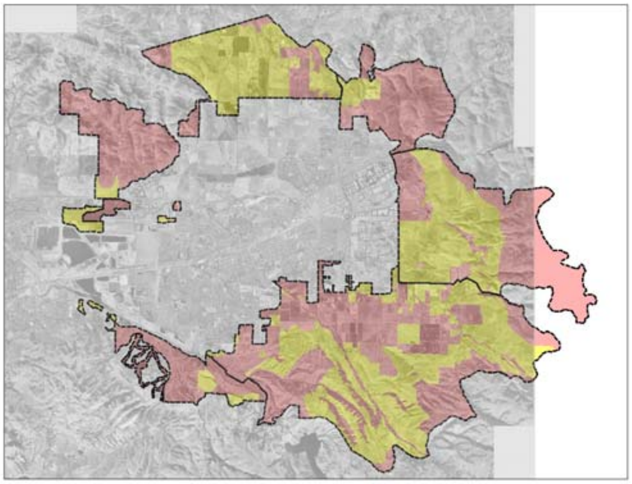
ZONE 7 WATER AGENCY

Non-Potable Water System Conceptual Master Plan



November 2005

WEST YOST & ASSOCIATES

Zone 7 Water Agency

Non-Potable Water System Conceptual Master Plan

Prepared by

West Yost & Associates

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LIST OF ACRONYMS

ac	Acre
af/ac	Acre-feet per acre
afa	Acre-feet annually
AWTP	Altamont Water Treatment Plant
BWA	Bartle Wells Associates
CASIL	California Spatial Information Library
DEM	Digital Elevation Model
DERWA	DSRSD-EBMUD Recycled Water Authority
DSRSD	Dublin San Ramon Services District
DVWTP	Del Valle Water Treatment Plant
DWR	California Department of Water Resources
EBMUD	East Bay Municipal Utility District
EBRPD	East Bay Regional Park District
ECw	Electrical Conductivity
GIS	Geographical Information System
GO	General Obligation
GW	Groundwater
Kw-hr	Kilowatt-hour
LARPD	Livermore Area Recreation and Park District
LAVWMA	Livermore-Amador Valley Water Management Agency
LWRP	Livermore Water Recycling Plant
M&I	Municipal and Industrial
Mg/L	Milligrams per liter
mgd	Million gallons per day
Non-Potable WMP	Non-Potable Water System Conceptual Master Plan
NRCS	Natural Resources Conservation Service
O&M	Operations and Maintenance
Phase III Study	Zone 7 Untreated Water System Study Phase III Analysis
PPWTP	Patterson Pass Water Treatment Plant
RO	Reverse Osmosis
SAR	Sodium Adsorption Ratio
SBA	South Bay Aqueduct
SFPUC	San Francisco Public Utilities Commission
SMMP	Stream Management Master Plan
SWP	State Water Project
TDS	Total Dissolved Solids
USGS	United States Geological Survey
WYA	West Yost & Associates
WWTP	Wastewater Treatment Plant
Zone 7	Zone 7 Water Agency

EXECUTIVE SUMMARY

This 2005 Non-Potable Water System Conceptual Master Plan is the culmination of over five years of studies related to meeting potential future untreated and agricultural demands in the Tri-Valley area. As the water supply wholesaler for the entire Tri-Valley area, the Zone 7 Water Agency retained West Yost & Associates (WYA) to evaluate possible ways of integrating planned potable water system infrastructure with potential future non-potable water system infrastructure to help meet increasing untreated and agricultural demands. WYA completed this evaluation in three phases, followed by the completion of this 2005 Non-Potable Water System Conceptual Master Plan. Table ES-1 provides an overview of the untreated water studies completed for Zone 7 by WYA.

Table ES-1. Summary of Untreated Water Studies for the Tri-Valley Area

Phase/Date	Key Assumptions
Phase 1 January 2000	• Considered a general non-potable study area of approximately 11,000 acres • Evaluated potential sources of water supply and future demands • Did not consider planning efforts being undertaken by the Tri-Valley Business Council (i.e., Vision 2010 Plan)
Phase 2 August 2000	• Considered the expanded planning area identified by the Tri-Valley Business Council Vision 2010 Plan
Phase 3 April 2001	• Evaluated the availability of required non-potable water and recycled water supplies • Assessed whether a reduced version of the Vision 2010 Plan was more cost-effective and feasible
Non-Potable Water System Conceptual Master Plan November 2005	• Refines/defines those areas that are suitable for various irrigated agricultural activities (based on soil type, slope criteria, and existing and planned land use, consistent with the work of NRCS) • Considers two new recycled water programs, one by City of Livermore and one by San Francisco Public Utilities Commission • Re-evaluates whether opportunities still exist to use recycled water supplies to meet future non-potable/agricultural water demands • Assumes a revised unit water use factor for agricultural irrigation • Develops revised blending ratios to provide appropriate water quality for agricultural use • Re-evaluates potentially available capacity in the SBA for use by agricultural interests, assuming institutional, operational, and financial issues can be reconciled • Identifies a potential, specific agricultural project and provides associated capital and O&M costs

As shown in Table ES-1, this Non-Potable Water System Conceptual Master Plan refines and updates many of the assumptions used in the previous studies. Table ES-2 provides an overview of the key assumptions and findings of this 2005 Non-Potable Water System Conceptual Master Plan as compared with the Phase III Study.

In addition to this Non-Potable WMP, WYA also prepared a supplemental report (Administrative Draft Supplemental Report Non-Potable Water System Conceptual Master Plan), dated July 2005. This report is provided in Appendix A, and conceptually identifies, evaluates, and develops an estimate of the capital costs for the most viable combinations of supply and infrastructure necessary to serve potentially irrigated acreage in the North Livermore planning area (Options A and B).

Table ES-2. Summary of Key Findings of Non-Potable Water System Conceptual Master Plan as Compared to the Phase III Study

Finding	Non-Potable Water System Conceptual Master Plan	Phase III Study
Maximum Irrigable Agricultural Area (see Tables 7 and 8)	22,340 acres (after removing lands where soil types were of poor agricultural quality, with restricted land use, existing agriculture, existing golf course, LARPD and EBRPD lands and where land slopes were too steep to irrigation) 13,650 acres (after removing areas based on economic feasibility)	25,300 acres (based on gross acreages, not accounting for site-specific limiting conditions)
Non-Potable Water Application Rate	1.61 af/ac/yr (from Zone 7's Agricultural Consultant based on actual application rates for wine grapes in Livermore)	2.25 af/ac/yr
Non-Potable Water Demand (see Table 9)	21,980 afa	58,500 afa @ 2.25 af/acyr 40,733 afa @ 1.61 af/ac/yr
Non-Potable Water Supply		
SBA (based on direct use) (see Table 10)	0 afa	34,100 afa
SBA (based on available off-peak conveyance capacity and requiring storage) (see Table 10)	40,430 afa	11,200 afa
Recycled Water Supply (available after other project demands are met) (see Table 12)	8,680 afa (requires storage) (only 1,370 af/yr available from LWRP)	19,326 afa
Non-Potable Water Quality: Revised Blending Ratios	DSRSD WWTP: • 1 part tertiary to 1.7 parts RO (with denitrification) • 1 part tertiary to 3.95 parts RO (without denitrification) • 1 part tertiary to 0.65 parts SBA water (with denitrification) • 1 part tertiary to 3.86 parts SBA water (without denitrification) LWRP: • 1 part tertiary to 1.6 parts RO (with denitrification) • 1 part tertiary to 4.7 parts RO (without denitrification) • 1 part tertiary to 2.3 parts SBA water (with denitrification) • 1 part tertiary to 4.6 parts SBA water (without denitrification)	1 part RO to 3 parts nitrified/denitrified tertiary water
Potential Specific Agricultural Project (see Tables 20 through 23)	3,100 acres in North Livermore B area @ 1.61 af/ac/yr = 4,990 or 5,000 acre-feet. SBA water conveyed to a future reclaimed gravel quarry via Altamont Creek. Storage provided in a future reclaimed gravel quarry Scenario 1: 5,000 afa of SBA water • Capital cost = $10,200/af • O&M Cost = $194/af • Includes cost of supply, storage at the future reclaimed gravel quarry, pumping stations, creek diversion, transmission and distribution Scenario 2: 880 afa of tertiary supply from LWRP and 4,120 afa of SBA water • Capital cost = $10,800/af • O&M Cost = $274/af • Includes cost of supply, storage at SMP-38, pumping stations, creek diversion, transmission and distribution	Scenario 1: Surface Water Option (49,100 acre-feet) • Capital cost = $4,721/af • O&M Cost = $250/af • Includes cost of supply, conveyance and transmission • Considered an untreated connection charge deposit by existing agricultural users • Does not include cost for storage (storage assumed to be in Chain of Lakes)
Costs Increased by 116% Over the Phase III Study (see Table 22)	$10,200 per acre-feet (costs for construction have increased significantly over the past five years and opportunities previously available during the Phase III study are not longer available)	$4,721 per acre-foot

INTRODUCTION

Over the last several years, the Tri-Valley area (Pleasanton, Livermore, Dublin) has experienced significant growth. Moreover, projections indicate that this growth will continue until the area reaches build-out of the adopted General Plans completed by each city in the area. Each General Plan identified the need to retain and, if possible, expand agricultural and open space areas. As the water supply wholesaler for the entire Tri-Valley area, the Zone 7 Water Agency (Zone 7), retained West Yost and Associates (WYA) to evaluate the possibility of integrating planned potable water system infrastructure with potential future non-potable water system infrastructure to help meet increasing untreated and agricultural demands. WYA completed this evaluation in three phases, followed by the completion of this 2005 Non-Potable Water System Conceptual Master Plan (Non-Potable WMP).

The first phase of this project, completed in January 2000, considered a general non-potable study area of approximately 11,000 acres and evaluated potential sources of water supply and future demands; however, the study did not consider expanded planning efforts being undertaken by the Tri-Valley Business Council (i.e., Vision 2010 Plan). WYA completed a second phase in August 2000 that considered the Vision 2010 Plan. The third phase (Untreated Water System Study Phase III Analysis, dated April 2001) evaluated the availability of required water and recycled water supplies, along with an assessment of whether a reduced version of the Vision 2010 Plan was more cost effective and feasible.

This Non-Potable WMP further refines/defines those areas that are suitable for various irrigated agricultural activities (based on soil type, slope criteria, and existing and planned land use, consistent with the work of NRCS). There have also been two new recycled water use programs proposed: one by the City of Livermore, and the other by the San Francisco Public Utilities Commission (SFPUC). The City of Livermore program studies the use of highly treated wastewater for non-potable agricultural use in either or both the South Livermore and North Livermore areas. The SFPUC project proposes to use City of Pleasanton wastewater to produce highly treated recycled water for use in the Sunol area. In view of these new proposed recycled water projects, this non-potable WMP also re-evaluated whether opportunities still exist to use recycled water supplies to meet future non-potable/agricultural water demands. Subsequent sections of this Non-Potable WMP are as follows:

- Summary of Results from the Phase III Study
- Refined Vision 2010 and Revised Recycled Water Demand
- Revised Recycled Water Supply
- Water Quality Issues and Revised Blending Ratios
- Potential Specific Agricultural Project
- Cost Comparison – Specific Project Compared to the Phase III Study
- Update to Previously Proposed Financial Plans by Bartle Wells Associates

SUMMARY OF PHASE III FINDINGS

Purpose of the Phase III Study

The purpose of the Untreated Water System Study Phase III Analysis (Phase III Study) was to evaluate the availability, from both physical and institutional standpoints, of non-potable water supplies, surface storage facilities, and alternative funding mechanisms to bridge the gap between the capital cost of implementing/constructing an expansion of the agricultural water system to meet potential future needs, compared to the ability of agriculture to pay for associated water supplies and related facilities. The Phase III Study also evaluated whether a reduced version of the Vision 2010 Plan was more cost-effective and feasible than Zone 7's previously planned untreated demand area. The results of the Phase III Study are summarized in the following sections:

- Untreated Water Demands Presented in the Phase III Study
- Untreated Water Supplies Presented in the Phase III Study
- Water Quality Issues and Blending Ratios Presented in the Phase III Study
- Untreated Water System Scenarios Presented in the Phase III Study

Untreated Water Demands Presented in the Phase III Study

The Phase III Study only evaluated areas within the boundary of Zone 7's service area which would be cost-effective to serve. The study excluded remote outlying areas requiring significant infrastructure to provide service, such as the Niles demand area, and areas already planned to be supplied with recycled water (e.g. DERWA project and DSRSD service area). The areas are shown geographically on Figure 1.

The Phase III Study identified approximately 26,000 acres available for agricultural development, including the existing untreated demand in South Livermore. Based on a water application rate of 2.25 acre-feet per acre (af/acre), the untreated water demand was approximately 58,500 acre-feet annually (afa). Table 1 presents the untreated water demand identified in the Phase III Study by planning area.

Table 1. Phase III Study – Untreated Water Demand

Area	Water Demand
I-680 Corridor	2,700 afa (1,200 ac)
North Livermore	21,500 afa (9,600 ac)
South Livermore	30,600 afa (13,600 ac)
Tassajara Creek Drainage Basin	2,000 afa (900 ac)
Pleasanton Landscaping	1,700 afa
Total	**58,500 afa (25,300 ac, approx.)**

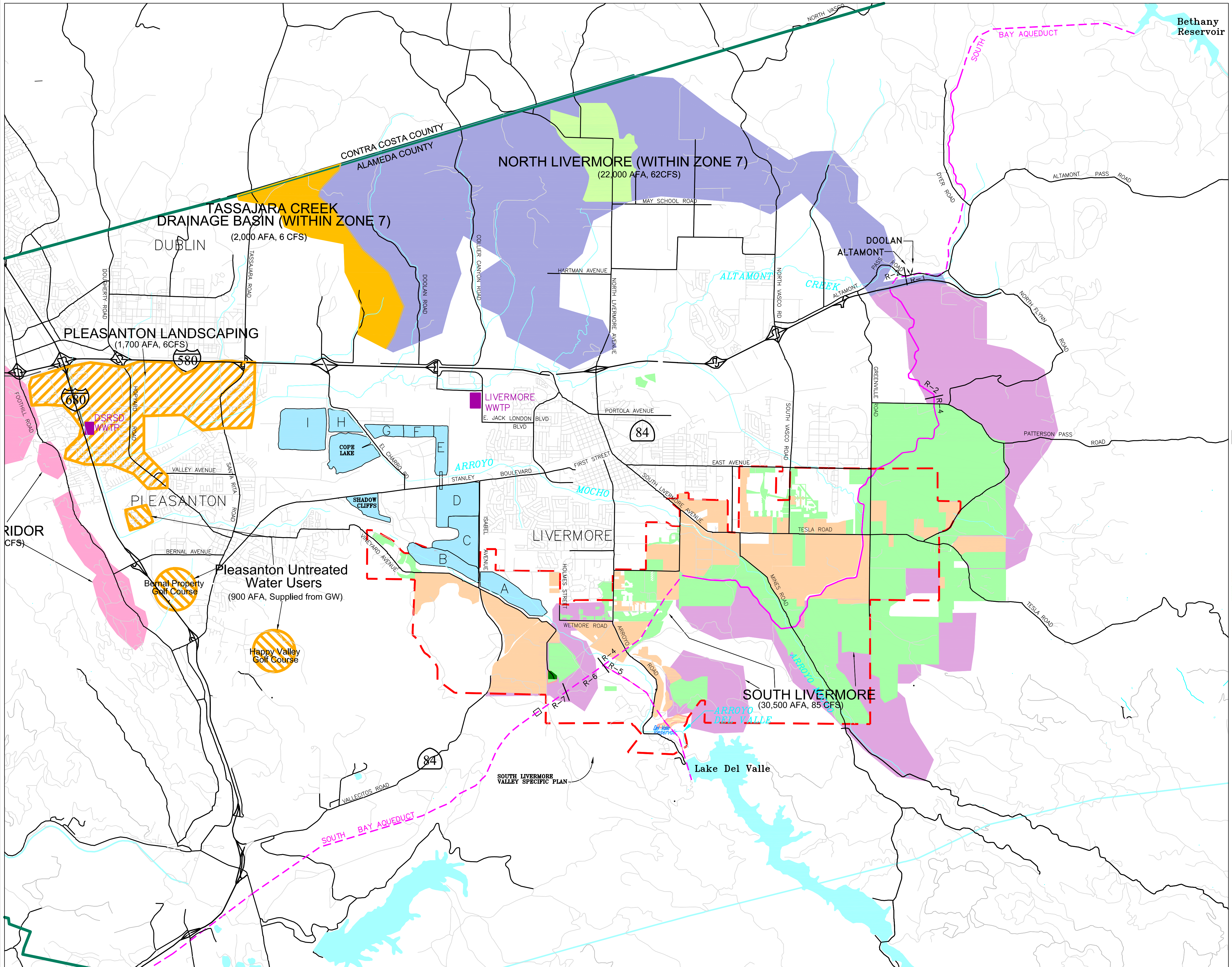

FIGURE 1

Zone 7 Water Agency Non-Potable Water System Conceptual Master Plan

Phase III Study Focus Areas

N

0 0.76 1.52

SCALE IN MILES

NOTES:

1. VISION 2010 PLANNING AREA ESTIMATED FROM MAP PROVIDED BY GREENINFO NETWORK, FIGURE ENTITLED "POTENTIAL TRI-VALLEY REGION-POTENTIAL FUTURE SCENARIO-FULL BUILDOUT", DATED AUGUST 1999.

LEGEND:

- NORTH LIVERMORE PROJECT AREA
- EXISTING AGRICULTURAL AREA (SOUTH LIVERMORE)
- FUTURE AGRICULTURAL AREA (SOUTH LIVERMORE)
- TASSAJARA CREEK DRAINAGE BASIN WITHIN ZONE 7
- I-680 CORRIDOR
- NORTH LIVERMORE (WITHIN ZONE 7)
- SOUTH LIVERMORE
- PLEASANTON LANDSCAPING
- PLEASANTON UNTREATED DEMANDS POTENTIALLY SERVED FROM GROUNDWATER
- ZONE 7 BOUNDARY
- SOUTH LIVERMORE PLAN BOUNDARY

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The demands identified in the Phase III Study were based on gross acreages, and did not account for site-specific limiting conditions (e.g., soil type and existing/planned land use). These limiting conditions were considered in this Non-Potable WMP.

Untreated Water Supplies Presented in the Phase III Study

The Phase III Study identified two main water supply sources to meet projected untreated water demands: imported surface water (e.g., State Water Project) and recycled water produced within the Tri-Valley area. Each is further discussed below.

<u>Previous Surface Water Supply Estimate Using Conveyance Provided by the South Bay Aqueduct (SBA)</u>

Zone 7 and the California Department of Water Resources (DWR) are currently designing an expansion of the SBA to help meet Zone 7's future municipal and industrial (M&I) water demands. Before and during preparation of the Phase III study, the agricultural community had over a year and a half to determine if there was interest in participating in the expansion of the SBA. However, due to time constraints specific to the expansion project and a policy decision by Zone 7 to adopt delivered water quality goals and continued system reliability for its M&I customers, and the system operational modifications required to implement these decisions, the project is moving forward without any designated additional capacity for expanded agricultural demand. The Phase III Study had assumed that expanded capacity would exist in the SBA to make use of direct water diversions by the agricultural community during the summer months.

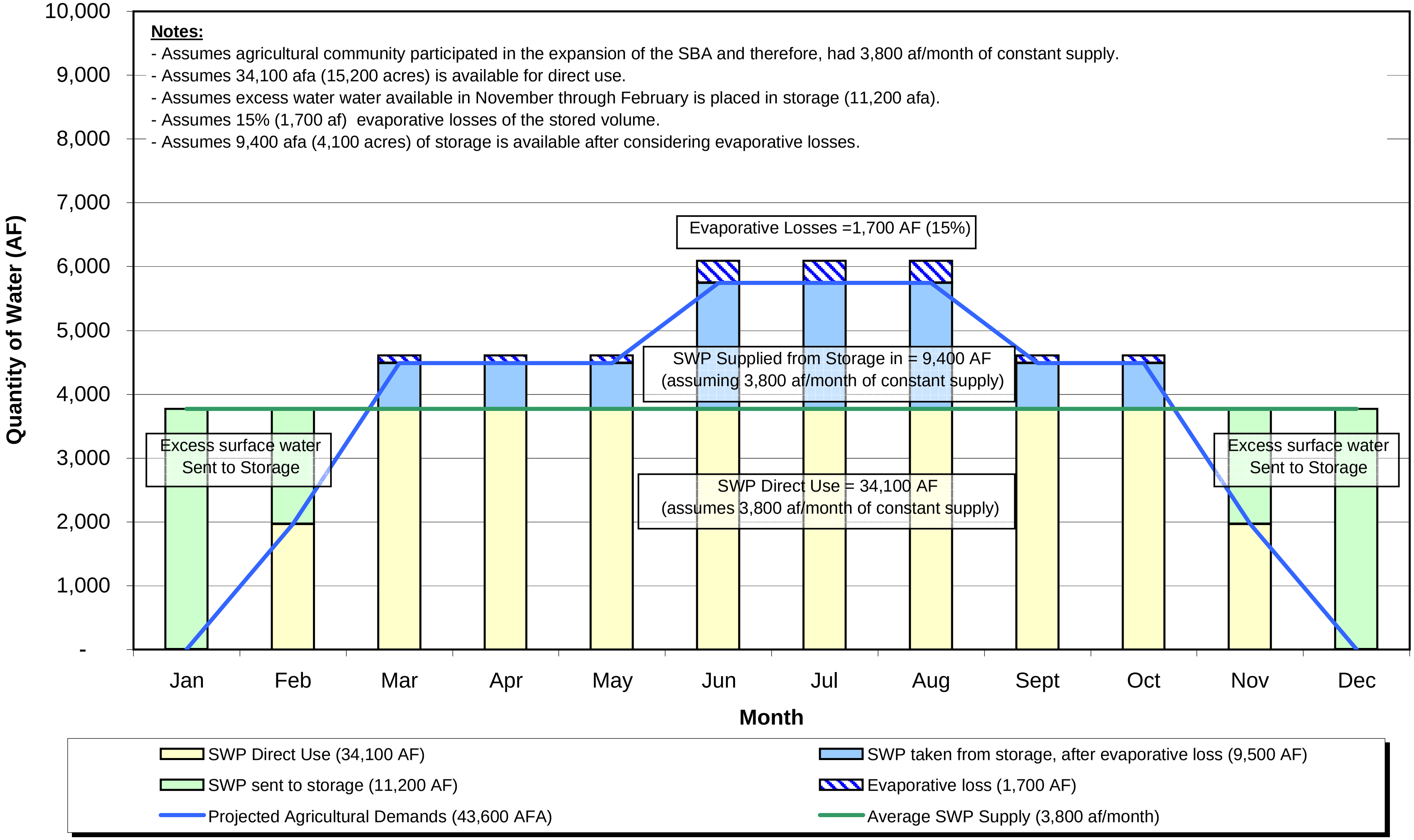
As shown in Table 1, the Phase III Study identified a total untreated demand of approximately 58,500 afa, including 14,900 afa of existing untreated demand (1,700 afa for landscaping in Pleasanton and 13,200 afa of existing agricultural demand in South Livermore). The Phase III Study assumed that the existing untreated demands (14,900 afa) could be supplied by local runoff captured in available storage (5,500 afa) and existing imported surface water available from the SBA through Pre-1997 untreated water allocations (9,400 afa). Consequently, an additional 43,600 afa (58,500 afa – 14,900 afa) (approximately 20,000 acres) of new imported surface water from the SBA was required.

The Phase III Study also assumed that the agricultural community would then participate in the expansion of the SBA and therefore, have available a constant monthly supply of 3,800 acre-feet per month (45,600 af/year). Consequently, approximately 34,100 afa (15,100 acres) would be available for direct use and approximately 11,200 acre-feet (4,200 acres after consideration for evaporative losses) could be stored in the low-demand months of November through February; approximately 15 percent (1,700 afa) was assumed for evaporative losses expected of the stored volume. Figure 2 illustrates the total additional imported surface water capacity the Phase III Study assumed the agricultural community would have available by participating in the SBA expansion.

However, this surface water supply capacity from the SBA was dependent on expansion of the SBA. Subsequent sections of this Non-Potable WMP will show that because there is no planned conveyance capacity for agriculture in the expanded SBA to deliver water for direct use, the only

FIGURE 2. Surface Water Supply and Demand

Required Surface Water Supply and Storage Identified in the Phase III Study



conveyance capacity that is available to agriculture will be “off-peak,” during low M&I demand periods, which will require storage to use.

Previously Identified Recycled Water Supply

The Phase III Study identified the City of Pleasanton, the Dublin San Ramon Services District (DSRSD), and the City of Livermore as having possible recycled water supplies available for use by the agricultural community. Furthermore, the Phase III Study assumed that the total recycled water supply available to meet projected untreated demands did not include those supplies already identified for use in previous planning studies completed by the DSRSD/East Bay Municipal Utility District (EBMUD) Recycled Water Authority (DERWA) and the City of Livermore. As shown in Table 2, the total available recycled water supply identified in the Phase III Study was 19,326 afa.

