CITY OF LIVE OAK

City of Live Oak
Water Master Plan

December 2009

Prepared for
City of Live Oak

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Rocklin, CA 95765

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Executive Summary

This Master Plan has been prepared on behalf of the City of Live Oak (City). Projected water demands were developed for land uses within the City limits and within areas of the General Plan Sphere of Influence (SOI). Water supply improvements consisting of wells, treatment, distribution, storage and pumping facilities to provide capacity for future growth have been determined. The total cost of the improvements was then used to develop a revised water connection fee. A summary of the Water System Master Plan results and recommendations is included in this chapter.

ES.1 LAND USE AND WATER DEMANDS

Projections of future water demands within the service area were developed using land uses included in the City's draft General Plan. The water demand projections based on existing development as well as future growth within the General Plan SOI are summarized in Table ES-1.

Table ES-1
Projected System Water Demands [a]

Planning Boundary	Average Day, MGal/d (gpm)	Maximum Day, MGal/d (gpm)	Peak Hour, MG (gpm) [c]
Existing Development (including approved unbuilt demands) [b]	1.9 (1,310)	4.8 (3,320)	1.2 (4,960)
Build-out within City Limits (Infill)	2.5 (1,750)	6.4 (4,430)	1.6 (6,610)
Build-out of SOI	10.5 (7,300)	26.7 (18,540)	6.6 (27,670)

(a) Water demands based on annual average demand with peaking factors applied. Unaccounted water is included in the average annual demand, but the peaking factor is not applied to unaccounted water for calculating peak hour and maximum day.

(b) Demands are higher than observed metered demand data due to the inclusion of approved unbuilt demands. Approved unbuilt demands were included because system capacity has been committed to these parcels.

(c) Per Title 22, Chapter 15, Section 64552, R-13-03, peak hour needs be met for four hours.

ES.2 EXISTING SYSTEM

The existing distribution system is shown in Figure ES-1. Historically, water supply within the City has been from groundwater wells. The City's well network has been expanded over the years and consists of four wells and a distribution system. A 1.4 million gallon (Mgal) ground-level storage tank provides storage which supplements peak demands and maintains system pressure.

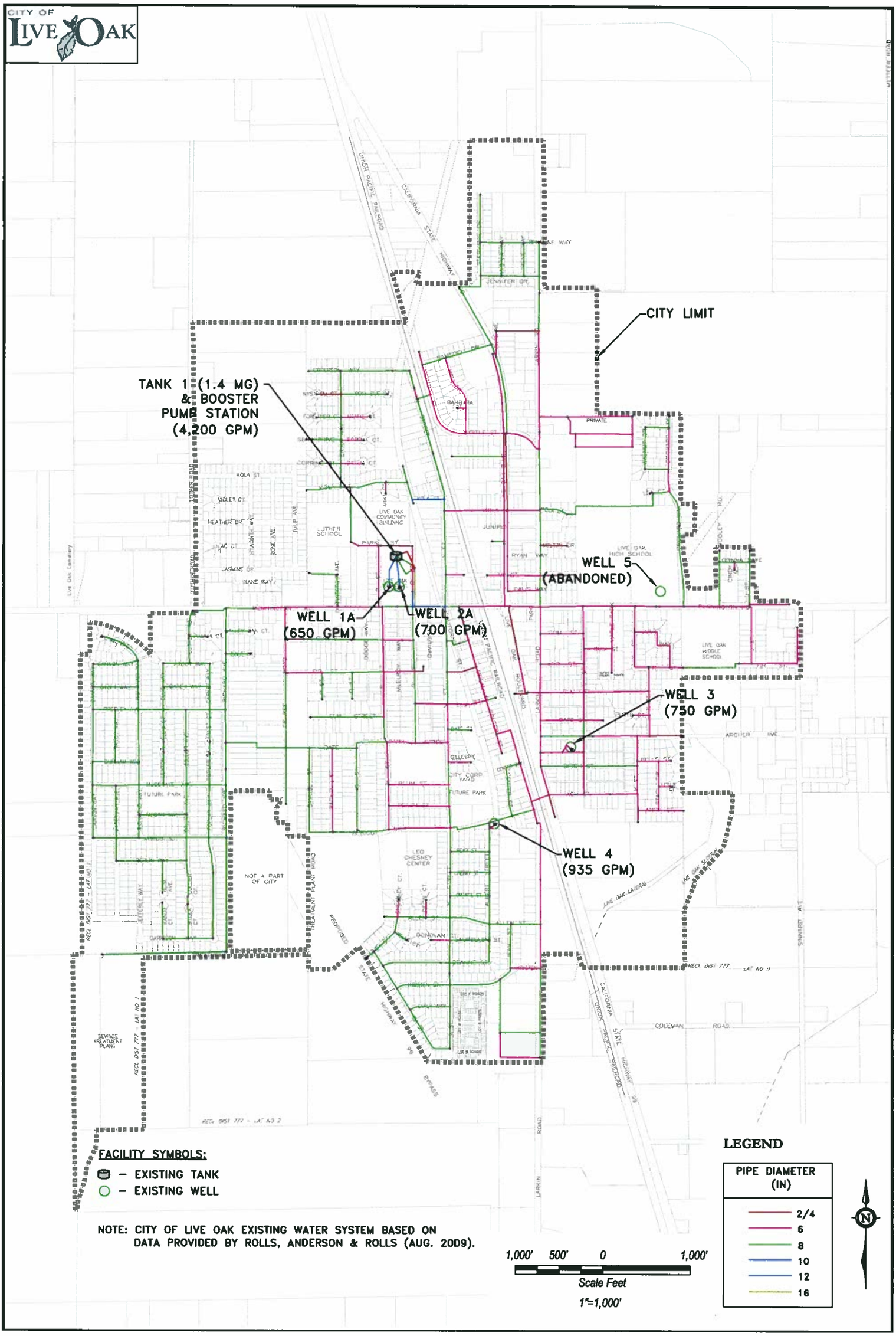

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FIGURE ES-1
EXISTING WATER SYSTEM

ES.2.1 EXISTING SYSTEM CAPACITY

The well capacity with all wells operating is approximately 4.4 MGD; however, the reliable well capacity is 3.0 MGD, which is based on the largest well being out of service. The available supply for maximum day demand (MDD) plus fire flow including the wells and flow from the tank is approximately 8.5 MGD. The tank provides 1.4 MGal of storage.

The average observed maximum day demand from 2006 through 2008 is approximately 3.4 MGD. Per California Waterworks standards (Title 22, Chapter 15, Section 64554, R-14-03), the system shall be capable of meeting MDD with the highest-capacity source off line. There is currently not reliable capacity for maximum day demand, because the supply must come from wells and not storage. With all wells in service, there is enough supply to meet current observed maximum day demand. The estimated committed maximum day demand, including demand from approved unbuilt units is 4.8 MGD.

Including supply from the wells and the tank through the booster pump station there is not enough supply to meet current fire flow requirements and maximum day demands. There is enough storage to meet peak hour demand for the required four hours. Hydraulic restrictions within the existing distribution system also limit the flow and pressure during the peak demand periods causing fire flow requirements not to be met.

ES.2.2 WATER QUALITY

All wells are sampled and tested for general mineral, general physical, bacteriological, inorganic, and organic chemical analyses in compliance with Title 22 requirements. Overall water quality from the wells meets the primary water quality criteria except for arsenic. After arsenic treatment was added to all wells, the wells have been in compliance with the arsenic Maximum Contaminant Level (MCL).

New wells will be required to meet the arsenic MCL. Based on historical water quality data from existing City wells, arsenic appears to be prevalent in the underlying groundwater. Treatment to remove the arsenic from the water will likely be necessary; however, treatment could potentially be avoided or reduced depending on the location and design of the well, but cannot be known until future wells are constructed.

Well 1 has exceeded the MCL for nitrate once. All wells have elevated nitrate levels, but are still below the MCL. Nitrate levels should be monitored closely in the City wells.

ES.3 RECOMMENDED IMPROVEMENTS

Water supply, treatment, storage, pumping and distribution improvements have been identified to meet future water demands and to correct existing deficiencies within the current system. A brief description and estimated costs are included below.

ES.3.1 EXISTING CONDITIONS

Remedies to meet current California Waterworks standards to provide reliable supply capacity include providing additional source capacity through construction of one new well with treatment. Additionally, replacing some smaller diameter pipelines would increase available fire flow capacity.

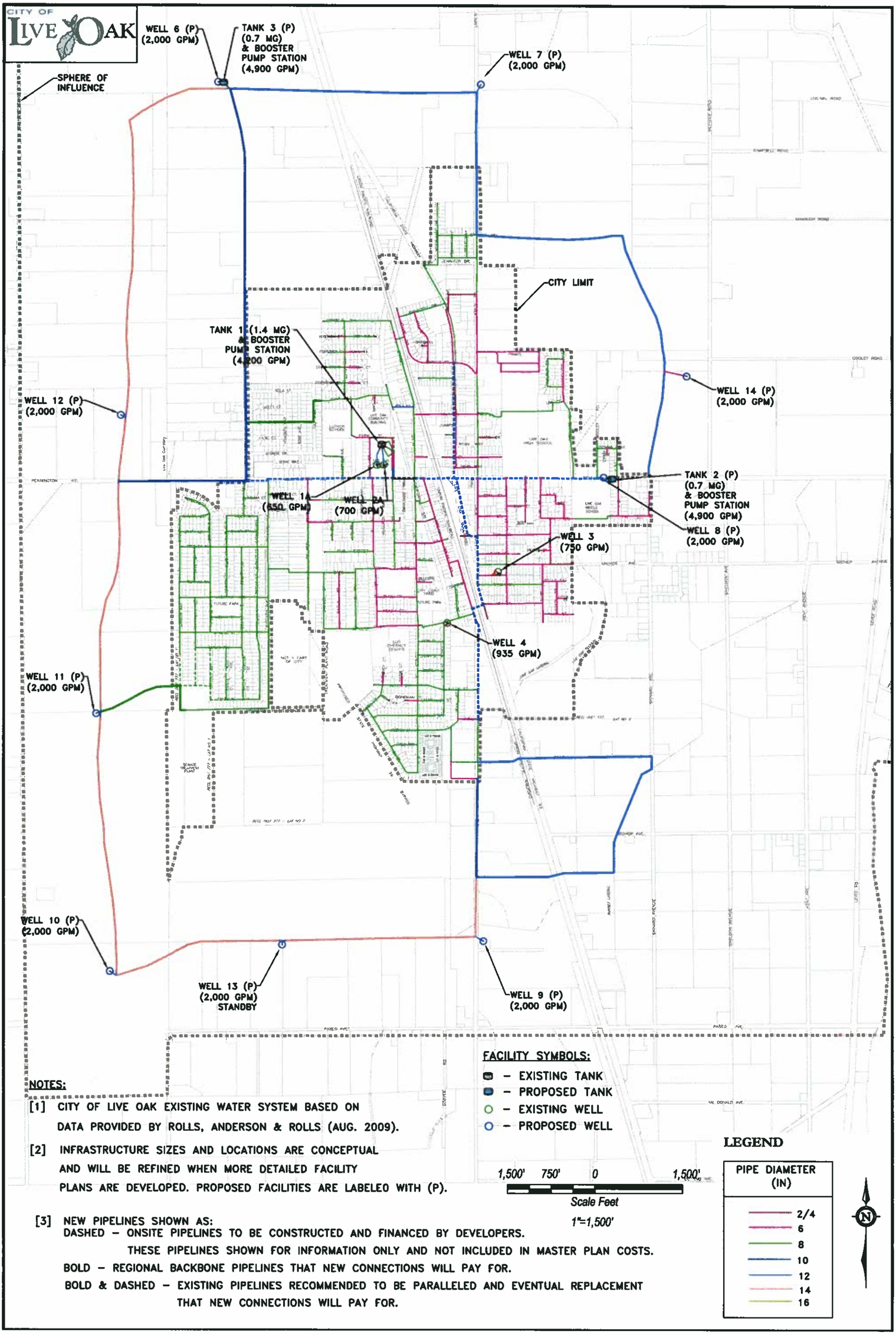
The estimated cost to address existing deficiencies is $5.8 million, and would be financed through rates. These costs include a 20-percent contingency and 20-percent allowance for engineering, administrative and legal fees.

ES.3.2 FUTURE CAPACITY

Improvements to increase system capacity to serve future growth include additional wells with treatment, extension of the distribution system, and additional storage and booster pump stations.

Future source capacity will be provided from new wells throughout the system. Future wells are expected to provide at least 2,000 gpm, but capacities could be higher. Eight new wells will be needed to serve future growth. If future wells have higher capacity, then fewer wells will be needed. New tank storage of 1.4 mgd and pumping facilities at 9,800 gpm will also be needed.

The estimated cost of the wells/treatment, distribution, pumping and storage is $49 million. The cost includes a 20-percent contingency and 20-percent allowance for administration, legal and engineering.



NOTES:

[1] CITY OF LIVE OAK EXISTING WATER SYSTEM BASED ON DATA PROVIDED BY ROLLS, ANDERSON & ROLLS (AUG. 2009).

[2] INFRASTRUCTURE SIZES AND LOCATIONS ARE CONCEPTUAL AND WILL BE REFINED WHEN MORE DETAILED FACILITY PLANS ARE DEVELOPED. PROPOSED FACILITIES ARE LABELED WITH (P).

[3] NEW PIPELINES SHOWN AS:
DASHED – ONSITE PIPELINES TO BE CONSTRUCTED AND FINANCED BY DEVELOPERS. THESE PIPELINES SHOWN FOR INFORMATION ONLY AND NOT INCLUDED IN MASTER PLAN COSTS.
BOLD – REGIONAL BACKBONE PIPELINES THAT NEW CONNECTIONS WILL PAY FOR.
BOLD & DASHED – EXISTING PIPELINES RECOMMENDED TO BE PARALLELED AND EVENTUAL REPLACEMENT THAT NEW CONNECTIONS WILL PAY FOR.

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FIGURE ES-2
BUILDOUT WATER SYSTEM WITH EXISTING DEFICIENCIES

ES.4 RECOMMENDED CONNECTION FEE

Facilities financed with connection fees include backbone facilities such as water supply, storage/pumping and distribution system improvements, which provide the necessary capacity to serve future growth. The cost of future expansions is assigned to future development and not existing residents.

Specific onsite improvements within specific developments that are needed to provide service to the development include distribution system piping, services, blow offs, fire flows in excess of normal requirements, and other appurtenances. Onsite improvements will be financed by the developer, constructed to City standards and deeded to the City. Onsite improvements are not included or credited to the connection fees.

The proposed water service fees for residential and non-residential water connections are included in Table ES-2. The fee includes three components:

1) **System Buy-In**: The system buy-in charge based on the City's existing water infrastructure assets. The analysis estimates the total cost of all of the assets at installation less accumulated depreciation.

2) **Future CIP Project Costs**: The future CIP project costs are based on the projected facility needs as identified in the Water Master Plan. These costs were split between existing and future users based on benefit. The costs allocated to future users are included.

3) **Meter Installation Costs**: The cost of installing and connecting a water meter to the City's distribution system is also included.

The proposed connection fees for residential and non-residential services under 1.5-inches are based on the anticipated demand and meter size. Connection fees for metered services larger than 1.5-inches should determined on a site-specific basis.

Table ES-2
Summary of Recommended Water Connection Fees

Service Type	Connection Fee
Residential Connection Fees	
Single Family	$7,398
Multi-Unit and Apartments	Site Specific
Non-Residential Connection Fee	
Meter Size, in	Connection Fee
5/8	n/a
3/4	$7,398
1	$11,370
Meter Size, in	Min. Connection Fee [(a)]
1.5	$21,399
2	$33,394
3	$72,543
4	$129,887
6	$283,290

(a) Recommended minimum connection fee; to be considered on site-specific conditions.

Chapter 1

Introduction

1.1 BACKGROUND

The City of Live Oak, California (City), located in the Sacramento Valley, is a community of approximately 8,500 people located along Highway 99 in a relatively urban environment. The City is located a short distance from major population centers and has the potential to significantly grow in the future. At this time the City is in the process of updating and/or generating new utility master plans for the anticipated future growth and to help identify any water infrastructure improvements required to address any current deficiencies. As a part of this process, this Water Master Plan has been developed to help identify existing water system issues and recommend system improvements to meet future growth within the planning area.

The existing City water supply and distribution system serves approximately 2,210 water service connections consisting of a mixture of schools, parks, residential, commercial, and industrial land uses. The existing City water supply system consists of four groundwater production wells, one ground level storage tank and booster pump station, and a network of distribution mains ranging in size from 4 inches to 16 inches in diameter. Two of the groundwater production wells pump directly into the 1.4 million gallon storage tank that provides suction water for the booster pump station. The combination of the booster pump station, and the two wells that directly supply water to the distribution system, maintain required system pressures.

This Water Master Plan was developed to provide the City with a recommended improvement plan that includes water supply wells, distribution pipelines, storage and pumping facilities to provide municipal water service for both the existing and identified future growth. The development of the Water Master Plan includes:

- Development of a logical expansion plan that can be phased based on growth projections and land uses.
- Projection of future water demands based on historical water use data and approved land uses as defined by City planning staff.
- Identify water infrastructure needs including supply, storage, pumping and distribution facilities.
- Develop opinion of probable costs for improvements that can be used in the establishment of appropriate water connection fees.
- Develop water connection fee recommendations.

1.2 SCOPE

The scope of work for this Water Master Plan consisted of the following major elements:

- Review of reports, drawings, land use and zoning maps, and other relevant drawings made available to ECO:LOGIC.
- Evaluate existing facilities, particularly in regards to how they will be impacted by future facilities.
- Develop future water demand estimates using planned land uses defined by the City's planning staff and existing water consumption data per existing land use type.
- Prepare a hydraulic water model of the water supply and distribution system using WaterGEMS Version 8i computer software.
- Evaluate existing water supply and distribution system. Identify existing system deficiencies and recommended infrastructure improvements to mitigate deficiencies.
- Evaluate planning level water infrastructure improvements to meet identified future water demands. These recommended improvements include supply, storage and distribution improvements to meet identified future growth and to maintain compliance with current applicable regulations including current California Waterworks Standards.
- Develop a planning level opinion of probable costs for identified infrastructure improvements and provide a recommended phasing for the improvements.
- Recommend an appropriate water connection fee schedule for future development identified within the current planning boundary.

1.3 ACKNOWLEDGMENTS

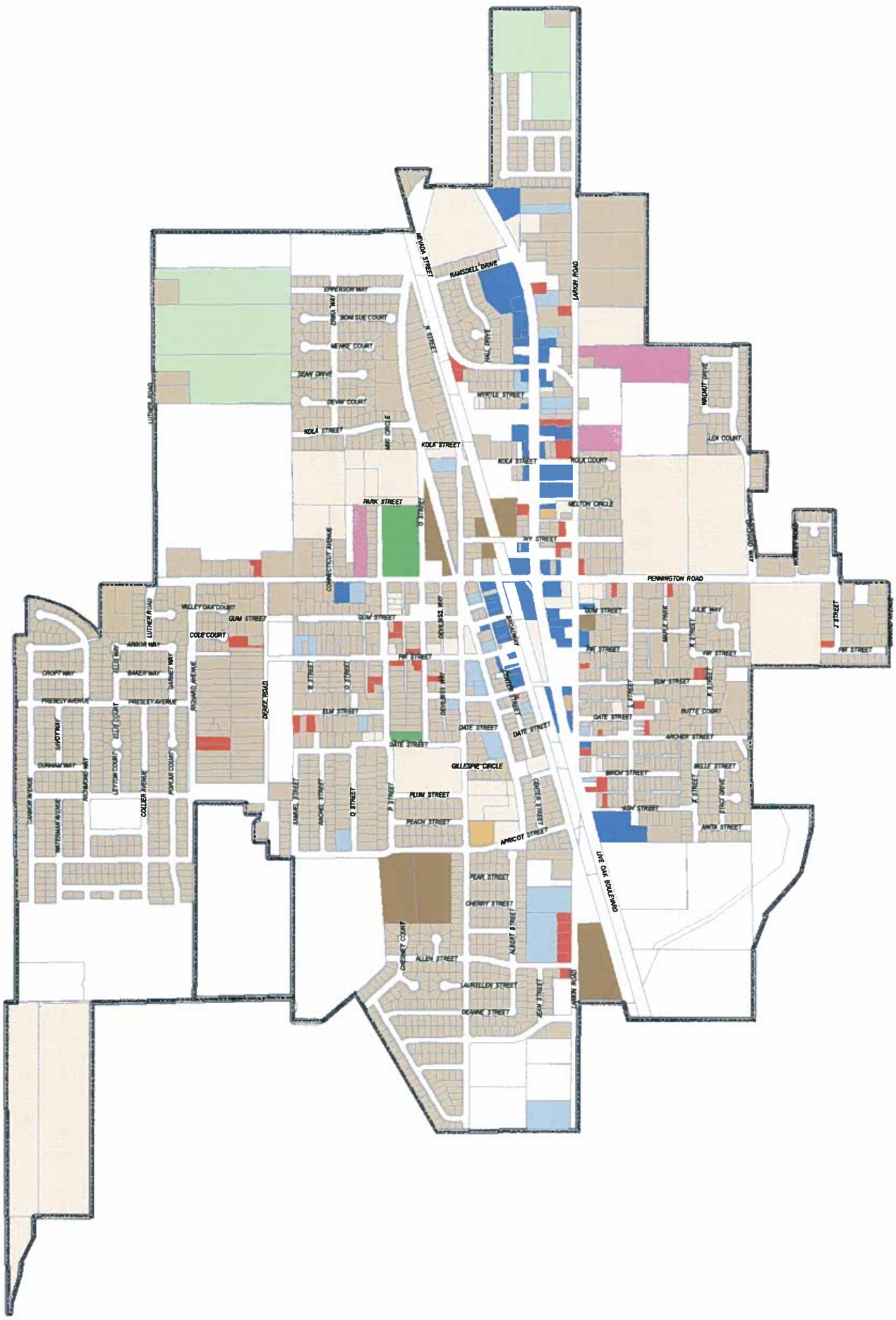
The cooperation, input, and support received from Aaron Orr and his staff at the City of Live Oak is gratefully acknowledged.

Chapter 2

Land Use and Water Demand

Estimates of future water demands, including the magnitude and location, are necessary to plan future water system improvements. Water demands are developed in this Chapter using existing and build-out land uses provided by the general plan consultant, EDAW AECOM, in April 2009. EDAW AECOM developed land uses for the City's draft General Plan. Projected water demands were estimated for land uses within the City limits and the City Sphere of Influence (SOI), as defined in the "Live Oak Preferred Alternative (New Growth Area)" figure prepared by EDAW AECOM in 2009, and shown on Figures 2-1 and 2-2. These areas are planned to be served by the City's water system. Areas outside the City SOI but still within the City's General Plan boundary are areas reserved for future growth, but have not been included in the current water infrastructure planning evaluation per direction by EDAW AECOM. Build-out within the SOI is estimated to occur by 2030 per EDAW AECOM direction and is part of the assumptions used in the development of the connection fee schedule. Actual growth will depend on a number of factors out of the City's control including the economy, interest by the development community to construct in the area, planned land use changes, and public support/opposition of new projects.

Unit water demand factors for each land use category were developed using meter data. These unit water demand factors were used in coordination with the land use, to project water demands.



LEGEND

- CITY LIMITS
- CIVIC / PUBLIC
- COMMERCIAL
- DUPLEX
- INDUSTRIAL
- MOBILE HOME
- MULTI-FAMILY RESIDENTIAL
- OFFICE
- PARK
- RURAL RESIDENTIAL
- SINGLE FAMILY RESIDENTIAL
- NO WATER SERVICE

NOTES:

1. EXISTING LAND USES BASED ON GIS SHAPEFILE FROM EDAW APRIL 2009.
2. ONLY PARCELS PROVIDED WATER SERVICE ARE INCLUDED.

500 0 500 1,000

Scale Feet

N

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FIGURE 2-1
WATER MASTER PLAN EXISTING LAND USE

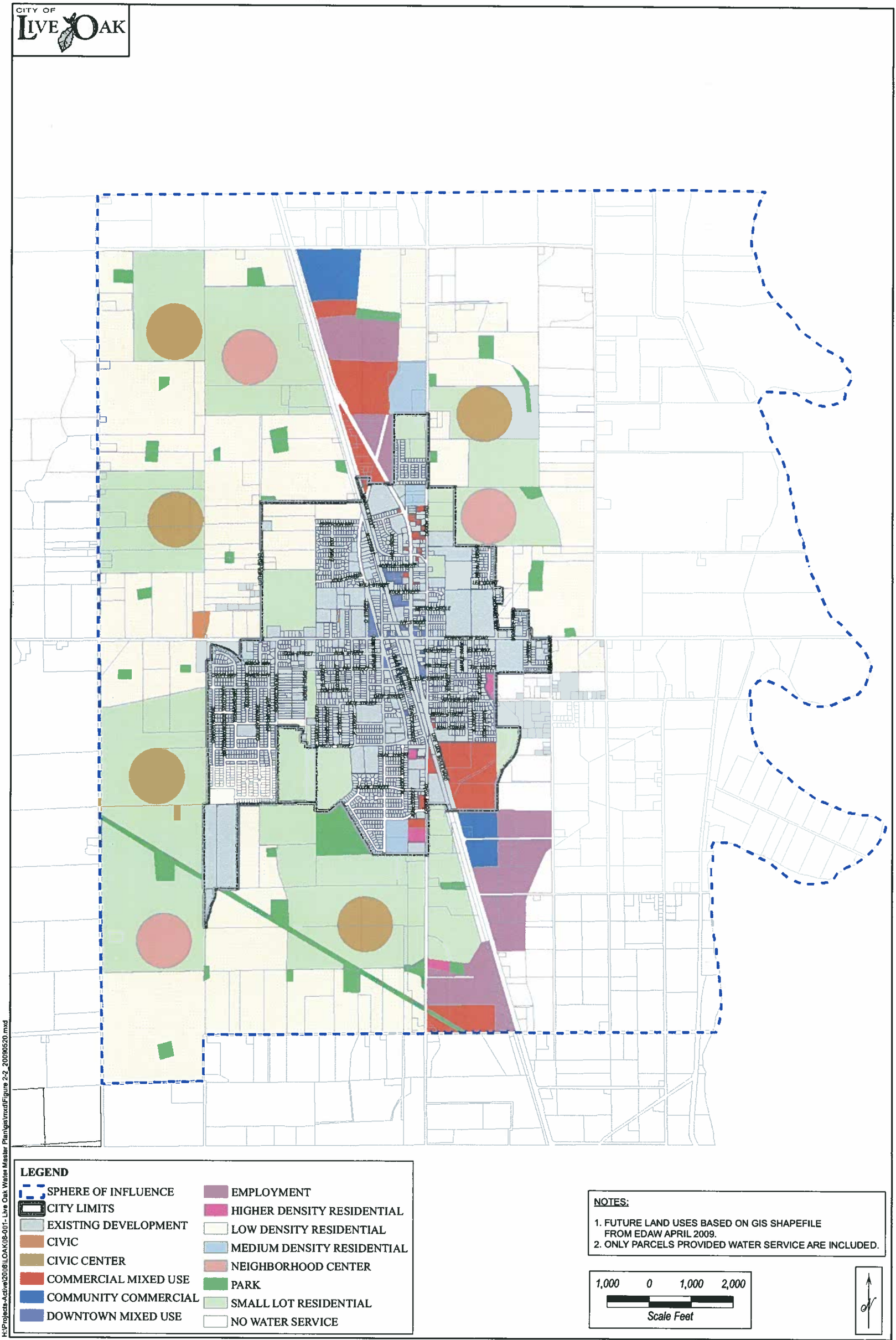

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FIGURE 2-2
FUTURE WATER MASTER PLAN LAND USE

2.1 LAND USE

Existing and proposed land use types were provided by EDAW AECOM in April 2009. Residential land uses are defined in terms of dwelling units (DU), which represent one equivalent residential unit. Nonresidential land uses are defined in terms of acreages.

A summary of the existing and build-out land uses are listed in Tables 2-1 and 2-2, respectively. The land use designations differ between existing and build-out land uses.

Table 2-1
Existing Land Use Designations [a]

User	Existing DU/ acre	Notes
Civic/ Public	-	Represents public facility uses including schools.
Commercial	-	Represents commercial land uses including hotels, restaurants, convenience stores, veterinary hospitals, day care centers, banks, laundromats, carwashes, and churches.
Duplex	2	The duplex units were assigned as two units per parcel.
Industrial	-	Represents the range of industrial uses.
Mobile Home	13	
Multi Family Residential	8.1	
Office		Represents professional land uses including office buildings, medical offices, and dental offices.
Park	-	Represents public park lands. These are currently irrigated with potable water.
Rural Residential	1	The rural residential units were assigned as one unit per parcel.
Single Family Residential	1	The single family residential units were assigned as one unit per parcel to better match the known number of units.

(a) Dwelling unit densities and development percentage from EDAW AECOM in April 2009.

Table 2-2
Build-out Land Use Designations [a]

User	Developable Area Factor (i.e. not roads), % [b]	Future DU/acre	Notes
Civic	80%	-	Represents public facility uses including schools.
Civic Center	80%	-	Civic Center consists of the following land uses: HDR 22% Park 19% School 19% Civic 6% MDR 33% The per acre water demand factor includes water demand for all these land uses on an area weighted basis.
Commercial Mixed Use	80%	-	▪ Mixed use is defined as 10 percent medium density residential and 90 percent commercial. ▪ The demand factor includes water demand for both medium density residential and commercial.
Community Commercial	80%	-	Represents commercial land uses including hotels, restaurants, convenience stores, veterinary hospitals, day care centers, banks, laundromats, carwashes, and churches.
Downtown Mixed Use	80%	-	▪ Mixed use is defined as 10 percent medium density residential and 90 percent commercial. ▪ The demand factor includes water demand for both medium density residential and commercial.
Employment	80%	-	Represents professional land uses including office buildings, medical offices, and dental offices.
Higher Density Residential (HDR)	-	19.45	
Low Density Residential		3.89	
Medium Density Residential (MDR)	-	10	

User	Developable Area Factor (i.e. not roads), % [b]	Future DU/acre	Notes
Neighborhood Center	80%	-	Neighborhood Center consists of the following land uses: Commercial Mixed Use 22% HDR 36% Park 6% Civic 3% MDR 32% The per acre water demand factor includes water demand for all these land uses on an area weighted basis.
Park	80%	-	Represents public park lands. These are currently irrigated with potable water.
Single Family Residential	-	5.83	
Small Lot Residential	-	6.8	
Reserve	Reserve areas will not be served with potable water.		
Preserve	Preserve areas will not be served with potable water.		
Railroad	Railroad areas will not be served with potable water.		
Orchard	Orchard areas will not be served with potable water.		
Open Land	Open land areas will not be served with potable water as there is no landscaping.		
Buffer	Buffer areas will not be served with potable water.		

(a) Dwelling unit densities and development percentage from EDAW AECOM in April 2009. Build-out land uses are different than existing land uses.

(b) Factor represents the percentage of buildable land after land for roads and other infrastructure has been removed.

A summary of land uses within the existing city limits and sphere of influence are listed in the following sections.

2.1.1 EXISTING LAND USE

Existing land uses were provided in a GIS shapefile by EDAW AECOM in April 2009. Existing land use of parcels with municipal water service is shown on the previous Figure 2-1. The acreage associated with each land use is listed in Table 2-3.

Table 2-3
Existing Land Use, acres [a]

Land Use	Total Acres [b]
Civic/ Public	t35
Commercial	23
Duplex	10
Industrial	20
Mobile Home	11
Multi Family Residential	19
Office	2
Park	6
Rural Residential	47
Single Family Residential	423
Total	696

(a) Based on existing land use GIS shapefile provided in April 2009 by EDAW AECOM. Only land uses with water demands are listed.

(b) Acreage has not been reduced to account for streets and infrastructure.

2.1.2 BUILD-OUT LAND USE

Projected land uses with municipal service within the sphere of influence are shown in the previous Figure 2-2. The acreage associated with each land use is listed in Table 2-4. Future water demands were estimated using the acreages associated with each land use category, and represent the potential maximum water demand if properties are fully developed per the planned land uses. Per the General Plan, certain parcels were assumed to redevelop. The following land uses were generally assumed to be redeveloped: open land, orchards, rural residential, and single family residential areas on large lots that could develop to a higher density.

Table 2-4
Build-out Land Use Without Existing Land Use, acres [a], [b]

Land Use	Acres [c]
Civic	14
Civic Center	157
Commercial Mixed Use	138
Community Commercial	59
Downtown Mixed Use	13
Employment	189
Higher Density Residential	11
Low Density Residential	1,523
Medium Density Residential	51
Neighborhood Center	94
Park	130
Small Lot Residential	1182
Total	3,561

(a) Based on the land use GIS shapefile provided by EDAW AECOM in April 2009. Only land uses with water demands are listed.

(b) Includes redeveloped existing land use, but does not include existing land use.

(c) Acreage has not been reduced to account for streets and infrastructure.

2.2 WATER PRODUCTION

Existing water use in the City of Live Oak was estimated utilizing historical water data from the existing water supply wells. The production data represents the amount of water pumped into the distribution system but not necessarily the actual customer demand. The majority of that water is sold and accounted for; however, a portion of the water is unaccounted for and "lost". Review of the production data is useful to establish water demands, peaking factors, and quantify the water system losses.

2.2.1 SUMMARY OF WATER PRODUCTION

Daily meter readings are collected at all of the well sites and provide a means to calculate maximum day, monthly, and annual production. Water production data provided by the City from 2005 through 2008 was used for the current evaluation.

Annual Production

The combined annual water production from all of the municipal supply wells is summarized in Table 2-5. Annual water production varies depending on average temperatures, seasonal rainfall, and the amount of distribution system flushing the City performs. As can be noted in the data there is a significant reduction in water production between 2005 and 2006. Between the

summer of 2005 and 2006 water meters were installed and are probably the cause for a significant decrease in water usage between the two years.

Table 2-5
Annual Water Production

Year	Water Production, MG
2005	535.7
2006	488.0
2007	460.0
2008	469.1

Monthly water production from 2004 through 2008 is shown in Figure 2-3. As expected, production increased during the warmer summer months as a result of irrigation. The highest monthly usage occurred in 2005, which corresponds to the elevated annual production in that year.

Given that there is a significant change in water usage from 2005 to 2006, most likely due to the installation of water meters at all services, years following the installation of the water meters will be more applicable to the development of future demands. It is standard to continue to see reductions in water used for several years after the installation of meters and billing system based on actual usage. Therefore, 2005 water production data was not used in the development of future demands and peaking factors.

