CITY OF LINDSAY
WATER FEASIBILITY STUDY

JANUARY 2023

Prepared for:

City of Lindsay

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ABBREVIATIONS

AB 1668	California Assembly Bill 1668
ADD	average day demand
af	acre-feet
af/year	acre-feet per year
CIP	capital improvement project
City	City of Lindsay
cfs	cubic feet per second
County	County of Tulare
fps	feet per second
GIS	geographic information system
gpcd	gallons per capita per day
gpm	gallons per minute
gpd/na	gallons per day per net acre
IRWM	Integrated Regional Water Management
MDD	maximum day demand
MG	million gallons
mgd	million gallons per day
ROW	right-of-way
SB 1157	California Senate Bill 1157 (Hertzberg)
SB 606	California Senate Bill 606
SBx7-7	California Senate Bill x7-7 (Water Conservation Act of 2009)
SRF	State Revolving Funds
USBR	United States Bureau of Reclamation

EXECUTIVE SUMMARY

The City of Lindsay (City) has a recognized potential water supply shortage. The City initiated this Water Feasibility Study (Study) to better understand the extent of the situation, explore the alternatives, and the schedule of improvements to mitigate the shortage.

The evaluation of the City's water system included a review of the water supplies and demands, the surface water treatment facility, the distribution system and storage systems for existing and future (through 2040) system characteristics.

Water System Demand

The historic supply and demand numbers were taken from City records and used to determine the average water use and future demand projections for the City. The 2020 water use was evaluated against a 20 percent reduction of the 10-year calculated baseline. Future demands were calculated based on three scenarios: indoor water use conservation requirements, 15% per capita demand reduction below current use, and "status quo" without any implemented water conservation beyond current measures.

Water System Supply

The City's water is supplied from both surface and groundwater sources. Evaluation of the water supply looked at the total quantity of water available during the winter months, when surface water supplies are not available, during the summer months when surface water is usually available, as well as a 'firm' groundwater supply. 'Firm' groundwater assumes the largest producing well is unavailable to account for the potential of that well being temporarily offline for maintenance activities or due to an unanticipated well failure.

Surface Water Treatment Facility

The Surface Water Treatment Facility (SWTF) provides water to the City primarily during the summer months. The SWTF's current operations were reviewed and deficiencies noted. Recommendations for potential short- and long-term solutions are described.

Distribution System

The water distribution system was evaluated in 2013 using a computer model to simulate operation of the system. The water model helped to identify areas with substandard operating pressures under high-flow conditions. These deficiencies are due primarily to undersized mains or too few points of interconnection. Based on this data, current recommendations for water main improvements are listed and described.

Storage System

The storage components of the water system provide redundancy, peak demand supply and fire flow for the City. Evaluation of the storage components revealed the water system has sufficient available storage volume and will not require improvement within the horizon of this study.

Recommendations

Based on the evaluations discussed above, if the City maintains its current per capita water usage rate, this study recommends the addition of three new wells (one in 2024, one in 2026, and one in 2030) in addition to the restoration of Well 11 in 2024. Significant water conservation efforts could reduce the need down to two new wells (one in 2024 and one in 2036) in addition to the restoration of Well 11 in 2024. Additionally, several capital improvement projects were identified based on information in the City's budget plan and as identified through the 2013 water model analysis. These include main line replacements and dead-end eliminations, DBP mitigation efforts, water plant upgrades, and clarifier renovations.

1 BACKGROUND

This section presents the objectives for this Study in addition to reference materials and acknowledgements to assist the reader in understanding the content presented. Abbreviations used throughout the Study are listed on Page vi.

1.1 Objectives

The primary objective of the water feasibility study is to provide a thorough review of current and projected water demand and supply, and the capacity of the existing water supply and distribution system to meet future needs.

The study includes recommendations to effectively manage the City's water supply, treatment, distribution, and demand in order to secure and maintain a sustainable system through the year 2040.

1.2 Report Organization

The feasibility study is organized into three overall sections.

Section 1 – Background This section presents the objectives and planning horizon for this Study in addition to a list of reference materials to assist the reader in understanding the content presented.

Section 2 – City of Lindsay Characteristics This section presents a description of the study area, zoning classifications, and details the historical and projected population.

Section 3 – Water System This section is divided into seven primary subsections including demand, supply, treatment system, distribution system, storage system, capital improvement projects, and other factors affecting the water system. The subsections include information on the following:

- Demand and Supply Subsections present discussions on the historic and projected demand and supply capacity and anticipated improvements needed to meet future demands;
- Treatment System Subsection evaluates the surface water treatment plant and future improvements that will be necessary to maximize the use of surface water;
- Distribution System Subsection presents results of the system's 2013 water model and evaluates the distribution system based on model outcomes;
- Storage System Subsection discusses the current and future storage requirements for the system to run optimally; and

- Capital Improvement Projects Subsection presents a list of necessary capital improvement projects based on the discussions presented in the previous subsections. This subsection also discusses prioritization of capital improvement projects and timing-based needs of the community and water system.

- Other Factors Affecting the Water System Subsection presents topics that have a current or future impact on the water system, including socio-economic factors, factors affecting the water supply, and water quality.

1.3 Reference Material

The following documents were referenced in the preparation of this feasibility study:

- City of Lindsay General Plan, 1989, Grunwald & Associates
- Supplemental Water Supply Feasibility Study, 1991, Charles Roberts Engineers
- Water and Sewer Master Plan, 1992, Metcalf & Eddy
- Water Supply and Storage Requirements Update, 1998, Carollo Engineers
- Water Supply and Storage Capacity Requirements, 2013, Akel Engineering Group, Inc.
- Water Feasibility Study, 2013, Provost & Pritchard Consulting Group
- Integrated Regional Water Management Plan, 2018, Kaweah River Basin Regional Water Management Group

2 CITY OF LINDSAY CHARACTERISTICS

This section presents a description of the Study Area, City land use and zoning classifications, and details the historical and projected population.

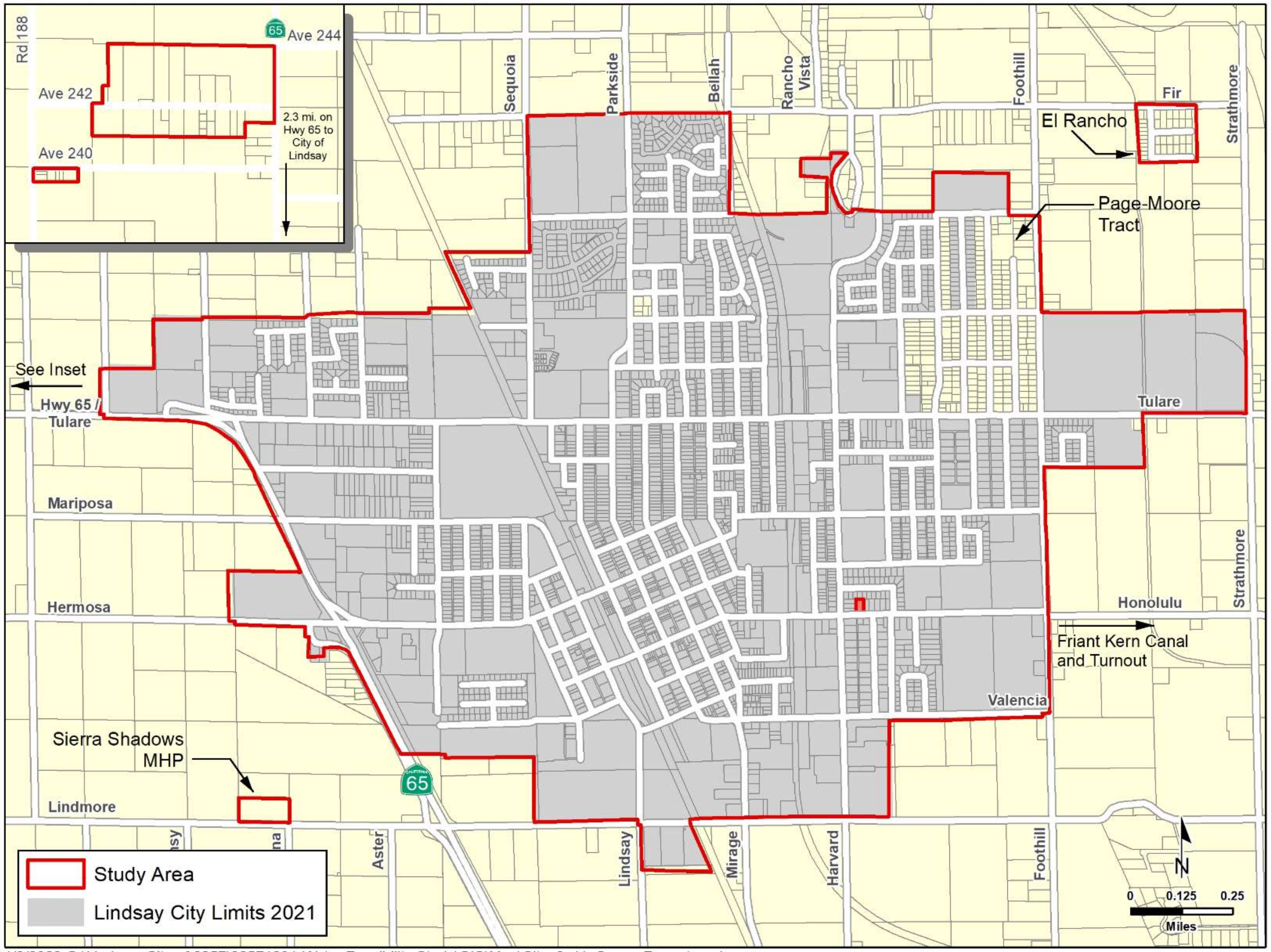
2.1 Study Area

The City is located in Tulare County, near the base of the Sierra Nevada Mountains in the San Joaquin Valley. The Study Area encompasses the area within the city limits, three developments outside the City limits that receive City water service, known locally as Page-Moore Tract, the Sierra Shadows Mobile Home Park, and El Rancho, and an area west of the City near the intersection of Road 188 and Avenue 242 ("Avenue 240 and 242 Connection"). The City encompasses approximately 1,747 acres and is home to nearly 13,000 residents, with an average of 3.29[1] people per household; the service areas outside the City limits contribute over 1,300 additional residents. This additional population has been considered for this Study.

The Study Area is delineated in Figure 2-1 by the red border; the gray areas are within the City limits, while the pale yellow area is County of Tulare. The county 'island' in the northeast portion of the study area is the area referred to above as Page-Moore Tract. Sierra Shadows Mobile Home Park is in the southwest portion of the Study Area and is not contiguous to the City limits; it is located on the north side of West Lindmore Street near Canna Avenue, approximately 0.5 miles west of the City limits. The El Rancho area is just to the northeast of the City, south of Fir Street, but not contiguous to the City limits. The "Avenue 240 and 242 Connection" area is shown as an inset in the map due to its distance from the City of approximately 2.3 miles.

[1] 2020 United States Census

Figure 2-1: Study Area



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2.2 Land Use

The City's predominant land use is residential. There are industrial use areas along the railroad right-of-way and commercial use areas both within the downtown and near the State Route 65 alignment. Of the 1,747 acres within the Study Area, over three-quarters are developed, leaving 151 acres of undeveloped area comprised of a variety of land uses including residential, mixed use and commercial.

