Chapter 6

Watershed Salt Management Monitoring Program

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6.1 Introduction

This chapter describes the Salt Management Monitoring Program (SMMP), an augmentation of existing Zone 7 monitoring efforts designed to track and quantify new salt loading within the watershed. The SMMP was also designed to comply with the requirements of the Master Water Recycling permit, Regional Board Order No. 93-159, issued jointly to Zone 7, the City of Livermore, and Dublin San Ramon Services District.

The Master Permit states "The permittees shall, pending development of a valley-wide Salt Management Plan, initiate an interim program to further characterize the groundwater basin with particular emphasis on monitoring potential impacts of Phase I projects on TDS concentration gradients throughout the basin. The program may make use of existing data, existing groundwater monitoring wells, monitoring programs for specific reuse sites, or additional data collection as may be necessary. It further states, "The Salt Management Plan shall include a comprehensive groundwater monitoring program. Gathering of data under the monitoring program shall serve three objectives: 1) Evaluation of effects of each project on local groundwater, 2) Evaluating overall trends in groundwater quality throughout the basin and monitoring any effects of water recycling programs on basin-wide groundwater quality, and 3) Enhancing understanding of the hydrogeology of the basin."

Zone 7 currently has extensive surface and groundwater monitoring programs in place with sites primarily located above the Main Basin. The primary purpose of the SMMP is to augment those monitoring programs so that the effects of new salt sources throughout the watershed on the groundwater basin may be estimated. New sources of salt may include additional irrigation associated with new urban and agricultural development, recycled water "retrofit" irrigation projects, and recycled water groundwater recharge projects. The SMMP also includes new monitoring wells to help investigate and better quantify the amount and quality of subsurface flow entering the Main Basin from perimeter areas and fringe sub-basins.

Following is a description of the near-term SMP monitoring program and related background material:

- A summary of the existing surface and groundwater monitoring programs,

- A brief description of the watershed approach taken to characterize existing and new salt loading,
- A description of future monitoring for recycled water recharge and irrigation projects, and
- A summary, as needed, of the annual review process for implementing additional monitoring (based on the actual new development in the watershed).

The estimated costs for the additional watershed monitoring associated with the near-term SMP is included in Section 6.5.

6.2 Existing Monitoring Programs

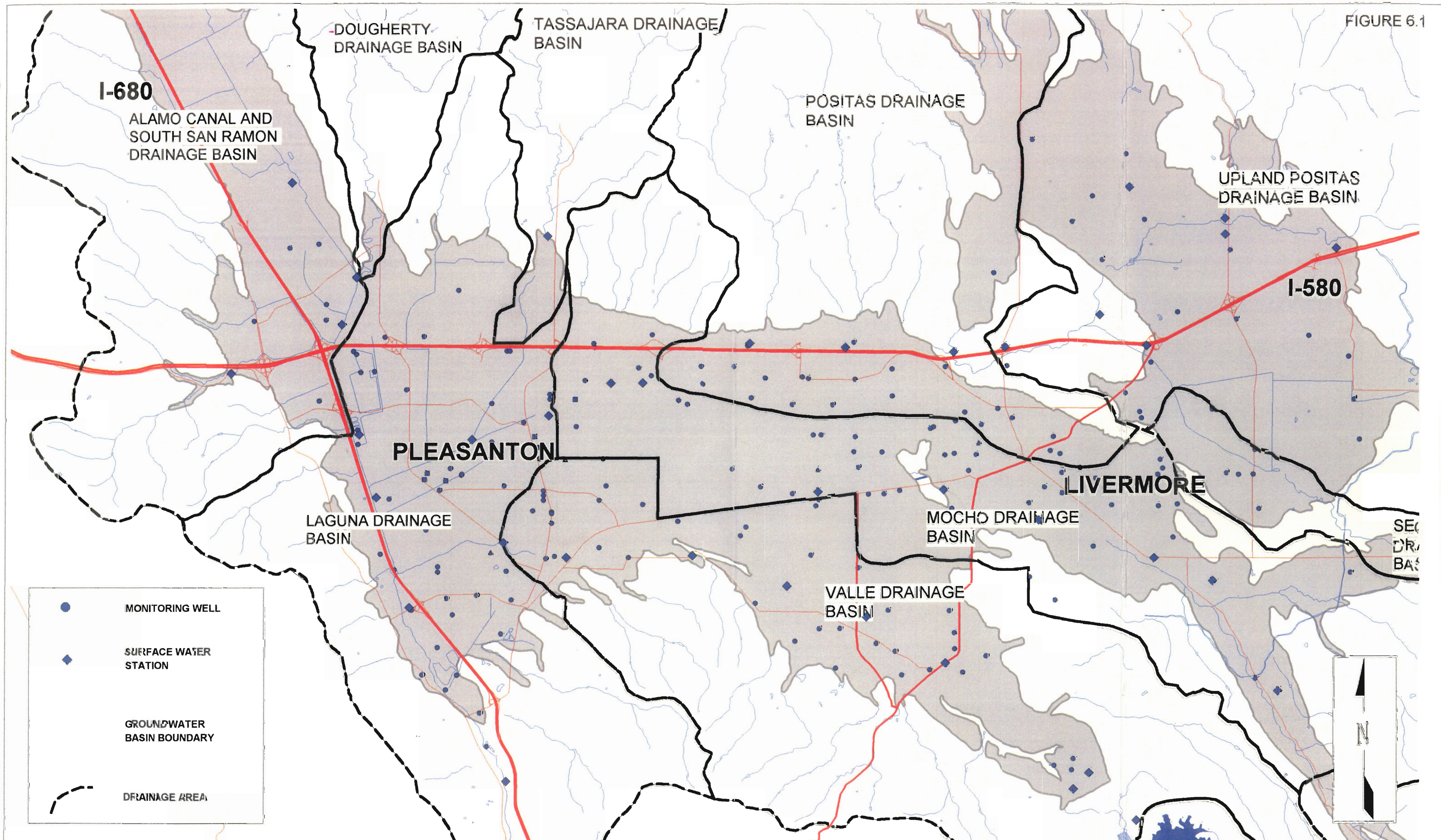
Zone 7 currently conducts extensive groundwater, surface water, and climatological monitoring programs (Reference K). These programs collect groundwater level and quality data, stream flow and water quality data, and rainfall and evaporation data, respectively. Chapter 4 contains a summary of historic water quality data collected through these programs. The existing surface and groundwater programs are designed primarily to help manage the hydrologic inventory in the main groundwater basin. However, the programs also serve to help Zone 7 protect and operate the groundwater basin and to maintain Zone 7's "water rights" for the Arroyo Valle. Figure 6.1 is a map of existing surface and groundwater monitoring sites.

Water quality and quantity data are collected and used to estimate the annual salt loading to the Main Basin. One long-standing groundwater monitoring program/project exists to monitor the effects of irrigation with recycled wastewater at Livermore's Las Positas Golf Course. Another project involves monitoring to establish baseline conditions at DSRSD's proposed Clean Water Revival groundwater injection project location. Additional information on these two projects is provided in Section 6.6. Chapter 5 describes the salt loading calculations used for the Main Basin determinations and presents the historic results.

Existing Groundwater Monitoring

Groundwater quality and level data are collected from a network of approximately 200 wells at regular intervals (monthly, quarterly, semi-annually, or annually). The Zone 7 groundwater-monitoring network for WY 1997 is shown in Figure 6.1. Zone 7, the City of Pleasanton Water Department, or California Water Service Company take groundwater level measurements in these "network" wells. The data are incorporated into Zone 7's groundwater level database.

Zone 7 collects groundwater quality samples from the network wells and submits them to Zone 7's water quality laboratory for analysis. In some cases, the City of Pleasanton and DSRSD sample their wells and provide the analytical results to Zone 7. Generally, wells



ZONE 7 WATER AGENCY 5997 PARKSIDE DRIVE PLEASANTON CA 94588	DRAWN GERALD GATES DESIGNED GERALD GATES CHECKED DAVID LUNN APPROVED	WATER RESOURCES ENGINEERING *1997 SURFACE AND GROUNDWATER MONITORING SITES*	SCALE 1" = 1 MILE DATE 16 APRIL 1998 FILE NO. B-151 | smp\PROGRAM.WOR

inside the main groundwater basin are sampled annually and wells outside the Main Basin are sampled semi-annually. All major municipal wells belonging to Zone 7, California Water Service, and the City of Pleasanton are sampled at least annually. The samples sent to the Zone 7 laboratory are analyzed for "major ions" (i.e., Ca, Mg, Na, K, HCO3, SO4, Cl, NO3, SiO2), boron, manganese, arsenic, electrical conductivity, pH, TDS, alkalinity and hardness.

Zone 7 prepares five types of reports during each water year:

1) An annual program design report outlining the planned well monitoring work for the upcoming water-year;
2) A monthly groundwater level report which exhibits hydrographs of all wells that are measured monthly;
3) A monthly groundwater quality report of laboratory results from the previous month's analyses;
4) An annual report summarizing the work performed during the year and the current groundwater conditions/trends; and
5) Annual "data reports" consisting of up-to-date hydrographs, hydrochemographs, and a print-out of all major mineral analysis results for each program and former program well.

In addition, groundwater contour maps are prepared each spring and fall to show regional groundwater levels and gradients within each basin.

Existing Surface Water Monitoring

Zone 7 uses a network of 47 recorder, metering, and staff gage sites to monitor the quality and quantity of surface water recharging the Main Basin and leaving the valley. This network characterizes the flow and water quality in all major tributaries of the watershed. The program emphasis is on base flow water quality since this is most representative of stream flow recharging the groundwater basin.

