LVMWD Report
No. 2389.02

LAS VIRGENES
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WATER DISTRICT

Integrated Water System Master Plan Update 2007

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Las Virgenes Municipal Water District

Project Manager David Lippman, PE

Boyle Engineering Corporation

Project Manager Dan Ellison, PE

Project Engineer Erik Boardman, EIT

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Section 1

Executive Summary

1.1 Overview

This Master Plan Update addresses the potable and recycled water systems of Las Virgenes Municipal Water District, examining the ability of the existing facilities to adequately meet the water demands now and over the next 25 years. The expected growth over the next 25 years, while significantly lower than earlier forecasts, will still mean that substantial capital projects are needed. This Master Plan lists recommendations for the proposed capital facilities and upgrades. This document updates the Integrated Water Master Plan written in 2000 (LVMWD Report No. 2096.06).

Much of the analysis, model, and report from the previous Master Plan have been used in generating this update, but with the following significant modifications:

- Facilities constructed since 1999 have been added. These include both system improvements, such as new east-west transmission pipelines, and new developments, notably the New Millennium, Mont Calabasas and Indian Springs developments, each of which has resulted in new pump stations, tanks, and distribution pipelines.

- Estimates of future "buildout" demands are lower than previous master plans. These lower estimates reflect the fact that a large amount of land has been (and will be) dedicated to parks and other open space. The result of these lower estimates is that fewer and smaller facilities will be needed to meet future demands.

- The results of important intervening studies, such as the West Hills Facilities Study (LVMWD Report No. 2143), the Tapia Effluent Alternatives Study (LVMWD Report No. 2321), and others have been included.

- New concepts for extending the recycled water system, for maximizing the use of Las Virgenes Reservoir, and for upgrading the water transmission system have been developed.

Because of the foundations laid by the previous master plans, this update has been able to focus more on strategic analysis than on data collection and model building. Through a step-by-step process of simultaneously developing, presenting, and discussing components of the Potable and Recycled Water Master Plans, a thoroughly "Integrated" Master Plan of both systems was sought. The result has been a truly collaborative effort where District staff has participated in the analysis and review of 30 interim products through a series of 13 workshop-style project meetings.

System Descriptions

The Las Virgenes Municipal Water District (LVMWD) owns and operates a potable water system that serves the cities of Agoura Hills, Calabasas, Hidden Hills, and Westlake Village, as well as unincorporated areas in the western portions of Los Angeles County, near Ventura County. The total service area of the District covers an area of approximately 125 square miles, with topography varying from a few feet above sea level to elevations exceeding 2500 feet. The topography and geography of the District has resulted in a complex delivery system of 22 separate potable water service zones, with the equivalent number of pump stations and storage tank facilities.

The Joint Powers Authority (JPA) of Las Virgenes Municipal Water District (LVMWD) and Triunfo Sanitation District (TSD) owns and operates the Tapia Water Reclamation Facility (Tapia WRF), which produces approximately 9.5 million gallons of recycled water per day. The JPA also owns and operates a complex distribution system, consisting of pipelines, pump stations, tanks and reservoirs, and associated appurtenances to deliver the recycled water to users in various areas of Los Angeles and Ventura Counties. This Master Plan addresses those facilities within LVMWD's service area in Los Angeles County.

Key Issues

Several key issues were primary considerations in the analysis and development of this Master Plan.

Tapia Permit Restrictions. The NPDES permit requirements for Tapia WRF prohibits the discharge of recycled water to Malibu Creek between April 15 and November 15. This directly affects the Recycled Water System, and indirectly affects the Potable Water System.

During this prohibition period, in the spring and fall, surplus recycled water exists and is disposed of by using spray fields and pumping the water to the Los Angeles River basin. Increasing the beneficial use of recycled water is thus important in minimizing the cost of these disposal activities. However, increasing the use of recycled water also means that a greater deficit of supply will exist during summer peaks, necessitating the use of larger quantities of potable water supplement.

Transmission of water from east to west. Earlier master plans recommended the construction, in phases, of a large-diameter transmission pipeline from Calabasas to Las Virgenes Reservoir, paralleling an existing transmission pipeline that follows roughly the 101 Freeway. This second pipeline has been a part of the District's long-term plans since 1963, when the backbone system was conceived.

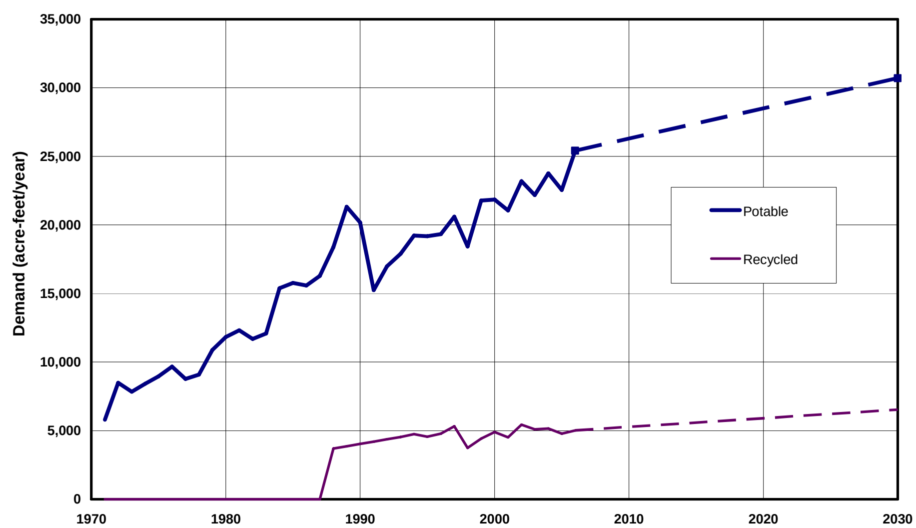
The first phase of this second pipeline system was completed in 2002, consisting of a 42-inch pipeline in Calabasas Road and an 18-inch pipeline in Mureau Road. This project significantly improved the hydraulics of the system, such that meeting maximum demands in the western part of the system was no longer problematic. Additional phases of this pipeline will be necessary, as development occurs and demands increase. This Master Plan shows the District will be able to construct smaller, shorter pipelines than originally planned, particularly if more water is drawn from Las Virgenes Reservoir during the summer.

Calleguas MWD Intertie. A connection to Calleguas Municipal Water District is highly recommended. There is excess supply available from Calleguas during the wintertime that could be a significant aid in the refilling of Las Virgenes Reservoir. The amount of reservoir water that is available for use during the summer is currently limited by the amount that can be refilled in the winter. A Calleguas connection would also serve as a valuable emergency supply to LVMWD.

Meeting future demands. There are systems that are near or at capacity, and significant investment will be needed over the next few years to meet the water demands of an increasing population. In all, facility investments of approximately $110 million may be needed by year 2030 to meet projected demands. Of this total, approximately $64 million may be needed for the potable water system and $49 million may needed for recycled water system. These costs do not include the costs of system expansions that will be funded by developers.

Figure 1-1 illustrates the historical demand for potable and recycled water and the demand within the District boundaries, and what is projected to buildout. As the demands increase, new pumping, storage and pipelines will be required to maintain satisfactory service to District customers. "Trigger points" have been provided for many of the recommendations outlined in this Master Plan. These are criteria or events that would determine when a new or upgraded facility will be needed.

Figure 1-1 – Historic and Future Water Demands



Seminole Zone Improvements. There is a potential need for very substantial investments in the Seminole/Latigo pressure zone, in the southwest portion of the District. This potential arises from the large number of undeveloped parcels in this area. Data suggest that the demands in this area could quadruple over the next 25 years.

It needs to be recognized that the planning for this area is inherently problematic. The terrain is very rugged and development is difficult. There is general lack of infrastructure, both roads and utilities. Land use densities are low, on the order of one residence for every 20 acres, further suppressing the development potential. As a result, more and more parcels in this area are being set aside for open space and parks, and the full development potential of the area is not likely to be realized.

However, even when these factors are considered, a large potential still exists for major increases in demands. Land values are increasing due to the scenic nature of the area, and with each incremental extension of roads and utilities, the development potential of nearby parcels increase. As development occurs, the water demands generated by each residence are expected to be significant as very large estates tend to be constructed. Because of these pressures, there will be a point where the demands are expected to exceed the capacities of the current pumping, pipeline, and storage facilities, requiring difficult decisions about the types of upgrades that should be constructed. This point has already been reached when it comes to pumping.

For the Potable Water Master Plan, considerable effort was spent analyzing the development potential of this zone and then developing a phased improvement program that allows construction of appropriate facilities for meeting various levels of demand.

1.2 Report Summary

The following is a brief introduction to each section included in this report and key findings:

Section 2 – Introduction and Background

This section presents a summary of the background and project purpose. The scope of the study included identifying sources of new demands and determining which subsystem components will require upgrades in order to meet both current and future demands. The historic context of the report is presented, including conclusions from earlier master plans and other reports, and critical issues facing the District.

Section 3 – Evaluation Criteria

This section describes the evaluation criteria that were used in modeling and analyzing the potable and recycled water systems. It also describes how pumping and storage capacity were evaluated and the parameters used in the hydraulic model. These include peaking factors, pump operations and pipeline flow velocities. Included in Section 3 are the cost estimating factors used to create the opinions of probable cost for capital projects.

Section 4 – Existing Facilities

This section describes the existing facilities that serve the District's service area. There are 22 defined potable water and four recycled water pressure zones within the district. Discussion is also provided regarding the Las Virgenes Reservoir and related filtration plant and pump station. The District system comprises over 400 miles of pipeline greater than 4-inches in diameter. The functions of the various pump stations, tanks/reservoirs, potable supplement facilities, and turnouts are described, with capacities and operating parameters.

Section 5 – Demands and Peaking Factors

This section discusses historic and existing demands for potable and recycled water in the LVMWD service area. It describes how peaking factors for each pressure zone were determined for Maximum Day Demand and Peak Hour Demand. This section also discusses the land use designations for each area in the District, as each area is unique in terms of population, demand patterns and developments. Unlike earlier master plans, this study used different peaking factors for each of the zones, based on geography, climate, and other characteristics. These peaking factors were derived from analysis of data for seven potable water zones and three recycled water zones. The maximum-day peaking factor used for the entire service area is 2.1, which is believed to be a conservative value.

Various tables in this section provide unit demands for various types of land uses and customers. These unit demands are available in various formats, such as gallons per day per person, or gallons per day per acre.

Maximum day recycled water demand is expected to grow from 14 MGD in the base year of 2007 to approximately 18 MGD at buildout (2030). These demand projections assume that the District will continue to be proactive in pursuing opportunities for extending the system and include the following projects: (1) Thousand Oaks Boulevard Extension, (2) Decker Canyon Project, (3) Calabasas City Center, and Woodland Hill Golf Course.

Section 6 – Water Supplies and Supply Options

This section examines the overall balance of supply and demand and discusses options for improving the reliability of water supply to the District. Some possible improvement projects include facilities to connect Twin Lakes, Box Canyon and Woolsey Canyon to the rest of the LVMWD system. (A project to connect Twin Lakes to the system is already underway.) Also, a connection to Calleguas MWD is discussed, as is expansion of the Las Virgenes Reservoir Filtration Facility to include two new filter beds.

The projected supply of recycled water is also examined. Supply to Tapia is expected to increase up to 25 percent by buildout. As this supply grows, it will be important to find new uses for the recycled water. This section also considers the contribution of supplemental water from both the Westlake Wells, which can provide up to 1.15 MGD influent to Tapia WRF, and various potable water supplement facilities.

In this analysis, it was assumed that when demand exceeds supply, supplemental potable water will be added in sufficient quantities to refill the tanks following a Maximum Demand Day. In the last master plan, considerable analysis was performed to determine if the system could be supplied during a "maximum demand week" without supplemental water - which it could not. Unless a large storage reservoir is constructed, potable supplement will be needed during peak periods, if sales of RW are maximized during the non-peak periods. Use of potable water to supplement the supply on peak demand days allows the District to sell more recycled water during other periods.

Section 7 – Evaluation of Existing Systems

This section presents an evaluation of the potable and recycled water systems as they exist today, with existing peak demands. The existing pump stations and tanks/reservoirs were evaluated for capacity to meet existing MDD under various pumping criteria. The hydraulic capacities of the pipelines were also evaluated, and recommendations for replacements or improvements are made. The major conclusions include:

- The Jed Smith Zone has a significant storage deficit on maximum demand days. Some of this deficit is made up by higher pumping during peak demands or pumping for longer periods. There are small storage deficits in other subsystems, however construction of facilities to increase storage by a small amount would not be economically feasible.

- A storage deficit of 3.9 million gallons currently exists in the western half of the 1235-ft zone. This deficit results in low water levels in the Equestrian Trails and Morrison Tanks.

- The Warner, Mulwood, and Twin Lakes Zones have pumping deficits applying 18-hour pumping criteria. Expansion of the Twin Lakes Pump Station is currently underway, and expansion of Warner is readily accomplished by equipping an existing spare position.

- Additional east-to-west transmission improvements may be needed soon.

- The potable supplement to the recycled water system cannot operate at capacity due to restrictions on the potable water side of the facility, so upgrades will be needed, particularly if the Decker Canyon and Thousand Oaks Boulevard extensions to the recycled water system are constructed.

- Maximum demands in the Seminole/Latigo Zone currently exceed the pump station capacity. The rebuilding of pumps has helped relieve short-term problems, but additional capacity is needed very soon.

Section 8 – Evaluation of Future Systems

This section examines the ability of the potable and recycled water systems to meet the projected buildout demands. The deficiencies are noted and possible upgrades are discussed. Notable deficiencies include:

- Modeling results show that water levels in the storage tanks in the western half of the 1235-ft zone drop rather quickly during maximum day demands, indicating that more storage will be needed to help maintain hydraulic gradients. Calculations show that 5 million gallons of storage may be needed by buildout.

- The Jed Smith and Seminole zones may not have enough storage capacity for maximum buildout demands. A few other zones have small, insignificant deficits.

- Pumping deficits in the Warner and Mulwood Zones are expected to grow.

- More east-west transmission pipeline improvements will be needed, particularly to supply the Morrison Supplement Facility and to help in the refilling of Las Virgenes Reservoir.

- The Seminole Zone will have large pumping deficits for the buildout condition. A second pump station and pipeline may be needed.

- Proposed extensions of the recycled water system to Malibu Golf Course, Baxter Pharmaceutical, and Woodland Hills Golf Course will increase demands on the Morrison Supplemental Facility and the Recycled Water Pump Station. Upgrades to these facilities will be needed.

Section 9 – Proposed Improvements

This section describes the new distribution, transmission, pumping, and storage facilities and upgrades that are needed in order to meet buildout demands. The description includes why and when the facilities are needed, and the possible alternatives. This section includes project descriptions divided by pressure zone and is built upon information discussed in Sections 7 and 8. The major proposed upgrades include:

- Expansion of Las Virgenes Reservoir Filtration Facility to include two new filters resulting in __ MGD plant capacity.

- Construction of a 5 MG finished water reservoir at the Las Virgenes Reservoir facility.
- East-west transmission upgrades and upgrades to the potable supplement facilities leading to Morrison Tank.
- Connection of Box Canyon, Woolsey Canyon and Twin Lakes to the remainder of the LVMWD system.
- Increase pumping in Warner/Cold Canyon, Twin Lakes, Mulwood, Jed Smith/Mountain Gate, and Seminole pressure zones.
- Possibly increase storage in Jed Smith/Mountain Gate and Seminole pressure zones.
- Improve water quality in Morrison, Saddle Peak and Latigo Tanks during periods of low demand.
- New storage tank for Three Springs Zone.
- Extensions of the recycled water system to Malibu Golf Course, Woodland Hills Golf Course, Baxter Pharmaceutical, and other customers.
- Replacements for Recycled Water Reservoirs 2 and 3.

This section also discusses how projects for the potable and water systems are interrelated; specifically how the Decker Canyon Project is part of a strategy for addressing problems in the potable water system's Seminole Zone and how improvements to the Morrison Supplemental facility (including increased potable water supply) is needed to minimize transmission upgrades in the recycled water system.

1.3 Recent System Improvements

In planning for the future, it is important to recognize that the current well running system is the result of many investments over decades. Since the last master plan was written, the following system upgrades have been constructed:

- Major transmission pipeline upgrades were constructed, including a 42-inch pipeline in Calabasas Road, an 18-inch pipeline in

Mureau Road, and a 20-inch replacement pipeline in Valley Circle Boulevard.

- The Morrison Pump Station / Recycled Water Supplement facility was constructed, which has the potential of providing up to 2000 gpm of additional supply in the western portion of the system. This facility eliminates the need for a booster pump station or additional transmission pipelines to keep the western portion of the recycled water system adequately supplied.

- As part of the New Millennium development in Calabasas, several important facilities were added or upgraded, including: (a) Parkway Recycled Water Pump Station, (b) Parkway Recycled Water Tank, (c) expanded potable water supplement at Cordillera Tank, (d) Oak Pump Station, (e) Lower Oaks Tank, (f) Upper Oaks Tank, and various pipeline upgrades and system extensions traversing the development. The Ranchview Pump Station and Tank and Upper Twin Lakes Pump Station and Tank were likewise added as part of other developments.

- Recycled Water system extensions north of the 101 Freeway to the L.A. Pet Cemetery Park and Lupin Hill School were designed and built by the District.

- Parallel potable water pipelines were recently constructed in Mulholland Highway, improving hydraulic conditions and increasing system reliability.

- A project to double the capacity the Eastern Recycled Water Pump Station was designed and is currently under construction. This project will not only assist in disposal of excess recycled water through the 005 Discharge Facility, but also provides greater flexibility to balance demands and supply between the eastern and western systems. The expansion also makes possible eastward extensions of the recycled water system that are explored in this update.

- A project is underway to increase the capacity of Twin Lakes Pump Station, and to provide a capable and more reliable source of emergency supply to the facility.

- Another project is underway to complete a second recycled water transmission pipeline, from Tapia WRF to Reservoir 2.

- As developments have been built, many new customers, large and small, have been added to the recycled water system. In addition to the New Millennium development, other significant developments have included the Mont Calabasas and Riverwalk developments.

Section 2

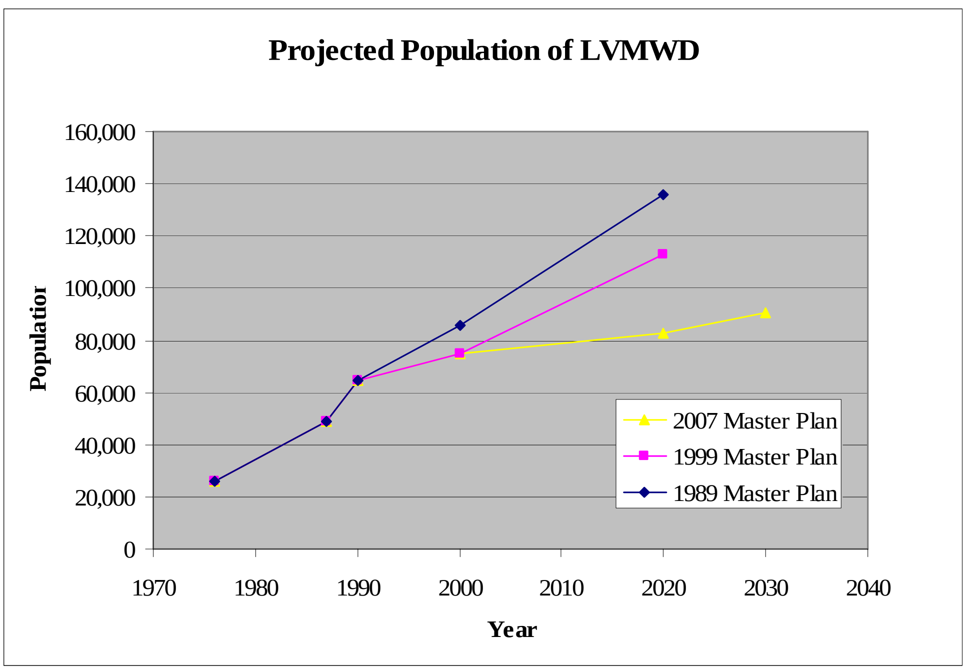
Introduction and Background

This Integrated Master Plan Update combines and summarizes the Potable Water and Recycled Water Plan Updates prepared this year, and further refines the interrelationships between the two systems. In brief, the use of recycled water lowers the demand for potable water, while the recycled water systems create a need for supplemental potable water during the peak summer months.

In May 2000, Boyle Engineering completed the last LVMWD Integrated Master Plan as the culmination of a similar master planning effort. While those master plan documents are far from obsolete changes have occurred, calling for new analysis and new thinking.

The most significant change that has occurred is the population projection and reduction of land available to development. All across the LVMWD service area, population densities permitted for undeveloped land were reduced, particularly land in unincorporated areas. At the same time, efforts have been underway to conserve more and more areas as National and State parkland and other open space, thus removing the land from development potential.

Figure 2-1



Overall, these changes have resulted in a population projection for the District that is lower than the one used a decade ago (see preceding chart,)[1]. Naturally, this affects how the LVMWD system should be planned—with such a reduction in projected population, one expects a reduction in the number and size of facilities needed. Notwithstanding this reduction, the projected population is still 30 percent higher than currently exists, and when and where, and at what rate the growth may occur is debatable.

An issue that has taken on a different importance for the District is the use of recycled water. In the 1980s and 1990s, the recycled water system was viewed as a means of utilizing a valuable resource, the effluent from the Tapia Water Reclamation Facility.[2] The recycled water system is no longer just a means of using a resource, but is also viewed as a means of meeting changing regulatory requirements. An order by the Los Angeles Regional Water Quality Control Board requires LVMWD to stop discharging recycled water into Malibu Creek during the months of April through November. This order is the culmination of increasing restrictions over the years and has far-ranging implications on how the District might design and operate its Recycled Water System, which in turn affects the way its Potable Water System will be operated.[3]

An issue of vital importance to the District is cost. The District faces two major challenges when it comes to costs: scarcity of supply source and geography. On the supply side, virtually all water used in the District originates in the Sacramento delta and is imported at significant cost. Currently, the average purchase cost is current

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[1] Population projections used throughout this Master Plan are based on a detailed study commissioned by the District called “Potable and Recycled Water Master Planning Forecasts” (Psomas, March 2007, LVMWD Report No. 2340.01) and analysis of current land use plans of the County and Cities.

[2] Among the alternatives considered at that time was a 1600 acre feet (AF) seasonal storage reservoir. Such a facility would have reduced demands on the potable water system, and decreased District dependence on MWDSC supplies. While seasonal storage has never been ruled out, environmental considerations make such a facility much less likely to occur.

[3] Options for addressing this issue were evaluated for the District in a “Creek Discharge Avoidance Study” and more currently the “Tapia Effluent Alternatives Study” (TEA Study). While some options can be implemented in the very near future, others will require further studies and discussions.

average rate is about $460 per AF.[4] On the geography side, the District is committed to serving a far-flung area, stretching from the northern end of the San Fernando Valley through the Santa Monica Mountains to the Los Angeles/Ventura County line. In between are hills, mountains, and canyons—not much which is flat. Much of the area is lightly populated, but with many large, estate-size homes, demands can be high. Providing reliable water delivery to such an area is an challenge.

Partly because of the water scarcity, the District and its Joint Powers Authority (JPA) partner, Triunfo Sanitary District, became a pioneer in the use of recycled water. The JPA is recognized in the industry for providing high quality recycled water, used in irrigating landscaped areas, such as golf courses, schools, parks, medians, businesses, and common green areas not irrigated by individual householders. The amount of wastewater that is recycled is among the highest in the state.

The existing areas within LVMWD boundaries where recycled water are used are primarily along the Ventura Freeway corridor and include the cities of Calabasas, Agoura Hills, Westlake Village, and unincorporated areas in between. Within TSD, the current service areas include Lake Sherwood and Oak Park/North Ranch. Proposed extensions to the service areas being considered include the Malibu Golf Course, various customers along the easterly portion of Thousand Oaks Boulevard within the City of Thousand Oaks, and portions of Woodland Hills.

On those days when recycled water demand exceeds the Tapia WRF supply, one hundred percent of the Tapia supply is used in the recycled system and the system is also supplemented by the addition of potable water. This supplement would not be required if there were additional storage (i.e., in a large reservoir) so that the recycled water in storage could be used to meet the peak summer demands. Existing storage is far from adequate to make up for a shortage of recycled water during those peak periods. Seasonal storage has been previously studied but

4 Rates now vary, depending on how much water is purchased at the Tier 1 rate ($453/AF) vs. the Tier 2 rate ($549/AF), with the structure of the charges intended to encourage conservation. This 5% increase compares to a general inflation rate in Southern California of 25% percent over the same previous. MWDSC rates have risen as that agency has confronted the various challenges in serving a rapidly growing population while tradition supplies (e.g., the Colorado River) have diminished.

not pursued, due to the inherent problems of siting, permitting, and constructing a dam and impoundment area. Furthermore, with current and foreseeable demands on the recycled water system, the need for storage does not outweigh the cost.

The demand for recycled water has steadily increased and is expected to increase in the future. This demand is partly due to development growth in the JPA's service area and to the advantages of using recycled water; it is also due to the District's proactive approach toward marketing recycled water. The District's effort is, in part, tied to the desire to maximize the use of recycled water and reduce (or eventually eliminate) discharges from the Tapia WRF to Malibu Creek or other waterways.

Specific Issues

These master plans are intended to provide a reliable water capital improvement plan that can be used in determining water rates, along with trigger points that will signal when a facility is needed. Among the issues addressed by this Master Plan are:

- **Las Virgenes Reservoir.** The judicious use of the reservoir allows the District to minimize peaking charges and (more importantly) meet peak demands in the western portion of the District with fewer upgrades to the backbone transmission system. Currently, the District's ability to use the reservoir is limited by the capacity of the Filtration Facility and the backbone system's capacity to refill the reservoir in the winter time. This master plan examines alternatives for increasing these capacities. An interconnection with Calleguas MWD is a key component.

- **Calleguas Municipal Water District (CMWD) Connection.** The District has had preliminary discussions with the staff of CMWD regarding an interconnection on the west end of the District. In the current concept, this interconnection would provide the District water during the winter, to help fill Las Virgenes Reservoir. In turn, the interconnection would provide CMWD with an alternate supply for emergencies.

- **Potable water supplement to Recycled Water System.** Several alternatives were discussed in the Recycled Water System Master

Plan for meeting peak demands that exceed supply. The impacts of these supplements on the Potable System were analyzed and discussed in the Potable Water Master Plan. This Integrated Plan outlines the improvements that are needed to both systems.

- **East-West Transmission.** The 1999 Master Plan recommended the construction of several new transmission mains to meet rising demand and improve operations. The most significant was a pipeline paralleling the freeway, starting near Calabasas Tank, and continuing nearly to Las Virgenes Reservoir. The size of the pipe was envisioned as 42 inches at the east end, diminishing in stages to 24 inches at the west. With a smaller projected population and the possibility of a CMWD interconnection, this recommendation has been reexamined and evaluated.

- **1235-foot System Storage.** The 1999 Master Plan recommended additional storage capacity in the backbone system, particularly a tank near Cornell Pump Station. The need and trigger points for such a storage addition is examined in this report. Alternate locations for additional storage in this zone are also discussed, particularly a finished water reservoir near the Las Virgenes Reservoir Filtration Facility.

- **Jed Smith/Mountain Gate System Improvements.** This subsystem has had difficulty in meeting demands during peak summer months. Recent upgrades have alleviated problems, but this may only be temporary, if demands from existing developed areas continue to grow. Also, as currently operated, there is no backup for the pumps at Mountain Gate Pump Station. This report provides recommendations for eliminating these problems and improving service to LVMWD customers in the area.

- **NPDES Permit Restrictions and the Use of Recycled Water.** Issues about the discharge permit requirements for the Tapia WRF have been a significant driver of many decisions regarding the recycled water system. Beginning in 1997, discharges to Malibu Creek have been prohibited between April 15 and November 15 of each year, except under special circumstances. This prohibition has prompted the JPA to implement various methods to dispose of excess water, often at considerable expense. Because of these costs, District staff has redoubled efforts to maximize the use of recycled water wherever practical. The Master Plan assumes that there will be no new regulations that limit the District's ability to distribute recycled water.

- **TEA Study.** There had been discussion that the creek discharge prohibition might be extended to the entire year, unless nutrients within the effluent were reduced to unprecedented levels. In recognition of these potential changes, the JPA produced the "Tapia Effluent Alternatives" (TEA) Study in December 2005 (LVMWD Report No. 2321.03), which studied a wide-range of options for avoiding discharges to Malibu Creek, none were economically feasible. Partly due to the JPA's efforts in addressing the discharge issues in a proactive manner, a new NPDES permit was issued in November of 2005, without the onerous restrictions that had been feared, but the JPA must still adhere to the discharge prohibition period that was imposed earlier, and must upgrade the Tapia WRF by May 17, 2010, to reduce nutrients in any effluent discharged to Malibu Creek or the Los Angeles River.

Section 3

Design Criteria

3.1 Planning Period

The planning period for this Master Plan is through the year 2030. Since the last master plan, portions of the area have been put into conservation, and in other areas the development has slowed. The population and demand projections for this Master Plan derive from *Potable and Recycled Water Master Planning Demand Forecasts* (Psomas, October 2006, LVMWD Report No. 2340).

3.2 Peaking Factors

The term "peaking factors" are ratios used to relate the Average Day Demand to the larger Maximum Day or Peak Hour Demands. Definitions are as follows:

Average Day Demand (ADD) =	The yearly use divided over 365 days. For most days during the year, the actual consumption will be substantially larger or smaller than the ADD.
Maximum Day Demand (MDD) =	The maximum consumption that can be presumed on any day; generally occurs in the summer. The peaking factor for MDD is the ration of MDD/ADD.
Peak Hour Demand (PHD) =	The maximum consumption presumed during the largest demand hour of the maximum demand day. The peaking factor for peak hour is the ratio PHD/MDD.

For most potable water systems, peaking factors are derived for the system as a whole, not for specific subsystems. This is generally used because most systems contain differences that are insignificant, however LVMWD has many exceptions due to its topography and many micro climates.

The peaking factors used to analyze the potable water system of the District are included in the discussion in Section 5. The current peaking factors used in this Master Plan are shown in **Table 5-7**.

3.3 Fire Flows

Fire flows within the LVMWD service area are governed by Los Angeles County Fire Prevention Regulation No. 8, and are determined by the largest structure served by the facility. The most recent update of these requirements occurred on December 14, 2004. Rarely is the required fire flow specified by Los Angeles County Fire Department less than 1250 gpm. The developer or property owner is responsible for upgrades that are necessitated by construction of larger structures; the District is not responsible for upgrades where deficiencies exist.

The fire flows specified are required at a minimum of 20 psi residual pressure at the fire hydrant. If a pressure other than 20 psi is measured, it will be converted mathematically to determine compatibility. Where an area is not served by a tank, a fire pump or emergency generator must be available.

Table 3-1 Fire Flow Requirements			
Residential			
Building	**Fire Flow (gpm)**	**Flow Duration (hours)**	**Hydrant Spacing (max ft.)**
Single family dwelling and detached condominiums 1 to 4 Units less than 5,000 sq. ft.	1,250	2	600
Detached Condominiums 5 or more units less than 5,000 sq. ft	1,500	2	300
Two family dwellings (duplexes)	1,500	2	600
Multi-family dwellings, hotels, high-rise commercial, industrial	5,000	5	300
Other Structures and For Single Family Dwellings Greater Than 5,000 sq. ft.:			
Building Size (1st Floor Area)			
First Floor Area under 3,000 sr. ft.	1000 gpm	2 hours	300
3,000 to 4,999 sq. ft.	1250 gpm	2 hours	300
5,000 to 7,999 sq. ft.	1500 gpm	2 hours	300
8,000 to 9,999 sq. ft.	2000 gpm	2 hours	300
10,000 to 14,999 sq. ft.	2500 gpm	2 hours	300
15,000 to 19,999 sq. ft.	3000 gpm	3 hours	300
20,000 to 24,999 sq. ft.	3500 gpm	3 hours	300
25,000 to 29,999 sq. ft.	4000 gpm	4 hours	300
30,000 to 34,999 sq. ft.	4500 gpm	4 hours	300
35,000 or more sq. ft.	5000 gpm	5 hours	300

Conditions Requiring Additional Flow:

1) Each story above ground level - add 500 gpm per story

2) Any exposure within 50 feet - add a total of 500 gpm

3) Any high rise building (as determined by the jurisdictional building code) - fire flow shall be minimum of 3,500 gpm for 3 hours at 20 psi

4) Any flow may be increased by up to 1,000 gpm for hazardous occupancy.