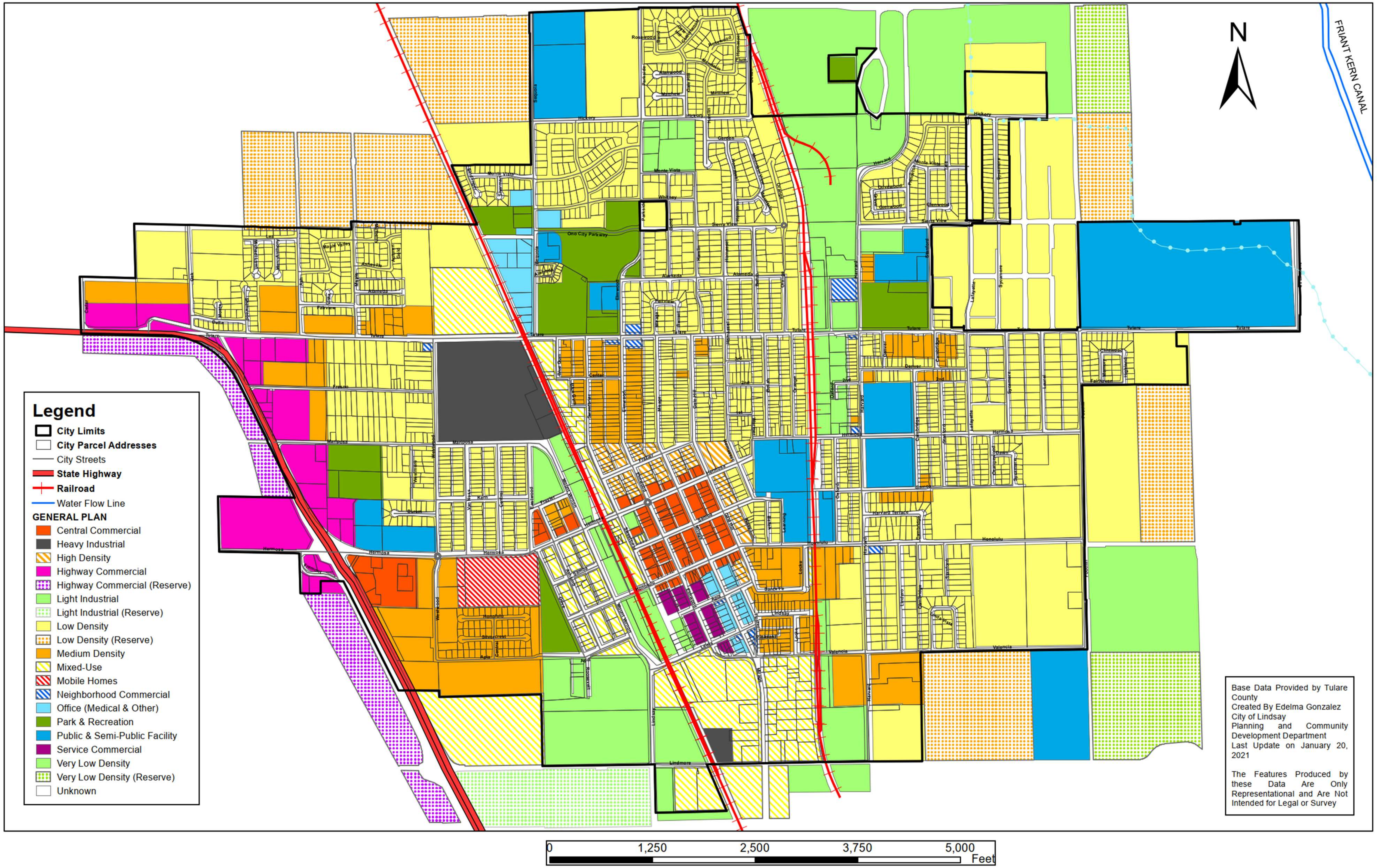
The City of Lindsay updated components of their General Plan and Land Use Maps in 2021. The updated Land Use Map is shown in Figure 2-2 and a summary of acreages by zoning designation is detailed in Table 2-1. This Study has a planning horizon of 2040.

Table 2-1: Land Use Acreages

Land Use Category	Total Developed Acres[1]	Percent of Total Acreage	Total Un-Developed Acres[1]	Percent of Total Acreage	Total Acreage
Residential					
Single Family Residential (R-1-7)	604.1	95%	29.8	5%	633.9
Multi-Family Residential (RM-3)	145.5	83%	28.9	17%	174.4
Multi-Family Residential (RM-MH8)	12.5	100%	0	0%	12.5
Non-Residential					
Central Commercial (CC)	28.6	89%	3.6	11%	32.2
Highway Commercial (CH)	48.7	74%	17.3	26%	66
Neighborhood Commercial (CN)	3.1	53%	2.7	47%	5.8
Service Commercial (CS)	8.5	85%	1.5	15%	10
Professional Offices (PO)	43.4	95%	2.2	5%	45.6
Office/High Density (RM-1.5)	15	96%	0.7	4%	15.7
Mixed Use	93.3	90%	10.8	10%	104.1
Heavy Industry (IH)	42.8	95%	2.1	5%	44.9
Light Industry (LI)	129.5	89%	16.7	11%	146.2
Resource, Conservation & Open Space (RCO)	203.5	96%	9.1	4%	212.6
Railroad	0	0%	20.3	100%	20.3
Unknown	0	0%	5.7	100%	5.7
Right-of-Way	217.2	100%	0	0%	217.2
Totals	**1595.7**	**77%**	**151.4**	**23%**	**1747.1**

[1] Data Provided by the City based on Zoning, Land Use, and Parcel Data (10/7/2022).

Figure 2-2: City of Lindsay General Plan Map



2.3 Historical and Projected Population

The City of Lindsay has a small but growing population. From 1975 through 1995, the population averaged a growth rate of approximately 2.5%; however, the growth rate began decreasing in 1995 and was only 0.8% from 2010 to 2020. Due to this slowing of growth, a future annual City population growth projection of 0.8% through 2040, and 1% after 2040 were used for this Study. Table 2-2 presents the historical population and future population assumptions. The data presented in Table 2-2 is used to estimate water usage later in the Study. The service population for the City's water system includes the City of Lindsay population as well as the populations of the Page-Moore Tract, Avenue 240 & 242 connections, and Sierra Shadow Mobile Home Park through 2015; after its addition in 2015, the El Rancho connections were also included.

Table 2-2: Population – Historical and Projected

Year	Service Population[1]
1975	7,036[2]
1980	8,106[2]
1985	8,876[2]
1990	9,504[3]
1995	10,484[4]
2000	11,463[3]
2005	12,106[5]
2010	12,934[3]
2015	13,380[4]
2020	14,024[3]
2025	14,539[6]
2030	15,074[6]
2035	15,631[6]
2040	16,211[6]
2045	16,969[6]
2050	17,765[6]
2055	18,601[6]
2060	19,480[6]

[1] Service Population includes City of Lindsay population, Page-Moore Tract, Ave 240 & 242 connections and Sierra Shadow Mobile Home Park through 2015 and includes El Rancho after 2015
[2] City population from 1989 General Plan
[3] City population from Census Data
[4] City population Interpolated
[5] City population from California Dept of Finance E-4 & E-5 Estimates
[6] Projection using 0.8% annual growth through 2040, and 1% after

3 WATER SYSTEM

This section is divided into seven primary subsections including demand, supply, treatment system, distribution system, storage system, capital improvement projects, and other factors affecting the water system. The subsections present information concerning the historic and projected water system demands and supply characteristics, an evaluation of the water treatment system, discussion of the 2013 water system model results and capital improvement projects needed to sustain the City's water supply efficiently and reliably.

3.1 Water System Demand

The following presents a progressive analysis of how the City has historically used water and, based on that history, project demands into the future. Actual historical water usage data was collected from the City and distributed using two data sets: land use and population. Compliance with Senate Bill x7-7 (SBx7-7) was evaluated. Finally, the distribution of water use was conducted to provide a relativity analysis and help provide an approximation of future demand. The objective is to provide the City with two valid trends to evaluate and track current and future water usage.

3.1.1 Historical Demand

Historical water demand was calculated in two ways. The first method used actual water production statistics and made use of the population for each year from 2001 through 2021 on a per-person (or per capita) basis. Annual water production records were obtained from the City for years 2013-2016. Monthly water production records were obtained from the City for years 2017-2021. The historical water demand and average demand per capita for 2012-2021 are detailed in Table 3-1.

The second method used to document historical water demand was Land Use, which calculated water unit factors based on existing developed land using net acreages. For the year 2021 the total water demand was distributed across the developed residential, non-residential, and non-metered acreages within the City's water service area. As shown in Table 3-2, the recommended existing unit factors for residential areas are 1,600[2] gallons per day per net acre (gpd/na), 2,000[2] gpd/na for non-residential areas, and 1,400[2] for non-metered areas.

While the first method may be used to estimate future water demand based on population, the second method, calculated water unit factors, could prove useful if the City grows through land acquisition.

[2] Values rounded in Table 3-2.

Table 3-1: Historical Water Use and Daily Demand

Year	Annual Water Production		Population	
	Total Annual (MGY) [3]	Daily Average (MGD)	System Population[1,2]	Per Capita Consumption (gpcd)
2012	901	2.47	13,112	188
2013	941	2.58	13,202	195
2014	818	2.24	13,291	169
2015	730	2.00	13,380	150
2016	793	2.17	13,667	159
2017	806	2.21	13,756	160
2018	804	2.20	13,846	159
2019	791	2.17	13,935	156
2020	731	2.00	14,024	143
2021	807	2.21	14,127	156

Notes:
[1] United States Census data in Census Year (2020) & Interpolated in other years
[2] Service Population includes City of Lindsay, Page-Moore Tract and Sierra Shadows Mobile Home Park, as the City provides water to these areas outside the city limits
[3]Million Gallons per Year

Table 3-2: Existing Demands and Unit Demand Factors

Land Use Classification	Existing Net Acreage (na)	Existing Production (gpd)[1]	Unadjusted Unit Factor (gpd/na)	Vacancy Rate (%)	Adjusted Unit Factor (gpd/na)	Recommended Unit Factor (gpd/na)	Balance Using Recommended Unit Factors (gpd)
Residential	762	1,170,234	1,540	3.2%[2]	1,590	1,600	1,220,000
Non-Residential	404	746,386	1,850	7.5%[1]	1,990	2,000	810,000
Non-Demand Generating[3]	217.2						
Non-Metered Demand[4]	212	293,407	1,380		1,380	1,400	300,000
Totals	**1,595.2**	**2,210,027**					**2,330,000**

Notes:
[1] Data provided by City staff
[2] E-5 Population Estimates for 2021
[3] Non-demand generating land use refers to the total right-of-way (roads) acreage.
[4] Non-metered demand is calculated as recorded production minus consumption (i.e. includes losses). See Section 3.1.3 for more detail.

3.1.2 SBx7-7 Baselines, Targets, and Compliance

The Water Conservation Act of 2009 (SBx7-7) required that all water suppliers increase their water use efficiency by 20% by the year 2020. The baseline water use efficiency for the City was set in its 2013 Water Feasibility Study as 199 gpcd. This value, reproduced in Table 3-3, was calculated using 10 years (2001-2010) of historical demand per capita data in accordance with the guidelines set in SBx7-7. The 2020 water use target was 160 gpcd, calculated as a 20% reduction from this baseline.

The City's 2020 actual water use was compared to the baseline and the 2020 target to evaluate compliance with SBx7-7. As demonstrated in Table 3-3, both the 5-year (2016-2020) average and the actual 2020 per capita consumption were compliant with the SBx7-7 requirements.

Table 3-3: Water Conservation Baselines & Targets Summary

Baseline Period	Baseline Years	Baseline (gpcd)	Calculated 2020 SBx7-7 Target (gpcd)	5-Year Average Per Capita Consumption (gpcd)[1]	Actual 2020 Per Capita Consumption (gpcd)
10-Year Base Daily Per Capita Water Use	2001-2010	199	160	155	143
[1]Calculated as the average of 5 years leading up to and including the compliance date: 2016-2020					

3.1.3 Current Demand

The City meters its residential, multi-family, commercial, institutional, industrial, and church customers and as it recently became an urban water user, has plans to meter all of its deliveries. Metered customers accounted for greater than 95% of service connections as of May 2022. Currently non-metered customers include government-owned facilities, city-owned facilities, landscaping areas, and the SWTP backwash, where less than 1 acre-foot (af) is required to backwash the SWTP approximately once every 7 days. Non-metered demand is calculated here as recorded production minus consumption (i.e. includes losses). Water use types are shown in Table 3-4 along with 2021 volumes.