Daily stream flow data are collected from ten recorder stations that provide continuous records of daily stream flow. Water samples from the ten stream recorder stations are field tested monthly for electrical conductivity and are analyzed annually for major mineral constituents. In addition, samples are collected from two of the stations quarterly and analyzed for major mineral content as required by Zone 7's Arroyo Valle 'water rights.' Two stations also have continuous conductivity monitors. The focus of the effort is on characterizing dry season base flow water quality and quantity. Five valley streams are studied in a synoptic program (i.e., where all sites are measured within a short period of time) to monitor groundwater and surface water exchanges. Variations in flow from station to station generally represent groundwater recharge or rising water.

Two types of routine surface water reports are prepared during the water year. The monthly surface water report includes a summary of stream flows, averaged and recorded daily, a tabulation of stream conductivity, and a summary of synoptic measurements. The annual report documents the program and presents all the finalized data collected during the water year.

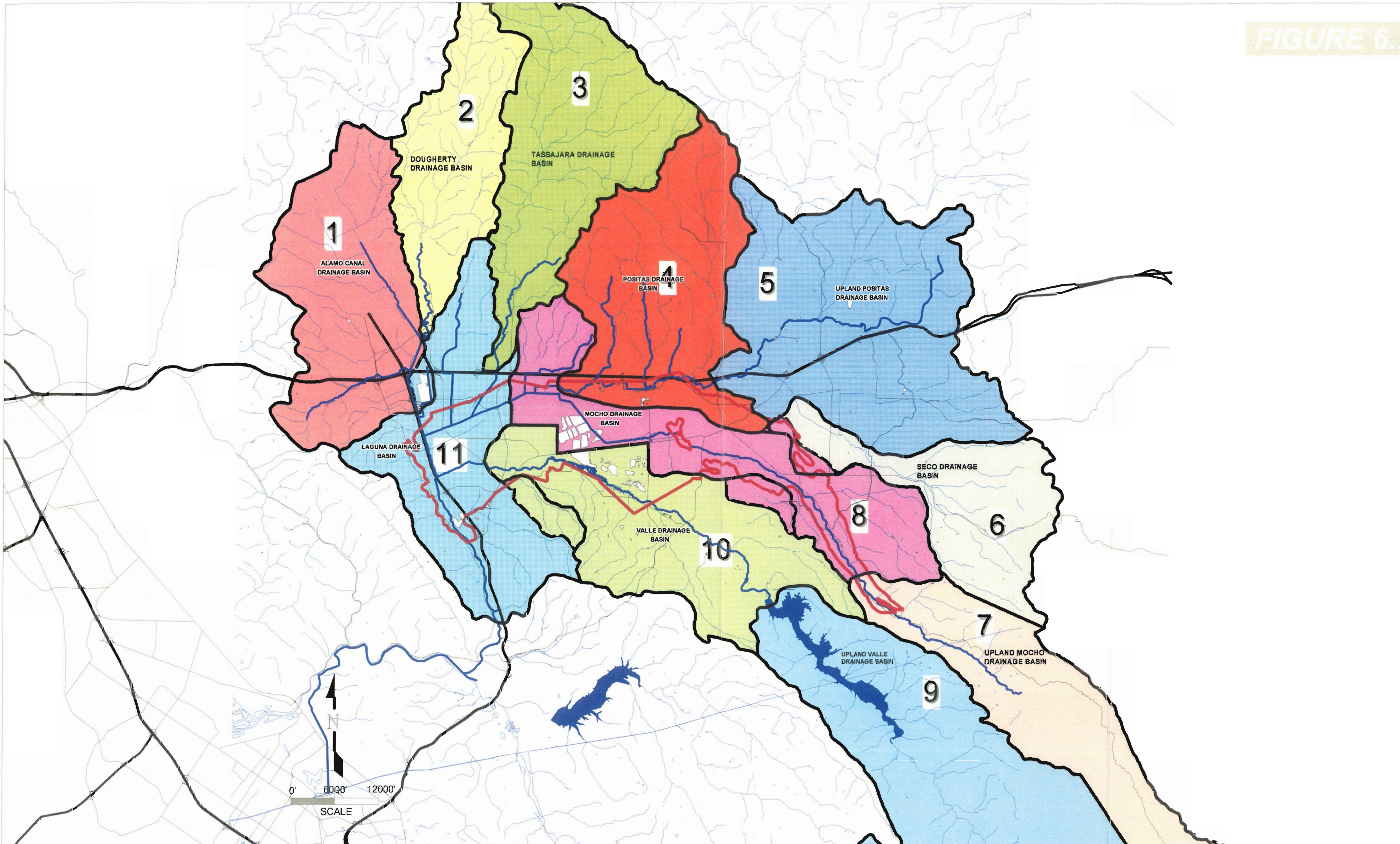
6.3 Watershed Approach to Characterize Existing and Expected New Salt Loading

As previously stated, the existing monitoring programs focus on water quality and quantity in the main groundwater basin of the watershed. The purpose of the SMMP is to augment those programs so that the total mass of salt moving in and out the watershed may be accounted for. For the purpose of salt management, salt sources in the watershed are considered to be either existing or future. Many future salt sources in the watershed are linked to irrigation associated with new urban and agricultural development, much of which will be located outside of the Main Basin. Accordingly, the SMMP focuses on enhancing the understanding of the hydrogeology of the fringe/main basin transition areas and recharge areas where the salt sources directly impact the Main Basin and/or flow out of the valley to Alameda Creek.

In developing this SMMP, the watershed was divided into eleven drainage basins (Figure 6.2). Each of those drainage basins was further subdivided into sub-drainage basins that represent unique characteristics with respect to ground and surface water. In Reference G, each of the drainage basins and sub-drainage basins are described and mapped. Key issues within each drainage basin are addressed with respect to future salt loading and future development. Reference G also contains examples of data reporting forms and a summary of background TDS, hardness, nitrate, and chloride water quality data for existing surface and groundwater stations in the SMMP network.

Reference G contains an evaluation of the wells and stations that might be associated with the SMMP at theoretical "full build-out" conditions to accurately track salt loading impacts from the associated development. This conceptual "ultimate" monitoring network was developed primarily to provide an estimate of the upper limit scope of the program if and when "full build-out" were to occur and all proposed monitoring sites turned out to be required to accurately track salt loading impacts. A more abbreviated program, perhaps operating only for a limited period of time, is believed to be adequate to characterize salt loading from the various sub-watersheds. As discussed below, the timing and intensity of future monitoring efforts will be linked to the relative magnitude of each sub-watershed's contribution to the overall Main Basin salt loading.

FIGURE 6.2



ZONE 7 WATER AGENCY
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WATER RESOURCES ENGINEERING
LIVERMORE-AMADOR VALLEY WATERSHEDS

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6.4 Recommended Near-Term Salt Management Monitoring Program

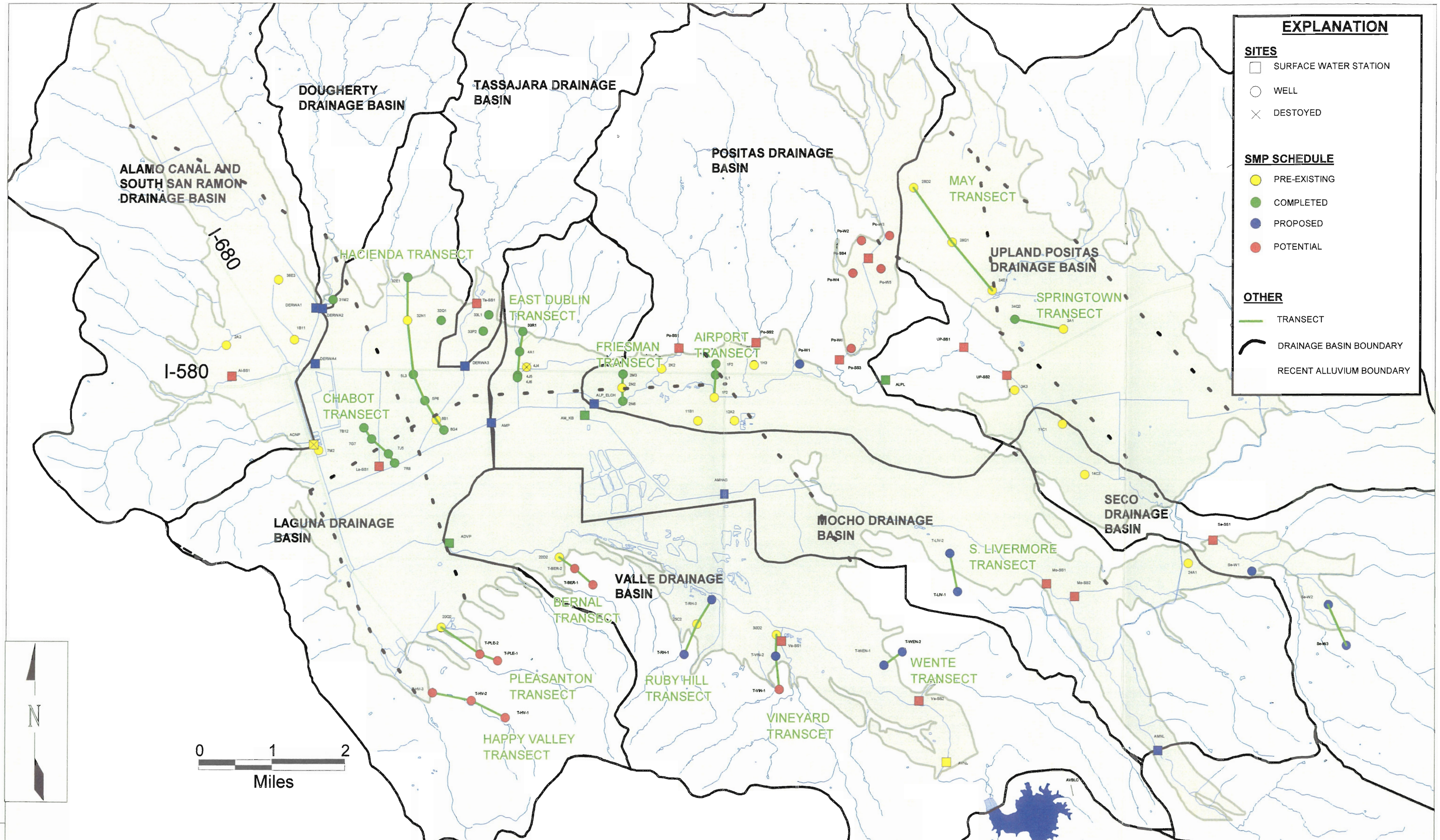
The emphasis of the near-term SMMP is to quantify salt loading in the watershed with particular attention paid to new sources of salt and to areas of geologic uncertainty. Accurately quantifying the salt loading in the watershed involves characterizing the groundwater basin with respect to mineral concentration gradients throughout the basin, evaluating the effects of future recycled water projects on local groundwater, evaluating overall trends in groundwater quality throughout the basin, and enhancing the understanding of hydrogeology of the basin.