5) Reductions in fire flow requirements can be achieved with fire resistive construction and/or fully sprinkled buildings.

Table 3-2 Number of Flowing Hydrants	
Fire Flow	**No. of Hydrants**
<1251 gpm	1
1251-3500 gpm	2
3501-5000 gpm	3

3.4 Storage Tanks/Reservoirs – Potable Water System

There are three specific volumes of water that the tanks and reservoirs in the Potable Water System are designed to store:

- **Operational Storage –** This storage allows the system to be operated daily for the given consumer demand for that system. This storage reduces the need for pumps to vary greatly with the variety of customer demands, thus increasing efficiency.

- **Emergency Storage –** This storage allows for customer service when a pump station or turnout is off-line in an emergency. The total emergency storage required is 5 hours of MDD; the approximate amount of time that it takes to put into effect emergency measures (i.e., connecting a generator).

- **Fire Storage –** This is the volume of water needed for the maximum fire duration and flow rate requirement in a zone lacking emergency pumping provisions, such as a fire pump or emergency generator.

Although the district system is often used to fight wild fires, such events can quickly deplete storage volumes and overtax pipelines and pump stations. The numerous hydrants that may be flowing and the many domestic systems that may be broken or left abandoned with sprinklers and hoses operating create demands on the system that are far in excess of the criteria used for system design. It is recognized within the industry that it is absolutely not practical to design and build a system that can be fully functional under such catastrophic circumstances.

The amount of operational storage varies greatly depending on whether the system is designed for continuous pumping (24 hours on max day), off-peak pumping (9 hours maximum per day), or mid-peak (18 hours maximum per day). Off-peak and mid-peak pumping have the advantages of lower electricity rates and more abundant facility capacity, but require larger facilities and greater capital outlay.

These pumping modes also result in larger facilities that are therefore more capable of overcoming unexpected problems such as equipment failures or demands that exceed forecasts.

3.5 Tanks and Reservoirs – Recycled Water System

For the Recycled Water System, some of the same principals apply, but there are differences:

- **No fire flow storage**. The recycled water system is not designed for fighting fires, and the tanks and reservoirs are not specifically designed for fire flow storage.

- **No emergency storage**. Because the system primarily is used for irrigation, service is considered more interruptable.

Notwithstanding the above, larger storage volumes are desirable in the recycled water system because of the need to balance day-to-day demands and supply, avoiding discharges of recycled water and minimizing the use of supplemental water to the greatest extent.

3.6 Pump Station Sizing

It is recommended to design, build and operate pump stations such that the following criteria are met:

- A pump station should be able to pump a volume of water that is equal to the Maximum Day Demand in a period of 18 hours or less. However, if the pump station is/was designed to operate in off-peak conditions the Maximum Day Demand should be pumped in 9 hours. Special approval is needed for new facilities where pumping Maximum Day Demand takes more than 9 hours.

- Pump stations must be able to replace Maximum Day Demand plus either emergency storage or fire flows, whichever is larger in volume, in 24 hours.

- When a certain zone contains no reservoir storage, the pump station must be able to meet Peak Hour Demands without the use of a standby fire pump *and* to meet Maximum Day Demands plus fire flow, with the use of a standby fire pump.

- Pump station should be able to meet or exceed all above criteria with a standby pump that is not normally operated.

3.7 Pipe Sizing

The governing factor for pipe sizing in the Las Virgenes Municipal Water District is hydraulic considerations to meet pressure requirements at anticipated flow rates. However, there are some guidelines to the minimum size of pipes in specific locations or in certain conditions. The minimum size for service laterals shall be 1 inch. For mains, a minimum of 4-inches is required on a dead end, beyond the last hydrant. When the main is feeding a hydrant, the minimum is 6-inches, and looping is required where it is feasible.

The following criteria are also used in the sizing and analysis of pipelines:

Maximum normal flow velocity, new pipeline	5 ft/sec
Maximum normal flow velocity, existing pipeline	10 ft/sec
Maximum flow velocity, fire flow	15 ft/sec
Maximum head loss, normal flow	5 ft/1000 ft

3.8 Replacement Schedules and Economic Lives

The individual water distribution system facilities have approximate useful lives, which depend on many factors, such as: amount of use, maintenance, overall capacity, construction quality, and others. **Table 3-3** provides an assumed estimate of operational life for key facilities before large-scale repair, replacement or refurbishment is needed. These estimated lives are based on Las Virgenes MWD Asset Lives Memorandum by Brown and Caldwell (dated September 11, 2006).

Table 3-3 Facility Replacement Schedule/Economic Life		
Asset Description	Useful Life	
	Months	Years
A. Major Buried Pipelines		
1. Sewers, all materials	1,200	100
2. Potable and recycled, all materials	900	75
B. Tanks and Buildings		
1. Concrete reservoirs	600	50
2. Welded steel storage tanks (except coating)	600	50
3. Pump stations (except pumps and electrical)	600	50
4. Sanitation concrete tanks, buildings	600	50
5. Headquarters construction	600	50
6. Construction of Westlake Filtration Plant	600	50
7. Construction of Rancho Composting Plant	600	50
8. Construction of Tapia WRF	600	50
C. Facility Piping, Appurtenances, Services, Roads		
1. Piping, valves and fittings/buried valves	420	35
2. Site work/roads/small structures	420	35
3. Potable water meter boxes, services, vaults, fire hydrants	420	35
4. Recycled water meter boxes, services, vaults, fire hydrants	420	35
D. Large Equipment		
1. Potable and recycled water pumps	300	25
2. Sanitation pumps, conveyors, centrifuges, large electrical	300	25
3. Sanitation control systems, electrical, chemical, grinders	300	25
4. Electrical and control facilities at pump stations and storage facilities	300	25
E. Small Equipment and Miscellaneous		
1. Design and engineering	300	25
2. Master plans, general EIRs and studies	60	5
3. Tank coatings	180	15
4. Potable and recycled water meters	180	15
5. Special vehicles, portable generators and pumps	120	10
6. Sanitation meters, lab equipment, small tools, radios, SCADA equipment	120	10
7. Furniture, carpet, blinds, phones	120	10
8. Vehicles, general use	72	6
9. Shop and garage equipment	60	5
10. PCs, software, meter readers	36	3

3.9 Opinion of Probable Cost/Economic Factors

Unless specifically noted otherwise, all cost and economic figures used in this report are based on applicable current rates, in 2007 dollars.

The opinion of probable construction costs for estimating purposes is shown in **Table 3-4**. The values shown in **Table 3-4** are based on previous construction bid costs.

The cost associated with right-of-way acquisition will vary for facilities that are not in current public right-of-way. An allowance estimated between $5 and $40 per square foot should be allocated for the fee parcels. For easements, allow approximately one-third the value of the fee title easement.

An estimate of 20 percent of the opinion of probable cost has been made for engineering, administration, and construction services for pipelines and reservoirs, where 30 percent for pumping stations has been estimated. Allowances for surveying and geotechnical investigations have been allocated. Also, a contingency of 15 percent has been allowed on the overall project cost.

Table 3-4
Construction Cost Estimating Criteria for Potable Water System Facilities

Item/Description	Unit Price Existing Development	Unit Price New Development
4-inch pipelines	$ 150/LF	$ 75/LF
6-inch pipelines	$ 175/LF	$ 90/LF
8-inch pipelines	$ 190/LF	$ 100/LF
10-inch pipelines	$ 210/LF	$ 105/LF
12-inch pipelines	$ 225/LF	$ 110/LF
14-inch pipelines	$ 240/LF	$ 115/LF
16-inch pipelines	$ 250/LF	$ 130/LF
18-inch pipelines	$ 270/LF	$ 150/LF
20-inch pipelines	$ 280/LF	
24-inch pipelines	$ 300/LF	
30-inch pipelines	$ 340/LF	
36-inch pipelines	$ 370/LF	
42-inch pipelines	$ 385/LF	
Welded Steel Water Tanks	$ 0.80/gal + $0.40/gal for site work	
Concrete Reservoirs	$0.90/gal + $0.45/gal for site work	
Pump Stations	See Figure 3-5 for $/HP	

Notes:

1) All costs are 2007 dollars (ENR Construction Cost Index/Los Angeles = 8871)

2) Pipeline costs are for developed areas based on analysis of historic costs for publicly bid projects in California, and include all pipeline related items including: mobilizations, excavation, backfill, appurtenances, services, casings and paving.

3) Pipeline costs for undeveloped areas are based on industry estimating guides and include an allowance for normal appurtenances, but do not include paving and mobilization.

Section 4

Existing Facilities

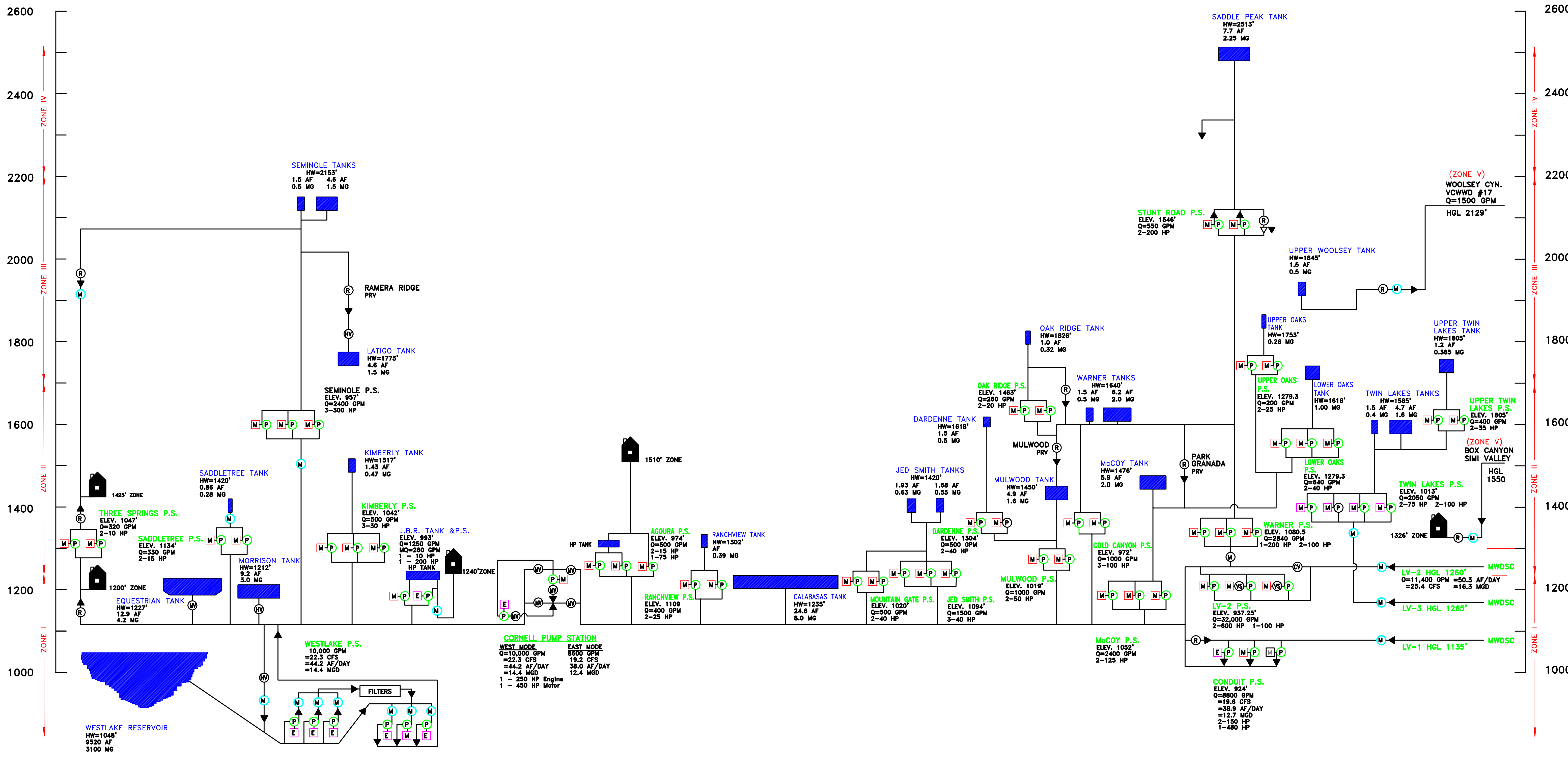
4.1 Potable Water System

The Las Virgenes Municipal Water District potable water system consists of a complex system of pumps, pressure zones, supply connections and reservoirs/tanks. There are 22 main pressure zones created by numerous facilities. The topography plays a large role in the complexity of the water delivery system of the District.

A brief overview of the major components of the District is outlined in **Table 4-1**. **Plate 1** and **Figure 4-1** display the facilities in plan and schematic profile.

4.1.1 Las Virgenes Reservoir, Pump Station and Filtration Plant

Las Virgenes Reservoir provides both seasonal and emergency storage capabilities. This storage allows LVMWD to purchase water from MWDSC in the winter and store it for summer. The storage capacity for this reservoir is 9500 acre-feet. Pertinent operational and design values are shown below in **Table 4-2**.



LEGEND

- P E — ENGINE DRIVE PUMP
- P M — ELECTRIC MOTOR DRIVE PUMP
- M — METER
- MV — MOTOR CONTROLLED VALVE
- VS — VARIABLE SPEED DRIVE
- CV — CHECK VALVE
- HP — HYDRO-PNEUMATIC
- HV — HYDRAULIC CONTROL VALVE
- R — REGULATOR STATION
- ZONES WITHOUT TANKS
- EXISTING FACILITY
- FUTURE FACILITY

SCALE

VERTICAL GRADIENT SCALE
1 UNIT = 100'
(2 — 200'; 1 — 100'; 0 — 0')

HORIZONTAL TANK VOLUME SCALE
1 UNIT = 3 MG
(0, 1; 0 MG, 1 MG, 2 MG, 3 MG)

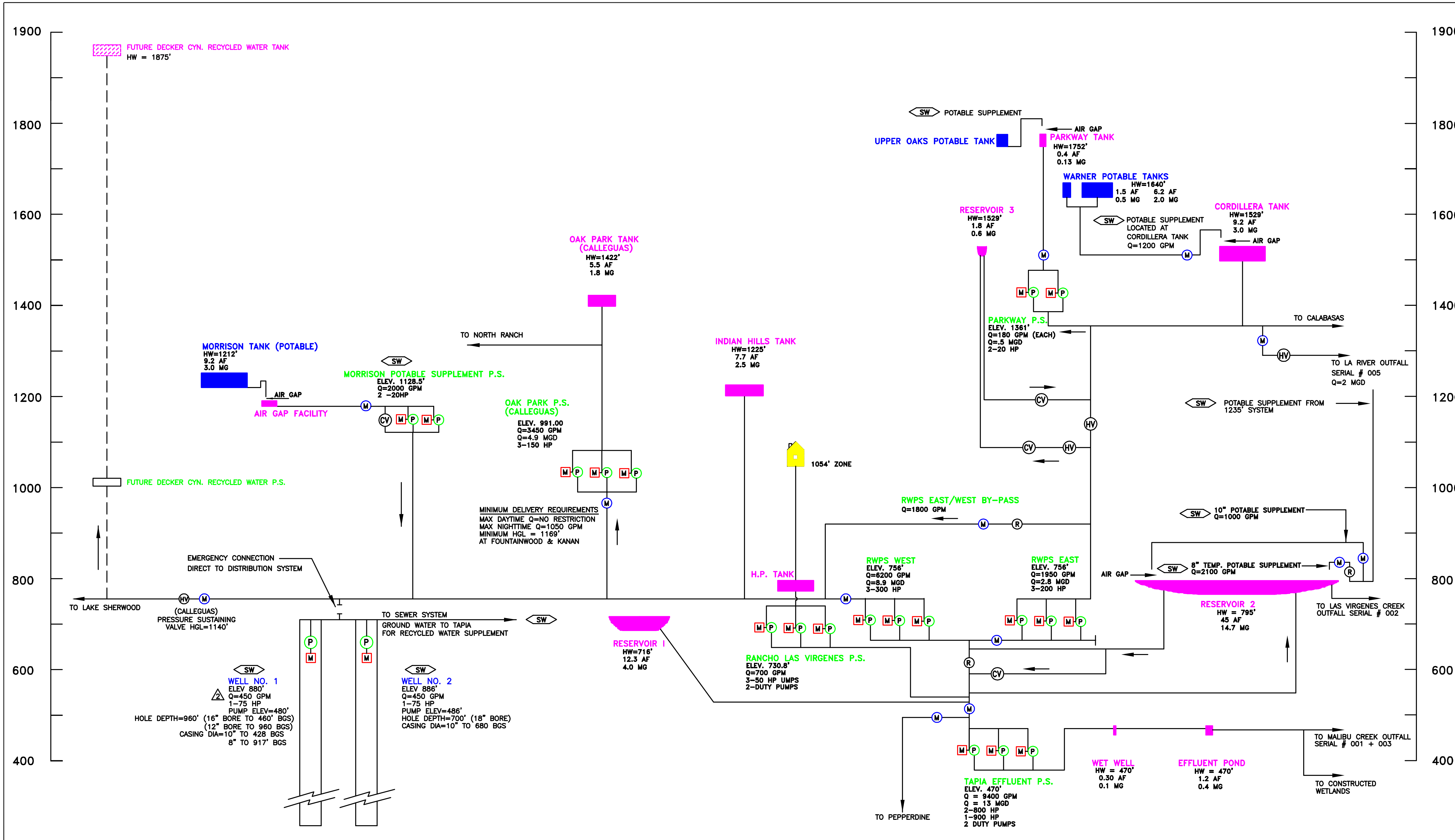
LAS VIRGENES MUNICIPAL WATER DISTRICT
INTEGRATED WATER SYSTEM MASTER PLAN

EXISTING POTABLE SYSTEM GRADIENT SCHEMATIC

23016.00 | SEPT 2007 | FIGURE 4-1

Table 4-1
Existing Pressure Zones

Zone / HWL	Tanks / Capacity	Supplied by	From Zone	Comments
1135 ft	--	MWD LV-1 Turnout	n/a	Can be Fed From 1235 ft
Main	Calabasas	Conduit Pump Station	1135 ft	
1235 ft	8 MG			
	(1235 ft)			
		MWD LV-2 Turnout	n/a	LV-2 PS is an in-line booster
	Morrison	LV-2 Pump Station		
	3 MG			
	(1212 ft)			
		Cornell Pump Station	n/a	Cornell PS is an in-line booster
	Equestrian Trails			(east or west)
	4.2 MG	Las Virgenes Reservoir,		Las Virgenes Reservoir contains seasonal and emergency storage
	(1227 ft)	Pump Station and		
		Filtration Plant		
JBR 1240 ft	Hydro-Pneumatic	JBR Pump Station	1235 ft	Used when gradient is low in 1235 ft zone
Box Canyon 1236 ft	None	City of Simi Valley	1550 ft	Serves upper Box Canyon, most can be fed by LVMWD if needed. Existing old pump fixtures could be re-installed
Ranchview 1302 ft	Ranchview 0.39 MG	Ranchview Pump Station	1235 ft	
Agoura 1350 ft	Hydro-Pneumatic	Agoura Pump Station	1235 ft	
Saddletree 1420 ft	Saddletree 0.3 MG	Saddletree Pump Station	1235 ft	
Jed Smith/Mtn. Gate 1420 ft	Jed Smith (2) 1.2 MG	Jed Smith Pump Station Mountain Gate Pump Station	1235 ft	
3 Springs 1425 ft	None	Three Springs Pump Station Westlake Blvd PRV from Seminole Zone	1235 ft 2153 ft	1235 fed from 1200 ft gradient
Mulwood 1450 ft.	Mulwood 1.6 MG	Mulwood Pump Station Mulwood PR Station	1235 ft 1640 ft	Supplies Dardenne PS
McCoy 1475 ft	McCoy 2.0 MG	McCoy Pump Station Various PR Stations	1235 ft 1640 ft	
Kimberly 1517 ft	Kimberly 0.5 MG	Kimberly Pump Station	1235 ft	
Twin Lakes 1585 ft	Twin Lakes (2) 2 MG	MWD LV-3 Turnout Twin Lakes Pump Station	1265 ft	Isolated from rest of LVMWD system
Lower Oaks 1616'	Lower Oaks 1.0 MG	Lower Oaks PS	475 ft	
Dardenne 1618 ft	Dardenned 0.5 MG	Dardenne Pump Station	1450 ft	
Warner/Cold Canyon 1640 ft	Warner (2) 2.5 MG	Warner Pump Station Cold Canyon Pump Station	1235 ft	Supplies many other zones Cold Canyon PS Supports Stunt Road PS
Upper Twin Lakes 1805 ft	Upper Twin Lakes 0.385 MG	Upper Twin Lakes Pump Station	1585 ft	Fed from Twin Lakes System
Upper Oaks 1753 ft	Upper Oaks 0.26 MG	Upper Oaks Pump Station	1475 ft	
Latigo 1775 ft	Latigo 1.5 MG	Seminole Subsystem Ramera Ridge PR Station	2153 ft	
Oak Ridge 1826 ft	Oak Ridge 0.32 MG	Oak Ridge Pump Station	1640 ft	
Woolsey 1845 ft	Upper Woolsey 0.5 MG	Ventura County WWD #17 Woolsey PR Station	2129 ft	Isolated from rest of LVMWD system
Seminole 2153 ft	Seminole (2) 2.0 MG	Seminole Pump Station	1235 ft	Largest Single Lift in District, Supplies Latigo Tank and Three Springs Zone
Saddle Peak 2513 ft	Saddle Peak 2.25 MG	Stunt Road Pump Station	1640 ft	Highest Elevation Zone in District



LEGEND

P E	ENGINE DRIVE PUMP	CV	CHECK VALVE
P M	ELECTRIC MOTOR DRIVE PUMP	HP	HYDRO-PNEUMATIC
M	METER	HV	HYDRAULIC CONTROL VALVE
MV	MOTOR CONTROLLED VALVE	R	PRESSURE REGULATOR
VS	VARIABLE SPEED DRIVE	BGS	BELOW GROUND SURFACE
Q	DESIGN FLOW	SW	SUPPLEMENTAL WATER
	ZONES WITHOUT TANKS	-----	FUTURE FACILITIES

SCALE

VERTICAL GRADIENT SCALE
1 UNIT = 100'

HORIZONTAL TANK VOLUME SCALE
1 UNIT = 3 MG

LAS VIRGENES MUNICIPAL WATER DISTRICT
INTEGRATED SYSTEM MASTER PLAN

EXISTING RECYCLED SYSTEM GRADIENT SCHEMATIC

23016.00 DEC. 2006 FIGURE 4-2

Table 4-2 Las Virgenes Reservoir Storage Data			
Water Level	Water Surface Elevation	Remaining Storage (AF)	Refill Volume (AF)
High Water	1048	9500	none
Typical Year Minimum[5]	1020	6500	3000
Normal Operating Minimum	1002	3600	5900
Extreme Minimum (emergencies only)	950	600	8900

4.2 Recycled Water System

The primary supply of recycled water is the Tapia Water Reclamation Facility (Tapia WRF). Various supplemental supplies, described below, have been developed for use on a temporary basis when the supply from Tapia WRF alone is not sufficient to meet the recycled water demand.

4.2.1 Tapia Water Reclamation Facility

Tapia currently treats about 9.5 MGD of wastewater during a typical day. In the future, this may increase to 12 MGD.

The Tapia WRF is operated jointly by Las Virgenes Municipal Water District (LVMWD) and Triunfo Sanitation District (TSD). The plant is located on Malibu Canyon Road and provides tertiary treatment for wastewater contributed by both LVMWD and TSD. The current design treatment capacity of the facility is 16.1 million gallons per day (MGD) but it is undergoing planned modifications which are expected to reduce its rated capacity to an average of 12 MGD. Currently, the plant produces about 9.5 MGD during the summer, without supplement from the Westlake wells.

[5] This is to be re-evaluated, as part of this study.

4.2.2 Westlake Wells

Use of the Westlake Wells can add 1.15 MGD to the RW supply.

Because of the high-iron content of the well water, the water is treated via the Tapia WRF prior to use. Treatment at Tapia is effective in diluting, oxidizing, and removing the iron.

The Joint Powers Authority (JPA) owns and operates two groundwater wells located in Westlake Village near the intersection of Lindero Canyon and Lakeview Canyon Road. Each well has a nominal capacity of approximately 400 gpm. Combined, they have a capacity of approximately 1.15 MGD. The wells have been used to directly supplement the recycled water system in the past. However, the iron and manganese content of the water resulted in staining of concrete structures such as walls or sidewalks; therefore, use of the wells was discontinued as a direct supplement to the recycled water system.

With proper blending or treatment, the water is otherwise suitable to use in the recycled water system. The JPA has provided such blending by conveying the groundwater to Tapia WRF via existing trunk sewers. After blending and treating, the groundwater enters the recycled water system with other water treated at Tapia WRF.

The wells are only used when supplemental water is needed to meet peak demands. Timing and control of well operation requires careful planning and coordination so that surplus flow is not mistakenly developed at Tapia WRF, especially during the creek discharge flow prohibition period.

4.2.3 Supplemental Potable Water

There are three locations within LVMWD where potable water may be added to the recycled water system, as shown in **Table 4-3**.

Table 4-3
Summary of Potable Water Supplement Facilities

Location	Description	Max. gpm
Reservoir No. 2 LV Valley System	Via a permanent buried pipe from 1235' potable system. Air gap into stand-pipe at reservoir.	400*
Reservoir No. 2 LV Valley System	Via a temporary pipe on surface from 1235' potable system. Air gap at pipe end at spillway into reservoir.	2100
Cordillera Tank Eastern System	Via a dedicated buried pipeline from 1640' potable system. Automatic flow control. Permanent air gap into tank.	1200
Morrison Supplemental Facility	Via an air-gap facility that feeds a low-lift pump station (see below for a more complete description).	1100 (current) 2000 (future)
Total Potable Water Supplemental Available (maximum – excludes 400 gpm at Res. 2)		4400 (current) 5300 (future)

* Originally designed for 1000 gpm. Air containment at pump station reduces capacity to 400 gpm.

At Parkway Tank, there is also an air gap through which potable water can be supplemented. This is feature that was easily constructed, but is only expected to be used during maintenance activities.

There are no comparable facilities in the TSD service area. In order to supplement the recycled water system with potable water in TSD's service areas, a large customer such as the North Ranch Golf Course must be removed from the recycled water system and temporarily served with potable water through an existing air gap into a water pond.

The recently constructed Morrison Supplemental Facility is designed for up to 2000 gpm, but can only produce about half that amount due to limitations within the potable water system.

Providing supplemental water in the western part of the system should avoid the need for upgrades to the RW transmission system.

Morrison Supplemental Facility

Morrison Supplemental Facility is located in Agoura Hills, near Reyes Adobe Road, north of the 101 Freeway. Because of the low-head differential between the Morrison Tank and the air-gap sump, the Morrison facility provides a very energy efficient way of providing supplemental water.

4.2.4 Pressure Zones

There are four recycled water pressure zones within LVMWD. The four zones are: LV Valley, Eastern, Western, and Parkway. A fifth pressure zone, in the Oak Park area, draws water from the Western System, and has a tank and pump station owned and operated by Calleguas MWD.

4.2.5 Pump Stations

The Recycled Water System consists of five pumping stations. All pump stations in the recycled system are vertical turbine pumps, powered by electricity. **Table 4-4** summarizes the pumping facilities.

The capacities of RWPS East and West are not additive. Due to restrictions in the suction piping, all six pumps cannot be run simultaneously.

Table 4-4
Existing Recycled Water Pump Stations

Name Location Nominal Suction HGL Nominal Discharge HGL	Pump # and Combination	Motor Size (HP)	Nominal Pumping Capacity (gpm)
Tapia Effluent Pump Station	1	800	4200
Tapia WRF	2	800	4200
Suction: 468’	3	900	6200
Discharge: 795’	1 and 2, 2 and 3	-	9400
	1, 2, and 3	-	-
RWPS East (pre-expansion)	1	200	800
LVMWD Headquarters	2	200	800
Suction: 795’	3	200	800
Discharge: 1529’	1 and 2, 2 and 3	-	1500
	1, 2, and 3	-	1950
RWPS East (post-expansion)	1	500	2000
LVMWD Headquarters	2	500	2000
Suction: 795’	3	500	2000
Discharge: 1529’	1 and 2, 2 and 3	-	3500
	1, 2 and 3	-	4500

Table 4-4 Existing Recycled Water Pump Stations			
Name Location Nominal Suction HGL Nominal Discharge HGL	**Pump # and Combination**	**Motor Size (HP)**	**Nominal Pumping Capacity (gpm)**
RWPS West	1	300	2200
LVMWD Headquarters	2	300	2200
Suction: 795’	3	300	2200
Discharge: 1225’	1 and 2, 2 and 3	-	4300
	1, 2, and 3	-	6200
Morrison			
Agoura Hills	1	20	1100
Suction: 1180’	2	20	1100
Discharge: 1225’	1 and 2	-	2000*
Parkway	1	20	180
Parkway Calabasas	2	20	180
Suction: 1529’	1 and 2		350
Discharge: 1750’			

* The use of two pumps at Morrison Pump Station will require additional modifications of the potable supply system.

4.2.6 Reservoirs

There are six existing reservoirs and tanks in the recycled water system (not including those in TSD’s service area). The locations, capacities, and other information are summarized in **Table 4-5**.

Table 4-5 Summary of Existing Recycled Water Reservoirs				
Name Location System	**Type**	**Capacity M.G.**	**High Water Elev. (ft)**	**Bottom Elev. (ft)**
Reservoir No. 2	Open	14.66	795	768
LVMWD HQ	Concrete Bottom	(45 AF)		
Las Virgenes Valley	Earthen Sides			
Reservoir No. 3	Open	0.60	1529	1516
Calabasas	Concrete Bottom	(1.8 AF)		
Eastern	Concrete Sides			

Table 4-5
Summary of Existing Recycled Water Reservoirs

Name Location System	Type	Capacity M.G.	High Water Elev. (ft)	Bottom Elev. (ft)
Cordillera	Covered	3.0	1533	1503
Calabasas	Welded Steel	(9.2 AF)		
Eastern	Tank			
Indian Hills	Covered	2.5	1225	1195
Agoura Hills	Welded Steel	(7.7 AF)		
Western	Tank			
Reservoir No. 1 (1)	Open	4.0	716	
Tapia WRF	Earthen Sides & Bottom	(12.3 AF)		
Parkway	Covered	0.13	1752	1737
Calabasas	Welded Steel	(0.4 AF)		
Parkway (Western)	Tank			

(1) Reservoir No. 1 is not currently used in any distribution system. It serves as a back-up for Tapia WRF plant water.
(2) Reservoir No. 3 is not currently used for storage. It however, remains in service to act as surge protection for RWPS East.

Section 5

Demands and Peaking Factors

5.1 Introduction

Ultimate demand in the District was projected based on an evaluation of existing usage, planning data and land use maps for the various areas within the District. Overall District population expectations have declined since the 1999 Master Plan.

For the most part, the basis for demand and population estimates used in this report is *Potable and Recycled Water Master Planning Demand Forecasts*, LVMWD Report No. 2340.01, March 2007, by Psomas. (This will be referred to as the "Psomas Report.") Other sources were also used, where more detailed analysis had been performed.

5.1.1 Population Projections

Population projections have declined since the 1999 Master Plan as shown in **Figure 2-1**. The LVMWD Master Plan of 1989 projected a total buildout population of 135,600 at the Year 2020 and the 1999 Master Plan projected a population of 112,930 at the same year. The new projected buildout population is approximately 90,000, at year 2030. This decline in the population forecast is due to the dedication of large areas of the District to park land and other open space use.

For the most part, large developments of 100 homes or more are a thing of the past in the District. Future growth will more likely take the form of in-fill development involving only a few parcels. Much of the population growth will result from an increase in density along the 101 Freeway, with multi-family residential units often replacing single-family units. However, much of the growth in water demands will occur in the southern portion of the District (particularly the Saddlepeak, Seminole, and Latigo Zones), where development is sparse and densities will remain low (one residence for every 5 to 40 acres), but steady development could eventually result in large demands.

Table 5-1 displays the population projections for each geographic location throughout the District.