Current conservation efforts abide by the City's Water Conservation Plan. The City is currently limiting water according to Phase IV – Drought Response Alert.

Table 3-4: Current Demand by Use Type

Use Type Consumption	Volume (MG)
Residential + Multi-Family	427
Landscape Districts + Commercial + Institutional + Churches	162
Industrial	110
Un-metered + Losses	107
Total	**806**

3.1.4 Projected Demand

Three scenarios have been evaluated to identify the most reasonable and prudent range of Projected Demands for the City. The first scenario was developed using California Assembly Bill 1668 (AB 1668) and California Senate Bill 606 (SB 606) indoor water use reduction requirements. The second scenario calculated the 15% water reduction called for by the Governor of California. The third scenario was derived by extending the current water use patterns into the future. While the horizon of this study only extends to 2040, projected demand is extended through 2060.

3.1.4.1 Water Use Targets

It is unrealistic to predict with a single scenario how the City will grow and use water resources. By extending the three scenarios described above into the future, the demand for water resources and infrastructure will have a higher probability of falling within the bounds established by these scenarios. As time passes, this range will provide the City with flexibility to make adjustments to their operations and infrastructure. The development of the demand projections for these scenarios is discussed below. Finally, the selected scenario is later shown jointly with water supply and maximum day demand in Figure 3-1.

<u>Scenario No. 1</u> – Required Conservation Water Use Target (119 gpcd)

Recent water conservation legislation (AB 1668, SB 606) required decreases in indoor residential water use to 55 gpcd by January 2025 and 50 gpcd by January 2030. The Department of Water Resources (DWR) and the State Water Resources Control Board (SWRCB) submitted a report to the legislature recommending that urban water suppliers achieve further water savings. In September 2022, the Governor signed this recommendation into law through California Senate Bill 1157 (SB 1157) (Hertzberg), requiring further reduction of indoor residential per capita consumption to 47 gpcd by January 2025 and 42 gpcd by January 2030.

To calculate this, projected water use was divided into the four consumption categories shown in Table 3-5. Future water consumption for these categories was projected based on the following: population growth, 5-year average per capita consumption, and projected residential demand. Population growth and 5-year average per capita consumption are shown in Tables 2-2 and 3-3, respectively. For projected residential demand, a 50:50 (outdoor: indoor) ratio[3] was used to determine the proportion of the residential demand subject to the legislation requirements for indoor consumption. The results of these calculations are shown in Table 3-5. For 2030 onward, the per capita water use in this scenario is 119 gpcd. The 2040 ADD would be 1.93 MGD in this scenario.

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[3] According to the Department of Water Resources (DWR), outdoor water use accounts for 50 percent of urban resident water use on average.

Table 3-5: Projected Demand by Use Type

Use Type Consumption	2025 Water Use (MG)	2030 Water Use (MG)	2035 Water Use (MG)	2040 Water Use (MG)
Residential + Multi-Family	264	245	254	263
Landscape Districts + Commercial + Institutional + Churches	170	176	182	189
Industrial	115	120	124	129
Un-metered + Losses	112	116	120	125
Total Water Use (MG)	**661**	**656**	**681**	**706**

Scenario No. 2 – 15% Conservation Water Use Target (136 gpcd)

In 2021, the Governor of California requested voluntary reductions of 15% across the State. This 15% per capita water use conservation target was selected as the second scenario for comparison. This percentage would require the City to continue its conservation efforts and is also achievable for the City to reach. This scenario yields a 2030 onward annual per capita consumption of 136 gpcd. This water usage scenario is shown in Table 3-6. By sustaining this usage rate, the City's 2040 ADD would be 2.20 MGD.

Scenario No. 3 – "Status Quo" Per Capita Demand Without Conservation (155 gpcd)

The City already fully meters water services for non-government owned properties and employs many conservation methods, leading to a comparatively low[4] 5-year per capita consumption of 155 gpcd. A fully metered system has an innate conservation component by illustrating to customers through their monthly bills, their individual water usage and how water and money can be saved by employing conservation techniques. A "status quo" water use scenario of 155 gpcd (based on 5-year average 2016-2020 demands) has been selected as a third water use target and alternative. The 2040 ADD for the City under this scenario would be 2.51 MGD.

Selected Scenario

Scenario No. 3 was selected as the target for infrastructure planning purposes. This scenario is appropriately conservative, based on existing usage characteristics. The water supply infrastructure and capital plan described in Sections 3.2 and 3.6 are based on the "status quo" per capita water use of 155 gpcd.

[4] Data from the State Water Resources Control Board indicate the average per capita use for the Tulare Lake region was 199, 207, and 207 gpcd for the years 2019, 2020, and 2021, respectively; this yields an average of 205 gpcd for that time period.

Table 3-6: Projected Water Demand - Water Use Target Methods

Year	Projected Population	Scenario No. 1: Required Conservation (119 gpcd)		Scenario No. 2: 15% Conservation (136 gpcd)		Scenario No. 3: "Status Quo" (155 gpcd)	
		Per Capita Demand (gpcd)	ADD (MGD)	Per Capita Demand (gpcd)	ADD (MGD)	Per Capita Demand (gpcd)	ADD (MGD)
2022	14,230	155	2.21	155	2.21	155	2.21
2023	14,333	145	2.08	153	2.19	155	2.22
2024	14,436	135	1.94	150	2.17	155	2.24
2025	14,539	125	1.81	148	2.15	155	2.25
2026	14,646	124	1.81	145	2.13	155	2.27
2027	14,753	122	1.81	143	2.11	155	2.29
2028	14,860	121	1.80	140	2.09	155	2.30
2029	14,967	120	1.80	138	2.07	155	2.32
2030	15,074	119	1.80	136	2.04	155	2.34
2031	15,185	119	1.81	136	2.06	155	2.35
2032	15,297	119	1.82	136	2.07	155	2.37
2033	15,408	119	1.84	136	2.09	155	2.39
2034	15,520	119	1.85	136	2.10	155	2.41
2035	15,631	119	1.86	136	2.12	155	2.42
2036	15,747	119	1.88	136	2.14	155	2.44
2037	15,863	119	1.89	136	2.15	155	2.46
2038	15,979	119	1.91	136	2.17	155	2.48
2039	16,095	119	1.92	136	2.18	155	2.49
2040	16,211	119	1.93	136	2.20	155	2.51
2041	16,360	119	1.95	136	2.22	155	2.54
2042	16,510	119	1.97	136	2.24	155	2.56
2043	16,661	119	1.99	136	2.26	155	2.58
2044	16,814	119	2.01	136	2.28	155	2.61
2045	16,969	119	2.02	136	2.30	155	2.63
2046	17,125	119	2.04	136	2.32	155	2.65
2047	17,282	119	2.06	136	2.34	155	2.68
2048	17,441	119	2.08	136	2.36	155	2.70
2049	17,602	119	2.10	136	2.39	155	2.73
2050	17,765	119	2.12	136	2.41	155	2.75
2051	17,929	119	2.14	136	2.43	155	2.78
2052	18,094	119	2.16	136	2.45	155	2.80
2053	18,261	119	2.18	136	2.48	155	2.83
2054	18,430	119	2.20	136	2.50	155	2.86
2055	18,601	119	2.22	136	2.52	155	2.88
2056	18,774	119	2.24	136	2.55	155	2.91
2057	18,948	119	2.26	136	2.57	155	2.94
2058	19,123	119	2.28	136	2.59	155	2.96
2059	19,301	119	2.30	136	2.62	155	2.99
2060	19,480	119	2.32	136	2.64	155	3.02

3.2 Water System Supply

3.2.1 Current Supply Capacity

This Study analyzed the adequacy of current water supplies to meet present and future demands. The City employs two types of water supplies: groundwater and surface water. The reliability of each is affected by a variety of outside factors.

The City relies heavily on surface water, which is affected by climate factors, canal maintenance periods, and high demand periods during the summer. Also, the relatively fixed flow rate of surface water limits its usefulness in dealing with the variability between winter and summer demands, straining the system's supply capacity and its ability to meet the demands, especially during times when the surface water supply is completely unavailable. The demand discussion above focused on ADD; however, the City must be able to meet consecutive Maximum Day Demands (MDD) during the summer months. Also, a critical time for the City is created by the maintenance cycle of the Friant Kern Canal, which is taken out of operation for two to four months in the fall of every third year, making surface water completely unavailable for that time. Because of these supply irregularities, summer and winter months are evaluated separately. Surface water supply records from 2013-2021 suggested that April through October should be considered summer months while November through March should be considered winter months.

Naturally, the demand in the summer months is substantially higher than the winter months. Fortunately, this higher summer demand occurs when the available water supply consists of both surface and groundwater. The winter supply is limited to the capacity of the groundwater wells for the time when the Friant Kern Canal is offline for maintenance. The City's water supply capacity is detailed in Table 3-7. Table 3-7 also shows operational capacity compared to rated capacity. Each of the active wells have operational capacity listed when only one well is pumped at a time. In addition, because of the interaction between Wells 14 and 15, when both wells are being pumped, their operational capacities are further decreased.

The City's supply capacity is calculated both as Total Capacity and Firm Capacity. Total Capacity is the simple addition of all water supply sources available during the winter or summer months. Firm Capacity is equal to the total capacity minus the capacity of the largest source available during the summer or winter months. The Firm Capacity is considered the readily available supply used to meet MDD. Due to maintenance activities, emergency situations, and/or water quality problems the Firm Capacity is used to evaluate supply adequacy.

The current Firm Capacity for the summer months is 3.67 MGD, while it is only 1.08 MGD for the winter months.

Table 3-7: Water Supply Capacity

Supply Source	Status[2]	Rated Capacity[1]		Water Supply Capacity: Single Groundwater Well Operational Capacity		Water Supply Capacity: Multiple Groundwater Wells Operational Capacity		Water Supply Capacity: Surface Water Treatment Capacity	Water Supply Capacity: Emergency Supply[3]
		(gpm)	(MGD)	(gpm)	(MGD)	(gpm)	(MGD)	(MGD)	(MGD)
Well 2	Abandoned	600	0.86	-	-	-		-	-
Well 4	Abandoned	800	1.15	-	-	-		-	-
Well 6	Abandoned	800	1.15	-	-	-		-	-
Well 11	Inactive	1,000	1.44	-	-	-		-	-
Well 13	Landscape Irrigation Only	1,100	1.58	-	-	-		-	-
Well 14	Active	750	1.08	750	1.08	520	0.75	-	0.75
Well 15	Active	1,200	1.73	900	1.30	800	1.15	-	1.15
Water Treatment Plant	Active	1,800	2.59	-	-	-		2.59	-
	Totals				**2.38**		**1.90**	**2.59**	**1.90**
Available Supply									
		Summer Supply			**Winter Supply**				
		(gpm)	(MGD)		(gpm)	(MGD)			
Firm Capacity[6]		2,550	3.67		750	1.08			
Total Capacity		3,120	4.49		1,320	1.90			

[1] *Water Supply and Storage Requirements Update, June 1998, Carollo Engineers.*
[2] *Wells 2, 4, and 6 have been abandoned due to water quality issues; Well 13 is utilized for landscape irrigation purposes only.*
[3] *Total emergency supply excludes the SWTP.*
[4] *The SWTP production ranges from 1,600 to 1,800 but for purposes of identifying total capacity, 1,800 has been utilized.*
[5] *Winter Months Supply excludes the SWTP.*
[6] *Firm Capacity excludes the largest production well. Therefore, the Working Capacity Single Well Operation supply capacity is used.*
[7] *Total Capacity includes the largest production well. Therefore, the total capacity is calculated based on multiple well operational capacity.*

3.2.2 Projected Supply Capacity

For comparison, the projected supply capacity was evaluated on the demand assumptions described in Scenario No. 1 Required Conservation Water Use Target (119 gpcd) and Scenario No. 3 "Status Quo" Water Use (155 gpcd) water demands. The California Water Works Standards require that public water systems have the capacity at all times to meet the system's MDD. For the reasons discussed in Section 3.2.1, peaking factors for MDD were calculated separately for summer and winter. The ADD for each of these periods was adjusted based on the peaking factors for MDD. The MDD from 2013- 2021 occurred in August 2013 for the summer period and in December 2013 for the winter period. The calculation protocol set forth in the California Water Works Standards was followed, and monthly data made available by the California Division of Drinking Water were used. For this Study, these peaking factors were calculated as 2.3 for summer Maximum Day and 2.1 for winter Maximum Day.