Table 2. Phase III Study - Recycled Water Supply

Source	Total Supply Generated, afa	Annual Demand, afa	Available Annual Supply, afa
City of Pleasanton	10,000	0	10,000
DERWA/DSRSD	11,400	9,374	2,026
City of Livermore	12,800	5,500	7,300
Total	**34,200**	**14,874**	**19,326**

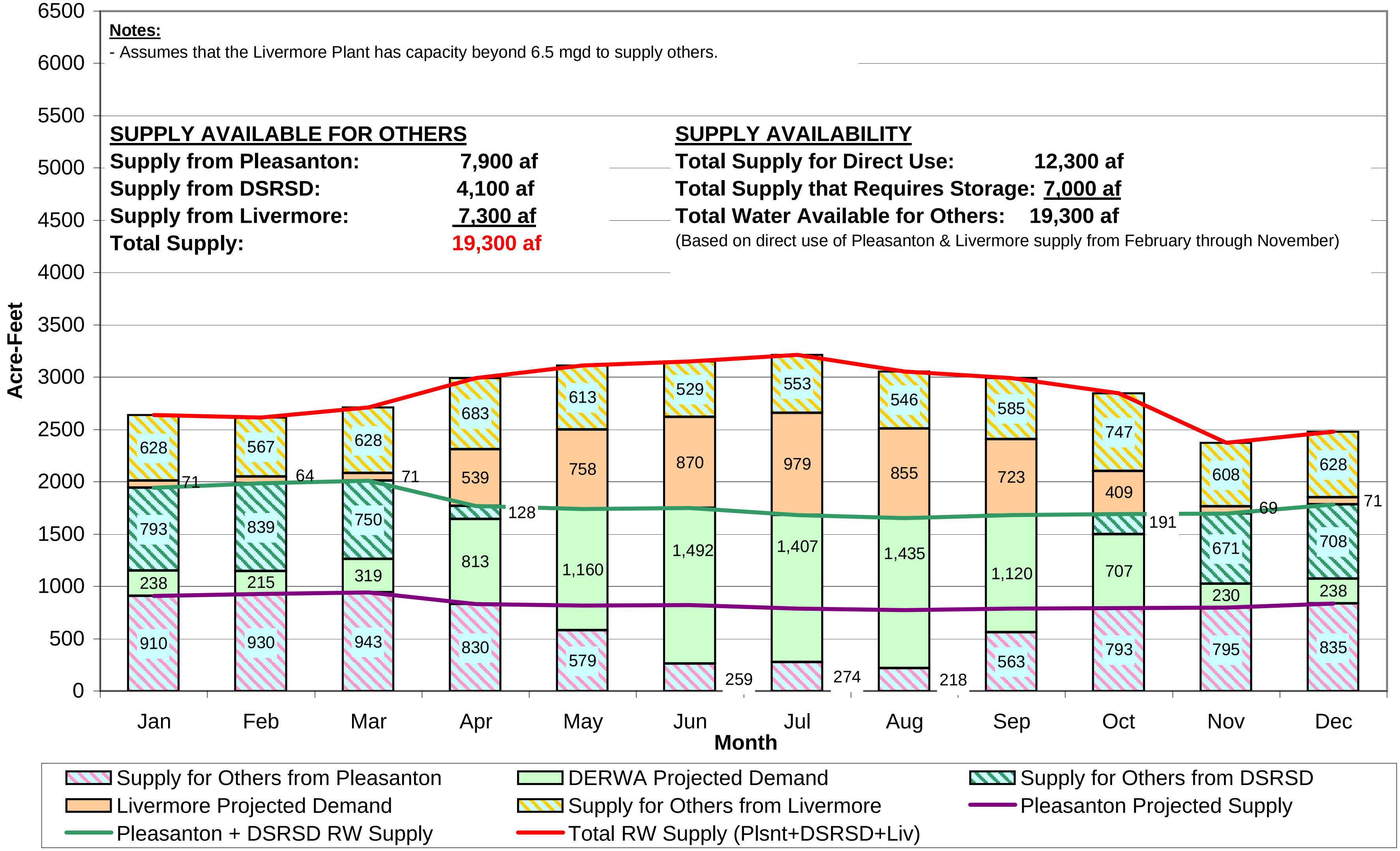
Additionally, the Phase III Study assumed that the City of Livermore’s Water Recycling Plant (LWRP) would be expanded beyond its current capacity of 5 million gallons per day (mgd) so that all of its secondary effluent at buildout (11.1 mgd) could be used. As shown in Figure 3, the total amount of recycled water previously available for direct use was 12,300 afa (7,900 afa from Pleasanton and 7,300 afa from Livermore); 7,000 afa required storage.

However, the total quantity of available recycled water was dependent on the availability of Pleasanton’s recycled water and the assumed expansion of tertiary treatment capacity at the LWRP. Subsequent sections of this Non-Potable WMP will show that current recycled water supplies are no longer available for direct use and any use of available recycled water supplies will require storage.

Water Quality Issues and Blending Ratios Presented in the Phase III Study

The first two studies completed by WYA identified the facilities required to supply the new agricultural users. The capital costs associated with these new facilities were high and therefore, it was assumed in the Phase III Study that a highly marketable and high value crop (i.e. wine grapes) would have to be grown to make the project economically viable. However, water quality concerns had to be evaluated as the high salt and nitrogen content in these recycled water supplies prevented its direct use as irrigation water for wine grapes.

Figure 3. Phase III Monthly Recycled Water Supply & Demand



Therefore, the Phase III Study assumed that tertiary treated recycled water supplies would be separated into two streams: one stream treated through nitrification/denitrification processes and the other treated with a Reverse Osmosis (RO) system to reduce salt concentrations. The two streams would then be blended at a ratio of 1 part RO to 3 parts nitrified/denitrified tertiary water to produce a supply source suitable for wine grape irritation purposes. Tables 3 and 4 present the previous water quality criteria for wine grapes, the water quality of the tertiary water, RO water, and SBA water, along with required blending ratios.

Untreated Water System Scenarios Presented in the Phase III Study

The Phase III Study considered three scenarios for supplying future untreated water demands. The first and third scenarios assumed that imported surface water would supply all non-potable water demands. The third scenario was a smaller version of the first and only included those areas within Zone 7's service area considered to be likely candidates for a future agricultural program. The second scenario assumed that imported surface water and blended recycled water would supply untreated water demands. Table 5 presents the three scenarios. Costs for each of these scenarios are discussed in detail in the cost section of this Non-Potable WMP.

REFINED AGRICULTURAL AREAS

Redefining the Focus Areas within the Tri-Valley Area

In the Phase III Study, areas available for agricultural development were identified based on gross acreage which was available in a given area, and did not consider specific limiting factors (e.g., soil type or existing land use) in detail. However, soil type, slope criteria and existing and planned land use criteria were used in this Non-Potable WMP evaluation to redefine the potentially available irrigated agricultural areas. Based on work completed by the Natural Resources Conservation Service (NRCS) and available planning documents, unsuitable soil areas were eliminated from consideration. In addition, acreages were removed based on excessively steep land slopes, existing and planned incompatible land use plans, and economic feasibility. The economic feasibility aspect was based on pump lift and power costs.

WYA redefined the original potentially irrigable agricultural areas identified in the Phase III Study (see Figure 1) based on seven geographic locations and proximity to existing water delivery infrastructure. These seven focus areas were:

- Collier/Doolan Canyon
- Greenville
- North Livermore A
- North Livermore B
- South Livermore A
- South Livermore B
- Vasco/Laughlin

Table 3. Phase III Summary of Recycled Water Quality Criteria

Key Irrigation Water Quality Parameters		Units	CRITERIA: Degree of Use Restriction[1,1A] for Agricultural Use: None	Slight to Moderate	Severe	Grape-Specific Criteria[2]: Maximum Permissible Concentration	Possible Adverse Effect If Concentration Exceeded	DSRSD Effluent Water Quality: DSRSD Effluent Water Quality[5] 1995 Monthly Averages	DSRSD Effluent Water Quality[6] July 2000	Blended Water Quality 3.0 Effluent: 1.0 RO Blend
Salinity										
	Electrical Conductivity (Ecw)	umhos/cm	**<700**	700-3000	>3000	1000 [3]	reduced yield	890	1040	**690**
	Total Dissolved Solids (TDS)	mg/L	**<450**	450-2000	>2000	640 [3]	reduced yield	571	580	**440**
Infiltration								SAR=4.7	Data Not Available	**SAR=2.9**
	Sodium Adsorption Ratio (SAR) = 0-3 and ECw =		**>700**	700-200	<200					**690**
	SAR =3-6 and ECw =		>1200	1200-300	<300			890		
	SAR = 6-12 and ECw =		>1900	1900-500	<500					
	SAR =12-20 and ECw =		>2900	2900-1300	<1300					
	SAR = 20-40 and ECw =		>5000	5000-2900	<2900					
Specific Ion Toxicity										
	Sodium (Na)									
	surface irrigation	SAR	<3	3-9	>9			4.7	Data Not Available	**2.9**
	sprinkler irrigation	mg/L (me/L)	<70 (3)	>70 (3)		**<100[4] (4.4)**		127 (5.5)	Data Not Available	**95 (4.2)**
	Chloride (Cl)									
	surface irrigation	mg/L (me/L)	<140 (4)	140-355 (4-10)	>355 (10)	**125 [4] (3.5)**		109 (3.1)	120 (3.4)	**90 (2.5)**
	sprinkler irrigation	mg/L (me/L)	<110 (3)	>110 (3)			leaf injury	109 (3.1)	120 (3.4)	**90 (2.5)**
	Boron	mg/L	<0.7	0.7-3.0	>3	**0.6[4]**	reduced plant growth and yield	0.7	Data Not Available	**0.6**
	Trace Elements (see Table 4)									
Other Effects (affects susceptible plants)										
	Nitrate-Nitrogen	mg/L as N						3	2.3	**2.27[10]**
	Available Nitrogen[9]	mg/L as N				**10 [4,9]**	Excessive vigor and delayed ripening of grapes, unbalanced wine, possible ground water contamination at higher N levels	42	Data Not Available	**32[10]**
	Total Nitrogen	mg/L as N	<5	5-30	>30			64 [8]	Data Not Available	**50[10]**
	Calcium	mg/L (me/L)				**80[4] (4)**	Plugging of irrigation emitters	89 (4.4)	Data Not Available	**70 (3.3)**
	Magnesium	mg/L (me/L)				**50[4] (4.1)**	Plugging of irrigation emitters	15.7 (1.3)	Data Not Available	**12 (1.0)**
	Bicarbonate (HCO_3) (overhead sprinklering only)	mg/L (me/L)	<90	90-500	>500	**<245[4] (4)**	Plugging of irrigation emitters	260 (4.3)	230[7]	**200 (3.3)**
	pH (normal range 6.5-8.4)					**8.0[4]**		7.7	Data Not Available	**7.5**

Notes:

1 Source: Table 4.6 Guidelines for Interpretations of Water Quality for Agricultural Irrigation in Guidelines for the On-Site Retrofit of Facilities Using Disinfected Teriary Recycled Water (AWWA) and Table 3-4 Guidelines for Interpretation of Water Quality for Irrigation, in Irrigation with Reclaimed Municipal Wastewater - A Guidance Manual, Pettygrove and Asano. ssumptions are listed in Table 3 of this technical memorandum.

1A Degree of Restriction on Use: When the guideline indicate no restriction on use, full production capability of all crops without the use of special practices is assumed. A "restriction on use" indicates there may be a limitation in choice of crop, or special management may be needed to maintain full production capability

2 Source: Unless otherwise noted, Information taken from "Drought Tip 92-19" Water Quality Guidelines for Trees and Vines, Grattan and Oster in cooperation with DWR-Water Conservation Office, Department of Land, Air, and Water Resources at University of California, USDA)

3 The grape-specific salinity criteria is taken from Table 1 of the source noted in note (2), and is the estimated maximum irrigation water salinity that can be used on grapes and still maintain 100% yield potential. Assumes 15% leaching fraction and well-drained soil.

4 Source: Data provided by Zone 7 Agricultural Consultant. The consultant identified these concentration values as the long-term, applied water concentrations which can be tolerated by grapes during repeated applications here in the Livermore Valley. Boron critieria is per personal communication to WYA on 3/29/2001.

5 DSRSD WWTP effluent water quality taken from *Table 5-1 Summary of DSRSD WWTP Secondary Effluent Water Quality*, in *San Ramon Valley Recycled Water Program* (DERWA), Montgomery Watson July 1996.

6 July 2000 water quality received from DSRSD WWTP staff 12/5/2000.

7 Specific Alkalinity is not given. Alkalinity is assumed to all be bicarbonate alkalinity. Since the effluent pH is about 8, almost all the alkalinity should be bicarbonate.

8 Total nitrogen consists of ammonia-nitrogen, nitrate-nitrogen, nitrite, and organic-nitrogen.

9 Per UC/Alameda and Contra Costa County Farm Advisor and assumes Available Nitrogen is Nitrite-N, Nitrate-N, Ammonia-N and 1/3 of Organic N. UC/Alameda and Contra County Farm Advisor recommends a maximum value of 10 mg/L available N. The 5 mg/L criteria is based on data provided by Zone 7 Agricultural Consultant.

10 Does not account for nitrogen removal through separate nitrification/denitrification treatment process to be added to existing wastewater treatment process.

Table 4. Phase III Comparison of Recommended Maximum Concentrations of Trace Elements[a] and DSRSD Effluent

Element (Symbol)	Recommended Maximum Concentration[b] (mg/L)	DSRSD Effluent Quality[c] (mg/L)	Effluent Concentration Exceeds Maximum Recommended Concentration?	Remarks
Aluminum (Al)	5	0.03	NO	Can cause non-productivity in acid (pH < 5.5), but more alkaline soils at pH > 7.0 will precipitate the ion and eliminate any toxicity.
Arsenic (As)	0.1	0.00	NO	Toxicity to plants varies widely, ranging from 12 mg/L for Sudan grass to less than 0.05 mg/L for rice.
Beryllium (Be)	0.1	0.01	NO	Toxicity to plants varies widely, ranging from 5 mg/L for kale to 0.5 mg/L for bush beans.
Cadmium (Cd)	0.01	0.00	NO	Toxic to beans, beets, and turnips at concentrations as low a 0.1 mg/L in nutrient solutions. Conservative limits recommended due to its potential for accumulation in plants and soils to concentrations that may be harmful to humans.
Cobalt (Co)	0.05	0.00	NO	Toxic to tomato plants at 0.1 mg/L in nutrient solution. Tends to be inactivated by neutral and alkaline soils.
Chromium (Cr)	0.1	0.01	NO	Not generally recognized as an essential growth element. Conservative limits recommended due to lack of knowledge on its toxicity to plants.
Copper (Cu)	0.2	0.03	NO	Toxic to a number of plants at 0.1 to 1.0 mg/L in nutrient solutions.
Fluoride (F)	1	0.85	NO	Inactivated and neutral and alkaline soils.
Iron (Fe)	5	0.19	NO	Not toxic to plants in aerated soils, but can contribute to soil acidification and loss of availability of essential phosphorus and molybdenum. Overhead sprinkling may result in unsightly deposits on plants, equipment and buildings.
Lithium (Li)	2.5	Data Not Available	Data Not Available	Tolerated by most crops up to 5 mg/L; mobile in soil. Toxic to citrus at low concentrations (<0.075 mg/L). Acts similarly to boron.
Manganese (Mn)	0.2	0.03	NO	Toxic to a number of crops at a few tenths to a few mg/L, but usually only in acid soils.
Molybdenum (Mo)	0.01	0.01	NO	Not toxic to plants at normal concentrations in soil and water. Can be toxic to livestock if forage is grown in soils with high concentrations of available molybdenum.
Nickel (Ni)	0.2	0.00	NO	Toxic to a number of plants at 0.5 to 1.0 mg/L; reduced toxicity at neutral or alkaline pH.
Lead (Pd)	5	0.01	NO	Can inhibit plant cell growth at very high concentrations.
Selenium (Se)	0.02	0.00	NO	Toxic to plants at concentrations as low as 0.025 mg/L and toxic to livestock if forage is grown in soils with relatively high levels of added selenium. An essential element to animals, but in very low concentrations.
Tin (Sn)	---	Data Not Available	No max. concentration given	Effectively excluded by plants; specific tolerance unknown.
Titanium (Ti)	---	Data Not Available	No max. concentration given	
Tungsten (W)	---	Data Not Available	No max. concentration given	
Vanadium (V)	0.1	Data Not Available	Data Not Available	Toxic to many plants at relatively low concentrations.
Zinc (Zn)	2	0.05	NO	Toxic to many plants at widely varying concentrations; reduced toxicity at pH > 6.0 and in fine textured or organic soils.

[a] Source: Table 4.4 of Guidelines for the On-Site Retrofit of Facilities Using Disinfected Tertiary Recycled Water (AWWA), which was adapted from the National Academy of Sciences (1972) and Pratt (1972).

[b] The maximum concentration is based on water application rate which is consistent with good irrigation practices (10,000 m3 per hectare per year). If the water application rate greatly exceeds this, the maximum concentrations should be adjusted downward accordingly. No adjustment should be made for application rates less than 10,000 m3 per hectare per year. The values given are for water used on a continuous basis at one site.

[c] DSRSD Effluent Water Quality stated is the higher of the available data sources (1995 vs. 2000)

Table 5. Phase III Untreated Water Supply Scenarios

Supply Scenario	Supply Components	Annual Supply Amount (afa)
Scenario 1: Surface Water Option Modified Vision 2010	Additional local runoff	5,500
	Pre-1997 untreated water allocation from SBA	6,650
	Post-1997 untreated water allocation from SBA	2,750[a]
	New imported surface water from SWP[b]	45,300
	Evaporative losses	(1,700)
	Total	58,500
Scenario 2: Recycled and Surface Water Option Modified Vision 2010	Additional local runoff	5,500
	Pre-1997 untreated water allocation from SBA	6,650
	Post-1997 untreated water allocation from SBA	2,750[a]
	New imported surface water from SWP[b]	27,200
	Evaporative losses	(1,100)
	Blended recycled irrigation water[c]	17,500
	Total	58,500
Scenario 3: Surface Water Option Zone 7's Estimated Water Demand	Additional local runoff	5,500
	Pre-1997 untreated water allocation from SBA	6,650
	Post-1997 untreated water allocation from SBA	2,750[a]
	New imported surface water from SWP[b]	13,300
	Evaporative losses	(700)
	Total	27,500

(a) Available for Post-1997 allocation contracts, as of January 2001 only.
(b) Additional surface water will be required to account for evaporative losses. For Scenario 1, an additional 1,700 afa will be required; for Scenario 2, an additional 1,100 afa will be required; for Scenario 3, an additional 700 afa will be required.
(c) Net quantity available for actual use. Does not include quantities for evaporative losses or brine reject water.

Figure 4 illustrates the locations of these seven focus areas, along with existing water delivery infrastructure. As shown in Table 6, the total acreage within these seven areas was approximately 38,430 acres. It should be noted that, private developers own most of the land within the North Livermore A focus area, south of May School Road. These landowners have indicated that they plan to develop their land for urban use (e.g., housing and offices) and will not participate in any type of agricultural land use. Therefore, for the purposes of this Non-Potable WMP, it was assumed that these lands in the North Livermore A focus area would not be available for irrigated agricultural activities, and the total acreage was reduced to 34,440 acres.

Table 6. Total Area Within Focus Areas

Focus Area Name	Total Area Within Each Focus Area, acres[a]
Collier/Doolan Canyon	3,180
Greenville	7,230
North Livermore A[b]	3,990
North Livermore B	4,510
South Livermore A	14,700
South Livermore B	1,920
Vasco/Laughlin	2,900
Total Focus Area Acres	**38,430**
Total Area (without North Livermore A)	**34,440**

(a) Data based on area calculations using WYA's GIS system.
(b) Landowners in North Livermore A have indicated that they will not participate in any type of agricultural land use.

Area Removed based on NRCS Data, Available Planning Documents, and Land Slope Criteria

Using NRCS data, available planning documents, and land slopes for the Tri-Valley area obtained from a United States Geological Survey (USGS) 30-meter Digital Elevation Model (DEM), downloaded as a 1-degree block in June 2003 from the California Spatial Information Library (CASIL) website (http://gis.ca.gov), WYA identified seven limiting factors that would prevent additional irrigated agricultural development. These seven limiting factors included the following:

- Areas where soil types were of poor agricultural quality
- Areas with restricted use (e.g., environmentally sensitive and planned for urban use)
- Areas with existing agriculture
- Areas with existing structures
- Areas containing a golf course

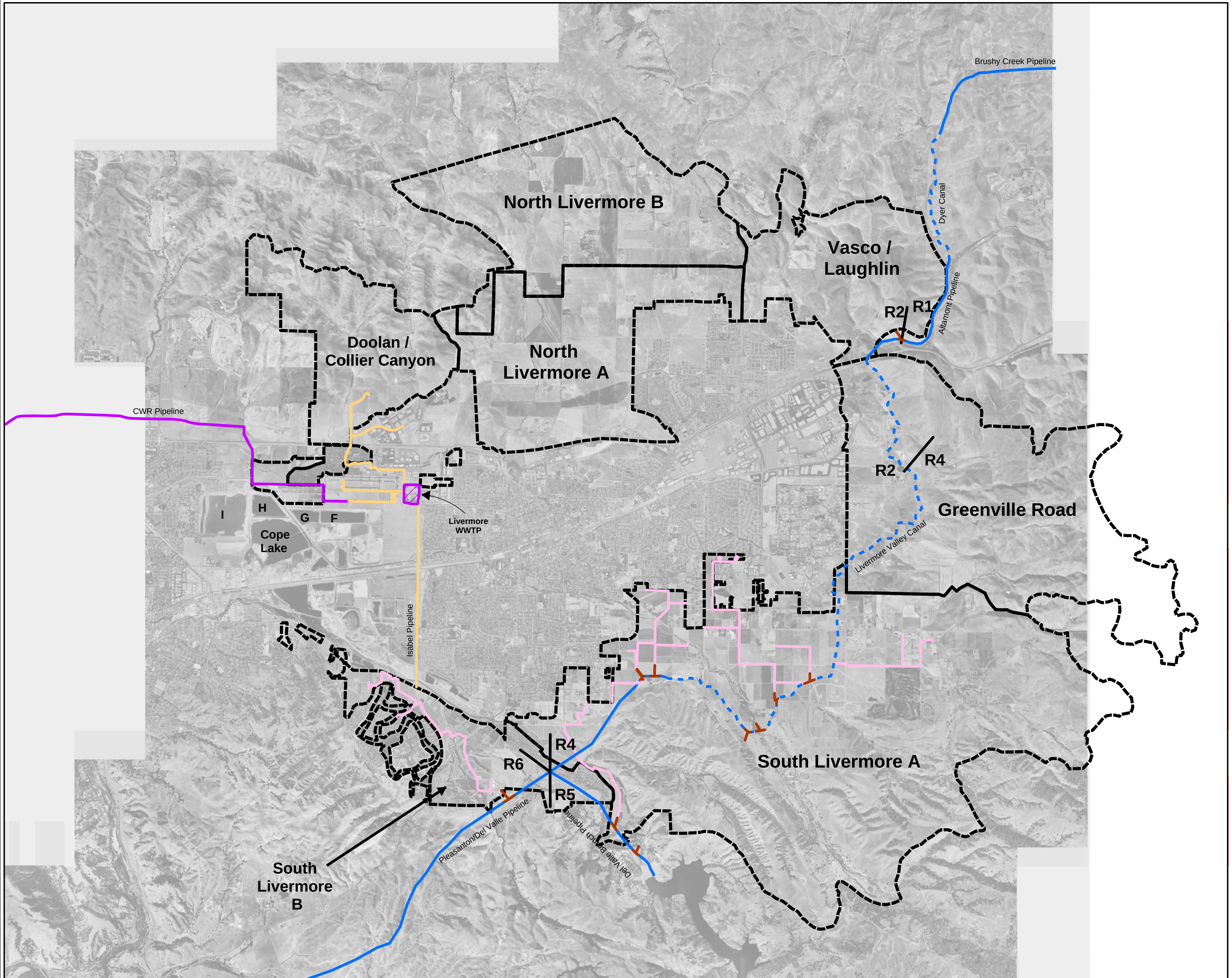


FIGURE 4

Zone 7 Water Agency Non-Potable Water Master Plan Conceptual Master Plan

Revised Focus Areas

N

0 0.3 0.6 1.2

Scale in Miles

NOTES:

LEGEND:

- Existing Livermore WWTP
- Focus Area Boundary
- South Bay Aqueduct: Canal
- South Bay Aqueduct: Pipeline
- Former CWR: Existing Recycled Water Pipeline
- Livermore: Existing Recycled Water System
- Wente: Existing Non-Potable Water System
- Reach
- Turnout from SBA

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- Areas owned and operated by the Livermore Area Recreation and Park District (LARPD) or East Bay Regional Park District (EBRPD)
- Areas where land slopes were too steep to irrigate

WYA removed land areas using slope criteria for drip irrigation provided by Zone 7's agricultural consultant; irrigable lands with a slope greater than 30 percent were eliminated due to the physical difficulty of operating farming equipment on slopes this steep. Other areas were also eliminated from agricultural use due to the passage of Measure D, which limits agricultural practices in North Livermore to slopes less than 20 percent.

Figures 5 through 10 illustrate the areas removed from each focus area. As shown in Table 7, the total acreage available for irrigated agricultural development after considering each of the limiting factors identified is 22,340 acres. The total area is approximately equal to the area previously identified in the Phase III Study (25,300 acres).

Table 7. Potential Maximum Irrigable Agricultural Area

Focus Area[(a)]	Total Area within Focus Area, acres[(a)]	Area Removed, acres[(b)]	Maximum Irrigable Agricultural Area, acres	Phase III Study Area, acres
Collier/Doolan Canyon	3,180	530	2,650	0[(c)]
Greenville	7,230	680	6,550	0[(d)]
I-680 Corridor[(e)]	0	0	0	1,200
North Livermore B	4,510	950	3,560	9,600
South Livermore A	14,700	7,190	7,510	13,600
South Livermore B	1,920	1,580	340	0[(f)]
Tassajara Creek Drainage[(g)]	0	0	0	900
Vasco/Laughlin	2,900	1,170	1,730	0
Total	**34,400**	**12,100**	**22,340**	**25,300**

(a) North Livermore A excluded from this Non-Potable WMP because land is planned for urban use only (e.g., housing and office buildings)

(b) Area calculated using WYA's GIS database.