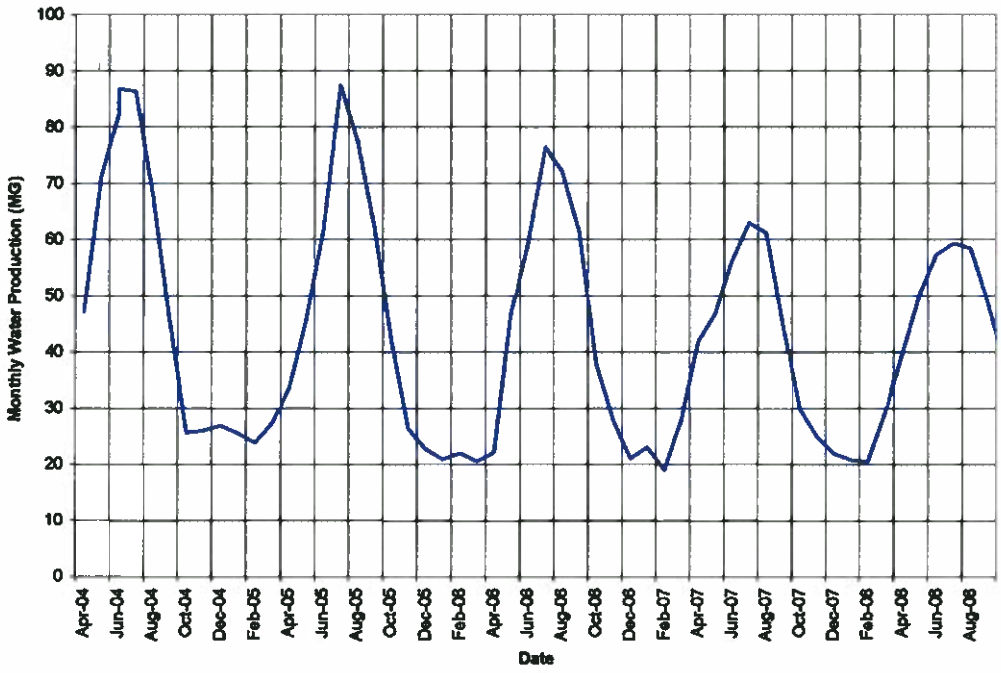


Figure 2-3
Monthly Water Production Data

Unaccounted Water

Unaccounted water is considered water that is produced and distributed but is not sold or metered. Sources of unaccounted water include leaks, slow meters, theft, fire protection, and unmetered water used for flushing dead ends within the system to maintain water quality.

Table 2-6 includes a summary of historical production and metered data that became available after 2006 with the installation of service meters. As shown in Table 2-6, the unaccounted water ranges from 0 to 4.2 percent. It is not clear why there is such a variation in the City's unaccounted water. The City replaced many of its old pipes with new pipes in 2008, which could explain the sudden reduction in unaccounted water in 2008 or it may be attributed to implementation of a new billing system associated with the newly installed service meters.

Table 2-6
Unaccounted Water

Year	Production, Mgal	Metered Water, Mgal	Unaccounted Water, %
2007	460	440.9	4.2
2008	469.1	469.2	0.0

Unaccounted water in the build-out model was assumed to be 4 percent based on 2007 data. Unaccounted water stays relatively constant throughout the year and therefore was added on top of projected demands without a peaking factor applied. Unaccounted water is included in the water demand projections discussed later in this Chapter.

Maximum Day (MDD) Water Production

Production data is typically the only daily data available because individual service meters are read on a monthly or bi-monthly basis and daily usage data is not available. In the case of Live Oak, the maximum day production would be expected to occur during the summer months, as is the case with most systems. The maximum day demand for 2008 occurred in August at 2.54 MGal/d. Maximum day to annual average productions were compared to calculate ratios as listed in Table 2-7. The average of the ratios was used as a peaking factor in projecting future maximum day demand.

Table 2-7
Maximum Day Water Production [(a)]

Month	Maximum Day Water Production, MGal/d	Annual Average Production, MGal/d	Ratio of Maximum Day to Annual Average Production
2006	4.9	1.3	3.9
2007	2.7	1.2	2.2
2008	2.5	1.4	1.8
Average	3.4	1.3	2.6

(a) Based on water production data.

The ratio of the maximum day to average daily demand of 2.6 was used for the purposes of this study, which is higher than normally observed. For example, the state of California recommends a peaking factor of 2.25 if no daily water production data is available, and a value of 2.5 is commonly used for planning purposes. The higher observed peak could be the result of the high temperatures typical of the Sacramento Valley where peak irrigation demands can spike during periods of extremely warm temperatures. The ratio of 3.9 in 2006 could have been the result of when the meters were read or some other abnormal event. This ratio is significantly larger than what would be expected. The industrial user does not cause an abnormal increase in maximum day demands which would skew the peaking factor.

Diurnal Production Pattern

Water demands in the City of Live Oak, as in all municipal water systems, are not constant throughout the day but vary with minimum flows typically occurring late at night with peaks occurring in the morning and again in the late afternoon/evening.

The peak demand periods typically occur between 5:00 a.m. to 9:00 a.m. when customers are waking, showering, and irrigating outside landscaping. A second peak demand period typically occurs between 4:00 p.m. and 8:00 p.m. when customers are arriving home after work, preparing meals and performing outside chores such as landscaping. Peaks can be reduced by encouraging irrigation during non-peak hours.

Well production meters are read daily, but no hourly data are available. Per California Waterworks standards (Title 22, Chapter 15, Section 64554, R-14-03) a peaking factor of 1.5 was multiplied by the maximum day demand to determine the peak hour demand. This peaking factor was applied to all demands within the City regardless of whether the water demand was residential or commercial.

Summary of Peaking Factors

The peaking factors developed in this section and used for predicting future water demands are summarized in Table 2-8.

Table 2-8
Water Use Peaking Factors

	Peaking Factor
Maximum Day/ Annual Average [a]	2.6
Peak Hour/Maximum Day [b]	1.5

(a) Based on well production data.
(b) Based on typical values for published data.

Water Production Per Capita

The water production per capita for 2006 through 2008 is shown in Table 2-9. Per capita production ranged from 151 to 179 gpd per person with an average of 162 gpd per person.

Table 2-9
Annual Water Production Per Capita

Year	Population [a]	Annual Water Production, MG	GPD per capita
2006	7,466	488.0	179
2007	8,119	460.0	155
2008	8,539	469.1	151
Average	-	-	162

(a) Based on population estimates from *State of California, Department of Finance, E-4 Population Estimates for Cities, Counties and the State, 2001-2008, with 2000 Benchmark. Sacramento, California, May 2008.*

2.3 WATER DEMAND FACTORS

Infrastructure improvements to the water supply system necessary to serve future growth depend on the magnitude and location of the water demands. For master planning purposes, it is convenient to express the water demands for each type of development in the form of a water demand factor on a gallon per acre per day basis or gallon per day per dwelling unit.

The City of Live Oak's water system is metered and billing records include the type of service, and consumptive use information. The meter data from February 2006 through August 2008 were used to develop existing water demand factors by use type. The resulting annual average water demand factors are listed in Table 2-10.

Table 2-10
Annual Average Unit Water Demand Factors

Water User	Annual Average Water Demand Factor (gpd per acre or DU)
Existing	
Civic/ Public [a]	2,800 gpd/acre
Commercial [a]	1,500 gpd/acre
Duplex [a]	500 gpd/DU
Industrial [a]	2,000 gpd/acre
Mobile Home [a]	300 gpd/DU
Multi Family Residential [a]	300 gpd/DU
Office [a]	1,500 gpd/acre
Park [a]	3,000 gpd/acre
Single Family Residential [a]	500 gpd/DU
Rural Residential/ Ranch [a]	525 gpd/DU
Build-out	
Civic [a]	2,800 gpd/acre
Civic Center	3,912 gpd/acre
Commercial Mixed Use [a]	1,390 gpd/acre
Community Commercial [a]	1,500 gpd/acre
Downtown Mixed Use [a]	1,390 gpd/acre
Employment [a]	1,500 gpd/acre
Higher Density Residential [a]	300 gpd/DU
Low Density Residential [a]	500 gpd/DU
Medium Density Residential [a]	400 gpd/DU
Neighborhood Center	3,982 gpd/acre
Park [a]	3,000 gpd/acre
Small Lot Residential [a]	500 gpd/DU

(a) Calculated from meter data.

2.4 PROJECTED WATER DEMANDS

The land uses combined with the unit water demand and peaking factors were used to estimate future water demands under build-out conditions. The build-out demand condition is used to evaluate water supply improvements necessary to satisfy these demands and comply with applicable minimum design criteria and regulations regarding the provision of municipal water service.

The resulting water demand projections based on existing development and future build-out are listed in Table 2-11.

Table 2-11
Projected System Water Demands [a]

Planning Boundary	Average Day, MGal/d (gpm)	Maximum Day, MGal/d (gpm)	Peak Hour, MG (gpm) [c]
Existing Development (including approved unbuilt demands) [b]	1.9 (1,310)	4.8 (3,320)	1.2 (4,960)
Build-out within City Limits (Infill)	2.5 (1,750)	6.4 (4,430)	1.6 (6,610)
Build-out of SOI	10.5 (7,300)	26.7 (18,540)	6.6 (27,670)

(a) Water demands based on annual average demand with peaking factors applied. Unaccounted water is included in the average annual demand, but the peaking factor is not applied to unaccounted water for calculating peak hour and maximum day.

(b) Demands are higher than observed metered demand data due to the inclusion of approved unbuilt demands. Approved unbuilt demands were included because system capacity has been committed to these parcels.

(c) Per Title 22, Chapter 15, Section 64552, R-13-03, peak hour needs be met for four hours.

Chapter 4 includes a discussion of the water supply improvements to increase system capacity to serve future growth and the associated demands based on the projected water demands discussed in this section.

2.4.1 Phasing of Growth

The draft General Plan build-out land use was used to project water use in 2030. The water use was assumed to grow linearly from 2008 until 2030. The projected water demand by year is listed in Table 2-12.

Table 2-12
Phasing of Projected System Water Demands[a]

Year	Average Day, gpm	Maximum Day Demand, gpm	Peak Hour Demand, gpm [b]
2008	1,310	3,320	4,960
2010	1,850	4,700	7,020
2015	1,910	4,840	9,090
2020	3,270	8,300	11,150
2025	4,630	11,760	13,220
2030	7,300	18,540	27,670

(a) Water use was assumed to grow linearly from 2008 until 2030.

(b) Per Title 22, Chapter 15, Section 64552, R-13-03, peak hour needs be met for four hours.

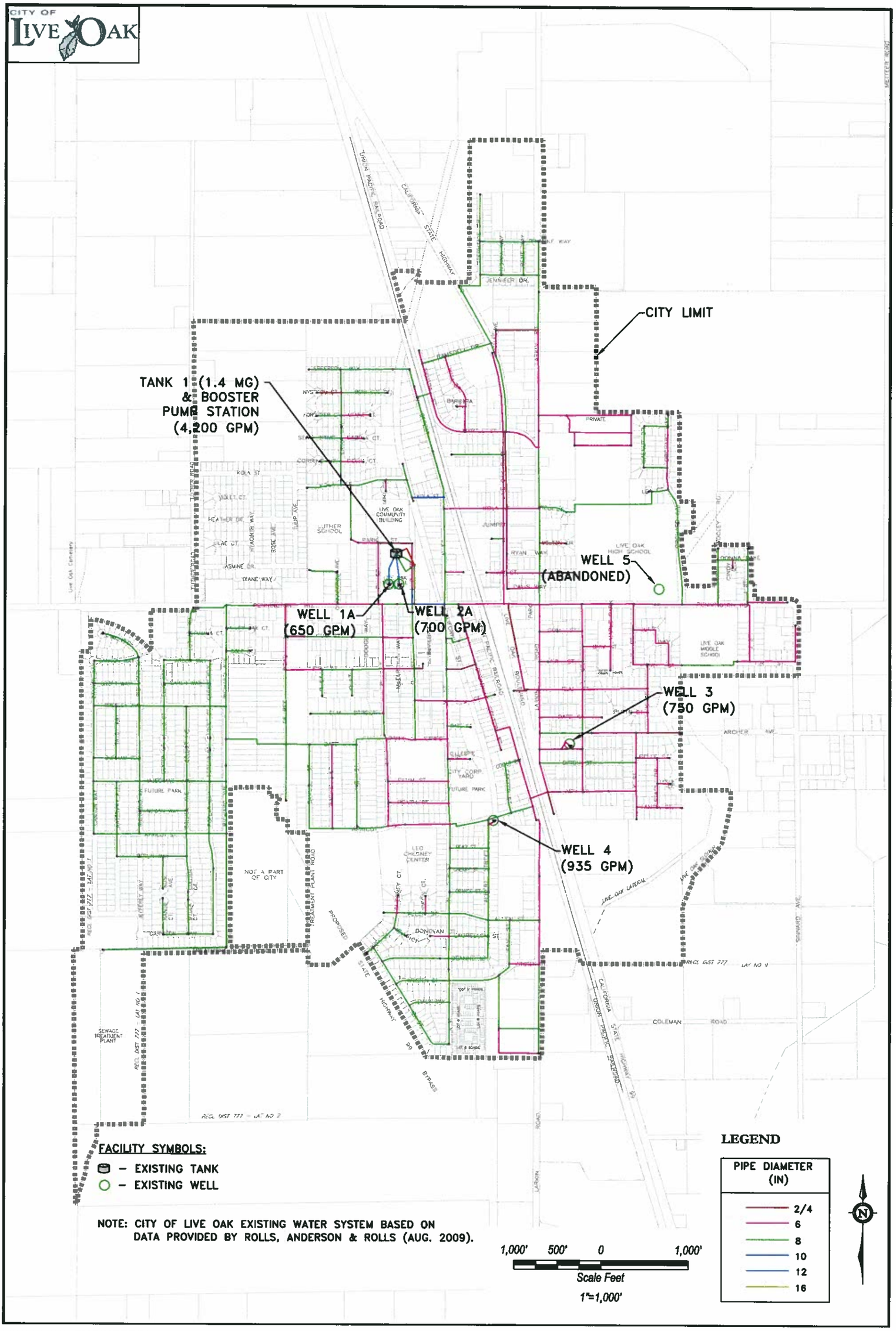
Chapter 3

Existing Facilities

A description of the existing water facilities, including wells, storage, pumping equipment and distribution system are included in this Chapter, along with a discussion regarding the water quality from each well. An assessment of the groundwater aquifer, and long-term ability of the aquifer to provide a reliable water supply is included in the City's Urban Water Management Plan (UWMP).

3.1 EXISTING WELL SYSTEM

Water supply for domestic water service and fire flow is supplied from four wells owned and operated by the City. The wells are numbered 1 through 4 and their locations are shown on Figure 3-1. Table 3-1 describes each well. Data included in the table is based on City input, and data excerpted from the Department of Health Service's Live Oak well information data sheet. Information includes details about the well construction, capacity and mechanical equipment. This information was not independently verified in the field and is strictly based upon information provided by others.



ECO:LOGIC ENGINEERING
CITY OF LIVE OAK - WATER MASTER PLAN

FIGURE 3-1
EXISTING WATER SYSTEM

Table 3-1
Well System Summary

Name		Well 1A	Well 2A
State Well Number (DWFOB)		17N/03E-32N01 M	17N/03E-32N02M
Location (Cross Streets, etc.)		Corporation Yard on O Street	Corporation Yard on O Street
Date Drilled		(1951)	(1951)
Neighborhood		Park	Park
Lot Size		5 Acres	5 Acres
Distance To: Sewer		75 feet to lateral	80 feet to lateral
	Sewage Disposal	Sewered area	Sewered area
	Abandoned Well	None	None
	Property Line	>100 feet	>150 feet
Housing:	**Type**	Block Building	None
	Condition	Good	NA
	Floor (material)	Concrete	Concrete
	Drainage	Good	Good
Well Depth		236'-7" (292 feet)	393 feet (210 feet)
Drillers Report on File (yes or no)		(Yes)	(Yes)
Casing:	**Depth(s)**	67'-5" (66 feet)	(66 feet)
	Diameter(s)	10-inch (13-inch)	10-inch (13-inch)
	Material	(Steel)	(Steel)
	Height above Floor	(8-inch)	(17-inch)
	Distance to perforations	120 feet (None)	110 feet (None)
	Surface Sealed (yes or no)	Yes (Yes)	Yes (Yes)
	Gravel Pack (yes or no)	Yes (No)	Yes (No)
	Annular Seal (depth)	(None)	(None)
Impervious Strata:	**Thickness**	3 feet	6 feet
	Depth to	43 feet	46 feet
Water Levels:	**Static**	11 feet (17.3 feet)	(11 feet)
	Pumping	(51.5 feet)	(37.2 feet)
Pump:	**Make**		
	Type	Submersible	Submersible
	Production (gpm)	1000-1100 GPM	1000 - 1100 gpm
	Depth to Bowls	Unknown	Unknown
	Lubrication	Water	Water
	Power	Electric motor 50 – HP	Electric motor 50 – HP
	Auxiliary Power	Yes	Yes
	Control	Tank Level	Tank Level
	Discharge Location	Above ground	Above ground
	Discharge To	Sand separator/Storage Tank	Sand separator/Storage Tank
Pump to Waste (yes or no)		Yes	Yes

Name		Well 3	Well 4
State Well Number (DWFOB)		16N/03E-05G01 M	16N/03E-05G03 M
Location (Cross Streets, etc.)		Archer St. side of alley	Apricot Street
Date Drilled		1960	1983
Neighborhood		Residential	Residential
Lot Size		21' X 50'	Triangle 75" X 270 feet
Distance To: Sewer		>100 feet	53 feet
	Sewage Disposal	Sewered area	Sewered area
	Abandoned Well	25' from original well	None
	Property Line	10 feet	16 feet
Housing:	**Type**	None	None
	Condition	NA	NA
	Floor (material)	Concrete	Concrete
	Drainage	Good	Good
Well Depth		426 feet	426 feet
Drillers Report on File (yes or no)		Yes	
Casing:	**Depth(s)**	370 feet	426 feet
	Diameter(s)	13-inch	16-inch
	Material	Steel	Steel
	Height above Floor	12-inches	12 inches
	Distance to perforations	100 feet	390 feet to highest
	Surface Sealed (yes or no)	Yes	Yes
	Gravel Pack (yes or no)	No	No
	Annular Seal (depth)	None	58 feet
Impervious Strata:	**Thickness**	45 feet	36 feet
	Depth to	47 feet	53 feet
Water Levels:	**Static**	11 feet	11 feet
	Pumping	1500 gpm	Not Available
Pump:	**Make**	Byron-Jackson	Jacuzzi
	Type	Vertical turbine	Vertical turbine
	Production (gpm)	1,100 gpm	1,340 gpm
	Depth to Bowls	Unknown	Unknown
	Lubrication	Water	Water
	Power	Electric motor 60 – HP	Electric motor 75 – HP
	Auxiliary Power	No	Yes
	Control	Pressure	Pressure
	Discharge Location	Above ground	Above ground
	Discharge To	Sand separator	Sand separator/ Hydropnuematic tank
Pump to Waste (yes or no)		Yes	Yes

Wells 1A and 2A have been modified due to the addition of a 1.4 million gallon water storage tank and booster pump station. The modifications included new pumps and reconstruction of the wells. The California Department of Health Services (DHS) considers the modifications to be of such an extent that the wells are now considered new water supply sources, and have been renamed as Wells 1A and 2A, and are referred as such throughout this document.

The City relies on Wells 1A, 2A and 3 for the majority of the water produced within the City. Wells 1A and 2A discharge directly to the storage tank. Water is then pumped from the tank into the distribution system using the booster pump station. Wells 1A and 2A are constant speed pumps and are controlled by the adjustable level set-point in the storage tank. Wells 1A and 2A are hard wired to run together when called on. The booster pump station is controlled by the SCADA.

Well 3 discharges directly into the distribution system and uses a variable frequency drive (VFD) control system. When in operation the VFD is programmed to maintain a discharge pressure of 61 pounds per square inch (psi). If the booster pump station is on, Well 3 is programmed to be on.

Well 4 discharges into a 5,000 gallon (nominal) hydropneumatic tank. Well 4 supplements the supply as needed and turns on at 40 psi and turns off at 55 psi. Well 4 historically has had problems with taste and odor. After arsenic treatment was installed, there has been no more complaints about taste and odor.

Well 5 has been decommissioned due to arsenic and nitrate. The City has no intentions of activating the well in the future.

Testing of Well 6 after drilling indicated nitrate concentrations above the allowed maximum concentration level, and the well was never developed as a water supply and was capped. The City has no intentions of activating the well in the future.

All of the well sites are secured with fences and locked gates. There are fiberglass buildings installed at all well sites to provide climate control for ferric chloride and better protection from vandalism. There is adequate space available for routine operation and maintenance except at Well 3. Well 3 is located on a small parcel in an alley behind some homes.

All of the wells and booster pump station, except Well 3, are equipped with diesel powered back-up generators with automatic transfer switches.

The treatment filters described in Section 3.5.7 limit the well production. Adding more filters would increase production capacity. However, there is no more room at Well 3 for filters. The maximum productivity even with different pumps and motors would be 1,000 gpm for Wells 3 and 4, 2,000 gpm for the combination of Wells 1A and 2A.

3.1.1 CHLORINE FACILITIES

The City actively maintains a chlorine residual of one ppm within the distribution system. The City's groundwater supply is not considered to be under the influence of surface water, and chlorination is not required; however, system operators maintain a residual as a preventative measure against potential bacteriological contamination of the distribution system. Chlorine facilities at all of the sites consist of a chemical feed peristaltic pump and a storage tank.

The chlorine feed rate is flow based at a Well 3, and the tank. The chlorine dose at Well 4 is controlled manually, and requires very little adjustment because the pump discharges at a constant rate. Chemical feed pumps are started when the well pump starts and turnoff when the well pump shuts down. At the Well 1A/2A site, chlorine is injected at the well head, between the pump discharge and the storage tank. If needed, chlorine can also be added at the tank outlet.

Liquid sodium hypochlorite at 12.5 percent-concentration is purchased from a local supplier and stored in double contained tanks at each site. A 300-gallon tank is provided at Wells 1A and 2A, and 115-gallon tanks are provided at the other well sites. The tanks provided about one or two weeks of storage depending on demands, and is considered appropriate to minimize the degradation of the chlorine solution as it ages.

Typically, the chlorine residual within the distribution system is maintained between about 0.5 to 1 mg/L, which is well below the maximum disinfectant residual limit for chlorine of 4 mg/L, and is considered good practice.

3.1.2 ADDITIONAL APPURTENANCES

Each of the wells has a flow meter to totalize the water produced from each well. Meters are read daily. Magnetic flow meters record and totalize flows from Wells 1A and 2A. Wells 3 and 4 each have turbine type flow meters. Hours of pump runtime are also recorded.

Each of the wells is controlled locally, and there is no centralized operating or monitoring system. The supervisory, control and data acquisition system (SCADA) only monitors the water level in the storage tank.

All of the wells are equipped with a sand separator on the discharge to prevent any sand from entering the distribution system.

3.2 STORAGE AND PUMPING FACILITIES

The City's 1.4 million gallon storage tank is located at the City's Corporation yard site, and is adjacent to wells 1A and 2A. The storage tank was constructed in 2005 to satisfy water demands resulting from development occurring in the western portion of the City. The tank and booster pump station provide additional pumping capacity and emergency storage for the entire system.

The booster pump station has a reliable capacity of 4,200 gallons per minute. There are four pumps, three duty and one stand-by, with a capacity of 1,400 gpm each. The pumps operate on a variable frequency drive (VFD), which vary the speed of the pump(s) to maintain the distribution system pressure at the set-point, which is typically around 60 psi.

The pump suction is directly from the storage tank. Table 3-2 summarizes the specifications of the storage tank booster pump station.

Table 3-2
1.4 Million Gallon Storage Tank Booster Pump Station Specifications

Item	Number or Name
Pump	American Marsh Pumps
Number	4 (3 duty 1 standby)
Type	horizontal split-case
RPM	1750
Capacity (each pump)	1400 gpm @ 145 feet
Control	Cutler Hammer VFD
Motor	TECO Westinghouse Motor Comp
Size	75 hp
RPM	1770
Voltage	230/450
Phase	3
Standby Power	Diesel Generator
Manufacturer	Kohler
Size	445 KW
Control	Automatic

Wells 1A and 2A pump directly to the tank. Typically the wells alternate between fill cycles. The pumps in Well 1A or 2A start and stop when the water level in the storage tank reaches the appropriate set-points. Typically the pump will start when the water level drops to 20-feet, and stop when the water level reaches 25 feet.

Operations staff report that during the summer, when water demands are high, the water level in the tank typically drops during the day, because demands exceed the capacity of Wells 1A and 2A. The tank level recovers during the night when demands decrease.

3.3 DISTRIBUTION SYSTEM

A summary of the distribution system by pipeline diameter and pipeline material is shown in Tables 3-3 and 3-4. Distribution system data were provided in August 2009 by Rolls, Anderson & Rolls. Pipeline diameters range from two to sixteen inches in diameter. The system is constructed from various types of materials including asbestos cement, ductile iron and PVC piping. For the most part, the distribution system is looped, which provides flexibility, improves water quality, and reduces pressure losses throughout the system. City staff flush mains approximately 24 hours per month.

In the last few years, the City has replaced many of the smaller diameter asbestos concrete, cast iron and galvanized steel pipes. The intent of the pipe replacement was to reduce the water system losses that may be caused by the older pipelines and to increase system conveyance capacity.

Table 3-3
Distribution System Summary by Pipeline Diameter [a]

Diameter (inch)	Length (miles)	Percentage
2	0.7	2
4	0.3	1
6	11.1	37
8	18.1	60
10	0.1	0
12	0.0	0
16	0.1	0
Total	30.4	100

(a) Data provided August 2009 by Rolls, Anderson & Rolls. Private distribution system pipes were included.

Table 3-4
Distribution System Summary by Pipeline Material [a]

Material	Length (miles)	Percentage
Asbestos Cement	8.4	28
Ductile Iron	6.4	21
PVC	14.5	48
Other	1.1	4
Total	30.4	100

(a) Data provided August 2009 by Rolls, Anderson & Rolls. Private distribution system pipes were included.

There is not a formal leak detection program, but the leaks are repaired when found or reported.

3.3.1 SERVICES

There are approximately 2,210 service connections that all have meters. The City design standards require copper or polyethylene service lines between the main and the meter. Overall City staff report that the services are in good shape.

3.3.2 HYDRANTS

There are approximately 267 fire hydrants throughout the City. The City exercises its valves and fire hydrants as required to perform periodic flushing of the mains. The City does not have a comprehensive program for exercising hydrants and valves. Some of the hydrant shut off valves are old, and do not shut off tight. The City is currently in development of a valve maintenance program which will standardize exercising of valves and develop a replacement schedule for defective valves.

3.4 EXISTING WATER SUPPLY CAPACITY

Water supply capacity from the wells depends on specific operating conditions, particularly groundwater level and system pressure.

Table 3-5 summarizes the pumping capacity of the booster pump station and Wells 1A, 2A, 3, and 4.

Table 3-5
City of Live Oak System Reliable Capacity

Well Number	Status	Reliable Capacity (GPM)
1A	Active	650
2A	Active	700
3	Active(a)	750
4	Active(a)	935
5	Abandoned	0
Booster PS	Active (assumes one pump off)	4,200
	Total Reliable System Pumping Capacity (Wells 3 and 4, and Booster PS) Wells 1A and 2A feed the tank.	5,885

(a) Based on data provided August 2009 by City.

3.4.1 COMPARISON OF EXISTING DEMAND AND SUPPLY

The existing reliable supply capacity and demand scenarios are listed in Table 3-6.

Table 3-6
Existing Demand and Supply Comparison

Scenario	Reliable Supply	Average Day Demand[c]	Maximum Day Demand[c]	Maximum Day + Fire Flow Demand[d]	Peak Hour Demand [e]	Surplus/ (Deficit)
Existing Development-Annual Average (gpm)	2,100 [a]	1,310	-	-	-	790
Existing Development-Maximum Day (gpm)	2,100 [a]	-	3,320	-	-	-1,220
Existing Development-Maximum Day+ Fire (gpm)	5,885 [b]	-	-	7,320	-	-1,435
Existing Development-Peak Hour (MG)	1.4 [b]	-	-	-	1.2	0.2

(a) Includes Wells 1A, 2A, and 3. Well 4 is not included, because it is the largest source per Title 22, Chapter 15, Section 64554, R-13-03. The booster pump station is not included because average day and maximum day supply must come from the wells.

(b) Includes Wells 3 and 4 and booster pump station. The largest source out of service is the standby pump at the booster pump station.

(c) Demand includes committed unbuilt demands and is therefore higher than actual demand.

(d) Based on a fire flow of 4,000 GPM as discussed in Chapter 4.

(e) Per Title 22, Chapter 15, Section 64552, R-13-03, peak hour needs be met for four hours.

For existing conditions, the City does not have reliable supply capacity for maximum day. Furthermore, hydraulic restrictions within the existing distribution system limit the flow and pressure during the peak demand periods causing fire flow requirements not to be met.

3.5 WATER QUALITY

Public water supplies must meet water quality standards established to protect the public health and to assure consumer acceptance. "Domestic Water Quality and Monitoring Regulations" as adopted by the State of California include bacteriological; general physical; and inorganic, organic, and general chemical monitoring, testing, and maximum contaminant level requirements applicable to public water supplies (Title 22 requirements). It is our understanding that monitoring and testing of the City's water supply has been carried out in accordance with the applicable requirements. Results of these tests are discussed below and presented in Table 3-7.

3.5.1 TASTE AND ODOR

Historically Well 4 has had taste and odor issues. After arsenic treatment was installed, taste and odor no longer appeared to be a problem. The well is operated during normal operation. No other taste and odor problems have been reported for the other existing municipal wells.

3.5.2 BACTERIOLOGICAL QUALITY

Based on the number of active water service connections, the City collects water samples for bacteriological analysis every month based on their October 2005 Bacteriological Sample Siting Plan (Department Of Health Services Public Water System Annual Inspection, February 7, 2007). Prior to October 2004 the City has had some water sample lab test results indicate the presence of bacteriological activity in the past. These are believed to have been the result of not following proper sampling protocols, and of inappropriate disinfection of well head water. There have been no positive bacteriological samples collected since October 2004.

3.5.3 ORGANICS

Wells 1 and 2 have had positive samples for EDB and DBCP. The redrilled wells, Wells 1A and 2A, were non-detect for EDB and DBCP in their initial sampling in 2006. Wells 1A and 2A will continue to be sampled every three years. The sampling requirement for organics has been waived for the other wells.

The initial sampling for Well 2A on February 28, 2006 detected 1.06 µg/L MTBE that was confirmed in a second sample on April 21, 2006 with the result of 1.73 µg/L. The next quarterly sampling on October 9, 2006 produced a non-detectable MTBE result. Well 2A will continue to be sampled every three months for MTBE while the other wells will be sampled every six years.

3.5.4 ARSENIC

Arsenic is a natural occurring element originating from erosion of natural deposits and is known to cause various types of cancer, harm the central and peripheral nervous systems, as well as heart and blood vessels, and cause serious skin problems with prolonged exposure to low concentrations in potable water. Arsenic has a Primary Maximum Contaminant Level (PMCL) which was lowered from 50 parts per billion (µg/L) to 10 µg/L in 2006. To address the lower arsenic regulation, treatment has been added to Wells 1A, 2A, 3, and 4, as discussed in Section 3.5.7. After adding treatment these wells have been in compliance with the arsenic standard since February 2009.

3.5.5 NITRATE

Historically, water pumped from Wells 1 and 2 have had higher nitrate concentrations than water from Wells 3 and 4. Nitrate concentration in Well 1 ranged from 8.9 mg/L in a sample taken on February 14, 1995 to 106.8 mg/L in a sample taken on April 7, 2005. This maximum value in Well 1 was the only recorded violation of the 45 mg/L MCL and based on subsequent sampling is considered to be an erroneous result, either due to lab or sampling errors. However, Well 1 has had other recent results of up to 35.6 mg/L taken on June 16, 2005, which is close to the MCL.

The nitrate concentration in Well 2 ranged from 13.7 mg/L in a sample taken on April 4, 1995 to 41.25 mg/L in a sample taken on August 22, 2005.

Natural nitrate concentrations in groundwater typically range from 0.1 to 10 mg/l. Common sources of nitrate in groundwater include contamination from human or animal wastes, and leaching of salts from fertilizers used in agriculture, and natural occurring salts in the groundwater.

Nitrate levels should be monitored closely in all of the City wells.

3.5.6 HARDNESS

Hardness in the range of 150 to 250 mg/l as CaCO3, (calcium carbonate) can be considered hard. As shown in Table 3-7, hardness of the water varies from a minimum of 164 mg/l at Well 1, to a maximum of 251 mg/l at Well 4. Although hardness reduces the cleansing capacity of soaps, it has little effect on synthetic detergents and is not considered a water quality problem below 300 mg/l.

Table 3-7
Water Quality Constituents of Concern

Chemical	MCL	Unit	Max Results	Date	Min Result	Date
Well 1/ 1A Water Quality Constituents of Concern						
Arsenic (after treatment added)	10.0	µg/L	13	1/9/08		
Nitrate (As NO3)	45	mg/l	106.80	04/07/05	8.90	02/14/95
Nitrate + Nitrite (As N)	10	mg/l	3.65	11/21/96		
Nitrite (As N)	10	mg/l	0.00	12/13/05		
Hardness (Total)	(a)	mg/l as $CaCO^3$	250.00	12/13/05	164.00	01/03/06
Well 2/ 2A Water Quality Constituents of Concern						
Arsenic (after treatment added)	10.0	µg/L	13	1/9/08		
Nitrate (As NO3)	45	mg/l	41.25	08/22/05	13.70	04/04/95
Nitrate + Nitrite (As N)	10	mg/l	3.86	11/21/96		
Nitrite (As N)	10	mg/l	<1	11/21/96	0.00	06/03/03
Fluoride (F) Natural Source	1.7	mg/l as $CaCO^3$	0.37	01/28/04	0.10	03/03/05
Hardness (Total)	--	µg/L	228.00	03/03/05	205.00	06/04/04
Well 3 Water Quality Constituents of Concern						
Arsenic (after treatment added)	10.0	µg/L	1.5	11/6/08		
Nitrate (As NO3)	45	mg/l	15.00	06/24/04	10.06	03/11/03
Nitrate + Nitrite (As N)	10	mg/l	2.68	11/21/96		
Nitrite (As N)	10	mg/l	<1	11/21/96	0.00	06/03/03
Fluoride (F) Natural Source	1.7	mg/l as $CaCO^3$	0.12	11/02/99		
Hardness (Total)	--	µg/L	175.00	06/24/04	167.00	03/03/05

Chemical	MCL	Unit	Max Results	Date	Min Result	Date
Well 4 Water Quality Constituents of Concern						
Arsenic (after treatment added)	10.0	µg/L	Below MCL			
Nitrate (As NO3)	45	mg/l	30.20	03/03/05	2.80	09/18/01
Nitrate + Nitrite (As N)	10	mg/l	3.02	11/21/96		
Nitrite (As N)	10	mg/l	<1	11/21/96	0.00	06/03/03
Fluoride (F) Natural Source	1.7	mg/l as $CaCO^3$	0.11	11/02/99		
Hardness (Total)	--	µg/L	251.00	03/03/05	203.00	06/24/04

(a) No regulated MCL, however, levels over 300 mg/l begin to affect aesthetics.

3.5.7 WELLHEAD TREATMENT

Wellhead arsenic treatment, using the high rate Pyrolusite method, was added in 2008 to four well sites including 1A/2A, 3, and 4. At each well site the added treatment components include skid mounted arsenic treatment vessels with manganese oxide media, chemical storage and chemical metering pump station. Chemicals used in the treatment process include ferric chloride, potassium permanganate, and sodium hypochlorite.