Table 5-1 Population Projections by Location from Potable and Recycled Water Demand Forecasts						
Location	2005	2010	2015	2020	2025	2030
Agoura Hills	23,445	23,749	24,053	24,357	24,661	24,965
Calabasas	22,664	23,481	24,298	25,115	25,933	26,750
Hidden Hills	2,074	2,106	2,139	2,171	2,203	2,235
Unincorporated Los Angeles County Canoga Park	962	1,106	1,250	1,393	1,537	1,681
Unincorporated Los Angeles County Chatsworth	2,184	3,047	3,191	3,248	3,306	3,364
Unincorporated Los Angeles County West Hills	788	913	1,037	1,162	1,286	1,411
Unincorporated Los Angeles County (excluding Chatsworth, Canoga Park and West Hills)	8,382	10,978	13,575	16,172	18,768	21,365
Westlake Village	8,856	8,897	8,937	8,977	9,017	9,057
LVMWD Service Area Totals	69,355	74,277	78,480	82,595	86,711	90,828

5.2 Potable Water Demands

5.2.1 Existing Average Day Demand

Flow data were analyzed from the three turnouts, LV-1, LV-2 ad LV-3, as well as Las Virgenes Reservoir Pump Station. For the analysis, the storage tank levels were not taken into consideration, as it is assumed that they are refilled each day. The total demand measured for 2005 was 20,946 acre feet. This results in an average day demand of 57.4 acre-feet per day.

Table 5-2 illustrates the changes in average day demand from 1999 to 2005. It should be noted, however, that 2005 was a particularly wet year. Data for 2007 shows demands that are approximately 15 percent higher.

Table 5-2 Comparison of Actual Demands			
Subsystem	**1999 ADD (gpm)**	**2005 ADD (gpm)**	**Change (%)**
1235 Zone	8267	8075	-2.3%
Box Canyon	88	45	-48.9%
Dardenne	131	125	-4.6%
Deerlake Ranch			
JBR/Agoura		49	
Jed Smith	900	925	2.8%
Kimberly	120	104	-13.3%
Latigo	115	118	2.6%
Lower Oaks			
McCoy	1079	895	-17.1%
Mulwood	714	643	-9.9%
Oakridge	71	69	-2.8%
Ranchview		73	
Saddlepeak	133	174	30.8%
Saddletree	77	61	-20.8%
Seminole	428	403	-43.2%
Three Springs		105	
Twin Lakes	355	347	-2.3%
Upper Oaks		7	
Upper Twin Lakes		28	
Warner Tanks	442	663	50.0%
Woolsey	67	76	13.4%
Total (gpm)	12,987	12,985	-0.2%
Total (AF)	20,950	20,946	

Demands based on analysis of billing records

Figure 5-1 shows the monthly consumption of water and 12-month trailing average. **Figure 5-2** shows annual consumption.

Figure 5 - 1

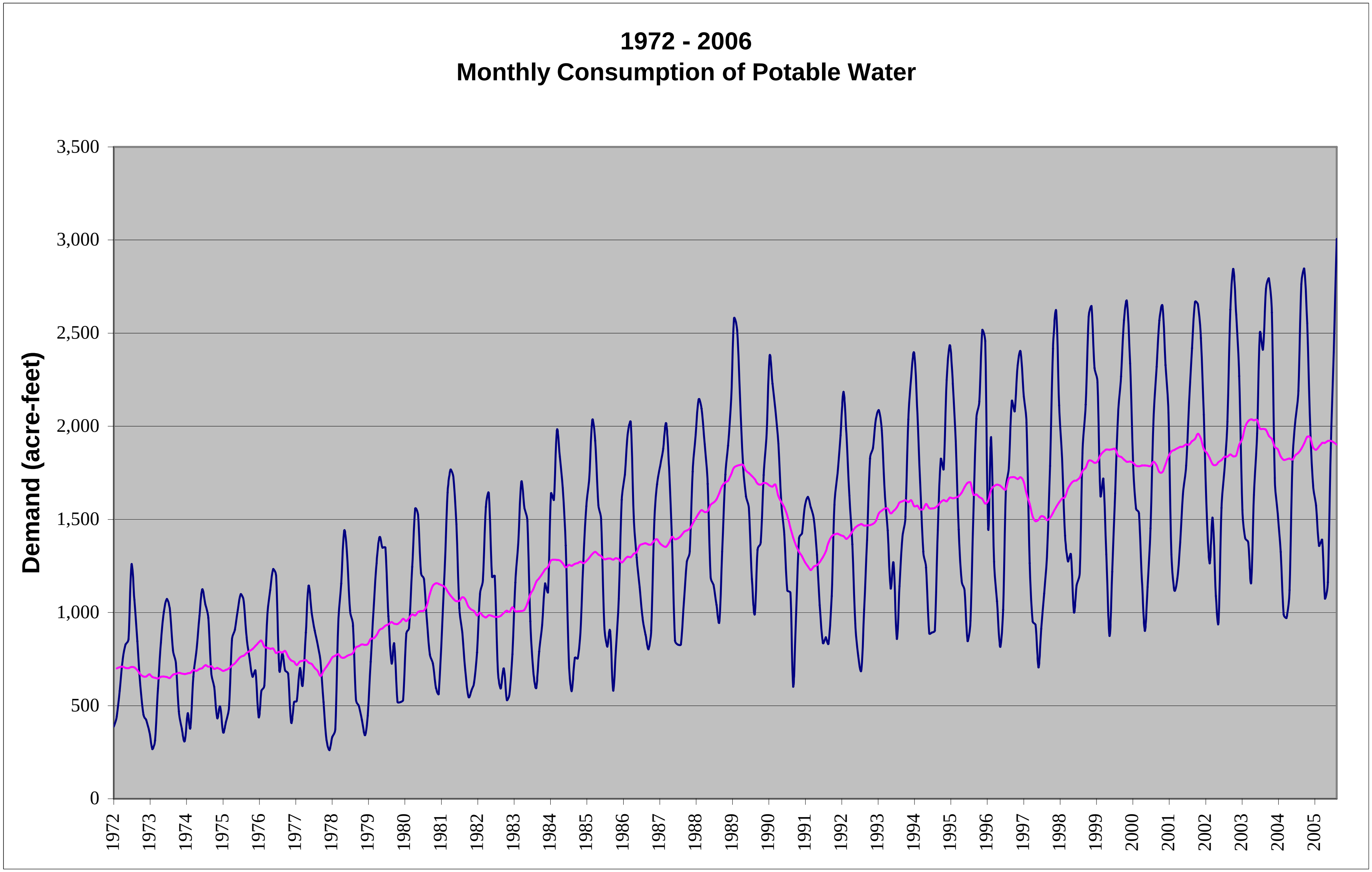


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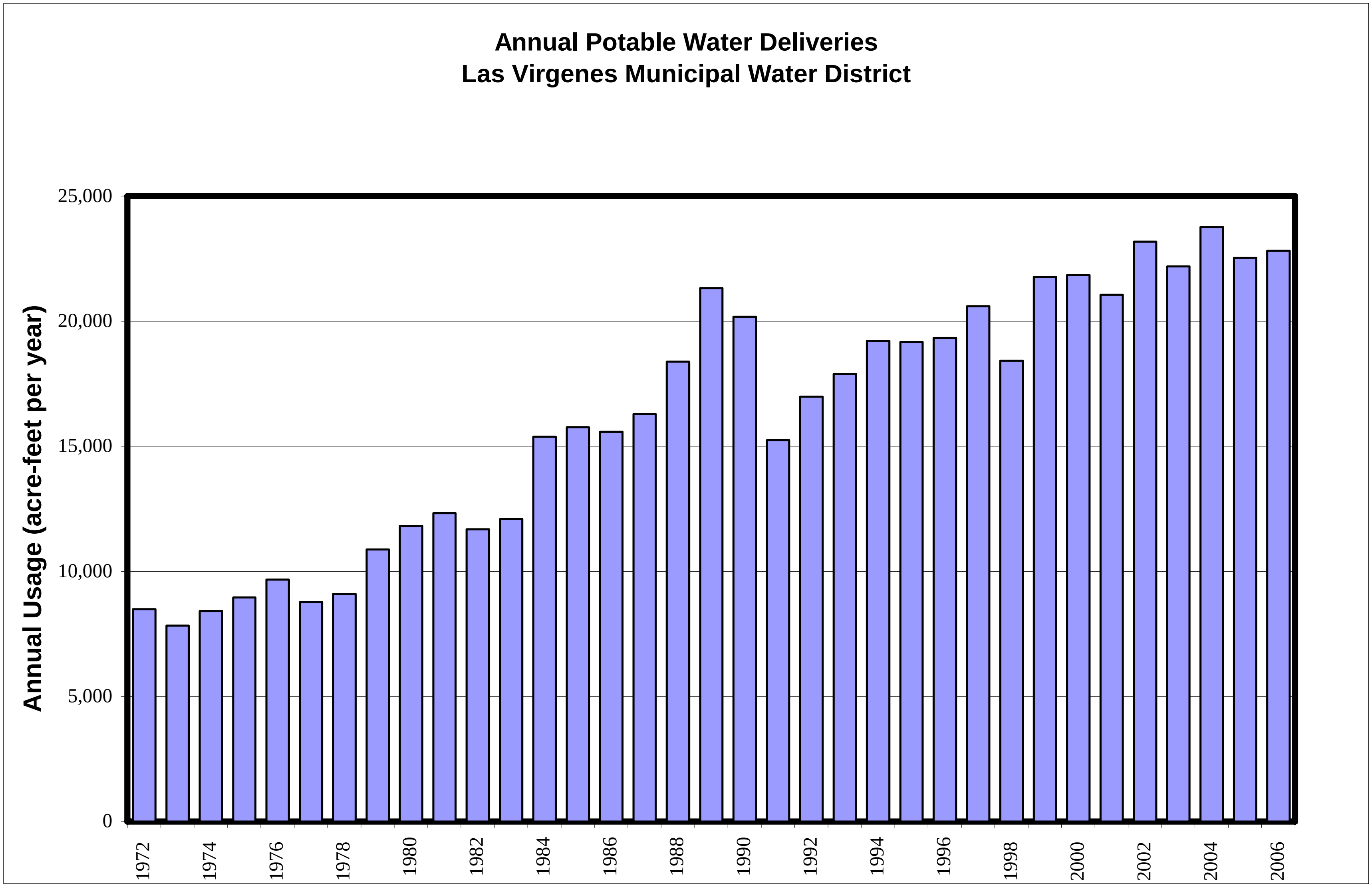
Figure 5 - 2



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5.2.2 Future Potable Water Demand

This Master Plan, with updated demand information and peaking factors has determined the maximum day demands for 2030 to be 30,700 acre-feet per year. The historical demand and projected future demands per capita are shown in **Table 5-3**.

Table 5-3
Average per Capita Water Use (gallons per day)

Pressure Zone	2005	2015	2030
1235-foot Main	319	323	336
Dardene	332	331	328
Jed Smith	528	529	531
Kimberly	218	218	217
Latigo	193	322	392
Lower Oaks	0	351	743
McCoy	320	319	318
Mulwood	262	263	266
Oakridge	531	509	486
Ranchview	944	943	941
Saddle Peak	547	546	545
Saddletree	344	343	341
Seminole	691	596	560
Twin Lakes	436	258	218
Upper Oaks	200	303	408
Upper Twin Lakes	424	353	294
Ventura County	114	147	161
Warner	257	259	262
Woolsey	133	139	147

Table 5-4 summarizes the estimated future MDD demands used in this Master Plan Update and indicates the source of the estimate.

Table 5-4 Future Demand Projections Used in This Master Plan		
Zone	2030 MDD (gpm)	Basis of Demand Forecast
1235 Zone	23,480	2005 Urban Water Management Plan
Box Canyon	88	1999 Master Plan
Dardenne	198	2005 Urban Water Management Plan
JBR/Agoura	140	2005 Urban Water Management Plan
Jed Smith	2,455	LVMWD Report No. 2202, Jed Smith/Mt. Gate Subsystem Demand Analysis Report, June 2002
Kimberly	250	250 is average of 1999 MP and 2005 Urban Water Management Plan
Latigo	407	Sensitivity analysis (medium probability), see Section 5.6 of the Potable MP.
Lower Oaks	621	Calculated from 2007 LVMWD SCADA information
McCoy	2,000	2000 is average of 1999 MP and 2005 Urban Water Management Plan
Mulwood	1,100	2005 Urban Water Management Plan
Oakridge	135	2005 Urban Water Management Plan
Ranchview	153	2005 Urban Water Management Plan
Saddlepeak	448	2005 Urban Water Management Plan
Saddletree	92	2005 Urban Water Management Plan
Seminole	4,025	Sensitivity analysis (medium probability), see Section 5.6 of the Potable MP.
South Woolsey	840	Land Use Data
Three Springs	251	2005 Urban Water Management Plan
Twin Lakes	2,199	From LVMWD Report 2297.00, but using new MDD peaking factor. Includes Deerlake Ranch.
Upper Oaks	231	Calculated from 2007 LVMWD SCADA information
Upper Twin Lakes	112	2005 Urban Water Management Plan
Warner Tanks	1,700	1999 Master Plan, but with new MDD peaking factor
Woolsey	320	1999 Master Plan

5.2.3 Demand Factors

Las Virgenes Municipal Water District serves potable water to many different types of customers, including golf courses, parks, schools, large estate-style homes, smaller single-family homes, condominiums, apartments, business parks, and others. It is not a simple matter to determine the distribution of potable water demand over the District's service area. Demand factors (factors used to estimate the demand for potable water, in gallons per minute (gpm) on an acreage basis) were developed by analyzing billing records, meter route maps, land use maps, and other planning documents. The demand factors were developed for the prior master plan and are retained here for use in planning future development.

Table 5-5 shows the results of this analysis, presenting demand factors that may be used for estimating potable water demand for future development in the District.

Table 5-5
Las Virgenes Municipal Water District
Potable Water Master Plan
Demand Factors by Land Use for Future System

City/ Area	Type of Land Use	Demographics		Demand Factors for Future ADD	
		Density (units/acre)	Persons per Unit	Average Day Demand per Person (gpd/person)	Average Day Demand (gpd/unit)[2]
Agoura Hills	High Density Residential	>15	2.80	190	532
	Medium Density Residential	6 - 10	2.80	190	532
	Single Family Residential	2 - 6	2.80	190	532
	Low Density Residential	1 - 2	2.80	325	910
	Very Low Residential	0.2 - 1	2.80	325	910
	Rural Residential	0.05 - 0.2	2.80	325	910
	Commercial/Business Park	–	–	–	870 gpd/acre
	Park/Recreation	–	–	–	50 gpd/acre
	Public Facility	–	–	–	275 gpd/acre
Calabasas	Single Family Residential	2 - 6	2.50	250	625
	Single Family–Large Estate	1 - 3	2.50	325	813
	Multiple Family Residential	2 - 16	2.50	200	500
	Mobile Home	2 - 8	2.50	150	375
	Rural Residential	1	2.50	300	750
	Rural Community	1 - 2	2.50	200	500
	Hillside – Mountainous	0.10	2.50	300	750
	Commercial/Business Park	–	–	–	2000 gpd/acre
	Public Facilities – Institutional	–	–	–	450 gpd/acre
	Public Facilities – Recreational	–	–	–	40 gpd/acre
	Open Space – Recreational	–	–	–	40 gpd/acre
	Open Space – Resource Protection	1du/160ac	2.50	300	750

Table 5-5
Las Virgenes Municipal Water District
Potable Water Master Plan
Demand Factors by Land Use for Future System

City/ Area	Type of Land Use	Demographics		Demand Factors for Future ADD	
		Density (units/acre)	Persons per Unit	Average Day Demand per Person (gpd/person)	Average Day Demand (gpd/unit)[2]
Hidden Hills	Single Family Residential	2	3.50	660	2310
	Residential-Agricultural, suburban	1	3.50	660	2310
	Community Use	–	–	–	900 gpd/acre
	Commercial Restricted	–	–	–	2,000 gpd/acre
L.A. County (North)	Low Density Residential	1 - 6	2.95	100	295
	Low/Medium Density Residential	6 - 12	2.95	100	295
	Medium Density Residential	12 - 22	2.95	100	295
	High Density Residential	>22	2.95	100	295
	Non-Urban/Rural Residential	2	2.95	100	295
	Commercial/Industrial	–	–	–	1275 gpd/acre
	Public and Semi-Public Facilities	–	–	–	1500 gpd/acre
L.A. County–Santa Monica Mountains North (101 Corridor)	Rural Residential	0.5 - 1	2.95	250	738
	Low Density Residential	1 - 2	2.95	250	738
	Low Density Residential–Large Estate	1 - 2	2.95	463	1366
	Medium Density Residential	2 - 4	2.95	250	738
	Intermediate Density	4 - 8	2.95	150	443
	Open Space	–	–	–	–
	Mountain Lands 20	1du/20ac	2.95	250	738
	Mountain Lands 10	1du/10ac	2.95	250	738
	Mountain Lands 5	1du/5ac	2.95	250	738
	Commercial	–	–	–	1275 gpd/acre
	Public and Semi-Public Facilities	–	–	–	–

Table 5-5
Las Virgenes Municipal Water District
Potable Water Master Plan
Demand Factors by Land Use for Future System

City/ Area	Type of Land Use	Demographics		Demand Factors for Future ADD	
		Density (units/acre)	Persons per Unit	Average Day Demand per Person (gpd/person)	Average Day Demand (gpd/unit)[2]
L. A. County–Malibu Local Coastal Area	Mountain Land	1du/20ac	2.95	400	1180
	Rural Residential	1/2 - 1du/10ac	2.95	400	1180
	Low Density Residential	1 - 2	2.95	400	1180
	Single Family Residential	2 - 4	2.95	250	738
	Medium Density Residential	4 - 8	2.95	250	738
	Intermediate Density Residential	8 - 10	2.95	250	738
	High Density Residential	10 - 20	2.95	250	738
	Mountain Land—Seminole & Latigo	1du/20ac	2.95	550	1623
	Rural Residential—Seminole & Latigo	1/2 - 1du/10ac	2.95	550	1623
	Low Density Residential—Seminole & Latigo	1	2.95	550	1623
	Institution and Public Facilities	–	–	–	–
	Commercial	–	–	–	1275 gpd/acre
	Low-intensity Visitor Serving Commercial Recreation	–	–	–	124 gpd/acre
	Recreation-Serving Commercial	–	–	–	–
	Parks	–	–	–	–
Westlake Village	Low Density Residential	0 - 4	2.80	550	1540
	Low Density (Three Springs)	0 - 4	2.80	600	1680
	Medium Density Residential	4 - 7	2.80	220	616
	Intermediate Density Residential	7 - 10	2.80	220	616
	High Density Residential	10 - 18	2.80	220	616
	Very High Density Residential	18 - 25	2.80	220	616
	Mobilehome Residential	(1)	2.80	220	616
	Commercial/Business Park	–	–	–	950 gpd/acre
	Commercial Recreation	–	–	–	35 gpd/acre
	Public/Schools	–	–	–	1300 gpd/acre
	Park	–	–	–	1450 gpd/acre
	Open Space	–	–	–	–
	Cemetery	–	–	–	763 gpd/acre

1. Density of mobile home development in Westlake Village will be compatible with that of existing development.

2. Average Day Demand for residential uses is shown in gallons per day per unit; ADD for other uses is shown in gallons per day per acre.

5.3 Recycled Water Demands

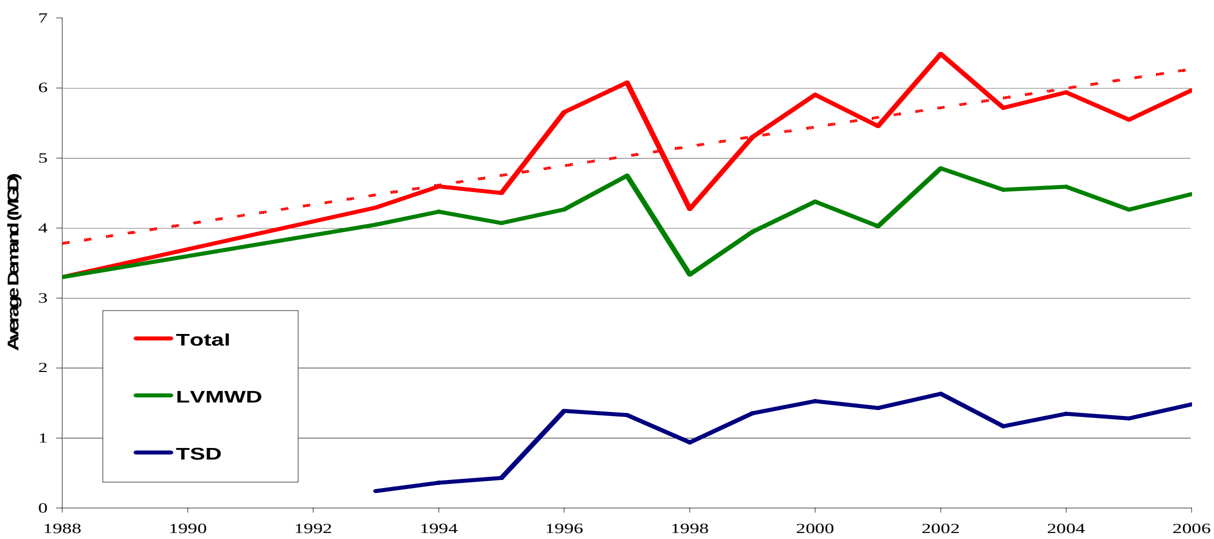
Diminishing growth in demands is expected as few large customers will be added to the system. Most growth will come from in-fill development and conversion of relatively small customers to recycled water.

Recycled water demands vary greatly over the course of a day. Peak demands for recycled water generally occur during the night, with significant reductions in demand during the day. Recycled water demands also vary greatly over the seasons (more so than potable water demands), and are greatly affected by droughts and wet periods.

5.3.1 Historic Recycled Water Demand

Overall records of recycled water sales are shown in **Figure 5-3**, which shows an upward trend in sales since the inception of the system in 1988.

Figure 5-3
Historic Recycled Water Deliveries



5.3.2 Unit Recycled Water Demand Factors

The amount of water applied per acre of landscaping varies, as shown in the figures at the right, which were derived from District billing records.

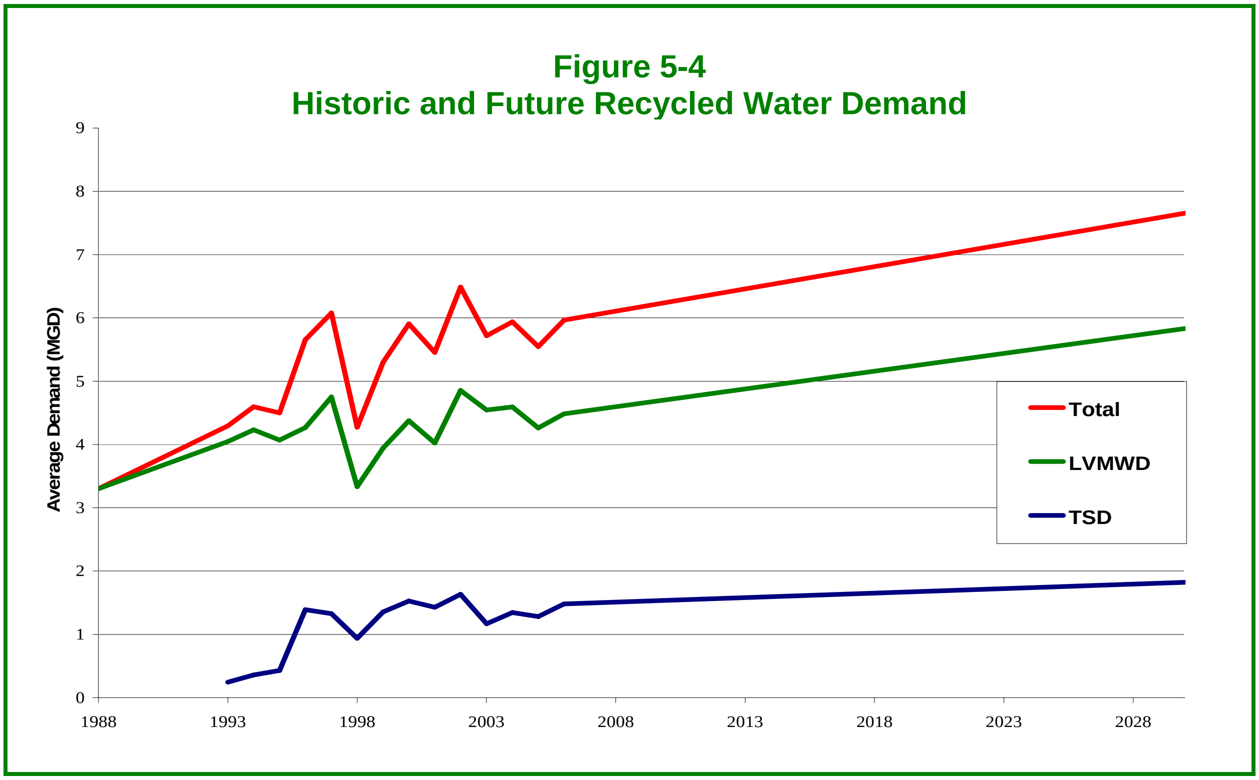
Unit demand factors are used for estimating potential consumption of recycled water used for landscape irrigation. The actual consumption of water varies greatly by type of user. Shown below are the yearly demands calculated for several existing recycled water customers, as determined by an analysis of billing records in the District.

a.	Residential H.O.A.	2.8 acre-feet/year/acre
b.	Commercial/Industrial	5.8 acre-feet/year/acre
c.	Schools	2.7 acre-feet/year/acre
d.	Agriculture (minimum)	3.0 acre-feet/year/acre
e.	Golf Courses	3.5 acre-feet/year/acre

5.3.4 Estimated Future Demand

Future demands are illustrated in **Figure 5-4**. The estimate of future demands is based on the following:

- **Oak Park/North Ranch.** The future TSD demand includes an increase of about 50 acre-ft/year in the Oak Park area.



- **Lake Sherwood:** No increase in demand for Lake Sherwood is anticipated.

*The growth in demand shown in **Figure 5-2** will result if the major projects identified in this plan are constructed, included extensions to Malibu GC, Baxter, and Woodland Hills GC.*

- **In-fill Development within Las Virgenes MWD:** It has been assumed recycled water demands associated with in-fill development will increase in rough proportion to increases in wastewater flow to Tapia WRF.

- **Major Recycled Water Extension Projects:** For the purpose of this master plan analysis, it has been assumed that the following recycled water system extensions will be constructed: (1) Decker Canyon Project (Malibu Golf Course), (2) Thousand Oaks Extension Project (Baxter Pharmaceutical and Westlake High School), (3) Agoura Road Gap, and (4) Woodland Hills Golf Course.

Conversions of large areas of existing residential customers to recycled water (Hidden Hills, Medea Valley, and others) is considered in this Master Plan, but the demands from these areas have not been explicitly included in demand projections. The demands generated by these conversions are assumed to be a part of the in-fill development allocation.

The conversion of large residential areas to recycled water is probably not economical, but extensions of the system should be considered on a case-by-case basis.

Table 5-6 tabulates the existing and buildout demands for various service areas, and shows how these demands compare to those predicted in the previous master plan. This table shows that future demands, even with this aggressive program of extensions, will be 13 percent lower than estimated in 1999.

Table 5-6
Recycled Water Maximum Day Demands (MGD)

	2007 Master Plan	
	Current	Future
Las Virgenes Valley System	1.5	1.5
Lake Sherwood	0.9	0.9
Oak Park/North Ranch	2.9	3.0
Decker Canyon Project	0	0.9
T.O. Blvd. Project	0	1.0
Agoura Road Gap	0	0.1
Other Western System	5.4	6.4
Subtotal – Western Demands	*9.2*	*12.3*
Ahmanson Ranch	0	0
Calabasas City Center	0	0.1
Other Eastern System	2.8	3.4
Woodland Hills GC & Other LA	0	1.0
Subtotal – Eastern Demands	*2.8*	*4.5*
Total RW System Demand	***14.0***	***18.3***

5.4 Peaking Factors

5.4.1 Peaking Factors

The term "peaking factors" refers to the ratio of one flow to another. Most generally, peaking factors are calculated for Maximum Day Demand (MDD) and Peak Hour Demand (PHD). MDD is the highest total daily demand during the year, and Peak Hour Demand is the highest demand during a single hour. When the peaking factor for MDD is discussed, it is simply the ratio of MDD to Average Day Demand (ADD), where ADD is the total annual demand divided by 365 days. The peaking factor for PHD is likewise the ratio of Peak Hour Demand to MDD.

5.4.2 MDD Peaking Factor

Prior Master Plans have calculated and applied a system-wide peaking factor for MDD of 2.1. However, with more refined data available through the District's SCADA system, a more detailed analysis was possible for this Master Plan. The demand patterns of each subsystem are different. Dwelling type, size, lot acreage and location all play a role in the demand for a pressure zone.

In addition to the backbone (1235-ft) system, peaking factors were calculated for six major subsystem. These were: Jed Smith, McCoy, Saddlepeak, Seminole, Twin Lakes and Warner. These system were selected because they are all relatively large systems, and because they are believed to represent the varying topography, customer base, and climatic zones of the District.

Daily production data were obtained from the District's meter readings at the turnouts, pump stations, storage tanks, and pressure reducing stations throughout the system. These data were analyzed for a one-year period, from October 2005 to September 2006.

5.4.3 PHD Peaking Factors

The calculation of PHD is more difficult. It requires that all flows into and out of a system be monitored, calculated, and added together simultaneously. This includes tank levels, pump flows, turnouts, and major PR station flows between zones. Difficulties arise, because the data are often recorded for different time intervals, and tank levels are recorded in 0.1 ft changes, which can often represent large quantities of water.

Table 5-7 shows the MDD and PHD peaking factors used for analysis of each zone in the potable water system.

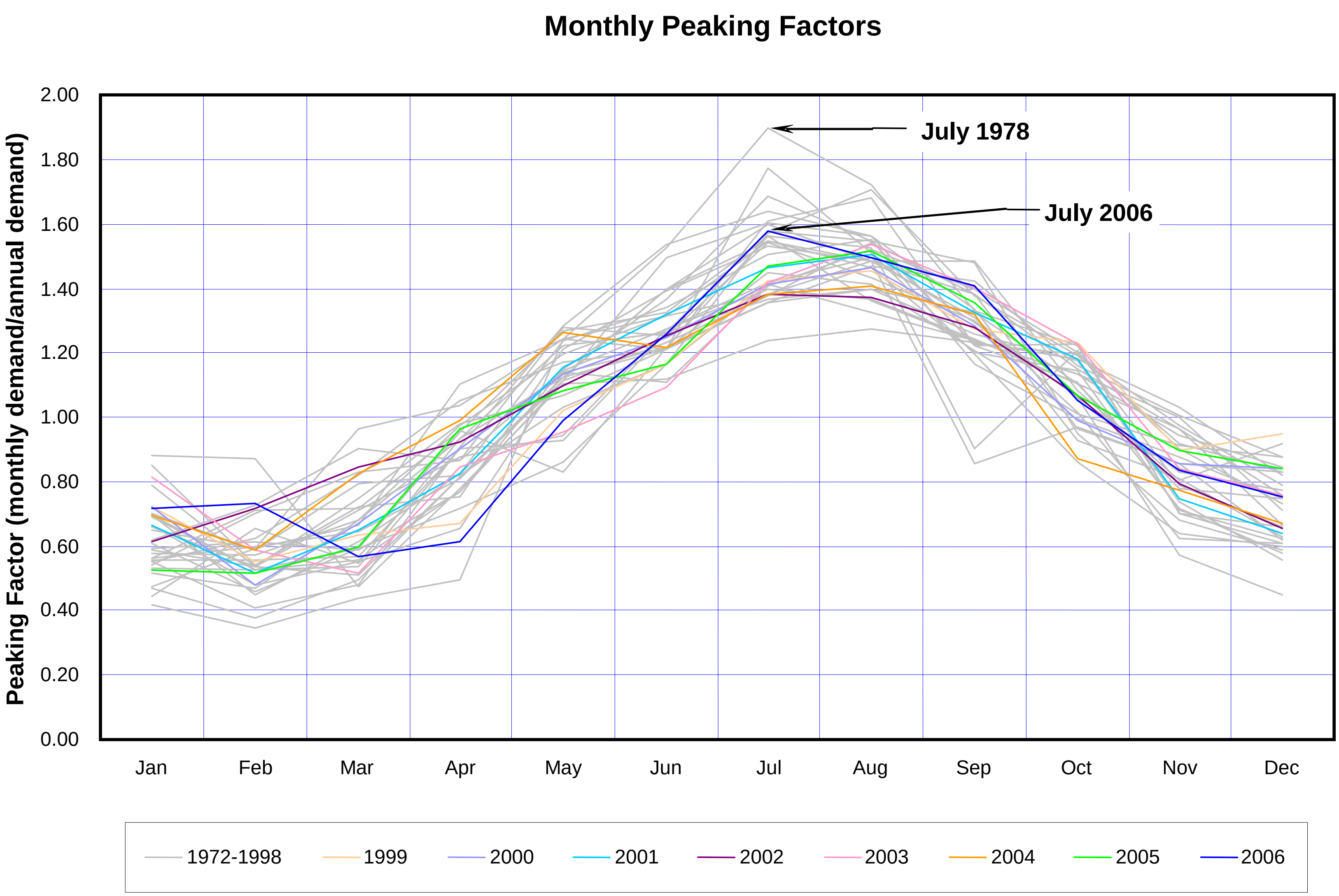
Table 5-7 Updated Peaking Factors				
Subsystem	MDD Peaking Factor	PHD Peaking Factor	Combined	Comments, Sources
1235 Zone	2.1	2.5	5.3	Calculated
Box Canyon	2.3	2.3	5.3	Estimated per Twin Lakes
Dardenne	1.5	3.5	5.3	Estimated per McCoy
Deerlake Ranch	3.2	2.65	8.5	Estimated per Twin Lakes
JBR/Agoura	1.8	3.5	6.3	Estimated per Jed Smith
Jed Smith	1.8	3.5	6.3	Calculated
Kimberly	1.8	3.5	6.3	Estimated per Jed Smith
Latigo	1.4	1.4	2.0	Estimated per Saddlepeak
Lower Oaks	1.5	3.5	5.3	Estimated per McCoy
McCoy	1.5	3.5	5.3	Calculated
Mulwood	1.5	3.5	5.3	Estimated per McCoy
Oakridge	1.5	3.5	5.3	Estimated per McCoy
Ranchview	1.8	3.5	6.3	Estimated per Jed Smith
Saddlepeak	1.4	3.7	5.2	Calculated
Saddletree	1.5	3.5	5.3	Estimated per McCoy
Seminole	3.4	2.15	7.3	Calculated
Three Springs	1.5	3.5	5.3	Estimated per McCoy
Twin Lakes	3.2	2.65	8.5	Calculated
Upper Oaks	1.5	3.5	5.3	Estimated per McCoy
Upper Twin Lakes	3.2	2.65	8.5	Calculated
Warner Tanks	2.4	3.1	7.4	Calculated
Woolsey	3.2	2.65	8.5	Estimated per Twin Lakes

(1) MDD = Maximum Day Demand

(2) PHD = Peak Hour Demand

Figure 5-5 shows monthly peaking factors and how they have varied over the last 35 years. It should be noted that the daily peaking factor (MDD peaking factor) is expected to be about 20 percent higher than the monthly factor.

