Coachella Water Authority

WATER MASTER PLAN

FINAL
AUGUST 2017

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SECTION 1
INTRODUCTION

The City of Coachella (City) was incorporated on November 26, 1946 and encompasses approximately 32 square miles in Riverside County, more specifically the Lower Coachella Valley. Shortly after incorporation, in the summer of 1951, low water pressure in the area prevented local businesses from operating efficiently, thereby causing the formation of the City's Water Department. In 1954, the City passed a bond to purchase and consolidate three private water companies: Abdelnous Water Company, Coachella Water Works, and Highway Water Company. The City Water Department was established in 1957, and is administered and managed by the Utilities General Manager under direct supervision of the City Manager. The City is responsible for the water service for its residents.

This section provides an overview of this 2016 Water Master Plan (WMP) Update for the City; including a brief description of the project background, the plan objective, the scope of work, data sources, and a list of abbreviations used throughout the report.

1.1 PROJECT BACKGROUND

The City's last water system master plan was completed by Dudek and Associates in July 2007. The WMP update evaluated the existing water distribution system and identified the major supply and distribution facilities to provide potable water for two future phases, the build-out of 42 planned development projects, of which 5 of the more notable projects are discussed later in this plan, and complete build-out within the City of Coachella's Sphere of Influence.

The intent of this current WMP is to develop a document that can be used as a guideline for the planning of the potable water system for the City. This WMP has a planning horizon of year 2035 and evaluates both the existing potable water system and the future water system that is recommended to meet the needs of the year 2035 service area and its customers.

This WMP covers the entire service area of the City, which mostly coincides with the City boundaries. With over 7,776 water meters, the City currently serves a population of about 43,633. The addition of new developments will potentially increase the population to 134,890 by 2035.

1.2 OBJECTIVE

The City's goal is to provide cost-effective and fiscally responsible water service that meets the water supply needs, water quality, system pressure and reliability requirements for its customers. The objective of this WMP update is to assist the City in achieving these goals.

For this WMP, a hydraulic model of the potable water system was created. The calibrated potable water system model includes water pipelines of 6-inch diameter and larger in the City's water system. Future system improvements that will become necessary to meet the year 2035 service conditions are added to analyze the future conditions and make recommendations for system improvements.

The purpose of this report is to prepare a Capital Improvement Program (CIP) that includes system improvements required to meet the water system needs, including growth, through the year 2035. The improvements are identified by analyzing the potable water system under existing and future demand conditions. The CIP will provide the City with a water system planning road map for the future.

1.3 SCOPE OF WORK

The Scope of Work (SOW) of this WMP consists of the following tasks:

- Data gathering and research required for the hydraulic analysis and final report
- Develop existing system demands from planning criteria
- Determine actual system demands throughout the different land uses
- Build and create the network model using H20Net Version 11 and input the data required
- Project potable water demands for development to year 2035
- Run the analysis on the existing system
- Check system pressures and velocities for Max Day demands plus fire flows and Peak Hour demands to determine any deficiencies within the existing system
- Use field data to calibrate the Model
- After system calibration check system pressures and velocities for Max Day demands plus fire flows and Peak Hour demands to determine any deficiencies within the existing system
- Analyze the potable water distribution system under existing conditions
- Analyze the potable water distribution system under future conditions
- Perform a water supply analysis
- Prepare a pipeline replacement program
- Identify potable water system improvements for existing and future water system
- Prepare a Capital Improvement Program (CIP) for the Potable Water System
- Prepare an inclusive report summarizing findings and recommendations

1.4 DATA SOURCES

For the preparation of this report, City staff supplied reports, maps and other sources of information. In addition, several meetings with City's Utilities and Planning Departments were held to obtain a thorough understanding of the City's information and needs. Pertinent materials included: water system atlas maps, historical well production and billing data, planning and development information, land use information, aerial photography, operations data, and various Engineering Reports and Plans. A complete list of reference documents is provided in **Appendix A**.

1.5 ABBREVIATIONS

To conserve space and improve readability, abbreviations have been used in this report. Each abbreviation has been spelled out in the text the first time it is used. Subsequent usage of the term is usually identified by its abbreviation. The abbreviations used are shown in **Table 1-1, List of Abbreviations.**

Table 1-1
List of Abbreviations

Abbreviation	**Description**
AAL	Archived Advisory Level
ABW	Automatic Backwash
ac	acre
ac-ft	acre-feet
AFY	acre-feet per year
ADD	Average Day Demand
AMCL	Alternate Maximum Contaminant Level
AP	Administrative Professional
AC	Asbestos Cement
BMP	Best Management Practices
CCI	Construction Cost Index
CCR	Consumer Confidence Reports
CGPU	Coachella General Plan Update
CIP	Capital Improvement Program
City	City of Coachella
CP	Critical Pipe
CUWCC	California Urban Water Conservation Council
CVWD	Coachella Valley Water District
DBP	Disinfection By-Product
DHS	Department of Health Services
du	Dwelling unit
ENR	Engineering News Record
ENR CCI	Engineering News Record Construction Cost Index
EPA	(United States) Environmental Protection Agency
EPS	Extended Period Simulation
ft/s	feet per second
fps	feet per second
GC	General Commercial
GE	General Electric
GI	General Industrial
GIS	Geographical Information System
GP	General Plan
gpd	gallons per day
gpm	gallons per minute
GWR	Groundwater Rule
HAA	Haloacetic acids
HDR	High Density Residential
HGL	Hydraulic Grade Line
IDSE	Initial Distribution System Evaluation
IESWTR	Interim Enhanced Surface Water Treatment Rule
INF	Infrastructure
IOC	Inorganic Compounds
IP	Industrial Park
IRWMP	Integrated Regional Water Management Plan
LDR	Low Density Residential

LF	lineal feet
LRAA	Locational Running Annual Average
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MDD	Maximum Day Demand
MMP	Maximum Month Production
MRDL	Maximum Residual Disinfection Level
MRDLG	Maximum Residual Disinfection Level Goal
MDR	Medium Density Residential
MOU	Memorandum of Understanding
MWD	Metropolitan Water District of Southern California
MG	Million Gallon
MGD	Million Gallon per Day
MinDD	Minimum Day Demand
MFR	Multi-Family Residential
MMM	Multi-Media Mitigation
NC	Neighborhood Commercial
NL	Notification Levels
NTU	Nephelometric Turbidity Units
OEHHA	(State) Office of Environmental Health and Hazard Assessment
OMB	Office of Management and Budget
PHD	Peak Hour Demand
PHG	Public Health Goals
PR	Planned Residential
PRS	Pressure Reducing Station
PRV	Pressure Reducing Valve
psi	Pounds per Square Inch
PVC	Polyvinyl Chloride
ppb	Parts per Billion
ppm	Parts per Million
SCADA	Supervisory Control and Data Acquisition
SDWA	Safe Drinking Water Act
SFR	Single Family Residential
SOC	Synthetic Organic Compounds
SR	State Route
SWP	State Water Project
TDH	Total Discharge Head
TDS	Total Dissolved Solids
UFC	Uniform Fire Code
UWMP	Urban Water Management Plan
VOC	Volatile Organic Compounds
WDF	water demand factor
WMP	Water Master Plan
WSA	Water Supply Assessment

SECTION 2
PLAN SETTING

The Plan Setting provides a general overview of the study area, planning area demographics (including population, housing units and growth forecasts), and land uses in the following sections.

2.1 STUDY AREA

The City, incorporated in 1946, encompasses a sphere of influence of approximately 33,319 acres or 53 square miles.[1] The area is in the eastern portion of Riverside County and known as the Lower or East Coachella Valley. Its neighboring cities include La Quinta, Indio, and Palm Desert. The City overlays the Coachella Valley Groundwater Basin, Indio Sub-basin, DWR Basin Number 7-21-01, also known as the Whitewater River Sub-basin. Currently, the City limits extend beyond its current water distribution service area. However, the report study area takes into account the entire City limits and its sphere of influence to account for expansion of the existing system and growth. The study area is shown on **Figure 2-1** containing City limits boundary and City sphere boundary.

2.2 PLANNING AREA DEMOGRAPHICS

2.2.1 Population

The U.S. Census Bureau decennial population counts and California State Department of Finance population estimates were used to estimate the historic population in the City. Between 1970 and 2010, the City experienced an average annual growth rate of 5.2 percent. Historical population data within the City is presented in **Table 2-1**, below.

Table 2-1
Historical Population

Year	Population	Percent Change
1970	8,353	-
1980	9,129	9%
1990	16,896	85%
2000	22,724	34%
2010	40,704	79%

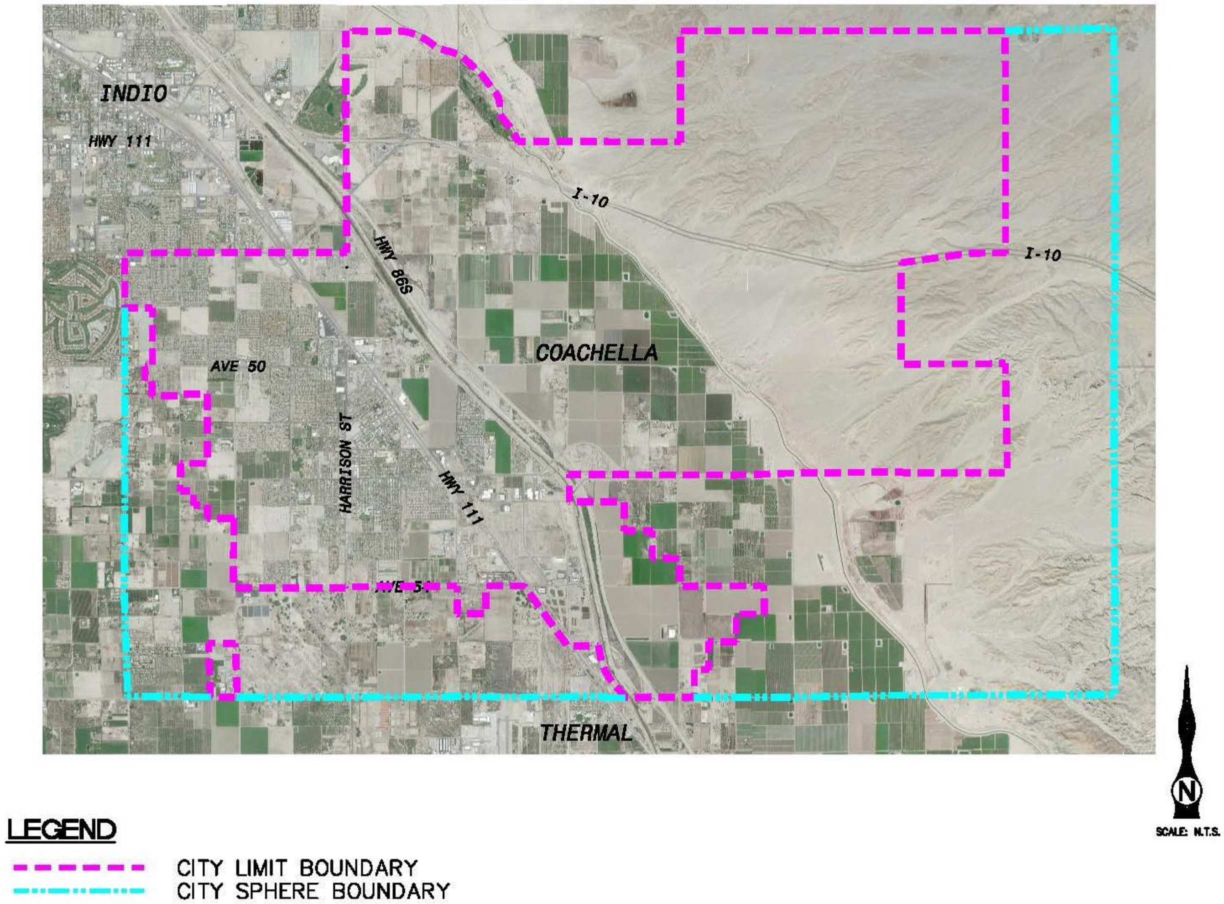
Source: Decennial Census, U.S. Census Bureau

During the late 1980's and the early 2000's, the City's population experienced large increases of 85 percent and 79 percent, respectively, which affected water demands. Both decades featured strong economic growth. Coachella Valley housing values remain below Southern California averages. These factors lead to a quick expansion in the housing market and open space areas were converted to residential land uses to meet housing demands. In recent years, the

[1] 2015 City of Coachella General Plan Update, Section 01 Introductions, p. 01-3

recession has slowed development and population growth. However, improving economic conditions will lead to improved growth conditions.

Figure 2-1
Study Area



2.2.2 Housing Units

In 2010, the City had 8,998 occupied housing units.[2] The City of Coachella has an average of 4.51 persons living within each occupied housing unit. Additionally, in 2007 there were approximately 5.8 persons on average living in mobile home units.[3] The City experienced a substantial increase in housing units, similar to population, from 2000 through 2010 with an increase of approximately 79 percent. **Table 2.2** shows historical housing units in the City.

[2] Decennial Census, U.S. Census Bureau
[3] 2015 Coachella General Plan Update, Section 3, Housing Units

Table 2-2
Housing Units

Year	Housing Units	Percent Change
1970	1,971	-
1980	2,298	17%
1990	3,830	67%
2000	5,024	31%
2010	8,998	79%

Source: Decennial Census, U.S. Census Bureau

In Coachella, 62.1% of the housing units were owner-occupied and 37.9% were renter-occupied in 2010, and 21.7% of homes are in multi-family structures. As compared to California as a whole, this was a higher proportion of owner-occupied units (56%) and lower proportion of renters (44%). Riverside County owner-occupied units are 67% with 33% renter-occupied units.[4]

2.2.3 Growth Forecasts

According to population projections provided by the California Department of Finance, and the Riverside County Transportation and Land Management Agency (RCTLMA)[5], the City's service area is expected to increase steadily in the future. The CGPU population projections are similar to the RCTLMA and vary by only 4 percent. Slow growth due to the economic downturn does not mirror the "substantial" projections provided by the State and County. However, development projects that have been on hold are returning, growth is beginning to trend positively, and with these developments, growth trends could begin to reflect County data in future years. **Table 2-3** shows the service area population increase through the year 2035 in 5 years increments based on the population data supplied in the CGPU. Full build out of the City's sphere of influence (SOI), for a total service area of approximately 53 square miles, is not anticipated until sometime after 2050.

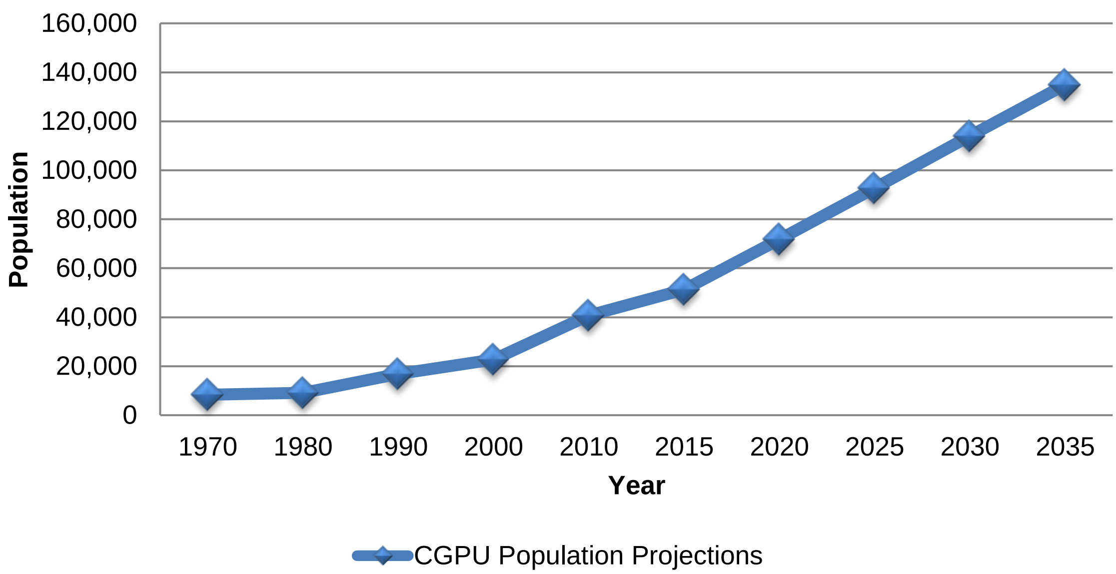
[4] 2015 Coachella General Plan Update, Section 3, Housing Units
[5] Population projections provided by the California Department of Finance, and the Riverside County Transportation and Land Management Agency (RCTLMA)

Table 2-3
Population Projections

Year	Population	Percent Change
1970	40,704	-
1980	9,129	9%
1990	16,896	85%
2000	22,724	34%
2010	40,704	79%
2015	51,287	26%
2020	71,802	40%
2025	92,624	29%
2030	113,928	23%
2035	134,890	18%

The CGPU population projections and trends from the year 1970 thru future year 2035 are also shown on **Figure 2-2**. This water system analysis assumes population growth will continue with new development thru year 2035. According to the California Department of Finance, the City's existing population as of January 1, 2014, is estimated at approximately 43,633 individuals with the overwhelming majority residing in the western section of the City. The City's existing population is lower than expected when compared to the projections provided in **Table 2-3**; however, the projections provide a conservative roadmap in planning for future growth and thus are used for this WMP.

Figure 2-2
Population Projections



2.3 LAND USE

According to the CGPU, by 2015, 18,530 acres of the City have been developed. The City's Planning Area/Sphere of Influence is 45,300 acres. Therefore, nearly 27,000 acres remain undeveloped. Of that undeveloped land, approximately 10 percent of it has been entitled for development. Existing land uses within the City consists primarily of single and multi-family homes.[6] There is a commercial/light industrial zone along the freeway corridor, agricultural zone east of Highway 86/111, and a heavier industrial zone in the southern part of the City. For this Water Master Plan, the range of land uses were divided into categories which coincide with the land uses established in the 2016 CWA Supplemental Water Supply Program and Fee Study and are as shown below:

- Single Family Residential
- Multiple Family Residential
- Commercial
- Schools / Institutional
- Industrial
- Landscape Irrigation

2.3.1 Existing and Future Land Uses

The existing and future land uses and quantities are summarized by general category in **Table 2-4**. This summary is based on 2015 CGPU, by Raimi and Associates, and the land uses as shown above. The CGPU identified the land use types throughout the City's boundary. Refer to **Figure 2-3** for General Plan Land Use Designations.

Table 2-4
Existing Land Use

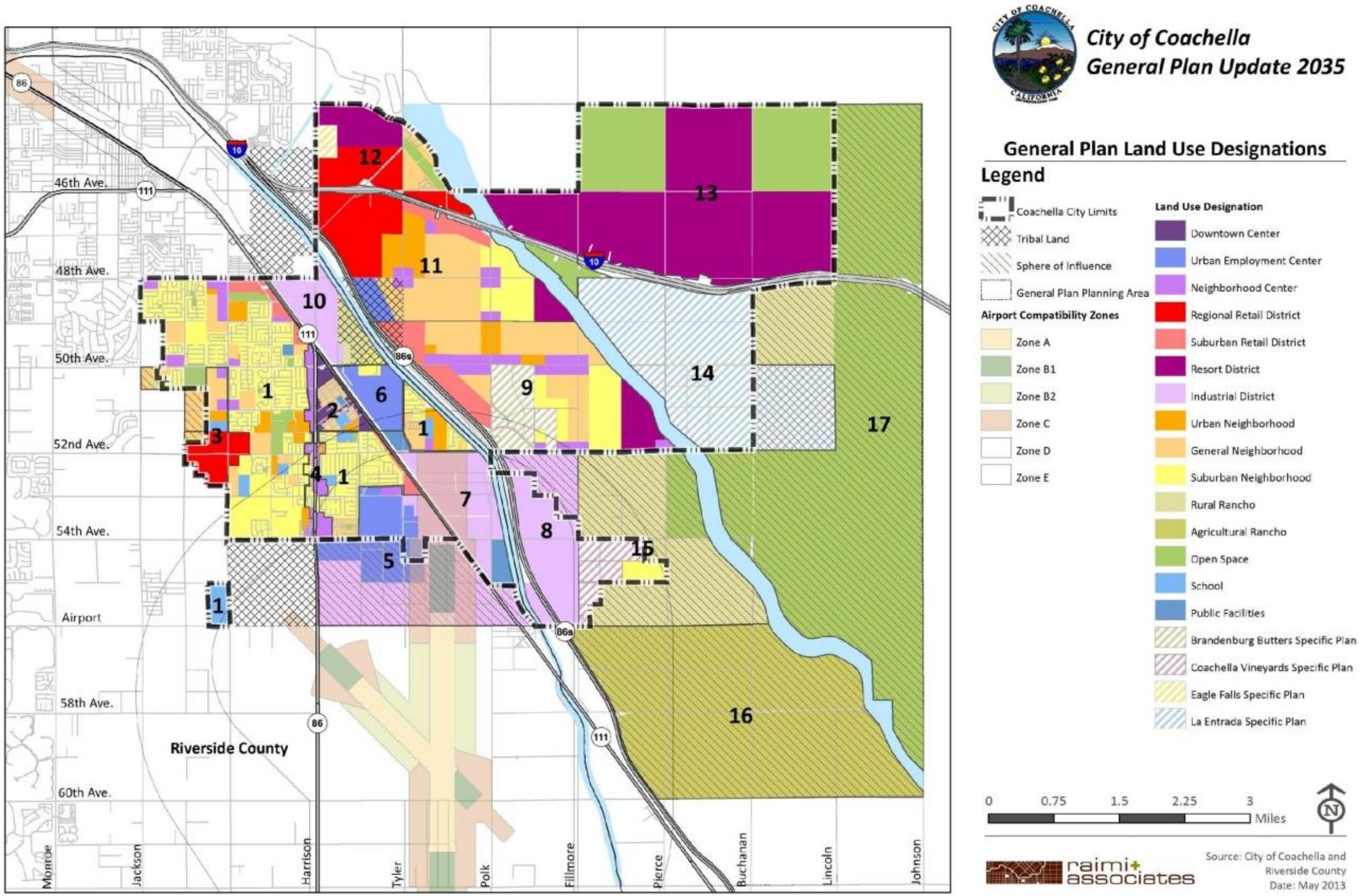
Land Use	Area (Ac.)
Single Family Residential	1,284
Multi-Family Residential	55
Commercial	239
Schools / Institutional	98
Industrial	897
Landscape Irrigation	163
Total:	**2,736**

Source: 2015 CGPU by Raimi and Associates

In summary, the primary categories of land use in the City are single family residential (SFR) at 1,284 acres (47 percent), MFR at 55 acres (2 percent), Commercial at 239 acres (9 percent), Schools/Institutional at 98 acres (4 percent), Industrial at 897 acres (33 percent), and Landscape Irrigation at 163 acres (6 percent). The four categories combined make up over 92 percent of the City's land uses in 2035.

[6] 2015 Coachella General Plan Update, Section 3, Land Use and Community Form

Figure 2-3
General Plan Land Use Designations



2.3.2 Development

The City is processing development applications for several projects (including specific plans) ranging in size from 10 residential units to mixed-use developments with over 7,500 residential units. The total number of proposed residential units associated with these projects is approximately 24,000 units.[7] These units are included in the City's SOI, which is not anticipated for full build out until after 2050. Given the changes in the housing market and other economic and demographic factors, many of the projects are undergoing amendments.[8] The following is a brief description and status of the City's larger development projects. Project locations are shown on **Figure 2-4** (Note: not all the projects shown on the exhibit are discussed below).

2.3.2.1 La Entrada

The La Entrada Specific Plan, approximately 2,200 acres on the eastern edge of the City, south of Interstate 10 and northeast of the All-American Canal, provides for approximately 7,800 residential units, 135 acres of mixed-use, elementary schools, 343.8 acres of parks, multi-purpose trails and 556.9 acres of open space. The La Entrada development has completed environmental review and is undergoing City development review. Construction is expected to follow the City's approval process. La Entrada is shown as Subarea 14 on **Figure 2-4**.

2.3.2.2 Coachella Vineyard

The Coachella Vineyard Specific Plan provides for 807 units in the southeastern area of the City. The Coachella Vineyard development is currently undeveloped and located in Subarea 8, east of State Route 86, on **Figure 2-4**.

2.3.2.3 Brandenburg Butters Specific Plan

The Brandenburg Butters project provides for 71.5 acres of commercial uses and 1,381 dwelling units. The project has been approved by City Council; however, no units have been constructed to date. This development is centrally located in Subarea 9, east of State Route 86, as shown on **Figure 2-4**.

2.3.2.4 Eagle Falls

The Eagle Falls Specific Plan resides in both Coachella (60 acres) and Indio (30 acres) on a 90-acre site. The project includes 295 units, of which 202 units will be within the City of Coachella. The Specific Plan provides for a gated golf course community and is included as part of the Cabazon Band of Mission Indians Fantasy Springs Master Plan. Rough grading has been completed for the Eagle Falls development; however, no units have been constructed to date. The Eagle Falls development is located in Subarea 12 as shown on **Figure 2-4**.

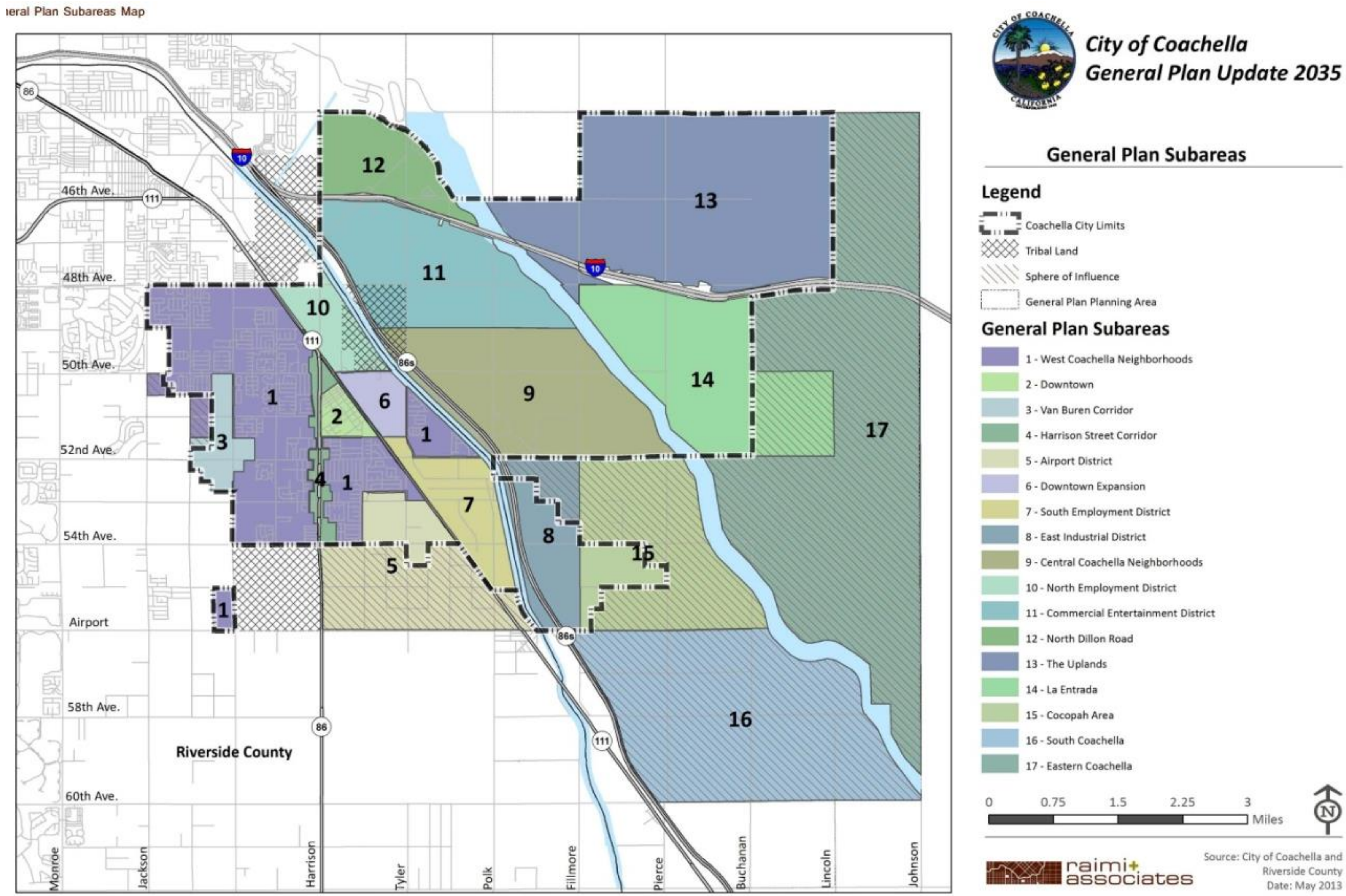
2.3.2.5 Shadow View

The Shadow View Specific Plan provides for a single-family residential community consisting of 1,600 dwelling units on 380 acres, a mixed-use commercial center on 100 acres, and a 37-acre park. The commercial site has a residential overlay that provides an option to construct up to 1,000 high-density residential units. The Shadow View development has been approved by City

[7] 2015 Coachella General Plan Update, Section 4, Specific Plans
[8] 2015 Coachella General Plan Update, Section 4, Specific Plans

Council. This development is located in western portion of Subarea 11, including some portion in Subarea 9, as shown on **Figure 2-4**.

Figure 2-4
General Plan Subareas



SECTION 3
EXISTING AND FUTURE WATER DEMANDS

Historical water production and demands, as well as the projected future water requirements for the City through year 2035 are presented herein. Water production refers to the total amount of water used within a distribution system to supply all metered existing development. In addition, production includes losses in the piping system (unaccounted-for-water losses). Unaccounted-for-water (water loss) is the difference between water produced and metered water deliveries. Metered water deliveries are also referred to as “water consumption” and “water demand” throughout this WMP. The historic water consumption establishes the average day demand for the City and sets the baseline for system modeling. Peaking factors are developed from maximum day demands for each year and applied to the average day demand to simulate a worst case scenario in the water model and determine potential system deficiencies. Water demand, the number of metered accounts, and water losses are used to determine the future water demand factor. Projected (future) water demand is estimated by multiplying land development projections presented in **Section 2** of this report by the future water demand factors. Projected future water demand will be applied to the water model to determine the necessary system improvements to serve growth in the City. The water model is further discussed in **Section 6**.

3.1 POTABLE WATER PRODUCTION AND DEMAND/CONSUMPTION

Groundwater is the only current domestic water supply source. Historic production, losses, demand, and peaking factors are discussed in the following sections:

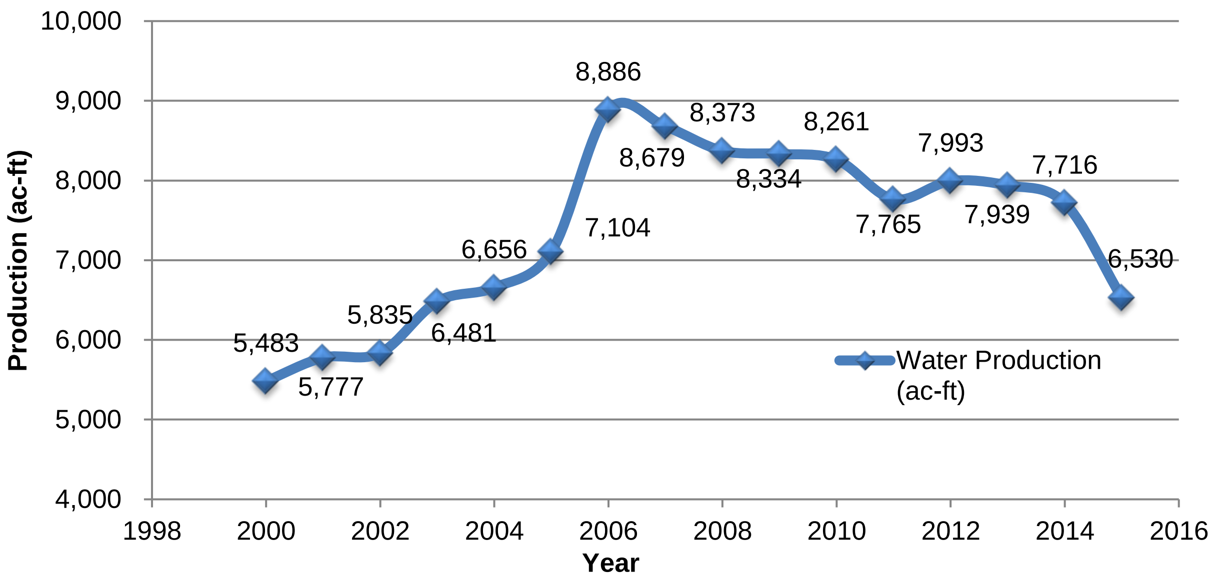
3.1.1 Historic Production

The historic production from groundwater wells and metered deliveries for the period 2000 through 2015, along with average day demand (ADD) is presented in **Table 3-1**. The City’s annual production increased from 5,483 acre-feet per year (AFY) to 8,886 AFY from 2000 to 2006, a 62 percent increase over that time period. The highest production year occurred in 2006 (8,885 AFY). A mostly decreasing production trend following the 2006 high can presumably be attributed to the slowed economic conditions that occurred. The Low production levels presented in the year 2015 compared to 2014 can be attributed to the Governor’s drought declaration and the City’s response to it. It is anticipated that demands will increase in the future due to growth, but will not reach the peak levels of 2007 for quite some time as a result of conservation efforts. The ADD is shown in both acre-feet per day (AFD) and million gallons per day (MGD). **Figure 3-1** illustrates the water production during the 16 year period.

Table 3-1
Historic Production

Year	Water Production (ac-ft)	Metered Water Deliveries (ac-ft)	Average Day Demand (ac-ft/day)	Average Day Demand (MGD)
2000	5,483	3,622	9.92	3.23
2001	5,777	2,894	7.93	2.58
2002	5,835	3,606	9.88	3.22
2003	6,481	5,067	13.88	4.52
2004	6,656	5,837	15.99	5.21
2005	7,104	4,981	13.65	4.45
2006	8,886	7,265	19.90	6.49
2007	8,679	8,453	23.16	7.55
2008	8,373	7,893	21.62	7.05
2009	8,334	8,170	22.38	7.29
2010	8,261	7,564	20.72	6.75
2011	7,765	6,795	18.62	6.07
2012	7,993	7,132	19.54	6.37
2013	7,939	7,091	19.43	6.33
2014	7,716	7,099	19.45	6.34
2015	6,530	5,911	16.19	5.28
Average:	**7,363**	**6,211**	**17.02**	**5.55**

Figure 3-1
Historic Production



3.1.2 Unaccounted-for-Water

The difference between water production and metered water deliveries (billed to customers) is defined as unaccounted-for-water, or water loss. Unaccounted-for-water is attributed to leaking pipes, faulty meters, unmetered or unauthorized water use, inaccurate meters, or other events causing water to be withdrawn from the system and not measured. Specific events that cause water loss include tank overflows, hydrant flushing, street cleaning, system flushing, and firefighting. **Table 3-2** provides a summary of unaccounted-for-water over the last 7-years, with an average water loss of 682 ac-ft or 9 percent per year. According to U.S. EPA, water loss goals for water agencies is typically around 16%.

Table 3-2
Unaccounted-For-Water

Year	Water Production (ac-ft)	Metered Water Deliveries (ac-ft)	System Losses (ac-ft)	System Losses (%)
2009	8,334	8,169	164	2%
2010	8,261	7,565	696	8%
2011	7,764	6,795	970	12%
2012	7,993	7,132	860	11%
2013	7,939	7,091	848	11%
2014	7,716	7,099	617	8%
2015	6,530	5,911	619	9%
Average:	**7,791**	**7,109**	**682**	**9%**

Unaccounted-for-water can be further reduced by installing temporary water meters for construction water and when flushing hydrants, which typically represent two of the larger types of unaccounted-for-water. However, 9% will be used to estimate future water losses.

3.1.3 Existing Demand by Customer Class

Historic water consumption (metered deliveries) information was presented in **Table 3-1**. The total water consumption can be further defined by the following billing/customer classifications:

- Single-Family Residential (SFR)
- Multi-Family Residential (MFR)
- Commercial
- Schools/Institutional
- Industrial
- Landscape Irrigation

These billing/customer classifications are later considered when determining the Future Annual Consumption Factors in **Section 3.2.3**.

3.1.4 Peaking Factors

Average day demand (ADD) is determined using total annual metered water deliveries and dividing by the number of days in the year, as presented in **Table 3-1**. ADD is used as a basis for estimating maximum day and peak hour demands (MDD and PHD). Inputting ADD into the system model will determine distribution system pressures and pipeline velocities during average demand conditions. Maximum day demand (MDD) is the maximum quantity of water used on any single day in a given year. MDD is used to evaluate water supply systems' capacities including data, pumping stations, and treatment facility capacities. Applying MDD to the system model will determine distribution system pressures and velocities during a peak day demand condition, such as a hot summer day. The City's water production facilities must be adequate to supply water at MDD. Peak hour demand (PHD) is the peak rate at which water is required during any one hour of the year. During PHD, minimum system pressures are experienced. The PHD condition is used to determine the size and location of distribution facilities. The above described peaking factors are based on daily production and billing data to account for the varying and/or peaking seasonal and hourly demand by water usage type. The historic peaking factors for years 2009 thru 2014 are presented in **Table 3-3**.

Table 3-3
Historic Peaking Factors

Year	ADD (MGD)	MDD (MGD)	MDD Peaking Factor	PHD (MGD)	PHD Peaking Factor
2009	7.29	11.03	1.5	N/A	N/A
2010	6.75	11.94	1.8	N/A	N/A
2011	6.07	12.57	2.1	20.41	3.4
2012	6.37	12.94	2.0	18.72	2.9
2013	6.33	12.91	2.0	19.08	3.0
2014	6.34	14.05	2.2	19.15	3.0
Average:	**6.52**	**12.57**	**1.9**	**19.34**	**3.1**

Note: 2015 data excluded from calculations due to lower than average factors in response to the State drought mandated conservation efforts.

In 2015, drought mandated water conservation efforts produced lower factors than in previous years and were, therefore, excluded from the average calculation. The average MDD and PHD peaking factors over the 2009 thru 2014 period are 1.9 and 3.1 respectively, and are utilized throughout the rest of this plan.

3.2 WATER DEMAND FACTORS

3.2.1 Existing Demand Factors

Water demand factors are determined by relating customer account billing data (metered data) for a particular land use type and the corresponding developed area. Using billing records, land uses, and historical production, water consumption amounts are distributed among land use categories and Annual Consumption Factors (ACF), expressed as acre-feet per acre, for each category are determined. Data is presented on **Table 3-4: Historical Annual Consumption Factors**.

Table 3-4
Historical Annual Consumption Factors

Land Use	FY 12/13 ACF (ac-ft/ac/yr)	FY 13/14 ACF (ac-ft/ac/yr)	FY 14/15 ACF (ac-ft/ac/yr)	Average ACF (ac-ft/ac/yr)
Single Family Residential	2.94	2.86	2.73	2.84
Multi-Family Residential	3.99	4.10	3.77	3.95
Commercial	1.54	2.29	2.63	2.15
Schools / Institutional	2.33	2.24	2.26	2.28
Industrial	0.92	1.01	0.97	0.97
Landscape Irrigation	2.46	2.50	2.80	2.59

Using the existing ACF's presented above and existing land use areas presented in the CGPU, existing 2016 annual consumption for the system can be estimated. The results are detailed in **Table 3-5.** It is estimated that 2016's consumption of 5,896 acre-feet will be 15 acre-feet less than 2015's consumption of 5,911 acre-feet.

Table 3-5
Existing Annual Consumption Factors

Master Plan Land Use	Area (ac)	Annual Consumption Factor (ac-ft/ac/yr)	Existing Annual Consumption (ac-ft)
Single Family Residential	1,284	2.84	3,652
Multi-Family Residential	55	3.95	217
Commercial	239	2.15	514
Schools / Institutional	98	2.28	223
Industrial	897	0.97	867
Landscape Irrigation	163	2.59	422
Total:	**2,736**		**5,896**

3.2.2 Conservation Factor

The Water Conservation Bill of 2009 (SBX7-7) set forth requirements for each water supplier to include baseline daily per capita water use, urban water use target, interim urban water use target, and compliance daily per capita water use in their Urban Water Management Plan (UWMP). The goal of SBX7-7 is to achieve a 20-percent reduction in water use per capita, statewide, by 2020. The City's daily per capita water use has consistently exceeded the State 20-percent reduction goals for the Colorado River region for the past 7-years; as such, the City is only required by SBX7-7 to meet a 5-percent reduction in daily per capita water use. Therefore, part of the reduction in future demand factors includes a 5-percent reduction to account for these on-going State conservation goals. The City continues to implement various water conservation measures to maintain compliance with State goals, discussed further in Section 4.10 Water Conservation.

3.2.3 Future Demand Factors

Future water demand factors are presented in **Table 3-6: Future Annual Consumption Factors**.[9] Using ACF's presented above in **Table 3-4: Historical Annual Consumption Factors**, together with future land use densities and water conservation measures (e.g. state mandated reductions, limited use of turf areas, desert-friendly landscaping, high efficiency irrigation system, water efficient household fixtures, etc.) annual consumption factors have been estimated for growth.