At the 1A/2A site, a backwash tank was also added to allow recycling of backwash water. However, the City currently does not recycle the backwash water. The backwash water is sent to a sand drying bed to separate the solids that are sent to the landfill. Due to site constraints at sites 3 and 4, the backwash water and sludge is disposed of into the existing sewer and treated at the wastewater treatment plant.

The wellhead treatment process monitoring system is connected to the existing SCADA system.

Chapter 4

Recommended Improvements

Water supply, treatment, storage, pumping and distribution improvements have been identified to meet future water demands and to correct existing deficiencies within the current system. Improvements are based on the background information presented in the preceding Chapters.

Improvements identified herein are based on a practicable and flexible means of expanding the water facilities to serve new growth and correct existing problems. A primary goal of the improvement staging is to minimize the necessary infrastructure and associated costs while ensuring a reliable water supply. A discussion of recommended planning level improvements considered necessary to provide an adequate future water supply is included below. Detailed engineering studies, environmental review and detailed design of the improvements will be necessary prior to constructing the improvements.

4.1 WATER SUPPLY AND TREATMENT FACILITIES

The City of Live Oak's water supply has historically been provided from groundwater wells, and groundwater is expected to remain the sole water supply for the City in the future. The methodology for determining the water supply and treatment facilities, including assumptions, is discussed in this section, and a description of specific improvements follows.

4.1.1 METHODOLOGY

The methodology used to identify water supply and treatment facilities is discussed below along with assumptions used regarding the configuration of future improvements including wells and treatment facilities.

Two critical water supply conditions must be met within the system:

- The reliable capacity of the water supply must meet short-term peaks when demands are high either due to diurnal variations in demand or due to fire flows, and
- The reliable capacity of the water supply must meet the maximum day demand condition, which represents the highest expected demand over a 24-hour period.

The critical short-term demand is the greater of either the maximum day plus fire flow (MDFF) condition or the peak hour (PH) demand. Currently, the MDFF condition is higher and governs, but as growth occurs the PH flow condition will exceed MDFF.

During the peak periods the system must be able to deliver the required flow from either the wells that pump directly into the system or pumped from the ground level tank. If demands

cannot be met, the system will experience low pressures, and/or areas within the system could experience water outages.

If adequate storage, and pumping from storage to the system is provided, the system's well capacity, does not have to meet the short-term peak demand condition (MDFF or PH). When the short-term demands exceed the well capacity, the storage tanks will provide the additional volume and the water level in the tank(s) will drop while the demand exceeds the supply. After the peak demand period subsides, and supply exceeds demands, the tanks will refill.

Operation of water systems utilizing storage in this manner is a common and accepted practice because it eliminates the need for excess supply capacity to meet short-term peaks. Not only does the addition of storage reduce the number of wells required in the system, but it can also result in a significant reduction in capital, operation and maintenance costs, especially if wellhead treatment is necessary.

The reliable well capacity within the system must be capable of supplying the maximum day demand. If the well capacity cannot meet the maximum day demand condition, then storage in the system, which was designed for four hours of peak demand, will draw down and the system runs the risk of losing system pressure, and/or running out of water over the course of the day. Reliable well capacity is defined as the largest well out of service.

The staging of the water supply improvements depends on demand growth, which will increase as residential, commercial and industrial development occurs within the City. Proposed water supply improvements (e.g. new wells, treatment and storage) need to be planned, designed and constructed prior to the actual growth that will create the demand.

Capital improvement items associated with additional water supply including new wells treatment, storage, tanks, and booster pumping are discussed below.

4.1.2 GROUNDWATER WELLS

Planning level assumptions regarding future wells are as follow:

- New wells will produce a minimum of 2,000 gallons per minute (gpm). Based on the well logs of the existing wells, the current production may be limited by the screened length and well casing size. Future wells may be able to produce more water by increasing the well casing size.
- Water quality will be similar to the existing wells and would require the same treatment as the existing wells. During well design the City should attempt to maximize water quality to avoid treatment, which could include deeper wells and/or screening selected intervals with the highest quality water.
- The underlying groundwater aquifer will provide adequate long-term water supply.
- Well water pumped into the system will be chlorinated.

- All new wells will be operated using a variable frequency drive (VFD) to adjust flow and pressure within the distribution system.
- Land needed for new wells will be provided by developers.
- New wells will be constructed inside a building and stand-by/emergency power will be provided utilizing a diesel powered generator and automatic transfer switch.
- The reliable system capacity will be sized so that MDD can be met with the largest well out of service.

4.1.3 TREATMENT

A detailed study of different arsenic treatment methods is beyond the scope of this master plan. The water quality of each well site will be different. A study of each new well's water quality will determine what level of treatment is required. Given the need for arsenic water treatment on existing wells, arsenic treatment will probably be required on new wells.

As the City expands the water supply, there are two concepts for the layout of arsenic treatment facilities, centralized treatment, or wellhead treatment. Centralized treatment would include one treatment plant with raw water conveyed from multiple wells to the treatment facility. Wellhead treatment would be similar to the existing treatment where arsenic treatment would be added at the well site. No raw water piping would be required. Alternatively, a treatment facility may be built for several wells in one region of the City. Planning level advantages and disadvantages for centralized treatment versus wellhead treatment are discussed below.

Centralized treatment has several advantages and disadvantages. The advantages of centralized treatment include the economy of scale for a larger facility, and potential cost savings of having one treatment facility to maintain and operate. Centralized treatment has several disadvantages. The first disadvantage is that all the new wells would be in close proximity. Due to heightened security, having all wells in the same area may not be desirable. For example, if a tanker truck spilled a hazardous chemical near the well field, all wells would be affected. Another disadvantage of having the wells in close proximity is the pumping interferences between wells. More energy would be spent pumping the wells, because there would be more drawdown with many wells next to each other. Furthermore, water supply will most likely be added incrementally as the demand occurs. Building a large treatment plant would require a large capital expenditure upfront. The actual treatment modules may be added incrementally, but the supporting infrastructure including site grading and site piping would need to be sized for build-out and constructed initially. If the water demand does not materialize, a large amount of capital would be spent unnecessarily.

The wellhead treatment has several advantages over centralized treatment including being able to build treatment only when the treatment capacity is needed, less pumping costs, no raw water pipelines, and not being dependent on one centralized area for source water. The disadvantage of wellhead treatment is the increased number of plants that would need to be operated.

The costs would vary between building a centralized treatment plant and wellhead treatment. Assuming that treatment needs to be built for nine 2,000 gallon per minute wells would require 25 MGD of treatment capacity. A centralized the plant may use several different technologies including green sand filters, coagulation with microfiltration or enhanced coagulation. Using a cost curve based on other plants, an average cost for a 25 MGD plant would be approximately a $1.70 per gallon or $39.1 million for a 25 MGD plant. In addition to the treatment cost, a raw water distribution system would be built from the well field to the treatment plant. Assuming approximately 12,000 feet of raw water conveyance pipelines ranging in size from 10 inches to 22 inches, the raw water system cost would be $2.4 million including a 20% contingency and 20% for administration and engineering costs.

For wellhead treatment, if a similar treatment system to what was built at Wells 1A/2A, construction costs would be approximately $1.2 million per well or $10.8 million for nine 2,000 gpm wells.

For the purposes of this master plan wellhead treatment was assumed to be installed at all future wells. As previously discussed, it is recommended that future wells be located and designed to try to eliminate the need for treatment.

Key assumptions for planning purposes regarding future treatment are summarized below:

- Future treatment units will be installed at individual wellheads thus eliminating the need for extensive raw pipelines to convey water to a centralized treatment plant.
- Future well treatment is assumed to be similar to the existing well treatment.

4.1.4 Storage Tank and Booster Pump Station

Storage and pumping facilities are discussed in this section. As previously noted, the addition of storage can reduce the system's source capacity by meeting short-term peaks from storage. The City currently relies on a ground-level storage tank in the middle of the City to meet peak demand and fire flow events.

Key assumptions for planning purposes regarding future storage and booster pumping are included below:

- Future storage tanks will be ground level and constructed of steel.
- Tanks will be located near a well which will fill the tank to help cycle the tank; alternatively site piping will allow the tank to be filled off the system (i.e. from other wells) or bypassed altogether.
- A booster pump station will pump water from the tank into the distribution system. System pressure will be maintained using a VFD or a hydropneumatic tank as determined during detailed design. A booster pump station will be sized to include the capacity of the well in addition to the flow from the tank.

- Chlorination facilities will be provided to pre-chlorinate water entering the tank and/or post chlorinate water as it leaves the tank.
- The tank will be operated in a manner to circulate water through the tank to prevent degradation of the water quality.
- The tank and booster pump station would be sized with a reliable capacity to supplement the system well capacity to meet the PH or MDFF condition. Emergency and equalization storage would not be included in the tank sizing.

New pipelines in the distribution system will be sized to convey peak flows from the tank site throughout the City to meet the design flow condition.

4.2 DISTRIBUTION SYSTEM

This section includes an analysis and discussion of the City's distribution system under current and future conditions. Key aspects of the analysis include an evaluation of:

- Flow characteristics of the existing system under average and peak demand conditions and development of improvements to mitigate existing deficiencies.
- Sizing of pipelines to serve new growth under average and peak demand conditions.
- Incorporating the location and design flow from water supply sources.

A hydraulic model was used to evaluate the existing pipeline system, determine the size and layout of future distribution facilities. The model allows for the analysis of multiple system configurations and demand scenarios. A summary of the key assumptions used in the model is included below.

4.2.1 HYDRAULIC MODELING SUMMARY

A hydraulic model of the Live Oak water distribution system was developed using Bentley's WaterGEMS V8i modeling software. The hydraulic model was used to determine the distribution system improvements. Summary tables of the model output are included in Appendix A and include node and pipe reports for existing conditions, and build-out with existing deficiencies.

Scenarios Analyzed. The water distribution system model development included three scenarios including:

- Existing distribution system to assess flow and pressure conditions under current conditions.
- Modified distribution system to mitigate deficiencies identified in previous scenario.
- Build-out of the system to serve future growth without existing deficiencies mitigation facilities.

Demand conditions analyzed for each scenario included average day demand (ADD), maximum day demand (MDD) and peak hour demand (PHD). Fire flow analyses were conducted during MDD conditions.

Existing system demands were estimated using historical customer usage data. Future demands were estimated by applying unit demand factors to the parcels within the planning area based on the type of land use. GIS software was used to calculate and spatially allocate average day and maximum day demands to model nodes based on the land use based on land uses discussed in Chapter 2.

4.2.2 Model Input and Design Criteria

The basic input and design criteria used in the model are summarized below.

Model Node Elevations. USGS information, including topographic maps and existing electronic benchmark data, were obtained and used to populate model nodes with elevations. There were no topographic surveys used to ascertain elevations, and were not considered necessary due to the relatively flat terrain within the study area.

Distribution System Pressures. Maximum system pressure is based on the booster pump station pumping pressure. The minimum distribution system pressure requirement is based on Sutter County design standards as follows:

- Average Day- ≥40 psi
- Maximum Day- ≥40 psi
- Peak Hour- ≥30 psi

Distribution Pipe Sizing. The pipes in the model were sized according to the following design criteria. Design criteria is from the City and supplemented by the County design criteria where no criteria were available in the City.

- Minimum pipeline diameter of 8 inches for all new and replaced pipelines.
- Pipe velocities should not exceed:
  - Maximum day demand- 5 fps
  - Peak hour- 7 fps.
- New piping "C" factor is 125.

Fire Flow Analysis. Fire protection is provided by Sutter County as the City does not have a fire department. The required fire flows are based on Sutter County standards. The following fire flow assumptions were applied:

- The critical design condition was maximum day plus fire flow (MDFF).
- The distribution system's ability to provide fire flow was analyzed. No attempt was made to model detailed hydrant connections and size hydrants, which could reduce flow depending on the configuration lateral, isolation valve and type and size of the hydrant.

- Maximum pipe velocity of 10 fps during the MDFF condition.
- Minimum residual distribution system pressure of 20 psi during MDFF condition.
- Single-family residential fire flows are 1,500 gpm for two hours.
- Multifamily fire flows are 2,500 gpm for three hours.
- Commercial and Light Industrial fire flows are 3,000 gpm for three hours.
- School fire flows are 4,000 gpm for four hours.
- Future developments will be responsible for augmenting fire flow where flow requirements in excess of 4,000 gpm are required.

4.3 RECOMMENDED IMPROVEMENTS

The following summarizes the water supply, storage, and distribution system improvements being recommended as a result of the planning level hydraulic modeling evaluation. The recommended planning level improvements address identified existing deficiencies and need to serve future growth within the planning area.

4.3.1 EXISTING DEFICIENCIES

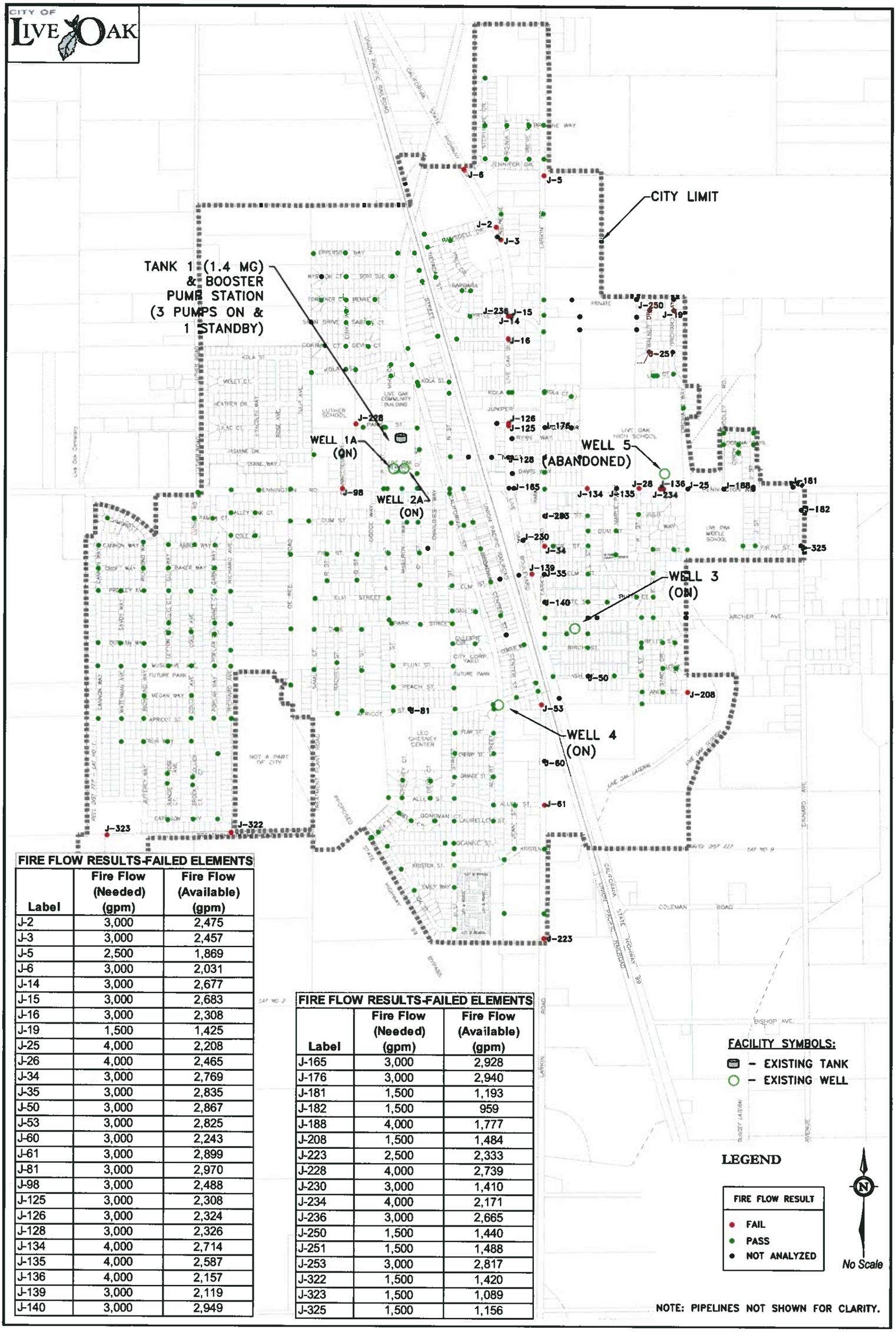
The City of Live Oak hydraulic water model was used to evaluate the existing system for possible water system deficiencies and develop water facility improvement recommendations to mitigate the identified deficiencies. The following section summarizes the results of this evaluation.

Source Capacity

Per California Waterworks standards (Title 22, Chapter 15, Section 64554, R-14-03), the system shall be capable of meeting MDD with the highest-capacity source off line. The existing reliable supply of Wells 1A, 2A, 3 is not sufficient to meet MDD. Therefore, a new well needs to be added. As discussed in Section 4.1.2, the future well is expected to provide at least 2,000 gpm.

Distribution System

The current distribution system is reliable and provides adequate service during normal flow conditions. The existing system is well looped, which increases flow and operational flexibility. However, the current fire flow requirements exceed the capacity of some portions of the existing water system. It should be noted that it is likely portions of the City water system were constructed before the current, higher fire flow requirements were adopted. The smaller diameter pipes in the existing water system cannot deliver the required fire flows due to high frictional head losses associated with high water velocities, resulting in pressure decreases below the minimum fire flow distribution system pressure of 20 psi. The existing available water system fire flows are shown in Figure 4-1.



FIRE FLOW RESULTS-FAILED ELEMENTS

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)
J-2	3,000	2,475
J-3	3,000	2,457
J-5	2,500	1,869
J-6	3,000	2,031
J-14	3,000	2,677
J-15	3,000	2,683
J-16	3,000	2,308
J-19	1,500	1,425
J-25	4,000	2,208
J-26	4,000	2,465
J-34	3,000	2,769
J-35	3,000	2,835
J-50	3,000	2,867
J-53	3,000	2,825
J-60	3,000	2,243
J-61	3,000	2,899
J-81	3,000	2,970
J-98	3,000	2,488
J-125	3,000	2,308
J-126	3,000	2,324
J-128	3,000	2,326
J-134	4,000	2,714
J-135	4,000	2,587
J-136	4,000	2,157
J-139	3,000	2,119
J-140	3,000	2,949

FIRE FLOW RESULTS-FAILED ELEMENTS

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)
J-165	3,000	2,928
J-176	3,000	2,940
J-181	1,500	1,193
J-182	1,500	959
J-188	4,000	1,777
J-208	1,500	1,484
J-223	2,500	2,333
J-228	4,000	2,739
J-230	3,000	1,410
J-234	4,000	2,171
J-236	3,000	2,665
J-250	1,500	1,440
J-251	1,500	1,488
J-253	3,000	2,817
J-322	1,500	1,420
J-323	1,500	1,089
J-325	1,500	1,156

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FIGURE 4-1
EXISTING WATER SYSTEM FIRE FLOW ANALYSIS

Hydraulic modeling was performed to develop planning level water facility improvements to address the fire flow deficiencies identified. The recommended water facility improvements to mitigate the fire flow deficiencies are shown in Figure 4-2. It is proposed that the existing pipelines will be paralleled with a new pipeline that has enough capacity to eventually abandon the original pipeline. The parallel mains are being recommended, instead of replacing the existing lines, as the age of existing distribution system is unknown. Some new pipelines are also recommended to fix the existing fire flow deficiencies.

The paralleling of the pipelines is expected to occur over time. The City should consider developing a detailed improvement plan that prioritizes specific improvements so that the most benefit can be realized as soon as possible. Prioritization would be based on several criteria such as:

- Severity of the fire flow deficiency
- Planned roadway improvements coupled with pipeline replacement to avoid resurfacing costs
- Type of development and anticipated risk of fire
- Frequency of leak repairs on particular segments
- Water quality complaints

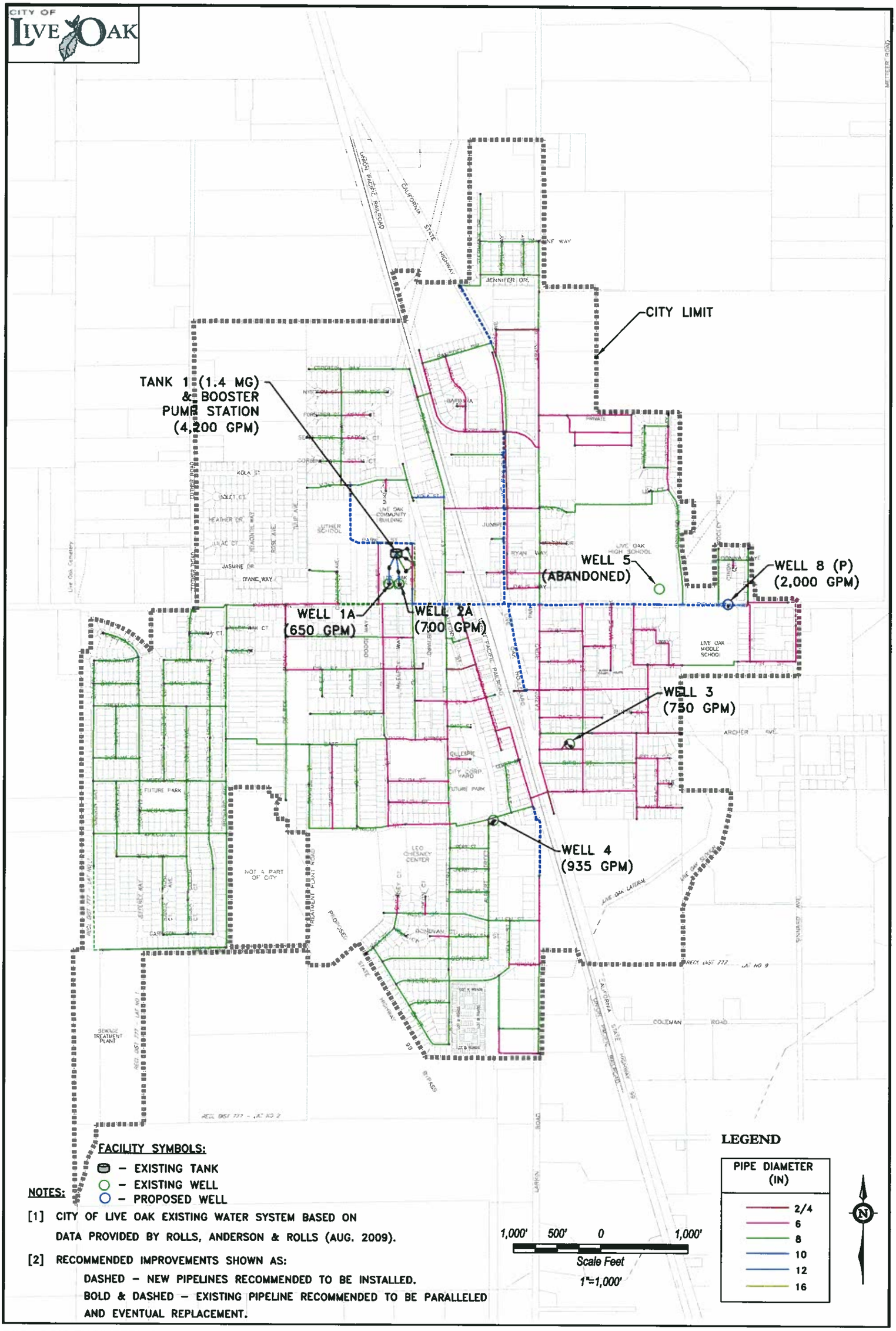

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FIGURE 4-2
PROPOSED IMPROVEMENTS TO MEET EXISTING FIRE FLOW REQUIREMENTS

Estimated Capital Costs – Existing Deficiencies

Opinions of probable cost are based on unit costs listed in Table 4-1.

Estimating costs to parallel existing pipelines is difficult without a detailed investigation. Factors that affect the cost include:

- Characteristics of the alignment including the amount of traffic, condition of existing roadway, other utilities in the area, etc.
- Construction bidding climate at the time of bidding.

A unit cost of $12 per inch per linear foot has been used based on other recent rehabilitation projects. Correction of existing deficiencies is normally financed through rates, not by connection fees as discussed in Chapter 5.

The estimates are based on the planning level evaluation and do not include site specific conditions, therefore a 20 percent contingency is included. Soft costs also represent a significant portion of capital improvement projects and include design, administration/legal and construction inspection and are estimated to be 20 percent of the total construction costs.

Table 4-1
Cost Basis

New Pipeline Cost	$10/in/LF
Parallel Pipeline Cost	$12/in/LF
Storage Tank Cost	$1/gal
Pump Station Cost	Based on recent bid data
Admin and Engineering	20% of capital cost
Contingency	20% of capital cost

Estimated costs for the improvements to parallel the small diameter pipelines are listed in Table 4-2.

Table 4-2
Proposed Improvements to Mitigate Existing Deficiencies
Opinion of Probable Cost [a]

Description	Qty.	Unit	Unit Cost	Total Cost
Well with treatment	1	Each	$2,700,000	$2,700,000
10" near Luther School and along Park Street	1,335	Length Feet	$120	$160,000
8" along O Street-new pipe	275	Length Feet	$80	$20,000
10" along Hwy 99	3,770	Length Feet	$120	$450,000

Description	Qty.	Unit	Unit Cost	Total Cost
8" along Pennington Road	515	Length Feet	$96	$50,000
10" along Pennington Road	3,520	Length Feet	$120	$420,000
10" along Larkin Road	850	Length Feet	$120	$100,000
8" along Cannon Way	1,060	Length Feet	$80	$80,000
6" along Sinnard Avenue	345	Length Feet	$60	$20,000
			Subtotal	**$4,000,000**
			Contingencies at 20%	$800,000
			Subtotal	$4,800,000
			Administration, Engineering @ 20%	$960,000
			Total	**$5,760,000**

(a) 20 Cities ENRCCI = 8,578 June 2009

4.3.2 RECOMMENDED IMPROVEMENTS - BUILD-OUT

Improvements to provide additional capacity to meet future demands are discussed in this section. These improvements are to expand system capacity to serve new growth and would be financed through connection fees.

Source Capacity

Future water capacity will be provided from new wells throughout the system. As discussed in Section 4.1.2, future wells are expected to provide at least 2,000 gpm. A total of 8 new wells will be needed. If future wells have higher capacity, then fewer wells will be needed. For planning purposes each well is assumed to be equipped with a treatment unit for arsenic removal.

Each well added to the system will require operation and maintenance attention, especially if treatment is needed. Therefore, limiting the number of wells is desirable. The number of wells can be reduced by:

- Maximizing the capacity of new wells
- Providing a storage tank and booster pump station

Attempting to design future wells with larger capacity should be a goal in the future, but will be limited to the aquifer characteristics. The addition of tanks and booster pump stations to meet peak demand periods to reduce the number of wells in a system is common practice, although the addition of a tank and pump station have some disadvantages:

- Tanks are typically unpopular with neighbors
- There is a loss of efficiency created when the water is pumped multiple times, once into the tank, and then into the distribution system
- The tank and booster pump station require maintenance

A preliminary new storage capacity of 1.4 Mgal (two tanks) has been identified in this master plan; however, the final storage volume should be evaluated as the production capacities of new wells are determined. If well capacity alone can provide adequate source capacity, the tank may be eliminated. Therefore, the City should plan to add two or three wells, assess the water quality and production rate from the wells, and then make a determination whether or not to add a tank and booster pump station and what size to make it.

The tank/pump station would eliminate three 2,000 gpm wells and the associated treatment units (if needed), which would provide significant savings to the cost of future improvements. Therefore, the proposed improvements include the tank and booster pump station. The decision to construct the tank should be deferred until the maximum reliable yield of future wells is determined and whether or not treatment will be required. Lower well yields and need for treatment will drive the decision in favor of adding additional tank storage.

Two tank locations are shown in Figure 4-3. A future well site could be initially developed without a tank. The well would pump directly into the distribution system until a tank were added, at which time the pump would be modified by changing the size or number of impellers and then pump to the tank at the lower pressure. The booster pump station would pump water from the tank to the system.

The combined build-out capacity of the two booster pump stations would be about 9,800 gpm based meeting peak hour demands. The initial pump station piping and layout would be designed to accommodate the 9,800 gpm flow, but the initial capacity constructed would be somewhat less depending on system demands and well outputs. Overtime, additional pumps would be added to the pump station, or the existing pumps upsized.

Based on the phasing described in Chapter 2, a summary of the water supply phasing is listed in Table 4-3.

Table 4-3
Phasing of Water Supply [(a)]

Year	Additional Wells	Total Wells	Additional Booster PS Capacity (gpm)	Total Booster Pump Station Capacity (gpm)	Additional Storage (MG)	Total Storage (MG)
2009	0	4		4,200		1.4
2010	3	7		4,200		1.4
2015	2	9		4,200		1.4
2020	1	10		4,200		1.4
2025	2	12		4,200		1.4
2030	1	13	9,800	14,000	1.4	2.8
Total	9	13	9,800	14,000	1.4	2.8

(a) Water use was assumed to grow linearly from 2009 until 2030.

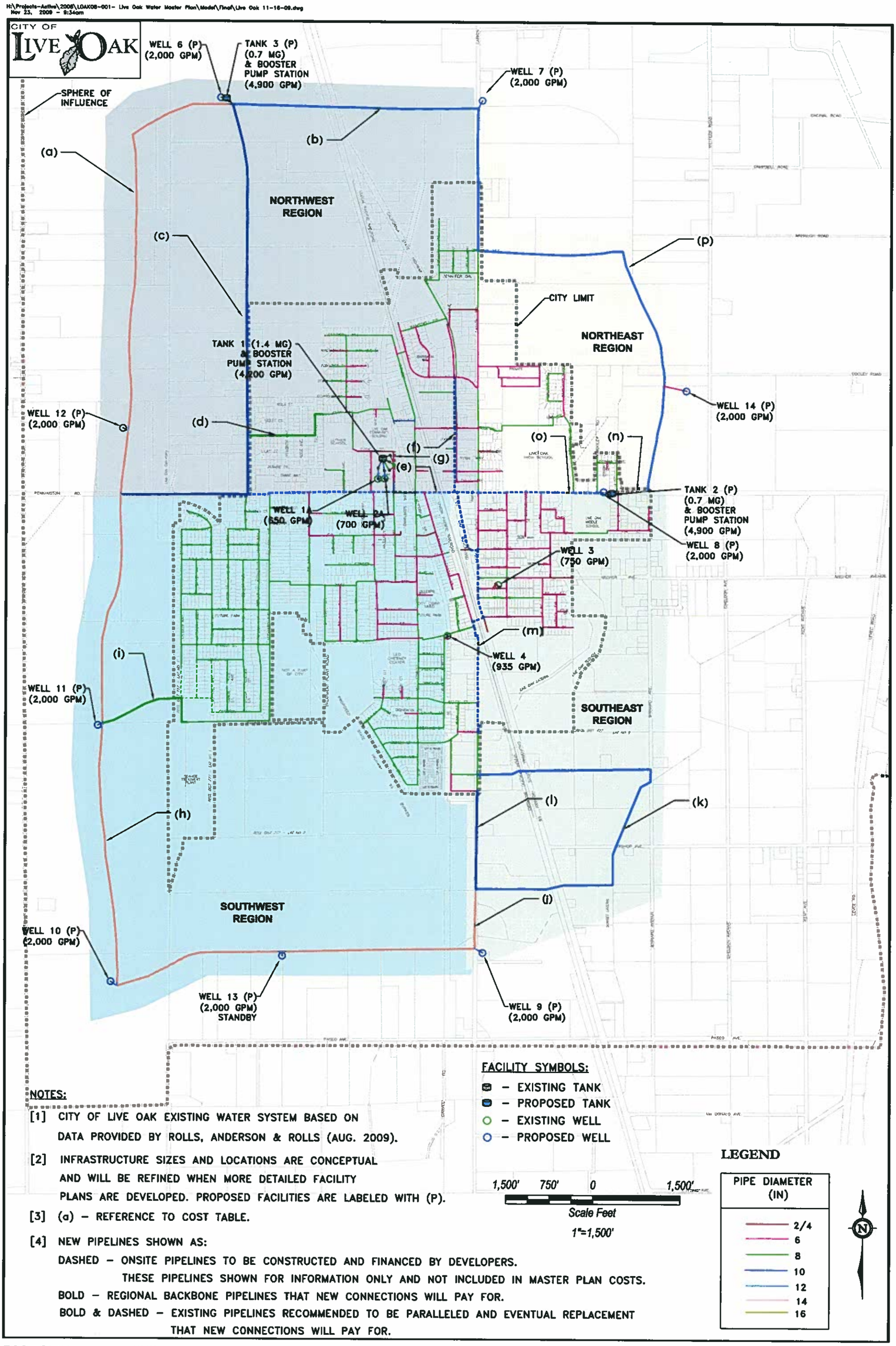

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FIGURE 4-3
BUILDOUT WATER SYSTEM WITH EXISTING DEFICIENCIES

Distribution System

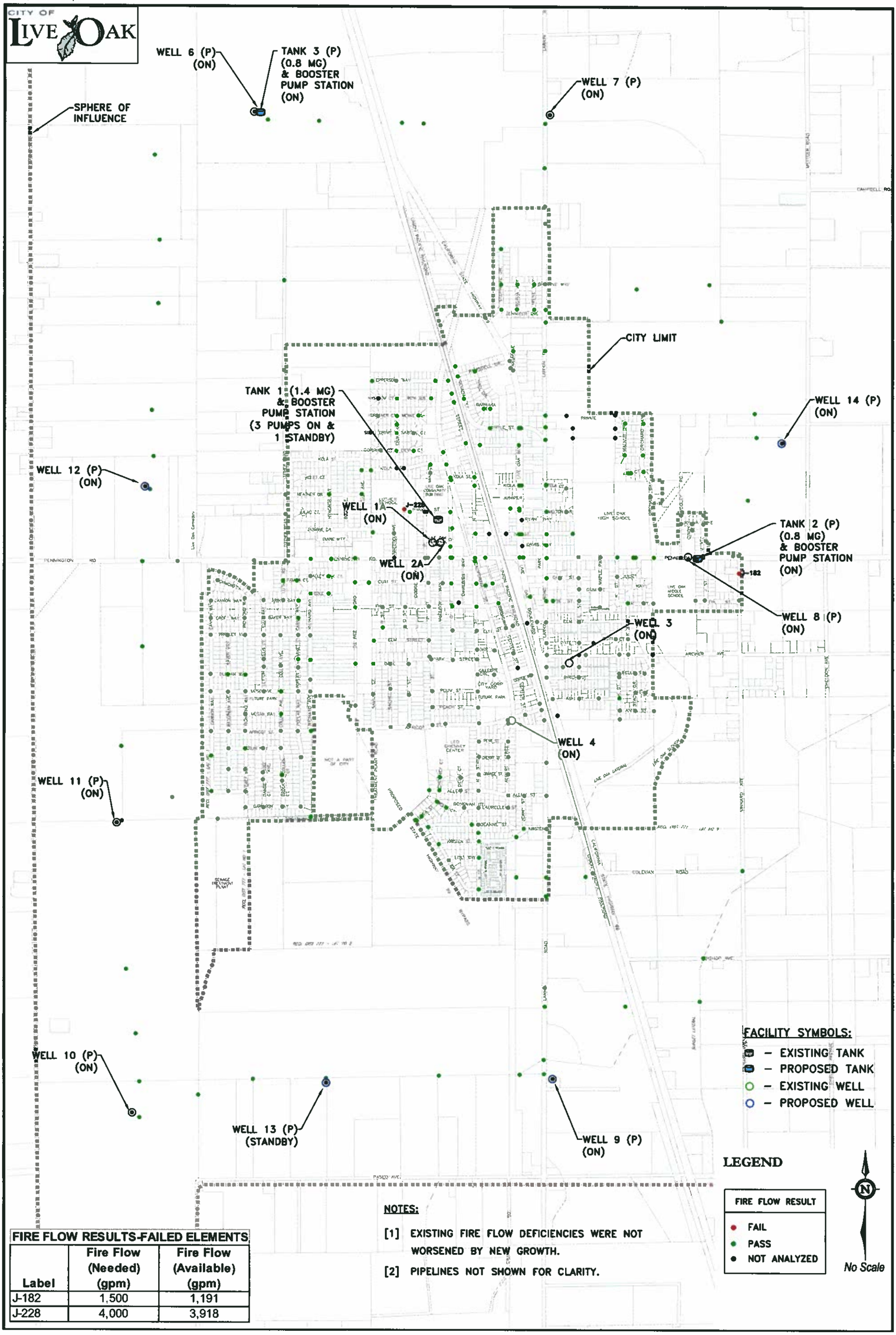
Planning level layout of the proposed water system was developed based on the results of the hydraulic modeling which accounts for the location of both water demands and supplies. Generally, water mains were located in future road right-of-ways as shown in the "Land Use Diagram" figure prepared by EDAW AECOM in 2009.