These calculations reveal an immediate supply deficit which must be addressed, as demonstrated in Table 3-8. Table 3-8 also tracks the supply deficit to determine at which point, for each water demand scenario, an additional water supply is needed. As shown in Table 3-8, the aggressive indoor water conservation efforts of Scenario No. 1 would require an immediate need for a 2,000 gpm (2.88 MGD) water supply. This could potentially be met with the immediate addition of two wells to the City's water supply. The City is currently restoring Well 11, which will provide an additional 1,000 gpm (1.44 MGD) water source upon completion. To address the immediate need, another 1,000 gpm (1.44 MGD) well is also needed in 2024. With population growth, it is estimated that a third well (750 gpm or 1.08 MGD) would be needed in 2036. Alternatively, if the status quo per capita water use is maintained, Table 3-8 reveals an immediate need for three wells totaling 2,750 (3.96 MGD): Well 11, a 1,000 gpm (1.44 MGD) well, and a 750 gpm (1.08 MGD) well; these well additions are discussed further in Sections 3.6.2 and 3.6.3. Under Scenario No. 3. A fourth well of at least 750 gpm (1.08 MGD) capacity would be required in 2034.

Additional calculations were performed to model a reduced allocation in the surface water supply during the summer months, which has been experienced over the last several years. Since 2012 the City has only received 100% allocation in three (3) years, with the range varying between 0% (2014, 2015) and 100% (2016, 2017, 2019). Note that both scenarios in Table 3-8 reflect this 40% allocation during summer months. Further discussion of this reduced allocation can be found in Section 3.7.2.

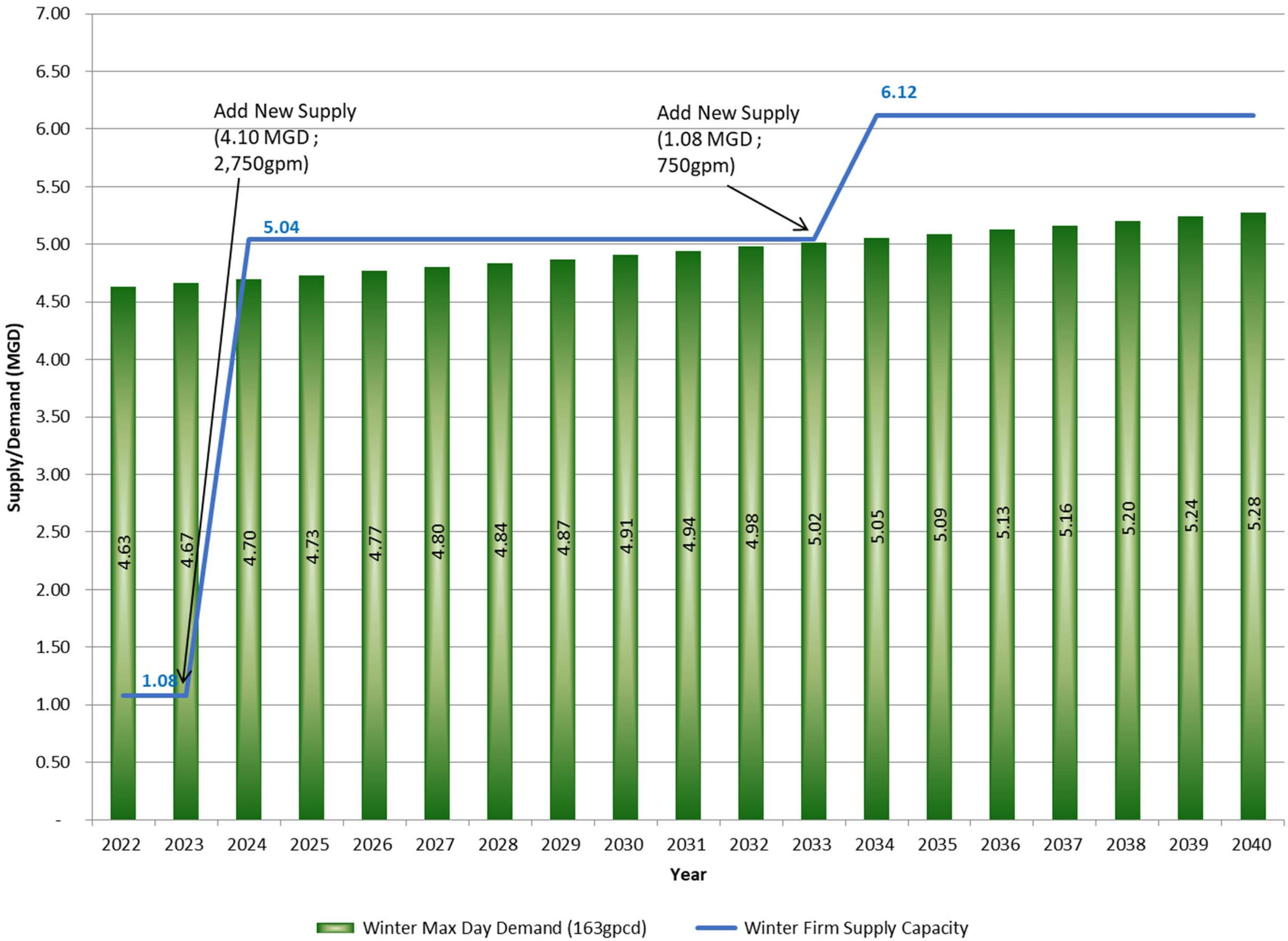
Calculation of the available supply using a reduced allocation of 40% still showed that the winter months, when no surface water is available, are the critical time for water supply and will control the need for additional water supply sources. Figure 3-1 illustrates the controlling scenario for MDD and how the deficit is corrected through addition of groundwater wells to the water supply. This figure corresponds to winter Scenario No. 3 in Table 3-8.

Table 3-8: Projected Demand and Supply Capacity

Year	Population	Average Daily Per Capita Water Use	Scenario No. 1: Required Water Conservation Target (119 gpcd)							Average Daily Per Capita Water Use	Scenario No. 3: Voluntary Water Conservation Target (155 gpcd)						
			Average Daily Demand	Maximum Day Demand		Maximum Day Supply Deficiency		Total Winter Water Supply	New Supply		Average Daily Demand	Maximum Day Demand		Maximum Day Supply Deficiency		Total Winter Water Supply	New Supply
				Summer	Winter	Summer	Winter					Summer	Winter	Summer	Winter		
		gpcd	MGD	MGD	MGD	MGD	MGD	MGD	gpm	gpcd	MGD	MGD	MGD	MGD	MGD	MGD	gpm
2022	14,230	155	2.21	5.07	4.63	-2.96	-3.55	1.08		155	2.21	5.07	4.63	-2.96	-3.55	1.08	
2023	14,333	145	2.08	4.78	4.36	-2.66	-3.28	1.08		155	2.22	5.11	4.67	-2.99	-3.59	1.08	
2024	14,436	135	1.94	4.47	4.08	-	-0.12	3.96	2,000	155	2.24	5.15	4.70	-	-	5.04	2,750
2025	14,539	125	1.81	4.17	3.80	-	-	3.96		155	2.25	5.18	4.73	-	-	5.04	
2026	14,646	124	1.81	4.16	3.80	-	-	3.96		155	2.27	5.22	4.77	-	-	5.04	
2027	14,753	122	1.81	4.16	3.79	-	-	3.96		155	2.29	5.26	4.80	-	-	5.04	
2028	14,860	121	1.80	4.15	3.79	-	-	3.96		155	2.30	5.30	4.84	-	-	5.04	
2029	14,967	120	1.80	4.14	3.78	-	-	3.96		155	2.32	5.34	4.87	-	-	5.04	
2030	15,074	119	1.80	4.14	3.78	-	-	3.96		155	2.34	5.37	4.91	-	-	5.04	
2031	15,185	119	1.81	4.17	3.80	-	-	3.96		155	2.35	5.41	4.94	-	-	5.04	
2032	15,297	119	1.82	4.20	3.83	-	-	3.96		155	2.37	5.45	4.98	-	-	5.04	
2033	15,408	119	1.84	4.23	3.86	-	-	3.96		155	2.39	5.49	5.02	-	-	5.04	
2034	15,520	119	1.85	4.26	3.89	-	-	3.96		155	2.41	5.53	5.05	-	-	6.12	750
2035	15,631	119	1.86	4.29	3.92	-	-	3.96		155	2.42	5.57	5.09	-	-	6.12	
2036	15,747	119	1.88	4.32	3.94	-	-	5.04	750	155	2.44	5.61	5.13	-	-	6.12	
2037	15,863	119	1.89	4.35	3.97	-	-	5.04		155	2.46	5.66	5.16	-	-	6.12	
2038	15,979	119	1.91	4.38	4.00	-	-	5.04		155	2.48	5.70	5.20	-	-	6.12	
2039	16,095	119	1.92	4.42	4.03	-	-	5.04		155	2.49	5.74	5.24	-	-	6.12	
2040	16,211	119	1.93	4.45	4.06	-	-	5.04		155	2.51	5.78	5.28	-	-	6.12	

[1]The 2,750 gpm (3.96 MGD) additional supply is from Well 11 (1,000 gpm) and from two supplementary new wells (1,000 gpm & 750 gpm)