Table 3-6
Future Annual Consumption Factors

Land Use	ACF (ac-ft/ac/yr)
Single Family Residential	2.85
Multi-Family Residential	2.69
Commercial	1.78
Schools / Institutional	1.32
Industrial	0.96
Landscape Irrigation	1.80

3.3 PROJECTED WATER DEMAND

Projected (future) water demand is estimated by multiplying projected land use areas by water consumption factors established in **Section 3.2.3**. **Table 3-7** summarizes the anticipated future water demands in 2020, 2025, 2030 and 2035. In 2035, water demand is estimated to total 16,259 AFY.

[9] CWA Supplemental Water Supply Program and Fee Study.

Table 3-7
System Future Water Demands

Total System	2016 Total Demand (ac-ft)	2020 Total Demand (ac-ft)	2025 Total Demand (ac-ft)	2030 Total Demand (ac-ft)	2035 Total Demand (ac-ft)
Single Family Residential	3,652	5,188	6,724	8,260	9,796
Multi-Family Residential	217	588	958	1,329	1,699
Commercial	514	901	1,287	1,674	2,061
Schools / Institutional	223	297	370	444	517
Industrial	867	910	953	996	1,038
Landscape Irrigation	422	603	785	966	1,147
Total:	**5,896**	**8,487**	**11,077**	**13,668**	**16,259**

3.3.1 Planning Subareas and 2035 Projected Growth

The City was divided into 17 subareas for planning purposes in the CGPU. Each subarea is unique and distinct with specific policies that guide future development.[10] As a result of varying levels of existing development, each subarea has its own amount of acreage that has already been developed and remaining acreage that will be developed in the future. Furthermore, each subarea has an applied percentage per land use that will be developed by the year 2035. For example, Subarea 1 has 716 acres of future build out area. Out of those 715 acres, 70% of residential land use and 30% of non-residential land use will be developed by the year 2035.[11] **Table 3-8** summarizes each subarea's built out acreage and 2035 land use percentages.

La Entrada project is one of the future developments mentioned above. The Project area, located in Subarea 14, consists of vacant land enclosed by Interstate 10 Freeway to the north, and the All American Canal to the west. Use of the property for the La Entrada Project would entail approximately 7,800 dwelling units expected over 2,200 acres of property. La Entrada will approximately generate a future water demand of 4,042.1 gpm. When compared to this Master Plan Subarea 14's water demand of 3,197.3 gpm (5158 AF), the demand is much greater. This is due to La Entrada planners using historical annual consumption factors, **Table 3-4**, rather than the consumption factors determined in **Table 3-5**.

[10] 2015 Coachella General Plan Update, Section 4, Subarea Descriptions
[11] 2015 Coachella General Plan Update, Section 4, Organization of This Element

Table 3-8
Subarea Built-Out Area and Percentages

Subarea	Future Build Out Area (Ac.)	2035 Residential % Max	2035 Non-Residential % Max
1	716	70	50
2	23	40	50
3	207	40	20
4	50	50	50
5	830	0	15
6	141	40	20
7	239	0	30
8	541	0	10
9	1,481	50	35
10	159	20	25
11	1,150	50	30
12	418	45	20
13	418	10	5
14	1,516	100	100
15	1,738	10	5
16	23	5	100
17	526	0	0

3.3.2 Added Demand

In order to calculate projected growth, added demands were calculated and applied to each of the subareas aforementioned. Distribution percentages of future build-out areas were applied to each land use category.

Using Subarea 1 as an example; **Table 3-8**, shows that 70% of residential and 50% of non-residential land use of 716 acres will be built out by the year 2035 totaling a net new build-out area. ACFs, from **Table 3-5**, were multiplied to each land use 2035 growth area to determine a 2035 added demand. **Table 3-9** lists 2035 added demand for Subarea 1.2035 Projected Growth and Added Demand Tables for all 17 Subareas can be found in **Appendix B**.

Table 3-9
2035 Projected Growth and Added Demand

Sub Area 1	Distribution (%)	Net New Build Out Area (Ac.)	Percent of Max Capacity (%)	2035 Growth (Ac.)	Annual Consumption Factor (ac-ft/ac/yr)	2035 Added Demand (ac-ft)
Single Family Residential	40%	286	70%	200	2.85	571
Multi-Family Residential	15%	107	70%	75	2.69	202
Commercial	33%	236	50%	118	1.78	210
Schools / Institutional	6%	43	50%	21	1.32	28
Industrial	0%	0	50%	0	0.96	0
Landscape Irrigation	6%	43	50%	21	1.80	39
Total:	**100%**	**716**		**437**		**1050**

3.3.3 5-Year Increments Added Demands

The 2035 added demands shown in **Table 3-7** were broken down by 5 year increment. The growth trends along these 5 year increments were calculated to align with the CGPU projections. Still using Subarea 1 as an example; **Table 3-10** shows Subarea 1's added demands broken down by 5-year increments thru the year 2035. Projected Demand Added by Subarea Tables for all 17 Subareas can be found in **Appendix B**.

Table 3-10
Projected Demand Added by Subarea

Sub Area 1	2020		2025		2030		2035	
	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)
Single Family Residential	143	88.4	285	176.9	428	265.3	571	353.8
Multi-Family Residential	51	31.3	101	62.7	152	94.0	202	125.4
Commercial	53	32.6	105	65.2	158	97.8	210	130.4
Schools / Institutional	7	4.4	14	8.8	21	13.2	28	17.6
Industrial	0	0.0	0	0.0	0	0.0	0	0.0
Landscape Irrigation	10	6.0	19	12.0	29	18.0	39	24.0
Total:	**263**	**162.8**	**525**	**325.5**	**788**	**488.3**	**1050**	**651.1**

3.3.4 Projected Total Demand by Zone

The City's existing distribution system is divided into two pressure zones, the 150 Zone and the Low Zone, further described in **Section 5**. Typically, pressure zones are established by the high water level (HWL) in reservoirs serving the system. The 150 Zone is established by the 1.5 MG reservoir (Dillon Rd. Reservoir) located at the northerly end of the system at 146 feet above mean sea level (msl). However, the Low Zone is established by specific operational discharge pressure set points at each well and/or booster, further defined in Section 5. While the method of setting the pressure zone in the City varies, the result provides an acceptable pressure range, between approximately 40 psi to 90 psi, throughout the zone. As elevation vary throughout a pressure zone, there must be adequate pressure to deliver the water, hence the acceptable pressure range. For this master plan, future pressure zones were established by determining growth areas, defining ground surface elevation ranges, and setting a HWL in future reservoirs that will serving the system with acceptable pressure. **Table 3-11** summarizes the projected total demands by zone showing the Low Zone, 150 Zone, 150+ Zone and the Total System.

Table 3-11
Projected Total Demand by Zone

Low Zone	2016		2020		2025		2030		2035	
	Total Demand (ac-ft)	Total Demand (gpm)	Total Demand (ac-ft)	Total Demand (gpm)	Total Demand (ac-ft)	Total Demand (gpm)	Total Demand (ac-ft)	Total Demand (gpm)	Total Demand (ac-ft)	Total Demand (gpm)
Single Family Residential	3,610	2,237.9	3,790	2,349.8	3,971	2,461.7	4,152	2,573.6	4,332	2,685.6
Multi-Family Residential	149	92.5	231	143.2	313	193.9	394	244.5	476	295.2
Commercial	323	200.2	403	250.1	484	299.9	564	349.8	645	399.6
Schools / Institutional	223	138.4	235	145.7	247	153.0	259	160.3	270	167.6
Industrial	867	537.5	898	556.4	928	575.3	959	594.2	989	613.1
Landscape Irrigation	422	261.5	439	272.1	456	282.7	473	293.3	490	303.9
Total:	**5,594**	**3,468.1**	**5,996**	**3,717.3**	**6,398**	**3,966.5**	**6,801**	**4,215.8**	**7,203**	**4,465.0**

Table 3-11 (continued)
Projected Total Demand by Zone

150 Zone	2016		2020		2025		2030		2035	
	Total Demand (ac-ft)	Total Demand (gpm)	Total Demand (ac-ft)	Total Demand (gpm)	Total Demand (ac-ft)	Total Demand (gpm)	Total Demand (ac-ft)	Total Demand (gpm)	Total Demand (ac-ft)	Total Demand (gpm)
Single Family Residential	42	26.2	552	342.3	1,062	658.4	1,572	974.5	2,082	1,290.6
Multi-Family Residential	68	42.2	214	132.7	360	223.3	506	313.9	652	404.5
Commercial	191	118.3	352	218.5	514	318.7	676	418.9	837	519.1
Schools / Institutional	-	-	19	12.0	39	24.0	58	36.0	77	48.0
Industrial	-	-	12	7.6	25	15.3	37	22.9	49	30.6
Landscape Irrigation	-	-	30	18.7	60	37.4	90	56.1	121	74.8
Total:	**301**	**186.7**	**1,181**	**731.9**	**2,060**	**1,277.1**	**2,940**	**1,822.3**	**3,819**	**2,367.5**

150+ Zone	2016		2020		2025		2030		2035	
	Total Demand (ac-ft)	Total Demand (gpm)	Total Demand (ac-ft)	Total Demand (gpm)	Total Demand (ac-ft)	Total Demand (gpm)	Total Demand (ac-ft)	Total Demand (gpm)	Total Demand (ac-ft)	Total Demand (gpm)
Single Family Residential	-	-	846	524.2	1,691	1,048.4	2,537	1,572.6	3,382	2,096.7
Multi-Family Residential	-	-	143	88.4	285	176.8	428	265.1	570	353.5
Commercial	-	-	145	89.7	290	179.5	434	269.2	579	359.0
Schools / Institutional	-	-	42	26.3	85	52.6	127	78.8	170	105.1
Industrial	-	-	-	-	-	-	-	-	-	-
Landscape Irrigation	-	-	134	83.1	268	166.3	402	249.4	536	332.6
Total:	**-**	**-**	**1,309**	**811.7**	**2,619**	**1,623.5**	**3,928**	**2,435.2**	**5,238**	**3,246.9**

Table 3-11 (continued)
Projected Total Demand by Zone

Total System	2016		2020		2025		2030		2035	
	Total Demand (ac-ft)	Total Demand (gpm)	Total Demand (ac-ft)	Total Demand (gpm)	Total Demand (ac-ft)	Total Demand (gpm)	Total Demand (ac-ft)	Total Demand (gpm)	Total Demand (ac-ft)	Total Demand (gpm)
Single Family Residential	3,652	2,264.1	5,188	3,216.3	6,724	4,168.5	8,260	5,120.7	9,796	6,072.9
Multi-Family Residential	217	134.7	588	364.3	958	593.9	1,329	823.6	1,699	1,053.2
Commercial	514	318.5	901	558.3	1,287	798.1	1,674	1,037.9	2,061	1,277.6
Schools / Institutional	223	138.4	297	183.9	370	229.5	444	275.1	517	320.7
Industrial	867	537.5	910	564.1	953	590.6	996	617.2	1,038	643.7
Landscape Irrigation	422	261.5	603	374.0	785	486.4	966	598.9	1,147	711.3
Total:	**5,896**	**3,654.8**	**8,487**	**5,260.9**	**11,077**	**6,867.1**	**13,668**	**8,473.3**	**16,259**	**10,079.4**

SECTION 4
WATER SUPPLY

The City's existing and future water supply sources are presented herein. Water supplies to meet the projected demands through 2035 are identified. Several water supply sources are presented and analyzed to identify a water portfolio that best meets the City's water supply requirements.

The analysis herein includes a water quality evaluation and water conservation considerations. Future water supply needs are determined by comparing the available water supplies with the water demands under existing and future demand conditions. Future water supply sources outlines two categories of future water sources: definite future water sources that will be available to the City in the near future and possible future water sources that may be developed.

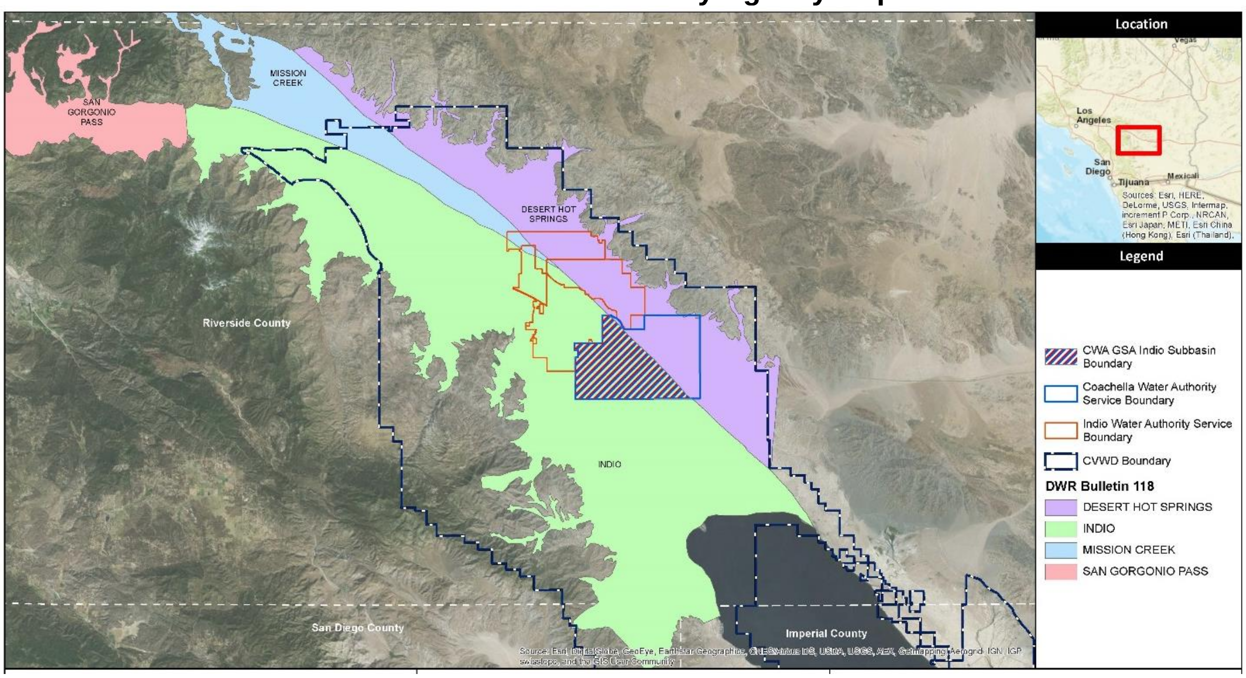
4.1 EXISTING WATER SUPPLIES

CWA produces all of its water supplies from the Coachella Valley Groundwater Basin, specifically, the East Whitewater River Subbasin, which is continuously replenished at the local and regional level pursuant to a variety of water supply projects and programs. The East Whitewater River Subbasin is regionally managed by CVWD, CWA, and IWA. CVWD has statutory authority to replenish local groundwater supplies and collect assessments necessary to support a groundwater replenishment program as provided in the County Water District Law. As indicated in CVWD's 2015 UWMP and various other Coachella Valley water supply planning documents (e.g. CVWD 2010 Coachella Valley WMP and CVWD 2011 Subsequent Program Environmental Impact Report (SPEIR)), the Coachella Valley groundwater basin area serves as an expansive conjunctive use resource that is capable of ensuring a sufficient and sustainable water supply to serve existing uses and projected growth during normal, single-dry and multiple-dry years over an extended planning horizon, currently established as the year 2045. Not only does the basin contain vast reserves of local groundwater (approximately 30 million AF at 1,000 foot depth), it has substantial available storage space that has been utilized and will continue to be utilized to store millions of acre-feet of supplemental supplies that become available during normal and above-normal years. Those surplus supplies are recharged to the basin for later use during dry periods.

In 2002, CVWD prepared a Water Management Plan to provide a road map for meeting future water demands throughout Lower Coachella Valley, including the City. It includes recommendations for enhanced water conservation, additional imported supplies, source substitution, and groundwater recharge elements. CVWD successfully implemented an urban water conservation program, acquired additional SWP supplies, constructed the initial phase of the Mid-Valley Pipeline, and constructed the Thomas E. Levy Groundwater Replenishment Facility. CVWD updated the Plan in 2010. The new 2010 CVWMP recommends greater conservation (agricultural conservation, additional urban conservation, and golf course conservation), supply development (acquisition of additional imported water supplies, recycled water use, and desalinated drain water), groundwater recharge program enhancements, and source substitution programs. A number of new projects and programs are recommended for implementation.

In 2014, the State Legislature approved and the Governor signed into law the Sustainable Ground Water Management Act (SGMA). SGMA consists of three bills that commits the State to locally controlled, sustainable groundwater management and provide local tools and authority for local agencies to achieve that sustainability goal over a 20-year implementation period. SGMA requires the groundwater resources be managed sustainably for longer term reliability and multiple economic, social, and environmental benefits for current and future beneficial uses. SGMA and its implementation will advance investment in water conservation, water recycling, expanded water storage, safe drinking water, wetlands and watershed restoration. SGMA implementation will include three basic steps: 1) form a groundwater sustainability agency, 2) adopt a groundwater sustainability plan, and 3) fully implement the plan over the next 20 years achieving the sustainability goals. Coachella Water Authority is exclusive GSA within its jurisdictional boundary. See **Figure 4-1**.

Figure 4-1
CWA Groundwater Sustainability Agency Map



4.2 GROUNDWATER

Groundwater[12] is the principal source of municipal water supply in the Coachella Valley. The main groundwater source for the entire valley is the Coachella Valley Groundwater Basin, Indio Subbasin, DWR Basin Number 7-21-01, also known as the Whitewater River Subbasin, as shown in **Figure 4-2**. The east (lower) portion of the Whitewater River Subbasin is shared by CVWD, Indio Water Authority, and Coachella Water Authority (City), together with numerous private groundwater producers.

Additional groundwater basin information including a description of the basin, the rights of the public water system (PWS) to use the basin, the overdraft status of the basin, any past or planned overdraft mitigation efforts, and historical use of the basin by the PWS, projected use of the basin by this WMP, and a sufficiency analysis of the basin that is to be utilized to supply are presented herein.

4.2.1 Basin Description

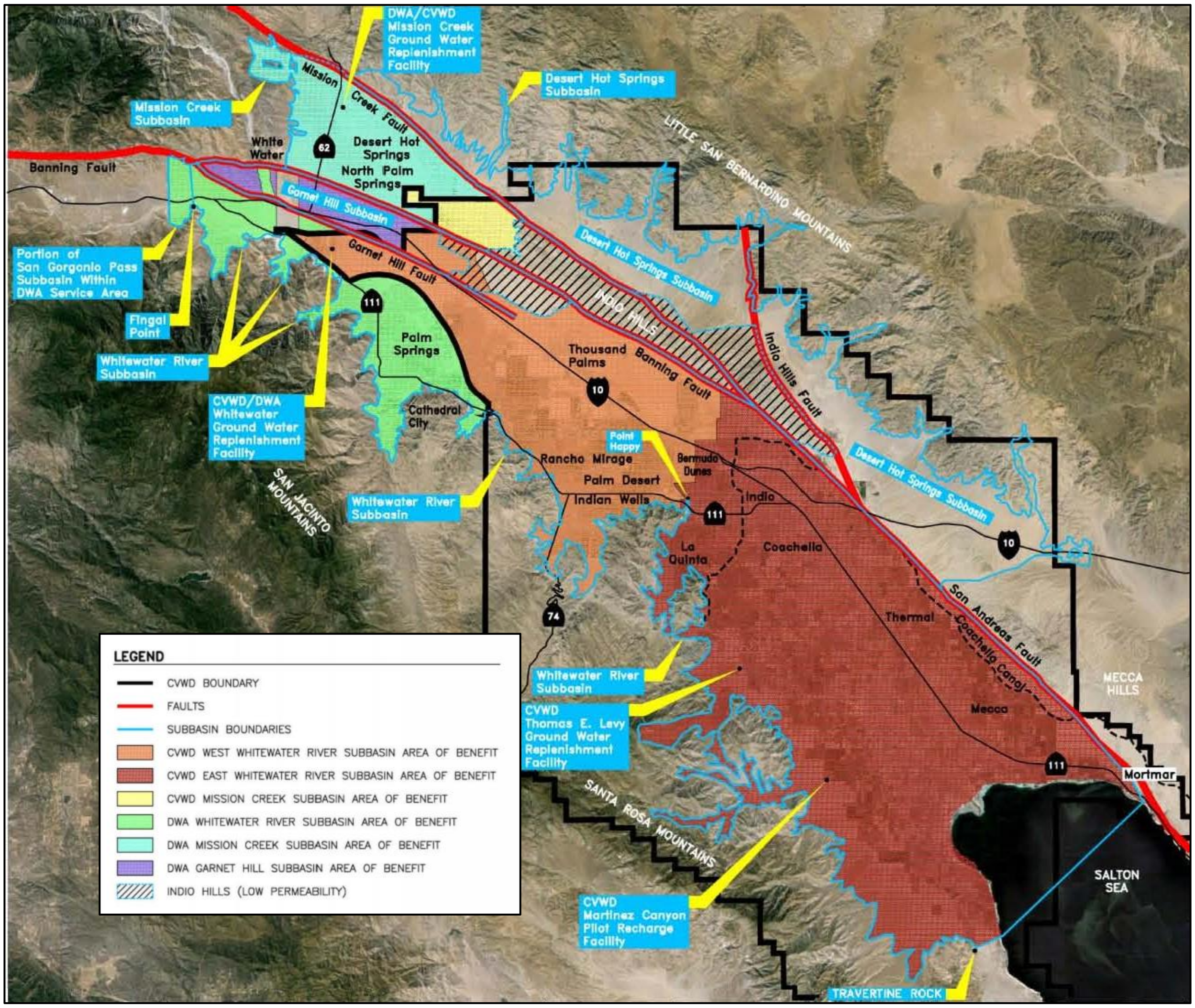
The Whitewater River Subbasin underlies a major portion of the valley floor and encompasses approximately 400 square miles. Beginning approximately one mile west of the junction of State Highway 111 and Interstate 10, the Subbasin extends southeast approximately 70 miles to the Salton Sea. It is bordered on the southwest by the Santa Rosa and San Jacinto Mountains and is separated from other basins by the Garnet Hill and San Andreas faults.[13]

4.2.2 Public Water System Use Rights

As noted by DWR Bulletin 118, the basin is not adjudicated. As such, there are no specifically established limitations on the rights of the City to withdraw water. Bulletin 118 notes that groundwater management in the basin is a local responsibility and will remain local provided Coachella Valley Water Agencies comply with SGMA. Therefore, decisions regarding basin conditions and controlled overdraft are the responsibility of local agencies. With specific regard to the Whitewater River Subbasin and surrounding areas, CVWD, one of the region's SWP contractors, developed the 2010 CVWMP for the long-term management of groundwater resources. As detailed in the Plan, CVWD has determined that the total projected water supplies available to the basin area, including the City and its SOI, during normal, single-dry and multiple-dry periods throughout the year 2045 are sufficient to meet the needs of existing uses and projected growth.[14]

[12] The term groundwater refers to local groundwater and imported, recycled and other supplies that are continuously recharged to the basin and extracted from groundwater wells.
[13] Engineer's Report on Water Supply and Replenishment Assessment 2016-2017
Mission Creek, West Whitewater River, and East Whitewater River Subbasin Areas of Benefit.
[14] 2010 CVWMP, pp. 7-2 to 7-12; 2011 SPEIR, pp. 3-4 to 3-9.

Figure 4-2
Groundwater Basins



Moreover, the potential environmental effects of implementing the projects and programs contained in the 2010 CVWMP have been analyzed in accordance with CEQA, and the determination has been made that implementation of the 2010 CVWMP will have a beneficial effect on groundwater resources[15]. CVWD, with assistance from other water agencies, including the City's Coachella Water Authority, have been implementing water supply projects, programs and related management actions of the CVWMPs since 2002. A notable requirement under the CVWMP is that the City must pay a replenishment assessment charge (RAC) for each acre-foot of groundwater produced. RAC is used to replenish the groundwater aquifer with imported water supplies.[16]

In addition to the CVWMP process, in February 2014 the Coachella Valley Integrated Regional Water Management Plan (IRWMP) was developed to promote a regional approach for addressing water management issues and to enhance the region's eligibility for state funding opportunities for water resource projects. The IRWMP was created by the Coachella Valley Regional Water Management Group (CVRWMG), which is a partnership of CWA, CVWD, DWA, Indio Water Agency, Valley Sanitary District, and the Mission Springs Water District.

4.2.3 Status of Groundwater Basin

As noted above, the 2010 CVWMP Update and 2011 SPEIR conclude that the total projected water supplies available to the basin area, including the City and its SOI, during normal, single-dry and multiple-dry periods throughout the year 2045 are sufficient to meet the needs of existing uses and projected growth[17]. Along with those conclusions, the 2010 CVWMP states that the demand for groundwater in the Basin has annually exceeded the natural recharge of the groundwater basin and that condition has caused groundwater levels to decrease in portions of the East (Lower) Valley and has raised concerns about water quality degradation and land subsidence. If left unaddressed and unmanaged, such groundwater conditions could result in increased groundwater pumping costs, continued decline of groundwater levels, and water quality degradation in the Basin. Because of the difficult nature of quantifying overdraft, CVWD has based its assessment of the issue on the change in freshwater storage in the Basin. For 2014, the latest report available, there was a gain in storage which was opposite from the losses experienced in previous years and was estimated at 3,636 ac-ft.[18] Importantly, and as noted throughout the water supply planning documents that support its analysis, Basin conditions have been and will continue to be fully addressed and comprehensively managed. Consistent with the conclusions of CVWD's 2010 CVWMP Update and 2011 SPEIR, it is expected that continued implementation of CVWMP recommendations will improve overdraft conditions and have a beneficial effect on the groundwater basin[19].

[15] 2010 CVWMP, pp. 7-18 to 7-31; 2011 SPEIR, pp. 3-23 to 3-33.
[16] CVWD Engineers Report on Water Supply and Replenishment Assessment, East (Lower) Whitewater River Subbasin Area of Benefit, 2014-2015.
[17] 2010 CVWMP, pp. 7-18 to 7-31; 2011 SPEIR, pp. 3-23 to 3-33.
[18] CVWD Engineers Report on Water Supply and Replenishment Assessment, Lower Whitewater River Subbasin Area of Benefit, 2014-2015.
[19] 2010 CVWMP, pp. 7-18 to 7-31; 2011 SPEIR, pp. 3-23 to 3-33.

4.2.4 Groundwater Management Efforts

As presented in **Section 4.1** above, CVWD continues to successfully implement an urban water conservation program, has acquired additional SWP supplies, and has constructed the Thomas E. Levy Groundwater Replenishment Facility, among other water management programs and actions. The 2010 CVWMP Update recommends greater conservation (agricultural conservation, additional urban conservation, and golf course conservation), supply development (acquisition of additional imported water supplies, recycled water use, and desalinated drain water), groundwater recharge program enhancements, and source substitution programs as means of improving basin conditions while ensuring a sufficient and sustainable source of water supply for existing and projected uses throughout the region.[20].

4.2.5 Historical Use of the Basin

The City has eight groundwater production wells (six active, two inactive). In 2013, as shown on **Table 3-1, Historic Production**, the City produced approximately 7,939 ac-ft of groundwater. The operating conditions and controls for the wells vary, with some wells operating year-round and some operate seasonally. The system is controlled by a Supervisory Control and Data Acquisition (SCADA) system to ensure maximum efficiency of groundwater resources. The City presently uses approximately five percent of the total volume of water withdrawn from the East (Lower) Whitewater River Subbasin each year, see **Section 3.1**, **Table 3-1** for the City's annual groundwater production in the Subbasin over the past 14 years. **Table 4-1** presents estimated total groundwater production in the Subbasin over the past 15 years.

As indicated herein, substantial regional efforts are ongoing, led by CVWD, to recharge the Whitewater River Subbasin with imported water together with other local supplies. Those efforts are made possible in large part because of CVWD's role as SWP contractor. However, the Coachella Valley does not have a direct physical connection to the SWP system. Therefore, CVWD has entered an exchange agreement with the Metropolitan Water District of Southern California (MWD), whereby MWD delivers Colorado River supplies to CVWD in exchange for like amounts of CVWD's SWP supplies. The Colorado River deliveries are made through MWD's Colorado River Aqueduct, which crosses through the Coachella Valley. Among other things, the exchange agreement allows for advanced deliveries and storage of Colorado River water in the Coachella Basin, thereby providing flexible and efficient water management opportunities. The large storage capacity of the Basin and the large volume of water in storage allow CVWD and other local water providers, such as the City, to pump needed supplies from the Basin during dry years, where large amounts of water can be recharged in normal and above normal years.

[20] In addition to the information and analyses presented in this WMP, other descriptions of the projects and programs within the City and CVWD service areas are set forth in the City 2010 UWMP, CVWD 2010 UWMP, CVWD 2010 CVWMP and 2011 SPEIR.

Table 4-1
Estimated Groundwater Production
East (Lower) Whitewater River Subbasin[21]

Year	Acre-feet[1]
1999	168,300
2002	166,700
2003	199,800
2004	172,300
2005	172,000
2006	172,000
2007	172,000
2008	172,000
2009	160,000
2010	150,000
2011	145,000[3]
2012	120,064
2013	119,194
2014	123,465
2015	113,706

4.2.6 Projected Groundwater Use and Sufficiency of the Basin

As presented in **Section 3**, total water demand for the year 2015 was 6,530 acre-feet per year (AFY). The projected water demand for the City is estimated at approximately 26,967AFY in 2035. For additional information regarding projected demand, please refer to **Section 3.4**.

Substantial evidence demonstrates that the groundwater and recharged groundwater supplies of the Coachella Valley Groundwater Basin are and will continue to be sufficient during normal, single-dry and multiple dry years over the 20-year projection and beyond to meet the projected demand associated with the future development.[22]

4.3 WATER AGREEMENTS

In September 2009, CVWD and the City signed a Memorandum of Understanding (2009 MOU) to assist in ensuring a sufficient and reliable water supply for development projects within the City and a major portion of its sphere of influence (SOI) in a manner consistent with CVWD's 2010 CVWMP Update, and as amended from time to time. Under the terms of the 2009 MOU, various means are identified by which the City can provide for the supply of supplemental water to offset the demands associated with development projects approved by the City. For instance, under the 2009 MOU the City can participate in funding CVWD's acquisition of supplemental water supplies to offset demands associated with newly approved projects within the City's SOI.[23]

[21] Engineer's Report on Water Supply and Replenishment Assessment, East (Lower) Whitewater River Subbasin Area of Benefit 2016-2017, Table VII-1.
[22] City's 2010 UWMP, CVWD's 2010 CVWMP Update and CVWD's 2011 SPEIR
[23] CVWD 2010 CVWMP Update, p. 3-3

In February 2013, CVWD and the City signed a Memorandum of Understanding (2013 MOU) regarding implementation of the 2009 MOU. Among other things, the 2013 MOU further specifies the mechanism by which the City can finance and acquire supplemental water supplies from CVWD to meet the projected demands of new development projects, and establishes a process for preparing and adopting Water Supply Assessments and Written Verifications for such projects. The 2013 MOU expressly acknowledges and applies future development projects, and the supplemental water supplies referred to in the 2013 MOU have been considered by CVWD as part of the 2010 CVWMP Update and related 2011 SPEIR.

4.4 COLORADO RIVER WATER

Colorado River supplies are important to the Coachella Valley for two primary reasons. First, a substantial portion of California's share of Colorado River water is allocated directly to CVWD. Second, much of the replenishment supplies used in the Valley come from MWD's allocation of Colorado River water, via the exchange agreement for SWP supplies as discussed above.

Colorado River water has been a major source of supply for the Coachella Valley since 1949 with the completion of the Coachella Canal.[24] The Colorado River is managed and operated in accordance with the *Law of the River,* the collection of interstate compacts, federal and state legislation, various agreements and contracts, an international treaty, a U.S. Supreme Court decree, and federal administrative actions that govern the rights to use of Colorado River water within the seven Colorado River Basin states. The *Colorado River Compact*, signed in 1922, apportioned the waters of the Colorado River Basin between the Upper Colorado River Basin (Colorado, Wyoming, Utah, and New Mexico) and the Lower Basin (Nevada, Arizona, and California). The Colorado River Compact allocates 15 million AFY of Colorado River water: 7.5 million AFY to the Upper Basin and 7.5 million AFY to the Lower Basin, plus up to 1 million AFY of surplus supplies. The Lower Basin's water was further apportioned among the three Lower Basin states by the *Boulder Canyon Project Act* in 1928 and the 1964 U.S. Supreme Court decree in *Arizona v. California*. Arizona's basic annual apportionment is 2.8 million AFY, California's is 4.4 million AFY, and Nevada's is 0.3 million AFY. California has been diverting up to 5.3 million AFY in recent years, using the unused portions of the Arizona and Nevada entitlements. Mexico is entitled to 1.5 million AFY of the Colorado River under the *1944 United States-Mexico Treaty for Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande*. However, this treaty did not specify a required quality for water entering Mexico. In1973, the United States and Mexico signed Minute No. 242 of the International Boundary and Water Commission requiring certain water quality standards for water entering Mexico.[25]

California's apportionment of Colorado River water is allocated by the 1931 *Seven Party Agreement* among Palo Verde Irrigation District (PVID), Imperial Irrigation District (IID), CVWD and MWD. The three remaining parties, the City and the County of San Diego and the City of Los Angeles, are now part of MWD. The allocations defined in the *Seven Party Agreement* are shown in **Table 4-2** below. In its 1979 supplemental decree in the *Arizona v. California* case, the United States Supreme Court also assigned "present

[24] CVWD 2010 CVWMP Update, Section 4.2, Colorado River
[25] CVWD 2010 CVWMP Update, Section 4.2, Colorado River

perfected rights" to the use of river water to a number of individuals, water districts, towns and Indian tribes along the river. These rights, which total approximately 2,875,000 AFY, are charged against California's 4.4 million AFY allocation and must be satisfied first in times of shortage. Under the 1970 *Criteria for Coordinated Long-Range Operation of the Colorado River Reservoirs* (Operating Criteria), the Secretary of the Interior determines how much water is to be allocated for use in Arizona, California and Nevada and whether a surplus, normal or shortage condition exists. The Secretary may allocate additional water if surplus conditions exist on the River (see additional discussion below).[26]

Table 4-2
Priorities and Water Delivery Contracts
California Seven Party Agreement of 1931

Priority	Description	Acre-ft/year
1	Palo Verde Irrigation District gross area of 104,500 acres of Coachella Valley lands	3,850,000
2	Yuma Project (Reservation Division) not exceeding a gross area of 25,000 acres within California	
3(a)	IID, CVWD and lands in Imperial and Coachella Valley's to be served by the All American Canal	
3(b)	Palo Verde Irrigation District – 16,000 acres of mesa lands	
4	Metropolitan Water District of Southern California for use on coastal plain	550,000
	Subtotal – California Basic Apportionment	4,400,000
5(a)	Metropolitan Water District of Southern California for use on coastal plain	550,000
5(b)	Metropolitan Water District of Southern California for use on coastal plain	112,000
6(a)	IID and lands in the Imperial and Coachella Valley's to be served by the All American Canal	300,000
6(b)	Palo Verde Irrigation District – 16,000 acres of mesa lands	
	Total	**5,362,000**

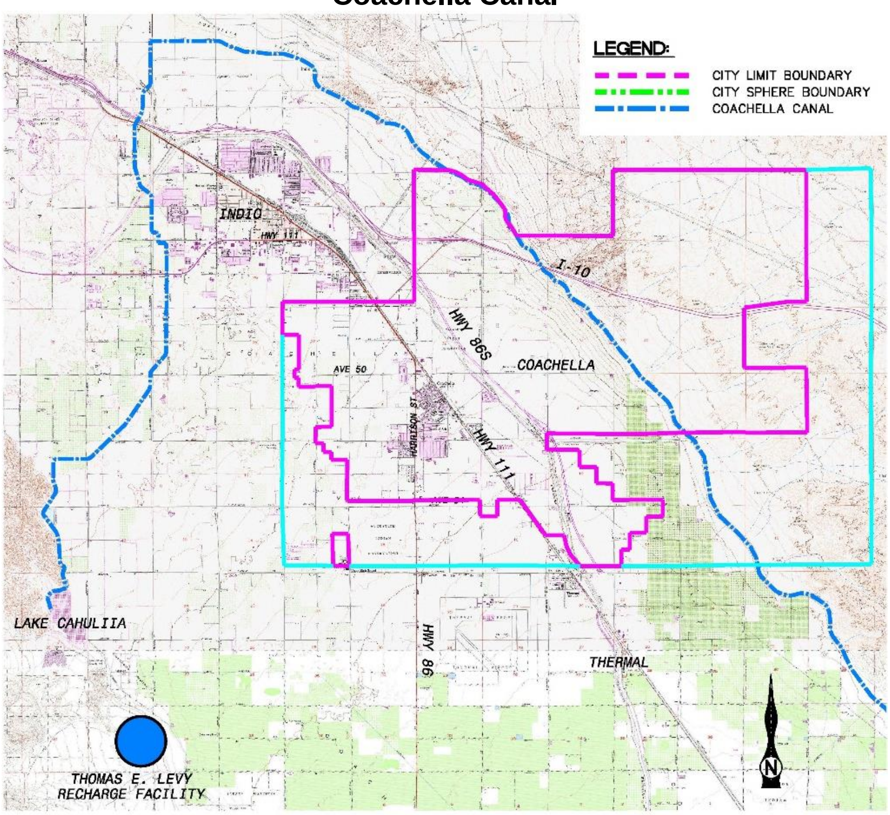
Sources: United States Bureau of Reclamation, http://www.usbr.gov; CVWD 2010 CVWMP Update, Table 4-2.

[26] CVWD 2010 CVWMP Update, Section 4.2, Colorado River

California's Colorado River supply is protected by the 1968 Colorado River Basin Project Act, which provides that in years of insufficient supply on the main stream of the Colorado River, supplies to the Central Arizona Project shall be reduced to zero before California will be reduced below 4.4 million ac-ft in any year. This assures full supplies to the Coachella Valley except in periods of extreme drought. As further described below, delivery analyses performed for the Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lakes Powell and Mead indicated that California would only experience shortages if the total shortage in the Lower Basin exceeds 1.7 million AFY.[27]

The Coachella Canal (Canal) is a branch of the All-American Canal that brings Colorado River water into the Imperial and Coachella Valleys. Historically, CVWD received approximately 330,000 AFY of Priority 3A Colorado River water delivered via the Coachella Canal. The Canal originates at Drop 1 on the All-American Canal and extends approximately 122 miles, terminating in CVWD's Lake Cahuilla; see **Figure 4-3**. The service area for Colorado River water delivery under CVWD's contract with Reclamation is defined as Improvement District No. 1 (ID-1) which encompasses most of the East Valley and a portion of the West Valley north of Interstate 10. Under the 1931 California Seven Party Agreement, CVWD has water rights to Colorado River water as part of the first 3.85 million AFY allocated to California. CVWD is in the third priority position along with IID.[28]

Figure 4-3
Coachella Canal



[27] CVWD 2010 CVWMP Update, Section 4.2, Colorado River
[28] CVWD 2010 CVWMP Update, Section 4.2, Colorado River

4.4.1 Quantification Settlement Agreement

Although the rights and relative priorities to Colorado River supplies as discussed above remain established under the *Law of the River*, an additional framework applies in California. In 2003, CVWD, IID and MWD successfully completed negotiation of the Quantification Settlement Agreement (QSA). The QSA quantifies the Colorado River water allocations of California's agricultural water contractors, beginning in 2003 and extending 75 years, and provides for the transfer of water between agencies.

Specific programs under the QSA include lining portions of the All-American and Coachella Canals, which conserve approximately 96,000 acre-feet annually. As a result, about 80,000 acre-feet of conserved water is delivered to the San Diego County Water Authority ("SDCWA") by exchange with MWD. Also included under the QSA is the Delivery and Exchange Agreement between MWD and CVWD that provides for MWD to deliver annually up to 35,000 acre-feet of MWD's State Water Project contractual water to CVWD by exchange with MWD's available Colorado River supplies. In calendar year 2011, under a supplemental agreement with CVWD, MWD delivered 105,000 acre-feet which consisted of the full 35,000 acre-feet for 2011 plus advance delivery of the full contractual amounts for 2012 and 2013.[29]

Under the QSA, CVWD has a base allotment of 330,000 AFY. In accordance with the QSA, CVWD has entered into water transfer agreements with MWD and IID that increase CVWD supplies by an additional 129,000 AFY as shown in **Table 4-3** below.[30]

Table 4-3
CVWD Deliveries under the QSA

Component	2010 Amount (AFY)	2045 Amount (AFY)
Base Allotment	330,000	330,000
1988 MWD/IID Approval Agreement	20,000	20,000
Coachella Canal Lining (to SDCWA)	-26,000	-26,000
To Miscellaneous/Indian PPRs	-3,000	-3,000
IID/CVWD First Transfer	12,000	50,000
IID/CVWD Second Transfer	0	53,000
MWD/SWP Transfer	35,000	35,000
Total Diversion at Imperial Dam	**368,000**	**459,000**
Less Conveyance Losses[1]	-31,000	-31,000
Total Deliveries to CVWD	**337,000**	**428,000**

Source: CVWD 2010 CVWMP Update, Table 4-3

[1] Assumed losses after completion of canal lining projects.