(c) The Phase III Study included the acreage for Collier/Doolan Canyon in the North Livermore category

(d) The Phase III Study included the acreage for Greenville in the South Livermore category.

(e) The I-680 corridor acreage was eliminated from this Non-Potable WMP due to economic feasibility.

(f) The Phase III Study included the acreage for South Livermore B in the South Livermore category.

(g) This Non-Potable WMP included acreage for the Tassajara Creek Drainage Basin in the North Livermore category.

As shown in Figure 11, the current study decreased the total irrigable acreage estimated by the Phase III Study by approximately 2,960 acres due to the elimination of North Livermore A (see

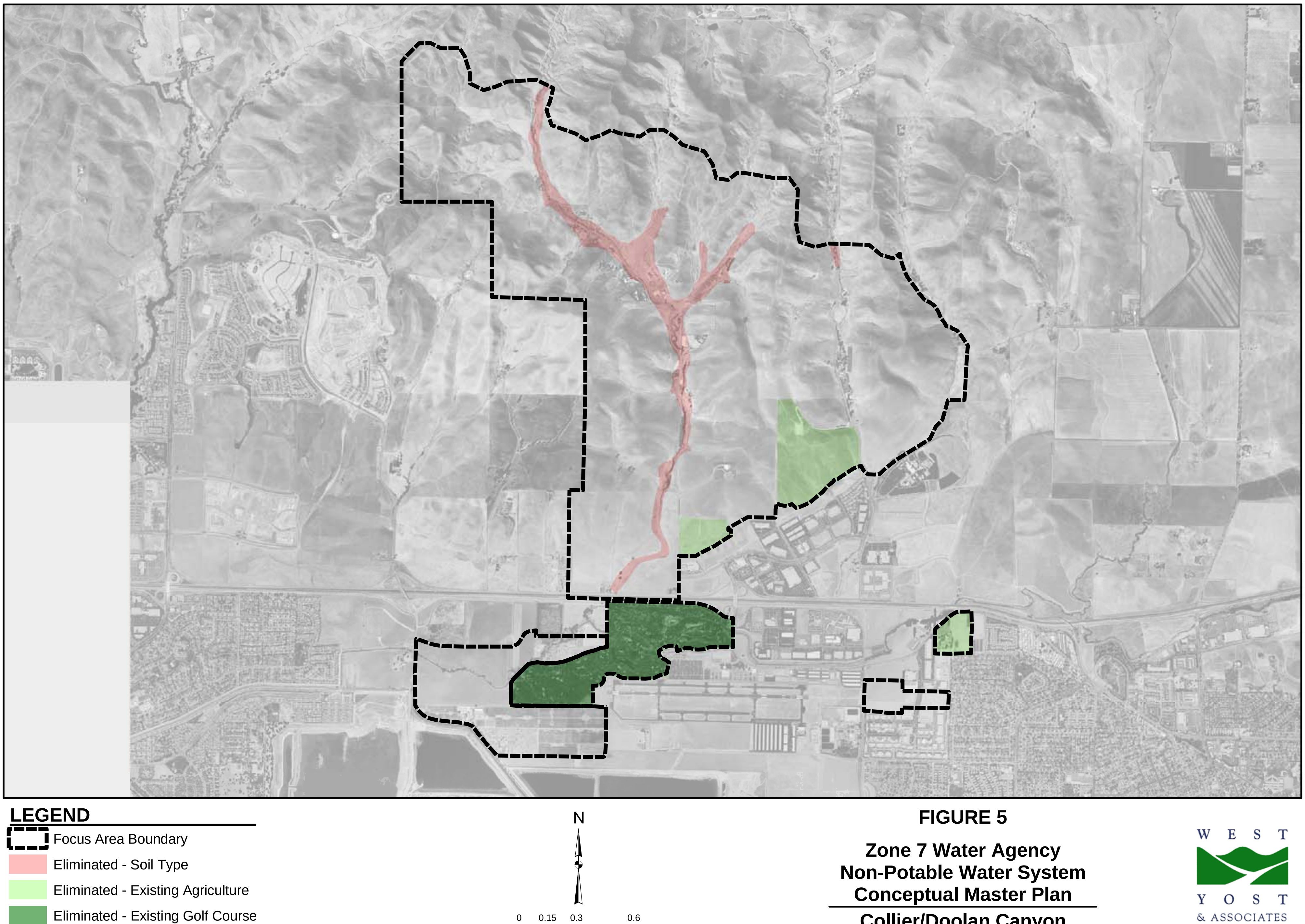

FIGURE 5

Zone 7 Water Agency
Non-Potable Water System
Conceptual Master Plan

Collier/Doolan Canyon
Potential Remaining Irrigable Agricultural Area

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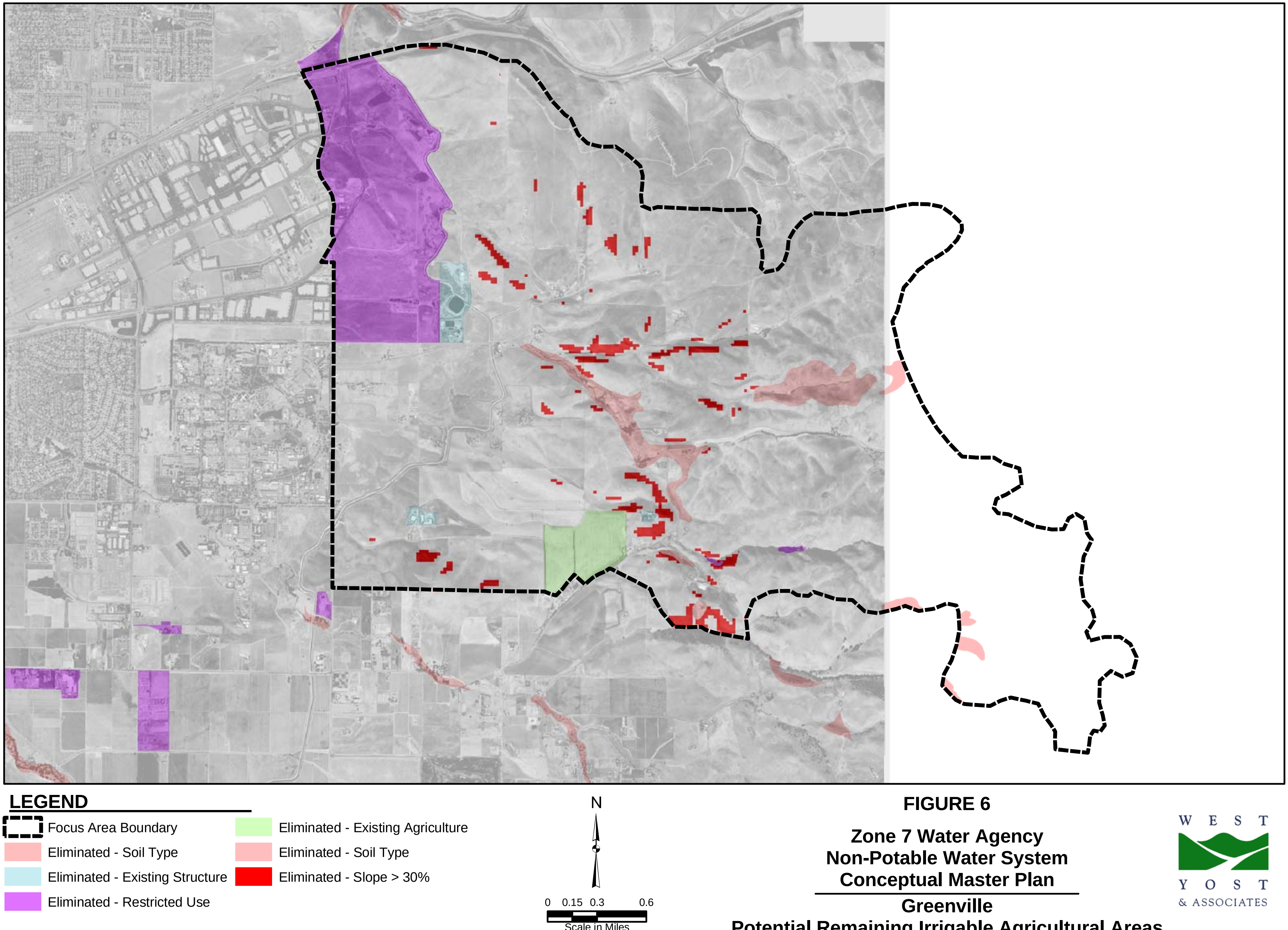

FIGURE 6

Zone 7 Water Agency
Non-Potable Water System
Conceptual Master Plan

Greenville
Potential Remaining Irrigable Agricultural Areas

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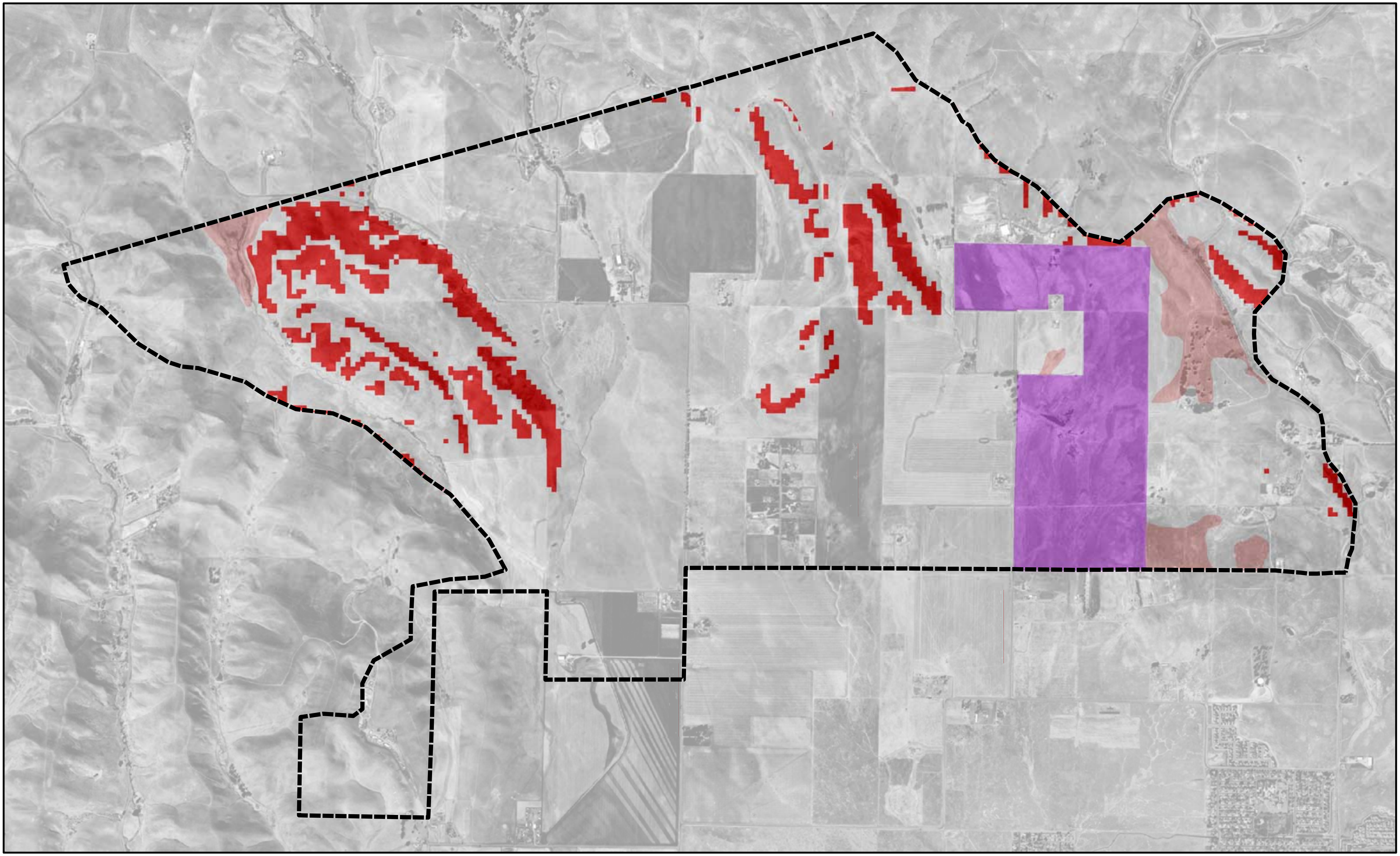

LEGEND

- Focus Area Boundary
- Eliminated - Soil Type
- Eliminated - Restricted Use
- Eliminated - Slope > 20%

N

0 0.125 0.25 0.5
Scale in Miles

FIGURE 7

Zone 7 Water Agency
Non-Potable Water System
Conceptual Master Plan

North Livermore Option B
Potential Remaining Irrigable Agricultural Areas

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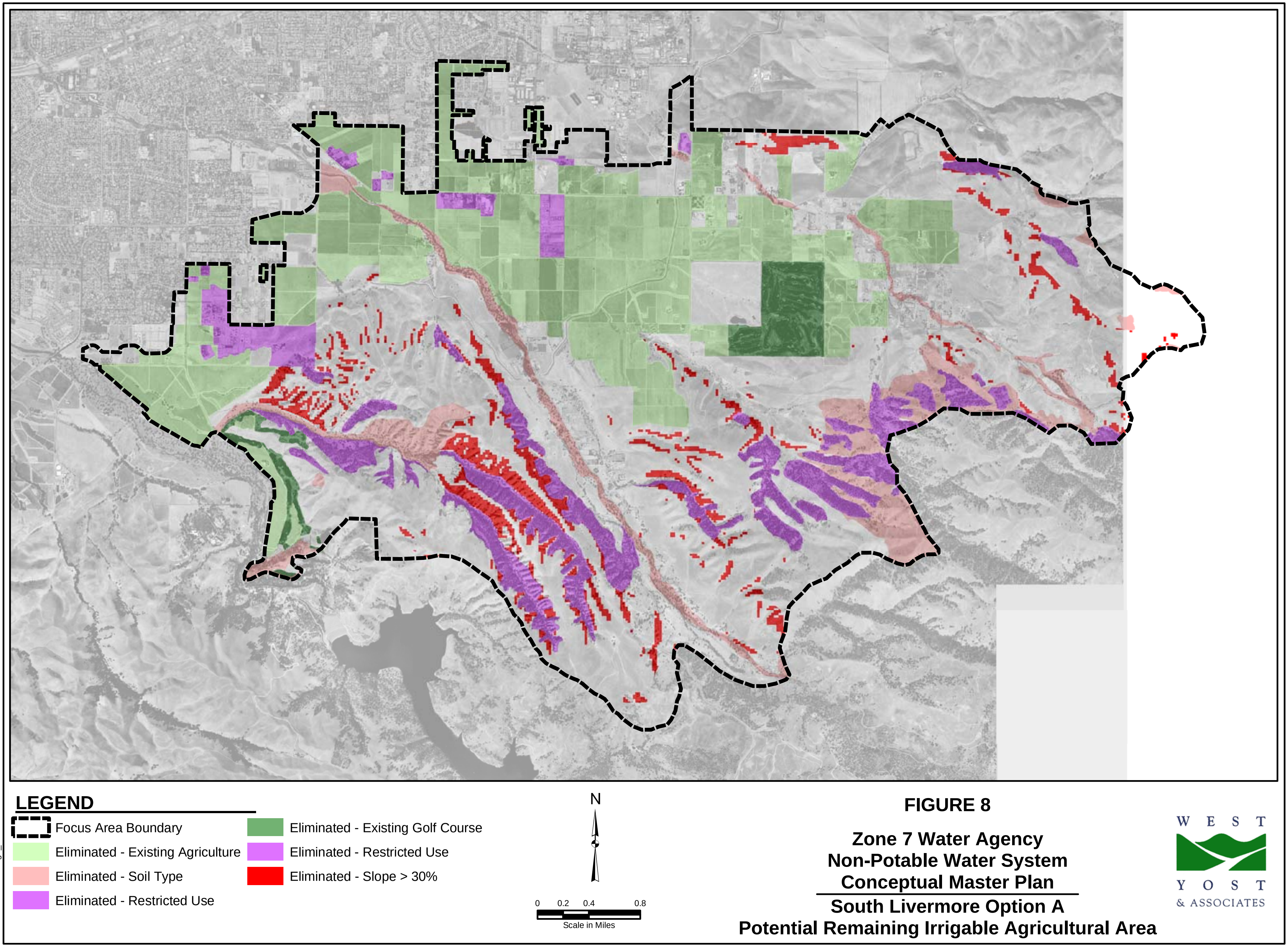

FIGURE 8

Zone 7 Water Agency
Non-Potable Water System
Conceptual Master Plan

South Livermore Option A
Potential Remaining Irrigable Agricultural Area

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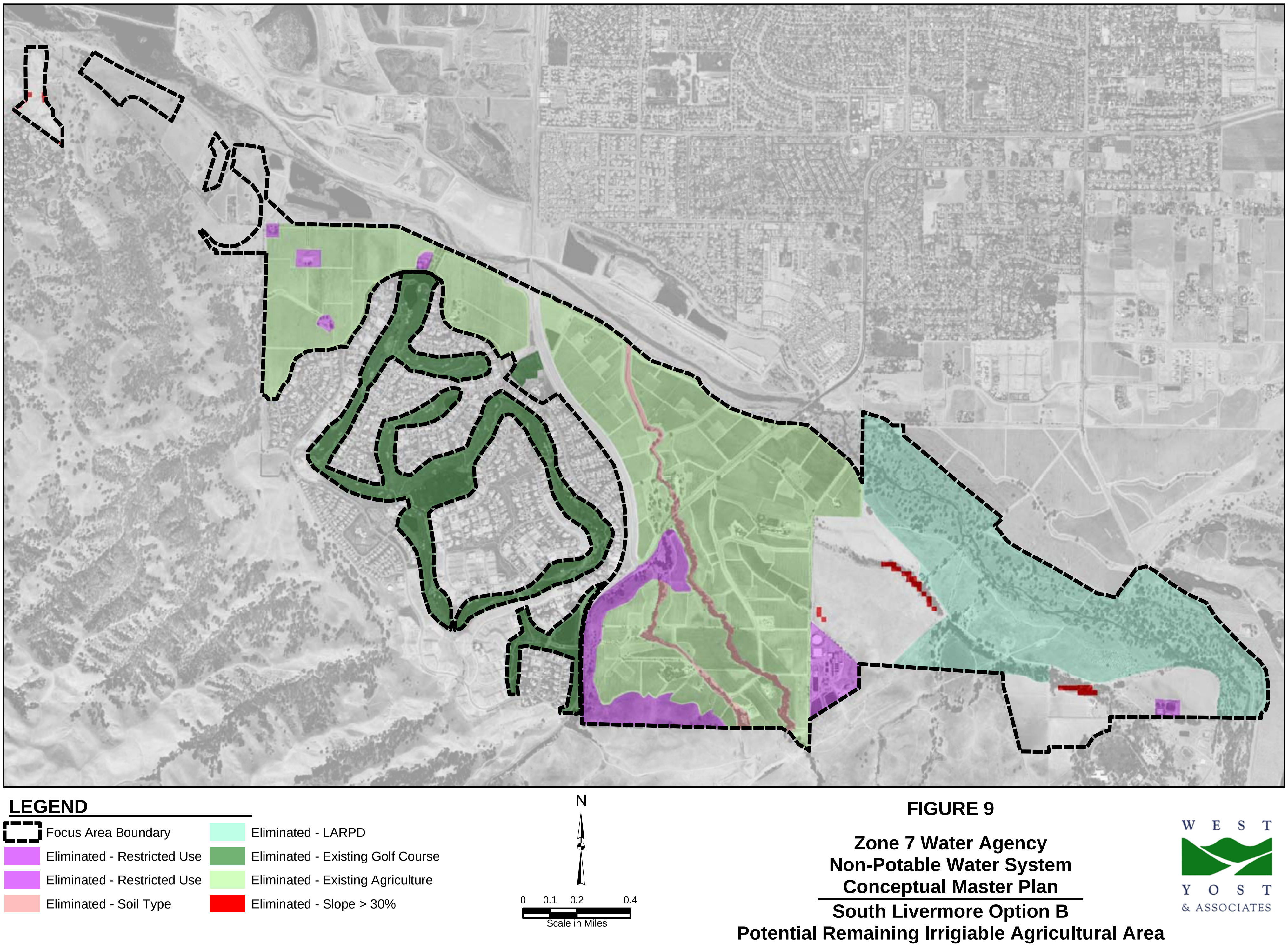

FIGURE 9

Zone 7 Water Agency
Non-Potable Water System
Conceptual Master Plan

South Livermore Option B
Potential Remaining Irrigiable Agricultural Area

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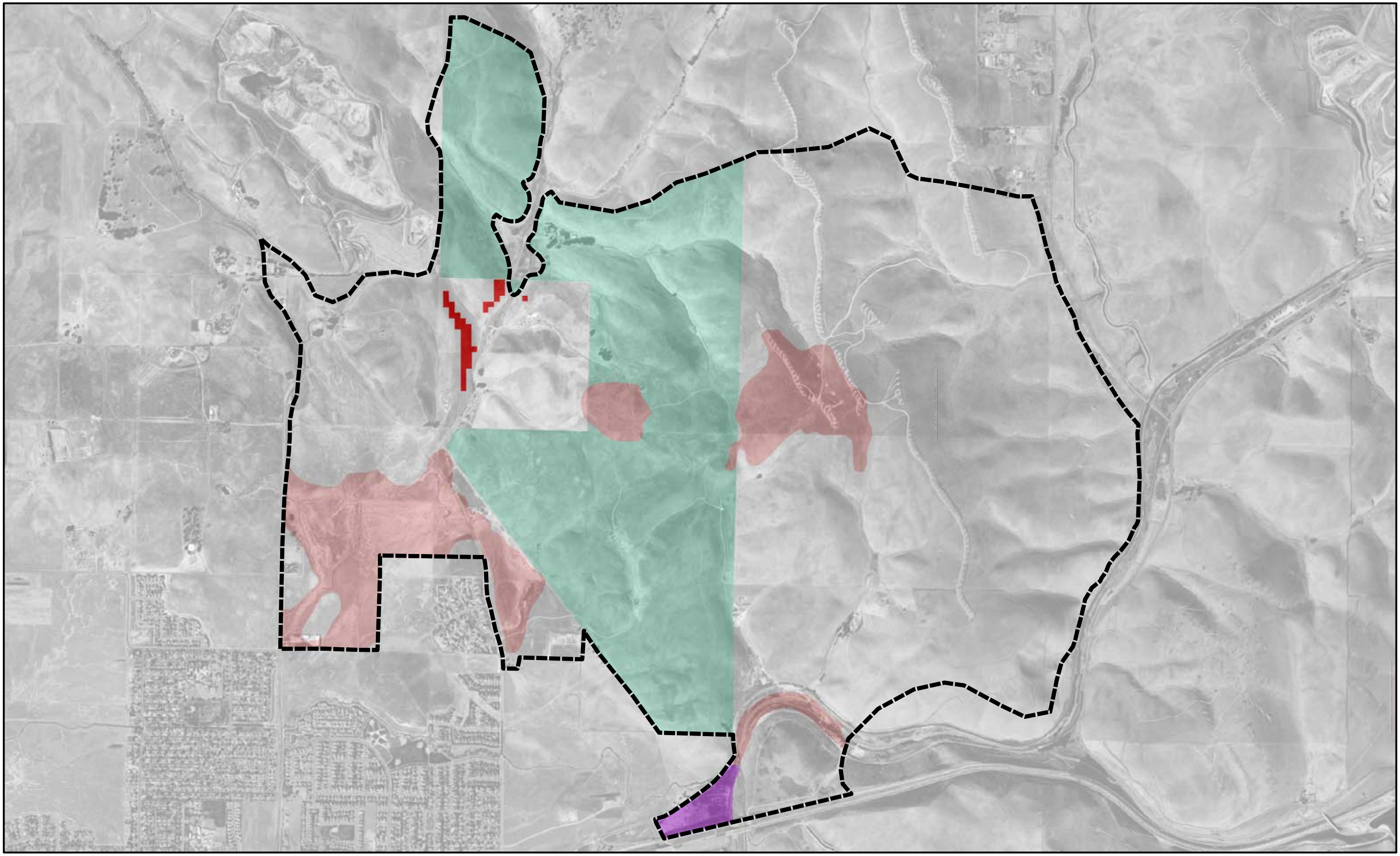

LEGEND

- Focus Area Boundary
- Eliminated - Soil Type
- Eliminated - EBRPD
- Eliminated - Restricted Use
- Eliminated - Slope > 30%

N

0 0.1 0.2 0.4
Scale in Miles

FIGURE 10

Zone 7 Water Agency
Non-Potable Water System
Conceptual Master Plan

Vasco/Laughlin
Potential Remaining Irrigable Agricultural Area

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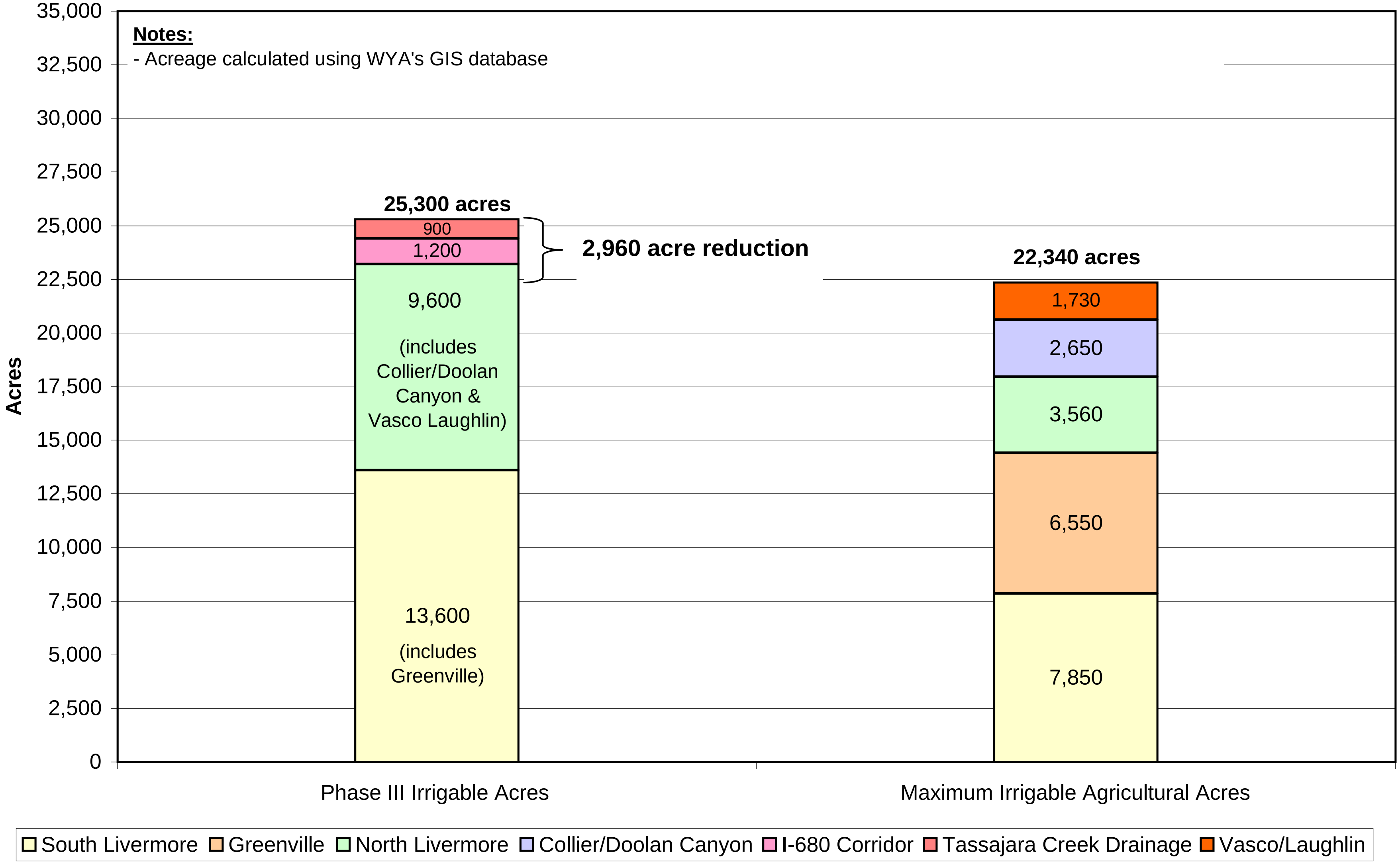
Figure 11. Potential Maximum Irrigable Agricultural Acres



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Zone 7 Water Agency
Non-Potable Water System
Conceptual Master Plan

Figure 4), elimination of the I-680 corridor area (see Figure 1), and refinement of available area using slope criteria, NRCS data, and available planning documents.