Figure 5 - 5



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The peaking factors for the recycled water system are shown in **Table 5-8**.

Table 5-8 Recycled System Peaking Factors	
Peak Day Demand (2002)	16 MG
Average Day Demand (2002)	6.5 MG
MDD Peaking Factor	2.5
Peak Hour - Peaking Factor	2.0
Peak Hour/ADD	5.0

5.5 Impact of Recycled Water Use on Potable Water Demands

The demand factors of **Table 5-5** indirectly account for the existing and future use of recycled water. Generally, recycled water has not been applied at single-family homes, so the residential demand factors are mostly not affected by recycled water use. Demands for the larger facilities like schools, golf courses, and parks are calculated and estimated on a case-by-case basis, and their demands are assigned to the potable or recycled water system, as appropriate. Virtually all of these types of customers are presently served with recycled water, with a few notable exceptions like Malibu Golf Course and Alice Stehl School. For smaller recycled water customers, like common area landscaping of homeowner associations and landscaping at commercial properties, the demands in **Table 5-16** reflect the use of recycled water. To a large extent, the recycled water system within Las Virgenes is built-out along the 101 Freeway corridor; and where practical the HOAs and commercial customers are served recycled water. The demands calculated in **Table 5-16** reflect this.

In Section 8 of this report, expected pumping and storage deficiencies in the Seminole Zone are discussed. A partial and interim solution to these deficiencies is a proposed extension of the recycled water system to Malibu Golf Course (also known as the Decker Canyon Project). If and when this project is built, it would significantly reduce the demands on the potable water system, particularly in the Seminole Zone.

Another way that demand for recycled water and potable water are related is in the fact that there is not enough recycled water available to meet the peak demand for recycled water. During times (usually during the summer) when demand exceeds recycled water supply, potable water is added to the recycled water system (supplemental water). This currently happens at three locations in the recycled water system: Cordillera Tank (1200 gpm), Reservoir 2 (about 2100 gpm) and Morrison Pump Station (about 1000 gpm). These quantities have been included in the hydraulic analysis of the potable water distribution system.

Section 6

Water Supplies and Supply Options

This section examines the existing sources of water for both the potable and recycled water systems, how the supplies compare to current and future demands, and how the reliability and quantity of supply may be improved.

6.1 Potable Water System

Potable water for the Las Virgenes Municipal Water District comes from four sources: three "turnouts" from MWDSC and the filter plant/pump station at Las Virgenes Reservoir. There are other, small connections, with Ventura County Water Works District for connections that provide supply at Woolsey Canyon and Upper Box Canyon, but over 99% of the District's water is delivered through the four primary sources. Las Virgenes Reservoir is not a true source of water, as the water stored there essentially comes from the three turnouts.

A fifth supply source is recommended: a connection to Calleguas Municipal Water District. This connection would offset other capital expenditures and provide emergency supply. This connection could particularly assist in the refilling of Las Virgenes reservoir during winter months.

6.1.1 Balance of Potable Water Supply and Demand

Table 6-1 estimates demands for certain years:

Table 6-1
System Wide Potable Water Demand

	Yearly	Average Day	Maximum Day
1999	22,000 AF	13,700 gpm (31 cfs)	29,000 gpm (64 cfs)
2005	25,400 AF	15,750 gpm (35 cfs)	33,100 gpm (74 cfs)
2015	28,800 AF	28,800 gpm (40 cfs)	37,500 gpm (84 cfs)
2030	33,900 AF	33,900 gpm (47 cfs)	44,100 gpm (98 cfs)

The supply from MWDSC turnouts have current supply capacities, as well as capacities that have been planned for future demands. These are shown in **Table 6-2.**

Table 6-2 Available Potable Water Supply		
Turnout	**Current Capacity**	**Planned Capacity**
LV-1	11,000 gpm (24 cfs)	11,000 gpm (24 cfs)
LV-2	20,000 gpm (45 cfs)	34,00 gpm (75 cfs)
LV-3	1,800 gpm (4 cfs)	3,100 gpm (7 cfs)
Total	33,000 gpm (73 cfs)	48,000 gpm (106 cfs)

An upgrade of the LV-3 turnout is currently being designed, to serve growing demands in the northeast portion of the District. The LV-2 capacity is limited by the capacity of the transmission piping. Upgrades are recommended, as outlined in Section 9.

6.1.2 Supply from Las Virgenes Reservoir

The primary purpose for Las Virgenes Reservoir is to provide a backup supply of potable water when there is an interruption of service from MWDSC. The reservoir also provides a source of seasonal supply, helping provide water to the western part of the District during the summer.

In earlier studies, it had been suggested that the filter plant and pump station should have the ability to provide a minimum of 65 percent of ADD. This was based on the minimum demands that occur during the winter, and should approximate consumption for basic community needs without landscape irrigation. However, during recent MWDSC outages in the winter, much higher demands have been experienced. Based on this recent experience, District staff has determined that a better goal for supply from Las Virgenes Reservoir is 75 percent of ADD. This will allow the District to meet customer demands during most wintertime MWDSC outages, as well as meet customer demands following an earthquake or other major emergency, after a public notice to conserve water has been issued.

The current, sustainable flow from Las Virgenes Reservoir is approximately 8,400 gpm (12 mgd). The existing filter plant can be expanded with the addition of two filter beds, as was planned in its original design, achieving a peak (rated) capacity (with one filter out of operation) of approximately 14,000 gpm (20 MGD), with a sustainable flow capacity estimated at 12,000 gpm (17 mgd). As illustrated in **Table 6-3**, a plant expansion is needed now to have sufficient emergency flows following earthquakes and other disasters. The need for this expansion will become greater as the population grows.

Table 6-3
Las Virgenes Filter Plant Demands and Capacities

	Current (2005)	Future (2030)
75% of ADD	9,800 gpm	13,300 gpm
Current Capacity - Peak	11,600 gpm	
Current Capacity- Sustained	8,400 gpm	
Expanded Capacity - Peak	14,000 gpm	
Expanded Capacity - Sustained	12,000 gpm	

Although the expanded plant will fall short of meeting 75 percent of future ADD on a sustained basis, it is hoped that conservation measures would eventually take hold following an earthquake or similar emergency, and demands could be reduced to 65 percent of ADD or less.

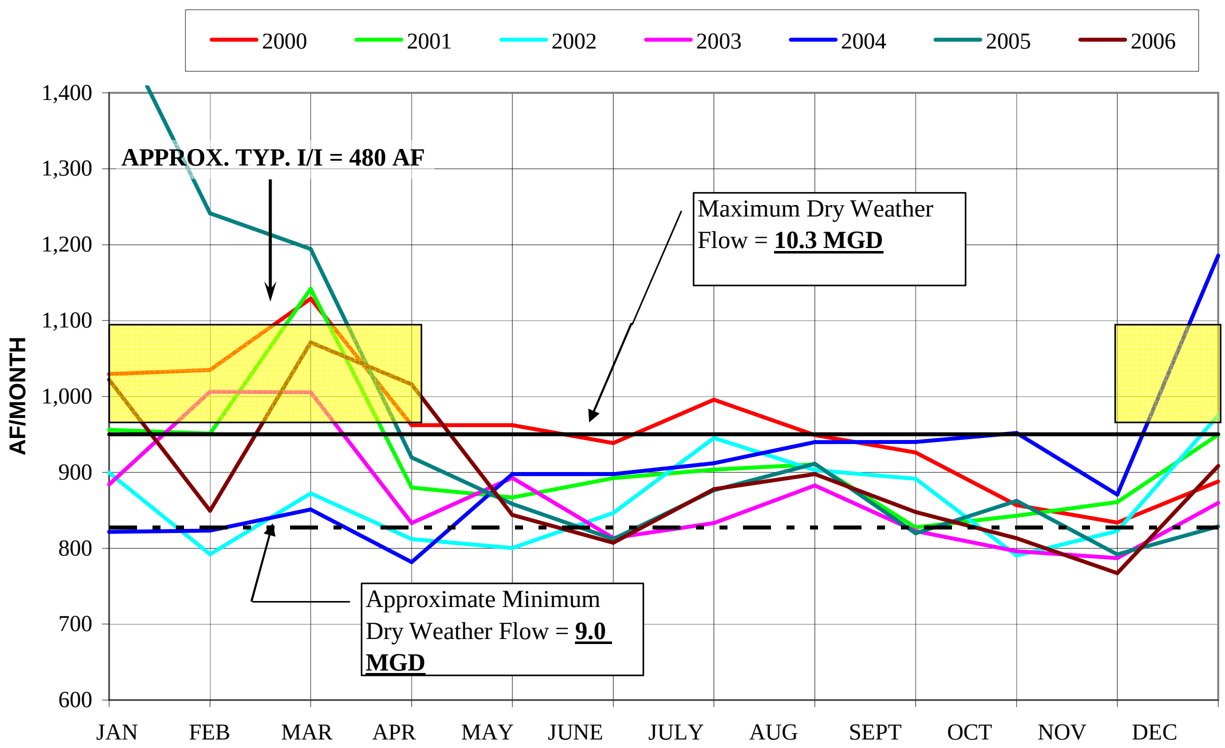
6.2 Recycled Water Supply

The year-round supply of recycled water to the JPA's Recycled Water System is tertiary-treated wastewater produced at the Tapia Water Reclamation Facility. Supplies of groundwater from the Westlake Wells and potable water are also available to supplement the recycled water to meet peak demands. These supplemental sources allow a greater volume of wastewater to be recycled during non-peak periods which results in greater overall usage of recycled water.

6.2.1 Historical Recycled Water Supply

The average daily flows to Tapia WRF are fairly constant, but do show some seasonal variation. Flows are generally highest in the wintertime after rain, due to inflow and infiltration (I/I) into the sewer pipelines. Infiltration is the result of water entering joints or cracks in the sewers from the ground either due to a high water table or due to interflow in the ground (interflow refers to storm water, which enters the ground and flows through the soils). Infiltration tends to increase wastewater flows throughout the winter period with some variation. Inflow is a result of storm water entering manhole lids, illegal storm-water cross connections, or from other surface features. It peaks with rain, but decreases shortly after the rain. **Figure 6-1** shows the monthly variation in Tapia WRF inflow from 2000 to 2006, with January generally being the largest inflow month.

Figure 6-1
Tapia WRF Flows - Composite



6.2.2 Projected Recycled Water Supply

Table 6-4 shows the current and future customer base that is expected to contribute flows to Tapia. The numbers in this table derive from internal studies by TSD and LVMWD and are expressed in terms of equivalent residential units (ERUs). An ERU is a single family house, apartment, or residential condominium unit. Commercial and industrial properties are also measured in terms of ERUs, except that a large commercial property may be many ERUs—how many is typically determined by the number of plumbing fixtures that are served.

Table 6-4
Current and Estimated Future Tapia WRF Customers

	ERUs		
	2000	2007	2030
U1/U2 Improvement Districts	23,300	24,500	29,000
Triunfo Sanitation District	11,500	12,000	12,500
Totals	34,800	36,500	41,500

Source: LVMWD Report No. 2254.00

6.2.2.1 Tapia Flows

Based on the data above, Las Virgenes MWD has concluded that the Tapia WRF need only be sized to accommodate 12 MGD of flow at buildout. The plant was originally designed for 16 MGD, but is undergoing modifications which will result in a reduction in rated capacity.

As shown in **Figure 6-1**, existing dry-weather flows at Tapia WRF are between 9.5 and 10.3 MGD. Much of the year, the wastewater flow could be greater except that Las Virgenes MWD diverts a portion of flows to the City of Los Angeles, when the water is not needed for recycling.

6.2.2.2 Potable Water Supplement and West Lake Wells

Facilities to provide supplemental potable water to the recycled water system were listed earlier in **Table 4-1**. Currently, up to 6.3 MGD

(4400 gpm) of potable supply can be provided. With upgrades that are recommended for the Morrison Supplemental Facility, this total should increase to 7.6 MGD (5300 gpm).

In addition to these potable water supplements, the District also has two wells that are used. When additional water is needed, the wells will discharge to the sewer collection system, and the well water is treated at Tapia, mixed with wastewater flows. By routing the water through Tapia, the high iron and manganese content of the well water is reduced.

6.2.2.3 Total Recycled Water Supply

Table 6-5 shows the projected available supply to the recycled water system for years 2007, 2010, 2020, and 2030. These flows are in terms of the average daily flows during the highest recycled water demand period, which is July and August. It should be noted that the flows in winter (in terms of averages) create excess recycled water when compared to the demand.

Table 6-5
Estimated RW Supply During Maximum Demand

	2007	2010	2020	2030
Equivalent Residential Units (ERUs)	36,500	38,500	40,000	41,500
Tapia WRF Flow (MGD)	9.5	10	11	12
Westlake Wells Supplement (MGD)	1.15	1.15	1.15	1.15
Total Water Available in Recycled Water System w/o Potable Supplement (MGD)	10.6	11	12	13
Available Potable Water Supplement (MGD)	6.3	6.3	7.6	7.6
Total Water Available in Recycled Water System (MGD)	17	17	20	21

6.2.3 Seasonal Recycled Water Demand vs. Supply

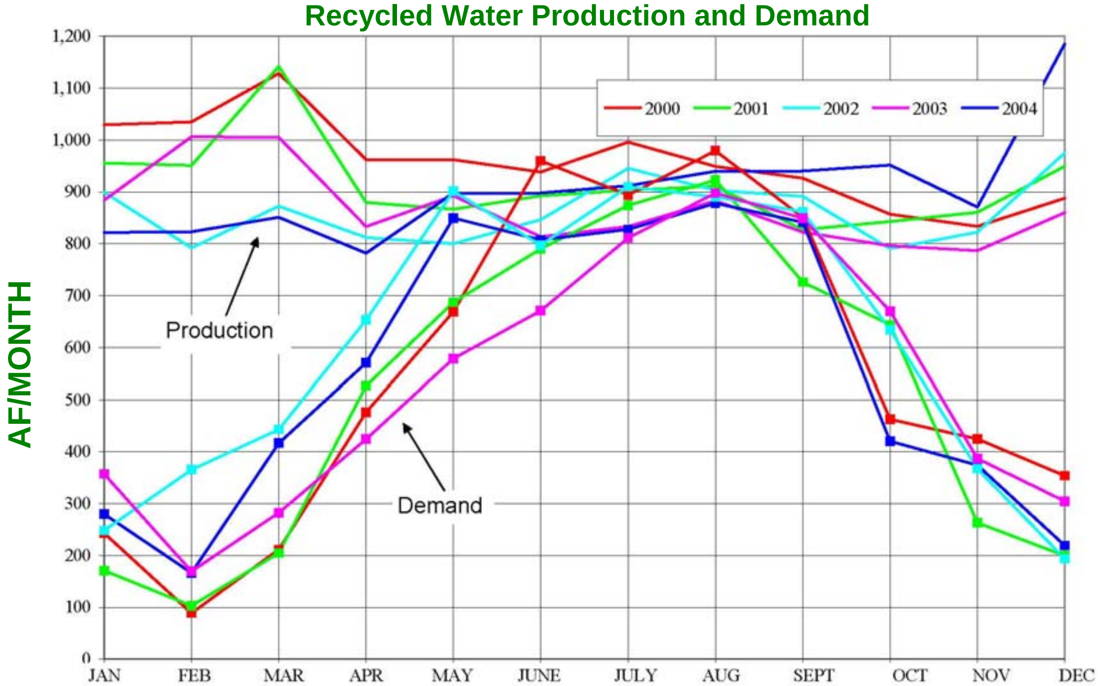
The day-to-day supply of recycled water is relatively constant. When variations do occur, they are primarily due to infiltration and inflow which can sometimes more than double the daily flows at the treatment plant during winter storm events. Conversely, demands for recycled water are highly variable, with peak demands occurring during the summer.

Figure 6-2 shows the historic monthly averages for supply and demand of recycled water from 2000 to 2006. From this figure, the following can be noted:

- Average monthly peak demands only occasionally exceed average monthly supply. This argues against the construction of the seasonal storage reservoir, given the current demands. Such a reservoir might be used infrequently at best.

- Even with the concerted efforts of the District to market recycled water both inside and outside the District, a considerable amount of recycled water goes to waste in the late fall and winter months.

Figure 6-2
Recycled Water Production and Demand



6.2.3.1 Seasonal Storage Option

During the winter months, and particularly so during rainy periods, the Tapia WRF flows are the greatest, but demands are the lowest. On the other hand, during the summer, recycled water demands will frequently exceed the amount of water that is available from Tapia WRF, even with the use of the Westlake wells. Rather than discharge tertiary treated water to Malibu Creek and the Los Angeles River, another option would be to store some or all of the winter surplus for use in the summer.

Several studies have looked at seasonal storage and determined that it is not a practical alternative for the foreseeable future. Among the problems identified with any seasonal storage options are:

- The total amount of supplemental water currently needed to meet recycled water demands is relatively low. Demands would need to increase substantially for any seasonal storage project to be worth considering.
- There are no ground-water basins that can be used for seasonal storage of recycled water within or near the service area. As such, above-ground storage would be needed.
- The volume of seasonal storage that is needed would be larger than can be practically provided with tanks. Therefore an aboveground, dam-impounded reservoir is the only option.
- Extensive environmental studies would be required, and considerable opposition would be expected before a sizable reservoir project in or near the service area would be approved.

Section 7

Evaluation of Existing Systems

7.1 Existing Potable Water System

This section examines capability of the existing facilities to meet the maximum existing demands.

7.1.1 Reservoir/Tank Storage

This Master Plan will use the term "reservoir" and "tank" interchangeably. Section 3 discussed the three components of reservoir storage: operational, emergency and fire flow storages. The exception is Las Virgenes Reservoir, which will always be referred to in full name, providing seasonal and emergency storage for the 1235 foot zone.

Table 7-1 shows the reservoirs/tanks which currently have deficits when the criteria of Section 3 are applied.

Table 7-1
Summary of Current Storage Facilities

Subsystem	Deficit	Comment
Jed Smith	0.73 MG	18-hour deficit, deficit would still exist at 24-hour pumping.
McCoy	0.03 MG	Negligible
Saddle Tree	0.02 MG	Negligible
1235-Zone West	3.86 MG	This deficit is reflected in low water levels in Equestrian Trail and Morrison Tank during peak summer usage.

The deficits in the Jed Smith system and 1235-Zone West are presently overcome by additional pumping during peak hours.

7.1.2 Pumping Stations

Table 7-2 summarizes the analysis of the current pump stations. Pump stations in the 1235 main zone are not included in the table, as they are addressed separately as part of the hydraulic analysis of that zone.

Table 7-2
Summary of Current Reservoir and Pump Station Capacities

System	Reservoir Adequate for: Off-Peak	Reservoir Adequate for: 18-Hour	Pump Station Adequate for: Off-Peak	Pump Station Adequate for: 18-Hour	Comments
Agoura + JBR	n/a	n/a	n/a	n/a	Hydropneumatic, operates 24-hours
Dardenne	no	yes	yes	yes	More storage required for off-peak operation
Jed Smith/Mt. Gate	no	no	no	yes	Upgrade Needed
Kimberly	no	yes	no	yes	200 gpm short for off-peak
Latigo	yes	yes	n/a	n/a	Served by Seminole through PRV
Lower Oaks	yes	yes	yes	yes	No capacity problems
McCoy	no	no	no	yes	Can be fed by PRVs
Mulwood	no	(minor)	no	no	Can be fed by PRVs
Oak Ridge	no	yes	yes	yes	Pumping capacity for off-peak, not enough storage
Ranchview	yes	yes	yes	yes	No capacity problems
Saddle Peak/Stunt Road	yes	yes	no	yes	Storage for off-peak, not pumping
Saddle Tree	no	no (minor)	yes	yes	
Seminole	yes	yes	no	yes	Needs more pumping
Three Springs	n/a	n/a	no	no	Supplied by PRV
Twin Lakes	no	yes	no	no	Needs more pumping
Upper Oaks	no	yes	no	yes	OK for 18-hour, if two pumps operate
Upper Twin Lakes	yes	yes	yes	yes	No capacity problems
Warner	no	yes	no	no	Pump output low due to poor suction
Woolsey	no	yes	n/a	n/a	Supplied by PRV

Table 7-2 shows the pump stations together with the reservoirs because the operations between pump station and reservoirs are highly integrated:

- Deficiencies in reservoir storage can be overcome by improving pump station capacity to directly feed customer supply during peak demands.
- Deficiencies in pump capacity can be overcome by increasing pumping hours. However, 24-hour pumping is not recommended (1235 main zone excluded).
- Off-peak pumping is a viable option only if both the tank/reservoir and pumping station are sized and operated appropriately.

It should be noted that the determination of pump station capacities is less accurate than that of reservoir/tank storage capacities. Reservoirs are defined simply by geometry, where pump capacity is dependant on many factors:

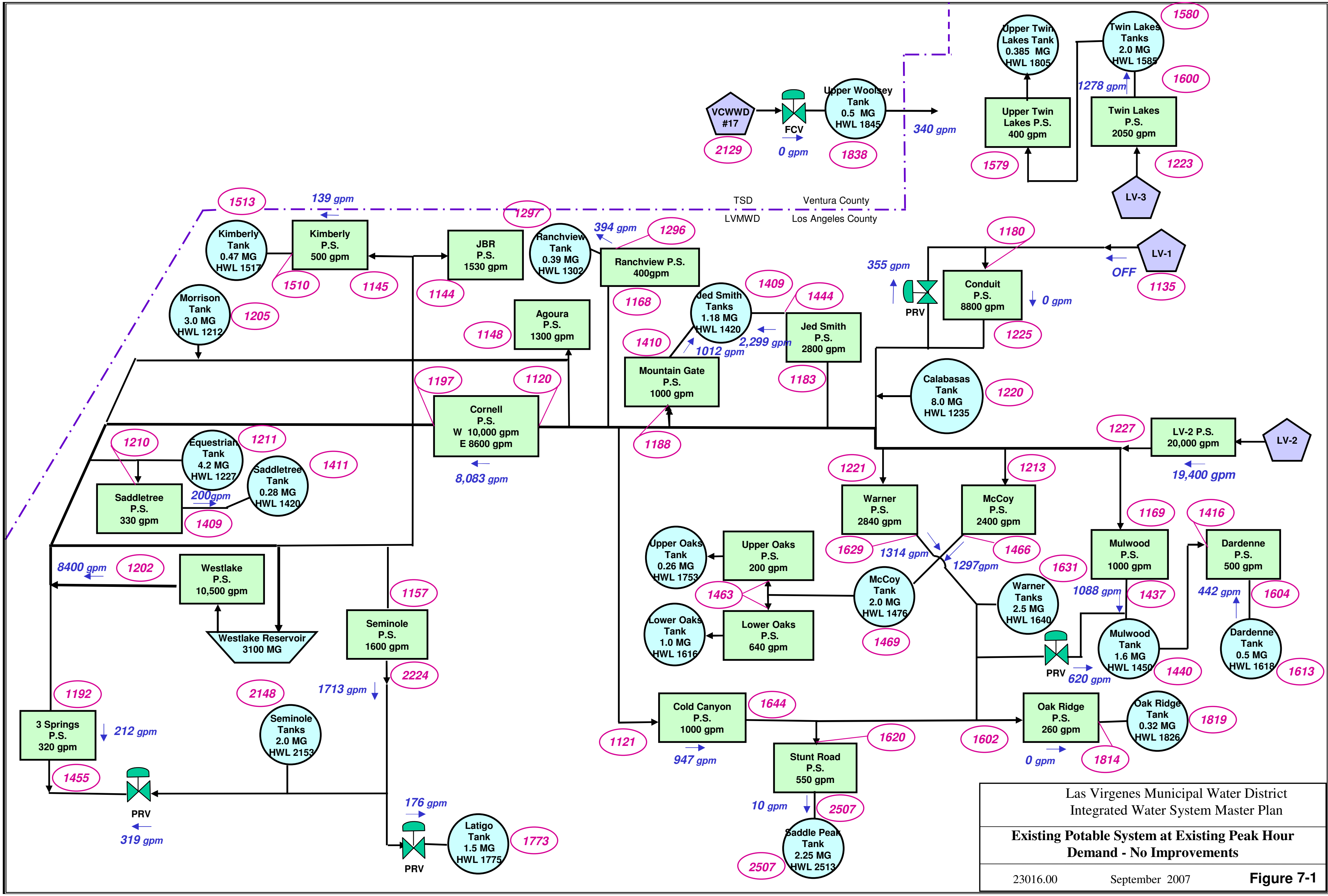
- Pump outputs are functions of pressure and flow rate. As pump pressures increase, flow rates decrease. Flow rates are also dependant on reservoir tank levels.
- The age of the pump highly affects pump output and efficiency, as does the age of the motor.
- Changes to the pump (impeller) may have altered the pump characteristics.
- Flow rate measurements are inherently less accurate than reservoir capacity requirements.

7.1.3 Hydraulic Analysis - Existing Potable System with Peak Hour Demands

Figure 7-1 provides a schematic of the potable water system with existing peak hour flows through the existing potable water system; no improvements are incorporated into this analysis. The results are based on 19,400 gpm (43 cfs) supplied at LV-2, 8,400 gpm (19 cfs) supplied by Westlake Reservoir, and no supply was modeled from LV-1 turnout.

At peak hour flows, the suction and discharge gradients at Cornell Pumping Station are well below the design parameters of 1165 feet on the suction side and 1210 feet on the discharge side, but significantly higher than they were in 1999 before improvements to the transmission system were constructed. The model calculates a suction gradient of 1120 feet and a discharge gradient of 1197 feet. While the pipeline between LV-2 and Calabasas Tank, and between Calabasas Tank and Cornel Pump Station, is sizable (24- to 42-inch, with most of the length being 30-inch), it is a long reach—over 35,000 feet, or six miles. Even a small amount of headloss every thousand feet of pipe results in a very significant change in gradient between Calabasas Tank and Cornell Pump Station.

As the population of the District grows and demands increase, earlier problems with pressures and flows in the transmission system are expected in return. Since the improvements were constructed in 2002, demands have increased about 15 percent, with another 15 to 20 percent increase expected. Much of this increase will occur in the Seminole/Latigo Zone and other areas in the western part of the District.



Las Virgenes Municipal Water District
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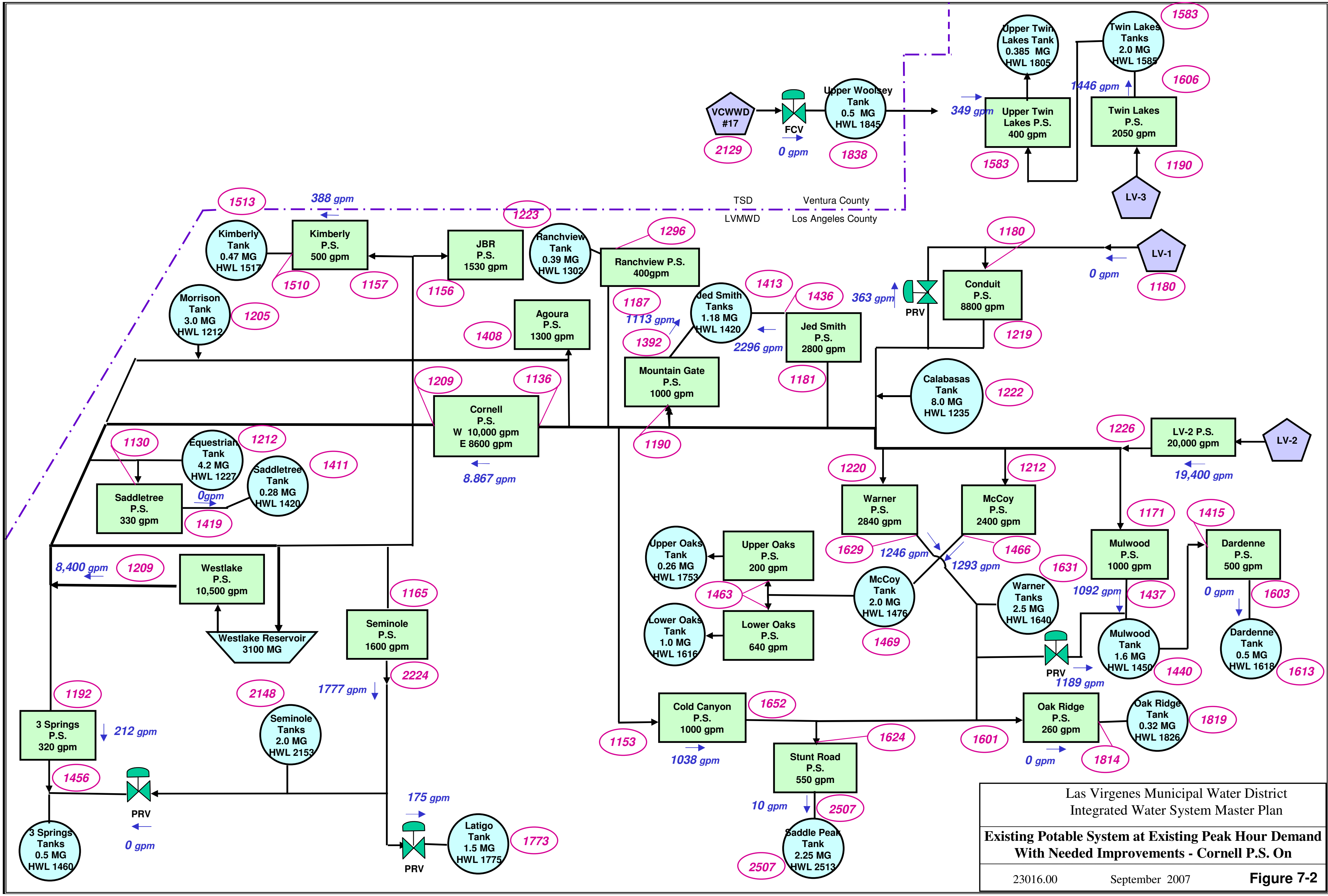
Existing Potable System at Existing Peak Hour Demand - No Improvements

23016.00 September 2007 **Figure 7-1**

Figure 7-2 shows the results of our analysis with a portion of the improvements that are recommended for future build out. If constructed sooner rather than later, these pipelines will further improve east-to-west transmission of water, and raise the gradients at Cornell. Also, a facility to provide potable water supplement to the recycled water system has been constructed at Morrison Tank. This facility is designed to provide up to 2,000 gpm of supplement, but the current transmission pipelines are not adequate to fully use this facility. The full use of this facility will be needed if major extensions to the western recycled water system are constructed, particularly if both the Decker Canyon Project and the Thousand Oaks Boulevard Extension Project are constructed.