[29] MWD 2013 Preliminary Official Statement, Water Revenue Refunding Bonds, Appendix A, p. A-16

[30] CVWD 2010 CVWMP Update, Section 4.2.1, Qualification Settlement Agreement

As of 2010, CVWD receives 368,000 AFY of Colorado River water deliveries under the QSA (See **Table 4-5** above). This includes the base entitlement of 330,000 AFY, MWD/IID Approval of 20,000 AFY, 12,000 AFY of IID/CVWD First transfer, and 35,000 AFY of MWD/SWP transfer. It also includes the 26,000 AFY transferred to San Diego County Water Authority (SDCWA) as part of the Coachella Canal lining project and the 3,000 AFY transfer to Indian Present Perfected Rights (PPRs). CVWD's allocation will increase to 459,000 AFY of Colorado River water by 2026 and remain at that level for the 75 year term of the QSA. After deducting conveyance and distribution losses, approximately 428,000 AFY will be available for CVWD use.[31]

4.4.2 Colorado River Basin Study

In December 2012, the Bureau of Reclamation (BOR) issued its Colorado River Basin Water Supply and Demand Study (2012 Study). According to BOR, the 2012 Study was prepared against the backdrop of challenges and complexities of ensuring a sustainable water supply and meeting future demand in the Colorado River system. Notably, the 2012 Study recognizes that because of the Colorado River system's ability to store approximately 60 million acre-feet of water (or nearly four years of average natural flow of the River), all requested deliveries have been met in the Lower Basin, despite recently experiencing the worst 11-year drought in the last century.[32]

The 2012 Study concludes that, without additional future water management actions among the Upper and Lower Basin states, a wide range of future imbalances is plausible, primarily due to uncertainties inherent in future water supply.[33] Comparing the median long-term water supply projections against the median long-term water demand projections, and factoring in the myriad factors having the potential to affect the availability and reliability of River supplies and demands (such as climate change, species and other environmental issues, social trends, economic and legal forces, and technical capabilities), the 2012 Study shows that a long-term projected imbalance of 3.2 million acre-feet or more could occur by the year 2060.[34]

To address such potential long-term imbalances, the 2012 Study identifies and discusses a broad range of potential options to resolve the differences between water supply and demand. During the study period, over 150 options were received and organized into four groups: (1) those that increase Basin water supplies; (2) those that reduce Basin water demands; (3) those that focus on modifying operations; and (4) those that focus primarily on Basin governance.[35] Moreover, recognizing that no single option is likely sufficient to resolve potential water supply and demand imbalances, the 2012 Study developed groups and portfolios of options to reflect different adaptive strategies.[36]

[31] CVWD 2010 CVWMP Update, Section 4.2.1, Qualification Settlement Agreement
[32] BOR Colorado River Basin Water Supply and Demand Study 2012, Executive Summary, p. ES-1
[33] BOR Colorado River Basin Water Supply and Demand Study 2012, Executive Summary, p. ES-6
[34] BOR Colorado River Basin Water Supply and Demand Study 2012
[35] BOR Colorado River Basin Water Supply and Demand Study 2012, Executive Summary, p. ES-7
[36] BOR Colorado River Basin Water Supply and Demand Study 2012, Executive Summary, p. ES-11

Importantly, the 2012 Study recognizes that *complete* elimination of Basin vulnerability is not likely obtainable, yet concludes that implementation of various adaptive management options results in a significant reduction in vulnerability (e.g., the percentage of future scenarios resulting in Lake Mead elevations being less than 1,000 feet msl is reduced from 19 percent to only 3 percent).[37] Indeed the 2012 Study states that implementation of management portfolios are projected to be successful in significantly improving the resiliency of Basin resources to vulnerable hydrologic conditions. Similar to the extraordinary conservation and management efforts being undertaking throughout the Coachella Valley, the 2012 Study concludes that supply augmentation, water reuse and conservation will be critical tools in managing potential supply and demand imbalances.[38]

4.5 TRANSFER AND EXCHANGE OPPORTUNITIES

Water transfers involve the temporary or permanent sale or lease of a water right or contractual water supply between willing parties. Water can be made available for transfer from other parties through a variety of mechanisms.

The City is exploring opportunities to exchange non-potable groundwater for water from the Coachella Canal. Certain groundwater in the East (Lower) Coachella Valley has higher levels of dissolved solids and fluoride, and thus is not suitable for potable purposes. However, that supply may be suitable for irrigation and other non-potable uses. In turn, Canal water that is currently used only for irrigation purposes could be treated or left untreated and used for potable or non-potable urban uses.[39]

CVWD, DWA, and Indio Water Authority are considering the acquisition of additional imported water supplies to augment existing supplies. CVWD plans to acquire up to 50,000 AFY of additional water supplies through either long-term leases or entitlement purchases from willing parties.[40] Potential sources might include the Delta Wetlands Project which would store surplus water at two Delta islands for later delivery, Sacramento Valley irrigation water transfers, or purchase(s) of additional Table A water from other SWP contractors.[41]

Since currently there is no conveyance facility to deliver SWP water to the Coachella Valley, CVWD and DWA cannot directly receive their SWP supplies. Instead, pursuant to exchange agreements, the CVWD and DWA SWP water is delivered to MWD, which in turn delivers an equal amount of CRA water to CVWD and DWA to be recharged at the Thomas E. Levy (Levy), Whitewater and Mission Creek recharge facilities. CVWD and DWA are required to pay for their respective SWP costs and MWD is required to pay for its CRA costs. The original exchange agreements were entered in 1967. In 1983, the agreements were extended to 2035.

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[37] BOR Colorado River Basin Water Supply and Demand Study 2012, Executive Summary, p. ES-14
[38] BOR Colorado River Basin Water Supply and Demand Study 2012
[39] City 2010 UWMP, Section 4.5, Transfer And Exchange Opportunities
[40] CVWD 2010 CVWMP Update, Section6.4.3, Future Imported Water Acquisitions
[41] CVWD 2010 CVWMP Update, pp. 8-4 to 8-7

CVWD has operated a pilot recharge facility at Dike 4 near Avenue 62 since 1997. Construction of the full scale Levy facility was completed in mid-2009. Thereafter, substantially more recharge has occurred in the East (Lower) Whitewater Subbasin. The Levy facility has an estimated capacity to recharge 40,000 AFY. In addition to the Levy facility, CVWD is planning construction of the Martinez Canyon recharge facility that is expected to recharge between 20,000 and 40,000 AFY on an average basis. The 2010 CVWMP considers alternative recharge scenarios to effectively recharge imported water at Whitewater, Levy, and Martinez to provide the greatest benefit for the groundwater basin.[42]

4.6 WATER QUALITY

The quality of Coachella Valley groundwater is high and most of the groundwater delivered to urban customers receives only disinfection[43]. The City of Coachella obtains all of its potable water from the Coachella Valley Groundwater Basin by way of its 6 active groundwater wells. These wells are all located west of the San Andreas Fault. The City maintains a range of 0.2 to 1.5 parts per million gallon (ppm or mg/L) residual of chlorine in the drinking water throughout its system. This water is routinely monitored to ensure compliance with all requirements set forth by the U.S. Environmental Protection Agency (EPA), through the Safe Drinking Water Act, and the California Department of Public Health (CDPH), through Title 22.

The City hasn't had any violations of the Maximum Contaminant Level (MCL) for any monitored primary, secondary, or microbial contaminants over the past 7 years[44]. The City's water quality also meets all secondary MCL's known as Public Health Goals (PHG's). PHG's are set by the California EPA and are the level of contaminants in drinking water below which there is no known or expected health risk.

There are two major developments within the City's SOI that are expected in the near future, they are the La Entrada and Desert Lakes Developments. Both are scheduled to be built on the east side of the San Andreas Fault, which lies outside of the Whitewater River Subbasin. These developments would lie within the Fargo Canyon Subarea of the Desert Hot Springs Subbasin[45]. Within this area, groundwater is generally of unacceptable quality (TDS >1,000 mg/L) and the native yield is limited.[46] Groundwater, recently extracted east of the Coachella Valley Storm Channel which generally follows the same alignment as the San Andreas Fault, also reported elevated levels of fluoride[47]. Private wells in the area have also reported elevated arsenic levels exceeding the drinking water regulations[48].

Groundwater supplies for developments overlying the Fargo Canyon Subarea of the Desert Hot Springs Subbasin will be produced west of the San Andreas Fault due to

[42] CVWD 2010 CVWMP Update, Section 6.6, Groundwater Recharge
[43] 2010 CVWMP Update, Section 6.7.3, Groundwater Quality and Treatment
[44] Based on the City of Coachella Water Quality reports, 2007-2012
[45] 2010 CVWMP Update, Figure 4-1, Coachella Valley Groundwater Subbasins
[46] 2010 CVWMP Update, Section 6.4.6, Other Local Groundwater
[47] 2015 Coachella General Plan Update, Section 3, Water Quality, Pg. 03-21
[48] 2010 CVWMP Update, Section 5.1.3.1, Arsenic

aforementioned water quality issues on the east side. While well head or centralized treatment for these contaminants is possible, it may or may not prove to be economical.

4.6.1 Hexavalent Chromium

The historic primary drinking water standard for total chromium was 50 parts per billion (ppb or µg/L), which was established in 1977 for California. The EPA adopted the same 50 µg/L standard for total chromium, but in 1991 raised the federal MCL to 100 µg/L. California did not follow US EPA's change and stayed with its 50 µg/L standard. In August of 2013 CDPH proposed a new MCL of 10 µg/L for hexavalent chromium. By July 1, 2014 CDPH adopted the new MCL of 10 µg/L. CWA will need to make upgrades and additions to their system in order comply with the new CDPH mandated MCL for hexavalent chromium. In July 2016, the department of drinking water accepted CWA's hexavalent chromium compliance plan. CWA is on track to be in compliance with the hexavalent chromium MCL by the SB385 mandated January 1, 2020 deadline. This plan anticipates that all existing and future wells will require hexavalent chromium treatment in order to comply with California's new MCL.

CWA and Indio Water Authority (IWA) teamed up in order to produce a mutually beneficial solution that put both parties on a path toward compliance with the new regulations. Hazen and Sawyer was retained to conduct a study on the treatment and compliance for the lower maximum contaminate level (MCL) for Hexavalent Chromium. The final report of the study was completed August 2015. The study showed that strong based anion exchange was the recommended treatment technology for CWA's wells. In addition, several options exist for strong based anion exchange treatment implementation that are currently being evaluated by CWA; subsequently funding, design, environmental review, and construction are to follow.

4.7 RECYCLED WATER OPPORTUNITIES

Recycled water is a significant resource that can be used to help expand the local and regional water supply portfolio. Wastewater that has been highly treated and disinfected can be reused for landscape irrigation, certain agricultural applications, and a variety of other purposes.[49] Recycled water has historically been used for irrigation of golf courses and urban landscaping in the Coachella Valley.[50] Additionally, the substitution of an alternative water source reduces groundwater extraction and allows the groundwater to remain in storage, thus reducing overdraft.[51]

Since irrigation requirements are affected by seasonal variations, there exists a recycled water supply/demand imbalance particularly during summer months when evapotranspiration is the highest. During winter months when irrigation demands are lower, wastewater that is not recycled would be discharged to percolation-evaporation ponds where most of the percolated water enters the groundwater basin. The use of

[49] Coachella Valley Water Management Plan Update, January 2012, Section 4 – Existing Water Supplies, Subsection 4.5 – Recycled Water. Page 4-22.
[50] CVWD 2010 CVWMP Update, Section 4.7.3, Recycled Water
[51] Engineer's Report on Water Supply and Replenishment Assessment, East (Lower) Whitewater River Subbasin Area of Benefit 2016-2017, Table VII-10.

recycled water for irrigation may reduce some of the evaporative losses that occur in the percolation ponds. Another challenge associated with recycled water use is the need for a separate distribution system.

Currently, the City does not have infrastructure in place to treat, convey, store and distribute recycled water. In order to identify a comprehensive recycled water program, a number of issues must be addressed, including:

- **Demand**-the principal non-potable uses for recycled water are golf courses, schools, urban landscape such as parks and sports fields, other irrigation and agriculture.
- **Treatment**-California Department of Public Health standards indicate that wastewater effluent be treated to tertiary treatment quality for landscape and other non-potable uses.
- **Conveyance and Distribution**-a separate distribution system will be required to convey recycled water to locations of use. Typically, wastewater treatment plants are located in areas at lower elevations than potential users; therefore, pumping will likely be required together with conveyance pipelines.
- **Storage**-since recycled water use will include both higher and lower demands, storage will likely be required.

The City is in the process of completing a recycled water feasibility study, a study on implementing a recycled water program. If the treatment system upgrade feasibility study produces a favorable result, and tertiary treatment is added to the facility, potential uses of recycled water could be implemented, including non-potable water systems for larger developments, such as La Entrada or regional recycled water facility between Indio Water Authority, Valley Sanitary District, and Coachella Sanitary District.

4.8 FUTURE WATER PROJECTS

The City continues its efforts to meet water demand through development of future water projects. Additional sources of supply will be required to meet demands associated with projected growth, one of which is Coachella Canal water. Canal water is a significant water supply source for the Coachella Valley. One of the underlying principles in the development of the CVWD 2010 CVWMP Update is to fully use the available Canal water supply. This is achieved by conversion of agricultural users and golf courses from groundwater to Canal water, development of dual piping for urban users and treatment of Canal water for urban use and groundwater recharge.[52]

The City will continue to evaluate the use of Canal water as a source substitution for drinking water supplies obtained from groundwater. As projected growth occurs in the East Valley and farms are converted to urban land uses, agricultural demand for Canal water will decrease. To avoid increased urban groundwater pumping and to use the Valley's Colorado River water supply fully, there will be a need to treat Canal water for urban use. Potable use will require Canal water treatment to meet drinking water standards. In anticipation of constructing potable water treatment facilities, CVWD completed a pilot treatability study for Canal water in 2008 (Malcolm-Pirnie, 2008c). This study investigated alternative approaches to treatment of Colorado River water delivered

[52] CVWD 2010 CVWMP Update, Section 6.5.2, Groundwater to Canal Water Conversion

for urban use. The study recommended that blending treated Colorado River water with local groundwater be further evaluated to ensure customer satisfaction.[53]

In addition, untreated Canal water will be used in the future in large developments in the East Valley for outdoor purposes, i.e., lawn and park irrigation. These measures are necessary to reduce overdraft and to insure continued full use of the Valley's Colorado River water supplies. Dual source plumbing systems will be a feature of new development in the East Valley to provide outdoor use of untreated Canal water. Untreated canal water will provide 67 percent to 80 percent of the landscape demand for new development.[54]

4.9 WATER CONSERVATION

In response to the Water Conservation in Landscaping Act of 2006 (Assembly Bill 1881, Laird), requiring cities and counties to adopt water conservation ordinances by January 1, 2010, CVWD worked with the Coachella Valley Association of Governments (CVAG), Coachella Valley cities, Riverside County, other water agencies, and the Building Industry Association to develop a Regional Landscape Water Conservation Ordinance. The Regional Landscape Ordinance not only meets the state requirements, but also is tailored specifically to the unique climate and water conservation needs of the Coachella Valley, including the City. The City has adopted CVAG's the model landscape ordinance.

The new ordinance encourages limited use of turf areas and reduces landscape irrigation consumption by mandating high efficiency irrigation systems and low water use landscaping.

Additionally, the City's two tiered rate structure includes a variable commodity charge (monthly charge based on the amount of water used or consumed by the customer in hundreds of cubic feet (HCF)) and a fixed metered account charge (basic monthly rate by meter size). The rates have been designed to recover the full cost of water service in the commodity charge, while discouraging wasteful water use, and will continue to be implemented into the future. Tiered rates are designed to incentivize customers to be proactive in reducing water use. Tiered water rates went into effect for residential customers in May 2010 and the rates for consumption are shown in **Table 4-4**.

Table 4-4
Rates for Consumption Charge

Tiers	Effective Date					
	5/1/2010	1/1/2011	1/1/2012	1/1/2013	1/1/2014	1/1/2015
Block 1 Rate (per HCF) 0 to 41 HCF	$1.05	$1.16	$1.30	$1.36	$1.43	$1.50
Block 2 Rate (per HCF) Over 41 HCF	$1.21	$1.31	$1.45	$1.51	$1.58	$1.65

[53] CVWD 2010 CVWMP Update, Section ES-4.2.3, Source Substitution
[54] CVWD 2010 CVWMP Update, Section ES-5.4.3, Source Substitution

Other conservation measures that the City has enacted include:

- Collaborating with Coachella Valley Resource Agency (CVRA) for conducting water audits. The plan is to identify and reduce water uses from the largest customers.
- Providing assistance to low-income families to retrofit older houses with newer water efficient fixtures (i.e. low flow shower heads and ultra-low flush toilets).
- Piping and meter review to account for any losses within the system due to leaks.
- Meter calibration to enhance effectiveness of measuring consumption.
- School education programs promoting water conservation.
- Installation of ultra-low flush toilets for new developments.
- Offering a turf removal rebate program for residents who want to reduce outdoor water use by converting their front lawn to desert-friendly landscaping.
- A prohibition for wasting water in Municipal Code Section 13.03.044 which states it is unlawful for any person to willfully or neglectfully waste water in any manner whatsoever. The measurement of success for this program is a reduction in water waste violations in the future.

4.10 SUMMARY

As part of this WMP, the City will continue to design water system improvements to enhance conservation, identify additional water supplies, potential source substitutions, and alternative supplies as demands increase and enhance local groundwater recharge.

SECTION 5
EXISTING AND FUTURE WATER SYSTEM

5.1 EXISTING WATER SYSTEM

The existing water system consists of two different pressure zones, six active groundwater production wells, three storage reservoirs, three booster pumping stations, and 120 miles of conveyance and distribution pipelines. Locations of the water facilities are shown on **Figure 5-1 Existing Distribution System** and a hydraulic schematic representation of the existing water facilities and their interactions is presented on **Figure 5-2 Existing System Hydraulic Schematic**. The following sections provide a description of the pressure zones and their corresponding distribution facilities. These facilities include supply, storage, booster station, and distribution system components.

5.1.1 Existing Pressure Zones

The current water system is divided into two (2) pressure zones, the Low Zone and the 150 Zone. Currently, the Low Zone Area is generally south of 48th Avenue, bounded by Jackson Street on the west, the Coachella Valley Storm Channel on the east, and 56th Avenue on the south. The Low Zone provides water service to the majority of the City and as the City continues to grow, the Low Zone will extend further east and south. Typically, pressure zones are established by the high water level (HWL) in reservoirs serving the system; however, the Low Zone is established by specific operational discharge pressure set points at each well and/or booster. Currently, the 3.6 MG Low Zone reservoir (Mecca Reservoir) booster pump station (Well 12 Booster) sets the hydraulic gradient, which maintains a constant discharge pressure. The discharge pressure is set by system operators and can vary seasonally. Based on current average well settings, the Low Zone has a hydraulic grade line (HGL) of approximately 90 feet above mean sea level (msl). A pressure relief valve at the Mecca Reservoir will open and relieve excess pressure into the reservoir if upstream pressures exceed the current 75 psi set point.

The 150 Zone service area is generally north of 48th Avenue and supplies primarily commercial and light industrial users along Interstate 10 freeway corridor with the Spotlight 29 Casino being the main water use for the zone. The HWL in the 150 Zone is served by the 146' msl above HWL of the 1.5 MG reservoir (Dillon Rd. Reservoir) located at the northerly end of the system. The hydraulic gradient will fluctuate based on the changing water level in the reservoir. **Table 5-1** summarizes the City's existing pressure zones and the pressure zone boundaries are shown on **Figure 5-1**.

Table 5-1
Existing Pressure Zone Characteristics

Zone Name	HWL/ HGL (ft)	Min Ground Elevation (ft)	Max Ground Elevation (ft)	Min Pressure (psi)	Max Pressure (psi)
Low	90	-110	-35	54	87
150	146	-40	35	38	81

Note: Min and max pressures listed are based on pressure zone elevations served. Reservoir water levels, booster settings, well settings and demand fluctuations will vary actual pressure amounts within each zone.

For each zone, the minimum and maximum ground elevation help determine the elevation range served in that zone. This information aids in identifying existing system parameters and as a means to determine system improvements. For example, the elevation range can be used to determine a favorable site for a new reservoir and what the resultant HWL may be.

5.1.2 Existing Water Production

As presented in **Section 4**, the City has one principal production source, local groundwater pumped from the City-owned wells. All active wells will require hexavalent chromium treatment facilities to be constructed in order to comply with California's new MCL of 10 μg/L by the Senate Bill No. 385 mandated January 1, 2020 deadline. There are currently eight (8) wells within the City's distribution system; of which, six (6) wells are currently operational and two (2) are inactive. Wells 7 and 10 were made inactive due to declining capacity. The total pumping capacity of active wells is approximately 11,759 gallons per minute (gpm) or 16.9 million gallons per day (MGD). The well capacities are obtained from the Pump Check hydraulic test reports conducted in 2013 and information gathered from the City's operations staff, included as **Appendix C**.

Operating conditions and controls vary for each well, with some wells operating either year-round and others seasonally. Some of the wells are operated by timers, with the ability to shut them down during off-peak hours. Pump system pressures are maintained by variable frequency drive controls on a majority of the pumps. Over pressurization of the system is prevented by downstream control valves when the system water demands reduce during off-peak hours. Well 12 is equipped with a pressure relief valve that will relieve excess pressure into the City's Mecca Reservoir in the Low Zone. Approximately 91 percent of the City's well capacity is located in the Low Zone and approximately 9 percent of the City's well capacity is located in the 150 Zone. Physical and operational data for the City's wells is summarized in **Table 5-2** and the well locations are shown on **Figure 5-1**.

Figure 5-1
Existing Distribution System

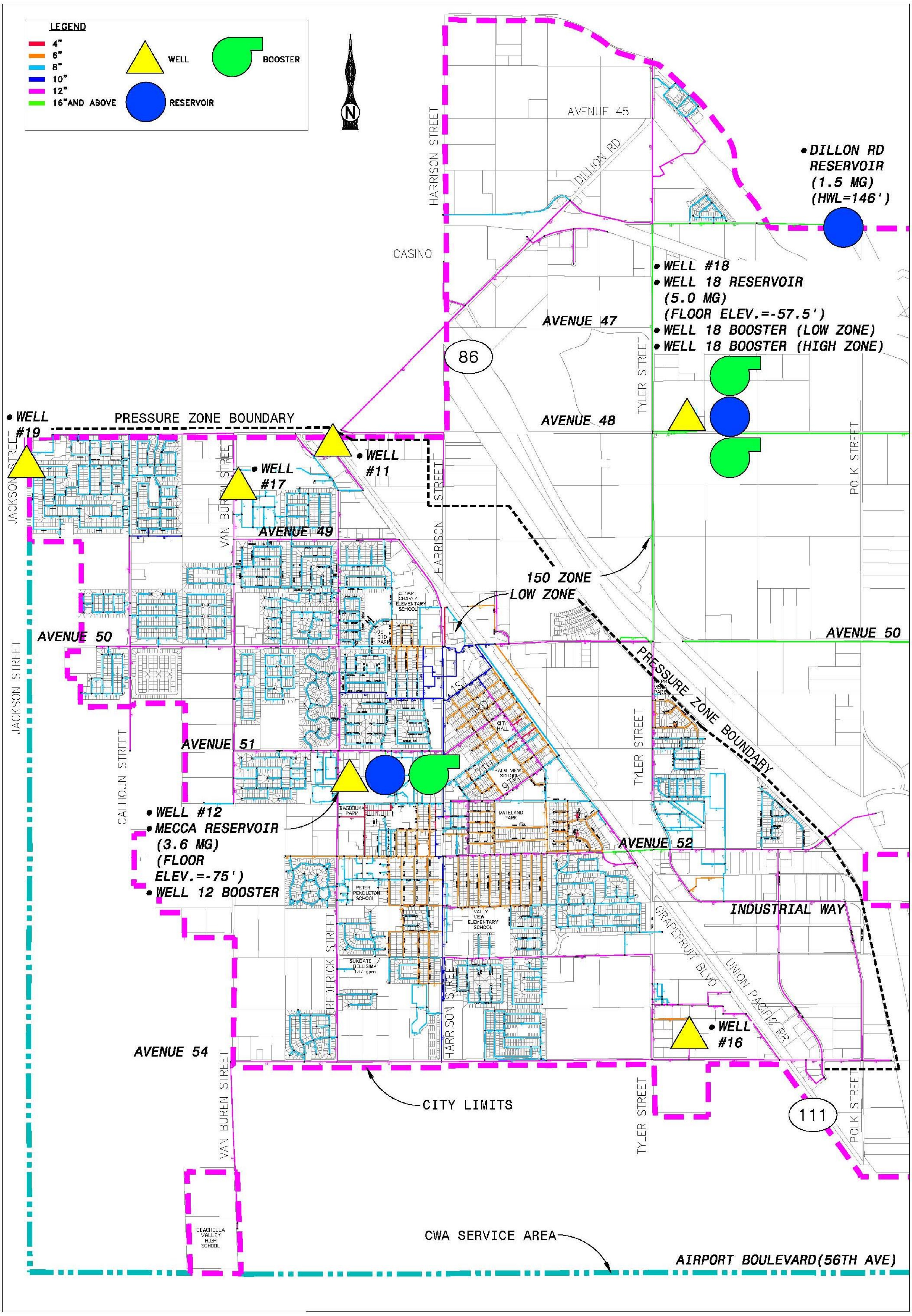


Figure 5-2
Existing System Hydraulic Schematic

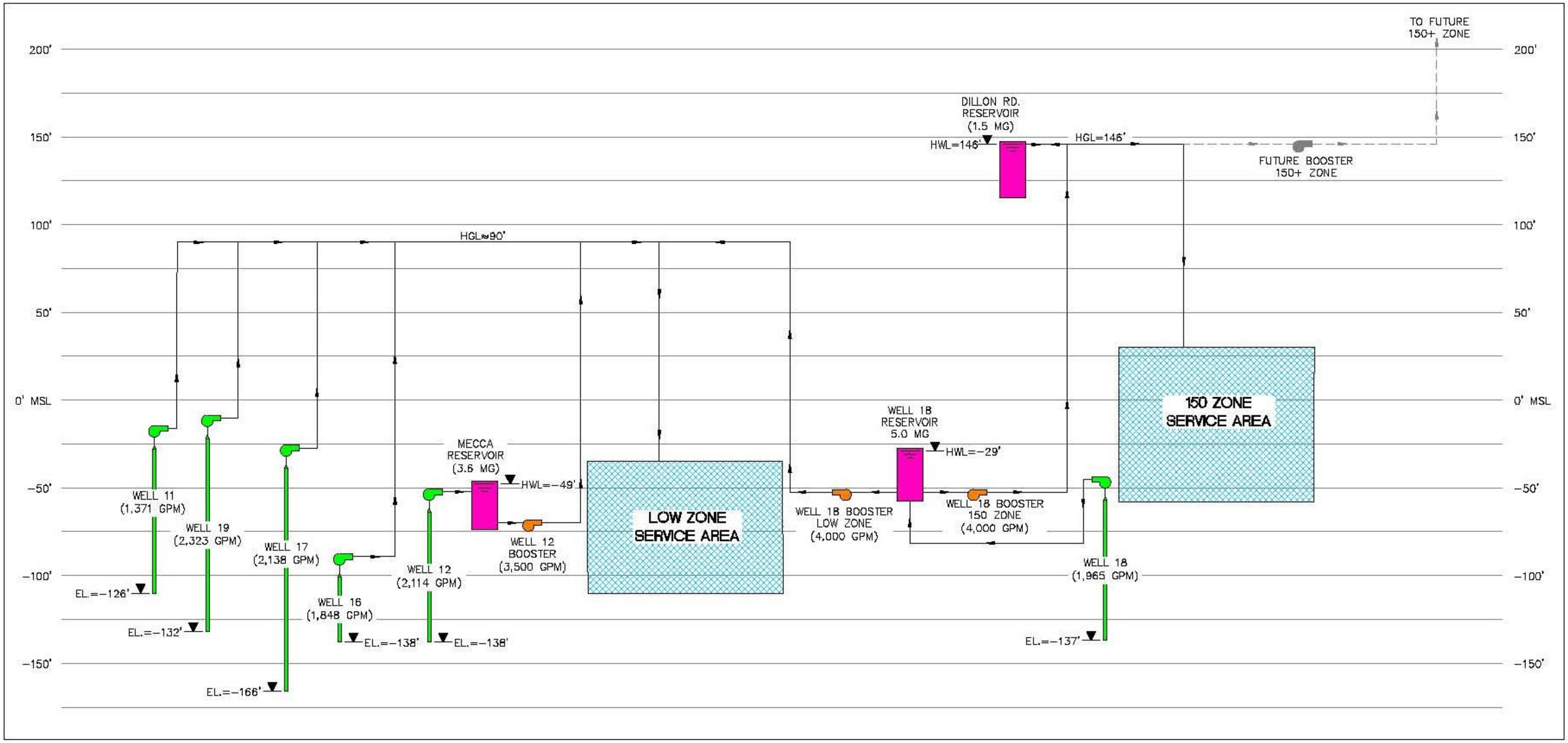


Table 5-2
Existing Groundwater Well Characteristics

Well No.	Location	Pressure Zone	Status	Capacity Range[1],[2] (gpm)	Total Pumping Head (ft)	Depth to Standing Water (ft)	Draw-Down (ft)	Ground Elevation (ft)	HGL Elevation (ft)	Discharge Pressure (psi)
7	Harrison St. & Cairo St.	Low	Inactive	450 - 580	-	-	-	-	-	-
10	Ave. 48 & Tyler St.	150	Inactive	450 - 580	-	-	-	-	-	-
11	Ave. 48 & Indio Blvd.	Low	Active	1,371	282	84	42	-42	90	68
12	Ave. 51 & Harrison St.	Low	Active	2,114	134	76	30	-62	90	12
16	Ave. 54 & Tyler St.	Low	Active	1,848	N/A[3]	39	N/A[3]	-98	90	85
17	Calle Teco Maria & Avenida Europa	Low	Active	2,138	N/A[4]	N/A[4]	N/A[4]	-37	90	52
18	Ave. 48 & Tyler St.	150	Active	1,965	153	80	41	-55	150	14
19	Ave. 48 & Jackson St.	Low	Active	2,323	258	112	28	-20	90	51

[1] Data for Well No's. 11, 12, 16, 17, 18 are obtained from Pump Check pump tests, included as **Appendix C**.
[2] Capacities obtained from City's Water Production Report. All the subsequent analyses in this report are based on these capacities.
[3] Due to an obstruction in the well, Pump Check was unable to collect total pumping head and draw-down.
[4] No historic pump test data was available at the time of this WMP.

5.1.3 Existing Water Storage Reservoirs

There are three (3) storage reservoirs within the City with the following capacities: 1.5 MG, 3.6 MG, and 5.0 MG. The City has a total reservoir storage capacity of approximately 10.1 MG; of which, approximately 1.5 MG lies within the 150 Zone.

The 3.6 MG Low Zone reservoir (Mecca Reservoir) was constructed in 1987 and is located at the southwest intersection of Avenue 51 and Mecca Avenue. The reservoir does not establish the Low Zone hydraulic gradient, but acts as the forebay to an adjacent booster station for Well 12.

The 5.0 MG reservoir (Well 18 Reservoir) is located northeast of the intersection of Avenue 48 and Tyler Street. The Well 18 Reservoir is used as a forebay for booster which supply both the 150 Zone and the Low Zone. Originally Well 18 Reservoir was to be supplied by Well 10 and Well 18; however, Well 10 is inactive and expected to remain so. Therefore, Well 18 Reservoir is only supplied by Well 18. The reservoir has a booster station that is capable of pumping to both the 150 Zone and Low Zone. The booster station is described in more detail in **Section 5.1.4 Existing Booster Pumping Stations**.

The 1.5 MG reservoir (Dillon Rd. Reservoir) is located near the intersection of Vista Del Norte and Polk Street. The Dillon Rd. Reservoir establishes the HWL and hydraulic gradient of the 150 Zone. The reservoir maintains supply and pressure to the City's water system through gravity. The supply source for the Dillon Rd. Reservoir was Well 10 and Well 18; however, as described above, Well 10 is inactive and will only be supplied by Well 18. Additionally, Well 11 has been configured to allow the well to supply the reservoir during emergencies or periods of extreme high demand through the opening of a normally closed valve.

Table 5-3 provides a detailed summary of the City's storage reservoirs.

Table 5-3
Existing Storage Reservoir Characteristics

Reservoir ID	Pressure Zone	Year of Const.	Type of Const.	Dia. (ft)	Height (ft)	Volume (MG)	Percent Total (%)	Bottom Elevation (ft)	High Water Elevation (ft)
Mecca	Low	1987	Welded Steel	158	26	3.6	34%	-75	-49
Well 18	Low & 150	2007	Welded Steel	175	28.5	5.0	51%	-57.5	-29
Dillon Rd.	150	1971	Welded Steel	90.5	32	1.5	14%	114	146
					Total Capacity:	**10.1**			

Based on industry standards, the average life expectancy of steel reservoirs is estimated between 50 years and 100 years. If reservoirs have been properly maintained and regularly repainted or re-coated every 15 to 20 years, the life expectancy is closer to 100 years. Based on field observations and discussions with City staff, existing storage facilities are in fairly good condition and have been maintained and recoated on a regular basis. The existing three storage reservoirs have an expected service life as follows:

- Mecca Reservoir was constructed in 1987 with a remaining service life of 71 years;
- Well 18 Reservoir was constructed in 2007 with a remaining service life of 91 years; and
- Dillon Road Reservoir was constructed in 1971 with a remaining service life of 55 years.

Therefore, no improvements are recommended based on age are recommended. However, the City has not completed a seismic vulnerability assessment on existing reservoirs and it is recommended that the City complete a seismic assessment to ensure reliability of storage facilities in during a seismic event.

5.1.4 Existing Booster Pumping Stations

The City operates two booster pumping stations: the Mecca Reservoir booster pump station (Well 12 Booster) and the Well 18 Reservoir booster pump station (Well 18 Booster).

The Well 12 Booster Station supplies water to the Low Zone and receives suction supplies from the 3.6 MG Mecca Reservoir. The Well 12 Booster has three (3) existing pumps. Pump speeds are controlled by variable frequency drives (VFD's) to maintain a preset discharge pressure; which is currently set at 62 psi, but can vary seasonally.

The Well 18 Booster Station supplies both the 150 Zone and Low Zone, and receives suction supplies from the 5.0 MG Well 18 Reservoir. The Well 18 Booster has two (2) separate pump systems, one for the 150 Zone and one for the Low Zone. Each pump system has two (2) existing pumps with pump speeds controlled by VFD's. The 150 Zone pump system is sized to operate under a condition when the Dillon Rd. Reservoir is out of service for repairs.

The Well 18 Booster Station is operated when the Dillon Rd. Reservoir in 150 Zone requires replenishment or the Low Zone is low on pressure. The Well 18 Booster Station was constructed to allow for a future one pump expansion for both the 150 Zone and Low Zone Systems. **Table 5-4** provides a detailed summary of each booster pump station. Additionally, their locations are shown on **Figure 5-1** and schematically represented on **Figure 5-2**.

Table 5-4
Existing Booster Pumping Stations Characteristics

Booster Pump	No. of Pumps	Pump (hp)	Design Head (ft)	Average Capacity (gpm)	Pump Speed (rpm)	VFD	Overall Efficiency (%)	Backup Power	Discharge Zone
Well 12 Booster	3	100	158	3,500	1,800	Yes	80	Yes	Low
Well 18 Booster	2	125	150	4,000	1,800	Yes	80	Yes	Low
Well 18 Booster	2	200	160	4,000	1,800	Yes	80	Yes	150

5.1.5 Existing Distribution Pipelines

The City's distribution system network consists of approximately 120 miles of pipeline, which range from 4-inches to 36-inches in diameter. **Table 5-5** summarizes the total length of the City's distribution system pipeline by size. Note that that the numbers presented in the table are based on the pipelines included in the hydraulic model only, which do not include service laterals and pipelines of less than 4-inch in diameter.

Table 5-5
Summary of Existing Pipelines by Diameter

Diameter (inch)	Total Length (feet)	Total Length (miles)	Percentage of Total Length (%)
4	5,038	1.0	0.8%
6	81,045	15.3	12.8%
8	337,495	63.9	53.4%
10	18,115	3.4	2.9%
12	168,597	31.9	26.7%
16	21,233	4.0	3.4%
24	70	0.0	0.0%
Total:	**631,593**	**119.6**	**100%**

As shown in **Table 5-6**, about 66 percent of the distribution system network consists of 6-inch and 8-inch diameter pipes, while 26 percent of the distribution system network is comprised of pipes that are 12 inches in diameter. All pipes that have a diameter of 16-inch and greater are defined as transmission mains. Approximately 3.5 percent of the distribution system network is characterized as transmission mains. The City currently requires new pipelines to be at least 8-inches in diameter. It is estimated that a majority of pipes in the City's water distribution system network were installed between year 1940 and year 1990. The older pipes reside in the southerly section of the lower zone and the newer pipes are up to the northerly section. Approximately 70 percent of the pipelines are installed between 1976 and 1990. Currently, the City does not have a program in place to replace aging or undersized pipelines. However, pipelines with a history of repairs (e.g. leaks) or with diameters less than 8-inches should be systematically replaced; further discussed in **Section 8, Capital Improvement Program**.

As indicated below in **Table 5-6**, asbestos cement (AC) is the most common pipeline material in the City. AC pipelines comprise about 80 percent of the City's distribution system network. The remaining pipelines are either polyvinyl chloride (PVC), ductile iron (DI), or steel.

Table 5-6
Summary of Existing Pipelines Percentages by Material

Material	Percent of Distribution System (%)
Asbestos Cement (AC)	80%
Polyvinyl Chloride (PVC)	15%
Ductile Iron (DI) & Steel	5%

5.2 SYSTEM COMPONENT EVALUATION

Evaluation of the water system's production capacity and reliability, storage capacity and condition are performed outside of the hydraulic model and are based on industry standards. These industry standards are typically the range of values used to evaluate the safety and dependability of a water system. These ranges of values were compiled using input from CWA Staff, applicable regulatory standards, design standards and guidelines that are widely acknowledged within the water industry and are typical ranges of values that are acceptable for the criteria in question. Within this section, the evaluation criteria will be presented along with an evaluation of the existing and future system based on demands presented in **Section 3, Existing and Future Water Demand**.

5.2.1 Evaluation Criteria

The City must be capable of providing sufficient water supply and storage capacity to meet the minimum criteria listed in **Table 5-7**.

Table 5-7
Water System Evaluation Criteria

Evaluation Criteria	Value	Units	Evaluation Demand Conditions
Demand Peaking Factors			
Max Day Demand	1.9 X ADD	gpm, MGD	N/A
Peak Hour Demand	3.1 X ADD	gpm, MGD	N/A
Supply Capacity			
Entire System I	Provide MDD with largest source out of service using the firm well capacity		MDD
Storage Volume			
Operational	25% of MDD (24 hour period)	MG	MDD * 0.25 * 24 hrs
Fire	Highest requirement with in pressure zone	MG	MDD
Emergency	100% of ADD	MG	ADD * 24 hrs
Fire Flows			
Mobile Homes and Manufactures Housing	500	gpm	MDD - 2 hrs
Single Family Residential	1,000	gpm	MDD - 2 hrs
Multi-Family Residential, Commercial, and light industrial lot < 1 AC	2,500	gpm	MDD - 2 hrs
Spotlight Casino	3,000	gpm	MDD - 2 hrs
School	3500 – 2 hrs	gpm	MDD - 2 hrs
Commercial, and Medium industrial lot > 1 AC	4,000	gpm	MDD - 2 hrs
Heavy Industrial	5,000	gpm	MDD - 2 hrs

5.2.2 Existing System Evaluation

The existing system's supply capacity, reliability and storage capacity were evaluated and presented in the following sections:

5.2.2.1 Existing Production Capacity and Reliability

As presented in **Section 3, Existing and Future Water Demands,** present day ADD was determined to be 5.28 MGD. MDD is the maximum quantity of water used on any single day in a given year. The City's water supply facilities must be adequate to supply water at the MDD rate. Also presented in **Table 3-3** is the MDD peak factor of 1.9. The existing system-wide MDD is 10.24 MGD and was calculated by multiplying the ADD by the average MDD peak factor. Furthermore, the PHD is the peak rate at which water is required during any one hour of the year. During PHD, minimum system pressures are experienced. The PHD peak factor is 3.1 and the existing system wide PHD is 16.37 MGD.

The existing water production facilities in the City's system are described in **Section 5.1.2**, **Water Production**. A supply analysis was performed on the existing system by adding all the available water production facilities while placing the largest well out of service, known as the firm capacity. The firm capacity was then compared to the existing MDD. The difference between the firm capacity and the MDD nets the system's supply surplus or supply shortage. **Tables 5-8** summarize this analysis by taking the largest well out of service, Well No. 19. Two wells, Well No. 7 and Well No. 10 are currently inactive and are not included in the analysis.