In general, the strategy behind the near-term monitoring program is to immediately collect sufficient data to document baseline conditions, and to add additional groundwater monitoring sites as necessary to document the impacts of new sources of salt to the watershed. To realize this strategy, existing wells are taken advantage of immediately and existing surface water monitoring stations will be upgraded to collect continuous flow and conductance data. As development occurs and/or irrigation projects come on-line, new wells will be added as appropriate to the monitoring network.

This SMP program was implemented in 2000 and much of the previously proposed work has already been completed since then. Therefore, the components of the SMP are describe herein as:

- **Pre-existing** – Items that already existed prior to the implementation of the SMP Program.
- **Completed** – Items that were proposed in the original Draft SMP and are already completed.
- **Proposed** – Items proposed in the original Draft SMP that still are to be completed, and
- **Potential** – Possible items to be completed in the future, depending on effectiveness of Pre-existing, completed, and proposed items.

A summary of the monitoring sites along with a brief rationale for including each in the monitoring program is given in Table 6.1. The network of SMP wells corresponds to areas of hydrogeologic uncertainty and areas in which near-term future development could alter current salt loading characteristics in the watershed. The primary purpose of the proposed surface and groundwater monitoring is to establish baseline conditions throughout the watershed so that the impacts of future development and irrigation may be accurately assessed. Figure 6.3 and Table 6.1 show that, in general, the recommended new wells have been placed in "transects" incorporating existing wells where available. The primary purpose of the transects is to help quantify both current and future salt migration with respect to subsurface flow in areas of new salt loading and/or hydrogeologic uncertainty (see basin connectivity discussion in Section 3.3). When complete, the SMP monitoring network will include at least 56 monitoring wells and 11 surface water stations (15 including the proposed DERWA stations).



