b. Current sustainable yield assumes continuation of existing basin wide pumping practices.
c. Excludes potential effects of increased conservation measures. See Section 3 for description.

2.11.2 Water Quality Requirements

The water supplied to solve the basin balance problem must be suitable for its intended uses. Specific water quality parameters of concern for irrigation include salinity, sodium hazard, chloride and sodium toxicity, and pathogens. The tolerance of crops to various water quality constituents can vary by crop type, and different varieties of the same crop can exhibit markedly different growth responses to waters of similar quality. Crop tolerance to constituents in the irrigation water, soil conditions and prevailing climate are important factors in assessing the suitability of a particular water for irrigation. The Revised BMP irrigation water quality objective is summarized in Table 2-9.

Table 2-9: Revised BMP Irrigation Water Quality Objectives

Constituent	Units	Revised BMP Objective
TDS	mg/L	500
Adjusted SAR	-	3.0
NO3 – N	mg/L	10
Chloride	mg/L	140

3 Management Measures

In order to protect and enhance groundwater and surface water resources in the Pajaro Valley, there are management measures that can be undertaken by the PVWMA that do not involve the construction of new projects. This section presents various measures that can be used to lessen water demand, increase the yield of the groundwater basin (the predominant current water supply), maintain optimal water quality, and protect and enhance surface water resources. These include:

- Demand management options to reduce water demand;
- Pumping management options to increase the sustainable yield of the groundwater basin;
- Watershed management options to ensure groundwater recharge; and
- Well management options to maintain water quality.

The PVWMA recently undertook a significant public based process that resulted in publication of Water Conservation 2000 (WC 2000). Many of the measures and strategies discussed in the following sections are also included in WC 2000 (CH2M Hill & RBSmith, February 2000), which was received by the PVWMA Board of Directors in February 2000.

3.1 Demand Management Options

Demand management measures include options such as water conservation, land fallowing and tiered water pricing. These measures can be employed as alternatives to, or in conjunction with, new water supply projects to help solve the overdraft and seawater intrusion problem.

This section identifies and describes the potential demand management options that were evaluated as part of this Revised BMP. Also presented are the goals, implementation issues, cost estimates (as appropriate) and potential impacts associated with each option.

3.1.1 Water Conservation

PVWMA developed WC 2000 to serve as a guidance document to achieve cost-effective increases in water conservation. The WC 2000 incorporates water conservation programs from around the state that are applicable in the Pajaro Valley. Under the WC 2000, conservation would be achieved through voluntary actions without restrictions or enforced land use changes. The plan identifies cost-effective conservation opportunities of approximately 4,500 AFY of agricultural conservation and 500 AFY of urban conservation. Correcting on-farm irrigation system deficiencies, improving irrigation scheduling techniques, and conducting mobile laboratory evaluations are all methods that can be effective in increasing agricultural water conservation. The WC 2000 proposed agricultural conservation program calls for the following actions:

- Evaluate the PVWMA water metering program;
- Submit annual grower water conservation plans;
- Prepare the PVWMA annual report of water use and conservation;
- Provide records of historic pumping;
- Continue grower education and demonstration projects;
- Install CIMIS weather stations;
- Provide irrigation scheduling technology/assistance;
- Institute mobile irrigation laboratory program;
- Seek financial assistance to fund the PVWMA water conservation program;
- Seek financial assistance for irrigation system improvements; and

- Continue ongoing public education program.

Urban conservation can be achieved through water audits, a landscape water conservation ordinance, and toilet and washing machine rebate programs. The WC 2000 proposed urban conservation program calls for the following actions to conserve a projected 500 AFY:

- Conduct residential water audits;
- Conduct commercial, industrial, and institutional audits;
- Offer high efficiency washing machine rebates;
- Institute commercial toilet rebate program;
- Create and maintain demonstration gardens;
- Report previous water use on billings;
- Distribute conservation notices;
- Implement conservation pricing;
- Conduct large landscape water audits and retrofit program; and
- Draft and approve landscape water conservation ordinances.

The cumulative cost of implementing the above conservation plan to PVWMA is approximately $2,130,000 over seven years, or $3,029,000 over 10 years (CH2M Hill & RBSmith, February 2000), and does not include costs to farmers to implement such conservation measures. The present worth values shown in Table 3-1 were calculated assuming uniform annual expenditures over the seven and ten year periods. For the purposes of the Revised BMP, it was assumed that these water conservation practices would be implemented over a seven year time period. Excluded from the costs presented in Table 3-1 are the costs attributable to the farmer or owner.

Table 3-1: Conservation Present Worth Analysis

Conservation Plan	Cumulative Cost	Uniform Annual Cost	Present Worth
7-Year	$2,130,000	$304,000	$1,700,000
10-Year	$3,029,000	$303,000	$2,200,000

Notes:
1) Adapted from *Water Conservation 2000* (CH2M Hill and RBSmith Consulting, February 2000).
2) Present worth costs are based on a 30-year lifetime, 6% interest.
3) Costs presented in Table 3-1 exclude on-farm or other owner costs.

Additional water conservation program spending by the PVWMA would not necessarily result in additional voluntary conservation savings. To achieve higher levels of conservation, the PVWMA would need to implement mandatory conservation measures requiring enforced land use changes or significant capital investment by farmers. The PVWMA Board of Directors has determined that such an approach would be inconsistent with the mission, goals, and objectives of the PVWMA.

Conservation also has a number of indirect benefits, with respect to erosion control, surface runoff, and leaching of nitrates and other pollutants into the groundwater. However, irrigation improvements that significantly reduce deep percolation will also reduce recharge of the aquifers.

The PVWMA and the City of Watsonville are actively implementing water conservation measures identified in WC 2000. For additional details on conservation, refer to the *Water Conservation 2000* document (CH2M Hill and RBSmith Consulting, February 2000).

3.1.2 Water Pricing

The PVWMA currently imposes an augmentation charge for water use within PVWMA area. The augmentation charge is levied via metering of wells providing agricultural and urban water supplies within its service area. With some renovation of the metering program, alternative water pricing programs could be used to promote demand reduction in several ways. These include raising flat rates and implementing tiered water pricing.

Currently, the PVWMA augmentation charge is a flat rate of $50 per acre-foot. One option for managing water demand is to raise the augmentation charge to promote water conservation. This would encourage users not to waste water.

Another option is to implement tiered water pricing. Tiered water pricing is an incremental pricing system in which the price of water increases as the amount of water consumed exceeds certain threshold values. This management mechanism can promote conservation and/or alter water use practices. The plan would set varying levels of water pricing associated with water application rates for various crop types, which may promote conversion to crop types with lower water uses. Crops with a low water application requirement would fall into a low pricing tier, while crops with higher application rates would fall into a higher tier. Under the tiered structure, wasteful or high-use irrigators incur significantly higher water costs.

An increase in water rates or a tiered water structure would provide an incentive for conservation and would minimize wasting of water. Both methods of water pricing were considered for implementation. A recommended rate structure is discussed in Section 9.

3.1.3 Land Fallowing

The land fallowing option involves the acquisition or leasing of agricultural land and retirement of that land from production or development. Fallowing the land from production would reduce groundwater pumping by reducing water demand. Acquiring the land would stop property owners from pumping groundwater from the basin. As applied in the Pajaro Valley, the estimated capital cost to acquire agricultural land is approximately $20,000 to $30,000 per acre. This cost does not include the additional impacts of lost taxes, production, and jobs to the economy of the Valley.

Model analyses indicate that the most effective location for land fallowing from the standpoint of basin management would be within the coastal area. Eliminating coastal area pumping would allow for formation of a hydraulic groundwater barrier adjacent to the Pacific Ocean, minimizing seawater intrusion.

The cost of land fallowing would be significant. For example, fallowing 1,000 acres of land in the coastal area at a cost of $20,000 to $30,000 per acre would cost between $20 and $30 million. The removal of 1,000 acres of irrigated agriculture in the coastal area would reduce demand by approximately 2,000 AFY. Alternatively, land could be leased instead of purchased. This would allow for agricultural production during wet years when additional water supplies may be available. This option would cost approximately $1,500 per acre per year of demand reduction and associated economic impacts to the Pajaro Valley. (Note: The land lease unit cost of $1500 is assumed to be the Pajaro Valley average. However, in the coastal area the annual cost to lease land is approximately $2500 to $3000 per acre.) This makes land fallowing a costly option in the Revised BMP.

3.2 Pumping Management

The PVIGSM simulation of groundwater levels and seawater intrusion in the Pajaro Valley groundwater basin indicates that coastal groundwater pumping reductions would be more effective at preventing seawater intrusion than basin-wide pumping reductions. As discussed in Section 2.8, the elimination of coastal pumping creates a hydrostatic barrier that results in a sustainable yield of up to 48,000 AFY, doubling the sustainable yield of the basin. This assumes that 100% dependable supplemental supplies (i.e. supply from desalination or water recycling) are available to augment pumping. This pattern of pumping management optimizes the basin yield, but necessitates the construction of a distribution network to supply coastal users with the water they need. This also calls for a supplemental water supply to serve the coastal distribution system.

The sustainable basin yield is a function of the interrelationship between yield, water conservation, irrigation recharge, and reliability of water supply. These relationships become significant with alternatives that rely heavily on high levels of water conservation and on water sources with low reliability. High levels of water conservation can affect the sustainable yield because the amount of recharge to the groundwater basin is reduced. Surface water sources with low reliability can require additional groundwater pumping to meet demand during low water years. Therefore, the sustainable yield of the basin would be less than 48,000 AFY if land fallowing, high levels of conservation, or less reliable water supplies are implemented.

3.3 Summary of Demand and Demand Management

Although there are several options available to optimize the groundwater basin, they are insufficient by themselves to balance demand without providing an additional sustainable supply, as shown in Table 3-2.

Assuming 5,000 AFY of water conservation measures and an increase in basin yield of 24,000 AFY with coastal pumping restrictions, a basin wide overdraft of 16,000 AFY would still remain under current conditions. However, based on PVIGSM results, approximately 18,500 AFY of coastal pumping reductions are required to eliminate seawater intrusion. Therefore, to eliminate seawater intrusion approximately 18,500 AFY of supplemental supplies must be delivered to the coastal area. The strategy to eliminate seawater intrusion is to provide 18,500 AFY of supplemental supply to the coastal area while maintaining basin balance.

Future water use in the Pajaro Valley is projected to increase the required supplemental supply from 16,000 to 25,000 AFY (an increase of 9,000 AFY) by 2040. This overdraft will have to be met with new water supplies if a balance between demand and supply is to be achieved. Land fallowing via land leases could be used to bring about a basin balance, however, its annual unit cost of $1,500 per acre of land (plus economic impacts) precludes its use on a wide scale.

Water conservation and land fallowing are management options that reduce the amount of irrigation, which in turn reduces the amount of groundwater recharge and basin yield. Furthermore, water supplies with low reliability result in excessive groundwater pumping during dry years, which adversely affects (lowers) the sustainable yield of the groundwater basin. Model results showing this relationship can be found in *PVIGSM Technical Memoranda* (Montgomery Watson/AT Associates, May 2000). Examples of water sources with low levels of reliability would be sloughs and small streams, whereas an example of a high reliability source would be recycled water.

Table 3-2: Identification of Required Supplemental Supplies with Conservation

Optimization Option	Balancing Current Conditions (AFY)	Balancing 2040 Conditions (AFY)
Agricultural Demand	59,300	64,400
Urban Demand	12,200	16,100
Total Demand	**71,500**	**80,500**
Corralitos Filter Plant	(1,100)	(1,100)
Other Surface Water Diversions	(1,000)	(1,000)
Total Groundwater Demand[a]	**69,000 (rounded)**	**78,000 (rounded)**
Current Basin Sustainable Yield	(24,000)	(24,000)
Future Increased Yield Due to Pumping Management at Coast and Reliable Supplemental Supply Projects[b]	(24,000)	(24,000)
Water Demand without Conservation	**21,000**	**30,000**
Increased Agricultural Conservation (Achieved by 2010)[c]	(4,500)	(4,500)
Increased Urban Conservation (Achieved by 2010)[c]	(500)	(660)
Required Additional Supply[d]	**16,000**	**25,000 (rounded)**

Footnotes:

a. Values rounded to two significant figures or to the nearest thousand to represent the values significant accuracy.
b. The amount achieved if supply is 100% reliable. With less reliable supply, the amount of increased yield would be lower. The amount of increased groundwater yield of the Alternatives (except Local-Only Alternative) developed in Section 5 would be 23,000 AFY given their level reliability.
c. Conservation to be achieved over several years, but is included here to show impact on current levels of demand.
d. This value represents the supplemental supplies required to meet the overall water balance in the basin assuming 100% supply reliability. However, PVIGSM results indicate that elimination of approximately 18,500 AFY of pumping along the coast is required to eliminate seawater intrusion.

3.4 Watershed Management

In addition to the implementation of measures and projects to increase sustainable water supply for the Pajaro Valley, it is important to protect and monitor watershed conditions within the Pajaro Valley. Non-point source (NPS) pollution is likely to be the most significant threat to the water quality in the Pajaro Valley watersheds. NPS pollutants originate from a wide range of sources that are not required to have an NPDES Permit. In general, these pollutants come from sources over which water users have some level of control (e.g. fertilizer and pesticide runoff, animal waste management, paint, oil, anti-freeze poured directly into storm drains, etc.). Therefore, programs that promote and educate the public on the control of such pollutant sources can be very effective.

The SWRCB and RWQCBs are empowered by the State's Porter-Cologne Water Quality Control Act to regulate water pollution, including NPS pollution. Through cooperative efforts, the SWRCB, RWQCBs, and other organizations have developed management measures for control of NPS pollution. In 1988, the California NPS Management Plan was adopted. The plan identifies sources and potential management measures for prevention and control of NPS pollution.

Watershed management is a key aspect in protecting ground and surface water supplies, water quality, and ensuring continued beneficial use of water. A complete Watershed Management Plan is not included

in the Revised BMP. However, the framework for developing key programs that would be included in a Watershed Management Plan is discussed in the following sections. Included herein are potential management measures and monitoring programs that could be implemented to protect water supplies for future beneficial use, including environmental protection and enhancement.

3.4.1 Water Resource Monitoring Program

Water resource monitoring is a key aspect in understanding and evaluating basin conditions. Data collected is often used to evaluate contaminant transport, groundwater flow, surface water recharge, and other water resources aspects. Ultimately monitoring provides the data and information for management of water resources within the basin. The Pajaro Valley consists of groundwater and surface water resources that are interconnected within the basin. This section identifies the current groundwater and surface water monitoring programs and identifies potential enhancements to the programs that may be implemented.

Groundwater Monitoring:

Groundwater monitoring programs are typically implemented to provide data for evaluation of basin conditions. In addition, monitoring programs are used to track groundwater contaminants and ultimately provide data and information that can be used to implement programs and strategies to protect groundwater supplies. This section highlights the current groundwater monitoring program and provides a general framework for development of an enhanced groundwater monitoring program.

Data collected under the current PVWMA groundwater monitoring program includes:

- Water quality data;
- Groundwater elevation data; and
- Geologic and hydrogeologic data.

These data, in conjunction with other basin features, provide the framework for understanding basin characteristics such as groundwater recharge and pollutant transport. These data also provide a mechanism for identifying water quality issues such as seawater intrusion, nitrate contamination, and contaminant movement within the groundwater system.

PVWMA's current groundwater monitoring program consists of monthly well sampling and analysis of select wells (Note: Some wells monitored under the program are sampled on a biannual or annual basis). The monitoring program covers sampling of selected production wells and monitoring wells throughout the basin. Water purveyors in the basin such as the City of Watsonville, Aromas Water District, Pajaro Sunny Mesa, and California State Water Company also provide additional well data. In all, PVWMA tracks approximately 170 wells throughout the basin and maintains a database and geographical information system (GIS) to manage, analyze, and summarize data.

Well monitoring includes measurement of groundwater levels and collection of water samples for analysis. Wells in the basin are screened at various intervals with some wells screened in multiple aquifers. Well logs provide screening data and depth for the wells within the monitoring program. The majority of the groundwater wells are screened within the Aromas aquifer, the main production aquifer in the basin.

The collected data are compiled and summarized in an annual water resources report, which is completed at the end of each calendar year. The annual report includes water quality data, evaluates the extent of the

seawater intrusion, water table contours, and discusses other groundwater areas of concern. In addition, the report includes results from any hydrogeologic studies that have taken place over the water year. The extent of overdraft and seawater intrusion in the Pajaro Valley has been demonstrated in these annual reports and the need for programs and projects to improve these conditions is well documented.

Implementation of demand management and development of supplemental water supply projects will improve groundwater conditions and eliminate further seawater intrusion. It will therefore be important to monitor groundwater level and quality data to measure the effectiveness of these programs. Because of the significant future changes in overall water supply and groundwater pumping, an enhanced groundwater-monitoring program is needed. Potential enhancements to the groundwater monitoring program include:

- Monitoring Network – Expanding the monitoring network by installing new monitoring wells to provide a good basis for determining the movement of seawater intrusion;
- Water Quality Analysis – Monthly sampling and analysis of groundwater quality, investigation of aquifer screening levels, isotope analysis, water dating analysis;
- Groundwater Level Measurement – Monthly tracking of groundwater levels;
- Aquifer Transport Study – Developing an increased understanding of recharge of the aquifers and contaminant transport;
- Groundwater Modeling Updates – Continue updating of the PVIGSM, including updated land and crop use data available approximately every seven years from the Department of Water Resources, and modeling of contaminant transport;
- Database Management – Upgrading existing database. Developing tools for management and reporting of data including GIS compatibility; and
- Annual Reporting – Expanded analysis of collected data, seawater intrusion front, contaminant migration, documenting observed changes in groundwater levels and groundwater migration.

In addition to the development of an enhanced groundwater monitoring program, PVWMA is also pursuing potential funding opportunities, including state and federal grants, to help offset the cost of the enhancements to the monitoring program.

Surface Water Monitoring:

The current surface water monitoring includes sampling and analysis at approximately 25 sites within the PVWMA service area. Surface water monitoring spans the wet weather season and samples are taken on a biweekly schedule. Water quality data are managed in a database application. The USGS also maintains several gage stations within the Pajaro Valley providing flow data for select surface water in the basin.

Potential enhancements to the surface water monitoring program include:

- Water Quality Analysis – Continued monitoring of water quality of surface waters;
- Flow and Level Monitoring – Measurement of river, creek, and slough flows and measurement of lake levels;
- Modeling Updates – Continue updating of the PVIGSM and modeling of contaminant transport;
- Database Management – Maintaining and upgrading existing database. Developing tools for management and reporting of data; and
- Annual Reporting – Summarizing collected data, constituent issues, documenting observed changes in water quality levels and surface water flows.

In addition to water quality and flow monitoring, reporting, and management, the program should step up efforts to track, meter, and monitor surface water diversions. These tasks are key to protecting and managing water supplies. Surface water diversions could affect natural recharge to the groundwater basin and limit natural dilution of potential constituent concentrations of concern. In addition to the Corralitos Creek Filter Plant diversions, other surface waters are diverted for agricultural purposes. Such diversions over 10 AFY are required by the PVWMA to be metered under Ordinance 93-2 (Amended by Ordinance 96-2).

3.4.2 Recharge Area Protection Program

Groundwater resources in the Pajaro Valley result from stream recharge, percolation of rainfall, deep percolation of irrigation water, and inflow into the groundwater basin from adjoining groundwater systems. The protection of areas within the basin that serve to recharge the groundwater aquifers is critical to providing a reliable, long-term groundwater supply. Recharge areas are protected by the Counties of Santa Cruz and Monterey. For example, the Santa Cruz County General Plan and Local Coastal Plan limits or constrains development within identified recharge areas in order to protect groundwater supplies. In addition, new development must meet County policies for stormwater runoff in recharge area. PVWMA does not have a formal policy or ordinance protecting high recharge areas.

PVWMA could implement a basin-wide management measure to enhance groundwater stability through the protection of key areas of recharge. This effort could begin with a public outreach program designed to inform area residents and decision makers of the importance of protecting groundwater recharge areas.

Because clay layers inhibit deep percolation through much of the central and western portions of the Pajaro Valley, deeper aquifers rely on undeveloped areas of native vegetation or agricultural lands generally located in the eastern portions of the Valley to provide recharge through surface water infiltration and rainfall. As these or other areas in the Pajaro Valley are subject to impervious development, infiltration of precipitation would be reduced, thus reducing recharge of the underlying aquifers. Basin yield would decrease, and the negative pressure within the deep aquifers would cause the seepage of lower-quality water from above through semi-confined layers that would otherwise act as barriers.

3.4.3 Nitrate Management Program Framework

This section briefly summarizes nitrate issues and concerns in the Pajaro Valley and provides a framework for development of a nitrate management program. A complete nitrate management program is not included in the Revised BMP, as the major focal point of the document is to address seawater intrusion and the need for water supply management and projects. However, a program should be developed in the near future to address nitrate issues, as nitrates are a potential public health and agricultural concern.

As previously discussed in Section 2.9.2, groundwater nitrate contamination has been documented as a problem within the Pajaro Valley. Elevated nitrate concentrations in excess of the drinking water standard of 10 mg/L N (nitrogen) are typically observed in wells west of Highway 1, in the wells east of the City of Watsonville and in other localized areas within the PVWMA boundary. Nitrate concentrations in the basin are shown in Figure 3-1. Because agriculture is the major land use in the Pajaro Valley, elevated nitrate concentrations are likely due to fertilizer application and agricultural practices. However, other sources of nitrogen contamination include septic tank drain fields and animal facilities. In addition, nitrate concentrations occur naturally in groundwater due to biologic activity or decomposition of geologic deposits, but natural concentrations of nitrate rarely exceed the Primary Drinking Water Standard of 10 mg/L N.

The SWRCB and RWQCB, in conjunction with other stakeholders, have developed guidance for implementation of watershed management measures, including nitrate management. A "three-tiered approach" is the recommended implementation strategy for controlling pollution and protecting water supplies. The "three-tiered approach" recognizes that the most effective management is achieved through voluntary implementation of management measures. Tier 1 is therefore based on outreach and education programs that promote and encourage voluntary implementation of management measures to reduce contamination. Tiers 2 and 3 of the approach include increasing regulatory action to ensure implementation of management measures.

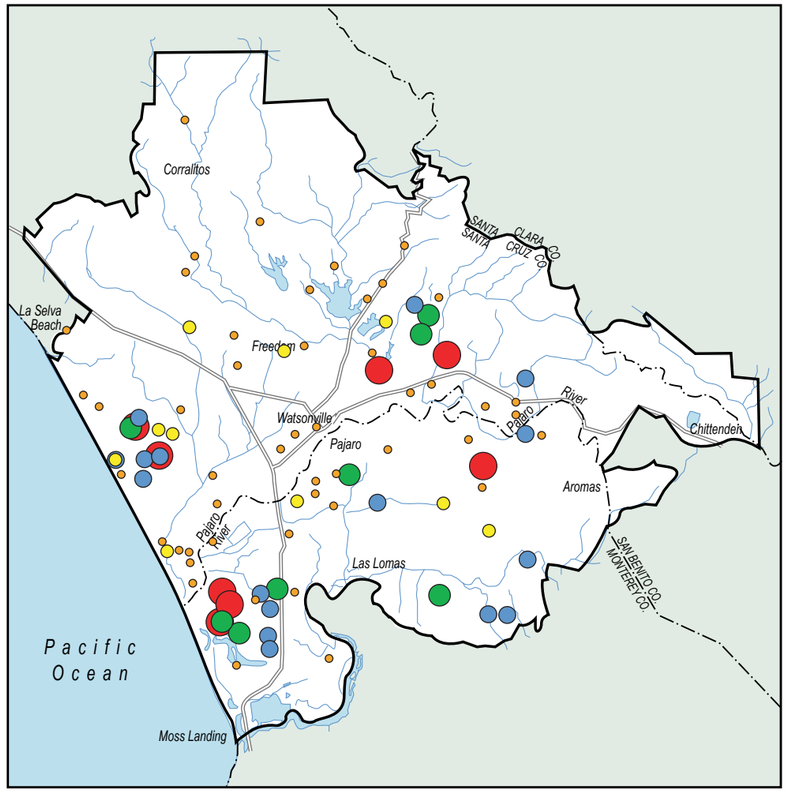
Currently, PVWMA is a member and participant on the Monterey County Water Resource Agency (MCWRA) Nitrates Committee, which is tasked with addressing agricultural and urban nitrate issues. The committee has coordinated and sponsored public outreach events to educate the community on nitrates management. PVWMA has co-sponsored and participated in these events. In addition, the committee has developed pocket guides for management of agriculture nitrates on which the PVWMA co-sponsored and participated. However, increased efforts are necessary to protect water resources within the Valley.

PVWMA should develop a nitrate management program promoting voluntary implementation of the management measures. Because the major sources of nitrate contamination in the Pajaro Valley are due to agricultural practices, septic tanks, and animal facilities, the nitrate management program should focus attention on promoting management measures to decrease nitrate contributions from these sources. Potential management measures for reducing nitrates contamination include:

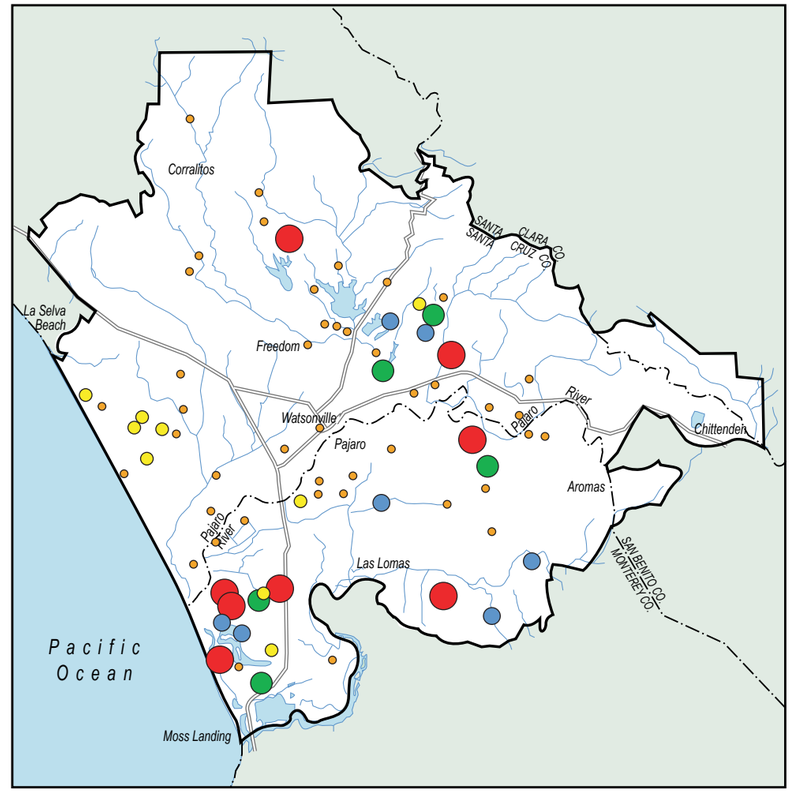
- Crop nutrients budgeting;
- Identifying crop types, and amounts and timing of nutrients;
- Identifying hazards to site and adjacent environment;
- Water sampling and analysis to determine nitrate concentrations;
- Soil sampling and analysis to determine available nutrients;
- Plant tissue sampling and analysis;
- Calibrating nutrient equipment;
- Irrigation techniques to prevent leaching of nutrients;
- Controlling discharge from animal facilities;
- Runoff management of agricultural and urban areas; and
- Monitoring and maintaining septic tanks.

More detailed monitoring is necessary to better understand the extent and sources of nitrate contamination in the various basin aquifers. PVWMA could then detail and implement a nitrates management plan. In the interim, a public outreach program could be implemented to provide education relative to controlling nitrate leaching into the groundwater system. A cooperative education and outreach effort with the Counties of Monterey, Santa Cruz, and San Benito and other local agencies could be developed.

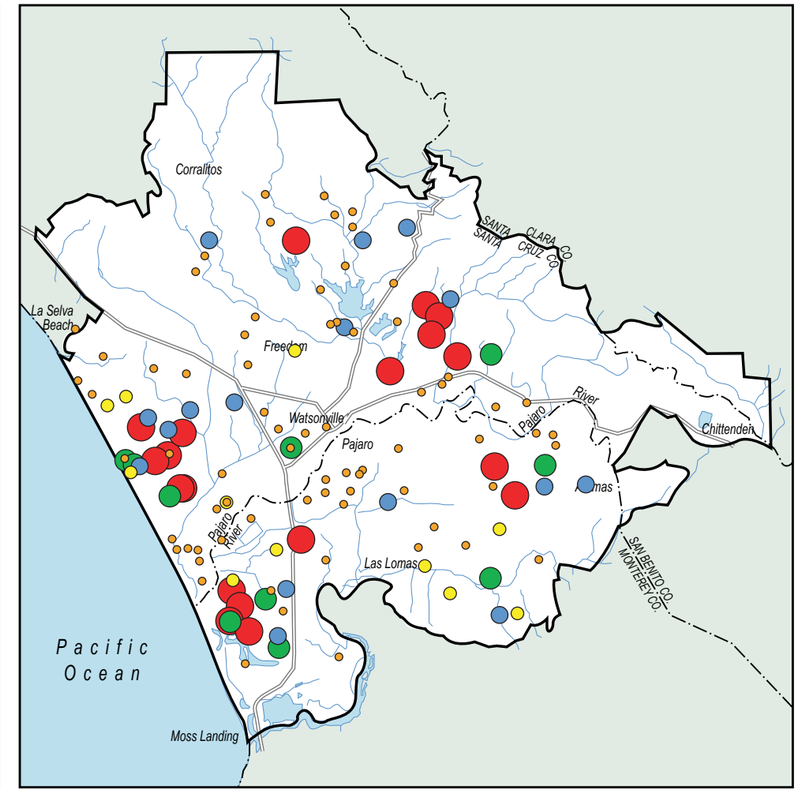
Nitrate Concentrations Predrought (1979 - 1986)



Nitrate Concentrations Drought (1987 - 1992)



Nitrate Concentrations Postdrought (1993 - 1998)



LEGEND

Nitrate Concentration (mg/liter)

- 0.1 - 25.0
- 25.1 - 45.0
- 45.1 - 90.0
- 90.1 - 135.0
- 135.1 - 486.0

- PVWMA Boundary
- Roads
- County Boundaries
- Waterbodies
- Rivers and Streams

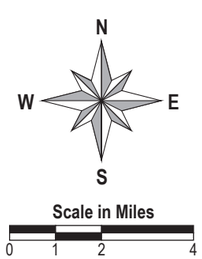


Figure 3-1: Nitrate Levels in the Pajaro Valley

3.4.4 Water Metering Program

Water use data provided by PVWMA's water metering program provide a mechanism for billing, planning, and water management. The data are especially critical for managing the Pajaro Valley groundwater basin and the funding of solutions to eliminate seawater intrusion. PVWMA's metering program includes monitoring and reading meters, maintaining and calibrating meters, and repairing or replacing meters.

In 1993, the PVMWA adopted Ordinance 93-2 requiring the installation of flow meters on all water supply facilities capable of producing over 10 AF of water annually. This included both groundwater and surface water facilities. Production facilities of less than 10 AF are approximated for billing purposes. Water use by non-metered agricultural production facilities is estimated to be about 1% of the total water use in the PVWMA service area.

The Ordinance required mandatory meter installation by the end of 1995 and most meters were installed in 1994. Turbine meters with an expected life of 5 years and propeller meters with a life of 8 years were the typical meters installed. These types of flow meters have a typical accuracy of 5% with regularly scheduled maintenance. However, since the installation of meters approximately 8 years ago, there has been limited maintenance of the meters due primarily to limited Agency resources. As a result, a significant number of broken and malfunctioning meters have not been repaired, resulting in lower than typical accuracy. PVMWA currently estimates that the water metered had an error of approximately 16% in 2001. Therefore, the PVWMA is developing an enhanced metering program to improve the accuracy of the program.

PVWMA is in the process of developing and implementing an enhanced meter program that includes the following tasks:

- Meter Readings for Billing - Biannually in June and December;
- Meter Readings for Maintenance - Biannually in the Spring and Fall;
- Maintenance and Calibration Program – Each meter to be checked, serviced and repaired at least once every two years;
- Ultrasonic Meter Accuracy Tests – Meter testing in conjunction with maintenance and calibration program;
- Turbine Meters Replacement Program – Turbine meters have become obsolete and replacement parts are no longer available. Therefore, turbine meter replacement with propeller meters is an ongoing task.
- Propeller Meter Repairs – Repair of aging propeller meters is critical for monitoring and maintaining accurate data.
- Database Tracking – PVMWA staff is in the process of developing a database to track and manage the metering program. The database shall allow for effective tracking and management of metering activities and resources.

The enhanced metering program will provide confidence in the collected data and will be a valuable tool for future planning and management of the groundwater basin. Data could be used to calibrate the PVIGSM model and validate model results. These data shall allow for evaluation of conservation efforts and accurate collection of augmentation charges for developing supplemental water supplies.

3.4.5 Well Management Program

Well management is critical to ensure maximum groundwater quality in the Pajaro Valley because wells can serve as conduits for transport of contaminated water from one aquifer to another. Therefore, the PVWMA needs to undertake a comprehensive well management program with regard to well decommissioning and well replacement. For additional information on the regulatory processes of well management, see Feeney et al, March 1999.

Well Decommissioning:

Wells are constructed in varying manners, including those with a single screened interval and those with multiple screened intervals. Wells with single screened intervals, if properly constructed with well seals between aquifers, extract groundwater from a single aquifer. Wells with multiple screened intervals can be used to extract water from more than one aquifer. Within the Pajaro Groundwater Protection Zone of the Santa Cruz County portion of the PVWMA (Zone boundaries are published on a map on file with the Environmental Health Office), new well construction is limited to wells being completed in a single aquifer only (Feeney, et al, March 1999).

When not in operation, wells with screened intervals in multiple aquifers can serve as a conduit to allow groundwater to flow from one aquifer to another. This can pose problems if one of the aquifers is intruded with seawater, or is otherwise contaminated. In particular, seawater has a higher specific gravity than fresh water. As seawater intrudes into and contaminates a fresh water aquifer, there is an increase in specific gravity that will cause the “heavier” seawater-intruded-groundwater to flow down a well and into the lower elevation aquifer, resulting in seawater contamination of the lower aquifer. This effect may be magnified by the hydrostatic pressure difference between aquifers.

It is therefore important that a consistent procedure be developed to guide decommissioning of groundwater wells that are abandoned from operation. The California Department of Water Resources has regulations that govern the construction and destruction of wells (DWR, 1974) that are applicable to all of California. The Monterey County Water Resources Agency adopted an ordinance that incorporates the requirements set by DWR, including sealing of the well casing to prevent vertical migration of contaminated water within the well. The PVWMA has a program for notifying the respective county whenever an abandoned well is discovered. PVWMA may consider an ordinance similar to that adopted by MCWRA.

Well Replacement:

Well replacement is a concern to groundwater users throughout the Pajaro Valley. Along the coast, where seawater intrusion is occurring, some wells that are seawater intruded may have to be replaced with wells that are drilled into a non-intruded aquifer. In inland areas, well deepening is used to enhance well yield or escape nitrates or other water quality problems associated with the shallow groundwater zones. These replacement wells may be needed to meet the users’ water needs on an interim basis, while the long-term water supply projects are being built.

A current Santa Cruz County regulation allows a well to be replaced only with a well that is constructed to the same depth, unless CEQA documentation prepared by the well owner demonstrates such a replacement will have no detrimental impact on groundwater resources. The purpose of this regulation is concern that replacement of wells in shallow intruded aquifers with wells in deeper, less-intruded aquifers could serve to accelerate seawater intrusion into the deeper aquifer.

Once implemented, the projects identified and evaluated in this draft Revised BMP will obviate the need for this regulation because they will eliminate over-drafting and seawater intrusion of the basin by providing an overall long-term reduction in coastal groundwater pumping.

In the inland areas of the Pajaro Valley the need for this regulation is also questioned, because replacement wells drilled to a deeper aquifer do not directly impact the advance of seawater intrusion, nor overall basin groundwater balance. The groundwater underlying the Pajaro Valley flows into the aquifers from the surrounding aquifers, infiltrates through the river and streambeds, and recharges through the soil structure. In general, the flow of groundwater in the aquifers underlying the Pajaro Valley is from the inland areas toward Monterey Bay, with the exception of the areas along the coast where groundwater levels are below sea level and seawater flows into the aquifer.

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4 New Water Supply Projects

This section identifies and describes water supply, storage and distribution projects evaluated as part of this Revised BMP. The projects presented herein include local surface water supplies, recycling of treated wastewater, and importation of water from the CVP. These projects can be combined in various ways with the management options described in Section 3 to develop different management strategies to balance water demand with sustainable water supply.

While two given projects may share a common project component, the cost and yield of this component could vary depending upon the overall project composition. All the projects discussed in this Revised BMP are summarized in Table 4-1, and are described in greater detail in the subsequent sections. Project descriptions give a general overview of the project including location, estimated yield, water quality, implementation issues, and estimated costs. In the descriptions, each component is discussed at a level such that common components can be compared between projects.

It should be noted that each project is made up of several common water supply elements: water source, conveyance, storage, and distribution. In many cases, one or more of these elements are not necessary. For example, local water projects may not have a conveyance element, and consistently reliable supplies may not call for a storage element.

As mentioned in Section 2.8, the Coastal Distribution System (CDS) has already been identified as a common element of all management strategies, and is therefore being implemented. It must be constructed in order to supply coastal users as a part of the pumping management strategy to maximize the sustainable yield of the Basin. Each of the projects in this section relies upon the CDS except for the Murphy's Crossing Project, which is located inland and relies on recharge and the Inland Distribution System (IDS). In most cases, the CDS is a part of the distribution element, while in other cases, it comprises the distribution element entirely.

Construction cost estimates were developed for the projects based on conceptual designs. The estimates were developed for guidance in project evaluation and implementation and are based on information available at this time. The cost estimates include contingencies of 20% for construction, 17.5% for engineering, legal, administration, and permitting, and 5% for environmental and permitting. Final costs will depend on actual labor and material costs, competitive market conditions, actual site conditions, final project scope, implementation schedule, and other variable factors. Construction cost estimates are based on first quarter, 2001 price levels.

Annual operation and maintenance (O & M) costs were based on the following factors:

- Pipeline O & M – 1% of estimated construction cost
- Diversion, Pump, and Filter O & M – 2.5% of estimated construction cost, plus power costs
- Percolation Ponds, Injection & Extraction Wells O & M – 2% of estimated construction cost, plus power costs
- Dams and Reservoirs O & M – 0.15% of estimated construction cost
- Reverse Osmosis Treatment O & M – 5% of estimated construction cost, plus power costs
- Power Cost – $0.15 per kilowatt-hour

Annualized construction cost estimates were developed using an interest rate of 6% and a 30-year recovery period.

Table 4-1: Summary of New Water Supply Components

Project	Yield	Implementation Issues
Harkins Slough with Supplemental Wells and Connection	1,100	Diversion and Recharge Basin construction completed in 2001.
Coastal Distribution System	N/A	
Recycled Water Project (4,000 AFY)	4,000	Blending with higher quality water needed to meet TDS goals. $0.5 M blending facility included.
Recycled Water Project, Southeast Dunes Recharge Basin (6,000 AFY)	6,000	Blending with higher quality water needed, RO may be needed for recharge. $0.5 million blending facility included.
Recycled Water Project, Harkins Slough Recharge Basin, North Dunes Recharge Basin (7,700AFY)	7,700	Same issues as the above recycled water project. Includes $0.5 million blending facility.
Murphy Crossing with Recharge Basins	1,600	Assumes 980 AFY of direct use. DFG has protested project; NMFS has requested additional studies.
Watsonville Slough with North Dunes Recharge Basin	1,200	Water rights permit and restoration of Slough required.
College Lake, Pinto Lake Diversion	1,800	Water rights permit required; DFG, NMFS have protested project.
Expanded College Lake, Pinto Lake, Corralitos Creek, Watsonville Slough, Harkins Slough, ASR	6,700	Same issues as above two projects, plus need water rights permit for Corralitos Ck. Reverse osmosis treatment may be needed for ASR.
60-inch Import Water Project with Inland Distribution System (in lieu recharge)	10,300	Requires EIR and EIS.
54-inch Import Water Project with ASR	11,900	Requires EIR and EIS, includes filtration treatment cost.
42-inch Import Water Project with ASR	6,900	Requires EIR and EIS, includes filtration treatment cost.
Bolsa de San Cayetano, Pajaro River Diversion	5,000	Significant seismic and environmental issues.
Seawater Desalination		Disposal of brine would pose permitting difficulties.

Note: See Sections 4.1 – 4.12 for additional information about data contained in Table 4-1.

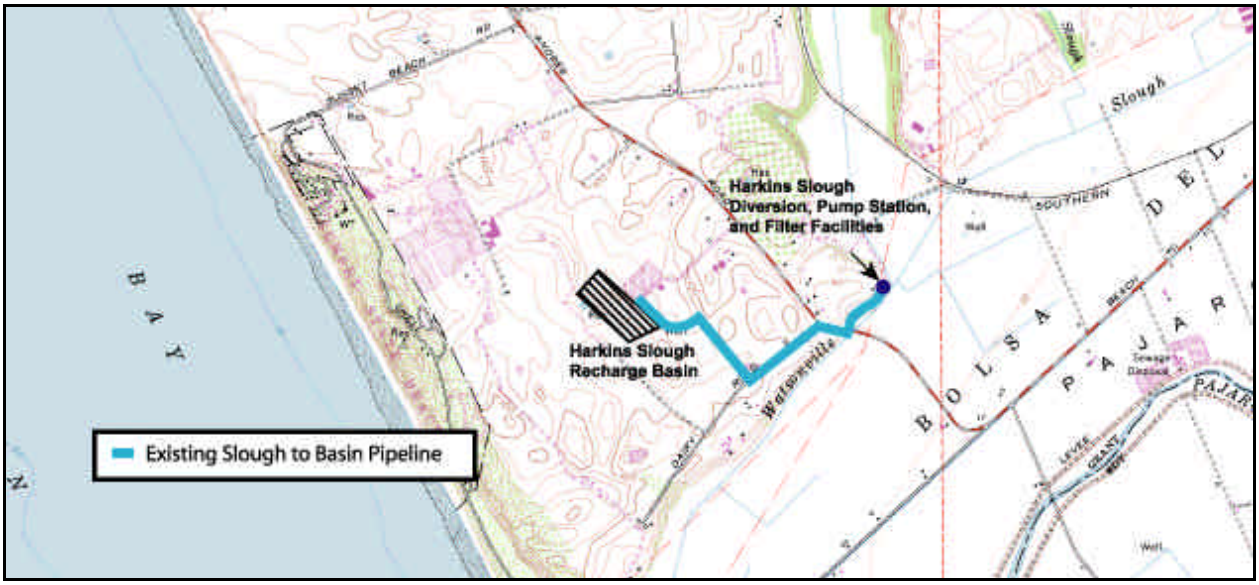
4.1 Harkins Slough Project

Description:

Harkins Slough is a partially channelized, ephemeral waterway that originates in an area of residential properties north of Watsonville. The slough flows south to its confluence with Watsonville Slough just east of the intersection of Dairy Road and San Andreas Road. Historically, Harkins Slough floods during the winter, inundating roads and threatening railroad tracks. To minimize flooding, the Santa Cruz County Public Works Department operates flood control pumps at the confluence of Harkins and Watsonville Sloughs. The pumps at Harkins Slough pump water over a wall into Watsonville Slough. The wall prevents backflow from Watsonville Slough into Harkins Slough and reduces flooding impacts. The Harkins Slough Project utilizes the two existing slough flood control pumps to divert water for irrigation supply.

The Harkins Slough Project is a common element of all water management strategies, and has been constructed. The Harkins Slough Project was evaluated as a part of the *Pajaro Valley Water Management Agency Local Water Supply and Distribution Projects Environmental Impact Report* (ESA, 1999). Construction is scheduled for completion in fall 2001. A map showing the location of the Harkins Slough Project, along with the portion of the CDS constructed to allow delivery of water developed from the Harkins Slough Project is included as Figure 4-1.

Figure 4-1: Harkins Slough Project



Diversion of the water will typically occur between December and May, when Slough water is available and of highest quality. Slough water will be filtered and pumped to the Harkins Slough recharge basin for storage in the shallow groundwater aquifer. Extraction wells are located around the recharge basin to supply water to the CDS during the irrigation season. The project elements include a screened inlet structure, inlet pump station, wet well, filtration facility, booster pump station, recharge basin, pipelines, and supplemental wells. Additional information about the project is located in the *Harkins Slough Design Drawings* (Montgomery Watson, March 2000).