Tables 5-8
Existing Water Supply Analysis – System-wide

Well No.	Pressure Zone	Status	Firm Capacity (gpm)	Total Capacity (gpm)
11	Low	Active	1,371	1,371
12	Low	Active	2,114	2,114
16	Low	Active	1,848	1,848
17	Low	Active	2,138	2,138
18	150	Active	1,965	1,965
19	Low	Active	0	2,323
Total Production Capacity			9,436	11,759
Year	**MDD**		**Surplus / Shortage Supply**	
	MGD	**gpm**	**MGD**	**gpm**
Existing	10.24	7,110	**3.35**	**2,326**

It can be concluded that the water system is capable of providing sufficient water supply to meet existing demands with a surplus of 2,326 gpm.

Furthermore, a water supply analysis was done on the existing water system by zone. The analysis was done by adding all the available water supply per zone and subtracting the largest pumping unit (firm capacity). Well No. 18 provides supply to the Well 18 Reservoir, which acts as a forebay for the Well 18 Booster Station (Low Zone and 150 Zone). In order to be conservative, it can be assumed that supply from the Well 18 Booster Station can only be considered as the total capacity of Well No. 18 and not the Capacity of the Boosters and furthermore should be split evenly between the Low Zone and the 150 Zone. As a result, the analysis will show supply from this site as Well No. 18 with half being provided to the Low Zone and half is being provided to the 150 Zone.

Well No. 12 is similar in that it provides water to the Mecca Reservoir, which acts as a forebay for the Well 12 Booster Station, and which boosts water into the Low Zone. In order to be conservative, it can be assumed that supply from the Well 12 Booster Station can only be considered as being the total capacity of Well No. 12. As a result, the analysis will show supply from this site as Well No. 12.

Table 5-9 analyzes the production capacity of each zone by taking the largest water supply source out of service in each zone.

Table5-9
Existing Water Supply Analysis– Zone

Pressure Zone	Production Facility	Status	Firm Capacity (gpm)	Total Capacity (gpm)
Low	Well #11	Active	1,371	1,371
	Well #12	Active	2,114	2,114
	Well #16	Active	1,848	1,848
	Well #17	Active	2,138	2,138
	Well #18	Active	983	983
	Well #19	Active	0	2,323
	Zone Production Capacity		**8,454**	**10,777**
Pressure Zone	**Production Facility**	**Status**	**Firm Capacity (gpm)**	**Total Capacity (gpm)**
150	Well #18	Active	0	983
	Zone Production Capacity		**0**	**983**
Pressure Zone	**MDD per Zone**		**Surplus / Shortage Supply**	
	MGD	**gpm**	**MGD**	**gpm**
Low	9.73	6,754	**2.45**	**1,699**
150	0.51	355	**-0.51**	**-355**

It can be concluded that the City is capable of providing sufficient water supply to the existing system for the Low Zone with a surplus of 1,699 gpm. The analysis shows that the 150 Zone has a deficiency of 983 gpm. This deficiency is a result Well No. 18 being the only source of non-emergency supply for the 150 Zone. It should be noted that with Well No. 18 in service, the 150 Zone production capacity of 983 gpm is approximately 2.8 times higher than the 355 gpm MDD. Additionally, in an emergency situation CWA Staff indicated that a normally closed valve located near Well No. 11 could be opened to provide additional supplies. Projects addressing this 150 Zone deficiency will be discussed later in **Section 8, Capital Improvement Program**.

5.2.2.2 Storage Capacity

The role of a reservoir is to provide water storage for a water system, known as total storage. Total storage can be broken down into 3 separate types, operational storage, fire storage, and emergency storage. Operational storage provides pressure to the distribution system and provides a reliable supply source for daily demand fluctuations, fire storage provides a consistent source to meet firefighting demands for a set period of time in the service area, and lastly emergency storage provides water reserves during emergency situations such as system failures, main breaks, and power outages. Each scenario and its evaluation criteria are discussed in greater detail below.

5.2.2.2.1 Operational Storage

Operational storage is defined as the volume of storage required to supply the difference between source supply (wells) and demand fluctuations throughout the day. Generally, operational storage supplies the peak hour flows in excess of daily supply capacity during a MDD scenario. Peak hour flows typically occur during the morning and late afternoon when consumers prepare for daily activities and arrive home from daily activities. The operational storage volume used during these peak hours will be replenished during off-peak hours when demand is at its lowest, typically during the nighttime when most consumers are asleep.

Sufficient operational storage can allow a City to operate its system using reservoir storage during peak hours and avoid pumping during peak electrical demand periods, resulting in a cost savings. According to the American Water Works Association (AWWA), operational storage is recommended to be approximately 25% to 33% of the MDD experienced during one maximum day. It is recommended that City maintain an operational storage capacity of at least 25% of MDD for the Low Zone and 30% for the 150 Zone. The higher requirement for the 150 Zone is due to the arid climate fact that the 150 Zone is a smaller service area. Refer to **Table 5-11, Existing Storage Requirement** for the storage requirements summary which includes operational storage.

5.2.2.2.2 Emergency Storage

Emergency storage is defined as the volume of storage required during an emergency situation available for domestic consumption. The emergency storage volume is usually based on the City's past experience with emergency situations and the expected duration to correct the emergency situation. Storage is provided for emergency situations such as: power failures for an extended time, failure of water supply production facilities, failure of water transmission facilities, transmission or distribution main breaks, several simultaneous fires, water contamination, or other unplanned events. As these emergency situations are difficult to predict in size, scope, and quantity, emergency storage evaluation criterion is based on past experience and engineering judgment.

The most likely emergency situation is an extended power failure, well and/or booster pump failure, or a transmission main failure, any of which would limit distribution capacity in a localized area. In the event of a widespread loss of electrical power, the City would lose production facilities not equipped with a backup power source. Reservoirs that supply the distribution system from booster pump stations must therefore have a backup power source to satisfy the emergency storage requirements. Note that both the Well 12 Booster Station and the Well 18 Booster Station are equipped with backup power. This backup power ensures that the 3.6 MG

Mecca Reservoir and the 5.0 MG Well 18 Reservoir volumes can be included in the storage analysis.

Additionally, for zones that have direct supply from groundwater wells, the groundwater aquifer can also be credited for emergency water storage if the well is equipped with an emergency generator. The volume of emergency storage credited to each well is the total volume that can be pumped while backup power is supplied (usually a 24-hour's worth of fuel). In the event of a transmission main break, the City would lose transmission capabilities for that main only. Note that the City can typically respond to and repair most main breaks within 24-hours. Based on the above and discussions with City staff, the emergency storage requirement is set at 100 percent of the ADD for each pressure zone. This emergency storage will meet customer demands for a period of 24-hours to allow for repair of main breaks, restoration of power, or repair equipment failures. Note that Well No. 19 is equipped with backup power. Well 19 has a capacity of 2,323 gpm, which if ran for a 24 hour period on backup power would net 3.3 MG worth of storage.

5.2.2.2.3 Fire Storage

The Insurance Services Office (ISO) establishes general fire flow standards, and these general standards are applied by local jurisdictions, such as the Riverside County Fire Department and the City. The general standards take into consideration the type of occupancy, type of construction and construction materials, distance from other structures, and other factors when assigning fire flow requirements. The fire flow requirements for the City's water system are based on the Riverside County Fire Department requirements, including Ordinance Numbers 460 and 787. The Riverside County Fire Department has established minimum fire flows for general building categories, but may be reduced by 50 percent when building are equipped with approved fire sprinkler systems. Land use type over the specified duration determine fire flow and storage requirements in a pressure zone. The fire flow requirements for the various land use types are listed in **Table 5-10**.

Table 5-10
County of Riverside Fire Flow Criteria

Land Use Type	Minimum Required Fire Flow	Required Duration	Evaluation Demand Conditions
Mobile Homes and Manufactures Housing	500 gpm	2 hours	MDD
Single Family Residential	1,000 gpm	2 hours	MDD
Multi-Family Residential, Commercial, and light industrial lot < 1 AC	2,500 gpm	2 hours	MDD
Spotlight Casino	3,000 gpm	2 hours	MDD
Commercial, and Medium industrial lot > 1 AC	4,000 gpm	2 hours	MDD
Heavy Industrial	5,000 gpm	2 hours	MDD
School	3,500 gpm	2 hours	MDD

Based on land use type, the highest existing fire flow requirement for the Low Zone would correspond to the Commercial and Medium Industrial Section. Therefore, the fire flow requirement for the Low Zone is 4,000 gpm over a 2 hour period. This results in a total fire flow of 480,000 gallons. Consequently, the fire storage required for the Low Zone is 480,000 gallons or 0.48 MG. For the existing 150 Zone, Spotlight Casino governs the fire flow requirements, which results in a fire storage requirement of 360,000 gpm or 0.36 MG. There will only be one fire per pressure zone at any one time when calculating fire storage within this plan.

Refer to **Table 5-11** for the storage requirements summary which includes operations, emergency, and fire storage. In this analysis, the low zone storage consists of the 3.6 MG Mecca Reservoir, 2.5 MG's from the 5.0 MG Well 18 Reservoir, and the 3.3 MG's from Well No. 19. The 150 Zone storage consists of the remaining 2.5 MG's from the 5.0 MG Well 18 Reservoir, and the 1.5 MG Dillon Road Reservoir. Future storage requirements are evaluated on a zone by zone basis and are discussed further in **Section 5.2.3, Future System Evaluation**.

Table 5-11
Existing Storage Requirements

Existing Storage (MG)								
Pressure Zone	**Demands**		**Storage Requirements**				**Summary**	
	ADD	**MDD**	**Operational**	**Emergency**	**Fire**	**Total**	**Existing Storage[(1)]**	**Surplus / Shortage**
Low	5.01	9.71	2.43	5.01	0.48	**7.92**	9.4	1.48
150	0.27	0.52	0.16	0.27	0.36	**0.79**	4.0	3.21
Total:	**5.28**	**10.24**				**Total:**	**13.4**	**4.70**

(1) Assumes 3.3 MG from Well 19 running 24 hours under emergency power.

According to Table 5-11, there is an existing 1.48 MG surplus of storage in the Low Zone and a surplus of 3.21 MG for the 150 Zone. The overall existing system has a surplus of 4.76 MG storage.

5.2.3 Future System Evaluation

To provide reliable water, the water system must be able to meet future supply and storage demands. The following is an evaluation done on the water system based on future demands.

5.2.3.1 Future Production Capacity

As presented in **Table 3-11**, future average day demands were determined for the years 2020, 2025, 2030 and 2035. From **Table 3-3**, the MDD peaking factor of 1.9 was multiplied to the calculated future ADDs to obtain future MDDs, which are the maximum quantity of water used on any single day in a given year. The City's water supply facilities must be adequate to supply water at the future MDD rate. **Table 5-12, Future Average and Max Day Demands** summarizes these demands.

Table 5-12
Future Average and Max Day Demands

Year	**Low Zone**		**150 Zone**		**150+ Zone**		**Total System**	
	ADD (MGD)	**MDD (MGD)**	**ADD (MGD)**	**MDD (MGD)**	**ADD (MGD)**	**MDD (MGD)**	**ADD (MGD)**	**MDD (MGD)**
2020	5.35	10.39	1.05	2.04	1.17	2.27	7.58	14.70
2025	5.71	11.08	1.84	3.57	2.34	4.54	9.89	19.18
2030	6.07	11.78	2.62	5.09	3.51	6.80	12.20	23.67
2035	6.43	12.47	3.41	6.61	4.68	9.07	14.51	28.16

From the figures presented in Table 5-12, an analysis was done on the future of the water system to determine the surplus or shortage supply capacity. Again, the largest well was taken out of service and the remaining wells were added (firm capacity). Future MDDs were compared to the total obtained from firm capacity. The results are detailed below in **Table 5-13, Future Supply Analysis – System-wide**.

Table 5-13
Future Supply Analysis – System-wide

Well No.	Pressure Zone	Status	Firm Capacity		Total Capacity	
			gpm	MGD	gpm	MGD
11	Low	Active	1,371	1.97	1,371	1.97
12	Low	Active	2,114	3.04	2,114	3.04
16	Low	Active	1,848	2.66	1,848	2.66
17	Low	Active	2,138	3.08	2,138	3.08
18	150	Active	1,965	2.83	983	1.41
19	Low	Active	0	0	2,323	3.35
Total Production Capacity			**9,436**	**13.59**	**10,777**	**15.52**

Year	MDD	Surplus / Shortage Supply
	MGD	MGD
2020	14.70	-1.11
2025	19.18	-5.60
2030	23.67	-10.08
2035	28.16	-14.57

From the table above, it can be noted that by the year 2020, there will be a shortage of water supply of 1.11 MGD. The shortage increases up to 14.57 MGD by the year 2035. Projects addressing these future deficiencies will be discussed later in **Section 8, Capital Improvement Program**.

Furthermore, a supply analysis was done by zone. The years 2020, 2025, 2030 and 2035 future demands were compared to the existing water production units. Again, just like in Section 5.2.2.1, the largest pumping unit was taken out of service to better analyze supply capabilities and Well No. 18's capacity was split evenly between pressure zones. Wells were added at the time stamp where supply is needed, it was assumed that future wells can produce approximately 2,000 gpm (2.88 MGD). The following **Table 5-14, Future Supply Analysis – Zone Specific** lists the results.

Table 5-14
Future Supply Analysis – Zone Specific

Zone	Production Facility	Status	Firm Capacity (gpm)	Total Capacity (gpm)
Low	Well #11	Active	1,371	1,371
	Well #12	Active	2,114	2,114
	Well #16	Active	1,848	1,848
	Well #17	Active	2,138	2,138
	Well #18	Active	983	983
	Well #19	Active	0	2,323
	Total Production Capacity		**8,454**	**10,777**

Zone	Production Facility	Status	Firm Capacity (gpm)	Total Capacity (gpm)
150	Well #18	Active	983	983
	Well #20	2018 CIP	0	2,000
	Total Production Capacity		**983**	**2,983**

2020							
Zone	**MDD per Zone**		**Surplus / Shortage Supply**		**Needed Supply Well**	**Added Supply(1)**	**New Surplus / Shortage Supply**
	MGD	**gpm**	**MGD**	**gpm**		**gpm**	**gpm**
Low	10.39	7,212	1.79	1,242	0	0	1,242
150	2.04	1,420	-0.63	-437	1(3)	2,000	1,563
150 +	2.27	1,575	-2.27	-1,575	2(2)	2,000	425

2025							
Zone	**MDD per Zone**		**Surplus / Shortage Supply**		**Needed Supply Well**	**Added Supply(1)**	**New Surplus / Shortage Supply**
	MGD	**gpm**	**MGD**	**gpm**		**gpm**	**gpm**
Low	11.08	7,695	1.09	758	0	0	758
150	3.57	2,478	0.73	505	0	0	505
150 +	4.54	3,150	-1.66	-1,150	1	2,000	850

Note: Table 5-14 continued on next page.

Table 5-14 (continued)
Future Supply Analysis – Zone Specific

2030							
Zone	**MDD per Zone**		**Surplus / Shortage Supply**		**Needed Supply Well**	**Added Supply(1)**	**New Surplus / Shortage Supply**
	MGD	**gpm**	**MGD**	**gpm**		**gpm**	**gpm**
Low	11.78	8,179	0.40	275	0	0	275
150	5.09	3,535	-0.80	-552	1	2,000	1,448
150 +	6.80	4,724	-1.04	-724	1	2,000	1,276

2035							
Zone	**MDD per Zone**		**Surplus / Shortage Supply**		**Needed Supply Well**	**Added Supply(1)**	**New Surplus / Shortage Supply**
	MGD	**gpm**	**MGD**	**gpm**		**gpm**	**gpm**
Low	12.47	8,662	-0.30	-209	1	2,000	1,791
150	6.61	4,593	0.56	390	0	0	390
150 +	9.07	6,299	-0.43	-299	1	2,000	1,701

(1) Each new supply well is expected to produce an average of 2,000 gpm.
(2) 2-2,000 gpm Wells were added in year 2020 for the 150+ Zone in order to provide a 2,000 gpm Firm Capacity
(3) Well shown is planned for construction in 2018 per CWA's 5-Year Planned Construction Project schedule (Well #20).

It can be concluded that the City will be capable of providing sufficient water supply to the Low Zone through the year 2030, but will need to add supply starting in 2035. Just as shown in the existing system analysis from Section 5.5.5.1 Production Capacity and Reliability, the 150 Zone has a deficiency of 983 gpm and a new well (Well #20) is planned to be built in 2018, which will add approximately 2,000 gpm to the zone. As a result, Well No. 18 will no longer be the only source of non-emergency supply for the 150 Zone. The 150+ Zones will require supplies be developed once development begins in those areas. It is anticipated that by 2020 the 150+ zone will require a minimum of 2.27 MGD or 1,575 gpm. **Table 5-14** shows that two wells will be needed by 2020, one by 2025, one by 2030, and one by 2035. Further explanation of the projects addressing zone supply deficiencies identified in Table 5-14 are discussed later in **Section 8, Capital Improvement Program**.

5.2.3.2 Future Storage Capacity

The role of water storage reservoirs is to provide operational storage, fire suppression storage, and emergency storage to a water supply system. Using the criteria described in **Section 5.2.2.2**; Operational, Emergency and Fire Flow storage was analyzed to better understand the system's future needs. **Table 5-15, Future Storage Analysis**, lists the findings for the year 2020, 2025, 2030 and 2035. The role of water storage reservoirs is to provide operational storage, fire suppression storage and emergency storage to a water supply system.

A zone by zone comparison of available and future required storage depicts that by the year 2020, there will be a deficit of 2.3 MG in the 150+ Zone. As a result, the 150+ Zone will have to construct a 2.5 MG reservoir to remedy the storage deficiency. By the year 2025, another 2.5 MG reservoir will be needed to make up the 1.6 MG storage deficiency in the 150+ Zone. In the year 2030, both the 150 and 150+ Zones will need a 2.0 MG and 3.0 MG reservoirs, respectively, to address their 0.6 MG and 1.0 MG deficiencies. Lastly, by the year 2035, the Low Zone will need to construct a 1 MG reservoir to address its 0.6 MG storage deficiency. Further explanation on the projects addressing zone storage deficiencies identified in Table 5-15 are discussed later in **Section 8, Capital Improvement Program**.

Table 5-15
Future Storage Analysis

2020

Zone	Demands (MG)		Storage Requirements (MG)				Summary (MG)		New Storage (MG)	
	ADD	MDD	Operational	Emergency	Fire	Total	Existing Storage	Surplus / Shortage	Added Storage	New Surplus / Shortage Storage
Low	5.4	10.4	2.6	5.4	0.48	**8.4**	9.4	1.0	0.0	1.0
150	1.1	2.0	0.6	1.1	0.42	**2.1**	4.0	1.9	0.0	1.9
150 +	1.2	2.3	0.7	1.2	0.42	**2.3**	0	-2.3	2.5	0.2
Total:	**7.6**	**14.7**				**Total:**	**13.4**	**0.6**	**2.5**	**3.1**

2025

Zone	Demands (MG)		Storage Requirements (MG)				Summary (MG)		New Storage (MG)	
	ADD	MDD	Operational	Emergency	Fire	Total	Existing Storage	Surplus / Shortage	Added Storage	New Surplus / Shortage Storage
Low	5.7	11.1	2.8	5.7	0.48	**9.0**	9.4	0.4	0.0	0.4
150	1.8	3.6	1.1	1.8	0.42	**3.3**	4.0	0.7	0.0	0.7
150 +	2.3	4.5	1.4	2.3	0.42	**4.1**	2.5	-1.6	2.5	0.9
Total:	**9.9**	**19.2**				**Total:**	**15.6**	**-0.5**	**2.5**	**2.0**

2030

Zone	Demands (MG)		Storage Requirements (MG)				Summary (MG)		New Storage (MG)	
	ADD	MDD	Operational	Emergency	Fire	Total	Existing Storage	Surplus / Shortage	Added Storage	New Surplus / Shortage Storage
Low	6.1	11.8	2.9	6.1	0.48	**9.5**	9.4	-0.1	0.0	-0.1
150	2.6	5.1	1.5	2.6	0.42	**4.6**	4.0	-0.6	2.0	1.4
150 +	3.5	6.8	2.0	3.5	0.42	**6.0**	5.0	-1.0	3.0	2.0
Total:	**12.2**	**23.7**				**Total:**	**18.4**	**-1.6**	**5.0**	**3.4**

2035

Zone	Demands		Storage Requirements				Summary		New Storage (MG)	
	ADD	MDD	Operational	Emergency	Fire	Total	Existing Storage	Surplus / Shortage	Added Storage	New Surplus / Shortage Storage
Low	6.4	12.5	3.1	6.4	0.48	**10.0**	9.4	-0.6	2.88(1)	0.4
150	3.4	6.6	2.0	3.4	0.42	**5.8**	6.0	0.2	0.0	0.2
150 +	4.7	9.1	2.7	4.7	0.42	**7.8**	8.0	0.2	0.0	0.2
Total:	**14.5**	**28.2**				**Total:**	**23.4**	**-0.3**	**1.0**	**0.7**

(1) Storage volume based on 2,000 gpm well added to Low Zone in 2035 being equipped with backup power for a 24 hour period.

SECTION 6
SYSTEM MODEL

This section describes the methods utilized to develop and calibrate the City's potable water system hydraulic model. This section will present the design criteria and methodologies used for analysis, model development, calibration efforts, and the modeling scenarios.

The hydraulic model was created using the existing water system information as described in Section 5 along with the Design Criteria as presented below. Initially, the development of the model distribution network was created from atlas maps, as-builts and discussions with City Staff. Water facilities, (pipelines, wells, pump stations, reservoirs, valves, and control valves) were entered into the network.

Subsequently, the allocation of pressure zones, ground elevations and water demands are discussed. This section then includes a discussion of the model calibration process, which is used to verify the model results with field measurements. Finally, this section concludes with a discussion of the various modeling scenarios included in this plan. The calibrated model is used to perform system analyses of the system under existing demand conditions and future demand conditions, discussed in **Section 7, Distribution System Analysis**.

6.1 DESIGN CRITERIA

Evaluation of the water system's distribution system is performed utilizing the hydraulic model using industry standards. These industry standards are typically the range of values used to evaluate the safety and dependability of a water system. These ranges of values were compiled using input from CWA Staff, applicable regulatory standards, design standards and guidelines that are widely acknowledged within the water industry and are typical ranges of values that are acceptable for the criteria in question. Within this section, the evaluation criteria will be presented. A summary of the distribution system evaluation criteria used in the report is shown below in **Table 6-1**.

Table 6-1
Water System Evaluation Criteria

Evaluation Criteria	Value	Units	Evaluation Demand Conditions
Demand Peaking Factors			
Max Day Demand	1.9 X ADD	gpm, MGD	N/A
Peak Hour Demand	3.1 X ADD	gpm, MGD	N/A
Fire Flows			
Mobile Homes and Manufactures Housing	500	gpm	MDD - 2 hrs
Single Family Residential	1,000	gpm	MDD - 2 hrs
Multi-Family Residential, Commercial, and light industrial lot < 1 AC	2,500	gpm	MDD - 2 hrs
Spotlight Casino	3,000	gpm	MDD - 2 hrs
School	3,500	gpm	MDD - 2 hrs
Commercial, and Medium industrial lot > 1 AC	4,000	gpm	MDD - 2 hrs
Heavy Industrial	5,000	gpm	MDD - 2 hrs
System Pressures			
Minimum Pressure, during Peak Hour	40	psi	PHD
Minimum Pressure, with fire flow	20	psi	MDD + FF
Maximum Pressure, during average day	110	psi	ADD
Maximum Daily Pressure Swing, during normal conditions	25	psi	ADD
Maximum Pipeline Velocity			
Maximum Velocity, during peak hour	7	fps	PHD
Maximum Velocity, with fire flows	10	fps	MDD + FF

6.1.1 System Pressures

There is a range of water pressures that are acceptable within a potable water system. These system pressures are evaluated under four different scenarios and are as listed in **Table 6-1.** The system pressure evaluation only includes demand nodes as they are the only locations which need to meet said pressure requirements.

The first two scenarios evaluate minimum allowable pressures under Peak Hour Demand (PHD) and Maximum Day Demand (MDD) plus fire flow conditions. According to the American Water Works Association (AWWA), the minimum pressure criterion for normal PHD conditions is 40 pounds per square inch (psi), while the minimum pressure criterion under MDD with fire flow conditions is 20 psi. Lower pressure can be seen within the system, but will be limited to junctions near reservoir inlets/outlets.

Maximum pressures are also evaluated within the system under Average Day Demand (ADD) scenarios. According to the American Water Works Association (AWWA), the maximum pressure criterion for normal ADD conditions is 110 psi. This allows for the use of the common Class 150 water pipe to be used throughout the distribution system. It is recommended that pressure regulators be placed at residential services where the pressures exceed 80 psi. Additionally, it is recommended that the system should not experience a daily pressure swing greater than 25 psi.[56]

6.1.2 Pipeline Velocities

Pipeline velocities are evaluated in the system for two different maximum conditions as listed in **Table 6-1**. The maximum velocity criterion is intended to decrease the potential for the damage or erosion of pipeline linings.

The first condition evaluated is maximum velocity during PHD events and shall be no great than 7 feet per second (fps). The second condition is maximum velocity evaluated during MDD with fire flows and shall be no greater than 10 fps. Design velocities for transmission mains may be lower in certain situations in order to reduce friction losses and meet the minimum pressure criterion as explained above.

6.1.3 Fire Flow

Providing emergency fire protection is one of the greatest responsibilities of a City's water system. This emergency fire protection is known as fire flow. The system must be able to provide adequate water flows for various land use types at a minimum pressure of 20 psi for specific durations as summarized in **Table 6-1.** For each service zone, the fire flow and storage requirements are determined by the highest fire flow requirement based on land use type over the specified duration.

Based on land use type, the highest existing fire flow requirement for the Low Zone corresponds to the Commercial and Medium Industrial Section. Therefore, the fire flow requirement for the Low Zone is 4,000 gpm over a 2 hour period with MDD. For the existing 150 Zone, Spotlight Casino's requirement governs with a 3,000 gpm fire flow over a 2 hour period with MDD. Each zone is evaluated based upon the aforementioned requirement. There will only be one fire per pressure zone at any one time when evaluating fire flow within this plan.

[56] AWWA M32, Third Edition, Section 5.3, System Design Criteria.

Future fire flow requirements for the 150 Zone are increased to the "School" requirement by year 2020 as estimated by the growth projections presented in **Section 3**. Currently there are no anticipated developments within the City which would require greater fire flows (i.e. Commercial and Medium Industrial > 1 ac. Lot, and Heavy Industrial). If future development types of greater fire flow requirements occur, the pressure zone servicing said developments will need to be analyzed for greater requirements.

6.2 MODEL DEVELOPMENT

The hydraulic model for the City was created in *H_2ONET Version 11* using facility information supplied by the City. *H_2ONET* is a water distribution modeling, analysis, and design software which is integrated within AutoCAD.

6.2.1 Data Collection

The City provided detailed information which was used for the model's creation and development. This information includes, but was not limited to:

- City Base Maps
- CAD drawings showing water mains and water facilities
- Water atlas sheets
- Water Demands
- Well performance and testing data
- Facility as-built drawings
- Storage reservoir data
- Booster Pump curves and performance testing data
- Pump controls and settings of pressure regulating valves
- Water production and customer usage records
- City of Coachella 2006 Water Master Plan Update (Dudek, 2006)
- General Plan and land use information
- Ground elevation contour lines
- Street centerline data

6.2.2 Model Construction

The water model was created from scratch as there was no existing model available at the time of creation. Pipelines included in the hydraulic model were obtained from as-builts and water atlas maps provided by the City. Only pipelines that are active and owned by the City are included in the model. All irrigation pipes, abandoned pipes, and water service laterals are excluded. The model creation process for wells, pump stations reservoirs and pressure reducing stations is described below.

6.2.3 Water Facilities

The City's existing water system contains three reservoirs, two booster pumping stations, and eight groundwater wells, six of which are operational. The water facilities are modeled based on the hydraulic schematic presented in **Figure 5-2** and information provided by the City staff. City staff provided information regarding the operation of facilities, settings of control valves, well operations, and booster station controls. More detailed descriptions of the modeled water facilities are given below:

6.2.3.1 Wells

The existing six active groundwater wells are included in the hydraulic model. Each well is modeled as a reservoir and a pump, where the reservoir represents the groundwater source, while the pump represents the well pump. When adequate data is available the reservoirs are modeled as fixed head reservoirs with a water elevation equal to the standing groundwater level minus drawdown. The pumps are modeled using the results of well pump tests provided by the City, included in **Appendix C, Hydraulic Test Reports**. If adequate data is unavailable, the fixed head reservoirs are modeled with a water elevation equal to site ground elevations with well pumps being modeled using discharge data. **Table 5-2** lists pertinent information for each of the groundwater wells included in the model.

6.2.3.2 Storage Reservoirs

The model includes three existing reservoirs. For analysis, the initial water level of the reservoirs are taken as two thirds full. The initial water level represents the water depth at the beginning of a hydraulic simulation. The storage reservoir information included in the model is summarized in **Table 5-3.**

6.2.3.3 Booster Pumping Stations

The hydraulic model includes the two existing booster pumping stations, with a total of 7 booster pumps. Booster pumping stations are modeled with the best available information; either a multi-point curve based on the manufacturer's curve data or using the results of well pump tests provided by the City, which are also included in **Appendix C, Hydraulic Test Reports**. Pump tests can be an important tool used to reflect the decrease in mechanical performance associated with age. Pump controls were obtained from data provided by the City and its Operators. Pertinent information for each of the booster pumps included in the model is listed in **Table 5-4**.

6.2.4 Pressure Zones

There are two pressure zones within the City's existing water distribution system which were modeled. The High Zone, also known as the 150 Zone, has an HGL elevation of 146 feet above sea level, which is controlled by the HWL of the 1.5 MG Dillon Road. The Low Zone has an HGL of approximately 90 feet above sea level and it's established by pressure setting controls on the wells and boosters within the low zone. The low zone and high zone are not connected by any type of pressure reducing station and are effectively modeled the same way with no interconnections.

6.2.5 Elevation Assignment

The ground elevations of all model nodes were assigned using the most current USGS mapping for the region and or data field notes provided by the City.

6.2.6 Water Demand Allocation

The allocation of water demand for existing conditions are described below:

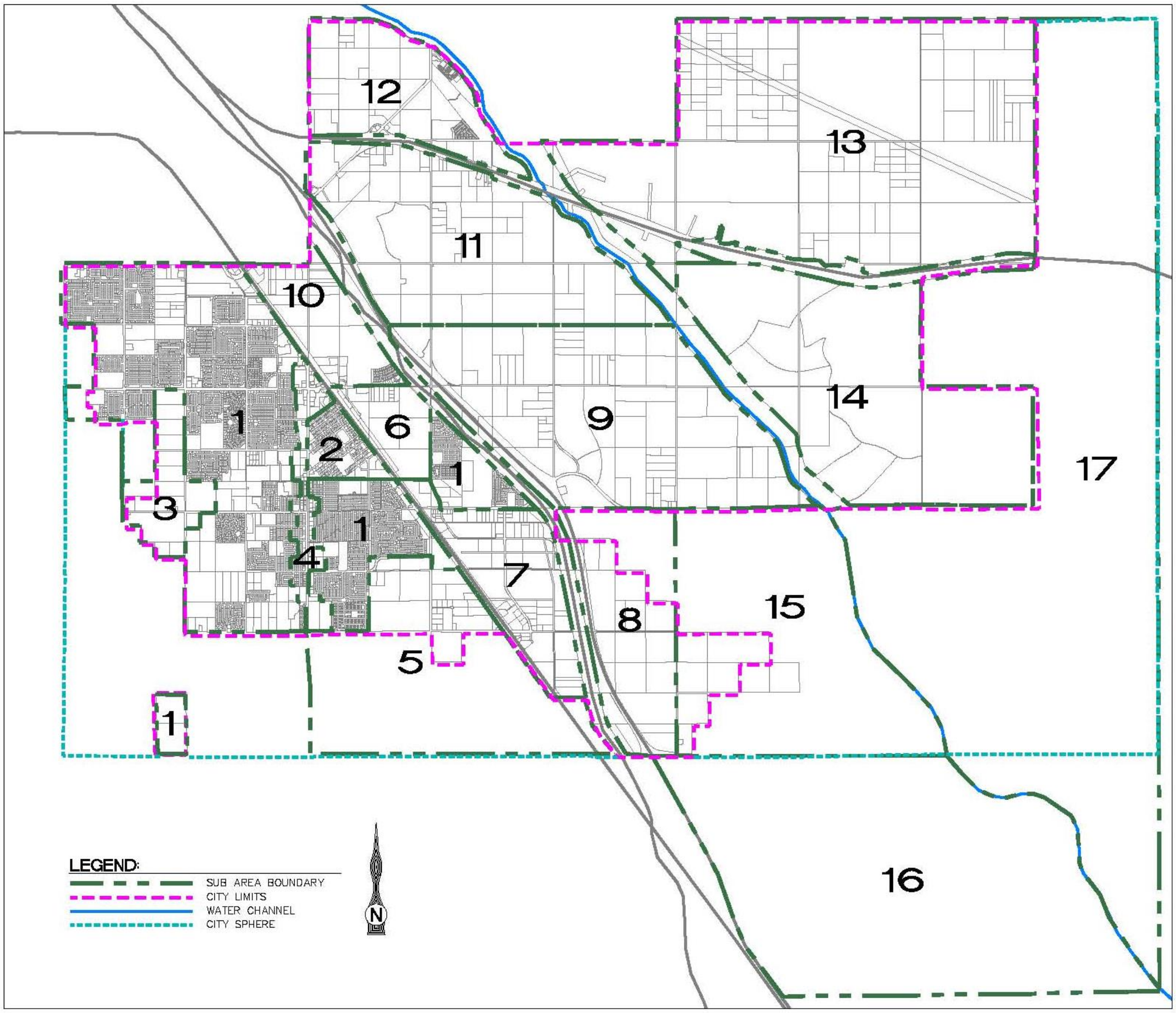
6.2.6.1 Existing System Water Demands

Existing annual consumption factors (ACF's) were determined by relating average historic customer account billing data for a particular land use type and the corresponding developed area as presented in **Section 3.2.1, Existing Demand Factors**. These existing ACF's are expressed in acre-feet per acre on an annual basis for each of the different land use categories.

6.2.6.2 Model Allocation of Existing Demands

Existing ACF's were used to establish demands at model nodes throughout the system. Demands were established by calculating the acreage of developments throughout the City and then multiplying the appropriate ACF for the particular land use. These demands were calculated in acre-feet per year and then converted in to gallons per minute. This was done manually at all the locations of developments throughout the City within the model using aerial imagery and input from the City in order to apply demands throughout the City's model.

Figure 6-1
Future Growth Sub Areas



6.3 MODEL CALIBRATION

The existing condition hydraulic model is calibrated in order to enhance the accuracy of the model results. This ensures that model conditions and results accurately reflect real world field conditions. Once calibrated, the model can be used to identify system deficiencies and assist in planning efforts to address these deficiencies by optimizing the sizing of pipelines and other various facilities. Model calibration is the practice of comparing field data with model results and making model modifications where appropriate to match the field results as close as possible. Typical adjustments include modifying system interconnections, operational settings, assigned elevations, piping roughness factors, demand allocations, etc.

CWA SCADA and field data was gathered in order to facilitate model calibration efforts. First was a Baseline Test, which was used to establish set points which could be compared to the model. Data was gathered for all of the CWA sites along with pressure gauge reading at 6 fire hydrant locations throughout the City. This data and a map of the 6 locations can be viewed in **Appendix D, Model Calibration**.

Once the Baseline Test was completed, CWA performed operational changes to the system, waited 10 minutes for the system to stabilize and then record the data as described above in the baseline test. The system was always returned to the Baseline Test conditions before moving onto the next Operational Change. This was done in order to obtain a reliable indication of how the system reacts to modified conditions. There were a total of 3 operational changes performed to different areas within the CWA's system and are described below. The results of these operational changes can also be viewed in **Appendix D, Model Calibration**.

- **Operational Change #1:** Shut off Well #11 and Well #16. Wait 10 minutes to allow the system to stabilize and then record all data at the exact same point in time.
- **Operational Change #2:** Shut off Booster 1 Low Zone and Booster 2 Low Zone at the 5.0 MG Reservoir Site. Wait 10 minutes to allow the system to stabilize and then record all data at the exact same point in time.
- **Operational Change #3:** Shut off Booster 1 and Booster 2 at the 3.6 MG Reservoir Site. Wait 10 minutes to allow the system to stabilize and then record all data at the exact same point in time.

Based on the results, it is concluded that CWA's system responds automatically when sources of supply are taken off line as they were in the 3 operational changes. This can be attributed to the large number of variable frequency drive (VFD) well and pump motors used throughout the City. This was shown with the small variations in the results recorded in Appendix D.

The model was compared to pressures and data gathered in the field. The small differences between the average annual demand distribution that is allocated to the nodes within model and the demand distribution that occurred in the field on calibration day may have contributed to some slight discrepancies between the model and field conditions. However, model results are satisfactory and the pressures simulated by the model are a good representation of actual field conditions.

6.4 FUTURE MODEL

The future water system model is based on current water system conditions and current control settings. Based on the analysis of future water demands found in Section 3 and the analysis of future supply and storage from Section 5, it was concluded that new supply and storage facilities would need to be put in place over the upcoming years in order to meet the demands of a growing City. The model takes into account the future water demands and future facilities as described in the sections below.

6.4.1 Future Water Demand Allocation

The allocation of water demand for projected future demands are described below:

6.4.1.1 Future Demands

The addition of future demands are based on a similar process as the existing water demands; however, future water demand factors were established using lower ACF's which account for future land use densities and water conservation measures as described within **Section 3.2.3, Future Demand Factors.**

6.4.1.2 Model Allocation of Future Demands

The City was divided into 17 sub areas for planning purposes in the CGPU and as show in **Figure 6-1, Future Growth Sub Areas**. Each subarea is unique and distinct with specific policies that guide future development.[57] As a result of varying levels of existing development, each subarea has its own amount of acreage that has already been developed and remaining acreage that will be developed in the future.

These 17 subareas were used in order to calculate projected growth through the year 2035. Added demands were calculated for each subarea using the added development with their land areas and corresponding future ACF's. The 2035 added demands were then broken down into 5 year growth increments per CGPU population growth trends. Projected demands added by Sub Area and Total Demands can be found in **Appendix B, Projected Growth, Added Demands, and Total Demands**. These demands were then distributed by year on subareas within the water model.

6.4.2 Future Water Facilities

Future supply wells and future storage reservoirs were taken into account when developing the City's water system model. **Sections 5.2.3.1 and Section 5.2.3.2** further explain the analysis behind these future facilities. Future facilities within the model are also discussed in the sections below.

6.4.2.1 Future Production Wells

As discussed in the supply analysis found in **Section 5.2.3.1**, several wells will be required at different timestamps to meet future demands. **Table 6-2** lists productions wells by the zone and by the year they will be needed. This plan anticipates that all future groundwater production will require Hexavalent Chromium treatment in order to comply with California's MCL of 10 mg/L.

[57] 2015 Coachella General Plan Update, Section 4, Subarea Descriptions

Table 6-2
Future Production Wells

Year	Zone	Number of Supply Wells Needed	Well Names
2020	Low	0	
	150	1	Well #20
	150 +	2	Well #21& Well #22
2025	Low	0	
	150	0	
	150 +	1	Well #23
2030	Low	0	
	150	1	Well #24
	150 +	1	Well #25
2035	Low	1	Well #26
	150	0	
	150 +	1	Well #27

CWA provided a list of projects discussed further in **Section 6.4.2**, which are planned for construction in the next one to five years. One of these projects is the construction of Well #20 for the 150 Zone in the year 2018. From the table above, it can be seen that Well #20 will be required by the year 2020 for the 150 Zone. Therefore, this future well was incorporated in the future water system model in the year 2018 to align with CWA's construction schedule.

Each new supply well is expected to produce an average of 2,000 gpm to the water system model at the different time stamps shown above. These new supply wells were placed in the future water system model in order to meet the City's future demands developments. All future production wells for the 150+ Zones will be pump into the 150 Zone. Water will be boosted to the 150+ Zone's from the reservoirs at the 146' HWL. Developments requiring water supplies at higher elevations will be able to boost water from the 150 Zone up into higher future zones.

All future production wells for the City's Low and 150 Zones were located west of the Coachella Valley Storm Channel due to the groundwater quality concerts discussed in Section 4.7 and east of Grapefruit Boulevard in order to avoid influencing CWA's existing wells located further to the west. Future wells for the 150+ Zone may be placed east of Grapefruit Boulevard but are not recommended to be located east of the San Andreas Fault due to water quality concerns. Future developments looking to produce groundwater with wells located in areas of potentially poor groundwater quality may explore options such as additional treatment, but will be required to meet all CWA conditions of approval.