The intent of the proposed plan provided herein is to provide a conceptual layout of the facilities. Modifications to the proposed layout, such as altering the alignments to coincide with roadways, property lines, etc. are anticipated as specific improvement plans are developed and submitted for the City's review. Detailed engineering studies specific to the project will be necessary, along with environmental review and development of plans and specifications prior to construction. The new pipelines shown represent equivalent capacity. More pipes of a smaller diameter may be constructed if they meet the equivalent capacity shown in the master plan.

The new pipelines interconnect with existing pipelines to create additional looping within the system as shown in Figure 4-3. Future wells, discussed below, will connect at various locations. The facilities identified in this scenario are for supplying future growth and did not include mitigation of existing system deficiencies. The facilities identified to supply future growth were sized to not make any existing problems worse. The fire flow for build-out with existing deficiencies analysis is shown on Figure 4-4. A secondary benefit of the additional looping developed as part of the build-out system included mitigation of several fire flow deficiencies associated with the existing system.

The proposed improvements as envisioned at build-out will meet the design criteria; however, the system will be constructed incrementally as development progresses and additional evaluations will need to be performed to size pipelines such that all design conditions are satisfied during the incremental expansion of the system. The result of the incremental evaluations should also conform with the build-out infrastructure requirements.

As an example if a project were to be approved in the southern portion of the SOI, far away from existing sources of supply, the fire flow condition may not be met, even though the system has ample source capacity at the time of the development. In this case, the project proponent should be required to construct a new well in the vicinity, or if necessary a tank and pump station. These requirements would be discovered during the design and design review process.



FIRE FLOW RESULTS-FAILED ELEMENTS

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)
J-182	1,500	1,191
J-228	4,000	3,918

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FIGURE 4-4
FIRE FLOW ANALYSIS
BUILDOUT WATER SYSTEM WITH EXISTING DEFICIENCIES

Estimated Capital Costs – Build-out

The opinion of probable cost for the identified water infrastructure improvements to supply future growth is summarized in Table 4-4. The location of the recommended future water infrastructure is shown on Figure 4-3. The estimates are based on planning level analysis and do not include site specific conditions, therefore a 20 percent contingency is included. Soft costs also represent a significant portion of capital improvement projects and include design, administration/legal and construction inspection and are estimated to be 20 percent of the total construction costs.

Table 4-4
Proposed Improvements Opinions of Probable Cost For New Users [a]

ID	Description	Qty.	Unit	Unit Cost	Total Cost
Supply					
	Tank	700,000	Gallons	$1	$700,000
	Tank	700,000	Gallons	$1	$700,000
	Booster Pump Station	230	Horsepower	$1,180,000	$1,180,000
	Booster Pump Station	230	Horsepower	$1,180,000	$1,180,000
	Wells with treatment	8	Each	$2,700,000	$21,600,000
				Subtotal	$25,360,000
Northwest					
a	14" water main - new	8,055	Length Feet	$140	$1,130,000
b	12" water main - new	4,235	Length Feet	$120	$510,000
c	10" water main - new	8,915	Length Feet	$100	$890,000
d	8" water main - new	1,670	Length Feet	$80	$130,000
e	12" water main - replacement	1,440	Length Feet	$144	$210,000
f	10" water main - replacement	1,970	Length Feet	$120	$240,000
g	8" water main - new	275	Length Feet	$80	$20,000
				Subtotal	$3,130,000
Southwest					
h	14" water main - new	14,810	Length Feet	$140	$2,070,000
i	8" water main - new	1,965	Length Feet	$80	$160,000
				Subtotal	$2,230,000
Southeast					
j	14" water main - new	1,025	Length Feet	$140	$140,000
k	12" water main - new	7,560	Length Feet	$120	$910,000
l	10" water main - new	1,685	Length Feet	$100	$170,000
m	10" water main - replacement	4,560	Length Feet	$120	$550,000
				Subtotal	$1,770,000

ID	Description	Qty.	Unit	Unit Cost	Total Cost
Northeast					
n	14" water main - replacement	570	Length Feet	$168	$100,000
o	12" water main - replacement	4,900	Length Feet	$120	$590,000
p	12" water main - new	9,245	Length Feet	$120	$1,110,000
				Subtotal	$1,800,000
				Construction Subtotal	**$34,290,000**
				Contingencies at 20%	$6,860,000
				Subtotal	**$41,150,000**
			Administration, Engineering @ 20%		$8,230,000
				Total	**$49,380,000**

(a) 20 Cities ENRCCI = 8,578 June 2009.

Chapter 5

Proposed Connection Fee

Capacity improvements and associated capital costs have been identified in previous Chapters of this master plan. Facilities financed with connection fees include backbone facilities such as water supply, storage/pumping and distribution system improvements, which provide the necessary capacity to serve future growth. A recommended water connection fee to fund these improvements is developed in this chapter. Consistent with California law, the cost of future expansions should be assigned to future development and not existing users.

Specific onsite improvements within specific developments that are needed to provide service to the development include distribution system piping, services, blow offs, fire flows in excess of normal requirements, and other appurtenances. These improvements are financed by the developer, constructed to City standards and deeded to the City. These "onsite" improvements should be paid for by the developer and are not included or credited to the connection fees.

Depending on the nature of the improvements and the amount and timing of development, sufficient funds from connection fees may not fully fund the capacity expansions in the short-term. In such cases it is typical for developers to provide capacity in excess of their need with a reimbursement from the City as additional connections occur.

5.1 METHODOLOGY

Development of the connection fee must have a relationship to the cost of providing the service. California law and case history dictate that no user pay more than their fair share of the cost to provide public services. To simplify the process of determining the share of these costs for which an increment of future development is responsible, the concept of the Equivalent Dwelling Unit (EDU) will be used. An EDU represents the water demand in relation to the water demand for a single-family dwelling unit.

Multi-family residential, commercial and industrial demands can be represented as a multiple of EDUs depending on their relative demand. In this way, the demands from various land uses can be put in terms of EDUs to determine the appropriate connection fee.

This method is a common and simple means of determining the connection fee and still considers the relative demand that new service places on the system.

5.1.1 Formulation of Fee

As noted above, the EDU will serve as the basis for the water connection fee. The actual connection fee is dependent on the capital cost of improvements needed to serve the

development. The typical single family home in Live Oak uses an average of 500 gpd (as described in Chapter 2). The recommended connection fee is calculated based on the capital cost estimate for the improvements required to provide service to a single EDU within the system. It should be pointed out that existing users are not expected, or legally bound, to pay for capital improvements needed to expand the water system to serve new users. Thus, the connection fee is based solely on the number of new EDUs served by a given increment of water system improvements.

The fee calculated in this analysis will be referred to as the 2009 Connection Fee and includes three components:

1) **System Buy-In**: The system buy-in charge based on the City's existing water infrastructure assets. The analysis estimates the total cost of all of the assets at installation less accumulated depreciation.

2) **Future CIP Project Costs**: The future CIP project costs are based on the projected facility needs as identified in the Water Master Plan. These costs were split between existing and future users based on benefit. The costs allocated to future users are included in the 2009 Water Connection Fee.

3) **Meter Installation Costs**: The cost of installing and connecting a water meter to the City's distribution system is also included in the 2009 Water Connection Fee.

Each of these fee components and how they were computed are discussed in greater detail in Appendix **B**.

Residential Connection fee

The connection fee will vary depending on the type of development (e.g. single family, duplex, multi-unit, etc.) and the demand on the system. Table 5-1 includes a summary of the various types of residential development. Recommended connection fees are included for single-family dwellings. There is significant variation in the type of multi-family and apartment buildings, and their associated water demands. Due to the lack of accurate meter reading data for these units, average water demand ranges within the City cannot be established. The usage rate depends on the number of units, landscaping, and amenities (e.g. pool, spa and landscaping). Connection fees for multi-family and apartments should be based on the meter size and usage as discussed in the following section.

Table 5-1
Summary of Residential Connection Fee

Water User	Equivalent Dwelling Units (EDUs)	Annual Average Water Demand Factor, gpd/connection	Connection Fee
Single-Family Home	1.0	500	$7,398
Multi-unit Housing	Varies	Varies[(a)]	Site specific
Large Apartment	Varies	Varies[(a)]	Site specific

(a) Demand factor can vary. Connection fee should be based on site-specific conditions related to demands.

Non-Residential/Multi-Unit/Apartment Connection Fee

Non-residential, multi-unit, and apartment connection fees are discussed in this section. Historically the connection fees have been calculated using the meter size as determined by the meter equivalence ratio. This method can result in a connection fee that is too high or low in the larger meter sizes. A discussion of meter ratios and the recommended connection fee based on demand follows.

The size of the meter required to provide flows desired by the user can be used to determine the connection fee based on the meter equivalence ratio. Meter equivalent ratios are a common means of scaling connection fees and are based on the maximum capacity of the meter.

The meter equivalence ratio is typically calculated based on the maximum capacity of a particular size of meter as determined by the American Water Works Association (AWWA) standards. Table 5-2 includes a summary of the meter ratios through a 6-inch meter. The table includes meter ratios used by the AWWA standard and the proposed equivalence ratio determined and recommend as the basis moving forward.

Table 5-2
Meter Equivalence Ratios

Meter Size, in	Meter Ratio		Meter Capacity (gpm) [c]
	AWWA [a]	Proposed [b]	
5/8	1	n/a	20
3/4	1.5	1	30
1	2.5	1.7	50
1.5	5	3.3	100
2	8	5.3	160
3	17.5	11.7	350
4	31.5	21.0	630
6	70	46.7	1,400

(a) American Water Works Association (AWWA) meter ratio calculation based on a 5/8-inch meter.

(b) Proposed meter ratio based on ¾-inch meter as basis for ratio.

(c) Based on AWWA standards for maximum flow through meter.

The proposed meter equivalence ratio was revised from the AWWA standard because the City Standards state that the minimum meter size is a ¾-inch meter. AWWA bases the meter equivalence ratios on a 5/8-inch meter; however, for our calculations the smallest meter used is a ¾-inch meter so the proposed equivalences are based on a ¾-inch meter capacity as a reference.

Basing the connection fee on the meter size works well with smaller meters up to 1-inch. The demand placed on the system by larger meters could be excessive, especially if onsite storage were provided to equalize peaks. As an example, a 2-inch service could place a demand of 230,000 gpd (160 gpm x 1440 min) on the system, which is the equivalent of 460 single-family

homes (requiring a $3.4 million connection fee based on an EDU basis). As the meter gets larger, this discrepancy increases.

Connection fees for non-residential service connections are presented in Table 5-3 based on the revised meter ratios. Connection fees for meters 1.5-inch and greater should be calculated on a site-specific basis; however, the minimum recommended connection fee for 1.5- through 5-inch meters is included in Table 5-3.

Table 5-3
Non-Residential Water Service Connection Fee

Meter Size	Based on Revised Meter Ratios[b]
5/8	n/a
3/4	$7,398
1	$11,370
1.5 [a]	$21,399
2 [a]	$33,394
3 [a]	$72,543
4 [a]	$129,887
6 [a]	$283,290

(a) Minimum recommended connection fee; to be determined on a site-specific basis.

(b) Revised meter ratio based on ¾ meter as standard.

Summary of Proposed Water Connection fee

The proposed water service fees for residential and non-residential water connections are included in Table 5-4. The connection fees are considered based on demands for the particular non-residential service. Connection fees for metered services larger than 1.5-inches should determined on a site-specific basis.

Table 5-4
Summary of Recommended Water Connection Fees

Service Type	Connection Fee
Residential Connection Fees	
Single Family	$7,398
Multi-Unit and Apartments	Site Specific
Non-Residential Connection Fee	
Meter Size, in	Connection Fee
5/8	n/a
3/4	$7,398
1	$11,370
Meter Size, in	Min. Connection Fee [(a)]
1.5	$21,399
2	$33,394
3	$72,543
4	$129,887
6	$283,290

(a) Recommended minimum connection fee; to be considered on site-specific conditions.

5.1.2 INDEXING OF FEES

Indexing is used to provide for automatic adjustment of fees to account for inflationary cost increase. An enabling ordinance can provide for automatic fee adjustment on a prescribed date each year, or every other year or third year, etc. Annual indexing revisions are recommended to minimize the magnitude of the change and insure that revenue more closely follows expenses. One approach involves adjustment based on an accepted cost indicator such as the CPI (Consumer Price Index). The latter is preferred since it more closely reflects costs in the construction industry, which are used as the basis for computing connection fees. This approach provides the most accurate adjustment, although the incremental change (increase or decrease) is not known beyond the current year.

Appendix A

Hydraulic Modeling Result

Existing Water System - City of Live Oak

Junction Report - MDD

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)	Hydraulic Grade (ft)
J-1	77.1	8.37	73.5	247.0
J-2	76.8	5.28	73.9	247.5
J-3	76.5	10.13	74.0	247.5
J-4	76.8	2.98	74.1	247.9
J-5	77.7	6.23	73.2	247.0
J-6	77.8	24.71	73.2	247.1
J-7	77.0	27.75	73.9	247.8
J-8	76.5	16.84	74.1	247.8
J-9	76.5	9.53	74.1	247.8
J-10	76.6	3.49	74.0	247.7
J-11	76.8	15.21	74.0	247.9
J-12	76.6	0.95	74.7	249.3
J-13	76.3	13.83	74.2	247.9
J-14	76.0	0.00	74.3	247.6
J-15	76.0	2.80	74.2	247.6
J-16	75.9	16.23	74.3	247.8
J-17	75.9	5.91	74.2	247.4
J-18	76.0	17.08	74.0	247.0
J-19	75.9	8.32	73.9	246.7
J-20	75.9	2.37	73.9	246.7
J-21	75.8	9.90	74.0	246.7
J-22	75.7	6.89	74.0	246.8
J-23	75.7	6.78	74.0	246.8
J-24	75.7	22.41	74.0	246.8
J-25	75.8	17.98	74.0	246.7
J-26	75.5	18.14	74.2	247.0
J-27	75.6	14.79	74.2	247.0
J-28	75.6	11.06	74.2	247.1
J-29	75.6	11.70	74.1	246.9
J-30	75.5	14.76	74.4	247.5
J-31	75.4	12.96	74.4	247.4
J-32	75.5	7.31	74.4	247.4
J-33	75.3	3.65	74.5	247.6
J-34	75.2	1.37	74.6	247.7
J-35	75.1	7.23	74.7	247.8
J-36	75.1	5.26	74.9	248.1
J-37	75.2	3.12	74.8	248.1
J-38	75.3	8.26	74.7	248.0
J-39	75.3	10.48	74.7	248.0
J-40	75.3	13.22	74.6	247.7
J-41	75.4	6.63	74.7	248.0
J-42	75.3	6.76	74.8	248.1
J-43	75.3	6.92	74.8	248.2
J-44	75.2	11.36	74.9	248.4
J-45	75.2	5.28	74.9	248.4
J-46	75.1	5.20	75.0	248.5
J-47	75.1	3.09	75.0	248.4
J-48	75.1	6.81	74.9	248.2

Existing Water System - City of Live Oak

Junction Report - MDD

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)	Hydraulic Grade (ft)
J-49	75.0	3.75	74.9	248.2
J-50	75.1	11.43	74.9	248.3
J-51	75.0	4.30	74.9	248.2
J-52	75.0	2.85	75.0	248.4
J-53	75.0	6.84	75.1	248.5
J-54	75.0	0.95	75.1	248.6
J-55	75.0	3.59	75.1	248.6
J-56	74.7	16.21	75.2	248.6
J-57	74.5	9.98	75.3	248.5
J-58	74.5	17.01	75.2	248.4
J-59	74.5	19.24	75.2	248.2
J-60	74.9	16.37	75.0	248.2
J-61	74.8	21.65	75.0	248.1
J-62	74.3	9.16	75.2	248.1
J-63	74.2	13.49	75.2	248.1
J-64	74.5	22.55	75.1	248.1
J-65	74.7	4.07	75.0	248.0
J-66	74.4	8.87	75.1	248.0
J-67	74.4	2.30	75.1	248.0
J-68	74.0	6.31	75.3	248.0
J-69	74.0	5.28	75.3	248.0
J-70	74.0	10.66	75.3	248.0
J-71	74.0	6.50	75.3	248.0
J-72	74.0	8.18	75.3	248.1
J-73	74.0	7.92	75.3	248.1
J-74	74.1	8.35	75.3	248.1
J-75	74.0	6.76	75.3	248.1
J-76	74.1	10.88	75.3	248.2
J-77	74.0	10.58	75.3	248.0
J-78	74.1	14.91	75.4	248.4
J-79	74.2	13.44	75.4	248.5
J-80	74.2	9.06	75.5	248.8
J-81	74.0	18.45	75.8	249.2
J-82	74.0	9.59	75.9	249.4
J-83	74.0	5.73	75.9	249.4
J-84	74.5	14.42	75.7	249.4
J-85	74.6	10.29	75.7	249.5
J-86	75.0	5.15	75.5	249.4
J-87	75.0	6.44	76.0	250.6
J-88	75.0	8.58	75.4	249.3
J-89	75.0	8.61	74.3	246.8
J-90	75.3	6.36	76.0	251.0
J-91	75.0	7.55	76.1	250.9
J-92	75.0	16.71	76.6	252.0
J-93	74.9	12.38	76.7	252.3
J-94	75.0	13.73	76.9	252.6
J-95	75.1	10.88	77.6	254.4
J-96	75.2	5.23	78.7	257.0

Existing Water System - City of Live Oak

Junction Report - MDD

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)	Hydraulic Grade (ft)
J-97	75.2	23.68	78.3	256.3
J-98	75.3	16.95	77.1	253.5
J-99	75.3	12.43	77.3	254.0
J-100	75.2	13.86	77.5	254.3
J-101	75.4	16.23	77.0	253.5
J-102	75.7	11.96	75.6	250.6
J-103	75.8	14.20	75.5	250.4
J-104	75.8	16.76	75.5	250.4
J-105	76.0	9.95	75.3	250.1
J-106	76.0	5.31	75.3	250.1
J-107	76.2	5.17	75.1	249.8
J-108	76.3	4.91	75.0	249.7
J-109	76.0	9.98	75.2	249.8
J-110	76.1	8.40	75.2	249.8
J-111	75.9	9.08	75.4	250.1
J-112	75.9	3.27	75.6	250.6
J-113	75.7	5.17	75.7	250.6
J-114	75.6	16.08	75.7	250.6
J-115	75.8	3.24	75.6	250.6
J-116	75.6	7.12	75.7	250.6
J-117	75.6	5.15	75.7	250.6
J-118	75.6	7.37	75.7	250.6
J-119	76.1	7.79	74.3	247.8
J-120	76.7	6.86	74.5	248.9
J-121	75.6	8.80	75.8	250.9
J-122	75.7	4.86	74.6	248.1
J-123	75.7	7.68	74.7	248.3
J-124	75.6	5.31	74.9	248.7
J-125	75.5	0.66	74.9	248.8
J-126	75.5	1.43	74.9	248.7
J-127	75.4	2.56	74.6	247.8
J-128	75.4	1.10	75.2	249.3
J-129	75.4	5.04	75.2	249.3
J-130	75.3	7.63	74.6	247.7
J-131	75.4	27.06	74.5	247.6
J-132	75.3	6.10	74.6	247.7
J-133	75.2	5.52	74.7	247.8
J-134	75.3	11.62	74.5	247.5
J-135	75.4	21.99	74.4	247.3
J-136	75.6	11.14	74.1	246.8
J-137	75.3	7.57	74.6	247.7
J-138	75.0	2.06	74.7	247.8
J-139	75.1	0.56	74.7	247.8
J-140	75.1	13.13	74.8	248.0
J-141	75.0	3.72	77.1	253.2
J-142	74.8	10.35	77.3	253.4
J-143	74.5	14.01	77.3	253.3
J-144	74.8	7.26	76.8	252.2

Existing Water System - City of Live Oak

Junction Report - MDD

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)	Hydraulic Grade (ft)
J-145	74.7	4.94	76.6	251.7
J-146	74.3	16.82	76.9	252.1
J-147	74.5	15.66	75.9	250.0
J-148	74.5	10.12	75.9	250.0
J-149	74.2	15.13	75.9	249.6
J-150	74.1	13.13	75.8	249.3
J-151	74.0	17.85	76.0	249.6
J-152	74.0	11.90	75.9	249.4
J-153	74.5	9.00	75.3	248.6
J-154	74.0	14.65	75.3	248.0
J-155	74.0	2.14	75.3	248.0
J-156	74.0	4.38	75.3	248.0
J-157	75.3	6.97	74.8	248.1
J-158	75.1	5.73	74.9	248.1
J-159	75.0	9.34	74.9	248.1
J-160	75.5	6.07	74.3	247.3
J-161	75.5	5.70	74.6	247.8
J-162	75.5	5.12	74.5	247.6
J-163	75.4	8.26	74.5	247.6
J-164	75.2	10.13	74.6	247.6
J-165	75.2	3.09	75.4	249.5
J-166	75.2	3.54	75.5	249.8
J-167	75.2	5.07	78.2	256.0
J-168	75.1	5.36	78.5	256.6
J-169	75.1	1.95	78.6	256.8
J-170	74.9	1.72	80.4	260.7
J-171	75.1	6.60	79.5	258.8
J-172	75.0	11.70	80.3	260.7
J-173	75.3	9.56	77.6	254.7
J-174	75.4	5.81	77.6	254.7
J-175	75.4	24.13	74.4	247.4
J-176	75.4	9.76	74.5	247.6
J-177	75.6	5.23	74.4	247.5
J-178	75.6	12.83	74.3	247.4
J-179	76.0	10.69	73.8	246.7
J-180	76.0	2.61	73.8	246.7
J-181	76.0	0.00	73.8	246.7
J-182	76.0	0.00	73.8	246.7
J-183	75.8	7.11	73.9	246.7
J-184	75.8	0.74	73.9	246.7
J-185	75.8	0.71	73.9	246.7
J-186	75.8	1.06	73.9	246.7
J-187	75.7	1.43	74.0	246.7
J-188	75.9	16.03	73.9	246.7
J-189	75.9	22.25	73.9	246.7
J-190	74.8	9.90	76.7	252.2
J-191	74.8	11.25	76.3	251.2
J-192	74.8	13.07	76.3	251.2

Existing Water System - City of Live Oak

Junction Report - MDD

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)	Hydraulic Grade (ft)
J-193	75.0	5.81	75.3	248.9
J-194	74.7	5.57	76.0	250.4
J-195	74.9	11.83	76.0	250.6
J-196	74.3	10.56	75.9	249.7
J-197	74.6	7.60	76.0	250.4
J-198	74.8	6.05	77.6	254.1
J-199	75.0	7.18	77.6	254.4
J-200	74.9	6.36	78.1	255.5
J-201	75.1	2.33	78.0	255.3
J-202	75.0	6.36	77.6	254.3
J-203	74.8	2.87	78.5	256.2
J-204	75.0	5.46	74.2	246.5
J-205	75.0	6.58	75.4	249.3
J-206	75.3	5.41	74.8	248.1
J-207	75.1	5.76	74.9	248.1
J-208	75.0	4.86	74.9	248.1
J-209	75.1	7.87	75.0	248.5
J-210	75.0	11.67	77.1	253.2
J-211	75.2	2.45	76.3	251.6
J-212	75.3	7.79	74.5	247.6
J-213	75.8	2.59	73.9	246.7
J-215	75.9	28.46	73.9	246.7
J-216	75.7	23.55	74.0	246.8
J-217	76.0	5.34	74.1	247.2
J-218	76.9	14.89	73.8	247.5
J-219	75.5	4.86	74.6	247.9
J-220	75.3	2.14	74.6	247.7
J-221	75.2	9.27	74.6	247.7
J-222	75.1	12.38	74.9	248.3
J-223	74.3	3.65	75.1	248.0
J-224	74.0	3.30	75.3	248.0
J-225	75.2	3.57	74.3	247.0
J-226	75.2	15.33	79.7	259.4
J-227	75.6	11.36	76.4	252.2
J-228	75.6	23.47	76.1	251.5
J-229	75.2	3.66	77.9	255.3
J-230	75.1	6.68	74.7	247.8
J-231	74.7	9.03	77.6	254.1
J-232	75.0	2.96	80.6	261.1
J-233	76.6	4.20	74.7	249.2
J-234	75.6	9.40	74.1	246.8
J-235	74.5	9.06	75.3	248.6
J-236	76.0	5.09	74.3	247.7
J-237	75.1	0.00	81.4	263.2
J-238	75.1	12.77	75.4	249.4
J-245	75.3	7.26	74.6	247.7
J-246	75.2	11.64	76.9	252.9
J-247	74.8	7.50	76.7	252.0

Existing Water System - City of Live Oak

Junction Report - MDD

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)	Hydraulic Grade (ft)
J-248	74.7	12.99	76.8	252.3
J-249	75.0	6.21	78.0	255.3
J-250	75.8	6.31	73.9	246.7
J-251	75.7	10.19	74.0	246.7
J-252	75.3	7.60	74.8	248.1
J-253	75.2	5.76	74.6	247.7
J-254	75.2	4.41	74.3	246.9
J-255	75.2	7.42	74.3	246.9
J-256	75.1	4.73	74.3	246.8
J-257	75.1	11.06	74.3	246.8
J-258	75.5	32.08	74.3	247.2
J-259	74.3	8.53	75.2	248.0
J-260	75.1	0.00	74.3	246.8
J-261	75.0	9.48	74.2	246.6
J-262	75.1	7.08	74.2	246.6
J-263	75.0	8.97	74.2	246.4
J-264	75.0	8.21	74.2	246.4
J-265	74.8	9.06	74.2	246.3
J-266	74.7	7.26	74.2	246.3
J-267	74.8	11.78	74.2	246.3
J-268	74.8	12.25	74.2	246.2
J-269	74.5	16.00	74.3	246.2
J-270	74.3	34.71	74.4	246.2
J-271	74.3	10.21	74.3	246.2
J-272	74.7	9.11	74.2	246.2
J-273	74.9	13.57	74.1	246.2
J-274	75.0	9.90	74.0	246.2
J-275	75.1	9.08	74.0	246.2
J-276	74.9	9.87	74.1	246.2
J-277	75.0	11.43	74.0	246.2
J-278	75.2	10.01	74.0	246.2
J-279	75.3	10.19	73.9	246.1
J-280	74.6	10.80	74.3	246.2
J-281	74.4	13.67	74.3	246.2
J-282	74.5	11.27	74.3	246.2
J-283	74.2	43.45	74.4	246.2
J-284	75.0	35.61	74.0	246.1
J-285	75.0	1.90	74.1	246.3
J-286	75.0	9.59	74.1	246.2
J-287	75.0	5.79	74.1	246.3
J-288	75.0	6.81	74.1	246.3
J-289	75.0	5.49	74.2	246.4
J-290	75.0	8.18	74.2	246.4
J-291	75.1	5.43	74.1	246.4
J-292	74.5	7.31	74.3	246.2
J-293	75.0	9.61	74.3	246.6
J-294	74.0	5.01	75.3	248.0
J-295	74.0	11.70	75.3	248.0

Existing Water System - City of Live Oak

Junction Report - MDD

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)	Hydraulic Grade (ft)
J-296	73.7	16.98	75.4	248.0
J-297	73.5	24.66	75.5	248.0
J-298	73.6	12.91	75.4	248.0
J-299	73.8	7.82	75.4	248.0
J-300	73.8	5.62	75.4	248.0
J-301	74.0	4.67	75.3	248.0
J-302	74.0	10.13	75.3	248.0
J-303	76.4	5.01	74.9	249.7
J-304	76.7	9.37	74.8	249.5
J-305	76.9	12.51	74.6	249.5
J-306	76.6	8.42	74.7	249.4
J-307	76.4	8.58	74.9	249.5
J-308	76.4	9.67	74.9	249.5
J-309	76.2	8.47	75.0	249.7
J-310	76.3	12.09	75.0	249.6
J-311	76.5	8.50	74.9	249.5
J-312	78.0	1.13	73.1	247.0
J-313	78.5	1.35	72.9	247.0
J-314	78.1	17.85	73.1	247.0
J-315	78.1	28.04	73.1	247.0
J-316	78.2	11.70	73.0	247.0
J-317	78.9	11.88	72.7	247.0
J-318	78.7	8.18	72.8	247.0
J-319	78.5	7.31	72.9	247.0
J-320	79.5	10.40	72.5	247.0
J-321	75.5	10.03	77.0	253.5
J-322	73.7	3.09	74.0	244.8
J-323	73.0	206.53	73.7	243.4
J-324	76.6	0.74	74.7	249.3
J-325	76.0	0.00	73.8	246.7
J-326	74.2	0.00	74.4	246.2
J-327	74.3	0.00	74.4	246.2
J-328	74.9	0.00	74.1	246.2
J-329	74.8	0.00	74.1	246.2
J-330	74.7	0.00	74.2	246.2
J-331	74.5	0.00	74.3	246.2
J-332	74.5	0.00	74.3	246.2
J-333	74.3	0.00	74.4	246.2
J-334	73.9	0.00	74.5	246.2
J-335	74.0	0.00	74.5	246.2
J-336	74.3	0.00	74.4	246.2
J-337	75.0	0.00	74.0	246.1
J-338	73.8	0.00	74.6	246.2
J-341	76.2	11.83	75.2	249.9
J-342	75.7	33.05	74.0	246.7
J-343	75.0	11.45	75.5	249.4
J-344	74.2	10.09	75.9	249.6
J-345	74.6	15.33	75.7	249.5

Existing Water System - City of Live Oak

Junction Report - MDD

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)	Hydraulic Grade (ft)
J-346	74.8	11.06	74.2	246.2
J-347	74.6	0.00	74.2	246.2
J-348	73.9	0.00	74.5	246.2
J-349	73.9	0.00	74.5	246.2
J-350	73.8	0.00	74.6	246.2
J-351	74.2	0.00	74.4	246.2
J-352	74.4	0.00	74.3	246.2
J-356	74.2	0.00	74.4	246.2

Existing Water System - City of Live Oak

Pipe Report - MDD

Label	Diameter (in)	Length (ft)	Hazen-Williams C	Velocity (ft/s)	Headloss Gradient (ft/1,000 ft)
P-1	8	184	120	0.4	0.00
P-2	8	323	120	0.7	0.00
P-3	8	265	120	0.9	0.00
P-4	8	339	120	0.0	0.00
P-5	8	245	120	0.3	0.00
P-6	8	460	120	0.0	0.00
P-7	8	325	120	0.3	0.00
P-8	8	155	120	0.0	0.00
P-9	6	285	120	0.1	0.00
P-10	6	235	120	0.3	0.00
P-11	8	258	120	0.5	0.00
P-12	8	280	120	0.1	0.00
P-13	8	474	120	0.8	0.00
P-14	8	368	120	0.4	0.00
P-15	8	307	120	0.1	0.00
P-16	2	374	120	0.6	0.00
P-17	6	135	120	1.1	0.00
P-18	8	491	120	0.3	0.00
P-19	6	313	120	0.4	0.00
P-20	6	299	120	0.6	0.00
P-21	6	402	120	0.5	0.00
P-22	6	99	120	0.1	0.00
P-23	6	140	120	0.1	0.00
P-24	8	613	120	0.6	0.00
P-25	8	493	120	0.4	0.00
P-26	6	564	120	2.2	0.00
P-27	6	400	120	2.4	0.00
P-28	6	398	120	1.9	0.00
P-29	6	401	120	1.4	0.00
P-30	6	190	120	0.1	0.00
P-31	6	229	120	0.1	0.00
P-32	8	447	120	0.0	0.00
P-33	6	200	120	0.2	0.00
P-34	6	89	120	0.1	0.00
P-35	8	371	120	0.2	0.00
P-36	8	242	120	0.1	0.00
P-37	6	220	120	0.1	0.00
P-38	6	496	120	0.2	0.00
P-39	8	282	120	1.0	0.00
P-40	8	259	120	0.7	0.00
P-41	8	100	120	0.2	0.00
P-42	6	196	120	0.1	0.00
P-43	8	642	120	0.0	0.00
P-44	6	258	120	0.1	0.00
P-45	8	171	120	0.0	0.00
P-46	8	171	120	0.1	0.00
P-47	6	220	120	0.1	0.00
P-48	6	747	120	0.6	0.00

Existing Water System - City of Live Oak

Pipe Report - MDD

Label	Diameter (in)	Length (ft)	Hazen-Williams C	Velocity (ft/s)	Headloss Gradient (ft/1,000 ft)
P-49	6	500	120	0.3	0.00
P-50	4	163	120	0.1	0.00
P-51	8	110	120	0.0	0.00
P-52	6	369	120	0.6	0.00
P-53	8	269	120	1.3	0.00
P-54	8	269	120	1.2	0.00
P-55	8	131	120	1.0	0.00
P-56	6	142	120	0.4	0.00
P-57	8	681	120	0.4	0.00
P-58	6	400	120	0.3	0.00
P-59	6	99	120	0.4	0.00
P-60	4	153	120	0.2	0.00
P-61	6	356	120	2.2	0.00
P-62	8	360	120	1.3	0.00
P-63	8	346	120	1.1	0.00
P-64	6	255	120	0.2	0.00
P-65	6	320	120	0.7	0.00
P-66	6	285	120	0.5	0.00
P-67	8	111	120	0.3	0.00
P-68	6	129	120	2.5	0.01
P-69	6	292	120	0.5	0.00
P-70	6	636	120	0.2	0.00
P-71	6	403	120	0.3	0.00
P-72	6	377	120	0.4	0.00
P-73	6	197	120	0.1	0.00
P-74	6	207	120	0.1	0.00
P-75	8	496	120	0.2	0.00
P-76	6	669	120	0.1	0.00
P-77	8	484	120	0.0	0.00
P-78	8	135	120	0.0	0.00
P-79	6	136	120	0.0	0.00
P-80	6	186	120	0.4	0.00
P-81	6	289	120	0.7	0.00
P-82	6	236	120	1.0	0.00
P-83	6	274	120	0.8	0.00
P-84	6	273	120	1.2	0.00
P-85	6	564	120	0.3	0.00
P-86	6	297	120	0.1	0.00
P-87	10	365	120	0.2	0.00
P-88	8	241	120	0.2	0.00
P-89	8	413	120	0.1	0.00
P-90	8	112	120	1.5	0.00
P-91	8	396	120	0.1	0.00
P-92	8	283	120	0.0	0.00
P-93	6	504	120	0.2	0.00
P-94	6	506	120	0.5	0.00
P-95	6	161	120	0.8	0.00
P-96	6	182	120	0.8	0.00