Water Quality and Yield:

The key water quality parameters of concern for this project are Total Suspended Solids (TSS), turbidity, and the presence of *Phytophthora*. TSS and turbidity concentrations are a concern due to the potential clogging of the recharge basin or aquifer pores. Therefore, filtration was required to reduce TSS and turbidity. The finished water goals for TSS and turbidity are 10 mg/L and 10 NTU, respectively, with a maximum recommended value of 15 mg/L and 50 NTU for aquifer recharge via percolation (Montgomery Watson, October 1999). As discussed in Section 2.9, the presence of *Phytophthora* in Harkins Slough water was confirmed and is of concern. However, percolation of water into the groundwater basin has been shown to be an efficient *Phytophthora* removal mechanism (CH2M Hill, April 1999).

The water rights permit from the SWRCB limits the maximum diversion from Harkins Slough to 2,000 AFY. However, the average annual yield of the project is estimated to be 1,100 AFY, due to hydrologic conditions, recharge basin capacity, and minimum slough flow requirements.

Implementation:

The Harkins Slough Project is the first supplemental water supply project constructed by the PVWMA to help eliminate seawater intrusion. Environmental review, permitting, and design for this project were completed in 2000, and construction was completed in 2001.

The PVWMA is in the process of contracting for construction of one new supplemental well, modifying two existing wells, and connecting these wells to the portion of the distribution system constructed with the Harkins Slough Project. These three wells will be utilized to provide a supplemental supply to the Harkins Slough Project supply until additional supplies are developed. At that time, the three wells will continue to be utilized as peaking wells for the entire CDS.

Cost:

The total cost of the Harkins Slough Project, as shown in Table 4-2, is $6.6 million, including a $0.5 million CalFed grant that is pending final approval. Estimated annual O & M for the project is $0.3 million, including O & M for the wells and connections. The cost for the portion of the distribution system constructed is included with the CDS cost estimate.

The PVWMA has obtained a low-interest loan from the California State Water Resources Control Board for the Harkins Slough Project. The loan is for $5 million at an effective interest rate of just less than 3 percent, payable over 20 years. In addition, PVWMA is awaiting final approval of a $0.5 million CalFed grant for this same project.

Table 4-2: Harkins Slough Project Cost Estimate

Project Elements	**Cost Estimate ($ Millions)**
Harkins Slough Project	$7.1
Overall Cost	**$7.1**
CalFed Grant	($0.5)
Total	**$6.6**
Annualized Capital Cost	$0.5
Annual O&M Cost	$0.3
Total Annualized Cost	**$0.8**
Average Yield (AFY)	1,100
Unit Cost ($/AF)	**$708**

Notes:
1. Annualized costs are based on a 30-year capital recovery period at 6% interest.
2. All cost estimates are rounded to two significant figures or nearest $100,000.

4.2 Coastal Distribution System

Description:

A Coastal Distribution System (CDS) is necessary to eliminate coastal pumping and optimize the basin without affecting current agricultural practices in the coastal areas. As discussed in Section 2.8, coastal pumping reductions would provide a hydrostatic barrier to prevent seawater intrusion and increase the sustainable yield of the groundwater basin, provided that a substitute water supply is available to the area. Since a CDS is common to all water management strategies, the PVWMA initiated a conceptual study of the CDS in May 2001. The CDS was evaluated in the *Pajaro Valley Water Management Agency Local Water Supply and Distribution Projects Environmental Impact Report* (ESA, 1999).

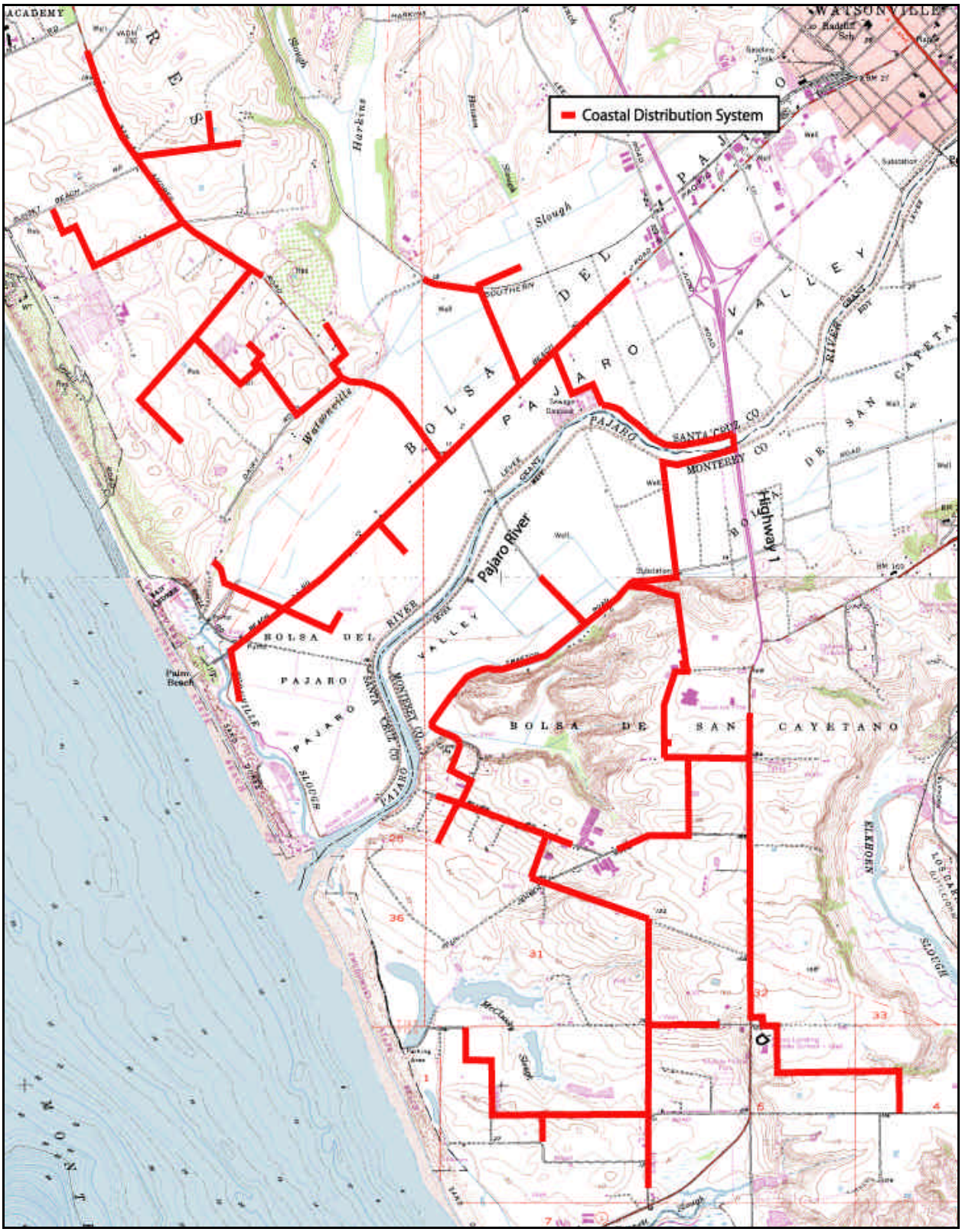
The area to be served by the proposed CDS, shown in Figure 4-2, is based on the pumping reduction identified by the PVIGSM as being necessary to balance the basin. The PVIGSM identified the need to eliminate 18,500 AF of coastal pumping to stop seawater intrusion. In the coastal area this amount of irrigation is equivalent to approximately 8,400 to 9,000 net irrigated acres. Initial analysis conducted for the CDS conceptual study has identified a service area of up to 8,960 net irrigated acres that could be supplied by supplemental water sources. A preliminary design was developed identifying a net 8,960-acre service area that would be supplied by supplemental water sources.

A portion of the CDS was constructed as part of the Harkins Slough Project. In the short term, water from Harkins Slough and proposed supplemental wells will provide irrigation water to this portion of the CDS. In the long-term, water for the entire CDS will be provided by the various water supply projects that PVWMA constructs.

The model results were based on a design flow rate of 75 cfs from the import pipeline (Section 4.10) and a delivery water pressure of 60 psi. Model results indicated that pumping requirements in the CDS were a function of the import water pipeline diameter. Construction of a 48-inch import pipeline would require pump stations to be construction within the CDS. A 54-inch pipeline would also require pumping, but less than that required for the 48-inch pipeline. Modeling results indicated that a 60-inch pipeline would not require additional pumping, as head from the Santa Clara Conduit would provide sufficient pressure to deliver water to the entire CDS at 60 psi.

CH2M Hill completed additional modeling with EPANET in 1999. The modeling effort included minor modifications from the TM 2.2 analysis such as modification of the pipeline alignments and turnouts. The hydraulic analysis included development and modeling of various system operating conditions throughout the year. Modeling included analysis of the overall system accounting for the various supplemental supplies. However, like the previous modeling, a 60-psi delivery pressure was assumed. In addition, the modeling was completed assuming the 48-inch import pipeline as the selected Import Project. Additional details on model results and criteria used in the analysis are contained in *Hydraulic Analysis of Local Water Supply Conveyance Systems* (CH2M Hill, February 1999). Since 1999, grower input has resulted in the refinement of design criteria and the target design delivery pressure for the system was increased to 80 psi. This change requires additional hydraulic modeling to confirm the number and location of any pump stations required to deliver water at 80 psi to growers connected to the CDS. This work is presently being completed as a part of the CDS conceptual design effort.

Figure 4-2: Coastal Distribution System



The CDS consists of approximately 26 to 30 miles of pipeline ranging in diameter from 8 to 48 inches, and is located along the alignments shown in Figure 4-2. To the extent possible, the distribution system will follow existing roadways and farm roads, and will deliver water to over 200 identified parcels in an area roughly bordered by Elkhorn Slough, Highway 1, Buena Vista Road, and the Pacific Ocean. The alignment includes several road, river, and slough crossings, and one railroad crossing.

Cost:

The cost of the CDS was estimated and is shown in Table 4-3. This cost estimate covers the entire distribution system even though a small portion of the CDS is already constructed to provide delivery of water from the Harkins Slough Project. The cost estimate for CDS pumping was included in the Import Water Project cost estimate, although additional facilities may be required based on the final design of the CDS.

Additional design details are contained in the *Pajaro Valley Water Management Agency Water Supply Project, Project Definition Report* (CH2M Hill, 1997).

Table 4-3: Coastal Distribution System Cost Estimate

Project Elements	**Cost Estimate ($ Millions)**
Coastal Distribution System Pipelines	$20.1
Crossings	$0.7
Appurtenances	$2.1
Subtotal	**$22.9**
Construction Contingency	$4.6
Easements	$0.4
Total Construction Cost	**$27.9**
Engineering, Legal, Admin, Permits	$4.9
Subtotal	**$32.7**
Environmental & Permitting Contingency	$1.6
Overall Total	**$34.4**
Annualized Construction Costs	$2.5
Annual O & M Costs	$0.3
Total Annualized Cost	**$2.8**

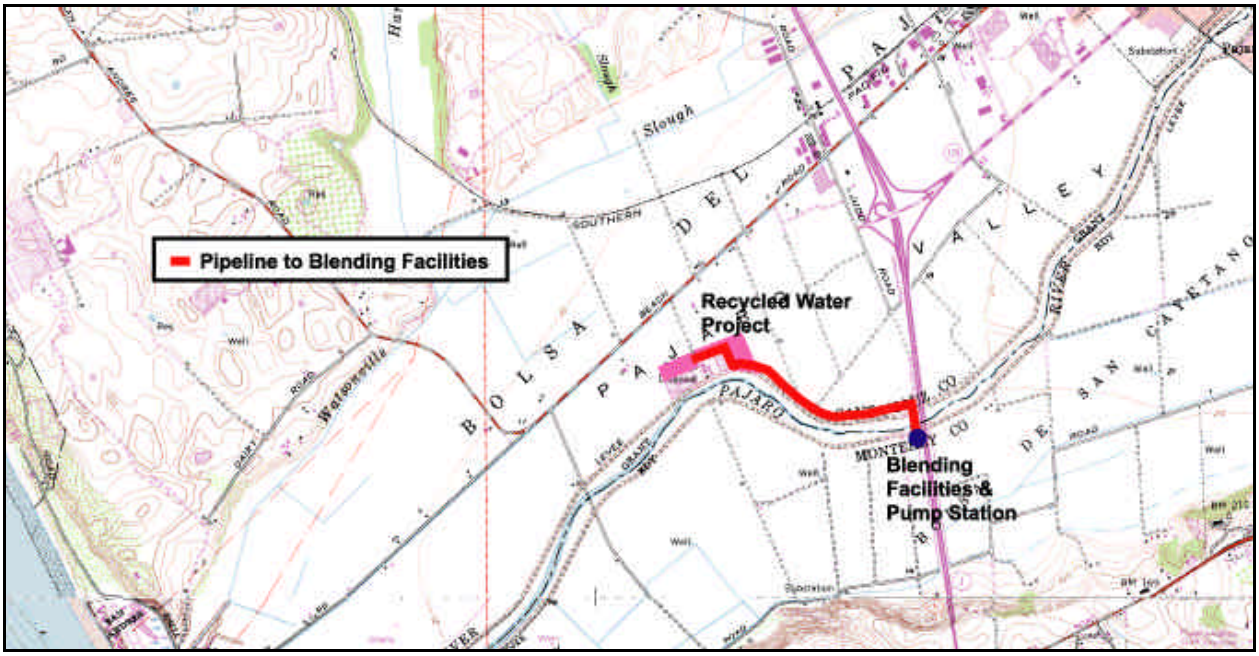
Notes:
1. Annualized costs are based on a 30-year capital recovery period at 6% interest.
2. Cost estimates based on 8,200 net irrigated acres shown in "TM 2.2 Distribution System" by CH2M Hill (February 1997) with costs updated to spring 2001 price level.
3. All cost estimates are rounded to two significant figures or nearest $100,000.
4. Includes cost of portion of facility associated with Harkins Slough Project that is presently under construction.

4.3 Recycled Water (4,000 AFY) with Blending Facility

Description:

The existing Watsonville Wastewater Treatment Facility (WWTF), located off Beach Road west of Watsonville as shown in Figure 4-3, is a secondary treatment plant providing service to a 21 square mile area within the City of Watsonville, Freedom County Sanitation District, Pajaro County Sanitation District, and Salsipuedes Sanitary District. The existing treatment process train includes screening, primary treatment, biotowers, suspended growth aeration basin reactors, and chlorination. Effluent produced by the plant is discharged into the Monterey Bay via an ocean outfall.

Figure 4-3: Recycled Water with Blending Facility



Additional treatment processes are required to produce recycled water at the WWTF. The City of Watsonville, in a joint effort with the PVWMA, is currently studying various filtration and disinfection processes that would allow the production of recycled water suitable for unrestricted irrigation. These processes include:

- Microfiltration;
- Conventional filtration (flocculation, sedimentation, granular media filtration);
- Contact filtration (granular media filtration);
- UV disinfection; and
- Chlorination.

Flows to the WWTF are not uniform and tend to vary both diurnally and throughout the week (RMC, March 2001). In order to minimize the treatment plant capacity and maximize the use of recycled water, construction of equalization basins and a clearwell will be required. Approximately 1 MG of secondary effluent equalization and 4 MG of clearwell storage were incorporated into all of the proposed treatment plant design process alternatives. All required pumping facilities were also included.

In addition to the recycled water facilities, a blending facility is necessary to improve the quality of water delivered to growers. Conceptually, recycled water would be delivered to the blending facility where it would be blended with one or more supplemental supplies and then pumped to pressure for delivery to the CDS. The exact location of the blending facility has not been determined. However, two potential locations for a blending facility are at the WWTF or at Highway 1 near the Pajaro River. Operational blending could be achieved by construction of a blending tank or through in-line blending.

A blending facility at the WWTF would utilize one of the clearwells proposed under the recycled water project. The clearwell could be constructed to serve a dual purpose of a blending facility and providing operational storage. A pump station would be constructed to deliver blended water to the CDS.

Blending facilities at Highway 1 and the Pajaro River are currently envisioned to consist of in-line or in-pipe blending. This blending alternative would be implemented if an import pipeline were to be constructed. Operationally, recycled water would be pumped into the pipeline where blending would occur prior to delivery to the first turnout in the CDS.

Water Quality and Yield:

The secondary effluent discharge limits specified in the discharge permit for the WWTF are summarized in Table 4-4.

Table 4-4: Watsonville Wastewater Treatment Facility Discharge Limits

Constituent	Units	Criteria		
		30-Day	7-Day Average	Daily Maximum
Effluent Limitations				
Flow	MGD	Effluent Daily dry weather flow shall not exceed a monthly average of 12.0 MGD		
BOD_5[a]	mg/L	25	40	85
TSS	mg/L	30	45	90
Grease and Oil	mg/L	25	40	75
Settleable Solids	mg/L	1.0	1.5	3.0
Turbidity	NTU	75	100	225
Acute Toxicity	TU_a	15	2.0	2.5
Total Coliform	MPN/100 ml	N/A	230 (median)	2,400
Receiving Water Limitations (measured at shoreline)				
Fecal Coliform	MPN/100 ml	200	N/A	N/A

Footnotes:
a. Source: City of Watsonville NPDES Permit, 1998.

Though not required for permit compliance, the City of Watsonville has implemented a weekly effluent sampling program to determine the concentration of parameters that are of interest to potential recycled water users. These data are being collected on a weekly basis during completion of the planned pilot study effort, which will continue through December 2001.

Preliminary data indicate that the recycled water salinity is significantly higher than the irrigation water quality objective of 500 mg/L. As a result, either blending of recycled water with higher quality water or additional treatment to further reduce the salinity is required for agricultural irrigation reuse. A feasibility study is being prepared by the City of Watsonville and the PVWMA to analyze the benefits and

constraints of blending recycled water with various water sources including groundwater, surface water from local sources, CVP water, and desalination. The expected TDS concentration of recycled water is between 700 – 900 mg/L. In order to deliver a water supply with a TDS concentration of 500 mg/L or below, it is also expected that water must be blended with better quality water at a 2.5 to 3:1 water-to-recycled water blend ratio (assuming a 350 mg/L or lower TDS supply as the blending source).

If groundwater were to be used as a potential blending source, wells would be located in an area outside the coastal service area. This is necessary in order to be consistent with pumping management measures to eliminate coastal pumping and thus increase the sustainable yield of the overall basin (see Section 3.2). The number of wells and their locations have not been finalized, but a probable location would be in an area to the South of the Pajaro River, east of Highway 1. Imported water would originate from the CVP project. The facilities required to deliver blended CVP water with recycled water are as described previously in this Section.

The average influent flow to the WWTF is approximately 7 MGD, or 7,800 AFY. However, in order to meet water quality objectives, the average annual yield would be limited to approximately 4,000 AFY. This assumes no long-term storage is available and includes limitations in daily production and water demand constraints.

Implementation:

Coordinating efforts between the PVMWA and the City of Watsonville are underway for development of this project. A feasibility study is being prepared by the City of Watsonville and a pilot study is underway to investigate treatment and disinfection alternatives. In addition, funding mechanisms (Title XVI Grant from the USBR) for the project are being identified and initial coordination steps have begun. Permits for operation of the recycled water facility and modification of permits for the overall WWTF would be required from the RWQCB.

Cost:

Construction of a Recycled Water Project allows the selected alterative to become eligible for Title XVI grant funding from the USBR. Title XVI grant is a part of the USBR water reclamation and reuse program authorized by the Reclamation Wastewater and Groundwater Study and Facilities Act of 1992 (Title XVI of Public Law [P.L.] 102-575, as amended). Under the Reclamation Wastewater and Groundwater Study and Facilities Act of 1992, the USBR is authorized to participate in all of the authorized water recycling projects at funding levels up to 25% of the total project cost. However, Section 1631 limits the Federal contribution to a maximum of $20 million (1996 dollars) per project (USBR website, November 2001). Hence, the Recycled Water Project would be eligible for up to $20 million in grant money from the USBR, based on an inclusive reclamation and reuse project consisting of recycled water treatment, storage, blending, and distribution facilities totaling at least $80 million.

Final selection of a preferred treatment process has not been completed. The City of Watsonville is pilot testing the microfiltration, contact filtration and UV disinfection processes between July and December 2001, in order to determine the suitability of the various processes for tertiary treatment at the WWTF. Results of a preliminary analysis (RMC, March 2001) indicated that conventional filtration and chlorination provide the most cost-effective process capable of meeting Title 22 regulations for unrestricted reuse. For evaluation purposes within the Revised BMP, it is assumed that the conventional filtration/chlorination system would be the constructed project.

The estimated cost for the Recycled Water Project is summarized in Table 4-5.

Table 4-5: Recycled Water Project Cost Estimate (Conventional/Chlorination)

Project Elements	Cost Estimate ($ Millions)
Equalization Basin	$1.4
Conventional Filtration	$3.5
Chlorination	$1.5
Clearwell	$3.4
Pump Station	$1.5
Connecting Pipeline to Blending Facility	$0.7
Appurtenances	$0.1
Blending Facility & Pump Station	$0.5
Subtotal	**$12.5**
Construction Contingency	$2.5
Land Purchase & Right of Way Easement	$0.5
Total Construction Cost	**$15.5**
Engineering, Legal, Admin, Permits	$2.7
Subtotal	**$18.3**
Environmental & Permitting Contingency	$0.9
Overall Total	**$19.2**
Annualized Construction Costs	$1.4
Annual O & M Costs	$1.5
Total Annualized Cost	**$2.9**
Annual Yield	4,000
Unit Costs ($/AF)	**$714**

Notes:
1. Annualized costs are based on a 30-year capital recovery period at 6% interest.
2. All cost estimates are rounded to two significant figures or nearest $100,000.
3. Reference: RMC, March 2001.

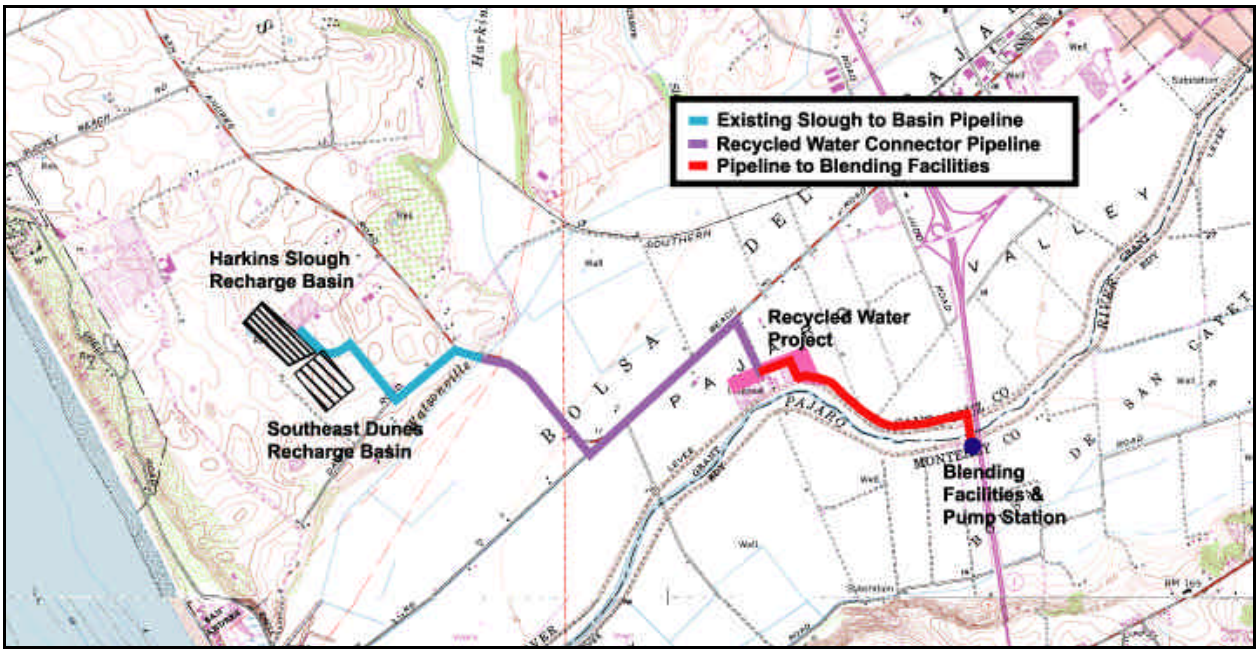
A more detailed evaluation of the benefits and constraints of each treatment alternative are included in the "Recycled Water Treatment Alternatives Report" (RMC, March 2001).

4.4 Recycled Water Project (6,000 AFY) with Southeast Dunes Recharge Basin

Description:

This recycled water project is identical to that described in Section 4.3, except a portion of the recycled water flow would be stored in the shallow groundwater aquifer east of San Andreas Road. The treatment facilities and blend facility described in Section 4.3 would be constructed along with the Southeast Dunes Recharge Basin. In addition to the treatment facilities, the project would require a transmission pipeline connecting the WWTF to the 24-inch Harkins Slough pipeline on San Andreas Road. The Southeast Dunes Recharge Basin would be located to the south of the existing Harkins Slough Recharge Basin shown in Figure 4-4.

Figure 4-4: Recycled Water Project with Southeast Dunes Recharge Basin



The proposed recharge basin would be used to store in the shallow groundwater aquifer approximately 2,000 AFY of recycled water. The basin would be adjacent to the existing Harkins Slough Recharge Basin. Facilities required at the Recharge Basin include monitoring wells, extraction wells, and associated connecting pipelines. Percolation of recycled water is assumed to span an 8-month period corresponding to the low irrigation demand period. Percolated recycled water would be extracted via recovery wells for use during the irrigation season.

Infiltration rates at the Southeast Dunes site have been assumed to be similar to infiltration rates at the Harkins Slough Recharge Basin (0.6 ft/day percolation rate). The basin consists of a percolation area of approximately 14 acres, assuming a square footprint. The depth of the basin is approximately 10 feet, with a side slope of 3H:1V. In addition, a 12-foot wide maintenance road would be constructed around the perimeter of the basin. The total area that the PVWMA would have to acquire is approximately 17 acres.

This project would recycle more than 75 percent of the available flow from the WWTF. This amount of recycling would result in a very large reduction in flow through the plant's ocean outfall. The outfall diffusers, and possibly the effluent pump station at the treatment plant, would have to be modified to preserve outfall performance and prevent marine encrustation of the outfall.

Water Quality and Yield:

Recycled water quality is discussed in Section 4.3. As discussed, the major issue of concern is the TDS concentration of recycled water. Water from the project will require blending prior to irrigation use in order to meet the water quality objective.

The average annual yield of the overall project is 6,000 AFY, which includes 4,000 AFY of direct use and 2,000 AFY of percolated and subsequently recovered recycled water in the Southeast Dunes Recharge Basin.

Implementation:

Implementation of the Recycled Water Project would require various funding mechanisms and coordination tasks, as described in Section 4.3. In addition, various permitting and consultations with jurisdictional agencies such as the CCRWQCB and Department of Health Services (DHS) would be required for permitting of the Southeast Recharge Basin. The recharge of recycled water is regulated by both CCRWQCB and DHS, and recent draft criteria (DHS, 2001) have identified potential restrictions of limiting recycled water percolation to a maximum blend of 50 percent recycled water. Additional treatment requirements may also be placed on this application by the CCRWQCB and DHS. These additional treatment requirements would likely include reverse osmosis, with microfiltration as a pretreatment. Additional water supplies for blending to reduce the percentage of recycled water percolated to below 50% have also not been identified. The costs for these additional measures have not been included in this cost estimate or project description.

Another issue of concern is the quantity of recycled water utilized in the CDS area. Under this project, the quality of blended water delivered would likely exceed the TDS goal of 500 mg/L, due to increased use of lower quality recycled water.

Cost:

The estimated capital cost for the Recycled Water Project with Southeast Dunes Recharge Basin (shown in Table 4-6) is $28.6 million, which includes a total land purchase of approximately 36 acres. The estimated annual O & M costs for the facilities are $2.1 million.

Table 4-6: Recycled Water Project with Southeast Dunes Recharge Basin Cost Estimate

Project Elements	Cost Estimate ($ Millions)
Equalization Basin	$1.4
Conventional Filtration	$3.5
Chlorination	$1.5
Clearwell	$3.4
Pump Station	$1.5
Connecting Pipeline to Blending Facility	$0.8
Connecting Pipeline to Recharge Basin	$1.1
Southeast Dunes Recharge Basin, Extraction/Monitoring Wells Basin Piping	$4.5
Appurtenances	$0.2
Blending Facility & Pump Station	$0.5
Subtotal	**$18.4**
Construction Contingency	$3.7
Land Purchase & Right of Way Easements	$1.1
Total Construction Cost	**$23.2**
Engineering, Legal, Admin, Permits	$4.1
Subtotal	**$27.3**
Environmental & Permitting Contingency	$1.4
Overall Total	**$28.6**
Annualized Construction Costs	$2.1
Annual O & M Costs	$2.1
Total Annualized Cost	**$4.1**
Annual Yield (AFY)	6,000
Unit Costs ($/AF)	**$690**

Notes:
1. Annualized costs are based on a 30-year capital recovery period at 6% interest.
2. All cost estimates are rounded to two significant figures or nearest $100,000.
3. Reference: RMC, March 2001.

4.5 Recycled Water Project (7,700 AFY) with Harkins Slough and North Dunes Recharge Basins

Description:

This project maximizes the use of recycled water by combining the Recycled Water Project and blending facility with the Harkins Slough and the North Dunes Recharge Basins to provide seasonal storage of recycled water. The project would utilize the existing Harkins Slough Recharge Basin and the proposed North Dunes recharge basin. This North Dunes basin would be located approximately 1,500 ft southwest of the intersection of Sunset Beach Road and San Andreas Road. The use of the Harkins Slough recharge basin is contingent on development of an alternative storage element for Harkins Slough diversions. The project includes construction of a 36-inch transmission pipeline connecting the WWTF to the 24-inch Harkins Slough transmission pipeline on San Andreas Road and a conveyance pipeline extending from the Harkins Slough pipeline west and north to the North Dunes site. In addition, monitoring wells, extraction wells, associated pipelines, and appurtenances would be constructed at the North Dunes Recharge Basin.

The project attempts to maximize use of recycled water, and assumes maximum recycled water production at the WWTF. In order to maximize yield, percolation of the full production of recycled water is necessary. With average plant flow of 7 MGD (4,900 gpm) and a Harkins Slough recharge basin capacity of 3,100 gpm, the required average percolation at the North Dunes recharge basin is 1,800 gpm. The average percolation rate at the North Dunes Site is approximately 0.32 ft/day (CH2M Hill, February 1999). The North Dunes Recharge Basin would have a 25-acre percolation area. Assuming a depth of 10 ft, side slopes of 3H:1V, and a 12 ft maintenance road around the perimeter of the basin the total area of the basin would be approximately 30 acres. Extraction wells would be located around the perimeter of the recharge basin. The location of these facilities is shown in Figure 4-5.

This project would recycle nearly all of the available flow from the WWTF. This amount of recycling would result in only minimum flow through the plant's ocean outfall. The outfall diffusers, and possibly the effluent pump station at the treatment plant, would have to be modified to preserve outfall performance and prevent marine encrustation of the outfall.

Water Quality and Yield:

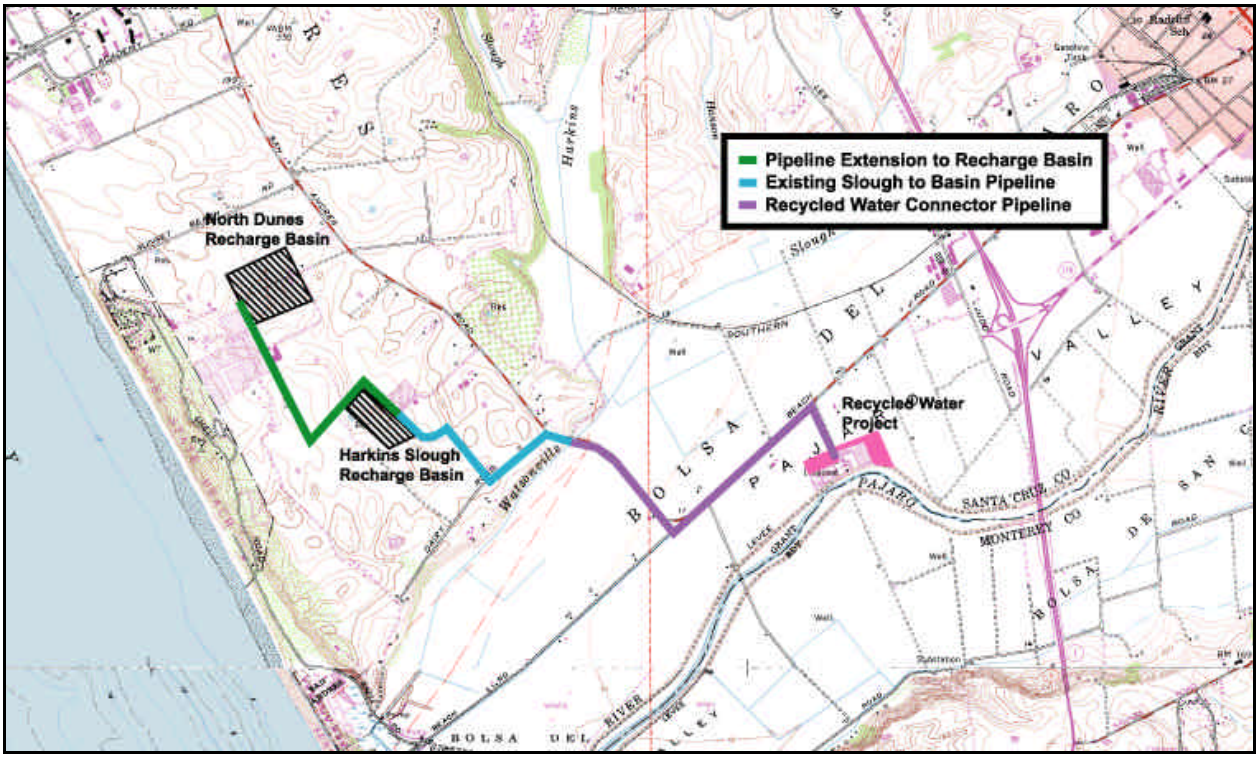
The expected water quality from the WWTF is discussed in Section 4.3.

The annual yield of the project is approximately 7,700 AFY including 4,000 AFY of direct use and storage of 3,700 AFY in the Harkins Slough and North Dunes Recharge Basins.

Implementation:

As previously discussed in Sections 4.3 and 4.4, funding and permitting are the two major implementation issues for construction of the Recycled Water components and the North Dunes Recharge Basin. In addition, percolation of recycled water at the Harkins Slough Recharge Basin would likely require additional permitting from DHS and the RWQCB, as discussed in Section 4.3. It is repeated here for clarity.

Figure 4-5: Recycled Water Project with Harkins Slough and North Dunes Recharge Basin



The recharge of recycled water is regulated by the DHS, and recent draft criteria (DHS, 2001) have identified potential restrictions in the ability of this use to meet water quality and operational requirements. Additional treatment requirements would likely be reverse osmosis, which would probably require microfiltration as a pretreatment. Additional water supplies for blending to reduce the percentage of recycled water percolated to below 50% have not yet been identified. The costs for these additional measures have not been included in this cost estimate or project description.

An additional concern is the quantity of recycled water utilized. Without additional treatment or blending, the delivered water to the growers would have TDS values exceeding the water quality objective of 500 mg/L, among other constituents. This would limit crop yield and production in the Pajaro Valley.

Cost:

The estimated capital cost for the Recycled Water Project and North Dunes Recharge Basin (shown in Table 4-7) is $34.4 million, which includes the land purchase of approximately 45.5 acres. The estimated cost excludes the cost of the existing Harkins Slough recharge basin. The estimated annual O & M costs for the facilities are $1.9 million.

Table 4-7: Recycled Water Project with Harkins Slough and North Dunes Recharge Basin Cost Estimate

Project Elements	Cost Estimate ($ Millions)
Equalization Basin	$1.4
Conventional Filtration	$3.5
Chlorination	$1.5
Clearwell	$3.4
Pump Station	$1.5
Connecting Pipeline between Recharge Basins	$0.8
Connecting Pipeline from WWTF to Existing Harkins Slough Pipeline	$1.8
North Dunes Recharge Basin, Extraction/Monitoring Wells, Basin Piping	$5.5
Appurtenances	$0.3
Blending Facility & Pump Station	$0.5
Subtotal	**$20.1**
Construction Contingency	$4.0
Land Purchase & Right of Way Easements	$1.4
Total Construction Cost	**$25.5**
Engineering, Legal, Admin, Permits	$4.5
Subtotal	**$30.0**
Environmental & Permitting Contingency	$1.5
Harkins Slough Recharge Basin/Wells/Pipelines (Existing)	$2.9
Overall Total	**$34.4**
Annualized Construction Costs	$2.5
Annual O & M Costs	$1.9
Total Annualized Cost	**$4.4**
Annual Yield	7,700
Unit Costs ($/AF)	**$567**

Notes:
1. Annualized costs are based on a 30-year capital recovery period at 6% interest.
2. Reference: RMC, March 2001.
3. All cost estimates are rounded to two significant figures or nearest $100,000.

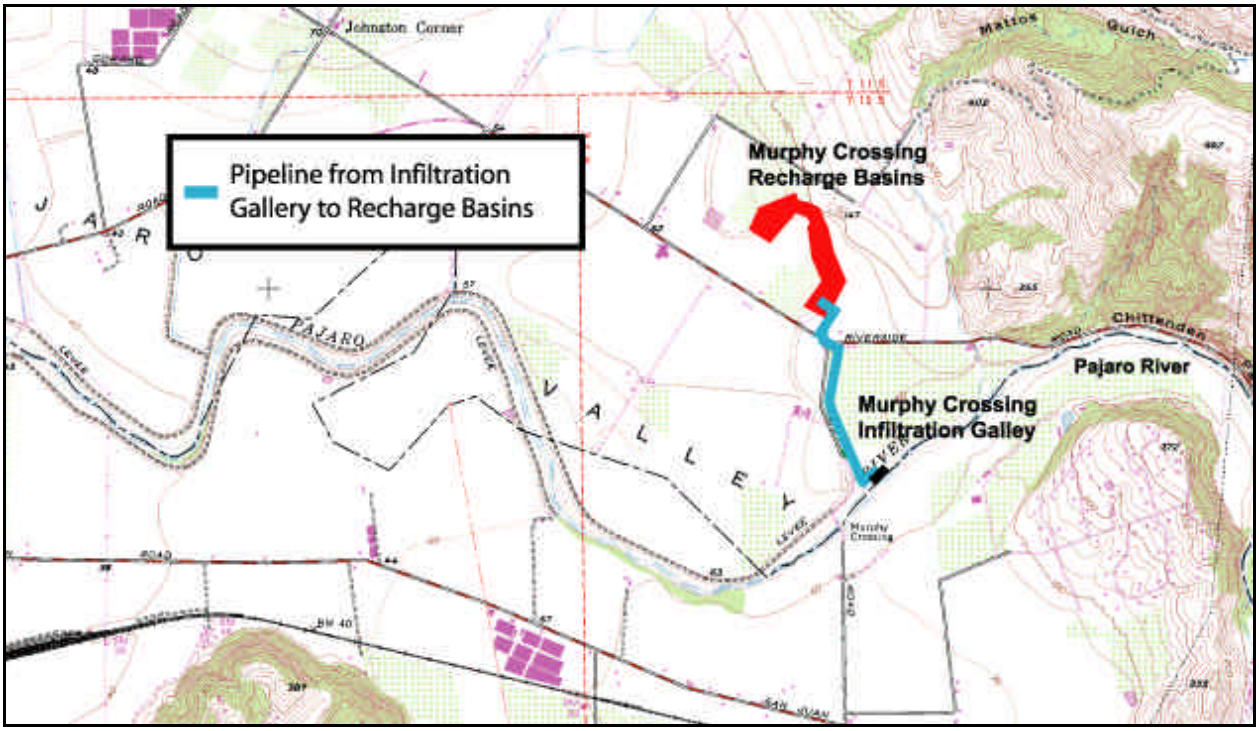
4.6 Murphy Crossing with Recharge Basins

Description:

The Murphy Crossing project would divert water from the Pajaro River between December and May, when Pajaro River water quality is within an acceptable range and streamflows are above the required minimum necessary to maintain steelhead habitat. An infiltration gallery located upstream of the Murphy Crossing Bridge would capture water for transportation to four recharge basins located in an unfilled section of an old stream channel to the north of the Murphy Road and Highway 129 intersection. During the irrigation season, this water would be extracted and delivered to agricultural users through the IDS. In addition, a portion of the diverted water could be utilized directly through the IDS.

The recharge basins would have a total area of 8.7 acres. Percolation rates for the basins range from 1.7 ft/day for basins 1, 2 and 3 to 0.56 ft/day for basin 4 (CH2M Hill, August 2000). The project also includes an infiltration gallery pump station, recovery wells, monitoring wells, and a connector pipeline from the infiltration gallery to the recharge basins. For additional details on this project element, see *Murphy Crossing Recharge and Distribution System 30% Design* (CH2M Hill, August 2000). The proposed locations of project facilities are shown in Figure 4-6, along with a portion of the IDS that could be constructed to deliver water to local farmers. With the exception of the infiltration gallery, which would be located in the Pajaro River, all of the proposed facilities would be located in areas currently in agricultural production.

Figure 4-6: Murphy Crossing Project



Water Quality and Yield:

The key water quality parameters of concern are TDS and *Phytophthora*. The expected TDS concentration of Pajaro River water is above the water quality objective of 500 mg/l. High TDS concentrations affect growth and crop production of sensitive crops such as strawberries and raspberries. Additional treatment or blending with higher quality water may be necessary to meet the RWQCB TDS objective. *Phytophthora*, similar to the Harkins Slough Project, can be removed by the percolation of water into the groundwater basin (CH2M Hill, April 1999). Water from the Pajaro River would be diverted with an infiltration galley, which may provide adequate *Phytophthora* removal allowing for direct use. However, if *Phytophthora* are not removed, it is assumed that either a special water treatment method could be implemented for removal *of the pathogen*, or delivery could be coordinated to ensure local strawberry farmers do not directly use Pajaro River water. The feasibility of either strategy is not fully known.

Based on USGS flow estimates at the Chittenden gage station (located on the Pajaro River just upstream of Murphy Crossing), it was estimated that the project's average annual available yield from the river would be 1,600 AFY. The analysis assumed a maximum diversion flow rate of 16 cfs. Based on percolation rates and basin size, the recharge limit of the project is approximately 620 AFY. The remaining yield of 980 AFY will be utilized directly for irrigation purposes, as discussed above. Additional details on the hydrologic evaluation are described in the *Impact of Revised Flow Depth Criterion for Pajaro River on Murphy Crossing Project* (CH2M Hill, February 1999) and Murphy Crossing Recharge and Distribution System 30% Design (CH2M Hill, August 2000).

Implementation:

The PVWMA has taken some steps to implement the Murphy Crossing Project. The Murphy Crossing Project was evaluated as a part of the *Pajaro Valley Water Management Agency Local Water Supply and Distribution Projects Environmental Impact Report* (ESA, 1999). The PVWMA has certified the EIR for the Murphy Crossing Project. An application for a water right was submitted to the SWRCB in 1995. However, protests by the Department of Fish and Game (DFG) over fishery and maintenance concerns have delayed the permitting process. The National Marine Fisheries Service (NMFS) and DFG have requested that additional investigations be undertaken to evaluate the sediment characteristic of the proposed infiltration gallery.

Cost:

The overall cost for the Murphy Crossing supply project is approximately $6.6 million including the cost of the connecting pipeline from the infiltration gallery to the recharge basins. This estimate does not include the cost of any portions of the inland distribution system or the potential water treatment facilities to remove *Phytophthora* to allow for direct use of Pajaro River water. The estimated annual operations and maintenance costs are $0.2 million. A summary of costs is included as Table 4-8.