Future 150+ Zone wells were modeled to lift water up the 146' HGL where additional storage reservoirs will be located. These reservoirs, discussed at greater length in Section 6.4.2.2, will provide suction supplies for future boosters which will lift water to the higher elevations of the 150+ zones. These future developments in the 150+ Zones can be found in Subareas 13 and 14 as shown on **Figure 16-1**.

6.4.2.2 Future Storage Reservoirs

As shown in the Section 5 analysis, new storage reservoirs will also be required at different timestamps to meet future demands. These storage volumes were incorporated in the future water system model in order to match the City's future needs. **Table 6-3** depicts at what timestamp and what zone a storage volume will be built.

Table 6-3
Future Storage Reservoirs

Year	Zone	Number of Storage Reservoirs Needed	Added Storage by Reservoir (MG)
2020	Low	0	0.0
	150	0	0.0
	150 +	1	2.5
2025	Low	0	0.0
	150	0	0.0
	150 +	1	2.5
2030	Low	0	0.0
	150	1	2.0
	150 +	1	3.0
2035	Low	1	1.0
	150	0	0.0
	150 +	0	0.0

From the table above, it can be seen that a 2.5 MG reservoir will be built in the year 2020 to meet future storage demands. Different sized reservoirs will be needed in different zones and at different years based on the analysis done in **Section 5.2.3.2, Future Storage Capacity**. The construction of these future reservoirs will also be outlined in Section 8's CIP. The water system model will take into account all these new reservoirs to better capture the City's water demands.

6.4.2.3 Future Transmission Mains

The future wells and reservoirs slated for the 150+ zones are mostly for the large planned development in Sub Area 14, discussed in **Section 2.3.2.1** and known as La Entrada. Additionally, there are a few other future developments which will require transmission pipelines. These transmission pipelines are required to transport water from production locations discussed in **Section 6.4.2.1, Future Production Wells** to development locations. **Table 6-4** depicts these transmission mains and at what timestamp they will be needed.

Table 6-4
Future Transmission Pipelines

Year	Project	Diameter (in.)	Length (ft.)	Project Description
2020	Sub Area 14 Transmission Pipeline (Phase 1)	24	18,550	24" Waterline; Avenue 48 - 150 Zone Booster to Polk Street & Polk Street - Avenue 48 to Avenue 50 & Avenue 50 - Polk Street to 2.5 MG 150+ Zone Reservoir No. 1
2020	Sub Areas 8 and 15 Transmission Pipeline	16	7,000	16" Waterline; Avenue 52 - Polk Street to Fillmore Street & Fillmore Street - Avenue 52 to 1,320 feet south
2020	Sub Area 16 Transmission Pipeline	16	10,300	16" Waterline; Avenue 54 - Polk Street to Fillmore Street & Fillmore Street - Avenue 54 to Airport Boulevard
2020	Sub Area 13 Transmission Pipeline	8	1,000	8" Waterline; Avenue 46 - 1.5 MG 150 Zone Reservoir to 1,000 feet east
2025	Sub Area 14 Transmission Pipeline (Phase 2)	24	13,400	24" Waterline; Fillmore Street - Avenue 50 to Avenue 52 & Avenue 52 - Fillmore Street to 2.5 MG 150+ Zone Reservoir No. 2
2025	Sub Area 14 Looping Transition Pipeline	24	6,250	24" 150+ Zone Looping Pipeline - Avenue 50 to Avenue 52

6.4.3 5-Year Planned Construction Projects

The water system model also incorporates future water facilities projects currently planned for by the City. **Table 6-5** below summarizes the projects identified by CWA staff. When applicable, these projects were integrated in the future water system model.

Table 6-5
5-Year Planned Construction Projects

Project Year	Project	Project Description
2017	4 Hot Tap Isolation Valves	Hot tap isolation valves, there are four locations in our system where turning water off requires turning off large sections of town. $50,000 (3 years)
2018	Whitewater Wash Bridge Pipeline @ Ave 50	Whitewater Wash Bridge Pipeline @ Avenue 50.
2018	Ave 50 - Tyler to Polk Ave & Polk Street - Ave 50 to Ave 52	Two miles of sixteen inch water line between Ave. 50 and Ave. 52 on Polk Street. When the bridge starts at Ave. 50 and the Whitewater Wash, it will disable the water line on Ave. 50 and cut off six million gallons of storage capacity to the low zone of our water system (2 years).
2018	Whitewater Wash Bridge Pipeline @ Dillon Road	Replace steel line crossing Whitewater Wash attached to bridge on Dillon road.
2018	150 Zone Looping Pipeline	Install 16" waterline on Ave 48 from Harrison Street to Tyler Street including provisions for Whitewater Wash crossing.
2019	Well 20	Drill additional well at Reservoir at well 18. Original designed had two wells pumping into reservoir but one of the wells was old and failed before construction was complete on reservoir at well 18. (2 years)
2019	8" Waterline Interconnection @ Grapefruit Blvd/Park Ln & Harrison Street.	8" waterline interconnection at Grapefruit Blvd/Park Ln & Harrison Street. Existing 4" waterline abandonment along Harrison Street - Grapefruit Blvd/Park Ln to Avenue 50. New service for customers lines along Harrison to existing 12" waterline.
2020	Grapefruit Blvd - Ave 49 to Mitchel Drive	Install 12" C900 waterline on Grapefruit Blvd. between Ave 49 and Mitchel drive.
2020	Van Buren Ave - Coral Mountain School to Ave 52 & Ave 52 - Van Buren Ave to Primativo Drive	Install 12" C900 waterline on Van Buren Between from Coral Mountain School to Avenue 52 and on Avenue 52 from Van Buren to Primativo Drive
2020	Grapefruit - Ave 52 to Ave 54 & Tyler Street - Old Ave 53 to Grapefruit Blvd	Install 12" waterline on Grapefruit Blvd between Ave 52 and Ave 54. Also Install 12" waterline on Tyler street between old Ave 53 and new Ave 53.
2021	Vista Del Sur - Tyler Street to 2000' West towards Dillon Rd	Install 12" waterline on Vista Del Sur from Tyler street to 2000' West towards Dillon Road
2021	Dillon Road - Vista Del Norte to Ave 44	Install 12" waterline on Dillon Road between Vista Del Norte and Ave 44.
2021	Ave 51 - Calhoun to Van Buren	Install 12" waterline on Ave 51 between Calhoun and Van Buren.

SECTION 7
DISTRIBUTION SYSTEM ANALYSIS

7.1 ANALYSIS SCENARIOS

To evaluate existing system components, testing was done to determine the ability of the system to meet demands under various demand scenarios. These demand scenarios include Average Day Demand (ADD), Maximum Day Demand plus Fire Flow (MDD + FF), and Peak Hour Demand (PHD). This analysis examines the system in order to determine if it has the ability toreliably meet the system demands under these typical scenarios using a combination of available water supply sources and storage. Once the existing system is evaluated, future demands are placed on the system and analyzed for each scenario.

7.1.1 Average Day Demand

During an ADD scenario the system experiences demands that are experienced during normal operation and typically seen outside of the hottest times of the year or the wettest times of the year. During this scenario, the system will normally experience higher pressures due to the lower demands. This analysis is performed in order to ensure that the system does not provide pressures that are too high. As stated in **Section 6**, the highest pressure allowable in the system under this scenario will be 110 psi. Additionally, customers that experience pressures over 80 psi require pressure regulators between the meter and customer to ensure customer plumbing fixtures are not damaged.

7.1.2 Maximum Day Demand +Fire Flow

Providing emergency fire protection is one of the greatest responsibilities of a City's water system. This emergency fire protection is known as fire flow. The system must be able to provide adequate water flows for various land use types at a minimum pressure of 20 psi for specific durations with a maximum pipe velocity of 10 fps. For each service zone, the fire flow and storage requirements are determined by the highest fire flow requirement based on land use type over the specified duration.

Based on land use type, the highest existing fire flow requirement for the Low Zone corresponds to the Commercial and Medium Industrial land use designation and therefore, the fire flow requirement for the Low Zone is 4,000 gpm over a 2 hour period with MDD. For the existing 150 Zone, the Spotlight Casino's requirement governs with a 3,000 gpm fire flow over a 2 hour period with MDD. Fire flow requirements for the 150 Zone are increased to the "School" requirement by year 2020 as estimated by the growth projections presented in Section 3. Each zone is evaluated based upon the aforementioned requirements and this plan assumes there will only be one fire per pressure zone at any one time when evaluating fire flows. Just as with the existing system, future growth in new pressure zones shall meet the highest land use fire flow requirements that will be present in the new zone. Currently the School designation will govern with the highest anticipated fire flow requirement for the future 150+ Zones.

7.1.3 Peak Hour Demand

During a PHD scenario, the system experiences demands that are only seen during the highest demand periods during normal operation. This typically occurs during the hottest day of the year during the hour with the highest demand. During this scenario, the system will typically experience lower pressures and higher velocities due to the higher demands. As stated in Section 6, the American Water Works Association (AWWA) establishes the minimum pressure criterion for normal PHD condition to be 40 psi and the maximum velocity during PHD events and shall be no great than 7 fps. Lower pressures and higher velocities may be seen within the system, but will be limited to junctions and pipelines near reservoir, well, and booster inlets/outlets.

7.2 EXISTING SYSTEM ANALYSIS (ADD, MDD+FF, PHD)

The existing system analysis is performed on the system model which was constructed as described in **Section 6.2, Model Development**. Below is a discussion of the existing system analysis performed.

7.2.1 Existing Average Day Demand

The existing ADD for the total system is 3,655 gpm and model results for the existing ADD scenario are show in **Appendix E**. CWA Staff reported that often times during a typical average day scenario, one, if not both, of CWA's non-variable frequency drive (VFD) equipped wells (Well #12 and Well #16) will be shut off, and as such, were modeled this way. This is due to the fact that the supply abilities of the other facilities within the Low Zone are adequate.

The use of VFD's in the Low Zone creates a condition where pumps and wells will ramp down during times of lower demands. These VFD equipped facilities, known as variable speed pumps (VSP's) within the model, help prevent excessive pressure within the Low Zone. In certain cases, the existing 12 inch diameter Whitewater Wash Bridge Pipeline at Avenue 50 can experience elevated velocities, thus creating a possible deficiency. These velocities vary from 0.1 fps to 7.76 fps, all depending on which facilities may or may not be running in the Low Zone. This is not a major concern given that this pipeline is scheduled to be replaced in 2018 with a larger 16 inch diameter pipeline as shown in **Section 6.4.2, 5-Year Planned Construction Projects,** and the existing piping on both sides of the bridge are already 16 inch.

7.2.2 Existing Maximum Day Demand + Fire Flow

The fire flow tests for the Low Zone (4,000 gpm) and the 150 Zone (3,000 gpm) during a MDD Scenario shows that the fire flow abilities for the Low Zone are adequate, while abilities in the 150 Zone at the Casino are insufficient. The results of the fire flow tests are shown within **Appendix E**.

Adding additional supplies in the 150 Zone and providing additional system looping will aid in providing sufficient pressure and flow. **Section 6.4.2, 5-Year Planned Construction Projects** identified two projects in year 2018 that will remedy this issue. The first project is Project No. 7 – Well #20, a new 2,000 gpm well for the 150 Zone. The second project is Project No. 15 - 150

Zone Looping Pipeline, which will consist of 5,280 feet of 16” waterline along Avenue 48 from Harrison Street to Tyler Street.

7.2.3 Existing Peak Hour Demand

The existing PHD for the total system is 11,331 gpm. During this scenario, all system wells and booster are modeled to be running. The wells and boosters are modeled as constant speed pumps rather than VSP’s due to the higher demand experienced during a PHD scenario in order to prevent a condition of excessive pump speeds. There are no existing deficiencies experienced and model results for the existing PHD scenario are shown in **Appendix E.**

7.3 FUTURE SYSTEM ANALYSIS

Future projects were integrated into the future model as previously discussed in **Section 6.4, Future Model**. All future improvements were integrated into the future model scenarios at the timestamp that they are expected to be operational. Below is a discussion of the future system analyses performed for the years 2020, 2025, 2030, and 2035.

7.3.1 2020 System Analysis (ADD, MDD+FF, PHD)

Along with the 2020 added demands, the 2020 system contains all of the facilities from the existing system and includes 11.1 miles of new pipelines, 6,000 gpm of new supply, and 2.5 million gallons of new storage. The 2020 ADD for the total system is 5,261 gpm. Under this scenario, none of the system pressures exceed the 90 psi maximum.

As noted in **Section 7.1.2, Maximum Day Demand + Fire Flow** the Low Zone fire flow requirement remains at 4,000 gpm, but the 150 Zone fire flow changes from 3,000 to 3,500 gpm with the inclusion of the “School” requirement. In 2020 the 150+ Zone also comes on line and its governing fire flow requirement is the 3,500 gpm “School” classification. The 2020 system can adequately handle these new fire flow amounts and meet the 20 psi residual requirement as a result of the projects discussed above in **Section 7.2.2**.

The 2020 PHD for the total system is 16,309 gpm. Under the 2020 PHD Scenario the system is able meet the 40 psi minimum pressure and does not exceed the 7 fps maximum velocity constraint. The 2020 model results for the ADD, MDD+FF, and PHD Scenarios are shown in **Appendix E.**

7.3.2 2025 System Analysis (ADD, MDD+FF, PHD)

Along with the 2025 added demand, the 2025 system contains all of the facilities from the 2020 system and includes 5.5 miles of new pipelines, 2,000 gpm of new supply, and 2.5 million gallons of new storage. The 2025 ADD for the total system is 6,867gpm. Under this scenario, none of the system pressures exceed the 90 psi maximum.

As noted in **Section 7.1.2, Maximum Day Demand + Fire Flow,** the Low Zone fire flow requirement is 4,000 gpm, the 150 Zone requirement is 3,500 gpm, and the 150+ Zone requirement is 3,500 gpm. The 2025 system can adequately handle these fire flow amounts and meet the 20 psi residual requirement. Much of this can be attributed to the projects listed in **Section 6.4, Future Model**, which were implemented to match growth over time.

The 2025 PHD for the total system is 21,288 gpm. Under the 2025 PHD Scenario, the system is able meet the 40 psi minimum pressure and does not exceed the 7 fps maximum velocity constraint. The 2025 model results for the ADD, MDD+FF, and PHD scenarios are shown in **Appendix E.**

7.3.3 2030 System Analysis (ADD, MDD+FF, PHD)

Along with the 2030 added demand, the 2030 system contains all of the facilities from the 2025 system and includes 4,000 gpm of new supply, and 5.0 million gallons of new storage. The 2030 ADD for the total system is 8,473 gpm. Under this scenario, none of the system pressures exceed the 90 psi maximum.

As noted in **Section 7.1.2, Maximum Day Demand + Fire Flow**, the Low Zone fire flow requirement is 4,000 gpm, the 150 Zone requirement is 3,500 gpm, and the 150+ Zone requirement is 3,500 gpm. The 2030 system can adequately handle these fire flow amounts and meet the 20 psi residual requirement. Much of this can be attributed to the projects listed in **Section 6.4, Future Model**, which were implemented to match growth over time.

The 2030 PHD for the total system is 26,267 gpm. Under the 2025 PHD scenario, the system is able meet the 40 psi minimum pressure and does not exceed the 7 fps maximum velocity constraint. The 2030 model results for the ADD, MDD+FF, and PHD scenarios are shown in **Appendix E.**

7.3.4 2035 System Analysis (ADD, MDD+FF, PHD)

Along with the 2035 added demand, the 2035 system contains all of the facilities from the 2030 system and includes 4,000 gpm of new supply, and 2.88 million gallons of new backup storage supplies. The 2030 ADD for the total system is 10,079 gpm. Under this scenario, none of the system pressures exceed the 90 psi maximum.

As noted in **Section 7.1.2, Maximum Day Demand + Fire Flow**, the Low Zone fire flow requirement is 4,000 gpm, the 150 Zone requirement is 3,500 gpm, and the 150+ Zone requirement is 3,500 gpm. The 2035 system can adequately handle these fire flow amounts and meet the 20 psi residual requirement. Much of this can be attributed to the projects listed in **Section 6.4, Future Model**, which were implemented to match growth over time.

The 2035 PHD for the total system is 31,245 gpm. Under the 2035 PHD scenario, the system is able to meet the 40 psi minimum pressure and does not exceed the 7 fps maximum velocity constraint. The 2035 model results for the ADD, MDD+FF, and PHD scenarios are shown in **Appendix E.**

SECTION 8
CAPITAL IMPROVEMENT PROGRAM

8.1 INTRODUCTION

This section defines the Capital Improvement Program (CIP) for CWA's water system. The CIP is intended to assist in identifying the financial resources needed to plan, design, and construct the projects identified in Sections 5, 6, and 7. These projects were identified in order to address existing deficiencies and to ensure the water system's ability to provide a reliable source of drinking water through the year 2035.

8.2 COST ESTIMATING BASIS

Cost estimates for the various projects identified are based on a number of factors. These factors include TKE's experience with similar construction projects, vendor input, and data provided by CWA. These cost estimates are planning level estimates which are based on the level of detail provided in this plan and are given in 2016 present values.

Construction costs for storage reservoir projects are assumed to be welded steel and are established on a $1/gallon basis. Costs for pipelines are assumed to be Steel, C-900 or C-905, and are established on a diameter and $1/foot cost. Well development and treatment facilities costs are based on data provided by vendors and CWA.

A 30% contingency value is added to the construction project cost, rather than the more typical 10% contingency value found in design with engineer's estimates. This is to account for the lower level of detail known during planning efforts, potential construction complications, site difficulties, and contractor bid fluctuations. A 20% value is also added to account for legal, administrative, and engineering costs.

8.3 WATER SYSTEM IMPROVEMENTS

This section discusses the water system improvements that will be necessary in order to ensure system reliability through the year 2035. A summary table and exhibit showing these improvements can be found in **Appendix F, CIP Summary**.

8.3.1 5-YEAR WATER SYSTEM IMPROVEMENTS

As presented in **Section 6.4.3, 5-Year Planned Construction Projects**, CWA identified a list of projects planned for construction over the next 5 years and additional projects were identified for the 2020 timestamp within **Section, 6.4.2 Future Water Facilities**. Below is a discussion of these projects.

8.3.1.1 2017 WATER SYSTEM IMPROVEMENTS

1. **3.6 MG Reservoir Interior Relining (CIP No. 6) - $0.38M**
   CWA indicated that the 3.6 MG reservoir needed relining and that it would occur in the year 2017.

2. **4 Hot Tap Isolation Valves (CIP No. 5) - $0.08M**
   CWA indicated that 4 strategically placed isolation valves would be hot tapped into the system and that this would occur in the year 2017.

3. **Aging Pipeline Replacement (CIP No. 48) - $1.5M**
   It is recommended that CWA set aside a budgetary amount of $1.5M/year in order to replace aging pipelines. An emphasis should be put on pipes with the highest leak history and greatest age.

8.3.1.2 2018 WATER SYSTEM IMPROVEMENTS

1. **Whitewater Wash Bridge Pipeline @ Avenue 50 (CIP No. 2) - $0.70M**
   The existing waterline is as old as the water system with a history of leaks. This improvement is anticipated to occur concurrently with the Avenue 50 Bridge project. The bridge distance is ≈ 780'.

2. **Whitewater Wash Bridge Pipeline @ Dillon Road (CIP No. 4) - $0.27M**
   Replace the existing 12” steel line crossing Whitewater Wash attached to bridge on Dillon Road with a new 16” waterline. There are reported leaks at joints. CWA has performed repairs with full circle clamps but the joints still leak. The bridge distance is ≈ 300'.

3. **150 Zone Looping Pipeline (CIP No. 15) - $1.85M**
   Install ≈ 5,280' of 16" waterline on Avenue 48 from Harrison Street to Tyler Street including provisions for Whitewater Wash crossing.

4. **Aging Pipeline Replacement (CIP No. 48) - $1.5M**
   It is recommended that CWA set aside a budgetary amount of $1.5M/year in order to replace aging pipelines. An emphasis should be put on pipes with the highest leak history and greatest age.

5. **Well No. 20 (CIP No. 7) - $3.75M**
   This new well will provide the needed additional firm capacity and fire flow in the 150 Zone.

6. **Well No. 20 Treatment (CIP No. 11) - $4.80M**
   Hexavalent Chromium treatment facility required to comply with California’s 10 μg/L MCL.

7. **Well No. 16 Treatment (CIP No. 17) - $4.65M**
   Hexavalent Chromium treatment facility required to comply with California’s 10 μg/L MCL added onto the existing Well No. 16.

8.3.1.3 2019 WATER SYSTEM IMPROVEMENTS

1. **8" Waterline Interconnection @ Grapefruit Blvd/Park Ln & Harrison Street. (CIP No. 1) - $0.21M**
   New 8" waterline interconnection at Grapefruit Blvd/Park Ln & Harrison Street and abandonment of the existing 4" waterline on Harrison Street - Grapefruit Blvd/Park Ln to Avenue 50. New services for customers along Harrison to existing 12" waterline.

2. **Avenue 50 - Tyler Street to Polk Street & Polk Street - Avenue 50 to Avenue 52 (CIP No. 3) – $2.93M**
   Construction of 9,750' of 16" waterline on Avenue 50 from Tyler Street to Polk Street and on Polk Street from Avenue 50 to Avenue 52. CWA notes this project will be needed before the Avenue 50 and Whitewater Wash bridge construction. This project will prevent the water system from being cut off from six million gallons of storage capacity to the low zone when the Avenue 50 waterline is disabled.

3. **Aging Pipeline Replacement (CIP No. 48) - $1.5M**
   It is recommended that CWA set aside a budgetary amount of $1.5M/year in order to replace aging pipelines. An emphasis should be put on pipes with the highest leak history and greatest age.

4. **Well No. 17 Treatment (CIP No. 18) - $4.65M**
   Hexavalent Chromium treatment facility required to comply with California's 10 μg/L MCL added onto the existing Well No. 17.

5. **Well No. 19 Treatment (CIP No. 20) - $14.55M**
   Hexavalent Chromium treatment facility required to comply with California's 10 μg/L MCL added onto the existing Well No. 19.

8.3.1.4 2020 WATER SYSTEM IMPROVEMENTS

1. **2.5 MG Storage (CIP No. 22) - $4.69M**
   2.5 Million Gallons of Storage to be constructed for the 150+ Zones.

2. **Grapefruit Blvd - Avenue 49 to Ed Mitchell Drive (CIP No. 8) - $0.41M**
   1600 of 12" C900 waterline on Grapefruit Blvd. between Avenue 49 and Ed Mitchell Drive.

3. **Van Buren Street - Coral Mountain School to Avenue 52 & Avenue 52 - Van Buren Street to Primativo Dr (CIP No. 9) - $0.69M**
   2780' of 12" C900 waterline from Coral Mountain School to Avenue 52 and on Avenue 52 from Van Buren to Primativo Dr.

4. **Grapefruit Blvd - Avenue 52 to Avenue 54 & Tyler Street - Old Avenue 53 to Grapefruit Blvd (CIP No. 10) – $1.67M**
   6,370' of 12" waterline on Grapefruit Blvd between Avenue 52 and Avenue 54 and on Tyler Street between old Avenue 53 and new Avenue 53.

5. **Sub Area 14 Transmission Pipeline (Phase 1) (CIP No. 42) - $6.96M**
   18,550' of 24" waterline to transport water supplies to Sub Area 14 developments. Waterline will be constructed on Avenue 48 from 150 Zone Booster Site to Polk Street & Polk Street from Avenue 48 to Avenue 50 & Avenue 50 from Polk Street to 2.5 MG 150+ Zone Reservoir (CIP No. 22) location.

6. **Sub Areas 8 and 15 Transmission Pipeline (CIP No. 43) - $2.63M**
   7,000' of 16" waterline to transport water supplies to Sub Areas 8 and 15. Waterline will be constructed on Avenue 52 from Polk Street to Fillmore Street and on Fillmore Street from Avenue 52 to 1,320 feet south.

7. **Sub Area 16 Transmission Pipeline (CIP No. 44) - $3.09M**
   10,300' of 16" waterline to transport water supplies to Sub Area 16. Waterline will be constructed on Avenue 54 from Polk Street to Fillmore Street and on Fillmore Street from Avenue 54 to Airport Boulevard.

8. **Sub Area 13 Transmission Pipeline (CIP No. 45) - $0.19M**
   1,000' of 8" waterline to transport water supplies to Sub Area 13. Waterline will be constructed on Avenue 46 from the 1.5 MG 150 Zone Reservoir to 1,000' east.

9. **Aging Pipeline Replacement (CIP No. 48) - $1.5M**
   It is recommended that CWA set aside a budgetary amount of $1.5M/year in order to replace aging pipelines. An emphasis should be put on pipes with the highest leak history and greatest age.

10. **Well No. 21 (CIP No. 26) - $3.75M**
    This new well will provide the needed new supplies for the 150+ Zones.

11. **Well No. 21 Treatment (CIP No. 34) - $4.13M**
    Hexavalent Chromium treatment facility required to comply with California's 10 μg/L MCL.

12. **Well No. 22 (CIP No. 27) - $3.75M**
    This new well will provide the needed new supplies for the 150+ Zones.

13. **Well No. 22 Treatment (CIP No. 35) - $4.80M**
    Hexavalent Chromium treatment facility required to comply with California's 10 μg/L MCL.

14. **Well No. 12 Treatment (CIP No. 16) - $4.80M**
    Hexavalent Chromium treatment facility required to comply with California's 10 μg/L MCL added onto the existing Well No. 12.

15. **Well No. 18 Treatment (CIP No. 19) - $4.80M**
    Hexavalent Chromium treatment facility required to comply with California's 10 μg/L MCL added onto the existing Well No. 18.

8.3.1.5 2021 WATER SYSTEM IMPROVEMENTS

1. **Vista Del Sur - Tyler Street to 2000' West towards Dillon Road (CIP No. 12) - $0.50M**
   2000' of 12" C900 waterline on Vista Del Sur from Tyler Street to 2000' West towards Dillon Road.

2. **Dillon Road - Vista Del Norte to Avenue 44 (CIP No. 13) - $1.11M**
   4,500' of 12" C900 waterline on Dillon Road between Vista Del Norte and Avenue 44.

3. **Avenue 51 - Calhoun Street to Van Buren Street (CIP No. 14) - $0.65M**
   2,640' of 12" waterline on Avenue 51 between Calhoun Street and Van Buren Street.

4. **Aging Pipeline Replacement (CIP No. 48) - $1.5M**
   It is recommended that CWA set aside a budgetary amount of $1.5M/year in order to replace aging pipelines. An emphasis should be put on pipes with the highest leak history and greatest age.

8.3.2 2025 WATER SYSTEM IMPROVEMENTS

1. **2.5MG Storage (CIP No. 23) - $4.69M**
   2.5 Million Gallons of Storage to be constructed for the 150+ Zones.

2. **Sub Area 14 Transmission Pipeline (Phase 2) (CIP No. 46) - $5.03M**
   13,400' of 24" waterline to transport water supplies to Sub Area 14 development. Waterline will be constructed on Fillmore Street from Avenue 50 to Avenue 52 and on Avenue 52 from Fillmore Street to 2.5 MG 150+ Zone Reservoir (CIP No. 23).

3. **Sub Area 14 Looping Transition Pipeline (CIP No. 47) - $2.34M**
   6,250' of 24" waterline from around Avenue 50 to Avenue 52 to provide water reliability and safety for the 150+ Zones.

4. **Aging Pipeline Replacement (CIP No. 48) - $6.0M**
   It is recommended that CWA set aside a budgetary amount of $1.5M/year in order to replace aging pipelines. An emphasis should be put on pipes with the highest leak history and greatest age.

5. **Well No. 23 (CIP No. 28) - $3.75M**
   This new well will provide the needed new supplies for the 150+ Zones.

6. **Well No. 23 Treatment (CIP No. 36) - $4.80M**
   Hexavalent Chromium treatment facility required to comply with California's 10 µg/L MCL.

8.3.3 2030 WATER SYSTEM IMPROVEMENTS

1. **2.0 MG Storage (CIP No. 24) - $3.75M**
   2.0 Million Gallons of Storage to be constructed for the 150 Zone.

2. **3.0 MG Storage (CIP No. 25) - $5.63M**
   3.0 Million Gallons of Storage to be constructed for the 150+ Zones.

3. **Aging Pipeline Replacement (CIP No. 48) - $7.5M**
   It is recommended that CWA set aside a budgetary amount of $1.5M/year in order to replace aging pipelines. An emphasis should be put on pipes with the highest leak history and greatest age.

4. **Well No. 24 (CIP No. 29) - $3.75M**
   This new well will provide the needed new supplies for the 150 Zone.

5. **Well No. 24 Treatment (CIP No. 37) - $4.80M**
   Hexavalent Chromium treatment facility required to comply with California's 10 µg/L MCL.

6. **Well No. 25 (CIP No. 30) - $3.75M**
   This new well will provide the needed new supplies for the 150+ Zones.

7. **Well No. 25 Treatment (CIP No. 38) - $4.80M**
   Hexavalent Chromium treatment facility required to comply with California's 10 µg/L MCL.

8.3.4 2035 WATER SYSTEM IMPROVEMENTS

1. **Aging Pipeline Replacement (CIP No. 48) - $7.5M**
   It is recommended that CWA set aside a budgetary amount of $1.5M/year in order to replace aging pipelines. An emphasis should be put on pipes with the highest leak history and greatest age.

2. **Well No. 26 (CIP No. 31) - $3.75M**
   This new well will provide the needed new supplies for the Low Zone.

3. **Well No. 26 Treatment (CIP No. 39) - $4.80M**
   Hexavalent Chromium treatment facility required to comply with California's 10 µg/L MCL.

4. **Well No. 27 (CIP No. 32) - $3.75M**
   This new well will provide the needed new supplies for the 105+ Zones.

5. **Well No. 27 Treatment (CIP No. 40) - $4.80M**
   Hexavalent Chromium treatment facility required to comply with California's 10 µg/L MCL.

APPENDIX A
DATA SOURCES

1. 2015 City of Coachella General Plan Update, Section 01 Introductions, p. 01-3
2. Decennial Census, U.S. Census Bureau
3. 2015 Coachella General Plan Update, Section 3, Housing Units
4. 2015 Coachella General Plan Update, Section 3, Housing Units
5. Population projections provided by the California Department of Finance, and the Riverside County Transportation and Land Management Agency (RCTLMA)
6. 2015 Coachella General Plan Update, Section 3, Land Use and Community Form
7. 2015 Coachella General Plan Update, Section 4, Specific Plans
8. 2015 Coachella General Plan Update, Section 4, Specific Plans
9. CWA Supplemental Water Supply Program and Fee Study.
10. 2015 Coachella General Plan Update, Section 4, Subarea Descriptions
11. 2015 Coachella General Plan Update, Section 4, Organization of This Element
12. See also: CVWD 2010 CVWMP, Section 4, Exist4 ing Water Supplies.
13. The term groundwater refers to local groundwater and imported, recycled and other supplies that are continuously recharged to the basin and extracted from groundwater wells.
14. Engineer's Report on Water Supply and Replenishment Assessment 2016-2017 Mission Creek, West Whitewater River, and East Whitewater River Subbasin Areas of Benefit.
15. 2010 CVWMP, pp. 7-2 to 7-12; 2011 SPEIR, pp. 3-4 to 3-9.
16. 2010 CVWMP, pp. 7-18 to 7-31; 2011 SPEIR, pp. 3-23 to 3-33.
17. CVWD Engineers Report on Water Supply and Replenishment Assessment, East (Lower) Whitewater River Subbasin Area of Benefit, 2014-2015.
18. 2010 CVWMP, pp. 7-18 to 7-31; 2011 SPEIR, pp. 3-23 to 3-33.
19. CVWD Engineers Report on Water Supply and Replenishment Assessment, Lower Whitewater River Subbasin Area of Benefit, 2014-2015.
20. 2010 CVWMP, pp. 7-18 to 7-31; 2011 SPEIR, pp. 3-23 to 3-33.
21. In addition to the information and analyses presented in this WMP, other descriptions of the projects and programs within the City and CVWD service areas are set forth in the City 2010 UWMP, CVWD 2010 UWMP, CVWD 2010 CVWMP and 2011 SPEIR.
22. Engineer’s Report on Water Supply and Replenishment Assessment, East (Lower) Whitewater River Subbasin Area of Benefit 2016-2017, Table VII-1.
23. City’s 2010 UWMP, CVWD’s 2010 CVWMP Update and CVWD’s 2011 SPEIR
24. CVWD 2010 CVWMP Update, p. 3-3
25. CVWD 2010 CVWMP Update, Section 4.2, Colorado River
26. CVWD 2010 CVWMP Update, Section 4.2, Colorado River
27. CVWD 2010 CVWMP Update, Section 4.2, Colorado River
28. CVWD 2010 CVWMP Update, Section 4.2, Colorado River
29. CVWD 2010 CVWMP Update, Section 4.2, Colorado River
30. MWD 2013 Preliminary Official Statement, Water Revenue Refunding Bonds, Appendix A, p. A-16
31. CVWD 2010 CVWMP Update, Section 4.2.1, Qualification Settlement Agreement
32. CVWD 2010 CVWMP Update, Section 4.2.1, Qualification Settlement Agreement
33. BOR Colorado River Basin Water Supply and Demand Study 2012, Executive Summary, p. ES-1
34. BOR Colorado River Basin Water Supply and Demand Study 2012, Executive Summary, p. ES-6

35. BOR Colorado River Basin Water Supply and Demand Study 2012
36. BOR Colorado River Basin Water Supply and Demand Study 2012, Executive Summary, p. ES-7
37. BOR Colorado River Basin Water Supply and Demand Study 2012, Executive Summary, p. ES-11
38. BOR Colorado River Basin Water Supply and Demand Study 2012, Executive Summary, p. ES-14
39. BOR Colorado River Basin Water Supply and Demand Study 2012
40. City 2010 UWMP, Section 4.5, Transfer and Exchange Opportunities
41. CVWD 2010 CVWMP Update, Section6.4.3, Future Imported Water Acquisitions
42. CVWD 2010 CVWMP Update, pp. 8-4 to 8-7
43. CVWD 2010 CVWMP Update, Section 6.6, Groundwater Recharge
44. 2010 CVWMP Update, Section 6.7.3, Groundwater Quality and Treatment
45. Based on the City of Coachella Water Quality reports, 2007-2012
46. 2010 CVWMP Update, Figure 4-1, Coachella Valley Groundwater Subbasins
47. 2010 CVWMP Update, Section 6.4.6, Other Local Groundwater
48. 2015 Coachella General Plan Update, Section 3, Water Quality, Pg. 03-21
49. 2010 CVWMP Update, Section 5.1.3.1, Arsenic
50. Coachella Valley Water Management Plan Update, January 2012, Section 4 – Existing Water Supplies, Subsection 4.5 – Recycled Water. Page 4-22.
51. CVWD 2010 CVWMP Update, Section 4.7.3, Recycled Water
52. Engineer's Report on Water Supply and Replenishment Assessment, East (Lower) Whitewater River Subbasin Area of Benefit 2016-2017, Table VII-10.
53. CVWD 2010 CVWMP Update, Section 6.5.2, Groundwater to Canal Water Conversion
54. CVWD 2010 CVWMP Update, Section ES-4.2.3, Source Substitution
55. CVWD 2010 CVWMP Update, Section ES-5.4.3, Source Substitution
56. AWWA M32, Third Edition, Section 5.3, System Design Criteria

2035 Projected Growth and Added Demand

Sub Area 1	Distribution (%)	Net New Build Out Area (Ac.)	Percent of Max Capacity (%)	2035 Growth (Ac.)	Annual Consumption Factor (ac-ft/ac/yr)	2035 Added Demand (ac-ft)
Single Family Residential	40%	286	70%	200	2.85	571
Multi-Family Residential	15%	107	70%	75	2.69	202
Commercial	33%	236	50%	118	1.78	210
Schools / Institutional	6%	43	50%	21	1.32	28
Industrial	0%	0	50%	0	0.96	0
Landscape Irrigation	6%	43	50%	21	1.80	39
Total:	**100%**	**716**		**437**		**1050**

Data from GPU:
Build Out Net New Acres: ***716***
2035 Res. Percent Max: ***70%***
2036 Non-Res. Percent Max: ***50%***

Sub Area 2	Distribution (%)	Net New Build Out Area (Ac.)	Percent of Max Capacity (%)	2035 Growth (Ac.)	Annual Consumption Factor (ac-ft/ac/yr)	2035 Added Demand (ac-ft)
Single Family Residential	30%	7	40%	3	2.85	8
Multi-Family Residential	15%	3	40%	1	2.69	4
Commercial	45%	10	50%	5	1.78	9
Schools / Institutional	4%	1	50%	0	1.32	1
Industrial	0%	0	50%	0	0.96	0
Landscape Irrigation	6%	1	50%	1	1.80	1
Total:	**100%**	**23**		**10**		**23**

Data from GPU:
Build Out Net New Acres: ***23***
2035 Res. Percent Max: ***40%***
2036 Non-Res. Percent Max: ***50%***

Sub Area 3	Distribution (%)	Net New Build Out Area (Ac.)	Percent of Max Capacity (%)	2035 Growth (Ac.)	Annual Consumption Factor (ac-ft/ac/yr)	2035 Added Demand (ac-ft)
Single Family Residential	40%	83	40%	33	2.85	94
Multi-Family Residential	15%	31	40%	12	2.69	33
Commercial	30%	62	20%	12	1.78	22
Schools / Institutional	10%	21	20%	4	1.32	5
Industrial	0%	0	20%	0	0.96	0
Landscape Irrigation	5%	10	20%	2	1.80	4
Total:	**100%**	**207**		**64**		**159**

Data from GPU:
Build Out Net New Acres: ***207***
2035 Res. Percent Max: ***40%***
2036 Non-Res. Percent Max: ***20%***

Sub Area 4	Distribution (%)	Net New Build Out Area (Ac.)	Percent of Max Capacity (%)	2035 Growth (Ac.)	Annual Consumption Factor (ac-ft/ac/yr)	2035 Added Demand (ac-ft)
Single Family Residential	15%	8	50%	4	2.85	11
Multi-Family Residential	40%	20	50%	10	2.69	27
Commercial	35%	18	50%	9	1.78	16
Schools / Institutional	4%	2	50%	1	1.32	1
Industrial	0%	0	50%	0	0.96	0
Landscape Irrigation	6%	3	50%	2	1.80	3
Total:	**100%**	**50**		**25**		**57**

Data from GPU:
Build Out Net New Acres: ***50***
2035 Res. Percent Max: ***50%***
2036 Non-Res. Percent Max: ***50%***

2035 Projected Growth and Added Demand

Sub Area 5	Distribution (%)	Net New Build Out Area (Ac.)	Percent of Max Capacity (%)	2035 Growth (Ac.)	Annual Consumption Factor (ac-ft/ac/yr)	2035 Added Demand (ac-ft)
Single Family Residential	0%	0	0%	0	2.85	0
Multi-Family Residential	45%	374	0%	0	2.69	0
Commercial	20%	166	15%	25	1.78	44
Schools / Institutional	6%	50	15%	7	1.32	10
Industrial	25%	208	15%	31	0.96	30
Landscape Irrigation	4%	33	15%	5	1.80	9
Total:	**100%**	**830**		**68**		**93**

Data from GPU:

Build Out Net New Acres:	***830***
2035 Res. Percent Max:	***0%***
2036 Non-Res. Percent Max:	***15%***

Sub Area 6	Distribution (%)	Net New Build Out Area (Ac.)	Percent of Max Capacity (%)	2035 Growth (Ac.)	Annual Consumption Factor (ac-ft/ac/yr)	2035 Added Demand (ac-ft)
Single Family Residential	10%	14	40%	6	2.85	16
Multi-Family Residential	40%	56	40%	23	2.69	61
Commercial	40%	56	20%	11	1.78	20
Schools / Institutional	4%	6	20%	1	1.32	1
Industrial	0%	0	20%	0	0.96	0
Landscape Irrigation	6%	8	20%	2	1.80	3
Total:	**100%**	**141**		**42**		**101**

Data from GPU:

Build Out Net New Acres:	***141***
2035 Res. Percent Max:	***40%***
2036 Non-Res. Percent Max:	***20%***

Sub Area 7	Distribution (%)	Net New Build Out Area (Ac.)	Percent of Max Capacity (%)	2035 Growth (Ac.)	Annual Consumption Factor (ac-ft/ac/yr)	2035 Added Demand (ac-ft)
Single Family Residential	0%	0	0%	0	2.85	0
Multi-Family Residential	0%	0	0%	0	2.69	0
Commercial	0%	0	30%	0	1.78	0
Schools / Institutional	0%	0	30%	0	1.32	0
Industrial	95%	227	30%	68	0.96	65
Landscape Irrigation	5%	12	30%	4	1.80	6
Total:	**100%**	**239**		**72**		**72**

Data from GPU:

Build Out Net New Acres:	***239***
2035 Res. Percent Max:	***0%***
2036 Non-Res. Percent Max:	***30%***