Existing Water System - City of Live Oak

Pipe Report - MDD

Label	Diameter (in)	Length (ft)	Hazen-Williams C	Velocity (ft/s)	Headloss Gradient (ft/1,000 ft)
P-97	6	317	120	0.9	0.00
P-98	6	324	120	0.5	0.00
P-99	8	191	120	0.6	0.00
P-100	8	169	120	0.7	0.00
P-101	8	344	120	0.7	0.00
P-102	8	398	120	0.5	0.00
P-103	6	190	120	1.1	0.00
P-104	8	437	120	0.0	0.00
P-105	6	326	120	0.2	0.00
P-106	8	184	120	0.8	0.00
P-107	6	319	120	1.0	0.00
P-108	6	322	120	0.5	0.00
P-109	6	172	120	0.7	0.00
P-110	6	174	120	0.1	0.00
P-111	6	312	120	0.3	0.00
P-112	8	450	120	0.1	0.00
P-113	6	151	120	0.1	0.00
P-114	8	177	120	0.2	0.00
P-115	6	341	120	0.2	0.00
P-116	2	260	120	0.3	0.00
P-117	6	158	120	0.5	0.00
P-118	6	421	120	0.0	0.00
P-119	2	606	120	0.9	0.00
P-120	6	351	120	1.3	0.00
P-121	6	181	120	0.2	0.00
P-122	6	218	120	0.7	0.00
P-123	6	525	120	0.7	0.00
P-124	6	613	120	0.9	0.00
P-125	6	294	120	0.2	0.00
P-126	6	275	120	0.1	0.00
P-127	6	485	120	0.5	0.00
P-128	4	303	120	0.6	0.00
P-129	6	128	120	0.2	0.00
P-130	8	595	120	0.0	0.00
P-131	8	124	120	0.3	0.00
P-132	8	254	120	0.3	0.00
P-133	8	260	120	0.3	0.00
P-134	8	275	120	0.4	0.00
P-135	8	233	120	1.0	0.00
P-136	8	271	120	0.9	0.00
P-137	8	274	120	1.3	0.00
P-138	8	239	120	1.7	0.00
P-139	8	249	120	1.5	0.00
P-140	8	258	120	1.5	0.00
P-141	6	228	120	3.0	0.01
P-142	6	149	120	2.0	0.00
P-143	8	367	120	2.1	0.00
P-144	8	367	120	3.1	0.01

Existing Water System - City of Live Oak

Pipe Report - MDD

Label	Diameter (in)	Length (ft)	Hazen-Williams C	Velocity (ft/s)	Headloss Gradient (ft/1,000 ft)
P-145	8	728	120	3.0	0.01
P-146	8	131	120	1.8	0.00
P-147	8	448	120	0.0	0.00
P-148	6	252	120	0.4	0.00
P-149	8	129	120	0.0	0.00
P-150	8	449	120	2.1	0.00
P-151	8	367	120	1.9	0.00
P-152	8	353	120	3.2	0.01
P-153	8	386	120	4.7	0.01
P-154	6	693	120	0.5	0.00
P-155	8	441	120	0.2	0.00
P-156	6	412	120	0.4	0.00
P-157	6	277	120	0.5	0.00
P-158	6	257	120	1.1	0.00
P-159	6	337	120	0.9	0.00
P-160	6	488	120	0.7	0.00
P-161	6	352	120	2.4	0.00
P-162	8	169	120	4.4	0.01
P-163	6	599	120	2.2	0.00
P-164	6	692	120	0.1	0.00
P-165	6	270	120	0.4	0.00
P-166	6	241	120	1.0	0.00
P-167	6	486	120	1.3	0.00
P-168	8	250	120	1.1	0.00
P-169	6	513	120	2.2	0.00
P-170	6	361	120	2.4	0.00
P-171	6	379	120	2.9	0.01
P-172	6	701	120	1.9	0.00
P-173	8	552	120	0.8	0.00
P-174	8	273	120	0.9	0.00
P-175	6	256	120	0.1	0.00
P-176	8	400	120	0.1	0.00
P-177	6	274	120	0.1	0.00
P-178	6	292	120	0.0	0.00
P-179	8	512	120	0.1	0.00
P-180	4	343	120	0.1	0.00
P-181	2	484	120	0.5	0.00
P-182	6	155	120	0.2	0.00
P-183	6	353	120	1.8	0.00
P-184	6	670	120	1.3	0.00
P-185	8	160	120	1.8	0.00
P-186	6	130	120	0.8	0.00
P-187	8	190	120	0.0	0.00
P-188	6	521	120	1.7	0.00
P-189	10	170	120	0.6	0.00
P-190	6	231	120	3.1	0.01
P-191	6	92	120	3.0	0.01
P-192	8	623	120	1.5	0.00

Existing Water System - City of Live Oak

Pipe Report - MDD

Label	Diameter (in)	Length (ft)	Hazen-Williams C	Velocity (ft/s)	Headloss Gradient (ft/1,000 ft)
P-193	6	368	120	0.2	0.00
P-194	8	757	120	0.9	0.00
P-195	6	244	120	0.2	0.00
P-196	6	185	120	1.4	0.00
P-197	6	211	120	0.9	0.00
P-198	8	268	120	0.7	0.00
P-199	8	749	120	2.3	0.00
P-200	6	344	120	0.0	0.00
P-201	2	876	120	0.4	0.00
P-202	6	435	120	0.7	0.00
P-203	8	130	120	0.0	0.00
P-204	8	303	120	1.4	0.00
P-205	6	287	120	2.2	0.00
P-206	8	275	120	0.8	0.00
P-208	6	16	120	1.3	0.00
P-209	8	49	120	1.1	0.00
P-210	8	136	120	0.0	0.00
P-211	6	338	120	0.1	0.00
P-212	6	25	120	0.1	0.00
P-213	6	455	120	0.0	0.00
P-214	6	176	120	1.0	0.00
P-215	6	980	120	0.0	0.00
P-216	8	886	120	0.3	0.00
P-217	8	153	120	0.1	0.00
P-218	6	685	120	2.1	0.00
P-219	6	373	120	1.4	0.00
P-220	6	38	120	2.2	0.00
P-221	6	321	120	0.0	0.00
P-222	6	55	120	1.0	0.00
P-223	6	516	120	0.8	0.00
P-224	6	193	120	1.0	0.00
P-225	8	853	120	1.7	0.00
P-226	4	25	120	3.0	0.01
P-227	4	363	120	3.3	0.01
P-228	6	42	120	4.9	0.02
P-229	6	469	120	2.7	0.01
P-230	6	382	120	1.4	0.00
P-231	6	366	120	1.3	0.00
P-232	6	450	120	0.8	0.00
P-233	8	842	120	0.0	0.00
P-234	8	209	120	0.3	0.00
P-235	8	40	120	0.0	0.00
P-236	6	239	120	0.8	0.00
P-237	6	154	120	0.9	0.00
P-238	6	57	120	2.5	0.01
P-239	6	524	120	3.9	0.01
P-240	8	156	120	3.0	0.01
P-241	8	53	120	2.5	0.00

Existing Water System - City of Live Oak

Pipe Report - MDD

Label	Diameter (in)	Length (ft)	Hazen-Williams C	Velocity (ft/s)	Headloss Gradient (ft/1,000 ft)
P-242	6	352	120	1.1	0.00
P-243	6	361	120	1.2	0.00
P-244	6	29	120	1.2	0.00
P-245	6	142	120	0.0	0.00
P-246	8	268	120	0.1	0.00
P-247	6	331	120	2.5	0.01
P-248	6	370	120	1.0	0.00
P-249	6	315	120	1.9	0.00
P-250	6	96	120	0.1	0.00
P-251	6	457	120	0.8	0.00
P-252	6	14	120	2.2	0.00
P-253	8	686	120	0.3	0.00
P-254	6	477	120	0.1	0.00
P-255	8	189	120	0.5	0.00
P-256	8	36	120	0.1	0.00
P-257	6	244	120	0.8	0.00
P-258	6	37	120	0.7	0.00
P-259	6	680	120	0.7	0.00
P-260	8	236	120	0.9	0.00
P-261	10	348	120	5.5	0.01
P-262	10	24	120	6.5	0.02
P-263	6	919	120	0.0	0.00
P-264	6	20	120	1.2	0.00
P-265	6	439	120	0.7	0.00
P-266	6	182	120	1.4	0.00
P-267	6	160	120	0.7	0.00
P-268	8	176	120	4.5	0.01
P-269	12	189	120	2.9	0.00
P-270	12	183	120	2.9	0.00
P-271	12	213	120	3.1	0.00
P-272	12	145	120	3.1	0.00
P-273	99	140	120	0.0	0.00
P-274	8	125	120	6.1	0.02
P-275	8	233	120	5.9	0.02
P-277	99	206	120	0.0	0.00
P-278	8	125	120	6.1	0.02
P-279	8	124	120	5.9	0.02
P-281	6	416	120	1.7	0.00
P-282	8	51	120	0.8	0.00
P-284	6	734	120	0.0	0.00
P-285	8	455	120	0.0	0.00
P-286	6	807	120	0.3	0.00
P-287	8	727	120	0.7	0.00
P-288	8	701	120	0.2	0.00
P-289	8	247	120	0.8	0.00
P-290	6	262	120	0.7	0.00
P-291	6	252	120	2.0	0.00
P-292	6	244	120	2.1	0.00

Existing Water System - City of Live Oak

Pipe Report - MDD

Label	Diameter (in)	Length (ft)	Hazen-Williams C	Velocity (ft/s)	Headloss Gradient (ft/1,000 ft)
P-293	8	734	130	0.1	0.00
P-296	6	68	130	4.3	0.01
P-297	6	95	130	4.3	0.01
P-298	16	445	130	4.7	0.00
P-299	8	315	120	1.9	0.00
P-300	6	363	120	3.4	0.01
P-301	8	907	120	1.6	0.00
P-302	6	211	120	2.7	0.01
P-303	8	305	120	0.0	0.00
P-304	8	299	120	0.1	0.00
P-305	6	217	120	2.5	0.01
P-306	8	339	120	2.5	0.00
P-307	8	350	120	2.1	0.00
P-308	8	184	130	0.3	0.00
P-309	8	272	130	0.0	0.00
P-310	8	476	130	0.1	0.00
P-311	8	269	130	0.1	0.00
P-312	6	510	120	0.4	0.00
P-313	8	105	120	0.3	0.00
P-314	6	309	120	0.5	0.00
P-315	6	345	120	0.1	0.00
P-316	6	207	130	0.6	0.00
P-317	8	262	120	0.8	0.00
P-318	8	276	130	0.0	0.00
P-319	8	259	120	0.7	0.00
P-320	8	278	130	0.1	0.00
P-321	8	320	120	0.9	0.00
P-322	8	1,220	120	0.7	0.00
P-323	8	405	130	1.7	0.00
P-324	8	610	120	0.0	0.00
P-325	8	184	120	0.2	0.00
P-326	8	397	130	1.0	0.00
P-327	8	303	130	1.0	0.00
P-328	8	212	130	0.0	0.00
P-329	8	304	130	0.9	0.00
P-330	8	299	130	0.5	0.00
P-331	8	267	130	0.5	0.00
P-332	8	261	130	0.7	0.00
P-333	8	257	130	0.4	0.00
P-334	8	259	130	0.3	0.00
P-335	8	280	130	0.4	0.00
P-336	8	256	130	0.1	0.00
P-337	8	604	130	0.1	0.00
P-338	8	267	130	0.3	0.00
P-339	8	255	130	0.1	0.00
P-340	8	255	130	0.1	0.00
P-341	8	514	130	0.1	0.00
P-342	8	303	130	0.1	0.00

Existing Water System - City of Live Oak

Pipe Report - MDD

Label	Diameter (in)	Length (ft)	Hazen-Williams C	Velocity (ft/s)	Headloss Gradient (ft/1,000 ft)
P-343	8	516	130	0.0	0.00
P-344	8	264	130	0.1	0.00
P-345	8	519	130	0.1	0.00
P-346	8	255	130	0.3	0.00
P-347	8	281	130	0.7	0.00
P-348	8	369	130	0.4	0.00
P-349	8	597	130	0.0	0.00
P-350	8	256	130	0.1	0.00
P-351	8	266	130	0.0	0.00
P-352	8	595	130	0.8	0.00
P-353	8	182	130	1.3	0.00
P-354	8	185	130	0.6	0.00
P-355	8	365	130	0.5	0.00
P-356	8	126	130	0.5	0.00
P-357	8	368	130	0.5	0.00
P-358	8	262	130	0.1	0.00
P-359	8	263	130	0.3	0.00
P-360	8	233	130	0.4	0.00
P-361	8	527	130	0.4	0.00
P-362	8	270	130	0.8	0.00
P-363	8	112	130	0.3	0.00
P-364	8	379	130	0.3	0.00
P-365	8	264	130	0.5	0.00
P-366	8	597	130	0.0	0.00
P-367	8	373	120	0.9	0.00
P-368	8	639	120	0.6	0.00
P-369	8	182	130	1.5	0.00
P-370	8	325	130	0.1	0.00
P-371	8	192	130	0.0	0.00
P-372	8	305	130	0.1	0.00
P-373	8	285	130	0.1	0.00
P-374	8	701	130	0.0	0.00
P-375	8	479	130	0.1	0.00
P-376	8	249	130	0.2	0.00
P-377	8	587	130	0.1	0.00
P-378	8	129	130	0.2	0.00
P-379	8	622	130	0.1	0.00
P-380	8	670	130	0.2	0.00
P-381	8	96	130	0.0	0.00
P-382	8	465	130	0.1	0.00
P-383	8	165	130	0.1	0.00
P-384	8	126	130	1.0	0.00
P-385	8	266	130	0.8	0.00
P-386	8	264	130	0.7	0.00
P-387	8	598	130	0.5	0.00
P-388	4	281	130	0.2	0.00
P-389	8	528	130	0.1	0.00
P-390	8	286	130	0.1	0.00

Existing Water System - City of Live Oak

Pipe Report - MDD

Label	Diameter (in)	Length (ft)	Hazen-Williams C	Velocity (ft/s)	Headloss Gradient (ft/1,000 ft)
P-391	6	328	130	0.1	0.00
P-392	8	366	130	0.1	0.00
P-393	8	191	130	0.1	0.00
P-394	8	390	130	0.0	0.00
P-395	8	173	130	0.1	0.00
P-396	8	260	130	0.1	0.00
P-397	8	239	130	0.4	0.00
P-398	8	382	130	0.3	0.00
P-399	8	249	130	0.1	0.00
P-400	8	253	130	0.1	0.00
P-401	8	171	130	0.0	0.00
P-402	8	381	130	0.0	0.00
P-403	8	381	130	0.0	0.00
P-404	8	542	130	0.1	0.00
P-405	8	377	130	0.7	0.00
P-406	8	328	130	0.1	0.00
P-407	8	649	120	1.3	0.00
P-408	8	541	120	1.4	0.00
P-409	8	420	120	0.2	0.00
P-410	8	928	120	0.0	0.00
P-411	8	462	120	0.1	0.00
P-412	8	770	120	0.1	0.00
P-413	8	470	120	0.7	0.00
P-414	8	461	120	0.6	0.00
P-415	6	578	120	0.2	0.00
P-416	6	381	120	0.4	0.00
P-417	8	463	130	0.4	0.00
P-418	8	392	130	0.3	0.00
P-419	8	1,305	130	1.3	0.00
P-420	8	1,418	130	1.3	0.00
P-421	8	192	130	0.5	0.00
P-422	8	204	130	0.5	0.00
P-423	6	521	120	0.0	0.00
P-424	6	416	120	0.0	0.00
P-425	8	264	130	0.2	0.00
P-426	8	267	130	0.1	0.00
P-427	8	342	130	0.0	0.00
P-428	8	541	130	0.1	0.00
P-429	8	259	130	0.3	0.00
P-430	8	263	130	0.1	0.00
P-431	8	411	130	0.0	0.00
P-432	8	271	130	0.0	0.00
P-433	8	368	130	0.0	0.00
P-434	8	261	130	0.0	0.00
P-435	8	254	130	0.1	0.00
P-436	8	542	130	0.0	0.00
P-437	8	257	130	0.2	0.00
P-438	8	201	130	0.8	0.00

Existing Water System - City of Live Oak

Pipe Report - MDD

Label	Diameter (in)	Length (ft)	Hazen-Williams C	Velocity (ft/s)	Headloss Gradient (ft/1,000 ft)
P-439	8	339	130	0.4	0.00
P-440	8	258	130	0.1	0.00
P-441	8	596	130	0.0	0.00
P-442	8	267	130	0.1	0.00
P-443	8	600	130	0.1	0.00
P-444	8	596	130	0.5	0.00
P-445	8	269	130	0.2	0.00
P-446	6	27	120	0.0	0.00
P-448	8	408	130	0.1	0.00
P-449	8	749	130	0.1	0.00
P-449	6	50	120	0.0	0.00
P-450	8	280	130	0.1	0.00
P-451	8	291	130	0.0	0.00
P-452	8	416	130	0.0	0.00
P-454	8	391	130	0.0	0.00
P-455	8	90	130	0.0	0.00
P-459	8	276	130	0.0	0.00
P-460	8	253	130	0.0	0.00
P-471	8	112	130	0.0	0.00

Existing Water System - City of Live Oak

Junction Report - MDD+FIRE

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Satisfies Fire Flow Constraints?	Junction w/Minimum Pressure (Zone)	Calculated Minimum Zone Pressure (psi)
J-1	1,500	1,824	TRUE	J-5	24.4
J-2	3,000	2,475	FALSE	J-320	20.0
J-3	3,000	2,457	FALSE	J-218	20.0
J-4	1,500	2,428	TRUE	J-11	20.0
J-5	2,500	1,869	FALSE	J-312	21.9
J-6	3,000	2,031	FALSE	J-320	20.3
J-7	1,500	2,488	TRUE	J-11	22.4
J-8	1,500	2,060	TRUE	J-9	20.0
J-9	1,500	1,785	TRUE	J-8	30.9
J-11	1,500	1,848	TRUE	J-4	38.3
J-12	1,500	2,573	TRUE	J-324	21.4
J-13	1,500	2,360	TRUE	J-9	24.1
J-14	3,000	2,677	FALSE	J-10	20.9
J-15	3,000	2,683	FALSE	J-14	20.9
J-16	3,000	2,308	FALSE	J-119	20.0
J-17	2,500	2,647	TRUE	J-217	20.7
J-18	1,500	1,896	TRUE	J-239	20.0
J-19	1,500	1,425	FALSE	J-20	20.0
J-21	1,500	1,538	TRUE	J-20	20.0
J-22	1,500	2,162	TRUE	J-20	20.0
J-23	1,500	2,189	TRUE	J-24	20.0
J-24	1,500	2,152	TRUE	J-23	21.4
J-25	4,000	2,208	FALSE	J-188	23.5
J-26	4,000	2,465	FALSE	J-234	23.6
J-27	1,500	2,257	TRUE	J-29	28.8
J-28	1,500	2,345	TRUE	J-29	23.5
J-29	1,500	2,144	TRUE	J-216	21.2
J-30	1,500	2,551	TRUE	J-28	27.1
J-31	1,500	1,560	TRUE	J-32	43.7
J-32	1,500	2,250	TRUE	J-31	20.0
J-33	1,500	2,772	TRUE	J-32	23.8
J-34	3,000	2,769	FALSE	J-221	22.3
J-35	3,000	2,835	FALSE	J-139	20.0
J-36	3,000	3,181	TRUE	J-140	24.7
J-37	1,500	3,296	TRUE	J-252	20.3
J-38	1,500	1,948	TRUE	J-39	48.4
J-39	1,500	3,160	TRUE	J-38	20.0
J-40	1,500	3,007	TRUE	J-137	27.7
J-41	1,500	2,765	TRUE	J-160	22.5
J-42	1,500	2,853	TRUE	J-206	21.0
J-43	1,500	2,934	TRUE	J-42	21.9
J-44	1,500	3,312	TRUE	J-43	22.3
J-45	1,500	3,225	TRUE	J-44	27.7
J-46	1,500	3,215	TRUE	J-36	27.3
J-47	2,500	3,277	TRUE	J-44	26.6
J-48	1,500	2,541	TRUE	J-51	22.1
J-49	1,500	2,198	TRUE	J-51	20.0
J-50	3,000	2,867	FALSE	J-222	25.4
J-51	1,500	1,802	TRUE	J-49	35.1

Existing Water System - City of Live Oak

Junction Report - MDD+FIRE

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Satisfies Fire Flow Constraints?	Junction w/Minimum Pressure (Zone)	Calculated Minimum Zone Pressure (psi)
J-53	3,000	2,825	FALSE	J-60	34.1
J-54	1,500	3,860	TRUE	J-53	21.5
J-55	1,500	3,752	TRUE	J-54	29.4
J-56	1,500	4,099	TRUE	J-54	23.0
J-57	1,500	3,953	TRUE	J-58	21.6
J-58	1,500	3,688	TRUE	J-59	21.6
J-59	1,500	3,459	TRUE	J-62	22.1
J-60	3,000	2,243	FALSE	J-61	46.2
J-61	3,000	2,899	FALSE	J-65	26.8
J-62	1,500	3,297	TRUE	J-63	20.6
J-63	1,500	3,156	TRUE	J-69	23.0
J-64	2,500	3,099	TRUE	J-61	21.6
J-65	2,500	2,635	TRUE	J-67	24.6
J-66	1,500	2,917	TRUE	J-65	22.4
J-67	2,500	2,524	TRUE	J-223	20.4
J-68	2,500	2,560	TRUE	J-223	22.3
J-69	1,500	3,126	TRUE	J-70	20.2
J-70	1,500	3,002	TRUE	J-69	23.9
J-71	1,500	3,046	TRUE	J-300	21.8
J-72	1,500	3,162	TRUE	J-73	20.0
J-73	1,500	1,963	TRUE	J-72	48.8
J-74	1,500	3,288	TRUE	J-77	20.2
J-75	1,500	2,936	TRUE	J-77	20.0
J-76	1,500	3,463	TRUE	J-74	21.5
J-77	1,500	1,966	TRUE	J-75	45.8
J-78	1,500	3,696	TRUE	J-76	21.6
J-79	1,500	3,959	TRUE	J-78	21.6
J-80	3,000	4,330	TRUE	J-79	22.5
J-81	3,000	2,970	FALSE	J-82	40.4
J-82	3,000	3,616	TRUE	J-81	25.7
J-83	2,500	3,662	TRUE	J-84	23.0
J-84	1,500	3,424	TRUE	J-345	26.8
J-85	1,500	3,637	TRUE	J-345	22.6
J-86	1,500	3,606	TRUE	J-343	22.9
J-87	1,500	2,087	TRUE	J-195	50.3
J-88	1,500	3,427	TRUE	J-323	20.0
J-89	1,500	2,468	TRUE	J-323	20.0
J-90	1,500	2,856	TRUE	J-245	26.6
J-91	1,500	3,307	TRUE	J-323	30.9
J-92	2,500	3,065	TRUE	J-247	20.1
J-93	1,500	3,314	TRUE	J-248	20.1
J-94	1,500	3,921	TRUE	J-93	21.7
J-95	1,500	4,188	TRUE	J-246	24.5
J-96	1,500	4,500	TRUE	J-97	25.8
J-97	1,500	4,256	TRUE	J-321	25.2
J-98	3,000	2,488	FALSE	J-321	20.0
J-99	1,500	2,806	TRUE	J-100	22.2
J-100	1,500	2,309	TRUE	J-99	38.3
J-101	1,500	2,094	TRUE	J-321	20.0

Existing Water System - City of Live Oak

Junction Report - MDD+FIRE

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Satisfies Fire Flow Constraints?	Junction w/Minimum Pressure (Zone)	Calculated Minimum Zone Pressure (psi)
J-102	1,500	2,975	TRUE	J-104	20.4
J-103	1,500	2,860	TRUE	J-104	20.0
J-104	1,500	2,259	TRUE	J-103	36.7
J-105	1,500	2,324	TRUE	J-106	30.7
J-106	1,500	2,672	TRUE	J-105	20.0
J-107	1,500	2,556	TRUE	J-110	20.0
J-108	1,500	2,517	TRUE	J-303	20.9
J-109	1,500	2,095	TRUE	J-107	34.5
J-110	1,500	1,694	TRUE	J-107	45.5
J-111	1,500	1,726	TRUE	J-106	46.6
J-112	1,500	2,653	TRUE	J-115	30.7
J-113	1,500	2,966	TRUE	J-114	20.0
J-114	1,500	2,184	TRUE	J-113	40.5
J-115	1,500	3,054	TRUE	J-112	20.0
J-116	2,500	3,111	TRUE	J-117	23.0
J-117	2,500	3,228	TRUE	J-116	20.0
J-118	2,500	3,406	TRUE	J-117	20.5
J-119	1,500	1,821	TRUE	J-16	36.7
J-120	1,500	2,799	TRUE	J-233	24.4
J-121	2,500	3,518	TRUE	J-118	21.4
J-122	3,000	3,062	TRUE	J-123	23.8
J-123	3,000	3,115	TRUE	J-122	21.9
J-125	3,000	2,308	FALSE	J-124	21.8
J-126	3,000	2,324	FALSE	J-124	20.0
J-128	3,000	2,326	FALSE	J-129	20.0
J-130	1,500	3,062	TRUE	J-131	20.0
J-131	1,500	1,537	TRUE	J-130	54.4
J-132	1,500	3,124	TRUE	J-220	21.6
J-133	3,000	3,209	TRUE	J-132	22.2
J-134	4,000	2,714	FALSE	J-135	29.0
J-135	4,000	2,587	FALSE	J-26	28.1
J-136	4,000	2,157	FALSE	J-234	22.0
J-137	1,500	2,824	TRUE	J-33	27.1
J-139	3,000	2,119	FALSE	J-138	20.0
J-140	3,000	2,949	FALSE	J-35	29.5
J-142	2,500	4,357	TRUE	J-190	28.3
J-143	1,500	4,326	TRUE	J-146	27.0
J-144	1,500	3,340	TRUE	J-190	20.0
J-145	2,500	3,688	TRUE	J-190	27.7
J-146	2,500	4,018	TRUE	J-143	33.6
J-147	1,500	1,974	TRUE	J-148	53.9
J-148	2,500	3,596	TRUE	J-147	20.0
J-149	2,500	3,894	TRUE	J-147	23.1
J-150	3,000	4,104	TRUE	J-149	24.2
J-151	2,500	3,318	TRUE	J-152	34.6
J-152	1,500	3,406	TRUE	J-151	32.7
J-153	1,500	4,383	TRUE	J-235	21.7
J-154	1,500	1,914	TRUE	J-155	45.1
J-155	1,500	2,548	TRUE	J-154	28.0

Existing Water System - City of Live Oak

Junction Report - MDD+FIRE

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Satisfies Fire Flow Constraints?	Junction w/Minimum Pressure (Zone)	Calculated Minimum Zone Pressure (psi)
J-156	1,500	2,805	TRUE	J-302	20.0
J-157	1,500	1,796	TRUE	J-206	35.5
J-158	1,500	1,675	TRUE	J-207	34.7
J-159	1,500	2,042	TRUE	J-208	20.0
J-161	1,500	2,490	TRUE	J-160	20.0
J-162	1,500	2,366	TRUE	J-163	20.0
J-163	1,500	1,759	TRUE	J-162	40.3
J-164	1,500	2,541	TRUE	J-253	32.6
J-165	3,000	2,928	FALSE	J-166	26.0
J-166	3,000	3,026	TRUE	J-165	22.3
J-167	3,000	4,500	TRUE	J-320	30.6
J-168	3,000	4,500	TRUE	J-320	33.1
J-169	3,000	4,500	TRUE	J-320	32.7
J-170	1,500	4,500	TRUE	J-320	40.0
J-171	1,500	4,500	TRUE	J-96	32.2
J-172	1,500	4,500	TRUE	J-226	36.5
J-173	1,500	3,988	TRUE	J-174	20.0
J-176	3,000	2,940	FALSE	J-175	20.0
J-177	3,000	3,040	TRUE	J-178	20.6
J-178	3,000	3,016	TRUE	J-258	20.7
J-179	1,500	1,739	TRUE	J-181	20.3
J-180	1,500	1,723	TRUE	J-181	20.0
J-181	1,500	1,193	FALSE	J-180	43.5
J-182	1,500	959	FALSE	J-325	34.3
J-183	1,500	1,538	TRUE	J-213	27.4
J-184	1,500	1,687	TRUE	J-185	20.0
J-185	1,500	1,627	TRUE	J-184	23.1
J-186	1,500	1,635	TRUE	J-187	23.0
J-187	1,500	1,694	TRUE	J-186	20.0
J-188	4,000	1,777	FALSE	J-186	20.6
J-189	1,500	1,739	TRUE	J-182	20.0
J-190	2,500	2,723	TRUE	J-144	35.8
J-191	2,500	2,599	TRUE	J-192	20.0
J-193	1,500	3,474	TRUE	J-191	35.7
J-194	1,500	3,870	TRUE	J-87	21.6
J-195	2,500	3,449	TRUE	J-87	20.0
J-196	1,500	3,817	TRUE	J-344	23.0
J-197	2,500	3,999	TRUE	J-194	20.3
J-199	2,500	4,259	TRUE	J-142	30.0
J-200	1,500	3,795	TRUE	J-95	38.1
J-201	1,500	4,356	TRUE	J-229	22.7
J-202	3,000	3,240	TRUE	J-141	39.8
J-203	1,500	4,500	TRUE	J-200	28.8
J-204	1,500	2,326	TRUE	J-323	21.2
J-205	1,500	2,225	TRUE	J-323	45.5
J-206	1,500	2,207	TRUE	J-157	20.0
J-207	1,500	2,028	TRUE	J-158	20.0
J-208	1,500	1,484	FALSE	J-159	42.2
J-209	3,000	3,326	TRUE	J-52	20.0

Existing Water System - City of Live Oak

Junction Report - MDD+FIRE

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Satisfies Fire Flow Constraints?	Junction w/Minimum Pressure (Zone)	Calculated Minimum Zone Pressure (psi)
J-210	3,000	3,292	TRUE	J-141	20.0
J-211	1,500	3,234	TRUE	J-90	30.7
J-212	1,500	2,762	TRUE	J-33	27.4
J-213	1,500	1,687	TRUE	J-183	20.0
J-215	1,500	1,801	TRUE	J-325	22.3
J-216	1,500	1,929	TRUE	J-215	22.0
J-217	1,500	2,108	TRUE	J-239	21.6
J-218	1,500	1,616	TRUE	J-320	44.9
J-221	1,500	2,580	TRUE	J-34	28.8
J-222	1,500	2,408	TRUE	J-48	33.8
J-223	2,500	2,333	FALSE	J-67	27.4
J-224	1,500	2,812	TRUE	J-154	20.0
J-225	1,500	2,371	TRUE	J-255	20.8
J-226	1,500	2,158	TRUE	J-100	56.5
J-227	1,500	2,696	TRUE	J-228	26.0
J-228	4,000	2,739	FALSE	J-227	25.2
J-229	3,000	4,274	TRUE	J-201	24.8
J-230	3,000	1,410	FALSE	J-139	46.9
J-231	1,500	4,499	TRUE	J-198	20.0
J-232	1,500	4,500	TRUE	J-320	40.4
J-233	1,500	2,882	TRUE	J-120	21.2
J-234	4,000	2,171	FALSE	J-136	21.2
J-235	1,500	4,380	TRUE	J-57	21.8
J-236	3,000	2,665	FALSE	J-10	20.0
J-237	1,500	4,500	TRUE	J-320	42.3
J-238	1,500	3,221	TRUE	J-45	29.3
J-245	1,500	2,372	TRUE	J-225	23.2
J-246	1,500	3,147	TRUE	J-211	33.3
J-247	1,500	2,510	TRUE	J-92	35.4
J-248	1,500	2,652	TRUE	J-93	36.8
J-249	2,500	4,500	TRUE	J-201	25.3
J-250	1,500	1,440	FALSE	J-20	20.5
J-251	1,500	1,488	FALSE	J-250	20.4
J-252	1,500	3,122	TRUE	J-37	25.2
J-253	3,000	2,817	FALSE	J-164	24.1
J-254	1,500	2,271	TRUE	J-255	20.0
J-255	1,500	2,036	TRUE	J-254	28.2
J-256	1,500	2,237	TRUE	J-257	20.0
J-257	1,500	2,009	TRUE	J-256	28.1
J-258	1,500	2,654	TRUE	J-23	24.4
J-259	1,500	2,920	TRUE	J-68	21.1
J-260	1,500	2,263	TRUE	J-262	21.9
J-261	1,500	2,244	TRUE	J-262	20.0
J-262	1,500	2,062	TRUE	J-261	26.5
J-263	1,500	2,284	TRUE	J-291	21.0
J-264	1,500	2,244	TRUE	J-265	22.8
J-265	1,500	2,292	TRUE	J-264	20.9
J-266	1,500	2,309	TRUE	J-279	20.2
J-267	1,500	2,303	TRUE	J-346	20.8