Figure 3-1: Winter Maximum Day Demand and Supply

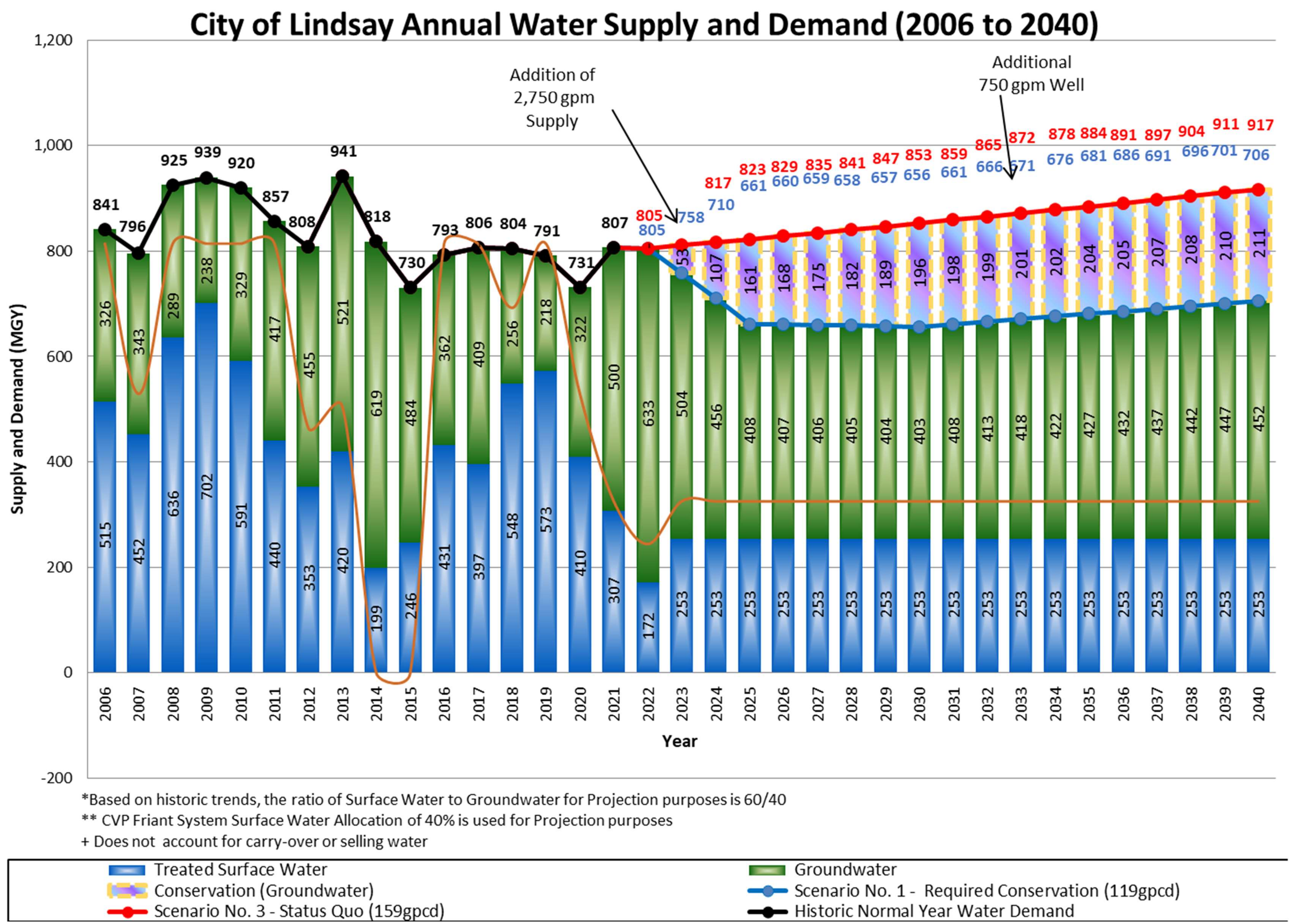


Projected demands and associated additional supply needs are both shown in Figure 3-2. The black, blue and red lines show the historical demand, Scenario No. 1 projected demand, and Scenario No. 3 projected demand, respectively. The envelope that opens between the two scenarios represents the area where the City's actual demand will likely fall; it allows the reader to see the range and potential effect of additional conservation measures.

The blue bars represent the historical and projected treated surface water, based upon available water. As noted in Figure 3-2, based on historic trends, the ratio of Surface Water to Groundwater for projection purposes is 60/40. The green bars represent pumped groundwater required under both scenarios. Because there is no additional supply of surface water identified, it is assumed the differential between the two demand scenarios would be supplied using groundwater.

It must be noted that the orange curve is a reconstruction of historical events, i.e., the rainfall and subsequent CVP Class 1 water allocations from 2006 to 2022. While in the future the City will surely see variations in the magnitude of CVP allocations, an allocation of 40% is projected here. Moreover, the order and duration of full and partial allocation will be dependent on actual hydrological occurrences and will not be exactly what is illustrated here. The final information presented in the figure are the supply improvement projects that are already planned by the City or are being proposed as a result of this Study (see Section 3.6)

Figure 3-2: Historic and Projected Supply and Demand



3.3 Water Treatment System

The City retains surface water supply and conveyance contracts with the United States Bureau of Reclamation (USBR), Friant Water Users Authority and potentially has access to 2,500 acre-feet per year, depending on annual water supply allocations established by USBR. Upon delivery of the surface water, the City treats and distributes potable water throughout the community, in addition to the groundwater supply. During the peak demand periods in the summer, when the surface water supply is available, the City's supply is primarily surface water, with groundwater augmenting the supply as necessary depending on the annual water supply allocations in effect each year. Surface water deliveries are halted while the Friant Kern Canal is taken off-line for general maintenance and dewatering, typically during every third year from November through as late as February; the supply scenario switches during this period and the City is entirely dependent on groundwater.

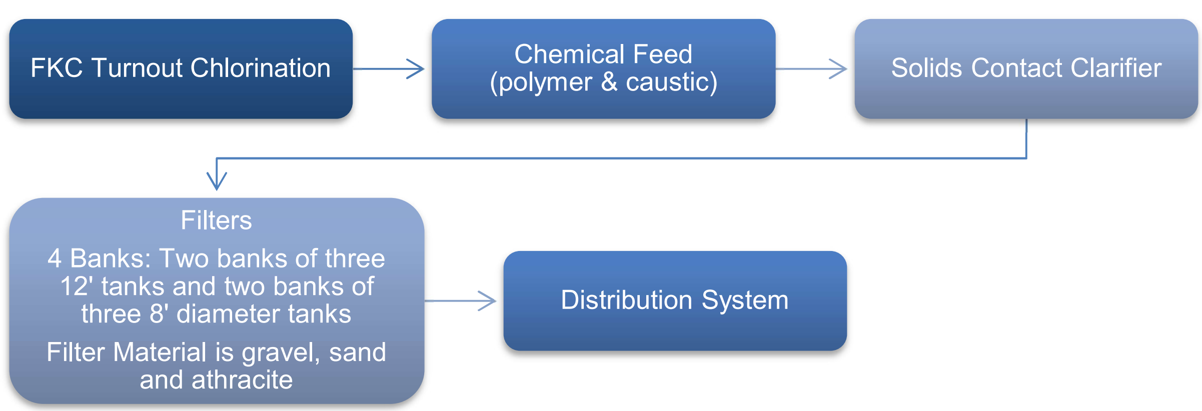
3.3.1 Surface Water Treatment System Evaluation

3.3.1.1 Current Operations

The surface water enters the City's infrastructure through a turnout at the Friant-Kern Canal, located approximately 1.3 miles east of the city limits, and travels through dual 12-inch pipes to the SWTP. At the turnout, chlorine is added in sufficient quantity to maintain a residual through the treatment process and into the distribution system. The SWTP treatment process is shown in Figure 3-3.

The SWTP is capable of handling flows between 1,600 and 1,800 gpm. The filters are backwashed approximately every seven days, based on source water turbidity levels that vary throughout the delivery year. The backwash is accomplished by backwashing one bank of filters at a time for 42 or 35 minutes per bank at 1,700 gpm or 750 gpm, for the 12' diameter and 8' diameter filters, respectively. Approximately 50 to 65 acre-feet of water is annually for backwash purposes. Backwash water is discharged via piped storm drain line to the City's stormwater basins.

Figure 3-3: SWTP Process



3.3.1.2 Current Deficiencies

The SWTP is operating with several deficiencies currently including decreased output during peak flows due to backwashing, ineffective floc formation, loss of backwash water, and elevated DBP levels at the storage tank.

- During peak flows, filter run times are reduced to a point where the filters are constantly backwashing, which decreases the output of the plant. It appears that, during peak flows, coagulation polymer is short-circuiting through the clarifier and carrying over to the filters, contributing to clogging and therefore shortening time between backwashes.
- No rapid mixing occurs following addition of the coagulant. This injection happens approximately 15 feet before the clarifier. This setup may not allow for optimal or even effective floc formation.
- The backwash wastewater is lost to the storm water basin and is not available for reuse. Surface water treatment plants can be designed and permitted to recycle backwash water in quantities up to 10% of the incoming plant flow.
- Levels of disinfection byproducts (DBPs) are elevated above the MCL at multiple sampling locations throughout the City starting in 2016. The City is conducting quarterly sampling and notifying the public until the DBP levels drop below the MCL. The City might also consider disinfection after filtration. The City identified funding in their Capital Improvement Plan (CIP) matrix to construct identified mitigation measures.

3.3.2 Short- and Long-Term Improvements

The four issues listed above can be partially mitigated or solved temporarily through several short-term options while permanent solutions may require longer-term planning and fund sourcing. The following noted observations were key in determining possible solutions.

- An analysis of the filter loading rates indicates that at 1,600 gpm, the filters are being loaded at 1.63 gpm/SF of filter area. This is well below the typical design rate of 3.0 gpm/SF. The carryover of solids from the solids contact clarifier appears to be leading to lower loading rates.
- When feeding a coagulant into the flow upstream of the clarifier, rapid mix is critical for effective floc formation. Flocculation is typically done in a separate chamber or baffled zone with the clarifier unit and that allows for at least 30 minutes of flocculation.
- The backwashing rates, times and volume of water appear to be normal for the diameter of the pressure filters.

Short Term Solutions

- If the City's solids contact clarifier can be retrofitted or upgraded, modify the solids contact clarifier by installing a rapid mix device such as a static mixer and installing a flocculation zone.
- If the City's solids contact clarifier can be retrofitted or upgraded, modify the solids contact clarifier by installing some sections of plate or tube settlers to allow for longer contact time in the clarifier.
- The recommended addition of a static mixer upstream of the clarifier should aid in organics removal, decreasing DBPs. Another potential option would be to replace two inches of anthracite in the pressure filters with two inches of granular activated carbon.

Long Term Solutions

- Add Additional Pressure Filters: In order to meet peak demand, more pressure filters could be added. However, there is very limited space available at the current water treatment plant site. Any additional filters would need to be placed at a different location.
- Relocate the point of chlorination from the canal turnout to the treatment plant. Preliminary design work has already been completed for a sodium hypochlorite feed system at the treatment plant, but final design and construction are not currently funded.
- Reuse the Backwash Wastewater: A new pond would need to be constructed to collect the backwash wastewater. The settled wastewater could then be returned to the head of the water treatment plant and mixed with the incoming raw water. A conceptual design has been prepared and is included in Appendix B.

3.4 Water Distribution System

The City's existing water distribution system is comprised of steel, asbestos-cement (AC) and polyvinyl-chloride (PVC) water mains, ranging in size from 4-inch through 12-inch. The water mains are typically located within the street rights-of-way; however, in some portions of town, mains are located within easements along the rear property line in residential back yards.