Sub Area 8	Distribution (%)	Net New Build Out Area (Ac.)	Percent of Max Capacity (%)	2035 Growth (Ac.)	Annual Consumption Factor (ac-ft/ac/yr)	2035 Added Demand (ac-ft)
Single Family Residential	0%	0	0%	0	2.85	0
Multi-Family Residential	0%	0	0%	0	2.69	0
Commercial	0%	0	10%	0	1.78	0
Schools / Institutional	0%	0	10%	0	1.32	0
Industrial	95%	514	10%	51	0.96	49
Landscape Irrigation	5%	27	10%	3	1.80	5
Total:	**100%**	**541**		**54**		**54**

Data from GPU:

Build Out Net New Acres:	***541***
2035 Res. Percent Max:	***0%***
2036 Non-Res. Percent Max:	***10%***

2035 Projected Growth and Added Demand

Sub Area 9	Distribution (%)	Net New Build Out Area (Ac.)	Percent of Max Capacity (%)	2035 Growth (Ac.)	Annual Consumption Factor (ac-ft/ac/yr)	2035 Added Demand (ac-ft)
Single Family Residential	45%	666	50%	333	2.85	949
Multi-Family Residential	10%	148	50%	74	2.69	199
Commercial	33%	489	35%	171	1.78	304
Schools / Institutional	6%	89	35%	31	1.32	41
Industrial	0%	0	35%	0	0.96	0
Landscape Irrigation	6%	89	35%	31	1.80	56
Total:	**100%**	**1,481**		**641**		**1549**

Data from GPU:

Build Out Net New Acres:	***1481***
2035 Res. Percent Max:	***50%***
2036 Non-Res. Percent Max:	***35%***

Sub Area 10	Distribution (%)	Net New Build Out Area (Ac.)	Percent of Max Capacity (%)	2035 Growth (Ac.)	Annual Consumption Factor (ac-ft/ac/yr)	2035 Added Demand (ac-ft)
Single Family Residential	25%	40	20%	8	2.85	23
Multi-Family Residential	0%	0	20%	0	2.69	0
Commercial	0%	0	25%	0	1.78	0
Schools / Institutional	0%	0	25%	0	1.32	0
Industrial	70%	111	25%	28	0.96	27
Landscape Irrigation	5%	8	25%	2	1.80	4
Total:	**100%**	**159**		**38**		**53**

Data from GPU:

Build Out Net New Acres:	***159***
2035 Res. Percent Max:	***20%***
2036 Non-Res. Percent Max:	***25%***

Sub Area 11	Distribution (%)	Net New Build Out Area (Ac.)	Percent of Max Capacity (%)	2035 Growth (Ac.)	Annual Consumption Factor (ac-ft/ac/yr)	2035 Added Demand (ac-ft)
Single Family Residential	28%	322	50%	161	2.85	458
Multi-Family Residential	20%	230	50%	115	2.69	309
Commercial	40%	460	30%	138	1.78	246
Schools / Institutional	6%	69	30%	21	1.32	27
Industrial	0%	0	30%	0	0.96	0
Landscape Irrigation	6%	69	30%	21	1.80	37
Total:	**100%**	**1,150**		**455**		**1078**

Data from GPU:

Build Out Net New Acres:	***1150***
2035 Res. Percent Max:	***50%***
2036 Non-Res. Percent Max:	***30%***

Sub Area 12	Distribution (%)	Net New Build Out Area (Ac.)	Percent of Max Capacity (%)	2035 Growth (Ac.)	Annual Consumption Factor (ac-ft/ac/yr)	2035 Added Demand (ac-ft)
Single Family Residential	35%	146	45%	66	2.85	187
Multi-Family Residential	15%	63	45%	28	2.69	76
Commercial	40%	167	20%	33	1.78	60
Schools / Institutional	4%	17	20%	3	1.32	4
Industrial	0%	0	20%	0	0.96	0
Landscape Irrigation	6%	25	20%	5	1.80	9
Total:	**100%**	**418**		**136**		**336**

Data from GPU:

Build Out Net New Acres:	***418***
2035 Res. Percent Max:	***45%***
2036 Non-Res. Percent Max:	***20%***

2035 Projected Growth and Added Demand

Sub Area 13	Distribution (%)	Net New Build Out Area (Ac.)	Percent of Max Capacity (%)	2035 Growth (Ac.)	Annual Consumption Factor (ac-ft/ac/yr)	2035 Added Demand (ac-ft)
Single Family Residential	53%	222	10%	22	2.85	63
Multi-Family Residential	0%	0	10%	0	2.69	0
Commercial	35%	146	5%	7	1.78	13
Schools / Institutional	6%	25	5%	1	1.32	2
Industrial	0%	0	5%	0	0.96	0
Landscape Irrigation	6%	25	5%	1	1.80	2
Total:	**100%**	**418**		**32**		**80**

Data from GPU:

Build Out Net New Acres:	*418*
2035 Res. Percent Max:	*10%*
2036 Non-Res. Percent Max:	*5%*

Sub Area 14	Distribution (%)	Net New Build Out Area (Ac.)	Percent of Max Capacity (%)	2035 Growth (Ac.)	Annual Consumption Factor (ac-ft/ac/yr)	2035 Added Demand (ac-ft)
Single Family Residential	55%	1,166	100%	1,166	2.85	3319
Multi-Family Residential	10%	212	100%	212	2.69	570
Commercial	15%	318	100%	318	1.78	566
Schools / Institutional	6%	127	100%	127	1.32	168
Industrial	0%	0	100%	0	0.96	0
Landscape Irrigation	14%	297	100%	297	1.80	534
Total:	**100%**	**2,120**		**2,120**		**5158**

Data from GPU:

Build Out Net New Acres:	*2120*
2035 Res. Percent Max:	*100%*
2036 Non-Res. Percent Max:	*100%*

Sub Area 15	Distribution (%)	Net New Build Out Area (Ac.)	Percent of Max Capacity (%)	2035 Growth (Ac.)	Annual Consumption Factor (ac-ft/ac/yr)	2035 Added Demand (ac-ft)
Single Family Residential	90%	1,564	10%	156	2.85	445
Multi-Family Residential	0%	0	10%	0	2.69	0
Commercial	0%	0	5%	0	1.78	0
Schools / Institutional	4%	70	5%	3	1.32	5
Industrial	0%	0	5%	0	0.96	0
Landscape Irrigation	6%	104	5%	5	1.80	9
Total:	**100%**	**1,738**		**165**		**459**

Data from GPU:

Build Out Net New Acres:	*1738*
2035 Res. Percent Max:	*10%*
2036 Non-Res. Percent Max:	*5%*

Sub Area 16	Distribution (%)	Net New Build Out Area (Ac.)	Percent of Max Capacity (%)	2035 Growth (Ac.)	Annual Consumption Factor (ac-ft/ac/yr)	2035 Added Demand (ac-ft)
Single Family Residential	0%	0	5%	0	2.85	0
Multi-Family Residential	0%	0	5%	0	2.69	0
Commercial	90%	21	100%	21	1.78	37
Schools / Institutional	0%	0	100%	0	1.32	0
Industrial	0%	0	100%	0	0.96	0
Landscape Irrigation	10%	2	100%	2	1.80	4
Total:	**100%**	**23**		**23**		**41**

Data from GPU:

Build Out Net New Acres:	*23*
2035 Res. Percent Max:	*5%*
2036 Non-Res. Percent Max:	*100%*

2035 Projected Growth and Added Demand

Sub Area 17	Distribution (%)	Net New Build Out Area (Ac.)	Percent of Max Capacity (%)	2035 Growth (Ac.)	Annual Consumption Factor (ac-ft/ac/yr)	2035 Added Demand (ac-ft)
Single Family Residential	40%	286	0%	0	2.85	0
Multi-Family Residential	15%	107	0%	0	2.69	0
Commercial	33%	236	0%	0	1.78	0
Schools / Institutional	6%	43	0%	0	1.32	0
Industrial	0%	0	0%	0	0.96	0
Landscape Irrigation	6%	43	0%	0	1.80	0
Total:	**100%**	**716**		**0**		**0**

Data from GPU:

Build Out Net New Acres:	***526***
2035 Res. Percent Max:	***0%***
2036 Non-Res. Percent Max:	***0%***

Total 2035 Growth (Ac.): 4,383

Projected Demand Added by Sub Area

Sub Area 1	2020		2025		2030		2035	
	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)
Single Family Residential	143	88.4	285	176.9	428	265.3	571	353.8
Multi-Family Residential	51	31.3	101	62.7	152	94.0	202	125.4
Commercial	53	32.6	105	65.2	158	97.8	210	130.4
Schools / Institutional	7	4.4	14	8.8	21	13.2	28	17.6
Industrial	0	0.0	0	0.0	0	0.0	0	0.0
Landscape Irrigation	10	6.0	19	12.0	29	18.0	39	24.0
Total:	**263**	**162.8**	**525**	**325.5**	**788**	**488.3**	**1050**	**651.1**

Sub Area 2	2020		2025		2030		2035	
	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)
Single Family Residential	2	1.2	4	2.4	6	3.7	8	4.9
Multi-Family Residential	1	0.6	2	1.2	3	1.7	4	2.3
Commercial	2	1.4	5	2.9	7	4.3	9	5.7
Schools / Institutional	0	0.1	0	0.2	0	0.3	1	0.4
Industrial	0	0.0	0	0.0	0	0.0	0	0.0
Landscape Irrigation	0	0.2	1	0.4	1	0.6	1	0.8
Total:	**6**	**3.5**	**11**	**7.0**	**17**	**10.5**	**23**	**14.0**

Sub Area 3	2020		2025		2030		2035	
	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)
Single Family Residential	24	14.6	47	29.2	71	43.8	94	58.4
Multi-Family Residential	8	5.2	17	10.4	25	15.5	33	20.7
Commercial	6	3.4	11	6.9	17	10.3	22	13.7
Schools / Institutional	1	0.8	3	1.7	4	2.5	5	3.4
Industrial	0	0.0	0	0.0	0	0.0	0	0.0
Landscape Irrigation	1	0.6	2	1.2	3	1.7	4	2.3
Total:	**40**	**24.6**	**79**	**49.3**	**119**	**73.9**	**159**	**98.6**

Sub Area 4	2020		2025		2030		2035	
	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)
Single Family Residential	3	1.7	5	3.3	8	5.0	11	6.6
Multi-Family Residential	7	4.2	13	8.3	20	12.5	27	16.7
Commercial	4	2.4	8	4.8	12	7.2	16	9.7
Schools / Institutional	0	0.2	1	0.4	1	0.6	1	0.8
Industrial	0	0.0	0	0.0	0	0.0	0	0.0
Landscape Irrigation	1	0.4	1	0.8	2	1.3	3	1.7
Total:	**14**	**8.9**	**29**	**17.7**	**43**	**26.6**	**57**	**35.4**

Projected Demand Added by Sub Area

Sub Area 5	2020		2025		2030		2035	
	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)
Single Family Residential	0	0.0	0	0.0	0	0.0	0	0.0
Multi-Family Residential	0	0.0	0	0.0	0	0.0	0	0.0
Commercial	11	6.9	22	13.7	33	20.6	44	27.5
Schools / Institutional	2	1.5	5	3.1	7	4.6	10	6.1
Industrial	7	4.6	15	9.3	22	13.9	30	18.5
Landscape Irrigation	2	1.4	4	2.8	7	4.2	9	5.6
Total:	**23**	**14.4**	**47**	**28.8**	**70**	**43.3**	**93**	**57.7**

Sub Area 6	2020		2025		2030		2035	
	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)
Single Family Residential	4	2.5	8	5.0	12	7.5	16	10.0
Multi-Family Residential	15	9.4	30	18.8	46	28.2	61	37.6
Commercial	5	3.1	10	6.2	15	9.3	20	12.4
Schools / Institutional	0	0.2	1	0.5	1	0.7	1	0.9
Industrial	0	0.0	0	0.0	0	0.0	0	0.0
Landscape Irrigation	1	0.5	2	0.9	2	1.4	3	1.9
Total:	**25**	**15.7**	**51**	**31.4**	**76**	**47.1**	**101**	**62.8**

Sub Area 7	2020		2025		2030		2035	
	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)
Single Family Residential	0	0.0	0	0.0	0	0.0	0	0.0
Multi-Family Residential	0	0.0	0	0.0	0	0.0	0	0.0
Commercial	0	0.0	0	0.0	0	0.0	0	0.0
Schools / Institutional	0	0.0	0	0.0	0	0.0	0	0.0
Industrial	16	10.1	33	20.3	49	30.4	65	40.5
Landscape Irrigation	2	1.0	3	2.0	5	3.0	6	4.0
Total:	**18**	**11.1**	**36**	**22.3**	**54**	**33.4**	**72**	**44.5**

Sub Area 8	2020		2025		2030		2035	
	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)
Single Family Residential	0	0.0	0	0.0	0	0.0	0	0.0
Multi-Family Residential	0	0.0	0	0.0	0	0.0	0	0.0
Commercial	0	0.0	0	0.0	0	0.0	0	0.0
Schools / Institutional	0	0.0	0	0.0	0	0.0	0	0.0
Industrial	12	7.6	25	15.3	37	22.9	49	30.6
Landscape Irrigation	1	0.8	2	1.5	4	2.3	5	3.0
Total:	**14**	**8.4**	**27**	**16.8**	**41**	**25.2**	**54**	**33.6**

Projected Demand Added by Sub Area

Sub Area 9	2020		2025		2030		2035	
	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)
Single Family Residential	237	147.0	474	294.0	711	441.0	949	588.0
Multi-Family Residential	50	30.9	100	61.7	149	92.6	199	123.5
Commercial	76	47.2	152	94.4	228	141.6	304	188.8
Schools / Institutional	10	6.4	21	12.7	31	19.1	41	25.4
Industrial	0	0.0	0	0.0	0	0.0	0	0.0
Landscape Irrigation	14	8.7	28	17.4	42	26.0	56	34.7
Total:	**387**	**240.1**	**775**	**480.2**	**1162**	**720.3**	**1549**	**960.4**

Sub Area 10	2020		2025		2030		2035	
	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)
Single Family Residential	6	3.5	11	7.0	17	10.5	23	14.0
Multi-Family Residential	0	0.0	0	0.0	0	0.0	0	0.0
Commercial	0	0.0	0	0.0	0	0.0	0	0.0
Schools / Institutional	0	0.0	0	0.0	0	0.0	0	0.0
Industrial	7	4.1	13	8.3	20	12.4	27	16.6
Landscape Irrigation	1	0.6	2	1.1	3	1.7	4	2.2
Total:	**13**	**8.2**	**26**	**16.4**	**40**	**24.6**	**53**	**32.8**

Sub Area 11	2020		2025		2030		2035	
	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)
Single Family Residential	115	71.0	229	142.1	344	213.1	458	284.1
Multi-Family Residential	77	47.9	155	95.9	232	143.8	309	191.8
Commercial	61	38.1	123	76.1	184	114.2	246	152.3
Schools / Institutional	7	4.2	14	8.5	20	12.7	27	16.9
Industrial	0	0.0	0	0.0	0	0.0	0	0.0
Landscape Irrigation	9	5.8	19	11.5	28	17.3	37	23.1
Total:	**269**	**167.1**	**539**	**334.1**	**808**	**501.2**	**1078**	**668.2**

Sub Area 12	2020		2025		2030		2035	
	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)
Single Family Residential	47	29.0	94	58.1	141	87.1	187	116.2
Multi-Family Residential	19	11.8	38	23.5	57	35.3	76	47.1
Commercial	15	9.2	30	18.4	45	27.7	60	36.9
Schools / Institutional	1	0.7	2	1.4	3	2.1	4	2.7
Industrial	0	0.0	0	0.0	0	0.0	0	0.0
Landscape Irrigation	2	1.4	5	2.8	7	4.2	9	5.6
Total:	**84**	**52.1**	**168**	**104.2**	**252**	**156.3**	**336**	**208.5**

Projected Demand Added by Sub Area

Sub Area 13	2020		2025		2030		2035	
	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)
Single Family Residential	16	9.8	32	19.5	47	29.3	63	39.1
Multi-Family Residential	0	0.0	0	0.0	0	0.0	0	0.0
Commercial	3	2.0	7	4.0	10	6.1	13	8.1
Schools / Institutional	0	0.3	1	0.5	1	0.8	2	1.0
Industrial	0	0.0	0	0.0	0	0.0	0	0.0
Landscape Irrigation	1	0.3	1	0.7	2	1.0	2	1.4
Total:	**20**	**12.4**	**40**	**24.8**	**60**	**37.2**	**80**	**49.6**

Sub Area 14	2020		2025		2030		2035	
	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)
Single Family Residential	830	514.4	1660	1028.8	2489	1543.2	3319	2057.6
Multi-Family Residential	143	88.4	285	176.8	428	265.1	570	353.5
Commercial	142	87.7	283	175.4	425	263.2	566	350.9
Schools / Institutional	42	26.0	84	52.0	126	78.1	168	104.1
Industrial	0	0.0	0	0.0	0	0.0	0	0.0
Landscape Irrigation	134	82.8	267	165.6	401	248.4	534	331.2
Total:	**1289**	**799.3**	**2579**	**1598.7**	**3868**	**2398.0**	**5158**	**3197.3**

Sub Area 15	2020		2025		2030		2035	
	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)
Single Family Residential	111	69.0	223	138.0	334	207.0	445	276.0
Multi-Family Residential	0	0.0	0	0.0	0	0.0	0	0.0
Commercial	0	0.0	0	0.0	0	0.0	0	0.0
Schools / Institutional	1	0.7	2	1.4	3	2.1	5	2.8
Industrial	0	0.0	0	0.0	0	0.0	0	0.0
Landscape Irrigation	2	1.5	5	2.9	7	4.4	9	5.8
Total:	**115**	**71.2**	**230**	**142.3**	**344**	**213.5**	**459**	**284.7**

Sub Area 16	2020		2025		2030		2035	
	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)
Single Family Residential	0	0.0	0	0.0	0	0.0	0	0.0
Multi-Family Residential	0	0.0	0	0.0	0	0.0	0	0.0
Commercial	9	5.7	18	11.4	28	17.1	37	22.8
Schools / Institutional	0	0.0	0	0.0	0	0.0	0	0.0
Industrial	0	0.0	0	0.0	0	0.0	0	0.0
Landscape Irrigation	1	0.6	2	1.3	3	1.9	4	2.6
Total:	**10**	**6.4**	**20**	**12.7**	**31**	**19.1**	**41**	**25.4**

Projected Demand Added by Sub Area

Sub Area 17	2020		2025		2030		2035	
	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)	Added Demand (ac-ft)	Added Demand (gpm)
Single Family Residential	0	0.0	0	0.0	0	0.0	0	0.0
Multi-Family Residential	0	0.0	0	0.0	0	0.0	0	0.0
Commercial	0	0.0	0	0.0	0	0.0	0	0.0
Schools / Institutional	0	0.0	0	0.0	0	0.0	0	0.0
Industrial	0	0.0	0	0.0	0	0.0	0	0.0
Landscape Irrigation	0	0.0	0	0.0	0	0.0	0	0.0
Total:	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**

Projected Total Demand by Zone

Low Zone	2016 Total Demand (ac-ft)	2016 Total Demand (gpm)	2020 Total Demand (ac-ft)	2020 Total Demand (gpm)	2025 Total Demand (ac-ft)	2025 Total Demand (gpm)	2030 Total Demand (ac-ft)	2030 Total Demand (gpm)	2035 Total Demand (ac-ft)	2035 Total Demand (gpm)
Single Family Residential	3,610	2,237.9	3,790	2,349.8	3,971	2,461.7	4,152	2,573.6	4,332	2,685.6
Multi-Family Residential	149	92.5	231	143.2	313	193.9	394	244.5	476	295.2
Commercial	323	200.2	403	250.1	484	299.9	564	349.8	645	399.6
Schools / Institutional	223	138.4	235	145.7	247	153.0	259	160.3	270	167.6
Industrial	867	537.5	898	556.4	928	575.3	959	594.2	989	613.1
Landscape Irrigation	422	261.5	439	272.1	456	282.7	473	293.3	490	303.9
Total:	**5,594**	**3,468.1**	**5,996**	**3,717.3**	**6,398**	**3,966.5**	**6,801**	**4,215.8**	**7,203**	**4,465.0**

150 Zone	2016 Total Demand (ac-ft)	2016 Total Demand (gpm)	2020 Total Demand (ac-ft)	2020 Total Demand (gpm)	2025 Total Demand (ac-ft)	2025 Total Demand (gpm)	2030 Total Demand (ac-ft)	2030 Total Demand (gpm)	2035 Total Demand (ac-ft)	2035 Total Demand (gpm)
Single Family Residential	42	26.2	552	342.3	1,062	658.4	1,572	974.5	2,082	1,290.6
Multi-Family Residential	68	42.2	214	132.7	360	223.3	506	313.9	652	404.5
Commercial	191	118.3	352	218.5	514	318.7	676	418.9	837	519.1
Schools / Institutional	-	-	19	12.0	39	24.0	58	36.0	77	48.0
Industrial	-	-	12	7.6	25	15.3	37	22.9	49	30.6
Landscape Irrigation	-	-	30	18.7	60	37.4	90	56.1	121	74.8
Total:	**301**	**186.7**	**1,181**	**731.9**	**2,060**	**1,277.1**	**2,940**	**1,822.3**	**3,819**	**2,367.5**

150+ Zone	2016 Total Demand (ac-ft)	2016 Total Demand (gpm)	2020 Total Demand (ac-ft)	2020 Total Demand (gpm)	2025 Total Demand (ac-ft)	2025 Total Demand (gpm)	2030 Total Demand (ac-ft)	2030 Total Demand (gpm)	2035 Total Demand (ac-ft)	2035 Total Demand (gpm)
Single Family Residential	-	-	846	524.2	1,691	1,048.4	2,537	1,572.6	3,382	2,096.7
Multi-Family Residential	-	-	143	88.4	285	176.8	428	265.1	570	353.5
Commercial	-	-	145	89.7	290	179.5	434	269.2	579	359.0
Schools / Institutional	-	-	42	26.3	85	52.6	127	78.8	170	105.1
Industrial	-	-	-	-	-	-	-	-	-	-
Landscape Irrigation	-	-	134	83.1	268	166.3	402	249.4	536	332.6
Total:	**-**	**-**	**1,309**	**811.7**	**2,619**	**1,623.5**	**3,928**	**2,435.2**	**5,238**	**3,246.9**

Total System	2016 Total Demand (ac-ft)	2016 Total Demand (gpm)	2020 Total Demand (ac-ft)	2020 Total Demand (gpm)	2025 Total Demand (ac-ft)	2025 Total Demand (gpm)	2030 Total Demand (ac-ft)	2030 Total Demand (gpm)	2035 Total Demand (ac-ft)	2035 Total Demand (gpm)
Single Family Residential	3,652	2,264.1	5,188	3,216.3	6,724	4,168.5	8,260	5,120.7	9,796	6,072.9
Multi-Family Residential	217	134.7	588	364.3	958	593.9	1,329	823.6	1,699	1,053.2
Commercial	514	318.5	901	558.3	1,287	798.1	1,674	1,037.9	2,061	1,277.6
Schools / Institutional	223	138.4	297	183.9	370	229.5	444	275.1	517	320.7
Industrial	867	537.5	910	564.1	953	590.6	996	617.2	1,038	643.7
Landscape Irrigation	422	261.5	603	374.0	785	486.4	966	598.9	1,147	711.3
Total:	**5,896**	**3,654.8**	**8,487**	**5,260.9**	**11,077**	**6,867.1**	**13,668**	**8,473.3**	**16,259**	**10,079.4**

PUMP CHECK
Pumping Systems Analysts
Hydraulic Test Report

Since 1958

(951) 684-9801 • Lic. 799498 • Fax (951) 684-2988

City of Coachella		Test Date:	02/09/2013
Dillon Road at 48th Avenue		Pump type:	DWT
		Plant:	Well #11

A test was made on this well pump and the following information was obtained.

EQUIPMENT

PUMP:	Peerless	SERIAL:	N/A
MOTOR:	Yaskawa	SERIAL:	0078317705
H.P.	150	STATE #:	05S08E31C035
METER:	AS5A8-568DKS	REF #:	PC 2074

TEST RESULTS

	TEST 1	TEST 2
Discharge, PSI	67.5	80.5
Discharge head, feet	155.9	186.0
Standing water level, feet	84.2	
Drawdown, feet	42.2	39.5
Pumping water level, feet	126.4	123.7
Total pumping head, feet	282.3	309.7
Gallons per minute flow	**1374**	**1296**
Gallons per foot of drawdown	32.6	32.8
Acre feet pumped per 24 hours	6.074	5.727
KW input to motor	116.9	115.3
HP input to motor	156.7	154.5
Motor load, % BHP	95.6	94.3
Measured speed of pump, RPM	1775	1774
KWH per acre foot	462.0	483.3
Overall Plant efficiency in %	**62.5**	**65.6**

Test 1 was the normal operation of the pump at the time of the test. The other results were obtained by throttling the pump discharge.

If you have any questions please contact Jon Lee at (951) 684-9801.

ANNUAL PUMPING COST ANALYSIS

City of Coachella Test date: 02/09/2013

Plant: Well #11
Meter No: AS5A8-568DKS
H.P. 150

The following cost analysis is presented as an aid to your cost accounting and planning. It is an **Estimate** based on the pump test data and your energy use or hours of operation during the previous 12-month period.

		EXISTING CONDITIONS
Total annual kWhrs		563,840
Total annual cost		$61,458.56
KW input to motor		116.9
Hours of operation per year		4823
Equivalent 24 hour days		200.9
Acre feet pumped per 24 hour day		6.0736
Average cost per kWhr		$0.1090
Average cost per hour		$12.74
Average cost per acre foot		$50.36
KWh per acre foot		462.0
Overall plant efficiency	%	62.5

PUMP CHECK
Pumping Systems Analysts

Hydraulic Test Report

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City of Coachella
84-641 Avenue 51

Test Date: 02/09/2013
Pump type: DWT
Plant: Well #12

A test was made on this well pump and the following information was obtained.

EQUIPMENT

PUMP:	Layne & Bowler	SERIAL:	800413
MOTOR:	US	SERIAL:	D12-AA78-MC5
H.P.	100	LAT/LON:	33.40.619n116.11.205w
METER:	5Y3DKS-100433	STATE #:	06508E06K025
		REF #:	PC 2068

TEST RESULTS

	TEST 1	TEST 2
Discharge, PSI	12.0	23.0
Discharge head, feet	27.7	53.1
Standing water level, feet	76.3	
Drawdown, feet	29.5	25.9
Pumping water level, feet	105.8	102.2
Total pumping head, feet	133.5	155.3
Gallons per minute flow	**2114**	**1941**
Gallons per foot of drawdown	71.7	74.9
Acre feet pumped per 24 hours	9.344	8.577
KW input to motor	83.5	83.9
HP input to motor	111.9	112.4
Motor load, % BHP	104.1	104.6
Measured speed of pump, RPM	1779	1779
KWH per acre foot	214.5	234.8
Overall Plant efficiency in %	**63.7**	**67.7**

Test 1 was the normal operation of the pump at the time of the test. The other results were obtained by throttling the pump discharge.

If you have any questions please contact Jon Lee at (951) 684-9801.

ANNUAL PUMPING COST ANALYSIS

City of Coachella

Test date: 02/09/2013

Plant: Well #12
Meter No: 5Y3DKS-100433
H.P. 100

The following cost analysis is presented as an aid to your cost accounting and planning. It is an **Estimate** based on the pump test data and your energy use or hours of operation during the previous 12-month period.

		EXISTING CONDITIONS	
Total annual kWhrs		292,250	
Total annual cost		$31,855.25	
KW input to motor		83.5	
Hours of operation per year		3500	Estimated
Equivalent 24 hour days		145.8	
Acre feet pumped per 24 hour day		9.3437	
Average cost per kWhr		$0.1090	
Average cost per hour		$9.10	
Average cost per acre foot		$23.38	
KWh per acre foot		214.5	
Overall plant efficiency	%	63.7	

PUMP CHECK
Pumping Systems Analysts
Hydraulic Test Report
Since 1958
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City of Coachella		Test Date:	02/09/2013
86-264 Avenue 54		Pump type:	DWT
		Plant:	Well #16

A test was made on this well pump and the following information was obtained.

EQUIPMENT

PUMP:	National	SERIAL:	N/A
MOTOR:	US	SERIAL:	K03-BF84A-M
H.P.	250	LAT/LON:	33.39.517n116.09.656w
METER:	AS5Y3-36DKS	STATE #:	06508B09N025
		REF #:	PC 2071

TEST RESULTS

	TEST 1
Discharge, PSI	85.0
Discharge head, feet	196.4
Standing water level, feet	38.7
Drawdown, feet	n/a
Pumping water level, feet	n/a
Total pumping head, feet	n/a
Gallons per minute flow	**1852**
Gallons per foot of drawdown	n/a
Acre feet pumped per 24 hours	8.184
KW input to motor	168.1
HP input to motor	225.3
Motor load, % BHP	86.3
Measured speed of pump, RPM	1787
KWH per acre foot	493.1
Overall Plant efficiency in %	**n/a**

Test 1 was the normal operation of the pump at the time of the test.

The standing water level was measured down through the pump column.

Due to an obstruction in the well, we were unable to obtain a pumping water level; therefore we were unable to quote the total head or overall efficiency of the pumping plant.

If you have any questions please contact Jon Lee at (951) 684-9801.

ANNUAL PUMPING COST ANALYSIS

City of Coachella — Test date: 02/09/2013

Plant: Well #16
Meter No: AS5Y3-36DKS
H.P. 250

The following cost analysis is presented as an aid to your cost accounting and planning. It is an **Estimate** based on the pump test data and your energy use or hours of operation during the previous 12-month period.

		EXISTING CONDITIONS
Total annual kWhrs		191,600
Total annual cost		$20,922.72
KW input to motor		168.1
Hours of operation per year		1139
Equivalent 24 hour days		47.5
Acre feet pumped per 24 hour day		8.1842
Average cost per kWhr		$0.1092
Average cost per hour		$18.36
Average cost per acre foot		$53.85
KWh per acre foot		493.1
Overall plant efficiency	%	n/a

PUMP CHECK
Pumping Systems Analysts

Hydraulic Test Report

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City of Coachella
Avenue 48 east of Tyler Street

Test Date: 02/09/2013
Pump type: DWT
Plant: Well #18

A test was made on this well pump and the following information was obtained.

EQUIPMENT

PUMP:	Goulds	SERIAL:	497709
MOTOR:	US	SERIAL:	J0520022439-GT-01
H.P.	100	LAT/LON:	33.42.076n116.09.642w
METER:	5Y3DKS-101864	STATE #:	05508E28N025
		REF #:	PC 2075

TEST RESULTS

	TEST 1	TEST 2
Discharge, PSI	14.0	24.0
Discharge head, feet	32.3	55.4
Standing water level, feet	79.7	
Drawdown, feet	40.9	33.7
Pumping water level, feet	120.6	113.4
Total pumping head, feet	152.9	168.8
Gallons per minute flow	**1966**	**1508**
Gallons per foot of drawdown	48.1	44.8
Acre feet pumped per 24 hours	8.686	6.666
KW input to motor	77.3	70.6
HP input to motor	103.6	94.6
Motor load, % BHP	98.8	90.3
Measured speed of pump, RPM	1785	1787
KWH per acre foot	213.6	254.2
Overall Plant efficiency in %	**73.3**	**68.0**

Test 1 was the normal operation of the pump at the time of the test. The other results were obtained by throttling the pump discharge.

If you have any questions please contact Jon Lee at (951) 684-9801.

ANNUAL PUMPING COST ANALYSIS

City of Coachella

Test date: 02/09/2013

Plant: Well #18
Meter No: 5Y3DKS-101864
H.P. 100

The following cost analysis is presented as an aid to your cost accounting and planning. It is an **Estimate** based on the pump test data and your energy use or hours of operation during the previous 12-month period.

		EXISTING CONDITIONS	
Total annual kWhrs		239,630	
Total annual cost		$26,095.71	
KW input to motor		77.3	
Hours of operation per year		3100	Estimated
Equivalent 24 hour days		129.2	
Acre feet pumped per 24 hour day		8.6858	
Average cost per kWhr		$0.1089	
Average cost per hour		$8.42	
Average cost per acre foot		$23.26	
KWh per acre foot		213.6	
Overall plant efficiency	%	73.3	

PUMP CHECK

Pumping Systems Analysts

Hydraulic Test Report

Since 1958

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City of Coachella
48-281 Playa Del Amor Street

Test Date: 02/09/2013
Pump type: DWT
Plant: Well #19

A test was made on this well pump and the following information was obtained.

EQUIPMENT

PUMP:	No Data	SERIAL:	N/A
MOTOR:	US	SERIAL:	J0620021248-100R-04
H.P.	200	LAT/LON:	33.41.895n116.12.966w
METER:	5Y3DKS-101235	STATE #:	05S07E56D035
		REF #:	PC 2073

TEST RESULTS

	TEST 1	TEST 2
Discharge, PSI	51.0	61.0
Discharge head, feet	117.8	140.9
Standing water level, feet	112.2	
Drawdown, feet	27.5	25.3
Pumping water level, feet	139.7	137.5
Total pumping head, feet	257.5	278.4
Gallons per minute flow	**2320**	**2160**
Gallons per foot of drawdown	84.4	85.4
Acre feet pumped per 24 hours	10.251	9.544
KW input to motor	156.8	154.4
HP input to motor	210.1	206.9
Motor load, % BHP	100.6	99.1
Measured speed of pump, RPM	1783	1783
KWH per acre foot	367.1	388.3
Overall Plant efficiency in %	**71.8**	**73.4**

Test 1 was the normal operation with the VFD operating at 60.0 Hz at the time of the test.

Test 2 results were obtained by partially throttling the pump discharge.

If you have any questions please contact Jon Lee at (951) 684-9801.

P.O. Box 5646, Riverside, California 92517

"Pump Testing, The Service That Pays For Itself"

ANNUAL PUMPING COST ANALYSIS

City of Coachella — Test date: 02/09/2013

Plant: Well #19
H.P. 200

The following cost analysis is presented as an aid to your cost accounting and planning. It is an ESTIMATE based on the pump test data and your energy use during the previous 12-month period.

	EXISTING CONDITIONS	
Total annual hours of operation	3100	Estimated
Total annual kWhrs	486080	
Total annual cost	$52,934.11	
Average Cost per kWh	$0.1089	

	Test 1	Test 2
KW input to motor	156.8	154.4
Acre feet pumped per 24 hour day	10.251	9.544
KWh per acre foot	367.1	388.3
Pumping cost per hour	$17.08	$16.81
Pumping cost per acre foot	$39.98	$42.28
Overall plant efficiency	71.8	73.4

FINAL RESULTS

CESTRADA @ COACHELLA.ORG

City of Coachella
Water Model Calibration Testing

TKE desires to gather SCADA and field data to finish calibration of the water system model to accurately reflect the City's water system as it stands today. The exercise will allow us to identify current system deficiencies and create a suitable CIP to match City Growth projections.

Baseline Test

TKE will need both the SCADA and the field data to be taken at the **exact same point in time**. Please see below for a listing of what data we will need at specific locations. This will serve as our baseline test.

SCADA:

- Wells:
  - Flow
  - Discharge Pressure
  - RPM/Speed
- Boosters
  - Flow
  - Discharge Pressure
  - RPM/Speed
- Tanks
  - Water Elevation

WELL 19 = 1780 RPM @ 200 HP
WELL 17 = 1785 RPM @ 200 HP
WELL 11 = 1775 RPM @ 150 HP
WELL 16 = 1780 RPM @ 250 HP
WELL 18 = 1780 RPM @ 100 HP
WELL 18 LOW ZONE BOOSTERS = 1785 RPM @ 125 HP
BOTH MOTORS
WELL 12 = 1780 RPM @ 100 HP
WELL 12 BOOSTERS = 1780 RPM @ 100 HP
THREE MOTORS

USE TO CALCULATE PUMP SPEEDS!

Field Data:

- Pressure gauge readings at each of the 6 fire hydrant locations show on the map.

Operational Change Tests

Once the baseline test is completed, TKE proposes to make an operational change in the system, wait 10 minutes for the system to stabilize and then record the data as described above in the baseline test. We propose a total of 3 operational changes, as shown below, to different areas of the system to obtain a reliable indication of how the system reacts to changes.

- **Operational Change #1:** Shut off Well #11 and Well #16. Wait 10 minutes to allow the system to stabilize and then record all data at the *exact same point in time.*
- **Operational Change #2:** Shut off Booster 1 Low Zone and Booster 2 Low Zone at the 5.0 MG Reservoir Site. Wait 10 minutes to allow the system to stabilize and then record all data at the *exact same point in time.*
- **Operational Change #3:** Shut off Booster 1 and Booster 2 at the 3.6 MG Reservoir Site. Wait 10 minutes to allow the system to stabilize and then record all data at the *exact same point in time.*

Test Date: 9-10-14
Test Time: ~~2:05 pm~~ 1:40pm

Pressure Gauge Tests

Location #	Pressure (psi)	
1	65	53-720 SLATE DR.
2	67	FLORENA & VERONICA
3	65	~~50-266 SAN SALANO~~ VINE & SEVENTH
4	68	GARDENIA & GERANO
5	52	50-266 SAN SALANO
6	51	CHAPARROSA & 48th

Baseline Test
Record all data at the exact same point in time.

OFF ALL DAY

Well #11 (NOT VARIABLE SPEED)

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
1604	63.3		

Well #16 (NOT VARIABLE SPEED)

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
0	75.4		

Well #17

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
1356	53.2		87.2

Well #19

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
761	46.8		42.9

1.5 MG Reservoir

Water level (ft)
29.9

3.6 MG Reservoir Site (NOT VARIABLE SPEED)

Well #12

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
0	NO GAUGE.		

3.6 MG Reservoir

Water level (ft)
24

Booster 1

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
0	65.3		OFF

Booster 2

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
0	65.3		OFF

Pressure Relief Valve

Status (open or closed)	Flow (gpm)
CLOSED	

5.0 MG Reservoir Site

Well #18 (NOT VARIABLE SPEED)

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
1422			

5.0 MG Reservoir

Water level (ft)
26.6

Booster 1 Low Zone

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
542	62.5		71

Booster 2 Low Zone

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%) OFF
Ø			

Booster 1 High Zone

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%) OFF
Ø			

Booster 2 High Zone

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%) OFF
Ø			

Test Date: 9-10-14
Test Time: 2:05 PM

ALREADY OFF

Pressure Gauge Tests

Location #	Pressure (psi)
1	65
2	66
3	64
4	66
5	49
6	50

Operational Change #1
Shut off Well #11 and Well #16. Wait 10 minutes to allow the system to stabilize and then record all data at the exact same point in time.

53-720 SLATE DR.
FLORENA & VERONICA
VINE & SEVENTH
GARDENIA & GERANO
50-266 SAN SALANO
CHAPARROSA & 48TH

LINE UNDER PRESSURE BUT NOT DISCHARGING

OFF ALL DAY

Well #11 (NOT VARIABLE SPEED)

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
0	0 51	0	0

LINE UNDER PRESSURE BUT NOT DISCHARGING

Well #16 (NOT VARIABLE SPEED)

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
0	0 74	0	0

Well #17

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
1917	50.4		93.7

Well #19

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
1498	45.6		42.9

1.5 MG Reservoir

Water level (ft)
29.7

3.6 MG Reservoir Site

Well #12

NO GAUGE

OFF

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
0			

3.6 MG Reservoir

Water level (ft)
24.0

Booster 1

OFF

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
OFF 0			

Booster 2

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
797	64.0		100

Pressure Relief Valve

Status (open or closed)	Flow (gpm)
CLOSED	

READ 100% BUT WAS FLUCTUATING

5.0 MG Reservoir Site

Well #18 (NOT VARIABLE SPEED) NO GAUGE

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
1425			

5.0 MG Reservoir

Water level (ft)
26.7

Booster 1 Low Zone

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
820	62		74

Booster 2 Low Zone

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)

Booster 1 High Zone

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
0		88	OFF

Booster 2 High Zone

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
0		88	OFF

PRESSURE IN LINES BUT NOT DISCHARGING.

Test Date: 9-10-14
Test Time: 2:30 pm

53-720 SLATE DR.

20 MINUTES

Pressure Gauge Tests

Location #	Pressure (psi)	
1	63	53-720 SLATE DR.
2	60.5	FLORENA & VERONICA
3	65	VINE & SEVENTH
4	44	GARDENIA & GENARO
5	51	50-266 SAN SALANO
6	50	CHAPARROSA & 48th

Operational Change #2
Shut off Booster 1 Low Zone and Booster 2 Low Zone at the 5.0 MG Reservoir Site. Wait 10 minutes to allow the system to stabilize and then record all data at the exact same point in time.

Well #11 (NOT VARIABLE SPEED)

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
1622	60.3		

Well #16 (NOT VARIABLE SPEED)

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
0	66.8 (PRESSURE IN LINE)		OFF

Well #17

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
1876.5	52.7		93.7

Well #19

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
949	46.5		42.8

1.5 MG Reservoir

Water level (ft)
29.5

NO GAUGE

OFF

3.6 MG Reservoir Site

Well #12

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
0			

3.6 MG Reservoir

Water level (ft)
23.9

OFF

Booster 1

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
0			

Booster 2

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
1510	63.2		52.5 — 100

FLUCTUATING.