Table 4-8: Murphy Crossing Project Cost Estimate

Project Elements	**Cost Estimate ($ Millions)**
Infiltration Gallery & Pump Station	$0.8
Recharge Basin & Basin Piping	$0.9
Recovery Wells	$1.2
Monitoring Wells	$0.4
Connecting Pipeline from Diversion to Recharge Basin	$0.6
Subtotal	**$3.9**
Construction Contingency	$0.8
Land Purchase & Right of Way Easements	$0.6
Total Construction Cost	**$5.3**
Engineering, Legal, Admin, Permits	$0.9
Subtotal	**$6.2**
Environmental & Permitting Contingency	$0.3
Overall Total	**$6.6**
Annualized Construction Costs	$0.5
Annual O & M Costs	$0.2
Total Annualized Cost	**$0.7**
Annual Yield (AFY)	1,600
Unit Cost ($/AF)	**$436**

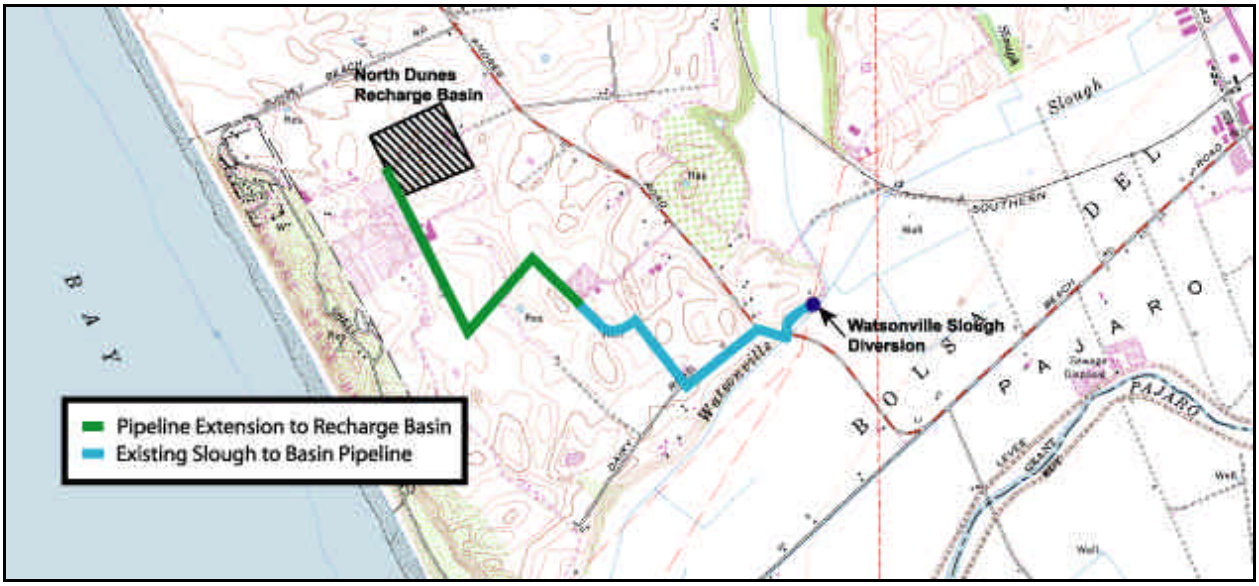
Notes:
1. Annualized costs are based on a 30-year capital recovery period at 6% interest.
2. Rounded to two significant figures or nearest $100,000.

4.7 Watsonville Slough with North Dunes Recharge Basin

Description:

The Watsonville Slough project would divert Watsonville Slough water during December to May for storage in the shallow groundwater aquifer. The stored water would be pumped and delivered to the CDS during high demand periods. Required facilities include construction of a diversion structure with a screened inlet, inlet pump station, wet well, filtration facility, a 7,500-gpm booster pump station, recharge basin, and pipelines. A map of the facilities is shown in Figure 4-7. The pump station would be constructed on the north bank of Watsonville Slough just west of the Harkins Slough confluence.

Figure 4-7: Watsonville Slough Project



Diverted water from Watsonville Slough would be filtered, pumped to the recharge site, and then stored in the shallow groundwater aquifer at the proposed North Dunes Recharge Basin. The North Dunes Recharge Basin would have a 25-acre percolation area. Assuming a depth of 10 ft, side slopes of 3H:1V, and a 12 ft maintenance road around the perimeter of the basin, the total area of the basin would be approximately 29.5 acres. The Watsonville Slough facilities would be connected to the existing 24-inch Harkins Slough Pipeline to convey water to the recharge basins. A pipeline extension would connect the existing pipeline at the Harkins Slough Recharge Basin to the North Dunes Recharge Basin. Recovery wells would be constructed around the recharge basin to extract water during the irrigation season.

Water Quality and Yield:

Raw water from the slough typically exhibits TSS and turbidity concentrations higher than those typically required for percolation. To avoid clogging the recharge basin, filtration will be needed to reduce the TSS to acceptable levels, and to achieve a turbidity level of less than 10 NTU (Montgomery Watson, October 1999). Similar to other surface waters in the Pajaro Valley, *Phytophthora* is a major concern in Watsonville Slough water. However, percolation of water into the groundwater basin has been shown to be an efficient *Phytophthora* removal mechanism (CH2M Hill, April 1999).

Watsonville Slough is a hydrologically dependent supply and the average project yield is estimated to be 1,200 AFY. The maximum yield of the Slough is assumed to be approximately 2,000 AFY.

Implementation:

Prior to construction of the Watsonville Slough Project, the PVWMA will need to obtain a water rights permit from the SWRCB. The CCRWQCB has indicated that they would seek restoration of Watsonville Slough as a mitigation for the PVWMA diverting water.

Cost:

The estimated capital cost for Watsonville Slough Project is $6.6 million, including costs for land purchase and pipeline, but not including slough restoration costs. The estimated annual O & M costs for the facilities are $0.1 million. Watsonville Slough costs are summarized in Table 4-9.

Table 4-9: Watsonville Slough Cost Estimate

Project Elements	**Cost Estimate ($ Millions)**
Watsonville Slough Diversion, Pumps, & Piping	$0.4
7,500 gpm Pump & Filters	$0.8
Recharge Basin with recovery wells, monitoring wells	$1.8
24-inch Pipeline to/from HS pipeline	$0.8
Fittings, Valves, etc.	$0.1
Subtotal	**$3.8**
Construction Contingency	$0.8
Land Purchase & Right of Way Easements	$0.8
Total Construction Cost	**$5.3**
Engineering, Legal, Admin, Permits	$0.9
Subtotal	**$6.2**
Environmental & Permitting Contingency	$0.3
Overall Total	**$6.6**
Annualized Construction Costs	$0.5
Annual O & M Costs	$0.1
Total Annualized Cost	**$0.6**
Annual Yield (AFY)	1,200
Unit Cost ($/AF)	**$498**

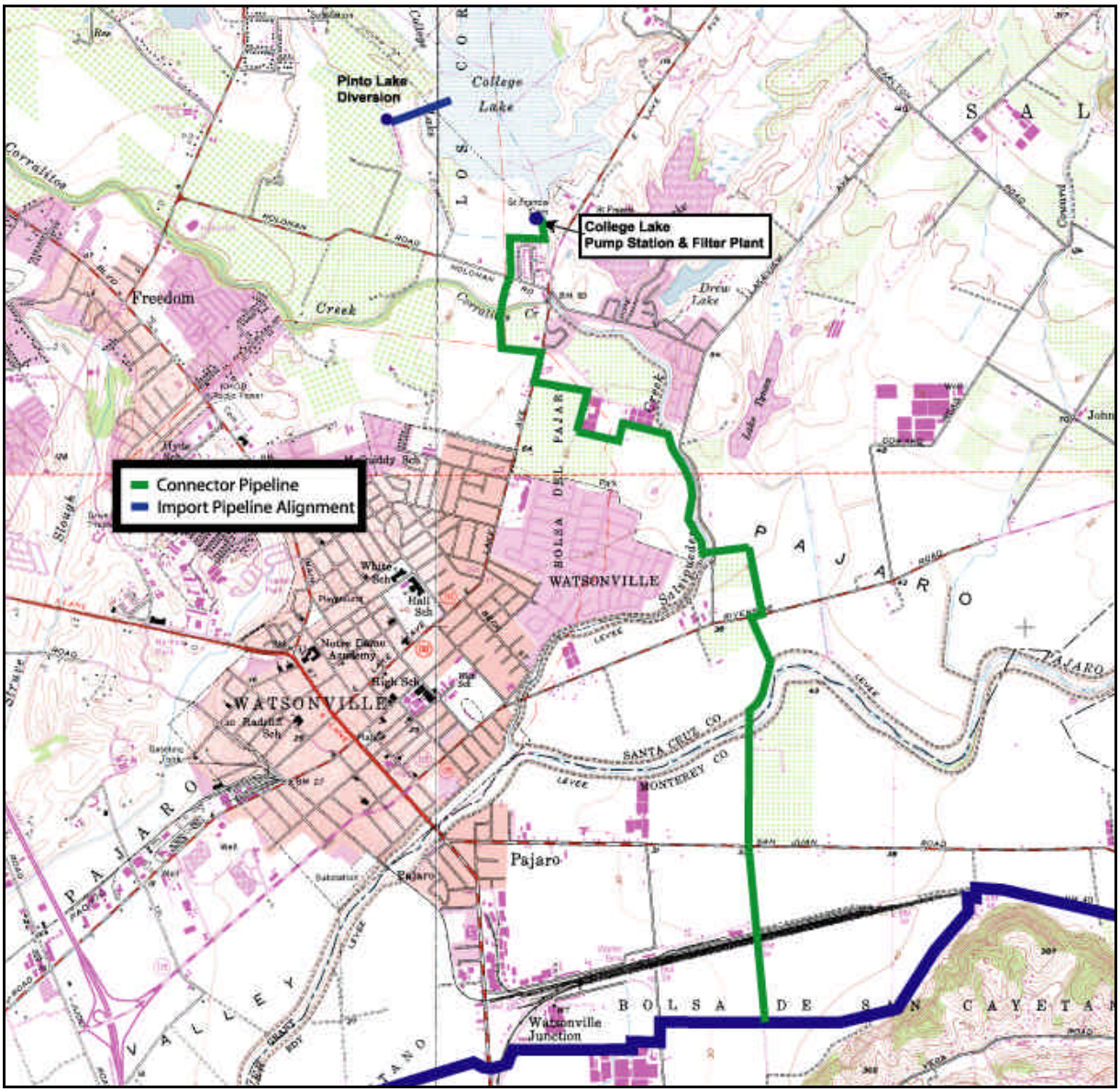
Notes:
1. Annualized costs are based on a 30-year capital recovery period at 6% interest.
2. Reference: Earles, February 2001.
3. All cost estimates are rounded to two significant figures or nearest $100,000.

4.8 College Lake Project with Pinto Lake Diversion

Description:

College Lake is a seasonal water body in a fault-controlled depression located to the north of Holohan Road and west of Highway 152, near the St. Francis Cemetery. A map of the lake is shown in Figure 4-8. The lake captures runoff from an 11,000-acre watershed during the winter (CH2M Hill, February 2000). The College Lake Reclamation District was formed in the early 1900's by landowners impacted by College Lake flooding. The Reclamation District owns and operates the existing headgate and pumps used to drain the lake. The pumps operate to drain College Lake by pumping the impounded water over the headgate into Salsipuedes Creek, which then converges with Corralitos Creek and eventually the Pajaro River.

Figure 4-8: College Lake with Pinto Lake Project



The existing headgate and weir elevation of 60.2 ft (Datum: NAVD88) results in the seasonal inundation of approximately 260 acres of land, with an overall storage capacity of approximately 1,400 AF. Under existing operations, pumping of College Lake water begins in April and is normally completed by May. Once drained, the lake bottom is planted for farming.

The College Lake Project includes a new adjustable height headgate/weir structure constructed downstream from the existing headgate. The new headgate would be designed to increase the maximum storage level of the lake by 2.3 feet, to a new maximum elevation of 62.5 feet. This would increase the total storage capacity of the lake from approximately 1,400 AF to approximately 2,000 AF, and increase the total inundated area from approximately 260 acres to approximately 300 acres (CH2M Hill, March 1999). The project would require purchase of a flood easement on the 40 additional acres that would be flooded annually. The project would also include construction of a screened inlet structure, a filter pump station, sand filtration, booster pump station, a new outlet weir structure, and pipelines.

The operating schedule of College Lake diversions would be based on diverting and pumping water stored in the lake to the coastal distribution service areas. The system's general operating period would be from December through mid-June, when runoff water is present in College Lake. The operating schedule would vary from year to year and would be based on the rainfall, other available supplies and irrigation demand. In general, the lake would be pumped down slowly during February and March, with increased pumping during May and June corresponding to increased irrigation demand. Additional information about the conceptual design can be located in the technical memoranda *Operational Conflicts for College Lake System and Suggested Conservation Measures to Protect Steelhead*, (CH2M Hill, March 1999) and *Local-Only Water Supply Alternative Evaluation* (RMC, May 2001).

In addition to the aforementioned College Lake facilities, a diversion from the Pinto Lake drainage channel would divert additional water supplies into College Lake. Pinto Lake drains by gravity through a concrete conduit to a drainage channel, which ultimately discharges into Salsipuedes Creek south of College Lake. The Pinto Lake diversion and associated pipeline alignment would divert water from the drainage channel to College Lake as shown in Figure 4-8. The diversion structure within the Pinto Lake drainage channel would divert water into a 24-inch conveyance pipeline from the diversion to College Lake. Water conveyed by the Pinto Lake diversion would flow into College Lake by gravity. Additional project details can be located in the *Local-Only Water Supply Alternative Evaluation* (RMC, May 2001).

Water Quality and Yield:

Although College Lake water quality data are limited, available data suggest that constituent concentrations vary seasonally. This is likely due to the seasonal nature of the water body. During the first storm events of the season, runoff collected in College Lake exhibits high levels of TDS, nitrates, and other pollutants. High nitrate concentrations are typically observed during the beginning of the rainy season with lower concentrations occurring through the rainy season. Water quality data indicates that nitrate concentrations in College Lake range from 0.3 to 20.3 mg/L N. It is assumed that diversions from College Lake would occur after the initial runoff has occurred and sufficient dilution has taken place. Therefore, additional water treatment is not required to control nitrates or TDS as water is expected to meet the irrigation water quality objectives.

An additional water quality parameter of concern is the presence of *Phytophthora*. College Lake collects runoff from several nearby farm fields. If *Phytophthora* is present in the fields, storm water runoff is a potential transport mechanism for *Phytophthora*. In a study performed in 1995, *Phytophthora* was found in College Lake (CH2M Hill, April 1999). Water captured in College Lake is proposed to undergo pressurized sand filtration prior to distribution. The filters and pump station will be located to the south

of College Lake on the west bank of Salsipuedes Creek. It is unclear whether *Phytophthora* can be effectively removed by filtering contaminated water through a pressurized sand media filter. Therefore, an alternative treatment process not included in this project description may need to be developed in order to remove *Phytophthora*.

There is limited water quality data available for Pinto Lake. However, after an initial flush downstream to Salsipuedes Creek that would be not be utilized as a water supply, the average TDS of Pinto Lake water is expected to be in the 280 to 300 mg/L range, based on PVWMA samples collected between 1994 and 1999 (Earles, October 2000). Additionally, due to the Pinto Lake's support of vibrant bird habitats, Pinto Lake water quality contains fecal bacterial concentrations higher than most other sources.

Based on hydrologic modeling, the potential annual average runoff into College Lake was estimated to be 4,700 AF (RMC, May 2001). However, it should be noted that the actual yield of the project would likely be lower due to storage constraints and mitigation measures. Preliminary discussions with CDF and NMFS have identified a flow requirement of at least 2 cfs to Salsipuedes Creek for fishery concerns. With a storage capacity of 2,000 AF, the estimated annual yield of the project is 1,800 AF after incorporating these concerns.

Implementation:

The PVWMA submitted a water rights application to the SWRCB in 1995 for diversion and storage at College Lake. The College Lake Project was included in the *Pajaro Valley Water Management Agency Local Water Supply and Distribution Projects Environmental Impact Report* (ESA, 1999). However, like the Murphy Crossing Project, protests by the DFG and NMFS have slowed the permitting process. Fishery concerns have been the main issue of protest, since College Lake is an identified habitat for Steelhead (*Oncorhynchus Mykiss*), a federally listed endangered species. The proposed operation plan for the College Lake Project conflicts with migration periods of adult and smolt Steelhead. In addition, mitigation measures such as increasing fish passage and supplying more water to Salsipuedes Creek would reduce the yield of the project and increase costs.

College Lake is also a potential location of a future Army Corps of Engineers (ACOE) flood control project. If the ACOE proceeds with a flood control project, PVWMA's College Lake project may need to be modified to allow for flood storage in conjunction with water supply operations.

For the Pinto Lake diversion, the PVWMA will need to secure a water rights permit from the SWRCB. In addition, the PVMWA will need to coordinate with the DFG and NMFS to identify impacts to the flow in Salsipuedes Creek as reduced runoff from Pinto Lake could impact Salsipuedes Creek.

Cost:

The estimated capital cost for the College Lake Project and the Pinto Lake Diversion is $14.1 million, including purchase of approximately 40 acres of flood easement. The estimated Annual O & M costs for the facilities are $0.3 million. College Lake and Pinto Lake Project costs are summarized in Table 4-10.

Table 4-10: College Lake with Pinto Lake Diversion Project Cost Estimate

Project Elements	Cost Estimate ($ Millions)
College Lake Headgate, Diversion Pumps, & Pinto Lake Diversion	$1.3
College Lake Filter Facilities & Pumps	$3.0
24-inch Pipeline to Import Pipeline	$3.7
Pipeline Appurtenances	$0.4
Environmental Habitat Mitigation	$1.0
Subtotal	**$9.3**
Construction Contingency	$1.9
Land Purchase & Right of Way Easements	$0.3
Total Construction Cost	**$11.5**
Engineering, Legal, Admin, Permits	$2.0
Subtotal	**$13.5**
Environmental & Permitting Contingency	$0.7
Overall Total	**$14.1**
Annualized Construction Costs	$1.0
Annual O & M Costs	$0.3
Total Annualized Cost	**$1.3**
Annual Yield (AFY)	1,800
Unit Cost ($/AF)	**$720**

Notes:
1. Annualized costs are based on a 30-year capital recovery period at 6% interest.
2. Reference: Earles, February 2001.
3. All cost estimates are rounded to two significant figures or nearest $100,000.

4.9 Expanded College Lake Project with Pinto Lake, Corralitos Creek, Harkins Slough, Watsonville Slough Diversions, and Aquifer Storage and Recovery

Description:

This project would build and expand upon the College Lake project described in Section 4.8. The Expanded College Lake Project would increase the total storage capacity of College Lake to 4,600 AF, would increase the number of water supplies stored in College Lake, and would add a seasonal storage component. In addition to Pinto Lake, new diversions to College Lake would include Corralitos Creek, Harkins Slough, and Watsonville Slough. An Aquifer Storage and Recovery (ASR) component would maximize capture of surface water. The following paragraphs discuss the details of the new elements necessary for the project, and refer the reader to previous sections for details on the projects already discussed.

The Expanded College Lake project would include a main earth dam, saddle dam, outlet works, spillway, pump station, and treatment facilities. The project would increase the maximum lake elevation from 60 ft to 69 ft, and would lead to inundation of approximately 420 acres of land, an increase of 160 acres from existing conditions (King, January 2000). The pump station, filtration facilities, and pretreatment facilities would be located to the south of the dam, adjacent to Salsipuedes Creek.

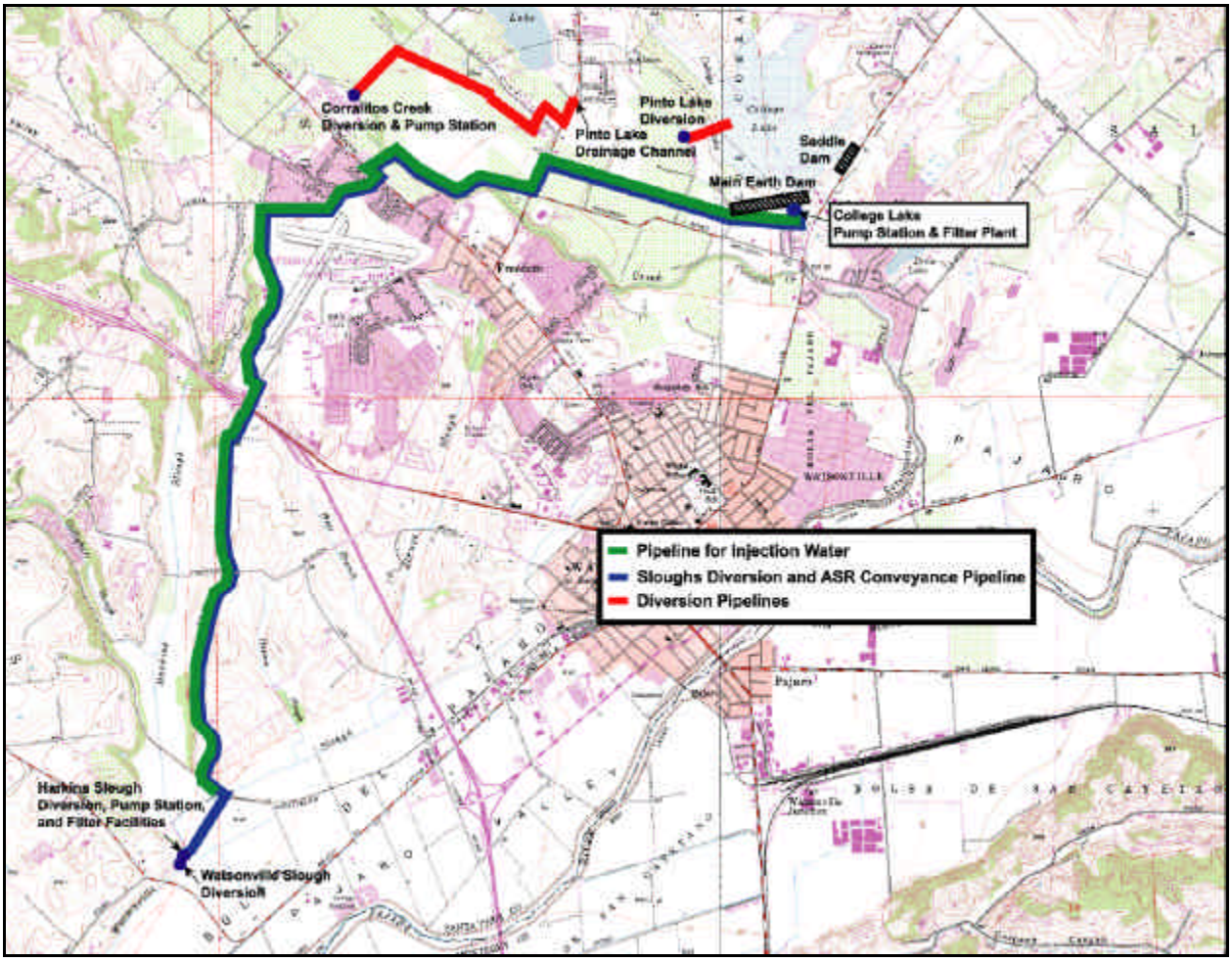
Figure 4-9 shows the approximate location of main dam and saddle dam required to construct the Expanded College Lake Project. The main dam would be constructed mainly on farmland, and would have an approximate footprint of 225 ft by 2200 ft. The saddle dam has an approximate footprint of 225 ft by 600 ft. The conceptual design of the main and saddle dam consist of a 40 ft wide crest at elevation of 79 ft, embankment slopes at 3:1 (H:V), a 25-foot wide berm at 74 ft, and embankment slopes at 3:1 (H:V) to the existing grade. The lowest existing tie-in grade is elevation 57 ft. The crest elevation of 79 ft provides a 10 ft of freeboard above the normal maximum water surface.

The dams would require approximately 160,000 cubic yards (CY) of borrow material from the lake bottom (100,000 CY) and a local rock quarry (60,000 CY) (RMC, May 2001). Filter zones, drain zones, and riprap in the dam would be constructed with material for a local rock quarry. For additional details on project element see *Evaluation of College Lake and Bolsa de San Cayetano Project* (King, January 2000).

The outlet works and spillway would be located on the easterly abutment near St. Francis Cemetery. The spillway consists of a 50 ft wide by 165 ft long ogee crest structure, set at an elevation of 69 ft. The outlet works consist of a 4.5 ft by 4.5 ft hydraulically operated slide gate, 4.5 ft diameter steel lined reinforced concrete conduit, 4.5 ft by 4.5 ft power operated control gate, and outlet channel (King, January 2000).

The Corralitos Creek and Pinto Lake diversion projects would divert water into College Lake for later treatment and injection/extraction (ASR) for seasonal storage. The Corralitos Creek diversion would route water into the Pinto Lake drainage channel near Green Valley Road. The Pinto Lake diversion would then divert both Corralitos Creek and Pinto Lake water from the Pinto Lake drainage channel into College Lake. The Corralitos Creek diversion would be located to the west of College Lake and north of the Watsonville airport. The Pinto Lake diversion is identical to the one discussed in Section 4.8.

Figure 4-9: Expanded College Lake Dam with Pinto Lake, Corralitos Creek, Harkins Slough, Watsonville Slough, and Aquifer Storage and Recovery



The Corralitos Diversion project includes a pump station and a 24-inch diameter conveyance pipeline from the diversion to the Pinto Lake drainage channel. The Corralitos Creek diversion will require a pump station adjacent to the diversion facilities. The total area impacted by the diversion structure and the pump station is an approximate 50 ft by 100 ft footprint. Additional project details can be found in the *Local-Only Water Supply Alternative Evaluation* (RMC, May 2001).

The Harkins Slough and Watsonville Slough diversions are discussed in Sections 4.1 and 4.7, respectively. However, this project would divert Harkins Slough and Watsonville Slough water to the College Lake filter facility in a 30-inch diameter pipeline extending from the confluence of the two Sloughs to the College Lake treatment plant. The Harkins Slough and North Dunes recharge basins would instead receive water from the WWTF (Section 4.5). All of the surface water supplies (except recycled water) would be collected and stored in College Lake. Water would be pumped from College Lake to a treatment facility for coagulation and filtration. Following treatment, water would be conveyed in a separate pipeline to an injection/extraction well field (ASR) located along the pipeline alignment between College Lake and Harkins Slough.

ASR is an alternative identified for seasonal or temporary storage of surface water supplies. The project would inject surface water in the groundwater aquifer during the winter months and then extract the water during the irrigation season. Modeling has indicated that the injected water would have limited vertical and horizontal movement within the aquifer. The ASR project, as evaluated in the *Local-Only Water Supply Alternative Evaluation* (RMC, May 2001), would supplement surface water storage at College Lake, allowing for increased capture and use of the surface supply projects identified above.

The ASR well field would be located along the dual pipeline alignment between the sloughs and College Lake. The pipeline alignment, as shown in Figure 4-9, would be approximately seven miles long, extending from the Harkins and Watsonville Slough Filtration Facilities along existing field roads to Airport Blvd. and Highway 1. The pipeline would then travel along the north side of the Watsonville Airport property to Freedom Blvd, and then parallel Corralitos Creek and Holohan Road to College Lake. This route would include major microtunnel sections at both ends of the airport property to cross under Highway 1 and streets and houses at Freedom Blvd. One pipeline would be dedicated to conveying water from the College Lake filter facility to the injection wells and would consist of multiple diameters. The second pipeline would serve a dual purpose of conveying water from the sloughs to College Lake during the winter and then delivering water from the injection wells and College Lake to the CDS during the irrigation season.

The ASR project includes 30 injection/extraction wells and would inject all the identified surface water supply sources at a rate of up to 5,400 AFY, between December and March. The injection wells would then be used for extraction between April and October. Rates of injection were estimated to be 500 gpm per well, while extraction rates could range from 500 to 1,000 gpm. Based on aquifer testing and computer modeling, the injection/extraction wells would need to be spaced approximately 2,000 ft apart to eliminate adverse mounding and drawdown impacts.

Water Quality and Yield:

College Lake and Pinto Lake water quality is discussed in Section 4.8. Harkins Slough and Watsonville Slough water quality are discussed in Sections 4.1 and 4.7, respectively. Expected yield from the sloughs in conjunction with the Expanded College Lake Project is 2,300 AFY.

Corralitos Creek water quality data was collected from the Corralitos Filter Plant. Water quality data are limited, though monthly TDS and TSS data are available between 1998 and 2001. The presence of *Phytophthora* in Corralitos Creek has been identified as the major constituent of concern. Based on hydrologic modeling and Pinto Lake drainage area, the estimated yields of the Corralitos Creek and Pinto Lake diversions are 650 and 550 AFY, respectively. However, this water requires capture and storage, and yield may potentially be reduced due to storage or operational limitations. A total minimum flow contingency of 5 cfs for the Corralitos Creek diversions was built into the model for assumed fishery and water quality requirements.

Injection water for ASR will consist of a blend of tributary runoff to College Lake and the aforementioned surface water diversions. Therefore, injection water quality will be a function of operations, the proportion of water from each source, and timing of diversions. Water quality is a major concern due to the potential impacts of ASR to existing potable groundwater supplies. Depending on the source of injection supplies, nitrate, aluminum, manganese, and salinity are of concern due to the anti-degradation policy of the RWQCB. In addition, *Phytophthora* is present in all of the proposed water supplies.

The Expanded College Lake Project would facilitate storage and utilization of surface water above that of the original College Lake Project concept. Hydrologic modeling of the Project included an analysis of water use and pumping from the reservoir. Model results indicate that the Expanded College Lake would typically be empty between June/July and October/November under the likely operations. The College Lake tributary area produces an average annual runoff of 4,700 AF, but the need for an estimated minimum fish release of 2 cfs and limitations on storage, the estimated yield is approximately 3,200 AFY. With the additional 2,300 AFY from the sloughs and 1,200 AFY from Corralitos Creek and Pinto Lake, the total yield of this project is estimated to be 6,700 AFY. The inundated College Lake land would be available for one crop rotation during this period if suitable soil conditions remain (RMC, May 2001).

Implementation:

The implementation issues for the Expanded College Lake Project include those discussed in Section 4.8. In addition, coordination efforts with the Division of Safety of Dams are necessary to secure permits for dam construction.

Implementation of the Watsonville Slough diversion was previously discussed in Section 4.7.

Implementation of the Corralitos Creek diversion requires attainment of a water rights permits from the SWRCB. In addition, coordination efforts with the DFG and NMFS would be required for the Corralitos Creek diversion, which is listed as habitat for Steelhead (*Oncorhynchus Mykiss*), an endangered species.

Due to potential impacts to potable water supplies, ASR could face opposition from the CCRWQCB and DHS. As a result, it may be necessary to implement additional water treatment measures over those assumed in the costs presented below. These may include reverse osmosis treatment at a centralized facility to remove nitrates, aluminum, arsenic, iron, and/or manganese from the water to be injected. Preliminary estimates indicate that the facility size and cost could be 21.7 MGD and $12.0 million, respectively. However, this cost is not included in the project cost estimate at this time since no definitive direction has been received from either the CCRWQCB or DHS at this time.

Cost:

The estimated capital cost for the Expanded College Lake Project, Pinto Lake, Corralitos Creek, Harkins Slough, Watsonville Slough Diversions, and the ASR project is $73.9 million, including land purchase of 420 acres (60 acres already owned by the PVWMA) for the reservoir. The estimated annual O & M costs for the facilities are $1.2 million. Cost estimates are summarized in Table 4-11.

Table 4-11: Expanded College Lake Project with Pinto Lake, Corralitos Creek, Harkins Slough, Watsonville Slough, and ASR Cost Estimate

Project Elements	Cost Estimate ($ Millions)
College Lake Dam, Dike, Spillway, Outlet Works	$7.8
College Lake Filter Facilities & Pump Station	$3.0
College Lake Pretreatment Facilities	$2.0
Road & Utility Relocation	$1.1
Watsonville Slough Diversion, Filter, & Pumps	$1.2
Pinto Lake Diversion	$0.4
Corralitos Creek Diversion	$2.6
ASR – Injection & Extraction	
Injection/Extraction Wells	$8.3
Monitoring Wells	$0.3
Pipelines for Injection	$5.4
Pipeline Sloughs to College Lake Pretreatment	$7.9
Subtotal	**$39.9**
Construction Contingency	$8.0
Land Purchase	$7.6
Flood Easements	$0.7
Total Construction Cost	**$56.2**
Engineering, Legal, Admin, Permits	$9.8
Subtotal	**$66.0**
Environmental & Permitting Contingency	$3.3
Harkins Slough Diversion, Filters, Pump Station	$4.2
Harkins Slough Wells and Connections	$0.9
Harkins Slough CalFed Grant	($0.5)
Overall Total	**$73.9**
Annualized Construction Cost	$5.4
Annual O & M Cost	$1.2
Total Annualized Cost	**$6.6**
Annual Yield (AFY)	6,700
Unit Cost ($/AF)	**$982**

Notes:
1. PVWMA already owns 60 acres of the Expanded College Lake area, which would not have to be purchased.
2. All cost estimates are rounded to two significant figures or nearest $100,000.
3. Annualized costs are based on a 30-year capital recovery period at 6% interest.
4. Reference: King, January 2000.

4.10 Import Water Project – Central Valley Project (CVP) with Various Storage Alternatives

General Description:

CVP Water is conveyed from the Delta of the San Joaquin and Sacramento Rivers through the Delta-Mendota Canal to O'Neill Forebay. The water is then pumped into San Luis Reservoir and diverted through the Pacheco Tunnel and the Pacheco Pumping Plant. At the pumping plant, the water is lifted to the high-level section of Pacheco Tunnel. The water flows through the tunnel and, without additional pumping, through the Pacheco Conduit to the bifurcation of the Santa Clara and Hollister Conduits, located east of Gilroy and north of San Benito. The water is then conveyed throughout the San Felipe service areas for irrigation and municipal uses (USBR, San Felipe website). CVP water deliveries to these areas began in 1987.

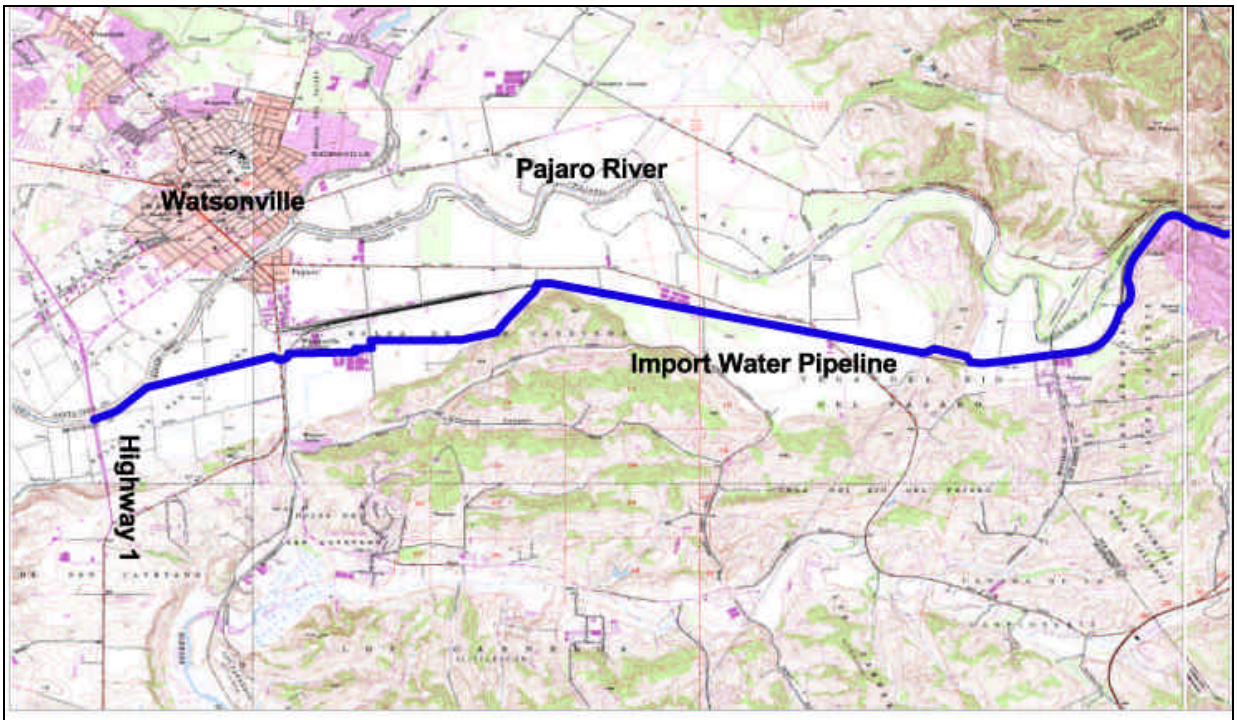
The San Felipe Division, which is operated by the United States Bureau of Reclamation (USBR), was constructed with a provision to serve CVP water to the Pajaro Valley. However, no facilities were ever constructed to connect the Pajaro Valley to the CVP. The Import Water project would connect a pipeline to the Santa Clara Conduit to import CVP water into the Pajaro Valley. The alignment of the import pipeline is shown in Figure 4-10. The facilities required include a 23-mile pipeline connecting the Santa Clara Conduit to the proposed CDS, and associated appurtenances. It is expected that water supplied to Pajaro Basin via the CVP can be delivered to the CDS with the existing pressure in the Santa Clara Conduit. A 36-inch turnout for PVWMA exists on the CVP pipeline east of Gilroy, north of Highway 25 near San Felipe Lake. The import pipeline would be sized from 42 to 60-inches in diameter depending on required yield and planned operation. Additional design details are summarized in *Pajaro Valley Water Management Agency Water Supply Project, Project Definition Report* (CH2M Hill, 1997).

General Water Quality and Potential Yield:

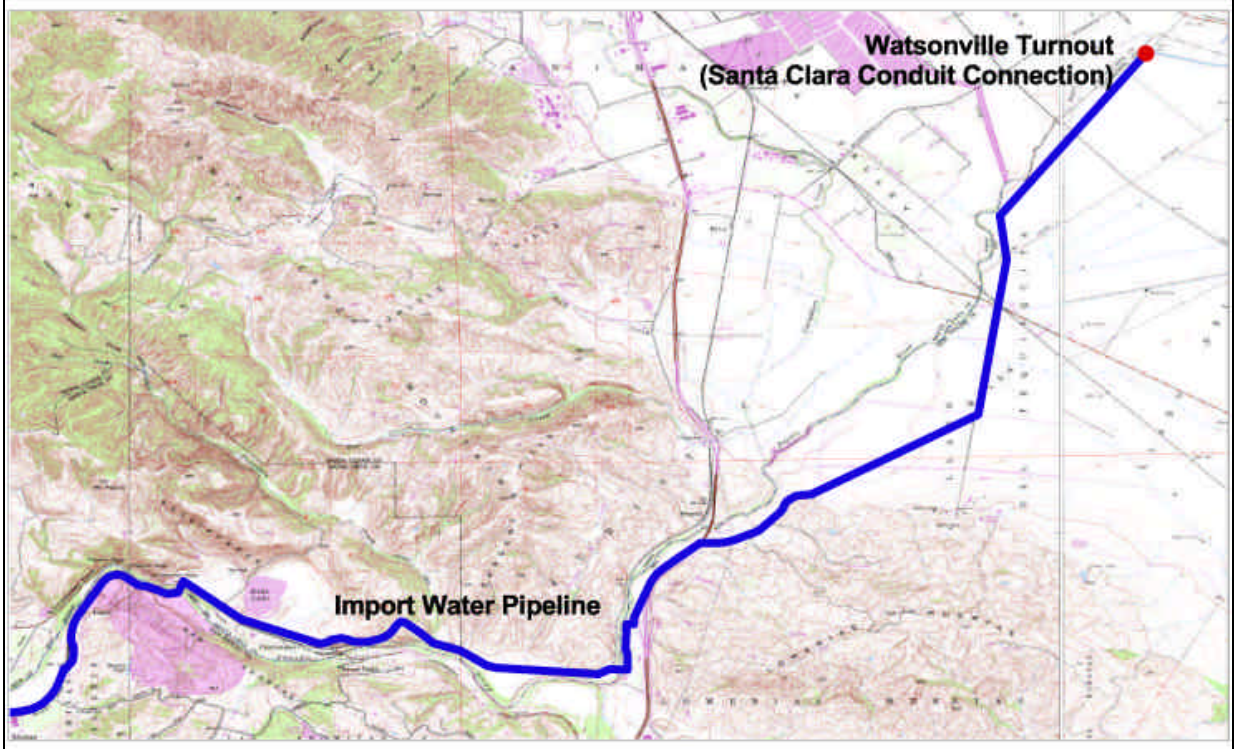
CVP water meets the identified agricultural water quality objectives. The presence of *Phytophthora* in CVP water is unknown at this time, and could be a factor of concern since it is suspected of being present in CVP supplies. However, *Phytophthora* is present in numerous surface waters of California that are used for irrigation in Central California without detrimental effect on agricultural production. CVP water quality fluctuates according to hydrologic conditions in northern California. In the late 1980's and early 1990's, California experienced several critical dry years. During this period, constituent concentrations were higher than normal. Recently, mineral concentrations in CVP water have been lower as California has experienced a series of wet years. Despite these hydrologic cycles, CVP water is a relatively high quality irrigation supply for even sensitive crops such as strawberries. The TDS of CVP water typically ranges between 190-420 mg/L with an expected average TDS of 300 mg/L.

The design capacity available to PVWMA in the Santa Clara Conduit is 75 cfs (USBR, September 1993). The San Felipe system was designed for use by the Santa Clara Valley Water District (SCVWD), San Benito County Water District (SBCWD), south Santa Cruz County, and north Monterey County, and has an overall design capacity of 330 cfs. Currently, only SCVWD and SBCWD take delivery of CVP water through the San Felipe system.

Figure 4-10: Import Water Pipeline Alignment



a) Import Pipeline Alignment between Highway 1 and Chittenden Pass



b) Import Pipeline Alignment between Chittenden Pass and Watsonville Turnout

The PVWMA has a CVP entitlement of 19,900 AFY reserved for it by USBR. However, in 1992, Title 34 - Central Valley Project Improvement Act (CVPIA) (Public Law 102-575) became law. The CVPIA has several provisions that prohibit the USBR from entering into new water contracts until certain environmental goals are attained. It is expected to be several years before the USBR fulfills these requirements. This has delayed negotiations with PVWMA for a new CVP contract for the 19,900 AFY entitlement. Although the CVPIA has prohibited the USBR from issuing new contracts, current law does permit assignments of existing CVP water contracts and transfers of water between CVP contractors.

In November 1998, the PVWMA entered into an agreement for the assignment of 6,260 AFY of contracted CVP water from the Mercy Springs Water District in northern Fresno County. The assignment is a joint agreement between the PVWMA, SCVWD, and Westlands Water District. The joint agreement stipulates the basis for the PVWMA acquiring all or a portion of this water supply between 2008 and 2017. However, if the PVWMA does not develop facilities to acquire this water by 2017, SCVWD and Westlands would be the sole recipients of all water entitlements assigned under the agreement.

In addition to these agreements, and as a result of the restrictions of CVPIA, the PVWMA is considering the purchase of other CVP water contract assignments and other possible water acquisitions to augment groundwater pumping in the Pajaro Basin.

The Import Water Project would be designed to provide sufficient water supplies to balance the water supplies in the Pajaro Basin. Annual yield is dependent on hydrologic conditions and the total CVP contract entitlement. Implementation of the full CVPIA requirements will affect long-term average annual water deliveries. As discussed in the CVPIA EIS, the long-term average water delivery for San Felipe Division contractors is estimated to be approximately 60% of the contracted amount.

The cost of acquiring new CVP supplies is based on the recent Mercy Springs Water District CVP contract assignment. The cost of the Mercy Springs contract assignment was $1,300/AF, expressed as a firm contract supply. Therefore, the estimated cost to obtain 1,000 AFY of firm supply is estimated at $1.3 million. Accordingly, to acquire a 1,000 AFY contract with a projected 60 percent supply reliability, the PVWMA should expect to pay $1.3 million for a nominal contract amount of 1,667 AFY (1,000 AFY/ 60 percent).

4.10.1 Draft BMP 2000 – 60-inch Import Water Project with Inland Distribution System and Supplemental Wells

The Draft BMP 2000 considered construction of a 48, 54, or 60-inch diameter pipeline. Under the Draft BMP 2000 recommended alternative, a 60-inch Import Pipeline was selected as the most cost effective project to facilitate delivery of the current maximum allotted flow rate of 75 cfs, while providing greater flexibility in meeting future conditions. In addition, the import project includes water banking by storing supplies in the groundwater aquifer as a means to realize the full annual average yield of a CVP contract. It allows storage of excess water in wet years and withdrawal of the stored water during dry years. In this way the full potential of a CVP entitlement would be realized. Storage in groundwater aquifers is the most cost-efficient method of achieving storage in the Pajaro Valley. The recommended BMP 2000 Alternative included an Inland Distribution System (IDS) and supplemental wells to provide in-lieu recharge and dry weather supply, respectively. In this case, the IDS acts as the storage mechanism allowing for in-lieu recharge (water banking) to fill the basin during wet years with pumping from on-site wells during dry years. The IDS and supplemental wells project descriptions are described in the following paragraphs.