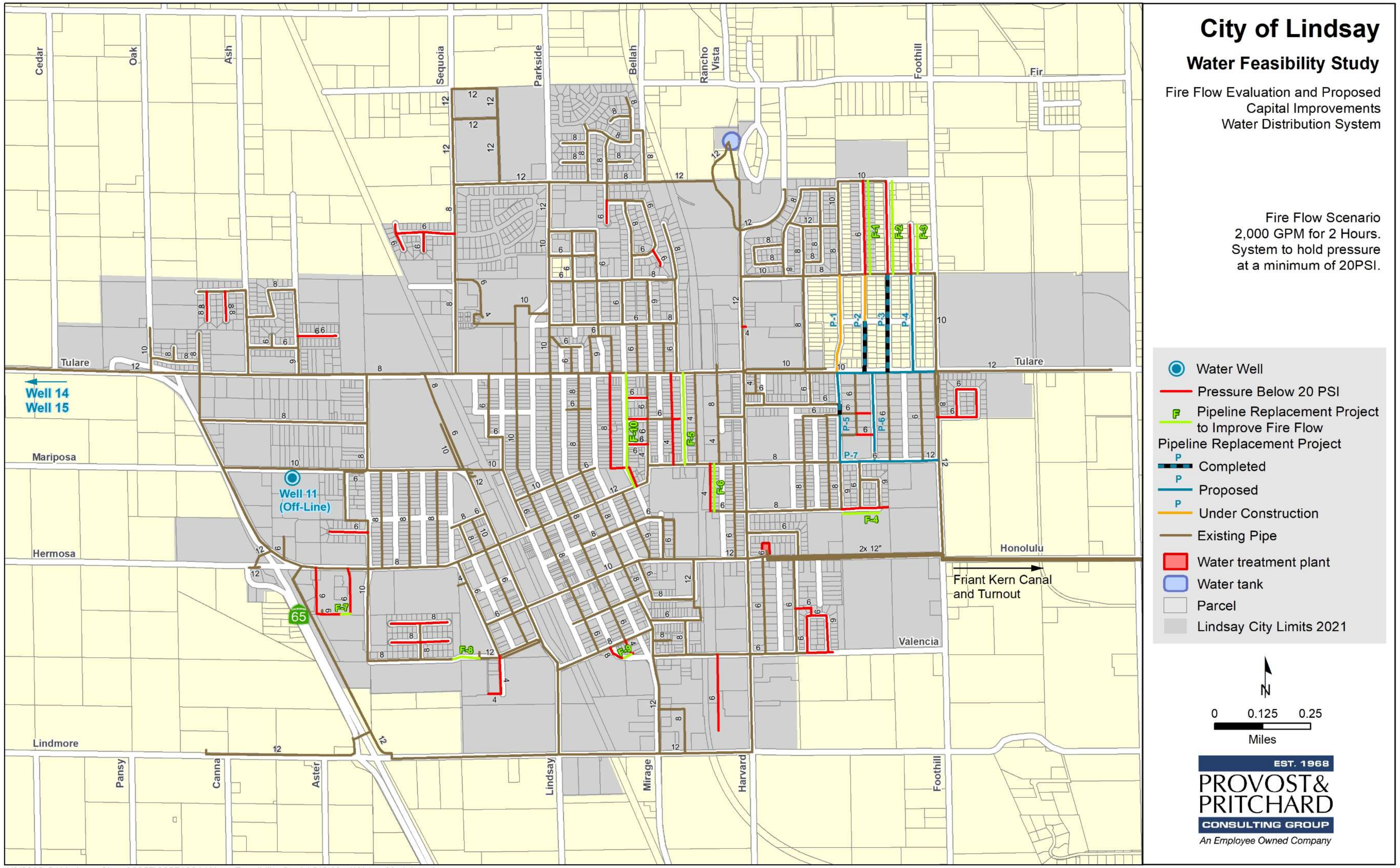
A system wide water model was completed with the Water Feasibility Report provided in 2013. Since the 2013 report, while some minor changes were made, no significant improvements to the water distribution system were made. Therefore, the existing model wasn't updated as part of this report. Similar conclusions from the 2013 water model analysis can be made and are discussed below.

Based on the evaluation from the 2013 model, there were several areas of concern within the distribution system that were noted to have pressure deficits during a fire event. A fire event pressure deficit is defined as the measured pipe pressure being lower than 20 psi during a 2-hour, 2,000 gpm fire event. The National Fire Protection Association and American Water Works Association recommend that a residual pressure of at least 20 psi be maintained to be effective for firefighting and public safety. If this minimum pressure is not met, it can become a public safety concern, where insufficient water supply can play a significant role.

As noted in the 2013 report, several of these deficits can be mitigated by installing additional water mains to complete system loops or by upsizing existing undersized water mains. The 2013 Fire Flow Evaluation figure has been updated to reflect 2021 City boundaries and updates to completed pipeline replacement projects (Figure 3-4), but the model has not been re-run. Figure 3-4 illustrates the areas of concern by showing the existing deficient water mains in red. A red line with green parallel line indicates the need for an existing water main improvement project to resolve the fire event deficiency. Additionally, in Figure 3-4 blue areas represent projects to improve the overall system efficiency by replacing or augmenting non-standard and undersized water mains. Furthermore, red areas are those areas with an identified pressure deficiency but without a readily apparent solution. These are areas where a ‘loop’ option is not readily available, generally those with only a single point of connection (i.e. a residential cul-de-sac) or those at dead-end locations.

Further details of possible water main improvement solutions are discussed in Section 3.6 Capital Improvement Projects and are listed in Table 3-10 CIP Matrix.

Figure 3-4: Fire Flow Evaluation



3.5 Water Storage System

The City's water storage requirements include operational, emergency and fire storage. The available storage consists of a single 4-million-gallon storage tank, at the north end of town. As suggested in the 2013 water modeling report, the Operational and Emergency storage requirements are each calculated at fifty percent of the ADD (Table 3-9). The Fire Storage requirement is based on fighting the largest possible fire, considered to be an industrial fire, requiring 3,000 gpm for three (3) hours (0.54 MG). The current and future storage requirements are detailed in Table 3-9 and illustrate that the existing storage capacity of 4.0 MG is sufficient to 2040 and possibly beyond.

Table 3-9: Water System Storage

Year	Population	Scenario No. 1: Required Conservation Target - 119 gpcd								Scenario No. 3: "Status Quo" - 155 gpcd							
				Storage Requirements								Storage Requirements					
		Average Daily Per Capita Water Use	Average Daily Demand	Operational	Fire	Emergency	Total	Available Storage	Remaining Storage[1]	Average Daily Per Capita Water Use	Average Daily Demand	Operational	Fire	Emergency	Total	Available Storage	Remaining Storage[1]
		(gpcd)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(gpcd)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)	(MG)
2022	14,230	155	2.21	1.10	0.54	1.10	2.75	4.0	1.25	155	2.21	1.10	0.54	1.10	2.75	4.0	1.25
2023	14,333	145	2.08	1.04	0.54	1.04	2.62	4.0	1.38	155	2.22	1.11	0.54	1.11	2.76	4.0	1.24
2024	14,436	135	1.94	0.97	0.54	0.97	2.48	4.0	1.52	155	2.24	1.12	0.54	1.12	2.78	4.0	1.22
2025	14,539	125	1.81	0.91	0.54	0.91	2.35	4.0	1.65	155	2.25	1.13	0.54	1.13	2.79	4.0	1.21
2026	14,646	124	1.81	0.90	0.54	0.90	2.35	4.0	1.65	155	2.27	1.14	0.54	1.14	2.81	4.0	1.19
2027	14,753	122	1.81	0.90	0.54	0.90	2.35	4.0	1.65	155	2.29	1.14	0.54	1.14	2.83	4.0	1.17
2028	14,860	121	1.80	0.90	0.54	0.90	2.34	4.0	1.66	155	2.30	1.15	0.54	1.15	2.84	4.0	1.16
2029	14,967	120	1.80	0.90	0.54	0.90	2.34	4.0	1.66	155	2.32	1.16	0.54	1.16	2.86	4.0	1.14
2030	15,074	119	1.80	0.90	0.54	0.90	2.34	4.0	1.66	155	2.34	1.17	0.54	1.17	2.88	4.0	1.12
2031	15,185	119	1.81	0.91	0.54	0.91	2.35	4.0	1.65	155	2.35	1.18	0.54	1.18	2.89	4.0	1.11
2032	15,297	119	1.82	0.91	0.54	0.91	2.36	4.0	1.64	155	2.37	1.19	0.54	1.19	2.91	4.0	1.09
2033	15,408	119	1.84	0.92	0.54	0.92	2.38	4.0	1.62	155	2.39	1.19	0.54	1.19	2.93	4.0	1.07
2034	15,520	119	1.85	0.93	0.54	0.93	2.39	4.0	1.61	155	2.41	1.20	0.54	1.20	2.95	4.0	1.05
2035	15,631	119	1.86	0.93	0.54	0.93	2.40	4.0	1.60	155	2.42	1.21	0.54	1.21	2.96	4.0	1.04
2036	15,747	119	1.88	0.94	0.54	0.94	2.42	4.0	1.58	155	2.44	1.22	0.54	1.22	2.98	4.0	1.02
2037	15,863	119	1.89	0.95	0.54	0.95	2.43	4.0	1.57	155	2.46	1.23	0.54	1.23	3.00	4.0	1.00
2038	15,979	119	1.91	0.95	0.54	0.95	2.45	4.0	1.55	155	2.48	1.24	0.54	1.24	3.02	4.0	0.98
2039	16,095	119	1.92	0.96	0.54	0.96	2.46	4.0	1.54	155	2.49	1.25	0.54	1.25	3.03	4.0	0.97
2040	16,211	119	1.93	0.97	0.54	0.97	2.47	4.0	1.53	155	2.51	1.26	0.54	1.26	3.05	4.0	0.95

[1]Remaining Storage shown as a positive number indicates a surplus of storage capacity; the system does not have any storage deficiencies.

3.6 Capital Improvement Projects

Through the process of analyzing supply, demand, storage capacity, treatment and modeling the system, several possible capital improvement projects presented themselves. These projects are described in the following sections and are separated into five categories: pipelines, groundwater wells, groundwater treatment, surface water treatment and tank improvements.

The Draft CIP from the City includes several projects. These are shown in Table 3-10, along with the proposed projects developed through this Study. It should also be noted that while additional water supplies are immediately needed, as demonstrated in Table 3-8, practical considerations (permitting, design, construction, bidding, etc.) restrict the immediate implementation of all suggested projects. The schedule proposed in the Draft CIP represents a suggestion of an expedient practical solution.

Table 3-10: CIP Matrix

Project No.	Project Type	Project Description	Notes	Project Limits	Project Specifics				Project Timing							Estimated Grand Total	Possible Funding Source
					Ex. Size/ Diam.	New Size/ Diam.	Replace/ New	Length	2023-2024	2024-2025	2025-2026	2026-2027	2027-2028	2028-2029	2029-2030		
Pipelines																	
Varies (See Table 3-11)	C	Main Line Replacement/ Dead End Elimination	1, 2	TBD	8 in	8 in	Replace	1,300 ft	$988,000	$988,000	$988,000	$988,000	$988,000	$988,000	$988,000	$6,916,000	Enterprise
Groundwater Wells																	
GW-1	C	Drinking Water Test Well #1	1	TBD			New		$300,000							$300,000	Enterprise
GW-2	C	New Well #1 (Winter Demand)	2, 4	TBD		850 gpm	New			$2,220,000						$2,220,000	Enterprise
GW-3	C	New Well #1 Infrastructure	2	TBD			New			$2,700,000						$2,700,000	Enterprise
GW-4	C	Drinking Water Test Well #2	1	TBD			New				$300,000					$300,000	Enterprise
GW-5	C	New Well #2 (Winter Demand)	2,4	TBD		1,000 gpm	New					$2,220,000				$2,220,000	Enterprise
GW-6	C	New Well #2 Infrastructure	2	TBD			New					$2,700,000				$2,700,000	Enterprise
GW-7	C	Drinking Water Test Well	1	TBD			New						$300,000			$300,000	Enterprise
GW-8	C	Replacement Well	2, 3	TBD		750 gpm	Replace							$2,220,000		$2,220,000	Enterprise
GW-9	C	New Well #3 (Winter Demand)	2, 3, 5	TBD		750 gpm	New								$2,220,000	$2,220,000	Enterprise
GW-10	C	New Well #3 Infrastructure	2	TBD			New								$2,700,000	$2,700,000	Enterprise
GW-11	C	Harvard Park Irrigation Well	1	TBD			New								$1,500,000	$1,500,000	Enterprise
GW-12	C	City Park Irrigation Water Well	1	TBD			New								$1,500,000	$1,500,000	Enterprise
Ground Water Well Treatment																	
WT-1	P	Well 11 - Treatment Alts	1, 2	Well 11			New		$25,000							$25,000	Enterprise
WT-2	P	Well 11 - Treatment PS&E	1, 2	Well 11			New		$150,000							$150,000	SRF[6]
WT-3	C	Well 11 - Water Treatment	1, 2	Well 11			New			$5,943,000						$5,943,000	SRF[6]
WT-4	C	Well 14 - Upgrades	1	Well 14			New		$150,000							$150,000	Enterprise
Surface Water Projects																	
SW-1	C	DBP Mitigation	1, 2	SWTP			New		$500,000							$500,000	Enterprise
SW-2	C	Filter Bank D Renovations	1	SWTP			Replace		$400,000							$400,000	Enterprise
SW-3	C	Water Plant Upgrades	1, 2	SWTP			Replace			$100,000						$100,000	Enterprise
SW-4	C	Clarifier Renovations	1, 2	SWTP			Replace			$10,000						$10,000	Enterprise
SW-5	C	Turnout Upgrades	1	Canal Turnout			Replace				$100,000	$100,000				$200,000	Enterprise
SW-6	C	Appurtenances (Approved CIP)	1	TBD			Replace		$120,000	$766,800	$472,000	$570,000	$20,000			$1,948,800	Enterprise
SW-7	C	Water Meters Digital Upgrade	1	TBD			Replace								$2,000,000	$2,000,000	Enterprise
Tank Improvements																	
T-1	C	Storage Tank Improvements	1	TBD			Replace				$450,000					$450,000	Enterprise
Totals									**$2,633,000**	**$12,727,800**	**$2,310,000**	**$6,578,000**	**$1,308,000**	**$3,208,000**	**$10,908,000**	**$39,672,800**	