Pressure Relief Valve

Status (open or closed)	Flow (gpm)
CLOSED.	

NO GAUGE

5.0 MG Reservoir Site

Well #18 (NOT VARIABLE SPEED)

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
1425			

5.0 MG Reservoir

Water level (ft)
26.9

ALL BOOSTERS OFF

Booster 1 Low Zone

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
0	0 36	0	0

OFF

Booster 2 Low Zone

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
0	0 36	0	0

OFF

Booster 1 High Zone

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
0	89		

OFF

Booster 2 High Zone

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
0	89		

OFF

PRESSURE IN LINES.

Test Date: 9-10-14
Test Time: 3:00 PM

15 MINUTES

Pressure Gauge Tests

Location #	Pressure (psi)
1	65
2	68
3	64
4	69
5	51
6	50

Operational Change #3
Shut off Booster 1 and Booster 2 at the 3.6 MG Reservoir Site. Wait 10 minutes to allow the system to stabilize and then record all data at the exact same point in time.

FLORENA & VERONICA
VINE & SEVENTH
GARDENA & GERANO
50-266 SAN SALANO
CHAPARROSA & 48th

Well #11 (NOT VARIABLE SPEED)

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
1430	60.6		

Well #16 (NOT VARIABLE SPEED)

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
	74.8		OFF

PRESSURE IN LINE

Well #17

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
1853	52.5		92.3

Well #19

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
810	45.9		42.9

1.5 MG Reservoir

Water level (ft)
29.5

NO GAUGE.

3.6 MG Reservoir Site

Well #12

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
0			

OFF

3.6 MG Reservoir

Water level (ft)
23.8

PRESSURE IN LINES.

Booster 1

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
0	0 63.8	0	0

OFF

Booster 2

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
0	0 63.8	0	0

OFF

Pressure Relief Valve

Status (open or closed)	Flow (gpm)
CLOSED	

NO GAUGE

5.0 MG Reservoir Site (NOT VARIABLE SPEED)

Well #18

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
1418			

5.0 MG Reservoir

Water level (ft)
27

Booster 1 Low Zone

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
747	62		73

Booster 2 Low Zone

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
0			~~73~~ OFF.

Booster 1 High Zone

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
0	89		OFF

Booster 2 High Zone

Discharge Flow (gpm)	Discharge Pressure (psi)	Pump Speed (rpm)	Pump Speed (%)
0	89		OFF

PRESSURE IN LINES.

City of Coachella
Water Model Calibration Testing

TKE desires to gather SCADA and field data to finish calibration of the water system model to accurately reflect the City's water system as it stands today. The exercise will allow us to identify current system deficiencies and create a suitable CIP to match City Growth projections.

Baseline Test

TKE will need both the SCADA and the field data to be taken at the **exact same point in time**. Please see below for a listing of what data we will need at specific locations. This will serve as our baseline test.

SCADA:

- Wells:
  - Flow
  - Discharge Pressure
  - RPM/Speed
- Boosters
  - Flow
  - Discharge Pressure
  - RPM/Speed
- Tanks
  - Water Elevation

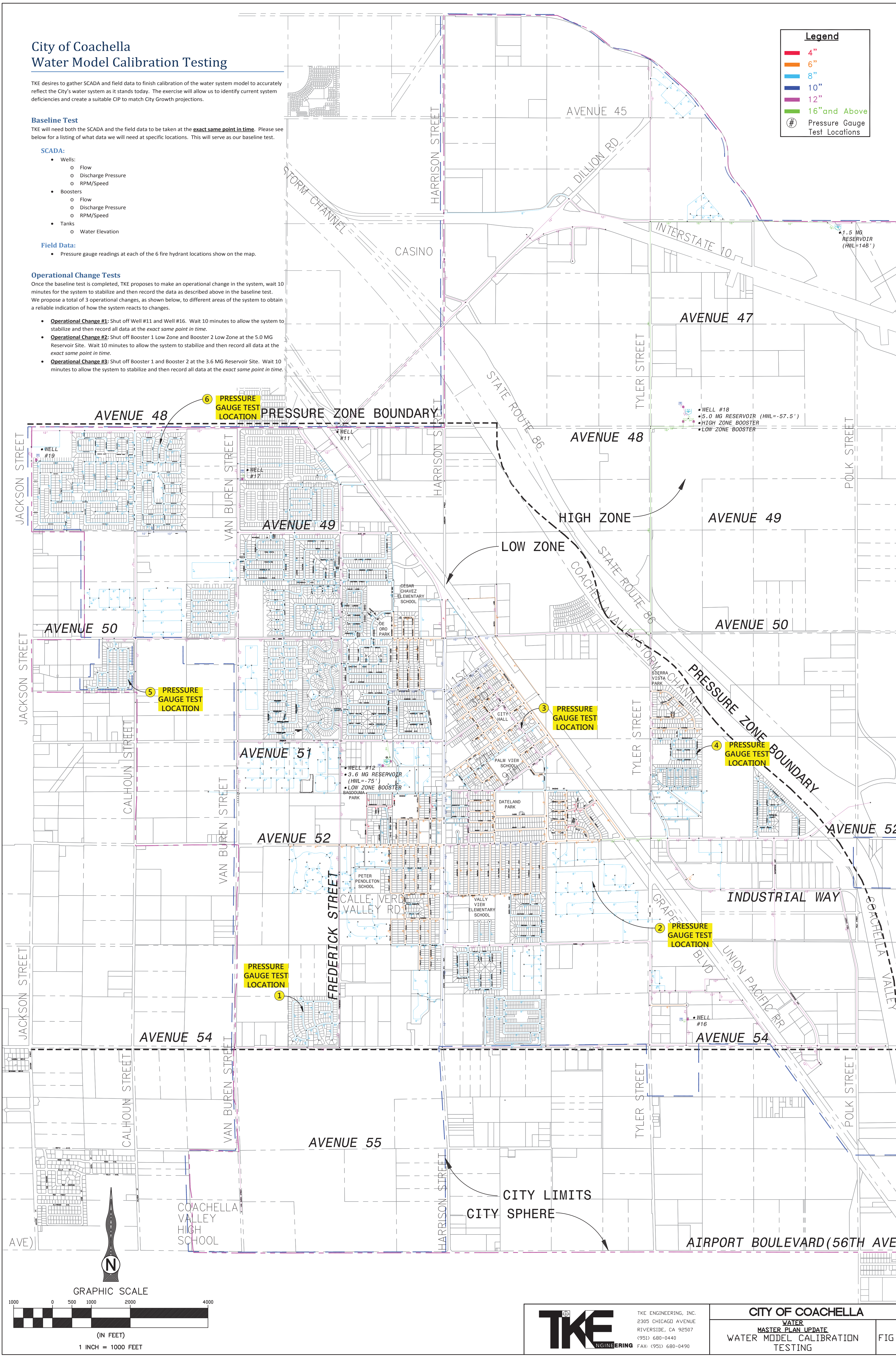
Field Data:

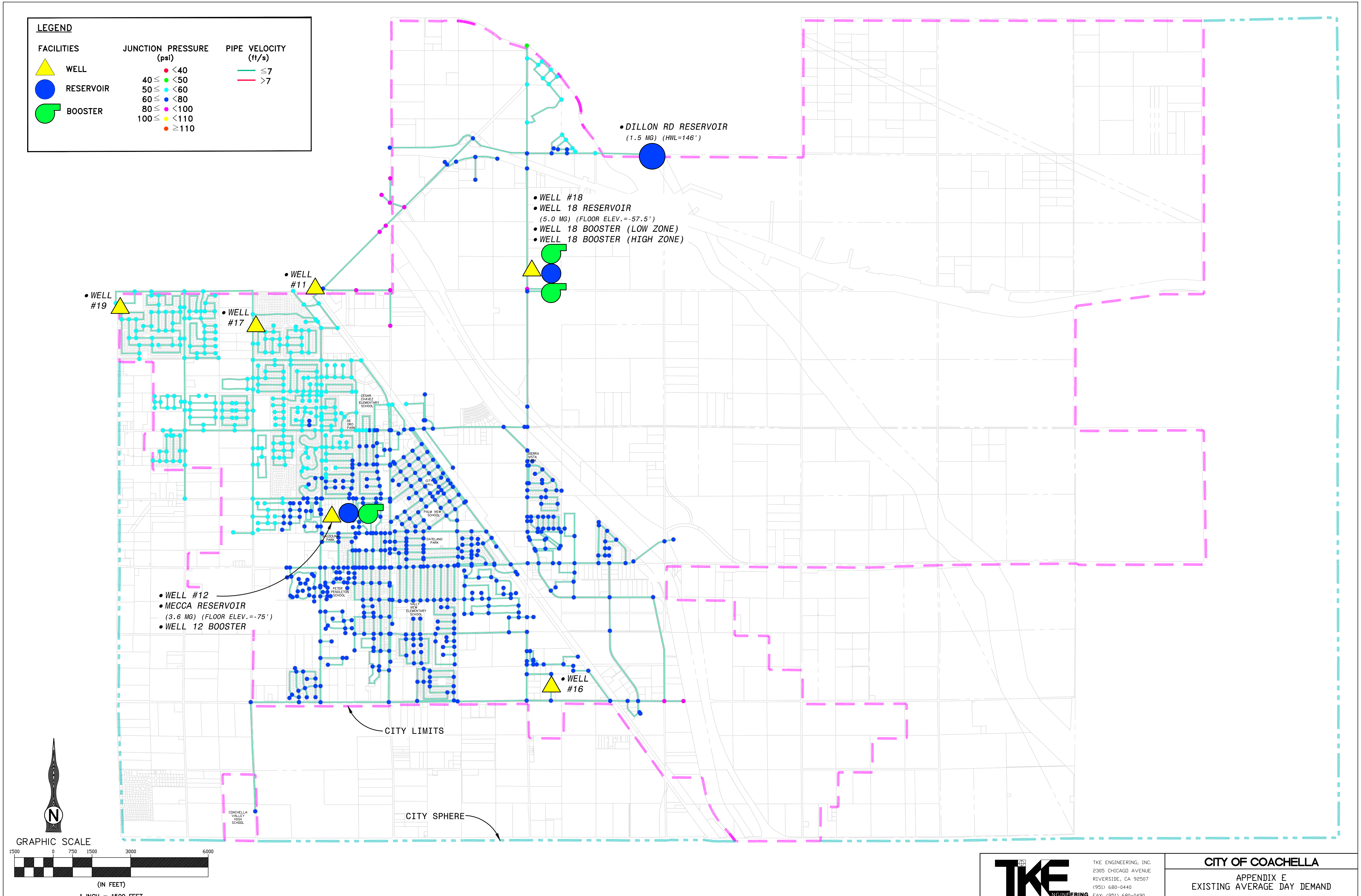
- Pressure gauge readings at each of the 6 fire hydrant locations show on the map.

Operational Change Tests

Once the baseline test is completed, TKE proposes to make an operational change in the system, wait 10 minutes for the system to stabilize and then record the data as described above in the baseline test. We propose a total of 3 operational changes, as shown below, to different areas of the system to obtain a reliable indication of how the system reacts to changes.

- **Operational Change #1:** Shut off Well #11 and Well #16. Wait 10 minutes to allow the system to stabilize and then record all data at the *exact same point in time.*
- **Operational Change #2:** Shut off Booster 1 Low Zone and Booster 2 Low Zone at the 5.0 MG Reservoir Site. Wait 10 minutes to allow the system to stabilize and then record all data at the *exact same point in time.*
- **Operational Change #3:** Shut off Booster 1 and Booster 2 at the 3.6 MG Reservoir Site. Wait 10 minutes to allow the system to stabilize and then record all data at the *exact same point in time.*




LEGEND
FACILITIES
WELL
RESERVOIR
BOOSTER
JUNCTION PRESSURE (psi)
<40
40 ≤ <50
50 ≤ <60
60 ≤ <80
80 ≤ <100
100 ≤ <110
≥110
PIPE VELOCITY (ft/s)
≤7
>7
DILLON RD RESERVOIR
(1.5 MG) (HWL=146')
WELL #18
WELL 18 RESERVOIR
(5.0 MG) (FLOOR ELEV.=-57.5')
WELL 18 BOOSTER (LOW ZONE)
WELL 18 BOOSTER (HIGH ZONE)
WELL #11
WELL #19
WELL #17
WELL #12
MECCA RESERVOIR
(3.6 MG) (FLOOR ELEV.=-75')
WELL 12 BOOSTER
WELL #16
CITY LIMITS
CITY SPHERE
GRAPHIC SCALE
1500 0 750 1500 3000 6000
(IN FEET)
1 INCH = 1500 FEET
N
TKE ENGINEERING
TKE ENGINEERING, INC.
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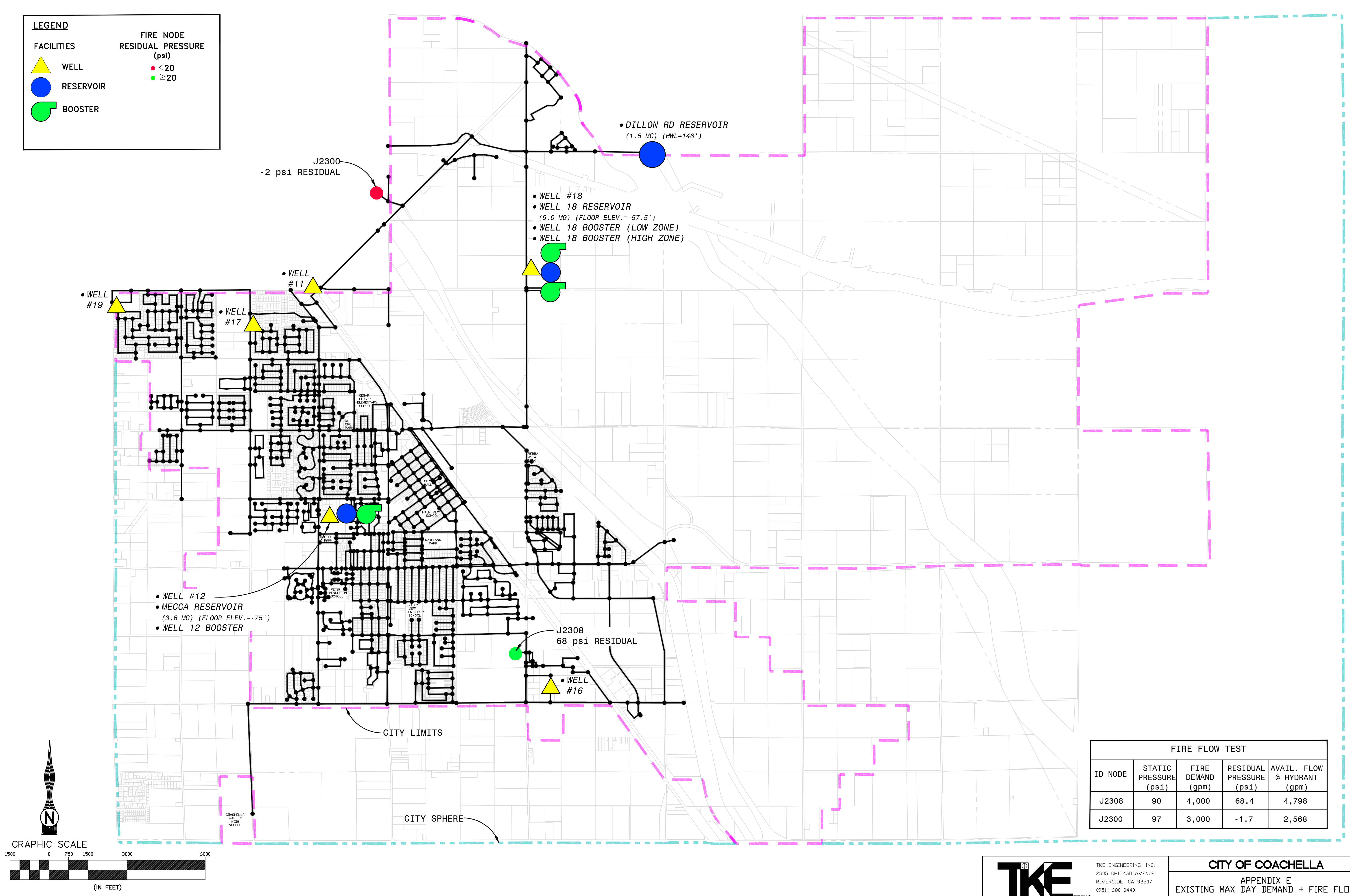
RIVERSIDE, CA 92507
(951) 680-0440
FAX: (951) 680-0490
CITY OF COACHELLA
APPENDIX E
EXISTING AVERAGE DAY DEMAND



FIRE FLOW TEST

ID NODE	STATIC PRESSURE (psi)	FIRE DEMAND (gpm)	RESIDUAL PRESSURE (psi)	AVAIL. FLOW @ HYDRANT (gpm)
J2308	90	4,000	68.4	4,798
J2300	97	3,000	-1.7	2,568

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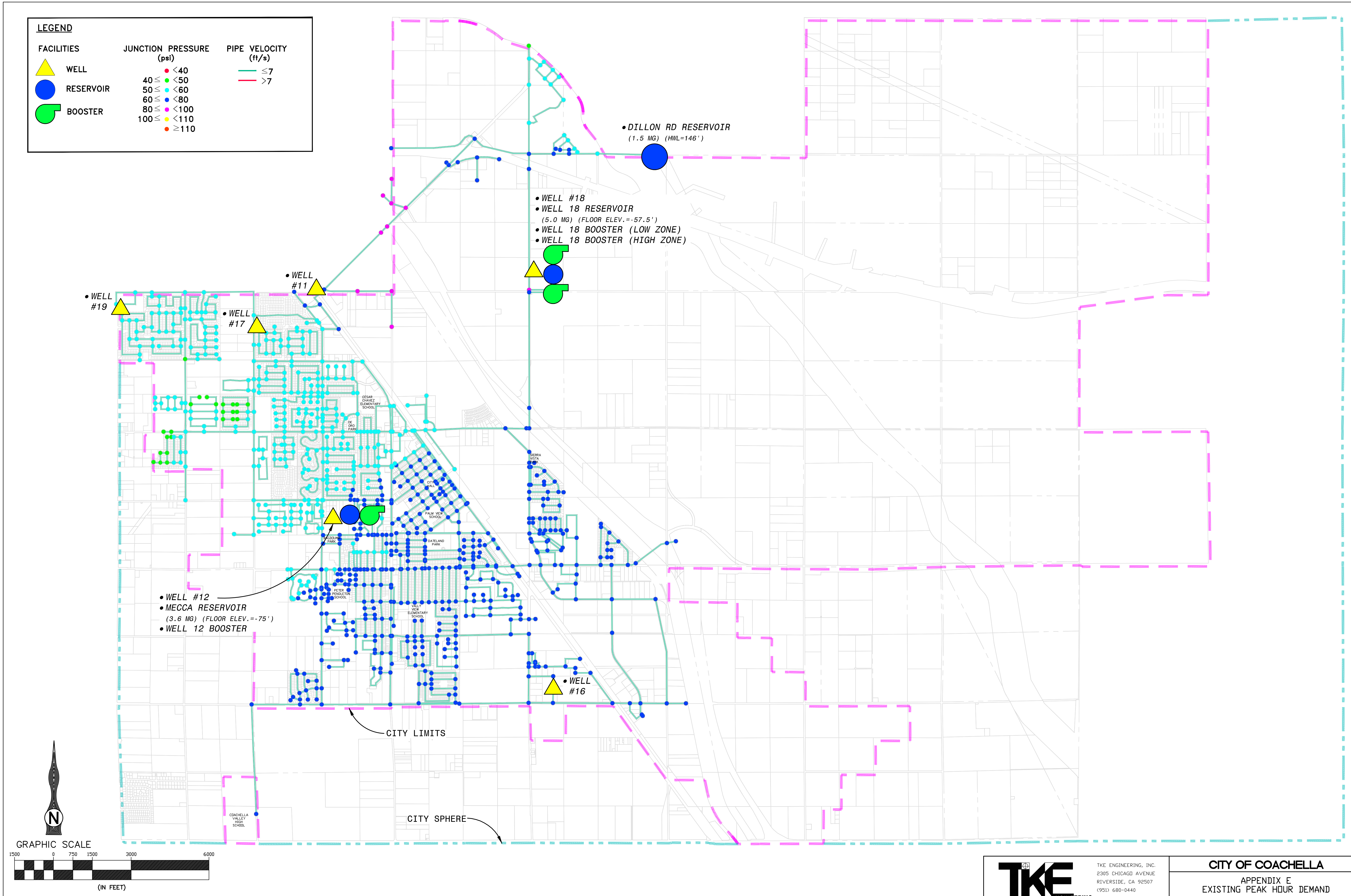
CITY OF COACHELLA

APPENDIX E
EXISTING MAX DAY DEMAND + FIRE FLOW



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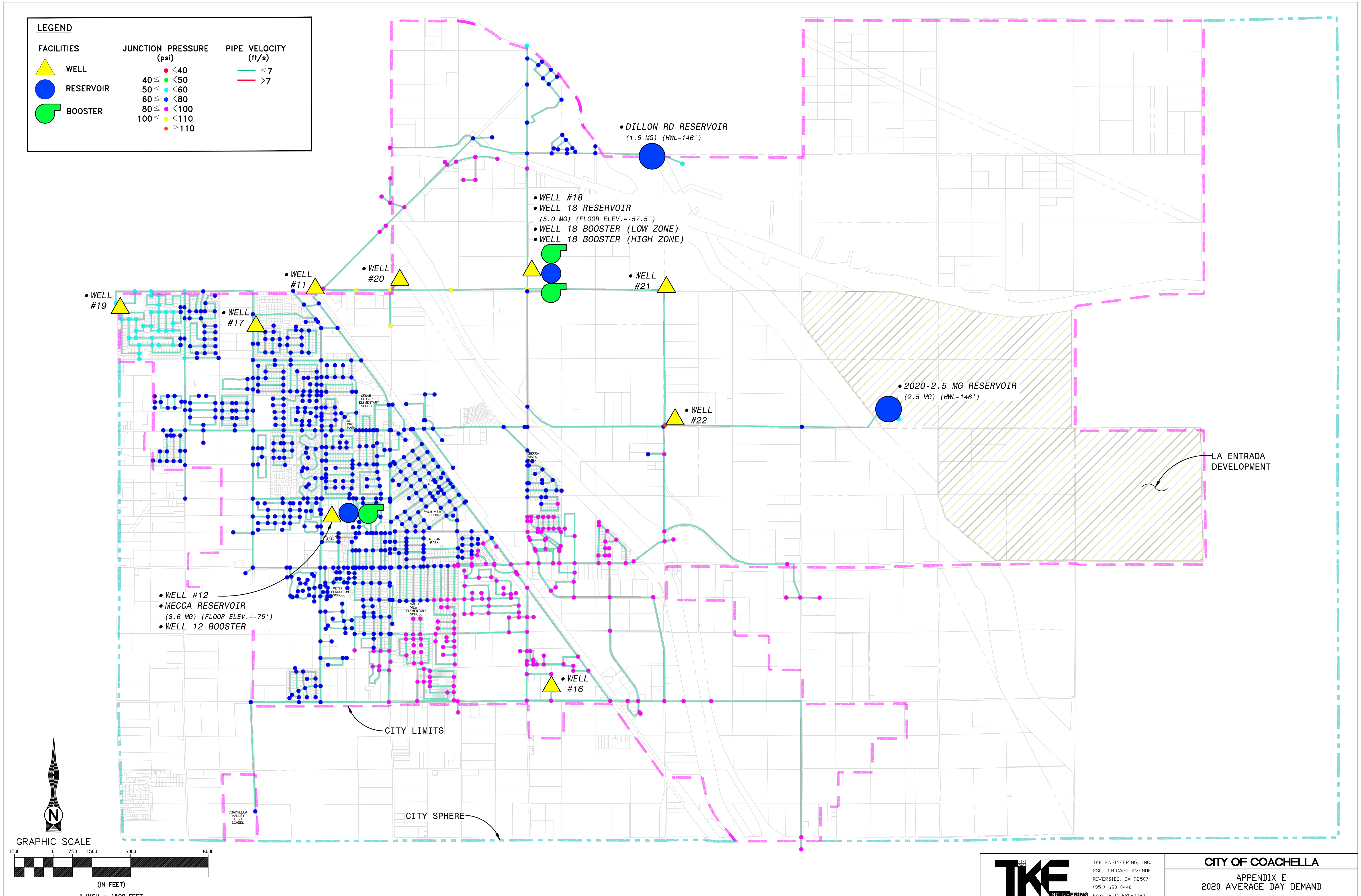
APPENDIX E
EXISTING PEAK HOUR DEMAND



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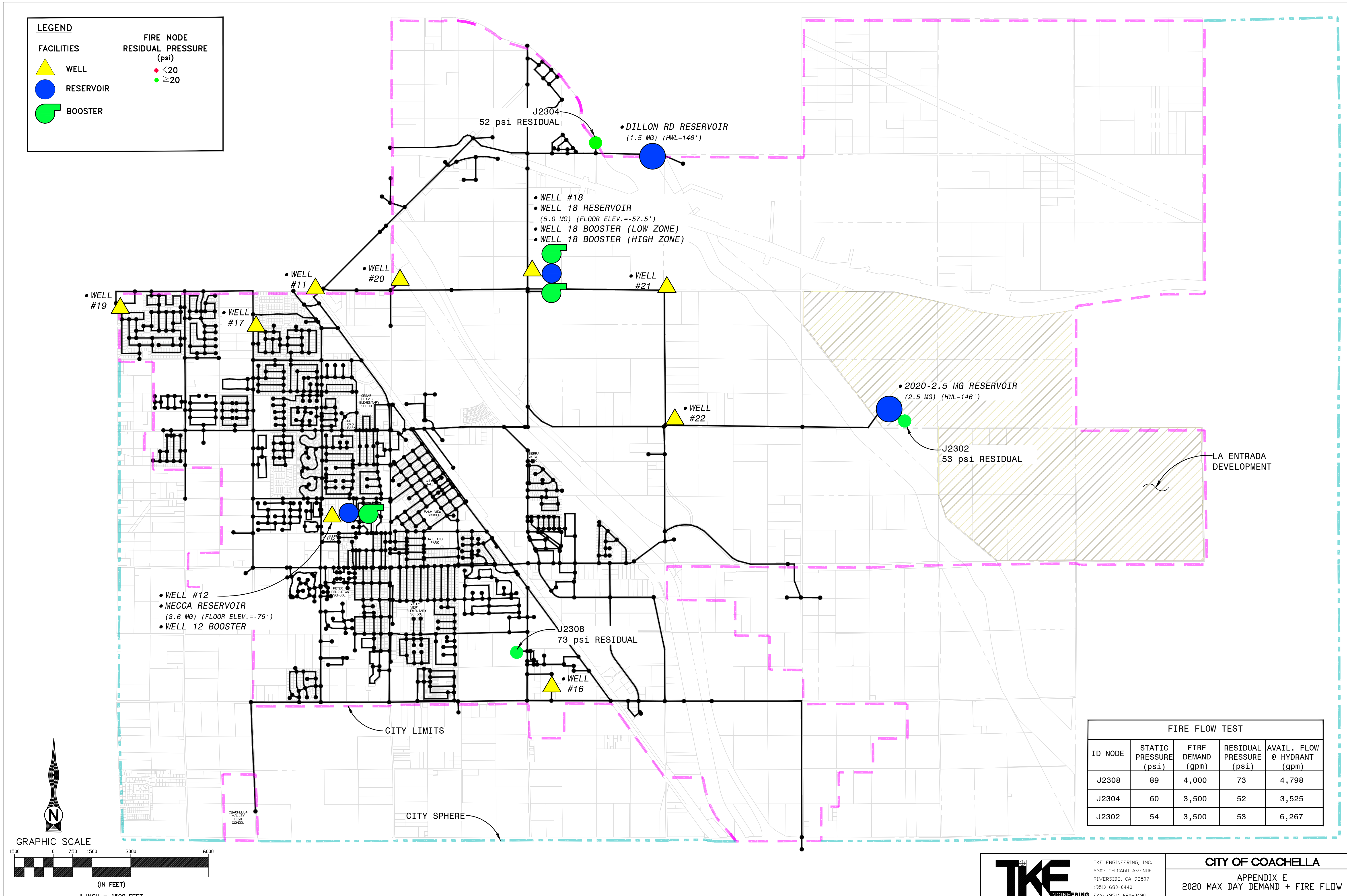
APPENDIX E
2020 AVERAGE DAY DEMAND



FIRE FLOW TEST

ID NODE	STATIC PRESSURE (psi)	FIRE DEMAND (gpm)	RESIDUAL PRESSURE (psi)	AVAIL. FLOW @ HYDRANT (gpm)
J2308	89	4,000	73	4,798
J2304	60	3,500	52	3,525
J2302	54	3,500	53	6,267

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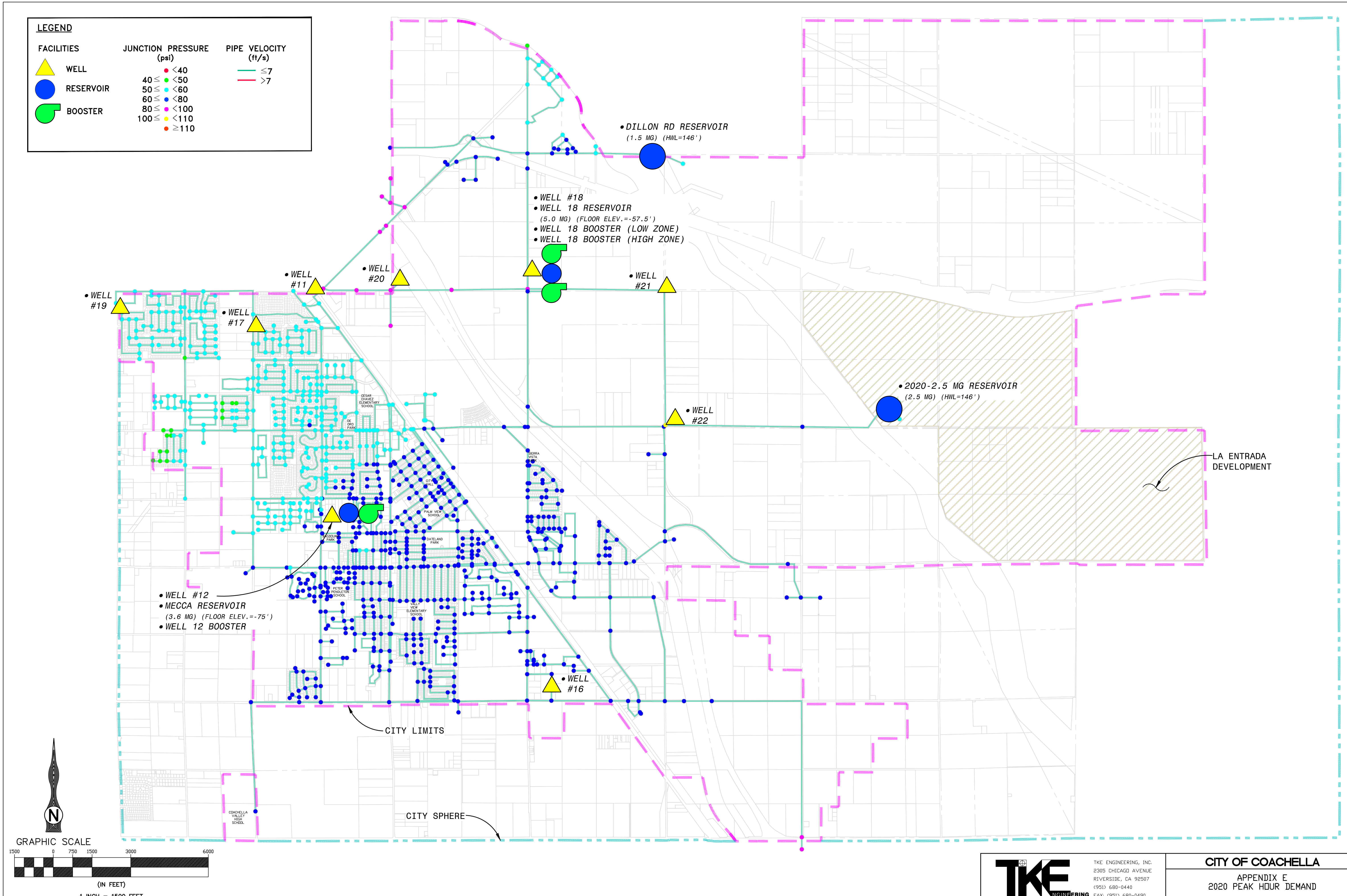
APPENDIX E
2020 MAX DAY DEMAND + FIRE FLOW



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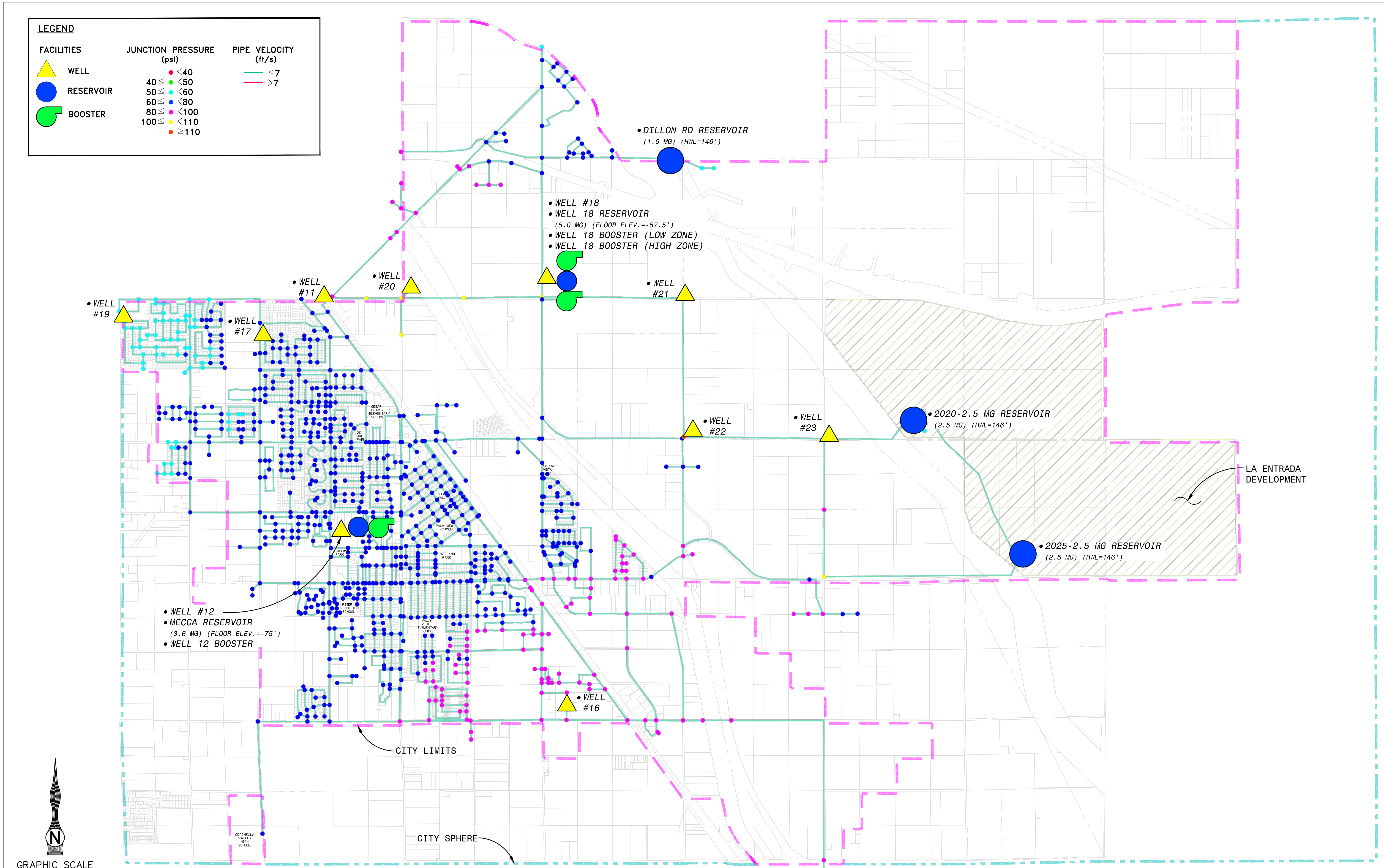
2020 PEAK HOUR DEMAND



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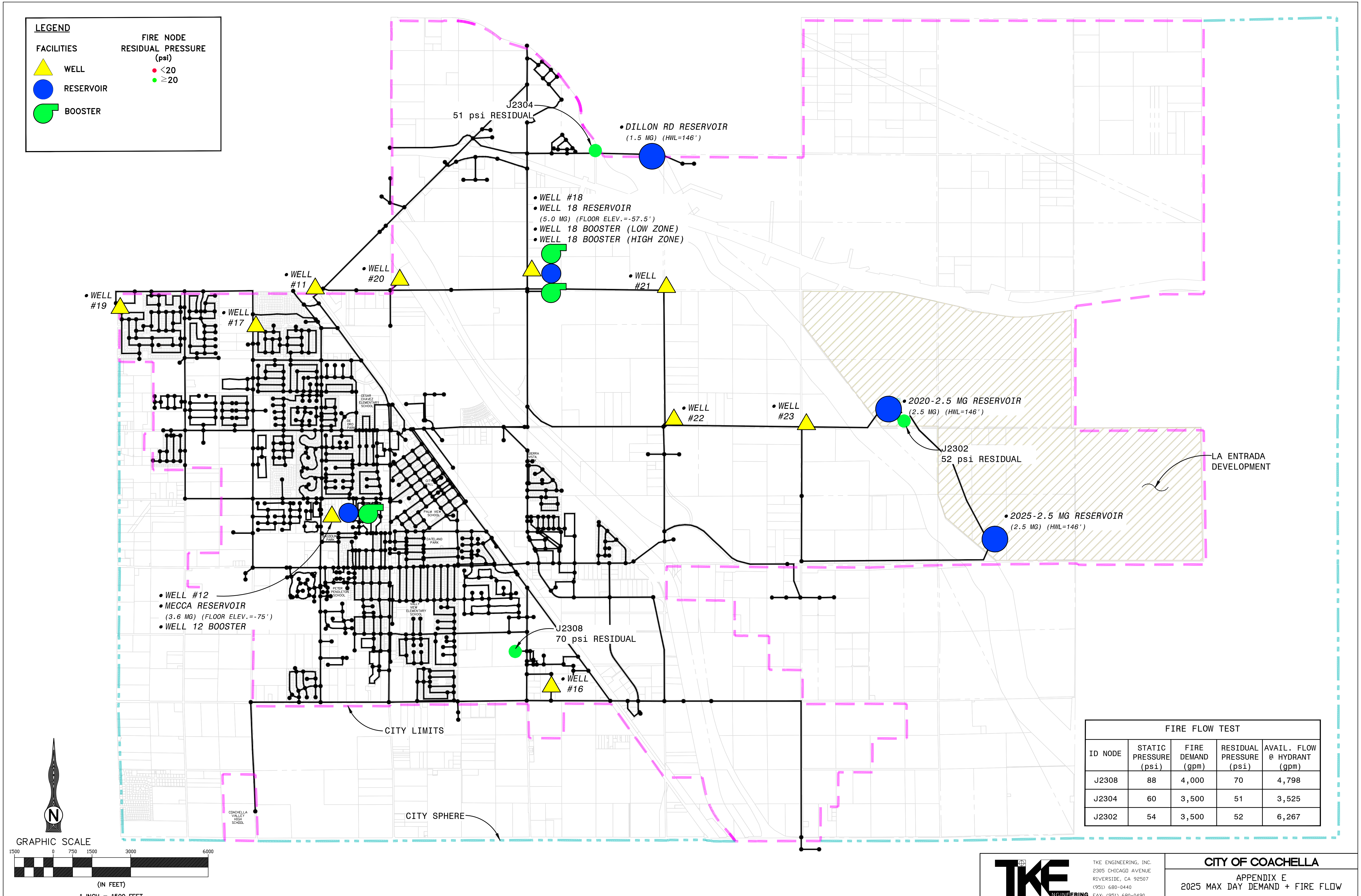
APPENDIX E
2025 AVERAGE DAY DEMAND



FIRE FLOW TEST

ID NODE	STATIC PRESSURE (psi)	FIRE DEMAND (gpm)	RESIDUAL PRESSURE (psi)	AVAIL. FLOW @ HYDRANT (gpm)
J2308	88	4,000	70	4,798
J2304	60	3,500	51	3,525
J2302	54	3,500	52	6,267