Existing Water System - City of Live Oak

Junction Report - MDD+FIRE

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Satisfies Fire Flow Constraints?	Junction w/Minimum Pressure (Zone)	Calculated Minimum Zone Pressure (psi)
J-268	1,500	2,300	TRUE	J-328	20.6
J-269	1,500	2,272	TRUE	J-292	21.0
J-270	1,500	2,278	TRUE	J-279	20.5
J-271	1,500	2,237	TRUE	J-281	21.0
J-272	1,500	2,241	TRUE	J-279	20.0
J-273	1,500	2,206	TRUE	J-274	21.0
J-274	1,500	2,189	TRUE	J-275	20.8
J-275	1,500	2,143	TRUE	J-278	20.3
J-276	1,500	2,155	TRUE	J-279	20.1
J-277	1,500	2,059	TRUE	J-279	20.0
J-278	1,500	2,065	TRUE	J-279	22.4
J-279	1,500	1,749	TRUE	J-277	31.8
J-280	1,500	2,201	TRUE	J-292	20.9
J-281	1,500	2,219	TRUE	J-274	21.2
J-282	1,500	2,219	TRUE	J-274	21.2
J-283	1,500	2,227	TRUE	J-282	21.4
J-284	1,500	2,189	TRUE	J-323	20.0
J-285	1,500	2,314	TRUE	J-323	20.2
J-286	1,500	2,315	TRUE	J-323	20.3
J-287	1,500	2,237	TRUE	J-288	21.2
J-288	1,500	2,240	TRUE	J-287	21.0
J-289	1,500	2,359	TRUE	J-288	20.3
J-290	1,500	2,302	TRUE	J-291	20.8
J-291	1,500	2,254	TRUE	J-263	22.3
J-292	1,500	2,198	TRUE	J-280	21.0
J-293	1,500	2,391	TRUE	J-323	20.7
J-294	1,500	2,872	TRUE	J-301	20.0
J-295	1,500	2,973	TRUE	J-301	21.1
J-296	1,500	2,960	TRUE	J-297	21.6
J-297	1,500	2,858	TRUE	J-298	21.5
J-298	2,500	2,647	TRUE	J-299	27.6
J-299	2,500	2,874	TRUE	J-298	20.8
J-300	1,500	3,051	TRUE	J-299	20.4
J-301	1,500	2,712	TRUE	J-294	24.8
J-302	1,500	2,561	TRUE	J-156	27.5
J-303	1,500	2,491	TRUE	J-310	20.1
J-304	1,500	2,454	TRUE	J-307	20.1
J-305	1,500	2,439	TRUE	J-311	20.2
J-306	1,500	2,485	TRUE	J-324	23.0
J-308	1,500	1,993	TRUE	J-304	35.0
J-309	1,500	2,197	TRUE	J-303	29.7
J-310	1,500	1,624	TRUE	J-303	46.1
J-311	1,500	2,099	TRUE	J-305	31.3
J-312	1,500	1,892	TRUE	J-313	20.5
J-313	1,500	1,857	TRUE	J-319	21.5
J-314	1,500	1,894	TRUE	J-313	20.5
J-315	1,500	1,907	TRUE	J-318	20.5
J-316	1,500	1,924	TRUE	J-320	20.0
J-317	1,500	1,861	TRUE	J-320	20.0

Existing Water System - City of Live Oak

Junction Report - MDD+FIRE

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Satisfies Fire Flow Constraints?	Junction w/Minimum Pressure (Zone)	Calculated Minimum Zone Pressure (psi)
J-318	1,500	1,888	TRUE	J-320	20.5
J-319	1,500	1,882	TRUE	J-313	20.4
J-320	1,500	1,611	TRUE	J-317	30.7
J-321	1,500	1,894	TRUE	J-101	28.6
J-322	1,500	1,420	FALSE	J-323	20.0
J-323	1,500	1,089	FALSE	J-322	37.8
J-324	1,500	2,520	TRUE	J-306	21.5
J-325	1,500	1,156	FALSE	J-182	20.0
J-326	1,500	2,240	TRUE	J-283	21.1
J-327	1,500	2,251	TRUE	J-336	21.3
J-328	1,500	2,258	TRUE	J-329	21.5
J-329	1,500	2,269	TRUE	J-330	20.4
J-330	1,500	2,203	TRUE	J-331	20.6
J-331	1,500	1,501	TRUE	J-352	41.6
J-332	1,500	2,179	TRUE	J-333	20.7
J-333	1,500	2,084	TRUE	J-351	20.7
J-334	1,500	2,177	TRUE	J-356	21.3
J-335	1,500	2,251	TRUE	J-338	20.5
J-336	1,500	2,250	TRUE	J-327	21.4
J-337	1,500	2,261	TRUE	J-323	20.1
J-338	1,500	1,501	TRUE	J-283	44.4
J-341	1,500	2,902	TRUE	J-233	27.3
J-342	1,500	2,142	TRUE	J-20	24.5
J-343	1,500	3,175	TRUE	J-86	32.5
J-344	1,500	3,399	TRUE	J-83	30.8
J-345	1,500	2,485	TRUE	J-84	46.1
J-346	1,500	2,210	TRUE	J-268	24.0
J-347	1,500	1,501	TRUE	J-348	43.6
J-348	1,500	1,501	TRUE	J-349	42.7
J-349	1,500	1,501	TRUE	J-350	42.5
J-350	1,500	1,501	TRUE	J-351	42.2
J-351	1,500	1,501	TRUE	J-333	41.4
J-352	1,500	1,501	TRUE	J-331	41.6
J-356	1,500	1,501	TRUE	J-332	43.6

Buildout Water System - City of Live Oak

Junction Report - MDD

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)	Hydraulic Grade (ft)
J-1	77.1	56.90	70.70	240.60
J-2	76.8	5.80	69.50	237.40
J-3	76.5	12.82	69.60	237.40
J-4	76.8	2.99	69.10	236.60
J-5	77.7	21.34	70.80	241.30
J-6	77.8	25.99	70.10	239.80
J-7	77.0	27.74	69.10	236.70
J-8	76.5	16.84	69.30	236.50
J-9	76.5	9.52	69.20	236.50
J-10	76.6	3.51	69.30	236.80
J-11	76.8	18.95	69.10	236.50
J-12	76.6	0.96	68.70	235.20
J-13	76.3	13.84	69.30	236.50
J-14	76.0	0.00	69.60	236.90
J-15	76.0	3.56	69.70	237.00
J-16	75.9	18.13	69.60	236.80
J-17	75.9	15.19	69.80	237.30
J-18	76.0	20.53	69.80	237.40
J-19	75.9	8.31	71.00	239.90
J-20	75.9	2.38	70.90	239.90
J-21	75.8	9.91	71.00	239.90
J-22	75.7	6.88	71.00	239.90
J-23	75.7	6.79	70.90	239.60
J-24	75.7	22.48	70.90	239.60
J-25	75.8	19.86	72.70	243.80
J-26	75.5	18.15	71.50	240.80
J-27	75.6	14.76	71.20	240.20
J-28	75.6	11.05	70.80	239.20
J-29	75.6	11.69	71.20	240.20
J-30	75.5	14.35	69.60	236.40
J-31	75.4	12.95	70.40	238.10
J-32	75.5	7.32	70.40	238.10
J-33	75.3	3.65	70.10	237.40
J-34	75.2	2.29	69.70	236.30
J-35	75.1	7.66	69.30	235.20
J-36	75.1	5.25	68.70	233.90
J-37	75.2	3.76	68.70	233.90
J-38	75.3	9.03	68.70	234.20
J-39	75.3	10.49	68.80	234.20
J-40	75.3	14.03	69.30	235.50
J-41	75.4	6.63	68.60	233.90
J-42	75.3	6.75	68.20	233.00
J-43	75.3	6.92	68.20	233.00
J-44	75.2	11.34	68.30	233.00
J-45	75.2	5.28	68.40	233.40
J-46	75.1	5.21	68.50	233.40
J-47	75.1	3.34	68.30	233.00
J-48	75.1	6.92	68.10	232.60

Buildout Water System - City of Live Oak

Junction Report - MDD

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)	Hydraulic Grade (ft)
J-49	75.0	4.75	68.10	232.50
J-50	75.1	13.54	68.10	232.60
J-51	75.0	50.65	68.10	232.40
J-52	75.0	8.53	67.70	231.40
J-53	75.0	7.38	67.50	231.00
J-54	75.0	0.95	67.60	231.20
J-55	75.0	3.59	67.70	231.40
J-56	74.7	16.22	67.50	230.80
J-57	74.5	10.06	67.00	229.40
J-58	74.5	17.01	67.00	229.40
J-59	74.5	19.23	67.00	229.30
J-60	74.9	23.91	67.20	230.20
J-61	74.8	36.96	67.00	229.70
J-62	74.3	9.15	67.10	229.30
J-63	74.2	13.48	67.10	229.30
J-64	74.5	22.94	67.00	229.40
J-65	74.7	16.53	67.00	229.50
J-66	74.4	9.65	67.10	229.40
J-67	74.4	2.47	67.00	229.30
J-68	74.0	6.31	67.20	229.30
J-69	74.0	5.28	67.20	229.20
J-70	74.0	10.66	67.20	229.20
J-71	74.0	6.48	67.20	229.20
J-72	74.0	8.18	67.20	229.30
J-73	74.0	7.93	67.20	229.30
J-74	74.1	8.35	67.10	229.30
J-75	74.0	6.76	67.20	229.20
J-76	74.1	10.89	67.10	229.30
J-77	74.0	10.59	67.20	229.20
J-78	74.1	14.91	67.20	229.40
J-79	74.2	13.43	67.20	229.50
J-80	74.2	9.07	67.40	230.10
J-81	74.0	18.45	67.90	230.90
J-82	74.0	12.64	68.10	231.40
J-83	74.0	21.75	68.30	231.80
J-84	74.5	51.16	68.10	231.90
J-85	74.6	11.43	68.20	232.20
J-86	75.0	10.99	68.10	232.30
J-87	75.0	16.82	68.10	232.40
J-88	75.0	16.03	68.20	232.70
J-89	75.0	8.61	68.30	232.80
J-90	75.3	13.34	69.10	235.10
J-91	75.0	16.47	68.50	233.40
J-92	75.0	17.98	68.60	233.50
J-93	74.9	12.63	68.60	233.60
J-94	75.0	13.73	68.60	233.70
J-95	75.1	10.88	69.00	234.70
J-96	75.2	5.23	69.50	235.70

Buildout Water System - City of Live Oak

Junction Report - MDD

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)	Hydraulic Grade (ft)
J-97	75.2	23.68	69.40	235.70
J-98	75.3	17.29	69.30	235.40
J-99	75.3	12.44	69.20	235.20
J-100	75.2	13.87	69.20	235.30
J-101	75.4	18.52	69.20	235.40
J-102	75.7	11.97	68.80	234.90
J-103	75.8	14.20	68.70	234.70
J-104	75.8	20.37	68.70	234.70
J-105	76.0	11.44	68.60	234.60
J-106	76.0	5.31	68.60	234.60
J-107	76.2	5.18	68.50	234.50
J-108	76.3	4.91	68.50	234.50
J-109	76.0	56.56	68.60	234.50
J-110	76.1	8.39	68.50	234.50
J-111	75.9	9.08	68.70	234.60
J-112	75.9	3.28	69.00	235.40
J-113	75.7	5.17	69.00	235.20
J-114	75.6	16.08	69.00	235.20
J-115	75.8	3.38	69.10	235.40
J-116	75.6	5.74	69.20	235.60
J-117	75.6	5.48	69.20	235.60
J-118	75.6	8.02	69.30	235.70
J-119	76.1	10.55	69.60	236.80
J-120	76.7	6.87	68.90	235.90
J-121	75.6	9.03	69.40	235.90
J-122	75.7	5.22	69.70	236.90
J-123	75.7	9.02	69.70	236.80
J-124	75.6	8.67	69.70	236.80
J-125	75.5	0.92	69.80	236.80
J-126	75.5	1.58	69.70	236.80
J-127	75.4	2.71	70.00	237.20
J-128	75.4	1.13	69.80	236.70
J-129	75.4	5.86	69.80	236.70
J-130	75.3	8.04	70.10	237.30
J-131	75.4	27.06	70.00	237.20
J-132	75.3	6.51	70.10	237.30
J-133	75.2	5.78	70.10	237.30
J-134	75.3	11.64	70.60	238.50
J-135	75.4	21.98	71.00	239.60
J-136	75.6	11.14	72.10	242.30
J-137	75.3	7.58	69.70	236.50
J-138	75.0	2.06	69.40	235.40
J-139	75.1	1.70	69.40	235.40
J-140	75.1	13.11	68.90	234.30
J-141	75.0	3.76	68.70	233.80
J-142	74.8	10.34	68.80	233.90
J-143	74.5	14.03	68.90	233.70
J-144	74.8	7.25	68.50	233.10

Buildout Water System - City of Live Oak

Junction Report - MDD

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)	Hydraulic Grade (ft)
J-145	74.7	4.95	68.40	232.70
J-146	74.3	16.82	68.70	233.00
J-147	74.5	15.65	67.90	231.40
J-148	74.5	10.11	67.90	231.40
J-149	74.2	15.13	67.90	231.10
J-150	74.1	13.13	67.70	230.70
J-151	74.0	17.86	68.10	231.40
J-152	74.0	11.90	68.10	231.30
J-153	74.5	8.99	67.10	229.70
J-154	74.0	22.53	67.10	229.20
J-155	74.0	40.97	67.10	229.20
J-156	74.0	4.37	67.10	229.20
J-157	75.3	6.97	68.10	232.80
J-158	75.1	5.90	68.10	232.60
J-159	75.0	11.43	68.10	232.50
J-160	75.5	4.57	68.60	234.10
J-161	75.5	5.69	68.80	234.40
J-162	75.5	4.31	69.10	235.30
J-163	75.4	8.27	69.10	235.30
J-164	75.2	10.33	70.10	237.20
J-165	75.2	3.00	69.90	236.70
J-166	75.2	3.55	69.90	236.70
J-167	75.2	5.98	69.70	236.40
J-168	75.1	5.36	69.70	236.20
J-169	75.1	1.60	69.80	236.40
J-170	74.9	1.71	69.80	236.30
J-171	75.1	6.60	69.60	236.00
J-172	75.0	10.83	69.80	236.30
J-173	75.3	9.13	69.60	236.20
J-174	75.4	5.88	69.60	236.20
J-175	75.4	24.12	69.90	237.10
J-176	75.4	9.80	70.00	237.30
J-177	75.6	5.24	70.00	237.30
J-178	75.6	13.38	70.00	237.30
J-179	76.0	12.91	75.00	249.30
J-180	76.0	3.61	75.00	249.30
J-181	76.0	0.00	75.00	249.40
J-182	76.0	0.00	72.40	243.20
J-183	75.8	7.10	74.60	248.20
J-184	75.8	1.00	74.70	248.50
J-185	75.8	0.98	74.70	248.50
J-186	75.8	1.05	74.50	247.90
J-187	75.7	1.42	74.50	247.90
J-188	75.9	16.53	74.10	247.10
J-189	75.9	22.26	72.40	243.20
J-190	74.8	9.94	68.50	233.10
J-191	74.8	11.25	68.30	232.60
J-192	74.8	13.69	68.30	232.60

Buildout Water System - City of Live Oak

Junction Report - MDD

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)	Hydraulic Grade (ft)
J-193	75.0	5.82	67.70	231.40
J-194	74.7	5.58	68.20	232.30
J-195	74.9	11.83	68.20	232.40
J-196	74.3	10.57	68.30	232.20
J-197	74.6	7.60	68.20	232.30
J-198	74.8	6.04	68.90	234.10
J-199	75.0	6.28	69.10	234.70
J-200	74.9	7.04	69.20	234.80
J-201	75.1	2.33	69.40	235.40
J-202	75.0	7.29	69.10	234.70
J-203	74.8	5.12	69.30	234.90
J-204	75.0	6.45	68.30	232.80
J-205	75.0	17.49	68.20	232.70
J-206	75.3	5.41	68.10	232.80
J-207	75.1	5.75	68.10	232.60
J-208	75.0	66.06	68.10	232.30
J-209	75.1	8.34	68.00	232.10
J-210	75.0	12.02	68.70	233.80
J-211	75.2	5.56	68.90	234.50
J-212	75.3	7.79	70.20	237.50
J-213	75.8	2.59	74.60	248.20
J-215	75.9	28.44	71.90	242.10
J-216	75.7	23.49	71.50	241.00
J-217	76.0	7.31	69.80	237.30
J-218	76.9	8.74	69.40	237.40
J-219	75.5	4.86	69.90	237.10
J-220	75.3	2.67	70.10	237.20
J-221	75.2	9.50	69.70	236.30
J-222	75.1	17.24	68.10	232.60
J-223	74.3	3.65	67.10	229.40
J-224	74.0	3.31	67.10	229.20
J-225	75.2	25.37	69.10	235.00
J-226	75.2	14.08	69.60	236.00
J-227	75.6	12.53	69.00	235.00
J-228	75.6	23.58	68.90	234.90
J-229	75.2	3.80	69.40	235.40
J-230	75.1	7.39	69.60	235.90
J-231	74.7	9.02	69.00	234.10
J-232	75.0	3.55	69.80	236.40
J-233	76.6	4.19	68.90	235.70
J-234	75.6	9.38	72.00	242.10
J-235	74.5	9.07	67.00	229.30
J-236	76.0	5.69	69.60	236.80
J-237	75.1	0.00	70.00	236.80
J-238	75.1	12.78	68.50	233.40
J-239	76.0	40.67	69.70	237.00
J-240	75.9	8.39	69.70	237.00
J-241	75.8	12.93	69.70	237.00

Buildout Water System - City of Live Oak

Junction Report - MDD

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)	Hydraulic Grade (ft)
J-242	75.9	17.97	69.70	237.00
J-243	75.8	15.06	69.70	237.00
J-244	75.8	7.59	69.70	237.00
J-245	75.3	19.38	69.10	235.00
J-246	75.2	18.24	69.00	234.60
J-247	74.8	9.14	68.70	233.50
J-248	74.7	14.37	68.70	233.60
J-249	75.0	5.96	69.40	235.40
J-250	75.8	6.32	71.00	239.90
J-251	75.7	10.28	71.00	239.90
J-252	75.3	7.94	68.60	233.90
J-253	75.2	6.42	70.10	237.10
J-254	75.2	4.41	68.90	234.50
J-255	75.2	7.41	68.90	234.50
J-256	75.1	5.12	68.70	234.00
J-257	75.1	11.79	68.70	234.00
J-258	75.5	32.32	70.20	237.70
J-259	74.3	11.58	67.10	229.30
J-260	75.1	0.00	69.20	235.00
J-261	75.0	9.48	68.90	234.20
J-262	75.1	7.07	68.80	234.20
J-263	75.0	8.97	68.50	233.40
J-264	75.0	8.21	68.50	233.20
J-265	74.8	9.06	68.50	233.10
J-266	74.7	7.25	68.40	232.90
J-267	74.8	11.77	68.40	232.90
J-268	74.8	12.25	68.40	232.80
J-269	74.5	15.99	68.50	232.80
J-270	74.3	34.71	68.60	232.80
J-271	74.3	10.22	68.50	232.80
J-272	74.7	9.10	68.40	232.80
J-273	74.9	13.57	68.30	232.80
J-274	75.0	9.91	68.20	232.80
J-275	75.1	9.09	68.20	232.80
J-276	74.9	9.88	68.30	232.80
J-277	75.0	11.43	68.20	232.80
J-278	75.2	10.01	68.20	232.80
J-279	75.3	10.20	68.10	232.80
J-280	74.6	10.80	68.50	232.80
J-281	74.4	13.68	68.50	232.80
J-282	74.5	11.28	68.50	232.80
J-283	74.2	43.43	68.60	232.80
J-326	74.2	0.00	68.60	232.80
J-327	74.3	0.00	68.60	232.80
J-328	74.9	0.00	68.30	232.80
J-329	74.8	0.00	68.30	232.80
J-330	74.7	1.55	68.40	232.80
J-331	74.5	4.32	68.50	232.80

Buildout Water System - City of Live Oak

Junction Report - MDD

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)	Hydraulic Grade (ft)
J-332	74.5	1.39	68.50	232.80
J-333	74.3	4.18	68.60	232.80
J-334	73.9	0.54	68.70	232.80
J-335	74.0	0.00	68.70	232.80
J-336	74.3	0.00	68.60	232.80
J-337	75.0	0.00	68.30	232.80
J-284	75.0	35.93	68.30	232.80
J-285	75.0	6.76	68.30	232.80
J-286	75.0	9.59	68.30	232.80
J-287	75.0	5.77	68.30	232.90
J-288	75.0	6.81	68.30	232.90
J-289	75.0	5.49	68.40	233.00
J-290	75.0	8.19	68.40	233.10
J-291	75.1	5.44	68.40	233.30
J-292	74.5	7.31	68.50	232.80
J-338	73.8	0.00	68.80	232.80
J-339	75.1	56.76	69.50	235.60
J-293	75.0	9.61	68.40	233.00
J-294	74.0	8.17	67.10	229.20
J-295	74.0	11.69	67.20	229.20
J-296	73.7	16.98	67.30	229.20
J-297	73.5	24.65	67.40	229.20
J-298	73.6	12.90	67.30	229.20
J-299	73.8	7.81	67.30	229.20
J-300	73.8	5.63	67.20	229.20
J-301	74.0	39.48	67.10	229.20
J-302	74.0	10.14	67.10	229.20
J-303	76.4	5.01	68.40	234.50
J-304	76.7	9.36	68.30	234.50
J-305	76.9	28.89	68.20	234.50
J-306	76.6	17.77	68.50	234.90
J-307	76.4	14.75	68.40	234.40
J-308	76.4	9.65	68.40	234.50
J-309	76.2	13.40	68.50	234.50
J-310	76.3	12.10	68.40	234.50
J-311	76.5	101.71	68.30	234.40
J-312	78.0	1.13	70.70	241.60
J-313	78.5	3.25	70.90	242.50
J-340	79.1	28.26	71.30	243.90
J-314	78.1	17.62	70.70	241.50
J-315	78.1	26.66	70.60	241.30
J-316	78.2	11.69	70.40	240.90
J-317	78.9	11.87	70.20	241.10
J-318	78.7	14.48	70.40	241.30
J-319	78.5	14.83	70.60	241.80
J-320	79.5	45.25	69.90	241.10
J-321	75.5	28.70	69.20	235.40
J-341	76.2	11.82	69.00	235.70

Buildout Water System - City of Live Oak

Junction Report - MDD

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)	Hydraulic Grade (ft)
J-342	75.7	33.04	71.50	241.00
J-343	75.0	13.17	68.00	232.10
J-344	74.2	10.09	68.30	232.00
J-345	74.6	15.33	68.10	232.00
J-346	74.8	11.06	68.40	232.80
J-347	74.6	9.49	68.40	232.80
J-348	73.9	6.44	68.80	232.80
J-349	73.9	5.88	68.70	232.80
J-350	73.8	5.67	68.80	232.80
J-351	74.2	4.59	68.60	232.80
J-352	74.4	5.28	68.50	232.80
J-322	73.7	4.00	68.70	232.60
J-323	73.0	213.29	69.00	232.50
J-353	73.5	6.25	68.90	232.80
J-354	73.6	3.55	68.90	232.80
J-355	73.8	6.63	68.80	232.80
J-356	74.2	1.04	68.60	232.80
J-357	74.0	5.43	68.70	232.80
J-358	73.4	7.69	69.00	232.80
J-359	73.5	5.94	68.90	232.80
J-360	73.8	4.79	68.80	232.80
J-361	75.1	119.63	70.30	237.60
J-368	79.0	225.73	72.10	245.80
J-369	75.2	55.17	70.20	237.50
J-370	75.5	122.29	69.00	234.90
J-371	75.4	24.38	69.00	235.00
J-372	75.5	123.91	68.90	234.70
J-373	75.7	24.92	68.80	234.70
J-374	75.8	33.92	68.70	234.70
J-375	75.3	23.65	69.10	235.00
J-377	78.6	742.82	70.70	242.10
J-378	74.4	145.02	71.30	239.10
J-379	74.0	302.81	71.30	238.70
J-380	73.2	263.86	71.60	238.60
J-381	71.8	519.40	72.20	238.70
J-382	70.0	537.61	72.10	236.70
J-383	69.3	269.08	72.30	236.50
J-384	69.0	203.53	72.50	236.50
J-385	68.6	269.53	72.70	236.60
J-386	68.5	86.37	71.60	233.90
J-387	68.8	81.78	70.70	232.20
J-388	69.1	145.53	69.90	230.80
J-389	70.7	122.00	69.30	230.80
J-390	71.6	102.91	69.10	231.50
J-391	72.5	47.03	68.90	231.70
J-392	73.5	18.02	68.30	231.40
J-393	75.0	82.63	66.90	229.60
J-394	75.0	132.13	66.70	229.30

Buildout Water System - City of Live Oak

Junction Report - MDD

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)	Hydraulic Grade (ft)
J-395	75.0	137.43	66.70	229.20
J-396	75.0	41.22	66.70	229.20
J-397	74.8	85.96	72.00	241.30
J-398	75.0	161.24	71.80	241.00
J-399	75.6	371.88	71.50	240.80
J-400	77.0	395.73	70.90	240.80
J-401	78.1	541.54	70.50	241.00
J-402	79.7	838.41	72.60	247.40
J-403	80.3	491.76	71.90	246.50
J-404	80.0	63.37	72.00	246.50
J-405	80.0	279.92	72.00	246.50
J-406	80.6	267.09	72.10	247.30
J-407	80.3	221.69	72.20	247.20
J-408	80.0	117.34	72.30	247.20
J-409	79.9	83.63	70.60	243.10
J-410	79.5	121.38	70.80	243.10
J-411	79.0	109.02	71.00	243.10
J-412	78.6	99.02	71.20	243.20
J-413	79.0	207.91	71.60	244.40
J-414	78.2	234.72	73.90	248.90
J-415	77.2	138.83	75.00	250.50
J-416	76.4	160.60	75.00	249.70
J-417	76.0	143.59	75.00	249.40
J-418	73.7	336.59	69.10	233.40
J-419	73.2	385.35	67.60	229.60
J-420	72.2	192.27	68.60	230.60
J-421	70.9	242.28	68.80	230.00
J-422	70.3	138.91	69.10	230.00
J-423	70.3	155.42	70.00	232.20
J-424	69.8	188.00	71.00	233.90
J-426	77.9	431.69	71.20	242.50
J-427	80.0	56.60	71.60	245.60
J-428	79.4	168.81	71.30	244.30
J-324	76.6	1.00	68.50	235.10
J-429	71.2	593.67	68.60	229.70
J-430	71.5	280.90	68.80	230.60
J-431	73.8	276.53	67.60	230.10
J-441	75.0	130.48	66.70	229.20
J-442	75.0	76.18	66.70	229.20
J-443	75.5	6.21	75.20	249.40
J-325	76.0	0.00	72.40	243.20
J-444	75.6	67.32	69.10	235.30
J-445	76.4	151.68	69.30	236.60
J-446	78.2	217.30	69.60	239.00

Buildout Water System - City of Live Oak

Pipe Report - MDD

Label	Diameter (in)	Length (ft)	Hazen-Williams C	Velocity (ft/s)	Head loss Gradient (ft/1,000 ft)
P-1	8	184	120	0.5	0.00
P-2	8	323	120	0.2	0.00
P-3	8	265	120	0.4	0.00
P-4	8	339	120	1.1	0.00
P-5	8	245	120	0.7	0.00
P-6	8	460	120	0.3	0.00
P-7	8	325	120	0.4	0.00
P-8	8	155	120	0.3	0.00
P-9	6	285	120	0.7	0.00
P-10	6	235	120	0.2	0.00
P-11	8	258	120	1.5	0.00
P-12	8	280	120	2.5	0.00
P-13	8	474	120	1.0	0.00
P-14	8	368	120	1.3	0.00
P-15	8	307	120	0.6	0.00
P-16	2	374	120	0.5	0.00
P-17	6	135	120	2.0	0.00
P-18	8	491	120	0.3	0.00
P-19	6	313	120	0.2	0.00
P-20	6	299	120	0.0	0.00
P-21	6	402	120	1.1	0.00
P-22	6	99	120	0.1	0.00
P-22P	6	742	120	0.3	0.00
P-23	6	140	120	0.1	0.00
P-23P	6	203	120	0.2	0.00
P-24	8	613	120	0.2	0.00
P-25	8	493	120	0.0	0.00
P-25P	6	150	120	0.2	0.00
P-26	6	564	120	1.6	0.00
P-27	6	400	120	1.9	0.00
P-27P	6	145	120	0.1	0.00
P-28	6	398	120	1.6	0.00
P-28P	6	263	120	0.5	0.00
P-29	6	401	120	1.6	0.00
P-30	6	190	120	0.1	0.00
P-31	6	229	120	0.2	0.00
P-32	8	447	120	0.3	0.00
P-33	6	200	120	0.3	0.00
P-34	6	89	120	0.1	0.00
P-35	8	371	120	0.3	0.00
P-36	8	242	120	0.1	0.00
P-37	6	220	120	0.1	0.00
P-38	6	496	120	0.5	0.00
P-39	8	282	120	0.2	0.00
P-40	8	259	120	0.7	0.00
P-41	8	100	120	0.3	0.00
P-42	6	196	120	0.1	0.00
P-43	8	642	120	0.1	0.00

Buildout Water System - City of Live Oak

Pipe Report - MDD

Label	Diameter (in)	Length (ft)	Hazen-Williams C	Velocity (ft/s)	Head loss Gradient (ft/1,000 ft)
P-44	6	258	120	0.1	0.00
P-45	8	171	120	1.6	0.00
P-46	8	171	120	1.6	0.00
P-47	6	220	120	0.1	0.00
P-48	6	747	120	1.2	0.00
P-49	6	500	120	0.7	0.00
P-50	4	163	120	0.1	0.00
P-50P	6	322	130	1.2	0.00
P-51	8	110	120	0.0	0.00
P-52	6	369	120	0.8	0.00
P-53	8	269	120	0.8	0.00
P-53P	6	651	130	0.1	0.00
P-54	8	269	120	0.7	0.00
P-55	8	131	120	0.2	0.00
P-55P	6	652	130	0.0	0.00
P-56	6	142	120	3.1	0.01
P-57	8	681	120	1.6	0.00
P-58	6	400	120	0.5	0.00
P-59	6	99	120	0.4	0.00
P-60	4	153	120	0.2	0.00
P-61	6	356	120	1.1	0.00
P-62	8	360	120	0.6	0.00
P-63	8	346	120	0.4	0.00
P-64	6	255	120	0.2	0.00
P-65	6	320	120	1.6	0.00
P-66	6	285	120	1.0	0.00
P-67	8	111	120	0.0	0.00
P-68	6	129	120	0.9	0.00
P-69	6	292	120	0.2	0.00
P-70	6	636	120	0.5	0.00
P-71	6	403	120	0.3	0.00
P-72	6	377	120	0.4	0.00
P-73	6	197	120	0.1	0.00
P-74	6	207	120	0.1	0.00
P-75	8	496	120	0.2	0.00
P-76	6	669	120	3.4	0.01
P-77	8	484	120	1.6	0.00
P-78	8	135	120	0.0	0.00
P-79	6	136	120	0.6	0.00
P-80	6	186	120	0.8	0.00
P-81	6	289	120	1.9	0.00
P-82	6	236	120	2.1	0.00
P-83	6	274	120	2.2	0.00
P-84	6	273	120	3.6	0.01
P-85	6	564	120	1.4	0.00
P-86	6	297	120	1.5	0.00
P-87	10	365	120	0.8	0.00
P-88	8	241	120	1.2	0.00

Buildout Water System - City of Live Oak

Pipe Report - MDD

Label	Diameter (in)	Length (ft)	Hazen-Williams C	Velocity (ft/s)	Head loss Gradient (ft/1,000 ft)
P-89	8	413	120	1.0	0.00
P-90	8	112	120	1.3	0.00
P-91	8	396	120	0.4	0.00
P-92	8	283	120	0.6	0.00
P-93a	10	506	130	0.7	0.00
P-94a	10	507	130	1.6	0.00
P-95a	10	163	130	1.7	0.00
P-96a	10	184	130	2.4	0.00
P-97a	10	319	130	2.7	0.00
P-98	6	324	120	2.0	0.00
P-99	8	191	120	0.6	0.00
P-100	8	169	120	0.3	0.00
P-101	8	344	120	0.1	0.00
P-102	8	398	120	0.3	0.00
P-103	6	190	120	0.5	0.00
P-104	8	437	120	1.5	0.00
P-105	6	326	120	1.2	0.00
P-106	8	184	120	1.4	0.00
P-107	6	319	120	2.2	0.00
P-108	6	322	120	1.9	0.00
P-109	6	172	120	2.5	0.01
P-110	6	174	120	0.9	0.00
P-111	6	312	120	1.9	0.00
P-112	8	450	120	0.2	0.00
P-113	6	151	120	0.1	0.00
P-114	8	177	120	0.0	0.00
P-115a	10	346	130	2.5	0.00
P-116	2	260	120	0.9	0.00
P-117a	10	159	130	2.5	0.00
P-118a	10	423	130	1.7	0.00
P-119a	10	609	130	1.8	0.00
P-120a	10	352	130	0.4	0.00
P-121	6	181	120	0.3	0.00
P-122	6	218	120	0.7	0.00
P-123	6	525	120	0.6	0.00
P-124a	10	614	130	0.3	0.00
P-125	6	294	120	0.1	0.00
P-126	6	275	120	0.1	0.00
P-127	6	485	120	1.9	0.00
P-128	4	303	120	0.6	0.00
P-129	6	128	120	0.2	0.00
P-130	8	595	120	0.1	0.00
P-131	8	124	120	0.2	0.00
P-132	8	254	120	0.3	0.00
P-133	8	260	120	0.2	0.00
P-134	8	275	120	0.5	0.00
P-135	8	233	120	0.9	0.00
P-136	8	271	120	0.6	0.00

Buildout Water System - City of Live Oak

Pipe Report - MDD

Label	Diameter (in)	Length (ft)	Hazen-Williams C	Velocity (ft/s)	Head loss Gradient (ft/1,000 ft)
P-137	8	274	120	1.7	0.00
P-138	8	239	120	2.1	0.00
P-139	8	249	120	1.6	0.00
P-140	8	258	120	1.3	0.00
P-141	6	228	120	2.6	0.01
P-142	6	149	120	1.7	0.00
P-143	8	367	120	1.8	0.00
P-144	8	367	120	0.8	0.00
P-145	8	728	120	0.7	0.00
P-146	8	131	120	1.4	0.00
P-147	8	448	120	0.0	0.00
P-148	6	252	120	0.4	0.00
P-149	8	129	120	0.0	0.00
P-150	8	449	120	1.5	0.00
P-151	8	367	120	1.2	0.00
P-152	8	353	120	1.9	0.00
P-153	8	386	120	2.5	0.00
P-154	6	693	120	1.0	0.00
P-155	8	441	120	0.7	0.00
P-156a	12	414	130	5.3	0.01
P-157a	12	278	130	4.3	0.01
P-158a	12	259	130	3.8	0.00
P-159a	12	338	130	3.3	0.00
P-160a	12	491	130	2.8	0.00
P-161a	12	353	130	2.3	0.00
P-162	12	169	120	2.0	0.00
P-163	12	599	120	1.1	0.00
P-164	6	692	120	0.7	0.00
P-165	6	270	120	0.5	0.00
P-166	6	241	120	0.6	0.00
P-167	6	486	120	1.5	0.00
P-168	8	250	120	0.7	0.00
P-169	6	513	120	1.6	0.00
P-170	6	361	120	1.8	0.00
P-171	6	379	120	1.8	0.00
P-172	6	701	120	0.8	0.00
P-173	8	552	120	1.4	0.00
P-174	8	273	120	0.9	0.00
P-175	6	256	120	0.1	0.00
P-176	8	400	120	0.4	0.00
P-177	6	274	120	0.7	0.00
P-178	6	292	120	0.8	0.00
P-179	8	512	120	1.6	0.00
P-180	4	343	120	0.0	0.00
P-181	2	484	120	1.4	0.01
P-182	6	155	120	0.2	0.00
P-183	6	353	120	1.4	0.00
P-184	6	670	120	1.0	0.00