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SALT MANAGEMENT PLAN
SURFACE WATER AND GROUNDWATER MONITORING SITES

DATE	Mar 3, 2004
FIGURE	6.3

TABLE 6.1
Summary of Salt Management Monitoring Program

	Drainage Basin	Type	#	Map ID	SMP ID	Database ID	Scope/Notes	Rationale	Status
Pre-existing	01-Alamo	W	1	1B11	1B11	3S/1W 1B 11	Pre-Existing Well	GWQ, geology, & rising water	Pre-existing
	01-Alamo	W	1	2A2	2A2	3S/1W 2A 2	Pre-Existing Well	GWQ, geology, & rising water	Pre-existing
	01-Alamo	W	1	36E3	36E3	2S/1W 36E 3	Pre-Existing Well	GWQ, geology, & rising water	Pre-existing
	01-Alamo	W	1	7M2	7M2	3S/1E 7M 2	Pre-Existing Well	GWQ, geology, & rising water	Pre-existing
	04-Positas	W	1	11B1	11B1	3S/1E 11B 1	Pre-Existing Well	GWQ entering main basin, geology	Pre-existing
	04-Positas	W	1	12A2	12A2	3S/1E 12A 2	Pre-Existing Well	GWQ entering main basin, geology	Pre-existing
	04-Positas	W	1	1H3	1H3	3S/1E 1H 3	Pre-Existing Well	GWQ, geology	Pre-existing
	04-Positas	W	1	2K2	2K2	3S/1E 2K 2	Pre-Existing Well	Subsurface flow	Pre-existing
	04-Positas	W	1	1P2	T-AIR-3	3S/1E 1P 2	Pre-Existing Well	Airport Transect (T-AIR), GWQ	Pre-existing
	04-Positas	W	1	2N2	T-FRI-2	3S/1E 2N 2	Pre-Existing Well	Friesman Transect (T-FRI), GWQ	Pre-existing
	05-Upland positas	W	1	3K3	3K3	3S/2E 3K3	Pre-Existing Well	GWQ, geology, & rising water	Pre-existing
	05-Upland positas	W	1	28D2	T-MAY-1	2S/2E 28D 2	Pre-Existing Well	May Transect (T-MAY)	Pre-existing
	05-Upland positas	W	1	28Q1	T-MAY-2	2S/2E 28Q 1	Pre-Existing Well	May Transect (T-MAY)	Pre-existing
	05-Upland positas	W	1	34E1	T-MAY-3	2S/2E 34E1	Pre-Existing Well	May Transect (T-MAY)	Pre-existing
	05-Upland positas	W	1	3A1	T-SPR-1	3S/2E 3A 1	Pre-Existing Well	Springtown Transect (T-SPR)	Pre-existing
	06-Seco	W	1	11C1	11C1	3S/2E 11C 1	Pre-Existing Well	GWQ, geology	Pre-existing
	06-Seco	W	1	14C3	14C3	3S/2E 14C3	Pre-Existing Well	GWQ, geology	Pre-existing
	08-Mocho	W	1	4J4	4J4	3S/1E 4J 4	Pre-Existing Well	GWQ. Well to be destroyed	Destroyed 2004
	08-Mocho	W	1	24A1	24A1	3S/2E 24A 1	Pre-Existing Well	GWQ & geology of eastern WS	Pre-existing
	10-Valle	W	1	22D2	T-BER-3	3S/1E 22D 2	Pre-Existing Well	Bernal Transect (T-BER), GWQ	Pre-existing
	10-Valle	W	1	25C2	T-RH-2	3S/1E 25C2	Pre-Existing Well	Ruby Hill Transect (T-RH)	Pre-existing
	10-Valle	W	1	30D2	T-VIN-3	3S/2E 30D 2	Pre-Existing Well	Vineyard Transect (T-VIN), GWQ	Pre-existing
	11-Laguna	W	1	32N1	T-HAC-2	2S/1E 32N 1	Pre-Existing Well	Hacienda Transect (T-HAC)	Pre-existing
	11-Laguna	W	1	8B1	T-HAC-5	3S/1E 8B 1	Pre-Existing Well	Hacienda Transect (T-HAC)	Pre-existing
	11-Laguna	W	1	20Q2	T-PLE-3	3S/1E 20Q 2	Pre-Existing Well	Pleasanton Transect (T-PLE), flow	Pre-existing
	01-Alamo	SS	1	ACNP	ACNP	ACNP	AC Near Pleasanton	Flow into ADLL from AC	Abandoned
	09-Upland Valle	SS	1	AVBLC	AVBLC	AVBLC	AV Below Lang Canyon	SW flow below Lang Canyon	Pre-existing
	10-Valle	SS	1	AVNL	AVNL	AVNL	AV near Livermore	SW flow from lake Del Valle	Pre-existing
	11-Laguna	SS	1	ADLLP	ADLLP	ADLLP	ADLL near Pleasanton	SWQ leaving Basin	Pre-existing
Completed for SMP	02-Dougherty	W	1	31M2	31M2	2S/1E 31M 2	Well for SMP	GWQ and GW flow	Drilled 2000
	03-Tassajara	W	1	33L1	33L1	2S/1E 33L 1	Well for SMP	GWQ	Drilled 2000
	03-Tassajara	W	1	33P2	33P2	2S/1E 33P 2	Well for SMP	GWQ	Drilled 2000
	04-Positas	W	1	1F2	T-AIR-1	3S/1E 1F 2	Well for SMP	Airport Transect (T-AIR), GWQ	Drilled 2000
	04-Positas	W	1	1L1	T-AIR-2	3S/1E 1L 1	Well for SMP	Airport Transect (T-AIR), GWQ	Drilled 2000
	04-Positas	W	1	2M3	T-FRI-1	3S/1E 2M 3	Well for SMP	Friesman Transect (T-FRI),	Drilled 2000
	04-Positas	W	1	2N6	T-FRI-3	3S/1E 2N 6	Well for SMP	Friesman Transect (T-FRI), GWQ	Drilled 2000
	05-Upland positas	W	1	34Q2	T-SPR-2	2S/2E 34Q 2	Well for SMP	Springtown Transect (T-SPR)	Drilled 2001
	08-Mocho	W	1	33R1	T-DUB-1	2S/1E 33R 1	Well for SMP	East Dublin Transect (T-DUB)	Drilled 2001
	08-Mocho	W	1	4A1	T-DUB-2	3S/1E 4A 1	Well for SMP	East Dublin Transect (T-DUB)	Drilled 2001
	08-Mocho	W	1	4J5	T-DUB-3	3S/1E 4J 5	Well for SMP	East Dublin Transect (T-DUB)	Drilled 2001
	08-Mocho	W	1	4J6	T-DUB-4	3S/1E 4J 6	Well for SMP	East Dublin Transect (T-DUB)	Drilled 2001
	11-Laguna	W	1	7B12	T-CHA-1	3S/1E 7B12	Well for SMP	Chabot Transect (T-CHA)	Drilled 2002
	11-Laguna	W	1	7G7	T-CHA-2	3S/1E 7G 7	Well for SMP	Chabot Transect (T-CHA)	Drilled 2002
	11-Laguna	W	1	7J5	T-CHA-3	3S/1E 7J 5	Well for SMP	Chabot Transect (T-CHA)	Drilled 2002
	11-Laguna	W	1	7R8	T-CHA-4	3S/1E 7R 8	Well for SMP	Chabot Transect (T-CHA)	Drilled 2003
	11-Laguna	W	1	32Q1	32Q1	2S/1E 32Q 1	Well for SMP	GWQ	Drilled 2000
	11-Laguna	W	1	32E1	T-HAC-1	2S/1E 32E 1	Well for SMP	Hacienda Transect (T-HAC)	Drilled 2000
	11-Laguna	W	1	5L3	T-HAC-3	3S/1E 5L 3	Well for SMP	Hacienda Transect (T-HAC)	Drilled 2001
	11-Laguna	W	1	5P6	T-HAC-4	3S/1E 5P 6	Well for SMP	Hacienda Transect (T-HAC)	Drilled 2000
	11-Laguna	W	1	8G4	T-HAC-6	3S/1E 8G 4	Well for SMP	Hacienda Transect (T-HAC)	Drilled 2001
	05-Upland positas	SS	1	ALPL	ALPL	ALPL	Upgrade-ALP at Livermore	SWQ in ALP entering main basin	Upgraded 2000
	08-Mocho	SS	1	AM_KB	AM_KB	AM_KB	Upgrade-AM at Kaiser Bridge	SWQ recharging West Amador	Upgraded 2001
	10-Valle	SS	1	ADVP	ADVP	ADVP	Upgrade-AV at Pleasanton	SWQ leaving AV, entering ADLL	Upgraded 2000
Proposed	04-Positas	W	1	Po-W1			Proposed Well for SMP	GWQ edge of DB	Proposed
	06-Seco	W	3	Se-W1 to 3			3 Proposed new wells	If development occurs	Proposed
	08-Mocho	W	1	T-LIV-1			Proposed Well for SMP	South Livermore Transect	Proposed
	08-Mocho	W	1	T-LIV-2			Proposed Well for SMP	South Livermore Transect	Proposed
	10-Valle	W	1	T-RH-1			Proposed Well for SMP	Ruby Hill Transect (T-RH)	Proposed
	10-Valle	W	1	T-RH-3			Proposed Well for SMP	Ruby Hill Transect (T-RH)	Proposed
	10-Valle	W	1	T-VIN-2			Proposed Well for SMP	Vineyard Transect (T-VIN)	Proposed
	10-Valle	W	1	T-WEN-1			Proposed Well for SMP	Wente Transect (T-WEN)	Proposed
	10-Valle	W	1	T-WEN-2			Proposed Well for SMP	Wente Transect (T-WEN)	Proposed
	01-Alamo	SS	1	DERWA1			Proposed - SSRC	Flow from SSRC	Proposed
	02-Dougherty	SS	1	DERWA2			Proposed - AC N. of 680	Flow from Dougherty DB into ADLL	Proposed
	03-Tassajara	SS	1	DERWA3			Proposed - Tassajara Creek	SWQ from Tassajara DB	Proposed
	04-Positas	SS	1	ALP_ELCH	ALP_ELCH	ALP_ELCH	Upgrade-ALP at El Charro Rd	SWQ from ALP to AM and ADLL	To be upgraded
	07-Upland Mocho	SS	1	AMNL	AMNL	AMNL	Upgrade-AM Near Livermore	SWQ, AM Near Livermore	To be upgraded
	08-Mocho	SS	1	AMHAG	AMHAG	AMHAG	Upgrade-AM at Livermore	SWQ in AM over main basin	To be upgraded
	08-Mocho	SS	1	AMP	AMP	AMP	Upgrade-AM near Pleasanton	SWQ in AM entering ADLL	To be upgraded
	11-Laguna	SS	1	DERWA4			Proposed - Dublin Sports Park	Inflow into Trench Line G-1-1	Proposed
Potential	04-Positas	W	5	Po-W2 to 6			5 Proposed wells		Potential
	10-Valle	W	1	T-BER-1			Proposed Well for Transect	Bernal Transect (T-BER)	Potential
	10-Valle	W	1	T-BER-2			Proposed Well for Transect	Bernal Transect (T-BER)	Potential
	10-Valle	W	1	T-VIN-1			Proposed Well for Transect	Vineyard Transect (T-VIN)	Potential
	11-Laguna	W	1	T-HV-1			Proposed Well for Transect	Happy Valley Transect (T-HV)	Potential
	11-Laguna	W	1	T-HV-2			Proposed Well for Transect	Happy Valley Transect (T-HV)	Potential
	11-Laguna	W	1	T-HV-3			Proposed Well for Transect	Happy Valley Transect (T-HV)	Potential
	11-Laguna	W	1	T-PLE-1			Proposed Well for Transect	Pleasanton Transect (T-PLE), flow	Potential
	11-Laguna	W	1	T-PLE-2			Proposed Well for Transect	Pleasanton Transect (T-PLE), flow	Potential
	01-Alamo	SS	1	Al-SS1			1 Proposed surface station		Potential
	03-Tassajara	SS	1	Ta-SS1			1 Proposed surface station		Potential
	04-Positas	SS	4	Po-SS1 to 4			4 Proposed surface stations		Potential
	05-Upland positas	SS	2	UP-SS1 to 2			2 Proposed surface stations		Potential
	06-Seco	SS	1	Se-SS1			1 Proposed surface station		Potential
	08-Mocho	SS	2	Mo-SS1 to 2			2 Proposed surface stations		Potential
	10-Valle	SS	2	Va-SS 1 to 2			2 Proposed surface stations		Potential
	11-Laguna	SS	1	La-SS1			1 Proposed surface station		Potential

AC	Alamo Canal
ADLL	Arroyo de La Laguna
ALP	Arroyo Las Positas
AM	Arroyo Mocho
AV	Arroyo Valle
DB	Drainage Basin
DERWA	DSRSD, EBMUD Recycle Water Agency
SS	Surface Station
GW	Groundwater
GWQ	Groundwater quality
SMP	Salt Management Plan
SSRC	South San Ramon Creek
SW	Surface Water
SWQ	Surface Water Quality
WS	Watershed

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Pre-Existing Monitoring Network

Following is a description of the pre-existing monitoring wells and surface water monitoring stations that were monitored for salt management purposes.

1) Twenty-five pre-existing monitoring wells were included in the SMMP to track groundwater levels and quality. Well 3S/1E 4J 4, initially included in the SMP, was destroyed in February of 2004. The 24 remaining wells are in the following drainage basins:

   - **Alamo Canal-South San Ramon Creek** – To monitor salt loading;
   - **Positas** – To investigate geologic uncertainty and groundwater quality at the edge of the Main Basin;
   - **Upland Positas** – To investigate geologic uncertainty and high TDS groundwater. The May Transect will consist of three of these pre-existing wells;
   - **Seco** – To investigate fringe basin geologic uncertainty and groundwater quality;
   - **Mocho** – To investigate fringe basin geologic uncertainty and groundwater quality;
   - **Valle** – To characterize groundwater quality entering the Main Basin; and
   - **Laguna** – To characterize groundwater quality entering and leaving the Main Basin.

2) Four pre-existing surface water recorder stations (AVBLC, south of Del Valle Reservoir, is not shown on Figure 6.3) were included in the SMMP to track stream water flow and quality in two major waterways in the watershed (Arroyo Valle and Arroyo de La Laguna). One of these stations (ACNP – Alamo Canal near Pleasanton) has since been abandoned. Data from the ADLLP (Arroyo de la Laguna below Pleasanton) stream gage station is collected by the USGS.

Already Completed for SMMP

The following items were proposed in previous versions of the SMP and have already been completed as part of the SMMP:

1) Twenty-one new wells were drilled from 2000 to 2003 in the Dougherty, Tassajara, Positas, Upland Positas, Mocho, and Laguna Drainage Basins. Their purpose is to better quantify the baseline subsurface flow into the Main Basin from the Camp sub-basin, and the salt impacts from new development in East Dublin, Dougherty Valley, Tassajara Valley and the Triad area in Livermore. These wells will be used to identify the fringe basin aquifers, and, along with other wells along the aquifer flow path, to track subsurface flows and quality into the main basin.

- **Dougherty** - One well will be used to monitor groundwater quality and flow from the Dougherty Basin into the Laguna Basin.

- **Tassajara** - Two wells will be used to monitor the impacts of recycled water use at Emerald Glen Park in East Dublin.

- **Positas** - Four wells will be used to monitor groundwater flow and quality from the northern boundary of the watershed. These wells will complete the Friesman and Airport Transects.

- **Upland Positas** - One new well will be used to quantify subsurface salt migration due to development in the Springtown area. This well will complete the Springtown Transect.

- **Mocho** - Four wells will be used to monitor groundwater flow and quality from the northern boundary of the watershed. These wells will complete the East Dublin Transect.