P = Planning Project; C = Construction Project
[1] Project Listed in Draft Capital Improvement Plan Provided by the City.
[2] Project Proposed for Inclusion in CIP; additional details in Water Feasibility Study.
[3] Supply Projects are potentially interchangeable based on timing and demand needs.
[4] Planned well replacement by the year 2030, as a result of reaching useful life expectancy.
[5] Additional well will be needed sometime after 2030 to address supply needs, as illustrated in Figure 3-1.
[6] SRF refers to the California State Revolving Fund

3.6.1 Pipeline Projects

The Draft CIP lists one pipeline project; the pipeline projects proposed as a result of this Study are listed in Table 3-11 and stem directly from the water model analysis conducted in 2013 (see Figure 3-4). These projects are divided into two categories: Fire Flow and Pipeline Replacement Projects. The Fire Flow Projects aim to correct pressure problems that limit the ability to meet fire standards in certain areas. The Pipeline Replacement Projects aim to replace old or undersized water mains or to complete loops in areas that limit system functionality. The projects proposed in Table 3-11 are proposed over a 7-year span.

Table 3-11: Pipeline Projects (From Water Model)

Project No.	Project Description	Project Limits	Project Specifics			
			Ex. Diam. (in)	New Diam. (in)	Replace / New	Length (ft)
Fire Flow Projects						
F-1	Replace existing undersized, old main	Sycamore Ave from Hickory St to Sierra View St	6	8	Replace	1,275
F-2	Replace existing undersized, old main	Laurel Ave from Hickory St to Sierra View St	4	6	Replace	1,275
F-3	Replace existing undersized, old main	Page Ave from Sierra View St north to end of cul-de-sac	4	6	Replace	630
F-4	Replace existing undersized, old main	Samoa St from Lafayette Ave to Sycamore Ave	6	8	Replace	525
F-5	Replace existing undersized, old main	Orange Ave from Tulare Rd to Hermosa St	4	8	Replace	675
F-6	Replace existing undersized, old main	Oxford Ave from Hermosa St to Samoa St	4	8	Replace	1,300
F-7	Install new main to complete loop	Behind shopping center near Hermosa St and Westwood Ave	---	8	New	180
F-8	Install new main to complete loop	Apia St along edge of Olive Grove Ball Park	---	8	New	380
F-9	Install new main to complete loop	Easement from Elmwood Ave to alley off Lewis St between Elmwood Ave and Mirage Ave	---	8	New	200
F-10	Relocate existing rear yard main to street ROW; complete loop	Homassel Ave from Tulare Rd to Hermosa St	8	8	Replace	1,625
Pipeline Replacement Projects						
P-1	Replace existing undersized, old main	Lafayette Ave from Sierra View St to Tulare Rd	4	6	Replace	1,300
P-2[1]	Replace existing undersized, old main	Sycamore Ave from Sierra View St to Tulare Rd	4	6	Replace	1,300
P-3[2]	Replace existing undersized, old main	Laurel Ave from Sierra View St to Tulare Rd	4	6	Replace	1,300
P-4	Replace existing undersized, old main	Page Ave from Sierra View St to Tulare Rd	4	6	Replace	1,300
P-5	Relocate existing rear yard main to street ROW and upsize	Lafayette Ave from Hermosa St to Tulare Rd	6	8	Replace	1,275
P-6	Relocate existing rear yard main to street ROW and upsize	Sycamore Ave from Hermosa St to Tulare Rd	6	8	Replace	1,250
P-7	Replace undersized main	Hermosa St from Lafayette Ave to Foothill Ave	6	8	Replace	1,350

[1] Completed from Tulare to Alameda
[2] Completed

3.6.1.1 Project Cost Estimates

Since the 2013 evaluation of pipeline projects, one and a half pipeline replacement projects have been completed. Projects P-3, and half of P-2 have been completed. Table 3-12 tabulates the approximate remaining cost of the projects listed in the 2013 report, along with an overall estimate for construction cost, contingency, design, and construction management. The cost estimates have been updated to reflect the average cost of projects recently completed or contracted, amounting to a construction cost of approximately $310 per lineal foot of water main. However, due to the conceptual nature of the proposed projects, detailed estimates should be prepared during the planning and design phases of each project. It is expected that this unit price includes all required items to fully install the pipe including material purchase, trench, compaction, roadway resurfacing and worker protections. These preliminary estimates are to provide the City with budgetary expectations.

Table 3-12: Pipeline Projects Construction Cost

Project No.	Construction Cost	Construction Contingency (30%)	Engineering & Construction Management (18%)	Total Preliminary Cost Estimate
Fire Flow Projects				
F-1	$391,900	$117,600	$70,500	$580,000
F-2	$391,900	$117,600	$70,500	$580,000
F-3	$192,900	$57,900	$34,700	$285,500
F-4	$162,300	$48,700	$29,200	$240,200
F-5	$208,200	$62,500	$37,500	$308,200
F-6	$398,000	$119,400	$71,600	$589,000
F-7	$55,100	$16,500	$9,900	$81,500
F-8	$116,300	$34,900	$20,900	$172,100
F-9	$61,200	$18,400	$11,000	$90,600
F-10	$499,000	$149,700	$89,800	$738,500
Subtotal				**$3,665,600**
Pipeline Replacement Projects				
P-1	$412,000	$123,600	$74,200	$609,800
P-2	$199,000[1]	$59,700[1]	$35,800[1]	$294,500[1]
P-3	Completed	Completed	Completed	--
P-4	$398,000	$119,400	$71,600	$589,000
P-5	$413,300	$124,000	$74,400	$611,700
P-6	$391,900	$117,600	$70,500	$580,000
P-7	$382,700	$114,800	$68,900	$566,400
P-8	$413,300	$124,000	$74,400	$611,700
Subtotal				**$3,253,300**

[1]Remaining estimated cost, as project has already been partially completed.

3.6.2 Groundwater Well Projects

Two types of groundwater well projects are proposed. The first is new supply wells to meet the City's demands. The Draft CIP includes three wells: two to supply irrigation to parks and one additional drinking water test well. As shown in Table 3-8 and Figure 3-1, the City will need additional wells in 2024, or as soon as feasible, to meet current winter demands. The Well 11 groundwater treatment project discussed in Section 3.6.3 will partially fulfill this need. In addition to this, three new supply wells and corresponding drinking water test wells and infrastructure will likely be needed. The timing of the third well will depend on per capita demand trends (see Section 3.2.2). These added supply sources can be provided via additional groundwater wells or through additional surface water storage (i.e. a reservoir) so surface water deliveries received spring through fall can be utilized during the winter months. Since the new wells will need to be located outside the existing City's water system in order to avoid groundwater that will require treatment, new infrastructure will be required. Estimates in Table 3-13 assume approximately 1 mile of infrastructure costs, but this could vary and should be investigated further in the design and planning phases of the projects.

The second type of groundwater well project is a replacement project. It is anticipated that within the next 5 years an existing well will reach the end of its serviceable life and require major rehabilitation or full replacement. These projects are all proposed as a result of this Study and are shown in Table 3-10.

3.6.2.1 Preliminary Engineer's Opinion of Probable Construction Costs

Preliminary construction costs have been prepared for each of these projects; however, during the planning and design process detailed cost estimates will be required and could possibly vary from the costs provided in Table 3-13.

Table 3-13: Groundwater Well Projects Construction Cost

Project Name	Project Description	Construction Cost	Construction Contingency (30%)	Engineering & Construction Management (18%)	Total Preliminary Cost Opinion
GW-1	Drinking Water Test Well #1	$202,700	$60,800	$36,500	$300,000
GW-2	New Well #1 (Winter Demand)	$1,500,000	$450,000	$270,000	$2,220,000
GW-3	New Well #1 Infrastructure	$1,824,300	$547,300	$328,400	$2,700,000
GW-4	Drinking Water Test Well #2	$202,700	$60,800	$36,500	$300,000
GW-5	New Well #2 (Winter Demand)	$1,500,000	$450,000	$270,000	$2,220,000
GW-6	New Well #2 Infrastructure	$1,824,300	$547,300	$328,400	$2,700,000
GW-7	Drinking Water Test Well	$202,700	$60,800	$36,500	$300,000
GW-8	Replacement Well	$1,500,000	$450,000	$270,000	$2,220,000
GW-9	New Well #3 (Winter Demand)	$1,500,000	$450,000	$270,000	$2,220,000
GW-10	New Well #3 Infrastructure	$1,824,300	$547,300	$328,400	$2,700,000
GW-11	Harvard Park Irrigation Well	$1,013,500	$304,100	$182,400	$1,500,000
GW-12	City Park Irrigation Water Well	$1,013,500	$304,100	$182,400	$1,500,000
Subtotal					$20,880,000

3.6.3 Groundwater Well Treatment Projects

The Draft CIP lists four groundwater well treatment projects, two for planning and two for construction, as shown in Table 3-10. Seen from another perspective, the Draft CIP includes three projects for Well 11 and one project for Well 14. These projects are anticipated to occur FY 2023-2024 through 2027-2028. The Planning and Construction phases for Well 11 Treatment are anticipated to occur in FY 2023-2024 and rely on the State Revolving Fund (SRF) funding sources yet to be initiated. These projects will allow the City to utilize Well 11 again as a potable water source and increase water supply and reliability. The upgrades planned for Well 14 will improve its efficiency and reliability.

3.6.3.1 Project Cost Estimates

Preliminary construction costs have been prepared for these projects; however, during the planning and design process, detailed cost estimates will be required and could possibly vary from the costs provided in Table 3-14. The recommended treatment alternative for Well 11 (WT-3) is perchlorate removal using a single-use anion exchange treatment system followed by nitrate removal using a regenerable anion exchange treatment system with on-site evaporation ponds for brine management. The estimated capital cost is $5,943,000. The estimated O&M cost is $119,690 per year plus $1.06/1,000 gallons produced.

Table 3-14: Groundwater Well Treatment Projects Construction Cost

Project Name	Project Description	Construction Cost	Construction Contingency (30%)	Engineering & Construction Management (18%)	Total Preliminary Cost Opinion
WT-1	Well 11 – Treatment Alternatives	--	--	--	$25,000[1]
WT-2	Well 11 – Treatment PS&E	--	--	$150,000	$150,000
WT-3	Well 11 - Treatment	$5,943,000	--	--	$5,943,000[1]
WT-4	Well 14 Upgrades	$150,000	--	--	$150,000

[1] Costs already included in Draft CIP from City.