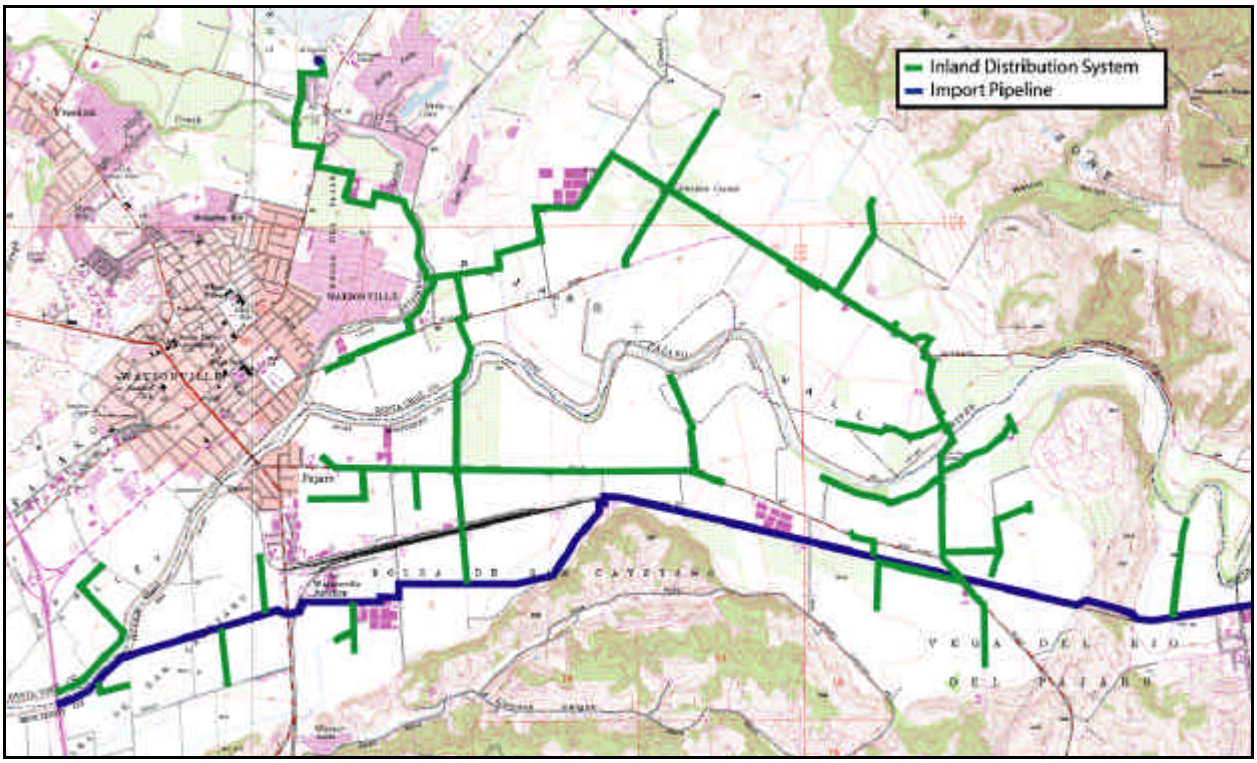
Inland Distribution System:

The IDS serves a dual purpose of balancing the basin and providing a mechanism for groundwater banking. Overdraft in the inland areas results in lowering of groundwater elevations, which contribute to unsustainable conditions. The IDS will also facilitate in-lieu banking of excess water supplies during wet weather years. By constructing the IDS, the PVWMA can take advantage of higher yields of CVP water during wet years, resulting in reduced groundwater pumping and additional in-basin storage. The additional in-basin storage is critical in achieving basin balance, as stored groundwater would be the major supplemental supply during dry years.

A preliminary analysis of the IDS was included in *Pajaro Valley Water Management Agency Water Supply Project, Project Definition Report* (CH2M Hill, 1997). In this evaluation, an Inland Service Area and a Murphy Crossing service area were individually identified and analyzed. In addition, the projects were also combined and analyzed. The description of the IDS discussed below is assumed to incorporate both the Inland Service Area and Murphy Crossing Service area from the evaluation.

The IDS would deliver water to a 7,900-acre service area roughly bound by State Highway 1 to the west, Murphy Crossing to the east, to the north by Salsipuedes Creek, Carlton Road, and Highway 129, and to the south by the Las Lomas area and Miguel Canyon Road. Distribution system alignments were developed and consist of nearly 20 miles of 10-inch to 30-inch diameter pipelines shown in Figure 4-11.

Figure 4-11: Inland Distribution System



Assumptions for the system were developed including a delivery pressure of 60 psi and a peak day flow of 43.6 MGD (CH2M Hill, 1997). Hydraulic modeling of the system was then completed assuming a 54-inch and 60-inch import pipeline. Model results indicated that no additional pumping is required for the IDS under the assumed system operations with a 54 or 60-inch diameter import pipeline. However, based

on more recent information from growers, an 80-psi delivery pressure is preferred. Therefore, additional modeling may be required to verify pumping requirements if this project is recommended for implementation. In addition, the final required IDS would be dependent on projects identified in conjunction with this project.

Supplemental Well Component:

Supplemental wells are necessary to supply water to the CDS during drought years to maintain the hydrostatic barrier, and allow the distribution system to meet peak demands during transient periods of demand fluctuation. By constructing supplemental wells, the PVWMA would eliminate coastal pumping during all years, even during drought years when CVP supplies were not fully available. PVIGSM results have demonstrated that this practice increases the basin sustainable yield. The well field would be located to the east of Highway 1 and in the general vicinity of the proposed import pipeline alignment. It would be located outside of the CDS area to limit seawater intrusion. Water from the supplemental wells would be conveyed to the import pipeline for transport to the coastal distribution system during drought years, and to handle peak delivery flows as needed.

The number of wells required to meet coastal demand is a function of the available water supply during drought years. During severe dry years, CVP deliveries could drop to *zero*, however, this has never been the case. Therefore, for evaluation purposes, the projected CVP delivery during severe dry years is estimated to be 10% of CVP entitlement. Preliminary design criteria for the supplemental wells include a minimum well spacing of 2,000 ft and a maximum well design flow of 2,000 gpm. Based on a design peak hour demand of 60,000 gpm for the CDS and assuming half of that flow would be supplied by the supplemental wells during a drought year; the project would require construction of 17 supplemental wells including two stand-by wells for reliability.

Yield – Draft BMP 2000 Import Project with Inland Distribution System:

The yield of the 60-inch Import project with IDS was developed specifically for the BMP 2000 Recommended Alternative. The Alternative remains a viable option and is discussed in Section 5. The required average annual deliveries of CVP water are 10,300 AFY, and assumes a total CVP contract amount of 17,200 AFY with 60 percent reliability. The yield of this project is very flexible and can be increased through procurement of additional import supplies.

Implementation – Draft BMP 2000 Import Project with Inland Distribution System:

Connection to the CVP system will require significant permitting and environmental evaluation. The CVP is a federally owned project and is operated by the USBR. Prior to implementation, the PVWMA will need to complete a federal (NEPA) EIS evaluating the environmental and social-economic impacts of the project. This EIS has been initiated and is scheduled for completion in 2002.

Comments and Issues on Draft BMP 2000 Import Water Project:

The Import Water Project section of the Draft BMP 2000 received significant comments during the public review period for that document. Based on comments received on the Draft BMP 2000, the PVWMA has investigated and evaluated additional options for reducing the need and scope of the import project and maximizing local water supply options. The following two import projects were selected by the PVWMA for evaluation under this Revised BMP.

1. A 54-inch Import Water Project with Aquifer Storage and Recovery

2. A 42-inch Import Water Project with Aquifer Storage and Recovery

In addition to ASR as a storage mechanism, Out-of-Basin Banking represents an additional potential storage option for CVP or other imported water supplies. If ASR is determined to be a non-feasible strategy, Out-of-Basin Banking may be used as an alternate. Project descriptions and cost estimates for the two new alternatives are discussed below, followed by a description of Out-of-Basin Banking.

4.10.2 54-inch Import Water Pipeline with Aquifer Storage and Recovery (ASR)

Description:

This project includes construction of a 54-inch import water pipeline along the alignment shown in Figure 4-10. Similar to the 60-inch diameter pipeline, the 54-inch pipeline would facilitate a maximum flow of approximately 75 cfs, equivalent to approximately 150 AF per day and the total allotment currently designated to the PVMWA. As discussed in previous sections, to realize a long-term average annual yield of 60%, the wet year supplies would need to be stored. Under this project ASR would be used to store and recover water from the groundwater basin.

ASR consists of a series of injection and extraction wells used to inject and store water during wet weather years for later extraction during dry years. The project would construct a network of injection and extraction wells located east of Highway 1, along the Import Pipeline alignment. The exact location of the supplemental wells has yet to be determined. Wells would be spaced approximately 2,000 feet apart and would have a maximum injection rate of 500 to 1,000 gpm, and a maximum extraction rate of 2,000 gpm. Based on a design peak hour demand of 60,000 gpm for the CDS and assuming half of that flow would be supplied by the injection and extraction (ASR) wells during a drought year; the project would require construction of 17 injection and extraction wells including two wells for reliability. Further, assuming a full 40 percent of the CVP contract amount of water would be available for storage through injection in any given year, the maximum injection rate would be approximately 660 gpm, assuming 15 wells in operation.

Pipeline laterals would connect the Import Water Pipeline to the supplemental wells. In addition, each supplemental well would be equipped with a filtration treatment process in accordance with DHS and CCRWQCB requirements for injection of surface waters. Prior to injection, CVP water would be filtered for compliance with DHS and CCRWQCB requirements. Upon extraction, water from the wells would be delivered to the CDS without additional treatment.

According to hydraulic modeling results, the 54-inch pipe would result in sufficient headlosses requiring at least one additional pump station to be constructed for the CDS on Sunset Beach Road (CH2M Hill, February 1997). Hydraulic modeling was completed assuming a delivery pressure of 60 psi. However, based on grower input, the preferred delivery pressure in the CDS is 80 psi. Therefore, additional pump stations may be required to provide delivery pressure of 80 psi.

Yield – 54-inch Import Project with ASR:

The yield of the 54-inch Import Project with ASR was developed for specific inclusion into the Modified BMP 2000 alternative discussed in Section 5. The required annual average yield of the project is 11,900 AFY assuming total required supplemental water supplies of 17,000 AFY for the Modified BMP 2000 Alternative. The yield of this project is very flexible and can be increased through procurement of

additional CVP supplies. Assuming a 60% CVP annual average yield, the total required CVP contract for this project is 19,800 AFY.

Implementation – 54-inch Import Project with ASR:

Implementation of the Import Pipeline with ASR will require significant permitting tasks and environmental evaluation, similar to that identified in Section 4.10.1 for the 60-inch pipeline. In addition, the PVWMA will need to procure water contracts for delivery of CVP water.

ASR of CVP water will require permitting from the CCRWQCB, which manages and regulates water resources and storage of water in the groundwater basin.

4.10.3 42-inch Import Water Pipeline with Aquifer Storage and Recovery

Description:

This project includes construction of a 42-inch Import Water Pipeline along the alignment shown in Figure 4-10. Like the 54-inch Project, ASR would provide storage and recovery in order to realize the full potential yield of the Import Pipeline Project. The 42-inch diameter pipeline is assumed to be the smallest reasonable Import Pipeline Project. Although the allotted flow to Pajaro is 75 cfs, to equal head losses associated with the 54-inch Project, the small pipeline would only deliver imported water at a maximum flow rate of 40 cfs (approximately 80 AF per day).

Like the 54-inch Project, ASR would consist of injection and extraction wells located along the Import Pipeline east of Highway 1. Similarly, the exact location of the supplemental wells has yet to be determined. Wells would be spaced approximately 2,000 ft apart along the pipeline and would have an assumed injection rate of 1,000 gpm. Extraction rates are assumed to be approximately 2,000 gpm. Based on a design peak hour demand of 60,000 gpm for the CDS and assuming half of that flow would be supplied by the injection and extraction (ASR) wells during a drought year, the project would require construction of 17 injection and extraction wells including two standby wells for reliability. Further, assuming a full 40 percent of the CVP contract amount of water would be available for storage through injection in any given year, the maximum injection rate for this alternative would be approximately 385 gpm, assuming 15 wells in operation.

Pipeline laterals would connect the Import Water Pipeline to the supplemental wells. In addition, each supplemental well would be equipped with a filtration treatment process in accordance with DHS and CCRWQCB requirements for injection of surface waters. Prior to injection, CVP water would be filtered for compliance with DHS and CCRWQCB requirements. Upon extraction, water from the wells would be delivered to the CDS without additional treatment.

A pump station along Sunset Beach Road would be required for an 80-psi delivery pressure. A more detailed analysis would be required prior to implementing this alternative.

Yield – 42-inch Import Project with ASR:

The yield of the 42-inch Import Project with ASR was developed for specific inclusion in to the Modified Local Alternative discussed in Section 5. The required annual average yield of the project is 6,900 AFY

assuming total required supplemental water supplies of 17,000 AFY for the Modified Local Alternative. The required CVP contract assuming a reliability of 60% is 11,500 AF.

The yield of this project could be increased through procurement of an additional CVP contract to meet future increases in water demand.

Implementation – 42-inch Import Project with ASR

Implementation of the 42-inch Import Pipeline with ASR would be identical to the 54-inch project except less CVP supplies would be needed.

Cost:

Pipeline sizes of 42, 54, and 60-inch were identified as potential Import Pipelines for this Revised BMP. The 54 and 60-inch pipelines are designed to convey a 75 cfs, the flow capacity available to the PVWMA in the Santa Clara Conduit, to the CDS. The 42-inch pipeline would convey a 40 cfs flow capacity to the CDS. Estimated construction costs for the various Import Pipelines are shown in Table 4-12. The table also summarizes the cost of the IDS and supplemental wells for the 60-inch project and the ASR facilities for the 42 and 54-inch projects.

In addition, varying levels of pumping within the coastal distribution system will be required depending on the pipeline size used. The costs for pumping within the CDS as a result of the sizing of the import pipeline are included in the cost estimates shown in Table 4-12.

The overall estimated cost of the 42-inch Import Pipeline with ASR is $73.9 million with an annual O&M of $1.6 million. The overall cost of the 54-inch Import Pipeline with ASR is $94.9 million with an annual O&M of $2.2 million. The overall estimated capital cost for the 60-inch Import Pipeline with IDS and Supplemental Wells is $117.4 million with an annual O&M of $2.2 million.

Table 4-12: Import Water Projects with Associated Storage Cost Estimate

Project Elements	Cost Estimate ($ Millions)		
	42-inch	**54-inch**	**60-inch**
Watsonville Turnout Structure	$0.1	$0.1	$0.1
Import Pipeline	$24.9	$32.0	$35.6
Crossings	$6.3	$7.9	$9.0
Appurtenances	$3.1	$4.0	$4.5
Inland Distribution System	-	-	$12.2
Supplemental Wells	-	-	$7.3
ASR-Injection/Extraction Wells	$5.6	$5.6	-
Monitoring Wells	$0.3	$0.3	-
Pump Stations required for CDS	$0.5	$0.5	-
Subtotal	**$40.8**	**$50.3**	**$68.5**
Construction Contingency	$8.2	$10.1	$13.7
Land Purchase	$0.5	$0.5	$0.5
Right of Way Easements	$0.7	$0.7	$1.0
Total Construction Cost	**$50.2**	**$61.7**	**$83.7**
Engineering, Legal, Admin, Permits	$8.8	$10.8	$14.7
CVP Water Entitlements	$9.0	$15.5	$13.4
Additional Water Treatment (Filtration for ASR) (including contingency for construction and engr, legal, admin, permits)	$2.4	$2.4	-
Subtotal	**$70.4**	**$90.3**	**$111.8**
Environmental & Permitting Contingency	$3.5	$4.5	$5.6
Overall Total	**$73.9**	**$94.9**	**$117.4**
Annualized Construction Costs	$5.4	$6.9	$8.5
Annual O & M Costs	$1.6	$2.2	$2.2
Additional O & M (Filtration for ASR)	$0.1	$0.1	-
Total Annualized Cost	**$7.1**	**$9.2**	**$10.7**
Annual Average Yield	6,900	11,900	10,300
Unit Costs ($/AF)	**$1,023**	**$770**	**$1037**

Notes:
1. Annualized costs are based on a 30-year capital recovery period at 6% interest.
2. Cost of the Import project is based on: CH2M Hill, 1997.
3. Annual average yield is assumed to equal only 60% of the contracted amount.
4. Costs Estimate includes cost of CVP entitlement.
5. All cost estimates are rounded to two significant figures or nearest $100,000.

4.10.4 Out-of-Basin Banking Option

Description:

An Out-of-Basin Water Banking program would allow the PVWMA to partner with another CVP contractor to exchange excess CVP import supplies from the PVWMA to another CVP contractor during wet or normal years. During dry years, the CVP contractor would transfer CVP water back to the PVWMA. For the PVWMA, Out-of-Basin banking increases the reliability of the CVP supply, and minimizes the need for additional storage facilities and the size of delivery pipelines.

Provisions of a water banking agreement typically require that the contractor acting as the water bank keeps a portion of this water, which is estimated to be approximately 10% of the total banked water supply. This 10% accounts for seepage, evaporation and unaccounted losses. In addition, the PVWMA would probably pay this contractor a nominal fee to provide this service. The water banking concept is being used successfully by other California water management agencies.

This option provides the PVWMA with either an alternative to an IDS or ASR if those storage elements were determined to be too costly, or a means to expand operational flexibility and increased reliability of supply in conjunction with an IDS or ASR element.

Implementation:

Out-of-Basin Banking is contingent on developing and negotiating an agreement with one or several CVP contractors/agencies to banking surplus water. There are potentially reduced local environmental impacts associated with not constructing additional capital facilities.

Cost:

The expected cost for Out-of-Basin Banking includes administrative and legal fees plus a minimal cost for banking water.

San Benito Water District currently has an agreement where they pay their banking partner approximately $20/AF for banking water in their service area. It is anticipated that the PVWMA will be able to enter into agreements with other contractors to bank water at similar costs ($20–25/AF) and conditions. An additional $50,000/yr in costs for managing and maintaining the contract, and legal fees, is also assumed.

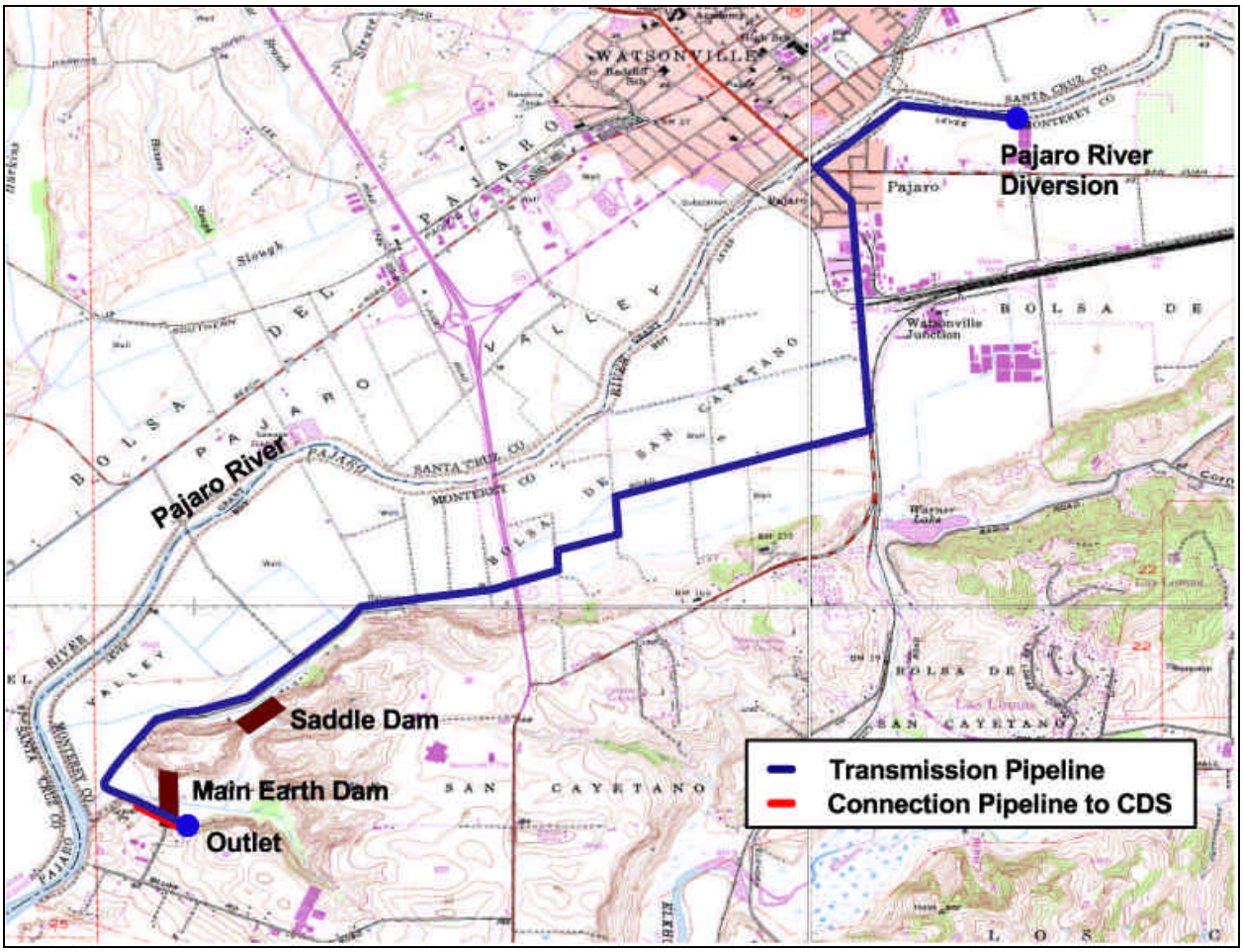
Prior to implementation of a banking agreement, a CVP contract and connecting pipeline to the CVP system are required. It is assumed that additional CVP supplies would be purchased and banked as needed, depending on the strategy selected.

4.11 Bolsa De San Cayetano with Pajaro River Diversion

Description:

The Bolsa De San Cayetano (Bolsa) Dam would be located in Monterey County on the south side of the Pajaro River and adjacent to Trafton Road, as shown in Figure 4-12. The Bolsa project would provide surface storage of 5,000 AF for Pajaro River diversions in addition to capture of limited runoff from a 723-acre drainage area. The reservoir is surrounded by 100 to 150 ft high terrace upland that has been eroded to form a canyon. The earth fill dam would be located across the mouth of the canyon, which forms the reservoir (King, January 2000).

Figure 4-12: Bolsa De San Cayetano with Pajaro River Diversion Project



Under the conceptual design, a 70 ft high earth dam with a crest length of 1,500 ft would be constructed to an elevation of 80 ft. A saddle dam on the north ridge would be approximately 700 ft long. The earth dams would be constructed from approximately 871,000 CY of reservoir borrow material and approximately 204,000 CY of filter, drain, and riprap material from the Aromas Quarry. The Pajaro River diversion facilities would consist of an infiltration gallery, filtration facilities, and pumping station located approximately 0.5 miles upstream of the confluence of Salsipuedes Creek and the Pajaro River.

In addition, a 6-mile conveyance pipeline from the diversion to the Bolsa reservoir would be required (King, January 2000).

Additional project details can be located in the *Evaluation of College Lake and Bolsa De San Cayetano Projects* (King, January 2000).

Water Quality and Yield:

As previously discussed in Section 4.6, TDS and *Phytophthora* are the major water quality concerns for water diverted from the Pajaro River. For additional information see Section 4.6.

The annual yield of the Bolsa project and Pajaro River Diversion is 5,000 AFY.

Implementation:

In addition to water quality concerns, the Bolsa project must address seismic hazards. The project is located nine miles to the west of the San Andreas Fault in an area that is partly ancient sand dunes, and is under the influence of the Sargent, Zayante-Vergeles, San Gregorio, and Monterey Bay faults. The area is vulnerable to a large magnitude earthquake that could result in liquefaction of saturated sand layers that exist within the basin fill deposits. The seismic stability of constructing a dam must be evaluated and incorporated into the final design. Mitigation costs for potentially required seismic upgrades and *Phytophthora* removal were not included in this analysis.

Implementation of the project will require significant permitting tasks and environmental coordination. A water rights permit from the SWRCB is required prior to diversion of water from the Pajaro River. In addition, coordination efforts with the DFG and NMFS are necessary to evaluate impacts on habitat and endangered species. In addition, coordination efforts with the Division of Safety of Dams are necessary to secure permits for dam construction.

Cost:

Table 4-13 summarizes the estimated cost for the Bolsa and Pajaro River Diversion Project. The estimated capital cost of the project is $87.8 million, which includes land purchase of approximately 170 acres. The estimated annual O & M costs for the facilities are $0.8 million.

Table 4-13: Bolsa De San Cayetano with Pajaro River Diversion Cost Estimate

Project Elements	**Cost Estimate ($ Millions)**
Bolsa Main Dam, Saddle Dam, Spillway, Outlet Works	$24.5
Road Relocation	$0.4
Pajaro River Diversion & Filter, & Filter Pumps	$13.0
Pump Station Diversion	$8.1
Transmission Pipeline	$8.4
Connecting Pipeline to CDS	$0.6
Subtotal	**$55.0**
Construction Contingency	$11.0
Land Purchase & Right of Way Easements	$5.1
Total Construction Cost	**$71.2**
Engineering, Legal, Admin, Permits	$12.5
Subtotal	**$83.7**
Environmental & Permitting Contingency	$4.2
Overall Total	**$87.8**
Annualized Construction Costs	$6.4
Annual O & M Costs	$0.8
Total Annualized Cost	**$7.2**
Annual Yield	5,000
Unit Costs ($/AF)	**$1,433**

Notes:
1. Annualized costs are based on a 30-year capital recovery period at 6% interest.
2. Reference: Modified from King, January 2000.
3. All cost estimates are rounded to two significant figures or nearest $100,000.

4.12 Seawater Desalination

Description:

Desalination is the process of converting seawater or other high TDS water into potable water. A desalination plant that treats Monterey Bay seawater could be constructed to provide water for agricultural irrigation. A seawater desalination project would theoretically provide a reliable supply of water for the Pajaro Valley, due to the abundantly available seawater and lack of seasonal or annual dependencies associated with the supply. Currently, Reverse Osmosis (RO) treatment is the most cost effective and feasible treatment option for desalination.

A desalination project would collect seawater via beach collectors[1] at the coast and convey it to the treatment plant via a new pipeline. The treatment plant would consist of membrane modules and high pressure feed pumps. The membranes are materials that act like a sieve, allowing the passage of water molecules while retaining dissolved impurities. To achieve this, feed water must be pressurized to approximately 1,000 pounds per square inch (psi) to drive the water molecules through the membrane. The high feed pressure results in very high energy costs.

The treated, low salt water would be conveyed to the CDS for blending with other sources of water and eventual use by growers.

Because seawater has a TDS concentration of approximately 35,000 mg/L, the membranes reject more than 50% of the feed water. Therefore, if 10,000 AFY of desalinated seawater is needed, the treatment plant has to be sized for a capacity of 20,000 AFY. This also results in the need for a dedicated pipeline and ocean outfall to dispose of 10,000 AFY of brine.

A reverse osmosis plant could be located anywhere in the Pajaro Valley, but two potentially suitable locations are the WWTF and adjacent to the Moss Landing Energy Facility. If an agreement could be reached with Duke Energy and the plant were located at Moss Landing, the existing cooling water intake and outfall facilities serving the Moss Landing Energy Facility could be utilized for a supply of seawater and for brine disposal. Further, locating the plant at Moss Landing could result in energy costs that are approximately one-half the energy cost of facilities taking energy from the distribution grid.

Water Quality and Yield:

Water quality would meet or exceed all identified objectives for irrigation water. A desalination plant could be sized according to water demands in the Pajaro Valley and would provide a highly reliable supply to the basin.

Implementation:

Implementation of a seawater desalination plant would involve siting of the treatment plant, the intake pipeline and the brine discharge pipeline/outfall. The brine outfall would be the most difficult of these facilities to locate and permit, given that the discharge point would be to the Monterey Bay Marine Sanctuary.

[1] The collectors would consist of a vertical reinforced concrete case with lateral screened pipes protruding toward the ocean. A pump located within the concrete column would deliver water to desalination facilities.

Use of RO would also increase the energy dependence of the PVWMA and would make the supplemental water supply more vulnerable to increases in energy costs or energy shortages.

Cost:

The high feed pressures and the need to 'double size' the treatment capacity result in a treatment cost of approximately $1,200/AF, assuming electric power costs at $0.12/kilowatt-hour. If power costs were lowered to $0.069/kilowatt-hour, the unit cost of treated water would drop to $1,005/AF (CPUC Plan B, 2001). This lower power cost might be available if the treatment plant were located near the Moss Landing Energy Facility.

In addition to the treatment costs are the costs for land acquisition, the seawater intake, and brine water discharge and outfall lines. Thus, the total unit cost of desalinized seawater would be even greater than the costs cited above. The extremely high cost for desalination of seawater for agricultural uses, coupled with its dependency on large quantities of power and other implementation issues identified, prevents this type of project from being carried forward into any of the strategies presented in Section 5.

4.13 Summary

The projects discussed in Section 4 would provide water of various qualities for irrigation use, including several high salinity supply projects. Therefore, in order to meet the water quality objective of this Revised BMP (see Section 2.9), some projects require blending with higher quality water. For instance, the recycled water project as currently defined would provide water with an expected TDS of up to 900 mg/L, so blending would be required in order to meet the water quality objective of 500 mg/L TDS.

Implementation of water supply projects will require permitting and coordination with jurisdictional agencies and stakeholders. As previously discussed, some of the projects, including ASR of surface water or percolation of recycled water, may require additional treatment facilities as required by governing laws or regulators. It should be noted that projects including injection of surface water and/or percolation of recycled water have an associated cost risk based on their current design.

In general, the projects in this section can be used for developing combinations of water supply project to balance the basin and eliminate seawater intrusion. However, some of the projects in this section are pertinent to specific alternatives presented in Section 5. This was the case with the Import Pipeline Project, which has a variable potential yield, but the specific yield is pertinent to a given combination of water supply projects. The import water projects are capable of supplying various levels of yield to the Pajaro Valley by purchasing additional CVP supplies as needed. However, each Import Project is specifically designed to supply water necessary for their associated alternatives in Section 5.

The water supply projects discussed in this section represent the most feasible set of project options identified for water supply to the PVWMA service area. The projects can be combined to develop various BMP alternatives to provide supplemental irrigation water to prevent seawater intrusion in the Pajaro Valley groundwater basin. However, it should be noted that many of the project elements are included in several of the projects. For instance, the Harkins Slough diversion facility is included in the Harkins Slough Project with Harkins Slough Recharge Basin and is also included in the Expanded College Lake project. Therefore, a combination including these two projects is not feasible. Similar instances of overlap are issues for the College Lake facilities, Watsonville Slough diversion, North Dunes Recharge Basin, Harkins Slough Recharge Basin, Recycled Water facilities, and Import Water pipeline elements.

An additional overlap concern is specifically identified for the Bolsa de San Cayetano with Pajaro River Diversion and the Murphy Crossing Project. Both projects would divert from the Pajaro River and would likely not be constructed in conjunction.

In Section 5, Basin Management Plan Alternatives are formulated to meet the Revised BMP objectives. The packaging of water supply projects into various strategies is identified and then evaluated.

5 Basin Management Plan Strategies

The previous draft BMP 2000 contained a recommended Basin Management Plan for balancing the basin and eliminating seawater intrusion. However, public review of that draft document indicated the need to more fully assess the merits of alternative management options, particularly those strategies that incorporate local supply options.

This section presents four alternative Basin Management strategies that incorporate a range of feasible local supply options that were identified and evaluated in Section 4. These alternatives are:

- **BMP 2000 Alternative**. This strategy is similar to the one identified in the draft BMP 2000 document published in May 2000. Modifications to this Alternative between the BMP 2000 document and this Draft Revised BMP were limited to updating individual cost estimates.
- **Local-Only Alternative.** This strategy demonstrates the costs and implications associated with developing *only* local water supplies and storage projects within the Pajaro basin. The Local-Only Alternative was developed based on recommendations from local stakeholders, and information about this alternative is extracted from *Local-Only Water Supply Alternative Evaluation* (RMC, May 2001).
- **Modified Local Alternative.** This strategy builds upon the projects that comprise the Local-Only Alternative and maximizes potentially feasible local projects. It supplements the local projects with the minimum quantity of imported water needed to balance supply with current demand. The concept behind this alternative was developed based on recommendations from local stakeholders.
- **Modified BMP 2000 Alternative**. This strategy presents a potential modification of the BMP 2000 alternative that reduces the size of the import pipeline. The size reduction is brought through in-basin storage with groundwater injection/extraction and elimination of the inland distribution system. Other project components were also modified from the original BMP 2000 alternative to maximize their cost effectiveness.

Table 5-1 compares the four alternatives in terms of which projects they involve and what issues may be associated with their implementation.

A description, cost estimate, map, operational strategies, requirements for meeting anticipated future agricultural and urban increases in water demand, and a discussion of each alternative is provided in the following sections.

Table 5-1: Comparison of Alternatives

Project	BMP 2000	Local-Only	Modified Local	Modified BMP	Issues and Comments
5,000 AF Water Conservation	..	..	..	..	Requires 5,000 AFY of water conservation.
Harkins Slough Project	..	..	..	..	Construction of diversion and recharge basin is complete.
Coastal Distribution System	..	..	..	..	Necessary to eliminate coastal pumping to maximize groundwater yield.
Recycled Water Project (4,000 AFY)	..			..	Blending facility required to meet water quality requirements; additional permits required.
Recycled Water Project (6,000 AFY)			..		Blending facility required to meet water quality requirements; additional permits required; additional treatment for recharge of recycled water.
Recycled Water Project (7,700 AFY)		..			Blending facility required to meet water quality requirements; additional permits required; additional treatment for recharge of recycled water.
Murphy Crossing Project	..				Protests from DFG; additional studies requested by NMFS.
Watsonville Slough Project		..	..		Water rights permit; restoration of the slough probably required.
College Lake Project			..		Protests by DFG and NMFS; water rights permit required.
Expanded College Lake Project		..			Same issues as above two projects; plus water rights permit required for Corralitos Creek. Injection may require reverse osmosis treatment.
60” Import Water Project	..				Implementation requires resolution of Measures D and K and acquisition of CVP contracts.
54” Import Water Project				..	Implementation requires resolution of Measures D and K and acquisition of CVP contracts; requires filtration for injection.
42” Import Water Project			..		Implementation requires resolution of Measures D and K and acquisition of CVP contracts; requires filtration for injection.
Additional 5,000 AFY Water Conservation via Land Fallowing		..			Requires the equivalent of 2,200 acres of basin-wide land fallowing, or approximately 800 to 1,000 acres of fallowing near the coast.
Bolsa de San Cayetano Project					Significant seismic, environmental and cost issues eliminated this component.
Seawater Desalination					Permitting difficulties for disposal of brine; cost-prohibitive.

Note: See Sections 5.1 – 5.4 for additional information about data contained in Table 5-1.

5.1 BMP 2000 Alternative

The BMP 2000 included a recommended alternative that incorporated imported CVP water to supplement locally developed supplies to eliminate seawater intrusion and balance the basin, without regard to the location of the water source. This strategy identified the following projects as components of the recommended BMP 2000 alternative:

- Coastal Distribution System;
- Conservation: 7-year plan (5,000 AFY);
- Harkins Slough with Harkins Slough Recharge Basin with Supplemental Wells and Connections (1,100 AFY);
- Murphy Crossing with Recharge Basins (1,600 AFY);
- Recycled Water (4,000 AFY); and
- 60-inch Import Water Project with Inland Distribution System and Supplemental Wells (10,300 AFY).

A map of the BMP 2000 facilities is shown in Figure 5-1. The BMP 2000 Alternative was created in order to meet current urban and agricultural demand of 71,500 AFY and eliminate seawater intrusion. The current BMP 2000 Alternative would fully meet existing demand conditions, but would not provide any additional supply necessary to meet future demands.

With existing supplies from the Corralitos Creek Filter Plant and other surface water diversions, the total groundwater demand is reduced to approximately 69,000 AFY. The implementation of the agriculture and urban water conservation program will further reduce the total groundwater demand to 64,000 AFY.

As previously discussed in Section 2.8.2, the basin sustainable yield assuming coastal pumping reductions and an extremely dependable supplemental supply is 48,000 AFY. However, when supplemental supplies are hydrologically dependent, the basin sustainable yield deceases as groundwater pumping is increased to meet demand during drought or below normal years. Due to the hydrologic dependency of the BMP 2000 Alternative water supply projects, the sustainable yield of the groundwater basin following implementation of the BMP 2000 alternative is estimated to be approximately 47,000 AFY.

With development of recycled water, Murphy Crossing, and Harkins Slough local supplies, the estimated average annual delivered CVP water required to balance the basin is 10,300 AF. Assuming an average CVP annual delivery of 60% of contract entitlement, the PVWMA will need to secure water contracts for approximately 17,200 AFY to meet this need. Total supplemental yield of the capital projects associated with this alternative were estimated to be approximately 17,000 AFY, representing a total sustainable yield for all supplies of 64,000 AFY.

Although 17,000 AFY is the total quantity of supplemental supply required to balance the basin, approximately 18,500 AFY of water must be delivered to the CDS in order to develop a hydrostatic barrier resulting in sustainable groundwater pumping of 47,000 AFY. Therefore, on average at least 1,500 AFY would be pumped from supplemental wells east of Highway 1 and delivered to the CDS.

In addition to providing in-lieu recharge and storage of water in the groundwater aquifer, the IDS also provides the benefit of supplying higher quality water to inland farmers that presently irrigate with lower quality water.

The water balance objective for this alternative is summarized in Table 5-2.

Figure 5-1: Map of BMP 2000 Alternative

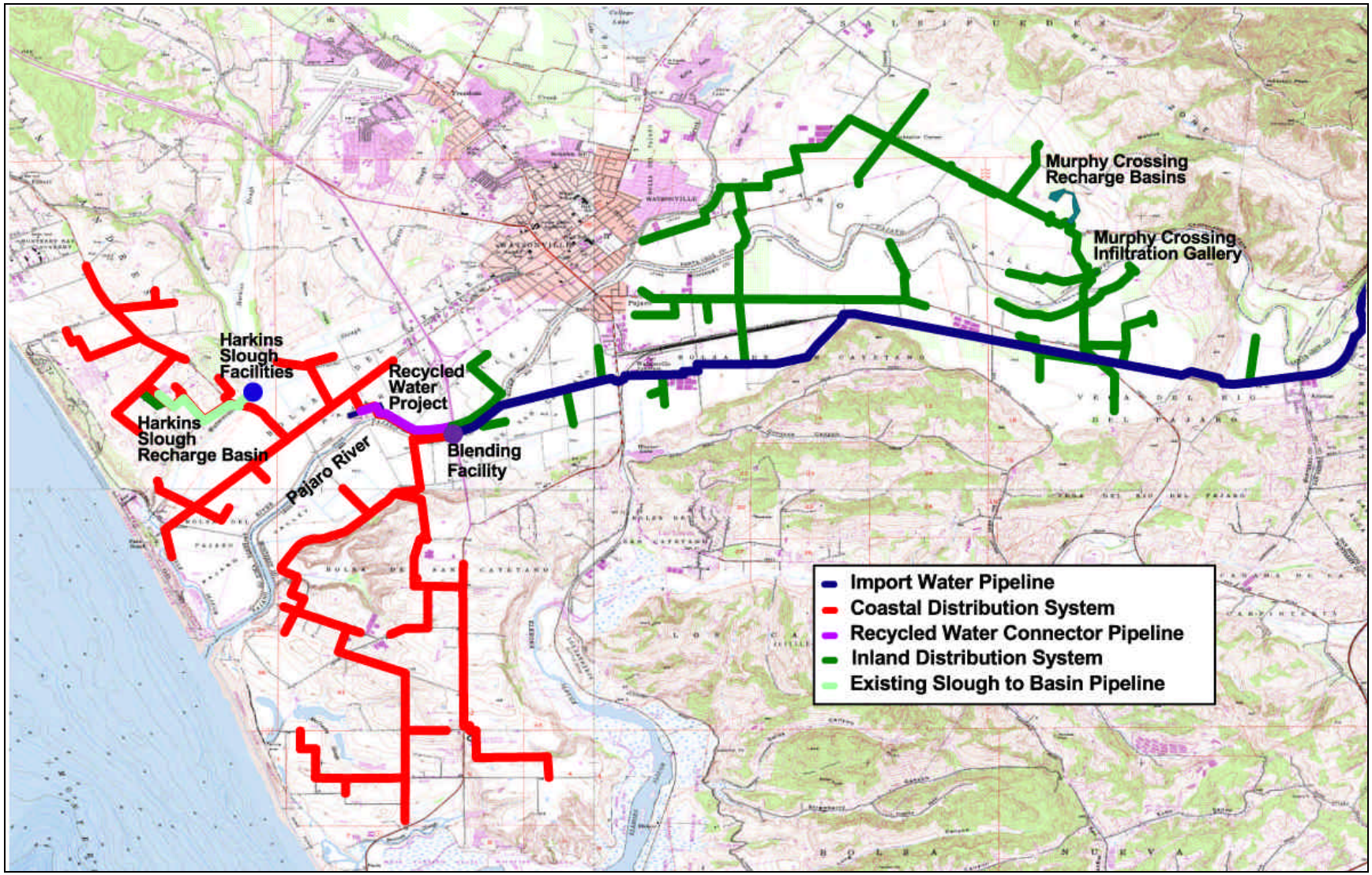


Table 5-2: BMP 2000 Alternative Water Balance Objective

Water Demand Objective	**AFY**
Current Agricultural	59,300
Current Urban	12,200
Total Demand	**71,500**
Corralitos Creek Filter Plant	(1,100)
Other Surface Water Diversions	(1,000)
Remaining Demand[a]	**69,000 (rounded)**
Future Agricultural and Urban Water Conservation	(5,000)
Total Demand Objective	**64,000**
Water Supply Objective	
Existing Basin Sustainable Yield	24,000
Increase in Sustainable Yield due to Coastal Pumping Management	23,000
Murphy Crossing with Murphy Crossing Recharge Basin	1,600
Harkins Slough with Harkins Slough Recharge Basin	1,100
Recycled Water	4,000
Import Water Project	10,300
Total Supply Objective	**64,000**

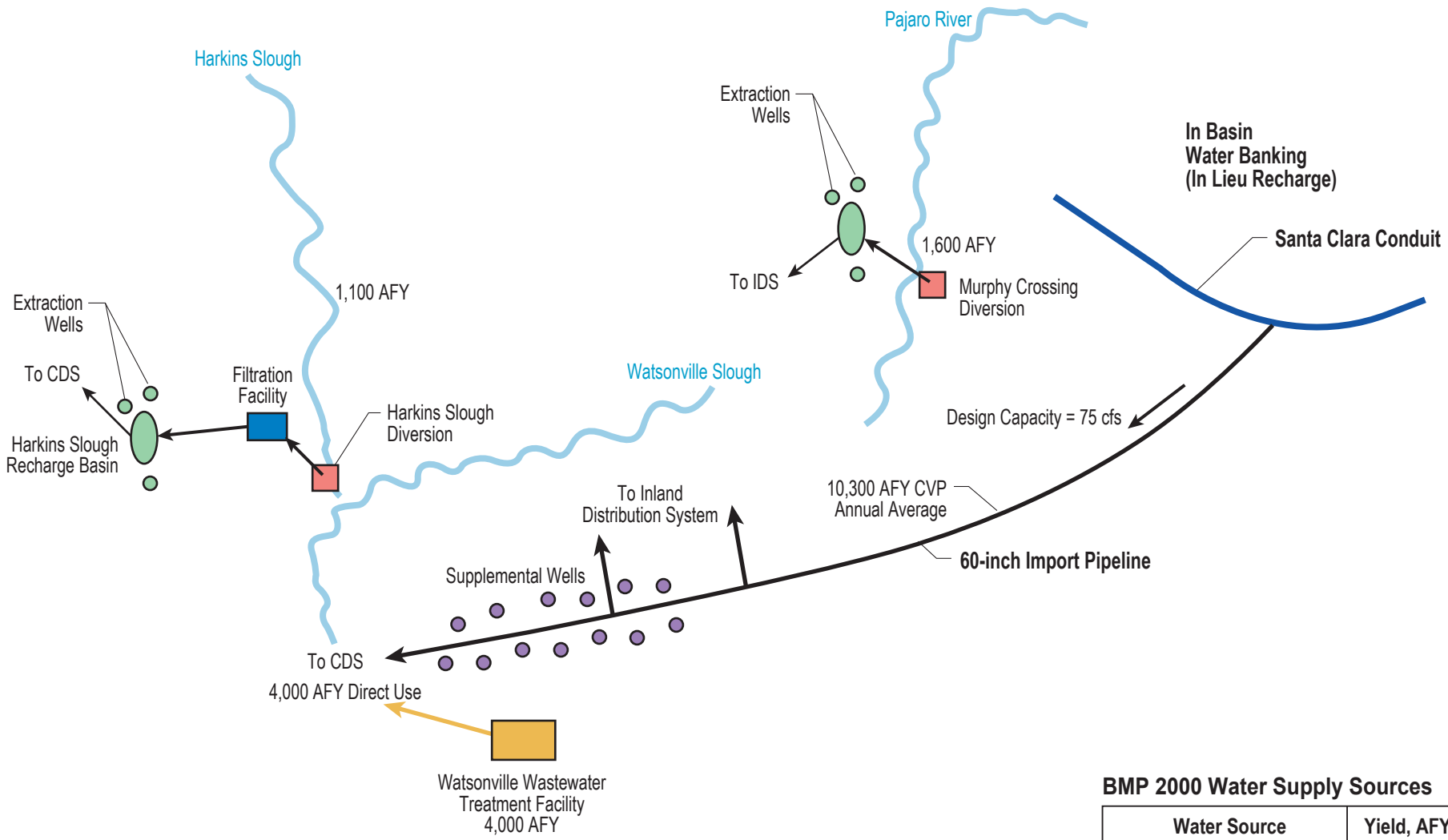
Footnotes:
a. Values rounded to two significant figures or to the nearest thousand to represent the values significant accuracy.