Area Removed Based on Economic Feasibility

WYA further reduced the maximum irrigable agricultural area (22,340 acres) using economic feasibility to help identify individual project areas available for a potential pilot agricultural project (Group 1 areas). Figure 12 illustrates the Group 1 Pilot Project areas. Table 8 presents the total acreage available for agricultural development after considering all limitations.

Table 8. Potential Irrigable Agricultural Areas after Considering Economic Feasibility

Focus Area[a]	Maximum Irrigable Agricultural Area, acres[a]	Area Removed Based on Economic Feasibility, acres[b]	**Potential Group 1 Pilot Project Irrigable Agricultural Areas, acres**	Phase III Study Area, acres
Collier/Doolan Canyon	2,650	2,230	**420**	0[c]
Greenville	6,550	3,200	**3,350**	0[d]
I-680 Corridor[e]	0	0	**0**	1,200
North Livermore B	3,560	460	**3,100**	9,600
South Livermore A	7,510	1,380	**6,130**	13,600
South Livermore B	340	50	**290**	0[f]
Tassajara Creek Drainage[g]	0	0	**0**	900
Vasco/Laughlin	1,730	1,370	**360**	0
Total	**22,340**	**8,690**	**13,650**	**25,300**

(a) North Livermore A excluded from this Non-Potable WMP because land is planned for urban use only (e.g., housing and office buildings)
(b) Area calculated using WYA's GIS database.
(c) The Phase III Study included the acreage for Collier/Doolan Canyon in the North Livermore category
(d) The Phase III Study included the acreage for Greenville in the South Livermore category.
(e) The I-680 corridor acreage was eliminated from this Non-Potable WMP due to economic feasibility.
(f) The Phase III Study included the acreage for South Livermore B in the South Livermore category.
(g) This Non-Potable WMP included acreage for the Tassajara Creek Drainage Basin in the North Livermore category.

As shown in Figure 13, this Non-Potable WMP decreased the total irrigable acreage (25,300 acres) estimated by the Phase III Study by approximately 2,960 acres, then further reduced the revised potential maximum irrigable agricultural area (22,340 acres) by 8,690 acres to identify potential Group 1 Pilot Project areas; the total Group 1 Pilot Project area is approximately 13,650 acres.

REVISED NON-POTABLE WATER DEMAND

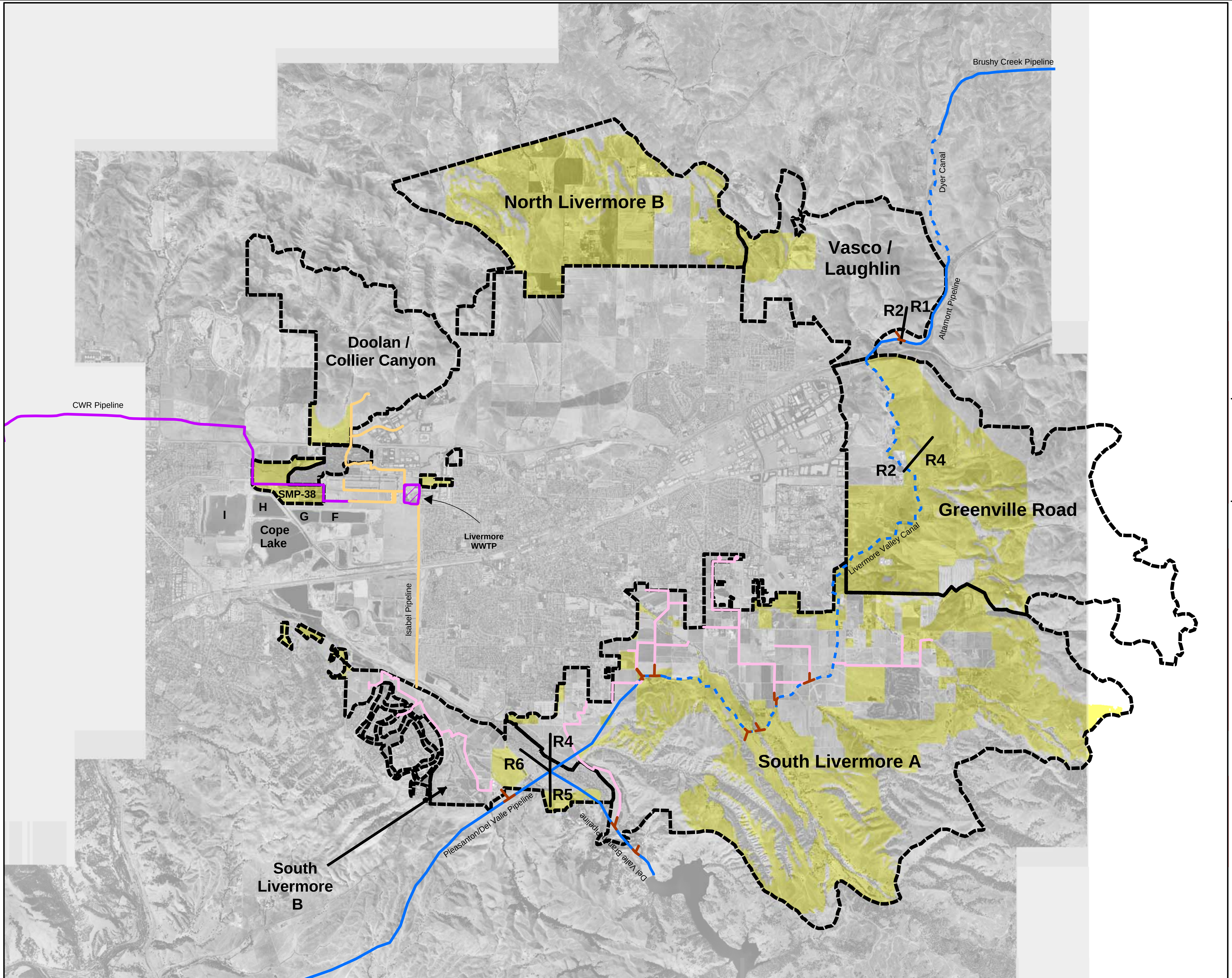
Revised Water Application Rate

In the Phase III Study, a water application rate of 2.25 af/ac/yr was used to calculate the non-potable water demands. For this study, Zone 7's Agricultural Consultant developed a revised application rate of 1.61 af/ac/yr based on actual application rates on wine grapes in the Tri-Valley

FIGURE 12

Zone 7 Water Agency Non-Potable Water System Conceptual Master Plan

Potential Group 1 Irrigable Agricultural Acres



N

0 0.3 0.6 1.2

Scale in Miles

NOTES:

LEGEND:

- Existing Livermore WWTP
- Focus Area Boundary
- South Bay Aqueduct: Canal
- South Bay Aqueduct: Pipeline
- Former CWR: Existing Recycled Water Pipeline
- Livermore: Existing Recycled Water System
- Wente: Existing Non-Potable Water System
- Revised Irrigable Acreage
- Reach
- Turnout

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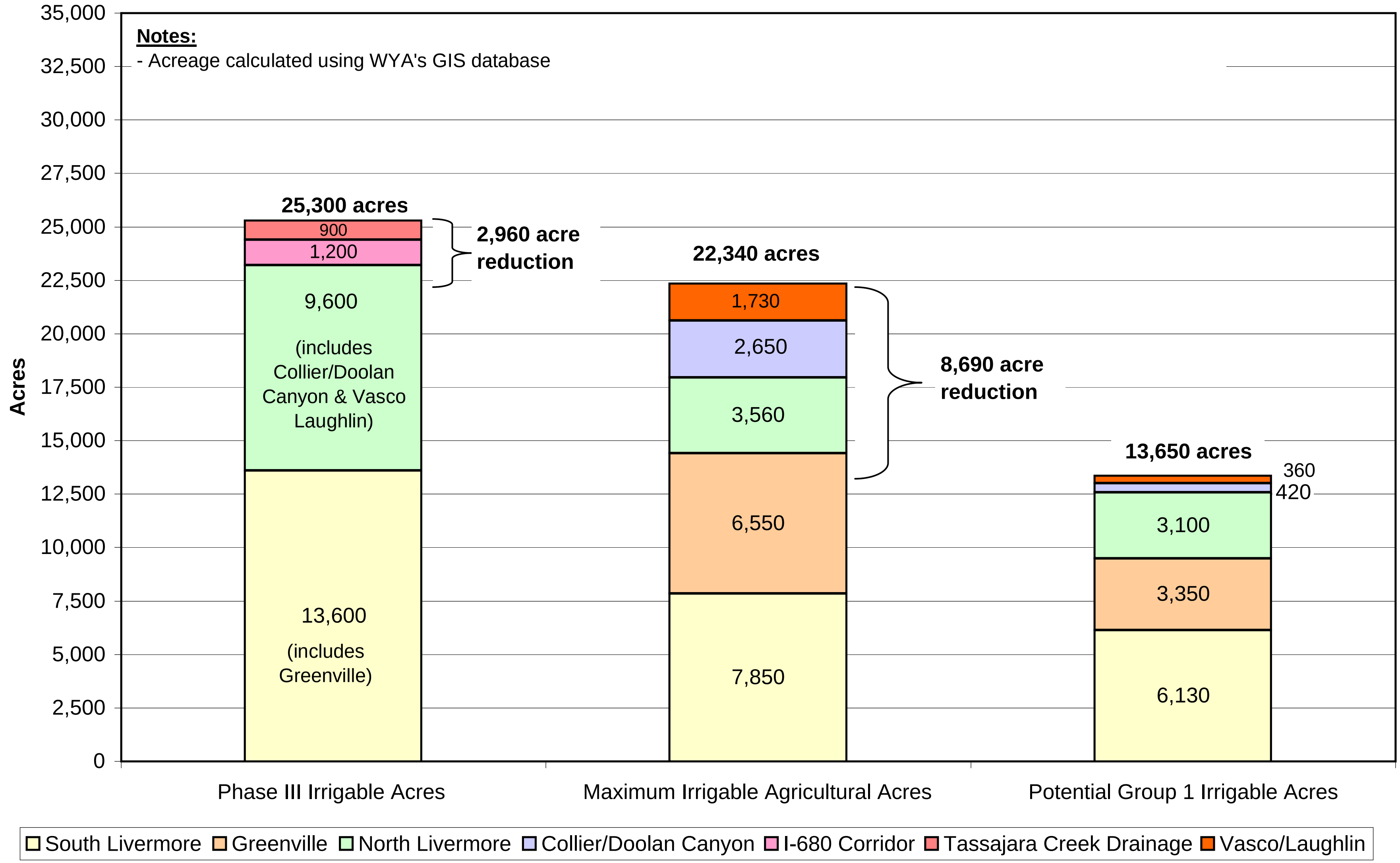
Figure 13. Potential Group 1 Irrigable Agricultural Area



area. In the development of this revised application rate, local microclimates, soil types, irrigation methods and local agricultural experience were considered in the evaluation of several different types of crops, including annuals, trees, berries and grapes. Application rates ranged from 1.21 af/ac/yr (for chili peppers) to 4.00 af/ac/yr (for strawberries). For purposes of this study, the 1.61 af/ac/yr application rate was selected to represent an economically feasible crop (wine grapes), which would allow for a maximum amount of agricultural acres to be developed based on the available non-potable supply.

Revised Non-Potable Water Demand

Based on a revised water application rate of 1.61 af/ac/yr and the potential Group 1 Pilot Project areas, the non-potable water demand for this Non-Potable WMP is approximately 21,990 afa. Table 9 presents the revised non-potable water demand.

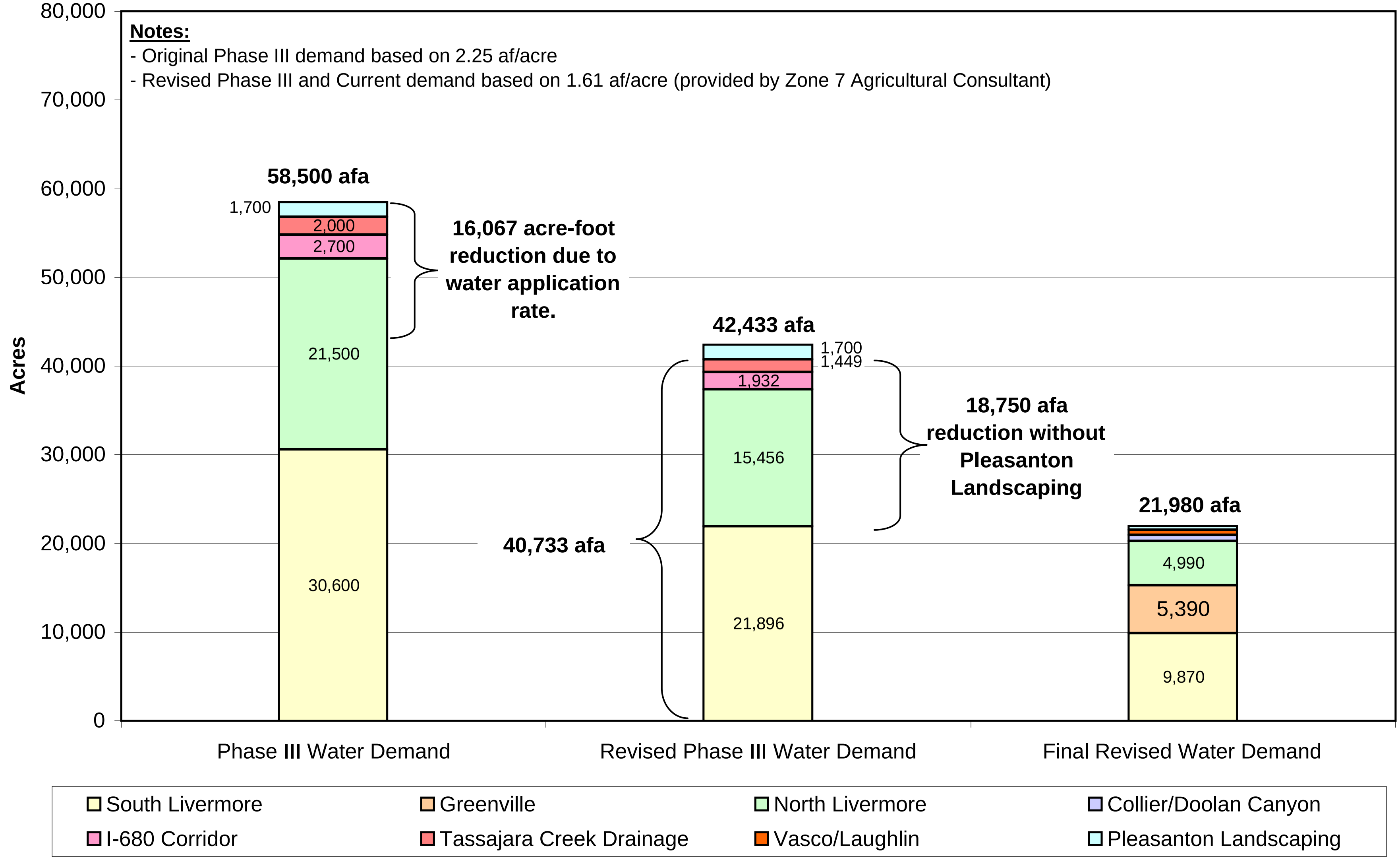
Table 9. Revised Non-Potable Water Demand

Area[a]	Revised Non-Potable Water Demand[h]	Phase III Water Demand[b,i]
Collier/Doolan Canyon	680 afa (420 ac)	0[c]
Greenville	5,390 afa (3,350 ac)	0[d]
I-680 Corridor	0[e]	1,932 afa (1,200 ac)
North Livermore B	4,990 afa (3, 100 ac)	15,456 afa (9,600 ac)
South Livermore A	9,870 afa (6,130 ac)	21,896 afa (13,600 ac)
South Livermore B	470 afa (290 ac)	0[f]
Tassajara Creek Drainage	0[g]	1,449 afa (900 ac)
Vasco/Laughlin	580 afa (360 ac)	0
Total	**21,980 afa (13,650 ac)**	**40,733 afa (25,300 ac)**

(a) North Livermore A excluded from this Non-Potable WMP because land is planned for urban use only (e.g., housing and office buildings)
(b) Does not include 1,700 afa demand for City of Pleasanton
(c) The Phase III Study included the acreage for Collier/Doolan Canyon in the North Livermore category
(d) The Phase III Study included the acreage for Greenville in the South Livermore category.
(e) The I-680 corridor acreage was eliminated from this Non-Potable WMP due to economic feasibility.
(f) The Phase III Study included the acreage for South Livermore B in the South Livermore category.
(g) This Non-Potable WMP included acreage for the Tassajara Creek Drainage Basin in the North Livermore category.
(h) Average water use of 1.61 af/ac/yr used to calculate water demand (based on Zone 7 Agricultural Consultant).
(i) Average water use of 2.25 af/ac/yr was used to determine demands in the Phase III Study (see Table 1); however, these were adjusted using a new water use of 1.61 af/ac/yr.

As shown in Figure 14, this Non-Potable WMP reduced the total demand by 18,750 afa (46 percent) using the refined Group 1 Pilot Project areas.

Figure 14. Revised Non-Potable Water Demand



REVISED NON-POTABLE WATER SUPPLY

There are currently two water supply sources potentially available to meet projected non-potable water demands:

- Imported surface water from the SBA
- Recycled water produced within the Tri-Valley area.

Revised Surface Water Supply Estimates from the SBA

As discussed previously, the SBA is being expanded to meet future M&I water demands. At this time, no conveyance capacity on the expanded SBA is planned for direct use for agriculture.

However, as shown on Figure 15, the SBA will have off-peak conveyance capacity available for possible use for expanded agricultural demand from January through June and August through December. The total off-peak water conveyance capacity available from the SBA is approximately 40,430 afa. If additional imported surface water supplies were acquired, this off-peak capacity could be used to convey this water into the Valley and then seasonally stored, if storage facilities were also available. As shown in Table 10, this Non-Potable WMP reduces the total SBA water supply conveyance capacity by only 4,900 acre-feet; however, all of the water supply from the SBA would now require storage.

Table 10. Total Available Off-Peak Water Supply Conveyance Capacity from the Expanded SBA

Use Type	Revised SBA Water Supply Conveyance Capacity, afa[a,b]	Phase III SBA Water Supply, afa[c]
Direct Use	0	34,100
Storage Required	40,430	11,200
Total	**40,430**	**45,300**

(a) Data obtained from Zone 7
(b) Based on a 130 cfs expansion with no capacity in July available for others
(c) Obtained from the Untreated Water System Study – Phase III Analysis

Revised Recycled Water Supply Estimates

Currently, two wastewater treatment plants (WWTP) exist within the Tri-Valley area that treat three sources of wastewater; the three sources of wastewater are the Cities of Pleasanton, Dublin, and Livermore. The City of Pleasanton's wastewater is treated at the DSRSD WWTP, along with wastewater from the City of Dublin; the City of Livermore has its own WWTP (LWRP). As shown in Table 11, there is projected to be a maximum of approximately 32,640 afa of recycled water available at buildout from these three sources.

Figure 15. Conveyance Capacity After SBA Expansion

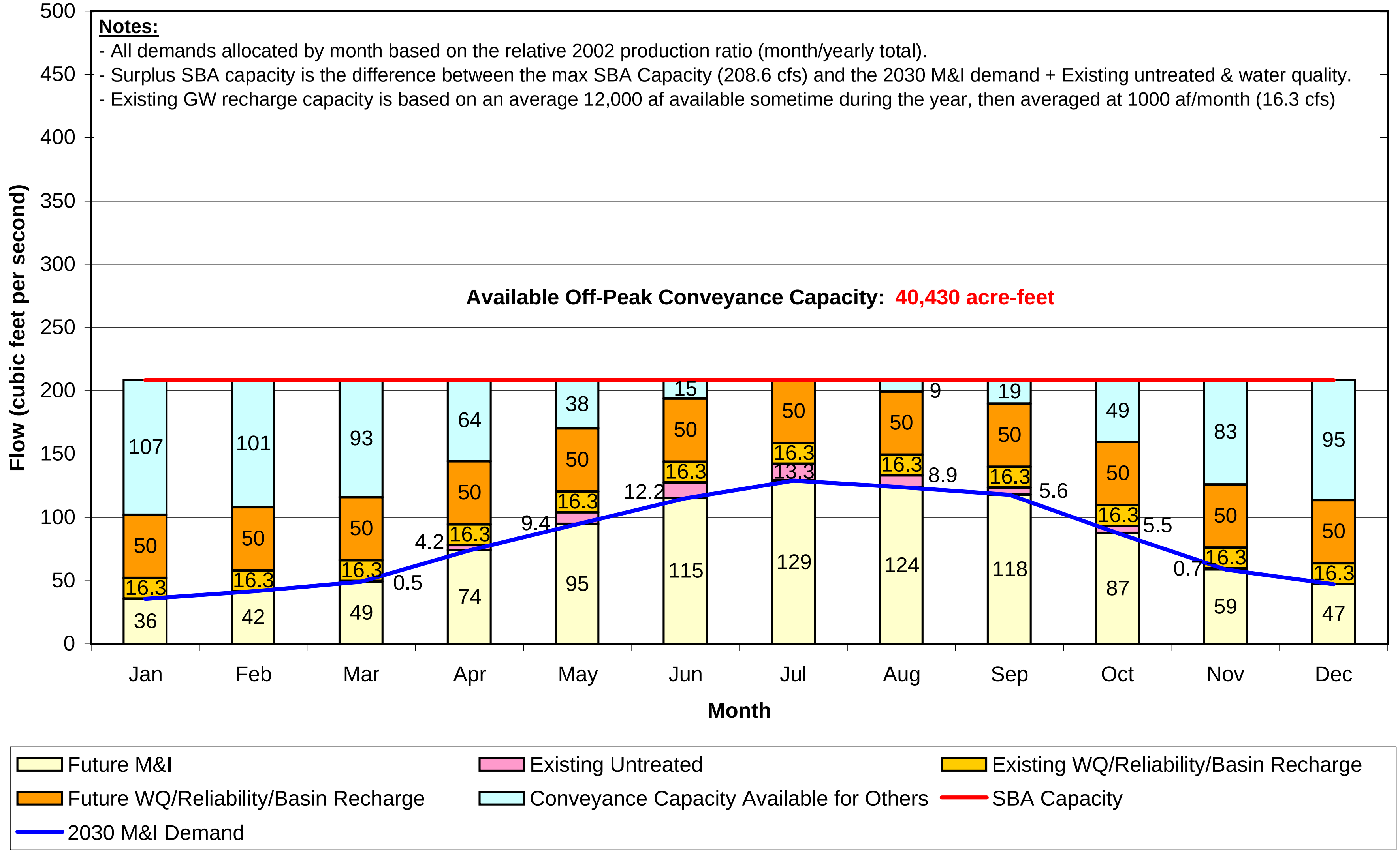


Table 11. Revised Total Recycled Water Supply

Supply Source	Current Supply, afa[a]	Phase III Supply, afa[b,c]
Pleasanton	10,866	10,000
DSRSD	9,511	11,400
Livermore	7,281	12,800
LAVWMA Discharge[d]	4,983	0
Total	**32,640**	**34,200**

(a) Assumes that tertiary capacity of Livermore WWTP is 6.5 MGD
(b) Assumes Livermore WWTP does not discharge to LAVWMA
(c) Assumes DERWA uses a portion of Pleasanton supply
(d) LAVWMA Discharge required because tertiary capacity is limited to 6.5 MGD

Since completion of the Phase III Study, Sunol Valley, the City of Livermore, and DERWA have submitted reports documenting their intent to either start their own agricultural development programs using recycled water supplies, or revising their projected recycled water demands. Consequently, WYA did not consider recycled water supplies already accounted for in these reports to be available for use in this Non-Potable WMP.