Buildout Water System - City of Live Oak

Pipe Report - MDD

Label	Diameter (in)	Length (ft)	Hazen-Williams C	Velocity (ft/s)	Head loss Gradient (ft/1,000 ft)
P-185	8	160	120	1.3	0.00
P-186	6	130	120	2.1	0.00
P-187	8	190	120	0.0	0.00
P-188	6	521	120	0.7	0.00
P-189	10	170	120	0.3	0.00
P-190	6	231	120	1.1	0.00
P-191	6	92	120	0.9	0.00
P-192	8	623	120	0.4	0.00
P-193	6	368	120	0.4	0.00
P-194	8	757	120	2.3	0.00
P-195	6	244	120	1.0	0.00
P-196a	10	185	130	2.6	0.00
P-197a	10	216	130	2.8	0.00
P-198	8	268	120	1.5	0.00
P-199	8	749	120	0.5	0.00
P-200	6	344	120	0.7	0.00
P-201	2	876	120	0.1	0.00
P-202	6	435	120	0.8	0.00
P-203	8	130	120	0.0	0.00
P-204	8	303	120	0.3	0.00
P-205	6	287	120	1.9	0.00
P-206	8	275	120	0.4	0.00
P-208	6	16	120	2.2	0.00
P-209	8	49	120	0.7	0.00
P-210	8	136	120	0.1	0.00
P-211a	12	341	130	4.7	0.01
P-212a	14	28	130	0.1	0.00
P-213a	14	457	130	0.5	0.00
P-214	6	176	120	0.5	0.00
P-215	6	980	120	1.9	0.00
P-216	8	886	120	0.8	0.00
P-217	8	153	120	0.8	0.00
P-218	6	685	120	1.2	0.00
P-219	6	373	120	1.1	0.00
P-220	6	38	120	1.7	0.00
P-221	6	321	120	1.1	0.00
P-222	6	55	120	0.9	0.00
P-223	6	516	120	1.4	0.00
P-224	6	193	120	1.6	0.00
P-225	8	853	120	1.2	0.00
P-226	4	25	120	0.8	0.00
P-227	4	363	120	1.2	0.00
P-228	12	42	120	1.5	0.00
P-229	12	469	120	1.3	0.00
P-230	6	382	120	1.8	0.00
P-231	6	366	120	1.3	0.00
P-232	6	450	120	0.5	0.00
P-233	8	842	120	0.1	0.00

Buildout Water System - City of Live Oak

Pipe Report - MDD

Label	Diameter (in)	Length (ft)	Hazen-Williams C	Velocity (ft/s)	Head loss Gradient (ft/1,000 ft)
P-234	8	209	120	1.2	0.00
P-235	8	40	120	0.0	0.00
P-236	6	239	120	2.3	0.00
P-237	6	154	120	2.5	0.01
P-238a	12	58	130	1.0	0.00
P-239a	12	526	130	1.3	0.00
P-240a	12	157	130	0.9	0.00
P-241	8	53	120	2.0	0.00
P-242a	10	354	130	0.4	0.00
P-243a	10	362	130	0.4	0.00
P-244a	10	29	130	0.4	0.00
P-245a	10	154	130	1.7	0.00
P-246	8	268	120	0.1	0.00
P-247	6	331	120	1.5	0.00
P-248	6	370	120	1.0	0.00
P-249	6	315	120	1.6	0.00
P-250a	10	98	130	2.7	0.00
P-251	6	457	120	0.4	0.00
P-252	6	14	120	1.7	0.00
P-253	8	686	120	0.3	0.00
P-254	6	477	120	0.1	0.00
P-255	8	189	120	1.7	0.00
P-256	8	36	120	0.1	0.00
P-257a	12	244	130	4.2	0.01
P-258a	12	38	130	4.3	0.01
P-259a	10	684	130	1.7	0.00
P-260	8	236	120	0.2	0.00
P-261a	12	349	130	0.4	0.00
P-262	12	24	120	3.3	0.00
P-263	6	919	120	0.0	0.00
P-264	6	20	120	2.1	0.00
P-265	6	439	120	0.9	0.00
P-266	6	182	120	1.8	0.00
P-267	6	160	120	1.7	0.00
P-268	12	176	120	2.0	0.00
P-269	12	189	120	2.9	0.00
P-270	12	183	120	2.9	0.00
P-271	12	213	120	3.1	0.00
P-272	12	145	120	3.1	0.00
P-273	8	140	120	8.4	0.04
P-274	8	125	120	0.0	0.00
P-275	8	233	120	0.0	0.00
P-277	8	206	120	8.4	0.04
P-278	8	125	120	0.0	0.00
P-279	8	124	120	0.0	0.00
P-281	6	416	120	0.5	0.00
P-282	8	51	120	3.5	0.01
P-284	6	734	120	0.3	0.00

Buildout Water System - City of Live Oak

Pipe Report - MDD

Label	Diameter (in)	Length (ft)	Hazen-Williams C	Velocity (ft/s)	Head loss Gradient (ft/1,000 ft)
P-285	8	455	120	0.1	0.00
P-286	6	807	120	0.1	0.00
P-287	8	727	120	1.1	0.00
P-288	8	701	120	0.2	0.00
P-289	8	247	120	0.5	0.00
P-290a	10	263	130	0.4	0.00
P-291	6	252	120	0.1	0.00
P-292	6	244	120	0.1	0.00
P-293	8	734	130	0.7	0.00
P-298	16	445	130	2.1	0.00
P-299	12	315	120	0.7	0.00
P-300	12	363	120	0.7	0.00
P-301	8	907	120	0.4	0.00
P-302	6	211	120	0.5	0.00
P-303	8	305	120	0.1	0.00
P-304	8	299	120	0.1	0.00
P-305	6	217	120	0.8	0.00
P-306	8	339	120	1.9	0.00
P-307	8	350	120	1.9	0.00
P-308	8	184	130	0.0	0.00
P-309	8	272	130	0.0	0.00
P-310	8	476	130	0.1	0.00
P-311	8	269	130	0.1	0.00
P-312	6	510	120	0.0	0.00
P-313	8	105	120	0.1	0.00
P-314	6	309	120	0.8	0.00
P-315	6	345	120	1.6	0.00
P-316	6	207	130	0.8	0.00
P-317	8	262	120	1.7	0.00
P-318	8	276	130	0.0	0.00
P-319	8	259	120	1.7	0.00
P-320	8	278	130	0.1	0.00
P-321	8	320	120	1.3	0.00
P-322	8	1,220	120	1.5	0.00
P-323	8	405	130	0.7	0.00
P-324	8	610	120	0.0	0.00
P-325	8	184	120	0.6	0.00
P-326	12	397	130	0.2	0.00
P-327	8	303	130	2.3	0.00
P-328	8	212	130	0.0	0.00
P-329	8	304	130	2.2	0.00
P-330	8	299	130	1.0	0.00
P-331	8	267	130	1.0	0.00
P-332	8	261	130	1.1	0.00
P-333	8	257	130	0.2	0.00
P-334	8	259	130	0.1	0.00
P-335	8	280	130	0.4	0.00
P-336	8	256	130	0.0	0.00

Buildout Water System - City of Live Oak

Pipe Report - MDD

Label	Diameter (in)	Length (ft)	Hazen-Williams C	Velocity (ft/s)	Head loss Gradient (ft/1,000 ft)
P-337	8	604	130	0.2	0.00
P-338	8	267	130	0.3	0.00
P-339	8	255	130	0.1	0.00
P-340	8	255	130	0.0	0.00
P-341	8	514	130	0.1	0.00
P-342	8	303	130	0.1	0.00
P-343	8	516	130	0.0	0.00
P-344	8	264	130	0.1	0.00
P-345	8	519	130	0.1	0.00
P-346	8	255	130	0.3	0.00
P-347	8	281	130	0.8	0.00
P-348	8	369	130	0.5	0.00
P-349	8	597	130	0.1	0.00
P-350	8	256	130	0.1	0.00
P-351	8	266	130	0.1	0.00
P-352	8	595	130	0.3	0.00
P-353	8	182	130	0.3	0.00
P-354	8	185	130	0.1	0.00
P-355	8	365	130	0.5	0.00
P-356	8	126	130	0.6	0.00
P-357	8	368	130	0.6	0.00
P-358	8	262	130	0.8	0.00
P-359	8	263	130	1.0	0.00
P-360	8	233	130	1.1	0.00
P-361	8	527	130	0.2	0.00
P-362	8	270	130	0.7	0.00
P-363	8	112	130	0.4	0.00
P-364	8	379	130	0.4	0.00
P-365	8	264	130	0.1	0.00
P-366	8	597	130	0.0	0.00
P-367	8	373	120	0.9	0.00
P-368	8	639	120	1.5	0.00
P-369	8	182	130	0.6	0.00
P-370	8	325	130	0.1	0.00
P-371	8	192	130	0.4	0.00
P-372	8	305	130	0.2	0.00
P-373	8	285	130	0.1	0.00
P-374	8	701	130	0.1	0.00
P-375	8	479	130	0.1	0.00
P-376	8	249	130	0.3	0.00
P-377	8	587	130	0.5	0.00
P-378	8	129	130	0.2	0.00
P-379	8	622	130	0.3	0.00
P-380	8	670	130	0.3	0.00
P-381	8	96	130	0.3	0.00
P-382	8	465	130	0.2	0.00
P-383	8	165	130	0.1	0.00
P-384	8	126	130	0.2	0.00

Buildout Water System - City of Live Oak

Pipe Report - MDD

Label	Diameter (in)	Length (ft)	Hazen-Williams C	Velocity (ft/s)	Head loss Gradient (ft/1,000 ft)
P-385	8	266	130	0.0	0.00
P-386	8	264	130	0.2	0.00
P-387	8	598	130	1.1	0.00
P-388	4	281	130	0.4	0.00
P-389	8	528	130	0.1	0.00
P-390	8	286	130	0.1	0.00
P-391	6	328	130	0.1	0.00
P-392	8	366	130	0.6	0.00
P-393	8	191	130	1.7	0.00
P-394	8	390	130	2.1	0.00
P-395	8	173	130	0.4	0.00
P-396	8	260	130	1.3	0.00
P-397	8	239	130	1.6	0.00
P-398	8	382	130	0.9	0.00
P-399	8	249	130	1.2	0.00
P-400	8	253	130	1.8	0.00
P-401	8	171	130	2.9	0.00
P-402	8	381	130	1.0	0.00
P-403	8	381	130	0.5	0.00
P-404	8	542	130	0.3	0.00
P-405	8	377	130	2.4	0.00
P-406	8	328	130	0.2	0.00
P-407	8	649	120	0.1	0.00
P-408	8	541	120	0.0	0.00
P-409	8	420	120	2.0	0.00
P-410	8	928	120	2.2	0.00
P-411	8	462	120	0.7	0.00
P-412	8	770	120	0.7	0.00
P-413	8	470	120	0.8	0.00
P-414	8	461	120	0.8	0.00
P-415	6	578	120	0.5	0.00
P-416	6	381	120	0.7	0.00
P-417	8	463	130	0.5	0.00
P-418	8	392	130	0.4	0.00
P-419	8	1,305	130	0.4	0.00
P-420	8	1,418	130	0.4	0.00
P-421	8	192	130	1.2	0.00
P-422	8	204	130	1.2	0.00
P-423	6	521	120	0.0	0.00
P-424	6	416	120	0.0	0.00
P-425	8	264	130	0.1	0.00
P-426	8	267	130	0.1	0.00
P-427	8	342	130	0.0	0.00
P-428	8	541	130	0.1	0.00
P-429	8	259	130	0.2	0.00
P-430	8	263	130	0.1	0.00
P-431	8	411	130	0.1	0.00
P-432	8	271	130	0.0	0.00

Buildout Water System - City of Live Oak

Pipe Report - MDD

Label	Diameter (in)	Length (ft)	Hazen-Williams C	Velocity (ft/s)	Head loss Gradient (ft/1,000 ft)
P-433	8	368	130	0.1	0.00
P-434	8	261	130	0.1	0.00
P-435	8	254	130	0.1	0.00
P-436	8	542	130	0.0	0.00
P-437	8	257	130	0.1	0.00
P-438	8	201	130	0.3	0.00
P-439	8	339	130	0.3	0.00
P-440	8	258	130	0.1	0.00
P-441	8	596	130	0.0	0.00
P-442	8	267	130	0.0	0.00
P-443	8	600	130	0.1	0.00
P-444	8	596	130	0.3	0.00
P-445	8	269	130	0.1	0.00
P-446	10	482	130	1.8	0.00
P-447	12	918	130	2.1	0.00
P-448	8	408	130	0.1	0.00
P-449	8	749	130	0.0	0.00
P-450	8	280	130	0.0	0.00
P-451	8	291	130	0.0	0.00
P-452	8	416	130	0.0	0.00
P-453	8	112	130	0.0	0.00
P-454	8	391	130	0.0	0.00
P-455	8	90	130	0.1	0.00
P-456	8	269	130	0.1	0.00
P-457	8	370	130	0.1	0.00
P-458	8	318	130	0.0	0.00
P-459	8	276	130	0.0	0.00
P-460	8	253	130	0.1	0.00
P-461	8	318	130	0.0	0.00
P-462	8	543	130	0.1	0.00
P-463	8	261	130	0.2	0.00
P-464	8	257	130	0.1	0.00
P-465	8	334	130	0.1	0.00
P-466	8	336	130	0.0	0.00
P-467	8	241	130	0.1	0.00
P-468	10	1,159	130	2.0	0.00
P-472	6	396	130	22.7	0.27
P-473	8	252	130	0.4	0.00
P-475	8	208	130	0.8	0.00
P-476	8	663	130	0.9	0.00
P-477	8	497	130	0.1	0.00
P-478	8	364	130	0.1	0.00
P-479	8	142	130	0.3	0.00
P-480	10	707	130	0.1	0.00
P-481	10	297	130	0.0	0.00
P-484	10	540	130	2.7	0.00
P-486	14	1,298	130	1.0	0.00
P-487	14	1,559	130	0.4	0.00

Buildout Water System - City of Live Oak

Pipe Report - MDD

Label	Diameter (in)	Length (ft)	Hazen-Williams C	Velocity (ft/s)	Head loss Gradient (ft/1,000 ft)
P-488	14	1,131	130	0.2	0.00
P-489	14	2,265	130	1.8	0.00
P-490	14	992	130	0.6	0.00
P-491	14	731	130	0.1	0.00
P-492	14	548	130	0.3	0.00
P-493	14	962	130	3.3	0.00
P-494	14	887	130	2.7	0.00
P-495	14	1,112	130	2.2	0.00
P-496	14	1,722	130	0.1	0.00
P-497	14	1,232	130	1.4	0.00
P-498	14	371	130	1.6	0.00
P-499	14	215	130	2.5	0.00
P-501	12	1,140	130	0.8	0.00
P-503	14	1,103	130	2.7	0.00
P-504	14	505	130	1.3	0.00
P-505	14	704	130	0.9	0.00
P-508	14	1,625	130	0.2	0.00
P-509	14	966	130	0.7	0.00
P-510	14	1,293	130	1.8	0.00
P-511	14	1,859	130	3.3	0.00
P-512	12	780	130	1.9	0.00
P-513	12	1,265	130	0.1	0.00
P-514	12	331	130	0.3	0.00
P-515	12	1,858	130	1.1	0.00
P-516	12	374	130	1.0	0.00
P-517	12	145	130	0.3	0.00
P-519	12	62	130	0.2	0.00
P-520	12	67	130	0.6	0.00
P-521	12	221	130	0.9	0.00
P-522	12	589	130	2.5	0.00
P-523	12	1,506	130	3.1	0.00
P-524	12	366	130	3.8	0.00
P-525	12	970	130	1.5	0.00
P-526	12	859	130	1.1	0.00
P-532	12	128	130	0.7	0.00
P-540	12	677	130	2.8	0.00
P-541	12	584	130	2.7	0.00
P-542	12	262	130	2.2	0.00
P-544	8	635	130	1.4	0.00
P-545	12	311	130	1.7	0.00
P-547	12	122	130	0.5	0.00
P-548	12	213	130	1.3	0.00
P-562	14	86	130	0.5	0.00
P-565	12	123	130	0.5	0.00
P-569	10	536	130	1.2	0.00
P-570	10	1,354	130	1.5	0.00
P-571	10	1,370	130	2.1	0.00
P-572	10	2,469	130	3.0	0.00

Buildout Water System - City of Live Oak

Pipe Report - MDD

Label	Diameter (in)	Length (ft)	Hazen-Williams C	Velocity (ft/s)	Head loss Gradient (ft/1,000 ft)
P-600	12	83	130	5.7	0.01
P-601	12	96	130	5.7	0.01
P-602	12	88	130	5.7	0.01
P-620	8	510	130	1.0	0.00
P-621	20	58	130	3.9	0.00
P-622	20	86	130	3.9	0.00
P-623	20	38	130	2.0	0.00
P-624	12	146	130	5.7	0.01
P-627	12	110	130	5.7	0.01
P-628	6	105	130	0.0	0.00
P-629	6	76	130	0.0	0.00
P-632	6	69	130	6.9	0.03
P-633	6	93	130	6.9	0.03
P-634	20	41	130	2.0	0.00
P-635	8	848	130	3.5	0.01
P-636	8	606	130	1.4	0.00
P-637	12	131	130	5.7	0.01
P-638	14	807	130	2.4	0.00
P-639	12	1,229	130	1.1	0.00
P-640	12	673	130	0.5	0.00
P-641	12	1,512	130	0.1	0.00
P-642	12	602	130	0.6	0.00
P-643	12	2,278	130	0.1	0.00
P-644	12	361	130	0.5	0.00
P-645	12	290	130	0.4	0.00
P-646	12	319	130	2.8	0.00
P-647	10	284	130	2.1	0.00
P-648	12	1,397	130	0.1	0.00
P-649	12	1,112	130	1.3	0.00
P-650	20	139	130	2.0	0.00
P-651	10	1,399	130	0.5	0.00
P-652	12	151	130	5.7	0.01
P-653	12	1,018	130	0.0	0.00
P-654	12	69	130	0.0	0.00

Note: The pipe recommended to be paralleled or replaced IS labeled with the name as the existing pipe with an additional suffix "a".

Buildout Water System - City of Live Oak

Junction Report - MDD+FIRE

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Satisfies Fire Flow Constraints?	Junction w/Minimum Pressure (Zone)	Calculated Minimum Zone Pressure (psi)
J-1	3,000	3,799	TRUE	J-5	47.3
J-2	3,000	4,500	TRUE	J-218	41.6
J-3	3,000	4,500	TRUE	J-218	34.1
J-4	1,500	4,231	TRUE	J-11	20.0
J-5	1,500	4,500	TRUE	J-1	33.4
J-6	3,000	4,500	TRUE	J-316	48.7
J-7	1,500	4,500	TRUE	J-11	28.6
J-8	1,500	3,035	TRUE	J-9	20.0
J-9	1,500	2,420	TRUE	J-8	39.1
J-11	1,500	2,557	TRUE	J-4	53.3
J-12	1,500	3,843	TRUE	J-324	22.6
J-13	1,500	3,900	TRUE	J-9	30.9
J-14	3,000	4,500	TRUE	J-15	51.1
J-15	3,000	4,500	TRUE	J-14	51.4
J-16	3,000	4,500	TRUE	J-119	52.5
J-17	1,500	4,500	TRUE	J-217	32.4
J-18	1,500	2,817	TRUE	J-239	20.0
J-19	1,500	1,885	TRUE	J-20	20.0
J-20	1,500	1,820	TRUE	J-19	23.6
J-21	1,500	2,101	TRUE	J-20	20.0
J-22	1,500	3,838	TRUE	J-20	20.0
J-23	1,500	3,803	TRUE	J-24	20.0
J-24	1,500	3,665	TRUE	J-23	23.7
J-25	4,000	4,500	TRUE	J-342	68.7
J-26	4,000	4,500	TRUE	J-135	67.8
J-27	1,500	4,228	TRUE	J-29	44.0
J-28	1,500	4,177	TRUE	J-29	36.5
J-29	1,500	3,795	TRUE	J-216	27.0
J-30	1,500	4,241	TRUE	J-162	36.0
J-31	1,500	2,025	TRUE	J-32	58.2
J-32	1,500	3,663	TRUE	J-31	20.0
J-33	1,500	4,500	TRUE	J-32	49.1
J-34	1,500	4,500	TRUE	J-221	37.2
J-35	3,000	4,500	TRUE	J-139	61.9
J-36	3,000	4,500	TRUE	J-46	61.0
J-37	1,500	4,500	TRUE	J-252	52.9
J-38	1,500	2,532	TRUE	J-39	66.1
J-39	1,500	4,500	TRUE	J-38	47.3
J-40	1,500	4,500	TRUE	J-137	61.0
J-41	1,500	4,401	TRUE	J-160	27.6
J-42	1,500	4,500	TRUE	J-206	22.8
J-43	1,500	4,500	TRUE	J-42	30.4
J-44	1,500	4,500	TRUE	J-43	51.2
J-45	1,500	4,500	TRUE	J-44	57.7
J-46	1,500	4,500	TRUE	J-47	60.3
J-47	2,500	4,500	TRUE	J-52	60.3
J-48	1,500	3,594	TRUE	J-51	23.4

Buildout Water System - City of Live Oak

Junction Report - MDD+FIRE

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Satisfies Fire Flow Constraints?	Junction w/Minimum Pressure (Zone)	Calculated Minimum Zone Pressure (psi)
J-49	1,500	2,833	TRUE	J-51	20.0
J-50	3,000	4,500	TRUE	J-222	32.3
J-51	1,500	2,145	TRUE	J-49	41.7
J-53	3,000	4,500	TRUE	J-60	55.4
J-54	1,500	4,500	TRUE	J-53	56.8
J-55	1,500	4,500	TRUE	J-54	57.6
J-56	1,500	4,500	TRUE	J-193	57.3
J-57	1,500	4,500	TRUE	J-58	51.9
J-58	1,500	4,500	TRUE	J-59	49.4
J-59	1,500	4,500	TRUE	J-76	48.6
J-60	3,000	4,500	TRUE	J-61	50.5
J-61	3,000	4,500	TRUE	J-65	47.5
J-62	1,500	4,500	TRUE	J-63	45.2
J-63	1,500	4,500	TRUE	J-73	43.1
J-64	2,500	4,500	TRUE	J-66	47.9
J-65	3,000	4,500	TRUE	J-396	48.3
J-66	3,000	4,500	TRUE	J-259	43.1
J-67	2,500	4,500	TRUE	J-396	34.9
J-68	2,500	4,500	TRUE	J-396	40.7
J-69	1,500	4,500	TRUE	J-70	37.3
J-70	1,500	4,500	TRUE	J-69	37.9
J-71	1,500	4,500	TRUE	J-300	37.3
J-72	1,500	4,500	TRUE	J-73	37.2
J-73	1,500	2,412	TRUE	J-72	62.1
J-74	1,500	4,500	TRUE	J-77	42.0
J-75	1,500	4,500	TRUE	J-77	22.6
J-76	1,500	4,500	TRUE	J-74	47.3
J-77	1,500	2,405	TRUE	J-75	57.4
J-78	1,500	4,500	TRUE	J-76	49.6
J-79	1,500	4,500	TRUE	J-78	52.1
J-80	3,000	4,500	TRUE	J-150	55.9
J-81	3,000	3,776	TRUE	J-82	52.2
J-82	3,000	4,500	TRUE	J-81	39.7
J-83	2,500	4,500	TRUE	J-84	40.8
J-84	1,500	4,500	TRUE	J-345	40.5
J-85	1,500	4,500	TRUE	J-345	41.7
J-86	1,500	4,500	TRUE	J-343	43.7
J-87	1,500	2,400	TRUE	J-195	59.6
J-88	1,500	4,500	TRUE	J-205	43.8
J-89	1,500	4,500	TRUE	J-204	46.7
J-90	1,500	4,500	TRUE	J-245	61.7
J-91	1,500	4,500	TRUE	J-92	51.2
J-92	1,500	4,003	TRUE	J-247	20.1
J-93	1,500	4,440	TRUE	J-248	20.1
J-94	1,500	4,500	TRUE	J-93	42.6
J-95	1,500	4,500	TRUE	J-246	53.4
J-96	1,500	4,500	TRUE	J-97	65.8

Buildout Water System - City of Live Oak

Junction Report - MDD+FIRE

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Satisfies Fire Flow Constraints?	Junction w/Minimum Pressure (Zone)	Calculated Minimum Zone Pressure (psi)
J-97	2,500	4,500	TRUE	J-321	65.6
J-98	3,000	4,500	TRUE	J-321	62.0
J-99	1,500	3,669	TRUE	J-100	23.3
J-100	1,500	2,808	TRUE	J-99	46.3
J-101	1,500	3,974	TRUE	J-321	20.0
J-102	1,500	4,500	TRUE	J-103	37.9
J-103	1,500	4,500	TRUE	J-106	34.9
J-104	1,500	4,441	TRUE	J-374	23.2
J-105	1,500	3,293	TRUE	J-106	40.3
J-106	1,500	4,283	TRUE	J-105	20.0
J-107	1,500	3,832	TRUE	J-110	20.0
J-108	1,500	3,703	TRUE	J-303	21.7
J-109	1,500	2,733	TRUE	J-107	44.4
J-110	1,500	2,062	TRUE	J-107	56.7
J-111	1,500	2,129	TRUE	J-106	59.2
J-112	1,500	3,849	TRUE	J-115	41.2
J-113	1,500	4,500	TRUE	J-114	27.7
J-114	1,500	2,875	TRUE	J-113	54.0
J-115	1,500	4,500	TRUE	J-112	30.1
J-116	2,500	4,500	TRUE	J-117	36.6
J-117	2,500	4,500	TRUE	J-116	36.6
J-118	3,000	4,500	TRUE	J-117	44.3
J-119	1,500	3,083	TRUE	J-16	64.2
J-120	1,500	4,500	TRUE	J-233	35.1
J-121	2,500	4,500	TRUE	J-118	48.0
J-122	3,000	4,500	TRUE	J-219	60.6
J-123	3,000	4,500	TRUE	J-122	60.9
J-124	1,500	4,500	TRUE	J-126	58.8
J-125	3,000	4,500	TRUE	J-124	59.2
J-126	3,000	4,500	TRUE	J-124	58.8
J-127	3,000	4,461	TRUE	J-219	32.9
J-128	3,000	4,500	TRUE	J-129	61.2
J-130	1,500	4,500	TRUE	J-131	50.1
J-131	1,500	1,924	TRUE	J-130	71.7
J-132	1,500	4,500	TRUE	J-220	57.1
J-133	3,000	4,500	TRUE	J-132	67.5
J-134	4,000	4,500	TRUE	J-212	67.8
J-135	4,000	4,500	TRUE	J-32	67.5
J-136	4,000	4,500	TRUE	J-234	67.5
J-137	1,500	4,500	TRUE	J-33	53.8
J-139	3,000	4,500	TRUE	J-138	59.8
J-140	3,000	4,500	TRUE	J-36	61.3
J-141	3,000	3,688	TRUE	J-210	31.3
J-142	2,500	4,500	TRUE	J-190	55.7
J-143	1,500	4,500	TRUE	J-146	54.8
J-144	1,500	4,286	TRUE	J-190	20.0
J-145	2,500	4,500	TRUE	J-190	40.5

Buildout Water System - City of Live Oak

Junction Report - MDD+FIRE

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Satisfies Fire Flow Constraints?	Junction w/Minimum Pressure (Zone)	Calculated Minimum Zone Pressure (psi)
J-146	2,500	4,500	TRUE	J-143	56.1
J-147	1,500	2,231	TRUE	J-148	62.5
J-148	2,500	4,500	TRUE	J-147	27.9
J-149	2,500	4,500	TRUE	J-147	42.2
J-150	1,500	4,500	TRUE	J-149	49.5
J-151	2,500	4,406	TRUE	J-152	44.7
J-152	1,500	4,500	TRUE	J-151	43.2
J-153	1,500	4,500	TRUE	J-235	55.0
J-154	1,500	2,315	TRUE	J-155	55.9
J-155	1,500	3,533	TRUE	J-154	35.0
J-156	1,500	4,243	TRUE	J-302	20.0
J-157	1,500	2,183	TRUE	J-206	42.3
J-158	1,500	1,983	TRUE	J-207	40.1
J-159	1,500	2,544	TRUE	J-208	20.0
J-161	2,500	3,699	TRUE	J-160	20.0
J-162	1,500	3,470	TRUE	J-163	20.0
J-163	1,500	2,227	TRUE	J-162	51.3
J-164	1,500	4,213	TRUE	J-253	50.3
J-165	3,000	4,500	TRUE	J-166	67.9
J-166	3,000	4,500	TRUE	J-129	67.8
J-167	3,000	4,500	TRUE	J-305	68.0
J-168	3,000	4,500	TRUE	J-249	66.0
J-169	3,000	4,500	TRUE	J-305	67.9
J-170	1,500	4,500	TRUE	J-305	68.0
J-171	1,500	4,500	TRUE	J-96	67.1
J-172	1,500	4,500	TRUE	J-305	68.1
J-173	3,000	4,500	TRUE	J-174	44.4
J-176	3,000	4,500	TRUE	J-175	41.6
J-177	3,000	4,500	TRUE	J-178	49.6
J-178	3,000	4,500	TRUE	J-258	49.3
J-179	1,500	4,500	TRUE	J-409	71.0
J-180	1,500	4,500	TRUE	J-409	71.0
J-181	1,500	4,500	TRUE	J-417	69.6
J-182	1,500	1,191	FALSE	J-325	41.4
J-183	1,500	3,607	TRUE	J-213	55.8
J-184	1,500	4,500	TRUE	J-185	46.1
J-185	1,500	4,500	TRUE	J-184	46.1
J-186	1,500	4,500	TRUE	J-187	45.5
J-187	1,500	4,500	TRUE	J-186	45.4
J-188	4,000	4,500	TRUE	J-25	70.6
J-189	1,500	2,994	TRUE	J-325	20.0
J-190	2,500	3,262	TRUE	J-144	42.1
J-191	2,500	3,096	TRUE	J-192	20.0
J-193	1,500	4,500	TRUE	J-191	49.0
J-194	1,500	4,500	TRUE	J-87	41.9
J-195	2,000	4,500	TRUE	J-87	24.7
J-196	1,500	4,500	TRUE	J-344	45.7

Buildout Water System - City of Live Oak

Junction Report - MDD+FIRE

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Satisfies Fire Flow Constraints?	Junction w/Minimum Pressure (Zone)	Calculated Minimum Zone Pressure (psi)
J-197	2,500	4,500	TRUE	J-194	43.8
J-199	3,000	4,500	TRUE	J-142	55.5
J-200	1,500	4,500	TRUE	J-95	58.2
J-201	1,500	4,500	TRUE	J-229	50.7
J-202	3,000	4,067	TRUE	J-141	50.4
J-203	1,500	4,500	TRUE	J-200	57.8
J-204	1,500	4,500	TRUE	J-285	43.1
J-205	1,500	2,852	TRUE	J-88	61.4
J-206	1,500	2,900	TRUE	J-157	20.0
J-207	1,500	2,547	TRUE	J-158	20.0
J-208	1,500	1,669	TRUE	J-159	49.4
J-209	3,000	4,500	TRUE	J-52	57.2
J-210	3,000	4,170	TRUE	J-141	20.0
J-211	1,500	4,500	TRUE	J-246	45.5
J-212	1,500	4,500	TRUE	J-164	51.9
J-213	1,500	4,500	TRUE	J-183	44.4
J-215	1,500	3,031	TRUE	J-325	29.7
J-216	1,500	3,257	TRUE	J-215	29.1
J-217	1,500	3,268	TRUE	J-239	25.3
J-218	1,500	2,230	TRUE	J-3	64.9
J-221	1,500	4,309	TRUE	J-34	42.7
J-222	1,500	3,297	TRUE	J-48	44.6
J-223	2,500	4,500	TRUE	J-419	36.7
J-224	1,500	4,245	TRUE	J-154	20.0
J-225	1,500	4,500	TRUE	J-255	59.9
J-226	3,000	4,500	TRUE	J-100	66.6
J-227	1,500	3,669	TRUE	J-228	33.3
J-228	4,000	3,918	FALSE	J-227	26.9
J-229	3,000	4,500	TRUE	J-201	51.1
J-230	3,000	4,500	TRUE	J-139	63.4
J-231	1,500	4,500	TRUE	J-198	50.0
J-232	3,000	4,500	TRUE	J-305	68.1
J-233	1,500	4,500	TRUE	J-12	33.9
J-234	4,000	4,500	TRUE	J-136	67.6
J-235	1,500	4,500	TRUE	J-153	55.3
J-236	3,000	4,500	TRUE	J-10	51.5
J-237	3,000	4,500	TRUE	J-305	68.4
J-238	1,500	4,500	TRUE	J-45	58.7
J-245	1,500	4,500	TRUE	J-225	61.0
J-246	1,500	4,291	TRUE	J-211	49.5
J-247	1,500	3,044	TRUE	J-92	42.0
J-248	1,500	3,244	TRUE	J-93	44.3
J-249	3,000	4,500	TRUE	J-201	55.9
J-250	1,500	1,912	TRUE	J-20	20.9
J-251	1,500	2,001	TRUE	J-250	20.7
J-252	1,500	4,500	TRUE	J-37	53.8
J-253	1,500	4,500	TRUE	J-164	44.2

Buildout Water System - City of Live Oak

Junction Report - MDD+FIRE

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Satisfies Fire Flow Constraints?	Junction w/Minimum Pressure (Zone)	Calculated Minimum Zone Pressure (psi)
J-254	1,500	4,500	TRUE	J-255	41.5
J-255	1,500	3,976	TRUE	J-254	48.2
J-256	1,500	4,500	TRUE	J-257	34.2
J-257	1,500	3,752	TRUE	J-256	45.6
J-258	1,500	4,500	TRUE	J-23	45.1
J-259	3,000	4,500	TRUE	J-66	43.2
J-260	1,500	4,500	TRUE	J-262	60.0
J-261	1,500	4,500	TRUE	J-262	44.8
J-262	1,500	4,392	TRUE	J-261	46.1
J-263	1,500	4,500	TRUE	J-291	44.8
J-264	1,500	4,500	TRUE	J-265	44.0
J-265	1,500	4,500	TRUE	J-264	43.7
J-266	1,500	4,500	TRUE	J-280	43.2
J-267	1,500	4,500	TRUE	J-346	43.2
J-268	1,500	4,500	TRUE	J-346	43.2
J-269	1,500	4,500	TRUE	J-292	41.0
J-270	1,500	4,500	TRUE	J-271	41.4
J-271	1,500	4,500	TRUE	J-281	38.0
J-272	1,500	4,500	TRUE	J-279	35.4
J-273	1,500	4,500	TRUE	J-274	34.4
J-274	1,500	4,500	TRUE	J-275	31.4
J-275	1,500	4,500	TRUE	J-278	23.3
J-276	1,500	4,500	TRUE	J-279	24.2
J-277	1,500	4,047	TRUE	J-279	20.0
J-278	1,500	4,077	TRUE	J-279	28.6
J-279	1,500	2,750	TRUE	J-277	47.0
J-280	1,500	4,500	TRUE	J-292	31.3
J-281	1,500	4,500	TRUE	J-282	36.9
J-282	1,500	4,500	TRUE	J-281	37.1
J-283	1,500	4,500	TRUE	J-282	39.1
J-284	1,500	4,500	TRUE	J-322	37.9
J-285	1,500	4,500	TRUE	J-204	42.8
J-286	1,500	4,500	TRUE	J-285	44.0
J-287	1,500	4,500	TRUE	J-288	34.9
J-288	1,500	4,500	TRUE	J-287	34.8
J-289	1,500	4,500	TRUE	J-288	46.2
J-290	1,500	4,500	TRUE	J-291	44.6
J-291	1,500	4,500	TRUE	J-290	44.8
J-292	1,500	4,500	TRUE	J-280	31.4
J-293	1,500	4,500	TRUE	J-289	48.7
J-294	1,500	4,492	TRUE	J-301	20.0
J-295	1,500	4,500	TRUE	J-301	29.6
J-296	1,500	4,500	TRUE	J-297	31.4
J-297	1,500	4,500	TRUE	J-298	24.9
J-298	2,500	3,907	TRUE	J-299	35.7
J-299	2,500	4,500	TRUE	J-298	24.5
J-300	2,500	4,500	TRUE	J-299	35.0