The improvements modeled in **Figure 7-2** include a 24-inch pipeline from Mureau Road to Las Virgenes Road and a pipeline from Cornell Pump Station, running westward and northward, toward Morrison Tank, terminating at Thousand Oaks Boulevard. The size of this latter pipeline varies from 12-inches to 18-inches.



Las Virgenes Municipal Water District
Integrated Water System Master Plan

Existing Potable System at Existing Peak Hour Demand With Needed Improvements - Cornell P.S. On

23016.00 September 2007 **Figure 7-2**

7.1.4 Fire Flow Analysis

The hydraulic model was used to determine which general areas receive fire flows significantly below what may be the current minimum standards.

This analysis was performed to provide general information for District Board, staff, and customers. It was not performed to identify capital improvements. As indicated earlier, water districts and other water utilities are not obligated to upgrade portions of their systems that do not meet current fire flow requirements. Typically, such systems complied with the standards that existed at the time they were constructed, and updating the system to increasingly higher standards would be economically unfeasible. It is purely a policy choice of the District, if any upgrades will be performed.

The results of the modeling for the fire flow analysis are displayed on **Figures 7-3 through 7-9**, of the Potable Water Master Plan.

7.2 Existing Recycle Water System

7.2.1 Hydraulic Analysis – Existing Recycled Water System with Peak Hour Demand

For the majority of the existing pipes in the system, there were minimal problems during Maximum Day Demands. There were some locations where velocities were above 5 fps, the maximum for new pipes, but the only location with high velocity is the Tapia WRF discharge pipeline (the only time 10 fps is exceeded is when the pump station is operated at maximum). Likewise, this is the only location where the maximum headloss is exceeded.

In general, system pressures under existing Maximum Day and Peak Hour Demands appear to be acceptable throughout the existing recycled water systems. However, each system has some localized areas that experience low pressures, as listed in **Table 7-4**.

Table 7-4 Areas with Low Pressures during Existing MDD (Existing System)	
Las Virgenes	North of Mulholland Highway (29 psi)
Valley System	Composting Facility at Las Virgenes Road (24 psi)
Eastern System	Vicinity of Reservoir 3
	Vicinity of Cordillera Tank
Western System	Vicinity of Indian Hills Tank
	South end of Redcoat Lane in Westlake Village (30 psi)

Although the computer model confirms low pressures in areas where sporadic problems have occurred, serious deficiencies do not exist.

Recycled water customers can frequently design their irrigation systems to operate with low pressures, using on-site pumps.

The criterion of 43 psi, (which is used in the potable water system) is somewhat arbitrary when applied to customer service connection in a recycled water system.

The low pressures along Las Virgenes Road and north of Mulholland Highway in the Las Virgenes Valley System reportedly present sporadic problems for customers, including the District's composting facility and Malibu Valley Farms. The model calculated low pressures of 26 psi and an average of 29 psi at the composting facility under existing peak hour conditions.

In the case of low pressures near reservoirs and tanks, these low pressures are to be expected due to the high ground elevations relative to the water level in the tanks. There are no customers in these areas, so the low pressures are inconsequential. It must also be recognized that irrigation systems frequently receive water at very low pressures and use on-site pumps that are designed as part of the on-site system. The 43-psi criterion is a standard taken from the potable water system, and may be somewhat arbitrary when applied here. The more pertinent criterion is whether a customer system can be feasibly designed or adapted to operate on the pressure that is available. This question is one that has to be addressed on a case-by-case basis, with cost being a major consideration.

7.2.1.1 Maximum Day Demand

The existing recycled water system with Maximum Day Demand is shown schematically on **Figure 7-3**. This schematic summarizes total supply and demand over a 24-hour period, and shows recycled water flows at key locations. It also shows the rate of potable water supplement that is being added to the system and the rate of water flowing into or out of the tanks and reservoirs.

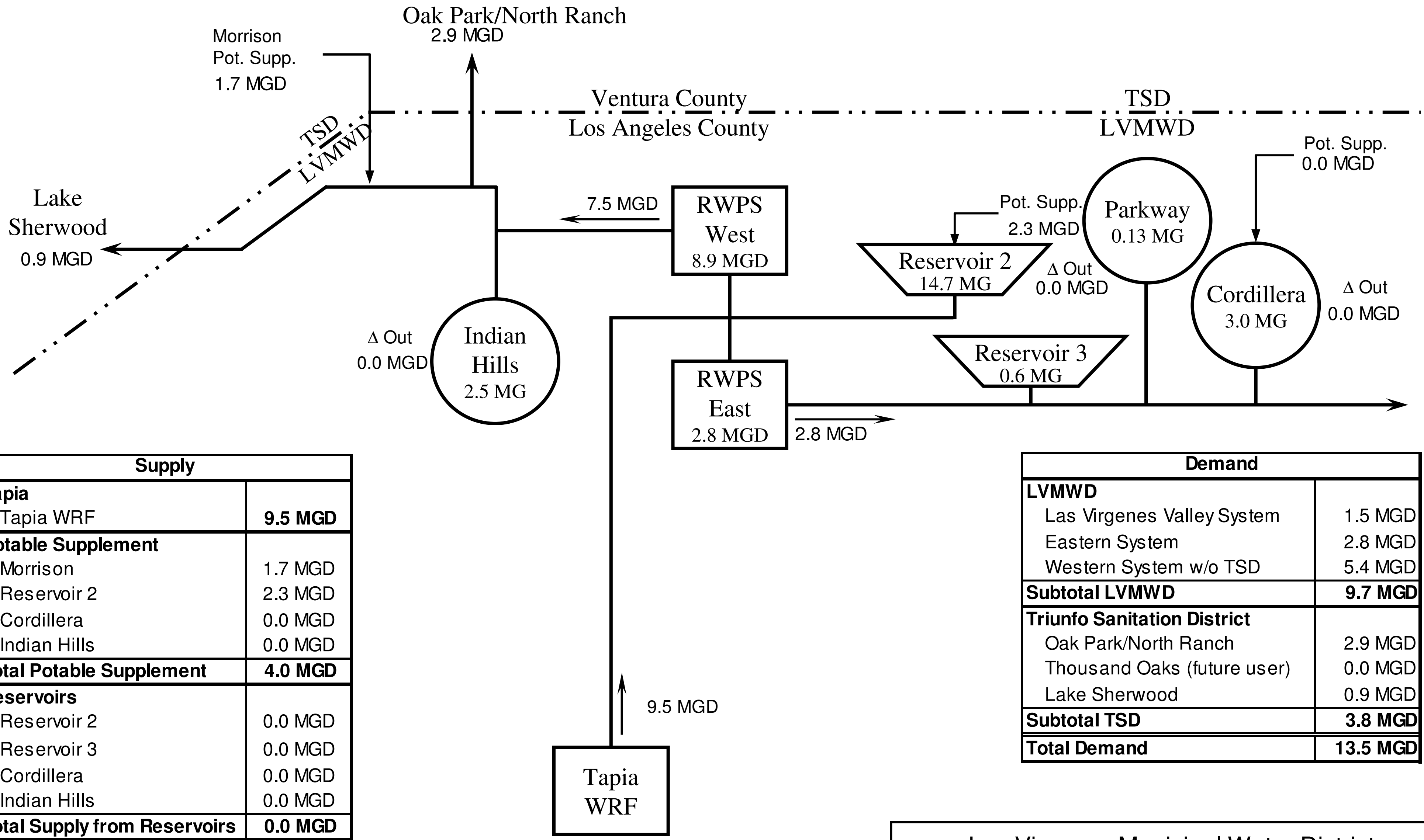
7.2.2 Storage Refill and Pumping Capacity – Recycled Water System

In the recycled water system, achieving a balance between supply and demand is a constant challenge. A certain amount of recycled water is produced each day, and seldom does it match the demands.

When demands exceed supply, the difference can be made up in three ways: (1) taking water from storage, (2) supplementing Tapia using the Westlake Wells, or (3) supplementing the system at various locations with potable water.

When determining how and where to bridge the gap between supply and demand, a prime consideration is location. The location of supplemental water needs to be such that the water can reach areas where it is needed, but there are other factors to be considered, such as energy consumption and impact on the potable water system.

Table 7-5 compares the recycled water supply and demand both system wide and in each of the major zones (western and eastern).



Supply	
Tapia	
Tapia WRF	**9.5 MGD**
Potable Supplement	
Morrison	1.7 MGD
Reservoir 2	2.3 MGD
Cordillera	0.0 MGD
Indian Hills	0.0 MGD
Total Potable Supplement	**4.0 MGD**
Reservoirs	
Reservoir 2	0.0 MGD
Reservoir 3	0.0 MGD
Cordillera	0.0 MGD
Indian Hills	0.0 MGD
Total Supply from Reservoirs	**0.0 MGD**
Total Supply	**13.5 MGD**

Demand	
LVMWD	
Las Virgenes Valley System	1.5 MGD
Eastern System	2.8 MGD
Western System w/o TSD	5.4 MGD
Subtotal LVMWD	**9.7 MGD**
Triunfo Sanitation District	
Oak Park/North Ranch	2.9 MGD
Thousand Oaks (future user)	0.0 MGD
Lake Sherwood	0.9 MGD
Subtotal TSD	**3.8 MGD**
Total Demand	**13.5 MGD**

Las Virgenes Municipal Water District
Integrated Water System Master Plan

Existing Recycled System at Existing MDD with Potable Supplement

23016.00 August 2007 **Figure 7-3**

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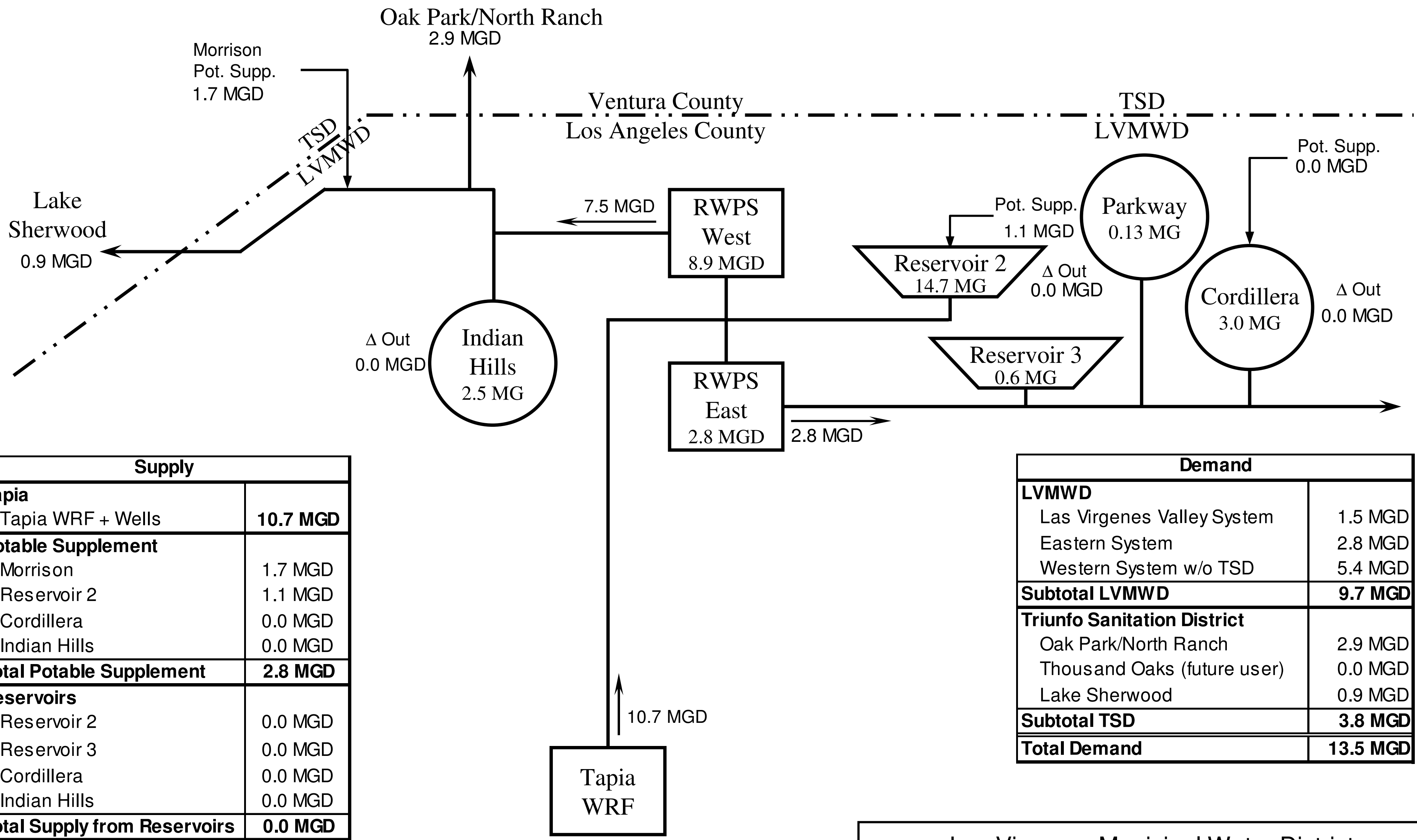


Supply	
Tapia	
Tapia WRF + Wells	**10.7 MGD**
Potable Supplement	
Morrison	1.7 MGD
Reservoir 2	1.1 MGD
Cordillera	0.0 MGD
Indian Hills	0.0 MGD
Total Potable Supplement	**2.8 MGD**
Reservoirs	
Reservoir 2	0.0 MGD
Reservoir 3	0.0 MGD
Cordillera	0.0 MGD
Indian Hills	0.0 MGD
Total Supply from Reservoirs	**0.0 MGD**
Total Supply	**13.5 MGD**

Demand	
LVMWD	
Las Virgenes Valley System	1.5 MGD
Eastern System	2.8 MGD
Western System w/o TSD	5.4 MGD
Subtotal LVMWD	**9.7 MGD**
Triunfo Sanitation District	
Oak Park/North Ranch	2.9 MGD
Thousand Oaks (future user)	0.0 MGD
Lake Sherwood	0.9 MGD
Subtotal TSD	**3.8 MGD**
Total Demand	**13.5 MGD**

Las Virgenes Municipal Water District
Integrated Water System Master Plan

Existing Recycled System at Existing MDD with Potable Supplement + Wells

23016.00 August 2007 **Figure 7-4**

BOYLE

Table 7- 5
Recycled Water Supplies and Facility Capacities (MGD)

	1999	2007
Recycled Water Supply Available		
Tapia WRF w/o wells	8.8	9.5
Reservoir 2 Supplement	4.5	4.5
Westlake Wells	1.2	1.2
Cordillera Supplement	0.1	1.7
Morrison Supplement	0	0.2
Total Supply	14	17
Subsystem Capacities		
RWPS West	8.9	8.9
Morrison Supplement	0	1.6
Total Western System Capacity	8.9	10.5
RWPS East	2.8	2.8
Cordillera Supplement	0.7	1.7
Total Eastern System Capacity	3.5	4.5
Recycled Water Demands (MDD)		
Subtotal Las Virgenes Valley System	1.5	1.5
Lake Sherwood	0.9	0.9
Oak Park/North Ranch	2.9	2.9
Decker Canyon Project	0	0
T.O. Blvd Project	0	0
Agoura Road Gap	0	0
Other Western System	5.3	5.4
Subtotal - Western Demands	9.1	9.2
Ahmanson Ranch	0	0
Calabasas City Center	0	0
Other Eastern System	2.6	2.8
Woodland Hills GC & Other LA	0	0
Subtotal - Eastern Demands	2.6	2.8
Total RW System Demand	***13***	***14***

* Air gap supplement has reduced capacity. Original design was for 1,000 gpm, only 400 gpm is available currently.

The capacity of the RWPS East and West are 2.8 MGD and 8.9 MGD respectively, with all available pumps in operation for a total of 11.7 MGD. **Figure 7-3** shows that currently, RWPS East must run continuously at full capacity, and RWPS West must run at 75 percent capacity; however this is based on no potable water supplement at Cordillera Tank. If the Cordillera supplement is used, pump station operations can be scaled back to approximately 60 percent of capacity. Similarly, without the potable water supplement at Morrison Air Gap/PS, there would be significant pumping deficiency in the western system.

The RWPS East is currently undergoing a large-scale expansion project. This project includes pipeline upgrades and installation of larger pumps. The construction will soon boost the capacity of RWPS East from 2.8 MGD to 6.5 MGD (1,950 gpm to 4,500 gpm). However, the full-capacity of eastern and western pump stations may not be used concurrently, due to limitations in the common suction piping.

7.2.3 Potable Water Supplement Supply

Potable water can be added to the recycled water system at various locations. Without these supplements, tanks in the recycled system would not be able to refill during Maximum Day Demand events.

From purely a cost standpoint, the following is the order of preference for the supplements that are used:

1. **Reservoir storage**. If the period when demands exceed supply is expected to be very short, water should be drawn from Reservoir 2 and the other District reservoirs. This avoids the need to purchase, pump, or treat additional water, and may also reduce the amount of water that must be disposed of later.

2. **Westlake Wells**. The current marginal cost to pump water from the Westlake Wells and treat it through the Tapia WRF is on the order of $300/AF, which is considerably less than the cost of purchasing supplemental potable from Metropolitan Water District, at a Tier 2 rate of $524/AF.

3. **Morrison Air Gap/Pump Station**. If potable supplement is necessary, it is most economical to add it through the Morrison

facility. When water is added via the Morrison facility, little energy is lost as it flows from the Morrison Tank (HWL 1,212 feet) to the Air Gap Facility (HWL 1,189 feet). To deliver the water from this sump into the Western Subsystem (HWL 1,225 feet) generally requires some pumping, but not always. When demands are particularly high, the gradient in the western end of the system will occasionally drop below the level of the Air Gap Facility, and water will flow by gravity.

4. **Cordillera Tank**. Potable water delivered to Cordillera Tank (HWL 1,529 feet) is taken from the Warner Subsystem (HWL 1,640). Thus approximately 100 feet of head is lost, when this facility is employed.

5. **Reservoir 2**. Potable water delivered to Reservoir 2 (HWL 795 feet) is taken from the Backbone System (HWL 1,235 feet). Thus approximately 400 feet of head is lost, when this facility is employed.

There are frequently operational reasons to use supplemental water in a different order than shown above. For instance, adding water to Reservoir 2 enables it to be pumped into both the Eastern and Western Subsystems, depending on where it is needed most. Also, the use of Cordillera relieves demands on RWPS-East, which might otherwise have to operate continuously.

Section 8

Evaluation of Future Systems

8.1 Future Potable Water

This section looks at how the systems might be modified to meet future demands.

8.1.1 235-foot Zone and Las Virgenes Reservoir

The analysis on the 1235-foot zone indicates shortages in storage that will grow from a current deficit of 3.7 MG to nearly 5 MG by buildout. This shortage is nearly all in the western portion of the zone and is reflected in the water levels in Equestrian Trail and Morrison Tanks dipping into the emergency reserve and sometimes the fire storage level during peak hours.

Las Virgenes Reservoir is a large source of seasonal storage. The current average flow from this reservoir is approximately 8000 gpm. This flow rate is limited by the capacity of the filtration plant. As discussed in Section 9, an expansion of the filter plant is recommended in order to provide adequate flow capacity following earthquakes and other unplanned interruptions in supply for MWDSC. The future capacity of the plant will be approximately 12,000 gpm (17 MGD).

By increasing the output of the plant, the amount of east-west transmission improvements required to supply MDD at buildout can be reduced. This increase in flow from the Reservoir Filter Plant during MDD conditions will require up to 4,800 acre-feet of refill to occur over the course of 6 months, when the average demands on the system are approximately 0.8 ADD.

Because the filtration output cannot be increased and decreased rapidly in response to diurnal variations in demands, there are advantages to constructing a storage tank at the reservoir in which finished water can be stored and used. There are also hydraulic advantages of providing this gradient support in the western portion of the District.

Unlike other tanks, pumping would be needed to draw water from this tank. This pumping would be accomplished with the existing finished water pumps at the Reservoir Pump Station. With three pumps operating, there is plenty of capacity to match the demands at peak hour. With two pumps operating, the demands will exceed capacity by about 200 gpm. This means that during build-out peak hour operations, all three pumps will be needed and there may be no standby capacity. It is recommended that the next time the pumps at this facility are replaced or refurbished, a capacity increase be investigated.

8.1.2 Pumping and Storage

Table 8-1 summarizes the analysis of pumping buildout condition.

Conclusions based on **Table 8-1 are**:

- There are reservoirs that do not have enough storage capacity to operate under 18-hour conditions. Of greater concern, there are reservoirs that do not have capacity to operate in 24-hour conditions: Jed Smith, and Seminole.
- There are a couple of reservoirs with a small deficit in storage. It is not economically feasible to provide small amounts of permanent storage to existing zones. These zones could potentially be served from a higher zone by PR station (if the higher zone has surplus storage itself). Also, more of the peak flow can be supplied by pumping if the deficit is particularly small, as maximum day demands seldom occur. It should be noted that the storage deficit calculations are based on population projections that cannot be completely precise, so future facilities should not be planned to make up small deficits unless there is other data to support planning.

Table 8-1
Future Pumping and Storage Requirements and Recommendations

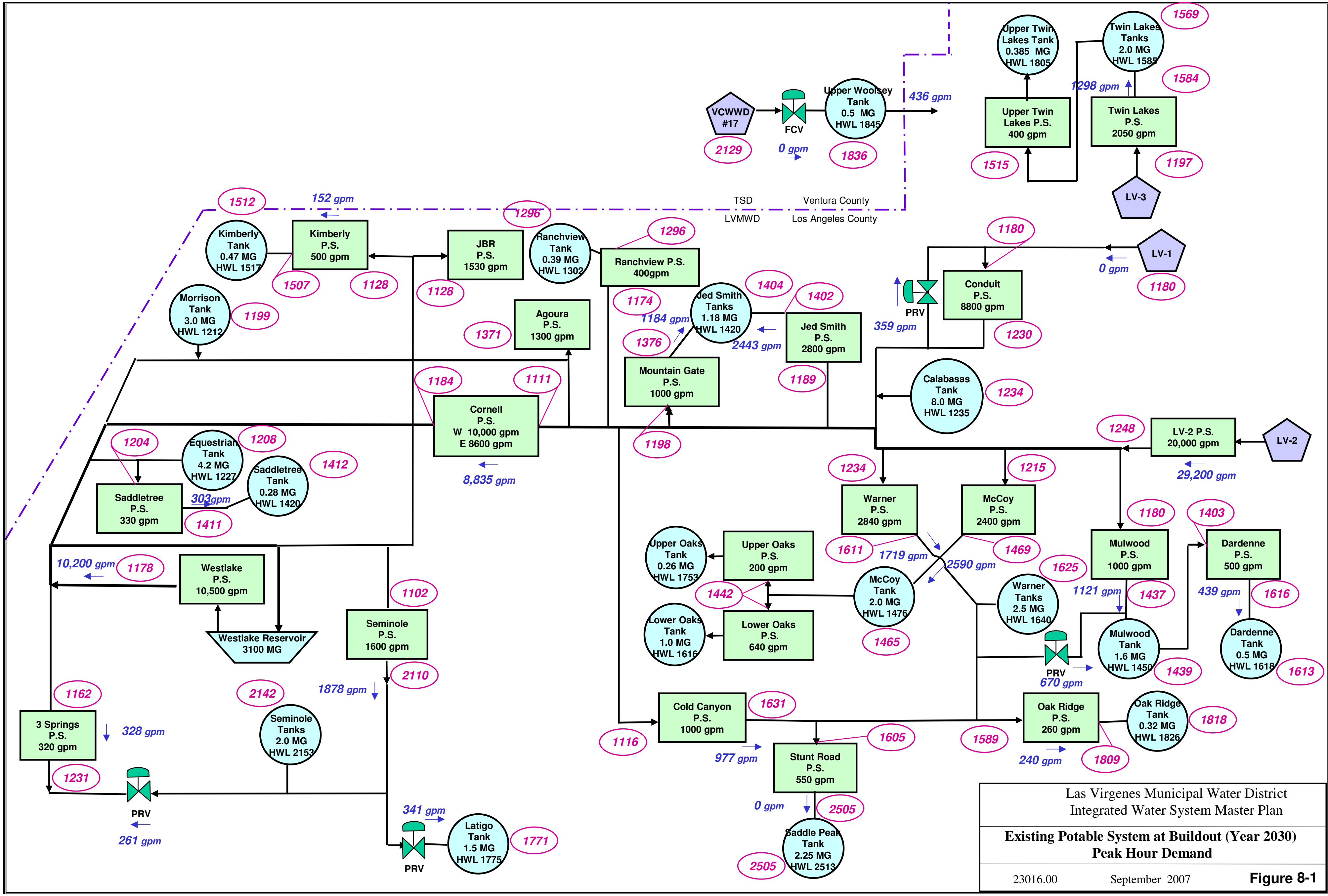
Zone or System	Criteria	Reservoir	Pump Station	Timing
1235-foot	24-Hour	4.6 MG deficiency that could be mitigated by 3 to 5 MG tank at Las Virgenes Reservoir and increase in filter plant capacity	See Section 9 Recommended: Calleguas MWD connection for reservoir refill and expand filtration plant	5 to 10 years. Existing deficit will grow more severe.
Dardenne	Off-peak	No improvements required	No improvements required	
Upper Agoura / JBR (future)	9-hour	New 0.36MG tank	New 1500 gpm pump station	Development driven
Kimberly	18-hour	No improvements required	No improvements required	
Lower Oaks	18-hour	No improvements required	More investigation needed	
McCoy	18-hour	0.14 MG deficit	Future deficit of 30 gpm Recommended: no improvement needed—existing PRVs or longer pumping hours can provide deficit	
Mnt. Gate Jed Smith	18-hour	1.27 MG deficit	Future deficit of 590 gpm. Recommended: Expand Mnt. Gate Pump Station.	2-3 years. No spare pumping unit currently exists at Mtn. Gate PS
Mulwood	18-hour	No improvements required	Deficit of 730 gpm Recommended: Add new duty and spare pumps.	3-5 years. High flows at PRV exist and no spare pumps.
Oak Ridge	18-hour	No improvements required	No improvements required	
Ranchview	Off-peak	No improvements required	No improvements required	
Saddle Tree	18-hour	No improvements required	No improvements required	
Seminole	18-hour	2.0 MG deficit	Future deficit of 4730 gpm	See improvement program, discussed in Section 10.
Stunt Road / Saddle Peak	Off-peak	No improvements required	Can meet off-peak with both pumps in operation	
Three Springs	Off-peak	0.55 MG needed at buildout	Future deficit of 550 gpm	Needed at Phase 3 of Seminole Zone Improvements
Twin Lakes	18-hour	No improvements required	Future deficit of 1340 gpm	Underway
Upper Oaks	Off-peak	No improvements required	No improvements required	
Upper Twin Lakes	Off-peak	No improvements required	No improvements required	
Warner Cold Canyon	18-hour	No improvements required	Future deficit of 440 gpm	2-3 years. To meet growing demands in several zones.
New Zones	Off-peak			Development driven

8.1.3 Hydraulic Evaluation with Buildout Demands

The capability of the existing potable water system to deliver projected buildout demand was evaluated. No improvements, other than pipeline extensions needed to reach potential new areas of demand, were included. **Figure 8-1** presents the results of that analysis. Pressures throughout the system are low. The suction gradient at Cornell Pump Station (which is operating in this scenario) is 1111 feet—54 feet lower than the design minimum gradient of 1165 feet. The discharge gradient at the pump station is 1164 feet—46 feet below the design minimum gradient of 1210 feet. Existing customers cannot be supplied water at the District's minimum pressure criteria of 43 psi with these gradients.

Figure 8-2 presents the results of a scenario with projected buildout demand being delivered by an improved distribution system. The most notable improvements are the additions of 24-inch pipelines parallel to the existing pipelines between the west end of Calabasas Tank and Las Virgenes Road. The scenario also includes previously recommended improvements, including a new 5 MG tank near Las Virgenes Reservoir, additional storage and pumping facilities throughout the subsystems, and a 1235-foot gradient supply to LV-1.

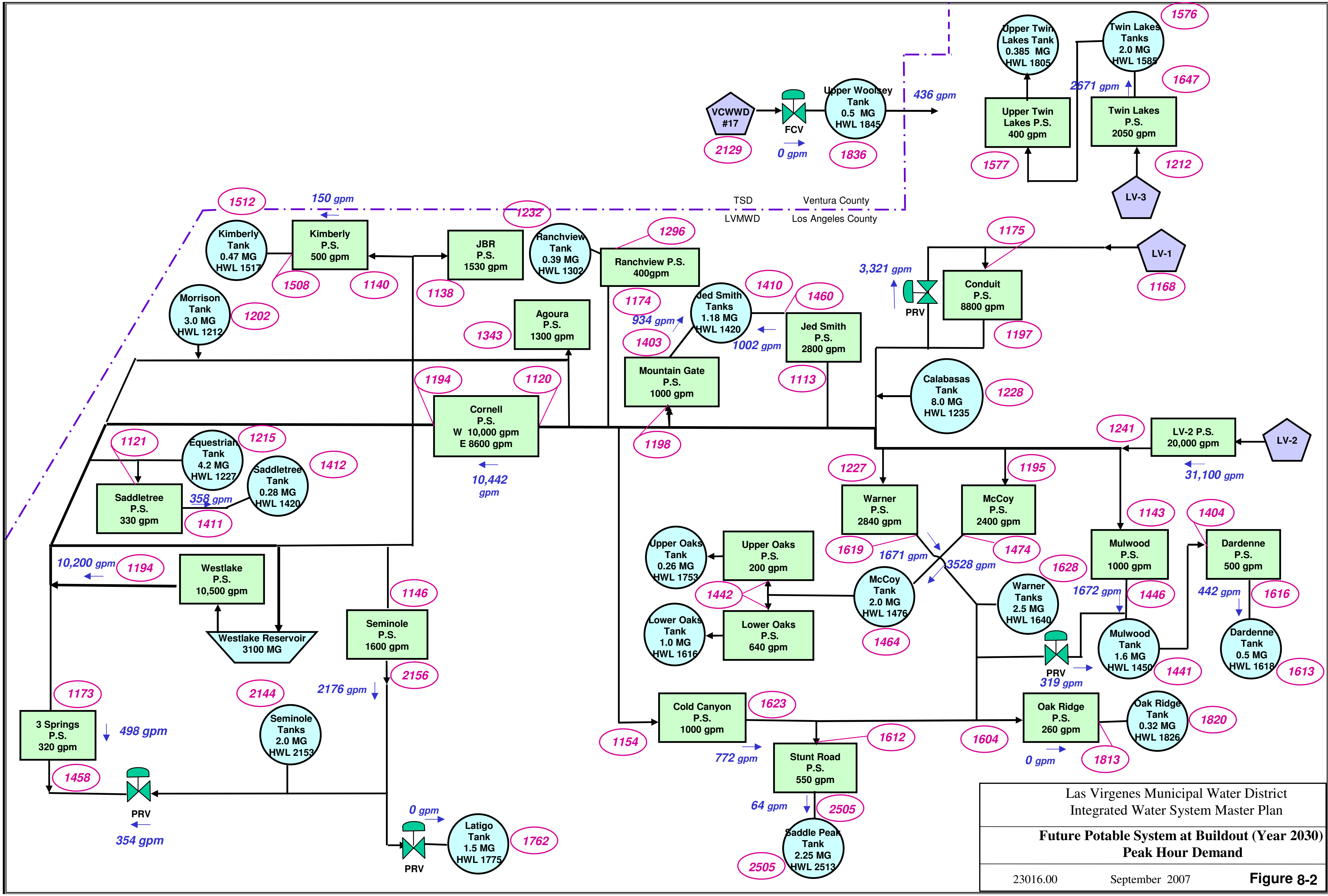
With these improvements, the suction gradient, with Cornell Pump Station pumping, is 1122 feet—still below the recommended gradient of 1165 feet, but well above the levels experienced in 1999. The discharge gradient at the pump station is 1195 feet, which is also less than the recommended minimum of 1210 feet, but again it is considerably better than historic lows.