- **Laguna** - Nine wells were drilled to quantify salt migration from the Dublin and Camp sub-basins to the Bernal and West Amador sub-basins. Four of these wells will complete the Hacienda Transect. Four will complete the Chabot Transect. One well (3S/1E 32Q 1) will monitor groundwater quality entering the northern portion of the main basin.

2) Three existing surface water monitoring stations were upgraded with the installation of automatic water quality monitoring equipment to monitor electrical conductivity, temperature, pH, and stream stage (water height).

   - **Upland Positas** - Arroyo Las Positas at Livermore (ALPL),

   - **Mocho** - Arroyo Mocho at Livermore (AMHAG), and

   - **Valle** - Arroyo Valle at Pleasanton (ADVP).

Proposed Monitoring Network

1) There are eleven new monitoring wells planned for the future. The majority of these wells are along the southern and eastern portions of the groundwater basin.

   - **Positas** - One new well is planned to quantify salt migration into the Main Basin from outlying areas and the fringe basins due to proposed development in North Livermore. It will be located where four sub-drainage basins come together.

   - **Seco** - Three new wells are planned to investigate groundwater flow and quality from the eastern portion of the groundwater basin.

- **Mocho** - Two new wells are proposed for the southern portion of the drainage basin. These wells will complete the South Livermore Transect.

- **Valle** - Five new wells are proposed. Four of these wells will complete the Wente and Ruby Hill Transects. One of these wells will be part of the Vineyard Transect. All are intended to help quantify groundwater flow and salt loading from the Livermore Uplands to the Main Basin, and in particular, the effects of irrigation projects, such as The Wente Vineyards golf course, Veterans Administration Hospital and Ruby Hills vineyards, on Main Basin recharge.

2) Four existing stations will be upgraded.

   - **Positas** - Arroyo Las Positas at El Charro (ALP_ELCH), recently relocated because of the realignment of a portion of the Arroyo Las Positas, will be upgraded with the installation of automatic water quality monitoring equipment for electrical conductivity, temperature, and pH.

   - **Upper Mocho** - Arroyo Mocho near Livermore (AMNL) will be upgraded with water quality monitoring and recording equipment.

   - **Mocho** - Arroyo Mocho at Kaiser Bridge (AM_KB, recently reinstalled because of the realignment of the Arroyo Mocho) will be upgraded with water quality monitoring and recording equipment. Arroyo Mocho near Pleasanton (AMNP) will also be upgraded with water quality monitoring and recording equipment.

3) Four new stream gaging stations will be constructed by DERWA and incorporated into the monitoring program following their completion. These are to be located at:

   - South San Ramon Creek,
   - Alamo Creek north of I-680,
   - The Dublin Sports Park, and
   - Lower Tassajara Creek.

Potential Monitoring Network

1) Potentially, there may be 13 additional wells. Five of these wells would complete the Pleasanton and Happy Valley Transects in the southern portion of the Laguna Drainage Basin. Another three would complete the Bernal and Vineyard Transects in the southern portion of the Valle Drainage Basin. Five wells would be located in the eastern portion of the Positas Drainage Basin.

2) Fourteen additional stream gages potentially may be installed. These would be installed if needed based on review of collected data to fill in "data gaps" and/or to provide baseline data relative to new development related salt loading sources.

Constituents to be Monitored

All wells and surface waters in the near-term monitoring program will be sampled and analyzed annually for "major ions" (i.e., Ca, Mg, Na, K, HCO3, SO4, Cl, NO3, SiO2), boron, manganese, selenium, chromium, arsenic, electrical conductivity, pH, TDS, alkalinity and hardness. As surface water monitoring stations are upgraded with automated water quality measuring instruments, electrical conductivity, temperature and pH will be recorded on a nearly continuous basis. Historic groundwater and surface water quality data from existing stations are summarized in Reference I.

6.5 Costs Associated with SMP Monitoring Program

Based on the monitoring program described above, a summary of the additional costs to implement the program is shown in Table 6.2. To develop that summary it was assumed that the capital cost for each additional well would be $5,000, new surface water stations would be $80,000 each, and recorder station upgrades would be $13,000 each. The laboratory costs are estimated at $300 per sample, and the estimated O&M labor to collect samples, maintain the stations, and produce the continuous record from the on-line instruments would be approximately 0.4 full-time equivalent (FTE) of an employee at $75,000/FTE/yr. The four proposed DERWA stations will be paid for by DERWA and their costs are not included in this table.

Table 6.2
Estimated Annual Costs
Salt Management Monitoring Program

	Monitoring Wells				Surface Water Stations					O&M	
Year	Existing	New	Capital Cost	Lab Cost	Existing	New	Upgrade	Capital Cost	Lab Costs	FTE	O&M Cost
Completed	24	21	$105,000	$13,500	3	0	3	$39,000	$900	0.4	$30,000
Proposed	45	11	$55,000	$16,800	7	4	4	$372,000	$3,300	0.4	$30,000
Potential	56	13	$65,000	$20,700	15	14	0	$1,120,000	$8,700	0.4	$30,000
Subtotal	24	45	$225,000	$51,000	3	18	7	$1,531,000	$12,900	1.2	$90,000

A summary of the total costs associated with the Salt Management monitoring program is shown in Table 6.3.

Table 6.3
Salt Management Monitoring Program
Estimated Total Costs

Year	Total Capital Cost	O&M Costs	Total Lab Cost	Total Cost
Completed	$144,000	$30,000	$14,400	$188,400
Proposed	$427,000	$30,000	$20,100	$477,100
Potential	$1,185,000	$30,000	$29,400	$1,244,400
Subtotal	$1,756,000	$90,000	$63,900	$1,909,900

6.6 Future Recycled and Untreated Water Use Related Monitoring

Future Demands

Zone 7 has compiled information from local municipalities on potential future untreated water demands as part of its water supply planning efforts (September 1999 Draft Integrated Water System Study Report, Water Transfer Associates). Figure 6.4 shows existing and future agricultural and non-agricultural demand areas (by code number) that could be served by various sources of untreated water including recycled water. Table 6.4 lists the individually coded demand areas by retailer service area. The largest potential future demand areas include development in Dougherty Valley, East Dublin, North Livermore (under comprehensive re-evaluation), plus increased South Livermore irrigated agriculture. Table 6.4 shows that the valley-wide untreated demand could increase from the existing 15,700 af/yr to as high as 37,300 af/yr.

The magnitude of gross salt loading from this level of development will depend on the TDS level in the sources of untreated water ultimately supplied. The source water projections shown in Table 6.4 represent one set of assumptions and are subject to change as projects evolve. Related work found that there was 34,000 af/yr of recycled water potentially available valley-wide, 18,000 af/yr of potential use currently identified by retailers, and potentially 16,000 af/yr available for other uses. More recycled water could conceivably be used than shown in Table 6.4 depending on institutional arrangements, quality requirements, cost, and other factors. The actual salt loading impacting the Main Basin from future untreated water irrigation will depend on project location relative to the Main Basin (see Section 11.2 map and description of relative percent impact zones) in addition to the untreated water supply TDS.

The near-term SMMP and potential future surface and groundwater monitoring stations described above and shown in Figure 6.3 are intended to track changes in salt loading at key junctures from best estimates of likely new development and new irrigation. It is not anticipated that most irrigation projects would require extensive additional individual groundwater monitoring. In new development there could very likely be a mixture of treated, untreated, and recycled water irrigation making it difficult, if not impossible, to track "recycled water" salt. The SMMP includes groundwater monitoring at a few