The locations of the supplemental wells have yet to be identified, but are anticipated to be in an area adjacent to the Import Pipeline between Highway 1 and Allison Road. Conservation measures included in the BMP 2000 Recommended Alternative would be at levels identified in the WC 2000. The water quality objective is also consistent with the CCRWQCB Basin Plan water quality criteria identified in Section 2. No out-of-basin storage of water is included in this alternative, although it could be incorporated if determined to be cost-effective.

Operational Strategy:

A flow schematic for the BMP 2000 alternative is shown in Figure 5-2.

CVP water would be the major source water supply, and would be conveyed from the Santa Clara Conduit to the CDS and IDS for direct use. Water from the CVP would be combined with water extracted from the Murphy Crossing recharge basin and direct Pajaro River diversions to supply the IDS. Supplying the IDS with supplemental water supplies results in in-lieu recharge of the basin, and a reduction in groundwater pumping. In the CDS, CVP water would be blended with recycled water at a blending facility located near the intersection of Highway 1 and the Pajaro River, prior to distribution. Water extracted from the Harkins Slough Recharge Basin would be blended within the San Andreas portion of the CDS. CDS deliveries provide a basis for stopping agricultural pumping along the coast to assist in the creation of the coastal hydrostatic barrier.



BMP 2000 Water Supply Sources

Water Source	Yield, AFY
Recycled Water	4,000
Harkins Slough	1,100
Murphy Crossing	1,600
CVP - Import Water	10,300
Total	**17,000**

Figure 5-2. BMP 2000 Schematic

During a normal rainfall year, farmers in the CDS would receive a blend of CVP, Murphy Crossing, and recycled water, with farmers in the Dunes area receiving the Harkins Slough Project water in addition to the blended supply. Supplemental wells would be utilized to meet peak day demands. Farmers in the IDS would receive a blend of Murphy Crossing and CVP water, supplemented by groundwater to meet peak day demands.

During a below-normal rainfall year, inland farmers would only receive water from the import pipeline after the CDS demands had been accounted for. As a result, inland farmers on the IDS would be required to maintain their on-site wells for use as a backup supply. Farmers receiving water from the CDS would be supplied water from supplemental wells during dry years in order to maintain the coastal hydrostatic barrier. The quantity of water conveyed to the CDS by supplemental wells would be the difference between CDS demand and available supplies from CVP, Murphy Crossing extraction, recycled water and Harkins Slough extraction.

During an above-normal year of CVP deliveries, both the CDS and IDS would be operated similar to a normal year. However, it is anticipated that the additional water supplies would be utilized by increased numbers of IDS farmers, resulting in increased in-lieu recharge in the inland portion of the groundwater basin. Less water would be pumped from the supplemental wells in order to maximize use of imported water supplies and maximize water stored in the inland and coastal groundwater basins.

Cost Estimate:

The BMP 2000 alternative relies mainly on imported and recycled water supplies. A significant portion of the cost is associated with construction of the Import Pipeline and associated facilities, and purchase of CVP contracts. The cost of the contract is estimated to be $1,300 per AF of firm contract supply, based on the cost of the Mercy Springs contract assignment, as described in Section 4.12. The cost of 10,300 AF average annual CVP water supplies is estimated to be $13.4 million.

The cost of the CVP contract is included in the cost of the 60-inch Import Water Project with IDS. In addition, the $117.4 million for the 60-inch Import Water Project with IDS includes costs for supplemental wells needed to meet peak demand and to supply additional water during drought years.

The cost estimate contained in Table 5-3 includes the same projects identified in the BMP 2000, but with cost estimates updated to Spring 2001. The updated costs reflect the result of bid estimates received for the Harkins Slough Project and additional information collected between the distribution of the Draft BMP 2000 and this document. Actual implementation costs may vary from the costs shown due to scheduling, design modifications or other actions.

Table 5-3: BMP 2000 Alternative Cost Estimate

Project Element	($ Millions)
Coastal Distribution System	$34.4
Conservation (7-year)	$1.7
Harkins Slough Project with Harkins Slough Recharge Basin	$6.6
Murphy Crossing with Recharge Basins	$6.6
Recycled Water Project (4,000 AFY)	$19.2
60-inch Import Water Project with Inland Distribution System, CVP contract purchase and Supplemental Wells	$117.4
Subtotal	**$185.8**
Financial & Bond Sale Cost @ 1.0%	$1.9
Recycled Water Grant (Title XVI)	$(20.0)
Total Capital Cost	**$167.6**
Annualized Capital Cost at 6% for 30 years	$12.2
Annual O & M Costs	$4.4
Total Annual Cost	**$16.6**
Income from PVWMA Delivery Charges on Customers Receiving Delivered Water @ $92 per AF (18,500 AFY)	$1.7
Adjusted Total Annual Cost	**$14.9**
Combined Sustainable Yield (AFY)	64,000
Cost per AF ($/AF)[a]	**$233**
PVWMA Delivery Charge for Customers Receiving Delivered Water ($/AF)	**$92**
Cost per AF plus PVWMA Delivery Charge for Customers Receiving Delivered Water ($/AF)	**$325**

Footnotes:
a. Cost to growers pumping from the groundwater basin.

Notes:
1. Spring 2001 construction costs.
2. Capital Recovery Factor (A/P) for 6% at 30 years is 0.07265.
3. Cost estimates include a Construction Contingency of 20%, Engineering/Legal/Admin/Permits Contingency of 17.5%, and Environmental and Permitting Contingency of 5%.
4. Cost per AF shown assumes (total annual costs minus total annual avoided cost of pumping) divided by combined sustainable yield.

Future conditions (2040 Demand):

In order to meet potential future increases in agricultural and urban water use, an additional 9,000 AFY (3,900 AFY of urban demand, plus 5,100 AFY of agricultural demand) of supplies must be identified and secured for development to occur. Local supply options to meet this demand could include College Lake, Watsonville Slough, and expanded recycled water use. However, the most cost-effective alternative would be an increase in the amount of imported CVP water. This would require purchase of additional CVP supplies and expansion or maximization of the existing coastal or inland distribution systems. It is also expected that this will increase the required number of supplemental wells, particularly if water deliveries from CVP average 60% of the CVP contract entitlement. It is not expected that an increase in CVP deliveries would require additional pumping (CH2M Hill, 1997).

Although expanded conveyance, distribution and supply facilities are required to meet future demands, these facilities have not been quantified in detail. For estimation purposes, it was assumed that the unit cost of these additional facilities would be similar to the unit costs of facilities evaluated in this document. The cost for increased distribution service area was based on the CDS cost estimate, assuming a similar $/AFY unit cost. The number of additional supplemental wells was assumed based on the percent increase in CVP contract entitlement. Preliminary cost estimates for these facilities are summarized in

Table 5-4. It should be noted that expansion of the water delivery capabilities would be incremental in nature, and would staged to respond to increased demands on as as-needed basis.

Table 5-4: Additional Facilities Required to Meet 2040 Agricultural and Urban Demand

Item	Quantity	Loaded Unit Cost	Cost ($ Millions)
CVP Contract	9,000 AFY	$1,300/AFY	$11.7
Increased Distribution[a]	9,000 AFY	$1,860/AFY	$16.7
Increased Supplemental Wells[b]	8 wells	$530,000/well	$4.2
Total Capital Cost			**$32.6**

Footnotes:

a. Unit cost estimate based on construction of a $34.4 million CDS serving 18,500 AFY.

b. The number of additional wells was based on a linear estimate assuming 15 wells to supply approximately half of the peak hour demand for an 18,500 AFY CDS. No additional wells are provided for reliability. Loaded unit cost for supplemental wells includes filtration treatment, pipelines, well, and land purchase of 1 acre. Estimates also include 20% contingency, 17.5% engr/legal/admin/permitting, and 5% environmental and permitting contingency.

Key Points and Implementation Issues:

Presented below is a summary of key points and implementation issues regarding this alternative:

- Utilization of the IDS for in-lieu groundwater banking and delivery of CVP water will improve water quality to many farmers in the inland portion of the basin. Numerous farmers in this area pump groundwater with TDS concentrations above 900 mg/L. Supplementing this source with CVP water would be expected to improve crop yield and soil drainage as well as increase groundwater levels.

- In addition to pumping benefits previously discussed, the 60-inch import pipeline with a maximum flow rate of 75 cfs provides sufficient flexibility in the event additional water supplies are required.

- Rights to water from a Pajaro River diversion at Murphy Crossing have yet to be obtained, and were challenged by DFG.

- Harkins Slough supplemental wells and connections will provide peaking supply for the distribution system until additional supplemental supplies can be developed. Once these supplies are developed, these wells would continue to provide peaking supply for the entire CDS.

5.2 Local-Only Alternative

The objective of the Local-Only Alternative (LOA) is to eliminate seawater intrusion through the implementation of local water supply projects and demand management measures, without importation of water from outside the basin. Demand management measures include high levels of conservation above those identified in WC 2000.

In developing the LOA, it was recognized that the overall quality of water supplied to growers would be less than the identified objectives, since a higher portion of the overall water supply is composed of recycled water. Therefore, the identified water quality objectives were not adopted as an objective of this alternative. Instead, the general aim of the LOA is to provide water quality that avoids a significant level of impact to agricultural production.

The LOA includes the following water supply projects and demand management plan:

- Coastal Distribution System;
- Conservation: 7-year plan (5,000 AFY);
- Additional Conservation (5,000 AFY);
- Expanded College Lake with Pinto Lake, Corralitos Creek, Harkins Slough, and Watsonville Slough Diversions, and Aquifer Storage and Recovery (6,700 AFY);
- Recycled Water Project with Harkins Slough and North Dunes Recharge Basin (7,700 AFY); and
- Land Fallowing (Achieved with annual agriculture land leases of 2,200 acres basin-wide.)

The proposed location of these facilities is shown in Figure 5-3.

The Local-Only Alternative would maximize the use of recycled water by constructing an additional percolation basin as well as use of the Harkins Slough recharge basin for seasonal storage of recycled water. The proposed North Dunes recharge basin and injection/extraction wells would be located approximately 1,500 ft southwest of the intersection of Sunset Beach Road and San Andreas Road. This would allow use of approximately 7,700 AF of annual recycled water for irrigation in the Pajaro Valley. The total yield of the Expanded College Lake Project with supplemental elements was estimated to be 6,700 AFY based on hydrologic analyses completed by the PVWMA, providing a total additional supply of approximately 14,400 AFY.

Additional conservation of 5,000 AFY was then assumed, increasing total agricultural and urban water conservation to 10,000 AFY (9,000 AFY agricultural and 1,000 AFY urban conservation) or approximately 14% of current overall PVWMA demands. The combined conservation is summarized in Table 5-5. Water use factors for various agricultural crops were reduced to account for either increased conservation or reduction in number of crop rotations. Modeling of the alternative was then completed with the PVIGSM to determine sustainable groundwater basin yield.

The Local-Only Alternative was modeled with the PVIGSM utilizing the local water supply projects that produce an average yield of 14,400 AFY, with conservation and no land fallowing. PVIGSM results from this scenario showed significant basin imbalance and seawater intrusion resulting from insufficient water supplies, reduced infiltration of surface water supplies, and the impact of hydrologic conditions on surface water supplies. As a result, demand management techniques above those modeled, such as those identified in Section 3, were required to bring the basin into balance and eliminate seawater intrusion.

A second model run was utilized to determine the required level of land fallowing necessary to meet these objectives. Based on modeling iterations, the LOA would require the equivalent of 2,200 acres of basin-wide agricultural land fallowing in addition to the assumed 14% conservation within the PVWMA service area in order to balance the basin. This land fallowing reduces the overall basin water demand by approximately 3,000 AFY. Modeling input assumptions are summarized in Table 5-5.

Table 5-5: PVIGSM Modeling Input to Achieve Basin Balance for LOA

Item	Assumption
Total Agricultural & Urban Conservation	10,000 or 14% (of Current Water Use)
Agricultural Land Fallowing[a]	2,200 acres

Footnotes:
a. The reduction in water demand due to land fallowing is in addition to other water conservation.

Notes:
1. The PVIGSM model assumes this result to be equivalent to 14,400 AFY from the hydrologic model. PVIGSM intricacies limit the input of the exact value.

As previously discussed in Section 2.8.2, the basin sustainable yield assuming coastal pumping reductions and an extremely dependable supplemental supply is 48,000 AFY. However, when supplemental supplies are hydrologically dependent, the basin sustainable yield deceases as groundwater pumping during drought or below normal years is increased to meet demand. Due to the hydrologic dependency of local surface water supplies, coupled with the low yield of supplemental supplies, the sustainable groundwater yield for the LOA has been estimated to be 42,000 AFY. Including demand management measures and the supplemental supply yield associated with the LOA, the supply and demand in the PVWMA boundary would be balanced at 56,000 AFY.

This sustainable yield estimate is based on the anticipated reliability of the various supplies, creation of the hydrostatic barrier and modeling assumptions. With development of the Recycled Water Project, the Harkins Slough and North Dunes Recharge Basins, and the Expanded College Lake Project, the total yield of the capital projects associated with this alternative was estimated to be approximately 14,400 AFY. This represents a total sustainable yield for all supplies of 56,000 AFY. The water balance objective for this alternative is summarized in Table 5-6.

Figure 5-3: Map of Local-Only Alternative

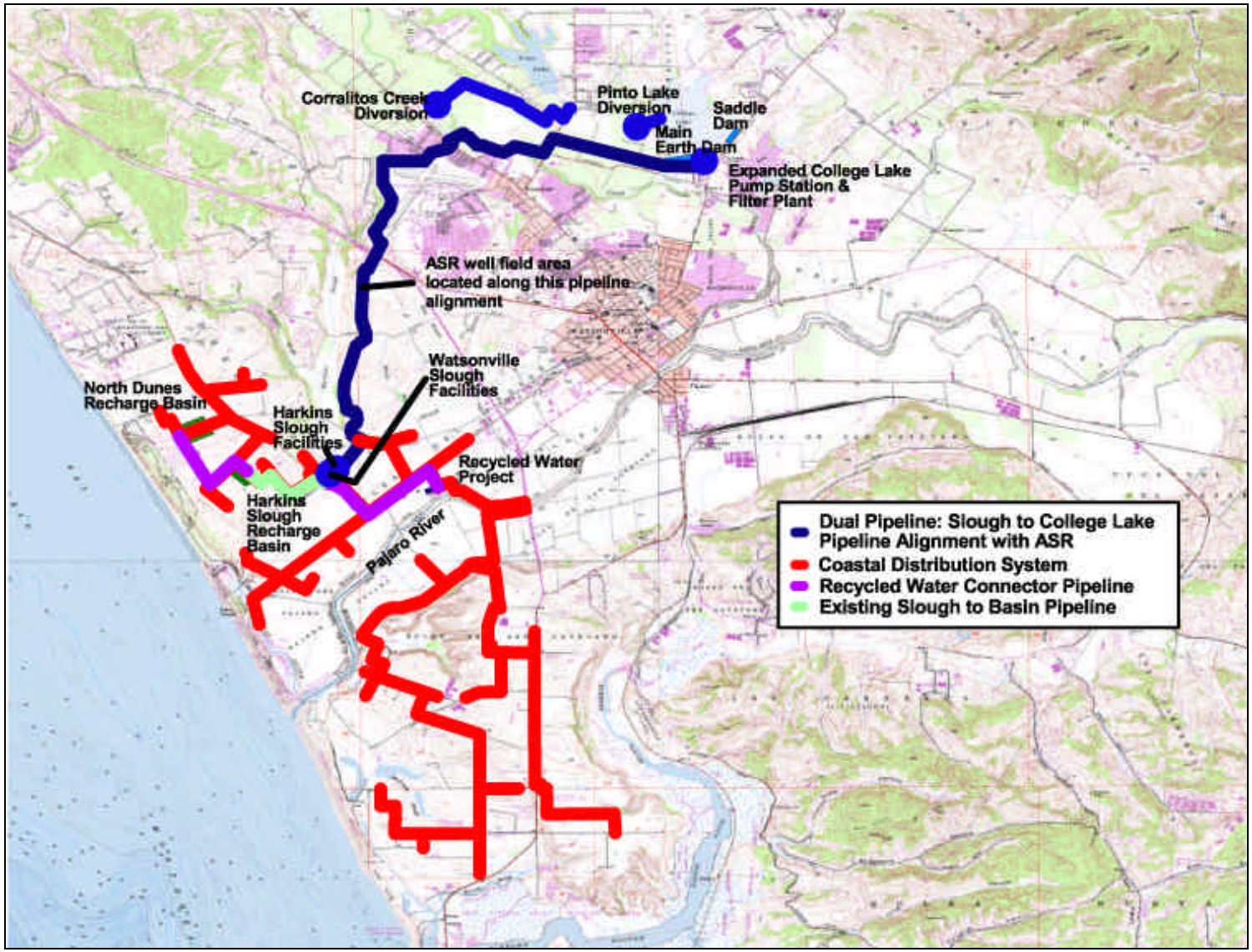


Table 5-6: LOA Water Balance Objective

Water Demand Objective	**AFY**
Current Agricultural	59,300
Current Urban	12,200
Total Demand	**71,500**
Corralitos Creek Filter Plant	1,100
Other Surface Water Diversions	1,000
Remaining Demand[a]	**69,000 (rounded)**
Future Agricultural and Urban Water Conservation (WC 2000)	(5,000)
Additional Water Conservation	(5,000)
Land Leases – Average Water Demand Mitigated	(3,000)
Total Demand Objective	**56,000**
Water Supply Objective	
Existing Basin Sustainable Yield	24,000
Increase in Sustainable Yield due to Coastal Pumping Management, demand management, and land fallowing	18,000
Expanded College Lake with Pinto Lake, Corralitos Creek, Harkins Slough, and Watsonville Slough Diversions, and ASR	6,700
Recycled Water Project with Harkins Slough and North Dunes Recharge Basin	7,700
Total Supply Objective[a]	**56,000 (rounded)**

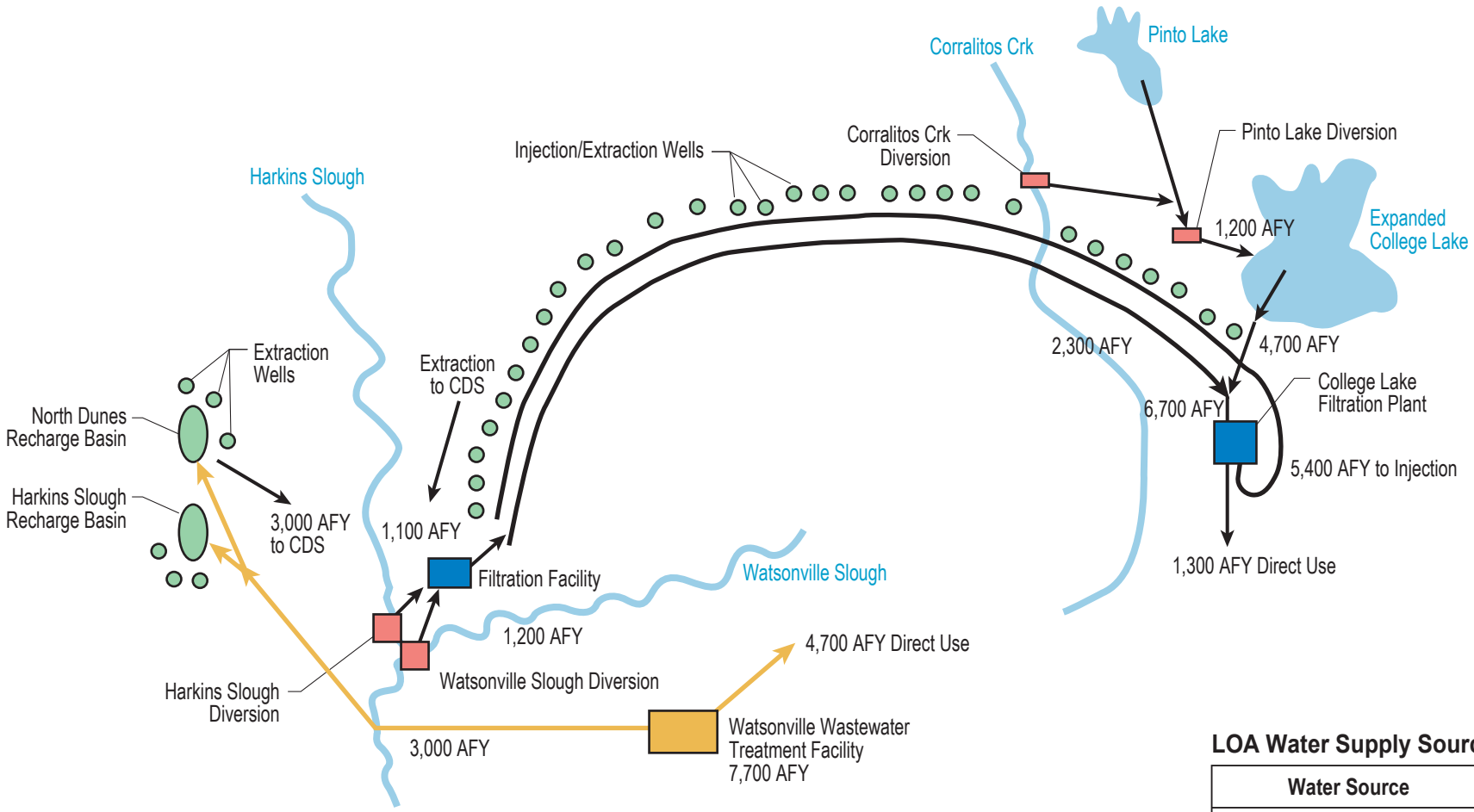
Footnotes:
a. Values rounded to two significant figures or to the nearest thousand to represent the values significant accuracy.

Operational Strategy:

A flow schematic for the LOA is shown in Figure 5-4.

Operationally, the Local-Only Alternative would maximize recycled water use, and at times will deliver up to 100% recycled water, which would result in TDS concentrations of up to 900 mg/L. This scenario is most likely during the beginning and end of the irrigation season. During these periods, water demands are nearly equal to the recycled water flow that is not directed to storage, and recycled water will comprise the entire water supply in many areas. The recycled water facility produces a daily average supply of 7 million gallons per day (RMC, May 2001). On an annual basis, local farmers would directly use approximately 3,000 AF of this water.

During low demand periods, nearly the entire recycled water treatment plant flow would be diverted to the North Dunes and Harkins Slough recharge basins. The Recycled Water Project with Harkins Slough and North Dunes recharge basins are described in Section 4.5.



LOA Water Supply Sources

Water Source	Yield, AFY
Recycled Water	7,700
Harkins Slough	1,100
Watsonville Slough	1,200
Pinto Lake & Corralitos Crk	1,200
College Lake	4,700
Losses due to Mitigation and Facilitiy Limitations	(1,500)
Total	**14,400**

Figure 5-4. Local-Only Alternative Schematic

The Local-Only Alternative would reroute water from the Harkins Slough and Watsonville Slough pump stations to College Lake, where it would be combined with water from College Lake, Corralitos Creek, and the Pinto Lake Diversion for ASR. Storage of water from the Harkins and Watsonville Slough Projects will require a conveyance pipeline from the sloughs to College Lake. The pipeline would serve a dual purpose of conveying water from the sloughs to College Lake for treatment and injection, then later delivery of water from the ASR wells to the CDS during the irrigation season. At College Lake, the water would be treated and then injected into the groundwater basin through wells located along a parallel conveyance pipeline. The Expanded College Lake Project could also provide storage for direct use. During the irrigation season, water would be pumped from the ASR wells and blended with recycled water extracted from the recharge basins plus recycled water directly produced at the WWTF in the plant clearwell. A central pump station would deliver the blended water to the CDS.

The entire CDS would be constructed for the Local-Only Alternative although on average only 14,400 AFY of supply would be available. Constructing the entire CDS would allow for increased agriculture during above normal rainfall years when additional water would be available from local supplies, and would allow the land fallowing to be moved throughout the CDS area.

During above normal and wet weather years, additional available surface water supplies would be stored in College Lake and injected into the groundwater basin. ASR would normally provide only seasonal storage, but during wet years there could be some carryover of injected water to the following year.

During severe dry years, little or no surface water supplies would likely be available. Therefore, the PVWMA would pump banked water from the ASR wells. Without surface water supplies, groundwater and recycled water would be the sole source of available supplies. Therefore, salinity and SAR levels are likely to be extremely high during dry periods.

Cost:

Table 5-7 summarizes the overall cost estimate for the Local-Only Alternative. This alternative has an estimated capital cost of $127.5 million, with an annual O & M cost of $6.6 million. The annual O & M cost includes $3.3 million for land fallowing leases based on unit cost of $1,500 per acre. Land leases were assumed to be the mechanism of land fallowing.

The estimated cost of additional conservation has a present worth of $1.7 million and was determined based on the unit cost of conservation efforts outlined in WC 2000. Although additional conservation may have a higher unit cost than that of the WC 2000, without additional data, a unit cost equal to that of the WC 2000 was used. The cost of this additional conservation is shown in Table 5-7.

Table 5-7: Local-Only Alternative Cost Estimate

Project Element	Cost ($ Millions)
Coastal Distribution System	$34.4
Conservation (7-year)	$1.7
Additional Conservation	$1.7
Expanded College Lake Project with Pinto lake, Corralitos Creek, Harkins Slough and Watsonville Slough Diversion, and ASR	$73.9
Recycled Water Project with Harkins Slough North Dunes Recharge Basin	$34.4
Construction Cost Subtotal	**$146.1**
Financial & Bond Sale Cost @ 1.0%	$1.5
Recycled Water Grant (Title XVI)	$(20.0)
Total Capital Cost	**$127.5**
Annualized Capital Cost at 6% for 30 years	$9.3
Annual Operation & Maintenance Costs	$3.3
Annual Land Leases[a]	$3.3
Total Annualized Cost	**$15.9**
Income from PVWMA Delivery Charges on Customers Receiving Delivered Water @ $92 per AF	$1.3
Adjusted Total Annual Cost	**$14.6**
Combined Sustainable Yield (AFY)	56000
Cost per AF ($/AF)[b]	**$259**
PVWMA Delivery Charge for Customers Receiving Delivered Water ($/AF)	**$92**
Cost per AF plus PVWMA Delivery Charge for Customers Receiving Delivered Water ($/AF)	**$351**

Footnotes:
a. Land fallowing is assumed to be achieved through land leases with an annual cost of $1,500/acre.
b. Cost to growers pumping from the groundwater basin.

Notes:
1. Spring 2001 construction costs.
2. Capital recovery factor (A/P) for 6% at 30 years is 0.07265.
3. Cost estimates include a Construction Contingency of 20%, Engineering/Legal/Admin/Permits Contingency of 17.5%, and Environmental and Permitting Contingency of 5%.
4. Cost for Recycled Water Project based on cost for conventional filtration and chlorination treatment processes. It does not include the expected cost of reverse osmosis treatment prior to percolation, cost for the potable water supply required for blending prior to percolation, or cost to improve water quality to meet the RWQCB basin plan objective.
5. Cost per AF shown assumes (total annual costs minus total annual avoided cost of pumping) divided by combined sustainable yield.

Future Conditions (2040 Demand):

The LOA has limited capability to further increase basin water supplies without construction of either a desalination or import water project. In order to meet anticipated future increases in agricultural and urban water use, an estimated additional 9,000 AFY (5,100 AFY Agricultural and 3,900 AFY Urban) of supplies must be identified and delivered or additional levels of demand management must be implemented to off-set supply increases that are short of the additional 9,000 AFY of demand. Additional demand management or local supplies could be implemented but are limited. Local supply projects may include the Murphy Crossing Project, Bolsa de San Cayetano Project, or a seawater desalination plant. Demand management options include purchasing additional agriculture land leases to reduce demand. However, these options would be costly and are not currently viewed as feasible or realistic.

There are no other obvious projects or management strategies to supply increases in urban water demand through construction of the LOA without developing a desalination plant or a water supply project

involving importation of water from outside the Pajaro Basin. All opportunities for local supply development involve costs greatly exceeding those available from a CVP supply.

Key Points and Implementation Issues

Presented below is a summary of the key points and implementation issues regarding this alternative:

- Implementation of the Local-Only Alternative will face a number of significant regulatory and socioeconomic challenges. The proposed Watsonville Slough, Pinto Lake, Corralitos Creek, and Expanded College Lake Projects will require extensive regulatory permitting efforts. No water rights have been secured for any of these projects. In addition, fishery issues and concerns may result in mitigation measures that reduce the potential yield and increase the overall cost.

- The proposed recycled water percolation project and ASR project face additional implementation issues due to a potential degradation of existing groundwater quality and future beneficial uses of the groundwater basin. As previously discussed, water quality from College Lake is a concern and additional treatment may be required to remove nitrates and other chemical constituents before it can be injected into the groundwater aquifers. In addition, it is uncertain if the RWQCB and other regulatory agencies would permit the percolation of tertiary treated recycled water without advanced treatment beyond Title 22 levels. The draft groundwater recharge regulations generally state that reverse osmosis or equivalent treatment is required for percolation or injection of recycled water (DHS, 2001). As the Local-Only Alternative is currently configured, the recycled water to be produced at the WWTF does not meet this standard. Tertiary treatment with microfiltration would likely be required prior to reverse osmosis. The cost of additional treatment facilities to meet potential regulatory compliance concerns is not included in the LOA as it is presently configured.

- If required by DHS, reverse osmosis treatment for ASR of College Lake water would increase the estimated capital cost of the LOA by at least $12.6 million and annual O & M costs by $0.6 million (Feeney, July 2001). The capital cost assumes a 20% construction contingency, 17.5% for engineering/legal/administration/permitting, and 5% for environmental and permitting. The annual O & M cost was calculated assuming 5% of construction cost of the facilities and assuming pumping of 5,400 AFY at 100 ft head and 80% efficiency. (If microfiltration were needed as a pretreatment step for the reverse osmosis treatment, this cost would increase.)

- DHS requirements for reverse osmosis treatment of recycled effluent that is percolated into the groundwater would add an estimated $4.2 million to the capital costs of the alternative and $0.2 million in annual O&M cost. The capital cost assumes a 20% construction contingency, 17.5% for engineering/legal/administration/permitting, and 5% for environmental and permitting. The annual O & M cost was calculated assuming 5% of construction cost of the facilities and assuming pumping of 3,700 AFY at 100 ft head and 80% efficiency. (If microfiltration were needed as a pretreatment step for the reverse osmosis treatment, this cost would increase.)

- The Local-Only Alternative may face opposition as a result of both water quality concerns and the amount of land fallowing required to balance the basin. The land fallowing alternative would have a significant economic effect on the region in lost jobs, income, etc., though the magnitude of this impact has not been identified in this document. It is also unknown if the PVWMA would have the ability to acquire land leases. Historically, any fallowing of farmland has encountered strong opposition.

- Water quality will also be a major issue, as farmers can expect to receive water TDS concentrations as high as 900 mg/l during portions of the year. This is a higher TDS concentration than would be delivered by any of the other alternatives and is above the goal of 500 mg/l. Desalination treatment could be added to reduce salinity, however, this would result in significant increases in capital and O&M cost.

- Harkins Slough supplemental wells and connections would be a temporary base load supply of water to the distribution system until sufficient supplemental supplies can be developed. Once these supplies are developed, these wells can serve as additional supplemental wells for the entire distribution system.

5.3 Modified Local Alternative

This alternative builds upon the components of the Local-Only Alternative, but maximizes the more feasible local projects and supplements them with a minimum quantity of imported water. The concept behind this alternative was developed based on input from local stakeholders.

The Modified Local alternative eliminates land fallowing, replaces the Expanded College Lake Project with supplemental supplies with the smaller College Lake Project, and reduces the quantity of percolated recycled water. In addition, the high levels of conservation were reduced to coincide with conservation estimates in the WC 2000. This alternative uses the following demand management options and water supply projects:

- Coastal Distribution System;
- Conservation: 7-year Plan (5,000 AFY);
- Harkins Slough Project with Harkins Slough Recharge Basin and Supplemental Wells (1,100 AFY);
- Watsonville Slough Project with North Dunes Recharge Basin (1,200 AFY);
- Recycled Water Project with direct use and storage in the Southeast Recharge Basin (6,000 AFY);
- 42-inch Import Water Project with ASR (Injection and Extraction Wells) (6,900 AFY); and
- College Lake with Pinto Lake Diversion (1,800 AFY).

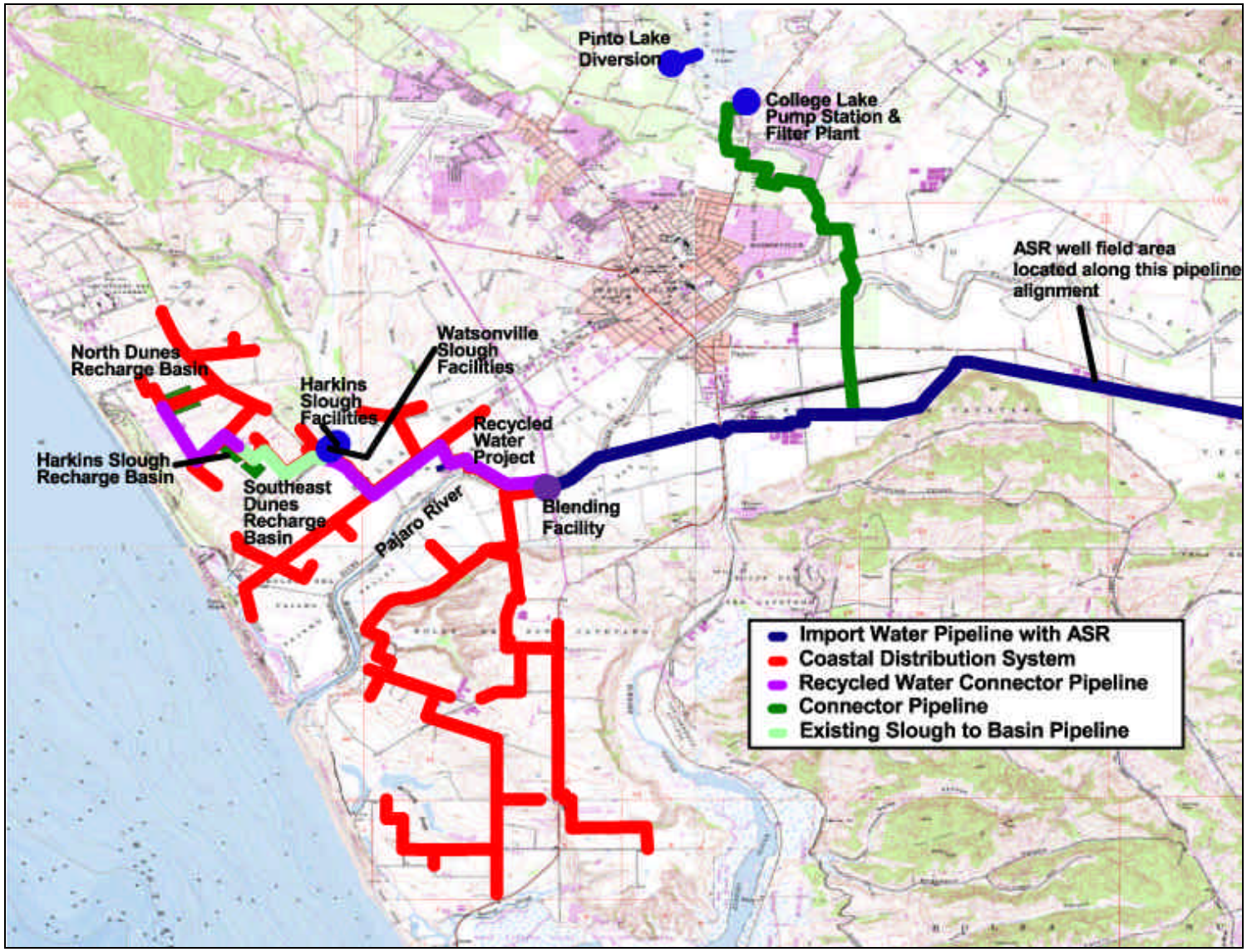
Additional details on each project, including water quality and yield are discussed in Section 4. A figure showing the location of physical facilities is included as Figure 5-5. The objective of this alternative was to eliminate seawater intrusion and balance the current agricultural and urban demand of the basin.

Conservation measures identified as a part of the Modified Local Alternative are the same as other alternatives being considered (except for the LOA), and result in water conservation of 5,000 AFY. This level of conservation reduces current groundwater demand to 64,000 AFY, *assuming no future increases*. The water quality objective of the Modified Local Alternative is intended to be consistent with the water quality objectives identified in Section 2. However, the quantity of recycled water to be used in this alternative will make it difficult to meet the desired salinity and SAR water quality criteria.

As previously discussed in Section 2.8.2, the basin sustainable yield assuming coastal pumping reductions and an extremely dependable supplemental supply is 48,000 AFY. However, as discussed earlier in Section 5, when supplemental supplies are hydrologically dependent the basin sustainable yield decreases as groundwater pumping during drought or below normal years is increased to meet demand.

Due to the hydrologic dependency of local and imported surface water supplies, the sustainable yield of the groundwater basin following implementation of the Modified Local Alternative is estimated to be approximately 47,000 AFY. With construction of the Southeast Dunes Recharge Basin for storing recycled water, the Watsonville Slough with North Dunes Recharge Basin, College Lake with Pinto Lake Diversion, and Harkins Slough, the estimated average annual CVP water required to balance the basin is 6,900 AFY. Assuming an average CVP annual delivery of 60%of contract entitlement, the PVWMA will need to secure water contracts for approximately 11,500 AFY to meet this demand. Total supplemental yields from the capital projects associated with this alternative were estimated to be approximately 17,000 AFY, representing a total sustainable yield for all supplies of 64,000 AFY.

Figure 5-5: Map of Modified Local Alternative



Although 17,000 AFY is the total quantity of supplemental supply required to balance the basin, approximately 18,500 AFY of water must be delivered to the CDS in order to develop a hydrostatic barrier resulting in sustainable groundwater pumping of 47,000 AFY. Therefore, on average at least 1,500 AFY would be pumped from supplemental wells east of Highway 1 and delivered to the CDS.

The water balance objective of the alternative is shown in Table 5-8.

Operational Strategy:

A flow schematic for the Modified Local Alternative is shown in Figure 5-6.

CVP water and recycled water will be the major sources of water supply for the Modified Local Alternative. CVP supplies would be utilized by the CDS both directly and via ASR.

During normal and above-normal rainfall years, recycled water would be conveyed to a blending facility located near the intersection of Highway 1 and the Pajaro River for blending with the combined CVP/College Lake/Pinto Lake water prior to distribution. Water extracted from the Harkins Slough Recharge Basin would be blended within the San Andreas portion of the CDS. CDS deliveries assist in the creation of the coastal hydrostatic barrier. Available CVP water above and beyond the total water demand would be filtered and injected into the groundwater aquifers. The ASR wells would be located along the Import Pipeline alignment, although exact locations of the wells and well treatment facilities have not been determined.

Table 5-8: Modified Local Alternative Water Balance Objective

Water Demand Objective	**AFY**
Current Agricultural	59,300
Current Urban	12,200
Total Demand	**71,500**
Corralitos Creek Filter Plant	1,100
Other Surface Water Diversions	1,000
Remaining Demand[a]	**69,000 (rounded)**
Future Agricultural and Urban Water Conservation	(5,000)
Total Demand Objective	**64,000**
Water Supply Objective	
Existing Basin Sustainable Yield	24,000
Increase in Sustainable Yield (Estimated) due to Coastal Pumping Management	23,000
Harkins Slough	1,100
Watsonville Slough with North Dunes Recharge Basin	1,200
College Lake with Pinto Lake Diversion	1,800
Recycled Water with Southeast Dunes Recharge Basin	6,000
Import Water Project	6,900
Total Supply Objective	**64,000**

Footnotes:
a. Values rounded to two significant figures or to the nearest thousand to represent the values significant accuracy.

In below-normal rainfall years, CVP allotments plus local water supplies will not meet CDS water demands. Therefore, CVP water previously stored in the groundwater basin would be pumped from the ASR wells and delivered to the CDS through the Import Pipeline. During severe dry-weather years, as little as 10% of CVP contract entitlement might be available. This supply would be distributed during the

high-demand months to meet peak agricultural demands and minimize the required number of extraction wells. It is assumed that no water from hydrologically dependent local supplies would be available. However, water from the Recycled Water Project would be available. Based on assumptions of coastal demand and assuming ASR wells would provide supply to meet half of the peak hour demand, it is estimated that approximately 17 injection/extraction wells would be needed[1].

This alternative is currently assumed to deliver water to the CDS only. It does not include provisions to serve areas within the inland area. Areas impacted by the injection/extraction wells or the CVP pipeline would not be permitted to connect to the pipeline until such time as additional supplies could be acquired.

Recycled water provides a highly reliable supply for the Pajaro Valley. Operationally, the project would supply 4,000 AF for direct use and percolate approximately 2,000 AFY into the shallow groundwater aquifer via the three Dunes recharge basins. The reason for the intermixing of water is that water would be conveyed from the Harkins Slough, Watsonville Slough and WWTF to the three recharge basins through a common pipeline. This would reduce the percentage of recycled water percolated in any one basin, which brings the proposed project closer to compliance with draft DHS groundwater recharge regulations that require recycled water to be no more than 50 percent of the water injected or percolated into the groundwater basin. Extraction wells located along the perimeter of the recharge basins would extract water during the irrigation season and would provide a peaking supply to augment CVP supplies. Groundwater storage for these supplemental supplies would be seasonal with percolation occurring in the winter months and extraction occurring during the irrigation season.

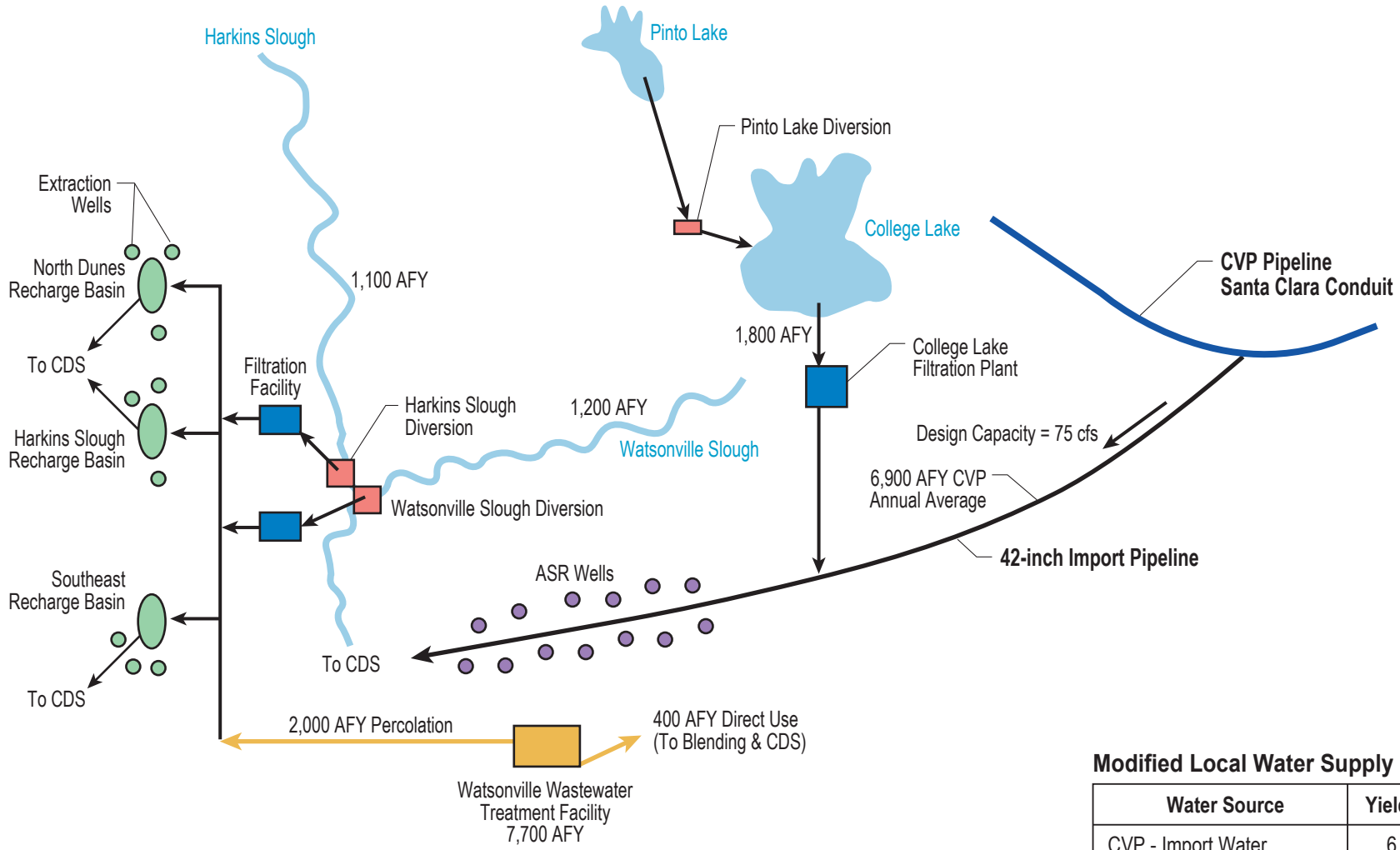
The College Lake Project would capture runoff from the College Lake Drainage area plus diverted water from the Pinto Lake diversion. Operationally, water from College Lake would be the first supply utilized during the irrigation season allowing for agricultural production once the lake is drained. College Lake water would be treated then delivered to the CDS by a pipeline that connects College Lake to the Import Water Pipeline. Water collected by the College Lake Project would be directly used, following filtration at the College Lake treatment facility.