Additionally, the Phase III Study assumed that the tertiary capacity of the LWRP would be expanded to treat its full buildout average dry weather flow of 11.1 MGD; however, the most recent report produced by the City of Livermore indicates that this expansion may not occur. Consequently, under this assumption, approximately 4,983 afa of the wastewater generated by the City of Livermore would be discharged down the Livermore-Amador Valley Water Management Agency (LAVWMA) pipeline because the LWRP will not have the capacity to treat it.

As shown in Table 12, the total recycled water demand projected for other non-potable/agricultural development projects in the Tri-Valley area (including recycled water supply discharged down the LAVWMA pipeline), has increased to approximately 23,960 afa. This represents a 9,090 afa (61 percent) increase in the total recycled water demand for other proposed projects and therefore, only 8,680 afa of recycled water supply is projected to be available for others.

Table 12. Revised Recycled Water Demands from Other Non-Potable Supply Development Projects

Demand Source	Current Study, afa[a,b]	Phase III Study, afa
Pleasanton	1,695	0
Sunol Valley	5,430	0
DERWA	5,937	9,374
Livermore[c]	5,911	5,500
LAVWMA Discharge	4,983	0
Total Recycled Water Demand	23,960	14,874
Total Recycled Water Supply	32,640	34,200
Recycled Water for Others	8,680	19,326

(a) Assumes that tertiary capacity of Livermore WWTP is 6.5 mgd
(b) DERWA demand provided by DSRSD, Livermore Option 3 is assumed; Sunol Valley Scenario #3 is assumed.
(c) City of Livermore demand requires storage

As shown on Figure 16, all of the available recycled water supply (8,680 afa) requires storage and only 1,200 afa is available from the LWRP.

WATER QUALITY ISSUES AND REVISED RECYCLED WATER BLENDING RATIOS

Water Quality Criteria

Even though potential non-potable water supplies are not for human consumption, the quality of these supplies is important, particularly if high value agricultural crops are sensitive to individual chemical constituents. For the purpose of this Non-Potable WMP, WYA used water quality criteria for wine grapes, a highly marketable crop, to evaluate the quality of available surface water and recycled water supplies. Additionally, Zone 7's recently adopted non-potable water quality criteria were incorporated into the evaluation. Table 13 presents the key water quality criteria used to evaluate the quality of non-potable water supplies.

Figure 16. Revised Monthly Recycled Water Supply & Demand

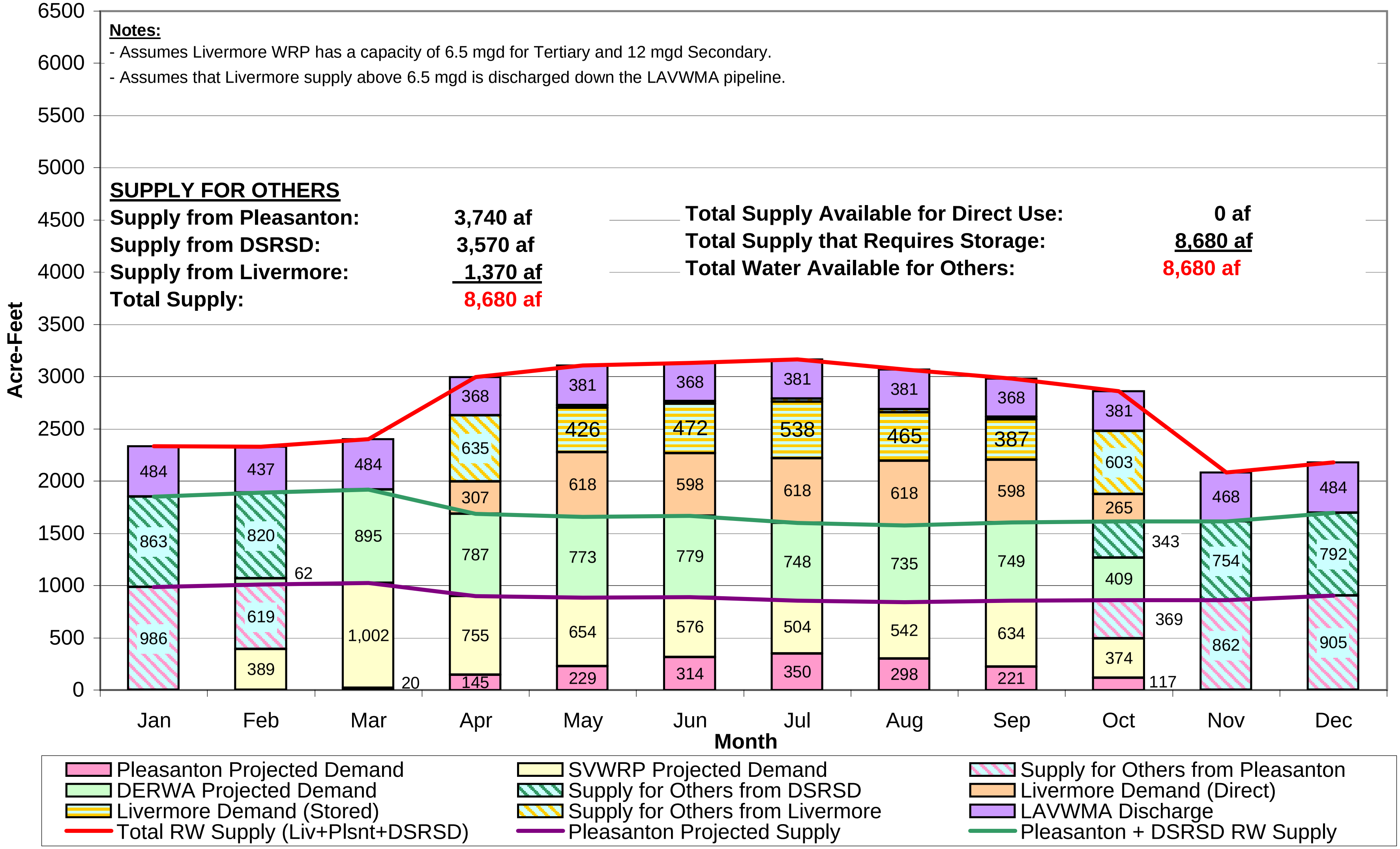


Table 13. Non-Potable Water Quality Criteria

Water Quality Parameter	Maximum Permissible Concentration, mg/L	Source
Electrical Conductivity	2,000[(a)]	Drought Tip 92-19 Water Quality Guidelines for Trees and Vines
Total Dissolved Solids	650	Zone 7 Non-Potable Water Targets
Boron	0.5	Zone 7 Non-Potable Water Targets
Sodium	100	Zone 7 Non-Potable Water Targets
Chloride	125	Zone 7 Non-Potable Water Targets
Available Nitrogen[(b)]	10	Zone 7 Non-Potable Water Targets
Calcium	100	Drought Tip 92-19 Water Quality Guidelines for Trees and Vines
Magnesium	55	Drought Tip 92-19 Water Quality Guidelines for Trees and Vines
Bicarbonate	400	Drought Tip 92-19 Water Quality Guidelines for Trees and Vines

(a) Measured as total nitrogen.
(b) Measured in units of μmhos/cm.

Similar to the Phase III Study, recent tertiary water quality data provided by the DSRSD and City of Livermore confirmed that the concentration of boron, available nitrogen, and Total Dissolved Solids (TDS) controlled whether each potential water supply could be used as irrigation water for wine grapes. Imported water supplies conveyed through the SBA are of appropriate water quality for direct use to irrigate wine grapes and all other irrigable agricultural corps. However, tertiary recycled water supplies produced at the DSRSD and LWRP would not be of appropriate quality to allow direct use of these supplies for irrigational use. Tables 14 through 17 present the most recent water quality data for these tertiary recycled water supplies and RO recycled water supplies from both the DSRSD and LWRP facilities. Tables 14 and 16 also present water quality data for imported surface water supplies conveyed through the SBA, as a comparison.

As shown in Table 16, there are two boron concentrations reported for the Livermore RO effluent. One value for the concentration of boron (0.06 mg/L) was recently reported in the City of Livermore's 2003 Recycled Water for Agricultural Reuse Feasibility Study, the second concentration of boron (0.7 mg/L) was reported in data provided to WYA by the City of Livermore. For this Non-Potable WMP, blending ratios were determined using both boron concentrations.

Table 14. Summary of DSRSD/Pleasanton Recycled Water Quality Criteria

Key Irrigation Water Quality Parameters		Units	CRITERIA: Degree of Use Restriction[1,1A] for Agricultural Use: None	Slight to Moderate	Severe	Grape-Specific Criteria[2]: Maximum Permissible Concentration	Possible Adverse Effect If Concentration Exceeded	Tertiary Effluent Concentration[5] 1995 Average	RO Permeate Concentration[5] 2002 Average	SBA Concentration 2002 Average	Blend #1 1.0 Tertiary: 0.65 SBA Blend
Salinity											
	Electrical Conductivity (Ecw)	umhos/cm	<700	700-3000	>3000	<2000 [3]	reduced yield	890	70	1400	1091
	Total Dissolved Solids (TDS)	mg/L	<450	450-2000	>2000	<650 [3]	reduced yield	571	25	258.1	650
Infiltration											
	Sodium Adsorption Ratio (SAR)							3.3	0	2.2	2.9
	SAR = 0-3 and ECw =		>700	700-200	<200						
	SAR =3-6 and ECw =		>1200	1200-300	<300						
	SAR = 6-12 and ECw =		>1900	1900-500	<500						
	SAR =12-20 and ECw =		>2900	2900-1300	<1300						
	SAR = 20-40 and ECw =		>5000	5000-2900	<2900						
Specific Ion Toxicity											
	Boron	mg/L	<0.7	0.7-3.0	>3	0.5[4]	reduced plant growth and yield	0.7	0.39	0.2	0.5
	Sodium (Na)	mg/L (meq/L)	<70 (3)	>70 (3)		<100[4] (4.3)		127 (5.5)	4.5 (0.19)	50.6 (2.2)	96.9
	Chloride (Cl)	mg/L (meq/L)	<110 (3)	>110 (3)		<125 [4] (3.5)	leaf injury	109 (3.1)	2.9 (0.08)	77 (2.2)	96.4
	Trace Elements (see Table 15)										
Other Effects (affects susceptible plants)											
	Available Nitrogen[7]	mg/L as N				<10 [4]	Excessive vigor and delayed ripening of grapes, unbalanced wine, possible ground water contamination at higher N levels	42	1.89	1.77	26.2
	Calcium	mg/L (meq/L)				<100[4] (5)	Plugging of irrigation emitters	89 (4.4)	0	22.4 (1.1)	62.8
	Magnesium	mg/L (meq/L)				<55[4] (4.5)	Plugging of irrigation emitters	15.7 (1.3)	0	11.2 (0.92)	13.9
	Calcium + Magnesium	meq/L				4		5.7	0	2.02	
	Bicarbonate (HCO_3)	mg/L (meq/L)	<90	90-500	>500	<400[4] (6.53)	Plugging of irrigation emitters	260 (4.3)	14.4	97.7 (1.6)	196.1
	pH (normal range 6.5-8.4)	--				<8.0[4]		7.9	7.2	8	7.5

Notes:

1 Source: Table 4.6 Guidelines for Interpretations of Water Quality for Agricultural Irrigation in Guidelines for the On-Site Retrofit of Facilities Using Disinfected Teriary Recycled Water (AWWA) and Table 3-4 Guidelines for Interpretation of Water Quality for Irrigation, in Irrigation with Reclaimed Municipal Wastewater - A Guidance Manual, Pettygrove and Asano. ssumptions are listed in Table 3 of this technical memorandum.

1A Degree of Restriction on Use: When the guideline indicate no restriction on use, full production capability of all crops without the use of special practices is assumed. A "restriction on use" indicates there may be a limitation in choice of crop, or special management may be needed to maintain full production capability

2 Source: Unless otherwise noted, Information taken from "Drought Tip 92-19" Water Quality Guidelines for Trees and Vines, Grattan and Oster in cooperation with DWR-Water Conservation Office, Department of Land, Air, and Water Resources at University of Ca

3 The grape-specific salinity criteria is taken from Table 1 of the source noted in note (2), and is the estimated maximum irrigation water salinity that can be used on grapes and still maintain 100% yield potential. Assumes 15% leaching fraction and well-drained soil.

4 Source: Data provided by Zone 7 Agricultural Consultant; the consultant identified these concentration values as the long-term, applied water which can be tolerated by grapes during repeated applications here in the Livermore Valley. Boron critieria is per personal communication to WYA on 3/29/2001.

5 DSRSD WWTP effluent water quality provided by DSRSD.

6 Total nitrogen consists of ammonia-nitrogen, nitrate-nitrogen, nitrite, and organic-nitrogen.

7 Per UC/Alameda and Contra Costa County Farm Advisor and assumes Available Nitrogen is Nitrite-N, Nitrate-N, Ammonia-N and 1/3 of Organic N. UC/Alameda and Contra County Farm Advisor recommends a maximum value of 10 mg/L available N. The 5 mg/L criteria data provided by Zone 7's Agricultural Consultant.

Table 15. Comparison of Recommended Maximum Concentrations of Trace Elements[a] and DSRSD Effluent

Element (Symbol)	Recommended Maximum Concentration[b] (mg/L)	DSRSD Effluent Quality[c] (mg/L)	Effluent Concentration Exceeds Maximum Recommended Concentration?	Remarks
Aluminum (Al)	5	0.03	NO	Can cause non-productivity in acid (pH < 5.5), but more alkaline soils at pH > 7.0 will precipitate the ion and eliminate any toxicity.
Arsenic (As)	0.1	0.00	NO	Toxicity to plants varies widely, ranging from 12 mg/L for Sudan grass to less than 0.05 mg/L for rice.
Beryllium (Be)	0.1	0.01	NO	Toxicity to plants varies widely, ranging from 5 mg/L for kale to 0.5 mg/L for bush beans.
Cadmium (Cd)	0.01	0.00	NO	Toxic to beans, beets, and turnips at concentrations as low a 0.1 mg/L in nutrient solutions. Conservative limits recommended due to its potential for accumulation in plants and soils to concentrations that may be harmful to humans.
Cobalt (Co)	0.05	0.00	NO	Toxic to tomato plants at 0.1 mg/L in nutrient solution. Tends to be inactivated by neutral and alkaline soils.
Chromium (Cr)	0.1	0.01	NO	Not generally recognized as an essential growth element. Conservative limits recommended due to lack of knowledge on its toxicity to plants.
Copper (Cu)	0.2	0.03	NO	Toxic to a number of plants at 0.1 to 1.0 mg/L in nutrient solutions.
Fluoride (F)	1	0.85	NO	Inactivated and neutral and alkaline soils.
Iron (Fe)	5	0.19	NO	Not toxic to plants in aerated soils, but can contribute to soil acidification and loss of availability of essential phosphorus and molybdenum. Overhead sprinkling may result in unsightly deposits on plants, equipment and buildings.
Lithium (Li)	2.5	Data Not Available	Data Not Available	Tolerated by most crops up to 5 mg/L; mobile in soil. Toxic to citrus at low concentrations (<0.075 mg/L). Acts similarly to boron.
Manganese (Mn)	0.2	0.03	NO	Toxic to a number of crops at a few tenths to a few mg/L, but usually only in acid soils.
Molybdenum (Mo)	0.01	0.01	NO	Not toxic to plants at normal concentrations in soil and water. Can be toxic to livestock if forage is grown in soils with high concentrations of available molybdenum.
Nickel (Ni)	0.2	0.00	NO	Toxic to a number of plants at 0.5 to 1.0 mg/L; reduced toxicity at neutral or alkaline pH.
Lead (Pd)	5	0.01	NO	Can inhibit plant cell growth at very high concentrations.
Selenium (Se)	0.02	0.00	NO	Toxic to plants at concentrations as low as 0.025 mg/L and toxic to livestock if forage is grown in soils with relatively high levels of added selenium. An essential element to animals, but in very low concentrations.
Tin (Sn)	---	Data Not Available	No max. concentration given	Effectively excluded by plants; specific tolerance unknown.
Titanium (Ti)	---	Data Not Available	No max. concentration given	
Tungsten (W)	---	Data Not Available	No max. concentration given	
Vanadium (V)	0.1	Data Not Available	Data Not Available	Toxic to many plants at relatively low concentrations.
Zinc (Zn)	2	0.05	NO	Toxic to many plants at widely varying concentrations; reduced toxicity at pH > 6.0 and in fine textured or organic soils.

[a] Source: Table 4.4 of Guidelines for the On-Site Retrofit of Facilities Using Disinfected Tertiary Recycled Water (AWWA), which was adapted from the National Academy of Sciences (1972) and Pratt (1972).

[b] The maximum concentration is based on water application rate which is consistent with good irrigation practices (10,000 m3 per hectare per year). If the water application rate greatly exceeds this, the maximum concentrations should be adjusted downward accordingly. No adjustment should be made for application rates less than 10,000 m3 per hectare per year. The values given are for water used on a continuous basis at one site.

[c] DSRSD Effluent Water Quality stated is the higher of the available data sources (1995 vs. 2000)

Table 16. Summary of Livermore Recycled Water Quality Criteria

Key Irrigation Water Quality Parameters	Units	Degree of Use Restriction[1,1A] for Agricultural Use: None	Slight to Moderate	Severe	Grape-Specific Criteria[2]: Maximum Permissible Concentration	Possible Adverse Effect If Concentration Exceeded	Tertiary Effluent Concentration[5]: 2002 Average	RO Permeate Concentration [5]: 2002 Average	SBA Concentration: 2002 Average	Blend #1: 1.0 Tertiary: 2.3 SBA Blend
Salinity										
Electrical Conductivity (Ecw)	umhos/cm	<700	700-3000	>3000	<2000 [3]	reduced yield	1400	70	1400	1400
Total Dissolved Solids (TDS)	mg/L	<450	450-2000	>2000	<650 [3]	reduced yield	635	31.8	258.1	370.9
Infiltration										
Sodium Adsorption Ratio (SAR)							4.8	1.04	2.2	3.1
SAR = 0-3 and ECw =		>700	700-200	<200						
SAR =3-6 and ECw =		>1200	1200-300	<300						1400
SAR = 6-12 and ECw =		>1900	1900-500	<500						
SAR =12-20 and ECw =		>2900	2900-1300	<1300						
SAR = 20-40 and ECw =		>5000	5000-2900	<2900						
Specific Ion Toxicity										
Boron	mg/L	<0.7	0.7-3.0	>3	0.5[4]	reduced plant growth and yield	1.2	0.06 - 0.7	0.2	0.5
Sodium (Na)	mg/L (meq/L)	<70 (3)	>70 (3)		<100[4] (4.3)		144 (6.3)	7.2 (0.31)	50.6 (2.2)	78.6 (3.4)
Chloride (Cl)	mg/L (meq/L)	<110 (3)	>110 (3)		<125 [4] (3.5)	leaf injury	175 (4.9)	8.8 (0.25)	77 (2.2)	106.3 (34.6)
Trace Elements (see Table 17)										
Other Effects (affects susceptible plants)										
Available Nitrogen[7]	mg/L as N				<10 [4]	Excessive vigor and delayed ripening of grapes, unbalanced wine, possible ground water contamination at higher N levels	47.9	1.93	1.77	15.6
Calcium	mg/L (meq/L)				<100[4] (5)	Plugging of irrigation emitters	32 (1.6)	1.6 (0.08)	22.4 (1.1)	25.3 (1.3)
Magnesium	mg/L (meq/L)				<55[4] (4.5)	Plugging of irrigation emitters	23 (1.9)	1.2 (.099)	11.2 (0.92)	14.7 (1.2)
Calcium + Magnesium	meq/L				4		3.5	0.179	2.02	2.5
Bicarbonate (HCO_3)	mg/L (meq/L)	<90	90-500	>500	<400[4] (6.53)	Plugging of irrigation emitters	321 (5.3)	16.1 (0.26)	97.7 (1.6)	164.6
pH (normal range 6.5-8.4)	--				<8.0[4]		7.9	7.9	8	8

Notes:

1 Source: Table 4.6 Guidelines for Interpretations of Water Quality for Agricultural Irrigation in Guidelines for the On-Site Retrofit of Facilities Using Disinfected Teriary Recycled Water (AWWA) and Table 3-4 Guidelines for Interpretation of Water Quality for Irrigation, in Irrigation with Reclaimed Municipal Wastewater - A Guidance Manual, Pettygrove and Asano. ssumptions are listed in Table 3 of this technical memorandum.

1A Degree of Restriction on Use: When the guideline indicate no restriction on use, full production capability of all crops without the use of special practices is assumed. A "restriction on use" indicates there may be a limitation in choice of crop, or special management may be needed to maintain full production capability

2 Source: Unless otherwise noted, Information taken from "Drought Tip 92-19" Water Quality Guidelines for Trees and Vines, Grattan and Oster in cooperation with DWR-Water Conservation Office, Department of Land, Air, and Water Resources at University of California, USDA)

3 The grape-specific salinity criteria is taken from Table 1 of the source noted in note (2), and is the estimated maximum irrigation water salinity that can be used on grapes and still maintain 100% yield potential. Assumes 15% leaching fraction and well-drained soil.

4 Source: Data provided by Zone 7's Agricultural Consultant; the consultant identified these concentration values as the long-term, applied water concentrations which can be tolerated by grapes during repeated applications here in the Livermore Valley. Boron critieria is per personal communication to WYA on 3/29/2001.

5 Livermore WWTP tertiary effluent water quality was either provided by the City of Livermore or taken from the 2003 B&C Feasibility Study - Recycled Water for Agricultural Reuse.

6 Total nitrogen consists of ammonia-nitrogen, nitrate-nitrogen, nitrite, and organic-nitrogen.

7 Per UC/Alameda and Contra Costa County Farm Advisor and assumes Available Nitrogen is Nitrite-N, Nitrate-N, Ammonia-N and 1/3 of Organic N. UC/Alameda and Contra County Farm Advisor recommends a maximum value of 10 mg/L available N. The 5 mg/L criteria is based on data provided by the Zone 7 Agricultural Consultant.

Table 17. Comparison of Recommended Maximum Concentrations of Trace Elements[a] and Livermore WRP Effluent

Element (Symbol)		Recommended Maximum Concentration[b] (mg/L)	Livermore Effluent Quality[c] (mg/L)	Effluent Concentration Exceeds Maximum Recommended Concentration?	Remarks
Aluminum (Al)		5	Data Not Available	Unknown	Can cause non-productivity in acid (pH < 5.5), but more alkaline soils at pH > 7.0 will precipitate the ion and eliminate any toxicity.
Arsenic (As)		0.1	Data Not Available	Unknown	Toxicity to plants varies widely, ranging from 12 mg/L for Sudan grass to less than 0.05 mg/L for rice.
Beryllium (Be)		0.1	Data Not Available	Unknown	Toxicity to plants varies widely, ranging from 5 mg/L for kale to 0.5 mg/L for bush beans.
Cadmium (Cd)		0.01	Data Not Available	Unknown	Toxic to beans, beets, and turnips at concentrations as low a 0.1 mg/L in nutrient solutions. Conservative limits recommended due to its potential for accumulation in plants and soils to concentrations that may be harmful to humans.
Cobalt (Co)		0.05	Data Not Available	Unknown	Toxic to tomato plants at 0.1 mg/L in nutrient solution. Tends to be inactivated by neutral and alkaline soils.
Chromium (Cr)		0.1	Data Not Available	Unknown	Not generally recognized as an essential growth element. Conservative limits recommended due to lack of knowledge on its toxicity to plants.
Copper (Cu)		0.2	0.0032	NO	Toxic to a number of plants at 0.1 to 1.0 mg/L in nutrient solutions.
Fluoride (F)		1	Data Not Available	Unknown	Inactivated and neutral and alkaline soils.
Iron (Fe)		5	0.08	NO	Not toxic to plants in aerated soils, but can contribute to soil acidification and loss of availability of essential phosphorus and molybdenum. Overhead sprinkling may result in unsightly deposits on plants, equipment and buildings.
Lithium (Li)		2.5	Data Not Available	Unknown	Tolerated by most crops up to 5 mg/L; mobile in soil. Toxic to citrus at low concentrations (<0.075 mg/L). Acts similarly to boron.
Manganese (Mn)		0.2	0.027	NO	Toxic to a number of crops at a few tenths to a few mg/L, but usually only in acid soils.
Molybdenum (Mo)		0.01	Data Not Available	Unknown	Not toxic to plants at normal concentrations in soil and water. Can be toxic to livestock if forage is grown in soils with high concentrations of available molybdenum.
Nickel (Ni)		0.2	Data Not Available	Unknown	Toxic to a number of plants at 0.5 to 1.0 mg/L; reduced toxicity at neutral or alkaline pH.
Lead (Pd)		5	Data Not Available	Unknown	Can inhibit plant cell growth at very high concentrations.
Selenium (Se)		0.02	Data Not Available	Unknown	Toxic to plants at concentrations as low as 0.025 mg/L and toxic to livestock if forage is grown in soils with relatively high levels of added selenium. An essential element to animals, but in very low concentrations.
Tin (Sn)		---	Data Not Available	No max. concentration given	Effectively excluded by plants; specific tolerance unknown.
Titanium (Ti)		---	Data Not Available	No max. concentration given	
Tungsten (W)		---	Data Not Available	No max. concentration given	
Vanadium (V)		0.1	Data Not Available	Data Not Available	Toxic to many plants at relatively low concentrations.
Zinc (Zn)		2	0.0164	NO	Toxic to many plants at widely varying concentrations; reduced toxicity at pH > 6.0 and in fine textured or organic soils.