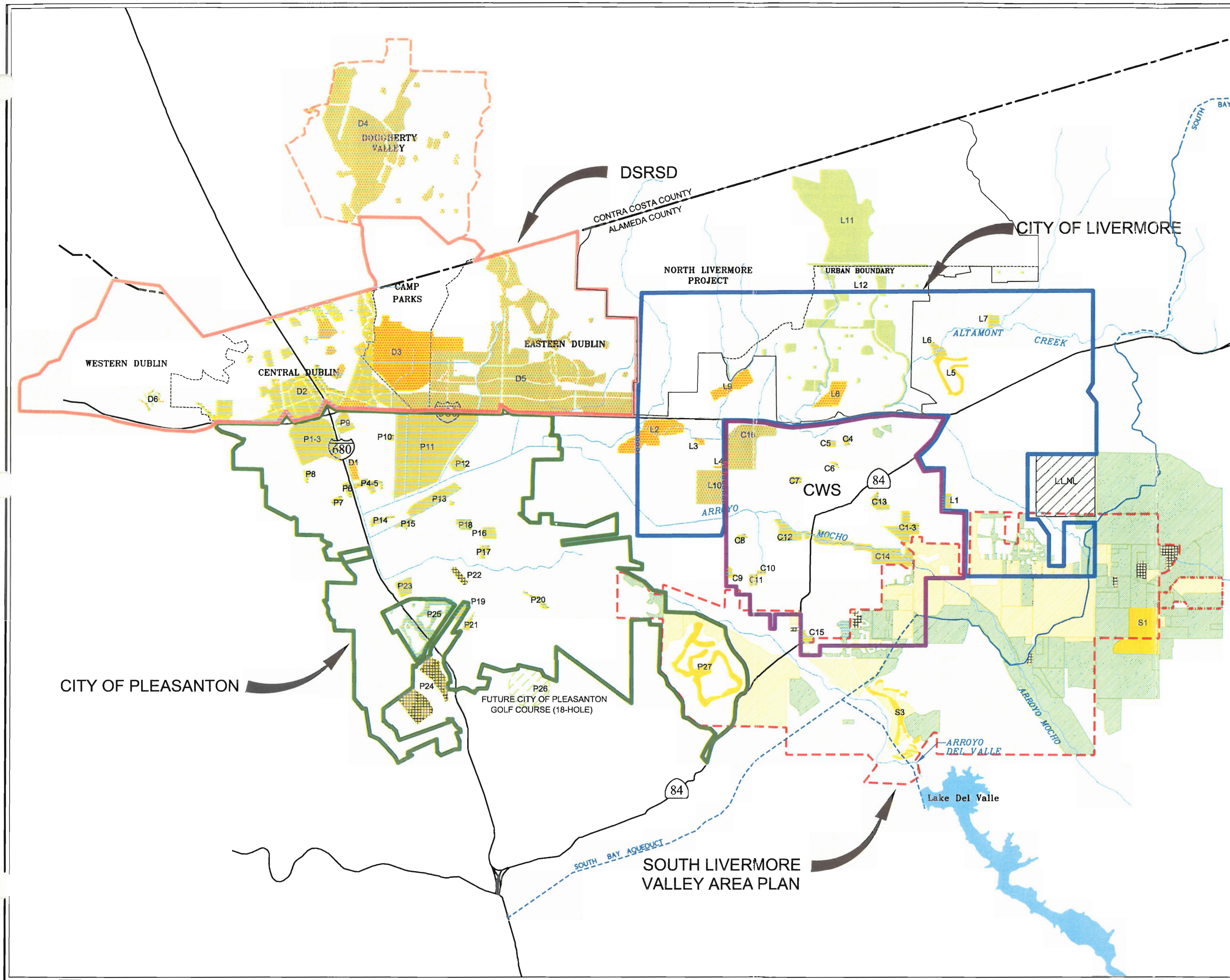


FIGURE 6.4

Zone 7 Water Agency Integrated Water System March 2000

PROPOSED WATER SUPPLIES TO SERVE EXISTING AND FUTURE UNTREATED WATER DEMANDS

N

0 4000 8000
SCALE IN FEET

NOTES:

1. SOURCES OF DATA:
   - CITY OF PLEASANTON RECYCLED WATER FEASIBILITY STUDY, ADMIN DRAFT REPORT, HYA & HYDROSCIENCE, INC., NOV 1998.
   - DSRSD DRAFT WATER MASTER PLAN, WYA, OCT 1999.
   - NORTH LIVERMORE PROJECT TECHNICAL MEMORANDA NO. 5-1,6,8,9, WYA, 1998.
   - ZONE 7 WATER SUPPLY PLANNING STUDY UPDATE, WTr, JAN 1999.
   - ZONE 7 MEMO VALLEY LAND USE, 1998 WY," OCT 1998.
   - PERSONAL COMMUNICATIONS WITH CITY OF LIVERMORE, CITY OF PLEASANTON, DSRSD, CWS AND MIKE GATZMAN, JUN-SEP 1999.

LEGEND:

- EXISTING UNTREATED WATER DEMAND AREA (NON-AGRICULTURAL)
- FUTURE UNTREATED WATER DEMAND AREA (NON-AGRICULTURAL)
- EXISTING UNTREATED WATER DEMAND AREA (AGRICULTURAL)
- FUTURE UNTREATED WATER DEMAND AREA (AGRICULTURAL)
- RECYCLED WATER
- PRIVATE GROUNDWATER
- ZONE 7 - TREATED WATER
- NO HATCH PATTERN: ZONE 7 - UNTREATED WATER

WTr
Water Transfer Associates

TABLE 6.4 Proposed Water Supply to Meet Existing and Future Untreated Water Demands

(Unless otherwise noted, data for this Table has been developed based on the sources of information listed at the bottom of the Table)

Retailer Service/Planning Area	Code (See Figure 1-2)	Untreated Water Demand Area (a)	Existing Water Demand (afa)	Future Water Demand (afa)	Source of Water (b) (as currently planned)	Comment
DSRSD	D1	DSRSD Wastewater Treatment Plant	6	6	Recycled	
	D2A	Central Dublin	790	790	Zone 7 - Treated	
	D2B	Central Dublin	260	260	Recycled	Demand currently on potable system; will be transitioned to recycled water system
	D3	Camp Parks	440	440	Recycled	Demand currently on potable system; will be transitioned to recycled water system
	D4	Dougherty Valley	0	1,520	Recycled	
	D5	East Dublin	0	2,385	Recycled	
	D6	Western Dublin	0	70	Recycled	
		Subtotal	1,500	5,400		
City of Pleasanton (includes adjacent areas)	P1	Stoneridge Mall	47	47	Zone 7 - Treated	
	P2	Stoneridge Drive	31	31	Zone 7 - Treated	
	P3	Stoneridge Corps Plaza	27	27	Zone 7 - Treated	
	P4	Val Vista Park	15	15	Zone 7 - Treated	
	P5	Donlon School	36	36	Zone 7 - Treated	
	P6	Muirwood Community Park	35	35	Zone 7 - Treated	
	P7	Lyoiksen School	20	20	Zone 7 - Treated	
	P8	Moller Park	11	11	Zone 7 - Treated	
	P9	Commerce Circle	32	32	Zone 7 - Treated	
	P10	Signature Center	12	12	Zone 7 - Treated	
	P11	Hacienda Business Park	183	183	Zone 7 - Treated	
	P12	Southern Pacific Development	21	21	Zone 7 - Treated	
	P13	Pleasanton Sports Park	230	230	Zone 7 - Treated	
	P14	Valley Trails Park	26	26	Zone 7 - Treated	
	P15	Pleasanton Tennis & Community Park	22	22	Zone 7 - Treated	
	P16	Amador Valley Community Park	21	21	Zone 7 - Treated	
	P17	Amador Valley High School	66	66	Zone 7 - Treated	
	P18	Harvest School	44	44	Zone 7 - Treated	
	P19	Pleasanton Middle High School	51	51	Zone 7 - Treated	
	P20	Kottinger Community Park	27	27	Zone 7 - Treated	
	P21	Centennial Park & Senior Center	25	28	Zone 7 - Treated	
	P22	County Fairgrounds/Golf Course	640	640	Private Groundwater	
	P23	Koll Business Center	171	171	Zone 7 - Treated	
	P24	Castlewood County Club	688	688	Private Groundwater	
	P25	SFWD Project	0	395	Zone 7 - Treated	
	P26	Future Pleasanton Golf Course	0	350	Zone 7 - Treated	
	P27	Ruby Hills Golf Course	--	--	Zone 7 - Untreated	See South Livermore Valley
		Subtotal	2,480	3,230		
CWS	C1	Livermore Civic Center & Park	17	17	Zone 7 - Treated	
	C2	St. Michaels Cemetery	48	48	Zone 7 - Treated	
	C3	Sunken Garden Park	19	19	Zone 7 - Treated	
	C4	Vista Meadows Park	10	10	Zone 7 - Treated	
	C5	Masonic Cemetery	15	15	Zone 7 - Treated	
	C6	Junction Avenue Park	6	6	Zone 7 - Treated	
	C7	May Poo Nissen Park	37	37	Zone 7 - Treated	
	C8	Pleasure Island Park	26	26	Zone 7 - Treated	
	C9	Holm-Well Park	14	14	Zone 7 - Treated	
	C10	El Padro Park	14	14	Zone 7 - Treated	
	C11	Max Baer Park	24	24	Zone 7 - Treated	Based on actual 1994-1998 CWS deliveries
	C12	Granada High School	39	39	Zone 7 - Treated	Based on actual 1994-1998 CWS deliveries
	C13	Livermore High School	40	40	Zone 7 - Treated	Based on actual 1994-1998 CWS deliveries
	C14	Robertson Park	148	148	Zone 7 - Treated	Based on actual 1994-1998 CWS deliveries
	C15	Independence Park	38	38	Zone 7 - Treated	Based on actual 1994-1998 CWS deliveries
	C16	Industrial Park Site	0	60	Recycled	Assumes future use of recycled water
		Subtotal	500	560		
City of Livermore	L1	Robert Livermore Park	90	90	Zone 7 - Treated	
	L2	Las Positas Golf Course	500	500	Recycled	
	L3	Livermore Municipal Airport	10	10	Recycled	
	L4	Livermore Wastewater Plant	5	5	Recycled	
	L5	Springtown Golf Course	185	185	Zone 7 - Untreated	Maximum Zone 7 Entitlement
	L6	North Livermore Park	38	38	Zone 7 - Treated	
	L7	Christiensen Park	40	40	Zone 7 - Treated	
	L8	Triad Development	90	171	Recycled	Assumes future use of recycled water
	L9	Las Positas College	16	67	Recycled	Assumes future use of recycled water
	L10	Industrial Park Site	0	60	Recycled	Assumes future use of recycled water
	L11	North Livermore Project - Zone A	0	1,867	Zone 7 - Untreated	(c)
	L12	North Livermore Project - Zone B	0	1,775	Zone 7 - Untreated	(c)
	L13	Isabelle Avenue	0	100	Recycled	
		Subtotal	970	4,910		
South Livermore Valley Valley (includes lands east of Greenville Road)	S1	Poppy Ridge Golf Course	815	815	Zone 7 - Untreated	1999 Zone 7 Request
	P27	Ruby Hills Golf Course	790	790	Zone 7 - Untreated	Maximum Zone 7 Entitlement
	S3	Wente Golf Course	350	350	Zone 7 - Untreated	Estimated based on water use for other golf courses in the region
		Agriculture	7,747	20,647	Zone 7 - Untreated	Estimated based on acreages
		Agriculture	245	245	Private Groundwater	Estimated based on acreages
		Subtotal	9,950	22,850		
Other		Altamont Landfill	328	328	Zone 7 - Untreated	Maximum Zone 7 Entitlement
TOTAL RECYCLED WATER DEMAND			1,330	5,580		
TOTAL PRIVATE GROUNDWATER DEMAND			1,570	1,570		
TOTAL ZONE 7 TREATED WATER DEMAND			2,610	3,360		
TOTAL ZONE 7 UNTREATED WATER DEMAND			10,200	26,800		
TOTAL VALLEY-WIDE UNTREATED DEMAND			**15,700**	**37,300**		

Notes:

(a) Untreated water demand areas identified based on current planning efforts by the Zone's retailers, discussions with local agricultural community representatives, and review of recent aerial photography. Minor untreated water demand areas may not be included.