Las Virgenes Municipal Water District
Integrated Water System Master Plan

Existing Potable System at Buildout (Year 2030)
Peak Hour Demand

23016.00 September 2007 **Figure 8-1**



Las Virgenes Municipal Water District
Integrated Water System Master Plan

Future Potable System at Buildout (Year 2030)
Peak Hour Demand

23016.00 September 2007 **Figure 8-2**

8.1.4 Seminole System (2153-foot Zone)

There is the possibility of considerable additional development resulting in a large increase in demand in the Seminole System. This development, however, is likely to be spread out (with large demands per dwelling unit). The development in the area is also difficult to predict. A detailed analysis of likely demands was performed based on topography, parcel size and adjacent parcel zoning. The possible improvements identified to meet these projected demands in the Seminole system are quite expensive, so careful planning is needed before any new facilities are constructed.

Many of the improvements recommended for the Seminole subsystem should not be constructed until they are warranted by development, but some improvements are necessary within a few years.

A multi-phase improvement program is outlined as Project 10 in Section 10. This program includes the following:

- **Expand Seminole Pump Station**. Add a fourth pump and enable three pumps to run.
- **Construct Decker Canyon Recycled Water Project**. This will relieve considerable demand from the system, and provide various other benefits.
- **Construct 3-Springs Tanks and Expand 3-Springs Pump Station**. Likewise, this removes demand from the system. It also is more energy efficient.
- **Construct a new pump station, tank, and pipeline**. This is a very expensive project, but may ultimately be required if demands in the area continue to grow.

8.1.5 MWD Outage Analysis

With the bulk of the LVMWD potable water supply being delivered directly from MWDSC, there is a need for an alternate supply during times this supply is interrupted. Planned outages for maintenance occur approximately every three to four years. During this time LVMWD must continue to provide its customers with reliable service.

The District is fortunate to have multiple supply options available through interconnections with surrounding agencies and with District storage. Los Angeles Department of Water and Power (LADWP) can provide supply at Kittridge and Germain, however the connection at Germain is not assumed to be permanent as it is connected through a fire hydrant to the Twin Lakes System. Supply is also provided to Box Canyon and Woolsey by Ventura County Water Works District No. 17. The majority of available emergency supply is available from Las Virgenes Reservoir. The available supplies are outlined in **Table 8-2**. This table displays the current capacities as well as the estimated future capacities at buildout. **Table 8-2** also displays the average consumption from the most recent outage and calculated demands for different times of the year.

Table 8-2
MWD Outage Analysis
Las Virgenes Supply vs. Demand

Supply	2007 Actual (avg)		2007 Capacity		2030 Capacity	
Westlake Reservoir	5,640	gpm	8,400	gpm	12,000	gpm(1)
LADWP Connection at Kittridge	6,450	gpm	8,100	gpm	8,100	gpm
LADWP Connection at Germain	530	gpm	1,350	gpm	0	gpm(2)
Other (Box Canyon, Woolsey)	180	gpm	180	gpm	0	gpm
Total	**12,800**	**gpm**	**18,100**	**gpm**	**20,100**	**gpm**

Table 8-2 (Cont.) MWD Outage Analysis Las Virgenes Supply vs. Demand						
Demands	**2007 Actual (avg)**		**2007 Estimated [(3)]**		**2030 Estimated [(3)]**	
Winter Demands	12,800	gpm	9,800	gpm	13,300	gpm
		%	0	%	0	%
Deficit with LADWP Supply	0					
	33	%	12	%	10	%
Deficit without LADWP Supply						
Spring/Fall Demands			13,000	gpm	17,700	gpm
Deficit with LADWP Supply			0	%	0	%
Deficit without LADWP Supply			34	%	32	%
Summer Demands			27,300	gpm	37,200	gpm
Deficit with LADWP Supply			34	%	46	%
Deficit without LADWP Supply			69	%	68	%

Table Notes:
(1) Assumes addition of 2 filters at treatment plant
(2) Ignores small demand from homes on Boulder Ridge Terrace
(3) Winter estimate = 75% of ADD, Spring/Fall Estimate = 100% of ADD; Summer Estimate = 210% of ADD

The most recent MWD outage occurred from January 13 to January 28 of 2007. During this time the turnouts at LV-1, LV-2 and LV-3 were taken off-line and the interties at Germain and Kittridge were activated. In addition to the LADWP supplies, the Westlake Filter Plant was put on-line and operated at a rate between 5 and 12 MGD.

Conclusions based on **Table 8-2**:

- Demands for the winter of 2006-2007 were much higher than 75% of ADD, possibly caused by unusually warm and dry weather with little rainfall.
- For 2007, approximately 50% of the demand was supplied by Las Virgenes Reservoir.
- With the source from LADWP available, there is ample supply to meet demands in winter and spring/fall.
- Summer demands cannot be met without LADWP supply under normal circumstances.

- If no supply is available from LADWP, there will be a deficit under all MWD outage conditions.

8.1.6 Use and Refill of Las Virgenes Reservoir

Las Virgenes Reservoir can provide up to 9,520 acre-feet of seasonal storage. This storage provides a source of emergency potable supply in the event MWD cannot deliver water to the District. The storage also helps maintain supply during peak demands.

The District's potable water system, therefore, must not only provide the capacity to distribute water purchased from MWD (at LV-1 and LV-2) and pumped out of Las Virgenes Reservoir; it must also have enough hydraulic capacity in the winter to replace the water taken out of Las Virgenes Reservoir during the rest of the year.

The District maintains a certain volume of water at all times in case it is needed as an emergency supply. The policy generally limited the annual use of reservoir water is about 3000 AF.

There are plans in place to upgrade the filter plant at Las Virgenes Reservoir to increase the capacity to 12,000 gpm. (17 MGD). Based on this increase, the refill would need to be approximately 4,800 acre-feet over the course of 6 months (for an average of 8.5 MGD).

With the proposed transmission improvements described earlier in this section, the reservoir cannot be refilled at the required rate in the required period. This is based on an analysis of the system, assuming that average customer demands are 80 percent of average day demand. The 80 percent figure reflects the average demand computed for the October through April period.

Two options were analyzed for refilling the reservoir within the required period of time:

- Option A: Additional transmission pipeline improvements and larger pipelines.
- Option B: An intertie with Calleguas MWD.

8.1.7 Calleguas MWD / LVMWD Intertie

Calleguas Municipal Water District is, like Las Virgenes Municipal Water District, a member agency of MWDSC. Both districts purchase MWDSC water through West Valley Feeder Number 2. Both districts supply water that is essentially identical in terms of water quality.

The LVMWD/CMWD Intertie Study indicates that Calleguas might have additional capacity—up to 20 cfs—available during the winter. Since it would be available on the western edge of the District, this supply would greatly improve LVMWD's capability to refill Las Virgenes Reservoir.[6]

In addition to providing wintertime supply to LVMWD, a connection to the Calleguas MWD potable water system would in turn provide an emergency supply from LVMWD to Calleguas MWD.

A west-end connection to Calleguas would require a 16-inch pipeline, approximately 8,900 feet in length, in Lindero Canyon Road from the Ventura County line to Kanan Road. A pump station might also be required in Ventura County; however, preliminary discussions have indicated that Calleguas would be responsible for the construction costs involved with the pump station.

With the existing system plus the supply from Calleguas MWD, the District can expect to get about 9,470 gpm, or a total of 5,023 acre-feet over the four-month refill period, into Las Virgenes Reservoir. With the recommended improvements in addition to the Calleguas supply, approximately 10,950 gpm, or 5,804 acre-feet over four months, can be returned to the reservoir.

8.2 Recycled Water

8.2.1 Future Recycled Supply vs. Demand

8.2.1.1 Buildout Demand

Table 8.3 displays the estimated Maximum Day Demand (MDD) and Average Day Demand (ADD) and supply for buildout year 2030 as

[6] Calleguas might also have additional capacity available during the summer; with the cancellation of the Ahmanson Ranch project, a large future demand was removed from the Calleguas system. However, to date, CMWD has been unwilling to commit any summer capacity to Las Virgenes.

used in the model. The table includes the current recycled water demand, an additional 20 percent demand for in-fill development, and potential large customers inside and near the LVMWD service area.

Table 8-3
Buildout Supply and Demand (2030)

		Annual (acre-ft)	ADD (MGD)	MDD (MGD)	ADD (gpm)	MDD (gpm)
DEMANDS	Current (2006)	6,500	5.8	13.5	4,000	9,400
	In-fill Development	1,300	1.3	2.2	980	1,500
	Decker Canyon Project	300	0.3	0.8	185	440
	T.O. Blvd Extension	342	0.3	0.6	220	530
	Woodland Hills G.C.	316	0.3	0.6	196	430
	Calabasas City Center	24	0.0	0.0	15	30
	Agoura Road Gap	42	0.0	0.1	26	73
	Total	8,800	8.0	17.0	5,600	12,400
		Acre-Ft		**MG**		**gpm**
SUPPLY	Tapia Buildout (2030)	13,400		12		8,300
	Westlake Wells	1,700		1.5		1,000
	Potable Supplement	5,200		4.6		3,200
	Total	20,300		18.1		12,500

8.2.1.2 Decker Canyon Project

A large potential user of recycled water is the Malibu Country Club Golf Course, as part of the Decker Canyon Project. This user is estimated to have an Average Day Demand of 185 gpm (MDD of 440 gpm), as shown in **Table 8-3**. This project requires a long pipeline (approximately 25,000 feet or 4.7 miles) to reach the golf course in addition to pumping and storage facilities (referred to as Decker Pump Station and Tanks).

In 2004, this recycled water project was designed, permitted, and advertised for bid, but never constructed. When bids were returned, the cost of the project was significantly higher than budget estimates, and the amount of grant funding that was available was insufficient to bridge the gap between what would have been the cost of the project and its value to the District.

The owner of the Malibu Golf Course considers recycled water as valuable insurance against possible curtailment of supply during droughts.

Interest in this project remains strong. Malibu Golf Course is the single largest user of potable water in Las Virgenes MWD, and its owner has been very supportive of the project. The owner sees the project as one way to assure the continuation of supply and the continuation of operations during extended droughts, when other outdoor uses of water might be sharply curtailed. From the District's perspective, construction of this project may be an important way of relieving potable water demands in the Seminole Subsystem, where maximum demands are approaching the capacity of the existing facilities, and new facilities will likely be costly. This latter issue is further discussed in the 2007 Potable Water Master Plan Update (LVMWD Report No. 2389.00).

The "Alternative Decker Canyon Project" would involve higher construction costs, but could serve the Medea Valley, Saddlerock Ranch, Triangle Ranch, and other customers.

Plate 4A (found at the end of this report) shows two alternatives for the Decker Canyon Project. The shorter, less expensive alternative would be located in Westlake Boulevard, drawing water from the Lake Sherwood pipeline. This is the alternative that was designed in 2004. The other alternative would draw water directly from the Indian Hills Tank, and generally follow Kanan Road toward the golf course. Although this alternative is longer and more costly, there are two considerations that make it advantageous:

- It could serve customers in the Medea Valley, Saddlerock Ranch, to Los Angles County "Fire Camps," the Calamigos Ranch, and several others along the route (a more definitive demand study is recommended if this is to be pursued).
- It would preserve space in Westlake Boulevard for a new potable water main that may be needed for the Seminole Subsystem. This is a narrow, winding road, where

construction is expected to be difficult. (During the design of the 2004 project, it became readily apparent that a recycled water main, in addition to an existing potable water main, would generally preclude the construction of a new potable water main, except at great difficulty.)

8.2.1.3 Alternative Decker Canyon Project

Plate 4A also shows an "Alternative Decker Canyon Project." The concept for this project developed during discussions with District staff regarding the future facilities needed to provide potable water to the Seminole Subsystem, although this alternative had been studied earlier as part of the "Malibu Golf Course Recycled Water Feasibility Study" (LVMWD Report No. 2163.00).

The Alternative Decker Canyon Project became a focus due to concerns about constructing both a RW and PW main within Highway 23.

During discussion with staff, it became apparent that one of the better solutions for the Seminole problem was a potable water pump station and pipeline that roughly mimics the location of the Decker Canyon Pump Station and Pipeline. One reason this was a favored alternative for the Seminole subsystem was that it provides better diversity of supply. However, placing a potable pipeline in this location would cause a problem, because the very narrow, winding road (Westlake Boulevard – Highway 23), has inadequate room for both another potable water main and a new recycled water main, except at great difficulty.

The State of California, Department of Health Services requires that pipelines for recycled water and potable water be separated by at least 4 feet and preferably by 10 feet, which would complicate both the design and construction of two new pipelines in this road. The road also traverses a steep mountain slope, and sections are prone to sliding, which makes the design of additional pipelines within this road even more difficult. The Alternative Decker Canyon Project is intended to solve this conflict by placing the proposed pipeline largely in Kanan Road.

8.2.1.4 Other Recycled Water System Extensions Projects Included in the Hydraulic Analysis

*Initial analysis shows that the **Alternative** Decker Canyon Project may have a lower cost per acre feet of water delivered; it would serve Medea Valley, Triangle Ranch, Saddlerock Rach, and Calamigos Ranch.*

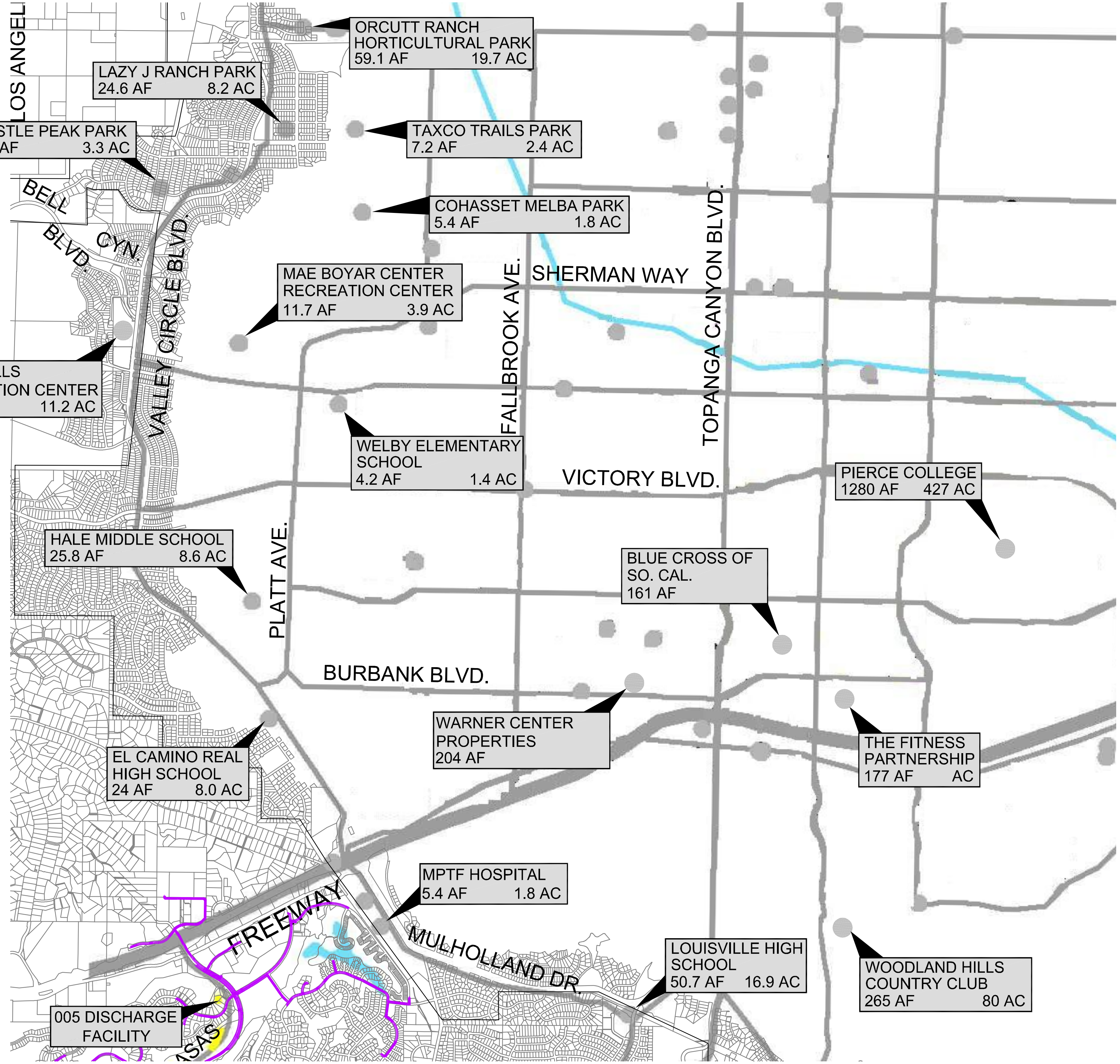
Descriptions of other system extension projects are shown on **Plates 4A and 4B**. The demands from these projects have been included in this master plan analysis:

- **Thousand Oaks Boulevard Extension:** An extension of the system in Thousand Oaks Boulevard, to Baxter Pharmaceutical, Russell Park, Westlake High School and a proposed park to be built near the corner of Thousand Oaks Boulevard and Lindero Canyon Road. (The proposed park is a potential customer not included in previous studies.)

- **Calabasas City Center:** An extension of the system to the Calabasas City Center, servicing several commercial properties along the way, the Alice C. Stelle Middle School, and Freedom Park.

- **Agoura Road "Gap" Project:** This project would close a small gap in the system and would serve future customers along the road, where existing parcels are undeveloped. Closing the gap would also serve to improve system hydraulics and reliability (by providing additional redundancy).

- **Woodland Hills Extension:** This project would serve several Los Angeles Department of Water and Power (LADWP) customers near the District boundary that were identified as potential recycled water users in a LADWP recycled water master plan for the southern San Fernando Valley (see **Figure 8-3**). Customers would include the Woodland Hills Golf Course, Louisville High School, and the Motion Picture Hospital.



LEGEND

EXISTING RECYCLED WATER

1500' 750' 0 1500' 3000'

SCALE IN FEET

BOYLE ENGINEERING CORPORATION

LAS VIRGENES MUNICIPAL WATER DISTRICT
RECYCLED WATER MASTER PLAN

POTENTIAL RW USERS
WEST SAN FERNANDO VALLEY

23016.00	JUNE 2007	FIGURE 8-3

8.2.2 Retrofit of Existing Single-Family Homes

Because the potential recycled water demands would be low, the cost of extending mains to serve existing residential areas would be relatively high. Such extensions need to be considered on a case-by-case basis.

Many of the homes in the District are on large lots with significant amounts of landscaping. The extension of recycled water to these existing customers faces several challenges, including concerns about cross-connection control and economics. In earlier studies, it was recommended that residential use be confined to front yards where a Homeowners' Association or similar entity might assume the responsibility for system operation. The following neighborhoods have been briefly investigated to assess feasibility:

- Hidden Hills
- Mountain View Estates
- New Millennium
- Oak Park
- Old Agoura
- Morrison Ranch
- Foxfield Drive area of Westlake Village

8.2.3 Oak Park System Extensions to Conejo Creek Park

A cluster of several parks in Thousand Oaks may be reachable from an extension of the Calleguas RW System.

This potential project was identified during a meeting with the City of Thousand Oaks. The general layout of the project is depicted in **Figure 8-4**, which shows that the Oak Park Water System (owned and operated by Calleguas MWD) currently terminates within about two miles of several parks that are owned and operated by Conejo Parks and Recreation Facility.

The potential area for irrigation with recycled water is approximately 92 acres. The service would include deliveries to Lang Ranch Community Park, Oakbrook Neighborhood Park, Fiore Playfield, Conejo Creek Park, and Waverly Park. The pipeline extension would be nearly 21,000 feet in length.

This project was not been investigated in detail. Discussion with Calleguas MWD indicates that the current Oak Park RW system is not capable of any significant additional loads.

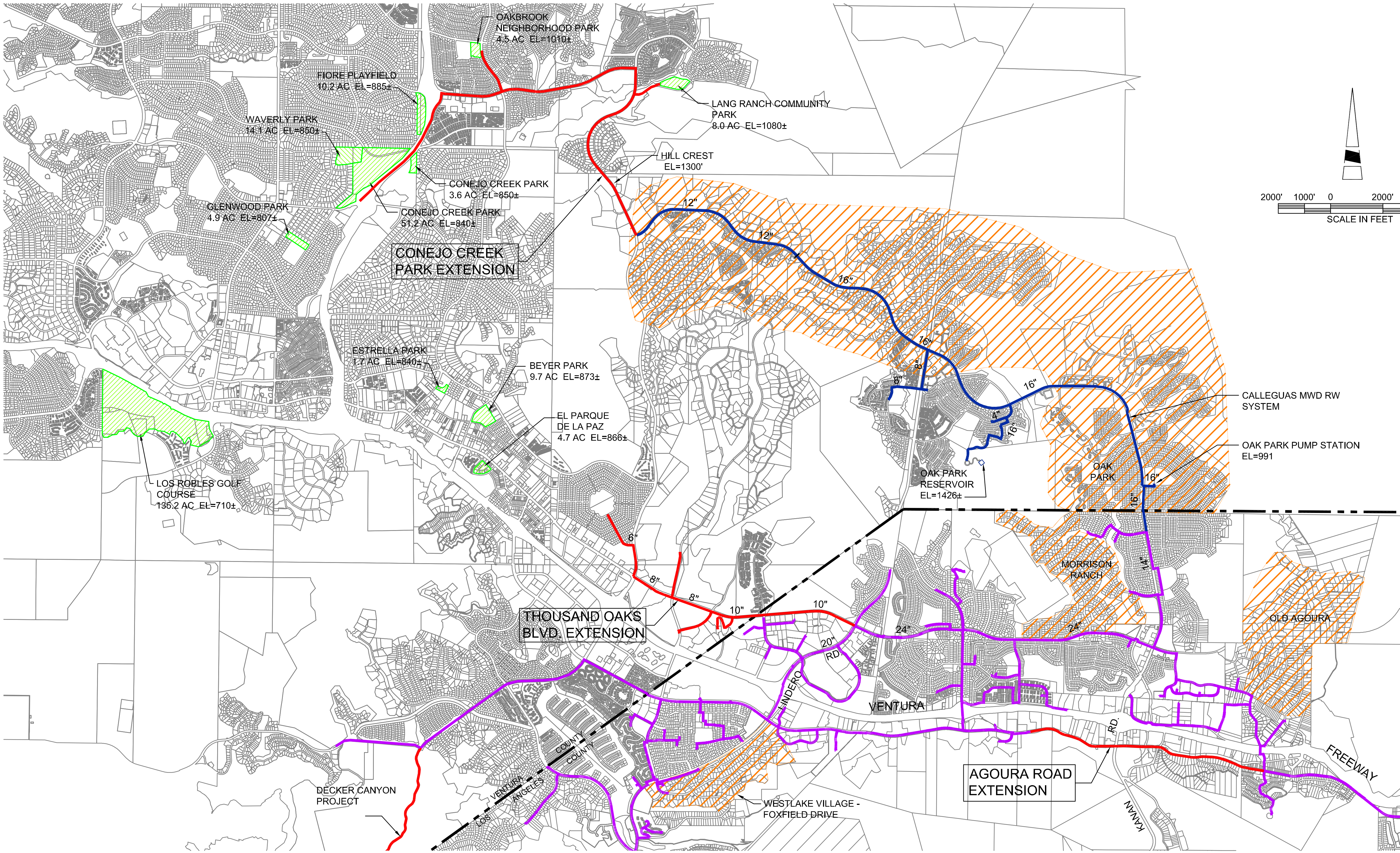
8.2.4 Pierce College

A proposed project to convey sewage to the City of L.A. may also create opportunities to convey recycled water to Pierce College.

Pierce College, located in the San Fernando Valley, near Victory Boulevard and Winnetka Avenue, has an estimated potential recycled water demand of 1280 acre feet per year, or roughly four times that of Malibu Golf Course.[7] The Los Angeles Department of Water and Power has examined pipeline alignments to serve recycled water to the college and other users in the southern San Fernando Valley, with water produced from the Donald C. Tillman Water Reclamation Plant, but completion of such facilities is estimated to be years away.

Las Virgenes MWD recently completed an alignment study for a project that would convey sewage from Calabasas to a connection point at Topanga Canyon Boulevard and Vanowen Street. The preferred alignment for this project is within an access road along the Arroyo Calabasas flood control channel. This alignment passes within about 9800 feet of Pierce College, and conceivably could be used for a recycled water pipeline as well as a sewer pipeline, assuming that Department of Health issues relating to pipeline separation can be resolved. Design and construction of the sewer interconnection project is believed to be several years away.

[7] Based on "South Valley Water Recycling Facility" Report, produced for L.A. Department of Water and Power, by Boyle Engineering Corporation, June 2005.



LEGEND

- LAS VIRGENES RECYCLED WATER PIPE
- PROPOSED EXTENSIONS
- EXISTING CALLEGUAS RW SYSTEM

BOYLE ENGINEERING CORPORATION

LAS VIRGENES MUNICIPAL WATER DISTRICT RECYCLED WATER MASTER PLAN		
POTENTIAL VENTURA COUNTY RW SYSTEM EXTENSIONS		
23016.00-0003	AUG. 2007	FIGURE 8-4

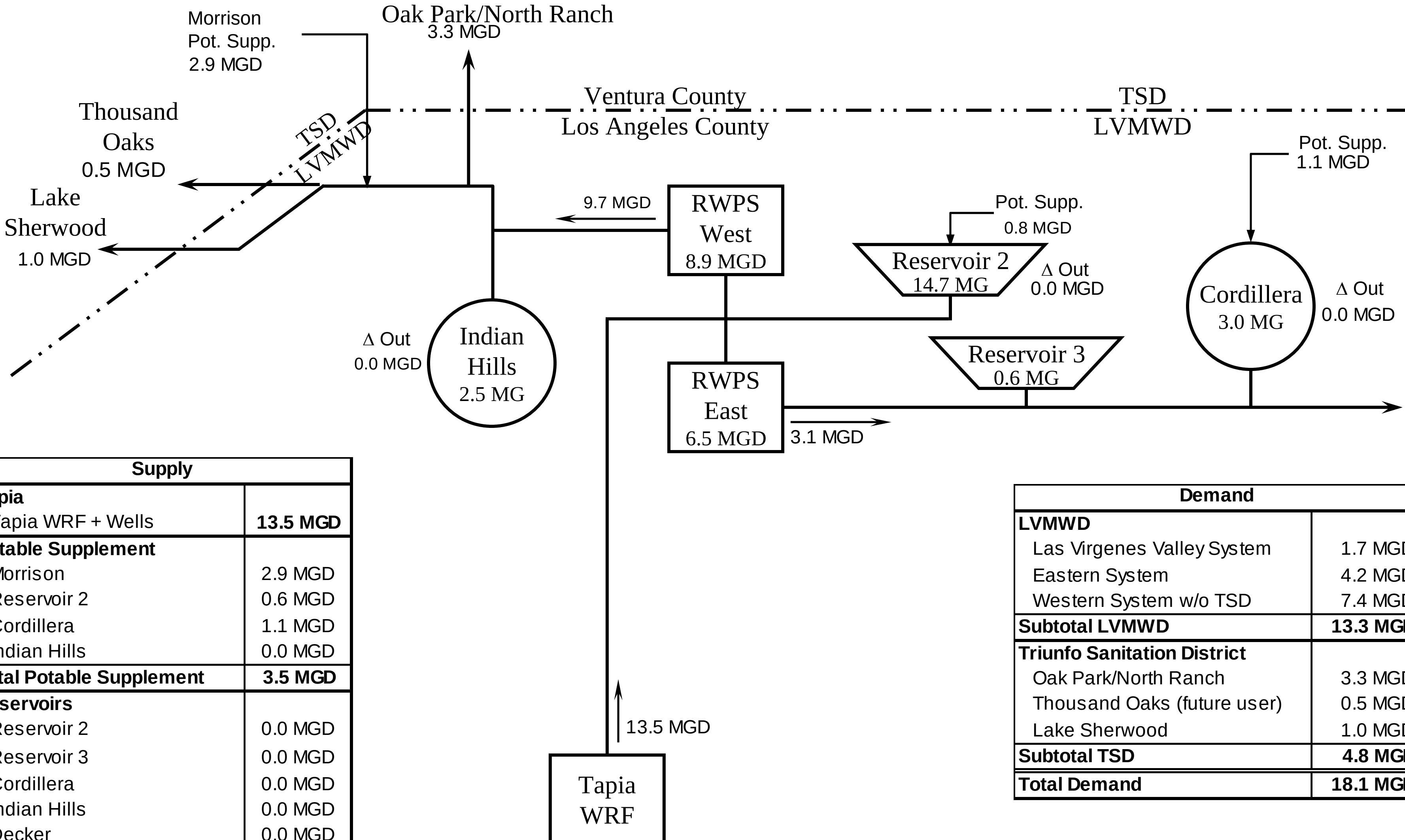
8.2.5 Hydraulic Analysis of Future Recycled Water System

The hydraulic model of the buildout recycled water system was updated with pipeline extensions constructed since the last Master Plan as well as an update of the demands. The model was run to determine if additional pipelines are required to serve customers at Maximum Day Demand.

Modeling Results:

- The buildout flow from Tapia WRF alone is insufficient to provide Maximum Day Demands. Potable supplement is needed at Morrison Tank, as well as supply from the Westlake Wells.
- In the Eastern System, there is sufficient pumping capacity via RWPS East (based on the maximum supply from Tapia WRF) However, RWPS West needs to be expanded or more potable supplement is needed in the Western System to meet buildout demands.
- All reservoirs refill during a 24-hour Maximum Day Demand period if Western System receives more pumping or potable supplement.

Figure 8-5 provides a schematic of the model results. It should be noted that the schematic shows that demands on RWPS West could exceed the capacity of the facility.



Supply	
Tapia	
Tapia WRF + Wells	**13.5 MGD**
Potable Supplement	
Morrison	2.9 MGD
Reservoir 2	0.6 MGD
Cordillera	1.1 MGD
Indian Hills	0.0 MGD
Total Potable Supplement	**3.5 MGD**
Reservoirs	
Reservoir 2	0.0 MGD
Reservoir 3	0.0 MGD
Cordillera	0.0 MGD
Indian Hills	0.0 MGD
Decker	0.0 MGD
Total Supply from Reservoirs	**0.0 MGD**
Total Supply	**18.1 MGD**

Demand	
LVMWD	
Las Virgenes Valley System	1.7 MGD
Eastern System	4.2 MGD
Western System w/o TSD	7.4 MGD
Subtotal LVMWD	**13.3 MGD**
Triunfo Sanitation District	
Oak Park/North Ranch	3.3 MGD
Thousand Oaks (future user)	0.5 MGD
Lake Sherwood	1.0 MGD
Subtotal TSD	**4.8 MGD**
Total Demand	**18.1 MGD**

Las Virgenes Municipal Water District
Recycled Water Master Plan

Future System at Future MDD

23016.00 August 2007 **Figure 8-5**

BOYLE

8.2.6 Recycled Water Storage Refill / Pumping Capacity

8.2.6.1 Supply, Capacity, and Demands at Buildout (2030)

Table 8-4 shows how future supplies, facility capacities and estimates of future demands compare. It also shows how these figures have changed since the 1999 Master Plan. Important items to note are:

- Total supplies to the system should be more than sufficient to meet the expected demands, even if all projects are built. The table shows that 21 MGD of supplies are expected and 18 mgd of demand. (It is important that supplies exceed demands by some margin, because the 12 MGD figure for Tapia production is the maximum that is expected, not the minimum.)

- Western subsystem capacity compares only marginally with subsystem demands, with approximately 11.9 MGD of capacity and 12 MGD of Maximum Day Demand. If all of the system expansion projects come to fruition, an upgrade of the RWPS West may be warranted.

If all of the western system extensions come to fruition, expansion of RWPS West or additional potable supplement in the west will be required.

- Eastern subsystem capacity is more robust, with about 8.2 MGD of capacity compared to 4.2 MGD of future Maximum Day Demand. This surplus capacity is attributable to the large upgrade that is planned for the RWPS East, which is planned for other reasons.

Table 8-4 **Buildout (2030) Recycled Water Supplies, Facility Capacities, and Demands (MGD)**		
	1999 Master Plan Buildout	**2007 Master Plan Buildout**
Recycled Water Supply		
Tapia WRF w/o wells	14	12
Reservoir 2 Supplement	4.5	3.6
Westlake Wells	1.2	1.2
Cordillera Supplement	1.7	1.7
Morrison Supplement	0	2.9
Total Supply	*21.4*	*21.4*
Subsystem Capacities		
RWPS West	17.8	8.9
Morrison Supplement	0	2.9
Total Western System Capacity	*17.8*	*11.8*
RWPS East*	4.6	6.5
Cordillera Supplement	1.7	1.7
Total Eastern System Capacity	*6.3*	*8.2*
Recycled Water Demands (MDD)		
Las Virgenes Valley System	1.5	1.5
Lake Sherwood	1.8	1.0
Oak Park/North Ranch	3.8	3.0
Decker Canyon Project	0	0.9
T.O. Blvd. Project	0.8	0.8
Agoura Road Gap	0	0.1
Other Western System	8.3	6.4
Subtotal – Western Demands	*15*	*12*
Ahmanson Ranch	1.2	0
Calabasas City Center	0	0.1
Other Eastern System	3.4	3.1
Woodland Hills GC & Other LA	0	1.0
Subtotal – Eastern Demands	*4.6*	*4.2*
Total RW System Demand	***21***	***18***

* 4.6 MGD was proposed expansion in 1999 MP. 6.5 MGD is current expansion project.