3.6.4 Surface Water Treatment Projects

The CIP Matrix lists seven (7) surface water treatment projects, all construction projects, as shown in Table 3-10. Three of these projects are suggested as a result of this study. These projects are anticipated to occur in FY 2023-24 through 2025-26. Projects in the Draft CIP which fell under the SW-6 category of Appurtenances include installation of turbidimeters, pneumatic valves, magnetic flow meters, water treatment booster pumps, and a gate valve exerciser, among other projects.

3.6.4.1 Project Cost Estimates

Preliminary construction costs have been prepared for this project; however, during the planning and design process, detailed cost estimates will be required and could possibly vary from the costs provided in Table 3-15.

Table 3-15: Surface Water Treatment Projects Construction Cost

Project Name	Project Description	Construction Cost	Construction Contingency (20%)	Engineering & Construction Management (15%)	Total Preliminary Cost Estimate
SW-1	DBP Mitigation	--	--	--	$500,000[1,2]
SW-2	Filter Bank D Renovations	--	--	--	$400,000[2]
SW-3	Water Plant Upgrades	--	--	--	$100,000[2]
SW-4	Clarifier Renovations	--	--	--	$10,000[2]
SW-5	Turnout Upgrades	--	--	--	$200,000[2]
SW-6	Appurtenances (Approved CIP)	--	--	--	$1,948,800[2]
SW-7	Water Meters Digital Upgrade	--	--	--	$2,000,000[2]

[1] Discussed in section 3.7.2
[2] Costs already included in Draft CIP from City.

3.6.5 Tank Improvement Projects

The Draft CIP lists one tank improvement project, which involves renovations to the storage tank. Recent inspection reports of the existing 4.0 MG storage tank state the anode protection system of the current tank is in good working condition (see Appendix C), however evaluation of the tank's coating viability and/or structural condition should be conducted by the City annually. If coating failures on the inside or outside of the tank are observed, additional projects for recoating should be scheduled.

This project is planned to begin FY 2024-25 and conclude FY 2025-2026. No additional tank improvement projects are being proposed as a result of this Study.

3.7 Other Factors Affecting the Water System

The Social-Economic factors described below are intended to highlight a few topics that may have a current or future impact to the water system and provide the City additional awareness and information.

3.7.1 Socio-Economic Factors

The community of Lindsay has a median household income (MHI) of $37,073 and is therefore considered a Disadvantaged Community (DAC)[5]. Additionally, DWR recognizes an ‘affordability level’ for services such as water, which is 1.5% of the community’s MHI. This equates to approximately $46.34 per month as the upper limit of what water services should cost to be considered affordable. Utilizing the average water demand of 155 gpcd and an average household size of 3.29, as discussed above, the calculated average water use for a household is 15,500 gallons per month or 2,070 cubic feet (cf). The City charges $19.97[6] for the first 500cf and $1.02 per subsequent 100cf; this equates to an average household water bill of $35.99 per month, which is 1.0% of the community’s MHI. The City is currently working on a water rate study to ensure fairness in the distribution of costs amongst rate payers while providing reliable water service to the community.

It is pertinent to understand why the monthly cost is relatively high as compared with MHI. This region has significantly limited and unreliable groundwater. Most of the groundwater has some form of contamination making the groundwater source unreliable. Due to the unreliable nature of the groundwater quality within the City, new wells will either require treatment or be located a distance from the City's existing water infrastructure system; either option will considerably increase costs for rate payers. Additionally, wellhead treatment incurs a considerable yearly operations and maintenance cost to provide safe drinking water. Furthermore, the City has to rely on providing treated surface water which is substantially more costly than providing groundwater, which adds to the costs required to provide safe and reliable water in the City.

3.7.2 Water Supply

As previously discussed, the City relies jointly on surface water and groundwater. There are substantial issues that affect both water supplies; however, the City relies on surface water as much as possible due to groundwater quality issues (discussed in Section 3.7.3) and overdraft concerns in the region as a whole. Surface water has had an increase in frequency of reduced allocations due to climate and restoration flows to the San Joaquin River.

The City’s contracted allocation allows for them to receive as much as 2,500 acre-feet per year (af/year), however, USBR maintains the right to reduce the allocation annually based on climate conditions (i.e. how much snowpack is in the Sierra Nevada mountains) and the amount of water permitted to flow to the San Joaquin River, based on the criteria set forth in the 2006 settlement agreement.

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[5] A DAC is identified as any community with an MHI less than 80% of the Statewide MHI. The DAC threshold is currently $56,982, as defined by DWR.

[6] For a 5/8” or 3/4" meter size; 1” meters have a base rate of $27.53 for the first 500 cf.

In the years between 2000 and 2022, the average annual allocation was 78%; however, in recent years between 2013 and 2022, the average allocation was 58%. These low allocations are due to the low seasonal rainfall the region has experienced. The San Joaquin River Restoration has a varying effect on the allocation, ranging from 0% to 20% reduction, based on the water year classification. Figure 3-5 shows the historical allocation to the City and Table 3-16 shows the percent reduction experienced by the City due to the San Joaquin River Restoration.

If the 40% allocation reduction used in Section 3.2.2 were applied to the surface water supply in Table 3-3 which showed firm and total capacity, the result would be the firm and total capacity in Table 3-17. Note that this reduced allocation was accounted for in Section 3.2.2, and Table 3-8 already accounts for this reduction when evaluating whether the summer or winter months' supply was the limiting supply. Table 3-17 illustrates the summer months supply during periods of surface water allocation reduction, accounting for only the present groundwater supply sources.

Figure 3-5: Historical USBR Allocation

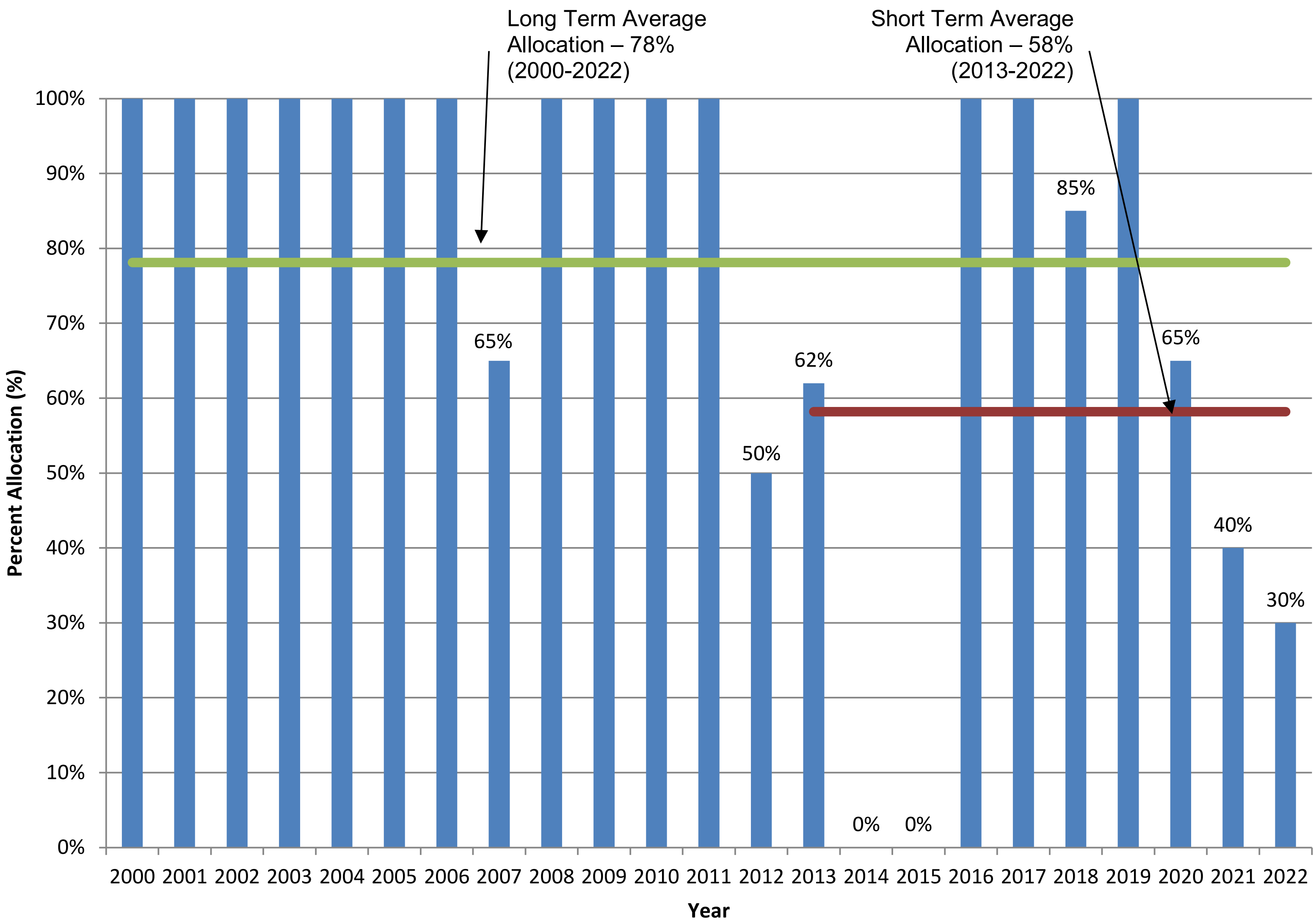

Table 3-16: Reduced USBR Allocation Due to San Joaquin River Restoration

Water Year Classification	Reduction	
	(af/year)	Percent (%)
Wet	0	0%
Normal-wet	0	0%
Normal-dry	195	8%
Dry	510	20%
Critical-High	430	17%
Critical-Low	130	5%

Table 3-17: Reduced Summer Months Supply

Reduced Summer Months Supply[1]		
	(MGD)	(gpm)
Firm Capacity[2]	2.12	1,470
Total Capacity	2.94	2,040

[1] Accounts for 40% Allocation in Surface Water Supply
[2] Excludes Well 15 (largest capacity well) for maintenance, water quality or other scenarios.

3.7.3 Water Quality

The City has several existing groundwater quality issues they are contending with, including lead and disinfection byproducts.

- The City experienced an Action Level and 90th percentile exceedance of lead in September 2021 at 4, out of 30, testing sites. The City is currently addressing this issue with additional testing, monitoring, and water system improvements.
- Disinfection byproducts (DBP), consisting of total trihalomethanes (TTHM), and haloacetic acids (HAA5), were found in exceedance of the maximum contaminant level (MCL). The City is working to collect samples, monitor the situation, and correct the issues.
- A single exceedance for turbidity was experienced by the City in March 2021. This exceedance was caused by changes in water quality in the Friant Kern Canal water supply and the City adjusted treatment operations to achieve compliance.
- Well 11 is inactive due to exceedances of the MCL for perchlorate and nitrate. The well will remain on inactive ‘emergency use only’ status until a proposed project to blend the water to reduce the perchlorate and nitrate to below the MCL level is funded and implemented.

In addition to existing water quality concerns, there are several contaminants that may become critical in the near future.

- While not officially adopted yet, the Division of Drinking Water recently announced a new draft Hexavalent Chromium (Cr6) MCL of 10 ppb (ug/L). Previously, it was regulated under the total chromium MCL. Existing water quality monitoring reports do not report this contaminant but the City will need to monitor it in the future. There may be an impact to City wells potential treatment methods include reverse osmosis or ion exchange.
- 1,2,3-Trichloropropane (1,2,3-TCP) has a primary MCL, established by the Division of Drinking Water in 2017, of 0.0005 μg/L This is a follow up of the Public Health Goal (PHG) of 0.0007 μg/L that was established in 2009. 1,2,3-TCP Since 1,2,3-TCP was used as a component in agricultural fumigants applied over large areas of California, it is reasonable to expect that the City may be impacted.

APPENDIX