(b) Water supply source identified is based on existing water supplies and discussion with Zone 7's retailers. Water supply sources are subject to change based on retailer planning efforts and further development of the Zone's Integrated Water System Master Plan.

(c) Although the City of Livermore is also planning on serving recycled water to these areas, the City is still requesting untreated water from Zone 7 for this area.

Sources of Information:

1. City of Pleasanton Recycled Water Feasibility Study, Administrative Draft Report, HYA & HydroScience Engineers, Inc., November 1998.
2. DSRSD Draft Water Master Plan, WYA, October 1999.
3. North Livermore Project Technical Memoranda No. 5-1, 6, 8, 9, WYA, 1998.
4. Zone 7 Water Supply Planning Study Update, WTr, January 1999.
5. Zone 7 Memorandum "Livermore Valley Land Use, 1998 Water Year," October 23, 1998.
6. Personal communications with City of Livermore, DSRSD, CWS, City of Pleasanton and Mike Gatzman (Wente Vineyards), June-September 1999.

indicator recycled water irrigation sites to track changes in local ambient groundwater quality and verify assumptions about travel times, percolate quality, and related issues.

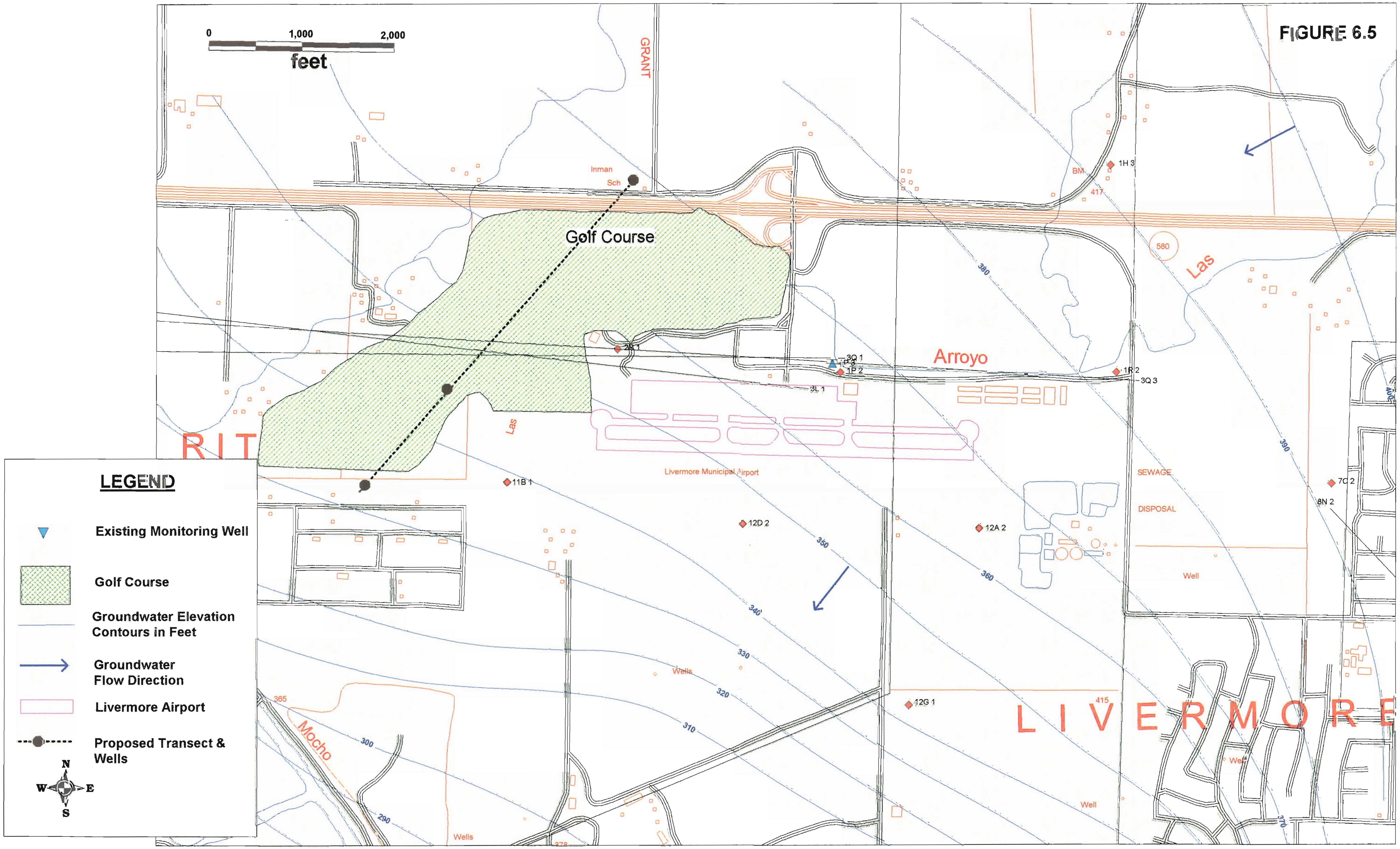
Several new projects proposing to use recycled water for groundwater recharge or irrigation are currently underway or in various stages of review and approval. In general, it is expected that individual recycled water projects will have some level of site specific monitoring, but not necessarily groundwater monitoring, required as part of the Master Permit approval process. Once such projects and associated monitoring programs are approved, the monitoring would be incorporated into the overall SMMP. Following is a brief description of existing and selected proposed recycled water irrigation and injection projects and a summary of the proposed or recommended monitoring programs.

Recycled Water Irrigation Projects

As shown in Figure 6.4 and Table 6.4, several large untreated water irrigation projects are currently proposed that could use recycled water or blends of recycled and other untreated water(s). Overall it is anticipated that use of recycled water for irrigation purposes will increase in the future. **For Zone 7 to be able to calculate the salt loading due to recycled water irrigation, any agency irrigating with recycled water shall submit a report to Zone 7 containing the monthly amount of water applied in each of the salt loading impact zone areas shown in Figure 11.2, the monthly average TDS of applied recycled water, the monthly complete mineral analysis, and an annual a map showing irrigated areas.** In the near-term, new or revised monitoring at three sites is recommended to expand baseline information and better evaluate potential future impacts of irrigation with recycled water use on the groundwater basin.

Livermore Golf Course—The Livermore Airport and Golf Course use about 400 AF of recycled water annually for irrigation. The current monitoring program consists of 10 wells installed jointly by Zone 7 and the USGS in the late 1970's. The collection and analysis of groundwater data was initially done by USGS and Zone 7, but the collection was taken over by Livermore in 1985. The RWQCB established monthly monitoring and reporting requirements in Water Reclamation Permit No. 90-102 issued to the Livermore Water Reclamation Plant. Zone 7 reviews the groundwater quality data submitted by Livermore to the RWQCB and makes additional water level and groundwater quality measurements. Zone 7 maintains records on monthly recycled water use, recycled water quality and the application areas and rates.

The 10 existing monitoring wells were established prior to expansion of both the Livermore Airport and the golf course. Figure 6.5 shows the current monitoring well locations and the area of applied recycled water. Eight of the 10 monitoring wells are effectively outside of the area of interest and cannot be classified as either up gradient or down gradient wells. It appears, therefore, that the historic network of wells should be modified as follows to account for the relocation and expansion of the golf course. It would provide more useful information if two lines of wells "or transects" were



ZONE 7 WATER AGENCY 5997 PARKSIDE DRIVE PLEASANTON CA 94588	DRAWN: C MAHONEY DESIGNED: G GATES CHECKED: M KATEN APPROVED:	SCALE: 1" = 1000'
	WATER RESOURCES ENGINEERING LIVERMORE WATER RECLAIMATION PLANT GROUNDWATER MONITORING SITES	DATE: November 30, 2000
		FILE NO. h:\smp\fig6.5

established, each containing three shallow monitoring wells. These lines of wells would be oriented to coincide with groundwater movement (see Figure 6.5). The first well would be up gradient to monitor background conditions. The second well would be located in the irrigation area and would monitor the effects of the applied recycled water. The third well would be down gradient and would monitor the groundwater as it leaves the irrigation area.

Revised reporting methods to display both level and quality data in terms of these lines, tracking changes to either level and/or quality, would be beneficial. The monthly monitoring of applied water quality, volume and area of application should be continued. The daily rainfall and pan evaporation data collected by LWRP should be continued to provide a record of local rainfall and evapotranspiration. The monitoring of local stream water quality and recharge rates calculated by Zone 7 should also be continued and reviewed in conjunction with the shallow well data. Groundwater quality in the down gradient wells is believed to be a combination of upgradient groundwater flow, stream recharge, applied water recharge from recycled water and rainfall recharge. Data should be collected and quantified in a manner suitable for use in future groundwater flow and transport modeling.