Cost:

The Modified Local Alternative relies mainly on supply from the Import Project and the recycled water facility. A significant portion of the cost is associated with construction of the import pipeline and associated facilities and purchase of CVP contracts. The cost of the 6,900 AFY average annual CVP water contract is estimated to be $9.0 million. This cost is included in the cost of the 42-inch Import Project with ASR. In addition, the cost for the 42-inch Import Water Project with ASR includes treatment facilities that are expected to be required prior to injection of CVP supplies.

Table 5-9 summarizes the estimated cost of the Modified Local Alternative. Assuming the PVWMA acquires a $20.0 million Title XVI recycled water grant, this alternative has an estimated capital cost of $147.6 million, with an annual O & M cost of $4.7 million.

1 Assumed 2 of the 17 wells were standby, for added reliability. It was also assumed that areas would not be impacted by drawdown associated with the pumping due to build up of groundwater levels, therefore allowing existing wells to continue operation.



Modified Local Water Supply Sources

Water Source	Yield, AFY
CVP - Import Water	6,900
Harkins Slough	1,100
Watsonville Slough	1,200
College Lake & Pinto Lake	1,800
Recycled Water Project	6,000
Total	**17,000**

Figure 5-6. Modified Local Alternative Schematic

Future conditions (2040 Demand):

In order to meet anticipated future increases in agricultural and urban water uses, an additional 9,000 AFY (3,900 AFY of urban demand, plus 5,100 AFY of agricultural demand) of supplies must be identified and delivered. The cost-effective local supply options may include Murphy Crossing and expanded recycled water use, though water quality from these two sources would degrade the quality of delivered water. It is expected that the most cost-effective alternative would be via additional supplies of CVP water. This would require purchase of additional CVP contracts, and expansion or maximization of the existing CDS or construction of a portion of the IDS. It would also increase the number of ASR wells required for banking of CVP water.

This increase in CVP deliveries would probably require additional pumping, or construction of a pipeline larger than the proposed 42-inch pipeline, based on modeling conducted at 75 cfs. Construction of a 42-inch pipeline potentially limits CVP deliveries. Costs for pumping and pump stations have not been determined, though previous modeling by CH2M Hill indicates that a large diameter pipeline without pumping may be more cost effective than smaller diameter pipelines that required pumping.

Table 5-9: Modified Local Alternative Cost Estimate

Project Element	**Cost ($ Million)**
Coastal Distribution System	$34.4
Conservation (7-year)	$1.7
Harkins Slough Project with Harkins Slough Recharge Basin	$6.6
Watsonville Slough with North Dunes Recharge Basin	$6.6
Recycled Water Project with Southeast Dunes Recharge Basin	$28.6
42-inch Import Water Project with ASR	$73.9
College Lake with Pinto Lake Diversion	$14.1
Construction Cost Subtotal	**$165.9**
Financial & Bond Sale Cost @ 1.0%	$1.7
Recycled Water Grant (Title XVI)	(20.0)
Total Capital Cost	**$147.6**
Annualized Capital Cost at 6% for 30 years	$10.7
Annual Operation & Maintenance Costs	$4.7
Total Annual Cost	**$15.4**
Income from PVWMA Delivery Charges on Customers Receiving Delivered Water @ $92 per AF	$1.7
Adjusted Total Annual Cost	**$13.7**
Combined Sustainable Yield (AFY)	64,000
Cost per AF ($/AF)	**$215**
PVWMA Delivery Charge for Customers Receiving Delivered Water ($/AF)	**$92**
Cost per AF plus PVWMA Delivery Charge for Customers Receiving Delivered Water ($/AF)	**$307**

Footnotes:

a. Cost to growers pumping from the groundwater basin.

Notes:

1) Spring 2001 construction cost.
2) Capital recovery factor (A/P) for 6% at 30 years is 0.07265.
3) Cost estimates include a Construction Contingency of 20%, Engineering/Legal/Admin/Permits Contingency of 17.5%, and Environmental and Permitting Contingency of 5%.
4) Cost for Recycled Water Project based on cost for conventional filtration and chlorination treatment processes. Cost does not include cost for reverse osmosis treatment prior to percolation, or cost required to ensure compliance of blended water with basin plan objectives.
5) Cost per AF shown assumes (total annual costs minus total annual avoided cost of pumping) divided by combined sustainable yield.

Although expanded conveyance, distribution and supply facilities are required to meet the future demand conditions, these facilities have not been quantified in detail. For estimation purposes, it was assumed that the unit cost of these additional facilities would be similar to the unit costs of facilities evaluated in this document. The cost for increased distribution service area was based on the CDS cost estimate, assuming a similar $/AFY number. The number of additional injection/extraction wells was assumed based on the percentage increase in CVP contract entitlement. Preliminary cost estimates for these facilities are summarized in Table 5-10.

Table 5-10: Additional Facilities Required to Meet 2040 Agricultural and Urban Demand

Item	Quantity	Loaded Unit Cost	Cost
CVP Contract	9,000 AFY	$1,300/AFY	$11.7
Increased Distribution[a]	9,000 AFY	$1,860/AFY	$16.7
Increased Injection/Extraction[b,c]	8 wells	$700,000/well	$5.6
Total Capital Cost			**$34.0**

Footnotes:

a. Unit cost estimate based on construction of a $34.4 million CDS serving 18,500 AFY.

b. The number of additional wells was based on a linear estimate assuming 15 wells to supply approximately half of the peak hour demand for an 18,500 AFY CDS. No additional wells are provided for reliability. Load unit cost for the wells includes filtration treatment, pipelines, wells, and land purchase of 1 acre. Estimates also include 20% contingency, 17.5% engr/legal/admin/permitting, and 5% environmental and permitting contingency.

c. Includes one monitoring well per injection/extraction well and wellhead treatment at each injection/extraction well.

Key Points and Implementation Issues

Presented below is a summary of the key points and implementation issues regarding this alternative:

- A 42-inch Import Pipeline with maximum flow rate of 40 cfs could allow delivery of future increased water supplies. However the amount of needed underground storage would be significant because the limiting flow rate would be insufficient to meet demands during the irrigation season. Therefore, it may be advisable to increase the size of the pipeline to allow for additional conveyance capacity during the irrigation season. An alternate solution would include construction of a pump station, but as previously stated this would probably be a higher cost alternative on a life cycle basis.

- Currently, no water will be delivered to inland areas in the currently defined alternative. However, the Import Pipeline alignment with a larger pipeline would make it very practical for inland growers to receive CVP water.

- Rights to water from the College Lake have yet to be obtained, and were challenged by DFG and NMFS. It is unknown how the resolution of this issue will impact implementation of this alternative.

- Water rights applications for Watsonville Slough and Pinto Lake have yet to be filed with the SWRCB. Securing water rights for the diversions is a significant effort due to expected challenges from environmental agencies.

- Direct use of filtered College Lake water may still lead to *Phytophthora* problems for local strawberry farmers. If this water cannot be directly used, yield will be reduced and alternate water supplies or treatment must be identified.

5.4 Modified BMP 2000 Alternative

This alternative presents a potential modification of the BMP 2000 alternative based on input from local stakeholders. This alternative reduces the diameter of the CVP pipeline by one nominal size through in-basin storage via injection/extraction (ASR). Other non-CVP projects were also modified from the original BMP 2000 alternative to maximize their cost-effectiveness. In addition, the Murphy Crossing and IDS projects were eliminated and 64,000 AFY of water is provided after conservation with no allowance for future needs.

The goal of this alternative is to meet the identified objectives for water quality, address regulatory issues, and develop reliable supplemental supplies at the lowest overall unit cost. The most feasible projects and policies were selected, and an alternative identifying the operational strategy for utilizing water from the various projects was created. In addition to the identified capital projects, conservation was selected for demand management. Land fallowing was not selected as a preferred policy, due to the expected economic impacts to the local economy. This Modified BMP 2000 alternative consists of the following demand management policies and water supply projects:

- Coastal Distribution System;
- Conservation: 7-year Plan (5,000 AFY);
- Harkins Slough Project with Harkins Slough Recharge Basin and Supplemental Wells and Connection (1,100 AFY);
- Recycled Water Project (4,000 AFY) and
- 54-inch Import Water Project with ASR (11,900 AFY).

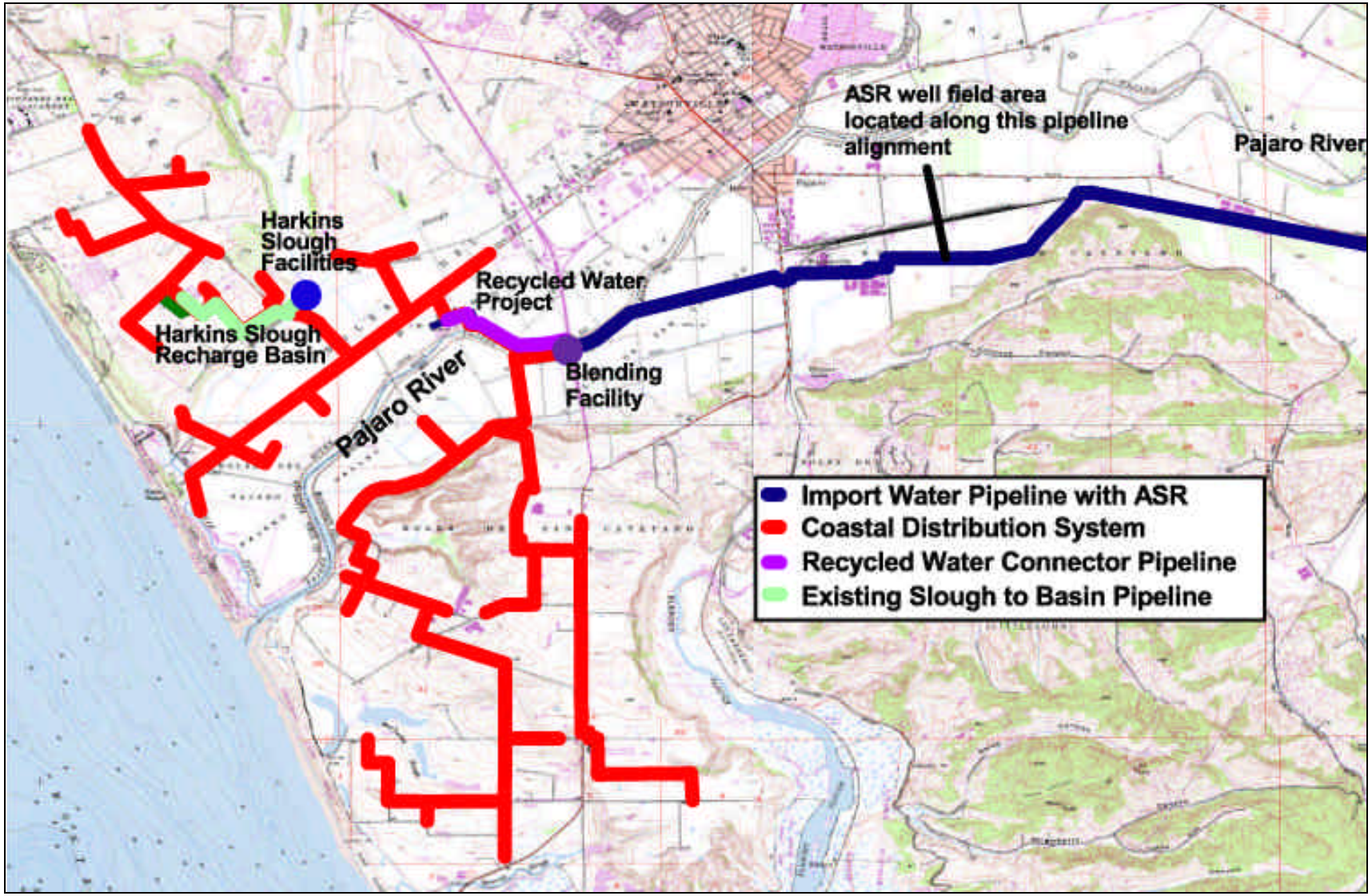
Additional details on each project, including water quality and yield are discussed in Section 4. A figure showing the location of physical facilities is included as Figure 5-7. The objective of this alternative is to eliminate seawater intrusion based on a current water use of 71,500 AFY. With existing supplies from the Corralitos Creek Filter Plant and other surface water diversions, the total groundwater demand is 69,000 AFY.

Conservation measures for the WC 2000 were identified as a part of the Modified BMP 2000 Alternative. The expected water conservation of 5,000 AFY would reduce groundwater demand to 64,000 AFY assuming no future increases.

As previously discussed in Section 2.8.2, the basin sustainable yield assuming coastal pumping reductions and an extremely dependable supplemental supply is 48,000 AFY. However, when supplemental supplies are hydrologically dependent, the basin sustainable yield deceases as groundwater pumping during drought or below normal years is increased to meet demand.

Due to the hydrologic dependency of local surface and imported CVP water supplies, the sustainable yield of the groundwater basin following implementation of the Modified BMP 2000 alternative is estimated to be approximately 47,000 AFY. With construction of the Recycled Water Project plus the existing Harkins Slough local supplies, the estimated average annual CVP water required to balance the basin is 11,900 AFY. Assuming an average CVP annual delivery of 60% of contract entitlement, the PVWMA will need to secure CVP water contracts of approximately 19,800 AFY to meet this need. Total supplemental yield of the capital projects associated with this alternative were estimated to be approximately 17,000 AFY, representing a total average sustainable yield for all supplies of 64,000 AFY.

Figure 5-7: Map of Modified BMP 2000 Alternative



Although 17,000 AFY is the total quantity of supplemental supply required to balance the basin, approximately 18,500 AFY of water must be delivered to the CDS in order to develop a hydrostatic barrier resulting in sustainable groundwater pumping of 47,000 AFY. Therefore, on average at least 1,500 AFY would be pumped from supplemental wells east of Highway 1 and delivered to the coast distribution system.

The water balance objective of the alternative is shown in Table 5-11.

Table 5-11: Modified BMP 2000 Alternative Water Balance Objective

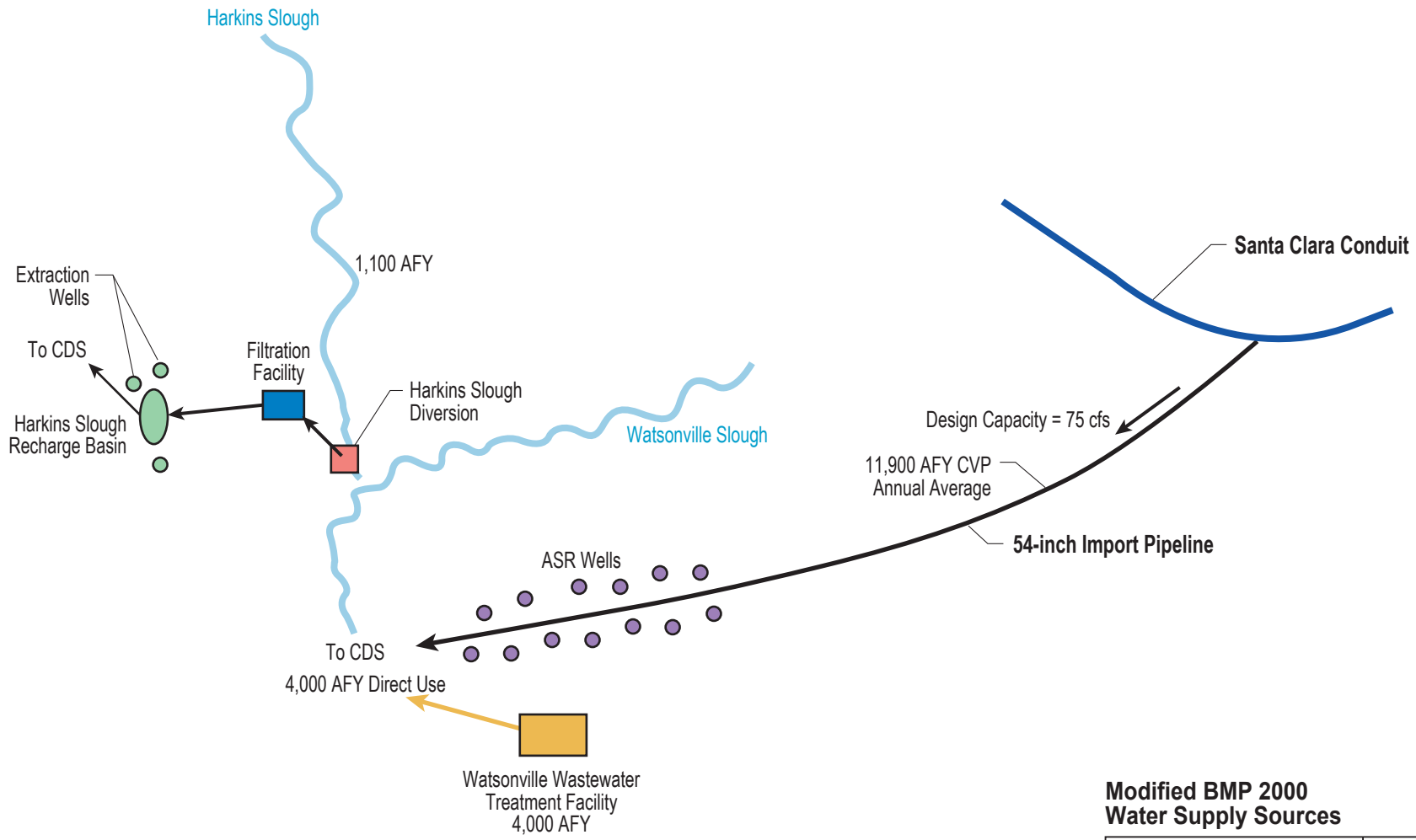
Water Demand Objective	**AFY**
Current Agricultural	59,300
Current Urban	12,200
Total Demand	**71,500**
Corralitos Creek Filter Plant	(1,100)
Other Surface Water Diversions	(1,000)
Remaining Demand[a]	**69,000 (rounded)**
Future Agricultural and Urban Water Conservation	(5,000)
Total Demand Objective	**64,000**
Water Supply Objective	
Existing Basin Sustainable Yield	24,000
Increase in Sustainable Yield (Estimated) due to Coastal Pumping Management	23,000
Harkins Slough	1,100
Recycled Water Project	4,000
Import Water Project with ASR	11,900
Total Supply Objective	**64,000**

Footnotes:
a. Values rounded to two significant figures or to the nearest thousand to represent the values significant accuracy.

Operational Strategy

Figure 5-8 shows a flow schematic for the Modified BMP 2000 alternative.

CVP water would be the major source of water supply, and would be conveyed from the Santa Clara Conduit to the CDS for direct use after blending with recycled water at a blending facility, located near the intersection of Highway 1 and the Pajaro River, prior to distribution. Similar to the Modified Local alternative, CVP supplies would be utilized by the CDS both directly and via ASR wells. Water extracted from the Harkins Slough recharge basin would be blended within the San Andreas portion of the CDS.



Modified BMP 2000 Water Supply Sources

Water Source	Yield, AFY
Recycled Water	4,000
Harkins Slough	1,100
CVP - Import Water	11,900
Total	**17,000**

Figure 5-8. Modified BMP 2000 Schematic

In average years, CVP deliveries plus water from the Harkins Slough extraction wells and Recycled Water Project would provide the water required to meet peak CDS demands. The ASR wells would be available to balance peak demands.

During above-normal rainfall years, CVP allotments plus supplies extracted from the Harkins Slough recharge basin and the Recycled Water produced at the WWTF are expected to meet or exceed CDS demands. Therefore, CVP water above current demands would be stored in the groundwater basin by injection utilizing wells located along the import pipeline alignment. The exact locations of the ASR wells have yet to be identified. Due to the lack of storage for recycled water and limited long-term storage for Harkins Slough supplies, these supplies would be utilized prior to utilizing the banked CVP water.

In below-normal rainfall years, stored CVP water would be pumped from the ASR wells would be utilized to augment surface water supplies and meet CDS demand. During the most severe dry-weather years, when as little as 10% contract entitlement might be available, all recycled water would still be available, and none would be available from Harkins Slough. Operationally, the 10% CVP entitlement would be distributed over the high demand months to reduce peak demand, therefore reducing the number of extraction wells required to meet the CDS demand. Based on assumptions of peak coastal demand and assuming wells would provide half of the peak supply, it is estimated that approximately 17 wells with a 2,000 gpm extraction rate would need to be constructed. This includes two standby wells for reliability.

The annual yield of recycled water for this alternative is limited to about 4,000 AFY by the recycled water facility daily flow rates and the irrigation demand for recycled water. Due to the absence of seasonal storage, flow not directly used by the farmers would be discharged to the WWTF outfall. Water quality is also a limiting parameter, given the desired TDS objective of 500 mg/L. Recycled water produced at the WWTF would be blended with recovered water from ASR wells and CVP water to create a uniform water supply for the CDS that meets or exceeds the water quality objectives. Some minor storage of recycled water is provided to maximize recycled water during peak hour demands.

CVP supply may not always be able to meet peak demands due to pipeline flow limitations. However, pumping from the ASR wells can make up any shortfall.

Cost:

The Modified BMP 2000 alternative relies mainly on supply of imported and recycled waters. A significant portion of the cost is associated with construction of the import pipeline and associated facilities and purchase of CVP supplies. The cost of the 11,900 AFY average annual CVP water supplies is estimated to be $15.5 million. This cost is included in the cost of the 54-inch Import Project with ASR. In addition, the cost for the 54-inch Import Water Project with ASR includes treatment facilities that are expected to be required prior to injection of CVP supplies.

This alternative has an estimated total capital cost of $138.3 million assuming a $20.0 million Title XVI grant for the Recycled Water Project. The alternative would incur an annual O & M cost of $4.3 million. Table 5-12 summarizes the estimated cost components of the Modified BMP 2000 Alternative.

Future conditions (2040 Demand):

In order to meet anticipated future increases in agricultural and urban water use, an additional 9,000 AFY (3,900 AFY of urban demand, plus 5,100 AFY of agricultural demand) of water must be delivered. The cost-effective local supply options include College Lake, Watsonville Slough, Murphy Crossing, and

expanded recycled water use. However, it is expected that the most cost-effective alternative would be additional imported CVP water.

Table 5-12: Modified BMP 2000 Cost Estimate

Project Element	Cost Estimate ($ Millions)
Coastal Distribution System	$34.4
Conservation (7-year)	$1.7
Harkins Slough Project with Harkins Slough Recharge Basin and Supplemental Wells and Connection	$6.6
Recycled Water Project (4,000 AFY)	$19.2
54-inch Import Water Project with ASR	$94.9
Construction Cost Subtotal	**$156.7**
Financial & Bond Sale Cost @ 1.0%	$1.6
Recycled Water Grant (Title XVI)	($20.0)
Total Capital Cost	**$138.3**
Annualized Capital Cost at 6% for 30 years	$10.0
Annual Operation & Maintenance Costs	$4.3
Total Annual Cost	**$14.3**
Income from PVWMA Delivery Charges on Customers Receiving Delivered Water @ $92 per AF	$1.7
Adjusted Total Annual Cost	**$12.6**
Combined Sustainable Yield (AFY)	64,000
Cost per AF ($/AF)[a]	**$198**
PVWMA Delivery Charge for Customers Receiving Delivered Water ($/AF)	**$92**
Cost per AF plus PVWMA Delivery Charge for Customers Receiving Delivered Water ($/AF)	**$290**

Footnotes:
a. Cost to growers pumping from the groundwater basin.

Notes:
1. Spring 2001 construction cost.
2. Capital recovery factor (A/P) for 6% at 30 years is 0.07265.
3. Cost estimates include a Construction Contingency of 20%, Engineering/Legal/Admin/Permits Contingency of 17.5%, and Environmental and Permitting Contingency of 5%.
4. Cost per AF shown assumes (total annual costs minus total annual avoided cost of pumping) divided by combined sustainable yield.

This would require purchase of additional CVP supplies, and expansion or maximization of the existing coastal system or development of an inland distribution system. It would also increase the number of ASR wells required for banking of CVP water. It is not expected that this increase in CVP deliveries will require additional pumping, based on modeling conducted at 75 cfs (CH2M Hill, 1997).

Although expanded conveyance, distribution and supply facilities are required to meet future demands, these facilities have not been quantified in detail. For estimation purposes, it was assumed that the unit cost of these additional facilities would be similar to the unit costs for such facilities as discussed in previous alternatives, and will be separately analyzed if and when needed. Preliminary cost estimates for these facilities are summarized in Table 5-13.

Table 5-13: Additional Facilities Required to Meet 2040 Agricultural and Urban Demand

Item	Quantity	Loaded Unit Cost	Cost Estimate ($ Millions)
CVP Contract	9,000 AFY	$1,300/AFY	$11.7
Increased Distribution[a]	9,000 AFY	$1,860/AFY	$16.7
Increased Injection/Extraction[b,c]	8 wells	$700,000/well	$5.6
Total Capital Cost			**$ 34.0**

Footnotes:

a. Unit cost estimate based on construction of a $34.4 million CDS serving 18,500 AFY.

b. The number of additional wells was based on a linear estimate assuming 15 wells to supply approximately half of the peak hour demand for an 18,500 AFY CDS. No additional wells are provided for reliability. Load unit cost for the wells includes filtration treatment, pipelines, wells, and land purchase of 1 acre. Estimates also include 20% contingency, 17.5% engr/legal/admin/permitting, and 5% environmental and permitting contingency.

c. Includes one monitoring well per injection/extraction well and well head treatment at each injection/extraction well.

Key Points and Implementation Issues

Presented below is a summary of the key points and implementation issues regarding this alternative:

- Under the Modified BMP 2000 Alternative, no water will be delivered to inland areas in the currently defined alternative. However, the Import Pipeline alignment would make it very practical for inland growers to receive CVP water, dependent upon securing an additional source of supply.

- The 54-inch pipeline with a maximum flow rate of 75 cfs provides flexibility to meet future demands through procurement of additional CVP water supplies and construction of expanded distribution systems. However, additional pumping may be required for portions of the CDS. Construction of a 60-inch pipeline might be substituted for the 54-inch pipeline at a lower life-cycle cost.

- Harkins Slough supplemental wells and connections will provide peaking supply for the distribution system until additional supplemental supplies can be developed. Once these supplies are developed, these wells would continue to provide peaking supply for the entire CDS.

5.5 Non-Economic Comparison of Alternative Strategies

Each of the four alternative strategies discussed above meet the primary objective of eliminating seawater intrusion and balancing the basin. To further differentiate between the alternatives, additional project criteria were added to reveal the relative merits of the various strategies. These include:

- Can Meet Existing and Future Water Needs;
- Limited Dependence on Out-of-Basin Water Supplies;
- Minimizes Regulatory Hurdles;
- Meets Water Quality Goals; and
- Economic Impact.

Each of the alternatives was ranked based on their ability to meet these criteria. The ranking system was based on a plus (+) or minus (-) scale with plus/minus (+/-) representing a neutral ranking. A plus score meant that the alternative met that criteria, while a minus score identified a failure to meet that criteria.

A detailed analysis of the environmental impacts and associated mitigation measures for each alternative is included in the Revised BMP Environmental Impact Report that is being prepared by PVWMA. This EIR will be available for public review and comment in October 2001.

A discussion of each criterion is provided below, followed by a summary of the criteria comparison.

5.5.1 Can Meet Existing and Future Water Needs

Water usage in the Pajaro Valley is expected to increase in future years, based on population growth and agricultural crop changes. While future conditions were addressed in previous sections for all four alternatives to the year 2040, it is expected that growth will continue subsequent to that year. The greater the ability of the selected alternative to provide the infrastructure and water needed to meet these future demands, the higher the score for the alternative.

The Local-Only Alternative would not be able to accommodate future growth without significantly greater capital investment in either an imported supply or in desalination, and so it receives the lowest score. The Modified Local Alternative has some room for expansion, but only through construction of a pump station or some other method of expansion of the capacity of the Import Pipeline. The other two options have larger import pipelines to accommodate the conveyance of more water without the construction of new facilities.

Another aspect of meeting existing and future water needs is reliability of supply. The Local-Only Alternative includes a Recycled Water Project that will provide over 50% of the supplemental water supplies. This supply would be extremely reliable. Surface water projects would provide the remaining supply for the Local-Only Alternative and would be highly dependent on hydrologic conditions.

The BMP 2000, Modified Local, and Modified BMP 2000 alternatives include smaller Recycled Water Projects that provide a reliable supply to the PVMWA service area. The three alternatives also include surface water projects that would likely produce limited yield during drought years and an import water project that would be subject to restrictions during drought years. However, this limitation is offset to some degree by the fact that an import pipeline and connection to the CVP would allow the PVWMA to purchase CVP water on the open market during drought years. Out-of-basin banking is another means of increasing the reliability of imported supplies. The Local-Only Alternative is incapable of obtaining

water from outside the basin or providing an opportunity to partner with another water agency in an out-of-basin arrangement.

5.5.2 Limited Dependence on Out-of-Basin Water Supplies

Water supplied from out-of-basin sources such as the CVP are not directly controlled by the PVWMA, and are largely dependent upon hydrologic and other factors outside its sphere of influence. This reduces the ability of the PVWMA to control this supply. A high score in this criterion represents higher dependence on in-basin supplies (limited dependence on out-of-basin supplies).

The Local-Only Alternative relies exclusively on development of local water supplies, and the Modified Local Alternative relies heavily on development of local supplies. The BMP 2000 Alternative and Modified BMP 2000 Alternative rely heavily on out of basin supplies to meet future water demand.

5.5.3 Minimizes Regulatory Hurdles

Each of the alternatives was developed with the aim of complying with expected local, state and federal regulations. However, the degree of mitigation associated with compliance with these regulations, and the difficulty associated with obtaining permits or agreements, varies greatly.

The Local-Only Alternative has the most significant implementation issues to address, including injection and extraction of surface water, percolation of recycled water, and securing water rights permits required for local surface water diversions. The Local-Only Alternative encounters numerous policy and regulatory issues with land fallowing. The BMP 2000, Modified BMP 2000, and Modified Local alternatives would all require NEPA evaluation for importing CVP water and connection to the CVP system. The BMP 2000 Alternative would also require securing water rights for the Murphy Crossing Project. Implementation issues associated with the Modified Local Alternative include percolation of recycled water and securing water rights permits for College Lake, Pinto Lake, and Watsonville Slough. The Modified BMP Alternative has the least number of unique implementation issues and would therefore be the easiest to implement.

5.5.4 Meets Water Quality Goals

Each of the alternatives has a different average expected water quality, which is largely based on the percentage of flow originating from CVP and recycled water supply sources. Alternatives maximizing recycled water use with minimal CVP or other dilution water are expected to have the lowest overall water quality, while alternatives with less recycled water use and greater CVP or other dilution water use will have the best water quality.

Because the Local-Only Alternative maximizes the use of recycled water, the water quality is lowest of the four strategies. The Modified Local Alternative relies slightly less on recycled water. The BMP and Modified BMP 2000 alternatives both rely heavily on CVP water, which is generally of good quality.

5.5.5 Economic Impact

The economic impact of the alternative strategy is the impact on the local economy resulting from the strategy. Alternative strategies that maximize the ability to farm agricultural lands scored the highest, while those strategies that require fallowing of significant amounts of farmland scored the lowest. Construction, operation and maintenance costs were also considered as a part of this criterion, and are discussed further in Section 5.6.

The Local-Only Alternative relies on land fallowing and additional conservation practices beyond the WC 2000 recommendations. The land fallowing alternative would have a significant economic effect on the region in lost jobs, income, etc., though the magnitude of this impact has not been identified in this document. These adverse impacts give it a low economic score. The other three alternatives allow agricultural lands to stay in production. All projects have relatively similar total capital costs.

5.5.6 Summary of Criteria Comparison

Based on the aforementioned criteria and a (+), (+/-), (-) scale with (+) being the best score and (-) being the worst score, the four alternatives were scored for each criterion. The results are shown in Table 5-14.

Table 5-14: Alternative Ranking Based on Identified Criteria

Criteria	BMP 2000 Alternative	Local-Only Alternative	Modified Local Alternative	Modified BMP 2000 Alternative
Can Meet Existing and Future Water Needs	+	-	+/-	+
Limited Dependence on Out-of-Basin Water Supplies	-	+	+/-	-
Minimizes Regulatory Hurdles	+/-	-	+/-	+
Meets Water Quality Goals	+	-	+/-	+
Economic Impact	+	-	+	+

The Local-Only Alternative clearly ranks lowest when compared to the other three strategies due to the following findings:

- It requires reduced agricultural irrigation equivalent to the fallowing of 2,200 acres basin-wide. The associated reduction in agricultural production would be costly to implement and would cause significant economic impacts to the local economy, particularly since this level of fallowing is in addition to 9,000 AFY of agricultural water conservation.

- Regulatory approval for recharging the groundwater with tertiary treated recycled water is problematic. The RWQCB and the DHS could require reverse osmosis treatment of recycled water prior to groundwater recharge, which would significantly increase the cost of the strategy beyond that shown herein.

- The water quality of this alternative will not meet the requirements of the agricultural users with regard to TDS. At times this alternative would deliver 100 percent recycled water to the users with TDS concentrations of 900 mg/L or higher.

The BMP 2000 and Modified BMP 2000 alternatives rate similarly in most aspects. However, the BMP 2000 Alternative includes Murphy Crossing, which has a DFG Water Rights protest against it. The BMP 2000 Alternative could be implemented without the Murphy Crossing Project if approval of water rights for Murphy Crossing becomes too great a hurdle. The Modified BMP 2000 Alternative includes ASR, which appears to comply with known regulatory statutes.

The three alternatives using imported water all have the flexibility to meet future water demands through importation of more water. However, the Modified Local Alternative is limited in this aspect, and would require construction of a pump station or other method of increasing the capacity of the import pipeline.

Under future conditions, ASR could become a seasonal operation instead of a long-term banking option to meet water supply and demand while operating the design constraints for the import pipeline. For the Modified BMP 2000 and BMP 2000 alternatives, the diameter of the import pipeline varies, this only impacts downstream pumping requirements, not overall water supplies as the maximum capacity for both pipelines is 75 cfs. These three alternatives all have the potential flexibility to deliver flows meeting fluctuating future demands.

5.6 Cost Comparison of Alternatives

A summary of the components and cost estimates for each of the four alternatives is contained in Table 5-15.

The costs identified in Table 5-15 are the most recent cost estimates, and should be considered planning level estimates. The costs can be expected to fluctuate based on numerous factors, including market conditions and implementation schedules. Markups for construction contingency, engineering, legal, administration, permits, and environmental contingency correspond to those assumed in Section 4.

Cost Ranking of Alternatives:

As shown in this Table 5-15, the Local-Only Alternative has the lowest total capital cost, while the Modified BMP 2000 Alternative has the second lowest capital cost. A key to the cost of all alternatives is the potential for a $20 million Title XVI grant to offset the cost of water recycling from the WWTF.

Cost of Delivered Water (Cost per AF plus PVWMA Delivery Charge):

Table 5-15 also shows the cost of delivered water (Cost plus PVWMA Delivery Charge) that would be required if this fee were to pay for all costs of any given alternative. (The term 'cost per AF' is used to distinguish it from the Augmentation Charge presently levied by the PVWMA on extraction of groundwater, and used for the purpose of paying the cost of purchasing, capturing, storing and distributing supplemental water.) The cost per AF is assumed to be recovered from total water sales (pumped groundwater and delivered water), and the cost of delivered water is assumed to be recovered only from those receiving delivered water. In the case of pumped groundwater, the cost per AF is the same as the augmentation charge. As shown, the cost per AF for all customers in the PVWMA service area would be the same assuming a flat rate structure. However, customers receiving delivered water would be expected to pay an additional $92/AF, the average avoided cost of pumping realized by these customers (RMC, May 2001). That is, by receiving delivered water these customers avoid the costs of developing, maintaining, and operating their wells. In that sense, delivered water has a 'benefit' of $92/AF greater than groundwater that has to be pumped by an individual farmer.

On this basis, the cost per AF range from $198 per acre-foot to $259 per acre-foot. For those users receiving delivered water, the cost recovery plus delivery fee per AF would range from $290 to $351 per acre-foot.

Cost Risks Associated with Local-Only and Modified Local-Only Alternatives:

The Local-Only Alternative has significant cost risks not presented in Table 5-15. The largest cost risk associated with the Local-Only Alternative is that regulatory authorities may require reverse osmosis treatment for surface water from College Lake prior to injection. Based on College Lake water quality data, nitrate concentrations have periodically exceeded drinking water standards (Feeney, July 2001).

In addition, aluminum, arsenic, manganese, and iron have also periodically exceeded drinking water standards, although the elevated concentrations could be related to sampling or analytical program errors. If required, reverse osmosis treatment could increase the estimated capital cost of the Local-Only Alternative by $12.6 million and annual O & M cost by $0.6 million (Feeney, July 2001).

Table 5-15: Summary of Alternative Cost Estimates

Project Element	Cost Estimate ($ Millions)			
	BMP 2000	**Local-Only Alternative**	**Modified Local**	**Modified BMP 2000**
Coastal Distribution System	$34.4	$34.4	$34.4	$34.4
Conservation (7-year)	$1.7	$1.7	$1.7	$1.7
Conservation (additional)		$1.7		
Harkins Slough Project (Existing) with Supplemental Wells and Connections	$6.6		$6.6	$6.6
Murphy Crossing with Recharge Basins	$6.6			
Watsonville Slough with North Dunes Recharge Basin			$6.6	
College Lake Project with Pinto Lake Diversion			$14.1	
Expanded College Lake, with Pinto Lake, Corralitos Creek, Watsonville and Harkins Sloughs, and ASR		$73.9		
42-inch Import Water Project with ASR			$73.9	
54-inch Import Water Project with ASR				$94.9
60-inch Import Water Project with IDS and Supplemental Wells	$117.4			
Recycled Water Project (4,000 AFY)	$19.2			$19.2
Recycled Water Project with Southeast Dunes Recharge Basin (6,000 AFY)			$28.6	
Recycled Water Project with North Dunes and Harkins Slough Recharge Basins (7,700 AFY)		$34.4		
Subtotal	**$185.8**	**$146.1**	**$165.9**	**$156.7**
Financial & Bond Sale Cost @ 1.0%	$1.9	$1.5	$1.7	$1.6
Recycled Water Grant (Title XVI)	($20.0)	($20.0)	($20.0)	($20.0)
Total Capital Cost	**$167.6**	**$127.5**	**$147.6**	**$138.3**
Annualized Capital Cost at 6% for 30 years	$12.2	$9.3	$10.7	$10.0
Annual O & M Costs	$4.4	$6.6	$4.7	$4.3
Total Annual Cost	**$16.6**	**$15.9**	**$15.4**	**$14.3**
Income from PVWMA Delivery Charges Water @ $92 per AF	$1.7	$1.3	$1.7	$1.7
Adjusted Total Annual Cost	**$14.9**	**$14.6**	**$13.7**	**$12.6**
Combined Sustainable Yield (AFY)	64,000	56,000	64,000	64,000
Total Water Delivered (AFY)	18,500	14,400	18,500	18,500
Cost per AF ($/AF)[a]	**$233**	**$259**	**$215**	**$198**
PVWMA Delivery Charge Delivered Water ($/AF)	$92	$92	$92	$92
Cost per AF plus PVWMA Delivery Charge of $92/AF ($/AF)	**$325**	**$351**	**$307**	**$290**

Footnote:
a. Cost to growers pumping from the groundwater basin.

Another cost risk is that regulatory authorities may require reverse osmosis for percolation of recycled water. As discussed previously, the CCRWQCB and DHS have required this level of treatment on most other projects that have recharged groundwater with recycled water. Based on the estimate of the level of facilities that may have to be added to the College Lake facilities, this requirement could add an estimated $4.2 million to the capital costs of the alternative and $0.2 million in annual O&M costs.

A third cost risk relates to the presence of *Phytophthora* in College Lake. The Expanded College Lake project includes the injection and extraction of College Lake water. Percolation has been identified as an effective means of *Phytophthora* removal, and so the cost estimate for the Expanded College Lake project includes sand filtration as a similar means for removal. However, it is undetermined whether the sand filtration or the injection/extraction process will be sufficient to eliminate *Phytophthora*. In the case that these removal mechanisms are unsuccessful, an alternative treatment process may have to be developed. Costs for this process development are unknown.

Like the LOA, the Modified Local Alternative has the same cost risk associated with percolation of recycled water in the Dunes Recharge Basins. Regulators may require reverse osmosis treatment of reclaimed water prior to percolation in to the shallow aquifer. However, the Modified Local Alternative would percolate a smaller quantity of recycled water. The Modified Local Alternative also faces the same cost risk associated with *Phytophthora* removal from College Lake waters.

5.7 Cost Comparison with Future Water Use

The four alternatives developed in Section 5.1 to 5.4 address various levels of water use for the Pajaro Valley, while balancing the basin and eliminating seawater intrusion. Cost to meet future demands were briefly addressed in each of the alternative sections. This section summarizes those discussions and provides a cost comparison if future (year 2040) water use is the objective of the alternatives.

The BMP 2000 alternative could meet growth in water demand through purchase of additional CVP supply. To meet future demands, this alternative would need to develop 9,000 AFY of additional supplies.

The Local-Only Alternative relies solely on local water sources and is only able to meet water demands by reducing the demand significantly through land leases and conservation measures, or through development of an additional source of supply such as desalination or water importation. Without such additions, this alternative is unable to meet any future growth in water demand.

The Modified Local Alternative and Modified BMP Alternative could meet growth in water demand through the purchase of additional CVP water supplies and conveying the water via the import pipeline. Additional supplemental wells, ASR facilities, and distribution facilities would be required.

The costs shown in Table 5-15 reflect the costs to current water users for the various projects needed to meet current water demands. The infrastructure provided by these projects would also serve to meet the growth in water demand projected for PVWMA's service area. Future users will pay for their fair share of these project costs by means of impact fees and/or capacity charges. These fees and charges would lower the costs to existing users and from those shown in Table 5-15.

5.8 Summary Comparison of Alternatives

A summary of findings for the alternatives is presented in Table 5-16. As shown in this table, the Modified BMP Alternative would result in the lowest cost per AF and has the flexibility to meet current and future water demands. It is able to deliver these attributes while avoiding significant regulatory hurdles. It also avoids the need for land fallowing (or its equivalent) and the associated economic impacts.

The BMP 2000 Alternative is similar to the Modified BMP Alternative, but results in higher costs primarily because of the inland distribution system and the additional water to supply the IDS. It does not appear to deliver higher levels of benefit to offset these higher costs.

The Local-Only Alternative results in the highest cost per AF. This alternative balances water supply and demand at a point significantly lower than today's water use levels. As a result, this alternative would require severe demand reduction measures. Although the economic impacts of such demand reductions were not quantified, they would be significant. This alternative does not have the flexibility to meet future demands, without construction of a desalination facility or an import pipeline, and has poor water quality.

The Modified Local Alternative has slightly higher costs than the Modified BMP Alternative and would incur greater regulatory hurdles. This alternative relies on development of surface diversions from water bodies that are habitat for endangered species. PVWMA would have to secure water rights for these diversions, which could prove difficult to obtain. The alternative also requires groundwater recharge with recycled water. DHS could require costly treatment levels beyond those assumed herein. Therefore, this alternative carries cost risks that are higher than those associated with the Modified BMP.

The Modified BMP Alternative is similar to the BMP 2000 Alternative, except it utilizes injection and extraction of CVP water through ASR in place of the IDS. Use of ASR for CVP water does not appear to be a significant regulatory hurdle. This alternative provides an alternate high quality supply that could be available to growers in the Murphy Crossing area that are affected by pour groundwater quality.