[a] Source: Table 4.4 of Guidelines for the On-Site Retrofit of Facilities Using Disinfected Tertiary Recycled Water (AWWA), which was adapted from the National Academy of Sciences (1972) and Pratt (1972).

[b] The maximum concentration is based on water application rate which is consistent with good irrigation practices (10,000 m3 per hectare per year). If the water application rate greatly exceeds this, the maximum concentrations should be adjusted downward accordingly. No adjustment should be made for application rates less than 10,000 m3 per hectare per year. The values given are for water used on a continuous basis at one site.

[c] Livermore WWTP effluent water quality taken from the 2003 B&C Feasibility Study - Recycled Water for Agricultural Reuse.

Revised Blending Ratios

This Non-Potable WMP considered two supply options to blend with the tertiary recycled water supply to produce an acceptable irrigation supply that would meet the water quality criteria for wine grapes:

- The first option assumed that the tertiary recycled water would be separated into two streams (one stream treated through nitrification/denitrification processes and the other treated with an RO system to reduce salt concentrations); the two streams would then be re-blended back together.
- The second option assumed that the tertiary recycled water would be blended with imported surface water conveyed through the SBA.

Using the data presented in Table 14, it was determined that tertiary water from the DSRSD WWTP must be blended at a ratio of 1 part tertiary to 1.7 parts RO water (assuming denitrification of the tertiary water supply) or 1 part tertiary to 3.95 parts RO water (assuming there is no denitrification). It was also determined that the DSRSD tertiary water supply must be blended at a ratio of 1 part tertiary to 0.65 parts imported SBA water (assuming denitrification), and 1 part tertiary to 3.86 parts SBA water (assuming no denitrification).

Using the data presented in Table 16, it was determined that tertiary water from the LWRP must be blended at a ratio of 1 part tertiary to 1.6 parts RO water (assuming denitrification) and 1 part tertiary to 4.7 parts RO water (assuming no denitrification), if the boron concentration of the LWRP effluent is 0.06 mg/L. No blending ratio will provide an appropriate quality of recycled water if the boron concentration of the LWRP effluent is 0.7 mg/L. It was also determined that the LWRP tertiary water supply must be blended at a ratio of 1 part tertiary to 2.3 parts SBA water (assuming denitrification) and 1 part tertiary to 4.6 parts SBA water (assuming no denitrification).

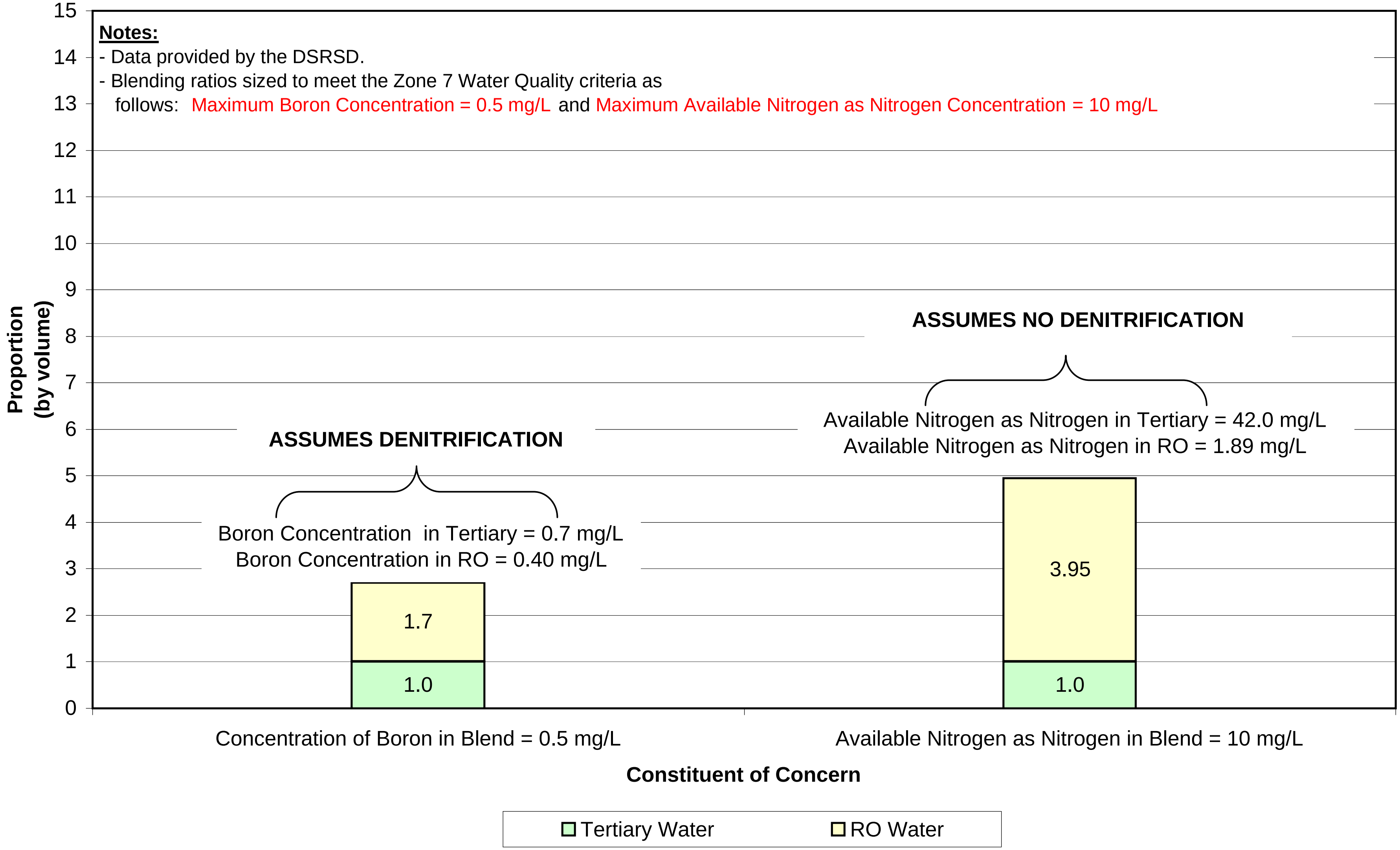
Figures 17 through 20 illustrate the blending ratios determined for each blending option. As shown in these figures, blending tertiary water with SBA water offers the best blending ratio should recycled water be used to meet non-potable irrigation demands.

Timing of Diversions from the SBA

As discussed previously, the concentrations of boron, nitrogen, and TDS in the applied irrigation water supplies control whether each source of water is suitable for the irrigation of wine grapes. Consequently, it is important to evaluate diversions from the SBA to determine if water quality is better during certain periods of the year, so that diverted supplies containing the lowest possible concentrations of boron, nitrogen, and TDS can be used for irrigation by the agricultural community.

Figures 21 through 23 illustrate the average boron, nitrogen, and TDS concentration in imported surface water supplies conveyed through the SBA, respectively, for the period between 1997 and 2003. As shown in these figures, the highest quality water flows down the SBA during July. However, as previously shown on Figure 15, there is no SBA conveyance capacity available for use by others during that month. Consequently, water should be diverted from the SBA during

Figure 17. DSRSD Tertiary Water to RO Blending Ratio



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j:\e\411\0205\RWAnalysis\Denitr_Blending_Ratio_calc_Ltr.xl
Tab: Fig17_DSRSD_RO

Figure 18. DSRSD Tertiary Water to SBA Water Blending Ratio

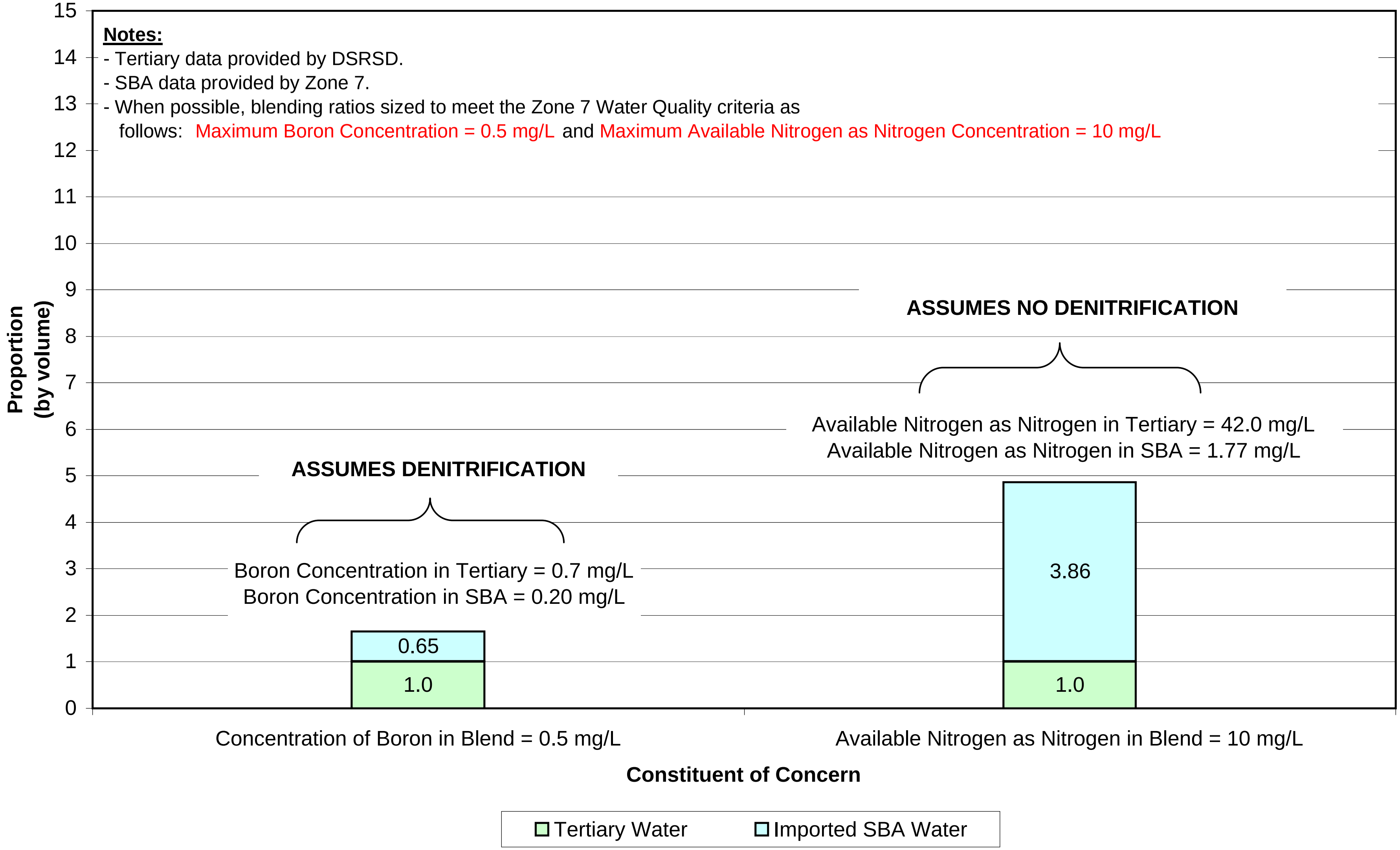
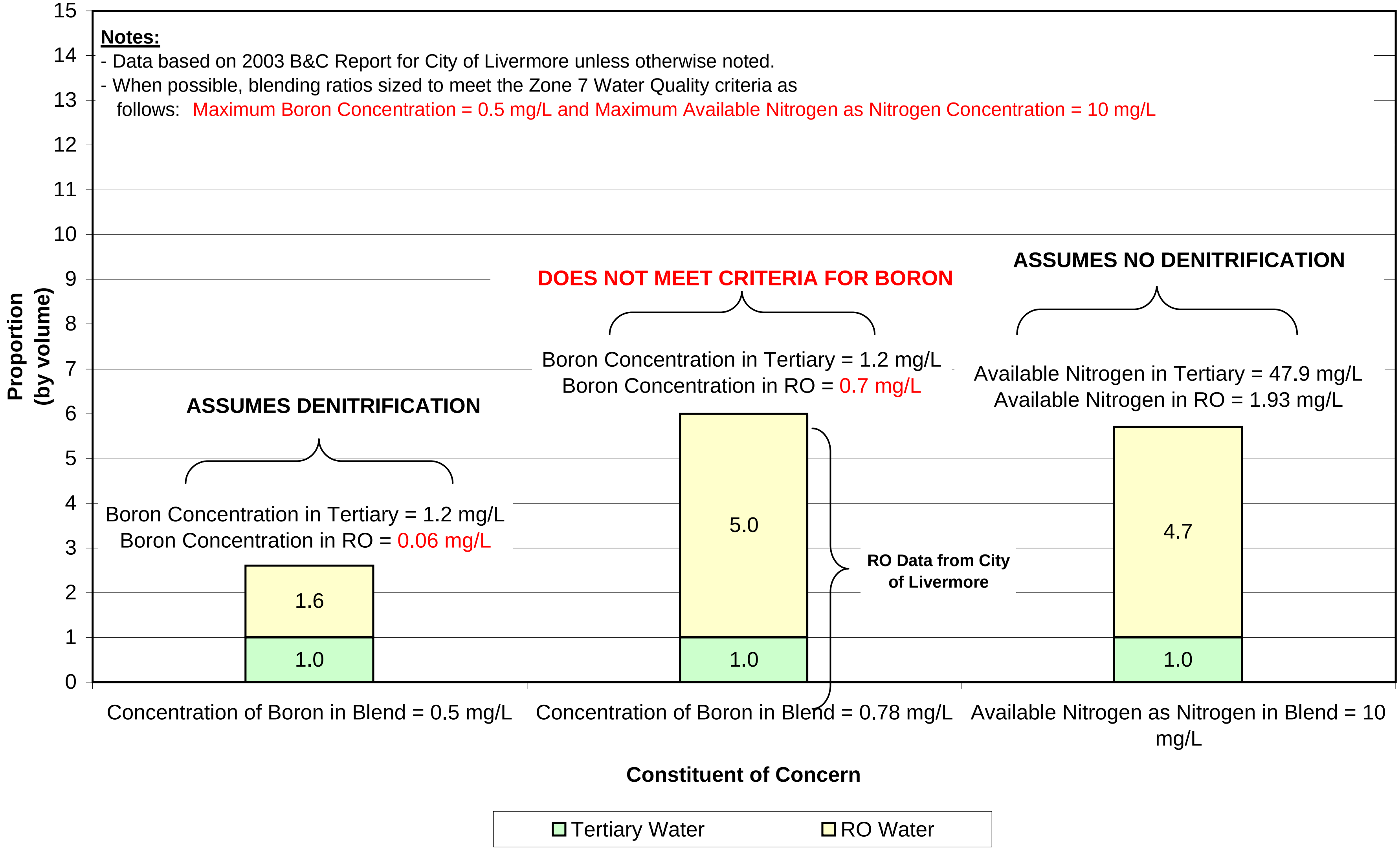


Figure 19. Livermore Tertiary Water to RO Blending Ratio



WYA--November 2005
j:\e\411\0205\RWAnalysis\Denitr_Blending_Ratio_calc_Ltr.xl
Tab: Fig19_Liv_RO

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Figure 20. Livermore Tertiary Water to SBA Water Blending Ratio

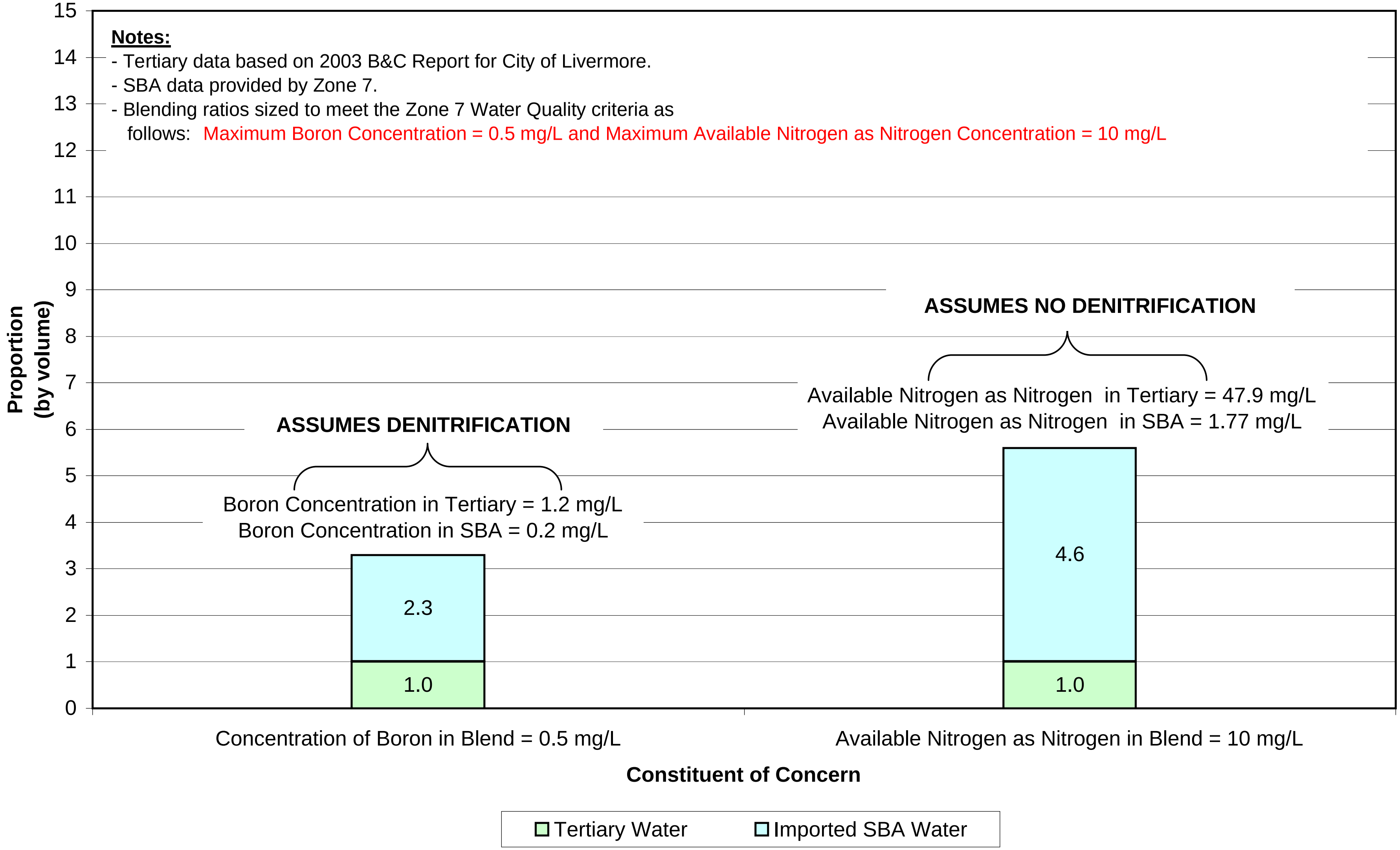


Figure 21. Average Boron Concentration
(Imported Surface Water Conveyed through the SBA Water)

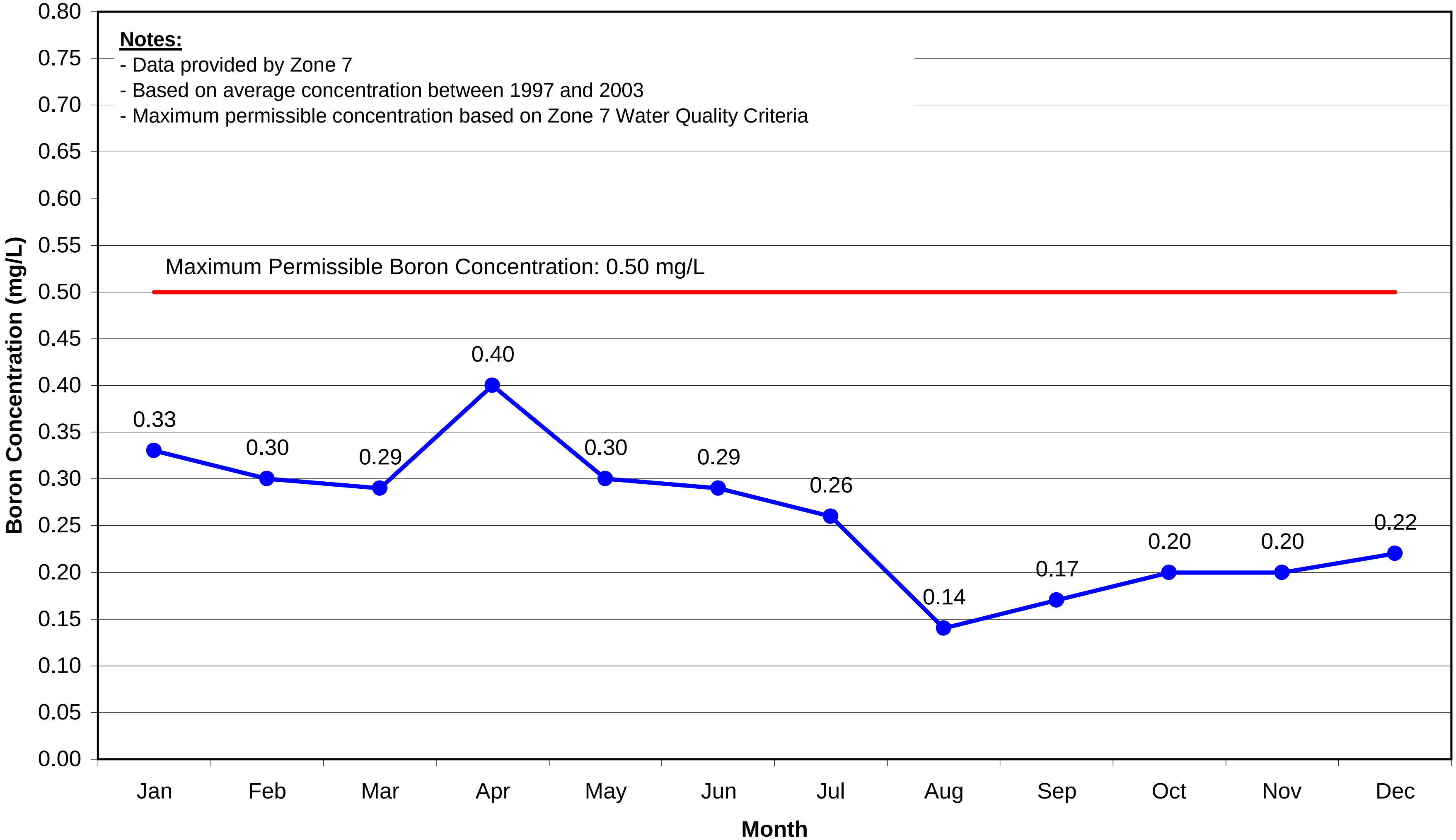
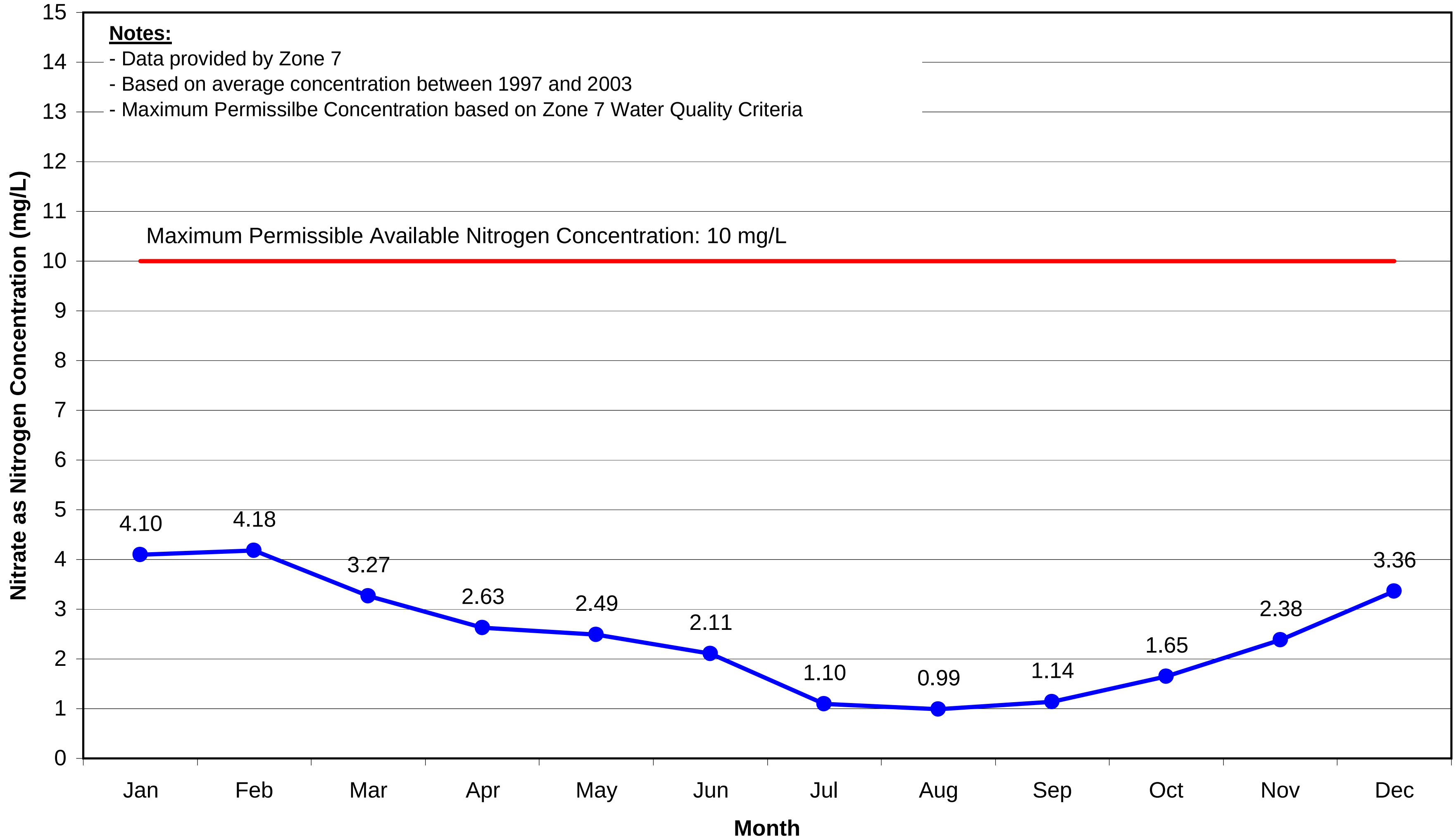