Given the long history of non-RO recycled water irrigation at this site, it is a valuable demonstration site for tracking and evaluating the impacts on groundwater nitrate, chloride and TDS levels associated with recycled water irrigation. Data collected from this site would be useful for helping to characterize the likely groundwater impacts of similar proposed irrigation projects within the Main Basin.

It does not appear that similarly intensive monitoring programs will be needed or justified at typical recycled water irrigation sites based on Zone 7 staff review of historic data, groundwater model results, and the incremental loadings relative to overall basin salt loadings. Results from Livermore and one new or retrofit irrigation site (below) should provide adequate representative documentation of irrigation impacts. However, it is recommended that the Zone 7 groundwater model be reviewed approximately every five years and the data collected from these recycled water projects and other SMMP monitoring wells, and applied water data be added to the historic model data sets. Predicted water quality from the model and actual monitored data should be reviewed, any significant discrepancies between the modeled results and actual results should be evaluated, and appropriate modifications should be made to the monitoring program and/or the model to improve the accuracy and utility of future SMMP results.

Public Parks—It is recommended that two shallow wells be constructed at a large park such as the Pleasanton Sports Park, Dublin Sports Grounds, or Emerald Glen Park that is irrigated with recycled water. One upgradient well would monitor background conditions and the other downgradient well would monitor the effects of irrigation with recycled water. The wells would be monitored quarterly for approximately one year and then annually once baseline conditions were established.

VA Hospital—The Veterans Administration (VA) Hospital wastewater treatment system and percolation ponds are located at the southern edge of the Main Basin. This system is also regulated by RWQCB Waste Discharge Requirements that include groundwater monitoring and reporting requirements. For consistency and completeness, it is recommended that the existing requirements be reviewed to evaluate the usefulness of the information being collected. As appropriate, recommendations could then be made for monitoring changes to best document the current and future impacts of the percolate on groundwater quality.

Potential RO Recycled Water Groundwater Recharge Projects

Both the City of Livermore and Dublin San Ramon Services District (DSRSD) have designed and built (in 1997 and 1998 respectively) advanced treatment facilities capable of producing RO recycled water in conformance with current Department of Health Services (DHS) and RWQCB Master Permit requirements for groundwater injection. Zone 7 staff, the TAG, and GMAC actively participated in review of and comment on product water and groundwater monitoring requirements in associated CEQA documents, DHS Engineering Reports, and groundwater modeling efforts. Proposed monitoring programs for all Title 22 regulated constituents and various recommended currently unregulated constituents were developed for the DSRSD Clean Water Revival project. Zone 7 staff provided recommendations on monitoring well locations and designs based in part on groundwater modeling work. Further work on finalizing monitoring plans was put on hold following the Zone 7 Board decision in Fall of 1998 to withhold support for these projects pending demonstration of increased public acceptability.

Presented below is an overview of the two proposed projects, preliminary recommended monitoring well locations, and general monitoring program elements based on TAG and GMAC recommendations as of the end of 1998.

Project Descriptions—In August 1997, the City of Livermore completed the construction of its Advanced Water Reclamation Facility. The facility provides microfiltration and reverse osmosis treatment of tertiary filtered recycled water. The facility can produce 0.75 mgd of RO recycled water that, as originally proposed, at some point in the future, following demonstration of increased public acceptability, could potentially be used to replenish the groundwater supply through direct injection into the main groundwater basin.

An existing well near the Livermore airport was selected for conversion to an injection well based on regulatory requirements, hydrogeologic characteristics of the region and basin, property ownership and access, existing potable well locations, and relative distance to the treatment facility. To meet capacity needs as well as to provide redundancy, a second well has been proposed that would accommodate 100 percent of the water production from the treatment facility. Recharge of recycled water would be achieved by injecting the water through the recharge well(s) to the target confined aquifer that is approximately 350 feet below the ground surface. This project was never fully completed and there are no plans to complete this project.

The DSRSD Clean Water Revival (CWR) Groundwater Replenishment Project is a 2.5 mgd advanced treatment project that uses microfiltration and reverse osmosis to produce RO product water (similar to the Livermore project) for potential injection into the Main Basin. Injection was proposed at two new wells, each capable of injecting 2.5 mgd. Each well would be 700 feet deep and capable of injecting at four different depths (see additional description in sections 8.8 and 10.3). This project was never fully completed and there are no plans to complete this project.

Potential Monitoring Wells—Proposed DHS regulations for groundwater recharge projects require monitoring wells located at a minimum of one-quarter and one-half the distance to the nearest potable extraction wells. To conservatively meet these requirements, three monitoring wells were proposed down-gradient from the recharge well, located 1/2, 1/4, and 1/8 of the way to the Stoneridge production well, plus one additional well mid-way south towards the nearest Cal Water well. The 1/8 location well would provide earlier information on the rate of movement of any injected water. The southerly well would provide information in the event that movement was to proceed upgradient from the Livermore injection locations toward the CWS well unexpectedly. One of the three monitoring wells could potentially be shared with one of Clean Water Revival's monitoring wells. Proposed injection and monitoring well sites are shown in Figure 6.3 (and in more detail in Figure 10.15). Each of the injection monitoring wells were proposed to be nested wells, screened at four different depths. Three nested wells were completed prior to the cancellation of the project. These three wells are now owned and monitored by Zone 7.

Monitoring wells for the CWR injection sites were proposed to be composed of seven additional wells located along transects extending from the injection sites towards the nearest potable production well (Stoneridge) and also towards Pleasanton production wells. Potential injection and monitoring sites are shown in Figure 6.3. This network would include wells installed at the required 1/2, 1/4, and 1/8 of the distance between each injection well and the nearest production well. Each of the monitoring wells would be nested wells to monitor groundwater quality at four different depths.

Potential Monitoring Programs—Based on communications through late 1998, groundwater samples were proposed to be taken at a minimum on a monthly basis, from four levels in the aquifer at each monitoring well, and analyzed for general minerals, metals, organic chemicals including TOC, and total nitrogen. This would exceed the minimum requirements of the proposed groundwater recharge regulations. Twenty-four hour composite samples would be collected daily from the feed pipe to the injection wells and tested for coliform bacteria. Grab samples of the RO reclaimed water would be collected weekly and analyzed for total nitrogen. On a quarterly basis grab samples would be analyzed for general minerals, metals, chlorinated hydrocarbons, chlorophenoxys, synthetics, and general physical characteristics.

Each treatment system incorporates real-time monitoring of several water quality parameters (e.g., TDS, TOC), which would allow for immediate correction, diversion for retreatment or storage, or shutdown if a problem is detected.

Proposed CWR monitoring was to include: quarterly sampling of RO product water for physical and aggregate parameters, a wide range of inorganic salts and metals, alpha and beta radioactivity, twenty-six volatile organic chemicals, and thirty-three non-volatile synthetic organic chemicals. In addition, the RO product water would be monitored daily for total coliform bacteria and total organic carbon, and weekly for total nitrogen.

On-going monitoring was initially proposed at monitoring wells DSRSD MON1, DSRSD MON2, DSRSD MON4, and DSRSD MON5. When RO recycled water was detected at wells DSRSD MON2 and DSRSD MON5, on-going monitoring would be initiated at wells DSRSD MON3, DSRSD MON6, and DSRSD MON7.

As the projects evolve, it was expected that these preliminary monitoring program elements would be reviewed and refined with input from Zone 7 and RWQCB staff. Draft implementation plans proposed initial injection of potable water, allowing time to confirm the rate and direction of water movement. If results met all criteria yet to be specified, increasing amounts of RO product water would then presumably be phased in.

6.7 Reporting and Refinement of the SMMP

The data collected as part of the SMMP will be used to identify changes in groundwater quality throughout the watershed, to refine salt loading estimates, and to provide input to the water resource allocation (WRMI) and groundwater models. Given that the SMMP was established in part to identify and fill existing data gaps and to provide a venue to evaluate the long-term effectiveness of the Salt Management Plan, an annual critique and refinement of the monitoring and data collection effort will be conducted.

Data collected as part of this SMMP will be used to critically evaluate the usefulness of the data collected relative to making salt management control measure decisions. The groundwater model and this monitoring program will be used in a complementary fashion, where monitoring program results are used as input to the model and the monitoring program subsequently uses the output from the model to help determine additional (or reduced) data needs. This SMMP approach will help to achieve long-term Salt Management Plan goals without consuming excessive resources that could otherwise be used to directly implement salt management measures.

Installation of future surface water monitoring stations and wells (beyond those described for years 1-3 above) will be delayed until a "trigger point" is reached. Triggers would vary by sub-watershed but could include percent of total salt loading represented by the upstream watershed, the approval of specific development projects, and/or the final approval of recycled water projects. Development and project approval status will need to be closely tracked to ensure that monitoring is initiated early enough to adequately establish baseline conditions. There would also be "sunset" triggers, where, for example, once a baseline were established, monitoring could be reduced or terminated until another trigger event occurred, thereby minimizing future SMMP costs.

Reports summarizing results obtained as part of the SMMP are proposed to initially be generated on a quarterly and annual basis. The development of the final format for the reports and the determination of their frequencies are tasks that will be completed by Zone 7 during the first year following submittal of the SMP to the RWQCB. In addition to data collected by Zone 7 for the SMMP, there are a number of other sources of data that may be useful for the SMP. Some of those sources include the City of Livermore, DSRSD, ACWD, mining companies, data collected as part of other NPDES permit self-monitoring programs, and Zone 7 stream flow data collected at non-SMP monitoring program sites. Relevant additional data will be incorporated as appropriate into applicable Zone 7 and SMP databases.