Section 9

Proposed Improvements

9.1 Potable Water System

9.1.1 Project No. 1: 5 MG Finished Water Tank and Filter Plant Expansion at Las Virgenes Reservoir

Justification: Based on hydraulic modeling analysis, during peak hour demands, the storage tanks in the western portion of the 1235-foot zone drop rather quickly. It would be desirable to construct a new tank in the vicinity of Las Virgenes Reservoir in order to reduce the rate at which the tanks' levels drop and increase water storage for use during peak demands. This tank would help the District make greater use of Las Virgenes Reservoir and serve future MDD with the less extensive east-west transmission improvements. A tank at this location would also help to increase gradients in the area when the Reservoir is being refilled. These options provide the most desirable hydraulic conditions and provide additional storage where it is needed.

Description: The facilities included in this proposed improvement include a prestressed concrete tank on the site of Las Virgenes Reservoir, to store treated water Also included are pipelines, and associated appurtenances.

Expansion of the Las Virgenes Reservoir Filtration Plant, adding two additional filters. This allows more water to be taken from the Reservoir.

Related Projects: Related to this project are two other projects:

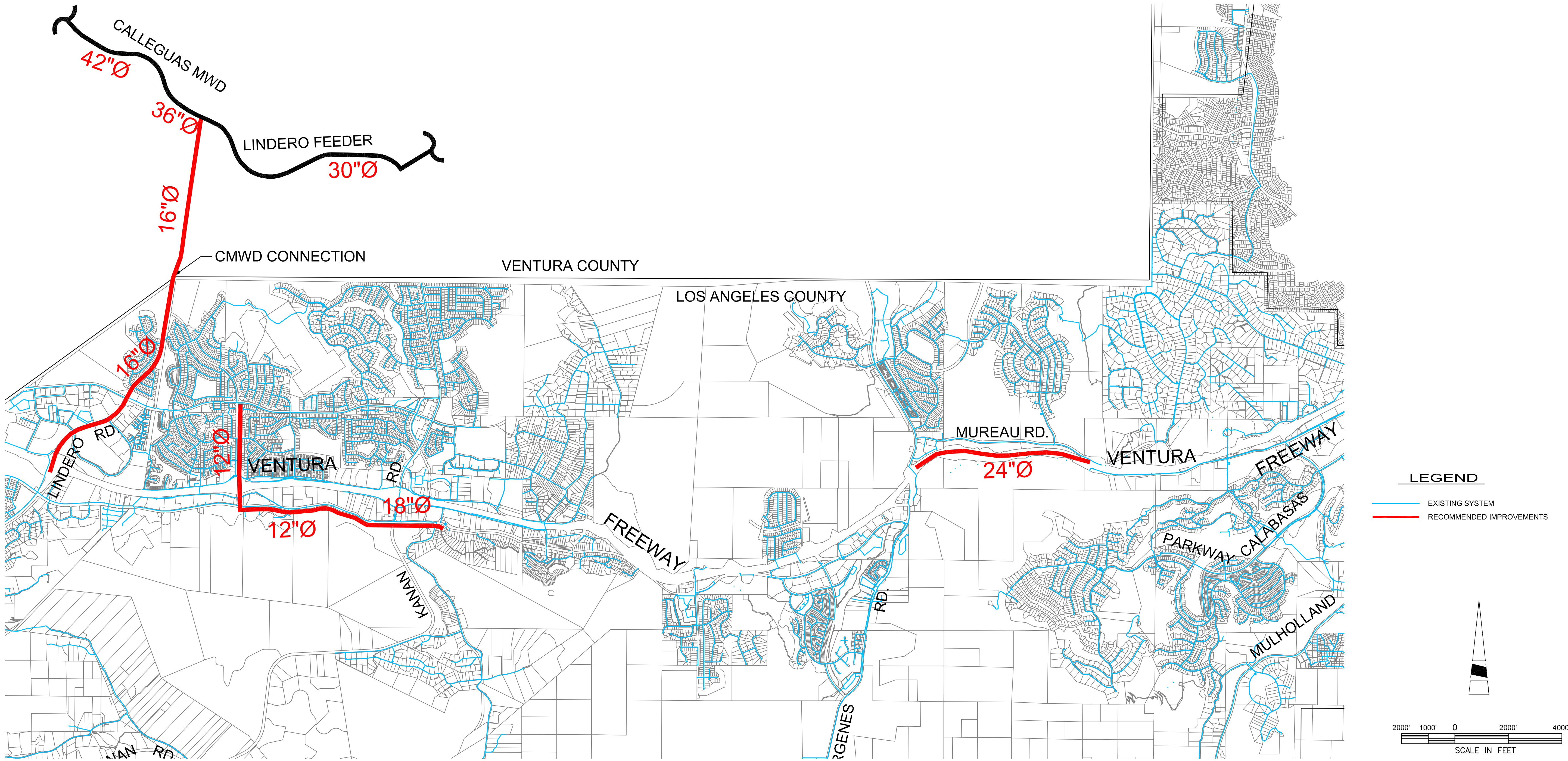
- An intertie with Calleguas MWD, which allows the Reservoir to be refilled in the winter.

9.1.2 1235-foot System East-West Transmission Improvements

The most important and expensive portion of the improvement program are the east-west transmission pipeline improvements. The current system is near maximum capacity and in this last year, demands have reached record levels. Improvements constructed in 2001 greatly improved a system that was barely able to meet peak demands, but demands have grown another 15 percent, and new improvements are needed.

The original construction of the main transmission pipeline is a 30-inch pipeline with plans for a parallel 42-inch pipeline. The design and construction of Cornell Pump Station, along with lower projected buildout demands have greatly reduced the need for large, long improvements to the main transmission system. Increased use of recycled water has also reduced the burden on the system.

For this Master Plan Update, there are two suggested alternatives for 1235-foot zone improvements as shown in **Figure 9-1** and **Figure 9-2**.

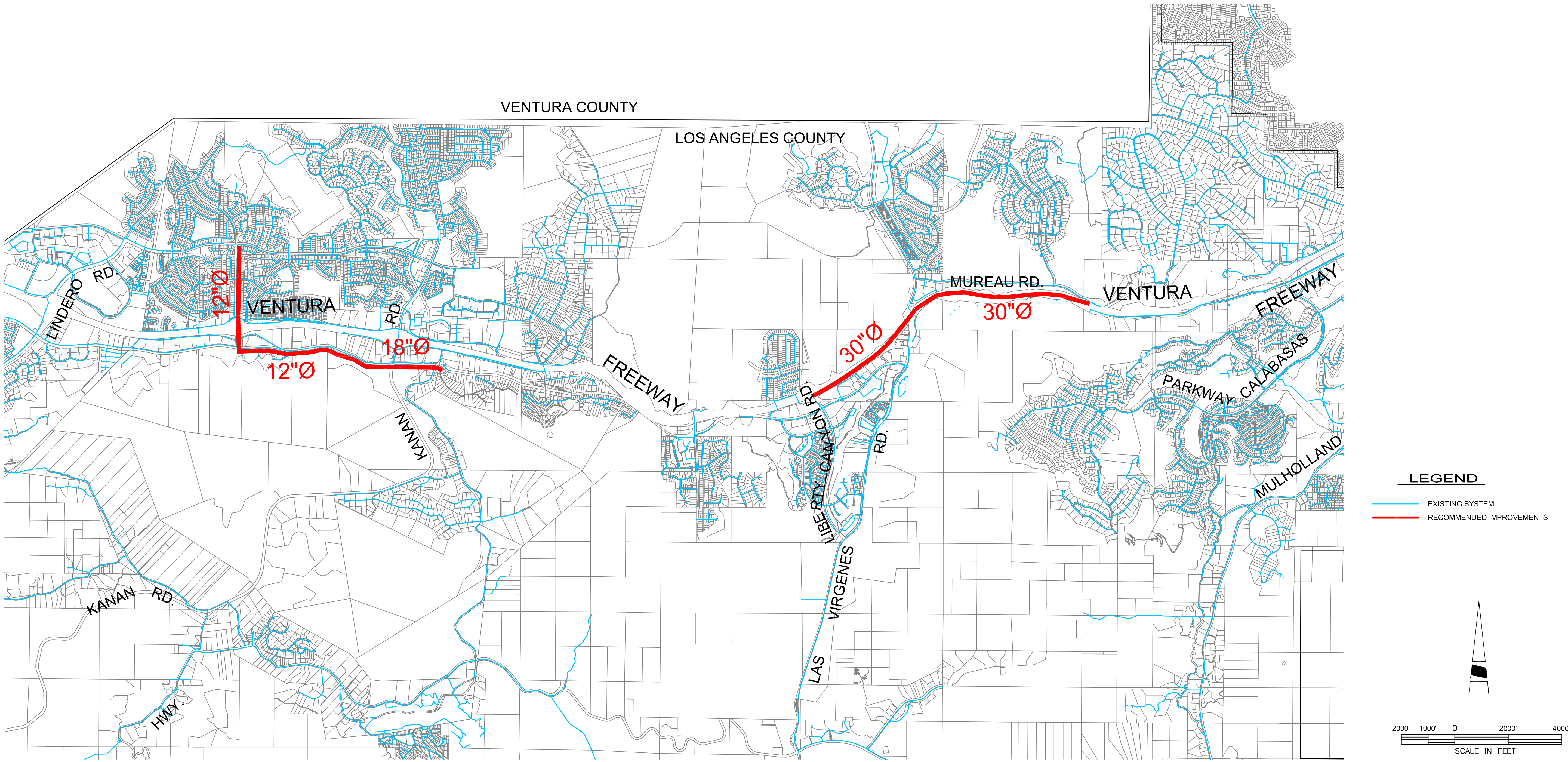


LAS VIRGENES
MUNICIPAL WATER DISTRICT
INTEGRATED WATER SYSTEM MASTER PLAN

POTABLE TRANSMISSION IMPROVEMENTS
WITH CALLEGUAS MWD CONNECTION

23016.00-0004	JULY 2007	FIGURE 9-1

BOYLE ENGINEERING CORPORATION



LAS VIRGENES
MUNICIPAL WATER DISTRICT
INTEGRATED WATER SYSTEM MASTER PLAN

POTABLE TRANSMISSION IMPROVEMENTS
WITHOUT CALLEGUAS MWD CONNECTION

23016.00-0004 | JULY 2007 | FIGURE 9-2

BOYLE ENGINEERING CORPORATION

DWG: F:\LVMWD\23016.00 – Potable & Recycled Water MP Update\0001\CAD\Exhibits\Potable\FIGURE 10-2.dwg USER: eboardman
DATE: Sep 18, 2007 2:38pm XREFS: baseparcels(6-25-06) CITY-BNDRY pipes after 1999 pipes before 2000 IMAGES:

9.1.3 Project No. 3: Calleguas MWD Intertie

Justification: A surplus supply from Calleguas MWD exists during the winter months. A portion of this supply could be transferred to LVWMD to aid in Las Virgenes Reservoir refill. This allows for greater use of reservoir storage, reducing the amount of backbone improvements needed for peak-hour conditions. It also would be a source of supply for emergencies and aid in system maintenance outages.

Project Description: Transmission system improvements needed for this project are shown in **Figure 9-1** and include a 16-inch diameter pipeline in Lindero Canyon Road, from the south side of the 101 Freeway to Kanan Road. Included in this project is a pressure reducing station needed near the District boundary and a metering facility.

Related Projects: Related to this project are improvements on the Calleguas side, in particular:

- A pump station at the District boundary to deliver flows back to Calleguas. This facility is needed if the project is to be a joint venture benefit. It would provide flows for emergencies and scheduled maintenance activities in the Calleguas area. The cost of this project has not been included in the capital improvements program because the pump station would be funded by Calleguas.

9.1.4 Project 4: Jed Smith/Mountain Gate System Improvement Program

Justification: Currently, this system is undersized to meet demands and the situation could worsen if the demands increase over the next 25 years. This growth in demands is not related to development as much as increasing water use at existing homes.

The implementation of the first step (Project 4A) is considered immediate, in order to reduce system problems and increase reliability, whereas the remainder of the pumping and storage upgrades will be driven by growth in demand.

Project Descriptions: The recommended program to correct these deficiencies is:

- **Project 4A:** Expand Mountain Gate Pump Station by 500 gpm to a total of 1,600 gpm and provide standby pumping unit. Included in this project will be about 250 feet of parallel discharge pipelines.

- **Project 4B:** Construct Adamor Hydropneumatic Pump Station to reduce demands on the Jed Smith/Mountain Gate System in the 1310-foot zone.

- **Project 4C:** Replace Jed Smith Tank No. 2 with 1.5 MG unit to increase zone storage.

- **Project 4D:** Add new pump position at Jed Smith Pump Station to increase pumping capacity by 850 gpm. Included in this project will be 550 feet of 12-inch suction piping needed in Round Meadow Road and 1750 feet of 8-inch discharge piping needed in Jed Smith Road.

9.1.5 Project 5: Warner Pump Station Expansion

Justification: There is currently a small pumping deficit at the Warner Pump Station which will grow to a rather large deficit under projected buildout demands. In order to maintain quality of service in the Warner Zone, the pump station will need to be expanded in the near future. The Warner PS supplies not only the Warner Tanks, but also supplies Saddlepeak, Oak Ridge, the Mulwood Systems. It also providespotable water supplement to Cordillera Tank in the recycled water system.

Project Description: It is recommended to add approximately 1000 gpm by adding a 200-hp pump and new can to the Warner Pump Station. (The pump station was constructed with a spare pump position, but the existing spare can is reportedly corroded.)

9.1.6 Project 6: Mulwood Pump Station Expansion

Justification: There is a pumping deficiency in the Mulwood Zone. In the summer, the two pumps run continuously and are supplemented by flow through the Mulwood PRV, which is now experiencing very high flows during summer peak periods. There are no spare pumps, and the failure of any component (pump station or PRV) will result in loss of water service for extended periods of time. This pump station also provides water to the Dardenne Zone, which would be similarly at risk. The projected buildout demands for the Mulwood zone are expected to increase quite significantly. This will put additional strain on the system.

The need for this upgrade is deemed to be short-term, as the PR station is already providing large flows during high demands. The pump station upgrade should be budgeted for 5 to 10 years.

Project Description: It is recommended to increase the pumping capacity in the Mulwood zone by 750 gpm to reduce reliance on the PR station and the Warner system. Adding an additional pump will require expanding the pump station, and possibly the procurement of additional property. In order to upgrade the pump station, the suction pipeline will also need to be upgraded.

9.1.7 Project 7: Twin Lakes Expansion and Emergency Supply Pipeline

Justification: Since construction of the Upper Twin Lakes Pump Station and Tank, the Twin Lakes Pump Station has reached near-capacity. When the proposed Deerlake Ranch development occurs, demands on the station and related facilities will be beyond capacity. The Deerlake Ranch development has been approved by the County, but the slowdown in the real estate market has delayed the start of work.

Project Description: An increase in pumping of approximately 750 gpm will be needed for buildout conditions, as well as suction pipeline upgrades and an upgrade of the LV-3 turnout. It is also recommended to construct an emergency supply pipeline to connect this system to the remainder of the LVMWD system. These deficiencies are considered near-term, and the project is currently in the design phase.

9.1.8 Project 8: Woolsey Canyon Project

Justification: The service area located in Woolsey Canyon is not currently connected to the remainder of the Las Virgenes System. Supply for the Woolsey Canyon area is delivered by Ventura County Water Works District No. 17, with an agreement that can be terminated with one year's notice. The system that is used to deliver water to the system is problematic, because it relies on a series of three pump stations and a long, undersized pipeline that crosses rugged terrain.

District 17 is currently exploring alternatives to improve supply to Bell Canyon and the preferred alternative is a joint venture project that would also serve Woolsey Canyon.

The system would also allow those customers in Bell Canyon, who currently receive water from Simi Valley to be connected to the LVMWD system.

This project is recommended to improve the reliability of supply to Woolsey Canyon. This project may also be required by Ventura County Water Works District No. 17, if they choose to cancel the service to this area.

Project Description: This project would consist of an 18-inch pipeline, a high-lift pump station, and all associated appurtenances to connect the Woolsey Canyon service area to the Las Virgenes System. The system would be sized to serve both Bell Canyon customers as well, and would be constructed as a joint venture between Las Virgenes and District 17.

9.1.9 Project 9: Three Springs Tank and Pumping Improvements

Justfication: In the analysis of pump stations presented in Sections 7 and 8, deficiencies are noted for the Three Springs Pump Station. This system is unique in that it operates without a tank, but utilizes PRV from the Seminole Zone in addition to a small pump station.

Currently, the demand exceeds the pump station flow rate, resulting in high PRV flows. The Three Springs Pump Station was designed to accommodate a future expansion and the District owns land that is designated for a Three Springs Tank. Construction of the tank and upgrades to the pump station would lessen demands on the Seminole Zone, which are already exceeding capacity of the pump station (see Project 10).

Project Description: It is recommended to construct 0.55 MG storage tank at the District owned location. A pump station expansion to add 250 gpm of pumping is also recommended.

The timing for the Three Springs upgrades should be short-term, since the need is current. The pumping and storage improvements are recommended for 3 to 5 years.

9.1.10 Project 10: Seminole Zone Pumping, Pipeline and Storage

Justification: As development occurs in the Seminole and Latigo Zones, demands are projected to increase by as much as four times the current demands. The complication with planning in the zone is that development is expected to be in small increments and spread wide across the zone. A brief review of the Seminole/Latigo System at buildout demand:

- In Section 8, the analysis of the pumping capacity in this zone revealed a buildout deficiency in excess of 3,000 gpm.
- In Section 8, the analysis of the tank storage determined that the tank storage in this zone will be deficient by approximately 2 MG.
- In Section 7, the analysis of the existing facilities determined that the current pump station is not keeping up with demands. Only a relatively large tank and a lessening of demands on week ends has kept customers fully supplied.

Project Description: Based on the nature of development in this zone, as previously discussed, it is recommended to make improvements in phases. The recommendations to correct these potential deficiencies are:

- **Project 10A:** Expand Seminole Pump Station to four pumps. This will provide increase pumping by 750 gpm in emergency situations.

- **Project 10B:** Construct Decker Canyon Project. This project will remove the demands from Malibu Golf Course from the Seminole System by use of water from the recycled system. This project also aids the recycled water system in creek discharge avoidance. The cost of this project is found in the Recycled Water CIP and has not been included in the Potable Water Master Plan (see Project 17).

- **Project 10C:** Construct Three Springs Zone Tank and Pumping Improvements. See Project 9.

- **Project 10D:** Construct Second Seminole Pump Station and New Tank. This pump station will increase pumping capacity in the zone and increase reliability. The new tank will increase the storage capabilities in the zone. Included in this phase are pipeline improvements between the pump station and tank in order to improve hydraulics.

The implementation of the first step is considered immediate; in order to reduce system problems and increase reliability, as there is already difficulty filling the Seminole Tank during times of high demand. Construction of the Decker Canyon Project is included in the Recycled Water Master Plan and is considered a near-term improvement. The final phase (Project 10D), consisting of a new pump station, tank and pipeline improvements will be very expensive and difficult, as the terrain in the area is rugged. Planning for this project should start once all the other projects are completed. If land in this area continues to be dedicated as open-space, the need for this last phase may be decades into the future.

9.1.11 New Zone Development

If development occurs in certain portions of the District, new pressure zones may be required. **Plate 3** shows the approximate boundaries of the existing and possible future pressure zones within LVMWD's service area. In general, these boundaries of the pressure zones are based on a combination of elevations, topography and proximity to tanks, pump stations and major pipelines. For master planning purposes, the facilities for these zones are identified and sized. The actual boundaries for the pressure zones may differ depending on the extent of development, piping network design and final grading of the lots. Per District policy, the cost of mains, pump stations and tanks for any new zones will generally be the financial responsibility of the developer. **Table 9-1** provides an overview of the possible new zones.

Table 9-1
Possible New Pressure Zones

Zone	Approx. Gradient	Information
Southern Twin Lakes	1750 feet	May be sparse development. Can get supply from LV-3, but would not be served from Twin Lakes PS
Kittridge	1300 feet	Too high to get supply from 1235-ft zone Will require pump station. Preliminary WSDR was prepared in 2007.
Upper Agoura	1350 feet	Will replace JBR and Agoura pump stations and serve new areas
Ladyface	1400 feet	Near Agoura Hills; too high for 1235 zone. To be supplied from 1235-ft zone.
Udell	1400 feet	Near Agoura Hills; too high for 1235 zone. To be supplied from 1235-ft zone.
Deerlake Ranch	1656 feet	Hydropneumatic Zone To get supply from Twin Lakes Zone

9.1.12 Miscellaneous Projects

Project 11: Emergency Generator at LV-2 Pump Station

Justification: To increase reliability of supply to the bulk of the LVMWD customers. Over 90 percent of the District water on maximum day must be pumped by this pump station.

Description: It is recommended to install a permanent emergency generator at the pump station for use during electrical supply interruption. The size of the generator and the number of pumps to be powered is a subject for future analysis.

Project 12: Connect LV-1 Turnout to West Valley Feeder No. 2

Justification: Currently, the LV-1 turnout is connected to the West Valley Feeder No. 1. The gradient at the West Valley Feeder No. 2 is approximately 100 feet higher and located in close proximity to West Valley Feeder No. 1. It is recommended to reconnect this turnout to reduce pumping costs at the (future) Woolsey Pump Station and increase the available flows from LV-1 and the Conduit Pump Station. The need for this project is further discussed in Section 9.

Project Description: The project includes a connection to West Valley Feeder No. 2, a small amount of 30-inch pipeline. However the improvement would also require upgrading sections of the 30-inch conduit pipeline to higher pressure rating.

Project 13: 1235 Zone Tank Rehabilitation

Justification. Recent inspections on Equestrian Trails Tank have shown that the columns and footings exhibit alkali-silica reactivity. Continued degradation may necessitate the need for structural repairs to the columns, such as the carbon-fiber reinforced plastic used at the Las Virgenes Reservoir Pump station. Also, Calabasas Tank has not been inspected for many years and likely needs recoating. Recoating is likely to be a major project, because the tank is integral to how the backbone system is operated.

Project 14: Improve Tank Water Quality

Justification: During the winter months, when demands are low, Morrison Tank remains full due to the hydraulic gradients in the system. This condition provides the possibility of nitrification problems in the tank. Other nitrification problems occur in the Saddlepeak Tank and Latigo Tank, mostly because these tanks are at the end of the system and are relatively large for the demands.

Description: Further investigation is needed to determine the extent of possible nitrification problems at storage tanks within the district. If nitrification tests do indicate a problem, chlorine boosters/mixers may be needed to promote circulation or maintain chlorine residuals in order to promote water quality. The chlorine boosters/mixers would consist of circulation pumps and on-site chlorine generation equipment housed in a small shed-like building.

Project 15: Move 36-inch Pipeline from Private Property

Justification: The current location of the inlet/outlet pipeline for the Las Virgenes Reservoir is located in an easement through the backyards of homes along Three Springs Drive and is buried quite deep. Leaks and breaks on this pipeline could result in significant damage to private property.

Project Description: It is recommended to construct a new pipeline of the same size in the public right-of-way. The existing pipeline would be filled with slurry and abandoned in place.

Project 16: Replace Smitty's Line

Justification: A 10-inch pipeline, known as "Smitty's Line," has experienced numerous failures in recent years. This pipeline raises reliability concerns for the small amount of customers that it serves.

Project Description: Replacement or rehabilitation of this pipeline should be based on continued assessment of facility conditions. One option may be slip lining.

9.2 Recycled Water System

9.2.1 Proposed Recycled Water System Extensions

Many different system extensions have been investigated in various studies, and the Tapia WRF Effluent Alternatives Study (LVMWD Report No. 2321.03) provides a good summary. The facilities proposed in this section derive from these studies as well as new concepts and analysis by the Boyle/Las Virgenes team.

Many of the proposed extensions are predicated on two projects that are already underway: (1) expansion of the RWPS-East Pump Station and (2) construction of a 24-inch pipeline that will parallel the existing 18-inch pipeline that delivers water from Tapia WRF to Reservoir 2, near District headquarters.

The Alternative Decker Canyon Project is predicated on development of Triangle Ranch.

The Woodland Hills GC extension is predicated on expansion of RWPS East (currently underway).

Some projects may require the completion of other projects. In particular, the Medea Valley extension and the Alternative Decker Canyon Project would likely follow a proposed development currently known as "Triangle Ranch." Similarly, the Woodland Hills and Calabasas City Center extensions are interdependent, and are predicated on completion of the RWPS-East Expansion Project that is currently underway, including new pipelines near the 005 Discharge Facility.

The proposed expansion projects in the western system are shown on **Plate 4A**, and eastern system expansion projects are shown on **Plate 4B**.

9.2.1.1 Project 17: Decker Canyon Project

The goal of the Decker Canyon Project is to provide recycled water service to the Malibu Golf Course and other smaller users along the pipeline path and vicinity. The Malibu Golf course is the largest potable water user in Las Virgenes, and has expressed a desire to become a recycled water customer. The customers to be served and the pipeline route were the subject of a 2001 Study (LVMWD Report No. 2163.00).

The proposed pipeline path would follow Westlake Boulevard and Decker Canyon Road, south from Potrero Road in Thousand Oaks to a new tank near Malibu Country Club. The Maximum Day Demand for this project is estimated to be 440 gpm. In order to deliver the water from Thousand Oaks, a high lift pump station (more than 700 feet) will be needed. Associated pipelines for this project are estimated to be on the order of 18,600 feet in length.

As discussed briefly in Section 8, this project serves two important purposes:

One of the Decker Projects may be needed to help relieve demands on the Seminole Zone of the potable water system.

- It makes greater use of recycled water, conserving potable water, and reducing creek discharges, and
- It relieves a large potable water demand from the Seminole Subsystem, where demands are approaching pipeline and pump station capacities; very expensive upgrades may be needed.

9.2.1.2 Project 17A: Alternative Decker Canyon Project

Plate 4A also shows an "Alternative Decker Canyon Project". The concept for this project developed during discussions with District staff regarding the future facilities needed to provide potable water to the Seminole Subsystem, although this alternative had been studied earlier as part of the "Malibu Golf Course Recycled Water Feasibility Study" (LVMWD Report No. 2163.00).

This alternative has the following other advantages:

The Alternative Decker Canyon Project became a focus due to concerns about constructing both a RW and PW main within Highway 23.

- It preserves room in Westlake Boulevard (Highway 23) for a possible future potable water pipe to serve the Seminole Zone.
- The project would also help to serve the Triangle Ranch development, Medea Valley, and other estate-sized parcels (developed and undeveloped) along the way in Triunfo and Lobo Canyons.
- The project could serve the Saddlerock Ranch, Calamigos Ranch, and two Los Angeles County Fire Camps (Camps Kirkpatrick and Miller). Estimates of recycled water demands for these customers are approximately 40 AF/yr for Saddlerock and Calamigos Ranch and 16 AF/yr for the fire camps.

This alternative project, when compared to the other alternative has the following disadvantages:

*Initial analysis shows that the **Alternative Decker Canyon Project** may have a lower cost per acre feet of water delivered; it would serve Medea Valley, Triangle Ranch, Saddlerock Rach, and Calamigos Ranch.*

- More than twice the length of pipeline is needed (10.4 miles vs. 3.4 miles). Although pipeline construction may be easier, because the road is less winding and the terrain is less rugged, the estimated cost would be considerably higher.
- A higher lift is required to get the water over the hill. The summit along this route is at elevation 2013, whereas the summit at the other route is at elevation 1875. At a cost of $0.10 per kW-hr, the added annual cost difference is about $6,000.

9.2.1.3 Project 18: Thousand Oaks Boulevard Extension

The customers associated with the Thousand Oaks Boulevard Extension Project include Westlake High Schools and Elementary School, Baxter, Russell Park and other commercial and residential users along Thousand Oaks Boulevard. The pipeline would run from Lindero Canyon Road westward to Westlake Elementary School. The total estimated Maximum Day Demand is 340 gpm. The total length of pipeline estimated at 17,000 feet and would include two laterals extending from the main extension.

9.2.1.4 Project 19: Calabasas City Center

The original extension for the Calabasas City Center suggested 8,200 feet of pipeline from Old Topanga Canyon Road north and east to Freedom Park near Mulholland Drive. This pipeline would serve Calabasas High School, the City Center median landscape, Alice C. Stelle Middle School and Freedom Park for a Maximum Day Demand of 30 gpm. LVMWD has suggested projecting this extension further into the San Fernando Valley to serve the Motion Picture Hospital and Woodland Hills Golf Course, as described below.

9.2.1.5 Project 20: Woodland Hills Golf Course Extension

This project stems from the Calabasas City Center Project to serve the Motion Picture Hospital, Louisville High School, Woodland Hills Golf Course and other commercial and residential users along a 30,000 foot long pipeline. The pipeline includes an extension from the end of the Calabasas City Center pipeline to Woodland Hills Golf Course, 1,800 feet of parallel pipeline to improve pressures, and a loop of 6,700 feet past the Motion Picture Hospital. This project would also require the Calabasas City Center Pipeline to be constructed and be sized to be a minimum of 12-inches in diameter. The Maximum Day Demand for this extension is estimated to be 430 gpm. The conceptual alignment following Mulholland Drive and Canoga Parkway is shown in **Plate 2B**. An additional parallel pipeline may be required in Park Sienna due to high velocity and headloss, as discussed in Section 8.

9.2.1.6 Project 21: Agoura Road Gap

The estimated Maximum Day Demand for the Agoura Road Gap Extension is 73 gpm. The customers that are included in this demand are future private and commercial users along Agoura Road between Ladyface Circle and Lewis Road. Pipeline for this project is estimated at 9,250 feet in length, and would connect to existing recycled water pipelines on both the east and west sides of the extension.

9.2.2 Supply and Transmission Upgrades

9.2.2.1 Project 22: RWPS – East Expansion

Construction of this project is currently underway, with completion expected by April of 2008. This project involves the upgrade of the pump station and also includes upgrades to pipelines at facilities at Reservoir 3 and the 005 Discharge Facility. The goal of the project is to upgrade the capacity of the pump station from about 1,950 gpm to about 4,500 gpm. The primary purpose is to allow the JPA to dispose of more water through the 005 Discharge Facility.

The RWPS Expansion Project can be readily justified on economic reasons, but also provides significant benefits to the operation of the recycled water system. First, it eliminates the need to add potable water at Cordillera Tank, enabling operators to make more effective use of the Morrison Air Gap/Pump Station facility, which is more energy efficient. Currently, water must be added at Cordillera during peak demands to make up for a pumping deficit that would otherwise occur in the Eastern System. Second, the project provides adequate supply to enable the Woodland Hills Golf Course Extension.

Modifications are needed to the potable water system, in order for the Morrison Facility to provide the flows needed for the western system extensions to Malibu GC and other major new customers.

9.2.2.2 Project 23: Morrison Air Gap Upgrades

The Morrison Air Gap/Pump Station Project, built in 2001, was designed with economy in mind. For this project, this meant that two pumps were installed, which could produce an ultimate facility capacity of approximately 2,000 gpm. However, it was understood that without extensive upgrades to the potable system supplying Morrison Tank, it would not be possible to operate both pumps.

The extent of modifications needed to the existing RWPS facility depends on how successful the District is in extending the system.

The air gap facility is currently fed with a 10-inch potable water pipeline. This 10-inch pipeline draws water through a pre-existing tee connection to the 18-inch diameter tank inlet/outlet pipeline. The size of this pipeline and how the connection was made was intended to minimize costs, recognizing the potable water system also needed to be upgraded, if the desired 2,000 gpm facility was to operate.

Modifications to this facility to achieve the 2,000 gpm capacity is recommended in this Master Plan so that the proposed system expansion projects in the Western System can be supplied, including the Decker Canyon and Thousand Oaks Boulevard Extension Projects. In concept, the upgrades would consist of:

- Replace the 10-inch supply pipeline with a 16-inch pipeline.
- Modify the actual air gap, to allow for higher flows.
- Replace the float-controlled globe valve (i.e., the "Cla-Valve") with a motor-controlled valve which has lower head-loss characteristics
- Provide electrical power and controls as needed.