Buildout Water System - City of Live Oak

Junction Report - MDD+FIRE

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Satisfies Fire Flow Constraints?	Junction w/Minimum Pressure (Zone)	Calculated Minimum Zone Pressure (psi)
J-301	1,500	3,997	TRUE	J-294	30.1
J-302	1,500	3,586	TRUE	J-156	34.0
J-303	1,500	3,619	TRUE	J-310	20.1
J-304	1,500	3,503	TRUE	J-307	20.1
J-305	1,500	3,450	TRUE	J-311	20.2
J-306	1,500	3,580	TRUE	J-324	26.3
J-308	1,500	2,541	TRUE	J-304	43.5
J-309	1,500	2,939	TRUE	J-303	36.7
J-310	1,500	1,950	TRUE	J-303	56.6
J-311	1,500	2,691	TRUE	J-305	39.2
J-312	1,500	4,500	TRUE	J-5	46.2
J-313	1,500	4,500	TRUE	J-319	54.3
J-314	1,500	4,500	TRUE	J-315	50.3
J-315	1,500	4,500	TRUE	J-320	46.9
J-316	1,500	4,500	TRUE	J-320	44.8
J-317	1,500	4,500	TRUE	J-320	34.1
J-318	1,500	4,500	TRUE	J-320	44.1
J-319	1,500	4,500	TRUE	J-318	50.2
J-320	1,500	3,048	TRUE	J-317	54.9
J-321	1,500	3,070	TRUE	J-101	41.1
J-322	1,500	3,393	TRUE	J-323	44.2
J-323	1,500	3,857	TRUE	J-322	36.0
J-324	1,500	3,683	TRUE	J-306	22.7
J-325	1,500	1,517	TRUE	J-182	20.0
J-326	1,500	4,500	TRUE	J-283	39.8
J-327	1,500	4,500	TRUE	J-336	41.0
J-328	1,500	4,500	TRUE	J-329	42.2
J-329	1,500	4,500	TRUE	J-330	41.0
J-330	1,500	4,500	TRUE	J-331	35.2
J-331	1,500	4,450	TRUE	J-352	22.6
J-332	1,500	4,500	TRUE	J-333	33.5
J-333	1,500	4,443	TRUE	J-351	23.2
J-334	1,500	4,500	TRUE	J-355	37.0
J-335	1,500	4,500	TRUE	J-338	41.0
J-336	1,500	4,500	TRUE	J-327	40.9
J-337	1,500	4,500	TRUE	J-347	39.4
J-338	1,500	4,500	TRUE	J-354	37.6
J-339	1,500	4,500	TRUE	J-369	60.1
J-340	1,500	4,500	TRUE	J-428	53.0
J-341	3,000	4,500	TRUE	J-233	44.5
J-342	1,500	4,120	TRUE	J-20	28.2
J-343	1,500	4,475	TRUE	J-84	42.1
J-344	1,500	4,500	TRUE	J-83	44.0
J-345	1,500	3,091	TRUE	J-84	58.6
J-346	1,500	4,500	TRUE	J-268	43.8
J-347	1,500	4,399	TRUE	J-348	34.5
J-348	1,500	4,340	TRUE	J-349	33.5

Buildout Water System - City of Live Oak

Junction Report - MDD+FIRE

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Satisfies Fire Flow Constraints?	Junction w/Minimum Pressure (Zone)	Calculated Minimum Zone Pressure (psi)
J-349	1,500	4,500	TRUE	J-348	29.4
J-350	1,500	4,500	TRUE	J-351	32.3
J-351	1,500	4,420	TRUE	J-333	23.8
J-352	1,500	4,431	TRUE	J-331	23.1
J-353	1,500	4,500	TRUE	J-350	33.4
J-354	1,500	4,500	TRUE	J-338	38.6
J-355	1,500	4,500	TRUE	J-334	37.6
J-356	1,500	4,500	TRUE	J-357	35.0
J-357	1,500	4,500	TRUE	J-360	35.3
J-358	1,500	4,500	TRUE	J-323	37.3
J-359	1,500	4,500	TRUE	J-355	37.1
J-360	1,500	4,500	TRUE	J-353	34.1
J-361	1,500	4,500	TRUE	J-369	50.4
J-368	1,500	3,062	TRUE	J-403	64.9
J-369	1,500	4,388	TRUE	J-361	51.6
J-370	1,500	4,436	TRUE	J-371	47.3
J-371	1,500	4,500	TRUE	J-370	46.6
J-372	1,500	4,456	TRUE	J-373	31.6
J-373	1,500	4,237	TRUE	J-374	31.6
J-374	1,500	4,334	TRUE	J-104	26.1
J-375	1,500	4,500	TRUE	J-370	50.6
J-377	1,500	4,500	TRUE	J-401	55.6
J-378	1,500	4,500	TRUE	J-379	58.8
J-379	1,500	4,500	TRUE	J-380	57.4
J-380	3,000	4,500	TRUE	J-381	57.1
J-381	3,000	4,500	TRUE	J-382	55.6
J-382	1,500	4,500	TRUE	J-383	47.0
J-383	3,000	4,500	TRUE	J-384	45.0
J-384	1,500	4,500	TRUE	J-429	43.1
J-385	1,500	4,500	TRUE	J-429	41.7
J-386	1,500	4,500	TRUE	J-429	37.9
J-387	1,500	4,500	TRUE	J-429	34.9
J-388	1,500	4,500	TRUE	J-429	31.6
J-389	1,500	4,500	TRUE	J-420	31.8
J-390	3,000	4,500	TRUE	J-420	34.9
J-391	3,000	4,500	TRUE	J-392	34.4
J-392	3,000	4,500	TRUE	J-431	34.5
J-393	3,000	4,500	TRUE	J-394	25.2
J-394	3,000	4,412	TRUE	J-395	22.1
J-395	3,000	4,349	TRUE	J-394	23.8
J-396	3,000	4,500	TRUE	J-441	28.9
J-397	1,500	4,500	TRUE	J-398	57.7
J-398	1,500	4,500	TRUE	J-399	56.1
J-399	3,000	4,500	TRUE	J-400	55.2
J-400	3,000	4,500	TRUE	J-401	53.4
J-401	1,500	4,500	TRUE	J-400	54.1
J-402	3,000	4,500	TRUE	J-403	64.1

Buildout Water System - City of Live Oak

Junction Report - MDD+FIRE

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Satisfies Fire Flow Constraints?	Junction w/Minimum Pressure (Zone)	Calculated Minimum Zone Pressure (psi)
J-403	1,500	4,500	TRUE	J-368	56.3
J-404	3,000	4,500	TRUE	J-405	52.9
J-405	3,000	4,500	TRUE	J-404	52.8
J-406	3,000	4,500	TRUE	J-407	53.1
J-407	1,500	4,500	TRUE	J-408	45.7
J-408	1,500	4,500	TRUE	J-407	45.5
J-409	1,500	4,500	TRUE	J-410	41.2
J-410	3,000	4,500	TRUE	J-409	41.0
J-411	1,500	4,500	TRUE	J-409	42.3
J-412	1,500	4,500	TRUE	J-409	46.8
J-413	1,500	4,500	TRUE	J-409	49.7
J-414	1,500	4,500	TRUE	J-413	58.2
J-415	1,500	4,500	TRUE	J-414	60.7
J-416	1,500	4,500	TRUE	J-409	65.6
J-417	1,500	4,500	TRUE	J-443	69.4
J-418	1,500	4,500	TRUE	J-358	47.2
J-419	3,000	4,500	TRUE	J-393	34.6
J-420	3,000	4,500	TRUE	J-430	27.6
J-421	1,500	4,500	TRUE	J-429	23.7
J-422	1,500	4,500	TRUE	J-429	23.7
J-423	1,500	4,500	TRUE	J-429	34.9
J-424	1,500	4,500	TRUE	J-429	37.9
J-426	3,000	4,500	TRUE	J-409	52.1
J-427	1,500	4,500	TRUE	J-428	54.0
J-428	1,500	4,500	TRUE	J-340	52.9
J-429	1,500	4,354	TRUE	J-421	26.7
J-430	1,500	4,500	TRUE	J-420	27.3
J-431	1,500	4,500	TRUE	J-393	32.9
J-441	3,000	4,500	TRUE	J-396	29.2
J-442	3,000	4,379	TRUE	J-395	25.4
J-443	1,500	4,500	TRUE	J-417	69.2
J-444	1,500	4,500	TRUE	J-445	43.9
J-445	1,500	4,500	TRUE	J-446	38.5
J-446	1,500	4,500	TRUE	J-445	38.6

Appendix B

Water Connection Fee Analysis

ECO:LOGIC
ENGINEERS · CONSULTANTS

3875 Atherton Road
Rocklin, CA 95765
916.773.8100 TEL
916.773.8448 FAX

To: **Satwant Takhar, City of Live Oak**

From: **Georgette Aronow**

CC: **Michael Harrison, Cindy Bertsch**

Date: **November 23, 2009**

RE: **Revised Draft Water Connection Fee Analysis**

ECO:LOGIC is currently in the process of preparing the Water Master Plan for the City of Live Oak. As part of that analysis it was requested that the Wter Connection Fee and the AB 1600 Fee be updated.

This analysis calculates one fee that would replace both the current Water Connection Fee and the AB 1600 Fee. The fee calculated in this analysis will be referred to as the 2009 Connection Fee and includes three components:

1) ***System Buy-In***: The system buy-in charge based on the City's existing water infrastructure assets. The analysis is based on the total cost of all of the water assets at installation less accumulated depreciation. The asset value information is based on the City's water asset depreciation table, which is included as Appendix A.

2) ***Future CIP Project Costs***: The future CIP project costs are based on the projected facility needs as identified in the Water Master Plan. These costs were split between existing and future users based on benefit. The costs allocated to future users are included in the 2009 Water Connection Fee.

3) ***Meter Installation Costs***: The cost of installing and connecting a water meter to the City's distribution system is also included in the 2009 Water Connection Fee.

Each of these fee components and how they were computed are discussed in greater detail below. **Table 1** summarizes the calculated connection fee.

Table 1
City of Live Oak
Water Connection Fee Analysis
Summary of the Calculated 2009 Water Connection Fee

DRAFT

Meter Size	EDU Factor	Infrastructure: Existing Buy-in Charge	Infrastructure: Future CIP Costs	Meter Installation Costs	Subtotal Cost	Admin. Charge 1.50%	Total Connection Fee
Less than 1"	1.00	$682	$5,127	$1,480	$7,289	$109	$7,398
1"	1.67	$1,137	$8,544	$1,520	$11,202	$168	$11,370
1 1/2"	3.33	$2,274	$17,089	$1,720	$21,083	$316	$21,399
2"	5.33	$3,639	$27,342	$1,920	$32,901	$494	$33,394
3"	11.67	$7,961	$59,810	$3,700	$71,471	$1,072	$72,543
4"	21.00	$14,329	$107,658	$5,980	$127,967	$1,920	$129,887
6"	46.67	$31,842	$239,241	$8,020	$279,103	$4,187	$283,290

MAJOR ASSUMPTIONS

This analysis and calculation of the 2009 Water Connection fee is predicated on several major assumptions, discussed in further detail below.

EQUIVALENT DWELLING UNITS (EDUS)

For water service, one equivalent dwelling unit (EDU) is the amount of water an average single family residence is assumed to use. The Water Master Plan assumes that one EDU uses 500 gallons per day.

The total capacity added to the water system by future improvements is estimated at 7.4 million gallons per day (gpd). This capacity would serve approximately 14,800 future EDUs.

Total water sold in 2008 was approximately 469 million gallons. This equates to approximately 1.3 million gallons per day and 2,570 current (existing) EDUs, assuming 500 gpd per EDU.

Therefore, there is capacity for 17,370 EDUs to be serviced upon completion of water infrastructure improvements described in the Water Master Plan.

EDU FACTORS

EDU factors are the method for equating a single family unit to other types of customers, such as non-residential customers. In the case of water infrastructure, it is typical to use the water meter size as a way of establishing EDU factors. Each meter size has a maximum flow rate and can be equated

back to one EDU (a single family unit). The meter flow rates were determined based on the INVENSYS Catalog, the typical type of meter installed by the City of Live Oak. Those flow rates and EDU factors are shown in **Table 2**.

Table 2
City of Live Oak
Water Connection Fee Analysis
Proposed EDU Factors

Meter Size, in	Capacity (gpm) [1]	Proposed EDU Factor
Less than 1	30	1
1	50	1.7
1.5	100	3.3
2	160	5.3
3	350	11.7
4	630	21.0
6	1,400	46.7

[1] Based on INVENSYS Catalog

SYSTEM BUY-IN CHARGE

The system buy-in costs are based on an inventory of the City's existing water assets (water lines, wells, and water storage tank). The analysis uses the City's water asset depreciation schedule as the basis for this calculation and is included as Appendix A.

The total water assets are estimated at $14.33 million, based on estimated costs at installation. Of that $14.33 million, the City has accumulated approximately $2.48 million in depreciation. The remaining net value of the assets, is therefore, estimated at $11.85 million as shown in Table 3.

The $11.85 million represents the value of the assets to spread over both existing and future users. The total cost is divided by the total EDUs, estimated at 17,370, for a cost per EDU of $682.33.

Table 3
City of Live Oak
Water Connection Fee Analysis
Summary of the Buy-In-Cost Analysis

Utility	Estimated Cost at Installation	Est. Total Accumulated Depreciation	Buy-In Costs Net of Accumulated Depreciation
	Costs Rounded to Thousands of Dollars		
Water	$14,335,196	$2,483,191	$11,852,004
EDUs			
Existing			2,570
Future			14,800
Total			**17,370**
Cost per EDU			**$682.33**

FUTURE CIP COSTS

The future CIP costs represent the costs of future facilities to be built to serve new development. Table 4 shows the facilities and costs as identified by the Water Master Plan. These costs are then distributed to existing and future users based on benefit of the facilities. The majority of the costs, $49.38 million of the $55.14 million in total costs, are allocated to new development.

Table 4
City of Live Oak
Water Connection Fee Analysis
Summary of Water Master Plan Capital Improvement Costs and Allocation to Existing and New Users

Description	Master Plan Capital Cost	Cost Distribution		Cost Allocation	
		Existing	New	Existing	New
Water Pipeline Replacement/ Paralleling Projects	$1,870,000	100%	0%	$1,870,000	$0
Two 0.7 MG Tanks	$2,016,000	0%	100%	$0	$2,016,000
Two 230 HP Booster Pump Stations	$3,398,000	0%	100%	$0	$3,398,000
Nine Wells with Arsenic Treatment	$34,992,000	11%	89%	$3,888,000	$31,104,000
Distribution System Improvements	$12,860,000	0%	100%	$0	$12,860,000
Total	**$55,136,000**			**$5,758,000**	**$49,378,000**

It is likely that the City will have to finance these costs at some future date in order to move forward with construction. Therefore, Table 5 calculates the cost per EDU including a financing factor.

The financing factor included in this initial calculation does not represent the full cost of financing, if the City were to finance all of the projects today, which is not likely. The annualized debt service payments are discounted by 3.5 percent, to reflect that the City is not planning to build these projects immediately. This results in the interest cost being cut by a factor of 50 percent.

The new facilities will add approximately 7.4 million gallons of additional capacity. If the total cost by the additional capacity is divided by the total gallons of treated water, the cost per treated gallon is estimated at $10.25.

One EDU is assumed to use approximately 500 gallons per day. Therefore, the cost per EDU is calculated at $10.25 * 500 to equal $5,127 per EDU.

Table 5
City of Live Oak
Water Connection Fee Analysis
Water - New Capacity and Fee per EDU

DRAFT

ITEM	*Assumption*	TOTAL COST
Total Project Cost		$49,378,000
Financing Factor [1]	**0.54**	$26,495,563
TOTAL COST		**$75,873,563**
Additional Capacity Added (GPD) [2]		7,400,000
Cost per Gallon		**$10.25**
Gallons/Day per EDU		500
Cost per EDU [3]		**$5,127**

"cost_EDU"

[1] Assumes that 100 percent of the costs are financed:

Financing Costs:	
Amount Financed	$49,378,000.00
Rate	6.00%
Term	30
Bond Load Factor	15%
Annual Debt Service	$4,125,346.64
Total Debt Service	$123,760,399.33
Net Present Value of Debt Service 3.5% *discount factor*	$75,873,562.82
Net Proceeds	$49,378,000.00
Financing Cost	$26,495,562.82

[2] As determined by ECO:LOGIC
[3] Assumes that the Fee will be escalated by 3.5% each year.

METER INSTALLATION COST

Table 6 shows the City's estimated cost for installing a meter, by the various meter sizes. This cost is included in the fee amount. It includes both the capital cost and the labor cost for the meter installation.

Table 6
City of Live Oak
Water Connection Fee Analysis
Calculation of Water Meter Installation Cost by Meter Size

					Labor				Total
Meter Size	Meter	Box	Lid	Subtotal	Hours	Cost Per Hour	Labor Cost	Total	Rounded
Less than 1"	$143.23	$23.85	$30.97	$198.05	16.00	$80.00	$1,280.00	**$1,478.05**	**$1,480.00**
1"	$180.87	$23.85	$30.97	$235.69	16.00	$80.00	$1,280.00	**$1,515.69**	**$1,520.00**
1 1/2"	$377.04	$27.05	$35.61	$439.70	16.00	$80.00	$1,280.00	**$1,719.70**	**$1,720.00**
2"	$573.21	$30.25	$40.24	$643.70	16.00	$80.00	$1,280.00	**$1,923.70**	**$1,920.00**
3"	$1,695.00	$36.67	$45.05	$1,776.72	24.00	$80.00	$1,920.00	**$3,696.72**	**$3,700.00**
4"	$2,805.00	$127.74	$489.14	$3,421.88	32.00	$80.00	$2,560.00	**$5,981.88**	**$5,980.00**
6"	$4,845.00	$127.74	$489.14	$5,461.88	32.00	$80.00	$2,560.00	**$8,021.88**	**$8,020.00**

Note: Costs for a 3, 4 and 6 inch meter is for a compound meter.

These three cost components are added together to compute the 2009 Water Connection Fee as shown in Table 1 above.

OTHER RECOMMENDATIONS

It is recommended that the City establish in its ordinance, at the time of fee adoption, the ability to increase the fee by 3.5% annually, at a minimum. The annual increase could also be linked to consumer price index (CPI) or the ENR Construction Cost Index.

This is particularly important if the City does plan to move forward with financing any of the CIP projects. If the fee is inflated annually, then the City should be able to recuperate the majority of the financing costs over time. The annual adjustment will also allow the City to stay current as the actual costs of meter installation will likely increase over time.

The City should also consider reviewing and updating the fee analysis every three years, particularly since at this time the construction timing of the projects are unkown.

Appendix A

Water Asset Valuation

City of Live Oak

FUND: 012 - WATER ENTERPRISE FISCAL YEAR: 07/2009-06/2010

DATE ACQUIRED	DESCRIPTION	ID	TOTAL LIFE	TOTAL COST	SALVAGE VALUE	PRIOR PERIOD ACCUM DEPR	CURRENT PERIOD 07/2009-06/2010	NET VALUE
01/01/94	1994 GORMAN RUP	000018-00	60	10,000.00	0.00	10,000.00	0.00	0.00
01/01/51	WELL #1 OLD COR	000049-00	720	20,000.00	0.00	19,503.47	0.00	496.53
01/01/74	WELL #1 OLD COR	000049-01	240	10,000.00	0.00	10,000.00	0.00	0.00
01/01/77	WELL #1 OLD COR	000049-02	240	5,000.00	0.00	5,000.00	0.00	0.00
01/01/77	WELL #1 OLD COR	000049-03	180	1,500.00	0.00	1,500.00	0.00	0.00
01/01/51	WELL #1 OLD CO	000049-04	360	10,000.00	0.00	10,000.00	0.00	0.00
01/01/91	WILL #1 OLD CO	000049-05	180	2,000.00	0.00	2,000.00	0.00	0.00
01/01/91	WELL #1 OLD CO	000049-06	180	25,000.00	0.00	25,000.00	0.00	0.00
01/01/91	WELL #1 - OLD C	000049-07	180	500.00	0.00	500.00	0.00	0.00
01/01/91	WELL #1 OLD COR	000049-08	180	2,000.00	0.00	2,000.00	0.00	0.00
01/01/91	WELL #1 OLD COR	000049-09	180	3,159.75	0.00	3,159.75	0.00	0.00
02/23/93	10140 O STREET	000049-10	0	1,148.22	0.00	0.00	0.00	1,148.22
01/01/51	WELL #2 OLD COR	000050-00	720	20,000.00	0.00	19,503.47	0.00	496.53
02/02/95	WELL #2 OLD COR	000050-01	240	10,000.00	0.00	7,207.33	0.00	2,792.67
01/01/65	WELL #2 OLD COR	000050-02	240	5,000.00	0.00	5,000.00	0.00	0.00
01/01/77	WELL #2 OLD COR	000050-03	180	1,500.00	0.00	1,500.00	0.00	0.00
01/01/51	WELL #2 OLD COR	000050-04	360	10,000.00	0.00	10,000.00	0.00	0.00
08/26/91	WELL #2 OLD COR	000050-05	180	2,000.00	0.00	2,000.00	0.00	0.00
01/01/51	WELL #2 OLD COR	000050-06	180	3,159.75	0.00	3,159.75	0.00	0.00
01/01/91	WELL #2 OLD COR	000050-07	180	25,000.00	0.00	25,000.00	0.00	0.00
01/01/91	WELL #2 OLD COR	000050-08	180	2,000.00	0.00	2,000.00	0.00	0.00
02/23/92	10140 O STREET	000050-09	0	1,148.22	0.00	0.00	0.00	1,148.22
01/01/60	WELL #3 ALLEY B	000051-00	720	25,000.00	0.00	20,633.47	0.00	4,366.53
01/01/73	WELL #3 ALLEY B	000051-01	240	12,000.00	0.00	12,000.00	0.00	0.00
01/01/60	WELL #3 ALLEY W	000051-02	240	5,000.00	0.00	5,000.00	0.00	0.00
01/01/77	WELL #3 ALLEY B	000051-03	180	1,500.00	0.00	1,500.00	0.00	0.00
01/01/60	WELL #3 ALLEY B	000051-04	360	10,000.00	0.00	10,000.00	0.00	0.00
01/01/92	WELL #3 ALLEY B	000051-05	180	2,000.00	0.00	2,000.00	0.00	0.00
01/01/60	WELL #3 ALLEY B	000051-06	240	1,000.00	0.00	1,000.00	0.00	0.00
08/01/54	ARCHER AVE WELL	000051-07	0	237.92	0.00	0.00	0.00	237.92
01/01/83	WELL #4 APRICOT	000052-00	480	40,000.00	0.00	26,507.83	0.00	13,492.17
01/01/83	WELL #4 APRICOT	000052-01	240	20,000.00	0.00	20,000.00	0.00	0.00
01/01/83	WELL #4 APRICOT	000052-02	240	8,000.00	0.00	8,000.00	0.00	0.00
01/01/83	WELL #4 APRICOT	000052-03	180	5,000.00	0.00	5,000.00	0.00	0.00
01/01/83	WELL #4 APRICOT	000052-04	360	20,000.00	0.00	15,673.06	0.00	4,326.94
10/26/98	WELL #4 APRICOT	000052-05	180	3,000.00	0.00	2,135.12	0.00	864.88
12/30/98	WELL #4 APRICOT	000052-06	180	19,160.00	0.00	13,415.21	0.00	5,744.79
12/30/98	WELL #4 APRICOT	000052-07	180	3,340.00	0.00	2,338.57	0.00	1,001.43
10/27/95	2569 APRICOT ST	000052-08	0	30,000.00	0.00	0.00	0.00	30,000.00
01/01/83	WELL #5 PENNING	000053-00	480	40,000.00	0.00	26,507.83	0.00	13,492.17
01/01/83	WELL #5 PENNING	000053-01	240	20,000.00	0.00	20,000.00	0.00	0.00
01/01/83	WELL #5 PENNING	000053-02	240	8,000.00	0.00	8,000.00	0.00	0.00
01/01/83	WELL #5 PENNING	000053-03	180	5,000.00	0.00	5,000.00	0.00	0.00
01/01/83	WELL #5 PENNING	000053-04	360	20,000.00	0.00	17,670.05	0.00	2,329.95
10/26/98	WELL #5 PENNING	000053-05	180	3,225.63	0.00	2,295.67	0.00	929.96
12/30/98	WELL #5 PENNING	000053-06	180	19,160.00	0.00	13,415.21	0.00	5,744.79
12/30/98	WELL #5 PENNING	000053-07	180	3,340.00	0.00	2,338.57	0.00	1,001.43
10/01/48	WELL #5 PENNING	000053-08	0	172.78	0.00	0.00	0.00	172.78
01/01/51	WATER PIPES - 1	000055-00	720	99,420.00	0.00	96,951.93	0.00	2,468.07
01/01/52	WATER PIPES - 1	000055-01	720	3,820.00	0.00	3,661.75	0.00	158.25

City of Live Oak

FUND: 012 - WATER ENTERPRISE FISCAL YEAR: 07/2009-06/2010

DATE ACQUIRED	DESCRIPTION	ID	TOTAL LIFE	TOTAL COST	SALVAGE VALUE	PRIOR PERIOD ACCUM DEPR	CURRENT PERIOD 07/2009-06/2010	NET VALUE
01/01/63	WATER PIPES - 1	000055-02	840	51,096.00	0.00	33,957.45	0.00	17,138.55
01/01/75	WATER PIPES - 1	000055-03	840	9,392.00	0.00	4,630.90	0.00	4,761.10
01/01/78	WATER PIPES - 1	000055-04	840	293,722.00	0.00	132,222.97	0.00	161,499.03
01/01/79	WATER PIPES - 1	000055-05	840	35,326.00	0.00	15,397.73	0.00	19,928.27
01/01/80	WATER PIPES - 1	000055-06	840	39,317.00	0.00	16,575.66	0.00	22,741.34
01/01/83	WATER PIPES - 1	000055-07	840	199,019.00	0.00	75,368.47	0.00	123,650.53
01/01/84	WATER PIPES - 1	000055-08	840	29,229.00	0.00	10,651.48	0.00	18,577.52
01/01/85	WATER PIPES - 1	000055-09	840	110,711.00	0.00	41,559.65	0.00	77,151.35
01/01/88	WATER PIPES - 1	000055-10	600	20,487.00	0.00	8,812.04	0.00	11,674.96
01/01/91	WATER PIPES - 1	000055-11	600	105,453.00	0.00	39,025.30	0.00	66,427.62
01/01/92	WATER PIPES - 1	000055-12	600	107,970.00	0.00	37,797.65	0.00	70,172.35
01/01/93	WATER PIPES - 1	000055-13	600	257,103.00	0.00	84,850.50	0.00	172,252.50
01/01/94	WATER PIPES - 1	000055-14	600	509,844.00	0.00	158,064.53	0.00	351,779.47
01/01/97	WATER PIPES - 1	000055-15	600	152,646.00	0.00	38,157.68	0.00	114,480.32
01/01/93	WATER METERS -	000056-00	180	116,181.00	0.00	116,181.00	0.00	0.00
01/01/98	WATER METERS -	000056-01	180	135,781.00	0.00	104,092.17	0.00	31,688.83
01/01/02	WATER METERS -	000056-02	180	10,769.00	0.00	5,382.35	0.00	5,386.65
02/27/03	WATER MAIN REPL	000086-00	360	299,386.00	0.00	63,260.39	0.00	236,125.61
01/01/51	FIRE HYDRANTS -	000101-00	600	17,472.00	0.00	17,472.00	0.00	0.00
01/01/52	FIRE HYDRANTS -	000101-01	600	581.00	0.00	581.00	0.00	0.00
01/01/63	FIRE HYDRANTS -	000101-02	600	7,469.00	0.00	6,947.99	0.00	521.01
01/01/75	FIRE HYDRANTS -	000101-03	600	2,163.00	0.00	1,492.94	0.00	670.06
01/01/78	FIRE HYDRANTS -	000101-04	600	37,233.00	0.00	23,464.71	0.00	13,768.29
01/01/79	FIRE HYDRANTS -	000101-05	600	5,944.00	0.00	3,627.07	0.00	2,316.93
01/01/80	FIRE HYDRANTS -	000101-06	600	4,823.00	0.00	2,846.46	0.00	1,976.54
01/01/83	FIRE HYDRANTS -	000101-07	600	8,191.00	0.00	4,342.74	0.00	3,848.26
01/01/84	FIRE HYDRANTS -	000101-08	600	4,353.00	0.00	2,220.68	0.00	2,132.32
01/01/85	FIRE HYDRANTS -	000101-09	600	23,943.00	0.00	11,735.13	0.00	12,207.87
01/01/87	FIRE HYDRANTS -	000101-10	600	13,796.00	0.00	6,209.97	0.00	7,586.03
01/01/88	FIRE HYDRANTS -	000101-11	600	2,359.00	0.00	1,014.63	0.00	1,344.37
01/01/91	FIRE HYDRANTS -	000101-12	600	12,666.00	0.00	4,687.46	0.00	7,978.54
01/01/92	FIRE HYDRANTS -	000101-13	600	12,942.00	0.00	4,530.76	0.00	8,411.24
01/01/93	FIRE HYDRANTS -	000101-14	600	32,024.00	0.00	10,560.68	0.00	21,455.32
01/01/94	FIRE HYDRANTS -	000101-15	600	30,680.00	0.00	9,511.52	0.00	21,168.48
01/01/95	FIRE HYDRANTS -	000101-16	600	2,895.00	0.00	839.55	0.00	2,055.45
01/01/97	FIRE HYDRANTS -	000101-17	600	9,026.00	0.00	2,256.13	0.00	6,769.87
09/15/04	APRICOT VILLAGE	000107-06	600	3,300.00	0.00	316.29	0.00	2,983.71
04/20/05	HOME FIRST ESTA	000109-06	600	15,624.00	0.00	1,310.25	0.00	14,313.75
04/20/05	HOME FIRST ESTA	000109-07	600	101,637.00	0.00	8,522.95	0.00	93,114.05
05/04/05	PENNINGTON RANC	000110-06	600	66,500.00	0.00	5,528.66	0.00	60,971.34
05/04/05	PENNINGTON RANC	000110-07	600	389,550.00	0.00	32,385.72	0.00	357,164.28
02/15/06	WALNUT VIEW SUB	000120-06	600	11,853.00	0.00	799.40	0.00	11,053.60
02/15/06	WALNUT VIEW SUB	000120-07	600	353,774.00	0.00	23,863.44	0.00	329,910.56
02/15/06	PEACHTREE II PH	000121-06	600	10,564.00	0.00	712.46	0.00	9,851.54
02/15/06	PEACHTREE II PH	000121-07	600	230,857.00	0.00	15,572.13	0.00	215,284.87
04/19/06	VALLEY OAK ESTA	000123-06	600	8,000.00	0.00	511.35	0.00	7,488.65
04/19/06	VALLEY OAK ESTA	000123-07	600	45,046.00	0.00	2,878.80	0.00	42,167.20
05/03/06	PEACHTREE III S	000124-06	600	21,000.00	0.00	1,327.10	0.00	19,672.90
05/03/06	PEACHTREE III S	000124-07	600	242,650.00	0.00	15,332.44	0.00	227,317.56
06/07/06	PENNINGTON RANC	000128-06	600	45,500.00	0.00	2,788.30	0.00	42,711.70

City of Live Oak

FUND: 012 - WATER ENTERPRISE FISCAL YEAR: 07/2009-06/2010

DATE ACQUIREU	DESCRIPTION	ID	TOTAL LIFE	TOTAL COST	SALVAGE VALUE	PRIOR PERIOD ACCUM DEPR	CURRENT PERIOD 07/2009-06/2010	NET VALUE
06/07/06	PENNINGTON RANC	000128-07	600	368,710.00	0.00	22,596.40	0.00	346,113.60
08/17/06	2006 CATERPILLA	000132-00	60	82,609.70	0.00	46,812.22	0.00	35,797.48
06/30/07	2006 CATERPILLA	000132-01	60	12,450.00	0.00	4,980.00	0.00	7,470.00
11/15/06	WATER STORAGE T	000134-00	360	2,305,590.01	0.00	204,941.44	0.00	2,100,648.57
02/21/07	Larkin Rd Impro	000138-04	600	326,465.00	0.00	15,235.08	0.00	311,229.92
10/20/06	Water Meter Imp	000141-00	120	1,478,134.97	0.00	394,169.28	0.00	1,083,965.69
07/18/07	PENNINGTON RANC	000142-06	600	61,600.00	0.00	2,361.41	0.00	59,238.59
07/18/07	PENNINGTON RANC	000142-07	600	412,282.00	0.00	15,804.22	0.00	396,477.78
07/01/08	Water Main Proj	000147-00	360	1,233,423.88	0.00	41,114.16	0.00	1,192,309.72
05/15/09	Arsenic Removal	000153-00	360	3,123,366.34	0.00	17,352.04	0.00	3,106,014.30
03/27/09	Water System Im	000154-00	360	67,224.49	0.00	560.19	0.00	66,664.30
	REPORT TOTALS			14,335,195.66	0.00	2,483,191.19	0.00	11,852,004.47

City of Live Oak

CLASS TOTALS BY FUND

ACTIVE ASSETS

FUND	CLASS	NUMBER	TOTAL COST	SALVAGE VALUE	DEPRECIATION	NET VALUE
012	100	5	32,707.14	0.00	0.00	32,707.14
012	400	3	105,059.70	0.00	61,792.22	43,267.48
012	500	45	714,276.13	0.00	620,119.88	94,156.25
012	600	58	13,483,152.69	0.00	1,801,279.09	11,681,873.60
GRAND TOTALS:		111	14,335,195.66	0.00	2,483,191.19	11,852,004.47

City of Live Oak

DEPARTMENT TOTALS

ACTIVE ASSETS

FUND	DEPARTMENT NUMBER		TOTAL COST	SALVAGE VALUE	DEPRECIATION	NET VALUE
012	1200	111	14,335,195.66	0.00	2,483,191.19	11,852,004.47
GRAND TOTALS:		111	14,335,195.66	0.00	2,483,191.19	11,852,004.47

City of Live Oak

G/L ACCOUNT TOTALS

ACTIVE ASSETS

FUND	ACCOUNT	NUMBER	TOTAL COST	DEPRECIATION
012	1027	5	32,707.14	
012	1031	106	14,302,488.52	
012	1033	106		2,483,191.19
GRAND TOTALS:		111	14,335,195.66	2,483,191.19