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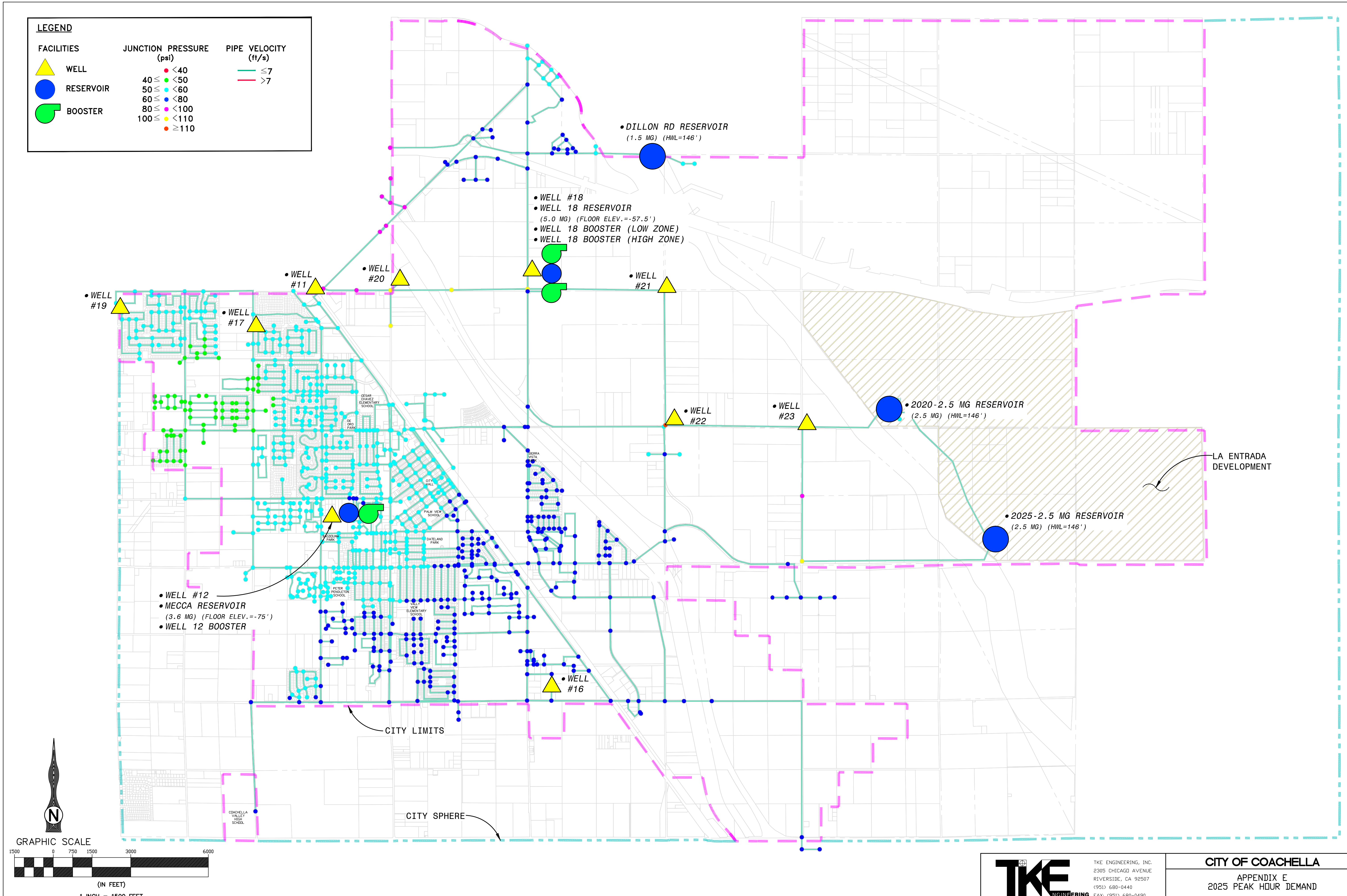
APPENDIX E
2025 MAX DAY DEMAND + FIRE FLOW



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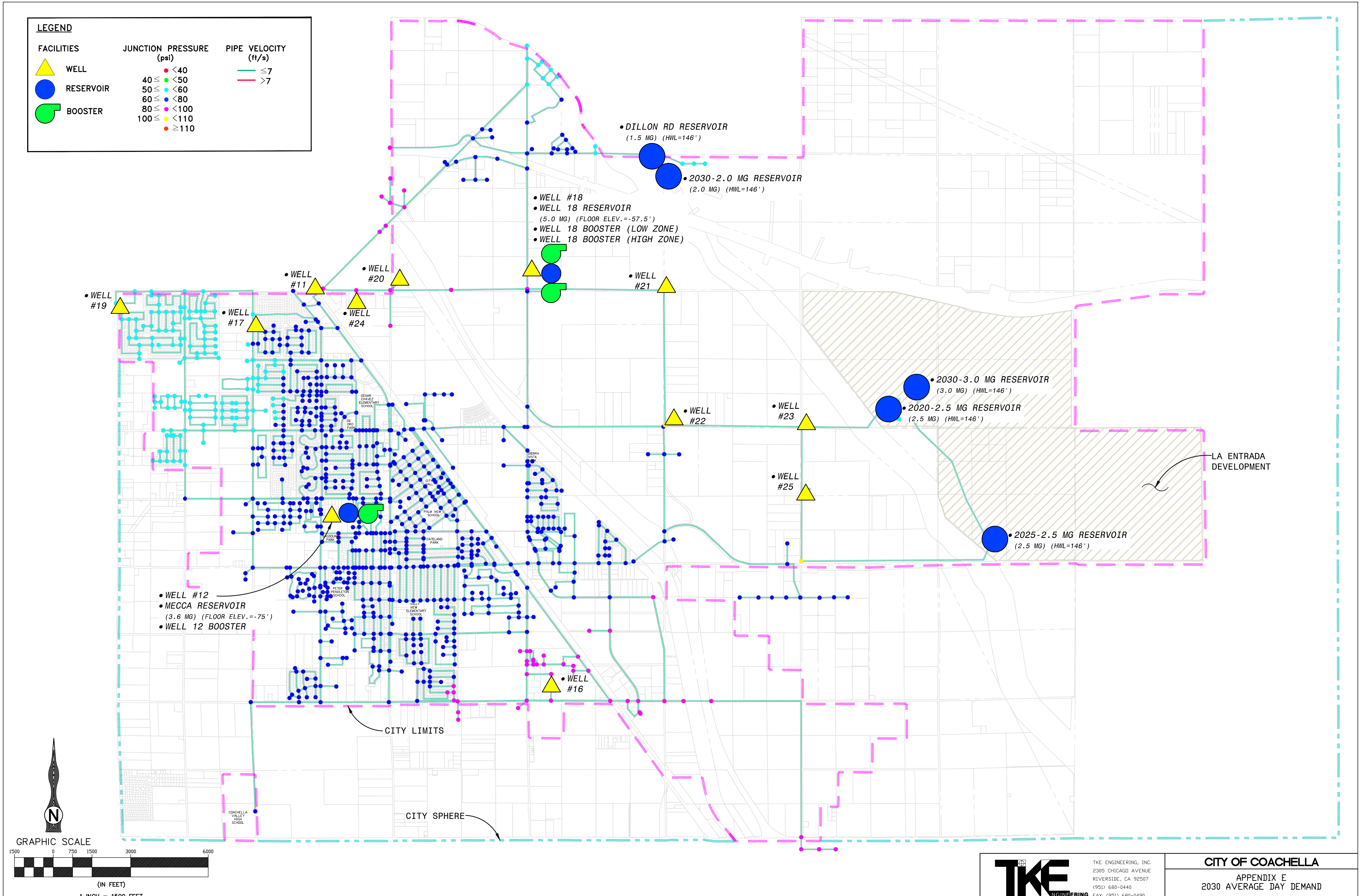
2025 PEAK HOUR DEMAND


LEGEND
FACILITIES
WELL
RESERVOIR
BOOSTER
JUNCTION PRESSURE (psi)
<40
40≤ <50
50≤ <60
60≤ <80
80≤ <100
100≤ <110
≥110
PIPE VELOCITY (ft/s)
≤7
>7
DILLON RD RESERVOIR
(1.5 MG) (HWL=146')
2030-2.0 MG RESERVOIR
(2.0 MG) (HWL=146')
WELL #18
WELL 18 RESERVOIR
(5.0 MG) (FLOOR ELEV.=-57.5')
WELL 18 BOOSTER (LOW ZONE)
WELL 18 BOOSTER (HIGH ZONE)
WELL #11
WELL #20
WELL #19
WELL #17
WELL #24
WELL #21
WELL #22
WELL #23
WELL #25
WELL #16
2030-3.0 MG RESERVOIR
(3.0 MG) (HWL=146')
2020-2.5 MG RESERVOIR
(2.5 MG) (HWL=146')
2025-2.5 MG RESERVOIR
(2.5 MG) (HWL=146')
LA ENTRADA DEVELOPMENT
WELL #12
MECCA RESERVOIR
(3.6 MG) (FLOOR ELEV.=-75')
WELL 12 BOOSTER
CITY LIMITS
CITY SPHERE
N
GRAPHIC SCALE
1500 0 750 1500 3000 6000
(IN FEET)
1 INCH = 1500 FEET
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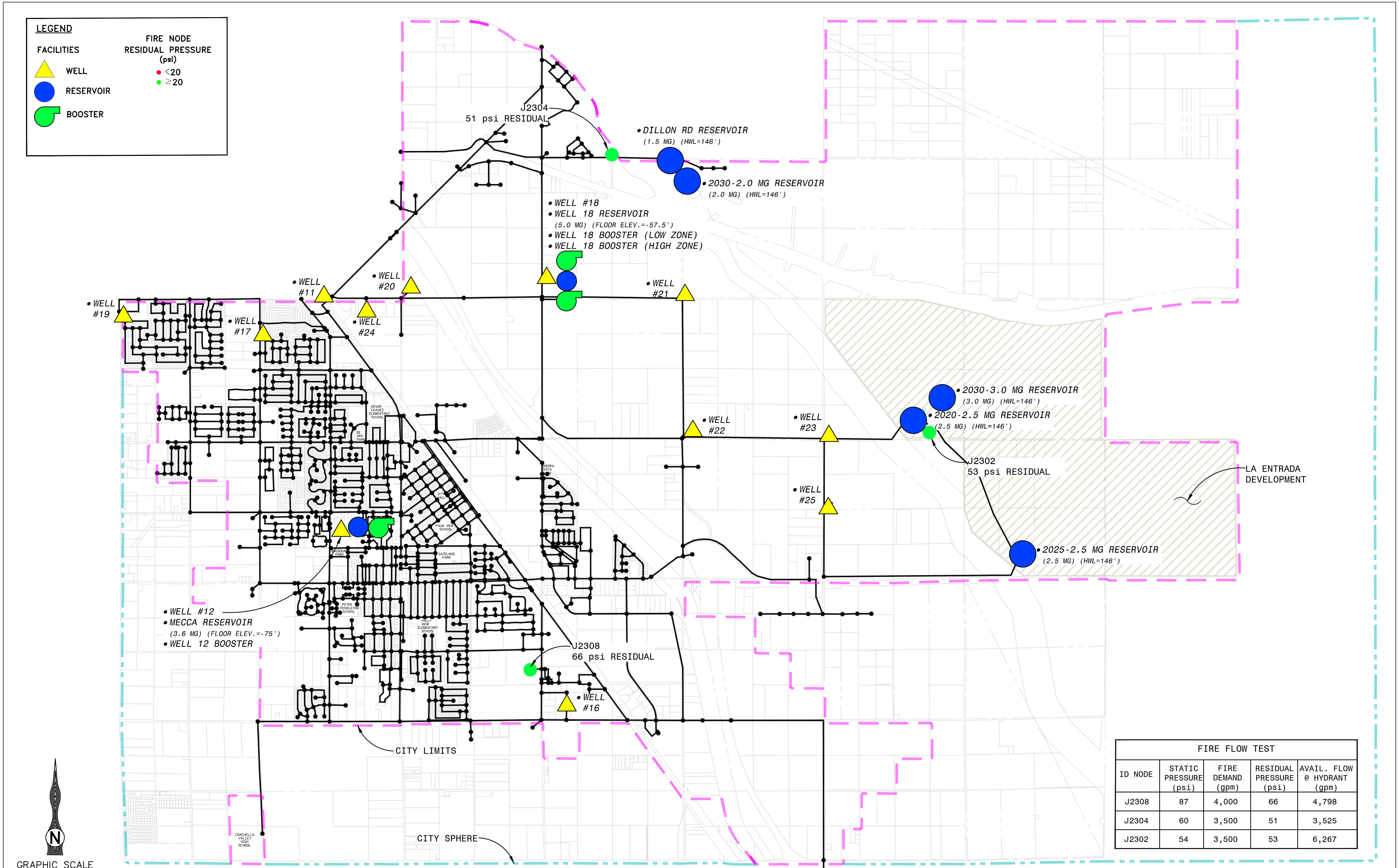
2030 AVERAGE DAY DEMAND



FIRE FLOW TEST

ID NODE	STATIC PRESSURE (psi)	FIRE DEMAND (gpm)	RESIDUAL PRESSURE (psi)	AVAIL. FLOW @ HYDRANT (gpm)
J2308	87	4,000	66	4,798
J2304	60	3,500	51	3,525
J2302	54	3,500	53	6,267

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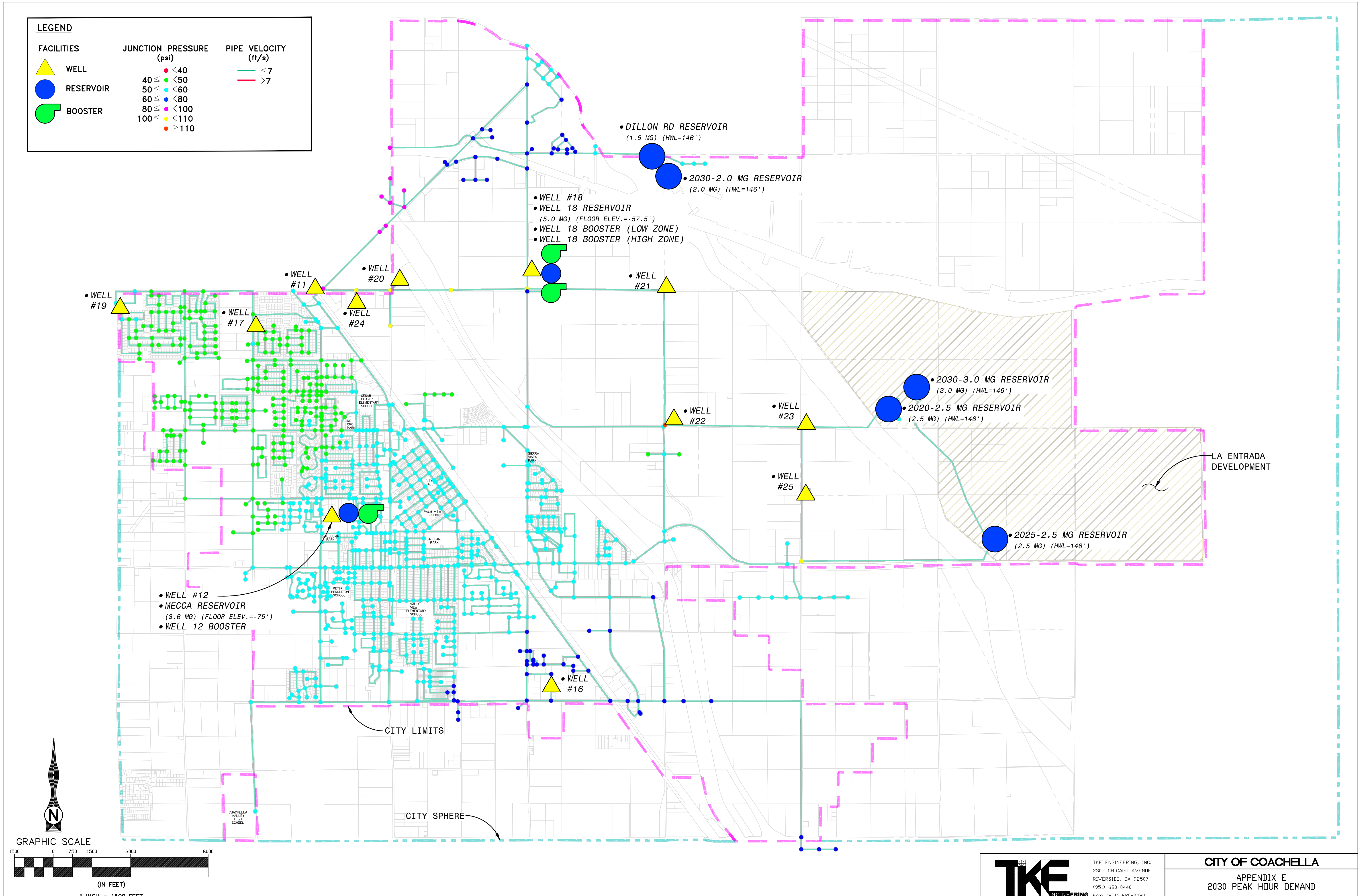
APPENDIX E
2030 MAX DAY DEMAND + FIRE FLOW


LEGEND
FACILITIES
WELL
RESERVOIR
BOOSTER
JUNCTION PRESSURE (psi)
<40
40≤ <50
50≤ <60
60≤ <80
80≤ <100
100≤ <110
≥110
PIPE VELOCITY (ft/s)
≤7
>7
DILLON RD RESERVOIR (1.5 MG) (HWL=146')
2030-2.0 MG RESERVOIR (2.0 MG) (HWL=146')
WELL #18
WELL 18 RESERVOIR (5.0 MG) (FLOOR ELEV.=-57.5')
WELL 18 BOOSTER (LOW ZONE)
WELL 18 BOOSTER (HIGH ZONE)
WELL #11
WELL #20
WELL #24
WELL #21
WELL #19
WELL #17
WELL #22
WELL #23
WELL #25
2030-3.0 MG RESERVOIR (3.0 MG) (HWL=146')
2020-2.5 MG RESERVOIR (2.5 MG) (HWL=146')
LA ENTRADA DEVELOPMENT
2025-2.5 MG RESERVOIR (2.5 MG) (HWL=146')
WELL #12
MECCA RESERVOIR (3.6 MG) (FLOOR ELEV.=-75')
WELL 12 BOOSTER
WELL #16
CITY LIMITS
CITY SPHERE
GRAPHIC SCALE
1500 0 750 1500 3000 6000
(IN FEET)
1 INCH = 1500 FEET
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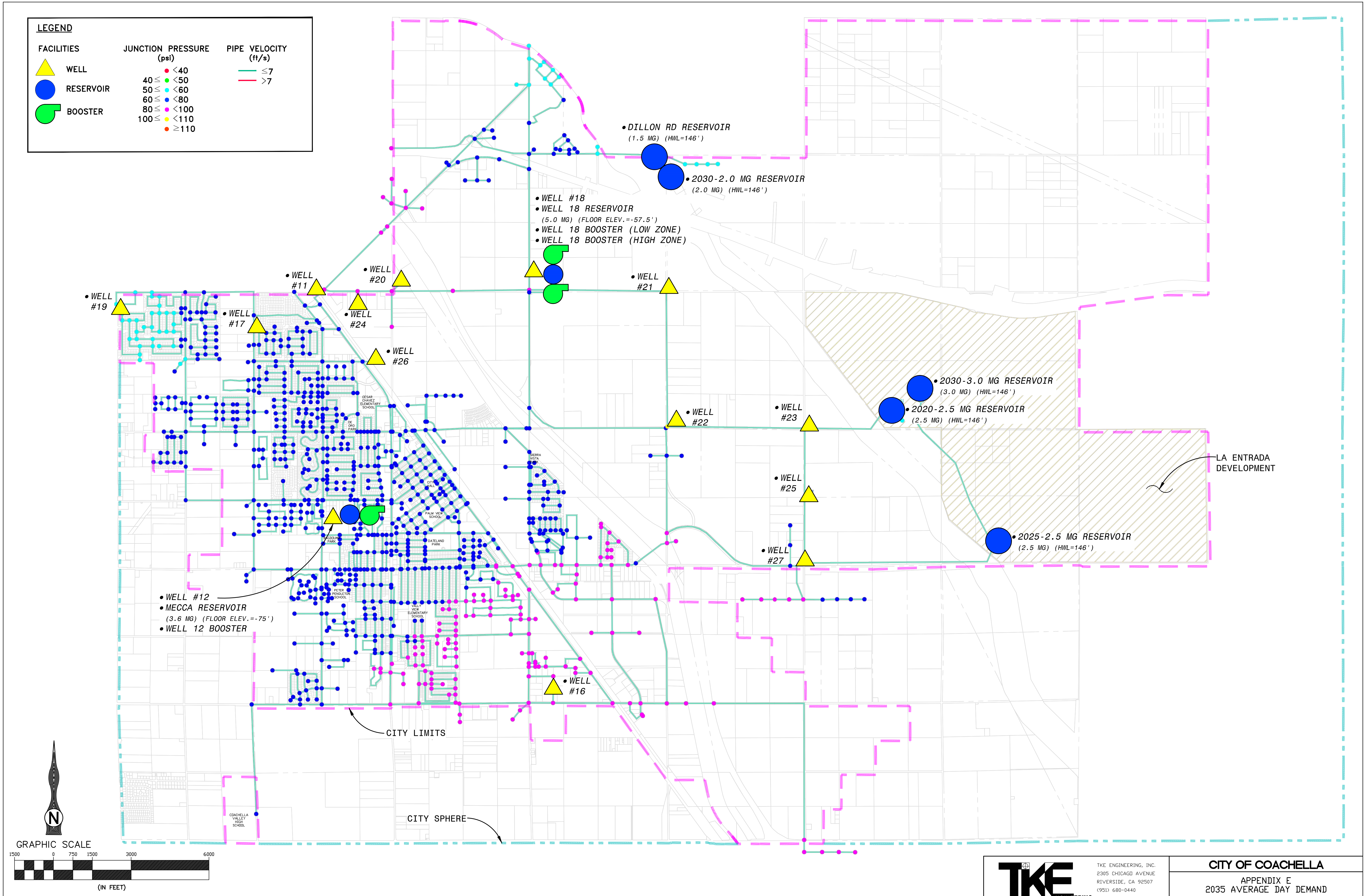
2030 PEAK HOUR DEMAND



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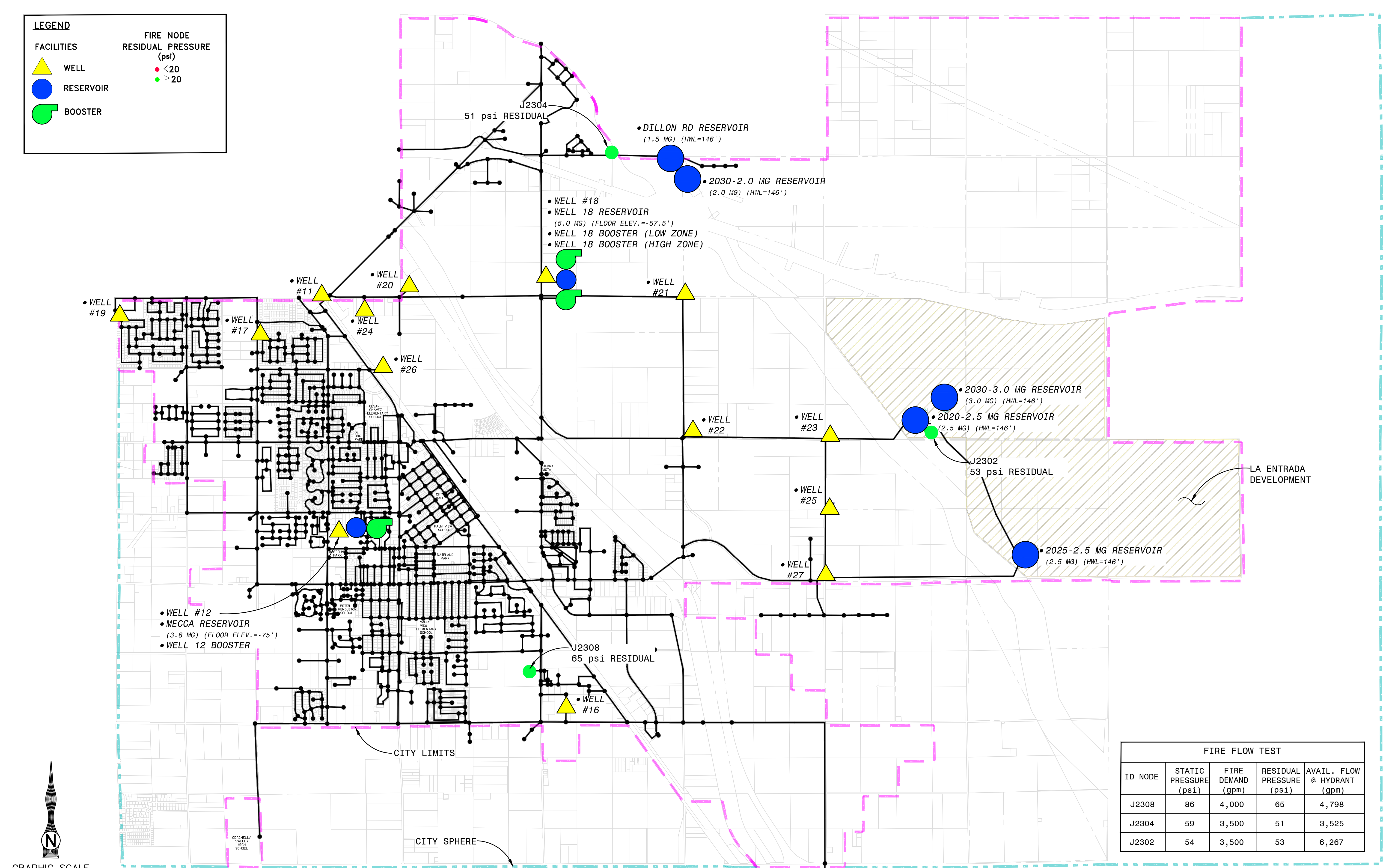
APPENDIX E
2035 AVERAGE DAY DEMAND



FIRE FLOW TEST

ID NODE	STATIC PRESSURE (psi)	FIRE DEMAND (gpm)	RESIDUAL PRESSURE (psi)	AVAIL. FLOW @ HYDRANT (gpm)
J2308	86	4,000	65	4,798
J2304	59	3,500	51	3,525
J2302	54	3,500	53	6,267

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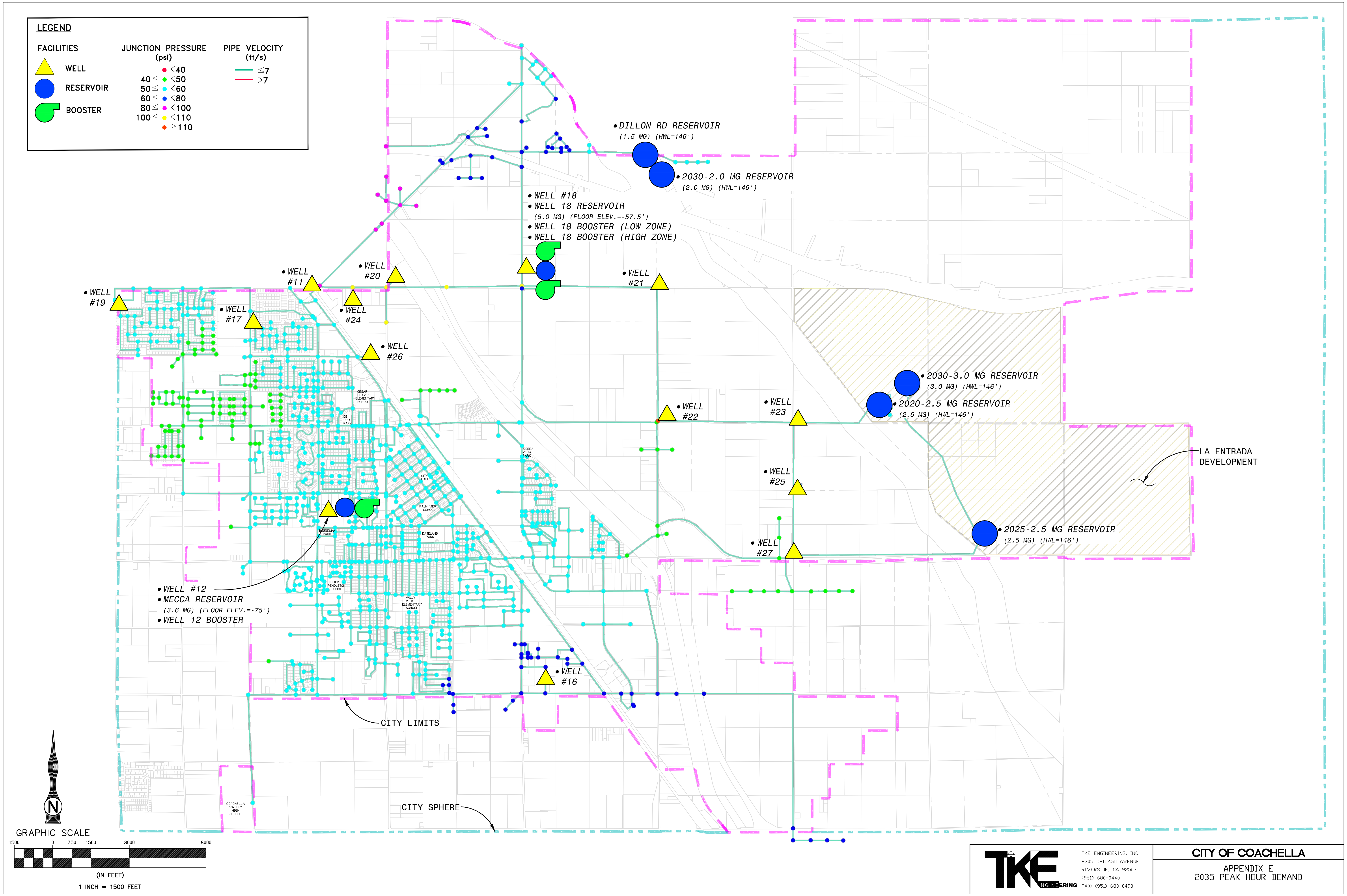
APPENDIX E
2035 MAX DAY DEMAND + FIRE FLOW


LEGEND
FACILITIES
WELL
RESERVOIR
BOOSTER
JUNCTION PRESSURE (psi)
<40
40≤ <50
50≤ <60
60≤ <80
80≤ <100
100≤ <110
≥110
PIPE VELOCITY (ft/s)
≤7
>7
DILLON RD RESERVOIR (1.5 MG) (HWL=146')
2030-2.0 MG RESERVOIR (2.0 MG) (HWL=146')
WELL #18
WELL 18 RESERVOIR (5.0 MG) (FLOOR ELEV.=-57.5')
WELL 18 BOOSTER (LOW ZONE)
WELL 18 BOOSTER (HIGH ZONE)
WELL #11
WELL #20
WELL #21
WELL #19
WELL #17
WELL #24
WELL #26
WELL #22
WELL #23
WELL #25
WELL #27
WELL #16
2030-3.0 MG RESERVOIR (3.0 MG) (HWL=146')
2020-2.5 MG RESERVOIR (2.5 MG) (HWL=146')
2025-2.5 MG RESERVOIR (2.5 MG) (HWL=146')
LA ENTRADA DEVELOPMENT
WELL #12
MECCA RESERVOIR (3.6 MG) (FLOOR ELEV.=-75')
WELL 12 BOOSTER
CITY LIMITS
CITY SPHERE
GRAPHIC SCALE
1500 0 750 1500 3000 6000
(IN FEET)
1 INCH = 1500 FEET
N
TKE ENGINEERING, INC.
2305 CHICAGO AVENUE
RIVERSIDE, CA 92507
(951) 680-0440
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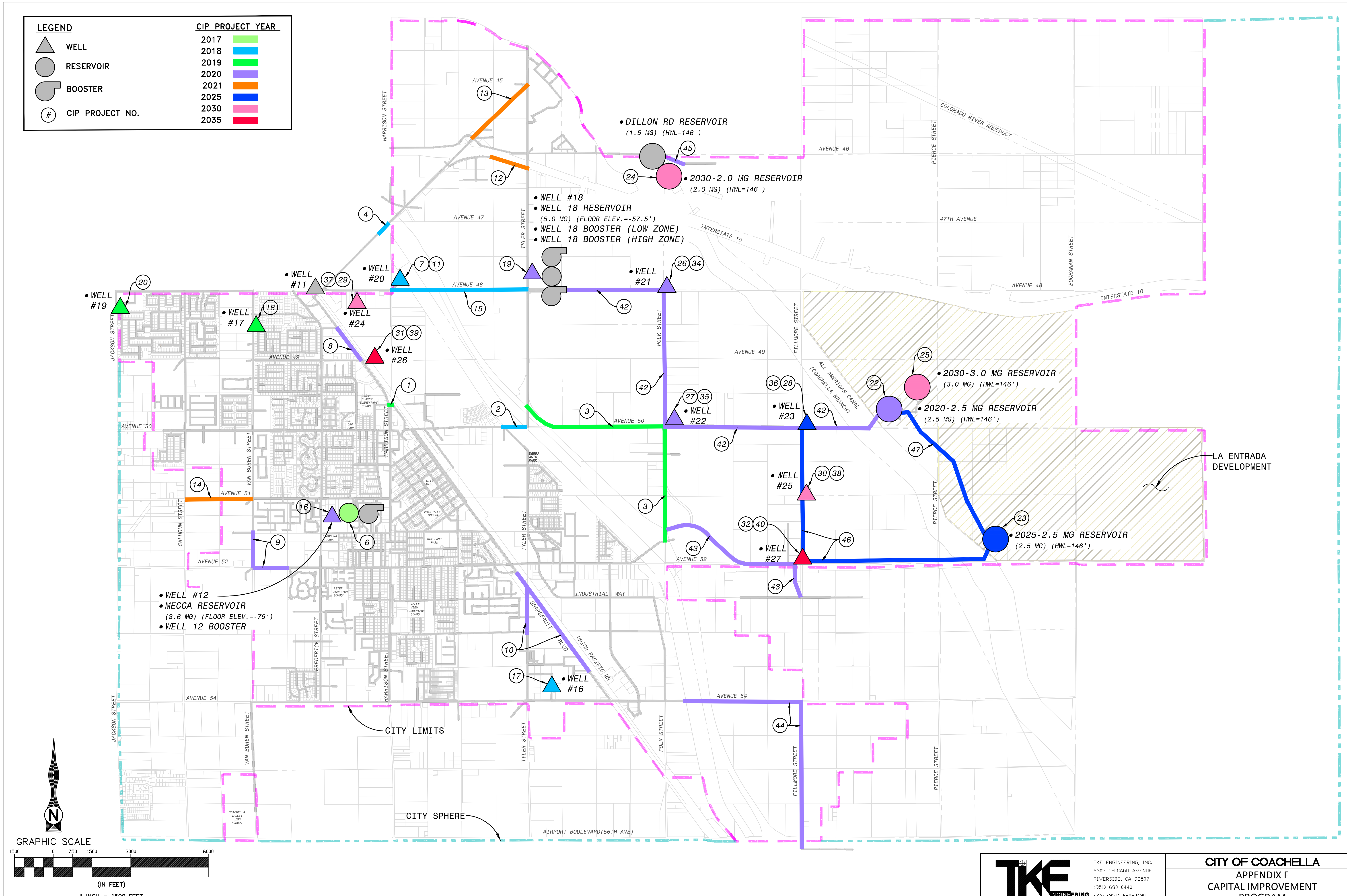
CITY OF COACHELLA
APPENDIX E
2035 PEAK HOUR DEMAND

Coachella Water Authority
2016 Water Master Plan
CIP SUMMARY

CIP No.	Project Name	Year 2017	2018	2019	2020	2021	2025	2030	2035
Storage Reservoirs									
6	3.6 MG Reservoir Interior Relining	$ 0.38							
22	2.5 MG Storage (150+ Zone)				$ 4.69				
23	2.5 MG Storage (150+ Zone)						$ 4.69		
24	2.0 MG Storage (150 Zone)							$ 3.75	
25	3.0 MG Storage (150+ Zone)							$ 5.63	
Pipelines									
1	8" Waterline Interconnection @ Grapefruit Blvd/Park Ln & Harrison Street.			$ 0.21					
2	Whitewater Wash Bridge Pipeline @ Ave 50		$ 0.70						
3	Ave 50 - Tyler to Polk St & Polk Street - Ave 50 to Ave 52			$ 2.93					
4	Whitewater Wash Bridge Pipeline @ Dillon Road		$ 0.27						
5	4 Hot Tap Isolation Valves	$ 0.08							
8	Grapefruit Blvd - Ave 49 to Ed Mitchell Drive				$ 0.41				
9	Van Buren Ave - Coral Mountain School to Ave 52 & Ave 52 - Van Buren Ave to Primativo Dr				$ 0.69				
10	Grapefruit - Ave 52 to Ave 54 & Tyler Street - Old Ave 53 to Grapefruit Blvd				$ 1.67				
12	Vista Del Sur - Tyler Street to 2000' West towards Dillon Rd					$ 0.50			
13	Dillon Road - Vista Del Norte to Ave 44					$ 1.11			
14	Ave 51 - Calhoun to Van Buren					$ 0.65			
15	150 Zone Looping Pipeline		$ 1.85						
42	Sub Area 14 Transmission Pipeline (Phase 1)				$ 6.96				
43	Sub Areas 8 and 15 Transmission Pipeline				$ 2.63				
44	Sub Area 16 Transmission Pipeline				$ 3.09				
45	Sub Area 13 Transmission Pipeline				$ 0.19				
46	Sub Area 14 Transmission Pipeline (Phase 2)						$ 5.03		
47	Sub Area 14 Looping Transition Pipeline						$ 2.34		
48	Aging Pipeline Replacement	$ 1.50	$ 1.50	$ 1.50	$ 1.50	$ 1.50	$ 6.00	$ 7.50	$ 7.50
Well Production									
7	Well 20 (150 Zone)		$ 3.75						
26	Well 21 (150+ Zone)				$ 3.75				
27	Well 22 (150+ Zone)				$ 3.75				
28	Well 23 (150+ Zone)						$ 3.75		
29	Well 24 (150 Zone)							$ 3.75	
30	Well 25 (150+ Zone)							$ 3.75	
31	Well 26 (Low Zone)								$ 3.75
32	Well 27 (150+ Zone)								$ 3.75
Treatment Facilities									
16	Well 12				$4.80				
17	Well 16		$ 4.80						
18	Well 17			$ 4.65					
19	Well 18				$4.80				
20	Well 19			$ 14.55					
11	Well 20		$ 4.80						
34	Well 21				$ 4.80				
35	Well 22				$ 4.80				
36	Well 23						$ 4.80		
37	Well 24							$ 4.80	
38	Well 25							$ 4.80	
39	Well 26								$ 4.80
40	Well 27								$ 4.80
Total (Million)		**$ 1.95**	**$ 17.68**	**$ 23.83**	**$ 48.52**	**$ 3.76**	**$ 26.61**	**$ 33.98**	**$ 24.60**
					5 Year Total ($M)	**$ 95.74**		**Total ($M)**	**$ 180.92**


LEGEND
WELL
RESERVOIR
BOOSTER
CIP PROJECT NO.
CIP PROJECT YEAR
2017
2018
2019
2020
2021
2025
2030
2035
• DILLON RD RESERVOIR (1.5 MG) (HWL=146')
• 2030-2.0 MG RESERVOIR (2.0 MG) (HWL=146')
• WELL #18
• WELL 18 RESERVOIR (5.0 MG) (FLOOR ELEV.=-57.5')
• WELL 18 BOOSTER (LOW ZONE)
• WELL 18 BOOSTER (HIGH ZONE)
• WELL #21
• WELL #20
• WELL #11
• WELL #19
• WELL #17
• WELL #24
• WELL #26
• WELL #22
• WELL #23
• WELL #25
• WELL #27
• WELL #16
• 2030-3.0 MG RESERVOIR (3.0 MG) (HWL=146')
• 2020-2.5 MG RESERVOIR (2.5 MG) (HWL=146')
• 2025-2.5 MG RESERVOIR (2.5 MG) (HWL=146')
LA ENTRADA DEVELOPMENT
• WELL #12
• MECCA RESERVOIR (3.6 MG) (FLOOR ELEV.=-75')
• WELL 12 BOOSTER
CITY LIMITS
CITY SPHERE
HARRISON STREET
TYLER STREET
POLK STREET
FILLMORE STREET
PIERCE STREET
BUCHANAN STREET
JACKSON STREET
VAN BUREN STREET
CALHOUN STREET
FREDERICK STREET
AVENUE 45
AVENUE 46
AVENUE 47
47TH AVENUE
AVENUE 48
AVENUE 49
AVENUE 50
AVENUE 51
AVENUE 52
AVENUE 54
INDUSTRIAL WAY
AIRPORT BOULEVARD(56TH AVE)
INTERSTATE 10
COLORADO RIVER AQUEDUCT
ALL AMERICAN CANAL (COACHELLA BRANCH)
GRAPEFRUIT BLVD
UNION PACIFIC RR
GRAPHIC SCALE
1500 0 750 1500 3000 6000
(IN FEET)
1 INCH = 1500 FEET
TKE ENGINEERING, INC.
2305 CHICAGO AVENUE
RIVERSIDE, CA 92507
(951) 680-0440
FAX: (951) 680-0490
CITY OF COACHELLA
APPENDIX F
CAPITAL IMPROVEMENT PROGRAM