Table 5-16: Summary Comparison of the Basin Management Strategies

Comparison Criteria	BMP 2000	Local-Only	Modified Local	Modified BMP
Total Yield (AFY)	64,000	56,000	64,000	64,000
Capital Costs ($ Million)[a]	$162	$128	$148	$138
Adjusted Total Annualized Costs ($ Million)[b]	$14.5	$14.6	$13.7	$12.6
Cost per AF[c] ($/AF)	$226	$259	$215	$198
Cost per AF + PVWMA Delivery Charge to Those Receiving Delivered Water ($/AF)[d]	$318	$351	$307	$290
Can Meet Future Water Demands?	Ö		Ö	Ö
Limited dependence on out-of-basin supplies?		Ö	Ö	
Minimizes significant regulatory/implementation hurdles?	Ö			Ö
Meets Water Quality Goals?	Ö		Ö[e]	Ö
Requires Land Fallowing or Other Measures with Significant Economic Impact?		Ö		

Footnotes:

a. Includes pro rata share of costs to balance basin at today's conditions and costs of additional water supplies
b. Annualized costs included annualized capital cost, operation & maintenance costs
c. Fee is applied to all water users based on first quarter, 2001 construction costs
d. Includes delivery charge of $92/AF for those customers receiving delivered water
e. Water quality goals are met only during certain times of the year

6 Revised Basin Management Plan Recommendation

The objective of this section is to identify a Recommended Alternative that meets the water supply goals of the PVWMA and the local community. In addition, this section summarizes the process used in selecting the Recommended Alternative, provides a cost estimate for the alternative, and identifies potentially viable future projects. Implementation and funding of the Recommended Alternative are discussed in Sections 7 and 8 of this document.

The Recommended Alternative is the Modified BMP 2000 Alternative with minor enhancements. The PVWMA Board of Directors identified the Modified BMP 2000 Alternative, with enhancements, as the preferred alternative after taking into account the public and stakeholder input, engineering and cost evaluations, environmental impacts, and direction from PVWMA staff. The Recommended Alternative provides a phased approach for meeting the major objectives and goals of the Pajaro Valley by eliminating seawater intrusion and balancing the basin in the most environmentally superior manner with the least amount of capital investment.

This section includes the following discussions:

- Draft BMP and Selection Process for Recommended Alternative;
- Recommended Alternative;
- Water Balance;
- Operational Strategy;
- Cost Estimate;
- Potential Future Projects; and
- Summary of Key Points.

6.1 Draft BMP and Selection Process for Recommended Alternative

The Draft Revised Basin Management Plan was completed and released for public and stakeholder review in August 2001. From August through November 2001, two public workshops were held to present projects and alternatives to the public and stakeholders. PVMWA also held two public BMP hearings, which consisted of presentations and question and comment sessions. Questions, concerns, and comments received during this period were addressed and noted for consideration in the development of the Final Revised Basin Management Plan. The Revised BMP Draft EIR was also released for public review in September 2001.

In addition to these public meetings, the projects and alternatives presented in the Draft Revised BMP were presented and discussed at public PVWMA Board of Directors meetings held from September through early December 2001. PVWMA also attended and participated in various public stakeholder meetings to present and answer questions on the Revised BMP and Revised BMP Draft EIR. The Draft EIR was utilized as a vehicle to solicit input from the various local, state and federal regulatory agencies.

Stakeholder and regulatory comments and additional evaluations played a key role in the selection process. Some of the most significant issues, comments, and developments include the following:

- Comments received from the DHS indicated that percolation of recycled water included in the Local-Only Alternative and Modified Local Alternative would not be a feasible project without

reverse osmosis treatment. The treatment is required because of the potential impact to groundwater resources whose beneficial uses include drinking water supply. Due to the expected cost of reverse osmosis treatment, percolation of recycled water was eliminated as a potential project.

- Following the release of the Draft Revised BMP, an evaluation of injection and extraction of CVP water was completed. The evaluation concluded that membrane treatment such as ultra-filtration or micro-filtration would be required prior to injection of CVP water into the groundwater basin. This was required to meet both the Surface Water Treatment Rule and to prevent plugging of the injection and extraction wells. As a result of these evaluations, the cost for the ASR wells and associated treatment, connection pipelines, and monitoring wells increased to $29.3 million including contingencies. The estimated annual O&M costs for the project is $0.9 million. Due to the increased cost, injection and extraction of CVP water is not recommended at this time. However, ASR remains a potential future option for in-basin banking.

The Recommended Alternative will be implemented using a phased approach to take into account project funding constraints, rate increases, and implementation tasks. This phased approached for implementation of the recommended capital improvement projects is discussed further in Section 7.

In addition to the specific project components included in the Recommended Alternative, it has been recognized that several local water supply projects might become viable in the future. If they become viable, they can be implemented to provide in-basin banking and meet future increases in water demand. These additional local water supply projects (described in Section 4) include the Watsonville Slough, College Lake, and Murphy Crossing Projects. They presently have issues of concern that preclude them from immediate implementation. However, they are all potentially viable future projects that could add to the diverse mix of water supplies available to the PVWMA, and are included as part of the Recommended Alternative.

In-basin banking facilities may also be constructed in the future to increase operating flexibility and provide greater local control of water supplies. Implementation of complete in-basin banking facilities was not included in the next phases of the recommended alternative due to cost considerations. However, they may be included in future phases of the project as funding becomes available, and if it is considered at that time more cost effective than continued use of out of basin banking.

6.2 Recommended Alternative

The goal of the Recommended Alternative is to meet the identified objectives for eliminating seawater intrusion, balancing the basin, addressing regulatory concerns, and developing reliable supplemental water supplies. Included with the Recommended Alternative under Potential Future Phases are three local surface water supply projects and two local water-banking projects. The potentially feasible local surface water supply projects include Watsonville Slough, College Lake and Murphy Crossing Projects (described in Section 4). The potential future local water-banking projects include in-lieu recharge in an Inland Distribution System or an Aquifer Storage and Recovery System. The inclusion of these projects into the Recommended Alternative is a result of public and stakeholder comments and funding considerations. This section reiterates some of the key project elements and discussion that were previously described in Section 5.4 Modified BMP 2000 Alternative. In addition, the recommended enhancements and modifications to the alternative are also discussed.

A phased implementation approach is necessary for the Recommended Alternative due to funding constraints and other factors. The phasing of the Recommended Alternatives is shown below. A map of the Recommended Alternative is shown in Figure 6-1.

Phase 1

- Conservation: 7-year plan (5,000 AFY);
- Harkins Slough portion of the Coastal Distribution System;
- Harkins Slough with Harkins Slough Recharge Basin, Supplemental Wells, and Connections (1,100 AFY);
- CVP Contract Assignment from Mercy Springs Water District for the Import Water Project;
- Watershed Management Programs.
    - Water Metering Program; and
    - Water Resources Monitoring Program.

Phase 2

- Remaining portions of the Coastal Distributions System;
- Import Water Project with Out-of-Basin Banking (13,400 AFY);
    - Acquisition of additional CVP Water Supplies;
    - Five supplemental wells;
    - Potential sale of water to users along the pipeline alignment.
- Recycled Water Project (4,000 AFY); and
- Watershed Management Programs.
    - Nitrate Management Program;
    - Wells Management Program; and
    - Recharge Protection Plan.

Enhancements were made to the Modified BMP 2000 Alternative to meet funding objectives and identified goals. The most significant change to the Modified BMP 2000 Alternative described in Section 5.4 is the strategy for water banking. Due to the estimated cost of ASR facilities and the funding constraints outlined in Section 8, out-of-basin banking was selected as an initial water banking option for the import water project. As funding becomes available for potential future phases, the interim out-of-basin banking option will be replaced by a local ASR and/or IDS banking option. With out-of-basin banking, the PVMWA would bank surplus water available during higher water delivery years with another CVP contractor. In return, PVWMA would receive water from the CVP contractor during lower water delivery years. For additional information on out-of-basin banking see Section 4.10.4.

In addition, five supplemental wells sited along the import pipeline alignment would be constructed for reliability and to provide peaking supply. The supplemental wells will also be used in conjunction with out-of-basin banking to provide water for the PVWMA during dry-years. As potential future phases are implemented, these supplemental wells could be used as ASR facilities after injection capabilities are added.

As part of this arrangement it is recommended that importation of CVP water increase by 1,500 AFY to 13,400 AFY (as compared with the Modified BMP Alternative) to allow a reliable delivery of 18,500AFY to the coastal area. This increase in CVP water would provide the flexibility of delivering 18,500 AFY directly to the coastal areas, or selling up to 3,000 AFY to interested users along the pipeline alignment. Any water sold to these users would be replaced with an equal amount of groundwater pumped from inland areas along the pipeline alignment. In this way, 18,500 AFY could still be delivered to the coastal areas.

Enhancements of existing and development of new Watershed Management Programs are also added as part of the Recommended Alternative. Existing Watershed Management Programs include the Water Metering Program and Water Resources Monitoring Program. The development of new Watershed Management Programs will include a Nitrate Management Program, Wells Management Program, and a Recharge Area Protection Program. In response to the recognized problem of nitrate contamination within the Basin, PVWMA has worked together with other public agencies on outreach tasks. However, no formal development of a Nitrate Management Plan has been completed.

Phase 1 of the Recommended Alternative has already been implemented by the PVWMA to near completion. The implementation included the initiation of the Water Conservation Plan, enhancements to the Water Metering Program, assessment of the Water Resources Monitoring Program, assignment of one CVP contract for import supply, construction of the Harkins Slough Project, and construction of a portion of the Coastal Distribution System in the vicinity of Harkins Slough and Beach Road. In addition, the PVWMA is preparing final documents for construction of the three supplemental wells at Harkins Slough scheduled for completion during the spring and summer of 2002.

Construction of Phase 1 capital projects began in 2000 and will be completed in 2002. The CVP contract assignment from Mercy Springs Water District was completed in November 1998. Conservation efforts began in 2000 and are schedule to continue through at least 2007. Enhancements to the Water Metering Program were also developed in 2000 and complete implementation of the recommended improvements is underway. The Water Resources Monitoring Program is currently undergoing assessment and is also scheduled for completion by the end of 2002.

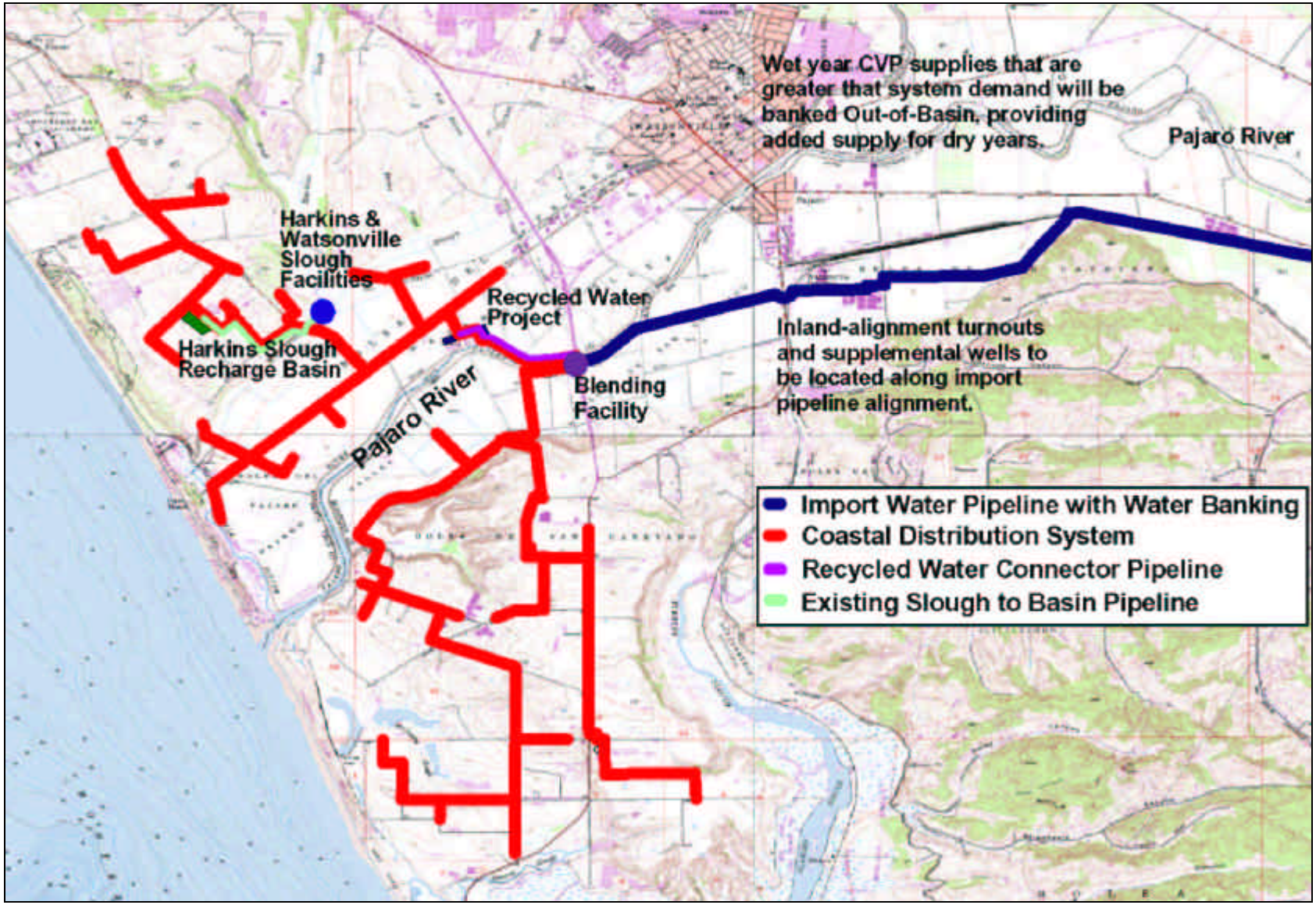
Construction of Phase 2 capital projects is scheduled to begin in 2004 with completion in 2007. Watershed management programs are continuing efforts and once enhanced, developed, or implemented, the programs would be maintained.

Phases 1 and 2 of the Recommended Alternative are scheduled for completion in 2007 and will address the overdraft and seawater intrusion associated with current groundwater demand on an annual average basis. However, the recommended facilities would meet approximately 90 percent of the CDS peak day demand assuming an 18 hour irrigation day. Extending the irrigation day to 20 hours would allow the estimated peak day demand to be met. Hence, providing estimated peak day flows within an 18 hour irrigation day, as well as meeting future increases in water use, will require additional funding beyond the proposed rate structure in Section 8. The projects listed under the Potential Future Phases are envisioned to be the most viable future projects, which could be constructed to provide in-basin banking, and/or to meet future increases in water use.

Potential Future Phases

- Aquifer Storage and Recovery (ASR) of CVP Water;
- Inland Distribution System (IDS);
- Watsonville Slough Project and North Dunes Recharge Basin;
- Murphy Crossing Project with Murphy Crossing Recharge Basins; and
- College Lake Project in coordination with Corp of Engineers flood protection project.

Figure 6-1: Recommended Alternative (Phase 1 and 2)



6.3 Water Balance

As previously discussed in Chapter 3.3, pumping of 18,500 AFY must be eliminated in coastal areas to stop seawater intrusion. Under the Modified BMP 2000 Alternative it was assumed that new water projects would supply 17,000 AFY and 1,500 AFY of inland groundwater would be pumped to the coast.

In the course of developing the Recommended Alternative, PVWMA decided to develop 18,500 AFY of new water supply rather than 17,000 AFY. Consequently, CVP purchase was increased from 11,900 AFY to 13,400 AFY for the Recommended Alternative. Although this amount of water is more than is needed to simply balance demand and supply, it provides increased operational flexibility. As described above, this approach allows delivery of up to 18,500 AFY directly to the coast, or selling up to 3,000 AFY to interested users on the pipeline alignment. Any water sold to these users would be replaced with an equal amount of groundwater pumped from inland areas along the pipeline alignment. In this way, 18,500 AFY could still be delivered to the coastal areas.

A summary of the new water supplies developed in the Recommended Alternative is presented in Table 6-1.

Table 6-1: New Water Supplies Developed by Recommended Alternative

Water Supply to Coastal Area [b]	**AFY[a]**
Harkins Slough with Harkins Slough Recharge Basin	1,100
Recycled Water Project	4,000
Imported CVP Water	13,400
Total	**18,500**

Footnote:
a. Values rounded to two significant figures or to the nearest thousand to represent the values significant accuracy.
b. Water required to be delivered at the coast to eliminate seawater intrusion.

The estimated implementation schedule indicates completion of Phase 2 of the Recommended Alternative by 2007. Thus, by 2007 sufficient water will be available in the coastal area to stop seawater intrusion.

As previously discussed, the peak day water delivery to the CDS will meet approximately 90 percent of the peak day demand, assuming an 18 hour irrigation day. Extending the irrigation day to 20 hours would allow the estimated peak day demand to be met. If extension of the irrigation day to 20 hours proved unacceptable to growers, additional storage, such as ASR wells, within the Pajaro Basin will be needed. These facilities would be added during future phases of the program. If additional storage is developed within the Pajaro Valley, out-of-basin banking could be phased out. Hence, out-of-basin banking may be only a temporary solution within the budgeted rate structure presented in Section 8.

Future increases in water use are expected in the PVWMA service area. Therefore, the PVWMA should continue to evaluate water use and local water supply options for maintaining basin balance. Feasible local water supply options include the development of the Watsonville Slough, College Lake, or Murphy Crossing Projects.

6.4 Operational Strategy

A flow schematic for the Recommended Alternative is shown in Figure 6-2.

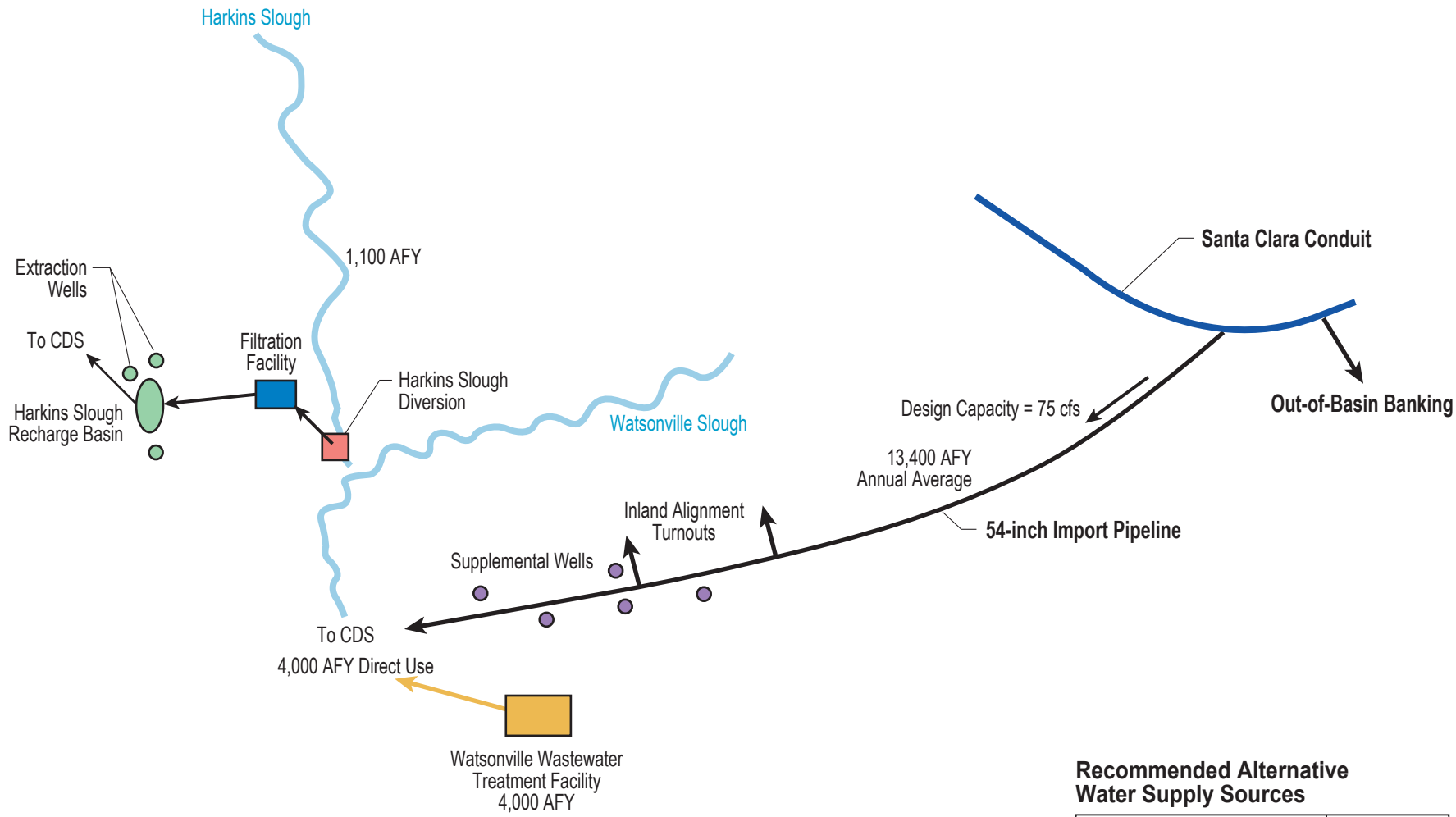
The operational strategy of the Recommended Alternative relies upon recycled and Harkins Slough water in combination with CVP water and groundwater as the major sources of supply. Recycled Water requires a source of blending water to reduce the TDS of the delivered water to 500 mg/l or less. The CVP water supply (some groundwater from inland wells would also be mixed with the CVP supply) will serve as the primary source of blend water to reduce the TDS levels of the recycled water. During years of low supply availability of CVP water, banked in-basin groundwater and out-of-basin banked supplies can be used as additional sources of dilution for the recycled water. Water provided to users on the CDS would be blended with recycled water at a blending facility, proposed to be located near the intersection of Highway 1 and the Pajaro River. Water extracted from Harkins Slough recharge basin would be delivered within the San Andreas portion of the CDS.

In average rainfall years, CVP deliveries plus water from the Harkins Slough recovery wells, inland supplemental wells, and the Recycled Water Project would provide the water required to meet CDS demand. The Harkins Slough recovery wells and inland-alignment supplemental wells would be used to meet peak delivery requirements.

During above-normal rainfall years, CVP deliveries, plus supplies extracted from the Harkins Slough recharge basin and the Recycled Water produced at the WWTF, are expected to exceed CDS. Therefore, CVP water deliveries above current demands would be banked with a CVP contractor through an out-of-basin banking agreement. Water users at the inland-alignment turnouts would also have access to direct CVP supplies during this period.

In below-normal rainfall years, PVMWA would minimal amounts from the CVP system. However, PVWMA would receive additional CVP deliveries through out-of-basin banking agreements. The PVWMA would also withdraw water from the supplemental wells to provide additional supply to the system. The additional CVP and supplemental well supplies would augment surface water and recycled water supply and help meet CDS demand. During these dry years, inland growers would be requested to utilize their existing wells during peak demand conditions. During the most severe dry-weather years, all recycled water would still be available, but it is not anticipated that any supply would be available from Harkins Slough.

The annual yield of the Recycled Water Project is limited to about 4,000 AFY by the recycled water facility daily flow rates, blending requirements, and the irrigation demand for recycled water. Due to the absence of seasonal storage, flow not required for irrigation would be treated to the existing levels and discharged to the WWTF outfall. Water quality is also a limiting parameter. Given the desired TDS



Recommended Alternative Water Supply Sources

Water Source	Yield, AFY
Recycled Water	4,000
Harkins Slough	1,100
CVP - Import Water	13,400
Total	**18,500**

Figure 6-2: Flow Schematic for the Recommended Alternative (Phase 1 & 2)

objective of 500 mg/L, recycled water produced at the WWTF would need to be blended with CVP water (some groundwater from inland wells would also be mixed with CVP supply) to create a uniform water supply for the CDS that meets or exceeds the water quality objectives. Due to the variation of flows into the WWTF, some minor storage of recycled water via equalization basins and a clearwell will be provided at the treatment plant for the purpose of maximizing recycled water use and minimizing the treatment plant design capacity.

6.5 Estimated Costs

The estimated capital cost of the Recommended Alternative is $130.6 million, in Spring 2001 dollars. The annual O&M cost is estimated to be $4.4 million. The cost estimate includes annual administration cost and annual average water banking costs for out-of-basin banking. As discussed in Section 4.10.4, in addition to administration and banking cost, an out-of-basin banking agreement also typically entails the contractor acting as the water bank to retain approximately 10% of the total banked water supply to account for seepage, evaporation, and unaccounted losses. The costs of potential future projects such as ASR, IDS, College Lake, Watsonville Slough, and the Murphy Crossing Projects are not included in the cost estimate. The estimated costs of these project elements are discussed in Section 4. In addition, it should be noted that the estimated cost is likely to increase due to inflation and other cost escalations, which will occur between Spring 2001 and actual project construction.

Table 6-2: Recommended Alternative Cost Estimate (Phase 1 and 2)

Project Element	**Cost Estimate ($ Millions)**
Coastal Distribution System	$34.4
Conservation and Watershed Management Programs	$1.7
Harkins Slough Project with Harkins Slough Recharge Basin and Supplemental Wells and Connection[a]	$6.6
Recycled Water Project (4,000 AFY)	$19.2
54-inch Import Water Project with Out-of-Basin Banking	$87.3
Construction Cost Subtotal	**$149.1[b]**
Financial & Bond Sale Cost @ 1.0%	$1.5
Recycled Water Grant (Title XVI)	($20.0)
Total Capital Cost	**$130.6**
Annualized Capital Cost at 6% for 30 years	$9.5
Annual Operations & Maintenance Costs	$4.4
Total Annual Cost	**$13.9**

Footnotes:

a. Includes $460,000 CalFed Grant, which reduces cost to $6.6 million. This project is complete except for three supplemental wells and associated piping.
b. Subtotal reflects sum of individual project elements before rounding.

Notes:

1. Spring 2001 construction cost.
2. Capital recovery factor (A/P) for 6% at 30 years is 0.07265.
3. Cost estimates include a Construction Contingency of 20%, Engineering/Legal/Admin/Permits Contingency of 17.5%, and Environmental and Permitting Contingency of 5%.

The amount shown for Conservation and Watershed Management Programs is the recommended increase in budget for these items. The $1.7 million shown is the present worth equivalent of $290,000 per year, which is the recommended increase. Currently these programs consume approximately $340,000 per year. Therefore, in combination with the recommended increase, the total recommended expenditures for these programs would be approximately $640,000 per year. The tentative allocation of this budget is shown in Table 6-3.

Table 6-3: Resource Allocation for Conservation and Watershed Management Programs

Watershed Management Programs	Current Resource Allocation	Recommended Increase in Allocation	Recommended Future Resource Allocation
Water Conservation Plan	$100,000	$100,000	$200,000
Water Metering Program	200,000	100,000	300,000
Water Resources Monitoring Program	40,000	60,000	100,000
Nitrate Management Program	0	15,000	15,000
Wells Management Program	0	7,500	7,500
Recharge Protection Program	0	7,500	7,500
Total Resources Allocation	**$340,000**	**$290,000**	**$630,000**

6.6 Potential Future Phases

As previously discussed, completion of Phases 1 and 2 of the Recommended Alternative will address approximately 90 percent of the CDS peak demand, assuming an 18 hour irrigation day. Extension of the irrigation day to 20 hours would allow the estimated peak day demand to be met. However, if the extension is unacceptable to growers, additional storage such as ASR wells, within the Pajaro Basin will be needed.

Addressing peak demand periods as well as future increases by 2040 in water use will require the construction of an in-basin banking system and additional water supply projects. An in-basin banking system is not being implemented at this time due to funding restrictions. In consideration of near-term cost-saving, out-of-basin banking provides a storage alternative for meeting the water demand in the Pajaro Valley the majority of the time with the least amount of initial capital investment. Furthermore, it is more prudent to reserve long-term storage decisions on ASR and IDS for in-basin banking until more information and studies can be completed and evaluated. The capital projects in Phase 1 and 2 will be designed with flexibility such that future projects can be incorporated into the system to meet the remaining current and future needs.

As more funding becomes available in the future, the potential future in-basin storage and local water supply projects discussed below could be constructed to meet the remaining current and future needs. These listed projects are envisioned to be the most viable future projects for construction to provide in-basin banking and/or increase local water supplies. Hence, the design of the recommended projects

included in the next phase of implementation and described in Section 6.2 should include provisions for future integration of the following projects.

Potential Future Phases – Envisioned Viable Projects

- Aquifer, Storage and Recovery (ASR);
- Inland Distribution System (IDS);
- College Lake Project;
- Watsonville Slough Project; and
- Murphy Crossing Project.

As previously discussed, addressing the entire overdraft and seawater intrusion impacts during peak demand periods as well as future increases in water use by 2040 will require the construction of additional capital projects such as in-basin banking facilities. An in-basin banking system would provide long-term reliability and allow more flexibility for the PVWMA. Construction of ASR facilities, an IDS, or a combination of the two, would provide in-basin banking for imported water. The banked water would then be pumped during below normal water delivery years when CVP supplies are reduced. These two banking projects were not included as part of the next phase of the Recommended Alternative due to funding constraints. However, design of the recommended projects should include provisions for future integration and connection of the ASR facilities and an IDS.

The College Lake Project was not considered a practical project at this time due to a potential ACOE flood protection project at College Lake and impacts to steelhead fisheries. Until the ACOE has completed flood protections studies, a water supply project at this location is not realistic. However, the College Lake Project may be feasible in the future. The ACOE is currently completing outreach efforts and collecting public and stakeholder inputs as a part of the initial phases of its planning study. To date, no schedule is available for the completion of ACOE flood projection evaluation.

Similar to the College Lake Project, the Watsonville Slough Project is not viable at this time. Environmental enhancement and restoration options are currently under evaluation and the Watsonville Sloughs Resource Conservation and Enhancement Plan is being developed. The viability of the Watsonville Slough Project is contingent on experience with the Harkins Slough Project and recommendations of the Resource Conservation and Enhancement Plan.

The Murphy Crossing Project faces several environmental issues and engineering challenges at this time. NMFS and DFG have requested that additional investigations be undertaken to evaluate the sediment characteristics of the proposed infiltration gallery. Therefore, pursuit of this project is currently not warranted. In addition, the most practical delivery of water supplied by the Murphy Crossing Project would be an IDS adjacent to the project. However, the project is still feasible and could be selected for implementation in the future.

6.7 Summary of Key Points

Presented below is a summary of key points of this section.

- The Recommended Alternative was selected through a rigorous process consisting of public outreach, and engagement of regulatory, jurisdictional agencies, and other stakeholders.

- The Recommended Alternative for eliminating seawater intrusion and balancing the basin is the Modified BMP 2000 Alternative with minor enhancements. The Recommended Alternative is to be implemented under a phased approach.

- Due to funding constraints, out-of-basin banking will be utilized as the near-term water banking strategy for the Recommended Alternative.

- The Recommended Alternative would provide new water supplies of 18,500 AFY. In conjunction with conservation of 5,000 AFY, seawater intrusion would be eliminated and basin balance would be achieved by 2007. Future increases in water use are expected, but the inherent flexibility of the Recommended Alternative would allow these demands to be met at a future time.

- Enhancements of existing, and development of new, Watershed Management Programs are also added as part of the Recommended Alternative,

- The estimated capital cost of the recommended alternative is $130.6 million with an annual O&M of $4.4 million.

The next steps for PVMWA are to begin the implementation process for each of the recommended projects. An implementation plan for the recommended alternative is described in Section 7. In addition, Section 8 describes the water rate structure that would be used to fund the projects.

7 Implementation Plan for Recommended Alternative

Implementation of the Recommended Alternative will necessitate numerous activities, ranging from engineering design, environmental documentation and permitting, financing, and construction. Environmental documentation for the Recommended Alternative includes two components: CEQA (California Environmental Quality Act) and NEPA (National Environmental Policy Act). CEQA compliance is scheduled for completion in February 2002. NEPA compliance is scheduled for completion in early 2003, and is being completed in a joint effort with the US Bureau of Reclamation. NEPA compliance is required for connection of the import pipeline to the CVP system and delivery of CVP water. NEPA compliance is also required for receipt of federal funding for the Recycled Water Project under Title XVI.

The purpose of this section is to identify project schedules and highlight significant tasks required for implementation of the Recommended Alternative. The identified tasks are focused on those required between the completion of this planning document (the Revised BMP) and completion of construction.

As previously discussed in Section 6, the Recommended Alternative is to be constructed in multiple phases. Construction of projects under Phase 1 has already begun and will be completed in 2002. Implementation of Phase 1 and 2 of the Recommended Alternative are described in detail below. A preliminary implementation plan for the Potential Future Phases is also included in Section 7.3.

Potential projects listed under future phases include options for in-basin water banking utilizing ASR, construction of an Inland Distribution System, and development of additional local water supplies. As funding becomes available in the future, the PVMWA should implement an in-basin banking option to address current peak demand periods, future increases in water use by 2040, and increase long-term reliability, flexibility, and local control of the CVP supplies. Construction of additional local water supply projects would be contingent on the need for additional water supply, results of environmental and flood control studies currently underway, and funding.

The projects included under each phase are shown below.

Phase 1 (Scheduled Completion in 2002)

- Conservation: 7-year plan (currently underway with 5,000 AFY to be achieved in seven years);
- Harkins Slough with Harkins Slough Recharge Basin and Supplemental Wells and Connections (1,100 AFY);
- Harkins Slough Portion of the Coastal Distribution System (CDS);
- CVP Contract Assignment from Mercy Springs Water District for the Import Water Project.
- Watershed Management Programs; and
    - Water Metering Program; and
    - Water Resources Monitoring Program.

Phase 2 (To be constructed in 2003 to 2007)

- Remaining Portion of the Coastal Distribution System;
- 54-inch Import Water Project with Out-of-Basin Storage (13,400 AFY);
    - Acquisition of additional CVP Water Supplies; and
    - Inland-alignment turnouts and five supplemental wells.
- Recycled Water Project (4,000 AFY); and
- Watershed Management Programs.
    - Nitrate Management Program;

- Wells Management Program; and
- Recharge Area Protection Program.

Potential Future Phases

- Aquifer Storage and Recovery (ASR) of CVP Water;
- Inland Distribution System;
- Watsonville Slough Project and North Dunes Recharge Basin;
- Murphy Crossing Project with Murphy Crossing Recharge Basins; and
- College Lake Project in coordination with Corp flood protection project.

Project schedules and critical tasks for Phases 1 and 2, and the associated projects are described in the following sections. No schedules were developed for potential future phases as the PVWMA has not set a timeline to move forward with those future projects at this time.

7.1 Phase 1

Implementation of Phase 1 of the Recommended Alternative is nearly complete. PVMWA has begun a conservation program to achieve levels of conservation identified in the Water Conservation 2000 (WC 2000) plan. The Enhanced Groundwater Monitoring and Enhanced Metering Programs will involve evaluation of the existing programs and building upon these evaluations to create a more effective monitoring and metering program for the PVWMA. Construction of the Harkins Slough project and Harkins Slough portion of the CDS was completed in fall of 2001. The final element of Phase 1 is construction/retrofitting and connection of the three supplemental wells that will initially provide a supplemental supply to the Harkins Slough portion of the CDS. Details of the implementation plan for the ongoing projects are discussed in the following sections.

7.1.1 Conservation Program Implementation

In February of 2000, the WC 2000 was completed by the consultant and accepted by the Board of Directors. Since acceptance of the WC 2000, the PVWMA has implemented many programs identified in the WC 2000 plan to promote agricultural water conservation. Conservation efforts have included mobile laboratory evaluations, installation of an additional CIMIS weather station, demonstration projects, outreach efforts, and farm conservation plan reporting. Mobile laboratory evaluations receive high participation from growers and were funded in cooperation with the San Luis & Delta Mendota Water Authority. Future funding of the mobile laboratory evaluations will be done in part through grants from CALFED. Funding allocation decisions have limited the PVWMA from full implementation of the outlined programs. As a result, the financial assistance program for grower irrigation system improvements has not been implemented.

Implementation of the WC 2000 Program has been focused on elements that would make the biggest impact first. Hence, the urban outreach aspect of the WC 2000 has been largely left to the City of Watsonville, which has a Water Conservation Program originally established in 1992. The City of Watsonville's program includes elements such as low-flush toilet rebate, industrial loans for water efficient facility modifications, free low-flow shower heads, school water education programs, the retrofitting of schools with low-flow plumbing fixtures, and other similar activities.

Ongoing conservation efforts identified in the WC 2000 are scheduled to continue until at least 2007. Full implementation of all the elements identified in the WC 2000 will require additional funding and

resources. Depending on the level of conservation that has been achieved and the opportunities for additional conservation, the program could be extended.

7.1.2 Harkins Slough Project with Harkins Slough Recharge Basin and Supplemental Wells and Connections Implementation

The Harkins Slough Project was the first water supply project to be implemented and constructed by the PVWMA. Construction of the diversion facilities and recharge basin were completed in 2001. Construction and retrofitting of the supplemental wells and connections is the final element of the project and is scheduled for completion in 2002. Approximately 150 AF of Harkins Slough water was diverted, treated, and percolated to storage in spring 2001 and full operations are scheduled for late winter or spring of 2002.

The Harkins Slough Project consists of pumping and treatment facilities located at the confluence of Harkins and Watsonville Sloughs, a transmission pipeline from the treatment facility to the recharge basin located off Dairy Road, and extraction wells with a connecting pipeline to the Coastal Distribution System.

7.1.3 Harkins Slough Coastal Distribution System Implementation

In conjunction with the Harkins Slough Project, a portion of the Coastal Distribution System was constructed to deliver water from the Harkins Slough Project and begin elimination of coastal pumping. Design of the project was completed in 2000 and construction was completed in the fall of 2001.

Additional portions of the CDS are to be constructed in conjunction with the Harkins Slough supplemental wells. These facilities are scheduled for completion in early 2002. In all, approximately 35,000 feet, or approximately 25%, of the CDS will be constructed under Phase 1.

7.1.4 Watershed Management Programs

As previously discussed in Section 3, PVMWA Staff is in the process of enhancing the Water Metering and Water Resources Monitoring Programs. Enhancements to the Water Metering Program, including development of a billing and meter tracking database, meter replacement, and regular maintenance, have been developed in 2000. The revamped metering program will improve revenue generation, allow evaluation of conservation efforts, and provide an increased understanding of water use in the basin.

The Water Resources Monitoring Program is currently undergoing evaluation so that the framework for enhancing this program could be developed. An enhanced Water Resources Monitoring Program will allow for better data collection necessary for accurate monitoring of contaminant migration, the seawater intrusion boundary, and surface water diversion. Surface water diversions monitoring will help the PVWMA study the effect of natural recharge and natural dilution of potential constituent concentrations of concern in the basin. In addition, the collected data would allow for evaluation of the effectiveness of water supply projects in eliminating seawater intrusion. The two programs will also provide PVMWA with data for protecting and managing water supplies while accurately evaluating and addressing future water needs for its service area.

7.1.4.1 Water Metering Program

In recognition of the importance of an accurate metering program, PVWMA has undertaken an evaluation of its existing metering program in 2000 and has identified a series of improvements. Recommendations

arising from this evaluation process include development of a comprehensive meter program database for tracking of billing and maintenance repair schedule, replacement of obsolete meter technology, and increased frequency of routine maintenance visits between scheduled meter readings. The goal is to implement all of the recommendations by the end of 2002.

7.1.4.2 Water Resources Monitoring Program

A comprehensive monitoring program will allow PVWMA to collect necessary data for evaluation of groundwater and surface water management issues. In addition to monitoring the progress of the Recommended Alternative in stopping seawater intrusion, an expanded groundwater monitoring program is also needed to provide a better understanding of the extent and changes in nitrate contamination. In the past, the groundwater quality monitoring program has been focused on agricultural related parameters. Hence, the PVWMA is in the process of reassessing and developing enhancements to its current groundwater monitoring program. These could include more analyses, such as water dating and isotope analyses, and expansion of the monitoring network for continued updates of the PVIGSM and modeling of contaminant transports. The new monitoring program could also include a database with Access 2000 and GIS compatibility.

Surface water monitoring is essential in understanding natural recharge in the basin and natural dilution of potential constituent concentrations of concern. In addition to water quality and flow monitoring, reporting, and management, enhancements to the surface water monitoring program should include stepped-up efforts to track, meter, and monitor surface water diversions. These tasks are keys to protecting and managing water supplies in the basin.

While the framework for the Water Resources Monitoring Program is being developed by PVWMA, implementation of the enhanced program will require additional budget and resources to perform laboratory analyses and update of the existing database and model. Although PVWMA currently has funds for groundwater monitoring, PVWMA is exploring future funding opportunities to offset the additional cost required for enhancing the Water Resources Monitoring Program.

7.1.5 CVP Contract Assignment from Mercy Springs Water District for the Import Water Project

As previously mentioned in Section 4.10, the PWMA entered into an agreement for the assignment of 6,260 AFY of contracted CVP water from the Mercy Springs Water District in November 1998. At 60 percent long-term average reliability, the contracted amount equals to 3,750 AFY, or 28 percent of the 13,400 AFY needed by the Import Water Project. The facilities for the Import Water Project are scheduled for completion in Phase 2.

7.2 Phase 2

Phase 2 of the Recommended Alternative would be implemented over the next five years and would provide facilities necessary to meet the existing basin overdraft and associated seawater intrusion problem during peak demand conditions assuming a 20 hour irrigation day. The capital projects in Phase 2 include the remaining portion of the CDS, the 54-inch Import Water Project with Out-of-Basin Storage, the Recycled Water Project, and some additional supplemental wells.

In addition to the capital projects, Phase 2 will also include development of the Nitrate Management Program, the Wells Management Program, and the Recharge Area Protection Program. The Nitrate Management Program would guide the PVWMA in taking the first step toward formally recognizing and addressing the potential nitrate contamination problem within the PVWMA service area. The Wells Management Program will help protect the groundwater quality in the Pajaro Valley by ensuring that wells are not a mechanism for transport of constituents from one aquifer to another. The Recharge Area Protection Program would help in enhancing groundwater stability by implementation of public outreach program designed to inform area residents and decision makers of the importance of protecting groundwater recharge areas.

Before construction of any capital projects in Phase 2 could begin, the PVWMA must secure additional CVP water supplies for the Import Water Project. The CDS and the Import Water Projects are dependent upon each other while the Recycled Water Project is dependent upon the Import Water Project for a reliable source of blending water to meet water quality objectives for irrigation. Hence, the start up scheduling for all three projects is set to coincide with each other in spring of 2007. Implementation details for the three projects are presented in the following sections.

7.2.1 Coastal Distribution System Implementation

In order to eliminate coastal pumping and stop seawater intrusion, supplemental water supplies replacing the existing groundwater supply must be delivered via a CDS to the coastal agricultural areas. The proposed CDS will deliver agricultural water supply originating from Harkins Slough, recycled water from the City of Watsonville Wastewater Treatment Facility blended with import water from the CVP and supplemental groundwater wells. The CDS will be designed to accommodate additional water from potential future local projects at College Lake, Watsonville Slough, and the Pajaro River at Murphy Crossing.

The required tasks for implementation of the CDS are broken into three major categories: environmental documentation and permitting, project design, and construction. The environmental documentation process for the project was completed under the Local Water Supply Project EIR in 1999. As previously mentioned in Section 7.1.3, a portion of the CDS has been constructed in conjunction with the Harkins Slough Project. In spring of 2001, the PVWMA approved and authorized a conceptual study for the remaining portion of the CDS. The design and permitting of the total CDS is expected to be completed by mid 2003.

As part of the design process, the PVMWA will need to secure the required land parcels/easements and environmental, development, and encroachment permits. Since construction of the CDS will not result in a significant permanent loss of land use, the required land acquisition process will not be lengthy and is scheduled for completion by the end of 2002. The environmental, development, and encroachment permits necessary for construction of the remaining portion of the CDS are scheduled for completion in 2003.

The advertisement, award, and construction of the remaining portion of the CDS is currently scheduled to start at the end of 2004 and is contingent upon approval from the PVWMA Board of Directors and available funding. Since a CDS is needed for the delivery of water to the coastal area and a CVP pipeline is needed as a source of water supply for the CDS, these two co-dependent projects are scheduled for completion at the same time. Construction of the CDS is expected to begin in fall 2004 and is scheduled for completion in spring of 2007. The proposed implementation schedule for the project is shown in Figure 7-1.