Figure 22. Average Nitrate as Nitrogen Concentration
(Imported Surface Water Conveyed through the SBA Water)



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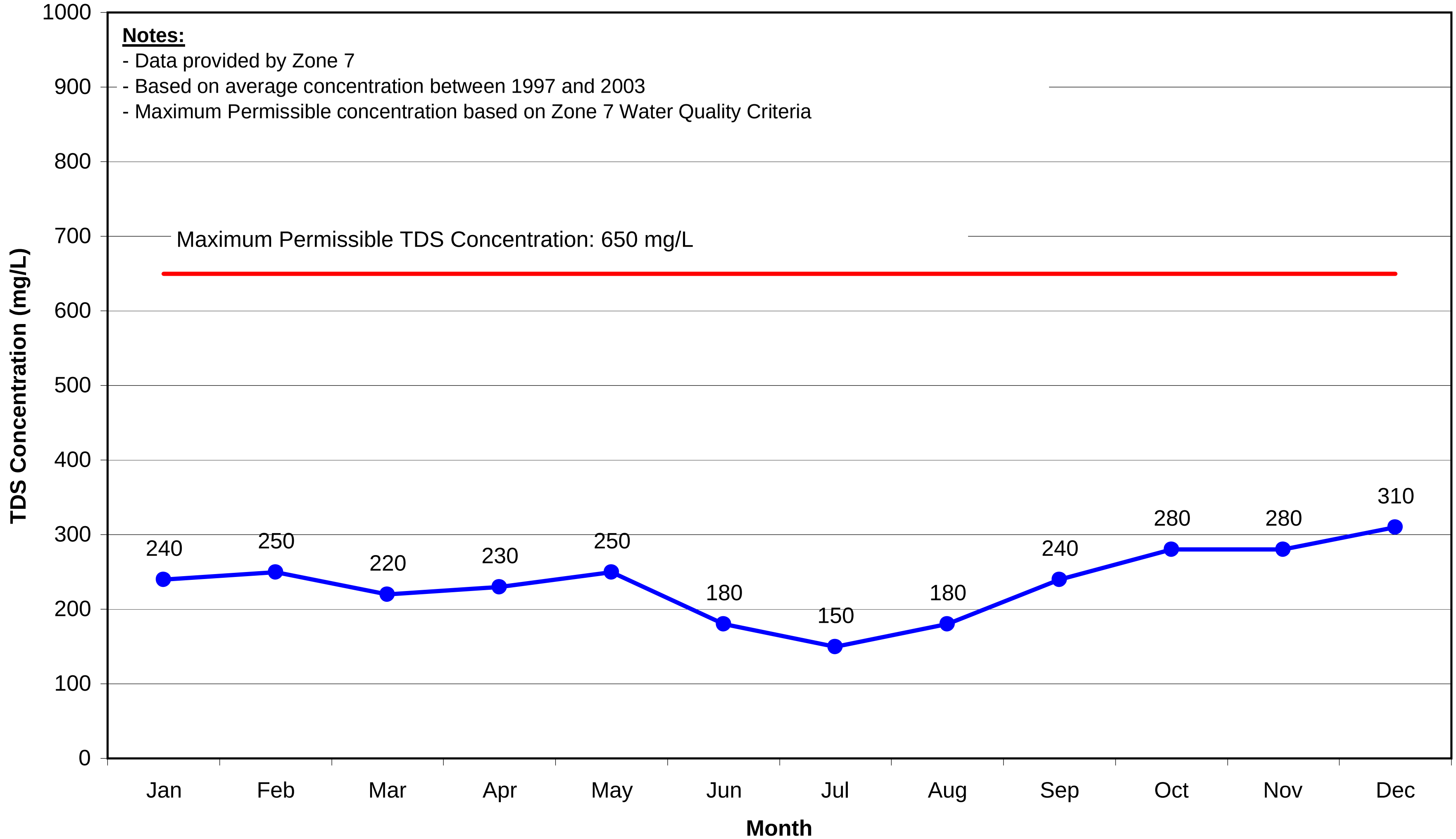
Tab: Fig22_Nitrate

Zone 7 Water Agency
Non-Potable Water System
Conceptual Master Plan

Figure 23. Average TDS Concentration (Imported Surface Water Conveyed through the SBA Water)



February, March, April, or May, to maximize variable high water quality supplies during periods of available SBA conveyance capacity to maximize available supply.

POTENTIAL SPECIFIC AGRICULTURAL PROJECT

Overview

Currently, there are no additional non-potable water supply sources in the Tri-Valley area available for direct use during July, the hottest month of the year. Therefore, any potential agricultural irrigation project will require seasonal water supply storage. For purposes of this study, it has been assumed that a future quarry located north of the Chain of Lakes will be available for use by Zone 7 for future storage of surface water necessary for non-potable supplies. Because Zone 7 does not own the future quarry site, an agreement for such use would need to be developed between Zone 7 and the owner. For planning purposes, this Non-Potable WMP assumed the future quarry site has a capacity of approximately 6,800 acre-feet and therefore, can support up to approximately 4,200 acres based on an application rate of 1.61 af/ac/yr (assuming no evaporative losses).

As discussed previously, the only water supply options available to meet untreated water demands include the use of imported water supplies conveyed through the SBA, or a blend of SBA water and tertiary effluent from the LWRP. It has also been shown that water from the SBA must be diverted between February and May to minimize poor water quality and maximize available supply. Table 18 presents the available SBA capacity by reach using March as a sample month from which to divert water. As shown in Table 18, Reach 1 provides the highest capacity for others and therefore, is used as the point of diversion from the SBA in this Non-Potable WMP. Figure 24 also illustrates the available capacity by reach for the month of March.

As shown on Figure 12, the three closest Group 1 Pilot Project areas which could be served from storage are: Collier/Doolan Canyon, North Livermore B, and Vasco Laughlin. Capital facility costs for two potential agricultural projects were developed; both are located in North Livermore B because it had the shortest pipeline alignments and represented the largest irrigable area.

The two scenarios for North Livermore Option B evaluated in this Non-Potable WMP are discussed in more detail below; the first scenario assumed the use of only imported surface water diverted at Reach 1 of the SBA, while the second scenario assumed the use of blended surface water from the SBA and tertiary water from the LWRP.

In addition to these two North Livermore Option B Scenarios, in July 2005, WYA also prepared a supplemental report (Draft Supplemental Report Non-Potable Water System Conceptual Master Plan, North Livermore Supply Options). This report is provided in Appendix A, and conceptually identifies, evaluates, and develops an estimate of the capital costs for the most viable combinations of supply and infrastructure necessary to serve potentially irrigated acreage in both North Livermore Options A and B.

Table 18. Capacity Available by Reach in March [a,b]

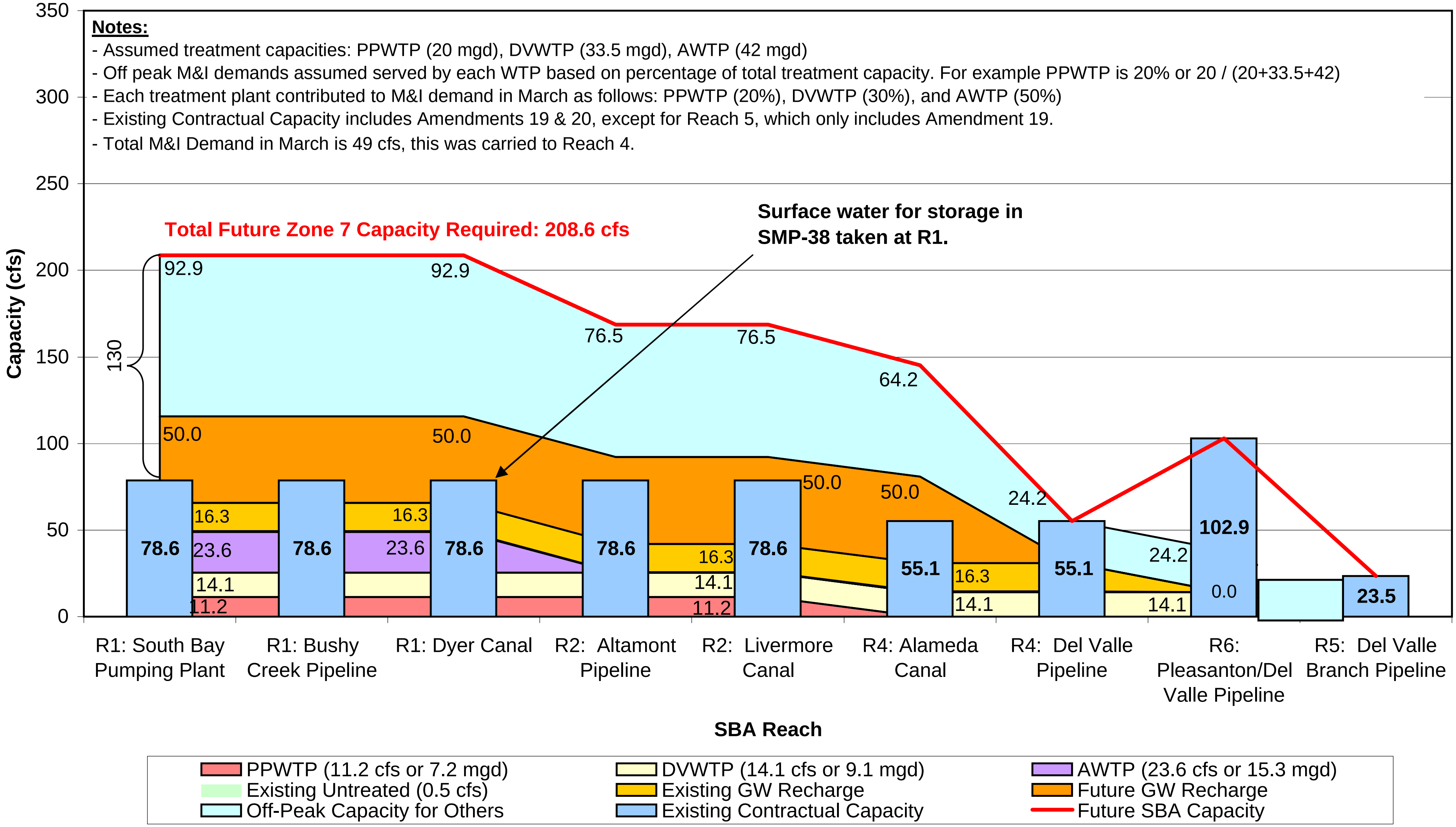
SBA Reach	Zone 7 Contractual Capacity (cfs)	SBA Expansion (cfs)	New Zone 7 Capacity (cfs)	PPWTP Demand (cfs)	DVWTP Demand (cfs)	AWTP Demand (cfs)	Existing GW Recharge (cfs)	Existing Untreated Demand (cfs)	Future GW Recharge (cfs)	Off-Peak Capacity for Others (cfs)
R1: SBPP	78.6	130.0	208.6	11.2	14.1	23.6	16.3	0.5	50.0	92.9
R1: BCP	78.6	130.0	208.6	11.2	14.1	23.6	16.3	0.5	50.0	92.9
R1: DC	78.6	130.0	208.6	11.2	14.1	23.6	16.3	0.5	50.0	92.9
R2: AP	78.6	90.0	168.6	11.2	14.1	0.0	16.3	0.5	50.0	76.5
R2: LC	78.6	90.0	168.6	11.2	14.1	0.0	16.3	0.5	50.0	76.5
R4: AC	55.1	90.0	145.1	0.0	14.1	0.0	16.3	0.5	50.0	64.2
R4: DVP	55.1	0.0	55.1	0.0	14.1	0.0	16.3	0.5	0.0	24.2
R6: P/DV	102.9	0.0	102.9	0.0	14.1	0.0	0.0	0.0	0.0	24.2
R5: DVBP	23.5	0.0	23.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0

(a) Assumes M&I demand is served from the PPWTP (20 mgd), DVWTP (33.5 mgd), and AWTP (42 mgd) based on a percentage of overall capacity. For example, the total treatment capacity is 95.5 mgd; therefore, the PPWTP will contribute 20%, DVWTP 30%, and AWTP 50%.

(b) M&I demand was carried through Reach 4.

SBPP = South Bay Pumping Plan
BCP = Brushy Creek Pipeline
DC = Dyer Canal
AP = Altamont Pipeline
LC = Livermore Canal
AC = Alameda Canal
DVP = Del Valle Pipeline
P/DV = Pleasanton / Del Valle Pipeline
DVBP = Del Valle Branch Pipeline

Figure 24. Conveyance Capacity Available for Others in March



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Zone 7 Water Agency
Non-Potable Water System
Conceptual Master Plan

Scenario 1: Imported Surface Water Supplied from Reach 1 of the SBA

As previously shown in Table 9, North Livermore Option B has approximately 3,100 acres of potentially irrigable acreage and therefore, approximately 4,990 or 5,000 afa of irrigated agricultural demand. Under Scenario 1, it was assumed that 5,000 afa of imported surface water would be diverted off peak from Reach 1 of the expanded SBA, transported to the future reclaimed gravel quarry through Altamont Creek, and then distributed from storage to irrigated agricultural areas located in the North Livermore Option Project area. Several new conveyance facilities including pumping plants will be required to transport these new water supplies to the untreated water users in North Livermore. Figure 25 shows the preliminary locations, and alignments of these required facilities.

As shown on Figure 25, to minimize capital facility costs there was no major transmission line assumed to transport surface water to the future reclaimed gravel quarry; rather, it was assumed that water diverted from Reach 1 of the SBA would be transported via Altamont Creek. This transmission option would require considerable effort to obtain the proper permits and environmental documents.

Scenario 2: Blended Tertiary Water and Surface Water

Under Scenario 2, it was assumed that the reclaimed quarry would first be filled with 880 afa of tertiary supply and then another 4,120 afa of imported surface from the SBA would be diverted from Reach 1 into the quarry, for a total supply of 5,000 afa. This provides a ratio of 1 part tertiary to 4.7 parts surface water; thereby, eliminating the need for denitrification (see Figure 20). As with Scenario 1, several new conveyance facilities, including pumping plants, will be required to transport new water supplies to the untreated water users in the North Livermore B Group 1 Pilot Project area. Figure 26 shows the preliminary locations and alignments of these required facilities. Scenario 2 also assumes the use of Altamont Creek to transport diverted water from the SBA to the reclaimed quarry; as discussed previously, this transmission option would require considerable effort to obtain the proper permits and environmental documents.

COST COMPARISON OF SPECIFIC PROJECT COMPARED TO THE PHASE III STUDY

Capital costs and operation and maintenance (O&M) costs were developed for each scenario described in the Phase III study and this Non-Potable WMP. Subsequent sections discuss each in detail.

Estimated Capital Costs

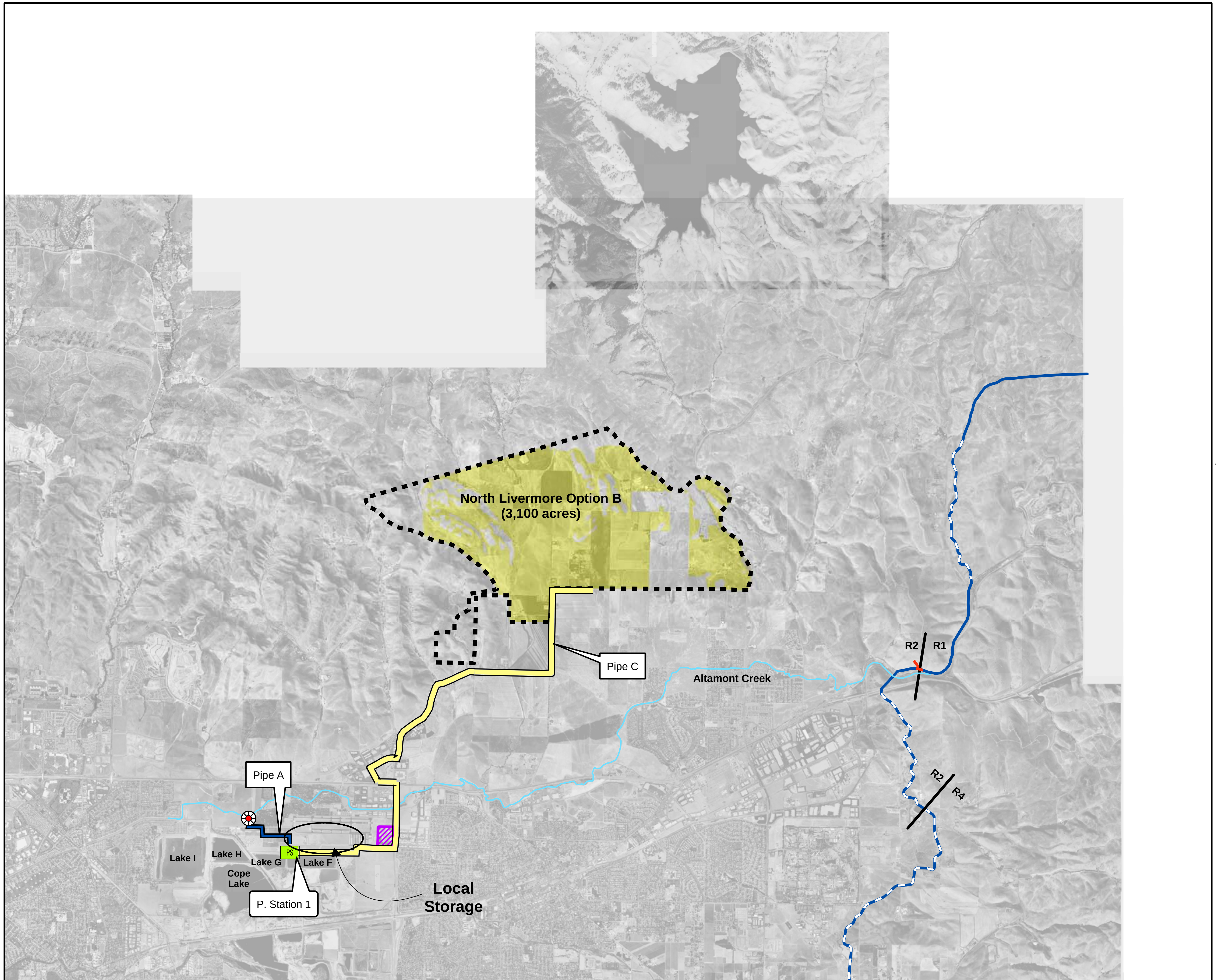
Capital costs for each non-potable water system scenario were estimated based on the following seven categories:

- Water Supply Source
- Treatment
- Storage

FIGURE 25

Zone 7 Water Agency
Non-Potable Water System
Conceptual Master Plan

SCENARIO 1



N

0 0.3 0.6 1.2
Scale in Miles

NOTES

NL Option A = 3,100 acres (5,000 acre-feet)
TOTAL COST: $51 million or $10,200/af

LEGEND

- Diversion Structure
- Altamont Creek
- South Bay Aqueduct: Canal
- South Bay Aqueduct: Pipeline
- Focus Area Boundary
- North Livermore B
- Existing Livermore WWTP
- Reach
- Turnout

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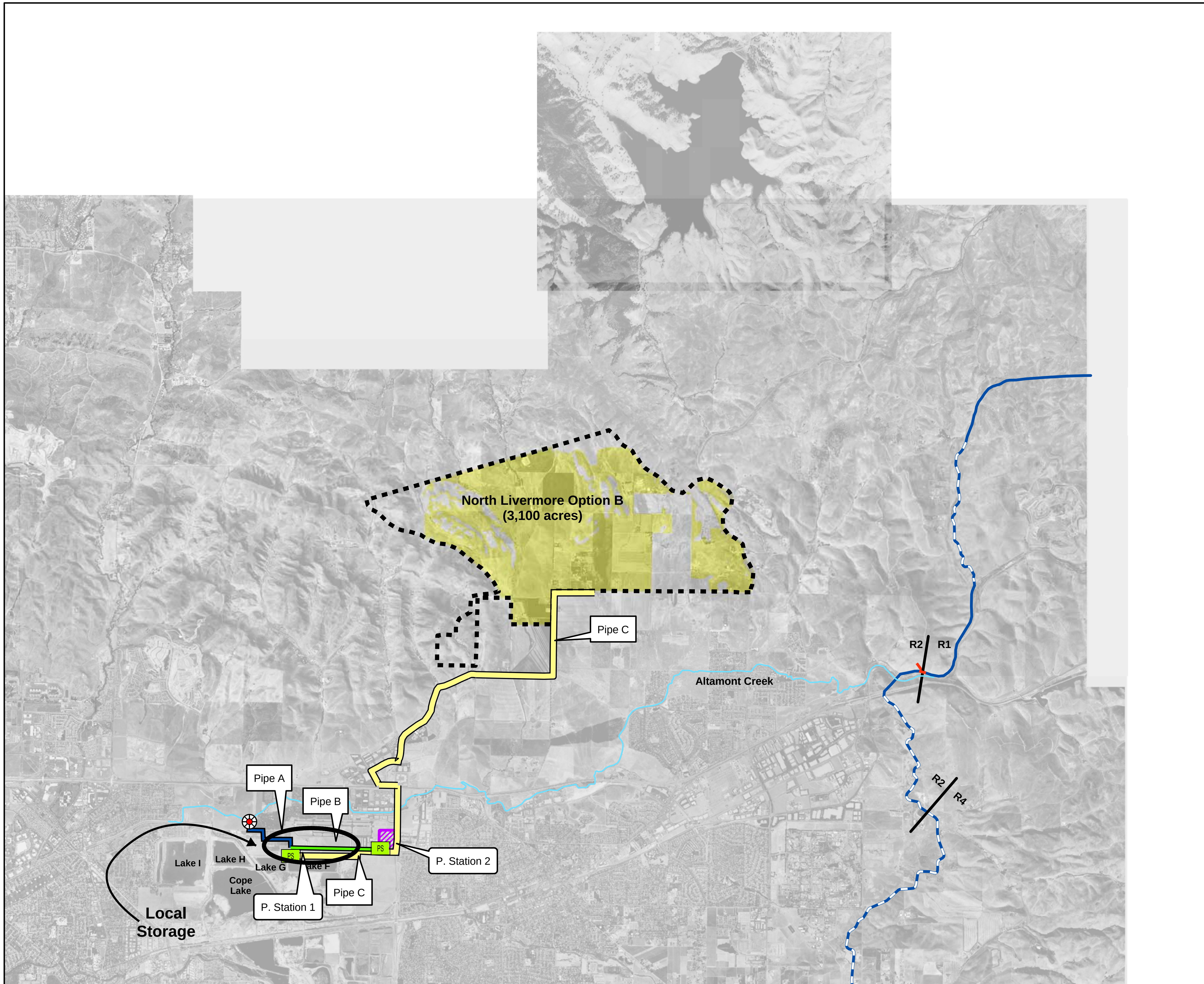

FIGURE 26

Zone 7 Water Agency
Non-Potable Water System
Conceptual Master Plan

SCENARIO 2

N

0 0.3 0.6 1.2
Scale in Miles

NOTES

NL Option A = 3,100 acres (5,000 acre-feet)
TOTAL COST: $78 Million or $7,800/af

LEGEND

- Diversion Structure
- Altamont Creek
- Reach
- Turnout
- Local Conveyance: Canal
- Local Conveyance: Pipeline
- Focus Area Boundary
- North Livermore B
- Existing Livermore WWTP

W E S T
Y O S T
& ASSOCIATES

- Diversions
- Transmission
- Distribution
- Pumping

Estimated Capital Costs in the Phase III Study

Water supply costs estimated in the Phase III Study were based on the source of supply, quantity of supply, cost of the supply, and the reliability of the supply. Imported deliveries from the SWP are not 100 percent reliable; consequently, a larger supply of water was needed in order to ensure that the quantities of water required were available, even during drought periods. Additionally, the Phase III Study assumed that the recycled water supply was provided at no cost.

Treatment costs estimated in the Phase III Study were based on providing additional treatment of the wastewater effluent (including denitrification, filtration, and RO treatment), in order to produce recycled water supply suitable for agricultural uses. Scenario 1 of the Phase III Study did not include an estimate for treatment because that scenario did not include the use of recycled water.

The Phase III Study did not include costs for storage because it was assumed storage would be available in the Chain of Lakes at no charge; however, it is likely that storage in the Chain of Lakes will not be available (as these storage facilities are planned for other storage needs), and that a new, reclaimed gravel quarry is the only potentially available storage facility.

The transmission and distribution costs estimated in the Phase III study included the cost to transport water from the SBA or the WWTP to a storage facility, and then distribute the water supply to agricultural users. Both components included the costs of pipelines and pump stations; the costs did not include right-of-ways.