9.2.2.3 Other RWPS Upgrades

Depending on how aggressively the District expands the RW system, additional upgrades to the Western and Eastern Recycled Water Pump Stations will be needed:

- Upgrade the existing 16-inch suction pipeline and surge tank to allow all pumps at both pump stations to operate simultaneously. This will provide greater operational flexibility.
- Install additional pumping capacity at RWPS West, if western demands surpass the current capacity

The open-air reservoirs are likely the greatest source of water quality deterioration in the RW system.

The use of recycled water in dual-plumbed commercial buildings may not be well received if the water has a green tinge.

9.2.2.4 Water Quality Concerns and Open Reservoirs

The quality[8] of the recycled water produced by Tapia WRF is reportedly very good, but it deteriorates within the distribution system. The greatest deterioration likely occurs in the District's open reservoirs, where sunlight helps dissipate chlorine and enables photosynthesis, which allows algae to grow. The algae, in turn, increase the chlorine demand, further depleting the chlorine. The algae are stimulated by the nutrients in the water, as well as the dust, bird droppings, and other contaminants that fall into the reservoir. Higher organisms then grow, fed by the algae.

9.2.3 Project 24: Reservoir 2 Replacement

This project includes a proposed 32 MG, covered, prestressed concrete tank replacement for Reservoir 2. The size of the tank was selected to make maximum use of the site. With a large tank, greater operational flexibility is provided, which will enable District operators to limit the purchase of potable water supplement and make greater use of recycled water.

To construct this tank, a temporary tank will be needed, to buffer the pumping of the Tapia Pump Station and the RWPS facilities. Although a more detailed analysis is warranted, it is believed that a small tank can be installed in the parking or laydown areas near the RWPS facility to serve this purpose. Construction is recommended for the winter months when system demands are low.

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[8] Note that the term "quality" in this discussion only refers to particles in the water, apparently entering the distribution system in the uncovered reservoirs. It does not refer to water quality requirements of DHS or Title 22.

9.2.4 Project 25: Reservoir 3 Replacement

A small tank is recommended for replacement Reservoir 3. This tank would preserve the surge protection and maintenance functions of the current reservoir.

The elevation of Reservoir 3 is below the hydraulic gradient when the RWPS-East is operating, which is most of the time. Only when the pump station is not operating, will water flow from the reservoir to customers in between the reservoir and Cordillera Tank (the New Millennium development). As a result, very little water flows into and out of the reservoir, making it largely ineffective for storage. The stagnation of water in the reservoir also exacerbates the water quality problems started in Reservoir 2. The reservoir itself might be considered a potential hazard, as houses have now been constructed nearby, and the site is relatively unsecured.

This reservoir serves two important functions:

- It enables the Cordillera Tank to be removed from service for scheduled maintenance (which is rarely needed).
- It provides surge protection for the pump station discharge piping (by preventing water column separation following a sudden power outage).

A partially buried, conventionally reinforced concrete tank, approximately 50,000 gallons in capacity, is proposed for replacing Reservoir 3.

9.3 Opinions of Cost

The following are approximate costs for the projects discussed earlier. The costs are based on 2007 dollars and appropriate escalation factors should be added when budgeting for future years.

The costs presented in this master plan are planning-level estimates and are based on costs for similar projects constructed in Southern California. Because these are planning level costs, often a more detailed analysis is needed for budgeting. The general level of accuracy for these project costs should be assumed to be +30 percent to -20%.

The opinions of probable cost provided in this report represent the opinion of Boyle Engineering as a design professional and are supplied for the general guidance of the District. These cost opinions may not account for all site-specific conditions that will affect actual costs.

Costs are in 2007 dollars. (For future reference, the current ENR[9] construction cost index for the Los Angeles area is 8871.)

9.3.1 Potable Water System Costs

9.3.1.1 Backbone System Improvement Costs

Table 9-2 shows the approximate costs of transmission and other improvements to the backbone of the Las Virgenes system.

Table 9-2
Potable Water System Backbone Improvement Costs

Project Name	Justification	Timing	Estimated Cost
5-MG Tank at Las Virgenes Reservoir	Needed to Make Full Use of Reservoir and helps defer pipeline improvements	5-10 years	$10,040,000
East West Pipeline: Calabasas Rd. to LV Road	Needed to prevent deterioration of system hydraulics. Needed as demand increases	2 years	$3,710,000
18-inch Pipeline: Cornell to Kanan	Needed to prevent deterioration of system hydraulics. Needed as demand increases	Approx. 5 years	$670,000
12-inch Pipeline: Kanan to T.O. Blvd.	Needed to prevent deterioration of system hydraulics. Needed as demand increases	Approx. 8 years	$3,010,000
Calleguas Connection	Aids in LV Reservoir refill and system reliability	2-5 years	$3,460,000
		Total Backbone Improvements	***$20,900,000***

[9] Engineering News Record

9.3.1.2 Existing Subsystem Capacity Improvement Costs

Table 9-3 shows the approximate costs of increasing the capacity of facilities in existing zones. The increase in capacity may be needed in response to increased zone demands caused by future development or an existing deficiency.

Table 9-3
Existing Potable Water Subsystem Capacity Improvements

Project Name	Justification	Timing	Estimated Cost
Mtn Gate PS Expansion	Adds needed capacity and improves reliability	2-3 years	$1,460,000
Adamor Pump Station	Dependent on demand growth in the zone (may not be needed)	5-15 years	$2,100,000
Replace Jed Smith Tank 2	Dependent on demand growth in the zone (may not be needed)	8-20 years	$1,820,000
Jed Smith PS Expansion	Dependent on demand growth in the zone (may not be needed)	10-25 years	$2,690,000
Warner PS Expansion	To meet demand growth in Calabasas and surrounding areas	2-3 years	$380,000
Mulwood PS Expansion	Needed to reduce pumping costs, increase reliability, and meet increasing demands	3-5 years	$1,930,000
Twin Lakes PS Expansion	Needed to supply approved developments	Now	$2,660,000
Woolsey Canyon Project	Needed to improve reliability of supply; may be required by Ventura County WWD 17	5-8 years	$4,380,000
3 Springs Improvements	Needed to relieve demands on Seminole PS	3-5 years	$3,020,000
Seminole Improvements	Needed to meet growing demands in the area	2+ years	$15,660,000
		Total Subsystem Capacity Improvements	***$36,100,000***

9.3.1.3 Reliability and Operations Improvement Costs

Table 9-4 shows approximate costs of projects intended to improve quality of service and reliability to Las Virgenes customers.

Table 9-4
Potable Water System Reliability and Operations Improvements

Project Name	Justification	Timing	Estimated Cost
LV-2 Pump Station Emergency Generator	Improves reliability, triggered by evaluation of SCE reliability	5 years	$290,000
LV-1 Connection to West Valley Feeder No. 2	Reduce pumping costs at (future) Woolsey PS and increase flows at LV-1 and Conduit PS	5-10 years	$2,410,000
1235 Zone Tanks Rehabilitation	Depends on assessment of facility conditions		$810,000
Improve Tank Water Quality	Needed to reduce nitrification at tanks and improve water quality	5-8 years	$810,000
Move 36" Reservoir Pipeline	Needed for safety and reliability	8-25 years	$1,540,000
Replace Smitty's Line	Depends on continued assessment of facility reliability	5-15 years	$1,350,000
		Total Reliability and Operations Improvements	**$7,200,000**

9.3.2 Recycled Water System Costs

9.3.2.1 System Extension Costs

Table 9-5 shows the approximate cost of proposed recycled water extension projects, per acre feet of water delivered annually.

Table 9-5
RW System Extension Costs

Project Name	Pipe Type	Length	Estimated Cost
Decker Canyon Project[1]	10"	18,600	$7,800,000
Thousand Oaks Blvd	4" to 10" PVC	17,000	$3,200,000
Woodland Hills G.C.	6" to 12" PVC	30,000	$7,600,000
Calabasas City Center	4" PVC	8,200	$1,700,000
Agoura Road Gap	8" PVC	9,250	$2,200,000
Triangle Ranch	4" to 10" PVC	10,000	$ N/A[2]
Medea Valley	10" PVC	11,000	$2,300,000
		Total System Extensions	***$24,500,000***

[1]This project also includes a pump station and tank, the costs of which are included in the table. The cost of the Decker Canyon Alternative is estimated at $11.9 million.
[2]Assumes cost of Triangle Ranch system, per WSDR No. 2257, to be funded by developer.

9.3.2.2 System Upgrade and Facility Replacement Costs

Table 9-6 estimates the costs for the system upgrade projects that have been described in this section. Each of these projects is considered essential to meeting the future demands presented in this report.

Table 9-6
RW System Upgrades and Facility Replacement Costs

Project Name	Estimate Cost
Tapia Effluent Pipeline	$3,600,000
RWPS – East Expansion (construction only*)	$1,900,000
Morrison Air Gap Upgrades	$ 250,000
RWPS Suction Pipeline Improvements	$ 250,000
RWPS West – Added pumping capacity	$ 250,000
Reservoir 2 Replacement	$18,900,000
Reservoir 3 Replacement	$400,000
Total Upgrades and Replacements	**$25,600,000**

* Engineering and permitting work have been completed, and are therefore considered sunk costs. RWPS East costs are based on bid price plus a small allowance (3%) for change orders.

9.4 Potable and Recycled Water Project Interrelationships

Several of the above projects for the potable and recycled water systems are directly interrelated, specifically the Decker Canyon Project is one component of a strategy for addressing problems in the potable water system's Seminole Zone, and the Morrison Supplemental facility, which is needed to minimize transmission upgrades in the recycled water system, will require upgrades to the potable water transmission system.

9.4.1 Seminole Subsystem Improvements and the Decker Canyon Project

Potable water demands in the Seminole Zone currently exceed the capacity of the pump station during high-demand periods. Because the ultimate demands in this zone are difficult to estimate, a multi-phased improvement program is recommended. The second phase of this improvement program is construction of the Decker Canyon Recycled Water Project, which would transfer a substantial portion of demands (the Malibu Golf Course, in particular) from the potable to the recycled water system. The advantages of constructing the Decker Canyon Project rather than constructing another potable water pump station, pipeline, and tank are: (1) greater beneficial use of recycled water, (2) reduced Tapia effluent disposal during the spring and fall, and (3) other sources of funding (i.e., grants) should be available for the recycled water project.

An *Alternative* Decker Canyon Project is also discussed in the Potable Water Master Plan. Although a significantly more costly project, the alternative project provides the following advantages: (1) it serves several other areas and the potential cost per acre-ft of water delivered may be lower and (2) it preserves space in Westlake Boulevard (State Highway 23) for a future potable water main that may be needed to serve the Seminole Zone.

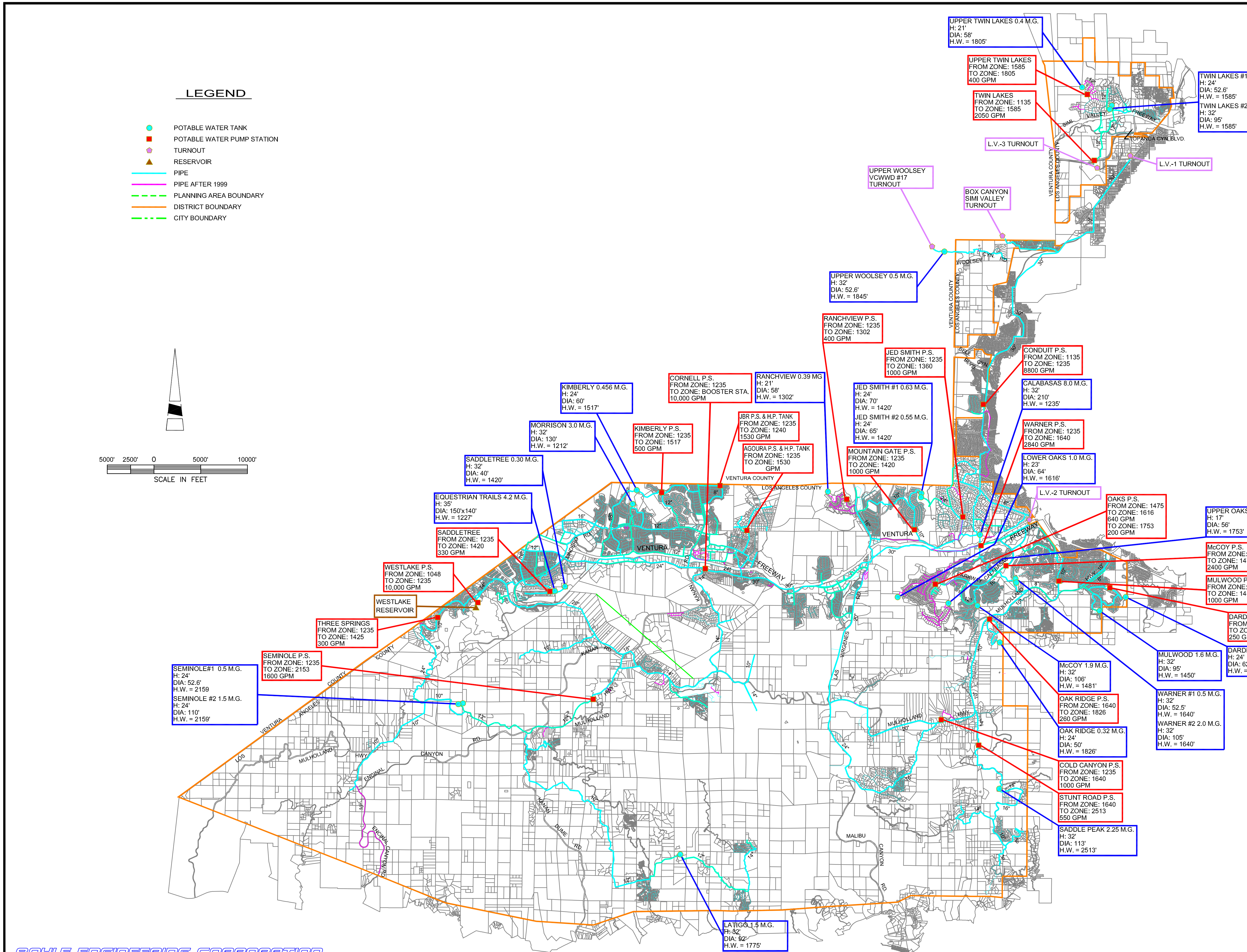
9.4.2 The Morrison Supplement Facility and Potable Water Transmission Upgrades

By constructing the Morrison Supplement Facility, the District elected to invest in transmission piping for the potable system rather than for both systems. Because recycled water demands during maximum day exceed supply from Tapia WRF, a substantial quantity of potable water supplemental water is needed. If a large portion of this supplemental water is added in the western part of the system, at the Morrison Facility in particular, additional upgrades to the recycled water transmission system can be avoided. However, use of the Morrison Supplement Facility also means that a greater burden in placed on the potable transmission system, requiring larger and perhaps more extensive upgrades than would otherwise have been necessary.

Currently, the supplemental facility can transfer approximately 1100 gpm from the potable system to the recycled system. The facility, however, was designed such that it could be upgraded to 2000 gpm. This increase in capacity will require modifications largely on the potable water side of the facility, particularly to transmission pipelines leading to Morrison Tank.

The analysis of the potable water backbone system has included this higher flow at the Morrison Supplement Facility. Expansion of the Morrison Supplement Facility is a necessity if the recycled system is extended to Malibu Golf Course and Baxter Pharmaceutical. Thus potable system upgrades may be needed relatively soon.

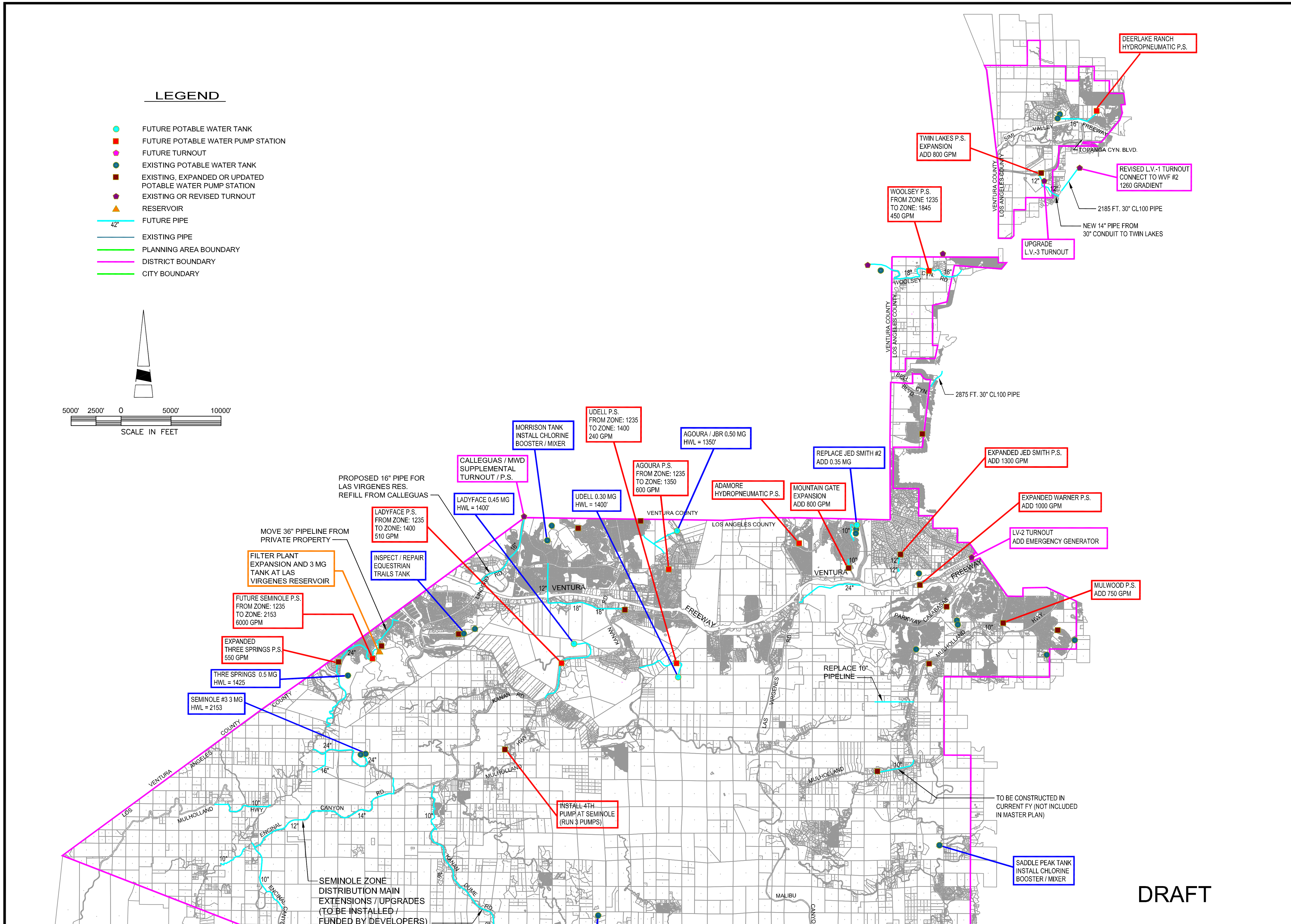
2007 Plates



LAS VIRGENES
MUNICIPAL WATER DISTRICT
INTEGRATED WATER MASTER PLAN

EXISTING POTABLE WATER SYSTEM

23016.00 | SEPT. 2007 | PLATE 1



LAS VIRGENES
MUNICIPAL WATER DISTRICT
INTEGRATED WATER MASTER PLAN

PROPOSED POTABLE WATER SYSTEM IMPROVEMENTS

23016.00 | SEPT. 2007 | PLATE 2

DWG: F:\LVMWD\23016.00 – Potable & Recycled Water MP Update\0001\CAD\Exhibits\Integrated\PLATE 2.dwg USER: eboardman
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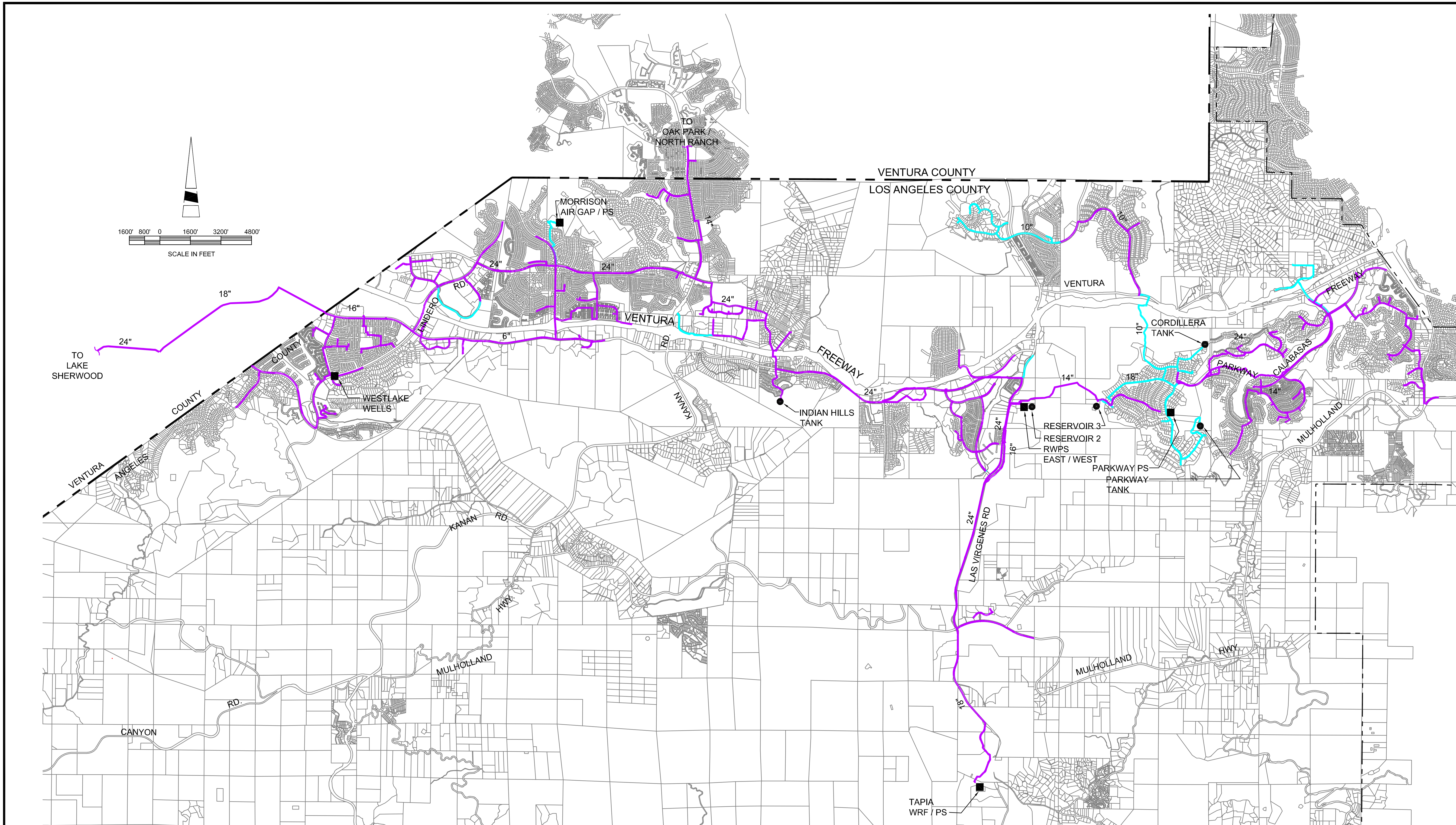

LEGEND

- RECYCLED WATER PIPE BEFORE 1999
- RECYCLED WATER PIPE 1999-2004
- TANK OR RESERVOIR
- PUMP STATION

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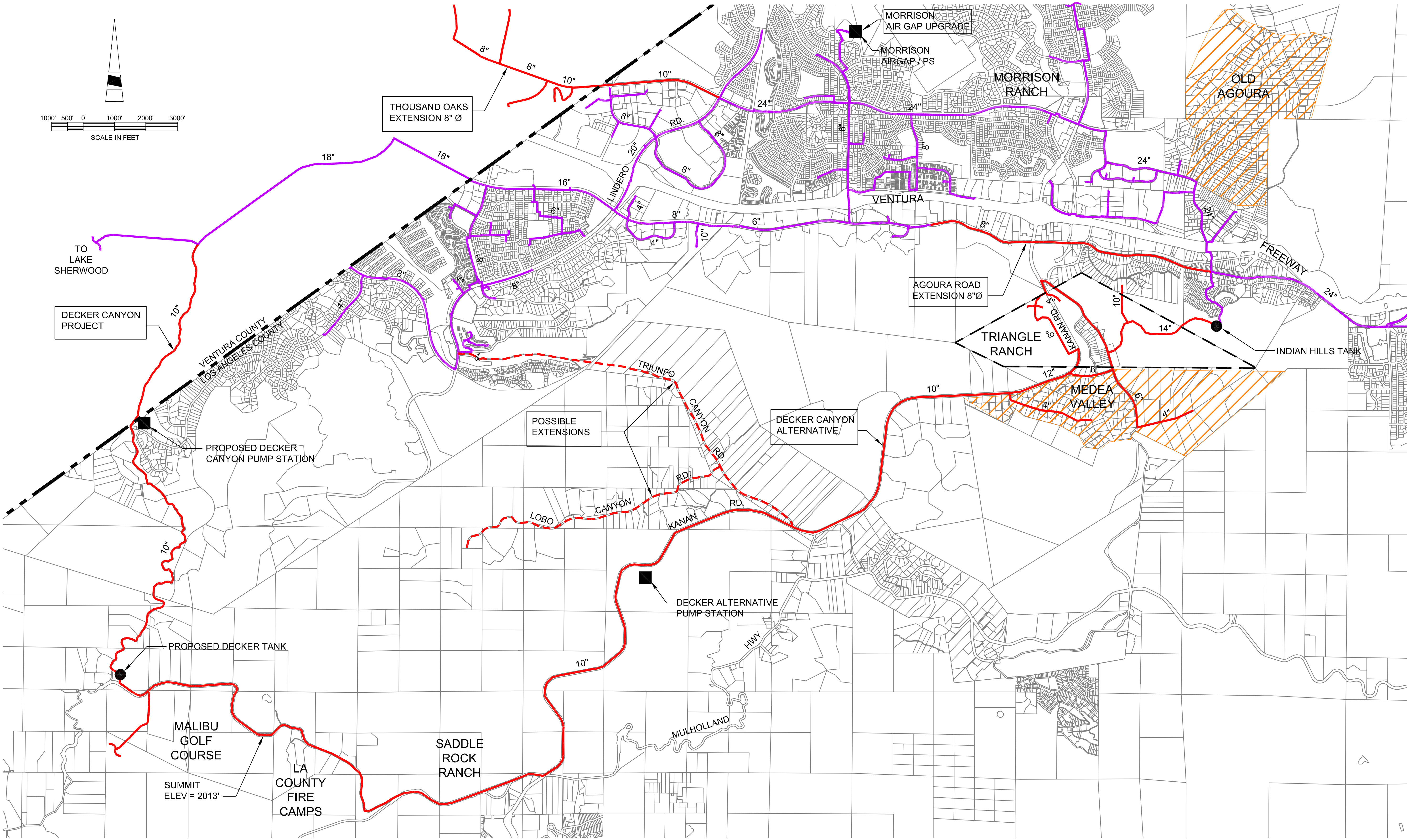
LAS VIRGENES
MUNICIPAL WATER DISTRICT
INTEGRATED WATER MASTER PLAN

EXISTING RW SYSTEM AND
CHANGES SINCE 1999

23016.00-0003	SEPT. 2007	PLATE 3



LEGEND

EXISTING RECYCLED WATER PIPE	POTENTIAL RESIDENTAL USE AREAS
PROPOSED EXTENSIONS	
TANK OR RESERVOIR	
PUMP STATION	

LAS VIRGENES
MUNICIPAL WATER DISTRICT
INTEGRATED WATER MASTER PLAN

PROPOSED EXPANSION
IN WESTERN RW SYSTEM

23016.00-0003 SEPT. 2007 PLATE 4A

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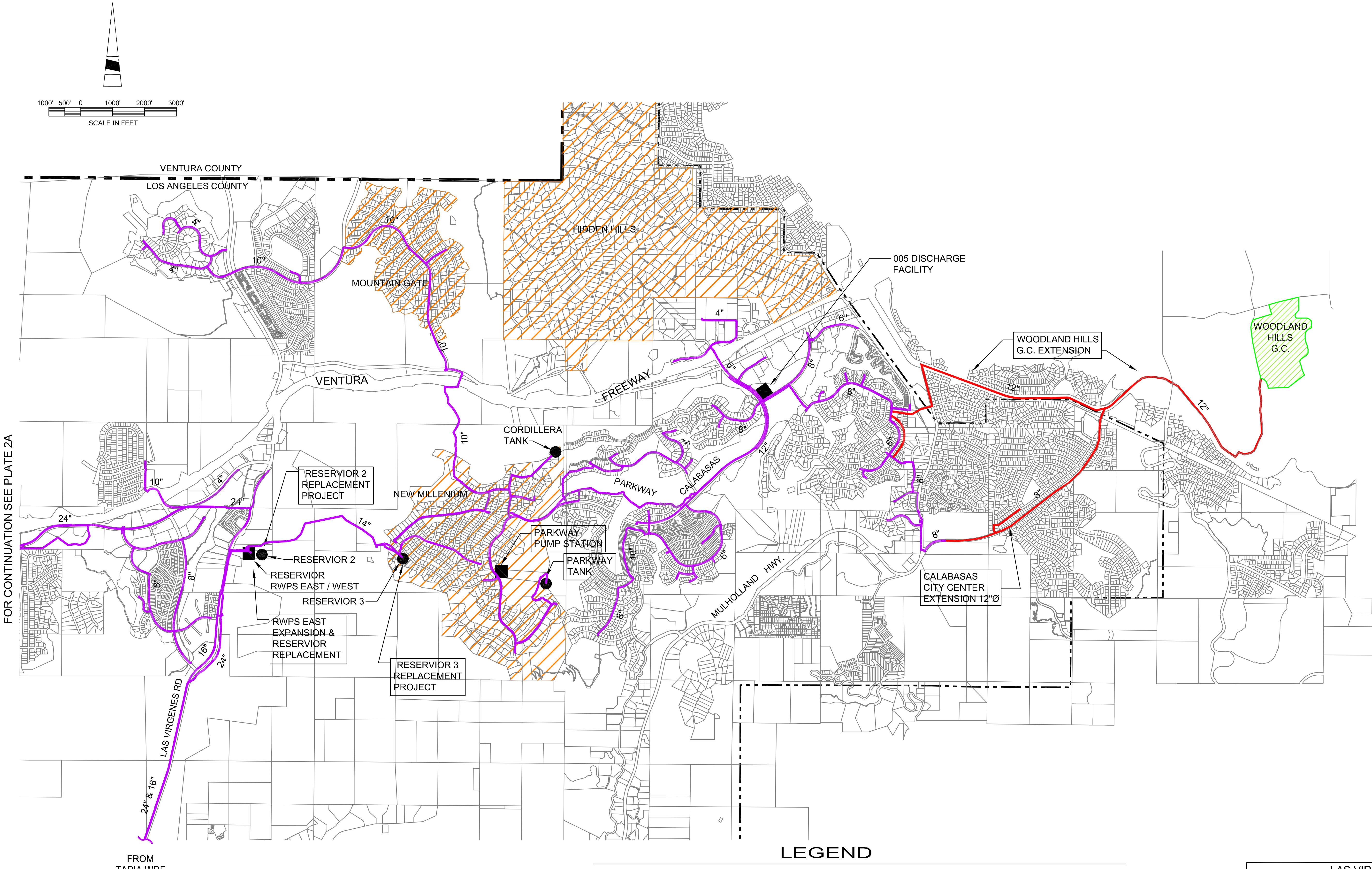

LEGEND

- EXISTING RECYCLED WATER PIPE
- PROPOSED EXTENSIONS
- TANK OR RESERVOIR
- PUMP STATION
- POTENTIAL RESIDENTAL USE AREAS

BOYLE ENGINEERING CORPORATION

LAS VIRGENES
MUNICIPAL WATER DISTRICT
INTEGRATED WATER MASTER PLAN

PROPOSED EXPANSION
IN EASTERN RW SYSTEM

23016.00-0003	SEPT. 2007	PLATE 4B