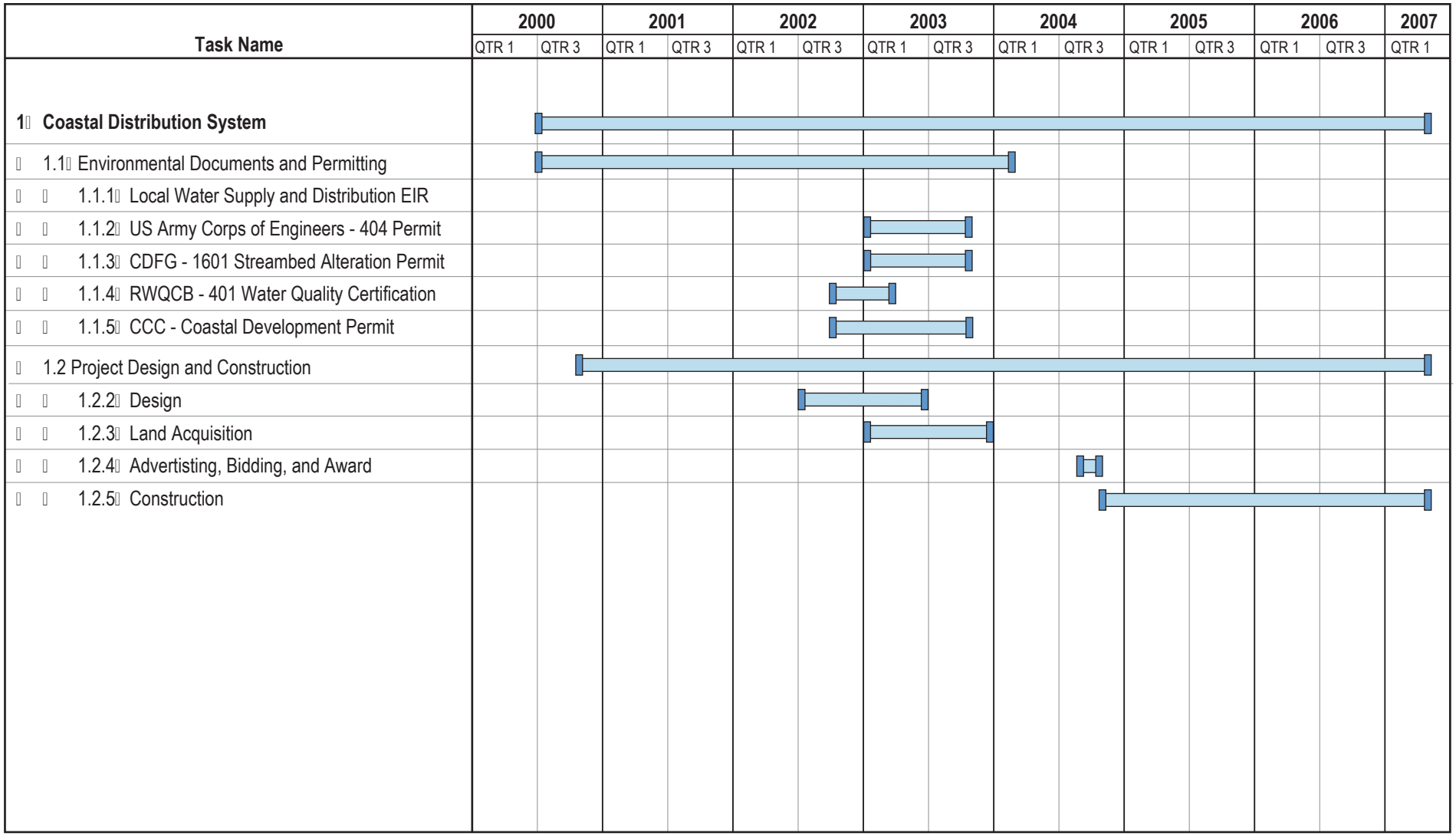


Figure 7-1: Coastal Distribution System Implementation Schedule

7.2.2 54-inch Import Water Project with Out-of-Basin Storage Implementation

The Import Water Project is a major component of the Recommended Alternative and will bring 13,400 AFY of high quality water into the Pajaro Valley to meet water demand and enable the quality of water from the Recycled Water Project to be suitable for irrigation use after blending. Construction of the import water pipeline is contingent on completion of several significant tasks including securing additional CVP water supplies, and environmental review under NEPA.

A CVP contract assignment from Mercy Springs Water District in Phase 1 has secured 28 percent of the CVP supplies needed for the Import Water Project. However, in order to have enough supplies for the Import Water Project, the PVWMA must secure an additional 72 percent of the 13,400 AFY CVP water supplies needed through assignments of existing contracts from other CVP Contractors. Assignment of a CVP contract will involve negotiations with other CVP contractors and coordination of the agreements with the USBR. In addition, CEQA/NEPA requirements must be fulfilled for each assignment. Completion of the necessary tasks to secure additional CVP water supplies is estimated to be a 20-month process. The purchase of additional CVP supplies via assignment appears to be a viable option as PVWMA is currently in the process of exploring assignment opportunities with various CVP Contractors.

After additional CVP water supplies are secured, an out-of-basin banking agreement with one or several CVP contractors/agencies to store surplus CVP water during above average water delivery years will be needed. Out-of-basin banking will increase the reliability of the CVP supply and minimize the need for additional storage facilities and associated costs in the Pajaro Valley.

As previously discussed, the Import Water Project requires CEQA and NEPA compliance as part of the environmental review process in addition to individual CEQA/NEPA evaluations for each water assignment/agreement. The Revised BMP EIR will fulfill the CEQA requirements for the Import Water Project and is scheduled for completion in February 2002. NEPA requirements for the Import Water Project will be fulfilled through an EIS scheduled for completion in early 2003. CEQA/NEPA for any additional CVP contract assignment will be completed as soon as a specific assignment is proposed.

Design of the import pipeline is expected to begin in early 2003, following completion of the EIS and securing of an additional water supply agreement. Various local and jurisdictional agency permits are required prior to construction of the project, and the permitting process would be completed in conjunction with design. The jurisdictional agencies and their required permits/review process are listed in the schedule shown in Figure 7-2 under the Environmental Documents and Permitting section. Construction-related permits such as encroachment permits are considered to be part of the design process and hence are not listed under the Environmental Documents and Permitting section.

Necessary land acquisition and easements for the project will also be negotiated during the design stage, including the agreements to construct and five supplemental/peaking wells along the pipeline alignment. The proposed implementation schedule is shown in Figure 7-2.

Construction of the Import Water Project is scheduled to begin in the summer of 2004. Accounting for the mobilization and start-up/testing period, and the anticipated rate of pipeline construction approximately 180 feet of pipe per day, the Import Water Project will be completed by the spring of 2007.

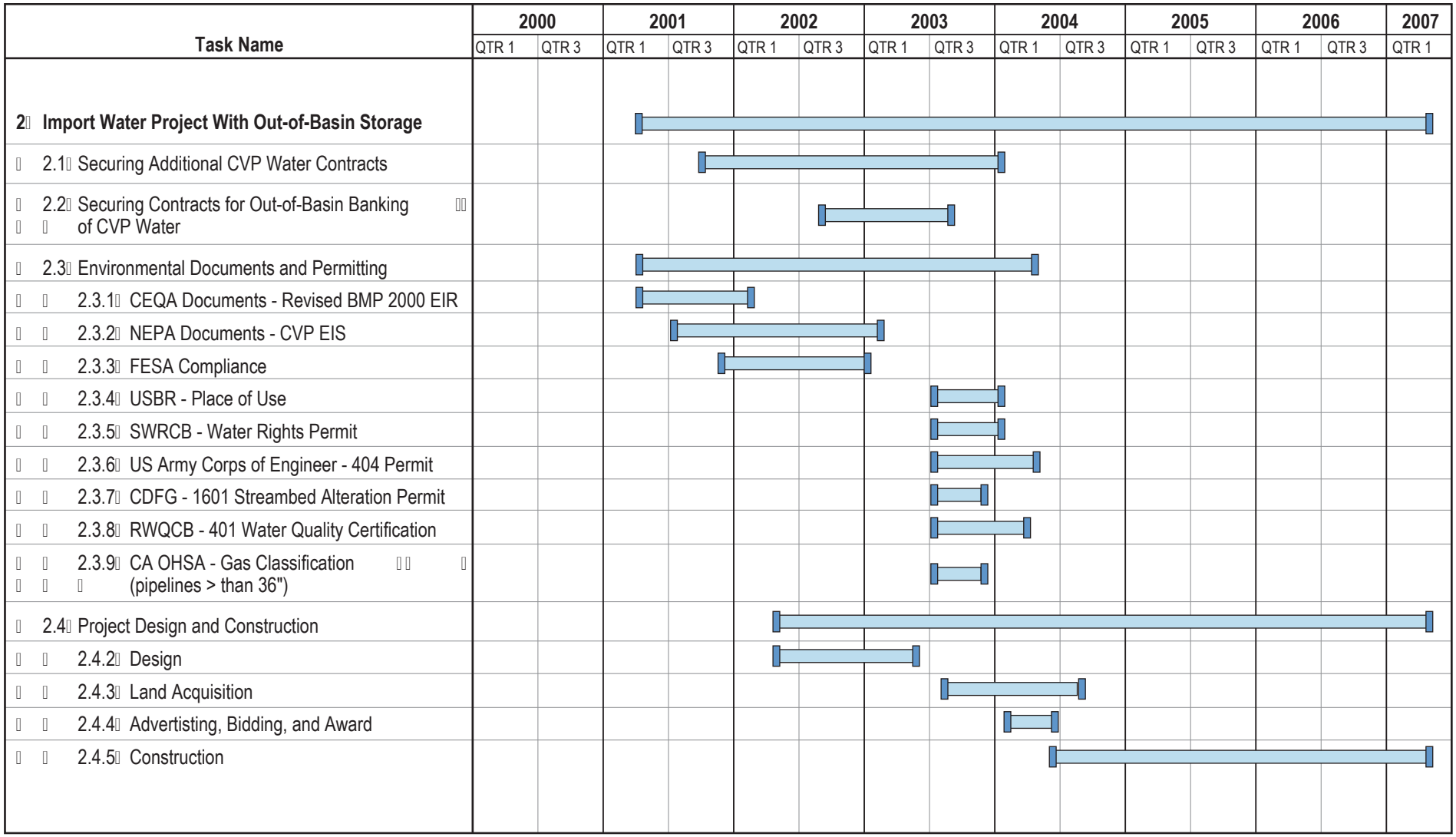


Figure 7-2: Import Water Project Implementation Schedule

7.2.3 Recycled Water Project Implementation

Construction of the Recycled Water Project is contingent on completion of several key tasks including approval of Title XVI funding from the USBR, appropriation of funding by Congress, securing import water for blending, execution of a cooperative agreement between the City of Watsonville (City) and PVWMA, and NEPA compliance. These tasks need to be completed prior to construction of the project.

Implementation of the Recycled Water Project is contingent upon approval for grant funding from the USBR and appropriation of such funds by Congress. In order to receive Title XVI funding, NEPA compliance for the project must first be completed. The NEPA evaluation is being conducted in cooperation with the USBR, and is scheduled for completion in early 2003.

In addition to USBR approval for Title XVI funding, an appropriation of funds from Congress is necessary prior to the release of money for construction of the project. The appropriations process is expected to span a 20-month period and would begin following a record of decision from the USBR.

The Recycled Water Project would also require a blending water supply in order to meet the irrigation water quality objective. Without a blending supply the Recycled Water Project would not be viable due to water quality issues. CVP water from the Import Water Project is the only adequate blending supply for recycled water on a sustained basis. Therefore, sufficient CVP supplies must be secured before the Recycled Water Project is built.

Another necessary task for this project is the development of a cost sharing and delivery agreement between the City of Watsonville and PVWMA. The agreement is necessary, as the City of Watsonville and PVWMA are the major stakeholders in the project. The City owns and operates the WWTF while the PVWMA has jurisdiction over management of water resources within its area.

The design of the Recycled Water Project is scheduled to start at the end of 2003, after the environmental documents and federal appropriation for Title XVI funding. The City and PVWMA are currently completing a feasibility study to evaluate treatment options and processes for the production of recycled water. A Recycled Water Feasibility Study report is scheduled for completion in early 2002. Construction permitting for the project would be completed during the design process. Construction of the Recycled Water Project could begin in the summer of 2005, with a completion target for spring of 2007, in accordance with the CDS and Import Water Project schedule. The proposed implementation schedule is shown in Figure 7-3.

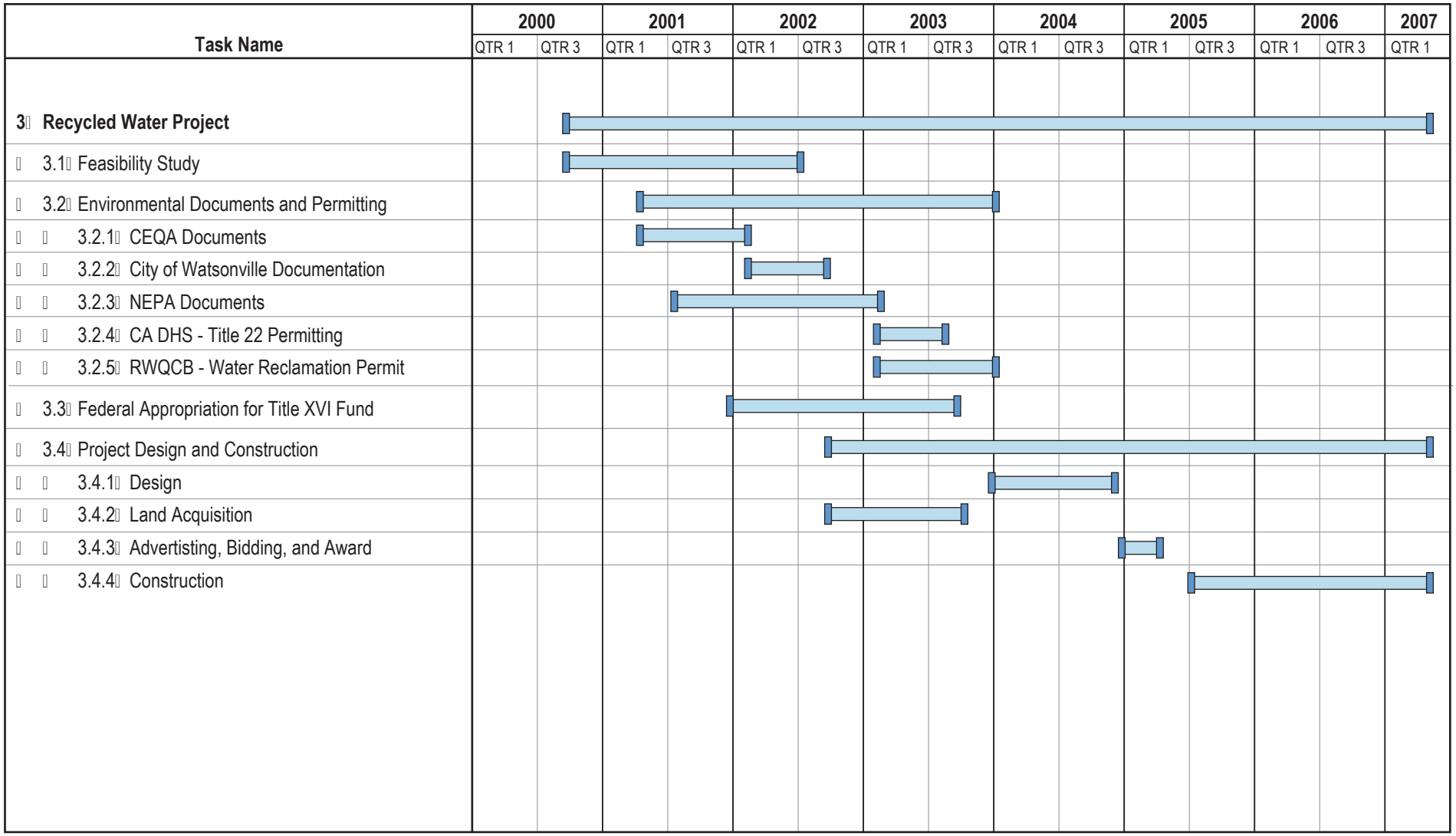


Figure 7-3: Recycled Water Project Implementation Schedule

7.2.4 Watershed Management Programs

The Nitrate Management Program, Wells Management Program, and Recharge Area Protection Program will be developed in Phase 2. As part of the Nitrate Management Program, the PVWMA is proposing to address nitrate contamination within the PVWMA service area by developing and implementing a Nitrate Management Plan. The Nitrate Management Plan would provide guidance for managing and reducing the levels of contribution to nitrate contamination in the Pajaro Valley and serve to increase public awareness and understanding of the situation. The Wells Management Program involves formalizing and adopting a guideline for well decommissioning and well replacement. The Recharge Area Protection Program will include cooperation with other public agencies and public outreach to inform area residents and decision makers of the importance of protecting groundwater recharge areas.

Funding and staffing resources are necessary in order to develop and implement these programs. Currently, no specific implementation schedule has been developed due to resource limitations. However, it is expected that funding and staffing would become available during Phase 2 and that implementation of each program could ensue.

7.2.4.1 Nitrate Management Program

The PVWMA is working with the Monterey County Water Resources Agency (MCWRA) to address agricultural and urban nitrate issues. Together, the two agencies have coordinated and sponsored public outreach events to educate the community on nitrates management and developed pocket guides for management of agricultural nitrates. However, increased efforts are necessary implemented to protect water resources within the Valley. Hence, the PVWMA should develop a Nitrate Management Plan that would identify management measures for reducing nitrate contamination. The plan would outline programs aimed at voluntary implementation of management measures as voluntary action is typically an effective means for reducing nitrate contamination. The goals of the plan would be similar to the Salinas Valley Water Project Nitrate Management Program (Montgomery Watson & RMC, 1998) and would include programs to:

1. Improve irrigation and fertilization practices to reduce the net nitrate/nitrogen load to the groundwater system via grower outreach and education program;
2. More accurate definition of the extent and fate of nitrate contamination in the Pajaro Valley groundwater basin; and
3. Define programs to protect domestic water supplies from nitrate contamination.

The program should include cooperative efforts with Monterey, Santa Cruz, and San Benito Counties to increase public awareness and outreach programs to educate the community on nitrate pollution in the Pajaro Valley. Implementation of the Nitrate Management Programs will require resources and personnel to develop the plan and manage the programs identified in the plan. The programs identified in the plan could be implemented using a phased approach consistent with available resources and funding. The phased approach would also give PVWMA a chance to evaluate and improve the programs applied before the implementation of subsequent phases. The Plan would also give a cost estimate for program implementation and identify potential grant and funding opportunities for nitrate management from regulatory agencies.

7.2.4.2 Wells Management Program

The development of the Wells Management Program will involve active monitoring of well decommissioning to ensure that the wells will not provide conduits for contaminants. The PVWMA currently has a program for notifying the respective county whenever an abandoned well is discovered. To go a step beyond monitoring, the PVWMA should also formalize and adopt guidelines for decommissioning of groundwater wells that are abandoned from operation. The guidelines could be based on existing regulations set by the California Department of Water Resources and an existing ordinance adopted by the Monterey County Water Resources Agency.

7.2.4.3 Recharge Area Protection Program

Protection of recharge areas within the PVWMA service area is critical in preserving water quality and supply within the basin. Recharge areas within the basin are primarily located in the eastern portion of the PVMWA service area. Contamination of, or development on, recharge areas would adversely affect the groundwater supplies of the entire basin. Therefore, it is critical that recharge areas are protected from both development and pollution.

A Recharge Area Protection Program is needed to preserve future groundwater supplies and quality. As previously discussed in Section 3.4.2, the local Counties are aware of key recharge areas and help in monitoring the water quality in these areas. However, a more formal program to spread awareness is recommended. The proposed program could consist of an outreach program designed to inform area residents and decision makers of the importance of protecting groundwater recharge areas. In addition, data from the Water Resources Monitoring Program could be used in developing a model for the key recharge areas and help in monitoring of the water quality in these areas.

7.3 Potential Future Phases

Potential future phases are contingent on the availability of funding, operational strategy, and on future water needs within the Pajaro Valley. Potential future phases include two local water-banking projects and three local water supply projects. As previously mentioned, elimination of overdraft and seawater intrusion impacts during peak demand periods as well as future increases in water use by 2040 will require the construction of an in-basin banking system and/or additional water supply projects. The projects identified were the most feasible and practical at this time. Implementation schedules for these potential future projects are not presently defined. Key implementation tasks for each project are summarized in the following sections.

7.3.1 Aquifer Storage and Recovery of CVP Water (ASR)

Once construction of the import water pipeline is completed and as more funding becomes available, a water banking strategy to store water locally in years when above-average supplies are available should be developed to accommodate peak demand periods, future increases in water use by 2040, and increased long-term reliability, flexibility, and local control of the CVP supplies. Banking of water locally would likely be achieved through ASR, in-lieu recharge, or a combination of both. A local water banking strategy should be developed while considering overall operations requirements during low and high water delivery years. Besides banking, ASR wells could be used to meet peak water demands and provide reliability to the system.

Previous analysis and evaluation of ASR for CVP water with regards to water quality and regulatory requirements indicate treatment is necessary prior to injection of CVP water into the groundwater system. Feasibility level studies have resulted in the recommendation of ultrafiltration (UF) as the preferred treatment process alternative. Ultrafiltration would treat CVP water prior to injection into the groundwater aquifers to meet and comply with the Department of Health Services (DHS) and Central Coast Regional Water Quality Control Board (CCRWQCB) requirements. Upon extraction, water from the wells could be delivered directly to the CDS without additional treatment. A byproduct of UF treatment is reject water, which could be either discharged back into the import supply pipeline or discharged to the WWTF.

Prior to moving forward with full-scale implementation of the ASR project, PVWMA should conduct a more detailed evaluation of existing groundwater quality in the proposed ASR well area and perform a pilot study of the recommended treatment process to gather more information. The pilot study would help PVWMA address water chemistry issues associated with blending of CVP water with groundwater. Furthermore, PVWMA would need to work with property owners to site additional wells at locations that would minimize agricultural and environmental impacts.

7.3.2 Inland Distribution System (IDS)

Construction of an IDS would allow for delivery of water from local or import supplies to inland growers and would reduce groundwater pumping leading to an in-lieu water bank. An IDS provides the ability to deliver water to lands not adjacent to the import pipeline, a benefit not afforded by any other project component.

One potential delivery system was identified in Section 4.10.1. However, the alignment and service area of the system is dependent on the specific needs of the owners and growers in the inland area. As future water needs and water resources are identified, the IDS can be designed to meet the goals and objectives of these inland owners and growers. By providing the inland growers with a water supply in lieu of groundwater pumping, the PVWMA would create an in-basin bank. This in-basin bank could be used to meet future water needs of the Pajaro Valley.

7.3.3 Watsonville Slough Project with North Dunes Recharge Basin

Implementation of the Watsonville Slough Project is dependent upon the recommendations of the Watsonville Sloughs Resource Conservation and Enhancement Plan currently being completed. The plan is evaluating environmental enhancements and restoration options. Recommendations included in the Resource Conservation and Enhancement Plan could affect the cost effectiveness, availability of water, and the feasibility of a water supply project at Watsonville Slough. If recommendations from the plan are favorable, implementation of the project could commence.

The most significant tasks for this project are securing water rights from the SWRCB and ensuring that slough water can be successfully percolated and recovered. The water rights process would require coordination with environmental stakeholders such as NMFS, ACOE, CCC, RWQCB, and USFWS. These stakeholders would likely require significant environmental mitigation measures to protect endangered species and enhance the Slough prior to water rights approval.

7.3.4 College Lake Project Implementation

The College Lake Project is not a viable project at this time due to flood protection evaluations being completed by the ACOE. Construction of the College Lake Project is contingent on completion of the flood protection studies and the recommended flood protection measures. If the evaluations by the ACOE recommend the use of College Lake for flood protection, then a multiuse project could be cost effective. The ACOE is currently completing outreach efforts and collecting public and stakeholder inputs for a planning investigation. To date, no schedule is available for the completion of the ACOE flood projection evaluation.

In addition, the development of College Lake as either a flood control or water supply project will face significant environmental issues, particularly as the project would impact steelhead fisheries. These issues would need to be addressed, including securing a water rights permit, prior to project implementation. In 1995, PVMWA applied for a water rights permit for the College Lake Project. However protests by several jurisdictional agencies and unresolved issues have resulted in delay of the permit being issued. Securing of the water rights permit would involve resolution of design and operations issues identified by the protesting agencies.

7.3.5 Murphy Crossing Project Implementation

The Murphy Crossing Project is still facing several environmental issues and engineering challenges at this time even though the EIR documentation for this project has been certified. Additional investigations requested by the NMFS and DFG would need to be completed before the project could be implemented.

In addition to the environmental and engineering issues, the most practical delivery of water supplied by the Murphy Crossing Project would be adjacent to the project via an IDS. Alternatively, once an import pipeline is constructed, water from Murphy Crossing could be conveyed through that pipeline to the CDS.

7.4 Summary of Key Points

Presented below is a summary of key points of this section.

- The Recommended Alternative will be implemented in multiple phases.
- Implementation of Phase 1 began in 2000 and includes Water Conservation and the Harkins Slough Project with supplemental wells along with a portion of the Coastal Distribution System.
- Phase 2 consists of the remaining portion of the Coastal Distribution system, the Import Water Project plus inland-alignment turnouts and five supplemental wells, the Recycled Water Project, and additional Watershed Management Programs.
- Since the CDS and Recycled Water Project are dependent upon the Import Water Project the construction completion date of all three projects is scheduled to coincide in the spring of 2007.
- Watershed Management Programs are integral parts of the Recommended Alternative and consist of the Water Metering Program, the Water Resources Monitoring Program, the Nitrate Management Program, the Wells Management Program, and the Recharge Area Protection Program.

- The enhanced Water Metering Program is being implemented; the framework for the Water Resources Monitoring Program is currently being developed; the development of the Nitrate Management Program, the Wells Management Program, and the Recharge Area Protection Program will be developed in Phase 2.

- Potential Future Phases consist of potential local water-banking projects and potential local water supply projects. An in-basin banking strategy may be needed to address current peak demand needs and future increases in water use. It should increase the long-term reliability and flexibility of the system, and provide more secure local control of the CVP supplies. The implementation of Potential Future Phases are contingent upon availability of funding and on future water needs within the Pajaro Basin.

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8 Proposed Rate Plan for Recommended Alternative

The Recommended Alternative requires an annual source of revenues of approximately $13.9 million to support debt payments and annual operations and maintenance costs, including CVP water purchases and energy costs. PVWMA conducted a series of public workshops to evaluate alternative rate approaches and to identify water users' issues of concern. This approach allowed the PVWMA Board of Directors to formulate a recommended rate plan that addressed these concerns.

8.1 Existing Rates and Restrictions

PVWMA has in place two sources of revenue. The first is a Management Fee that is levied on a parcel basis. The Management Fee results in annual revenues to PVWMA of approximately $400,000. The Management Fee is presently utilized for overall agency management and funding

The second source of revenue presently utilized by PVWMA is an Augmentation Charge. The Augmentation Charge is based on water use, and is administered primarily through well metering. The Augmentation Charge is limited by the agency's enabling legislation to 15 percent of the highest rate charged by the City of Watsonville. Based on the City of Watsonville water rate for customers outside the City limits, the maximum Augmentation Charge allowed by the enabling legislation is presently $162/AF.

The Augmentation Charge is further currently, limited to $50/AF by the passage of Measure D in 1998. A popular vote is scheduled for March 2002 to reinstate the legislative authority of PVWMA and remove this limitation. If the election in March is successful, PVWMA would be allowed to raise the Augmentation Charge to the limit allowed by the enabling legislation, presently $162/AF. The limit could increase in future years if the City of Watsonville raises rates.

8.2 Alternative Rate Structures

Several types of rate structures were considered by PVWMA, including:

- Flat Water Rate Structure;
- Tiered Water Rate Structure;
- Land Assessment Structure; and
- Water Rate and Land Assessment Combination Structure.

Flat Water Rate Structure:

A Flat Water Rate Structure would set all water sales at the same price per acre-foot of use. This rate structure is the simplest of all rate structures to understand and administer. A single water rate would apply to all users whether they used one acre-foot per acre or five acre-feet per acre. In this way a flat water rate avoids the administrative task of tracking the number of acres a user is irrigating with a given well/meter.

If the PVWMA used a Flat Water Rate Structure, nearly all of its income would come from water sales. In years when water sales are less than the assumed long-term average of 64,000 AF, PVWMA revenue would be insufficient to cover the annual costs. To bridge this revenue shortfall, the PVWMA would

need to set up a reserve fund. Bond sellers would probably require such a reserve fund with any of the alternative strategies presented herein. They could require that rates be increased by as much as 20 percent for the first five years to build up a reserve fund equal to one year's annualized costs.

Tiered Water Rate Structure:

A Tiered Water Rate Structure would charge progressively higher water rates as the demand of a user increases. For example, the first acre-foot per acre of demand would be at one price, the second acre-foot per acre would be at a higher price and the third acre-foot per acre of demand at a still higher price. If the rate tiers were set up to be 'cascading', the user of three acre-feet per acre would have one third of its water use billed at the lowest rate, one third of its use billed at the middle rate, and one third billed at the highest rate. The water bill for this user would be an average of the three rates.

A tiered structure can also be 'non-cascading'. In this case a user of three acre-feet per acre would see its entire water bill calculated at the highest tier rate.

For the PVWMA service area, tiered water rates would be developed on the basis of intensity of use (the amount of water used per acre of land irrigated). This basis is needed to account for the wide range in agricultural property sizes per water meter in the Pajaro Valley. Without this mechanism within a tiered structure, large property owners would be billed at the highest tier even if they grew crops with low water demands.

Use of tiered water rates alone would result in water sales being the sole source of income for the PVWMA. As with a flat rate, a reserve fund would likely be necessary to meet the requirements of bond sellers.

Tiered water rates are difficult to understand and administer because the rate tiers would be based on the amount of water used per acre of land irrigated. This would require the PVWMA to track acreage under irrigation meter-by-meter.

Land Assessment Rate Structure:

A Land Assessment Rate Structure could be used to raise all or part of the PVWMA annual costs. As the name implies, this source of PVWMA revenue would be an assessment on property. The assessment would be collected on the tax rolls, along with landowner's annual tax assessment payments. Because a land assessment is collected with the annual tax payment, the PVWMA has a greater assurance of receiving payment. Therefore, land assessments often ease the requirements of potential bond sellers. Depending upon how much of the costs are recovered by land assessments, the need to set up a reserve fund could be waived, or greatly reduced.

Proposition 218 requires that land assessments be based on the benefit that a given parcel derives from the project to be funded. To conform to this requirement, a property-by-property assessment must be made and the property owner notified. The assessed property owners must vote upon the assessment. Their votes are weighted based upon the assessment. That is, a property that is assessed $1000 would have twice the votes of a property that is assessed $500. A majority protest of the weighted votes would disapprove the assessment for all properties assessed.

Because land assessments have to be in direct proportion to the benefits derived by a given property, some rationale for assigning benefit must be established.

Water Rate and Land Assessment Combinations:

Water rates can be used in combination with land assessments to recover PVWMA costs. This approach would allow a portion of PVWMA costs to be recovered through a land assessment and the remainder through water use fees. Such an approach could be used to implement a policy that property receives a benefit due to implementation of a given project that is equal to a portion of a given project's costs, and that the remainder of the project benefits accrue to water users in proportion to the cost of service, and should be paid through water use fees.

As with the previous rate discussions, a wide range of combinations could be implemented.

8.3 Alternative Rate Evaluations

PVWMA evaluated alternative rate structures through a multi-phased public process. The first phase of the process included outreach to a number of affected and interested public groups and workshops with the Board of Directors. This initial phase served to identify the range of potential alternatives and constraints associated with each alternative. PVWMA solicited and received input from a number of community interest groups representing a range of agricultural and urban interests. Flat and tiered rates and land-based assessments were discussed, along with combinations of rates and assessments. This phase of the evaluation identified the wide range of perspectives of preferred rate structures, particularly the differences of opinion regarding tiered versus flat rates and the desire for some level of land-based assessments.

The second phase of the process focused on agricultural water rates since agricultural water users will be paying for their proportionate share, or approximately 80 to 85 percent of the project costs. This phase of the water rate evaluation process was used to solicit input from the agricultural community on specific alternative rate structures. An Ad Hoc Agricultural Rate Committee was established by the Board of Directors to facilitate input and discussion of alternative rate structures. The Ad Hoc Committee met three times to discuss alternative rate structures. The majority opinion of the Ad Hoc Committee was a recommendation that the PVWMA adopt a differentiated rate structure that charged a higher rate to the recipients of delivered project water. The recommendation was that the recipients of delivered water would pay approximately 15 to 25 percent more for water than a grower that pumps ground water.

In addition, a minority opinion of the Ad Hoc Committee identified the potential for a low tier (perhaps free) water rate that would be applied to individuals that pumped less than the proportionate sustainable yield of the basin. This proportionate level of sustainable yield was estimated to be the sustainable yield of the basin (24,000 AFY) divided by the total acreage within the PVWMA (79,600 acres), or approximately 0.3 AFY/acre.

The final phase of the rate evaluation process was undertaken by the Board of Directors through a series of public workshops that focused on specific alternative rate structures. Beginning in December 2001 and concluding in January 2002, the Board of Directors conducted three water rate workshops.

The Board workshops included discussion and evaluation of land-based assessments, flat rates, and differentiated flat rates. The Board considered the impacts of the alternative rate structures on both agricultural and municipal water users. The Board selected a differentiated flat rate structure as the basis for recovering costs associated with the Recommended Alternative.

8.4 Recommended Rate Plan

The Recommended Rate Plan is a differentiated flat rate that will result in one rate (Augmentation Charge) for individuals who pump groundwater, and a second, higher flat rate for individuals who receive delivered project water.

California law requires that these charges be based on the cost of service being provided. For the Recommended Alternative, the recommended basis for establishing the cost of service for delivered project water and for augmented groundwater is:

1. Recipients of delivered project water will pay the incremental cost of providing delivered project water to their properties as established by the incremental cost of constructing, operating and maintaining the Distribution System,

2. All water users, including recipients of delivered project water, pay a proportionate share of all remaining costs associated with the Recommended Alternative.

Based on the estimated costs of the Recommended Alternative, as presented in Section 6, the proposed rate structure would be:

Augmentation Charge	$158/AF
Delivered Water Charge	$316/AF

The Augmentation Charge would be increased on an incremental basis, assuming a successful election in March 2002. On this basis, the Augmentation Charge would be increased gradually from its current level of $50/AF to $158/AF[1].

Upon completion of the project and delivery of project water, the Delivered Water Charge would be applied to those water users receiving delivered water. That is, those water users who stop pumping and receive delivered water would move to the higher rate when they receive delivered water.

It should be noted that those water users who continue to pump groundwater will incur costs of approximately $92/AF to cover the cost of owning and operating their own wells and pumps. This cost, which is directly borne by the water user, must be considered when calculating the total cost of water for these users. Thus, their total cost of water would be approximately $250/AF ($92 + $158 Augmentation Charge). It is this cost that is directly comparable to the Delivered Water Charge of $316/AF that will be levied on users of delivered water.

Finally, as discussed in Section 6, the Recommended Alternative would meet peak demand of the CDS if the irrigation day were extended from 18 hours to 20 hours. If this is unacceptable to growers, additional in-basin banking projects could be constructed to meet peak demand conditions relative to today's level of water use. Future projects will have to be funded by all PVWMA water users.

Increases in water supply to meet future water demand above today's level of use must be addressed through future water supply projects, which should be paid for by future water users. In addition, future water users will be asked to 'buy into' the infrastructure that was constructed to meet today's demands. Therefore, PVWMA should adopt a rate structure that includes payment of an Impact Fee, which would be paid by property owners if they convert or develop lands resulting in increased water demand. The exact nature and amount of the Impact Fee needs to be determined.

[1] These rates are expressed in current dollars and would increase in the future with the overall rate of inflation.

References

1. Association of Monterey Bay Area Governments (AMBAG), "Pajaro River Watershed Water Quality Management Plan," June 1999.
2. Association of Bay Area Governments (AMBAG), Website: http://www.ambag.org/popchart.html, June 2001.
3. Bogenholm, Vanessa. "Crop Water Use Study 1994-1997." March 1998.
4. Boyle Engineering Corporation, "Water Capital Facilities Plan, Draft," August 15, 1990.
5. Boyle Engineering Corporation, Castroville Irrigation Water Supply Project, Small Reclamation Project (PL84-984) Loan Application Report," (Revised) August 17, 1992.
6. California Department of Health Services, "Groundwater Recharge Reuse – Draft," April 2001.
7. California Public Utilities Commission, "Monterey Peninsula Long-Term Water Supply Contingency (Plan B) Component Characterization", March 2000.
8. California Regional Water Quality Control Board, "Water Quality Control Plan, San Francisco Bay Region," Oakland, CA, 1995.
9. California State Water Resources Control Board, Bulletin No. 5, "Santa Cruz - Monterey Counties Investigation," August 1953.
10. CH2M Hill and RBSmith Consulting, "Pajaro Valley Water Management Agency Water Conservation 2000", February 16, 2000.
11. CH2M Hill, "Aquifer Storage and Recovery Well Field near College Lake", December 2000.
12. CH2M Hill, "College Lake Water Supply System Preliminary Design", February 2000.
13. CH2M Hill, "Connecting Pipeline Preliminary Design", February 2000.
14. CH2M Hill, "Hydraulic Analysis of Local Water Supply Conveyance Systems", February 1999.
15. CH2M Hill, "Impact of Revised Flow Depth Criterion of Pajaro River on Murphy Crossing", February 1999.
16. CH2M Hill, "Murphy Crossing Recharge and Distribution System 30% Design." August 2000.
17. CH2M Hill, "Operational Conflict for College Lake System and Suggested Conservation Measures to Protect Steelhead", March 1999.
18. CH2M Hill, "Pajaro Valley Water Management Agency Water Supply Project, Project Definition Report Vol. I, II, and III", 1997.
19. CH2M Hill, "Phase II Memo Report on Recharge Well Test at College Lake", June 1995.
20. CH2M Hill, "*Phytophthora* Information at College Lake and Harkins Slough", April 1999.
21. Earles, Jim. "Balancing Solution for Pajaro Valley Overdraft (Action Pajaro Valley Plan)", Oct. 2000.
22. Earles, Jim. "Balancing Solution for Pajaro Valley Overdraft (Gardiner Local Supply Plan) Preliminary Construction Cost Estimate", February 2001.
23. Earles, Jim. "PVWMA BMP Recommended Project Preliminary Construction Cost Estimate" Dec. 2000.

24. Environmental Science Associates, “CVP Water Supply Contract Assignment from Mercy Springs Water District (Contract No. 14-06-200-3365A) to Pajaro Valley Water Management Agency Environmental Impact Report”, November 6, 1998.
25. Environmental Science Associates, “Pajaro Valley Water Management Agency Local Water Supply and Distribution Environmental Impact Report”, May 7, 1999.
26. Feeney, Martin, “Personal Communication Letter: PVWMA Supplemental Wells/Injection Wells Water Quality Study – College Lake Injection Source Water Assessment/Treatment – Preliminary Findings”, July 2001.
27. Feeney, Martin, David Friedland, and Chris Clark. “PVWMA Policy Analysis: Water Well Construction, Destruction and Replacement, Regulatory Processes,” March 1999
28. Hanson, Randy, “Preliminary Draft – Groundwater/Surface Water Flow and Water Supply Options in the Pajaro Valley, Santa Cruz and Monterey Counties, California,” November 1999.
29. John Carollo Engineers, “City of Watsonville Reclamation Feasibility Report”, December 1994.
30. Jones & Stokes, “Pajaro Valley Water Management Agency State of the Basin Report”, (Final Draft) December 17, 2000.
31. King, Kenneth B., P.E., “Evaluation of Collage Lake and Bolsa de San Cayetano Projects”, January 2000.
32. Montgomery Watson/AT Associates, “PVIGSM Technical Memoranda,” 1999-2000.
33. Montgomery Watson, “Harkins Slough Construction Design Criteria”, March 2000.
34. Montgomery Watson, “Harkins Slough Design Drawing”, March 2000.
35. Montgomery Watson, “Harkins Slough Design Criteria and Facilities Layout”, October 1999.
36. Montgomery Watson, “Harkins Slough Project Specification”, 2000.
37. Montgomery Watson, “Operational Conflicts for College Lake System and Suggested Conservation Measures to Protect Steelhead” March 1999.
38. Montgomery Watson, “Pajaro Valley Water Management Agency Basin Management Plan”, Nov. 1993.
39. Montgomery Watson, “Pajaro Valley Water Management Agency Water Supply Project Summary Report”, May 19, 1998.
40. Montgomery, James M., “BMP Preliminary Analysis, Pajaro Valley Water Management and Augmentation Study”, January 1990.
41. Montgomery, James M., “Historical and Future Water Use, Pajaro Valley Water Management and Augmentation Study”, July 1990.
42. Montgomery, James M., “Pajaro Valley Groundwater - Surface Water Model Update, Draft”, February 1993.
43. Montgomery, James M., “Pajaro Valley Water Augmentation Study, Preliminary Supplemental Water Source Analysis”, October 1990.
44. Montgomery, James M., “Pajaro Valley Water Management and Augmentation Study, Pajaro Valley Hydrologic and Water Quality Model”, August 1990.
45. Montgomery, James M., “Pajaro Valley Water Management Pajaro Valley Water Augmentation Study, Preliminary Supplemental Water Source Analysis”, October 1990.

46. Montgomery, James M., “Screening of Water Supply Elements, Pajaro Valley Water Management and Augmentation Study”, November 1989.
47. Montgomery, James M., “Water Conservation Measures, Pajaro Valley Water Management and Augmentation Study”, January 1990.
48. Montgomery, James M., “Water Quality Enhancement Element, Pajaro Valley Water Management and Augmentation Study”, January 1990.
49. Pajaro Valley Water Management Agency. “State of the Basin Report”, April 2001.
50. Peavy, Rowe, and Tchobanoglous. Environmental Engineering. New York, 1985.
51. Questa Engineering Corporation, “Water Resources Management Plan for Watsonville Slough System Santa Cruz County”, prepared for the Association of Monterey Bay Area of Governments, November 6, 1995.
52. Raines, Melton and Carella, “Draft Local Water Supply Alternatives Feasibility Study”, December 1999.
53. Raines, Melton and Carella, “Draft Local-Import Water Supply Alternatives Evaluation”, May 2001.
54. Raines, Melton and Carella, “Draft Local-Only Water Supply Alternatives Evaluation”, May 2001.
55. Raines, Melton and Carella, “Pumping Cost Evaluation”, May 2001.
56. Raines, Melton and Carella, “PVWMA Basin Management Plan 2000”, May 2000.
57. Raines, Melton and Carella, “Recycled Water Treatment Alternatives Report”, March 2001.
58. Regional Water Quality Control Board, “Central Coast Region Basin Plan”, September 1994.
59. Santa Clara Valley Water District, “Integrated Water Resources Plan”, June 1999.
60. University of California Cooperative Extension, “Pajaro Valley Irrigation Project”, June 19.
61. U.S. Bureau of Reclamation, San Felipe website: http://dataweb.usbr.gov/html/sanfelipe.html#general.
62. U.S. Census Bureau, http://www.census.gov.
63. U.S. Department of Interior, Bureau of Reclamation, “Final Environmental Impact Statement (FEIS) for the San Felipe Division”, March 8, 1976.
64. U.S. Department of Interior, Bureau of Reclamation, “Plan of Study, Pajaro Valley Water Augmentation Study, Central Valley Project, San Felipe Division Watsonville Subarea”, May 1992.
65. U.S. Department of Interior, Bureau of Reclamation, http://dataweb.usbr.gov/html/sanfelipe.html, June 2001.
66. U.S. Department of Interior, Bureau of Reclamation, “Watsonville Subarea, San Felipe Division Central Valley Project”, September 1993.
67. U.S. Department of Interior, Bureau of Reclamation, http://www.usbr.gov/tcg/guidelines/, November 2001.
68. U.S. Department of Water Resources. DWR Bulletins 74-81 “Water Well Standards: State of California,” and 74-90, “California Well Standards,” DATE
69. U.S. Environmental Protection Agency (EPA), “Consumer Factsheet on Nitrates/ Nitrites,” http://www.epa.gov/safewater/dwh/c-ioc/nitrates.html.

70. U.S. Geological Survey, “Draft Ground-Water/Surface-Water Flow and Water Supply Options in the Pajaro Valley, Santa Cruz and Monterey Counties, California”, 1999.

71. U.S. Geological Survey, “Seawater intrusion, ground water pumpage, ground-water yield, and artificial recharge of the Pajaro Valley area, Santa Cruz and Monterey Counties, California,” 1974.

72. U.S. Geological Survey, “Water Resources Investigations Report 87-4281 – Geohydrology and Mathematical Simulation of the Pajaro Valley Aquifer System, Santa Cruz and Monterey Counties, California”, prepared in cooperation with the Santa Cruz County Flood Control and Water Conservation District, 1988.

73. U.S. Geological Survey website, http://www.usgs.gov.