Additionally, at the time the Phase III Study was completed, existing agricultural users had an untreated connection charge deposit; this deposit was included in the Phase III Study cost estimate. However, this program is no longer available and therefore, is not included in the costs/funding developed for Scenarios 1 and 2 of this Non-Potable WMP.

Table 19 presents the costs estimated in the Phase III Study for each scenario. As shown in Table 19, the lowest cost alternatives only included the use of surface water because the use of recycled water contained the additional expense of wastewater treatment. A unit capital cost of $4,721 per acre-foot of water will be used to compare the costs of the Phase III Study with the costs estimated in the current study.

Estimated Capital Costs for Scenarios Considered in this Non-Potable WMP

As discussed previously, the costs to use recycled water supplies from the DSRSD WWTP would generally be higher than those available from the LWRP because the LWRP is located closer to those areas potentially suitable for an agricultural project. Consequently, 4,120 afa of surface water supply will be blended with 880 afa of tertiary supply to fill the future reclaimed grave

Table 19. Phase III Total Capital Costs (in 2001 dollars)

	Untreated Water Supply Scenario								
	Scenario 1: Surface Water Option			Scenario 2: Recycled and Surface Water Option			Scenario 3: Surface Water Option with Previously Planned Zone 7 Demand		
Water Supply Reliability	100%	80%	70%	100%	80%	70%	100%	80%	70%
Water Supply (imported SW)	$139,049,000	$114,905,000	$104,038,000	$89,801,000	$74,146,000	$66,265,000	$50,700,000	$38,550,000	$34,110,000
Water Supply (recycled water)	NA	NA	NA	$0	$0	$0	NA	NA	NA
Recycled Water Treatment	NA	NA	NA	$99,637,000	$99,637,000	$99,637,000	NA	NA	NA
Conveyance	$58,614,000	$58,614,000	$58,614,000	$46,401,000	$46,401,000	$46,401,000	$23,260,000	$23,260,000	$23,260,000
Transmission	$70,928,000	$70,928,000	$70,928,000	$78,176,000	$78,176,000	$78,176,000	$33,950,000	$33,950,000	$33,950,000
Total Capital Cost	**$268,591,000**	**$244,447,000**	**$233,580,000**	**$314,015,000**	**$298,360,000**	**$290,479,000**	**$107,910,000**	**$95,760,000**	**91,320,000**
Post 1997 Untreated Connection Charge Deposit	$12,650,000	$12,650,000	$12,650,000	$12,650,000	$12,650,000	$12,650,000	$12,650,000	$12,650,000	12,650,000
Avoided Costs of LAVWMA Relining/Repair Project	NA	NA	NA	$25,000,000	$25,000,000	$25,000,000	NA	NA	NA
Remaining Capital Cost	**$255,941,000**	**$231,797,000**	**$220,930,000**	**$276,365,000**	**$260,710,000**	**$252,829,000**	**95,260,000**	**$83,110,000**	**78,670,000**
Unit Capital Cost ($/AF)	**$5,200**	**$4,700**	**$4,500**	**$5,600**	**$5,300**	**$5,150**	**$5,300**	**$4,600**	**$4,400**

quarry with 5,000 afa of water supply. This blending ratio (1 part tertiary to 4.7 parts surface water) requires no denitrification and therefore, no treatment costs were included.

Although the future reclaimed gravel quarry which was assumed to be available for the storage of non-potable water supplies is not yet specifically identified, there will be costs associated with converting this potential future quarry into a viable non-potable water storage reservoir.

This Non-Potable WMP assumed that surface water diverted from the SBA would be transported to a reclaimed gravel quarry via the Altamont Creek. Using the creek to transport surface water to the storage site eliminates the expense of installing a major transmission line and therefore, provides the least cost alternative. However, the use of the creek requires a diversion structure. The diversion structure would divert water from the creek into a transmission line that would fill the storage site. The cost of the diversion structure included a 10-foot high inflatable dam, fish screen, construction material, and necessary transmission line.

The cost assumptions for the transmission and distribution lines, including pump stations, for both scenarios of this Non-Potable WMP are similar to the assumptions made in the Phase III Study.

Tables 20 and 21 present the costs estimated for each scenario of this Non-Potable WMP. As shown in Tables 20 and 21, Scenario 1 is only $600 per acre-foot of water supplied lower than Scenario 2. Scenario 2, using blended surface water and recycled water, has a higher cost due to the extra expense of recycled water transmission lines not required for the surface water option.

Table 22 compares the lowest cost scenario of this Non-Potable WMP with the lowest cost scenario of the Phase III Study. As shown in Table 22, the currently estimated costs are about 116 percent higher than those in the Phase III Study.

Estimated Operation and Maintenance Costs

Operation and Maintenance (O&M) costs for Scenarios 1 and 3 of the Phase III Study and both scenarios of this Non-Potable WMP are essentially based on pumping costs, assuming a power cost of $0.15 per kilowatt-hour (kW-hr).

The O&M costs for Scenario 2 of the Phase III Study and this Non-Potable WMP also include incremental recycled water treatment plant O&M costs due to nitrogen removal, filtration costs, and RO treatment costs, in addition to pumping costs. The incremental treatment costs included the energy required to power blowers and to pump water through the plant during the nitrogen removal process. The filtration and RO treatment costs are based on the costs of O&M labor, chemicals, power, microfiltration membranes, RO membranes and expendables.

As shown in Table 23, the O&M costs for Scenario 1 of this Non-Potable WMP are significantly lower. The other scenarios of both studies required treatment and, therefore, have higher O&M costs.

Table 20. Estimated Costs for Scenairo 1 (in 2005 dollars)

Description	Unit Price	Unit	Quantity	Unit	Total Cost
Tertiary Water					
Cost of Tertiary Water [a]	500	$ / af	0	af	$0
Expansion to 6.5 mgd [b]	0	$ / mgd	0	mgd	$0
Local Storage					
Storage Cost [c]	1,500	$ / af	5,000	af	$7,500,000
Pumping Facilities [d]					
Pump Station 1 (from Storage)	2,286	$ / hp	1,000	hp	$2,286,000
Pump Station 2 (for Tertiary)	2,286	$ / hp	0	hp	$0
Pump Station 3 (from SBA)	2,286	$ / hp	0	hp	$0
Pump Station 4 (Boost for Pipe H)	2,286	$ / hp	0	hp	$0
Transmission Line (Pressurized Pipe Required) [e,f]					
Pipe A: 24" for Diversion Off Altamont Creek [e,f]	276	$ / lf	4,500	lf	$1,242,000
Pipe B: 24" for Tertiary to Local Storage [e,f]	276	$ / lf	0	lf	$0
Distribution Line (Pressurized Pipe Required)					
Pipe C: 36" from Local Storage [e,f]	414	$ / lf	38,500	lf	$15,939,000
				Subtotal	$26,967,000
				Design (10%)	$2,696,700
				Construction Management (10%)	$2,696,700
				Contingency (15%)	$4,045,050
				Program Implementation (5%)	$1,348,350
				Subtotal	**$37,753,800**
Description	Unit Price	Unit	Quantity	Unit	Total Cost
Surface Water Supply					
Water Right [h]	2,000	$ / af	5,000	af	$10,000,000
Local Conveyance [i]					
Direct Delivery off Local Conveyance [j]	730,769	$ / cfs	0.0	cfs	$0
Wheeling Cost for Off-Peak Delivery on Local Conveyance [k]	500	$ / af	5,000	af	$2,500,000
Non-Local Storage [i]					
Storage Cost [l]	2,200	$ / af	0	af	$0
Wheeling Cost for Surface Water into Non-Local Storage [k]	500	$ / af	0	af	$0
Diversions on Altamont Creek [i]					
Permanent Diversion Facility and Utilities [m]	600,000	$ / Diversion	1	Diversion	$600,000
				Subtotal	**$13,100,000**
				Total Capital Cost	**$51,000,000**
				Agricultural Water Supply in Acre-Feet	5,000
				Irrigated Acreage	3,100
				Total Capital Cost per Irrigated Acre	$16,500
				Total Capital Cost per Acre-feet	**$10,200**

[a] Unit cost is a rough estimate provided by the City of Livermore

[b] The City of Livermore is planning on expanding the Tertiary unit to 6.5 mgd regardless of program, so there is no cost to others

[c] Unit cost for local storage based on WYA's experience with similar projects

[d] Cost of pumps include motors, pumps, standby pumping capacity, and pump house

[e] Costs do not include purchase of right-of-way

[f] Unit cost based on $11.5 per inch of diameter per linear foot of pipe, not including contingency costs (see Appendix D of the 9/2003 Altamont Pipeline Alignment Study)

[g] Unit costs based on $71.7 per inch of diamter per linear foot of pipe, not including contingency costs (see Appendix D of the 9/2003 Altamont Pipeline Alignment Study)

[h] Unit cost of water right is based on WYA's experience with similar projects

[i] Unit costs already include design, construction management, contingency, and program implementation

[j] Unit cost based on total expansion of 130 cfs at a cost of $95 million or $730,769 per cfs

[k] Unit cost to wheel water is based on WYA's experience with similar projects

[l] Unit cost based on total expansion of 500,000 af at a cost of $1.1 billion or $2,200 per af

[m] Cost of diversion structure obtained from the February 2004 Draft Lake H, I, and Cope Lake Management Plan

Table 21. Estimated Costs for Scenario 2 (in 2005 dollars)

Description	Unit Price	Unit	Quantity	Unit	Total Cost
Tertiary Water					
Cost of Tertiary Water [a]	500	$ / af	880	af	$440,000
Expansion to 6.5 mgd [b]	0	$ / mgd	0	mgd	$0
Local Storage					
Storage Cost [c]	1,500	$ / af	5,000	af	$7,500,000
Pumping Facilities [d]					
Pump Station 1 (from Storage)	2,286	$ / hp	1,000	hp	$2,286,000
Pump Station 2 (for Tertiary)	2,286	$ / hp	25	hp	$57,150
Pump Station 3 (from SBA)	2,286	$ / hp	0	hp	$0
Pump Station 4 (Boost for Pipe H)	2,286	$ / hp	0	hp	$0
Transmission Line (Pressurized Pipe Required) [e,f]					
Pipe A: 24" for Diversion Off Altamont Creek [e,f]	276	$ / lf	4,500	lf	$1,242,000
Pipe B: 24" for Tertiary to Local Storage [e,f]	276	$ / lf	6,000	lf	$1,656,000
Distribution Line (Pressurized Pipe Required)					
Pipe C: 36" from Local Storage [e,f]	414	$ / lf	38,500	lf	$15,939,000
				Subtotal	$29,120,150
				Design (10%)	$2,912,015
				Construction Management (10%)	$2,912,015
				Contingency (15%)	$4,368,023
				Program Implementation (5%)	$1,456,008
				Subtotal	**$40,768,210**
Description	Unit Price	Unit	Quantity	Unit	Total Cost
Surface Water Supply					
Water Right [h]	2,000	$ / af	5,000	af	$10,000,000
Local Conveyance [i]					
Direct Delivery off Local Conveyance [j]	730,769	$ / cfs	0.0	cfs	$0
Wheeling Cost for Off-Peak Delivery on Local Conveyance [k]	500	$ / af	5,000	af	$2,500,000
Non-Local Storage [i]					
Storage Cost [l]	2,200	$ / af	0	af	$0
Wheeling Cost for Surface Water into Non-Local Storage [k]	500	$ / af	0	af	$0
Diversions on Altamont Creek [i]					
Permanent Diversion Facility and Utilities [l]	600,000	$ / Diversion	1	Diversion	$600,000
				Subtotal	**$13,100,000**
				Total Capital Cost	**$54,000,000**
				Agricultural Water Supply in Acre-Feet	5,000
				Irrigated Acreage	3,100
				Total Capital Cost per Irrigated Acre	$17,400
				Total Capital Cost per Acre-feet	**$10,800**

[a] Unit cost is a rough estimate provided by the City of Livermore

[b] The City of Livermore is planning on expanding the Tertiary unit to 6.5 mgd regardless of program, so there is no cost to others

[c] Unit cost for local storage based on WYA's experience with similar projects

[d] Cost of pumps include motors, pumps, standby pumping capacity, and pump house

[e] Costs do not include purchase of right-of-way

[f] Unit cost based on $11.5 per inch of diameter per linear foot of pipe, not including contingency costs (see Appendix D of the 9/2003 Altamont Pipeline Alignment Study)

[g] Unit costs based on $71.7 per inch of diamter per linear foot of pipe, not including contingency costs (see Appendix D of the 9/2003 Altamont Pipeline Alignment Study)

[h] Unit cost of water right is based on WYA's experience with similar projects

[i] Unit costs already include design, construction management, contingency, and program implementation

[j] Unit cost based on total expansion of 130 cfs at a cost of $95 million or $730,769 per cfs

[k] Unit cost to wheel water is based on WYA's experience with similar projects

[l] Unit cost based on total expansion of 500,000 af at a cost of $1.1 billion or $2,200 per af

[m] Cost of diversion structure obtained from the February 2004 Draft Lake H, I, and Cope Lake Management Plan

Table 22. Comparison of Cost Estimates (in 2005 dollars)

Facility Description	Scenario 1 of Non-Potable WMP (5,000 af) [a]	Scenario 1 of the Phase III Study (49,100 af) [a]	Percentage Difference
Storage	$10,500,000	$0	
Water Supply	$10,000,000	$114,905,000	
Distribution	$25,515,000	$58,614,000	
Transmission	$4,838,800	$70,928,000	
Subtotal [b]	$51,000,000	$244,447,000	
Post 1997 Untreated Connection Charge Deposit[c]	$0	($12,650,000)	
Total Capital Cost[b]	$51,000,000	$231,797,000	
Total Capital Cost per Acre-Foot	**$10,200**	**$4,721**	**116%**

[a] Includes contingency costs.

[a] Rounded to the nearest 1 million dollars.

[c] The connection charge deposit is no longer available and therefore, was not included in costs for Scenario 1 of this Non-Potable WMP.

Table 23. Operation and Maintenance Costs

O&M Cost Item	Scenario 1 of this Non-Potable WMP	Scenario 2 of this Non-Potable WMP	Scenario 1 of the Phase III Study
Cost per Acre-Foot	$194	$274	$250

UPDATE OF PREVIOUSLY PROPOSED FINANCIAL PLANS BY BARTLE WELLS

Overview

Bartle Wells Associates (BWA) prepared a draft *Agricultural Water System Financing Analysis* in April 2001. This study evaluated project financing alternatives and developed a funding strategy for two non-potable water supply and conveyance system options identified in the Phase III Study. The financing analysis was based on the premise that expansion of agriculture within Zone 7's water service area is closely linked to the availability of a reliable and reasonably priced supply of water. The report concluded that new agriculture alone would not be able to finance the estimated costs of the new water supply and infrastructure facilities required.

Following review and discussion of the engineering and financing program developed during 2000/2001, Zone 7 authorized WYA to refine the location of potential irrigable agricultural areas, projected non-potable water demands and potentially available water supplies, and then develop a revised capital facility cost estimate for a specific agricultural project. This section is intended to update BWA's earlier financing strategy to determine if any new engineering or other information would alter or supplement their 2001 recommended financing strategy.

The analysis will discuss implementation progress made by project beneficiaries such as the Tri-Valley Business Council. In addition, a short discussion of Zone 7's Stream Management Master Plan as a possible implementation vehicle is included.

Changes Since the Phase III Study and Financing Analysis

<u>Engineering Update</u>

As discussed in previous sections in this Non-Potable WMP Update, WYA's refined analysis of potentially irrigable agricultural areas has now excluded those areas identified as not suitable for irrigation purposes due to soil types, slope criteria, and existing and planned land use. The analysis also accounted for two new recycled water use programs; one proposed by the City of Livermore and the other proposed by SFPUC. The potential specific agricultural projects identified by WYA are estimated to cost between $10,200 and $10,800 per acre-foot of delivered water (see Tables 20 and 21). As shown in Table s 20 and 21, these costs are approximately 116 percent higher than what was estimated in the Phase III Study.

Implementation Progress by Project Proponents/Beneficiaries

The Tri-Valley Business Council has continued to actively coordinate and fund the activities of the Tri-Valley Agriculture Task Force, which includes representatives from business, agriculture, and local public agencies. The group is vitally interested in expanding agriculture in the Tri-Valley area. The Council's Vision 2010 encompasses economic vitality, agricultural enhancement, and open space planning.

Since 2001, Zone 7 has been working to secure additional quantities of SWP water entitlements. Zone 7 anticipated that agricultural interests would formulate a plan to financially participate in a share of this new water supply. However, agricultural interests were not able to develop such a plan in time to participate. Consequently, Zone 7 has proceeded to finance the entire water supply through M&I expansion funds.

Zone 7 understands that the Tri-Valley Council is currently working with agricultural interests to evaluate some form of assessment that could be used to finance additional agricultural water supply. The Tri-Valley Council will be a very valuable partner in any effort to implement new agricultural water supply and infrastructure for the Tri-Valley area.

As part of this study's update process, BWA met with a member of the Agriculture Task Force. A key theme of the discussion was that if a new water supply is available, even at a relatively high cost by agricultural standards, that agricultural interests will find an economic use for the water. High value crops are especially able to fund new water costs. Other topics discussed included the ability of agriculture to privately fund transmission and distribution facilities. This assumes that water is purchased at a turnout and that local landowners arrange for delivery from this point. Micro-supply projects such as small package water recycling plants located adjacent to large sewer lines where water would be treated and used locally were also discussed.

The Agriculture Task Force representative strongly believes that additional water supplies and corresponding infrastructure conveyance facilities should be planned and constructed to protect and enhance the quality of life for all interests in the Tri-Valley area.

Financing Alternatives Update

An innovative idea explored in BWA's 2001 report is a combination of agricultural land value and tax increment financing. This procedure recognizes and benefits from the increased value of land if a water supply is available. An agricultural tax increment financing has never been used before and would require state legislation. However, the idea could be widely used throughout the state and would likely receive legislative approval if supported by broad based groups and introduced by a local legislator. While public information for this type of program can be developed by public agencies such as Alameda County, Zone 7 and local cities, advocacy of public support must be funded privately. Policy groups like the Tri-Valley Business Council would be crucial for the implementation of such a plan.

The following revenue sources were used in the 2001 report to demonstrate possible plans to finance the water supply projects as conceived at that time. The revenue sources all remain viable options at this time. Any number and combination of revenue sources and financing methods are possible.

Agriculture Water Connection Charges: A water connection charge is employed by most California water agencies and is consistent with current Zone 7 policy. Connection charges are used to finance system expansions to serve future customers. The charge is collected at the time of initial connection to the system. In the case of an existing customer requiring additional capacity, the charges are collected at the advent of additional use. Such charges are implemented by board of directors' vote at a public meeting of the agency.

Connection charges would apply to all agriculture water use. Those users currently receiving such water under contract would pay the charge upon contract renewal. The charge would be levied only one time.

Agriculture Special Tax Bonds: The proposed water system is designed to benefit agriculture; therefore, a bond issue supported by agriculture property is reasonable. A two-thirds voter approval by registered voters is required to authorize the bonds. The bonds would be voted and secured only over agriculture properties and funded by a special tax per acre of agriculture land. Approval by agriculture would demonstrate their support of the project. A special tax of $24 per acre would support a special tax bond of about $8 million. The special tax would end after 25 years.

The Zone 7 Board of Directors would create a special improvement area and call for a special tax vote over the improvement area. A two-thirds majority of the votes cast is required to authorize the special tax. Bonds supported by the special tax could then be issued. A special tax of $24 per acre would raise about 15 percent ($8 million out of $51 million) of the project costs (Scenario 1) from this source.

Tax Increment: The availability of water for irrigation will increase the value of agriculture land. A share of this increase, which would only occur because of the availability of new water facilities, could be used to finance a share of the costs. Many California cities and counties use tax increment financing to encourage re-development in designated areas.

Generally, a single public agency cannot claim the entire tax increment. School districts, the county, and others must sign off for such a program to proceed. This report assumes that Zone 7 would receive a 40 percent share of the tax increment. This share would support about $10.4 million of bonds.

Tax increment financing has not yet been used to finance water facilities for agriculture. Use of this financing method would require special state legislation. If sufficient local support is generated, a local state legislator would likely introduce the required special legislation. This would constitute an innovative new plan that may be useful in other agricultural areas.

Development Mitigation Fees: Land included within a designated urban boundary is more valuable for future development than lands outside, but adjacent to, the urban boundary. In the case of this study, the lands adjacent to the urban boundary are planned to become irrigated agriculture rather than continue as grazing lands. Urban lands benefit from the open space effects of nearby agriculture. At the same time designated agricultural lands cannot benefit from increased value due to the potential of future urban development. A mitigation fee from urban development to support irrigated agriculture is appropriate. Such a development fee could be dedicated to agriculture water capital costs.

Zone 7 would work with the cities and the county to impose the fee upon new development. The mitigation fee would be collected along with other similar fees and would be uniform over Zone 7. A mitigation fee of $200 per dwelling unit equivalent would raise about $8.6 million.

Standby Charge: This charge to new and future agricultural water users is designed to fund the majority of water supply costs. Such costs include those to secure a firm water source. Designated agriculture lands would pay an annual charge based on current and projected water use.

The new water supplies benefit existing as well as future agriculture. The new supply increases reliability of the supply system. A greater charge would apply to future agriculture. For purposes of this report, existing and new agriculture land together would support 25 percent of standby charge revenue. Future agriculture land would also fund the remaining 75 percent of standby charge revenue. To raise $10 million, the charge would amount to about $3 per acre-foot for existing agriculture and would total about $15 per projected acre-foot for future agriculture.

Zone 7 would follow the requirements of the Uniform Standby Procedures Act. Standby charges would require a vote under Proposition 218. The Zone 7 Board of Directors would create a special improvement area of all agriculture lands and call for a standby charge tax vote over the improvement area. A two-thirds majority of the votes cast is required to authorize the standby charge.

Open Space General Obligation (GO) Bonds: Agriculture provides an open space benefit. Many public agencies purchase open space using GO bonds. Authorization of such bonds requires a two-thirds voter approval. The Zone 7 Board of Directors would call for an election over the entire agency. A two-thirds majority of the votes cast is required to authorize the bonds. GO bonds are payable from property taxes. A property tax rate of $0.005 per $100 dollars of assessed value (or $5 per $100,000 assessed value) would support a GO bond in the amount of about $12 million. As property values increase, the tax rate would decrease.

Sales Tax: Another source of general revenues to support agriculture and open space benefits would be from an increase in sales taxes. Revenues from a sales tax could be used to support a bond issue. Authorization of a sales tax surcharge requires a two-thirds voter approval. The Zone 7 Board of Directors would call for an election over the entire agency. A two-thirds majority of the votes cast is required to authorize the sales tax increase. An increase of 0.01 percent (i.e. 8 percent to 8.1 percent) would generate sufficient revenues to support a bond issue of about $33 million.

Wastewater User Avoided Costs: Previously, there was the opportunity to downsize the proposed LAVWMA export pipeline project, if local recycled water projects to supply agricultural water could be implemented. Since 2001, LAVWMA has proceeded with this project to construct a new wastewater export pipeline and this opportunity no longer exists.

Grants: The United States Bureau of Reclamation (USBR) and CALFED have provided grants to public agencies for wastewater reclamation projects. The combination of agricultural use and water recycling would likely be of much interest to them. Currently, USBR grant funding is not available, but there is effort underway to fund this federal program. CALFED has some funds available for water recycling projects.

Zone 7 would apply for a grant and the project would undergo considerable scrutiny. Receipt of a USBR grant would typically require 3 to 5 years or longer. A CALFED grant, if approved, might receive funding within 2 years.

A phased financing approach to match project costs will assist with project cash flow. In addition, a number of future low interest loans may be obtained from state and federal programs such as the California's State Revolving Fund loan program.

Agricultural Assessments: The Tri-Valley Business Council is exploring the use of agricultural; assessments to finance a share of water project costs. Depending on the structure employed, assessments may be used to pay debt service or could be used to fund a pay-as-you-go program.

No other changes in law, or other financing alternatives have changed the financing recommendations made in BWA's 2001 report.

Financing Analysis

The following key elements identified in BWA's 2001 report continue to be requirements for a successful financing plan:

1. Financing support is needed from all those benefiting from the development of an agricultural water system.
2. New agriculture users are direct beneficiaries of the program and need to identify a meaningful way to participate in the program.
3. Agricultural users must take the lead in supporting the project, by funding an equitable share of program costs.
4. Non-agricultural support will require some form of voter approval.
5. Non-agricultural support is dependent on a reasonable perceived project benefit and from the belief that direct beneficiaries are also paying an equitable share.
6. Some combination of revenue sources and financing methods would be required for successful implementation.

The following revenue sources and bonding methods, discussed above, continue to be possible options to finance the projects:

- Agriculture water connection charges
- Agriculture special tax bonds
- Tax increment
- General Obligation bonds

- Development mitigation fees
- Standby charges
- Assessments
- Grants

CONCLUSIONS

For the project to proceed, new agriculture must fund a major share of project costs and demonstrate their financial commitment to an enhanced agricultural water supply and conveyance system. As presented early in this report, water can substantially increase the value of agricultural land. Research indicates that land values in the potential irrigable agricultural areas within Zone 7's water service area will increase if water is available to the areas. If this is the case, existing agricultural land may be called to bear a higher level of the share of costs.

Implementation of an enhanced agricultural water supply will require some level of voter support. Successful voter approval of the proposed financing methods will require broad-ranged public support. Fortunately, a project encouraging an agricultural belt around urban areas would likely receive significant popular support. Working with the SMMP stakeholders to include an element of the agricultural water program in their financing plans may be a viable piece of the overall financing. A combination of coordinated and related programs would increase the beneficiary base and encourage public support.

The Tri-Valley Council has been reviewing the need for and working on options for additional agricultural water. This is the type of organization that is needed to help lead the program through the voter processes that will be required for successful implementation of the financing plan.

APPENDIX A

Supplemental Report
Non-Potable Water System Conceptual Master Plan